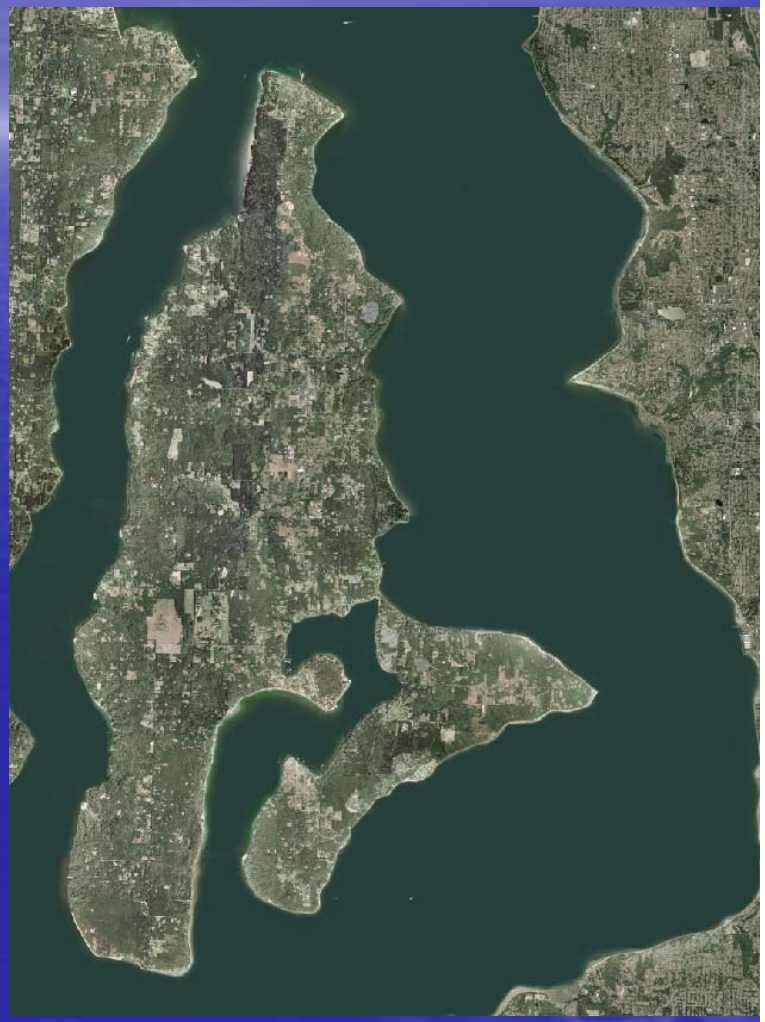
WELCOME!

Quartermaster Harbor Nitrogen Loading Study Phase One Findings

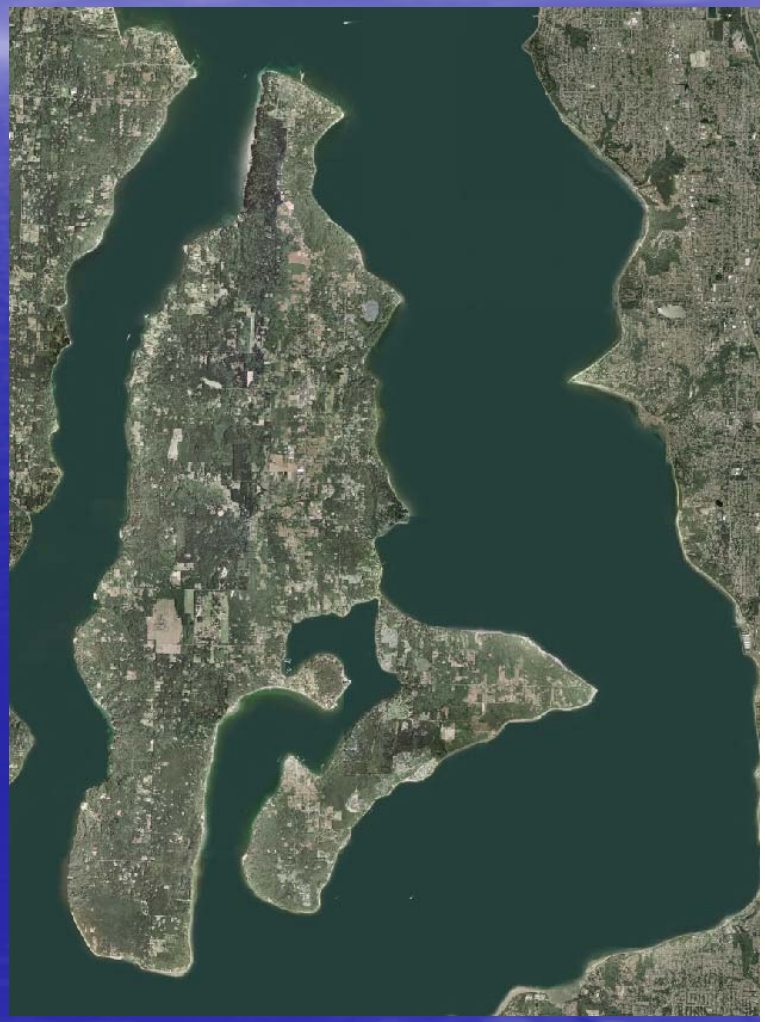
Vashon High School
Wednesday, October 6, 2010



www.KingCounty.gov/QMHnitrogenstudy

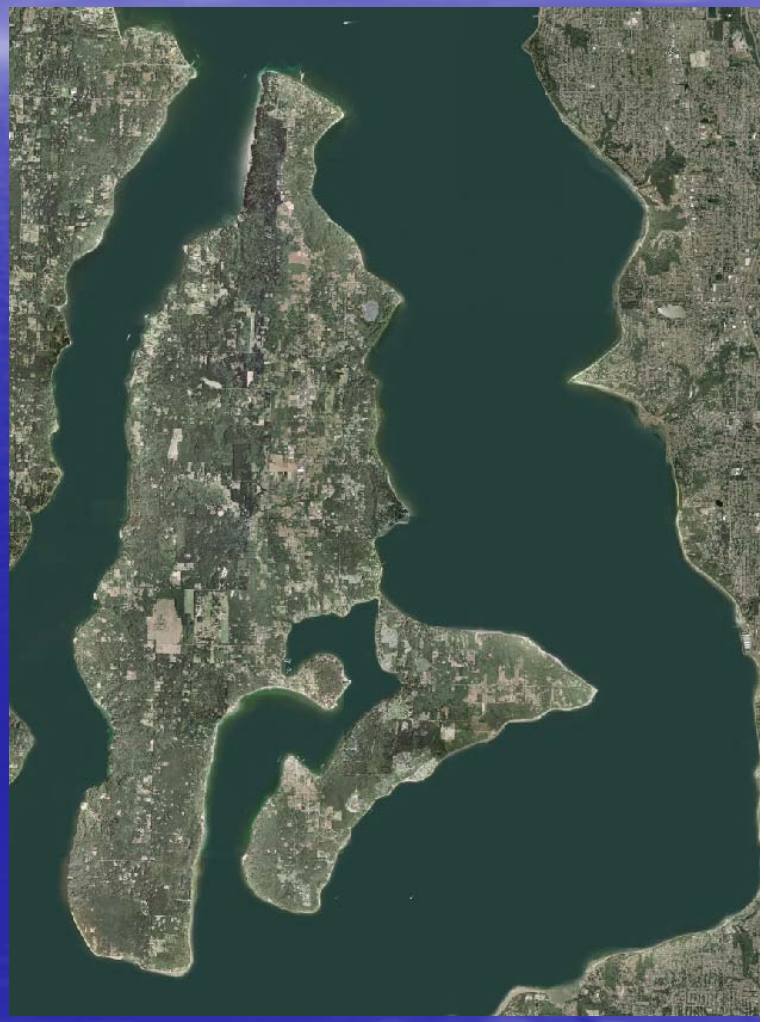
Quartermaster Harbor Focus of Many Federal Agencies and Puyallup Tribe

- U.S. Environmental Protection Agency (EPA) Region 10
- Puyallup Tribe shellfish harvest
- National Oceanic and Atmospheric Administration (NOAA) Sound Toxins



