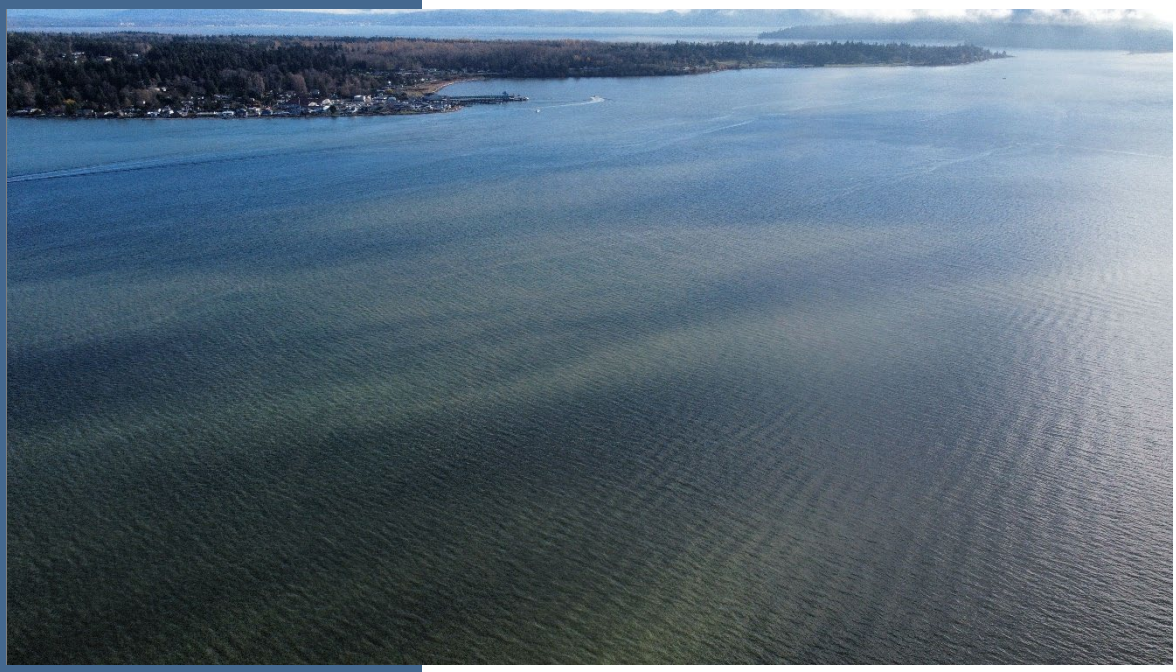

Research & Recommendations for Water Quality Trading for Permittees Under the Puget Sound Nutrient General Permit

By

PG Environmental

For the

Water Quality Program

Washington State Department of Ecology

Olympia, Washington

April 2023, Publication 23-10-006

DEPARTMENT OF ECOLOGY
State of Washington

Publication Information

This document is available on the Department of Ecology's website at:
https://apps.ecology.wa.gov/publications/summarypages/2310006.html

Cover photo credit

- Dustin Bilhimer, 2022

Related Information

Puget Sound Nutrient Credit Trading: Recommendations for Program Development (Publication 23-10-007)[1]

Contact Information

Water Quality Program

P.O. Box 47600
Olympia, WA 98504-7600
Phone: 360-407-6600
Website: Washington State Department of Ecology[2]

ADA Accessibility

The Department of Ecology is committed to providing people with disabilities access to information and services by meeting or exceeding the requirements of the Americans with Disabilities Act (ADA), Section 504 and 508 of the Rehabilitation Act, and Washington State Policy #188.

To request an ADA accommodation, contact Ecology by phone at 360-407-6600 or email at jeremy.reiman@ecy.wa.gov. For Washington Relay Service or TTY call 711 or 877-833-6341. Visit Ecology's website[3] for more information.

[1] https://apps.ecology.wa.gov/publications/SummaryPages/2310007
[2] https://ecology.wa.gov/About-us/Contact-us
[3] https://ecology.wa.gov/About-us/Accountability-transparency/Our-website/Accessibility

Research & Recommendations for Water Quality Trading for Permittees Under the Puget Sound Nutrient General Permit

Water Quality Program
Washington State Department of Ecology
Olympia, WA

April 2023 | Publication 23-10-006

Table of Contents

List of Figures and Tables

Figures

Tables

Acknowledgements

The authors of this report thank the following people for their contribution to this study:

1. Allan Brockenbrough, Virginia Department of Environmental Quality
2. Nicole Christ, Maryland Department of the Environment
3. Matthew Claucherty, Wisconsin Department of Natural Resources
4. Rachel Colyer, Pennsylvania Department of Environmental Protection
5. Rich Gannon, North Carolina Department of Environment and Natural Resources
6. Marco Graziani, Minnesota Pollution Control Agency
7. Bruce Henningsgaard, Minnesota Pollution Control Agency
8. Joey Hester, North Carolina Department of Environment and Natural Resources
9. Kevin Kirsch, Wisconsin Department of Natural Resources
10. Iliana Raffa, Connecticut Department of Energy and Environmental Protection
11. Gregorio Sandi, Maryland Department of the Environment
12. Sean Spencer, Wisconsin Department of Natural Resources

Acronyms

AKART	All known, available and reasonable methods of prevention, control and treatment
CTDEEP	Connecticut Department of Energy and Environmental Protection
DEQ	[Virginia] Department of Environmental Quality
DMR	Discharge monitoring report
EPA	U.S. Environmental Protection Agency
MDE	Maryland Department of the Environment
MPCA	Minnesota Pollution Control Agency
MS4	Municipal separate storm sewer system
NCDEQ	North Carolina Department of Environmental Quality
NPDES	National Pollutant Discharge Elimination System
PADEP	Pennsylvania Department of Environmental Protection
POTW	Publicly-owned treatment works
PSNGP	Puget Sound Nutrient General Permit
RCW	Revised Code of Washington
RIBITS	Regulatory In-Lieu Fee and Bank Information Tracking System
TBELs	Technology-based effluent limitations
TIN	Total inorganic nitrogen
TMDL	Total maximum daily load
WAC	Washington Administrative Code
WQBELs	Water quality-based effluent limitations
WQTAC	Water Quality Technical Advisory Committee
WWTPs	Wastewater treatment plants

I. Introduction

This report identifies options and recommendations for the Washington State Department of Ecology (Ecology) to consider for development of a water quality trading program in Puget Sound.[4]

Portions of Puget Sound are impaired for dissolved oxygen, due in part to discharges of nutrients from domestic wastewater treatment plants (WWTPs). To address these discharges, Ecology issued the Puget Sound Nutrient General Permit (PSNGP) in December 2021. In 2022, the Washington State Legislature passed a proviso in Engrossed Substitute Senate Bill 5693, Section 302 (46) to the Washington State Department Ecology as follows:

> (46) $350,000 of the general fund—state appropriation for fiscal year 2023 is provided solely for the department to recommend one or more draft structures for nutrient credit trading that could be used to efficiently and quickly achieve nutrient discharge reductions for point source dischargers covered under the Puget Sound nutrient general permit. By June 30, 2023, the department must submit a report to the appropriate committees of the legislature consistent with RCW [Revised Code of Washington] 12 43.01.036 that summarizes the draft structure or structures and describes a tribal consultation and a stakeholder engagement process to solicit feedback on the draft structure or structures and any necessary statutory changes and funding.

In response, Ecology issued a request for proposals for water quality trading research services in July 2022, and subsequently issued a contract to PG Environmental in October 2022 to develop this report describing research and recommendations for water quality trading in Puget Sound. Ecology intends to use the options and recommendations in this report to evaluate whether water quality trading can be used in conjunction with the PSNGP to achieve reductions in nutrient discharges more efficiently and quickly.

This report provides options and recommendations for trading program structures, laws and policies, and funding needs. The program structure options focus on the following major components of an effective trading program:

- Stakeholder involvement.
- Preliminary eligibility for participation.
- Managing risks and uncertainty.
- Trading boundaries and partners.
- Managing credit transactions.
- Effluent limitations and compliance evaluation.
- Credit certification and tracking.

[4] Throughout this report, "Puget Sound" refers to the area covered by the Washington Department of Ecology's Puget Sound Nutrient General Permit (PSNGP), referred to in the permit as "Washington Waters of the Salish Sea." The area includes the five basins within Puget Sound proper, the Northern Bays (Bellingham, Samish, Padilla), and the Washington portions of the Strait of Georgia and Strait of San Juan de Fuca.

When compiling options for trading laws and policy, we considered Ecology's existing authority to implement a water quality trading program and whether and how new laws, policies, and/or guidance can be used to support a trading program in Puget Sound. Funding options include the minimum funding needs to implement a program as well as funding for other activities to augment a trading program.

This report does not provide the level of specificity necessary to establish a functional water quality trading program, nor does it offer any conclusions on whether a market for water quality trading in Puget Sound exists. As detailed in this report, several factors that influence trading program development and the feasibility of a water quality trading market (e.g., permit limits, funding, stakeholder engagement, litigation) are uncertain at this time. The PG Team has identified these uncertainties and the underlying assumptions considered when developing the options and recommendations in this report; these recommendations are subject to change based on availability of updated scientific information and the outcomes of certain legal and permitting decisions.

PG Environmental developed this report with support from subcontractors Eastern Research Group, Inc., and Herrera Environmental Consultants, Inc. (collectively referred to as the PG Team) and in consultation with Ecology staff. The options and recommendations in this report are based on 1) the PG Team's understanding of the current science on nutrient loading and impacts in Puget Sound and the requirements in the PSNGP, 2) research on other state water quality trading programs, and 3) consideration of the U.S. Environmental Protection Agency's (EPA) water quality trading policy and guidance (EPA 2003, 2009).

To conduct the research for this report, the PG Team identified existing state water quality trading programs in the country most relevant to Puget Sound. The PG Team selected seven programs for in-depth research, focusing on those with recent, successful trades between WWTPs that facilitate trading through a general permit and involve trading for nutrients. The PG Team compiled and reviewed publicly available information about these programs and interviewed state agency staff. The interviews focused on a list of questions the PG Team developed in conjunction with Ecology (Appendix A). The procedures for conducting the research and summaries of the relevant details of each state program are provided in the Water Quality Trading Research Summary of Findings (Appendix B).

Using the research information, the PG Team identified options for water quality trading program structures, laws and policies, and funding. The report provides a narrative description of each option and, where available, examples from other state programs. For each trading program element, the PG Team made recommendations for the preferred option(s) for a water quality trading program in Puget Sound and corresponding rationale, including benefits and drawbacks. The program structure recommendations in this report are suggestions based on the PG Team's understanding of the watershed conditions, permitting and regulatory framework, and social/political landscape in the Puget Sound watershed; these recommendations are non-binding and are subject to change based on Ecology's needs and interpretation of new information as it becomes available.

II. Background

A. Puget Sound overview

Puget Sound is a natural resource of incredible value to Washington State and the entire United States. It provides billions in economic value to Washington State from commercial and recreational fishing, shellfish aquaculture, tourism, boating, and international trade (Ecology 2008). The nutrient-rich waters brought in by tidal currents from the Pacific Ocean provide nourishment for a vast diversity of life, from microscopic invertebrates to the salmon and orca whales so vital to the region's cultural history and identity. Puget Sound's 2,500 miles of shoreline provide critical habitat for fish, mammals, and birds, and provide shellfish harvesting and swimming opportunities for residents and visitors. However, deteriorating water quality is placing many of Puget Sound's valuable resources at risk. Low levels of dissolved oxygen have been identified in many parts of Puget Sound, and in some places, those low levels persist for most of the year. While there are numerous factors that influence dissolved oxygen levels in Puget Sound, recent modeling has indicated that nutrients generated from the watersheds and from WWTPs discharging directly to Puget Sound are the key contributors to the low dissolved oxygen problem.

The Washington State Department of Ecology maintains detailed descriptions of Puget Sound, its value, environmental threats, and protection efforts on its Puget Sound website.[5] Summary information in this section focuses on water quality impairments, nutrient permitting, water quality characterization, and efforts and relationships relevant to developing a water quality trading program in Puget Sound.

1. Water quality concerns

Ecology established marine dissolved oxygen standards at levels that fully support healthy aquatic species. These standards can also be used to limit the cumulative impacts of human actions. Roughly one-fifth of Puget Sound does not meet these standards each year (Ecology 2019). Areas within Puget Sound have been aggregated to basins to identify and summarize spatial patterns in water quality conditions. Table 1 lists the basins of Puget Sound (basins within Puget Sound proper plus the Strait of San Juan de Fuca, Strait of Georgia, and the Northern Bays), along with model-predicted number of days not meeting dissolved oxygen standards and relationships between nitrogen sources and noncompliance areas throughout Puget Sound, derived from the Salish Sea Model.[6] Areas predicted not to meet standards are located within all Puget Sound basins except Admiralty Inlet (Figure 1 and Table 1).

[5] https://ecology.wa.gov/Water-Shorelines/Puget-Sound

[6] The Salish Sea Model simulates hydrodynamic and water quality processes in Puget Sound. Ecology is using the model to evaluate the impact of anthropogenic nutrient loading on dissolved oxygen. More information on the model is available from the Washington Department of Ecology (https://ecology.wa.gov/Research-Data/Data-resources/Models-spreadsheets/Modeling-the-environment/Salish-Sea-modeling) and the Pacific Northwest National Laboratory (https://www.pnnl.gov/ssm-water-quality-dissolved-oxygen).

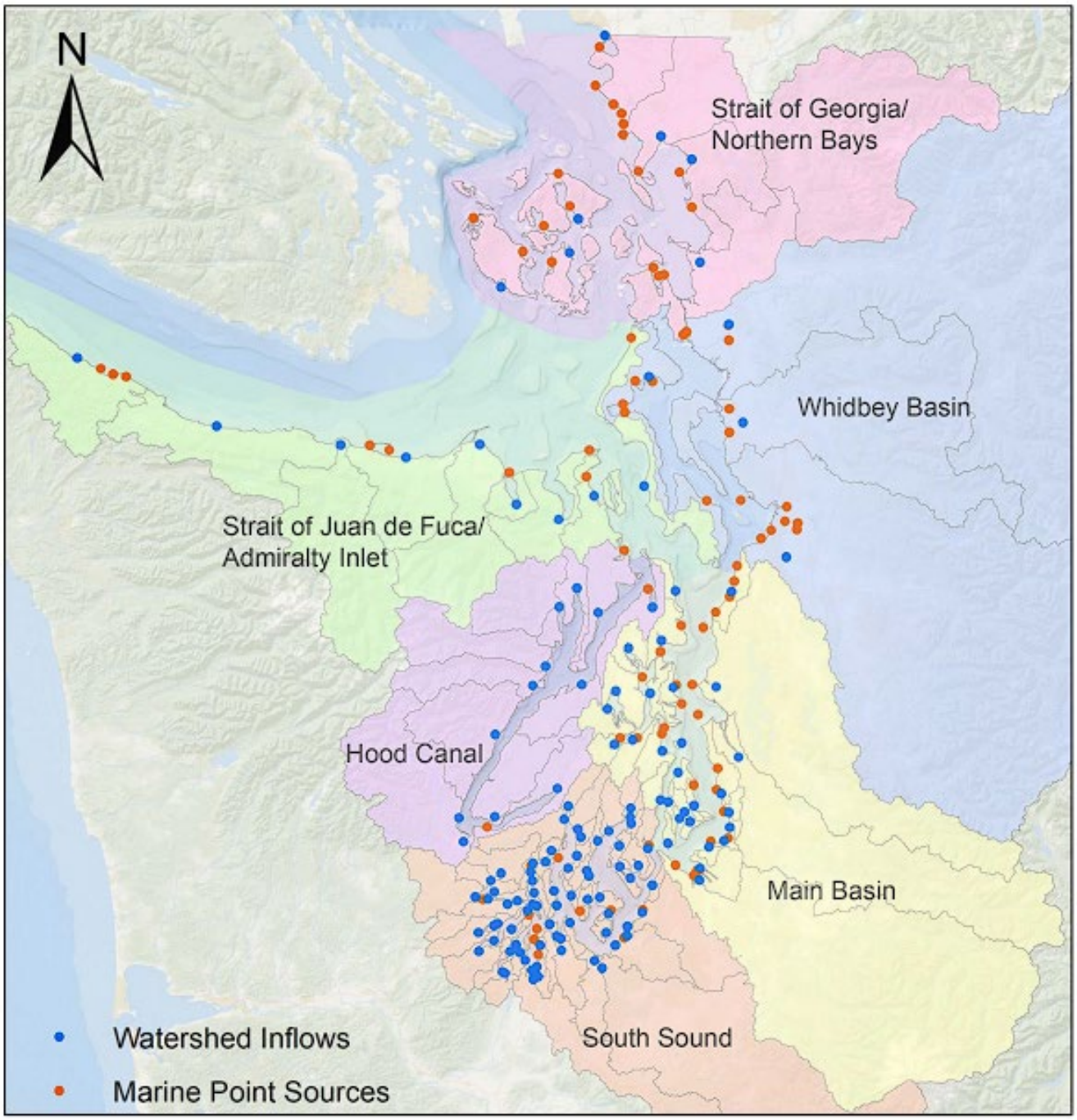

Figure 1. Map of the Puget Sound basins and their respective watersheds used in the Salish Sea Model Year 1 and Year 2 optimization scenarios (Ecology 2021)

Table 1. Summary of Puget Sound basins, areas not meeting dissolved oxygen standards, and sources of substantial influence on dissolved oxygen noncompliance

Puget Sound basin	Details and residence time[a]	Areas with predicted DO issues (maximum days not meeting standards)[b]	Location/source with substantial influence on DO in basin[c]
Strait of Juan de Fuca/ Admiralty Inlet	Short residence time with few areas of DO noncompliance due to high level of mixing and flushing from the Pacific Ocean. About 98% of water is of oceanic origin.	Discovery Bay (7)	Strait of Juan de Fuca/ Admiralty Inlet watersheds
Strait of Georgia/ Northern Bays	Short residence time and few areas of predicted noncompliance. Notably, there is substantial masking in Padilla and Samish Bays.	Bellingham Bay (24)	Strait of Georgia/ Northern Bays WWTPs and watersheds
Whidbey Basin	Inner bays have lengthy residence times. Notably, there is substantial masking in Skagit Bay and Port Susan.	• Skagit Bay (49) • Penn Cove (162) • Port Susan (128) • Holmes Harbor (75)	• Whidbey Basin WWTPs and watersheds • Main Basin WWTPs and watersheds • South Sound watersheds
Main Basin	Short residence time, excluding several bays west of Bainbridge Island. Discharges to the Main Basin have been predicted to impact DO compliance in all other basins.	• Liberty Bay (120) • Dyes Inlet (96) • Sinclair Inlet (156) • Quartermaster Harbor (164)	• Main Basin WWTPs and watersheds • South Sound WWTPs (minor relative to Main Basin influence) and watersheds
South Sound	Long residence times, especially in inner inlets and bays.	• Budd Inlet (162) • Eld Inlet (68) • Totten Inlet (43) • Oakland Bay (69) • Case Inlet (181) • Carr Inlet (192)	• Main Basin WWTPs and watersheds • South Sound WWTPs (minor relative to Main Basin influence) and watersheds
Hood Canal	Long residence times, especially in Lynch Cove at its terminus.	Lynch Cove (139)	• Main Basin WWTPs and watersheds • Hood Canal watersheds • Whidbey Basin watersheds

DO = Dissolved oxygen

[a] Longer residence times promote stagnation and buildup of pollutant concentrations, increase primary productivity and depletion of nutrients, increase nitrification (oxidation of ammonia to nitrate, which depletes oxygen), increase settling of particulate organic matter (e.g., dead algae), and increase decomposition of organic carbon (which depletes oxygen). Residence times are variable from year to year.

[b] From the 2006 existing conditions model scenario (Ecology 2021). The areas and numbers of days predicted to not meet standards are expected to change based on future modeling scenarios.

[c] Based on Salish Sea Model optimization scenarios 2 and 3 where WWTP or watershed loads are individually set to reference conditions (Ecology 2021). A substantial influence is defined here as at least a 25 percent reduction in the area not meeting standards.

Excess anthropogenic nitrogen has been identified as the primary pollutant driving extreme algal growth, also called eutrophication, in Puget Sound. The decomposition of algae and aquatic plants results in low dissolved oxygen levels. While the open ocean delivers the highest

nitrogen load to Puget Sound, Ecology has established that WWTPs discharging directly to Puget Sound are the largest anthropogenic source of nutrients to the sound. A combination of nutrient reductions from both these WWTPs and sources in the watersheds is likely necessary to attain water quality standards. The clearest pathway to predicted dissolved oxygen compliance includes comprehensive reductions from both WWTPs and watershed point and nonpoint sources throughout Puget Sound and throughout the year (Ecology 2019, 2021).

