

South Puget Sound Dissolved Oxygen Study

January 2009

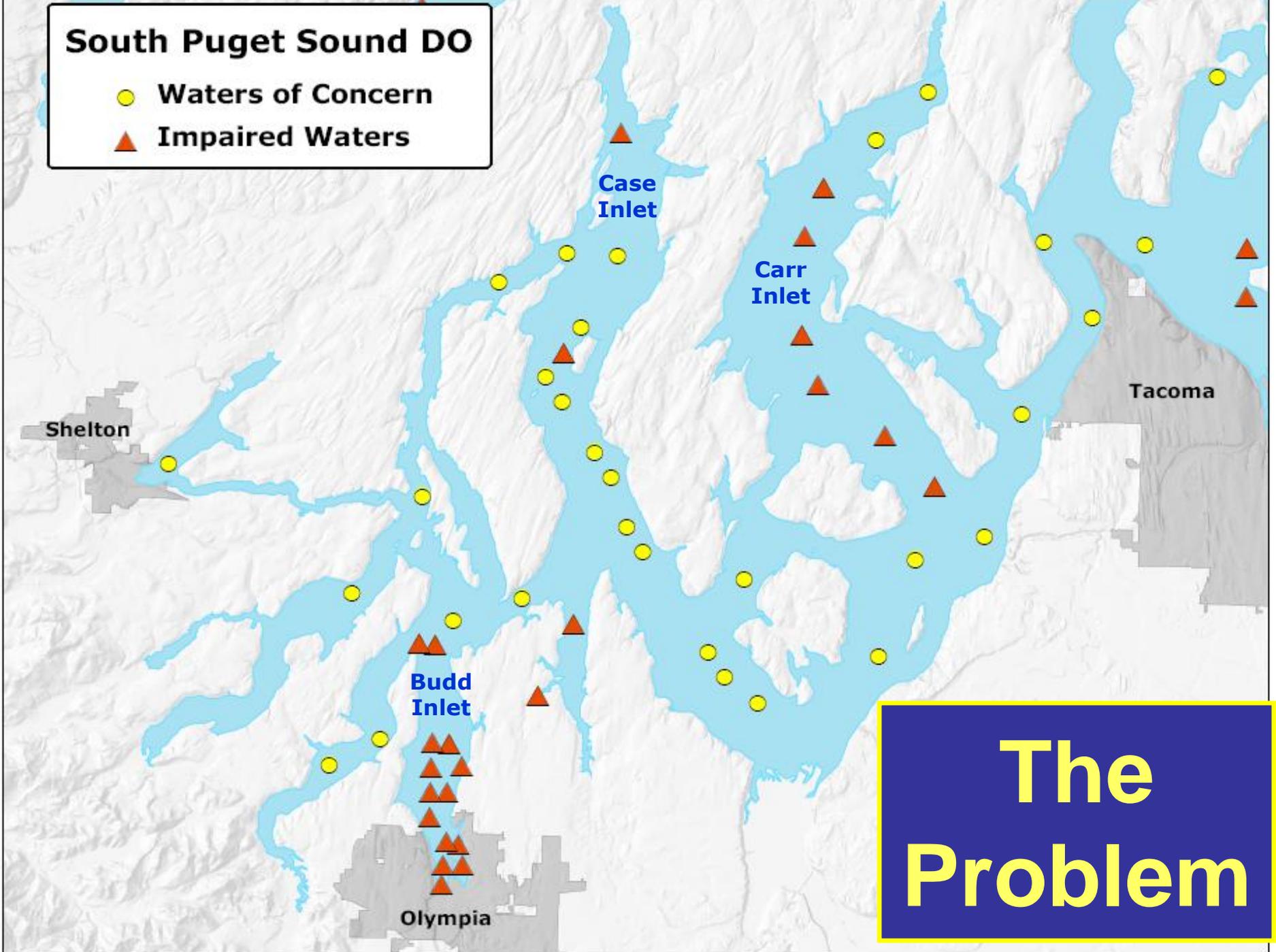
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akol461@ecy.wa.gov

South Puget Sound DO

- Waters of Concern
- ▲ Impaired Waters



**The
Problem**

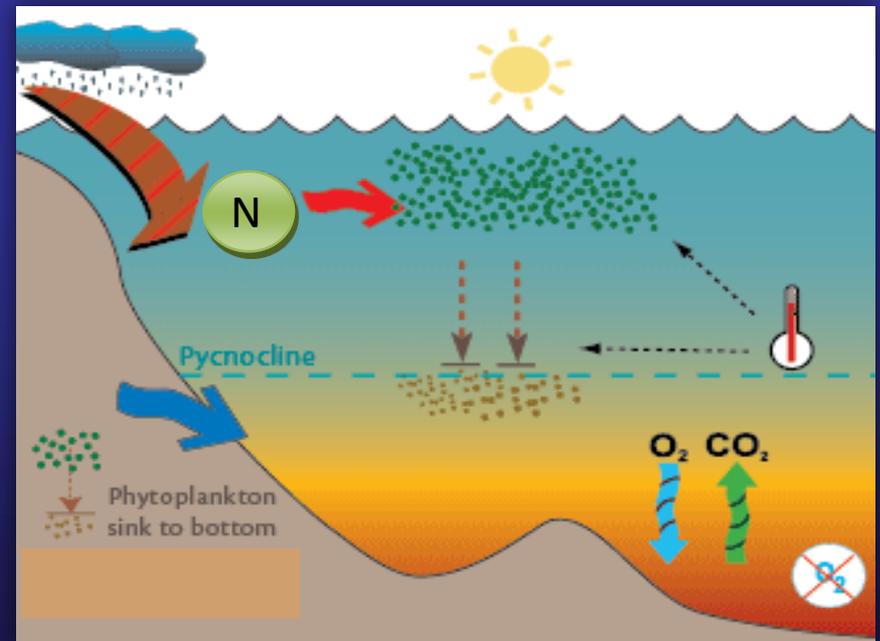
Goal of the Study

Determine how human activities (along with natural factors) affect low dissolved oxygen levels in South Puget Sound.



Primary Issues

- Nitrogen is the main pollutant that causes low dissolved oxygen levels
- Fish need oxygen
- Solve the problem before it gets worse



Long Term

If the study shows that something needs be done to protect dissolved oxygen levels in South Puget Sound, a plan of action that will result in clean water will be necessary.