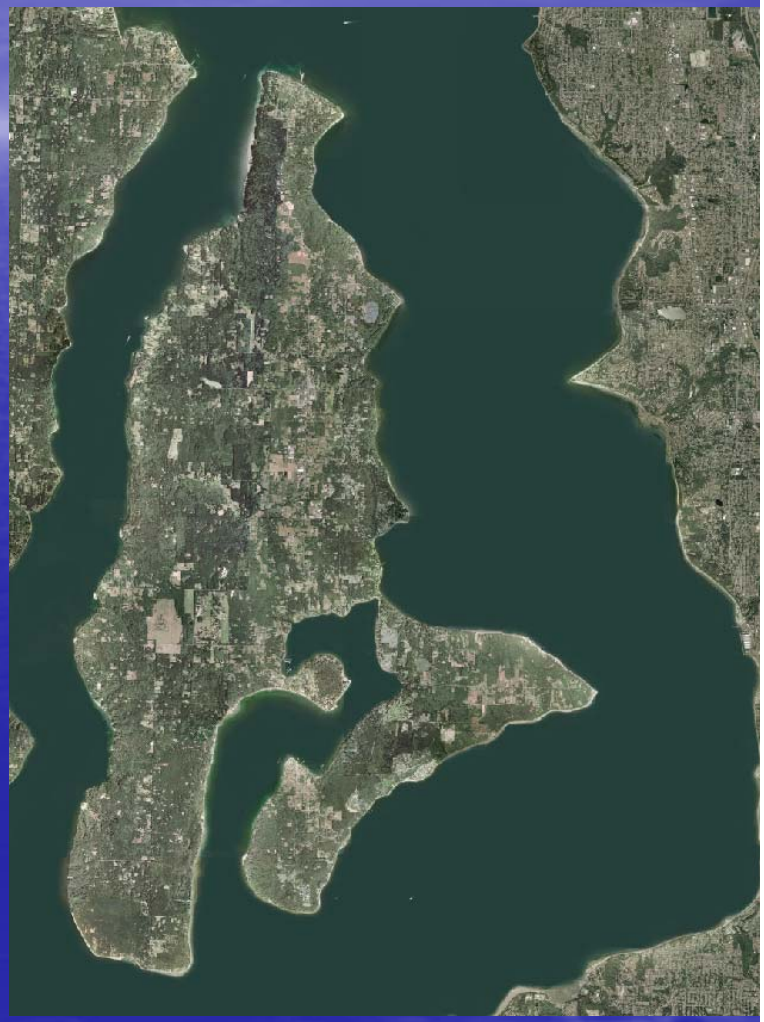
Quartermaster Harbor Focus of Many State Agencies and Nonprofits

- WA Ecology ambient monitoring
- WA Department of Health (DOH) shellfish program
- WA Department of Natural Resources (DNR)
- WA Fish and Wildlife
- Puget Sound Restoration Fund mussel raft study



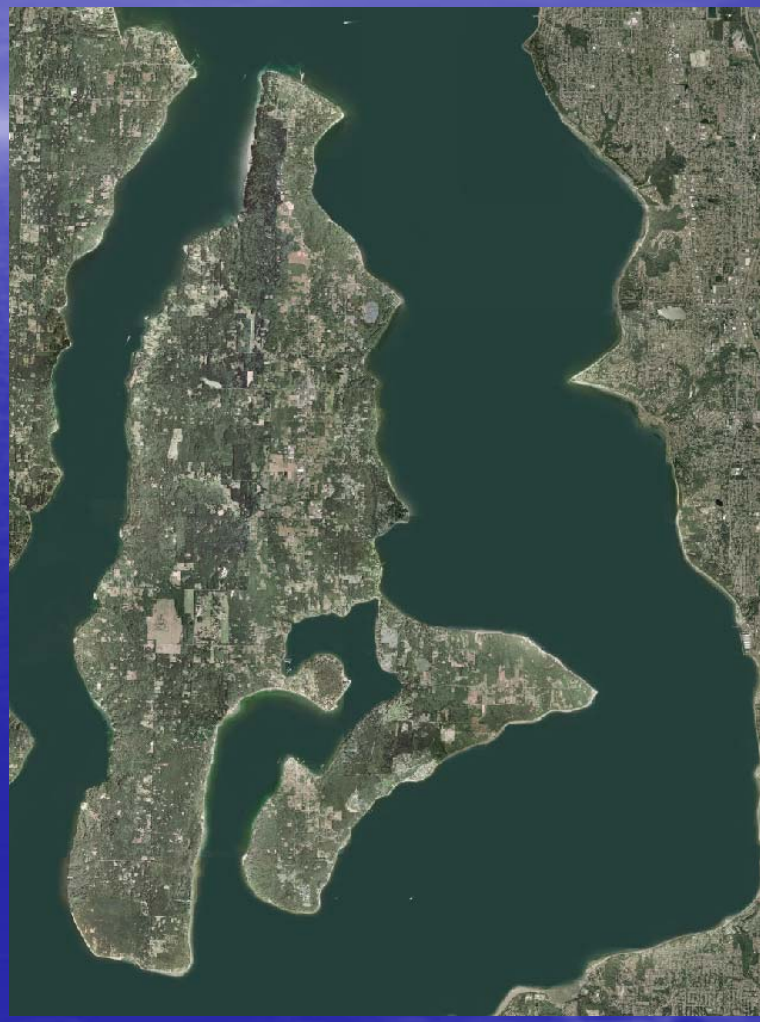
Quartermaster Harbor Focus of University Studies

- UWT *Alexandrium* study – Cheryl Greengrove
- UWT geoduck larvae study – Bonnie Becker



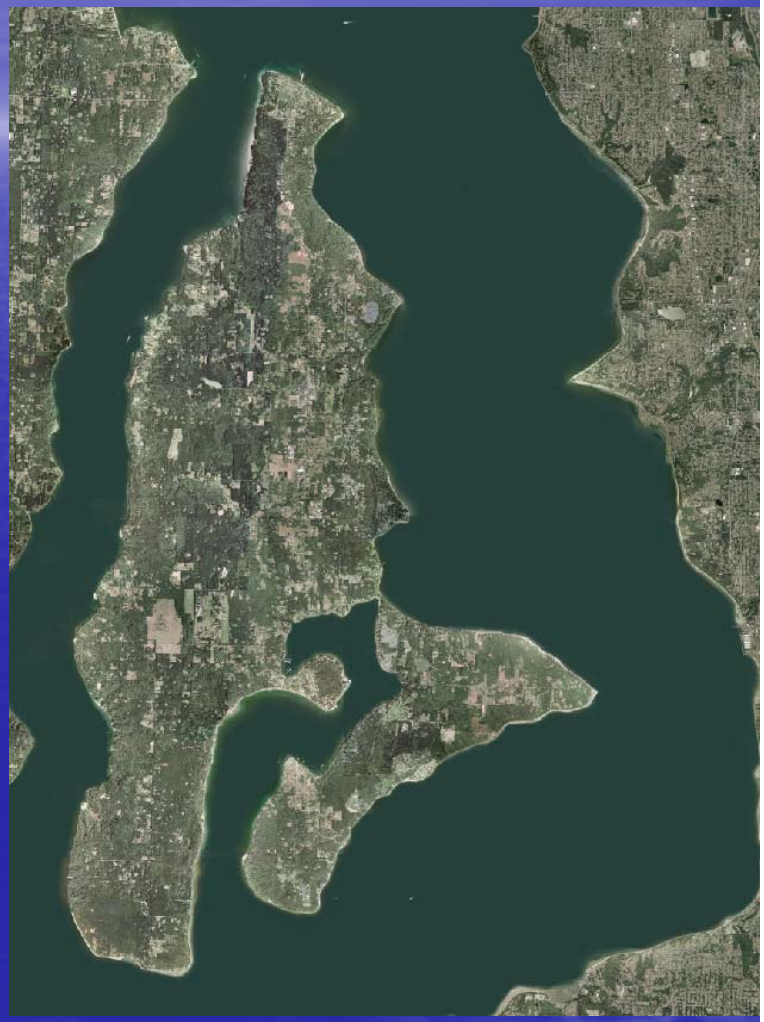
Quartermaster Harbor Focus of King County Agencies

- Public Health-Seattle King County (PH-SKC) Marine Recovery Area
- King County Rural Effectiveness Monitoring Study



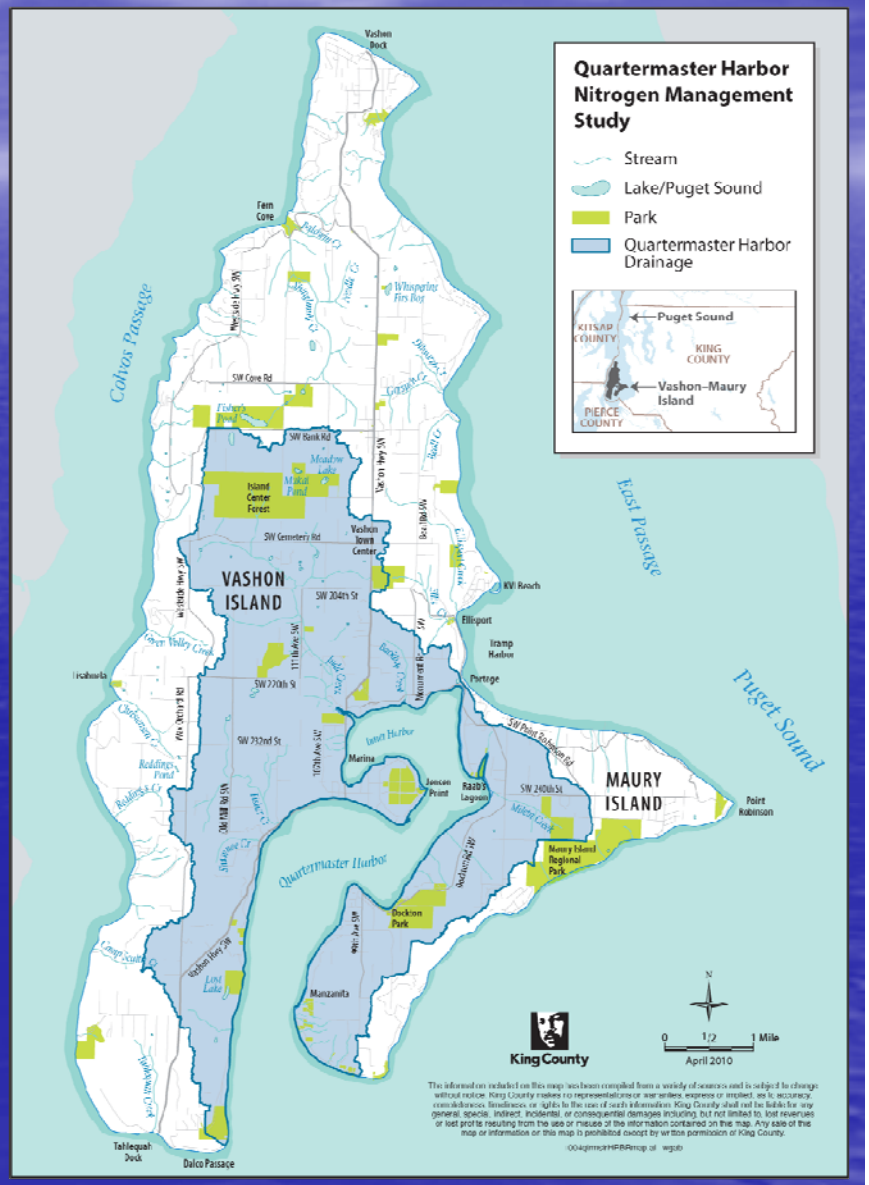
Quartermaster Harbor Focus of Local Community Government, Volunteers and Citizens

