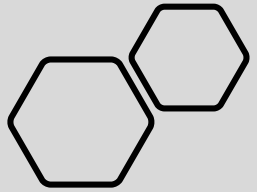
WTD Nutrient Management Strategy

Near term approach for long term results



King County

Department of Natural Resources and Parks

Wastewater Treatment Division

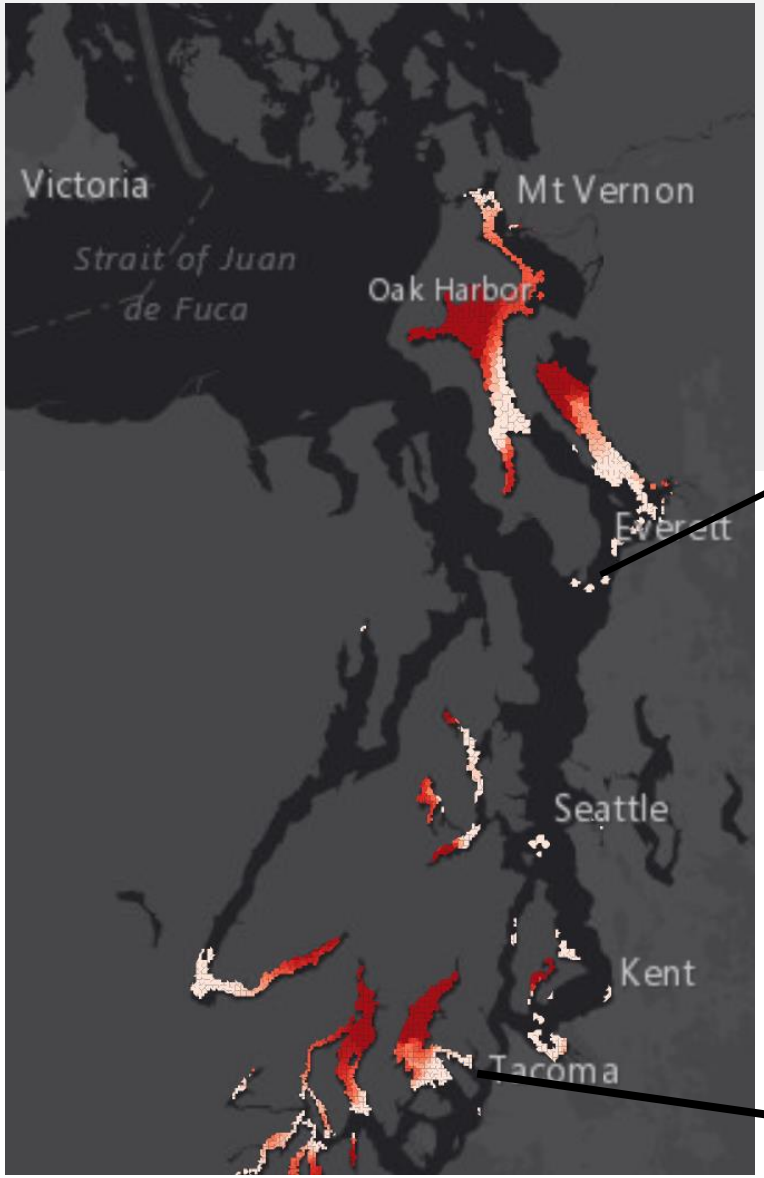
Background- What are the drivers?