The first set of Salish Sea modeling scenarios (Year 1 optimization scenarios) evaluated changes in marine dissolved oxygen due to reducing total nitrogen and total organic carbon at municipal wastewater plants that discharge directly to Puget Sound (Ecology 2019). The subregions (geographic areas that include watershed inputs and marine point source inputs) that comprise the Puget Sound region (Washington waters of the Salish Sea) vary greatly in terms of depth and hydrodynamics (i.e., mixing and transport). These subregions also vary in terms of how much nutrient loading comes from marine point sources and watershed nonpoint and point sources. Each of these characteristics (hydrologic characteristics and anthropogenic loading) affects the areal extent, duration, and magnitude of oxygen depletion. For example, discharges from WWTPs and rivers (watershed sources) in the Main Basin were found to influence compliance throughout Puget Sound due to the high total pollutant load and the Main Basin's ability to act as a throughfare to transport those discharges to areas predicted to not meet standards. Shallow bays and terminal inlets, like Henderson Inlet in South Puget Sound, are the most sensitive to eutrophication due to lower flushing rates compared to other basins. The remainder of this section summarizes key model results relevant to this report.

Salish Sea Model results: Impact of nutrient reduction by location

Based on the Year 1 optimization results, WWTP total nitrogen loads in the Main Basin substantially influence dissolved oxygen compliance throughout Puget Sound (Ecology 2021). Scenarios that reduced loads from Main Basin WWTPs to zero improved compliance in nearby areas, in South Sound inlets, in Whidbey Basin, and as far as Lynch Cove in Hood Canal. Overall, setting Main Basin WWTP loads to zero reduced the total Puget Sound predicted area of noncompliance by 63 percent (Ecology 2021).

Year 1 modeling also indicates that reducing loads from South Sound WWTPs modestly improved dissolved oxygen compliance in South Sound and Main Basin. Overall, setting South Sound WWTP loads to zero reduced the total Puget Sound predicted area of noncompliance by 8 percent.

Reducing loads from Whidbey Basin WWTPs primarily benefitted the local areas in the Whidbey Basin (Port Susan, Penn Cove, and Skagit Bay) and provided minor benefits to other Puget Sound basins. Overall, setting Whidbey Basin WWTP loads to zero reduced the total Puget Sound predicted area of noncompliance by 16 percent, according to the model results.

Year 1 modeling further indicates that reducing nitrogen loads from marine WWTPs in the following basins did not substantially impact predicted compliance in the whole of Puget Sound: Strait of Juan de Fuca/Admiralty Inlet, Strait of Georgia/Northern Bays, and Hood Canal. The lack of impact on compliance from these regions is due to their relatively small WWTP total nitrogen loads relative to the WWTP loads in other basins. However, it is understood these

WWTPs do contribute to the cumulative anthropogenic load causing noncompliance with water quality standards.

Reducing loading from WWTPs in Strait of Georgia/Northern Bays modestly improved predicted compliance in Bellingham Bay.

In terms of a single-region watershed load reduction influence, Whidbey Basin, South Sound, and Main Basin watershed nutrient reductions improved compliance outside of their respective regions. In separate simulations, setting watershed loads in each of those watersheds to reference conditions (i.e., estimated natural conditions without regional human sources) reduced predicted noncompliant total cumulative days and spatial extent in Puget Sound by approximately one-third. These three regional watershed reductions had a larger overall predicted impact compared to the other watersheds. However, compliance rates in Hood Canal, Strait of Juan de Fuca/Admiralty Inlet, and Strait of Georgia/Northern Bays are also greatly influenced by their immediate watershed loads. Reducing watershed loads to reference conditions for those three watersheds resulted in 100 percent compliance in their respective Puget Sound basins, while having little to no impact on other basins. The Whidbey Basin watershed loading also showed meaningful impact within its own basin, along with the Hood Canal Basin (Ecology 2021).

Salish Sea Model results: Impact of nutrient reduction timing

The Salish Sea Model established that reducing discharges throughout the year was important to increasing dissolved oxygen compliance. The Year 1 optimization modeling established that annual reduction of nutrients outperformed all seasonal scenarios, with respect to decreases in noncompliant area and cumulative number of noncompliant days. This is believed to be the result of fall and winter loads contributing to the sediment oxygen demand, along with persistent nutrient circulation in the water column (Ecology 2021).

2. Puget Sound Nutrient General Permit

Ecology issued the PSNGP on December 1, 2021; the permit became effective on January 1, 2022, and expires on December 31, 2026. Ecology proposed two sets of narrative limits for three categories of dischargers: dominant, moderate, and small. The narrative limits are identical for dominant and moderate dischargers. Proposed narrative limits for all plants require permittees to actively reduce their nutrient contribution as much as possible during the permit term. However, the group of permittees that constitute the dominant total inorganic nitrogen load into Puget Sound must do more than the permittees with the smallest total inorganic nitrogen loads. Permittees with total inorganic nitrogen loads exceeding 2,000 pounds per day qualify as dominant, those with 100 to 2,000 pounds per day as moderate, and those with less than 100 as small. Dominant loaders make up slightly more than 80 percent of the domestic point-source total inorganic nitrogen load, moderate loaders make up 19 percent, and small loaders make up less than 1 percent. Table 2 summarizes the PSNGP requirements for the three categories of dischargers.

Table 2. Summary of Puget Sound Nutrient General Permit requirements

WWTP category	TIN action level[a]	Action level exceedance corrective action[b]	Nutrient optimization plan[c]	Nutrient reduction evaluation[d]	AKART analysis[e]	Influent and effluent monitoring
Dominant (7 facilities)	X	X	X	X	X[d]	X
Moderate (20 facilities)	X	X	X	X	X[d]	X
Small (31 facilities)			X		X	X

TIN = total inorganic nitrogen; AKART = all known, available and reasonable methods of prevention, control and treatment

[a] If the total inorganic nitrogen TIN action level for individual WWTPs or the bubbled action levels listed for single jurisdictions are exceeded, the permittee must employ corrective actions.

[b] With the next Annual Report after an action level exceedance, permittees must propose an approach to reduce the annual effluent load below the action level. If a permittee exceeds an action level two years in a row, or for a third year during the permit term, the permittee must begin to reduce nitrogen loads by implementing the proposed approach submitted. This provision is currently stayed pending the result of ongoing litigation (see section I.A.4).

[c] Each permittee must develop, implement, and maintain a Nitrogen Optimization Plan to evaluate and implement operational strategies for maximizing nitrogen removal from the existing treatment plant during the permit term. Permittees must document their actions taken and apply an adaptive management approach at the WWTP. Permittees will quantify results with required monitoring under the PSNGP.

[d] All permittees must prepare and submit an approvable Nutrient Reduction Evaluation to Ecology for review by December 31, 2025. Permittees that maintain an annual TIN average of < 10 mg/L and meet their action level throughout the permit term must submit a truncated Nutrient Reduction Evaluation. Permittees that meet their action level throughout the permit term and maintain an annual average of < 10 mg/L TIN and a seasonal average of < 3 mg/L do not have to submit the Nutrient Reduction Evaluation. The Nutrient Reduction Evaluation must include an AKART analysis to evaluate treatment alternatives for TIN.

[e] Permittees must prepare and submit an approvable AKART analysis to Ecology for purposes of evaluating reasonable treatment alternatives capable of reducing TIN. Permittees must submit this report by December 31, 2025. Permittees that maintain an annual TIN average of < 10 mg/L and do not document an increase in load through their discharge monitoring reports (DMRs) do not have to submit this analysis.

3. Future water quality monitoring and modeling

Ecology has developed Year 2 optimization scenarios to further refine the results of the Year 1 scenarios described in section I.A.1. These scenarios will be included in Ecology's final Salish Sea Modeling report in mid-2024. The Year 2 scenarios evaluate multiple combinations of marine WWTP and watershed total nitrogen load reduction frameworks intended to answer the following questions:

1. Will dissolved oxygen compliance improve with bigger reductions near predicted noncompliant areas?
2. How do smaller sources further away from areas not meeting standards impact dissolved oxygen?
3. What are the dissolved oxygen improvements from different WWTP seasonal limits throughout the year?

Ecology plans to use the Year 2 optimization scenarios to evaluate targets for individual basin load reductions, watershed inflow load reductions, and point source wasteload allocations for

different basins. These Year 2 scenarios will inform the development of numeric water quality based effluent limitations (WQBELs) (Ecology 2022).

Additional well-defined modeling at the individual basin scale will be essential to identifying specific watershed sources of nitrogen contributing to criteria noncompliance and to establishing any future watershed load or wasteload allocations in Puget Sound watersheds.

4. Litigation

At least 10 appeals of the PSNGP have been filed by local governments operating wastewater treatment facilities, environmental advocacy groups, and tribes (e.g., Puget Soundkeeper Alliance, et al. v. Washington Department of Ecology, Pollution Control Hearings Board Case # 21-082c; City of Tacoma, et al. v. Washington Department of Ecology, Thurston County Court of Appeals Division 2, Case # 56859-4-II). These appeals seek outcomes ranging from modifying aspects of the permit to abolishing the permit and having Ecology begin a formal rulemaking process.

In addition, an environmental advocacy group has filed a lawsuit against EPA regarding failure to develop total maximum daily loads (TMDLs) for Puget Sound (Northwest Environmental Advocates v. U.S. EPA, filed December 7, 2021, in the U.S. District Court, Western District of Washington). The litigants specifically challenged EPA's alleged approval of Ecology's approach to controlling nutrient discharges to Puget Sound, including adoption of the PSNGP. One potential outcome of this action is that EPA Region 10 could be required to develop a TMDL for Puget Sound that would likely include nitrogen wasteload allocations for the WWTPs covered under the PSNGP.

5. Tribes and key stakeholders

There are eighteen federally recognized tribes with reservation waters and/or Usual and Accustomed (U&A) fishing and shellfish harvest areas in the Puget Sound, Strait of Juan de Fuca, and Strait of George and their watersheds (listed below). The six **bolded** tribes operate WWTPs that are permitted through EPA Region 10 under the National Pollutant Discharge Elimination System (NPDES).

- Jamestown S'Klallam Tribe
- Lower Elwha Klallam Tribe
- **Lummi Nation**
- **Makah Tribe**
- Muckleshoot Tribe
- Nisqually Indian Tribe
- Nooksack Indian Tribe
- Port Gamble S'Kallam Tribe
- **Puyallup Tribe of Indians**
- Samish Indian Nation
- Sauk-Suiattle Indian Tribe
- Skokomish Indian Tribe
- Snoqualmie Indian Tribe
- Squaxin Island Tribe
- Stillaguamish Tribe of Indians
- **Suquamish Tribe**
- **Swinomish Indian Tribal Community**
- **Tulalip Tribes**
- Upper Skagit Indian Tribe

Ecology began engaging Washington tribes at the onset of the budget proviso to develop recommendations for a trading program in Puget Sound and since the beginning of the Puget

Sound Nutrient Reduction Project.[7] Ecology will be providing a strategy for engaging all of Washington's tribes in future trading program discussions and development in their final report to the Washington State Legislature in June 2023.

Each individual sewer agency that is permitted to discharge to Puget Sound will be a stakeholder in any potential water quality trading program associated with the PSNGP. Additionally, it may be beneficial for Ecology to engage with sewer agency groups, including the Washington Association of Sewer & Water Districts, Metropolitan Water Pollution Abatement Advisory Committee, and Pacific Northwest Clean Water Association.

Other stakeholders include environmental groups that have been active in efforts that address nutrient reduction in Puget Sound. These include Washington Conservation Action (formerly Washington Environmental Council), Puget Soundkeeper Alliance, Deschutes Estuary Restoration Team, and Northwest Environmental Advocates.

B. Nutrient water quality trading overview

Water quality trading is intended to offer sources with pollutant reduction requirements an additional approach to achieving pollutant reduction goals. For permitted WWTPs with nutrient reduction requirements, water quality trading can provide two possible paths to permit compliance: 1) upgrading treatment technology to achieve permit limits, or 2) paying for nutrient credits from another source to meet permit limits. The effectiveness of water quality trading as an approach for achieving permit compliance and progress toward water quality goals depends on a variety of factors. Three important factors are water quality trading program structure, laws and policies, and funding. Having general knowledge of these factors is helpful when reviewing and evaluating water quality trading program options and recommendations.

1. Program structure

The design of a water quality trading program is fundamental to the program's potential success at achieving water quality goals. While a water quality trading program's design should be tailored to the specific characteristics of a watershed, water quality trading programs across the country share the common structural elements described below.

Preliminary eligibility for participation. Water quality trading programs define what types of sources can participate in trading activities and what basic requirements they must meet or characteristics they must have to be eligible to participate. This structural element helps to establish the universe of potential credit buyers and sellers.

Geographic boundaries and considerations. In addition to defining who can participate, water quality trading programs define where trading can take place. Some water quality trading program structures allow for watershed-wide trading, while others subdivide into smaller trading areas to better address localized water quality conditions and concerns. This decision

[7] https://ecology.wa.gov/Water-Shorelines/Puget-Sound/Helping-Puget-Sound/Reducing-Puget-Sound-nutrients/Puget-Sound-Nutrient-Reduction-Project

also affects the universe of potential credit buyers and sellers that can engage in trading activities.

Credit buying. Water quality trading programs establish requirements for credit buyers. Typically, NPDES permits establish a minimum control level for credit buyers (i.e., the pollutant load buyers must meet before buying credits to meet their permit limit). According to EPA's Water Quality Trading Toolkit, the minimum control level could either be a technology-based effluent limit (TBEL) or current discharge level. Additionally, federal policy specifies that point source dischargers cannot purchase credits to meet a TBEL. There may be other considerations or constraints placed on credit buyers as part of a water quality trading program's structure.

Credit selling. Water quality trading program structures also include requirements for credit sellers. In accordance with federal policy, credit sellers must reduce their pollutant load beyond their baseline to generate credits to sell. For point source credit sellers, baselines are the most stringent appliable effluent limitation in their permit. For nonpoint source credit sellers, the program establishes a baseline level of pollutant control that must be met before credits can be generated. In a watershed with a TMDL or similar analysis, federal policy states that nonpoint sources must meet the established load allocation before generating credits to sell. The program structure might also include other requirements or considerations for credit sellers.

Credit transaction mechanisms. The mechanism for credit transactions should align with the size of the water quality trading program's credit market, defined by both the number of potential trading partners and the anticipated number of credit sales. A smaller credit market may rely on separate negotiations between individual buyers and sellers, often referred to as bilateral negotiations. A larger market with a higher volume of transactions may need a higher level of program administration or a more centralized approach to facilitate credit buying and selling. Controlling transaction costs associated with water quality trading activities can be important to generating and sustaining participation in the market.

Credit certification and tracking. Regardless of the credit transaction approach, all water quality trading program structures include credit certification and tracking processes. Credit certification is when an agency checks the validity of credits and approves their status as credits to help buyers achieve compliance. Credit tracking involves registering and following credits through their life cycle, documenting generation, use, and expiration or retirement in a transparent manner. Trading program administrators use this information to ensure credit use conforms to the trading program rules (e.g., credits are used within the required time frame, credits are not sold more than once, appropriate trade ratios are applied). Some water quality trading program structures use a manual process for credit certification and tracking, while other structures incorporate more automated procedures for these functions.

Managing risks and uncertainty. Water quality trading program structures typically incorporate several mechanisms to manage the risk and uncertainty associated with technology performance, pollutant fate and transport, and scientific assumptions. Program structures rely on "trade ratios," which are credit discounts calculated to help manage risk and uncertainty. The types of trade ratios and associated values of these ratios vary from program to program, depending on watershed characteristics and associated scientific data. In general, trade ratios are established for trading to ensure that 1) the trade will result in water quality at the location

of the credit buyer's discharge that is the same or better than if the buyer met the limit through onsite treatment, and 2) the trade will not cause localized exceedances of water quality standards (i.e., hotspots) in the receiving water between the buyer's and seller's locations. Some program structures also include credit reserve pools as a form of insurance to help manage risk.

Compliance and enforcement. Outside of a water quality trading program context, permitting authorities have existing compliance and enforcement processes and protocols in place for permitted point source dischargers. Some water quality trading programs incorporate additional compliance and enforcement processes and considerations into the program structure to verify that permittees are achieving and maintaining compliance using credits. This can be an important program element when an NPDES permittee is purchasing credits to meet permit limits because their discharge monitoring will show that their effluent exceeds the limits. Additional compliance evaluation processes can help dischargers and the public understand how the permitting authority will ensure water quality is being protected. For example, in addition to discharge monitoring reports (DMRs), some states require trading-specific reports documenting details about the credits purchased to help evaluate compliance.

Stakeholder involvement. The timing and extent of stakeholder involvement in trading program design and implementation can affect the program's success. Some water quality trading programs involve stakeholders early in the design process to help shape the overall program structure; this approach can help achieve buy-in for the program and bolster participation. Other water quality trading programs focus stakeholder involvement on raising awareness after determining the design of the program. Incorporating stakeholder involvement as part of the program structure, without using stakeholder input to inform the structure, may have implications for trading program implementation over time.

2. Laws and policy

Trading programs employ various mechanisms to ensure water quality trading is legally defensible. All water quality trading programs involving NPDES permits use permit conditions to authorize credit purchases for compliance. Some states have provided authority for water quality trading programs in their statutes or regulations. In addition, many states issue policy or guidance documents with rules for water quality trading activities to ensure consistency with Clean Water Act and state requirements.

3. Funding needs

Available funding influences all aspects of water quality trading program design and implementation. Regardless of a water quality trading program's structure, all programs typically require funding in the form of staff resources and dollars to support the activities described below.

Building program processes and policies. Some of the more significant costs associated with water quality trading are related to the collaborative work of making policy decisions and then documenting the processes needed to make trading happen. This work is iterative in nature and often involves input from stakeholders, as well as interagency and intra-agency coordination.

Engaging tribes and stakeholders. Programs need funding to plan and conduct a robust stakeholder engagement process for generating input and buy-in on water quality trading program structure decisions and related program processes and policies.

Developing tools. Every water quality trading program, regardless of structure, uses a variety of tools to collect and manage trading information. From forms to guidance documents to tracking systems, these tools require funding to develop, pilot, and maintain.

Training and maintaining staff. The complexity of the water quality trading program structure dictates the number of staff needed to administer the program. Programs need funding to train and maintain staff to oversee the day-to-day operation of the trading program and to document decision-making and administrative procedures to preserve institutional knowledge when staffing changes. If the program expands over time, additional staff may be needed to support it, especially if the program structure grows more complex.

C. Unresolved factors influencing water quality trading considerations in Puget Sound (uncertainties)

There are several ongoing analyses and technical discussions in the Puget Sound watershed related to data, permitting, and litigation. Each of these evolving factors will have a ripple effect on elements of a water quality trading program when a final analysis or decision is made. It is important to understand the uncertainties surrounding these factors and the implications for future water quality trading program structure decisions. Each unresolved factor is presented below with a summary of how this factor will affect water quality trading decisions. Table 3 summarizes these factors and highlights which water quality trading program structure elements Ecology will need to revisit once these factors are resolved and new information becomes available.

Unresolved factor: modeling outputs from Year 2 optimization. Ecology is running the Salish Sea Model with new scenarios to further define a range of options for total nitrogen load reduction targets for marine WWTPs and watershed inflows. These scenarios will evaluate the importance of geography (at the basin level) and seasonality for reducing loads. Year 2 results are expected to be published in a report in the second half of 2024. Ecology will combine the Year 1 and 2 optimization results into a Volume 2 Salish Sea Model Report, which will go through an independent peer-review process. Those results will inform Ecology's decisions for total nitrogen load reduction targets that will be published in their Puget Sound Nutrient Reduction Plan in the first half of 2025.

Once the marine WWTP total nitrogen load targets in the Nutrient Reduction Plan are finalized, several water quality trading program elements have the potential to change. The ripple effects of modeling outputs on water quality trading are outlined below.

- Modeling outputs will inform total nitrogen load targets for marine WWTPs, and those targets will inform decisions about permit limits, specifically WQBELs, that could act as a driver for water quality trading.
- Modeling results will also inform the trading boundaries and trade ratios based on watershed characteristics and pollutant fate and transport. However, additional

modeling following the finalization of load targets in the Nutrient Reduction Plan is likely needed to fine-tune trade ratios. For example, if a nitrogen reduction in the Main Basin leads to more net improvement than the same reduction in the Northern Bays, what is the delivery ratio between WWTPs in those basins?

- Permit limits, trading boundaries, and trade ratios interact to affect credit supply and demand. If there is insufficient demand or demand with no supply within a trading boundary, there will be no market.

These ripple effects on trading program elements are not limited to the Salish Sea Model Year 2 optimization results. Other modeling efforts, and potential future Salish Sea Model runs, will be needed to further refine Ecology's understanding of the interaction between various nutrient sources, their timing and location, and their impact on dissolved oxygen impairments in Puget Sound. For example, future modeling could help define equivalency between discharges within a basin—for example, within the Main Basin, is a pound discharged at King County's West Point facility equivalent to a pound discharged at Bremerton's Wastewater Treatment Plant? This would allow Ecology to develop more specific delivery ratios with associated impacts on credit supply and demand. Other models under development could also supplement a trading program by informing establishment of trading boundaries, or they might help with designing a trading program that incorporates watershed point and nonpoint sources in the future.

Unresolved factor: permit limits. The PSNGP does not include numeric effluent limits at this time. Ecology will incorporate numeric limits in subsequent permit cycles. As described in section I.A.1, for point source dischargers participating in water quality trading, permits generally establish baselines for credit sellers (typically the most stringent limit in the permit) and minimum control levels for credit buyers. Numeric effluent limits in the PSNGP could be WQBELs, technology- or performance-based, or some combination of these.