- Vashon High School science program
- Lowtide Celebration
- Citizen beach monitors
- Septic Solutions subcommittee
- Groundwater Protection Committee
- Vashon-Maury Island Land Trust
- Concerned property owners



Quartermaster Harbor Nitrogen Management Study

- Study partners/team
- Study Area - Project Need
- Water Quality concern
- Study goals/Phases
- Monitoring



Project Partners

- EPA Region 10 Watershed Grant Program
- King County Department of Natural Resources, Water and Land Resources
- University of Washington Tacoma, Environmental Science
- Department of Ecology, Marine Monitoring
- Vashon-Maury Island Groundwater Protection Committee

Partner Roles

- EPA – $625K grant 2009 through 2012
- KC – Marine/stream/groundwater monitoring; N loading input; $268K match
- U of W Tacoma – marine monitoring and environmental science expertise
- Ecology – Model and simulate effect of N on dissolved oxygen in QH
- VMI GWPC – Outreach and evaluation

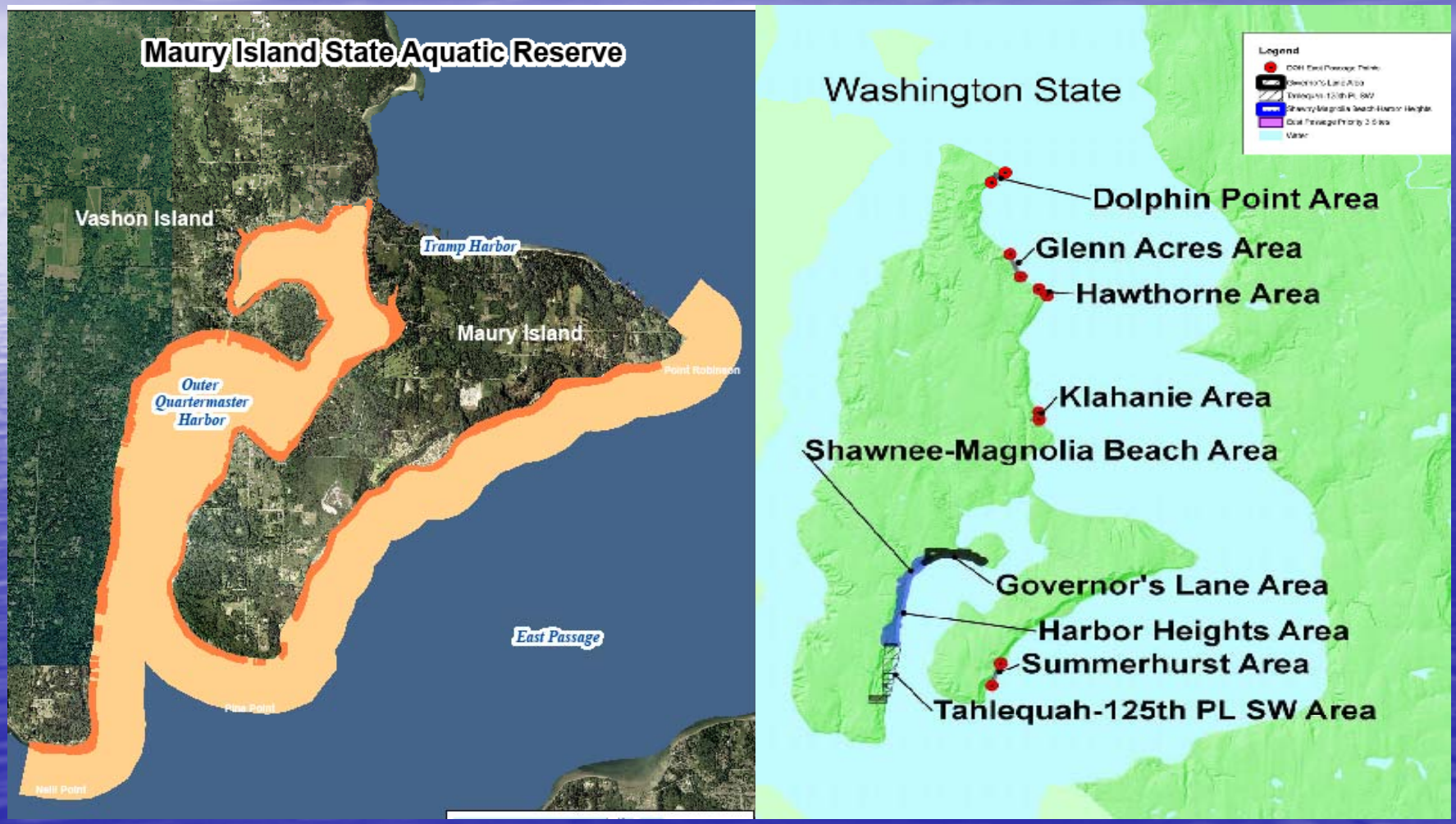
Study Team

- Curtis DeGasperi – Project Manager, KC
- Eric Ferguson – Surface/Groundwater monitor, KC
- Kim Stark - Marine monitoring, KC
- Cheryl Greengrove – Environmental Science, UWT
- Julie Masura – Researcher, UWT
- Skip Albertson – Marine Modeler, Ecology
- Larry Stockton – Public Outreach, KC

Study Area – Project Motivation

- Vashon-Maury Island
- Population 10,000
- Zoned rural
- ~40 percent of island drains to harbor
- Low dissolved oxygen observed in harbor
- QMH part of Marine Reserve (WA DNR) *and* Marine Recovery Area (PH-SKC)

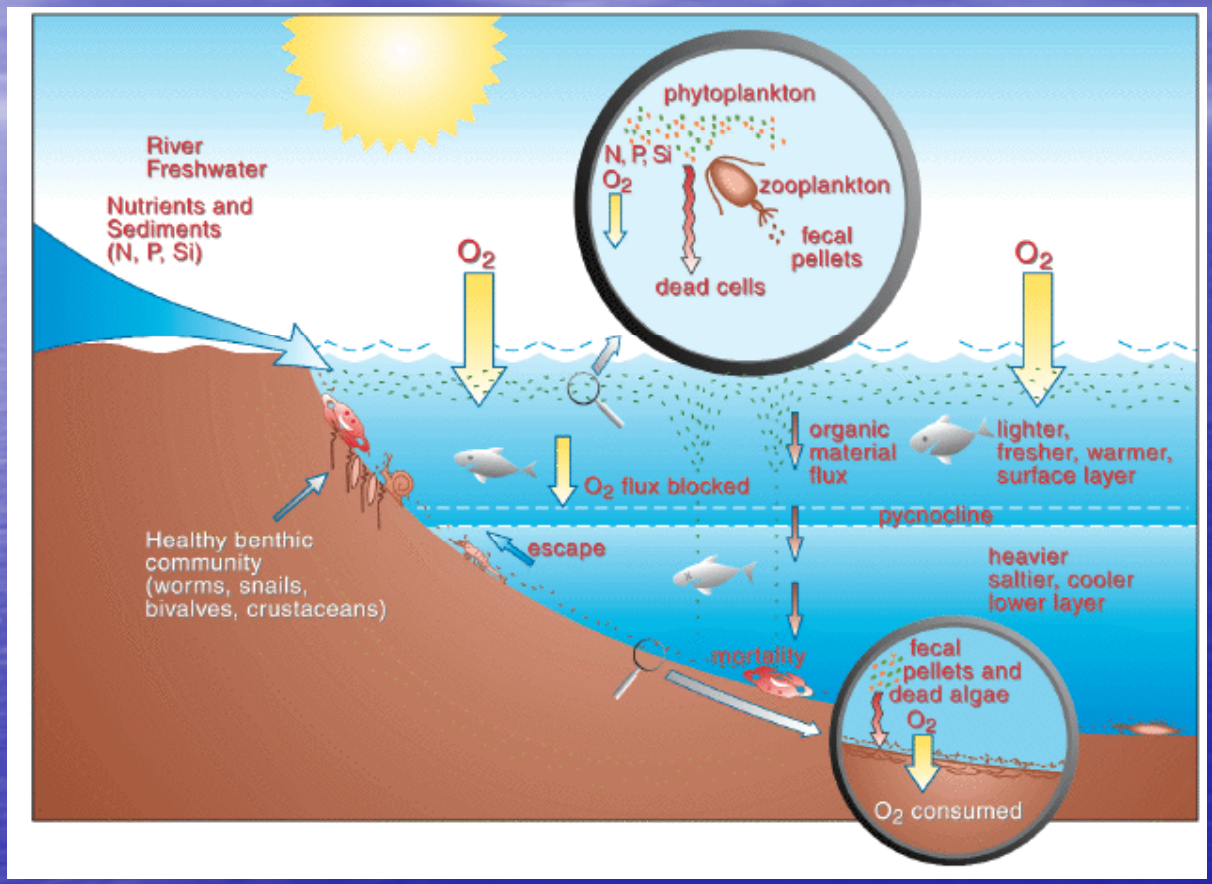
WA DNR Marine Reserve *and* PH-SKC Marine Recovery Area



