

Puget Sound Nutrient Forum

Salish Sea Modeling Scenarios 2019-2020

July 17, 2019



Today's Presenters



DEPARTMENT OF
ECOLOGY
State of Washington

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Today's Agenda

10:00 a.m.	Welcome <ul style="list-style-type: none">Recap of Puget Sound Nutrient Source Reduction Project
10:10 a.m.	Overview of Feedback from April 30 Forum <ul style="list-style-type: none">What we heard from the ForumProposed changes to scenarios: Yes/No explanationSteering Committee review process
10:30 a.m.	Finalized Modeling Scenarios for 2019-2020 <ul style="list-style-type: none">Scenarios 1-5Modeling ScheduleParking Lot
10:45 a.m.	Questions? <ul style="list-style-type: none">Please type in your questions to the WebEx chat box
11:15 a.m.	Next steps <ul style="list-style-type: none">August 7 Forum: Costs and Creative Solutions

Puget Sound Nutrient Source Reduction Project

Project Vision:

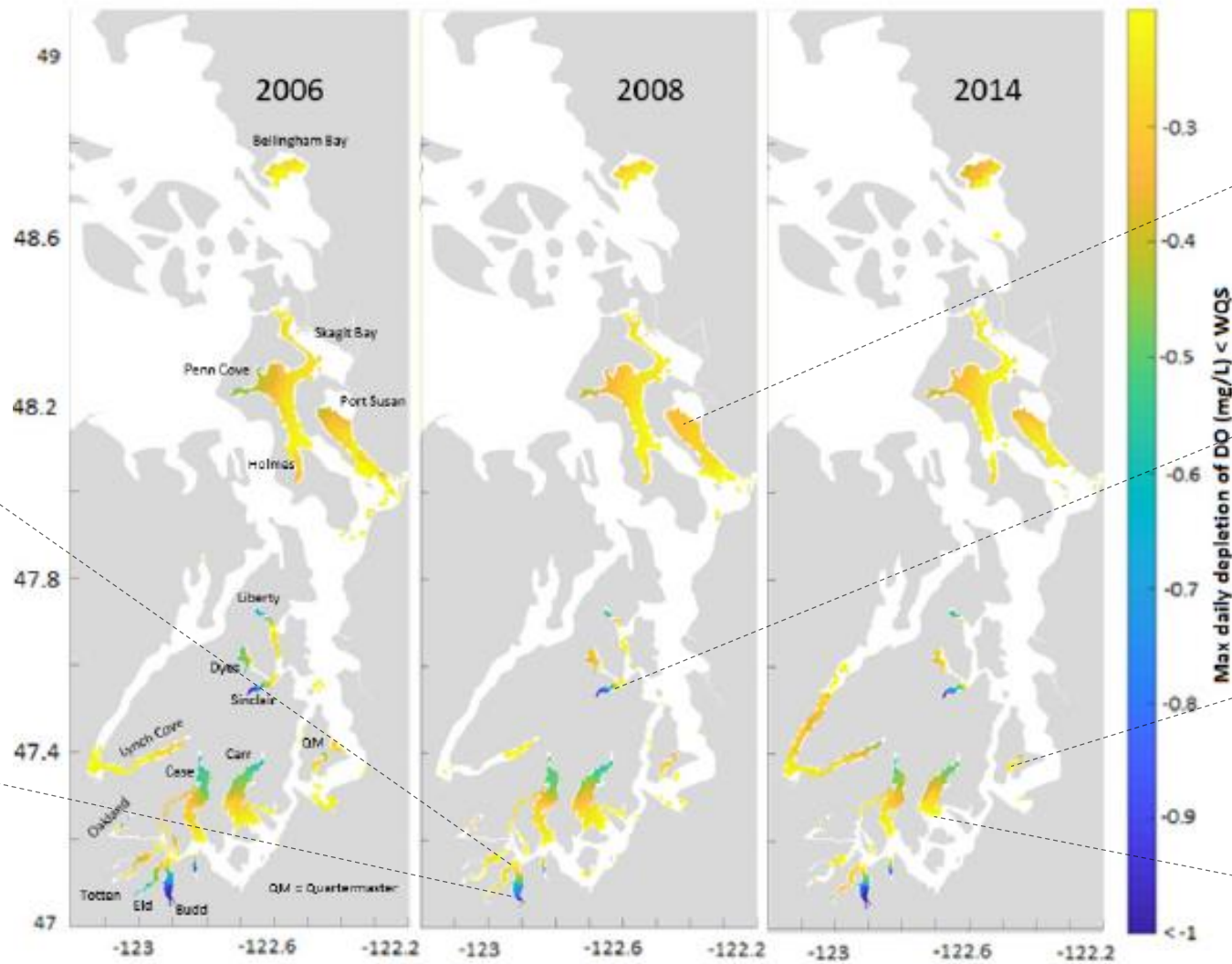
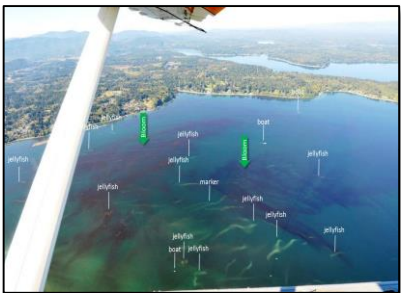
Develop and implement a Puget Sound nutrient source reduction plan to guide regional investments in point and nonpoint source nutrient controls so that Puget Sound will meet DO water quality criteria and protect aquatic life designated uses by 2040.