Involvement

1. Webpage

www.ecy.wa.gov/puget_sound

*then click on “South Puget Sound
Dissolved Oxygen Study”*

2. ListServ

3. Technical Advisory Committee

Next meeting: Spring 2009

Technical Advisory Committee

Tribes

WWTPs

University

Municipalities

Counties

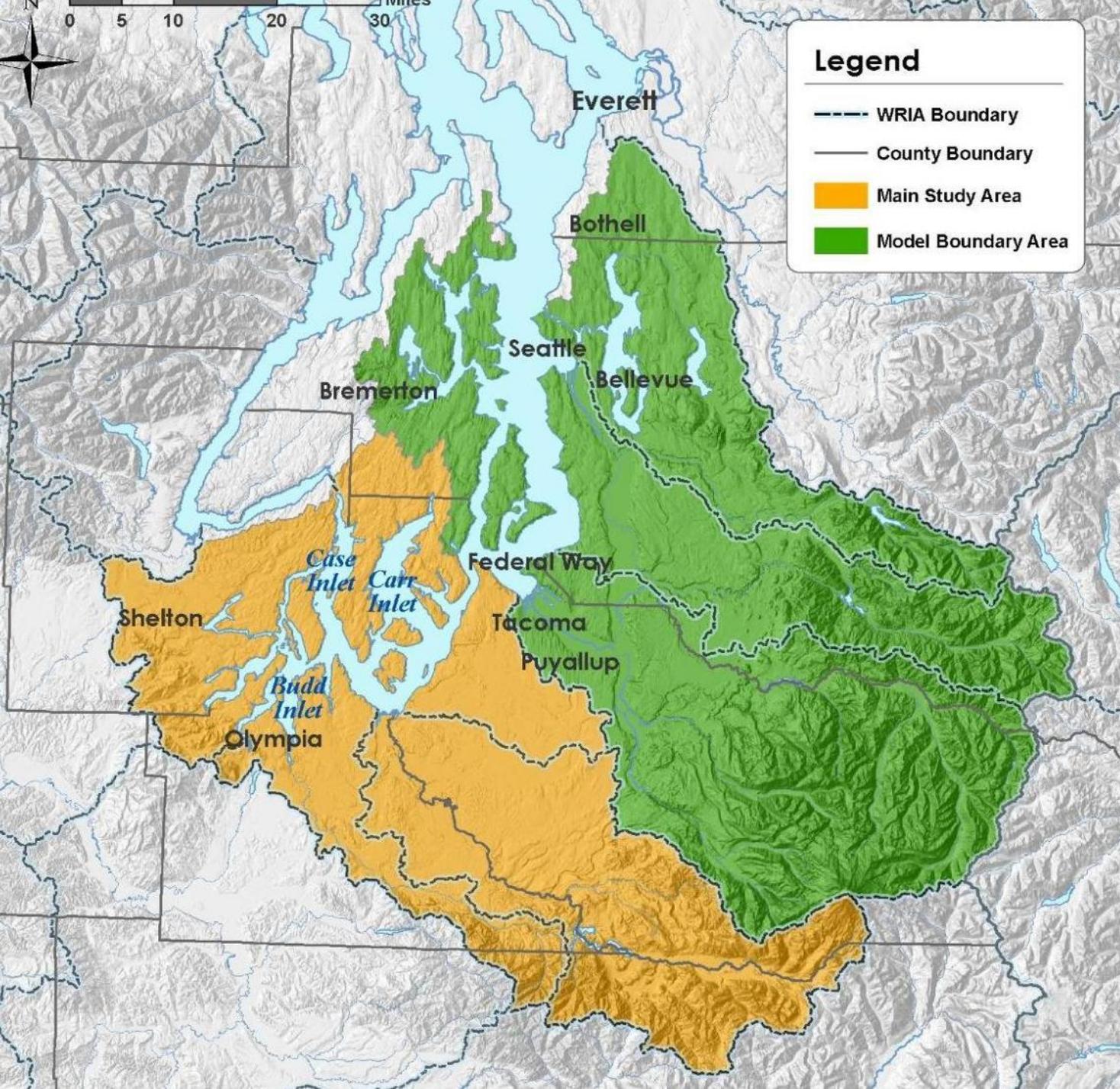
Business Interests

Conservation District

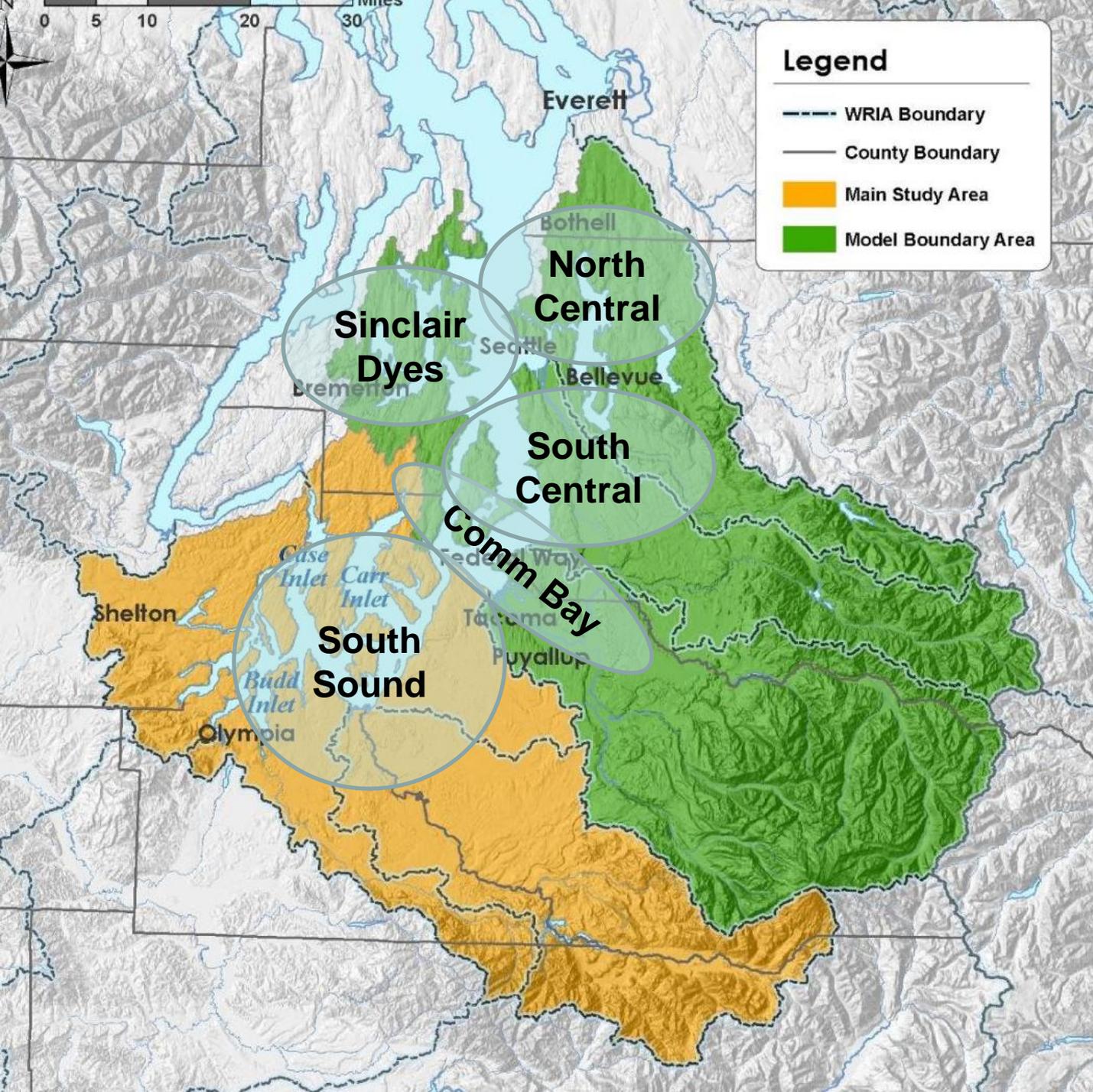
Department of Health

Environmental Groups

Federal Government

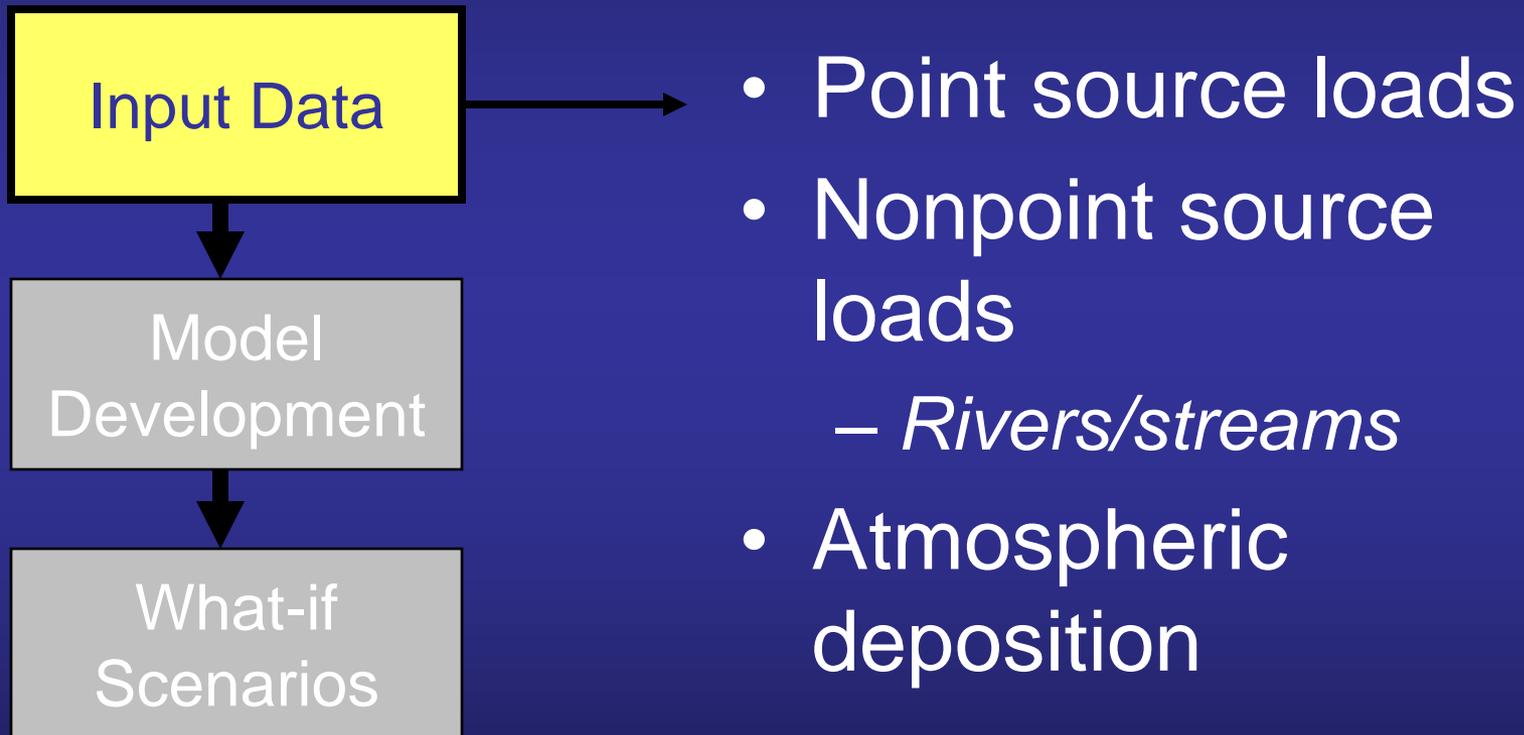


Study Area



Regions

1. Collect data to set up model



Nitrogen Loading to South Puget Sound

kg/day of dissolved inorganic nitrogen (DIN), measured September 2007

710

Rivers (including upstream septics, WWTPs, stormwater, groundwater, atmospheric deposition, and other point and nonpoint sources). The 710 kg/day accounts for about 85% of the watershed.

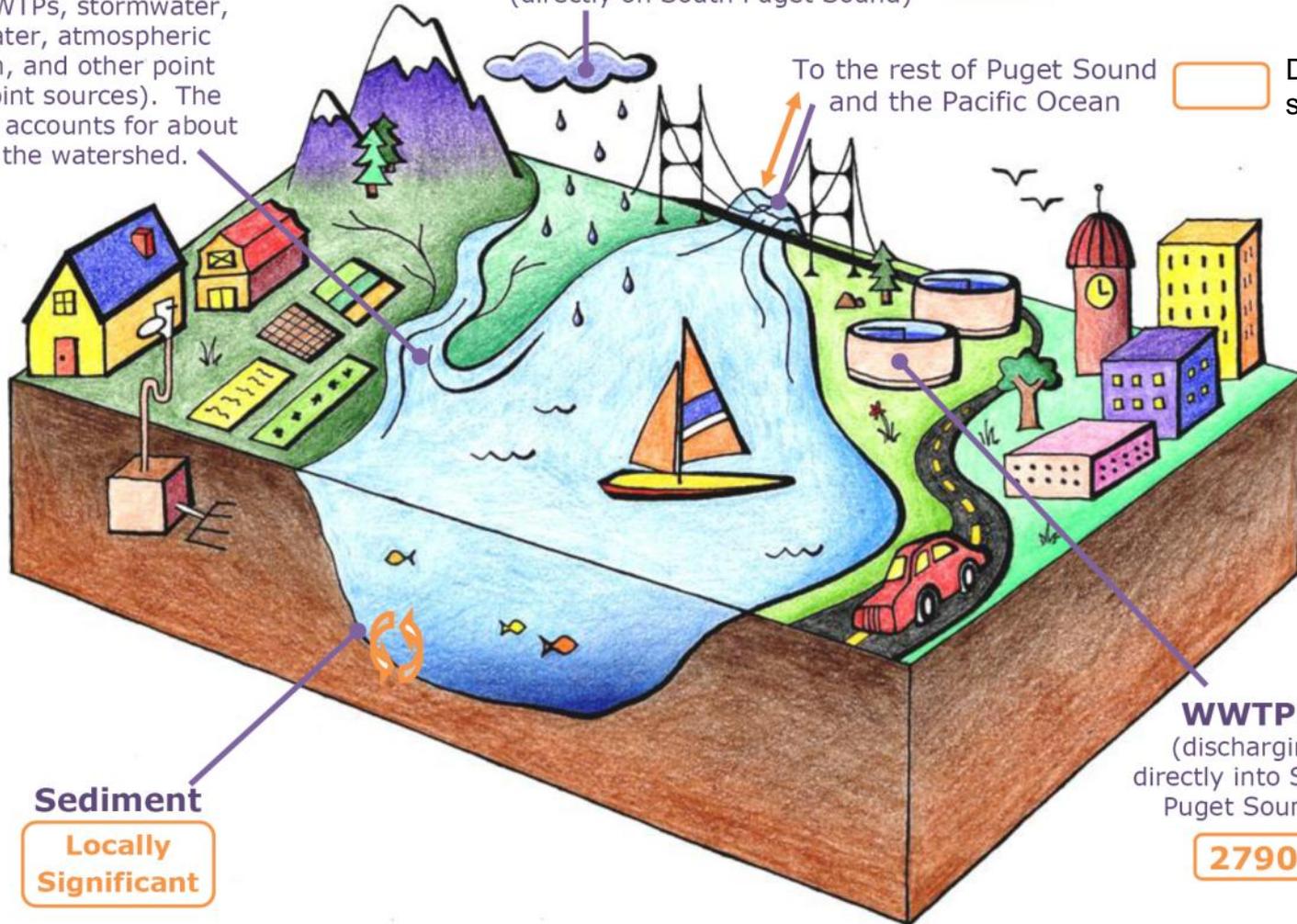
Atmospheric Deposition
(directly on South Puget Sound)

170*

To the rest of Puget Sound
and the Pacific Ocean



Determined soon...