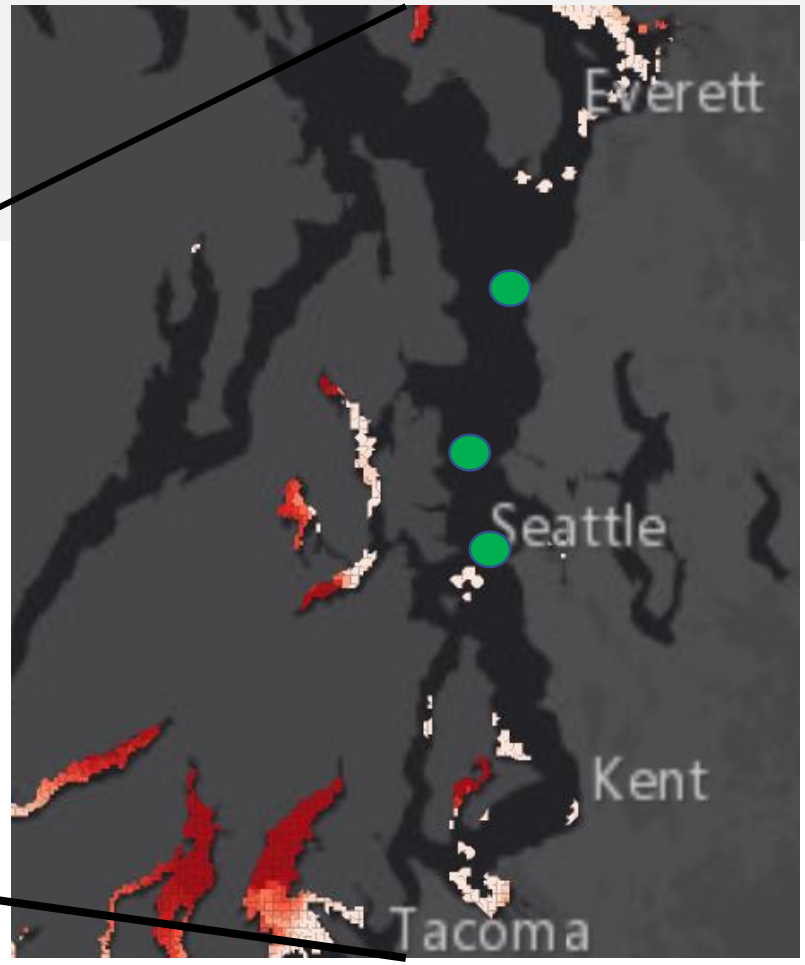
- Low dissolved oxygen (DO) levels have been found in Puget Sound
- Low DO is attributed to nitrogen loading – wastewater treatment plants are the largest dischargers of anthropogenic nitrogen
- Although Ecology has been working to better understand how, where and by what, low DO is being detected, they have faced lawsuits by environmental groups
- Northwest Environmental Advocates filed a petition for rulemaking that would require nutrient limits and tertiary treatment by wastewater treatment plants

- Ecology denied petition but committed to the following:
  - Set nutrient loading limits at current levels for all permitted dischargers
  - Require facilities to begin planning efforts to evaluate treatment implications of different nitrogen targets
  - For facilities capable of nitrogen removal, amend NPDES permit to include limits commensurate with their treatment capability

Timeline

2006-2014	• King County (KC) participated on a Technical Advisory Committee for Ecology's South Sound and Salish Sea Model development
2017	• July – KC staff presented nutrient and phytoplankton trends in central Puget Sound at Ecology's Puget Sound Nutrient workshop • Sept – KC met with Ecology to discuss Ecology's Puget Sound Nutrient Source Reduction Project and identify opportunities for King County to participate. • Nov – KC sent Ecology technical questions on the Salish Sea Model
2018	• Jan – Ecology presented KC with answers to technical questions on Salish Sea Model • April – Staff attend the Nutrient Form meetings (ongoing – monthly) • Sept – KC participated in Puget Sound Partnership's Implementation Strategy for Marine Water Quality
2019	• Jan – WTD begins Nitrogen Removal Study • Aug – Ecology announces Puget Sound Nutrient General Permit concept • Oct - KC comments in Ecology's General Permit solicitation process • Dec – Ecology announced Total Inorganic Nitrogen (TIN) caps in individual permits
2020	• Jan – Ecology announces moving forward with a general permit • Feb - General Permit Advisory Committee process begins – KC sits on the Advisory Committee • April – WTD contracts with The Freshwater Trust





Preliminary Modeling Results

- 88% of total nitrogen in the Puget Sound comes from Oceanic influx

King County discharge (green dots)