Why is Ecology pursuing nutrient reduction now?

- Our region's quickly growing population and impacts to infrastructure
- We have the Salish Sea Model to understand the problem and the results of potential improvements
- 2019 Bounding Scenarios report showed total human impacts causing violations of DO criteria
- 2019-2021 Modeling will further investigate human source impacts and lead to nitrogen and carbon load reduction targets for marine and watershed human sources.

Model and monitoring results agree Human sources of nutrients are having an impact on Puget Sound

Eutrophication Indicators



Bounding Scenarios show Puget Sound improvement from WWTP nitrogen removal

- The inner basins of Puget Sound share a portion of their waters, meaning discharges in one basin can affect water quality in other basins.
- If nutrient reductions are made at all domestic WWTPs as modeled (achieving 8 mg/L effluent DIN), the total area of Puget Sound *that does not meet DO criteria* will decrease from 20% to 10%.
 - That is around a 50% improvement in noncompliant days and area of sensitive inlets and bays.

Table ES1. Improvement in the number of noncompliant days due to nutrient reduction at wastewater treatment plants.

Year	Improvement in dissolved oxygen (% reduction in noncompliant days)		
	All plants	Mid & large plants	Large plants
2006	51%	43%	31%
2008	61%	49%	33%
2014	51%	42%	22%

Table ES2. Improvement in noncompliant area due to nutrient reduction at wastewater treatment plants.

Year	Improvement in dissolved oxygen (% reduction in noncompliant area)		
	All plants	Mid & large plants	Large plants
2006	47%	37%	23%
2008	51%	41%	24%
2014	42%	33%	13%

Puget Sound Nutrient Source Reduction Project Timeline



- Puget Sound Nutrient Reduction Project Kick-off
- Nutrient Forum initiated
- Salish Sea Modeling Report Volume I: Bounding Scenarios
- Nutrient Forum continues
- Year 1 Optimization Modeling started
- June Milestone- Year 1 Modeling Forum; share first year results
- Year 2 Optimization Modeling begins in the summer
- Finish Year 2 Modeling
- Salish Sea Modeling Report Volume II: Optimization Scenarios
- Develop a Puget Sound Nutrient Management Plan

April 30 Forum Recap

- April 30: Collected comments and proposed changes to scenarios at Forum meeting
- May 28: Summary of feedback emailed to Forum
- June: Steering Committee reviewed proposed changes and finalized Year 1 scenarios
- July 10: Final Year 1 modeling scenarios emailed to Forum

July Forum Meeting Packet

- Final list of Year 1 Scenarios
- Response to Forum Feedback
- Year 2 Parking Lot
- Important terms defined

Optimization Modeling Schedule

Year 1 (July '19-June '20)	Model five scenarios
Year 1 Milestone	Release technical memo Share results at Forum meeting Confirm next set of scenarios
Year 2 (July '20-June '21)	Revisit 'Parking Lot' scenarios Evaluate new combinations of reductions from marine and watershed sources
Year 2 Milestone	Public a report of modeling results Share results at Forum meeting

Review of Terms

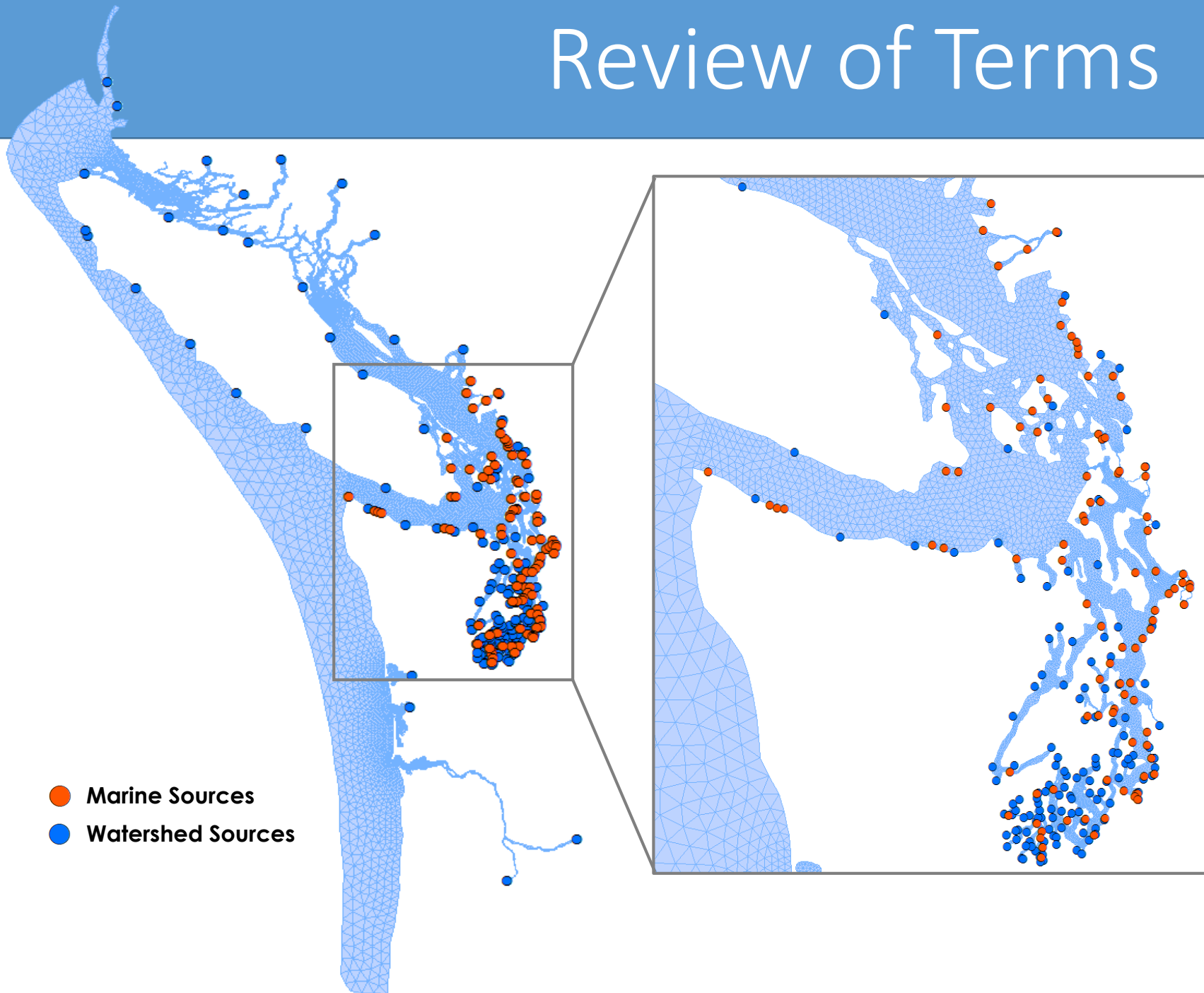
Model run: A set of inputs and boundary conditions for the model to hindcast or forecast the marine water quality response to those inputs.