Sediment

Locally Significant

WWTPs
(discharging directly into South Puget Sound)

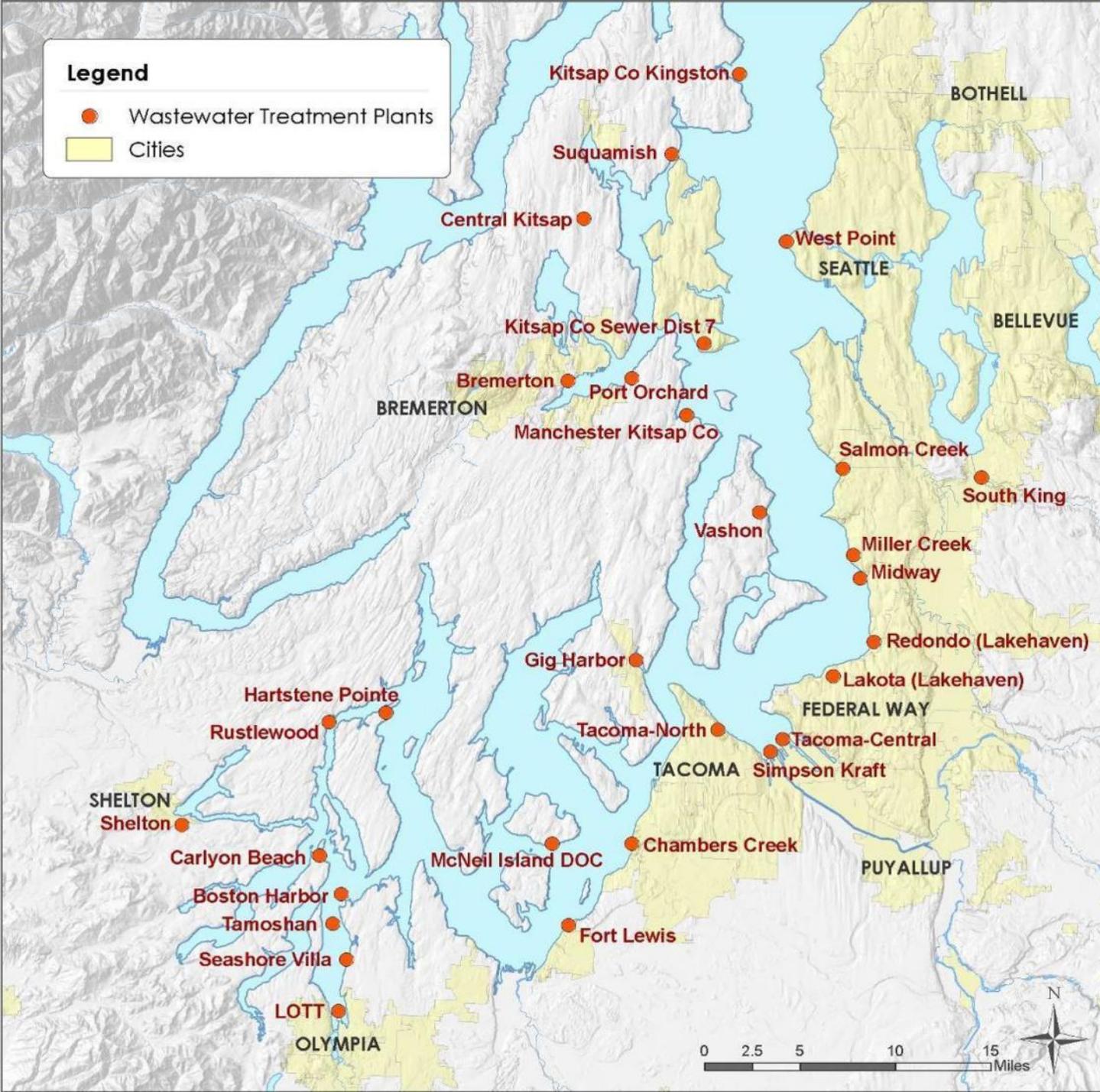
2790

Art: Jessica Moyer

*The atmospheric deposition load is an annual average

Legend

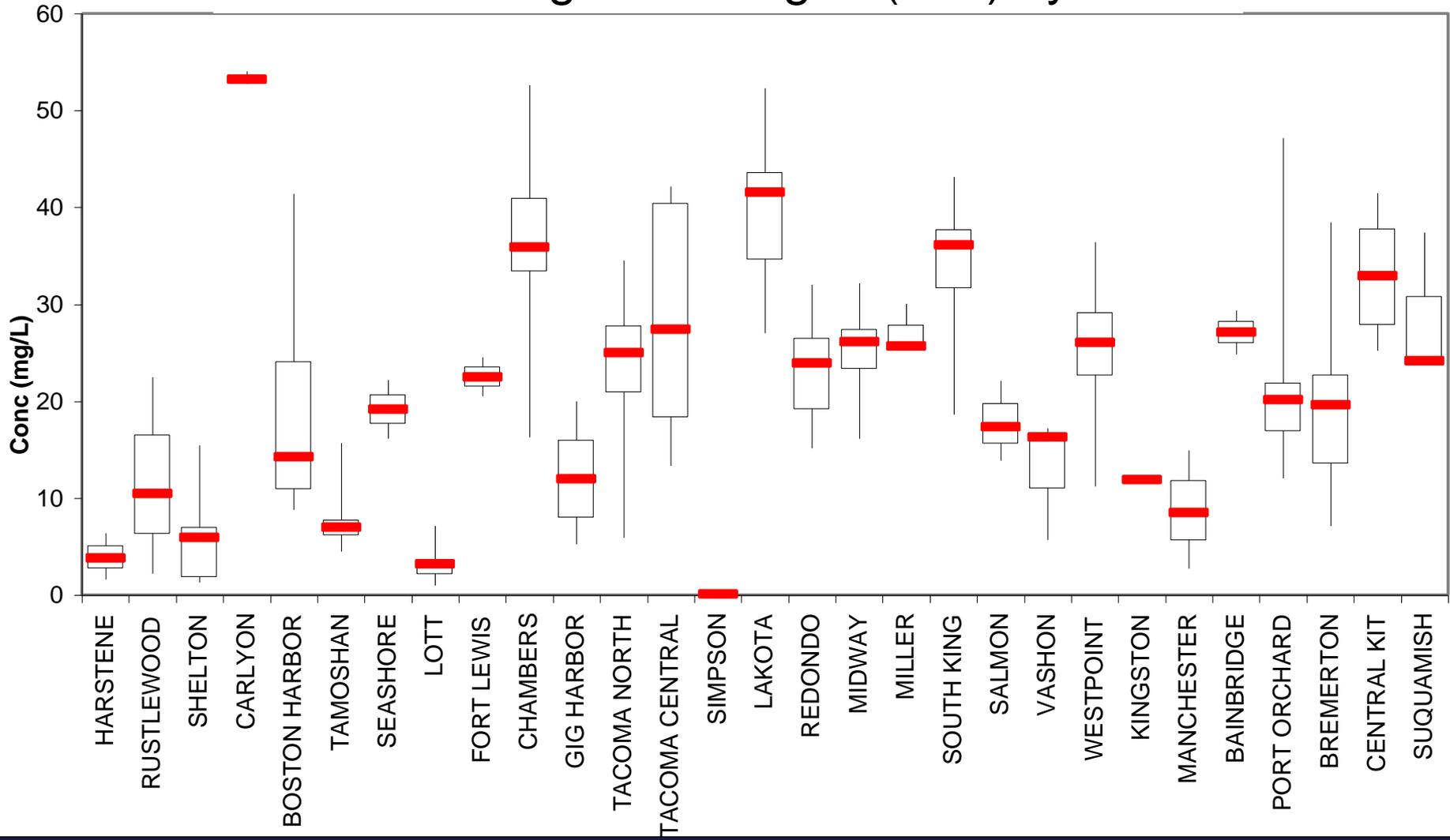
- Wastewater Treatment Plants
- Cities



**WWTPs
part of
the
study**

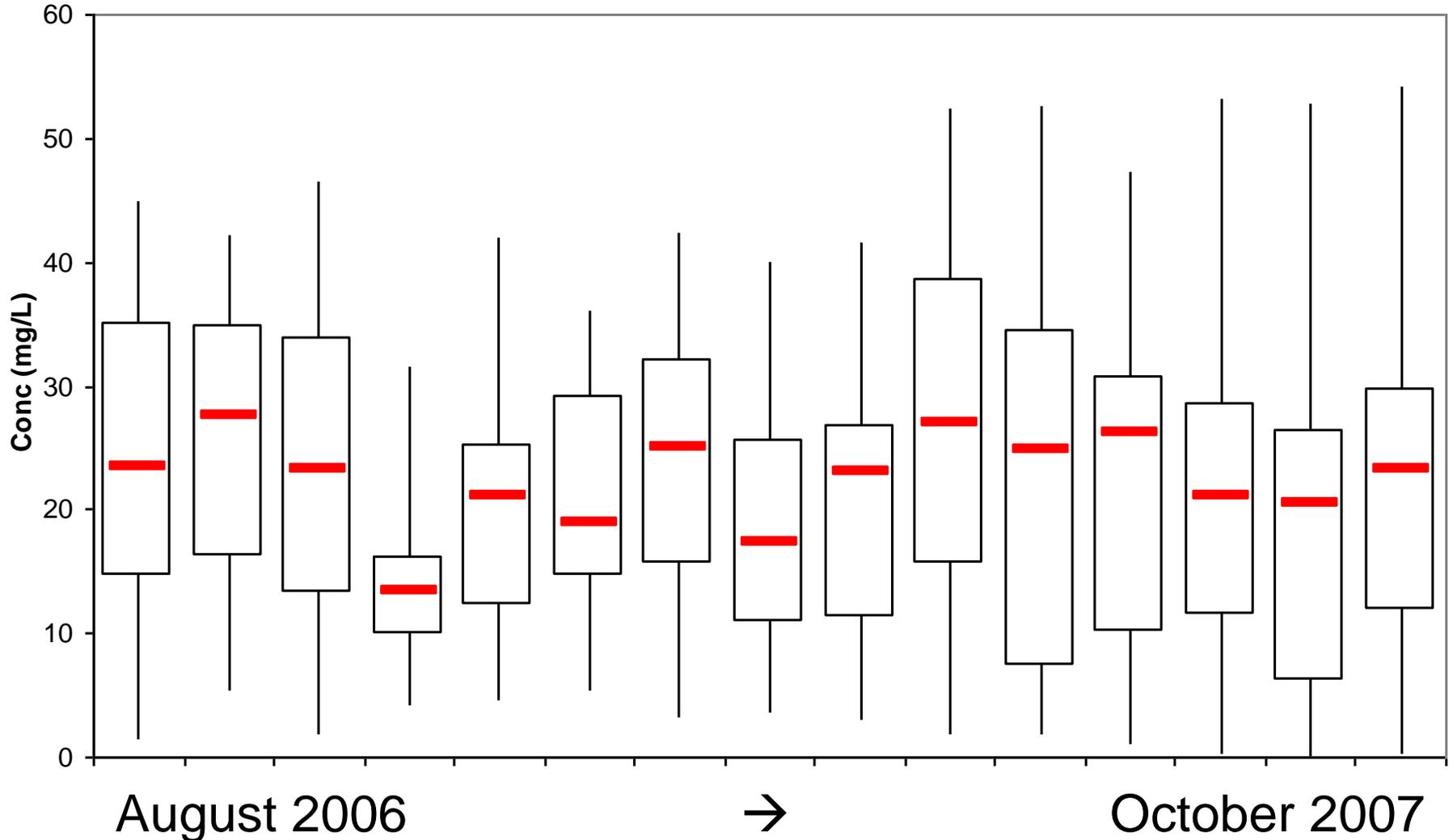
WWTP Concentrations

Dissolved inorganic nitrogen (DIN) by Plant

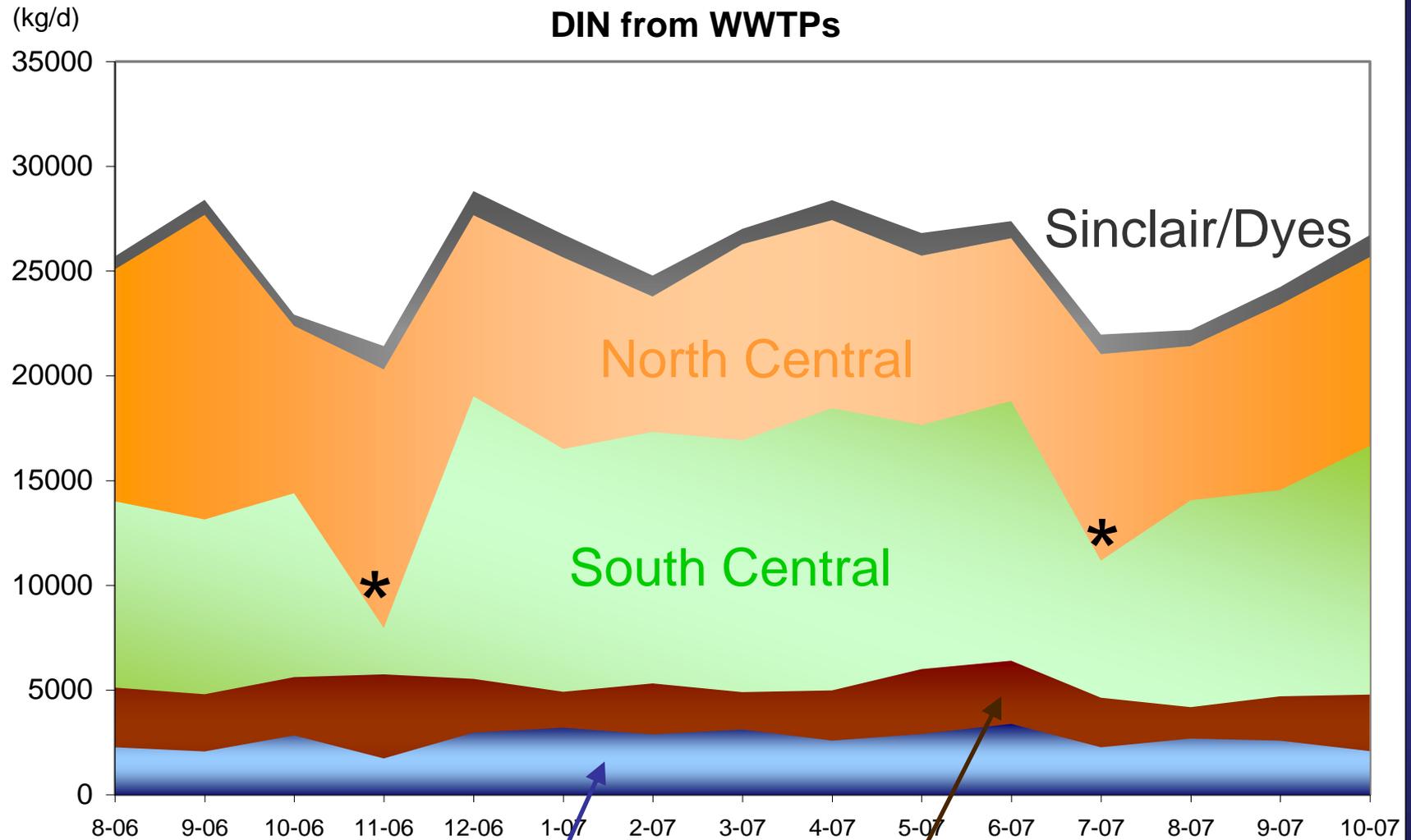


Nitrogen Loads from WWTP

Dissolved inorganic nitrogen (DIN) by Month