As mentioned above, WQBELs in the PSNGP would be based on total nitrogen load targets in the Nutrient Reduction Plan or as established in a Water Cleanup Plan or TMDL. There may be multiple options for establishing technology- or performance-based limits in the PSNGP. The current (and first) issuance of the PSNGP requires all WWTPs to perform an all known, available, and reasonable methods of prevention, control and treatment (AKART) analysis,[8] which includes both engineering and economic analyses, to determine a reasonable level of treatment for nitrogen removal at their facility. What constitutes AKART may vary for each facility since the analysis must consider facility size, space to expand at the existing location, cost of additional treatment, rate payer base, and community hardship. Permittees must submit the results of these analyses to Ecology by December 2025. Ecology will use the information from the AKART analyses to inform permit limits for comparison with WQBELs, which will be informed by the sources mentioned above.

[8] WWTPs with dominant and moderate loads must conduct the AKART analysis as part of the required Nutrient Reduction Evaluation (NRE); the NRE is not required for small load WWTPs, but they must perform a separate AKART analysis.

Once Ecology develops and incorporates numeric effluent limits into the PSNGP, several water quality trading program elements have the potential to change. The ripple effects of permit limits on water quality trading are presented below.

- Permit limits drive a facility's desire and ability to buy or sell credits.
- Facilities can only generate credits if they reduce nutrients to levels lower than the most stringent applicable limit in their permit (i.e., their trading baseline). If there is no credit supply because facilities cannot control beyond their baseline, there is no trading market.
- Facilities are not allowed to purchase credits to meet a TBEL under EPA's trading policy. However, federal TBELs for publicly owned treatment works (POTWs)[9] do not include limits for nutrients. Therefore, this aspect of the federal policy is not directly applicable to WWTPs trading nutrient credits. It may be possible to allow trading to meet performance- or technology-based limits based on state requirements. Limits based on state requirements might also be used to establish the minimum control level for credit buyers.

Unresolved factor: litigation. As described in section I.A.4 above, wastewater utilities and environmental advocacy groups have filed appeals related to the PSNGP; these appeals may not be settled until 2024. In addition, environmental advocates have filed litigation to compel the development of a TMDL. Other legal challenges associated with other technical and regulatory decisions (e.g., permit limits) may arise over time.

Resolution of the various appeals associated with the PSNGP and the litigation to compel a TMDL could affect several water quality trading program elements. The most significant ripple effects of litigation would start with permit limits, as described below.

- Identifying the implications of the range of appeals related to the PSNGP is challenging. Even if the appeals resulted in abolishing the PSNGP, this would not necessarily preclude water quality trading from happening, because WWTPs would still have individual NPDES permits and Ecology would incorporate nutrient limits in these individual permits versus through the general permit. A decision to remand or overturn certain permit special conditions could affect the amount or type of information available to Ecology that might support establishment of permit limits but would not prevent Ecology from developing limits.
- Successful litigation to compel a TMDL would result in one pathway to developing wasteload allocations that would inform the development of WQBELs, traditionally the primary driver for water quality trading. However, even if the litigation does not compel development of a TMDL, Ecology has other pathways under the Clean Water Act to develop WQBELs.

Unresolved factor: funding. Water quality trading program elements require resources for planning, development, implementation, evaluation, and continuous improvement. In addition, many WWTPs will likely need to upgrade their facilities to meet permit limits. The Washington

[9] Secondary Treatment Regulation at Code of Federal Regulations, Title 40, Part 133

State Legislature provided $9 million to help permittees offset the cost of complying with the requirements in the first PSNGP cycle. It is currently unknown what level of additional funding, if any, will be dedicated to helping WWTPs comply with the PSNGP. WWTPs traditionally receive funding through the Clean Water State Revolving Fund for necessary upgrades, and it may be possible to establish priorities or incentivizes to direct these grants and loans in a way that can supplement efforts, including water quality trading, to facilitate nutrient reductions as soon as possible.

The potential ripple effects of funding on water quality trading are presented below.

- Funding influences a facility's ability to upgrade to meet permit limits. Facilities that have funding to upgrade to achieve their permit limits may have the ability to achieve additional reductions to generate credits. Facilities that don't have funding to upgrade to achieve their permit limits may need to purchase credits to comply with their permit limit (i.e., credit demand).
- The magnitude of credit supply and demand will determine the size of the market and the level of water quality trading program infrastructure needed to support trading activity. When sufficient funding is available to support all necessary upgrades, there is no need for a water quality trading market.

Unresolved factor: tribal and stakeholder perceptions. Tribes' and stakeholders' perceptions of and attitudes toward water quality trading can affect whether permittees participate in trading activities—even if the economics of trading makes sense. Meaningfully engaging with tribes and stakeholders can reveal their perceptions and attitudes toward trading and make them more willing to support or participate in the program.

The potential ripple effects of tribal and stakeholder perceptions on water quality trading are presented below.

- This factor will likely never be fully certain, but through stakeholder engagement activities, Ecology can gauge the level of support and buy-in for water quality trading as an approach to permit compliance and nitrogen reduction. Once Ecology understands the level of support and willingness to participate, Ecology can adjust credit supply and demand estimates and plan water quality trading program infrastructure accordingly.
- If tribal and stakeholder perceptions and attitudes indicate an initial reluctance to support or participate in a water quality trading program, this may translate to a small water quality trading market. Ecology may choose to implement additional stakeholder or tribal engagement activities to help address less-than-favorable perceptions of and attitudes toward trading.
- If engagement successfully improves perceptions of and attitudes toward trading, stakeholders may be more willing to participate in water quality trading activities. This will affect the actual credit supply and demand for the water quality trading market, as opposed to the hypothetical credit supply and demand estimated in a feasibility analysis. While the feasibility analysis can help Ecology gauge the potential size of the market, willingness to participate in the market will dictate the actual size of the market

and the true water quality trading program infrastructure needs. A robust market with many participants may support trading through an association or credit exchange.

Table 3 summarizes the water quality trading program ripple effects associated with the unresolved factors and provides recommended steps for Ecology to consider when each factor is resolved in the future.

Table 3. Summary of trading program unresolved factors and potential ripple effects, including affected program elements, and associated recommended actions

Unresolved factor	**Affected water quality trading elements**	**Steps to take when factor is resolved/certain**
Salish Sea Modeling	• Permit limits (driver for trading) • Trading boundaries/geographic scope • Trade ratios • Potential credit supply and demand • Size of a trading market • Trading program infrastructure	• Develop permit limits • Propose trading boundary options • Propose trade ratios • Conduct a market feasibility analysis to determine credit supply and demand
Permit limits	• Potential credit supply and demand • Existence of a trading market • Trading program infrastructure	Conduct a market feasibility analysis to determine credit supply and demand
Outstanding litigation	• Permit limits (WQBELs/AKART) • Potential credit supply and demand • Size of a trading market • Trading program infrastructure	Develop permit limits
Funding	• Facility upgrades to meet or exceed permit limits • Potential credit supply and demand • Trading program infrastructure	Conduct a market feasibility analysis to determine credit supply and demand
Tribal and stakeholder perceptions	• Willingness to participate • Actual credit supply and demand • Size of a trading market • Trading program infrastructure	Adjust credit supply and demand estimates and align program infrastructure accordingly

III. Water Quality Trading Program Structure: Options and Recommendations by Element

A. Introduction and assumptions for recommendations

Effective water quality trading program structures reflect the unique characteristics of a watershed. Several evolving factors, including updated Salish Sea and future watershed modeling, final permit limits, funding availability, and litigation, will ultimately influence elements of water quality trading program design. These factors are discussed in section II.C, but exactly how and to what extent they will shape the final design of a trading program for Puget Sound is currently unknown. When real-world decisions alter the suite of assumptions used for this analysis, Ecology will need to revisit the recommendations presented below. Given the uncertainties in several key factors that are likely to affect the structure of the trading program, the PG Team generally recommends an initial trading program that is relatively simple in structure, but flexible to accommodate changes and potentially the need for more specificity as the uncertainties are resolved.

To help define the scope of water quality trading program structure recommendations for this analysis, the PG Team worked with Ecology to establish a set of assumptions. Without these assumptions, and given the uncertainties discussed above, the water quality trading program structure options and recommendations would have been far too extensive and general. **Note that these assumptions were created for use in this research and recommendation effort only; they are not intended to represent any type of actual permitting or programmatic decisions made by Ecology.**

- **Analysis Assumption 1:** Initially, only permittees covered under the PSNGP will be authorized to trade.
- **Analysis Assumption 2:** Initially, only sources with inputs in the Salish Sea Model will be authorized to trade.
- **Analysis Assumption 3:** Each permittee authorized to trade will have facility-specific numeric effluent limitations at the onset of the trading program. Further, it is assumed that trading will be possible based on the established limits (i.e., there will be a demand for credits and it will be possible for some permittees to generate credits).
- **Analysis Assumption 4:** Ecology will need to account for multiple dissolved oxygen impairment locations throughout Puget Sound when developing WQBELs and identifying hotspot locations.
- **Analysis Assumption 5:** There is broad preliminary support for water quality trading such that developing a program is appropriate.

These analysis assumptions define and limit the water quality trading program structure options and recommendations as described below.

Influence of Analysis Assumption 1: Initially, only permittees covered under the PSNGP will be authorized to trade.

This assumption impacts the size of a potential trading market by effectively determining that all trading will occur between marine WWTPs because they are covered under the permit. The PSNGP does not cover several point sources discharging directly to the Puget Sound, including industrial point sources and privately owned or tribal wastewater treatment facilities. If Ecology decides to open trading to these other marine point sources, the current modeling is in place to include them.

Influence of Analysis Assumption 2: Initially, only sources with inputs in the Salish Sea Model will be authorized to trade.

This assumption effectively determines that all trading will occur between sources that are inputs in the Salish Sea Model, also potentially limiting the size of a potential trading market. Initial modeling makes it clear that reductions will be needed from watersheds that flow to Puget Sound. Sources in the watersheds include WWTPs and other point sources, stormwater, and nonpoint sources.[10] A future phase of watershed modeling is planned and will provide the tools necessary to establish nutrient loading limits for these sources. Those limits could be used to establish the necessary trading provisions (e.g., defined baselines for credit sellers, minimum control levels for credit buyers, applicable trade ratios) allowing these sources to be included in a trading program.

Influence of Analysis Assumption 3: Each permittee authorized to trade will have numeric effluent limitations at the onset of the trading program and there will be credit buyers and credit sellers among existing permittees based on the established limits.

This analysis assumption directly influences recommendations related to eligibility for participation, trading boundaries and partners, and managing risks through trade ratios. The assumption that the effluent limitations will be set at levels that support a trading market is fundamental. This analysis does not make assumptions about how Ecology will approach establishing numeric effluent limits, what they will be based on, or ultimately what they will be. Further, this analysis does not suggest that the establishment of effluent limitations should be influenced by any considerations for ensuring markets for water quality trading.

Influence of Analysis Assumption 4: Ecology will need to account for multiple dissolved oxygen impairment locations throughout Puget Sound when developing WQBELs and identifying hotspot locations.

Unlike a riverine system, Puget Sound does not flow from upstream to down and discharge impacts cannot be modeled based on linear assimilation and delivery. In addition, existing data indicate that the sound's estuarine nature contributes not only to multiple areas of dissolved oxygen depletion impacts but also to natural cycles that contribute to these impacts. Ecology plans to model the relationship between reduced nitrogen discharges in individual basins and

[10] Ecology's modeling approach addresses all stormwater and nonpoint sources through the watersheds even if they discharge directly to marine waters.

the improvement in dissolved oxygen impacts in other basins and throughout Puget Sound. Accounting for different areas of influence when identifying and/or approving appropriate trading partnerships and boundaries, particularly during initial trades, will trigger the need for Ecology to closely administer the trading program. This should include either active involvement in approving proposed trades, by limiting trades to partners within basins or sub-basin boundaries, establishing program guidelines that define the required ratios for inter-basin trading, or some combination of these (as opposed to allowing permittees to identify, select and administer trades based only on market factors).

Influence of Analysis Assumption 5: There is broad preliminary support for water quality trading such that developing a program is appropriate.

Inherent in this assumption is a further one: that Ecology will undertake a preliminary stakeholder process and build on existing tribal engagement efforts to educate stakeholders and tribes about the basic concept of water quality trading and get early buy-in on whether to move forward with the development of a program. This assumption does not preclude the need for further tribal and stakeholder involvement to inform and guide water quality trading program development.

The PG Team acknowledges that these five assumptions could apply to the initial phase of trading. As discussed in section II.C, the recommendations in this report are being developed before much of the science, policy, and other key elements that will influence trading in the Puget Sound watershed are settled. Some of these assumptions may, and likely will, change during development of the trading program; however, the team needed to define a set of operating parameters that could reasonably be assumed to reflect the likely landscape for trading at the outset of the program.

B. Recommended program structure

This section summarizes the recommendations discussed in more detail in sections III.C–III.I below. Although the recommendations are discussed somewhat discretely in the context of common trading program elements, it is important to recognize the sequential relationship among the analysis assumptions and the recommendations. The summarized recommendations in this section are presented in an order that reflects that relationship to help illustrate the impact that certain key program structure decisions will have on other program structure decisions. Foundational to these recommendations, however, are the assumptions that:

- Trading is feasible among the Puget Sound permittees.
- There is at least preliminary support for trading.
- There is a need for permit limits to help Ecology and stakeholders understand the potential market.

The PG Team generally recommends a simplified trading program structure at the onset of trading, with additional elements added as Ecology learns more about the various, currently unresolved, factors that will impact the program structure (as described in section II.C). Appendix C summarizes how some of the recommended program elements might evolve based on new information resulting from changes in some of the unresolved factors.

1. Stakeholder involvement

The PG Team recommends, at a minimum, engaging the broadest range of stakeholders in the process of water quality trading design, implementation, and evaluation/adaptive management. For a more robust approach, the PG Team recommends an integrated one involving both broad participation and a more structured water quality trading advisory committee (WQTAC) to provide focused expert input on key decisions. To ensure the most comprehensive approach to stakeholder involvement, the PG Team recommends that Ecology also layer in targeted engagement opportunities, such as meetings with just permittees or just tribal leadership. The PG Team recommends a phased, overarching stakeholder engagement strategy that combines all three options for stakeholder involvement, starting early in the water quality trading development process to ensure maximum buy-in and less potential for litigation.

2. Preliminary eligibility for participation

Consistent with Assumptions 1 and 2, the PG Team recommends limiting eligibility for participation in the initial phase of the trading program to point source–to–point source trading between existing WWTPs covered under the PSNGP. The general permit does not cover point sources in the watersheds draining to Puget Sound or other direct dischargers to Puget Sound including industrial point sources and privately owned, tribally owned, or federally owned wastewater treatment facilities. Once the initial program is established, Ecology could consider expanding eligibility to participate in trading to other point sources and/or to allow point source–to–nonpoint source trading.

The PG Team also recommends allowing new and expanding dischargers to participate in trading as credit buyers to offset their loading.

3. Risks and uncertainty

Consistent with Assumption 4, the PG Team recommends that risk and uncertainty be managed using both facility-specific delivery ratios and basin-specific trading boundaries based on existing and planned modeling. However, if trading commences before these relationships are well-defined, the PG Team recommends establishing relatively conservative delivery ratios that hopefully could be reduced, expanding potential trading markets, when model results are available to refine the ratios. Finally, Ecology may want to use reserve and/or retirement ratios in Puget Sound basins needing greater water quality improvements (e.g., the South Sound and Whidbey Basin) and to provide additional assurances that water quality benefits will be achieved.

4. Trading boundaries and partners

The PG Team recommends that Ecology establish trading boundaries that align with modeled basins, and either allow trading only within each basin (intra-basin trading) or allow trading between certain basins (inter-basin trading) if supported by modeling. The PG Team also recommends that Ecology use trading boundaries in conjunction with trade ratios and other trading restrictions to prevent creation of hotspots. Accounting for regions of influence when approving appropriate trading partnerships and boundaries, particularly during initial trades, will trigger the need for Ecology to closely administer the trading program, either through

direct review and approval of proposed trades, or by establishing rules and/or trading boundaries that define subgroups of potential trading partners (as opposed to allowing permittees to identify, select and administer trades based only on market factors).

5. Managing credit transactions

Several potential limitations on the size of the trading market at the onset of the program (e.g., only intra-basin trading, restrictive permit limits limiting credit supply) suggest the initial trading market could be relatively small. The potential size of the trading market directly influences the options and recommendations for managing credit transactions.

The PG Team recommends that, during initial program implementation, Ecology allow bilateral "one-off" trades. A more complex structure for managing transactions is likely not necessary at the outset of trading because the number of potential trading partners is expected to be relatively small, given the associated recommendations for eligibility, trading boundaries, and trade ratios. Ecology could consider providing supporting documentation to help potential trading partners, such as example trade agreement language. The PG Team further recommends that Ecology not play a role in the financial transactions between partners.

If interest in trading expands over time and market feasibility is confirmed, the PG Team recommends exploring the concept of a discharger-led association or credit exchange. This structure may be beneficial if trading activity appears to increase over time and dischargers demonstrate an interest in continuing with trading activities but feel a burden doing so without more assistance. Ecology could help connect dischargers with other states' discharger association groups to help Puget Sound learn what is involved in establishing operating a trading association. In addition, the state could possibly provide seed funding to help permittees covered under the PSNGP establish a formal credit exchange.

6. Compliance and enforcement

The PG Team recommends either 1) assessing compliance by comparing DMR data to established permit limits, with a defined procedure for alternative compliance determination for credit buyers, or 2) establishing a process to calculate variable permit limits based on executed trades where DMR data are compared to the adjusted limits to determine compliance. The two options are functionally equivalent and likely represent no appreciable difference in the level of effort for compliance determinations. The first option may be more desirable in a market where permittees are likely to trade with multiple partners because it would not require multiple adjustments to the permit limits. A market feasibility analysis could help Ecology determine the appropriate route for reviewing compliance. Otherwise, Ecology could choose either according to its preference and input from permittees and other stakeholders.

7. Credit certification and tracking

Initially, the PG Team recommends that Ecology verify credit generation based on comparison of effluent monitoring results in DMRs and/or annual reports before credit transactions occur. Ecology will need to develop a database to track and verify credits and exchanges. The PG Team recommends that Ecology dedicate funding to set up the database at the outset of the

program, consider ways to integrate or pull data from existing databases and systems to the extent feasible, and consider adapting systems developed by other state trading programs.

If, later in the evolution of the trading program, Ecology allows partners to organize under a discharger-led association, that group could administer the credit certification and tracking process. In that event, the PG Team recommends Ecology clearly specify the credit tracking and verification rules and periodically review or audit the association's tracking and verification processes to ensure consistency with the trading program requirements.

C. Stakeholder and tribal involvement

Stakeholder and Washington State tribes engagement in the development of a water quality trading program is essential to ensure trust and buy-in. The approach for engaging stakeholders and tribes can vary, but should reflect the goals of the engagement process and the degree to which stakeholders and tribes have the opportunity to influence the design of water quality trading program elements. The overarching recommendation for Ecology is to start the engagement process early and continue throughout the program development process. The approach for stakeholder engagement may vary by stakeholder type, as well as phase of program development, with initial engagement opportunities intended to gauge the level of interest and range of perceptions about water quality trading and subsequent engagement focused on in-depth considerations related to specific program design elements.

Note: Ecology has acknowledged that tribes should be included in the general stakeholder process. Therefore, we opted to include tribes in the discussion of stakeholders. However, there is also precedence and benefits to engagement and government–to–government consultation with tribes outside of the typical stakeholder process. For this reason, Ecology elected to draft their own separate recommendations for a tribal engagement and consultation process. Ecology's recommendations can be found in their report to the Washington State Legislature (See Related Information).

1. Options

A. Option: state-led open stakeholder process

An open stakeholder process allows any interested person to participate in engagement opportunities related to water quality trading at any point in the process. This approach has benefits and challenges. In terms of benefits, it provides the broadest form of engagement. Challenges could include the need to bring newly participating stakeholders and tribes up to speed on the basics of water quality trading and decision points if they are joining midway through the process. However, this challenge could be addressed through well-designed outreach materials that stakeholders and tribes could review before participating in an engagement opportunity, or through a pre-meeting that offers foundational information to newly participating stakeholders and tribes before they participate in the main engagement event. This type of approach is most useful in the early phase of the water quality trading development process because it would give Ecology staff an opportunity to hear initial perspectives on water quality trading from a broad range of stakeholders and tribes.

In Minnesota, the Minnesota Pollution Control Agency (MPCA) used a broad state-led public engagement process to address water quality trading concerns. MPCA provided extensive outreach and stakeholder engagement while writing the general permit to address significant public concern that trading would not protect water quality. MPCA held many public meetings and responded to public comments and questions received during the permit development stage.

B. Option: state-led water quality trading advisory committee process

A WQTAC process is a more structured stakeholder engagement approach with a limited number of individuals representing a cross-section of key stakeholders (e.g., permittees, environmental advocacy groups, rate payers) and tribes. The WQTAC serves as a consultative group to the state agency, providing input on specific water quality trading program decisions. To assemble the WQTAC, the state agency usually invites key organizations and agencies to designate one or two representatives each to participate in regular meetings throughout the entire process. The WQTAC members as a whole provide interdisciplinary expertise as well as representative input and perspectives. Based on their expertise, they often have assignments to review and comment on documents related to the water quality trading program and share their input during WQTAC meetings with the full group. The benefit of this approach is a dedicated, representative body of stakeholders with technical knowledge to contribute to the water quality trading program decision-making using a structured process with cumulative group understanding. The potential challenges could include other stakeholders perceiving the process as having limited inclusivity and the final decisions not having broad stakeholder support.