Scenario: Set of model runs that answer nutrient management questions.

Reference conditions: prediction of marine water quality conditions without any human sources loads from Washington.

Existing conditions: hindcast of marine water quality with human source loads and hydrologic conditions for a given year.

Review of Terms



161 Watershed Sources

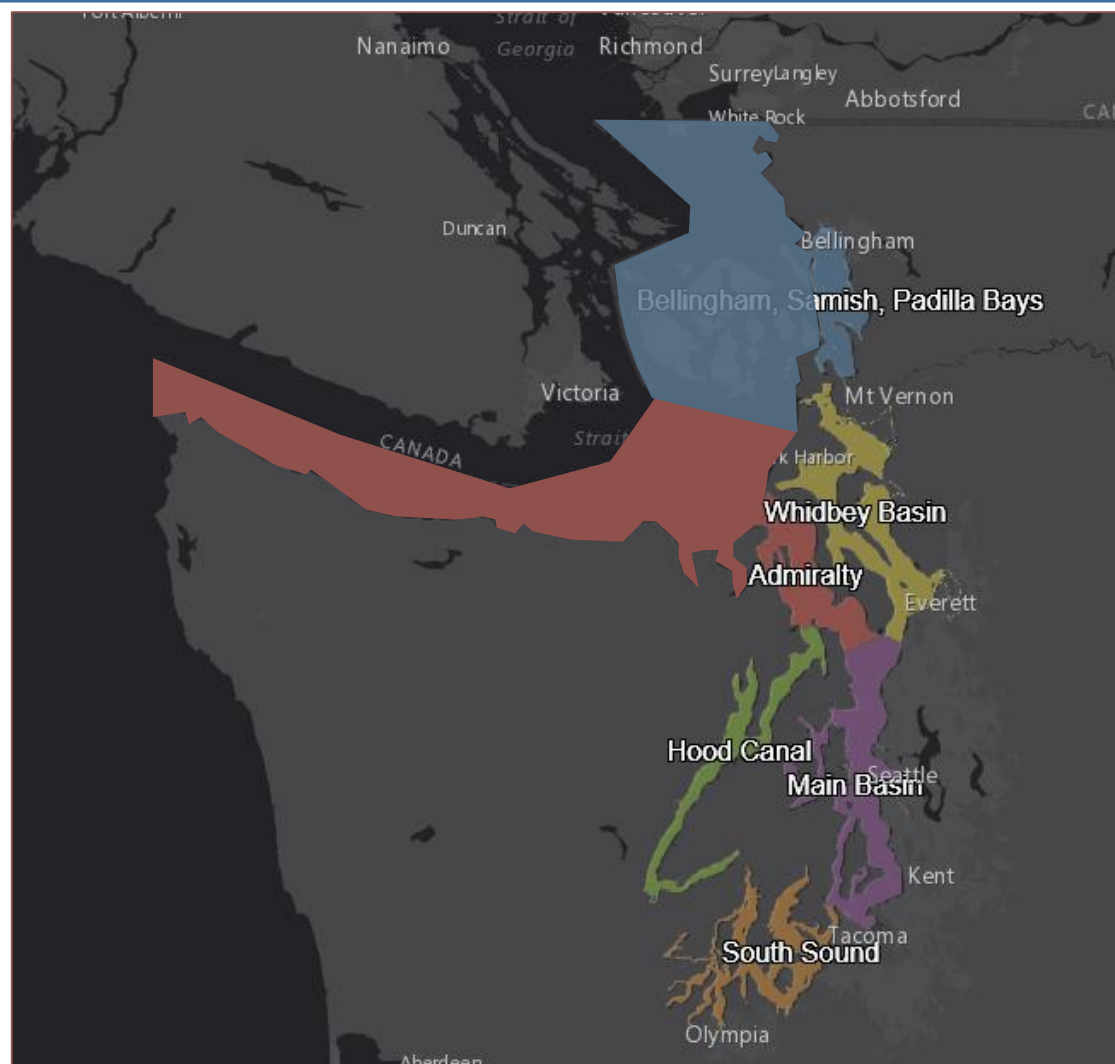
Rivers and streams entering Puget Sound, the Straits and the Pacific Ocean