Nitrogen Loads from WWTPs

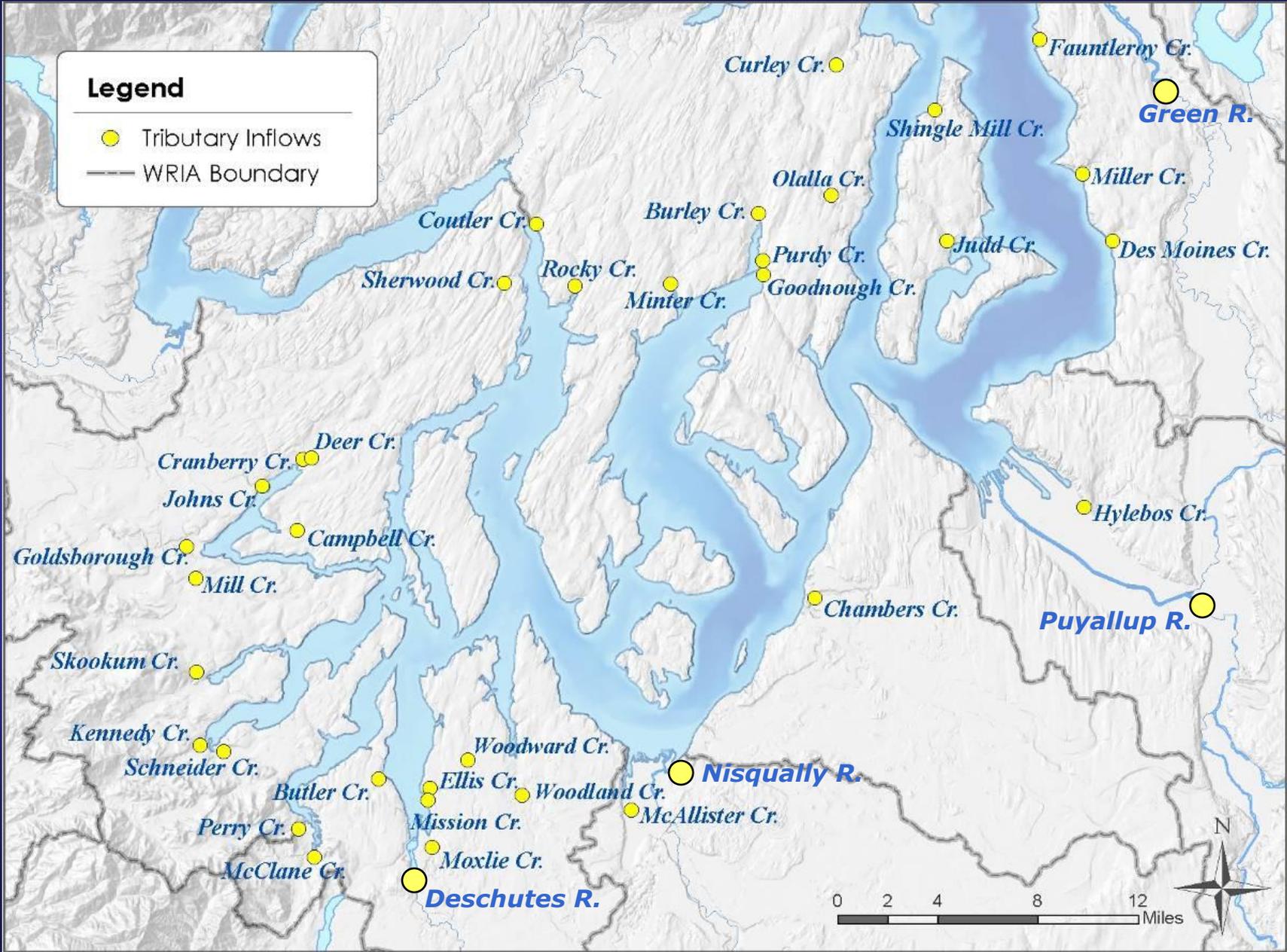


South Sound

Commencement Bay

* The two dips are an artifact of missed sampling and we will account for them

Tributary Monitoring

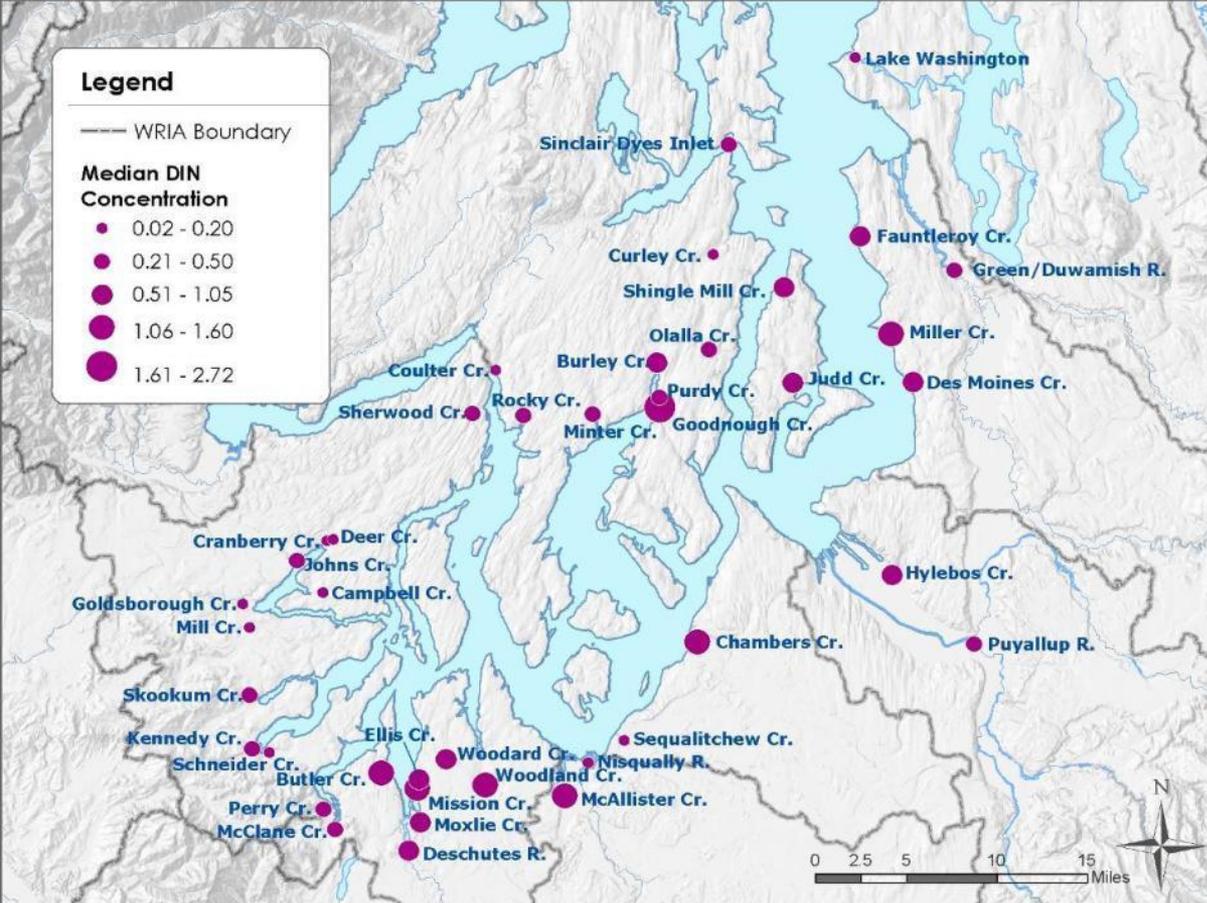


Legend

--- WRIA Boundary

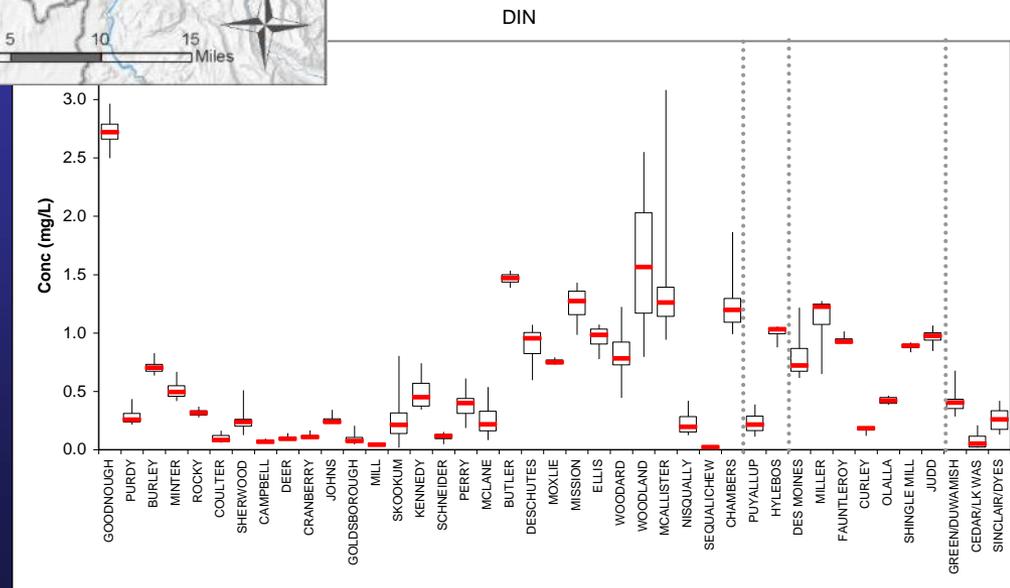
Median DIN Concentration

- 0.02 - 0.20
- 0.21 - 0.50
- 0.51 - 1.05
- 1.06 - 1.60
- 1.61 - 2.72



Tributary DIN concentration

See the on-line data report for all of the tributary and WWTP data for nitrogen, phosphorus, carbon, BOD, etc.