The Maryland Department of the Environment (MDE) engaged a 32-member WQTAC when developing Maryland's water quality trading program (Alliance for the Chesapeake Bay 2016). The WQTAC members represented regulated community, local governments, federal and state government agencies, the Maryland General Assembly, the academic and technical community, agriculture, business, and the environmental community. Maryland's WQTAC provided input on topics such as on the draft water quality trading manual and draft legislation. WQTAC meetings were always open to the public and the agendas allowed for public comment. According to MDE, the WQTAC approach resulted in a high level of support for the water quality trading program.

C. Option: state-led specific interest group process

This approach focuses on engagement opportunities tailored to specific types of interests (e.g., environmental advocacy groups, permittees, community rate payers, and tribes. The state agency plans and hosts engagement opportunities for specific groups, at which those groups share input on water quality trading topics. The benefit of this approach is that participating groups have the opportunity to raise the issues that are most important to them based on their role and unique perspectives. The challenges associated with this approach may include the desire of other specific groups to engage with each other in the process rather than have siloed engagement opportunities.

In Minnesota, discharger and environmental groups were instrumental in the development of the general permit and the trading program. Pennsylvania's program was developed with substantial input from stakeholders, including dischargers. Virginia's nutrient credit trading program was heavily influenced by the interests of wastewater dischargers in Virginia's portion of the Chesapeake Bay watershed via Virginia's Association of Municipal Wastewater Agencies.

2. Considerations and recommendations

First, it is important to note that this program element discussion uses "stakeholders" to refer broadly to persons, communities, businesses, organizations, governments, and other entities that could be affected positively or negatively by development and implementation of a water quality trading program. For Ecology, this includes communities, various state and federal agencies, permittees, other nutrient dischargers to Puget Sound and its watershed, environmental organizations, academic and research institutions, private citizens, and other water users. The engagement concepts and recommendations discussed throughout this report apply to all types of stakeholders but could be conducted separately for different groups.

The PG Team recommends implementing, at a minimum, Option A to engage the broadest range of stakeholders and tribes in the water quality trading design, implementation, and evaluation/adaptive management process over time. For a more robust engagement approach, the PG Team recommends an integrated approach involving Option A and Option B. To ensure the most comprehensive approach to engagement, the PG Team recommends that Ecology combine all three options for engagement in the development of a water quality trading program as part of a phased, overarching engagement strategy.

The PG Team recommends that—in the early phase of water quality trading program development, before any program design decisions are made—Ecology plan and implement an open engagement process as described under Option A. This approach seeks to involve the broadest range of stakeholders and tribes to obtain the greatest range of perspectives on water quality trading. Ecology could use this broad input to gauge key areas of support and concern, as well as identify individuals and organizations with an interest in playing a more substantive role in developing the water quality trading program.

Once it is in a position to get input on technical water quality trading program design decisions, Ecology should consider designing and implementing a more formal WQTAC approach as described under Option B. A WQTAC could review and offer technical expertise on key decisions related to risk mitigation (e.g., trade ratios), role and responsibilities of a discharger-led association, guidance document development, regulatory language, and other policies and protocols. The WQTAC should remain open to the public and allow for public comment at every meeting. In addition, the WQTAC should send representatives to broader public engagement opportunities to share their deliberative process with the broader general public.

Specific interest groups and tribes, as described under Option C, may be necessary as part of an overarching stakeholder engagement strategy to give a specific group (e.g., permittees, environmental advocacy groups) the opportunity to share their collective thoughts on a water quality trading program issue that directly affects their interests or responsibilities under the

trading program. Ecology could then share the input from specific-group engagements with the WQTAC as deliberations continue on a particular water quality trading issue.

D. Preliminary eligibility for participation

1. Options

The options presented in this section are not mutually exclusive. The PG Team assumes Ecology will implement Option A based on the foundational assumptions for this report. Ecology may choose to also implement Option B.

A. Option: Include all existing WWTPs covered under the PSNGP as eligible trading participants

To be eligible as a credit seller, a facility must be capable of nitrogen reductions beyond their baseline (i.e., the most stringent of the applicable TBEL, WQBEL, or other limits established in its permit).

To be eligible to participate as a credit buyer, the facility must be capable of achieving its applicable minimum control level, but incapable of reducing nitrogen to comply with a more stringent permit limit.

With respect to point source–to–point source trading, the general permits for nutrients issued by Connecticut (Long Island Sound), Minnesota (Minnesota River Basin), North Carolina (Neuse River, Tar-Pamlico, and Jordan Lake), and Virginia (Chesapeake Bay) restrict eligible point source trading partners to those point sources authorized under the general permit.

The point source credit buyer and seller eligibility criteria above are based on the general principles for point source–to–point source trading described in EPA's *Water Quality Trading Toolkit* and *Water Quality Trading Policy* (e.g., a credit seller must reduce its discharge below its most stringent effluent limitation, a credit buyer must meet its applicable minimum control level before it may buy credits to meet a permit limit, buyers may not purchase credits to comply with a federally-defined TBEL) and are consistent with the eligibility criteria for point source–to–point source trading in the trading programs reviewed.

B. Option: Include new dischargers as credit buyers

In this option, new and expanding dischargers could be eligible to participate as credit buyers—i.e., they could purchase credits to offset their loading, but could not participate as credit sellers. In addition to fully offsetting their discharged nutrient load, any new or expanding dischargers would also have to comply with Washington's antidegradation regulations (Washington Administrative Code [WAC] 173-201A Part III).

Maryland's trading program, Minnesota's general permit, and Virginia's general permit allow new and expanding facilities to purchase credits or offsets to offset their discharges. For these programs, allowing new and expanding facilities to purchase credits or offsets offers flexibility to accommodate growth in the watershed without contributing to existing impairments.

2. Considerations and recommendations

For the initial phase of the trading program, the PG Team recommends limiting eligibility for participation in the trading program to existing WWTPs covered under the PSNGP (Option A). This option will be simpler for Ecology to administer, since all participants will be under Ecology's jurisdiction and subject to the same or similar permit requirements. This option is also supported by the state of the current science, which is limited to evaluation of discharges to Washington Waters of the Salish Sea and excludes discharges in the watershed draining to Puget Sound.

Additionally, the PG Team recommends allowing new and expanding dischargers to participate in trading as credit buyers (Option B). Control of nutrient discharges to Puget Sound will become increasingly challenging due to population growth in the area and corresponding increases in nutrient loading to WWTPs. As stated in the PSNGP fact sheet, "Ecology cannot allow a new discharge to a listed waterbody (issuance of permit is prohibited) if the discharge will cause or contribute to a violation of water quality standards. Ecology may allow a new discharge if it meets the applicable water quality criteria." As noted above, new and expanding discharges are also subject to Washington's antidegradation requirements. WAC 173-201A-450 authorizes the use of water quality offsets for new or expanded discharges to comply with load allocations. Unless reserve capacity is included in the modeling of Puget Sound's loading capacity, the PG Team assumes that new and existing discharges can only be allowed if they offset 100 percent of the increased nutrient load. Allowing new and expanding facilities to participate in trading through the purchase of water quality credits to offset their loading could be a helpful tool for communities to accommodate growth while still ensuring attainment of water quality standards. However, this will only be feasible during the onset of trading if existing permittees have the capacity to generate sufficient credits to offset new discharges, which will be influenced primarily by the limits that are established. If the credit supply will not support offsets for new dischargers, this element could be considered later if the program is expanded to include new potential credit generators (e.g., other marine point source nutrient dischargers or watershed nutrient sources).

Once the initial trading program is established, Ecology could consider expanding eligibility to participate in trading to include:

- **Tribally owned and federally owned treatment plants.** This would require coordination with EPA Region 10, the NPDES permitting authority for tribes and federal facilities in Washington, to ensure appropriate trading requirements are included in their NPDES permits and to better understand the existing and planned nutrient requirements for EPA-issued permits. Results from the Year 2 optimization scenarios, or future modeling, for the Salish Sea Model could support inclusion of tribally and federally owned WWTPs.
- **Industrial dischargers and privately owned treatment works with significant nutrient loads.** This may require modifications to their individual permits to include appropriate trading requirements. Salish Sea Model Year 2 optimization may also support inclusion of industrial discharges and privately owned treatment works in a trading program.
- **Municipal separate storm sewer systems (MS4s).** In Maryland, most point source–to–point source trading occurs between WWTPs (sellers) and MS4s (buyers). In Wisconsin,

some WWTPs are considering installation of advanced treatment to generate credits to give to their permitted MS4s. This option could provide flexibility for communities to achieve required nutrient reductions from each of their permitted sources in a more comprehensive manner.

- **Point sources in the watershed draining to Puget Sound.** This would require improved scientific understanding of nutrient loading and impacts in Puget Sound watersheds, expected from ongoing freshwater modeling efforts and/or future watershed total nitrogen TMDL efforts.
- **Nonpoint sources.** Nonpoint sources may be a source of future credits; however, modeling and practical considerations would need to be addressed before the program could be expanded to include them. As discussed, efforts to model the impact of nonpoint source discharges and load reductions throughout the watershed are ongoing. Until those results are available, it is not possible to understand the potential for nonpoint source credit generation or develop appropriate trading ratios to apply to nonpoint source credits. In addition, Ecology should evaluate the freshwater modeling results to understand whether the potential nonpoint source credit supply justifies the additional administrative and transaction costs likely to result from including nonpoint sources. For example, Virginia's Nutrient Credit Exchange allows point source–to–nonpoint source trading, but because permitted WWTPs have been able to generate sufficient credits to meet the demand in Virginia, it has not been necessary to implement the procedures associated with generation and purchase of nonpoint source credits. Trading programs that allow point source–to–nonpoint source trading are typically more complicated to administer and verify compliance for than programs with only point source–to–point source trading. Before allowing nonpoint source trading, Ecology should ensure that credits generated from nonpoint sources would have the desired impact on water quality since modeling suggests that reductions from WWTPs will have the largest impact on water quality and the timing of credit generation from nonpoint sources (e.g., winter) may not correspond to the timing of nutrient impacts (e.g., summer months when longer residence times occur in Puget Sound due to lower watershed inflows). Additional ratios will also need to be applied to nonpoint source reduction to account for uncertainty in nutrient reduction performance.

E. Managing risks and uncertainty

As discussed in section I.A.1, trade ratios are used in water quality trading programs to manage various types of risk and uncertainty regarding the potential impact of a trade on water quality. The terminology used to describe trade ratios can be very program-specific and some programs use the same terms to describe different types of ratios. This report uses the categories and definitions of trade ratios laid out in EPA's *Water Quality Trading Toolkit for Permit Writers* and equates state-specific trade ratios from the research examples to the EPA categories and definitions.

The trade ratios needed to address water quality trading risk/uncertainty inherent in trading among facilities covered under the PSNGP will be driven primarily by facility performance, relative impact on impaired hypoxic zones, and avoidance of hotspots. Since trades will only be

between point sources at the outset of trading, uncertainty ratios to address measurement error and other risks inherit to nonpoint source trading will not be needed. Because point sources will have provided detailed effluent data as well as optimization data detailing performance expectations, Ecology should be able to calculate with certainty the load reduction anticipated at a generating facility; therefore, this report does not include uncertainty ratios as an option for Ecology. However, if future phases of implementation will allow nonpoint sources to participate in trading, the use of an uncertainty factor would be appropriate at that time.

1. Options

A. Option: location ratios

This option entails establishing a ratio for each potential trading partner that describes that facility's relative impact on a downstream receiving water at a specified point of compliance. A location ratio may be based on a facility's specific location, or a uniform ratio may be assigned to all facilities discharging to a specific sub-basin or stream segment. The ratios for two trading partners are combined to calculate the number of credits that must be purchased.

Simplified example:

- A pound of pollutant discharged at facility A has the same water quality impact as discharging half a pound of that pollutant at the compliance point. Location ratio = 2:1.
- A pound of pollutant discharged at facility B has the same water quality impact as discharging a quarter pound of that pollutant at the compliance point. Location ratio = 4:1.
- Facility A wants to purchase credits from facility B. Facility A must purchase 2 pounds of reduction from facility B for every pound of load it needs to offset at end-of-pipe (4:1 ÷ 2:1).

The Connecticut Department of Energy and Environmental Protection (CTDEEP) took this approach in the Nitrogen Credit Exchange Program and General Permit for Nitrogen Discharges to Long Island Sound. Equivalent credits are calculated by multiplying the total nitrogen credit (i.e., the difference between the annual "discharge limit" established in the permit and the annual load discharged) by an assigned equivalency factor that accounts for the geographic location of the WWTP and its impact on dissolved oxygen levels in the hypoxic areas of Long Island Sound (CTDEEP 2018). In general, the equivalency factors are higher for WWTPs closer to the hypoxic areas; for facilities with a relatively high equivalency factor, it may be more economical to undertake nitrogen removal projects than to purchase credits.

Virginia also uses a type of location ratio in its trading program. Though Virginia calls it a delivery factor, its function is to account for each facility's impact on the Chesapeake Bay based on that facility's location in the watershed. Dischargers east of the "fall line" for each river basin (i.e., those closest to the bay) have a delivery factor of 1, while those upstream have lower delivery factors. In general trading is allowed among dischargers within each river basin, but the Virginia Department of Environmental Quality (DEQ) created a split trade area to address a hotspot it had identified in a tidal area of one of the river basins (A. Brockenbrough, personal communication, December 12, 2022).

MDE uses a type of location ratio called an "edge of tide" factor, which is defined as "a numeric adjustment that reflects the rate at which pollutants are reduced through natural processes, such as hydrolysis, oxidation, and biodegradation, and manmade structures, such as dams, on their way through nontidal tributaries to the tidal waters of the Chesapeake Bay or its tidal tributaries." The purpose of the edge of tide factor is "to normalize loads based on delivery to the mainstem of the Chesapeake Bay" (Maryland 2018). Edge of tide factors are not directly applied to trade transactions, but are used to define geographic areas within which facilities may trade.[11]

In North Carolina, transport factors are applied to trading for point source nutrient allocations in the Neuse and Jordan Lake nutrient strategies. Transport factors are applied to credit buyers and sellers and reflect the estimated percent of nutrient loading from a point source discharger that reaches the receiving water of concern. In addition, "as a coarse control on delivery differences," North Carolina law restricts trading to areas defined by 8-digit hydrologic unit codes or smaller, so that point source discharges can be roughly equated with nutrient credits generated in the same area (NCDEQ 2018).

B. Option: delivery ratios

Delivery ratios are trade-specific and are used to account for the distance and hydrologic conditions that affect the water quality impact of discharges from trading partners discharging to the same waterbody of concern. As with location ratios, a facility's delivery ratio may be site-specific, or similar ratios may be assigned to all facilities discharging to a specific sub-basin or stream segment.

The Wisconsin Department of Natural Resources requires calculation of facility-specific trade ratios for each trading partner. The trade ratio includes a delivery factor to account for the distance between the credit generator and the credit user, as well as a downstream factor that accounts for local water quality impacts if the credit user is upstream of the credit generator.

Other programs included in the research do not use delivery ratios but, as described above, combine location ratios with geographic trading restrictions to account for trading partners' locations within the watershed.

C. Supplemental option: mechanisms to address transaction risk or supplement water quality improvements

Some programs establish ratios or other means of ensuring availability of credits or water quality outcomes. Several of the programs included in the research use a reserve ratio or offset fund to provide a source of credits that may be used by a credit buyer if a seller fails to generate the needed credits.

The Pennsylvania Department of Environmental Protection (PADEP), for example, uses a 10 percent credit reserve ratio for point sources. Each credit buyer must purchase 10 percent more credits than needed to meet its permit limits. These excess credits are used to establish a common pool of credits ("credit reserve") that may be used "to address pollutant reduction

[11] https://mdewin64.mde.state.md.us/WSA/Trading/index.html

failures and uncertainty" (PADEP n.d.). Presumably this refers to uncertainty in the water quality outcomes of approved trades based on uncertainty in the models used to calculate load reductions, trade ratios, etc. Similarly, credit buyers in Maryland may qualify to use credits from the MDE reserve pool if a seller does not fulfill its obligation under a trade agreement between the trading partners. The pool is created through application of a 5 percent reserve ratio to credit transactions (MDE 2020).

The Virginia DEQ, on the other hand, has established a Nutrient Offset Fund that serves a similar purpose. If a facility covered under Virginia's nutrient general permit cannot purchase credits from another facility to meet the assigned wasteload allocation, the general permit authorizes the facility to acquire sufficient nitrogen or phosphorus credits through payments made into the Nutrient Offset Fund. Virginia law establishes the Nutrient Offset Fund to be administered by the Virginia DEQ "to acquire nutrient credits or allocations from point or nonpoint sources that achieve equivalent point or nonpoint source reductions in the same tributary beyond those reductions already required by or funded under federal or state law or the Watershed Implementation Plan prepared for the Chesapeake Bay Total Maximum Daily Load…" (Virginia 2017).

Some programs also apply a retirement ratio to water quality trades to speed the rate of water quality improvements in watersheds where trading is allowed. Similar to a reserve ratio, a retirement ratio requires a credit buyer to purchase more credits than needed to meet the buyer's permit limits. The excess credits are then "retired," or removed from the market. None of the programs included in the research apply a retirement ratio specifically, but Maryland's program allows credits purchased through the reserve ratio to be retired to promote water quality improvement (MDE 2020).

North Carolina, on the other hand, does not apply these types of ratios. In its *Nutrient Trading and Joint Compliance Framework*, it cites the economic impact that they can have on trading markets: "…retirement ratios are often used to secure a net water quality benefit for trades. North Carolina's trading framework does not include a retirement ratio, instead being designed to promote cost-efficient trades that are nutrient neutral relative to direct compliance options." However, if a discharger association exceeds the group cap, or "bubble" limit, in its permit, North Carolina requires the association to acquire offset credits for the excess load.

2. Considerations and recommendations

During initial program implementation, Ecology will only allow trading between marine sources (WWTPs that discharge directly into Puget Sound). The Salish Sea and Puget Sound have a complex hydrology; they cannot be treated like a linear, riverine system with distinct "upstream and downstream" dischargers. In addition, there is no single downstream impaired waterbody with a single compliance point. Therefore, the use of a location ratio is not appropriate for a trading program that will involve only marine dischargers. If Ecology's trading program is expanded in the future to include watershed sources, a location ratio likely would be appropriate to account for each discharge's impact on Puget Sound but should be combined with other types of ratios to prevent hotspots in the tributaries with respect to both state and tribal water quality standards.

As discussed in sections III.E and III.F, based on several key assumptions the PG Team recommends that risk and uncertainty be managed using both facility-specific delivery ratios and basin-specific trading boundaries. MPCA's experience implementing trading under the Minnesota River Basin General Phosphorus Permit illustrates how delivery ratios and trading boundaries are interrelated. Permittees within the Minnesota River Basin are allowed to trade with each other and are responsible for finding and proposing trading partners, subject to approval by MPCA. Initially, MPCA established minimum trade ratios (delivery ratios) between dischargers based on location in the watershed and type of facility. However, in 2014 MPCA adopted new river eutrophication standards that allowed them to develop more accurate delivery ratios, highlighted the impact of hotspots on local water quality, and caused the initial trade boundaries to shrink. These changes limited potential trading partner combinations (B. Henningsgaard and M. Graziani, personal communication, December 9, 2022).

Puget Sound has many areas of dissolved oxygen impairment that must be addressed. Natural sources of nutrients and resulting hypoxia must also be accounted for when determining the impacts of buying credits rather than treating the discharge, varying even during certain times of the year. Based on this information, initial delivery ratios should be based on the basin location of each discharge and that basin's estuarine relationship with the hypoxic compliance areas. These relationships likely will also require that trade boundaries be small—likely based on basins—to prevent hotspots.

It is anticipated that the Salish Sea Model and other complementary modeling efforts will be the primary resources for understanding the complex relationships between nutrient discharges and dissolved oxygen levels, and their spatial and temporal distribution across Puget Sound. Currently there is a high level of uncertainty surrounding these relationships; initial modeling results suggest that reductions will be needed at WWTPs across the sound, as well as throughout the watershed, to meet dissolved oxygen standards and that the Main Basin WWTPs have a relatively higher influence across the sound. With ongoing development and optimization, it is anticipated that future modeling efforts will describe the relative impact of nitrogen load reductions within a basin on dissolved oxygen levels in various basins and impaired areas throughout Puget Sound.

Ideally this information would be available before trade ratios are established. Relying on estimated delivery ratios could set up partnerships that will not be long-lasting and may contribute to hotspots, which could undermine the support for trading in the long term.

If trading does commence before these relationships are well-defined, though, the PG Team recommends establishing relatively conservative delivery ratios that hopefully could be reduced, expanding potential trading markets, when model results are available to refine the ratios.

Year 1 (existing) and Year 2 (anticipated) results from the Salish Sea Model can be used to inform 1) where to allow inter-basin trading, and 2) appropriate ratios for trading between basins. Where the model results indicate that nutrient reductions in one basin would achieve water quality improvements/reduced dissolved oxygen impairments in another basin, trading between those basins is appropriate. Other basins would be limited to intra-basin trading.