Water Quality Concerns

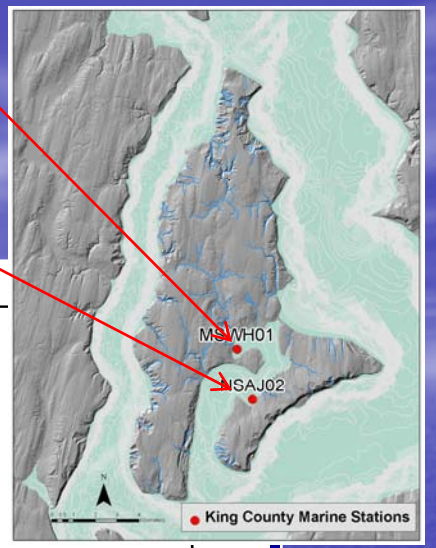
- Observed levels of dissolved oxygen near critical low levels in late summer/early fall
- Shellfish & other marine organisms at risk
- Similar problems observed in studies on Hood Canal and in South Puget Sound
- Nitrogen loading in streams/ground on Vashon-Maury Island

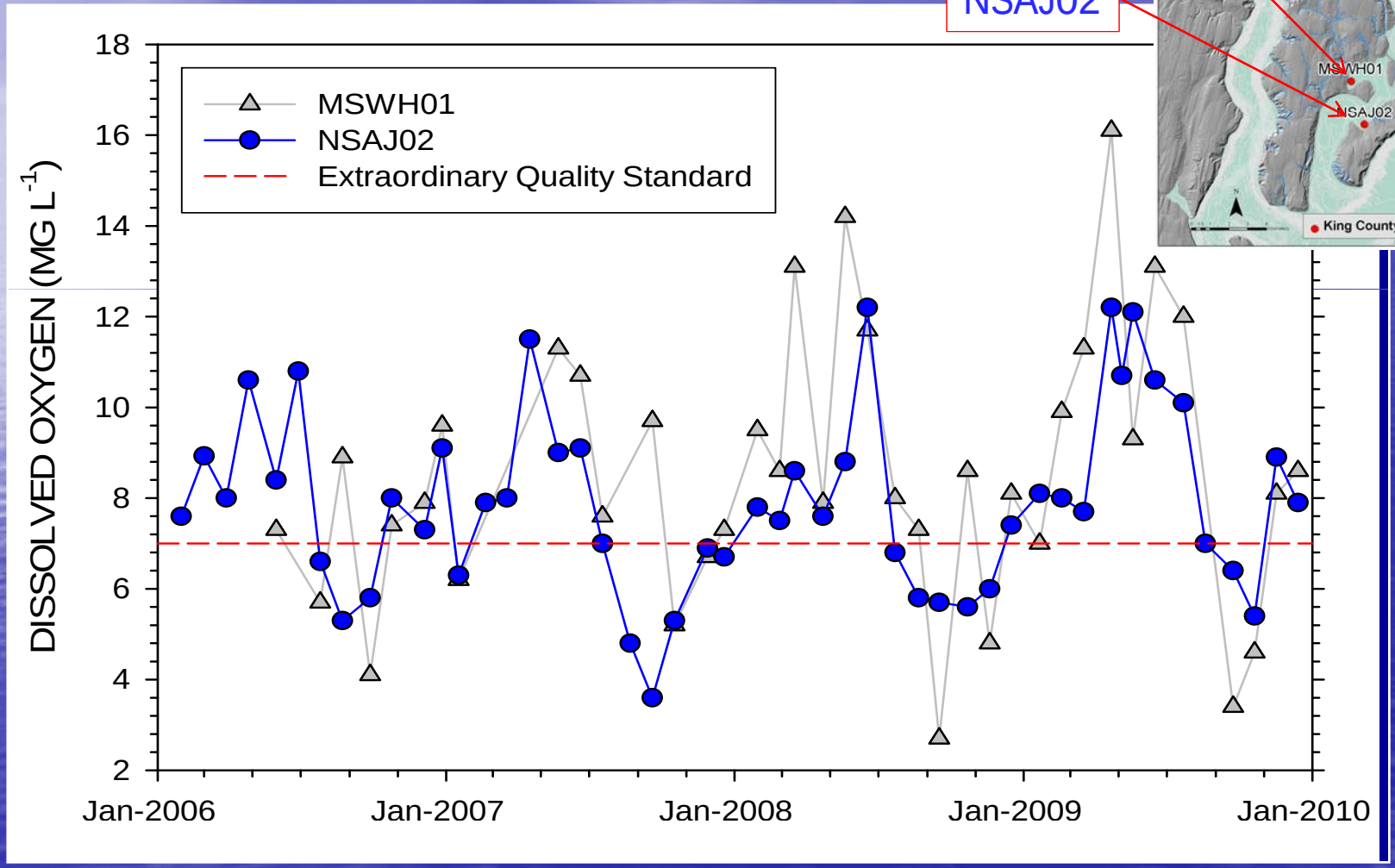
Marine Dissolved Oxygen Dynamics



Source: Downing JA, et al. Gulf of Mexico hypoxia: land and sea interactions. Task force report no. 134. Ames, IA:
Council for Agricultural Science and Technology, 1999;5.