SEPTEMBER 2007

Dissolved Inorganic Nitrogen Loads

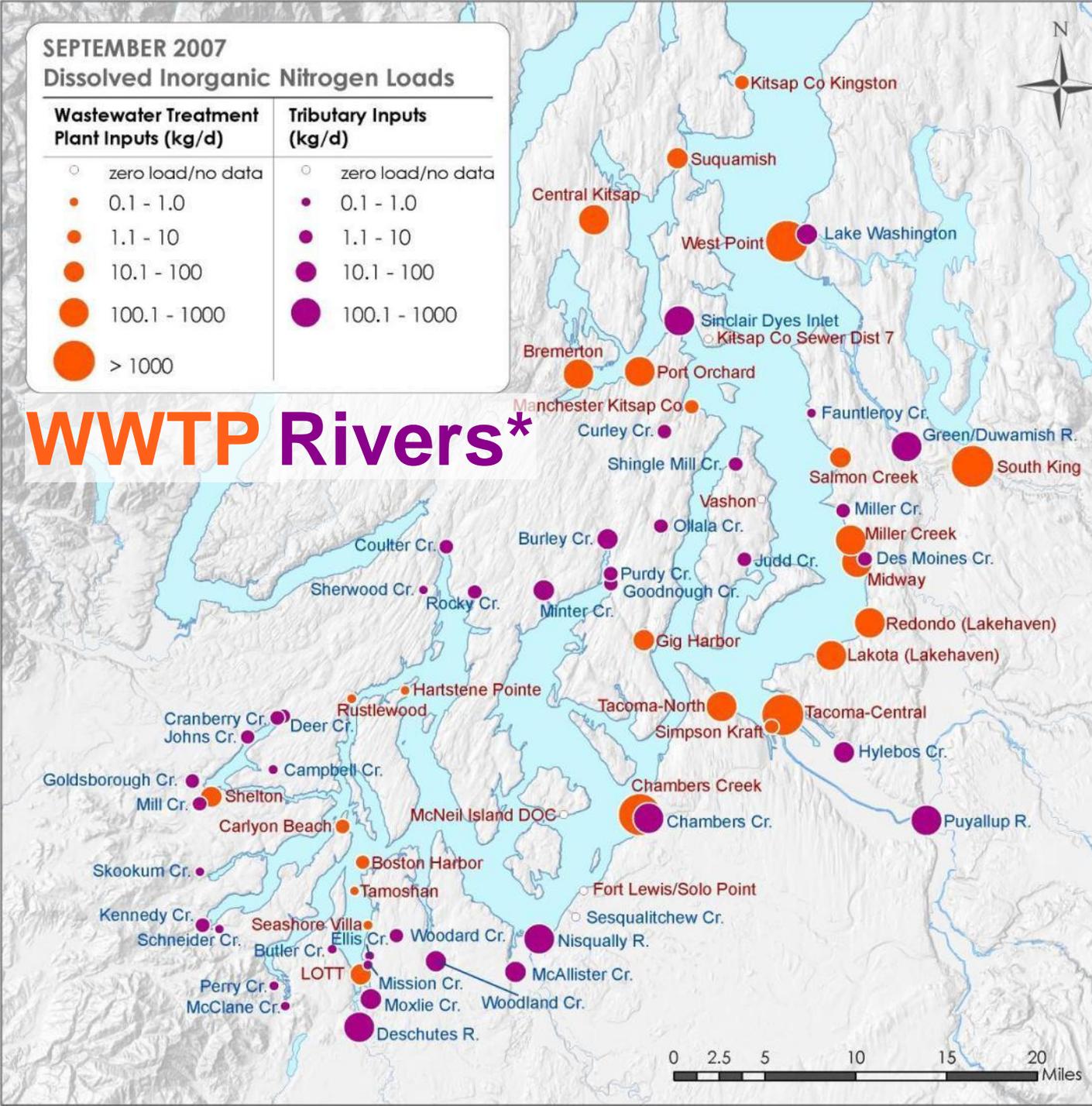
Wastewater Treatment Plant Inputs (kg/d)

- zero load/no data
- 0.1 - 1.0
- 1.1 - 10
- 10.1 - 100
- 100.1 - 1000
- > 1000

Tributary Inputs (kg/d)

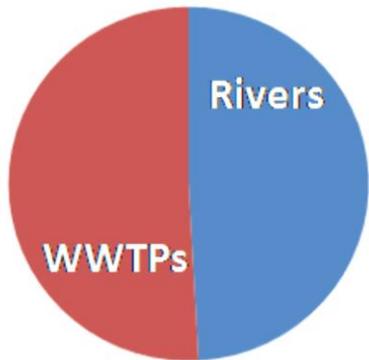
- zero load/no data
- 0.1 - 1.0
- 1.1 - 10
- 10.1 - 100
- 100.1 - 1000

WWTP Rivers*



Nitrogen Loads
(Critical Month)

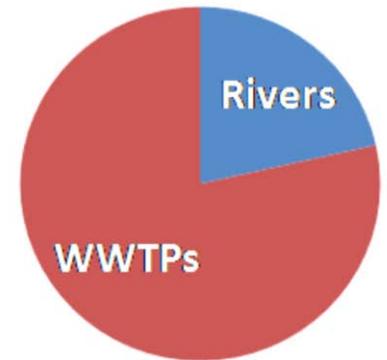
Annual



Nitrogen Load

DIN (kg/d)