- We discharge an equivalent of 4% of the oceanic total

Issues

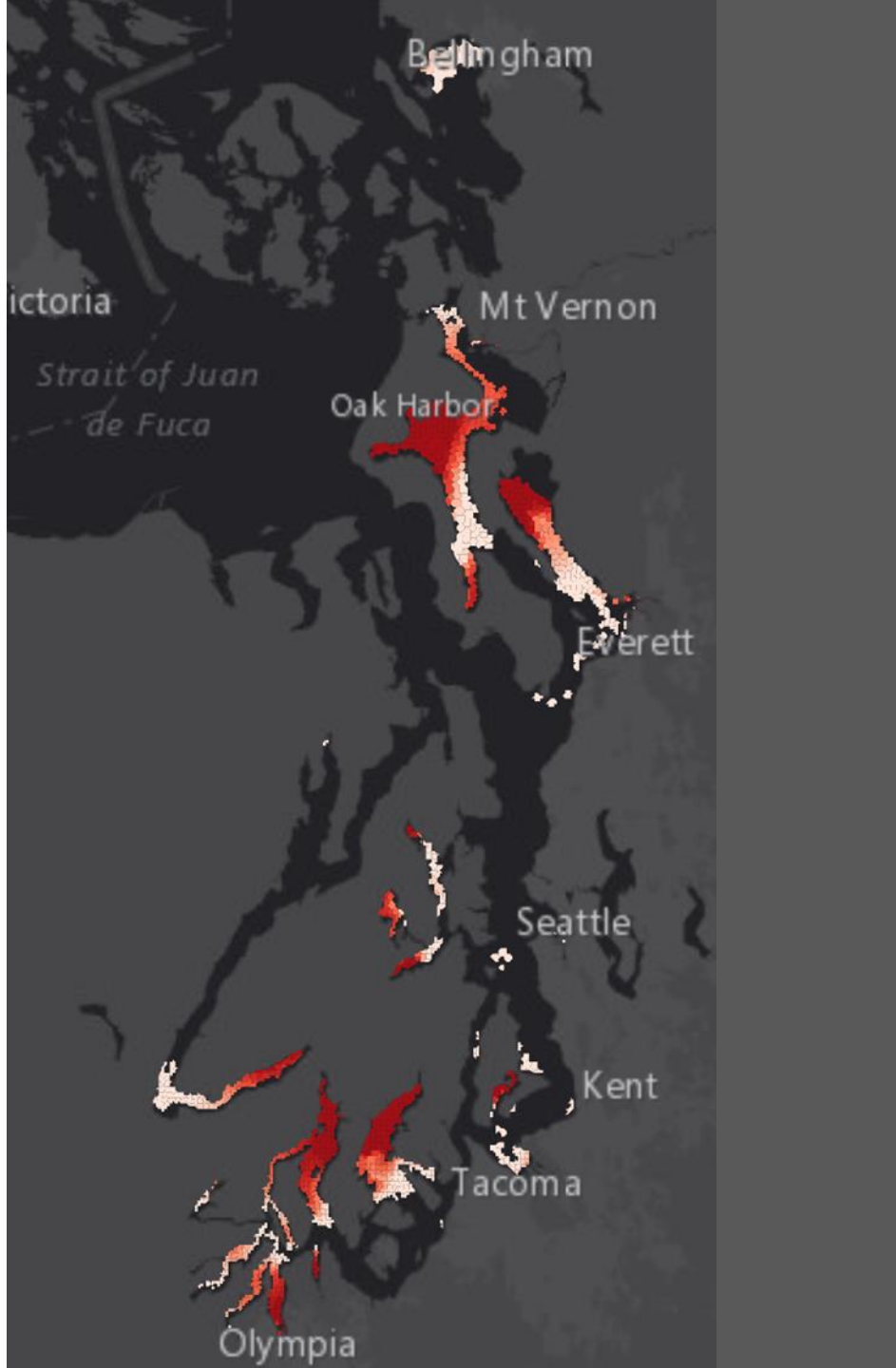
Modeling/Data: Not complete and there is disagreement between scientists and regulated entities and Ecology regarding accuracy. Will improvements be seen?

Timing: Ecology caps on nutrients by 2021. Total TIN limits established by 2022. South Plant and West Point NPDES permit with caps fall of 2020.