The Year 2 optimization scenarios will not sub-divide basins to describe impacts of load reductions from a specific facility on other areas within the same basin; therefore, it will not be possible to develop a delivery ratio for intra-basin trades. To account for this uncertainty in the modeling, Ecology may wish to conservatively estimate an intra-basin delivery ratio that is greater than 1:1. If funding and resources are available, Ecology may wish to develop future modeling scenarios that evaluate the impact of individual discharges at a sub-basin level or across basins to permit further refinement of delivery ratios and improve certainty about hotspot avoidance.

Finally, Ecology may want to use reserve and/or retirement ratios in Puget Sound basins needing enhanced water quality improvements (e.g., the Main Basin) and to provide additional assurances that water quality benefits will be achieved.

However, establishing conservative delivery factors and imposing retirement or reserve ratios will restrict trading markets. Increasing trading ratios increases the cost of credits because ratios are directly proportional to the amount of nutrient reductions that must be purchased by credit buyers. In addition, reserve ratios and retirement ratios reduce the number of credits that are available for credit buyers to apply directly to their compliance requirements.

Ecology should make decisions about whether to include these types of ratios pending the results of a market feasibility analysis. If the analysis suggests that credit costs will be a barrier to trading, or that the supply of credits will be limited, the state may want to consider an alternative mechanism for establishing a reserve pool of credits. For example, if a separate funding source were available for watershed projects (in advance of trading for watershed sources) or in-sound offset projects to supplement nutrient reductions achieved under the permit (including through trading), the resulting water quality improvements could be translated into credits available to credit purchasers if their trading partner fails to generate the expected credits needed for compliance. This could aid the trading market by providing greater certainty that credit generation failures will not result in non-compliance for credit buyers or failure to achieve the nutrient reductions needed to protect water quality. Further, the reserve pool could serve to speed water quality improvements if all trade transactions succeed and no dischargers need to purchase from the pool.

F. Trading boundaries and partners

1. Options

A. Option: Inter-basin trading across Puget Sound

Ecology could establish a single trading boundary for the entire Puget Sound and allow all permittees to trade with one another, regardless of the basin in which the credits are generated or purchased (i.e., inter-basin trading).

In Connecticut's Long Island Sound trading program, trading is allowed across the entire watershed, which covers most of the state, but edge-of-sound ratios (a type of equivalency ratio) are applied to account for the location of the discharge and its impact on dissolved oxygen levels in the sound. Similarly, North Carolina's general permits for the Neuse River and

Tar-Pamlico River basins allow trading among all dischargers within each basin. Individual limits are expressed as delivered loads to account for location and impact on the estuary.

B. Option: Intra-basin trading only

Alternatively, Ecology could establish multiple trading boundaries based on modeled basins and only allow trading between discharges within the same basin (i.e., intra-basin trading).

Maryland's Chesapeake Bay trading program initially established three trading regions that correspond to the three major watersheds that drain to the Chesapeake Bay. Later program updates further subdivided the trading regions based on "segmentsheds" established in the Chesapeake Bay Watershed Model (MDE 2020). Dischargers may only buy credits within the trading region where they were generated. MDE developed a map of purchasing regions,[12] corresponding to segments of each watershed, to help MS4s locate eligible regions from which to purchase credits.

C. Option: Intra-basin trading informed by modeling

This is a combination of Options A and B wherein Ecology could establish multiple trading boundaries based on modeled basins and allow trading between permittees within different basins based on modeled relationships between basins and predicted dissolved oxygen improvements.

Virginia's Chesapeake Bay trading program generally specifies that credits may only be purchased from the same tributary from which they were generated. However, permittees in the Eastern Shore Basin may purchase credits from the Potomac tributary at a trade ratio of 1:1 or the Rappahannock tributary at a trade ratio of 1.3:1. The Virginia DEQ allowed inter-basin trading in the Eastern Shore Basin because the market was small and eligible sources did not provide adequate credit supply and demand. Pennsylvania allows trading between dischargers in its two major watersheds that are tributary to the Chesapeake Bay, the Susquehanna and Potomac River Basins, subject to applicable trade ratios, but requires an additional 5 percent credit purchase to address uncertainties when trading between basins.

2. Considerations and recommendations

Trading in Puget Sound is unique among estuarine trading programs with respect to selection of appropriate trading boundaries because initial trading will be limited to discharges to the sound itself and will not include sources in the contributing watersheds. Nevertheless, the other programs offer relatable information about the considerations for selecting appropriate geographic boundaries for trading.

As noted in the key assumptions, there are multiple dissolved oxygen impairment locations throughout Puget Sound that Ecology must account for when developing WQBELs and an associated water quality trading program. This complexity makes it unlikely that technically based trade ratios can be developed to account for all of the risk and uncertainty associated

[12] https://mdewin64.mde.state.md.us/WSA/Trading/index.html

with all trading partner combinations in the entire Puget Sound and ensure water quality improvements. Therefore, the PG Team does not recommend Option A.

The PG Team instead recommends that Ecology establish trading boundaries that align with modeled basins (Option B or C).

Allowing trading only within each basin (Option B) would severely limit the supply and demand of credits available to potential trading partners; it could even preclude trading in certain basins due to the number of permittees (Table 4 and Figure 2).

Table 4. Number of potential trading partners (number of permittees) per basin

Basin	Potential partners
Admiralty Inlet	1
Whidbey Basin	12
Main Basin	22
South Sound	8
Hood Canal	0
Northern Bays	3
Strait of Juan de Fuca	6
Strait of Georgia	6

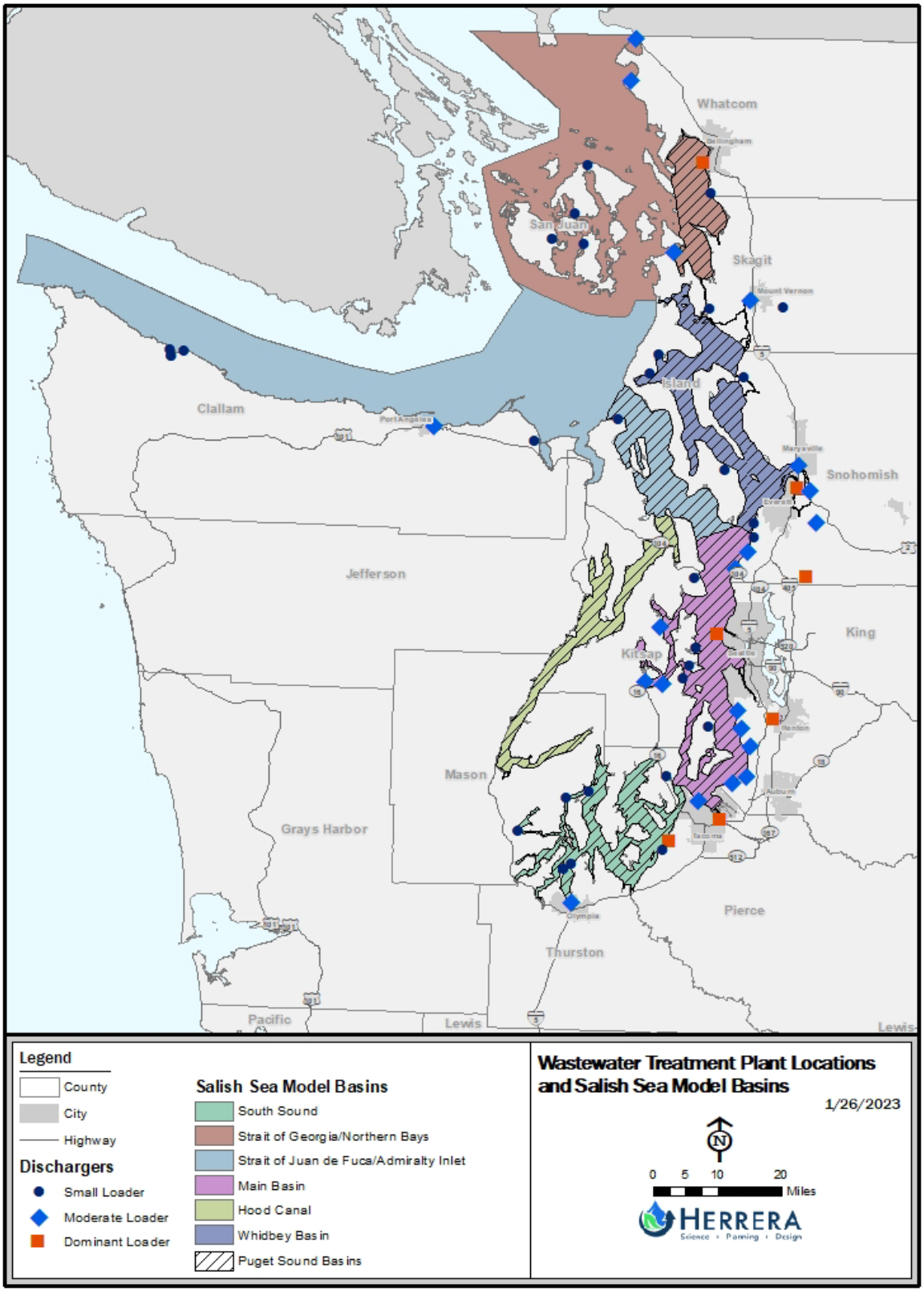

Figure 2. Distribution of PSNGP permittees throughout Puget Sound basins

Existing modeling suggests that discharges in one basin can affect the water quality in other basins as a result of the circulation patterns in Puget Sound, and that discharges to the Main Basin appear to have far-ranging impacts across the other basins in the sound. In addition, certain basins have initially been identified as more impacted by low dissolved oxygen than others. Therefore, the PG Team recommends that Ecology allow trading between certain basins (Option C). However, a more thorough understanding of the relationship between loading and impacts to water quality between basins is necessary to determine where it is appropriate to allow inter-basin trading. For example, the South Sound experiences low dissolved oxygen and eutrophication impacts more frequently than the adjacent Main Basin. Therefore, allowing trading only between specified basins could allow greater reductions (credit generation) in basins in need of the most reductions, and could allow permittees to comply via credit purchases for buyers in less impacted areas. Trading between basins, versus within basins, has a higher likelihood of creating hotspots; therefore, Ecology should use trade ratios and other trading restrictions to prevent them.

Based on the research, Ecology should delineate the basin-specific boundaries for trading based on the latest scientific understanding of nutrient loading and impacts in Puget Sound, including the relationship of nutrient loading and impacts between the five basins of Puget Sound proper (Admiralty Inlet, Whidbey Basin, Main Basin, South Sound, and Hood Canal), the Northern Bays (Bellingham, Samish, and Padilla Bays), the Strait of Juan de Fuca, and Strait of Georgia (Option C).

Whichever option is chosen, the PG Team anticipates that Ecology will need to closely administer the selection of trading partners during the initial phase of trading. This could take the form of pre-trading program development, with Ecology establishing specific trade restrictions, including trade ratios (see discussion in section III.E) and/or trading boundaries as discussed above to ensure selection of trading partners will achieve the desired water quality outcomes. Ecology administration of trading partners also could occur during program implementation through review and approval of individual trades proposed by permittees. If future modeling scenarios enable Ecology to evaluate the impact of individual discharges at a sub-basin level or across basins, Ecology could then identify allowable trading partners or use the information to inform approval of proposed trades to improve hotspot prevention.

G. Managing credit transactions

There are a variety of approaches for nutrient credit transactions between buyers and sellers in the water quality trading market. Several factors influence which approach makes the most sense for a particular water quality trading program: the number of potential buyers and sellers, the potential number of trades, the ability of buyers and sellers to meet all trading requirements, and the ability of a state agency to support transactions. Understanding how these factors interact in a particular watershed will help to inform the most appropriate option for managing credit transactions.

1. Options

A. Option: point source–to–point source bilateral trades

Bilateral trades are credit transactions negotiated between the buyer and the seller with no involvement from the state agency in the negotiation process. This means that the agency does not directly help point sources find credit sellers or facilitate discussions about credit quantities and pricing. The state agency may provide model trade agreement documents for buyers and sellers, or it may provide an online registry of available credits, but the interaction to reach an agreement happens without state agency involvement. The state agency's primary role in this type of credit transaction is typically credit verification (i.e., confirming credit generation and calculation).

In Pennsylvania, PADEP's main responsibilities in administering the trading program include permitting, tracking and verifying credits, and generating reports to document trades. The dischargers are responsible for trading individually among one another and the market determines the price of credits.

In Minnesota, permittees within the Minnesota River Basin are allowed to trade with each other and are responsible for finding and proposing trading partners. MPCA has to approve trading partners, but does not oversee the trades and is not involved with setting the price of credits or recording financial information. For bilateral trades, permittees are required to submit a "Legal Contract to Trade" form to MPCA for review and approval.

B. Option: discharger-led association/credit exchange

A discharger-led association or credit exchange is a self-organized group of point sources with formalized bylaws to facilitate credit transactions among members. In addition, the association can conduct compliance-related functions on behalf of the members, alleviating individual permittees of the need to individually meet these requirements. The activities of the discharger-led association or credit exchange occur without state oversight or the need to modify the permits of participating permittees. The state may sometimes provide funding or other assistance to help establish the association, recognizing that the association will produce efficiencies for the state agency in the long term. For example, the association may provide a single compliance report for 50 permittees, allowing the state to review one compliance report versus 50 individual reports.

In North Carolina, this approach is referred to as joint compliance. This approach allows a group of regulated entities within the same basin to form an association with bylaws governing internal contractual trading (NCDEQ 2019). Compliance is demonstrated through a "bubble" limit given to the association; members may purchase, lease, or sell allocations (credits) from other members of the association without the need for state agency oversight or permit modifications (NCDEQ 2019).

Virginia's Nutrient Credit Exchange Association plays a significant role in coordinating credit transactions and compliance planning for most of the regulated point source dischargers in Virginia's five Chesapeake Bay river basins. The concept of the Exchange was discharger-driven; they advocated for this approach to the state legislature. The Exchange serves as a credit

clearinghouse and conducts compliance planning and other functions on behalf of its member regulated point source dischargers, about 105 facilities with 73 owners (EPA 2021). The Exchange is a non-stock corporation authorized through regulation to create bylaws, develop processes for trading, and establish credit pricing. It is responsible for tracking the credit transactions, including the entities trading, number of trades, amounts traded, and other associated information. The Exchange compiles one annual compliance plan on behalf of its regulated members and submits the plan to the Virginia DEQ for review and approval each year (Virginia Nutrient Credit Exchange Association 2022). Note that bilateral trading (discussed under Option A) outside the Exchange is authorized. However, the Exchange offers credit purchasers more consistency and stability due to the type of credits offered through a class structure. The Class A credits require firm commitments over a specified timeframe for dischargers choosing to participate as Class A buyers or Class A sellers. The Exchange establishes a separate and more flexible market for Class B credits intended to help dischargers maintain compliance during unanticipated circumstances. The Virginia DEQ provided seed funding to establish the Exchange. With this funding, the Exchange organized its membership, hired an engineer and a lawyer, and developed bylaws and procedures. After the initial two-year period that was funded by the Virginia DEQ, the Exchange operated on its own based on revenue generated through membership dues.

C. Option: state-administered credit exchange

A state-administered credit exchange is similar in concept to Option B in that a group of permittees collectively exchange credits to achieve compliance, but in this case, the state agency establishes and administers the exchange. This includes creating and overseeing implementation of the bylaws governing the function of the exchange, the pricing structure, and the processes for credit transactions.

Connecticut's Nitrogen Credit Exchange Program for Long Island Sound is an example of a state-administered credit exchange. The CTDEEP worked in conjunction with the state-legislated Nutrient Credit Advisory Board to create the Long Island Sound Nitrogen Credit Exchange Program. All WWTPs covered under the Long Island Sound general permit for nitrogen discharges participate in the exchange as a condition of the permit. If a WWTP cannot comply with its discharge limit, it must purchase state-owned equivalent total nitrogen credits through the Nitrogen Credit Exchange Program to comply with the effluent limitation. Credit prices through the exchange are legislated, and the program framework creates the supply of, and demand for, credits. Initially, the state subsidized the credit exchange program by paying sellers for all credits generated, regardless of demand. As more WWTPs upgraded their treatment systems, the supply of credits increased and the demand decreased over time (in general, with the exception of several cold, wet years that affected treatment efficiencies). Eventually it became unsustainable for the state to purchase all credits generated at the legislated price. Now, CTDEEP invoices WWTPs that do not meet their discharge limits for the purchase of credits at the legislated price. The state then distributes those funds proportionally among the WWTPs that generate credits. CTDEEP attributes the success of this state-administered, non-voluntary credit exchange to intensive stakeholder engagement before and throughout the TMDL development process and extending through establishment of the nutrient credit exchange.

2. Considerations and recommendations

As stated above, several factors influence which transaction approach makes the most sense for a particular water quality trading program: the number of potential buyers and sellers, the potential number of trades, the ability of buyers and sellers to meet all trading requirements, and the ability of a state agency to support transactions. Ecology currently does not have the capacity to manage credit transactions due to staffing capacity and primary program responsibilities. As a result, the state-administered credit exchange (Option C) is not realistic for Ecology to consider.

The remaining factors related to the number of buyers and sellers and transactions, as well as the ability of buyers and sellers to individually meet their trading requirements, is not known or assumed through this report. Therefore, the PG Team recommends that Ecology consider starting with bilateral trades (Option A) and providing some of the documents that potential trading partners might need (e.g., example trade agreement language) to facilitate trade negotiations. As water quality trading activities expand in number, Ecology could consider working with permittees under the PSNGP to discuss the possibility of a discharger-led association and credit exchange (Option B). Ecology may want to consider using an approach similar to that used in Virginia: offer seed funding to permittees to establish an exchange. It is unlikely that Ecology would lead the effort to create an exchange for the same reasons that Option C is not an ideal approach for managing credit transactions (i.e., limited staff capacity to add new responsibilities related to trading program administration). (And, according to the Virginia DEQ, the success of the Exchange is rooted in the fact that dischargers led the development process.) However, the investment of funds to the development of a discharger-led exchange is an investment in creating efficiencies for future trading oversight activities (e.g., report reviews).

H. Effluent limitations compliance evaluation

Water quality trading is considered an alternate compliance mechanism to meet permit limits and Ecology will need to enforce those permit limits just as if they were being met at end-of-pipe through treatment alone. However, because trading allows some permittees to exceed their established permit limits at end-of-pipe, it will be necessary for Ecology to establish a procedure for evaluating compliance with effluent limitations for permittees who participate in trading.

1. Options

A. Option: assess compliance using established permit limits

In this option, both credit buyers and sellers are responsible for complying with the effluent limitations that are established in the permit, but an alternative compliance evaluation mechanism for credit buyers is articulated in the permit.

Credit sellers must achieve nitrogen reductions beyond their baseline requirement (i.e., the most stringent effluent limitation) to generate credits, and the established credit certification and tracking process (see section III.I) will prevent a permittee from selling more credits than they generate. To the extent that a seller has agreed, but fails, to generate a certain amount of

credits pursuant to a trading agreement with one or more buyers, the seller is subject to the remedies established in the trading agreement, but is only out of compliance with their permit if they fail to meet their permit limit or other permit requirements. Therefore, the traditional means of evaluating compliance using DMR data is sufficient for credit sellers under this option.

However, simply comparing discharge monitoring data to a credit buyer's permit limit will be insufficient to determine compliance. When a point source discharger participates in trading as a credit buyer, that discharger's effluent at the end-of-pipe will exceed the permit limit. Therefore, the permit would need to specify that the permit limit could be met through a combination of treatment to meet at least the minimum control level and the purchase of credits, subject to conditions that would be laid out in the permit. For credit buyers, the general permit would establish requirements for the information and level of detail that must be included in a trade agreement with the seller(s) (or facilitated through a trade association). The permit would also identify the associated reporting requirements, for example, identification of the trading partner(s) and their location(s), the amount of credits purchased, and the trade ratios applied. In addition, the NPDES permit would describe how compliance with the permit limit would be determined based on the DMRs and trade-specific reporting; essentially the state would look at the DMR data in conjunction with the information on credits purchased to ensure that the credit buyer has met the conditions for trading established in the permit. The credit buyer then would be responsible for compliance with their permit limit pursuant to the compliance determination procedures specified in the permit.

Under this option, if a seller fails to generate credits under the agreement and the buyer is unable to find an alternative source of credits, assuming the seller still meets its permit limit, only the credit buyer is out of compliance with the NPDES permit. The credit seller would only be subject to the remedies specified in the trade agreement established with the buyer. The state would not be involved in setting or enforcing the terms of that agreement.

PADEP issues NPDES permits to WWTPs that include cap loads based on wasteload allocations in the Chesapeake Bay TMDL. These are essentially WQBELs that have been translated into loading limits for total nitrogen and total phosphorus. PADEP requires dischargers to submit information on credit transactions that the state uses in combination with DMRs to determine compliance. This is accomplished through an annual cycle in which dischargers must submit electronic DMRs by September 30 of each year. The dischargers then have a two-month "truing period" during which they find trading partners, calculate credits, trade credits generated during the compliance year, and submit information to PADEP for review and certification. At the end of the truing period, PADEP uses the information from each discharger's monitoring report in combination with the information on credits purchased to determine whether each facility complied with its WQBEL.