Sept 2007



South Puget Sound

10,000

5,000

Rivers

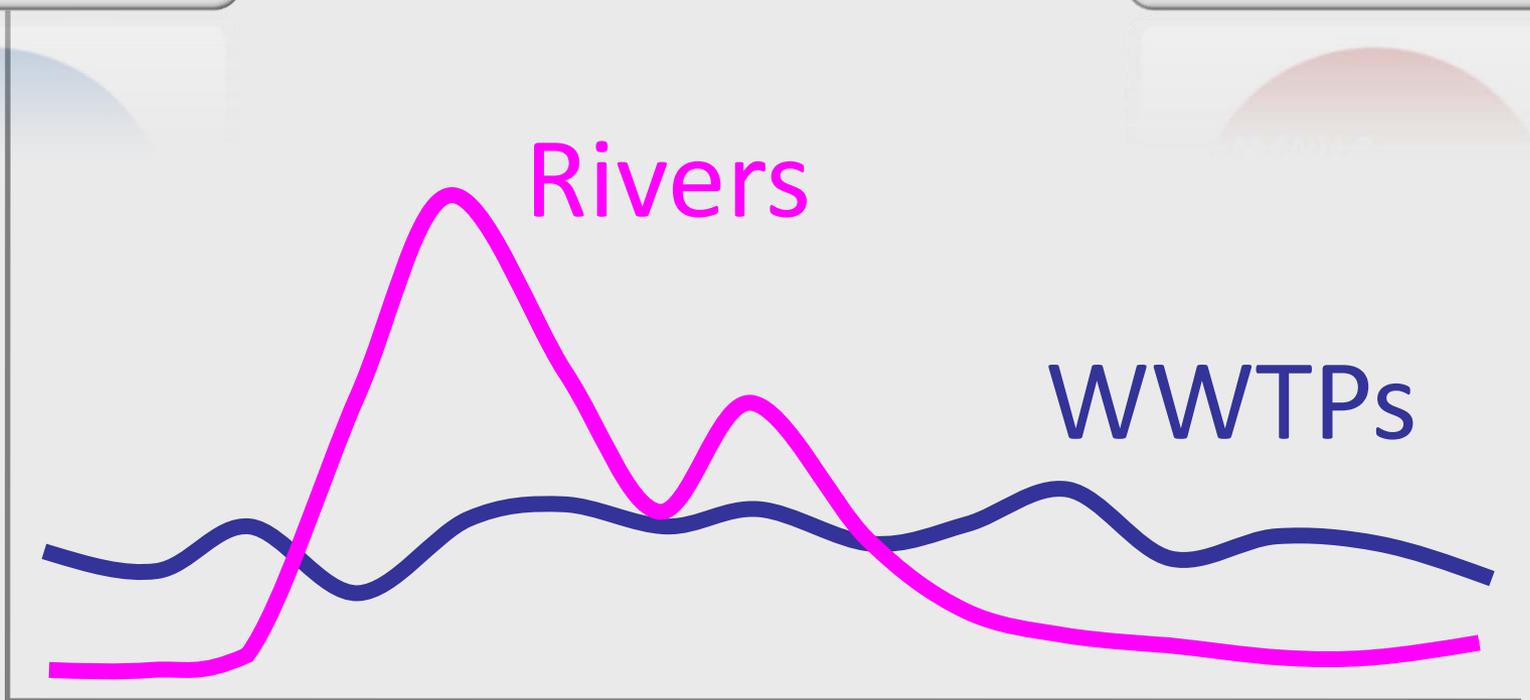
WWTPs

8/06

12/06

4/07

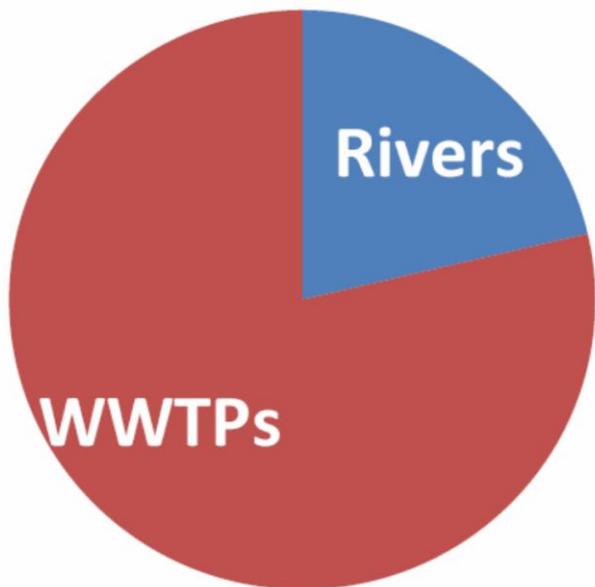
8/07



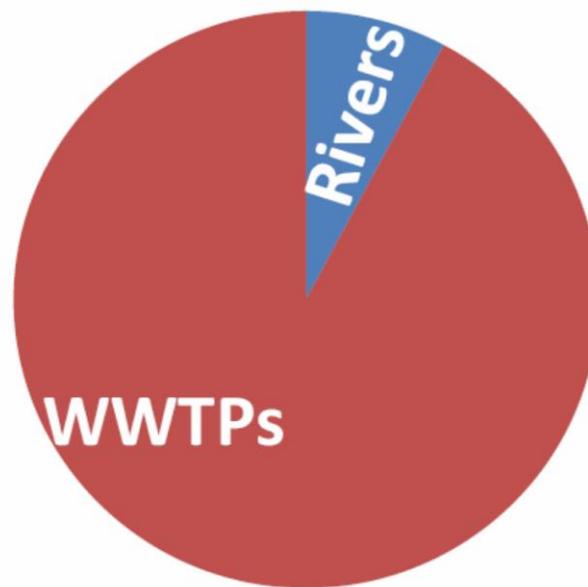
Nitrogen Load in South & Central Sound

South of the Edmonds; DIN

Annual



Sept 2007



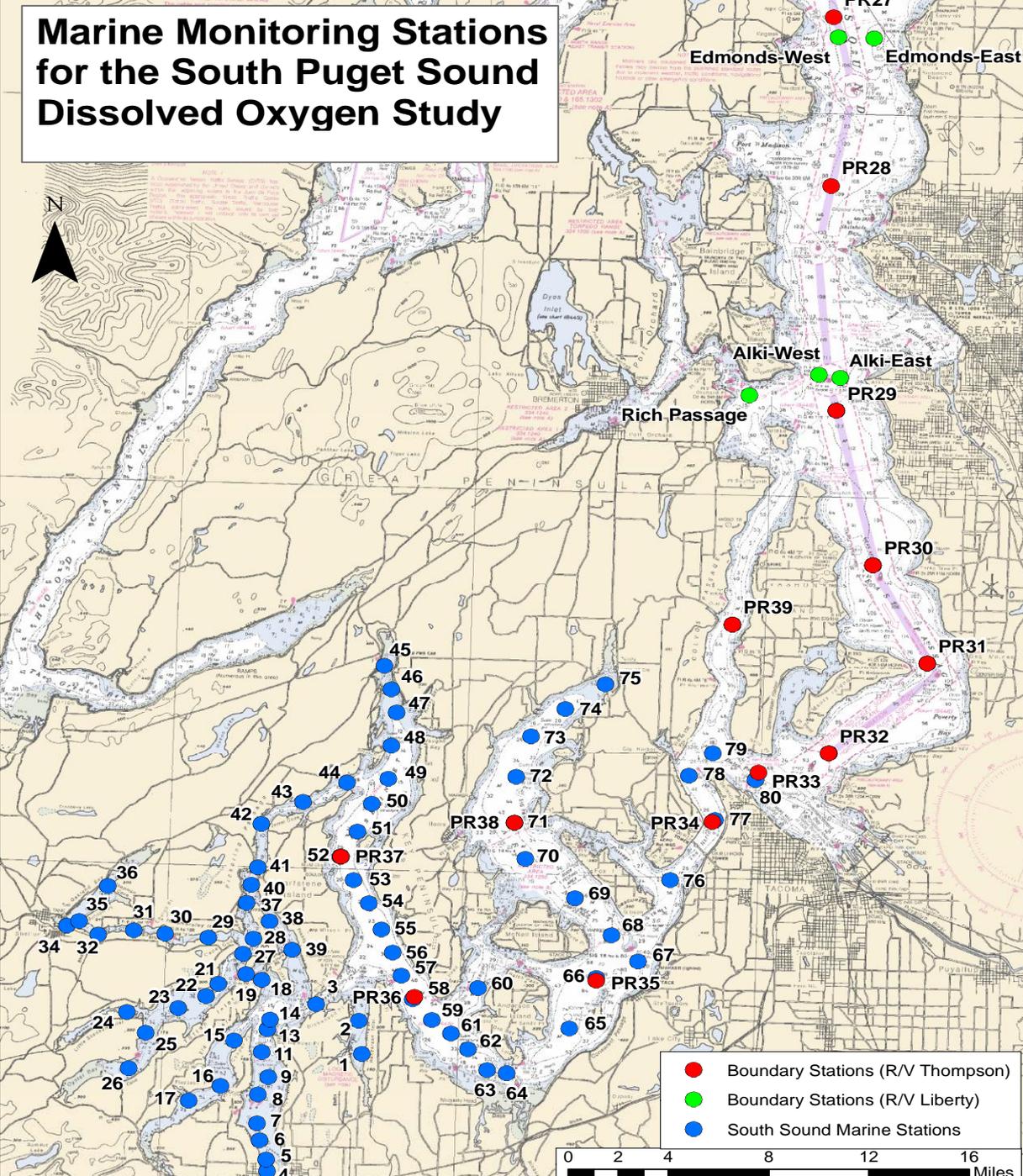
** River monitoring occurs near the mouth and include all upstream point, nonpoint, and natural sources of nitrogen*

Marine Data

- Ambient monitoring
- Monthly boundary sampling cruises
- Depth profiles
- Grab samples
- Productivity
- Currents (ADCP)

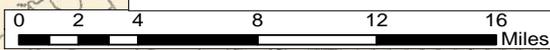


Marine Monitoring Stations for the South Puget Sound Dissolved Oxygen Study



South Sound Marine Stations

- Boundary Stations (R/V Thompson)
- Boundary Stations (R/V Liberty)
- South Sound Marine Stations