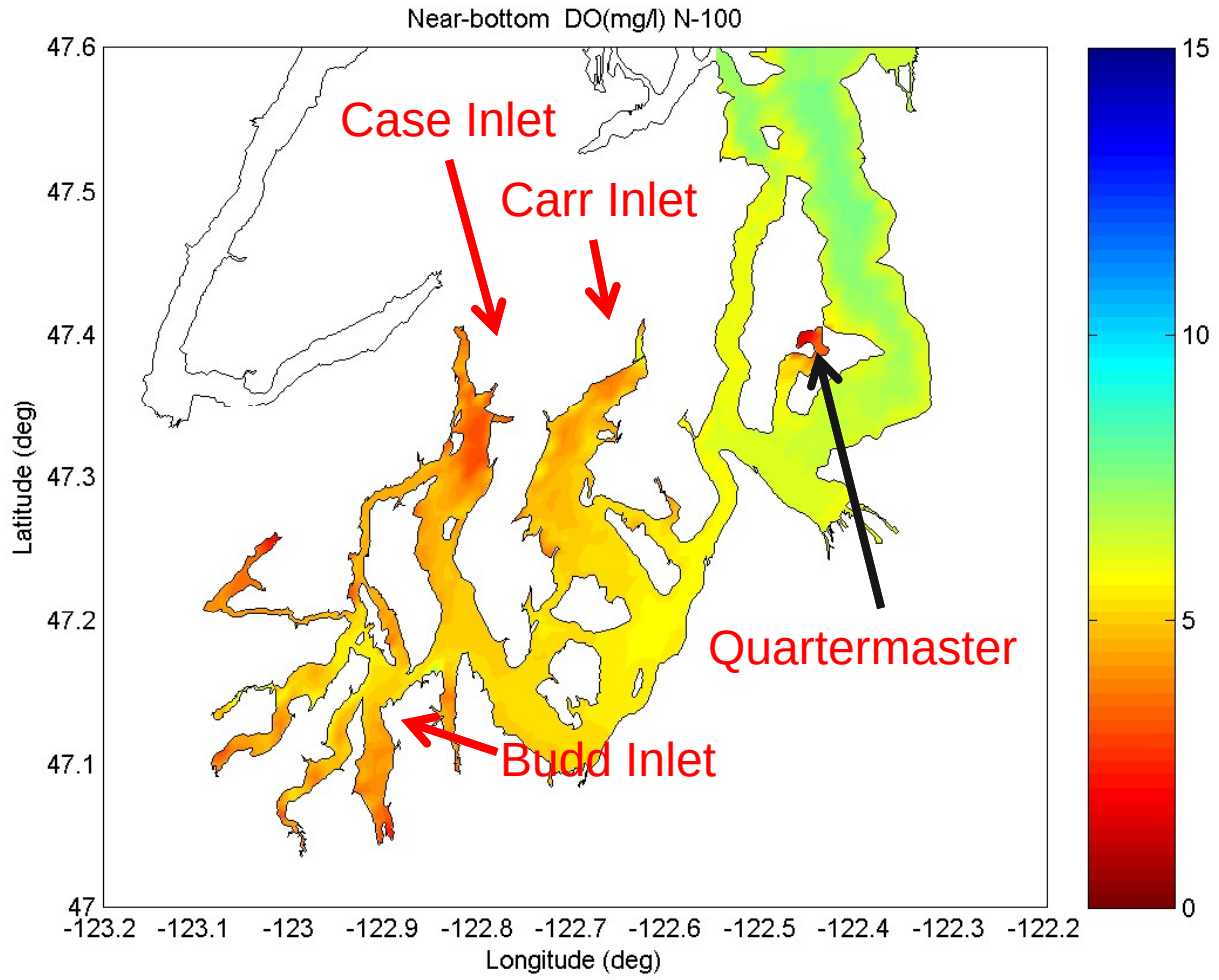
Marine Monitoring





http://www.kingcounty.gov/environment/data-and-trends/monitoring-data.aspx

South Puget Sound Dissolved Oxygen



Quartermaster Harbor Study Goals

- Evaluate the role of nitrogen loading to risk of low-level dissolved oxygen in QMH
- Identify & quantify N loading sources
- Model impacts of N on dissolved oxygen
- Identify & evaluate management strategies & costs
- Develop management recommendations working with stakeholders

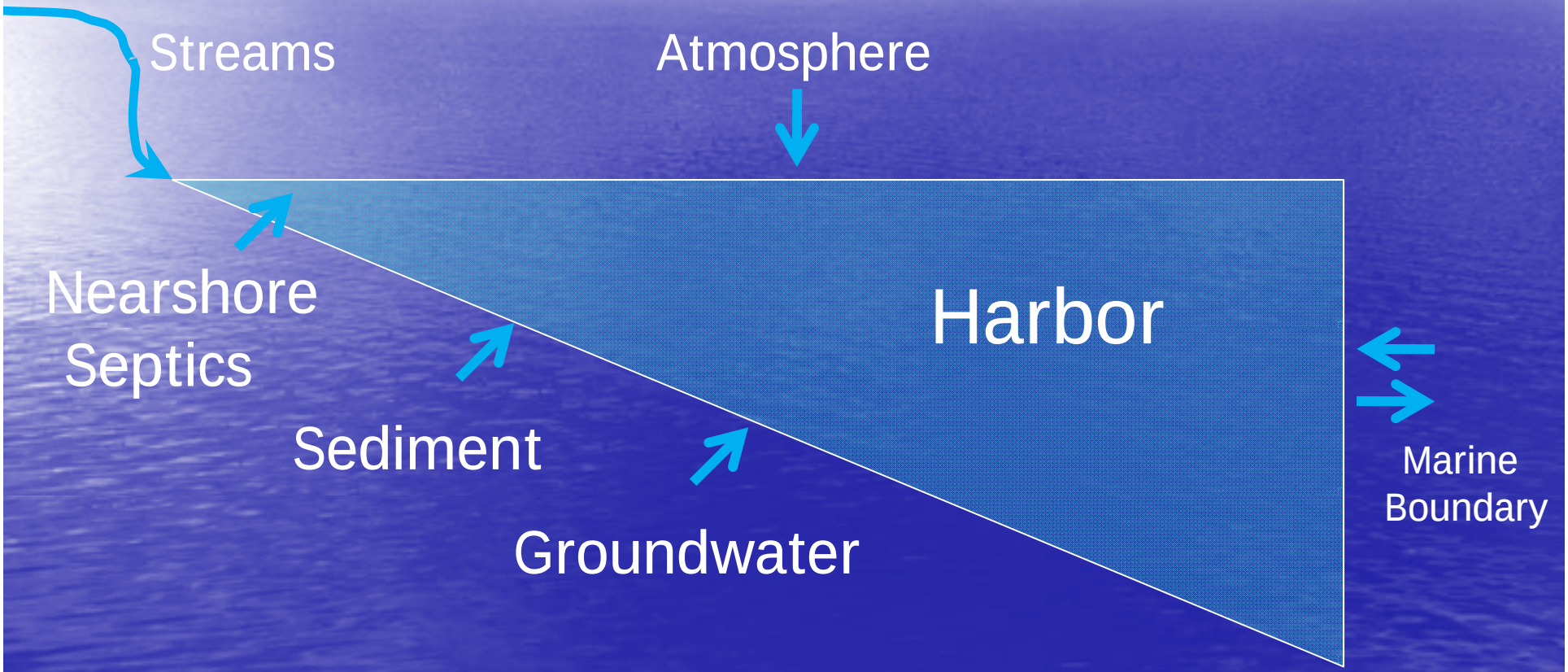
QMH N Study Phases 2009 through 2012

- Phase 1 Estimate N loading from existing data, published literature and sampling streams, ground and marine waters.
- Phase 2 Model the nitrogen loadings to QH & develop receiving water model
- Phase 3 Link N loading to QH oxygen level, simulate effect of N mgt scenarios and develop N mgt recommendations.

QMH N Study Outputs

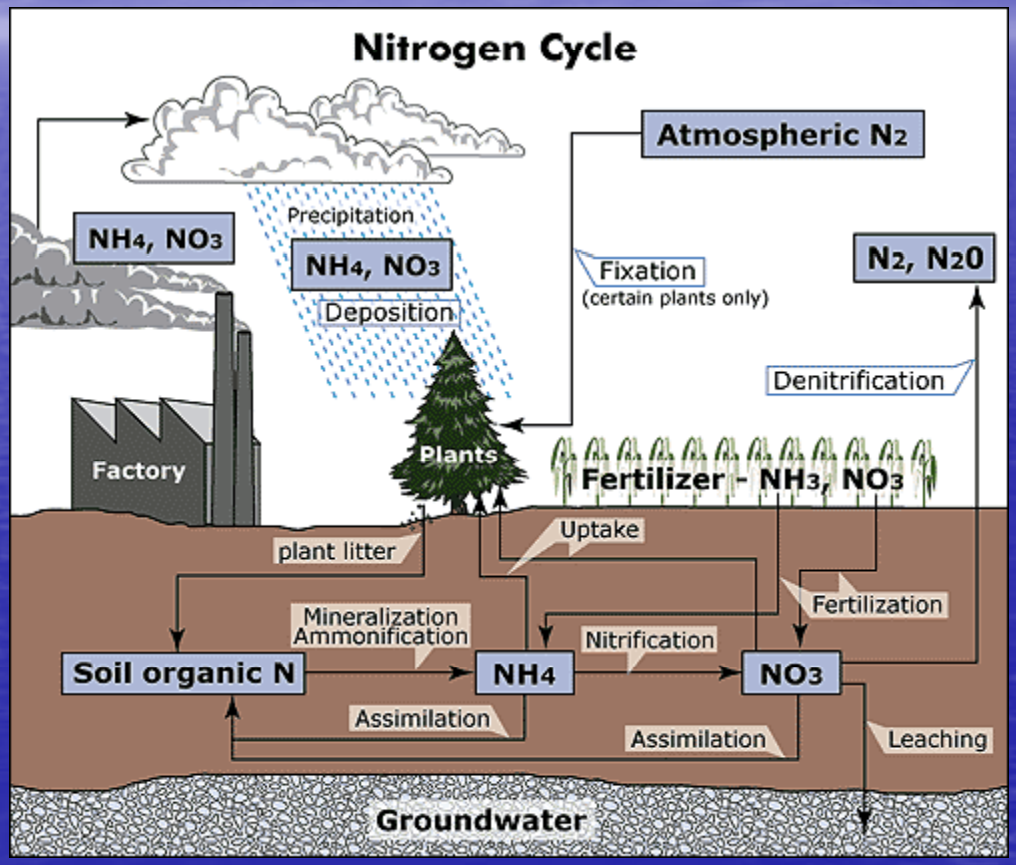
- Quality Assurance Project Plan
- Nitrogen Loadings report (estimate & survey)
- Water Quality Assessment report
- Benthic Flux Study
- Source Tracing Monitoring Plan (Mileta & others)
- Quartermaster Harbor model and documentation
- Evaluation of N management options
- Recommend policy and/or regulatory changes
- Public Outreach and Education (meetings, webpage, etc)