B. Option: establish a process to calculate variable permit limits based on executed trades

For this option, the permit would include the established permit limits, along with procedures for adjusting the limits for permittees that participate in water quality trading. The permit would specify the conditions for trading, including minimum control levels and other requirements. Permittees that do not participate in trading would simply be held to the

established permit limits. However, those that do trade would be required to calculate adjusted permit limits, in accordance with the procedures specified in the permit, and submit the adjusted permit limits and supporting information to Ecology. Compliance would be determined by comparing the permittees' DMR data to the adjusted permit limits. In this case, both credit buyers and sellers would be required to calculate the adjusted permit limits to support tracking and verification.

MPCA uses this approach in the Minnesota River Basin General Phosphorus Permit.[13] The permit specifies that dischargers may comply with their phosphorus limits either by meeting the limit end-of-pipe or by complying with an adjusted phosphorus limit for permittees that participate in trading. The permit conditions supporting this approach require permittees to complete and submit a "Legal Contract to Trade" form[14] that includes information about the trade for both the buyer and the seller. The form requires dischargers to report the following:

Buyer information

a. Upward adjustment to the buyer's limit
b. Jordan Biochemical Oxygen Demand (JBOD) factor: an equivalency factor that describes the impact of the buyer's phosphorus discharge at a downstream compliance location (Jordan, Minnesota)
c. The number of credits needed to adjust the limit (A × B)
d. The buyer's trade ratio (a percentage of the number of credits purchased, appears to act as a retirement or uncertainty ratio)
e. The total number of credits to be purchased (C × D)

Seller Information

f. The number of credits sold (must = E)
g. The seller's JBOD factor
h. Downward adjustment to the seller's limit (F ÷ G)

The permit specifies the equations that must be used to calculate the adjusted limits and specifies that trades are not effective and limits are not adjusted until MPCA receives and records the completed forms. (As discussed in section III.I, a fully developed program would ideally have a tracking system to facilitate electronic submittal and review of this type of information.) Appendix I of the permit includes different equations for permittees trading individually and for those trading through an association. Three sets of equations describe how to calculate the adjusted phosphorus limit, the actual phosphorus discharge, and the "Jordan Trading Units" (credits) available to sell or required to be purchased based on applicable trade ratios.

C. Option: make permanent changes to permit limits that reflect traded allocations

Through this type of trade, a seller agrees to permanently transfer part of their individual permit allocation to the buyer and as a result both permittees get new permit limits that

[13] https://www.pca.state.mn.us/sites/default/files/wq-b3-38.pdf
[14] https://www.pca.state.mn.us/sites/default/files/wq-b3-17e.pdf

reflects this allocation transfer (i.e., lower allocation for the seller and higher for the buyer). In this context, "allocation" refers to the amount of pollutant that each permittee is allowed to discharge.

For example, North Carolina allows permanent allocation trades through a bilateral contractual trading agreement but also permanent major permit modifications (NCDEQ 2019). This requires initial permit modifications for both permittees, then reopening the permits for any changes or if permittees are no longer able to generate credits in the future. According to the North Carolina Department of Environmental Quality (NCDEQ) staff interviewed, this approach disincentivizes trading (and additional load reductions) because partners are hesitant to give up allocations in case they want to expand in the future.

2. Considerations and recommendations

The PG Team recommends either Option A (assess compliance using established permit limits) or Option B (establish a process to calculate variable permit limits based on executed trades). Option C (make permanent changes to permit limits that reflect traded allocations) is not recommended because of the increased permitting burden. The PSNGP is an overlay permit that applies to all publicly owned marine WWTPs. Once permit limits are established, Ecology may not want to reopen and modify the permit due to the large number of permittees this would affect. Option C is also not recommended because it could disincentive participation in trading, with the effect of restricting the market, which may already be limited in Puget Sound.

Options A and B are functionally equivalent; Ecology could choose either according to its preference and input from permittees and other stakeholders. In Option A, the permit would lay out the conditions for trading, including reporting requirements, and Ecology would calculate the discharge level that the buyer must meet to comply with its permit limit (permit limit + credits purchased), ensuring any applicable trade ratios were applied to the credit purchase. In Option B, the permit also would lay out trading conditions, including information similar to that in Minnesota's permit that describes how adjusted limits would be calculated. Rather than calculating the buyer's compliance discharge level to determine compliance, Ecology would simply evaluate compliance by comparing the buyers' and sellers' DMR data to the adjusted limits. However, Ecology would need to review the submitted trade information to ensure the adjusted limits are correct. There may be no appreciable difference in the level of effort between these approaches. Option A may be more desirable in a market where permittees are likely to trade with multiple partners because it would not require multiple adjustments to the permit limit.

I. Credit certification and tracking

Water quality trading programs require processes to verify that nutrient reductions have occurred, certify that credit calculations are accurate, and track credit transactions transparently. State trading programs have established procedures and tools for credit certification and tracking that vary in terms of the level of administration required from the state agency and information needed.

1. Options

A. Option: Ecology verifies credits through effluent data reporting requirements and facilitates credit purchases

Ecology could calculate and verify credits based on effluent monitoring data reported through DMRs and/or annual reports required under the PSNGP. Using the effluent data, Ecology could also identify those permittees in need of credits to meet their permit limits and facilitate the purchase of necessary credits. Ecology would maintain an electronic database to track verified credit sales and purchases.

Under Connecticut's Long Island Sound Nitrogen Credit Exchange Program, dischargers covered under the General Permit for Nitrogen Discharges report monitoring data in DMRs and nitrogen analysis reports. The CTDEEP compiles the reported data, conducts quality control checks of those data, and calculates credits generated and needed by each discharger. Once credits have been calculated, CTDEEP facilitates the purchase of needed credits from credit buyers and distributes the proceeds to credit sellers.

B. Option: Ecology verifies credits through trading forms or other notification procedures before allowing credits to be sold

Under this option, trading partners would submit trading forms to Ecology documenting credits generated and associated credit calculations. Ecology would then verify credit generation by comparing information in the trading forms with effluent monitoring results submitted through DMRs and/or annual reports. Verified credits could then be sold. Ecology would maintain an electronic database to track verified credit sales and purchases.

Maryland's trading program requires credit sellers to estimate credits and submit a credit certification form to MDE; MDE then verifies the credits generated by reviewing DMR data. Upon verification, MDE places the certified credits on MDE's Water Quality Trading Register for sale. The Water Quality Trading Register provides a ledger of certified credits, their status, who has purchased and sold credits, and where trades have occurred.

In Pennsylvania, credit generators must submit a verification request form that identifies the number of credits generated and provide supporting DMR data. PADEP reviews the form and associated DMR data to verify the credits. Upon verification, the credit generator submits a registration request form, including a signed contract between the credit buyer and seller. Once reviewed by PADEP, the credits are "registered" (i.e., available for trade). The credit generators and buyers document the details of the actual transaction in a spreadsheet and submit it to PADEP.

Both Maryland and Pennsylvania are considering adapting the U.S. Army Corps of Engineers' Regulatory In-Lieu Fee and Bank Information Tracking System (RIBITS) to replace their current tracking systems. This tool is expected to allow real-time tracking and reduce the level of effort for MDE and PADEP to administer the program.

C. Option: Ecology verifies credits through trading forms or other notification procedures after credits are sold

Under this option, permittees would submit trading forms to Ecology documenting credits generated and purchased. Ecology would verify credit generation (after credits have already been sold) by comparing information in the trading forms with effluent monitoring results submitted through DMRs.

Under the Minnesota River Basin General Phosphorus Permit, permittees submit "Legal Contract to Trade" forms that identify the buyers and sellers and credit calculations with their annual compliance reports to MPCA. The MPCA reviews of the information in the annual reports to verify and certify the trades. Trades are not effective or valid, and cannot be used for compliance with the phosphorus mass limits until the trade forms are completed, received, and recorded by MPCA. According to interviews with MPCA staff, this simple system facilitates direct contact between permittees and lets parties know that credits are legitimate.

D. Option: A trading association tracks and verifies credits

Ecology could rely on a discharger-led association to track and verify credits. The association would provide annual (or more frequent) reports of credit transactions to Ecology.

Under Virginia's Chesapeake Bay trading program, the Virginia DEQ reviews DMR data and prepares a loading report each year summarizing the number of credits available and which entities need to trade. Credit buyers and sellers submit certification forms to a third party, the Virginia Nutrient Credit Exchange Association. The association reviews the data and credit transactions and prepares a reconciliation report documenting all credit transactions through the exchange for that year. Based on this report, the Virginia DEQ publishes a nutrient trades report on its website with all credit exchanges.

2. Considerations and recommendations

The credit certification and tracking approach described in Option A is only appropriate if Ecology creates a trading program with a group cap (or aggregate) limit (e.g., North Carolina's general permits) and/or a state-administered exchange (e.g., Connecticut's Nitrogen Credit Exchange Program) in which point source–to–point source transactions between individual facilities do not occur. Since all point sources covered under the PSNGP must report this information to Ecology, Ecology would have the necessary information available to track and verify credits under this approach. However, if Ecology creates a trading program that involves any point source–to–point source transactions between individual facilities, this approach would not be feasible because Ecology would need information on those transactions to track and verify which WWTPs generated and purchased credits.

The credit certification and tracking approaches described in Options B and C are similar in that they both require submission of trading forms to document credit transactions and supporting

calculations and would require Ecology to track and verify credit generation. However, they differ in the timing of when credits may be sold:

- Under Option B, credits may only be exchanged after Ecology verifies that they have been generated.
- Under Option C, credits are verified after they have already been exchanged.

Although it would require an additional administrative step for Ecology, verification of credits prior to exchange (i.e., Option B) is preferable to avoid potential non-compliance from errors in credit calculations. For example, if a credit seller makes an error in calculating credits and overestimates the amount of credits, the credit buyer may be out of compliance with their permit limit if the verification of credits occurs after their purchase and they cannot secure the remaining credits needed. This scenario can be avoided if credit verification occurs prior to the transaction.

The credit certification and tracking approach in Option D would be the least administratively burdensome for Ecology, but is limited to programs with trading associations. As discussed in section III.G, the PG Team anticipates bilateral trading among PSNGP permittees at the onset of trading. However, if a discharger-led trading association is formed in the future, Ecology should clearly describe the specific credit tracking and verification rules, as well as reporting requirements to allow Ecology to evaluate PSNGP compliance.

Unless it relies on a discharger-led association to track and verify credits, Ecology will need to develop a database to track and verify credits and exchanges. The complexity of the database will depend on the specifics of the trading program; at a minimum, the database should track information on credit certification, verification, and registration and enable electronic submission of monitoring data and trading forms. The PG Team recommends that Ecology consider ways to integrate or pull data from existing databases and systems (e.g., WQWebDMR) to the extent feasible. During interviews with the PG Team, CTDEEP staff emphasized the benefit of early investment in systems that can automate data reporting, verification, and analysis and can be adapted to accommodate program changes. PADEP staff also highlighted the necessity of having a tracking tool at the beginning of the program to streamline program administration.

IV. Water Quality Trading Laws and Policy

A. Washington's existing framework for water quality trading

The legal authority and framework for water quality trading in Washington is well-established in federal policy and state regulations. Although neither the Clean Water Act nor EPA's implementing regulations explicitly address water quality trading, it has been EPA's long-standing policy that authorization for the use of water quality trading to comply with NPDES permit limits is implicit in the Clean Water Act. EPA's 2003 *Water Quality Trading Policy* provides states with guidance on how to implement trading consistent with the Clean Water Act and its implementing regulations. EPA has reiterated this interpretation in subsequent guidance documents and policy statements, and in 2022 EPA signaled its intention to initiate a rulemaking clarifying how water quality trading may be used in NPDES permits (GSA 2022).

Washington's Water Pollution Control laws establish Ecology's authority to administer the NPDES permit program (RCW 90.48.260). Specifically, RCW 90.48.080 prohibits pollution of state waters and RCW 90.48.260 designates the Department of Ecology as the authorized agency to issue state waste discharge permits and NPDES permits to meet Clean Water Act requirements. Accordingly, Ecology has promulgated state water quality standards (Chapter 173-201A WAC) and regulations for issuing NPDES permits (Chapter 173-220 WAC) and state waste discharge general permits (Chapter 173-226 WAC). Further, the water quality standards at Chapter 173-201A-450 WAC specifically authorize use of water quality offsets, an approach similar to trading, to create assimilative capacity for new and expanding discharges. This language establishes a framework useful to inform water quality trading approaches to meet NPDES permit limits for existing discharges. Washington's statutes and rules together include the elements necessary to accommodate water quality trading as identified by EPA's 2003 trading policy: requirements to obtain permits, anti-backsliding provisions, the development of water quality standards including an antidegradation policy, and NPDES permit implementing regulations.

B. Other state examples

The state entities interviewed and researched for this analysis used a range of approaches for ensuring the appropriate legal authority to administer programs and articulating the program framework. As shown in Table 5, state approaches to establishing program rules vary from general guidelines and policies to extensive state regulations.

Table 5. Summary of state trading authority approaches and key points for each approach

State	Trading authority approach(es)	Key points on legal authority[a]
Connecticut	State law: Public Act 01-180[15] and Public Act 15-38[16]	Simple and flexible rules have allowed the state to adapt the program to address changes in water quality, program funding, and other needs.
Maryland	State law: Code of Maryland Regulations, Title 26, Subtitle 8, Chapter 11[17] Policy/guidelines: Maryland Trading and Offset Policy and Guidance Manual Chesapeake Bay Watershed[18]	The regulations provide clarity on program implementation but limit flexibility and are too restrictive in some cases.
Minnesota	State law: Minnesota Statutes, Chapter 115, Section 115.03[19] Policy/guidelines: Water Quality Trading Guidance[20]	Simple regulations increased flexibility and allowed the program to evolve to suit the state's needs.
North Carolina	State law: North Carolina Administrative Code, Title 15A, Chapter 02, Subchapter B[21] Policy/guidelines: North Carolina's Nutrient Trading and Joint Compliance Framework[22]	There is a statewide framework for trading; regulatory "nutrient strategies" establish comprehensive, basin-specific rules consistent with the framework.
Pennsylvania	State law: Pennsylvania Code, Title 25, Chapter 96, Section 8[23] Policy/guidelines: Phase 3 Watershed Implementation Plan Nutrient Trading Supplement[24]	Regulations provide flexibility to implement and revise the program without regulatory backlog. For example, the regulatory language includes phrases such as "the most current modeling tools" help to ensure current information is incorporated.
Virginia	State law: Code of Virginia, Title 62.1, Chapter 3.1, Article 4.02[25]	Discharger-driven state statute initially helped establish a trading framework but limits flexibility. Regulatory revisions are required to reissue permits or revise wasteload allocations.
Wisconsin	State law: Wisconsin Administrative Code, Department of Natural Resources, Chapter NR 283, Section 84[26] Policy/guidelines: Guidance for Implementing Water Quality Trading in WPDES Permits[27]	Simplicity in the language establishing legal authority for trading, supplemented with detailed program rules articulated in guidance provides flexibility for program adaptations.

[a] As discussed with state program representatives and based on program research.

[15] https://www.cga.ct.gov/2001/act/Pa/2001PA-00180-R00SB-01012-PA.htm
[16] https://www.cga.ct.gov/2015/ACT/PA/2015PA-00038-R00SB-00940-PA.htm
[17] https://mde.maryland.gov/programs/water/WQT/Documents/WQT_regulations.pdf
[18] https://mde.maryland.gov/programs/water/Documents/WQTAC/TradingManualUpdate4.17.17.pdf
[19] https://www.revisor.mn.gov/statutes/cite/115.03
[20] https://www.pca.state.mn.us/sites/default/files/wq-gen1-15.pdf

The legal authority of several states has evolved over time to better meet their program needs. For example, both Maryland and Pennsylvania's programs began with general policies; the states refined their programs several years later with adoption of state regulations. However, the two states implemented very different regulatory approaches, with Pennsylvania maintaining significant flexibility in their regulations and Maryland issuing prescriptive regulations.

Other programs, such as those in Wisconsin, Minnesota, and Connecticut, first adopted a general legislative framework to stand up their programs and later issued guidance documents to provide clarity and consistency in trading. Minnesota was required to incorporate trading into state statute because of a lawsuit. Minnesota representatives anticipated that they would need complex state regulations to oversee entities. However, they later found that flexibility was helpful for modifying their program once WWTPs had completed upgrades to provide enhanced nutrient removal.

Trading in North Carolina is unique, as trading is allowed through watershed-level trade associations, authority for which was established in legislative rules and is implemented through adoption of basin-specific regulatory nutrient strategies. This approach supports tailoring programs to watershed conditions, but the basin rules are comprehensive and details can be changed only through a rule revision.

States have modified their program structures to account for changes in water quality, market conditions, trade boundaries, standards, and available data. States with comprehensive, detailed rules had to navigate regulatory processes to accommodate program modifications and update general permits. For example, in 2020 Virginia adopted new regulations that establish standards and procedures for certifying nonpoint source credits. These regulations are expected to improve demand for nonpoint source credits in a market that has been dominated by point source–to–point source trades (Virginia Administrative Code n.d., Virginia 2019).

Representatives from Connecticut, Maryland, Minnesota, Pennsylvania, and Wisconsin highlighted the importance of having flexibility in regulations as their programs have evolved. Minnesota in particular attributes the success of its program to the design and implementation of simple systems and regulations. Pennsylvania identified the benefits of having simple regulations for general program structure that do not need to be revised when making program changes. Both Maryland and Minnesota have experienced successes in their programs and are

[21] http://reports.oah.state.nc.us/ncac/title 15a - environmental quality/chapter 02 - environmental management/subchapter b/subchapter b rules.pdf
[22] https://deq.nc.gov/media/10684/download
[23] http://www.pacodeandbulletin.gov/Display/pacode?file=/secure/pacode/data/025/chapter96/s96.8.html&searchunitkeywords=96.8&origQuery=96.8&operator=OR&title=null
[24] https://files.dep.state.pa.us/Water/BPNPSM/NutrientTrading/Phase 3 Watershed Implementation Plan Nutrient Trading Supplement.pdf
[25] https://law.lis.virginia.gov/vacodefull/title62.1/chapter3.1/article4.02/
[26] https://docs.legis.wisconsin.gov/statutes/statutes/283/v/84
[27] https://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=83858832

working to find the next logical steps for implementation. For example, Minnesota is considering phasing out its watershed general permit as most WWTPs no longer need to participate in trading, and Maryland is looking for additional sectors to add to the trading pool, including oyster aquaculture operations.

The Virginia representative explained that the dischargers were heavily involved with the design and regulation of the program. Virginia's General Assembly incorporated the program and general permit into state code, which helped establish the trading framework and was instrumental in assuring stakeholder buy-in and participation but has, in some instances, limited Virginia's flexibility to administer the program (A. Brockenbrough, personal communication, December 12, 2022). The lack of flexibility has resulted in challenges to the Virginia DEQ's ability to implement more stringent wasteload allocations in the general permit. Similarly, Maryland found that state regulations for the program serve as a helpful mechanism for continuity and reduced subjectivity based on interpretation. However, adopting detailed requirements into state law limits their ability to pivot and evolve the program and may contribute to faltering demand within the program.

C. Recommendations

As noted above, Washington currently has sufficient legal authority to implement water quality trading through the PSNGP. This finding is based on EPA's interpretation of the Clean Water Act with respect to authority for water quality trading, as well as Washington's adoption of laws and rules consistent with the relevant provisions of the Clean Water Act and its implementing regulations that support trading. The recommendations below build on Washington's existing statutory and regulatory framework. The PG Team is not recommending revisions to state statute. Further, the recommendations for revising state regulations are suggestions for refinements and are not necessary for Ecology to implement a water quality trading program. **The PG Team advises Washington to ensure any revisions made to state statute or regulations align with the federal Clean Water Act to preserve the state's authorizing framework that supports water quality trading.**

1. Establish initial trading program provisions through the PSNGP

Consistent with overarching recommendations to begin trading with a simple program structure until resolving some of the key uncertainties, the PG Team recommends that Ecology establish initial requirements for trading in the general permit rather than through adoption of regulations. Resolution of key uncertainties may provide information that will support more detailed program development in the future.

2. Clarify Washington's authority to implement water quality trading

Washington should consider clarifying its regulatory authority to implement water quality trading. As noted above, the existing offset provision at 173-201A-450 WAC refers to offsets for new and expanding discharges and does not expressly allow offsets or trading for existing sources such as those covered under the PSNGP. Although Washington's existing statutes and rules accommodate trading, clarifying the state regulations can put Ecology on clearer legal footing. This may be desirable given the myriad legal challenges to Ecology's current permit and

approach to reducing nutrients in Puget Sound. Express regulatory authority for trading could also help Ecology establish basic ground rules for trading in Puget Sound and beyond, as described in section IV.C.3 below. Ecology could consider clarifying the water quality offsets regulations at Chapter 173-201A-450(1) WAC by removing the reference to new or expanding discharges. Further, Ecology could add a provision to the NPDES rules at Chapter 173-220 WAC to explicitly allow water quality trading for existing dischargers.