99 Marine Sources

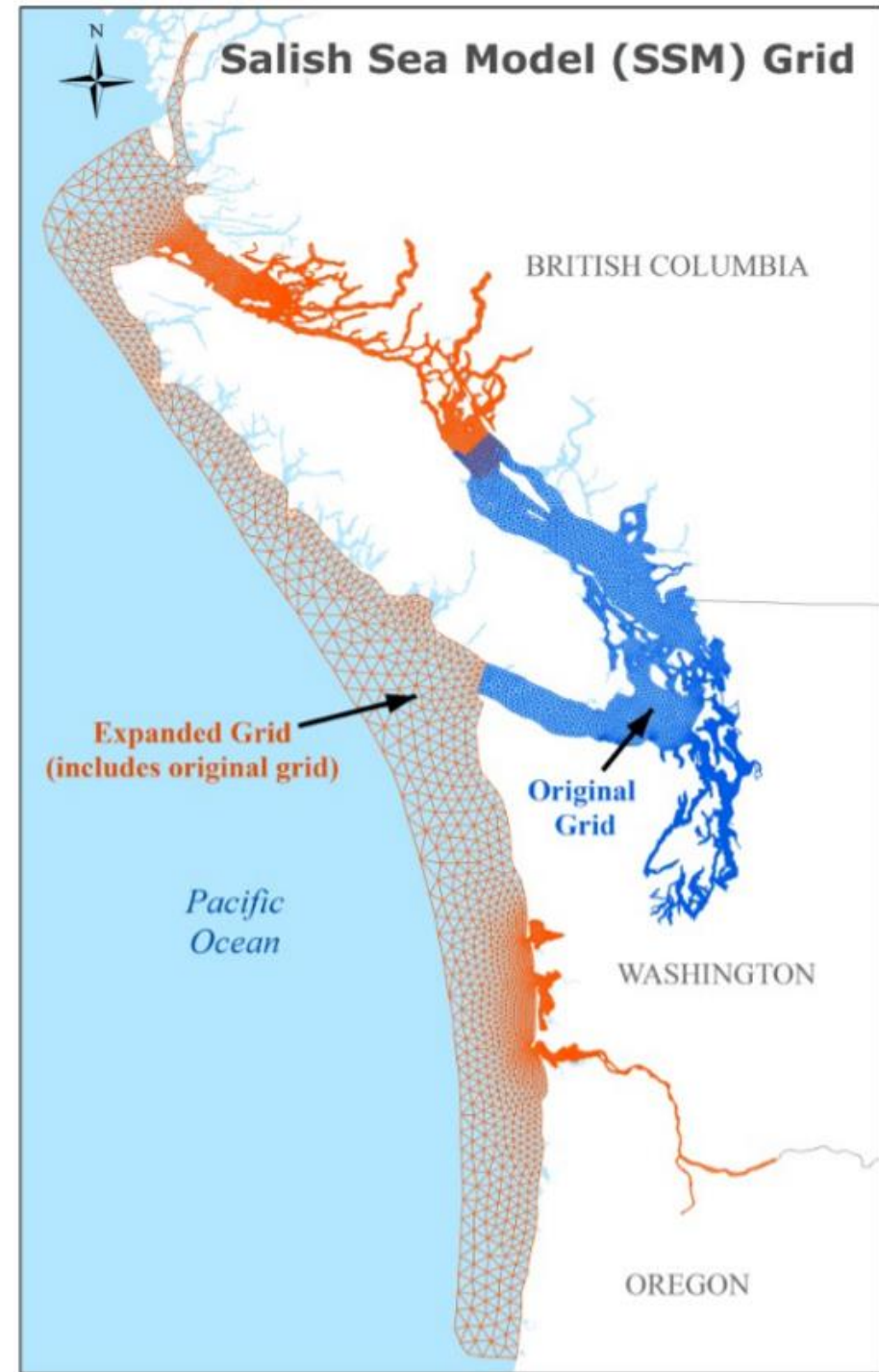
- All facilities with marine outfalls
- 78 U.S. WWTPs
- 9 Canadian WWTPs
- 10 industrial facilities

Puget Sound Basins

Grouping marine and watershed sources by areas with similar circulation and retention times to compare near-field and far-field effects of source inputs.



Final Year 1 Scenarios & Model Runs



Scenario 1: Watershed Significance by Basin

Objective: Understand the relative significance of existing watershed nutrient loads, grouped by basin, compared to reference DO conditions