Sources of Nitrogen to Quartermaster Harbor

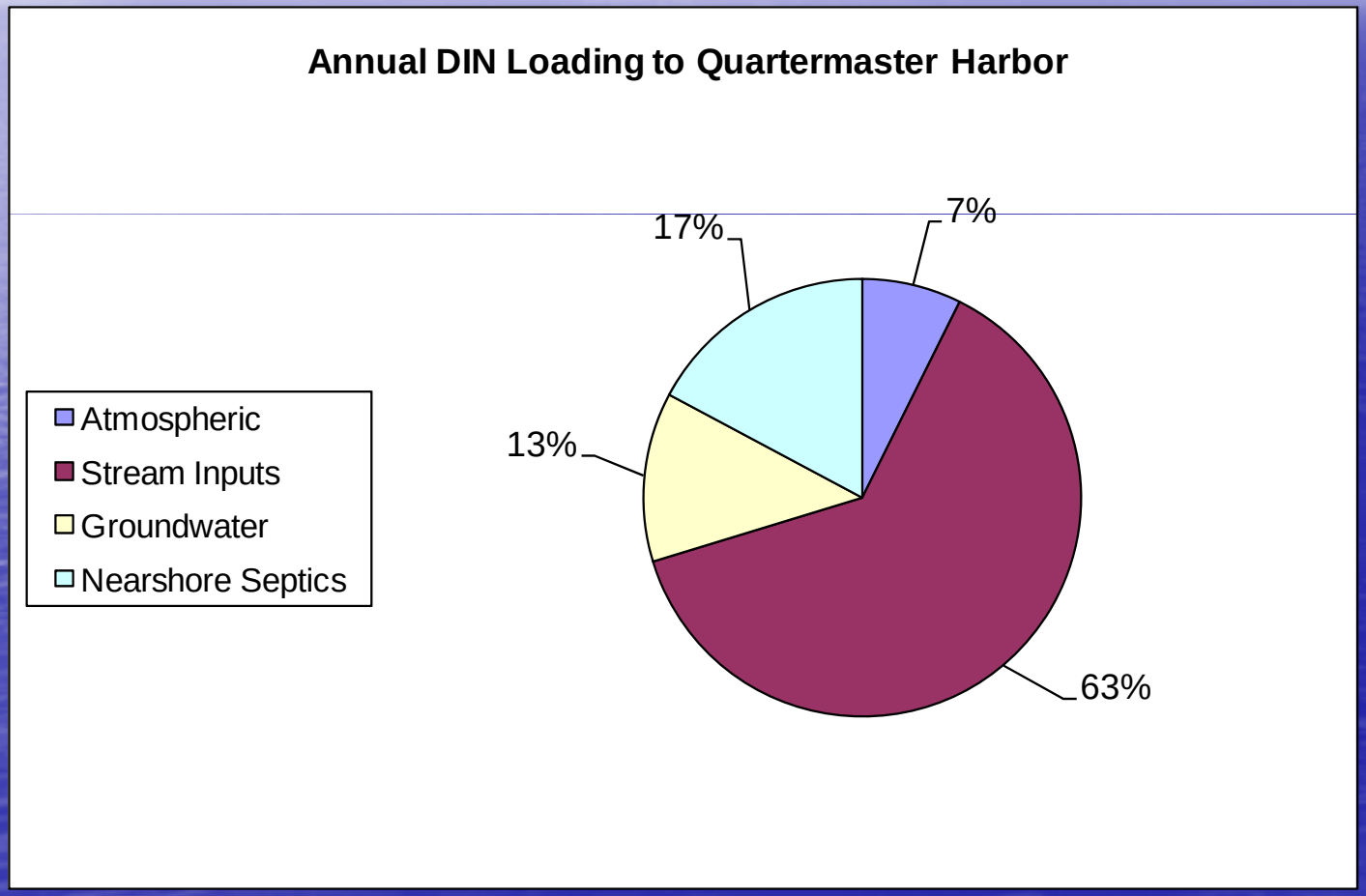


Sources of Nitrogen on VMI

- Atmosphere
- Septics
- Livestock
- Fertilizer
- Alders

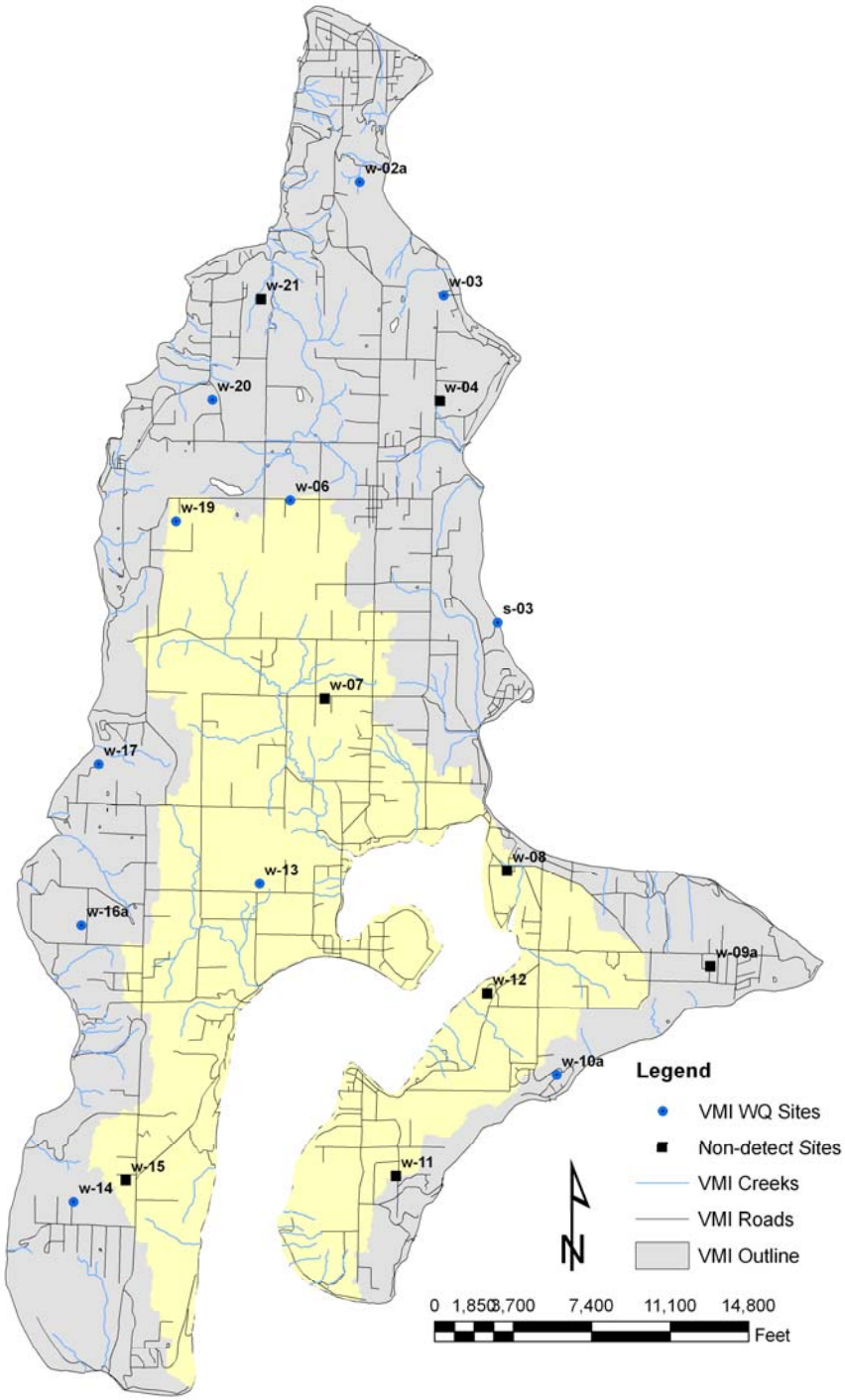


Dissolved Inorganic Nitrogen Load

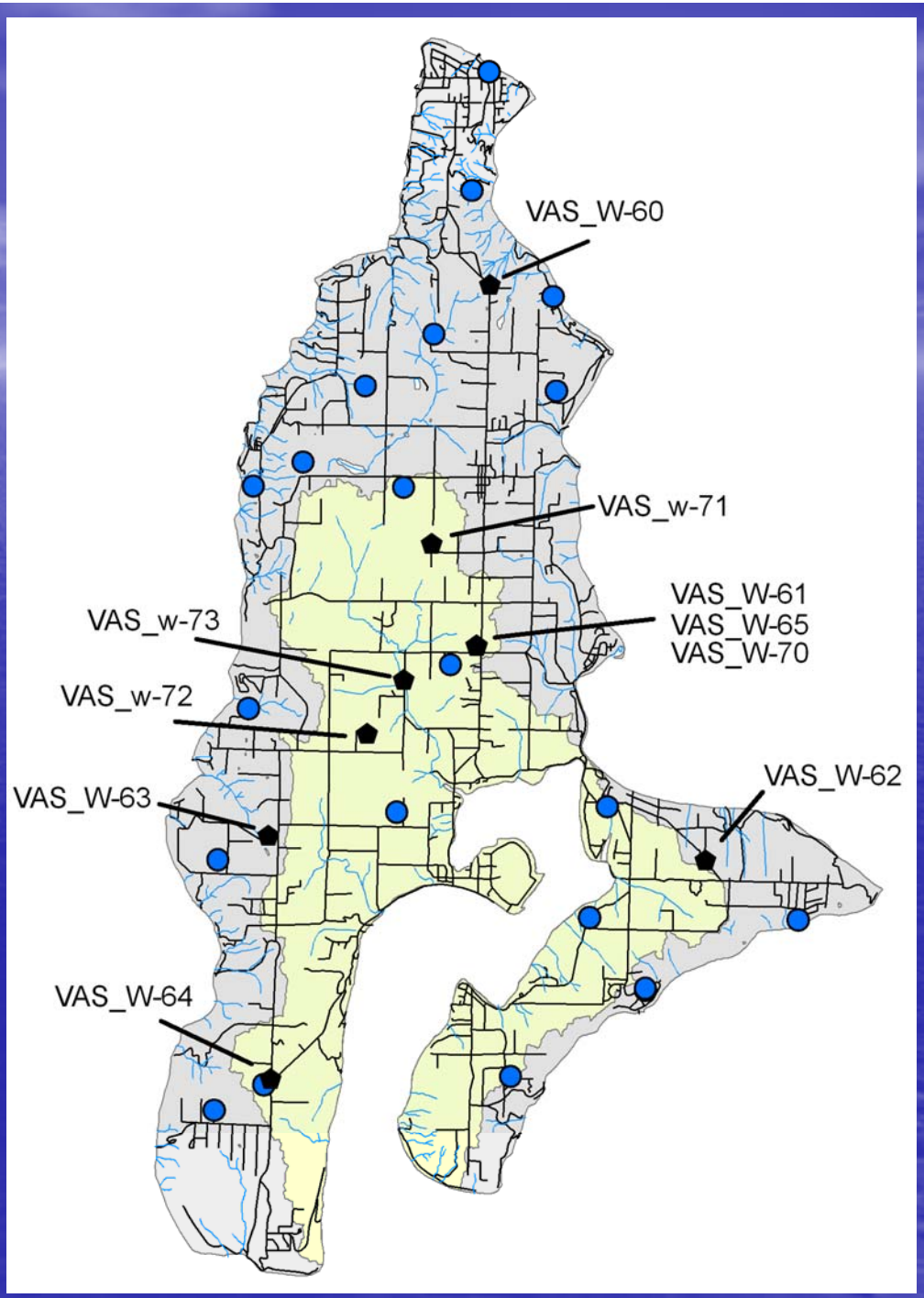


Groundwater Monitoring Sites — long term

- 19 long term monitoring sites – 8 sites within study area