Language authorizing water quality trading should clearly differentiate between offsets to allow new or expanded discharges (if this language is retained at Chapter 173-201A) and water quality trading as a compliance mechanism for existing dischargers. This language should also clarify Ecology's authority to implement trading through NPDES and waste discharge permits. Based on the PG Team's assessment that Washington's current legal authority is sufficient to begin implementing trading in Puget Sound, clarifying the regulations is not a high priority recommendation to be implemented in the near term. Washington could clarify its authority as part of another related update to Title 173 WAC or as part of a rulemaking to establish more specific trading program rules in future phases of implementation.

3. Keep trading rules simple to allow for program adaptation

Many of the state trading program representatives interviewed stressed the importance of flexibility in program rules to accommodate new science, lessons learned, and changes in funding and other conditions that impact trading program implementation. If Ecology elects to add provisions to its NPDES regulations specific to trading, the PG Team recommends a similar approach, where the basic ground rules for trading are clearly articulated in the regulations and the specific details of program implementation are laid out in guidance. This approach allows Ecology to more nimbly adapt the program to accommodate new information and changing watershed conditions without the potential delays inherent in administrative procedures for rule revisions. In addition, Ecology could establish program details specific to Puget Sound in guidance without necessarily applying the same structure to other watersheds in the state.

Basic ground rules for trading that are established in the regulations should set minimum standards that apply statewide and focus on water quality protection and consistency with existing regulations, like the conditions for offsets laid out at 173-201A-450(2) WAC, such as:

- Approval for trading conditioned on demonstrated water quality improvements based on a documented technical analysis.
- Requirement for binding legal instruments between trading partners.
- Responsibility for compliance.
- Requirements for additionality (i.e., only reductions beyond existing requirements may be traded).
- Applicability of antidegradation requirements.

Additional provisions might address the following:

- Provide an affirmative statement that water quality trading is allowed to meet a WQBEL in a permit.
- Clarify that water quality trading may not cause, nor contribute to, local water quality impairments or prevent the attainment of local water quality standards, including tribal water quality standards.
- Establish public access to information on adjusted permit limits (if used) and credit transactions to meet permit limits.
- Establish baselines for credit sellers.
- Clarify that credits may not be used to meet federally-defined TBELs.

V. Water Quality Trading Program Funding

Water quality trading programs have a wide array of funding needs and considerations that vary depending on the program design. This section addresses some of the potential funding needs and considerations for a Puget Sound water quality trading program implemented through the PSNGP. The funding needs and considerations presented in this section reflect the water quality program structure recommendations presented in this analysis, crafted using the five analysis assumptions.

This section discusses both funding needs and funding considerations in the context of water quality trading program structure recommendations. Funding needs in this section represent areas where funding resources will be essential to water quality trading program activities, regardless of the selected program design option. The magnitude of funding needed may vary, however, depending on the selected program structure option. Funding considerations below represent areas where funding is not essential to water quality trading program development and operation, but will influence the water quality trading program decisions and how the market operates.

A. Funding need: additional program development analysis and activities

Water quality trading program development involves making initial decisions about program design, such as developing permit and statutory language; planning and conducting stakeholder involvement activities; and creating programmatic protocols, review processes, guidance, and other trading resource documentation.

The initial water quality trading program structure recommendations will require funding for further program development in the following areas:

- **Developing trade ratios and trade boundaries to address risk and uncertainty.** The recommendations to use both facility-specific delivery ratios and basin-specific trading boundaries means that funding will be necessary to conduct additional analysis using updated modeling results. The PG Team assumes that further Salish Sea modeling information will provide sufficient information to develop ratios that support inter-basin trading. Ecology would need further funding for additional modeling to develop trade ratios for intra-basin trading or to support development of discharger-specific delivery ratios. Ecology may also require funding to hire a third party to translate the results into ratios/boundaries and to develop a process for obtaining and incorporating input from qualified stakeholders.
- **Conducting market feasibility analysis.** An important, often overlooked step in water quality trading program development is a market feasibility analysis. This analysis integrates information on permit limits, facility optimization, trade ratios, and trade boundaries to determine the potential credit supply and demand within trading areas. This type of analysis, coupled with information from stakeholders on willingness to participate, provides a strong indication of the likelihood for a water quality trading

market to develop and sustain over time. Ecology may need funding to conduct a market feasibility analysis or to hire a third party experienced in conducting this type of analysis.

- **Developing guidance for bilateral trades.** Although this program structure recommendation limits Ecology's involvement in negotiating trades among buyers and sellers, there will still be a need for water quality trading program guidance that documents what is required of credit buyers and sellers so that Ecology can evaluate and ensure permit compliance. In addition, Ecology may also want to provide sample trade agreement language for trading partners to use.
- **Investing in establishment of a discharger-led credit association.** If bilateral trading is robust or begins to expand over time and permittees are interested in creating a discharger-led credit association, Ecology may want to consider contributing seed funding to support the development of the association.
- **Developing protocols for credit certification and tracking.** The program will need a credit tracking system, whether it is simple or complex, and Ecology will need funding to develop credit tracking protocols. This may be funding for staff labor to develop the protocols or funding for a third party associated with the tracking system development.
- **Developing and implementing process for stakeholder and tribal involvement.** The PG Team recommends planning and implementing a broad stakeholder and tribal engagement process to obtain input on water quality trading program design options. While Ecology engages with stakeholders and tribes on a regular basis, engagement associated with developing a trading program may be more involved and could require third-party planning and facilitation assistance. This could be even more important if Ecology opts to use the more structured and possibly lengthier WQTAC approach for obtaining stakeholder technical input on more complex program design decisions (e.g., trade ratios and trade boundaries, credit true-up processes, credit tracking).

Water quality trading programs researched for this analysis identified initial program design, development, and implementation as the most resource-intensive phases of the water quality trading program.

- Wisconsin representatives explained that staffing was the most substantial cost of developing the program, as attorneys, policy makers, and engineers were needed for program development (K. Kirsch, personal communication, December 12, 2022). Wisconsin implemented a pilot study and economic feasibility analysis of trading in the Lower Fox River Basin (Great Lakes Commission 2016). The initiative was funded by the Great Lakes Commission, the U.S. Department of Agriculture Natural Resources Conservation Service, and the Wisconsin Department of Natural Resources. The study did not result in significant changes to the framework or implementation of the water quality trading program (K. Kirsch, personal communication, December 12, 2022).
- Virginia provided seed funding for the Nutrient Credit Exchange Association, an entity of dischargers that tracks and oversees trading, to become operational. Virginia provided approximately $200,000 per year for two years to hire an engineer and a lawyer and to develop bylaws and procedures. After this initial two-year period, the Exchange operated on its own with revenue generated through membership dues.

- Minnesota spent significant time developing the general permit in addition to providing extensive outreach and engagement to address public concerns about trading and water quality protection.

B. Funding need: staffing resources for program administration

Ecology should consider the funding needed for staff time to administer the day-to-day operations of the water quality trading program, particularly in critical seasons where review and approval processes are taking place. Based on the water quality trading program structure recommendations for Puget Sound, program research, and discussions with Ecology, Ecology will likely need at least one new staff person dedicated to administering the early phases of water quality trading with bilateral trading and simplified tracking using existing staff resources. However, if the water quality trading program expands over time as a result of future decisions related to program eligibility, Ecology may need to consider increasing the number of staff involved in administering the program. Use of a discharger-led association could reduce the need for increased staff resources by combining individual permittee trading reports into one overall report.

Water quality trading programs researched for this analysis vary in the number of staff needed to administer their programs based on the program structures. The staffing approaches range from dedicated staff in a single state agency division to implementation across multiple staff levels by differing agencies. Program collaboration also differs based on division of responsibilities.

- In Maryland, MDE implements the point source trading program (as well as some parts of the nonpoint source trading program) in conjunction with the Maryland Department of Agriculture. Maryland has two employees primarily responsible for overseeing trading, who spend approximately 20 percent of their time managing the trading program. These staff are typically busy during the first quarter of the year when credits are generated.
- Connecticut's highly collaborative program involved years of coordination between the state and municipalities during the program rollout. The initial program setup involved approximately five CTDEEP staff. Today, various elements of Connecticut's program are implemented by staff of varying levels (e.g., directors, engineers, inspectors) in different divisions of the agency, with one full-time equivalent dedicated to program administration. Other program functions are distributed across CTDEEP staff in various clean water and TMDL programs. These functions include coordinating upgrades through the Clean Water Fund, conducting quality control checks for discharge data, and ensuring dischargers implement and maintain nutrient removal projects as needed to achieve the necessary nutrient reductions (I. Raffa, personal communication, December 19, 2022).
- Wisconsin's program does not have dedicated full-time equivalents or separate funding for administration. Rather, the nonpoint source, point source, and water quality standards/TMDLs programs divide trading program duties and share resources. In

addition, five regional coordinators support the program by educating and working with permittees. While program coordinators estimate the program could be run with two dedicated full-time equivalents, they believe their integrated approach results in a stronger program and increases collaboration (M. Claucherty, personal communication, December 12, 2022).

- Minnesota has two staff members who primarily spend time on trading, but are also involved with other work (B. Henningsgaard and M. Graziani, personal communication, December 9, 2022).
- Pennsylvania's program is primarily administered by one staff person, with some managerial assistance. The PADEP representative estimated that they dedicate 90 percent of their time to administering the trading program, and they spend 50 percent of that time on nonpoint source trading, as it is more complex and time-consuming (R. Colyer, personal communication, December 9, 2022). The most significant costs of Pennsylvania's trading program are administrative and labor costs.
- Virginia primarily has one full-time employee responsible for overseeing the nutrient general permit; this employee is also responsible for Virginia's industrial stormwater general permit. Other responsibilities include general permit reissuance, DMR review, and report preparation. Issuing the general permit instead of having to issue and reissue individual permits has resulted in cost savings for the Virginia DEQ.

C. Funding need: program tracking tool development

As discussed in the recommendations for credit tracking, Ecology will need to develop a database or other electronic system to track and verify credits and exchanges. The complexity of the system will depend on the specifics of the trading program, but at a minimum, it should track information on credit certification, verification, and registration. A system that also accommodates electronic reporting of, and public access to, trading information could reduce the program administrative burden. Although the PG Team recommends that Ecology consider ways to integrate or pull data from existing databases and systems (e.g., WQWebDMR), Ecology will still need some funding to analyze the existing systems or develop a separate tracking tool. Ecology could consider adapting an existing trading tool used by another state and seek grants or other funding to support the adaptation process.

For example, MDE is relying on Pennsylvania's grant-funded efforts to adapt U.S. Army Corps of Engineers' RIBITS for use as a trading registry. RIBITS will help reduce manual tracking processes for credits, increasing the overall efficiency of the trading program administration and the level of transparency.

D. Funding consideration: WWTP upgrades

Resources to upgrade WWTPs are not necessary to launch a water quality trading program, but Ecology must consider availability of these resources because of the influence facility upgrades can have on credit supply and demand. Facilities with funding to implement technology upgrades and reduce nitrogen beyond their permit limits will have the ability to generate and sell credits. If a market feasibility analysis indicates demand will outpace supply, there may be a

need for resources to support facility upgrades that will expand the supply of credits. These resources could be municipal dollars or state resources in the form of grants and low-interest loans.

The Clean Water State Revolving Fund is the primary funding mechanism for WWTP treatment upgrades in Washington and it may be possible to prioritize funding in a way that will work with a trading program to achieve early treatment upgrades before PSNGP compliance deadlines. The Washington State Legislature provided dedicated funding to help permittees comply with the current PSNGP. The availability of additional state funding dedicated to nutrient removal treatment upgrades for permittees is currently unknown.

Many of the water quality trading programs researched for this analysis provided funding for WWTP upgrades through grants for nutrient removal projects and for plants to upgrade to a level equivalent to enhanced nutrient removal during the trading process. In most cases, larger plants with more available resources would be the first to make the upgrades and would generate credits for smaller WWTPs to purchase until they could finance upgrades. As state funding became available, other plants completed their upgrades as well.

- Connecticut's Clean Water Fund works with the state Clean Water State Revolving Fund to fund nitrogen removal projects and upgrades. Facilities request Clean Water Fund financing through the CTDEEP annually, and funds are allocated based on need using a point system. According to the Connecticut representative, the dischargers would not have accepted the non-voluntary trading concept without the assurance that funds would be available for upgrades. The Clean Water Fund provides 100 percent of financing for nitrogen removal projects through grants and low-interest loans.
- In Maryland, state funds appropriated through Maryland's Bay Restoration Fund Act provide 100 percent of funds to significant dischargers for enhanced nutrient removal upgrades; this reduces the incentive for trading in an open market. Thus, Maryland's trading program largely focuses on trades between WWTP and MS4 dischargers and does not currently authorize point-source–to–point source trading between WWTPs.
- Virginia developed its water quality trading program with the dischargers and identified two main paths for achieving nutrient reductions: paying for plant upgrades through Virginia's Water Quality Improvement Fund or trading. Through the Water Quality Improvement Fund, Virginia provided resources for up to 50 percent of upgrade costs for significant dischargers. Being able to fund the plant upgrades helped the dischargers generate credits for the market.

E. Funding consideration: reserve credit pool to manage risk/uncertainty

As discussed in section III.E, some programs include a reserve pool of credits or an offset fund that may be used if credit sellers fail to generate sufficient credits to meet credit buyers' demand. These types of "credit insurance" mechanisms can help facilitate trading markets where potential credit buyers are not confident in the credit supply. Credit reserve pools or offset funds are often funded through a reserve ratio or other type of fee applied to individual credit transactions. A trading feasibility analysis may help Ecology determine whether a reserve

pool, if desired, could be funded through the trading program without alienating credit buyers due to increased credit cost. If not, a separately funded reserve pool could help mitigate risk and uncertainty for credit buyers.

F. Summary of key funding recommendations

Based on the funding needs and considerations described above, the PG Team recommends that Ecology:

- Plan for significant funding to support water quality trading program development activities.
- Assume that it will need one dedicated staff person to administer the early years of a water quality trading program if it remains focused on WWTPs included in the PSNGP.
- Search for possible grants to support tracking system development or adaptation.
- Consider offering seed money to support a discharger-led association if permittees demonstrate an interest in pursuing this option.
- Explore options for expanding state-funded WWTP upgrades to help expand the supply of credits, particularly if a market feasibility analysis indicates demand will outpace supply.
- Consider options for a state-funded reserve pool of credits or an offset fund, if needed, to facilitate participation in trading.

VI. Recommended Next Steps for Water Quality Trading in Puget Sound

Before Ecology begins developing a formal water quality trading program, the PG Team recommends three critical first steps that will build the foundation for making decisions about the program structure recommendations in this report. Assuming the necessary staffing and resources are available, it seems reasonable that these steps could commence relatively soon.

The first is to continue and/or enhance existing tribal and stakeholder engagement to gauge interest in water quality trading. The second step would be for Ecology to determine what types of limits will be established in the permit and attempt to define at what level those limits will be set. Because interest in trading will be heavily influenced by the permit limits, the first two steps should be concurrent. These two initial steps will enable Ecology to assess, at least preliminarily, whether the permit limits will support trading amongst PSNGP permittees and whether the permittees are interested in water quality trading. If this preliminary assessment suggests that trading could be possible, the third step would be for Ecology to conduct a water quality trading feasibility analysis to better define the market and better understand how certain program structure decisions might impact the market.

A. Stakeholder and tribal engagement

Developing a plan to engage stakeholders and tribes at all phases of the water quality trading program decision-making process is a critical next step. Again, note that while the PG Team recommends that Ecology include tribes in their broader stakeholder strategy, Ecology will also be recommending a separate strategy for tribal engagement and formal consultation in their June 2023 report to the legislature.

Plans for stakeholder and tribal engagement should identify phased engagement goals, messages for different types of stakeholders, and input opportunities for key trading program discussions and decisions.

- **Establishing goals.** The ultimate goal of stakeholder and tribal engagement is to obtain input on important water quality trading decisions and ensure that the program structure reflects that input to the extent possible. Ecology should define other priority goals for engagement. Goals may vary by phase of the water quality trading program decision-making process.
- **Identifying key stakeholder groups and tribes.** Ecology currently engages with most, if not all, of the key stakeholder groups and tribes that have an interest in water quality trading decisions. These groups include the following:
    - Nutrient Reduction Forum
    - External general permit group
    - Tribes
    - Legislature
    - Environmental advocacy groups
    - Interested residents

- **Messaging.** The messaging used in the water quality trading program decision-making process will vary depending on the phase of the process and the type of stakeholder or tribe, due to their roles and interests in trading. In some phases, for some stakeholders and tribes, messaging may focus on the fundamentals of water quality trading. In subsequent phases, the messaging may focus on specific requests for feedback from stakeholders and tribes on key decisions. It is important to ensure all stakeholders and tribes engaged in the process see how their feedback is or is not reflected in final trading decisions and the associated rationale.
- **Identifying engagement opportunities.** The format and forum for engaging stakeholders and tribes will also vary. When possible, Ecology can leverage existing engagement opportunities (e.g., standing meetings) to share information on water quality trading and request feedback. However, the water quality trading decision-making process will likely require separate engagement opportunities to provide a forum for stakeholders and tribes to offer focused, meaningful input. This may take the form of a WQTAC with representative members who systematically participate throughout the process, offering input and expertise on aspects of program structure.

When developing a stakeholder or tribal engagement plan, Ecology can consider five phases that span water quality trading program development, launch, and evaluation.

- **Phase I: Pre-decisional recommendations on possible water quality trading options**
    - Purpose: Gauge various stakeholder groups' perceptions of water quality trading as an approach and their reactions to recommendations from this analysis.
    - Priority questions for this phase: What aspects of water quality trading evoke a positive response? What aspects of water quality trading generate concern? What new recommendations do stakeholders and tribes have in response to recommendations from this analysis? What next steps would stakeholders and tribes like to see Ecology take? Are stakeholders and tribes supportive of developing a water quality trading program?
- **Phase II: Exploratory input on specific elements of water quality trading** (if Phase I indicates that key stakeholders and tribes support moving forward)
    - Purpose: Generate feedback on focused aspects of the potential water quality trading program structure where input can help narrow and refine the suite of options, particularly those related to new information and data (e.g., updated model outputs, finalized litigation decisions).
    - Priority questions for this phase: Which option do you support most? What changes to an option would be needed to gain your support? Which options are dealbreakers and why? Which options has Ecology not presented that should be considered and why?
- **Phase III: Technical input on specific elements of water quality trading to achieve final decisions**
    - Purpose: Request key stakeholders' and tribes' informed perspectives on final water quality trading decisions related to structure, processes, policies, and protocols to ensure the program will meet the needs of participating entities.

    - Priority questions for this phase: The questions related to this phase will likely be very specific and focused on details associated with structure, process, and policy. Ecology may need to present the question or issue to key stakeholders and tribes for consideration, allow time for analysis away from a group setting, and provide an opportunity to share in-depth input on the topic during a subsequent group discussion. For some topics, stakeholders and tribes may need more than one meeting to achieve an acceptable and feasible decision.
- **Phase IV: Engagement on water quality trading program implementation launch**
    - Purpose: Present stakeholders and tribes with information on the final water quality trading program structure and processes and answer questions prior to initiating trading activity.
    - Priority questions for this phase: What aspects of the water quality trading program need clarification? What issues may be a barrier to participation for buyers or sellers? What additional information or resources do eligible sources need to support their participation in trading?
- **Phase V: Input on water quality trading program successes and challenges**
    - Purpose: Compile feedback on adjustments needed to the water quality trading program structure and associated processes and policies on a regular basis (at least annually).
    - Priority questions for this phase: What aspects of trading activities were the most challenging? How did trading benefit the facility? What are the priority recommendations for improving water quality trading for the future?

B. Determine permit limits

In most trading programs, demand for credits is driven by the need to meet new or more stringent WQBELs. Unless a permittee knows what effluent quality will ultimately be required, it is difficult for them to determine whether it is more affordable, practical, or desirable to purchase credits than to meet the WQBELs through onsite treatment. Establishing WQBELs for PSNGP permittees is likely to drive demand for credits, as the limits will likely be relatively stringent.

One exception to the need for established WQBELs to drive trading activity is in Colorado, which uses a combination of state regulations and policies to encourage individual permittees to reduce nutrient discharges in advance of regulatory deadlines. Colorado adopted performance-based nutrient standards with an effective date that is 15 years after adoption. Colorado also notified permittees that it would adopt numeric water quality criteria for nutrients at the same time the performance-based standards became effective. The state did not specify what the criteria would be but confirmed that they would be more stringent than the performance-based standards. Under Colorado's Voluntary Incentive Program for Early Nutrient Reductions (Policy 17-1[28]), permittees that achieve early nutrient reductions that go above and beyond those needed to meet performance-based standards will receive an

[28] https://drive.google.com/file/d/1faoaeB_z4TcFu5eGux8Qrf6Rj9WtfE5M/view

extended compliance schedule to meet the new WQBELs. Permittees may achieve the performance-based standards through onsite treatment, water quality trades, offsets, and other means (EPA 2022).

Colorado's approach may not be possible in Washington, as Ecology has signaled that numeric effluent limits would be included in the next permit. However, the general approach of allowing permittees to trade to meet or exceed performance-based standards in advance of more stringent WQBELs may be informative for development of compliance schedules that encourage accelerated progress toward reducing nitrogen loads to Puget Sound. For example, it may be possible to establish a compliance schedule with final WQBELs and interim, performance-based limits, where permittees may trade to meet the interim limits. Ecology could combine this approach with targeted funding that incentivizes early upgrades for permittees whose nutrient load reductions will have the greatest impact on water quality improvements. Those permittees could then sell credits to other permittees to comply with the interim limits, which would give the credit buyers more time to install upgrades needed to meet the WQBELs.