Stakeholder/Public Involvement: There has been limited interaction with key stakeholders during this process. Ecology is moving quickly. Public does not yet understand cost estimates

Cost: Removing nitrogen is costly. How are the environmental, equity and economic costs balanced? Anticipate billions over the next two decades

Implementation: Most facilities were not built to remove nitrogen and interim caps could limit growth.



Nitrogen Removal Study

Approach

1. Technology Screening
2. Nitrogen Removal Scenario Development
3. Technology Combination Screening
4. Site-Specific Analysis

Scenario Development

- Wanted a spectrum of all probable nitrogen (N) removal outcomes
- Used Ecology Bounding Scenario Report (January 2019) for concentrations

Less N removal → More N removal

"Base Case"	"Low Hanging Fruit" (sidestream)*	Seasonal removal 8 mg/L TIN limit	Year-round removal 8 mg/L TIN limit	Year-round removal 3 mg/L TIN limit
10%-55% removal	20%-66% removal	39%-60% removal*	75%-79% removal	85%-90% removal

Less $ → More $

* "Sidestream" refers to the treatment of liquid streams from dewatering solids at the treatment plant and this sidestream can be treated to remove nutrients.

West Point - Summary

	Scenarios	Total N removal	Constructability	Other impacts
1	Sidestream treatment, no effluent limit	20%	Feasible	Minimal
2	Year-round, lowest effluent possible, maintain capacity	75-85%	Most difficult (near impossible)	Extreme - conversion to all MBRs
3	Seasonal, lowest effluent possible, maintain capacity	55-60%	Extremely difficult	Very high – create parallel MBR plant within WP
4	Year-round, 8 mg/L effluent, reduced WP secondary capacity	**	New treatment plant required	High

South Plant - Summary

Scenarios		Total N removal	Constructability	Other impacts
1	Sidestream treatment	35%	Very feasible	Minimal
2	Seasonal, 8 mg/L effluent	40-45%	Feasible	Moderate
3	Year-round, 8 mg/L effluent equivalent	80%	Difficult	High
4	Year-round, 3 mg/L effluent	90%	Difficult	Very high

Brightwater - Summary

	Scenarios [a]	Total N removal	Constructability	Other impacts
1	Sidestream treatment [b]	66%	Very Feasible	Moderate
2	Year-round, 8 mg/L effluent TIN equivalent	77%	Feasible	Moderate
3	Year-round, 3 mg/L effluent TIN	89%	Moderate	High

a. Base case assumes new aeration basin, two new membrane basins, and new membranes installed to meet NPDES rated capacity.
b. BWABO project trialing Simultaneous Nitrification-Denitrification (SND), and this study assumes it is successful.

Nitrogen Removal Study Summary

Scope of the study was limited to determining costs and technical feasibility at current plant rated capacities – it does not account for forecasted growth.

Year Round Removal options for West Point would require shutting down secondary treatment and discharging primary during construction. An alternative would be building a fourth regional treatment plant in Seattle.

The Clean Water Plan is assessing the costs and impacts to accommodate capacity and nitrogen removal for future growth, upgrades to other processes (such as solids handling), modifications to meet near-term nitrogen cap requirements, bubble permitting and water quality trading.

Probable Cost Estimates and Annual Total Nitrogen (N) Removal Rates*				
	Scenarios			
Treatment Plant	Sidestream Treatment	Seasonal Removal 8-mg/L TIN	Year-round Removal 8 mg/L TIN	Year-round Removal 3 mg/L TIN
West Point	$90 million 20% N removal	$1.7 billion 55 - 60% N removal	Same cost as meeting 3 mg/L TIN	$2.9 billion 85% N removal
South Plant	$90 million 35% N removal	$650 million 40 - 45% N removal	$700 million 80% N removal	$2.05 billion 90% N removal
Brightwater	$125 million 65% N removal	Same cost as meeting year-round 8 mg/L TIN	$460 million 75 - 80% N removal	$480 million 90% N removal

The actual costs shown in millions may be +300% / -50% from those shown.*Probable cost estimates shown are planning-level capital costs for current rated plant capacities, 2020 dollars.