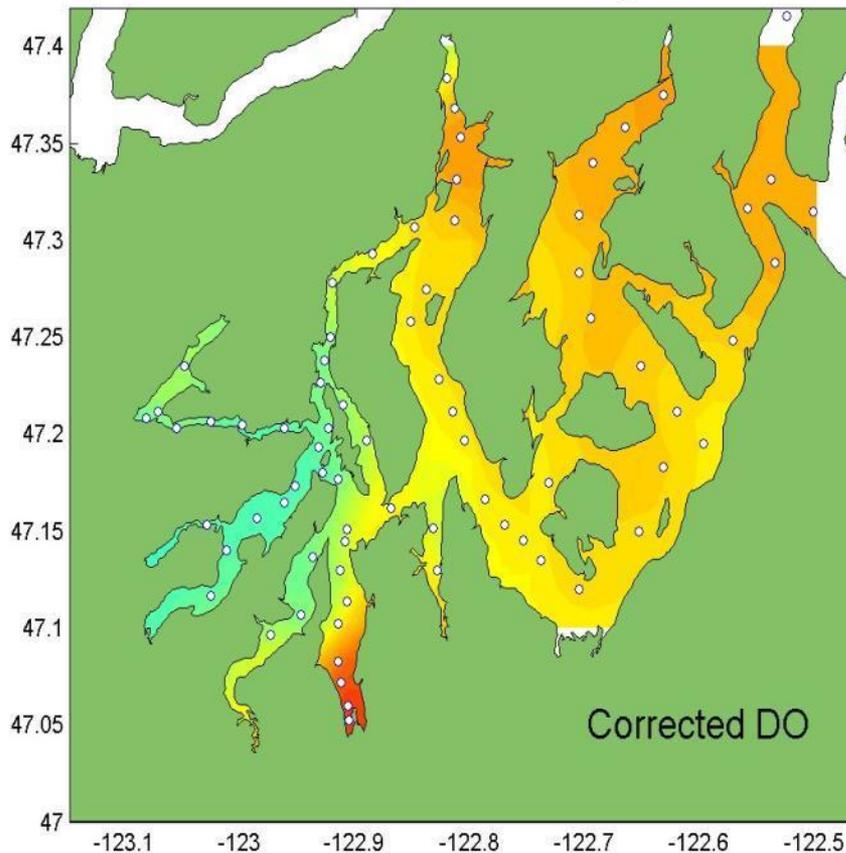


September Bottom Dissolved Oxygen

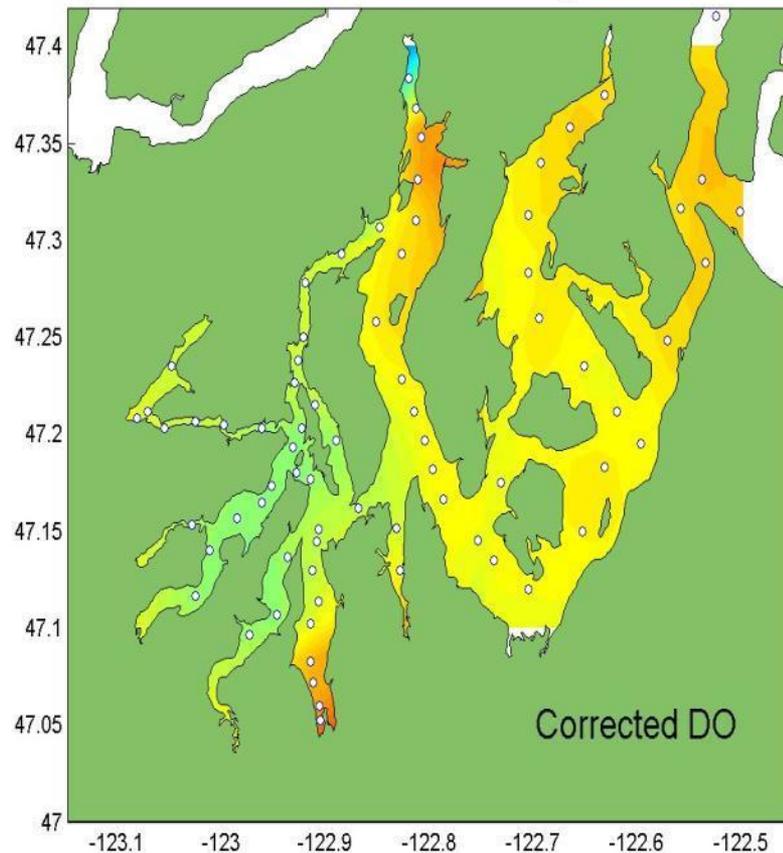
2006

2007

B2 Bottom DO - mg/l

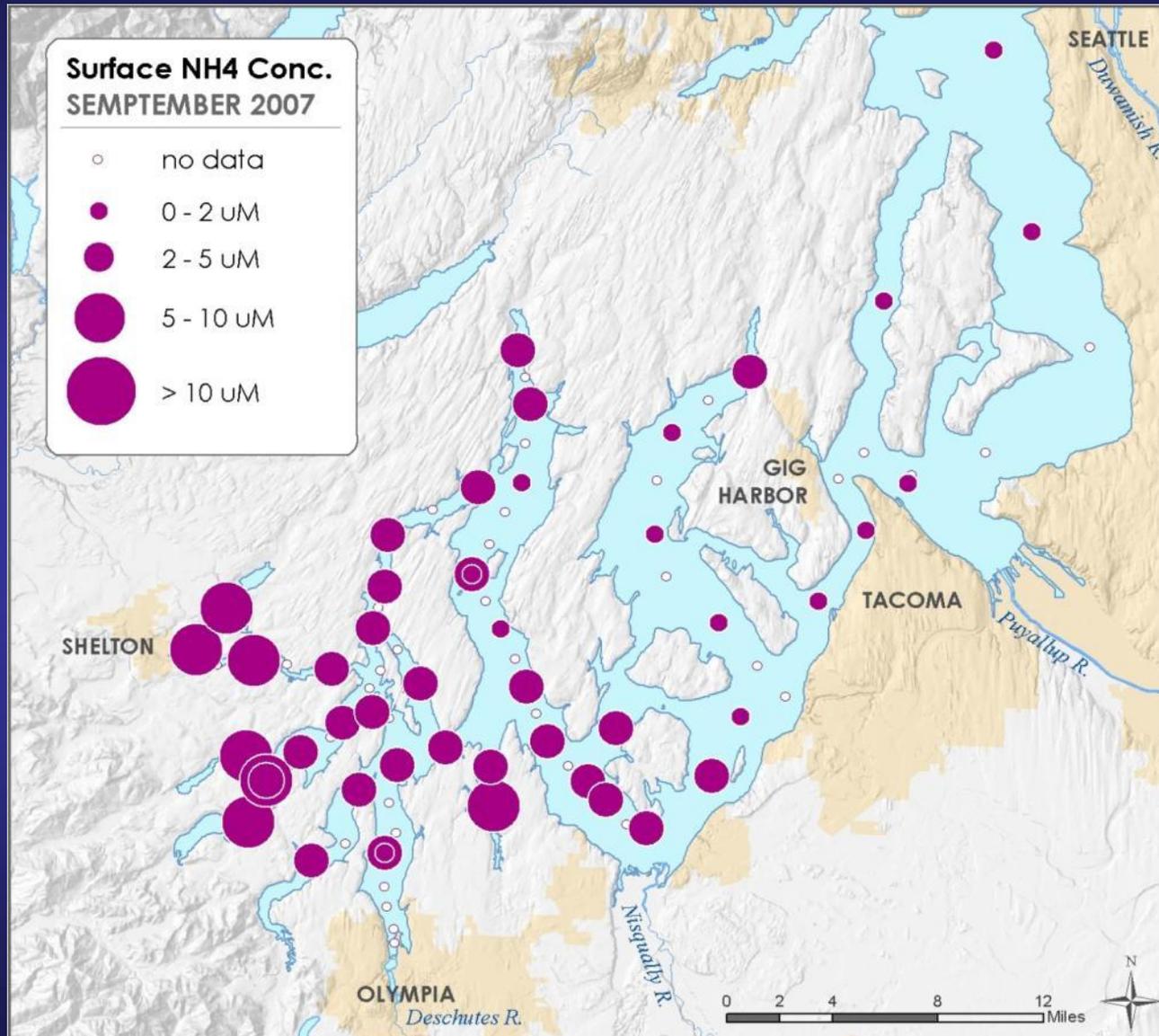


B6 Bottom DO - mg/l

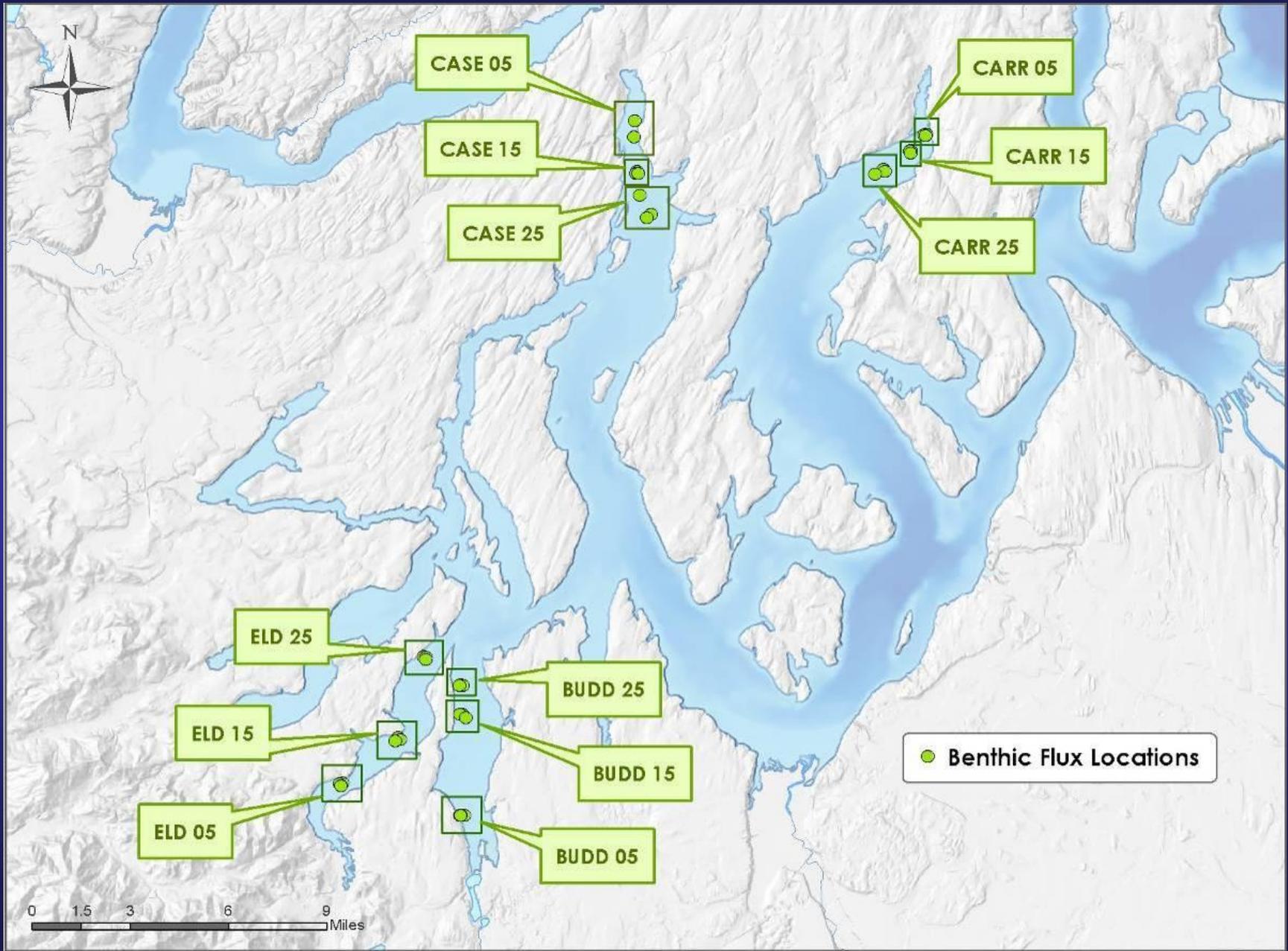


See the data report for more information...

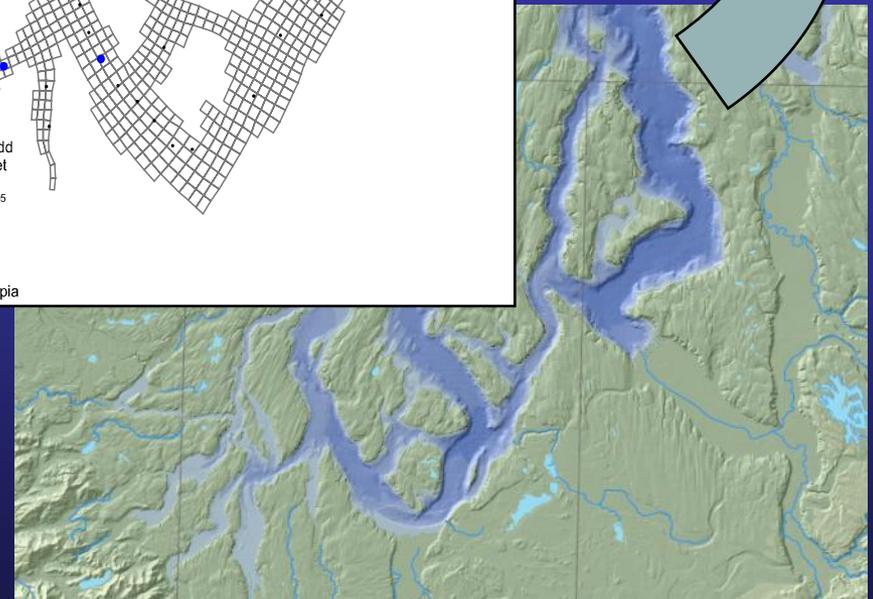
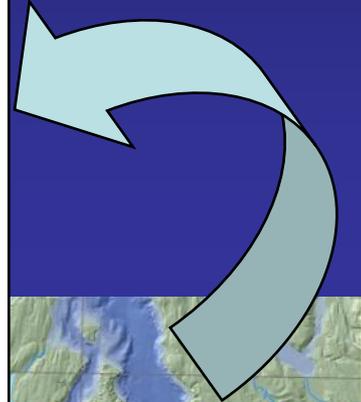
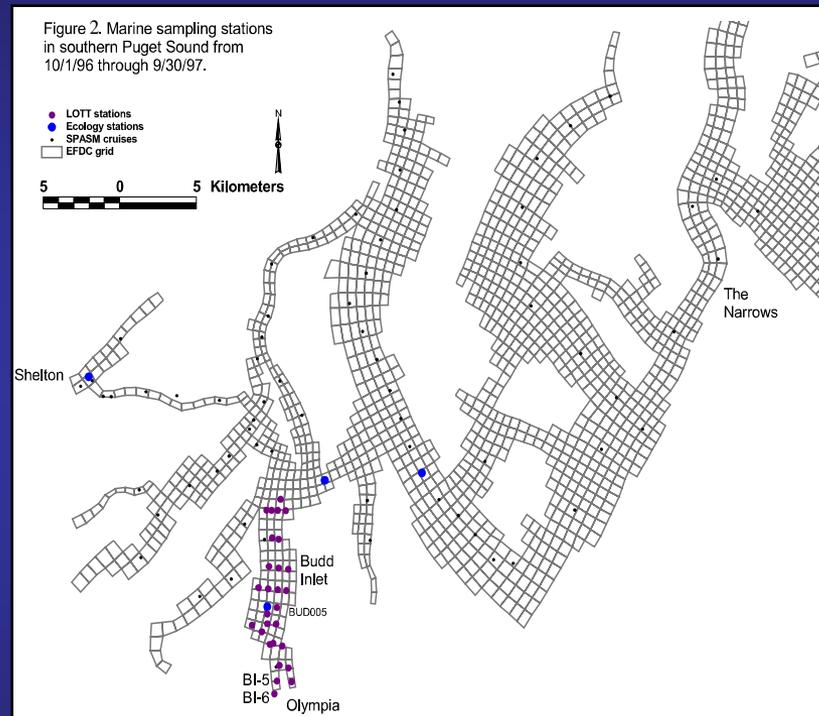
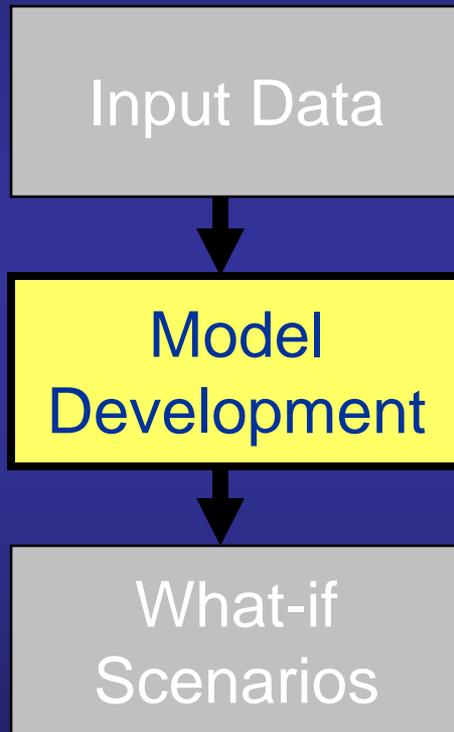
Marine Ammonium Concentration