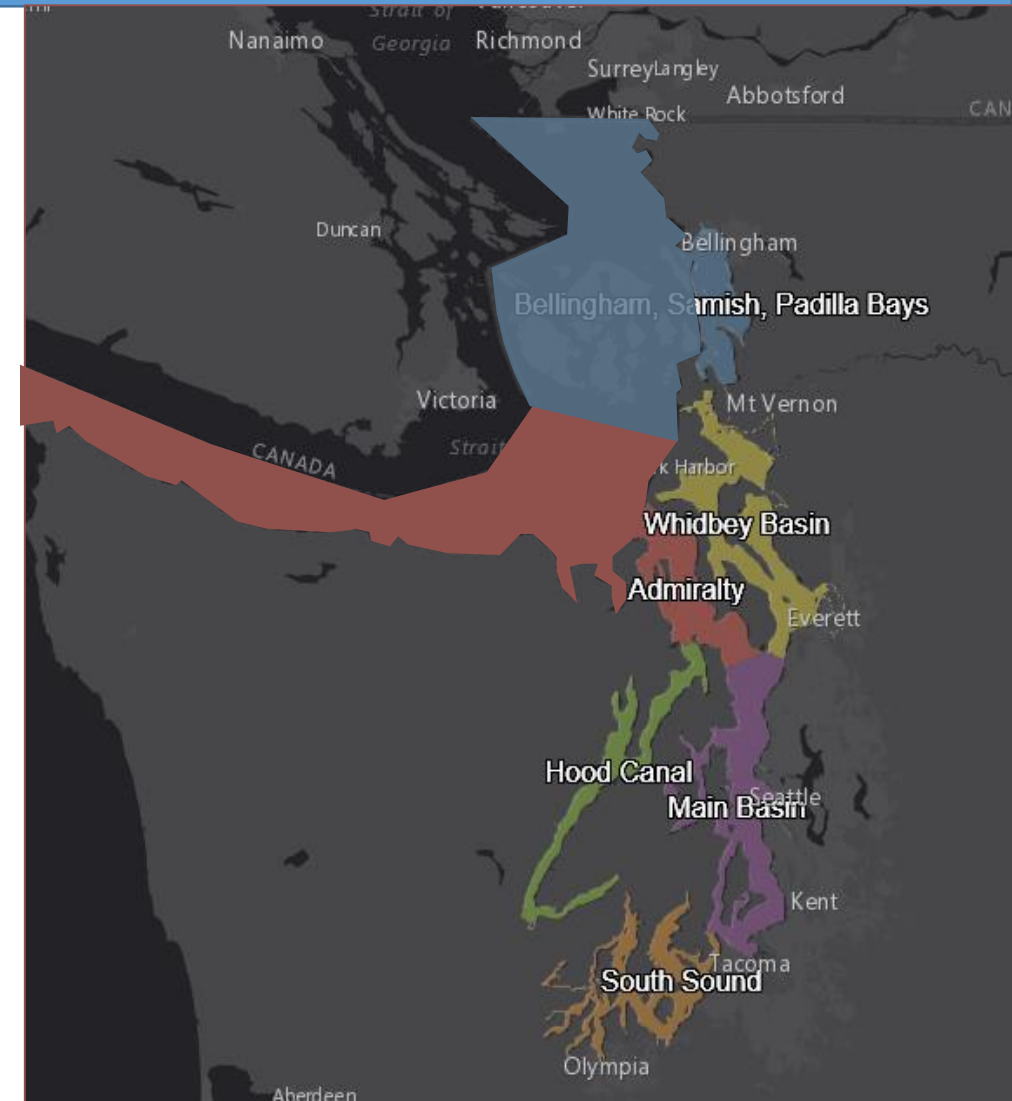
Changes made:

Inverse of original proposed scenario

- Focus basin watershed sources at reference
- Other basins at existing conditions
- Marine point sources at existing conditions

Basin regroupings:

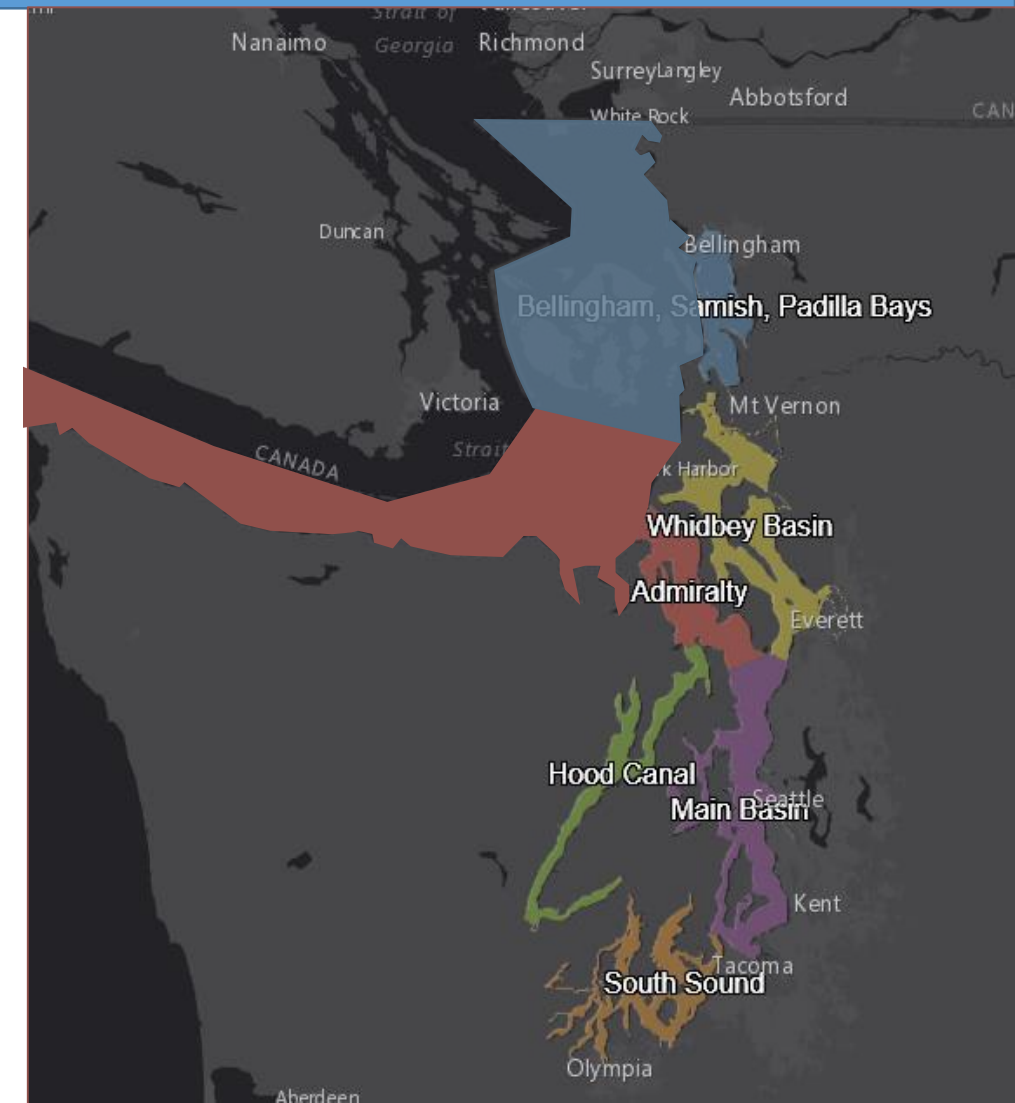
- Admiralty Inlet + Strait of Juan de Fuca
- Padilla/Samish/Bellingham Bay + Strait of Georgia