***TIN = Total Inorganic Nitrogen**

What we know

As nitrogen removal increases so do:

- Capital and operating costs
- Operational complexity
- Truck traffic (chemicals)
- Green house gas emissions
- Footprint requirement

Alternatives

- Permit flexibility
- Regional Partnerships
- Water Quality Trading

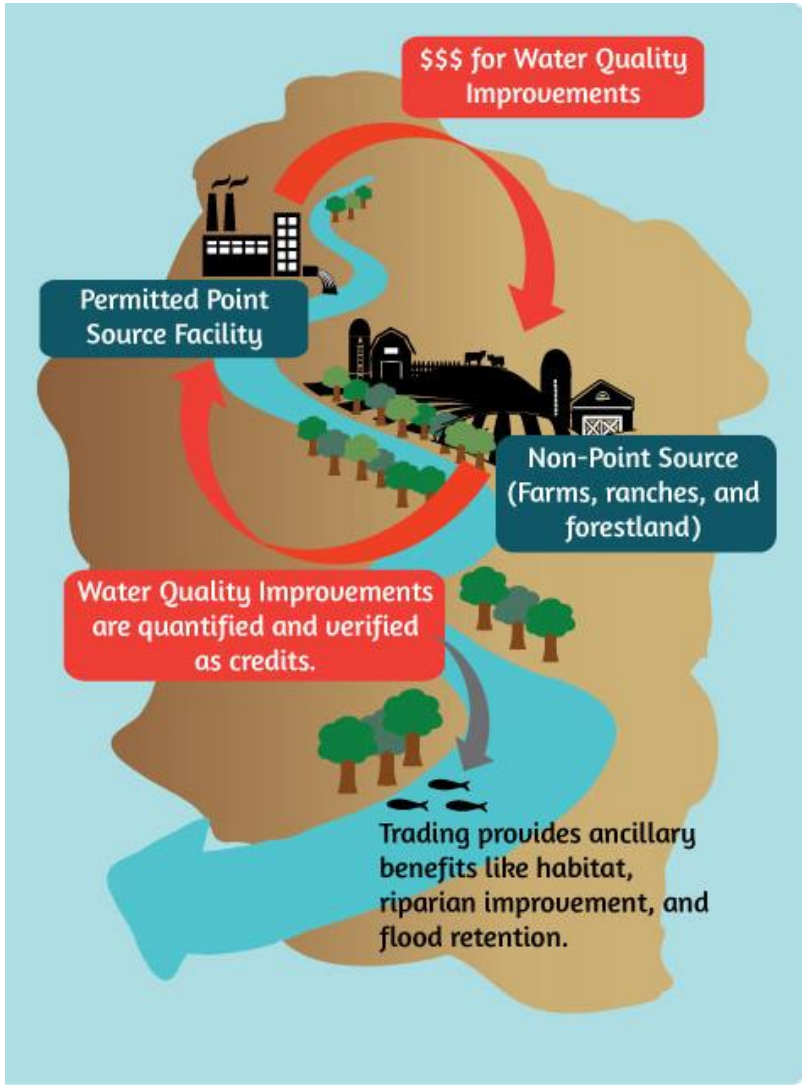
Water Quality Approach

Water quality trading/offsets provide:

- flexibility
- benefits that affect an entire watershed such as riparian improvements and fish and wildlife habitats

Water quality trading encompasses:

- non-point water pollution sources as well as point source
- provides economic incentives for non-point source dischargers to reduce nitrogen loading



Willamettepartnership.org

The Freshwater Trust

1. Policy, regulatory and legal

2. Engage stakeholders, regulators, partner agencies

3. Bridge KC efforts: Clean Water Healthy Habitat and Clean Water Plan

4. Outline a playbook for implementation

Next steps..

Further exploration:

- Best technology for site and process with expanded capacity
- System wide ‘bubble’ permit alternative using study results
- Optimization planning
- Water Quality Trading - develop a regional approach to water quality improvement

Continue:

- Participating in the Puget Sound Nutrients General Permit Advisory Committee and Nutrient Management Forum
- Working with the universities and regional partners to enhance our scientific understanding
- Coordination with Clean Water Healthy Habitat and Clean Water Plan to build framework for Water Quality Trading in partnership with The Freshwater Trust

Questions?

Rebecca Singer

Resource Recovery, WTD

Rebecca.singer@kingcounty.gov

206-477-5600