Through its partnership with the Pacific Northwest National Laboratory on the Salish Sea Model, Ecology is currently working on Year 2 optimization scenarios. Those results, which will inform development of WQBELs, are expected in 2023. As discussed in sections I.A.2 and II.C, the current permit requires several plans and analyses, including an AKART analysis, that could inform development of technology- or performance-based limitations, as well as compliance schedules for meeting future permit limits.

C. Trading feasibility analysis

A trading feasibility analysis will be a useful tool for Ecology to evaluate the true potential for water quality trading to help catalyze progress toward the nutrient load reductions necessary to achieve dissolved oxygen standards in Puget Sound. The PG Team acknowledges that a feasibility analysis is not strictly necessary, and several of the programs researched did not begin with one. However, a feasibility analysis can provide critical insight into the viability of a potential trading market and inform decisions about the details of a trading program structure that could help to bolster the market. For example:

- If the analysis suggests potential for many trading partners and an active market, Ecology might consider focusing engagement activities and resources to encourage formation of a discharger-led trading association to help with program administration.
- If the analysis suggests that any given credit buyer would need to source credits from multiple sellers, Ecology might select credit tracking and compliance evaluation approaches that facilitate tracking multi-partner trades.
- If the analysis suggests that credit costs will be a barrier to trading, or that the supply of credits will be limited, Ecology might seek ways to control credit costs such as those associated with reserve or retirement ratios.
- If the analysis indicates credit demand will outpace supply, Ecology might seek to incentivize Clean Water State Revolving Fund funding or identify alternative funding sources to support facility upgrades that will expand the supply of credits.

Although no longer featured on its water quality trading website, EPA's *Water Quality Trading Assessment Handbook*[29] is a useful reference for understanding the components and process of a feasibility analysis. The generalized phases described in the handbook are:

1. **Conduct a pollutant suitability assessment.** Determine whether the conditions and pollutant characteristics in a particular watershed warrant consideration of trading. This phase includes consideration of credit supply and demand.
2. **Evaluate the financial attractiveness of trading in the watershed.** Understand what makes water quality trading financially attractive and how to evaluate those factors for a specific watershed.
3. **Analyze the potential trading market infrastructure.** Consider the watershed's unique market infrastructure needs to select the most appropriate mechanisms to perform the functions needed from the market. This report includes many of the considerations relevant to selecting appropriate water quality trading program mechanisms.

Other published feasibility studies illustrate how this approach has been adapted and applied to specific watersheds. Two examples are listed below:

- Wabash River Watershed Water Quality Trading Feasibility Study[30]
- The Feasibility of Water Quality Trading Markets for Rangelands in California's Central Valley[31]

[29] https://nepis.epa.gov/Exe/ZyNET.exe/30005XSX.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C00thru05%5CTxt%5C00000008%5C30005XSX.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL

[30] http://kieser-associates.com/uploaded/wabash_wqt_feasibility_study_091411_final_report.pdf

[31] https://ucanr.edu/repository/fileaccess.cfm?article=93550&p=ETOHRA

VII. References

Alliance for the Chesapeake Bay. 2016. *Maryland Water Quality Trading Advisory Committee*. https://www.allianceforthebay.org/2016/03/maryland-water-quality-trading-advisory-committee/

CTDEEP (Connecticut Department of Energy and Environmental Protection). 2018. *General Permit for Nitrogen Discharges*. https://portal.ct.gov/-/media/DEEP/water/municipal_wastewater/2019NITROGENPERMITpdf

Ecology (Washington State Department of Ecology). 2008. *Focus on Puget Sound: Economic Facts*. Publication Number 06-01-006 (rev. 10/08). https://apps.ecology.wa.gov/publications/SummaryPages/0601006.html

Ecology. 2019. *Puget Sound Nutrient Source Reduction Project. Volume 1: Model Updates and Bounding Scenarios*. Publication Number 19-03-001. https://apps.ecology.wa.gov/publications/SummaryPages/1903001.html

Ecology. 2021. *Technical Memorandum: Puget Sound Nutrient Source Reduction Project Phase II—Optimization Scenarios (Year 1)*. https://www.ezview.wa.gov/Portals/_1962/Documents/PSNSRP/OptimizationScenarioTechMemo_9_13_2021.pdf

Ecology. 2022. *Fact Sheet for the Puget Sound Nutrient Draft General Permit*. https://fortress.wa.gov/ecy/ezshare/wq/permits/PSNGP_FactSheet2022.pdf

EPA (U.S. Environmental Protection Agency). 2003. *Water Quality Trading Policy*. https://www.epa.gov/npdes/water-quality-trading-policy-0

EPA. 2009. *Water Quality Trading Toolkit for Permit Writers*. EPA 833-R-07-004. https://www.epa.gov/npdes/water-quality-trading-toolkit-permit-writers

EPA. 2021. *Water Quality Trading and Offset Programs in the Chesapeake Bay Watershed: 2021 Review and Summary*. https://www.epa.gov/system/files/documents/2022-02/2021-chesapeake-bay-trading-and-offsets-summary_508-dec29.pdf

EPA. 2022. *Compendium of State and Regional NPDES Nutrient Permitting Approaches*. EPA-833-B-22-003. https://www.epa.gov/system/files/documents/2022-04/compendium-of-npdes-nutrient-permitting-approaches.pdf

Great Lakes Commission. 2016. *Water Quality Trading for Phosphorus in the Lower Fox River Watershed: A Handbook*. https://www.glc.org/wp-content/uploads/LowerFox-RiverTrading-Handbook.pdf

GSA (U.S. General Services Administration). 2022. *Agency Rule List – Fall 2022, Environmental Protection Agency*. Market-Based Approaches Under the National Pollutant Discharge Elimination System (NPDES) Program, RIN 2040-AG02. https://www.reginfo.gov/public/do/eAgendaMain?operation=OPERATION_GET_AGENCY_RULE_LIST&currentPub=true&agencyCode=&showStage=active&agencyCd=2000

Maryland. 2018. *Title 26 Department of the Environment, Subtitle 08 Water Pollution, Chapter 11 Maryland Water Quality Trading Program*. Code of Maryland Regulations 26.08.11. https://mde.maryland.gov/programs/water/WQT/Documents/WQT_regulations.pdf

MDE (Maryland Department of the Environment). 2020. *Purchasing Water Quality Credits FAQ*. https://mde.maryland.gov/programs/water/WQT/Documents/Guidance%20PDFs/Purchasing_FAQ.pdf

NCDEQ (North Carolina Department of Environmental Quality). 2018. *North Carolina's Nutrient Trading and Joint Compliance Framework: Discussion Draft #2*. https://deq.nc.gov/media/10684/download

NCDEQ. 2019. *North Carolina's Nutrient Trading Options*. https://lnba.net/system/files/RES%202019-10-22%20trading%20options.pdf

PADEP (Pennsylvania Department of Environmental Protection). n.d. *Nutrient Credit Trading*. https://www.dep.pa.gov/Business/Water/CleanWater/NutrientTrading/Pages/default.aspx

Virginia. 2017. *Nutrient Offset Fund*. Code of Virginia 10.1-2128.2. https://law.lis.virginia.gov/vacode/title10.1/chapter21.1/section10.1-2128.2/

Virginia. 2019. 9VAC25-900. *Certification of Nonpoint Source Nutrient Credits (adding 9VAC25-900-10 through 9VAC25-900-350)*. Virginia Register of Regulations. Vol. 35 Iss. 17. April 15, 2019. http://register.dls.virginia.gov/details.aspx?id=7420

Virginia Administrative Code. (n.d.). *Chapter 900. Certification of Nonpoint Source Nutrient Credits*. 9VAC25-900. https://law.lis.virginia.gov/admincode/title9/agency25/chapter900/

Virginia Nutrient Credit Exchange Association. 2022. *Exchange Compliance Plan: 2022 Annual Update*. https://www.deq.virginia.gov/home/showpublisheddocument/6987/638000460108430000

Appendix A. Research Questions

The PG Team worked with Ecology to develop a list of priority questions for conducting research interviews with water quality trading program managers. The master list of questions is provided below. The PG Team tailored the list of questions for each interview based on the program structure and elements of particular interest and to reflect any information available to the researchers in advance of the interview.

Framing question

Based on your experiences, what would be the most important piece of advice you would give a state just starting a trading program? If you were to do it over again, what would you change?

Program structure

- What factors predominantly influenced the design of this water quality trading program? What aspect of the water quality trading program did each factor influence the most?
- How did water quality trading program drivers change over time and how did these changes affect the design of the water quality trading program? For example, did the trading program focus on pre-TMDL trades and need to change to reflect a final, approved TMDL? How did changes to permit limits affect program design?
- Were there any unresolved legal challenges while the water quality trading program development process was underway? If so, how did these unresolved legal challenges affect trading program design decisions? Once resolved, how did the water quality trading program change?
- To what extent was potential supply and demand factored into program design considerations at the outset of the water quality trading program? What process was used to make this determination?
- If supply and demand was factored into program design after development of the trading program, how did this information alter program design?
- Which entities participated directly in the water quality trading program design and in what capacity?
- What are important characteristics or key criteria for state partners and other third party participants in trading program implementation?
- What is the role and level of involvement of the following entities in the regular administration of the water quality trading program:
    - Federal agencies.
    - State permitting agency.
    - Other state agencies.
    - Local agencies.
    - Individual permittees.
    - Brokers/third-party facilitators.
    - Watershed organizations or other NGOs.
    - Other entities?

- What type of coordination between/among these entities has been essential to water quality trading program success?
- What type of collaborative mechanisms are in place to help define roles and responsibilities among key entities (e.g., memorandum of understanding, partnership agreements, strategic planning documents)?
- How many dedicated FTEs are needed to support the water quality trading program? Which entities provides this staffing and what are the roles and responsibilities?
- What are the critical staff skills/expertise required to administer the water quality trading program effectively?
- Were any tribes located within the geographic footprint of the trading program and did you consult with them during program development?
- If yes, what did engagement/consultation look like?
- What were tribes' primary concerns with the trading program?

Operational processes

- Did the water quality trading program take a phased or iterative approach to allow for adaptive management? If so, what type of phasing occurred (e.g., pilot phase)?
- What are the eligibility criteria for participation in the water quality trading program?
    - Are all permitted facilities within the geographic footprint of the program allowed to participate in the trading program? (WWTPs on tribal land or military installations that are not subject to a state issued NPDES permit)
- What minimum control level (e.g., TBELs) does the water quality trading program use beyond eligibility criteria to allow participation in trading?
- How have the baselines changed over the course of time and what factors influenced the changes in baselines?
- What are the geographic considerations that influence the trading boundaries for trades among eligible entities (e.g., hotspot considerations that prevent certain facilities from trading)?
- How have trading boundaries changed over time and what factors informed boundary changes?
- What trade ratios does the water quality trading program use? What was the process and technical rationale related to the trade ratio development?
- How do permittees engage with one another to trade through the program?
- How does the water quality trading program verify and certify credits?
- What is the credit transaction process for transferring credits from one facility to another?
- What is the process for documenting and tracking trades? Does the water quality trading program use specialized tools for tracking? Is training required?
- How often does the water quality trading program report on progress and what formats are used to document progress? Which entities review water quality trading program progress documentation?
    - What does progress mean in this context and how is it measured?

- What types of risk mitigation approaches have been incorporated into the water quality trading program?
- How does the water quality trading program establish credit pricing (e.g., legislated formula, market-based credit pricing)?
- How has the structure of NPDES permit requirements affected the structure of the water quality trading program?
- What legal or technical challenges has the water quality trading program experienced related to program implementation over time? How have key partners resolved these challenges? Any insights as to how to avoid these types of challenges from the outset of the program?
- What are the planned changes or improvements to the water quality trading program to improve effectiveness? What is the primary driver for these changes?
- How has the water quality trading program affected the rate of facility upgrades? The rate of achieving water quality goals? Are there cost savings attributed to the water quality trading program?
- Has there been sufficient credit demand for the supply generated through the water quality trading program? If not, how has the water quality trading program addressed this issue?
- How do you define success for your trading program? Has your program been successful based on this definition?

Funding

- What were the most substantial costs associated with developing the water quality trading program (e.g., staffing, information technology to support analysis and tracking, outreach)?
- What was the overall budget for developing the water quality trading program?
- What lessons have been learned related to using resources most efficiently to develop the program?
- What is the overall annual budget for administering the water quality trading program?
- What are the most substantial costs associated with operating the water quality trading program?
- What are the primary or most critical sources of funding to support program operation?
- In what circumstances has the water quality trading program had to subsidize credit purchases? Who provided subsidy funding when needed?
- What factors most affect the economic sustainability of the water quality trading program?

Statutory considerations

- What new statute(s) were enacted to authorize and support the water quality trading program? What was the timeframe and process to develop and pass this statute? Was the legislative change absolutely necessary to implement the program?

- What existing statutes had to be modified to authorize and support the water quality trading program? What was the timeframe and process to amend and pass the modified statute?
- What other state or local regulations and ordinances needed to be passed or were in place that are essential to ensuring the water quality trading program structure and operations have the necessary authority to effectively function?
- What state, regional, watershed, or local policies are in place to ensure that the water quality trading program functions effectively?
- What new (or modified) statute, regulation, ordinance, or policy is still needed to improve the effectiveness of the water quality trading program?
- What were the most significant hurdles in establishing the necessary regulatory authority for the water quality trading program at the state and local levels?
- What schedule and costs considerations have been associated with developing and passing the regulatory framework to support the water quality trading program?
- What are the lessons learned related to developing and passing the necessary statute and regulatory framework to support the water quality trading program?
- If there have been legal challenges to the regulatory authority of the water quality trading program, how were those resolved and what statutory/regulatory modifications were needed as a result?

Appendix B. Interview Summaries

Available separately at
https://apps.ecology.wa.gov/publications/SummaryPages/2310006.html

Appendix C. Influence of New Information on Initial Recommendations

Section II.C discusses several factors that may change over time (future modeling outputs, permit limits, litigation, funding, tribal and stakeholder perceptions), providing new information to inform water quality trading program development. Figure C-1 and the text below summarize how new information resulting from changes in certain factors could influence specific initial recommendations and the potential resulting programmatic changes.

Factor 1. Stakeholder engagement during initial implementation suggests the need for an expanded market. This change could influence the initial program eligibility recommendation as follows:

- Initial Eligibility Recommendation: Puget Sound Nutrient General Permit (PSNGP) permittees only. Stakeholder engagement that suggests the need for an expanded market could lead to expanded eligibility for:
    - Other marine point sources
    - New/expanding dischargers (through offsets) if insufficient credits to include in initial program structure
- Watershed point sources and nonpoint sources. Expanding eligibility to watershed sources could lead to further changes to address risk and uncertainty for those sources including:
    - Location ratios for watershed sources' impacts on Puget Sound basins
    - Other ratios (delivery, uncertainty, etc.) to prevent tributary hotspots

Factor 2. Future modeling that describes impacts of watershed nutrient load reductions on Puget Sound basins. This factor could influence the initial program recommendations for eligibility and for managing risk and uncertainty as follows:

- Initial Eligibility Recommendation: PSNGP permittees only. Future modeling that describes impacts of watershed nutrient load reductions on Puget Sound basins could lead to expanded eligibility for watershed point sources and nonpoint sources.
- Initial Risk and Uncertainty Recommendation: Conservative delivery ratios that reflect available science. Future modeling that describes impacts of watershed nutrient load reductions on Puget Sound basins could lead to establishing the following ratios to accommodate resulting expanded eligibility to watershed sources:
    - Location ratios for watershed sources' impacts on Puget Sound basins
    - Other ratios (delivery, uncertainty, etc.) to prevent tributary hotspots

Factor 3. Salish Sea Model Year 2 optimization scenarios and future modeling refines understanding of marine wastewater treatment plant (WWTP) nutrient load reductions on Puget Sound basins. This factor could influence the initial program recommendations for managing risk and uncertainty and establishing trading boundaries as follows:

- Initial Risk and Uncertainty Recommendation: Conservative delivery ratios that reflect available science. Year 2 and future modeling that refines understanding of marine WWTP nutrient load reductions on Puget Sound basins could lead to refinements in the following:
    - Delivery ratios for marine WWTP discharges
    - Trading boundaries

- Initial Trading Boundaries Recommendation: Intra-basin trading; limited inter-basin trading that reflects available science. Year 2 and future modeling that refines understanding of marine WWTP nutrient load reductions on Puget Sound basins could lead to expanded inter-basin trading.

Factor 4. Future modeling describes the impact of individual nutrient discharges within and across basins. This factor could influence the initial program recommendations managing risk and uncertainty as follows:

- Initial Risk and Uncertainty Recommendation: Conservative delivery ratios that reflect available science. Future modeling that describes the impact of individual nutrient discharges within and across basins could lead to refinements in the following:
    - Delivery ratios for marine WWTP discharges
    - Trading boundaries

Factor 5. Market feasibility confirmed through analysis and/or stakeholder engagement. This factor could influence the initial program recommendations for managing risk and uncertainty and managing credit transactions as follows.

- Initial Risk and Uncertainty Recommendation: Conservative delivery ratios that reflect available science. Market feasibility confirmed through analysis and/or stakeholder engagement could lead to development of reserve or retirement ratios.
- Initial Credit Transaction Recommendation: Bi-lateral trades. Market feasibility confirmed through analysis and/or stakeholder engagement could lead to development of a discharger-led trading association.

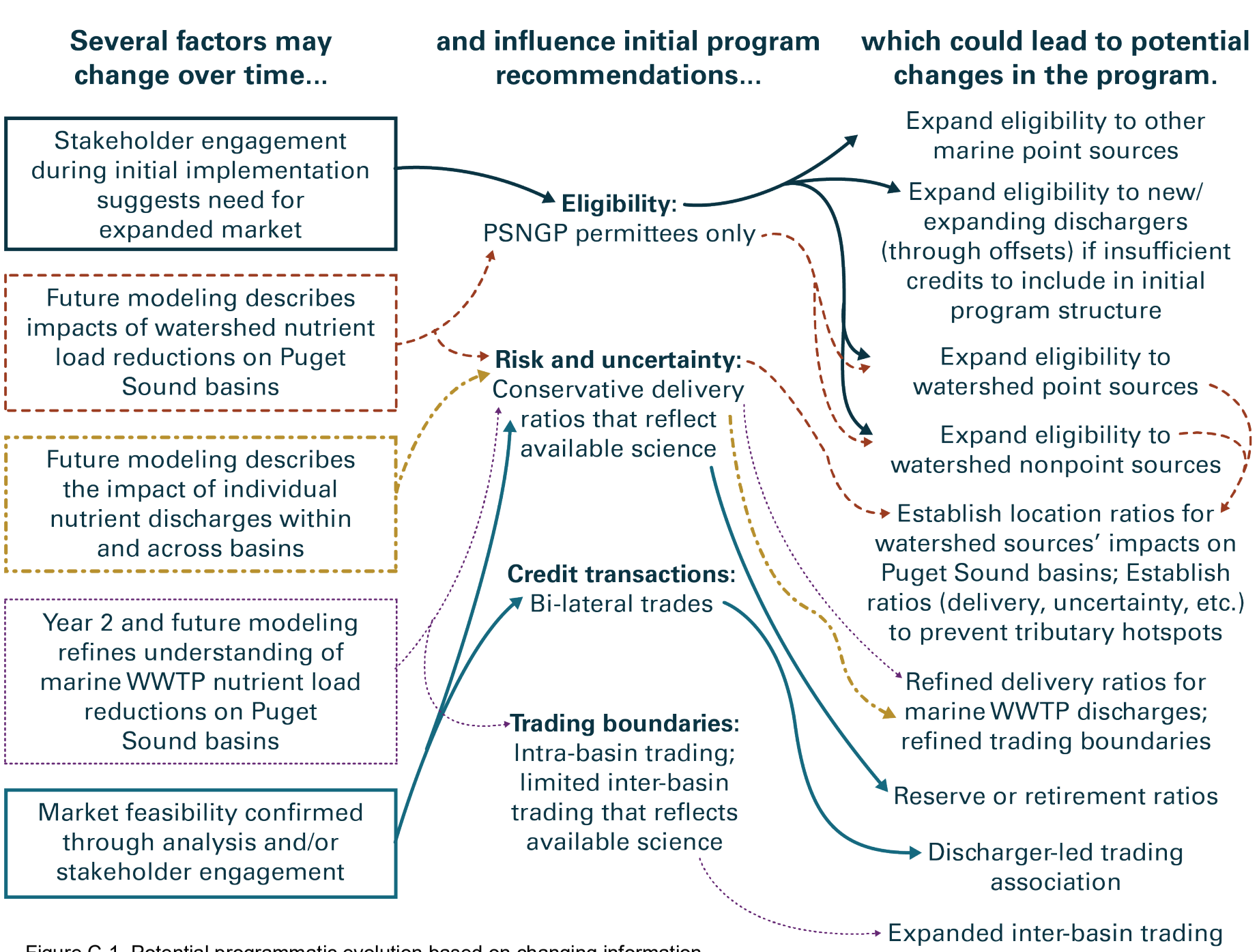

Figure C-1. Potential programmatic evolution based on changing information