- Monitoring water quality since 2001
- As part of the Water Resources Evaluation Project

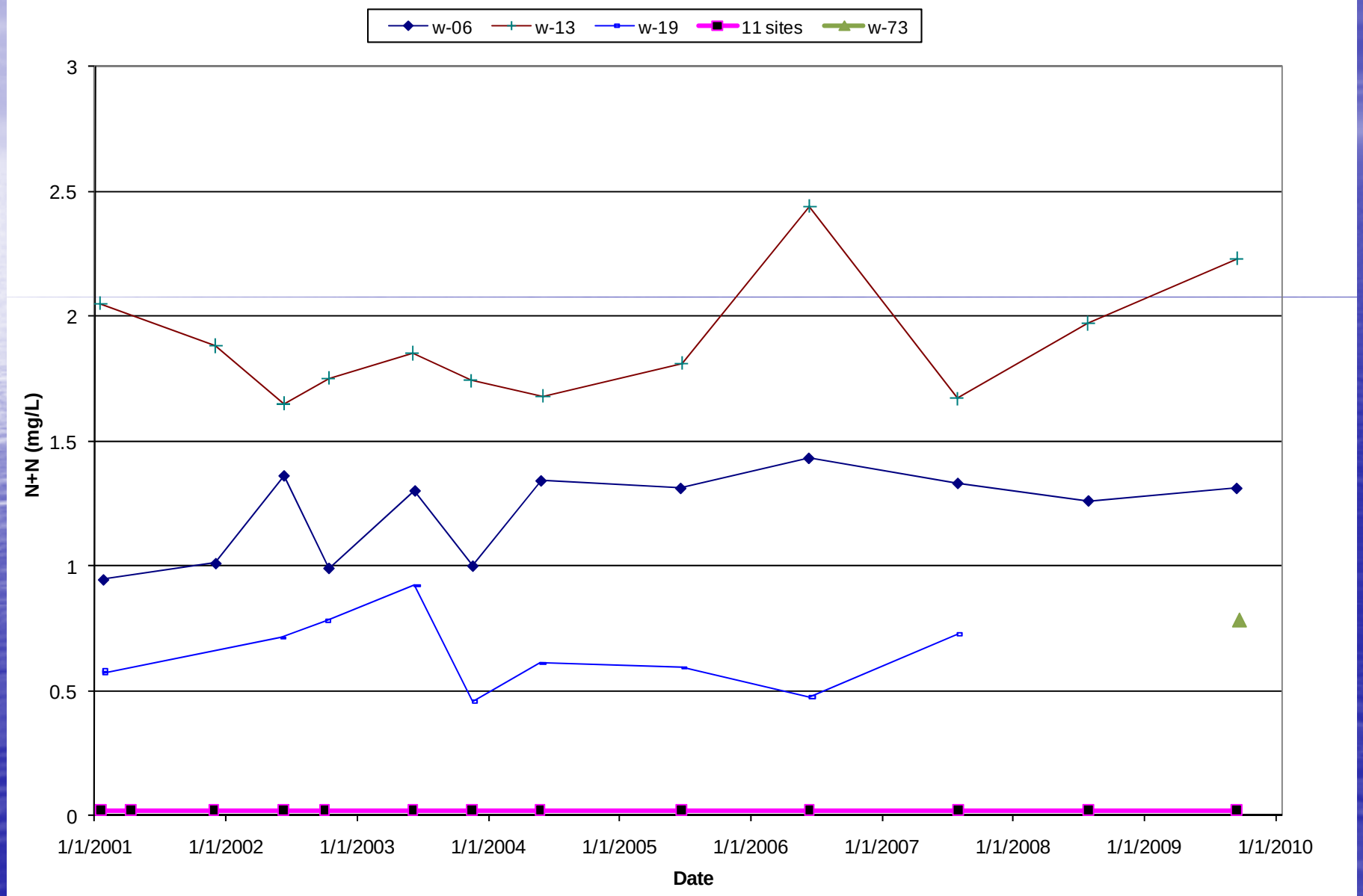


Groundwater Monitoring Sites — monitoring wells



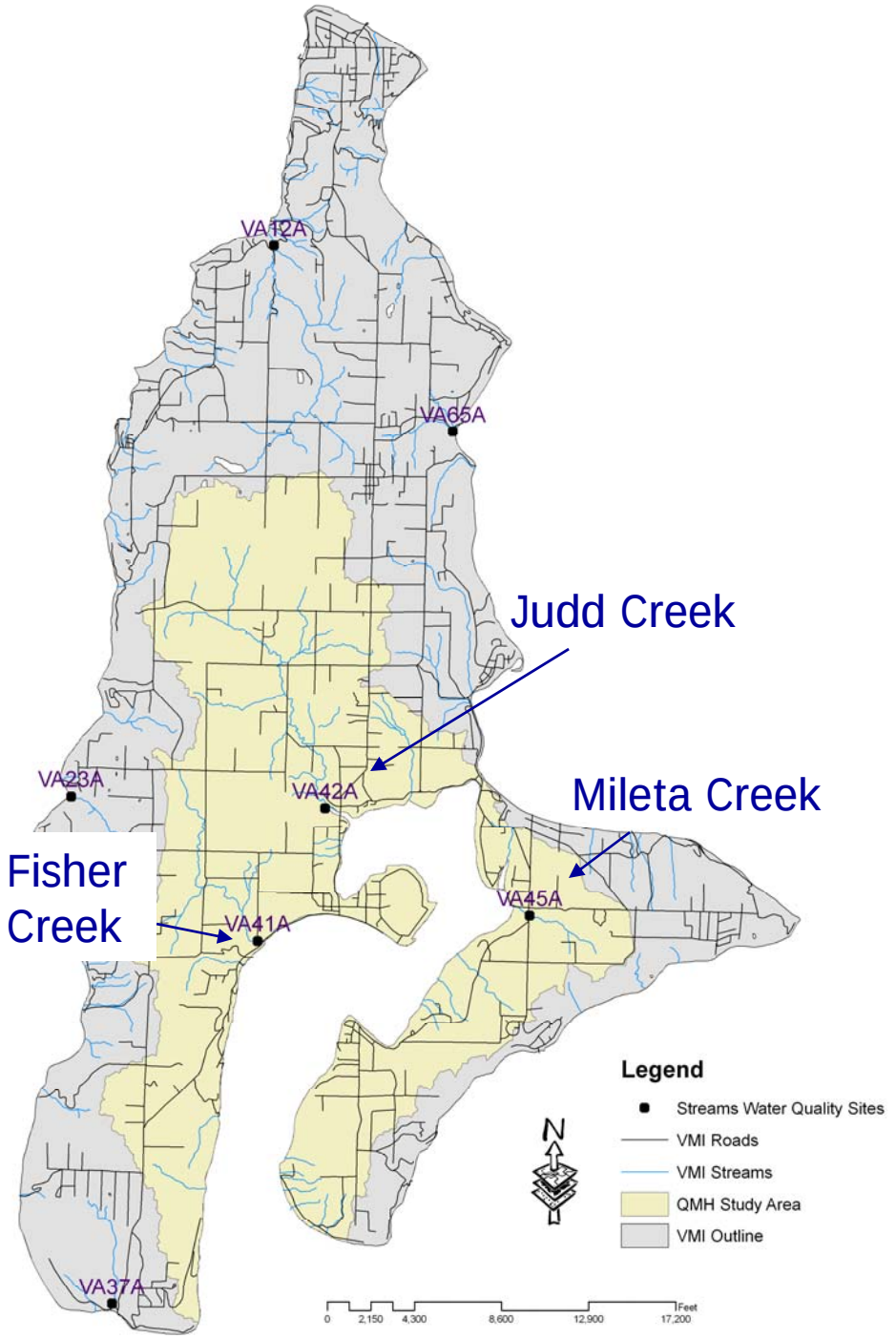
- 10 Monitoring well locations – 7 sites within study area
- Monitoring water quality since 2007
- As part of the Water Resources Evaluation Project