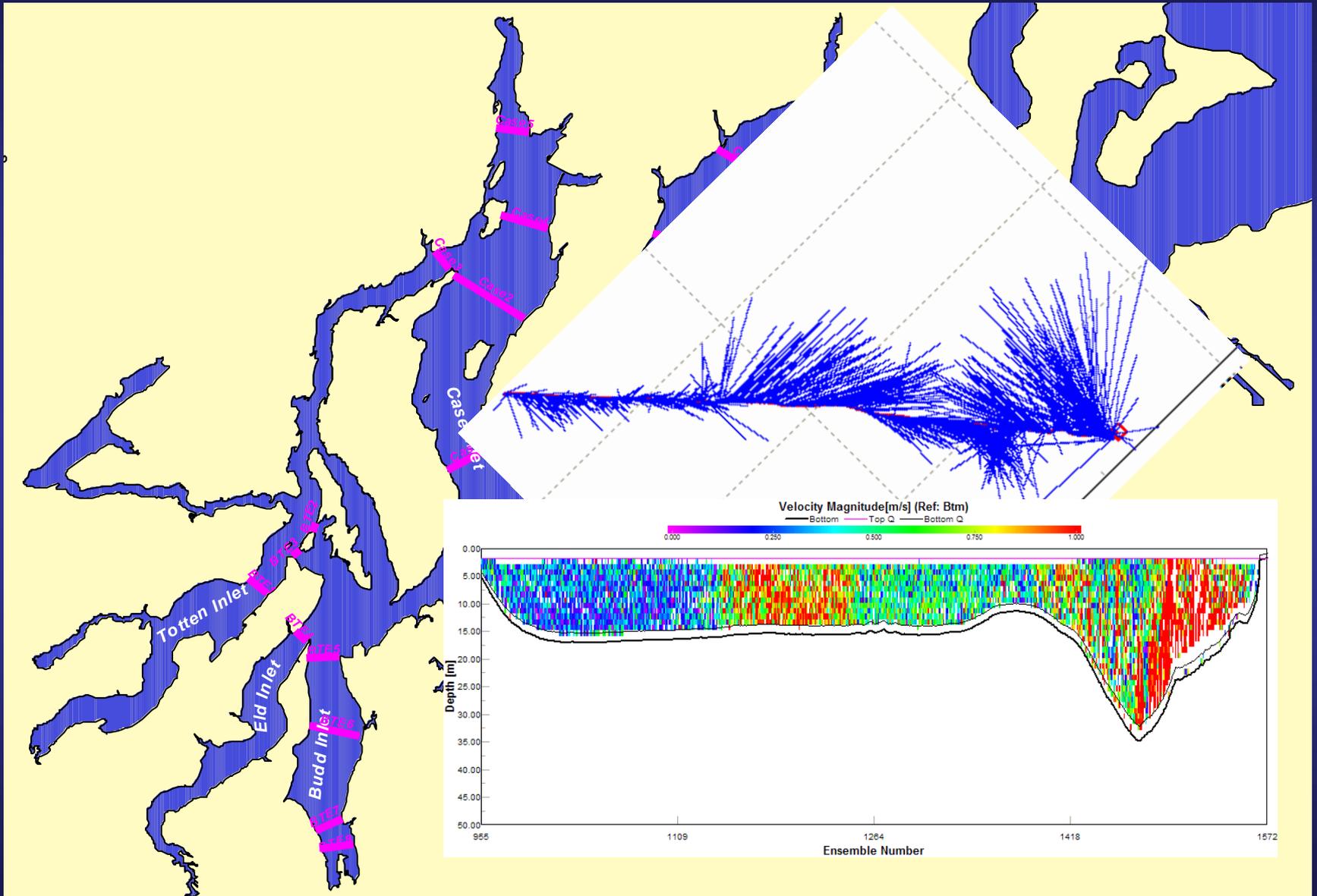
Sediment Flux



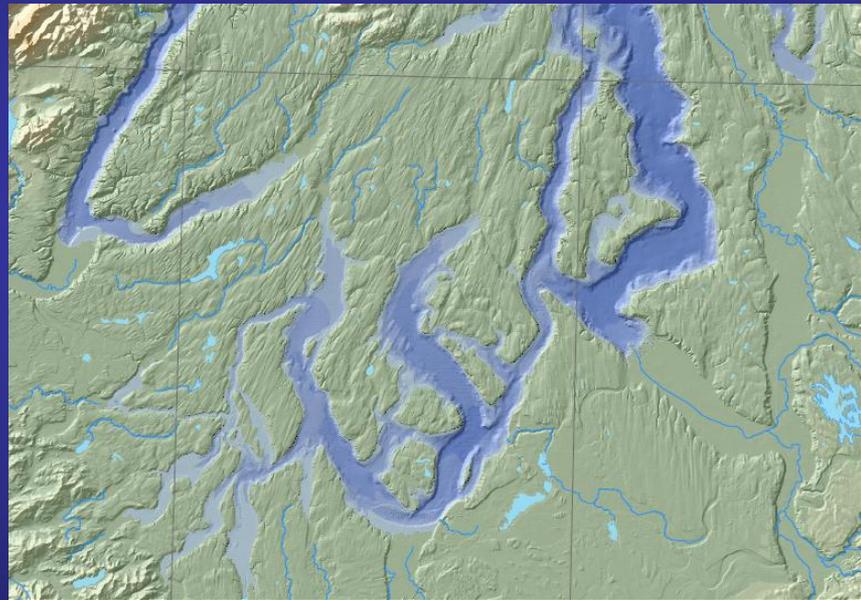
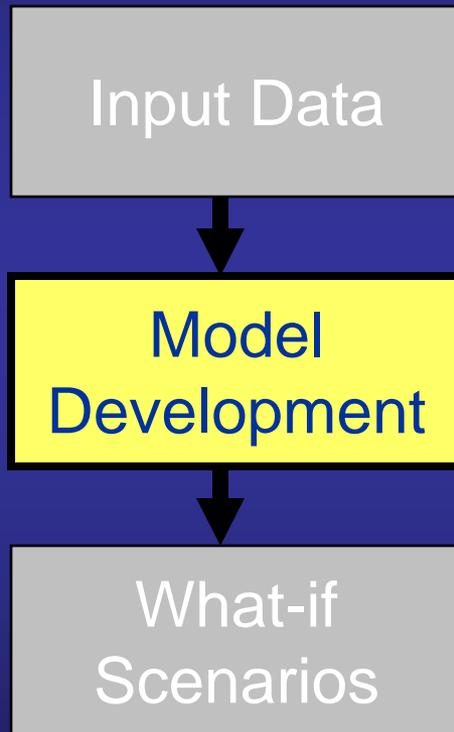
2a. Develop a model to represent complex physical structure



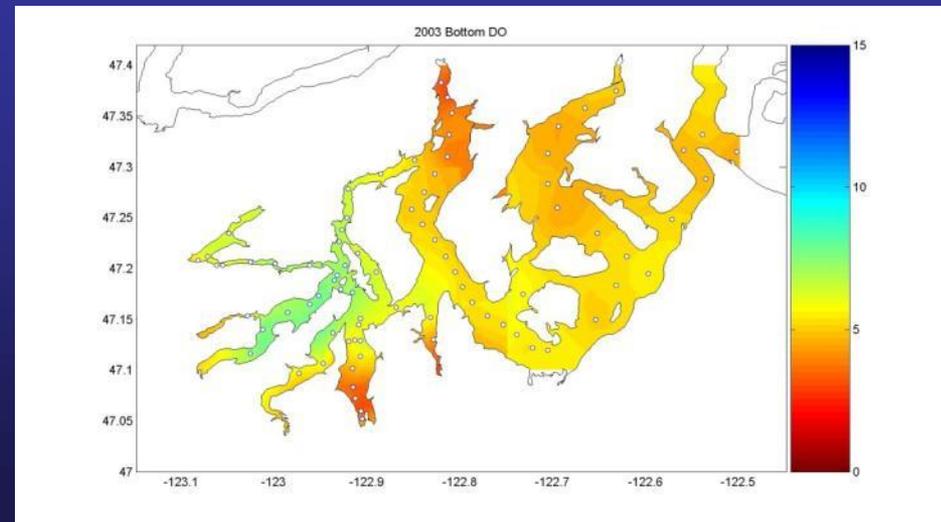
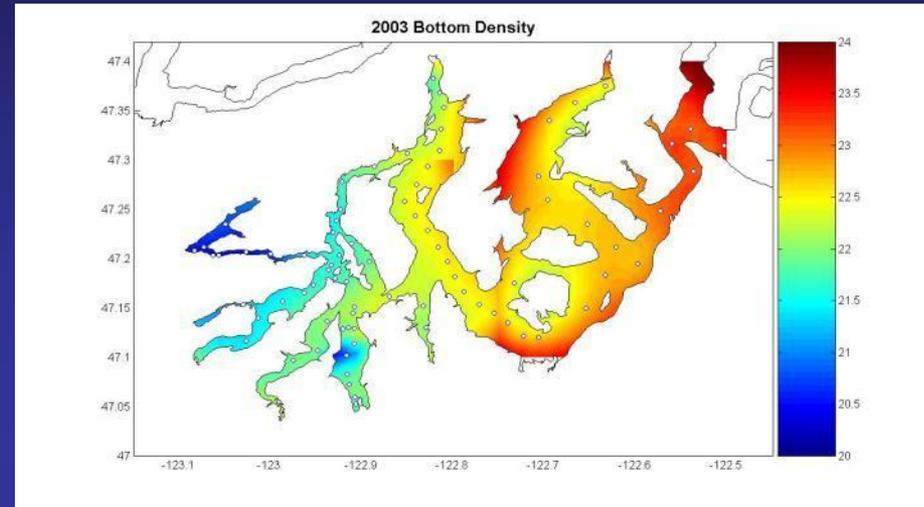
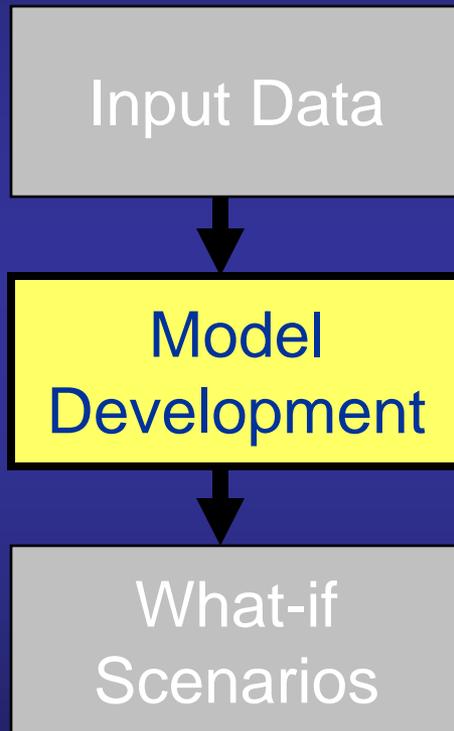
Where does the water go?



2b. Develop model to represent water quality processes



2c. Compare model output to data



3. Apply model to various what-if scenarios

Input Data



Model Development



What-if Scenarios



What if nitrogen loads decrease?



Will South Sound DO levels...

... improve markedly?

... remain low?

Schedule

Data Report	Soon
Hydrodynamic Report	Spring 2009
Modeling	Through 2009
Final Report	June 2010

Questions or Concerns?

If your organization has concerns or would like an individual meeting, please contact Andrew Kolosseus

South Puget Sound Dissolved Oxygen Study

www.ecy.wa.gov/puget_sound
*then click on “South Puget Sound
Dissolved Oxygen Study”*

Andrew Kolosseus
360-407-7543 akol461@ecy.wa.gov

Nutrients in Puget Sound

South Puget Sound Dissolved Oxygen Study

- Started 2006
- Fine scale with new monitoring data

Sound-Wide Nutrient Model

- Starting now
- Coarser scale with existing/literature data

Technical & Economic Evaluation of Nutrient Removal

- Starting now
- Engineering/economic analysis
- Foroozan Labib, lead. Statewide study.

Sound-Wide Nutrient Model

- \$740,000 new EPA money (EAP, PNNL, WQ)
- Starting soon!
- Sound-wide

Purpose

- Are nitrogen loads impacting water quality?
- Point and nonpoint
- Level of reductions necessary to reduce human impacts to acceptable levels.
- The project will not establish load or wasteload allocations
- Complements the nutrient technologies analysis.

Modeling

1. Box model for large-scale processes (EAP)
2. Intermediate-scale model (PNNL) to inform potential Puget Sound-wide management strategies and decisions

Advisory Committee

- People For Puget Sound
- Puget Sound Partnership
- King County
- NOAA
- USGS
- NWIFC
- Other tribal
- City of Everett
- WWU
- EPA
- Business

Technical & Economic Evaluation of Nutrient Removal

- Foroozan Labib, PDS, staff lead
- \$400,000 new money from EPA
- Municipal WWTP

Purpose

- Evaluate a range of advance nutrient removal technologies that could be implemented in Washington
- Technical and Economic

Scope

- Statewide
- Freshwater and marine water
- Nitrogen and phosphorus

Other

- Internal committee
- Ecology writes scope of work
- Contractor does work
- EPA assists with economics

South Puget Sound Dissolved Oxygen Study Advisory Committee

- | | | |
|---------------------|--|--|
| • Dave Adams | Citizens for a Healthy Bay | Utilities and Waste Management |
| • John Bolender | Mason Conservation District | King County WTD |
| • Seth Book | Mason County Department of Health Services | Simpson Tacoma Kraft |
| • Kevin Buckley | Snoqualmie Tribe | U.S. Geological Survey |
| • Ben Cope | EPA Region 10 | EPA Region 10 |
| • Bill Dewey | Taylor Shellfish Co. | Mason County Environmental Health |
| • John Eliasson | Washington State Dept. of Health | Tacoma Wastewater Treatment Plant |
| • Duane Fagergren | Puget Sound Partnership | People for Puget Sound |
| • Larry Ekstrom | Pierce County Public Works and Utilities | People for Puget Sound |
| • Cheryl Greengrove | University of Washington - Tacoma | LOTT Alliance |
| • Dave Lenning | Washington State Dept. of Health | LOTT Alliance |
| • Mitsuhiro Kawase | University of Washington | Pierce County Public Works and Utilities |
| • Bill Kingman | City of DuPont | WA State Dept of Health |
| • Andrew Kolosseus | Department of Ecology | |
| • John Konovsky | Squaxin Island Tribe / NWIFC | |
| • Tom Moore | Mason County Department of | |
| • Bruce Nairn | | |
| • Greg Narum | | |
| • Anthony Paulson, | | |
| • Dave Ragsdale | | |
| • Debbie Riley * | | |
| • Dan Thompson | | |
| • Heather Trim | | |
| • Bruce Wishart | | |
| • Tyle Zuchowski | | |
| • Wayne Robinson | | |
| • Dan Wrye | | |
| • Lynn Schneider | | |