Scenario 1: Watershed Significance by Basin

Scenarios Runs:

- Keep marine point sources to existing levels.
- Evaluate impacts of watersheds by keeping watershed loading into one basin at reference loads.
- Set watershed loadings into other basins to existing conditions. Repeat for each basin.
- Calculate anthropogenic impact of watersheds with the 2006 and 2014 reference condition.



Scenario 2: Marine Point Source Reductions by Basin

Objective: Understand the relative significance of marine point sources, grouped by Puget Sound Basin, compared to reference DO conditions

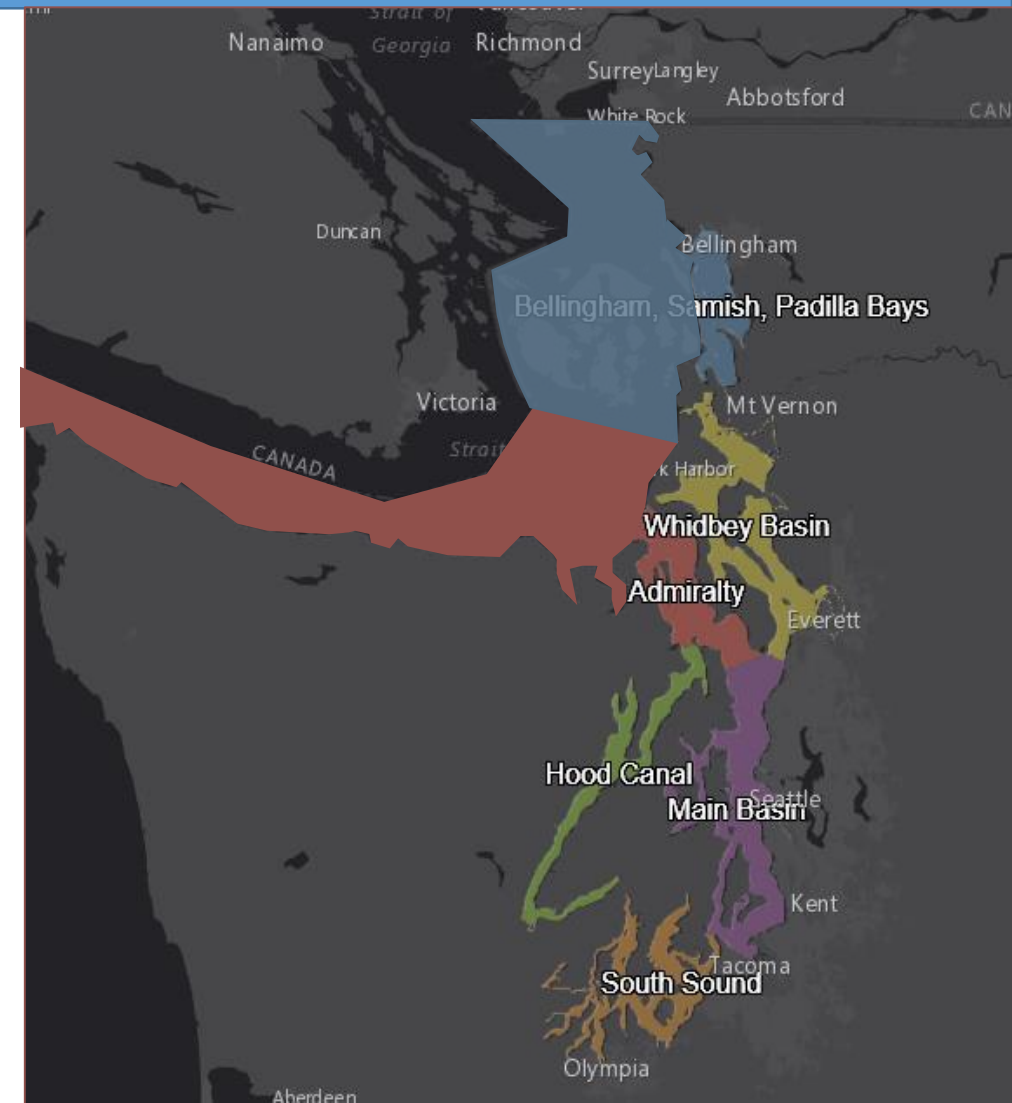
Changes made:

Inverse of original proposed scenario

- Focus basin marine point sources at reference
- Other basins at existing conditions
- Watershed sources at existing conditions

Basin regroupings:

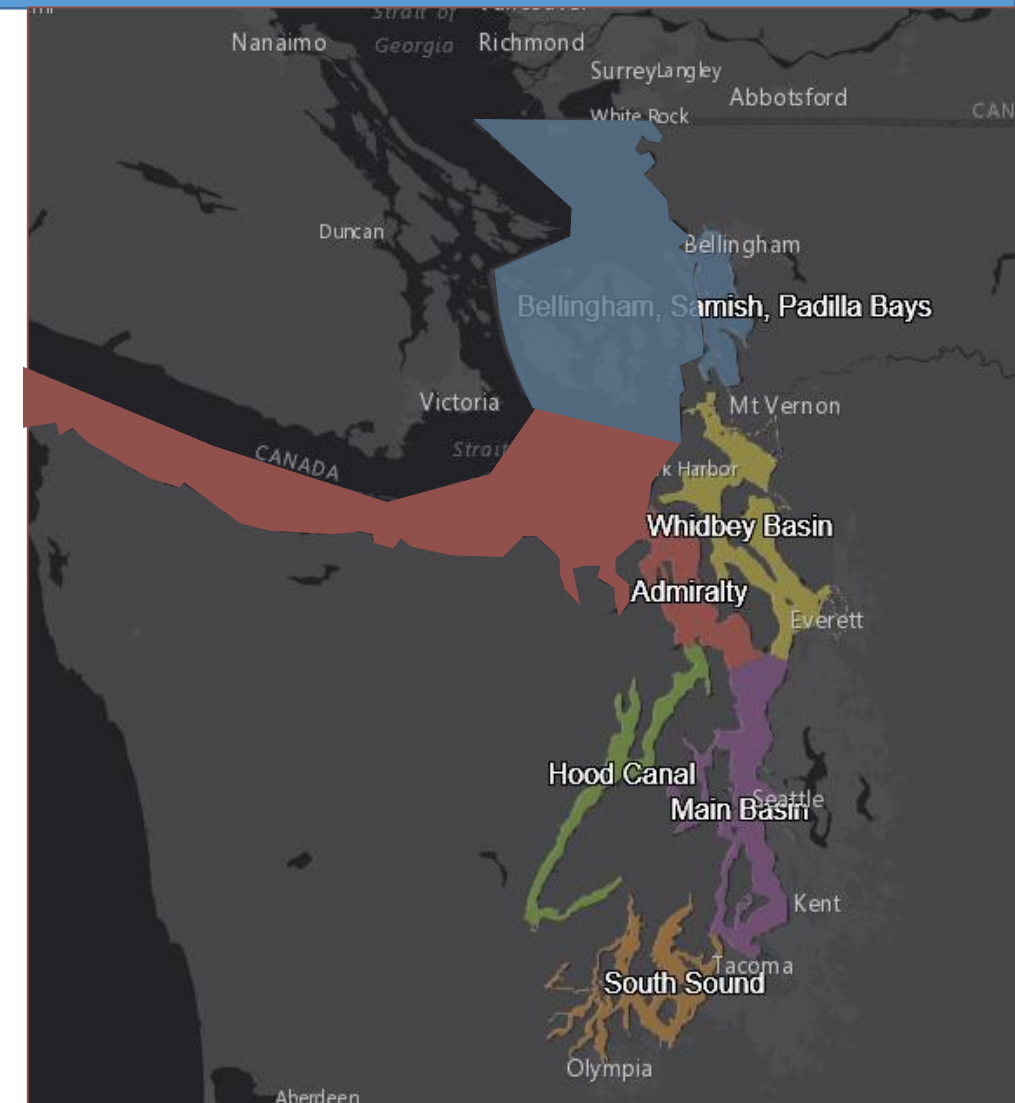
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- Padilla/Samish/Bellingham Bay + Strait of Georgia



Scenario 2: Marine Point Source Reductions by Basin

Scenarios Runs:

- Keep watershed sources to existing levels.
- Set marine point sources discharging into one basin at reference conditions.
- Set marine point sources discharging into all other basins to existing conditions. Repeat for each basin.
- Calculate anthropogenic impact with the 2006 reference conditions.



Scenario 3: Annual vs. Seasonal Marine Point Source Nutrient Load Reductions

Objective: Understand wastewater seasonal nutrient load reductions compared to reductions in annual loading and the resulting improvement to water quality

Changes:

- Model treatment levels in lbs/year instead of concentrations



Scenario 3: Annual vs. Seasonal Marine Point Source Nutrient Load Reductions

Scenario Runs:

- Set marine point sources to assumed specific level of dissolved inorganic nitrogen (DIN) reduction (and commensurate dissolved organic carbon (DOC) reduction) with operational levels year-round.
- Compare to bounding scenario runs (seasonal treatment levels of 8mg/L)



Scenario 4: Future Population Growth

Objective: Understand the impacts of population growth on future DO levels

Changes made:

- Run a business as usual scenario: set marine point sources to existing conditions
- No climate change runs—these will be delayed until Year 2



Scenario 4: Future Population Growth

Scenario Runs:

- Set a baseline condition scenario with marine and watershed sources at reference levels of DIN.

Population growth runs:

- Use existing ocean boundary and climate conditions and marine wastewater effluent flows with population growth at 2040 levels under the **'low'** population growth projections OFM.
- Use existing ocean boundary and climate conditions and marine wastewater effluent flows with population growth at 2040 levels under the **'high'** population growth projections OFM.

Scenario 5: Everybody, Everywhere

Objective: Understand the total nutrient reductions needed to meet DO standards in Puget Sound through testing the improvement from a range of nutrients reductions at marine point sources and watershed sources

Inputs are TBD based on results of earlier scenario modeling:

- Set marine point sources at advanced nutrient removal levels.
- Set watershed sources at total anthropogenic DIN load reductions.
- Adapt marine point source and watershed sources inputs.

Parking Lot for Year 2

- Sub-basin evaluation of sensitive watersheds
- Climate changes scenario
- Everybody, Everywhere—continue optimization
- Refinement of Year 1 Scenarios
- Continue to update inputs with best available data

Questions?

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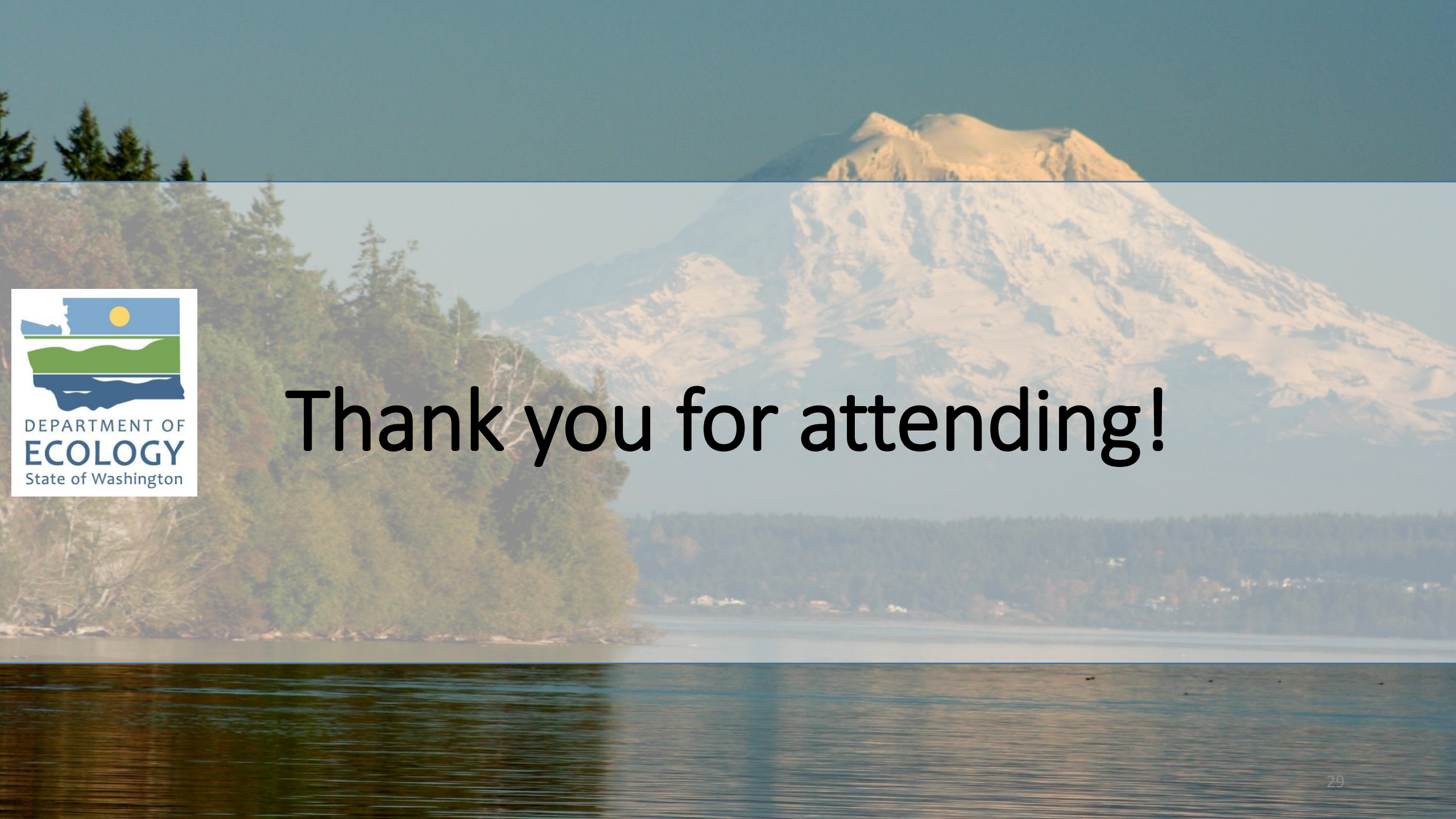
Next Forum Meeting

Costs and Creative Solutions for Nutrient Management

Green River College

August 7, 2019 (WebEx and in-person)

10am -3pm



Thank you for attending!