Groundwater WQ Monitoring

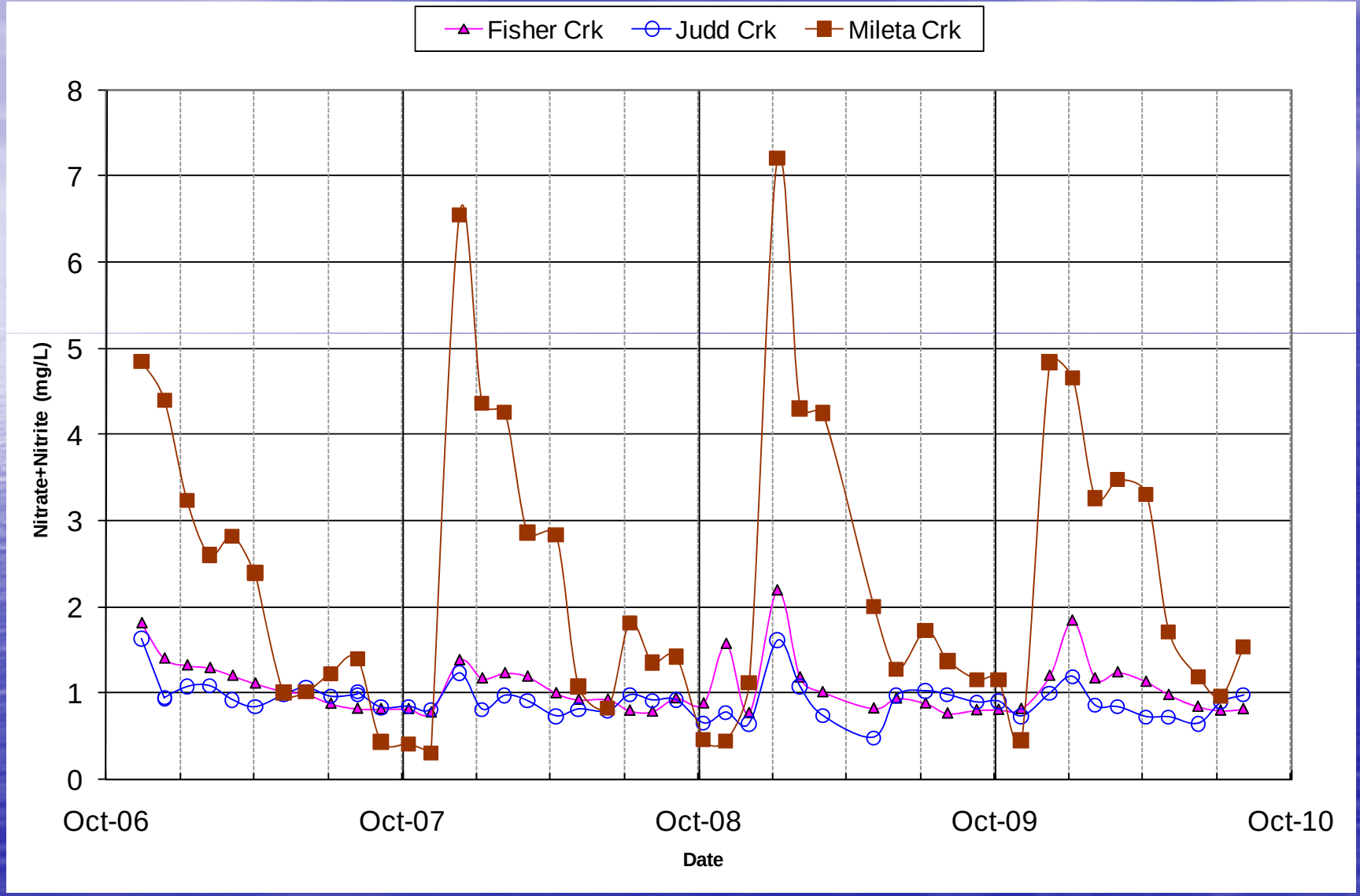


Stream Monitoring Sites

- 4 Active stream WQ sites – 3 sites within study area
- Monitoring water quality since 2006
- As part of the Water Resources Evaluation Project

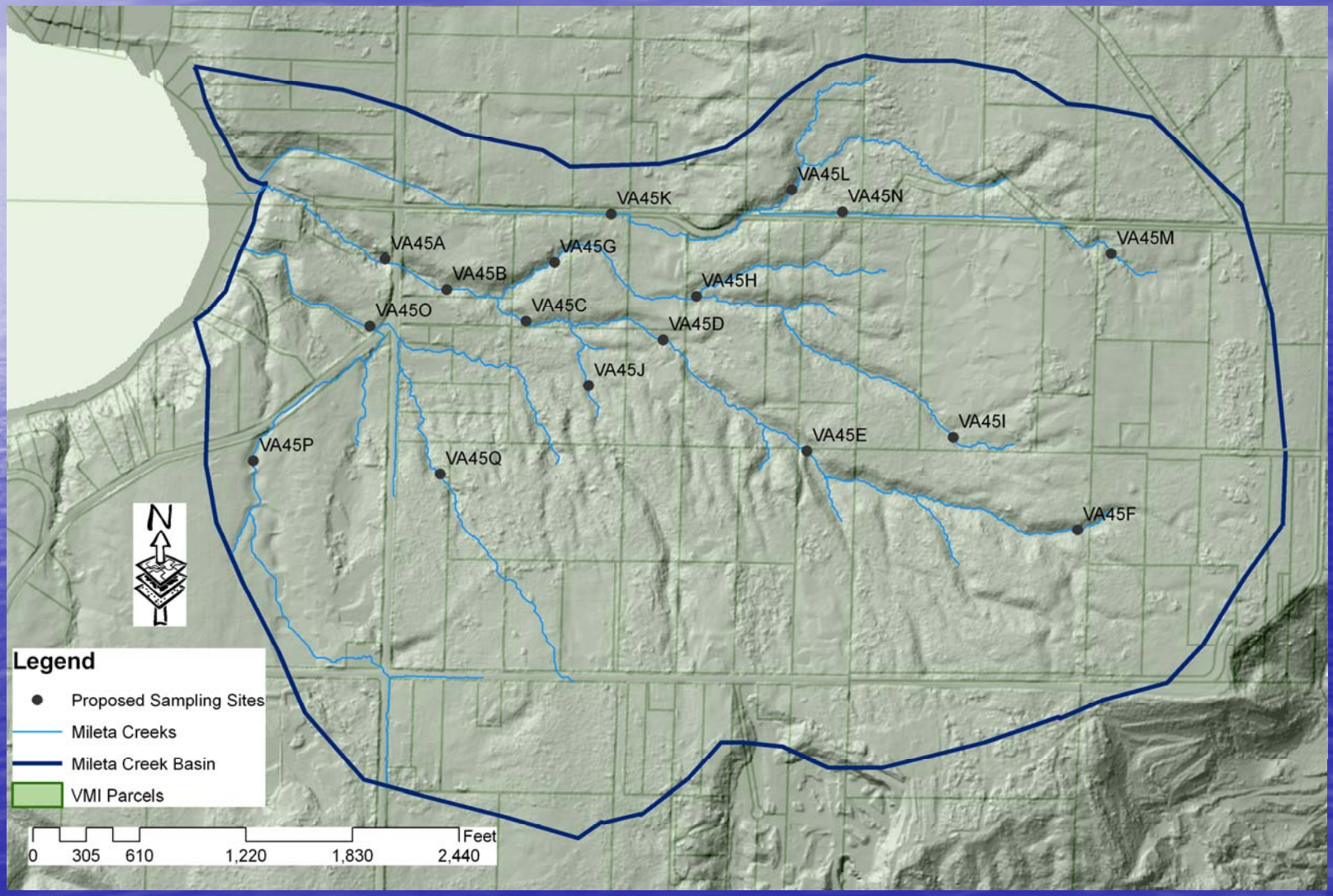


Stream Monitoring

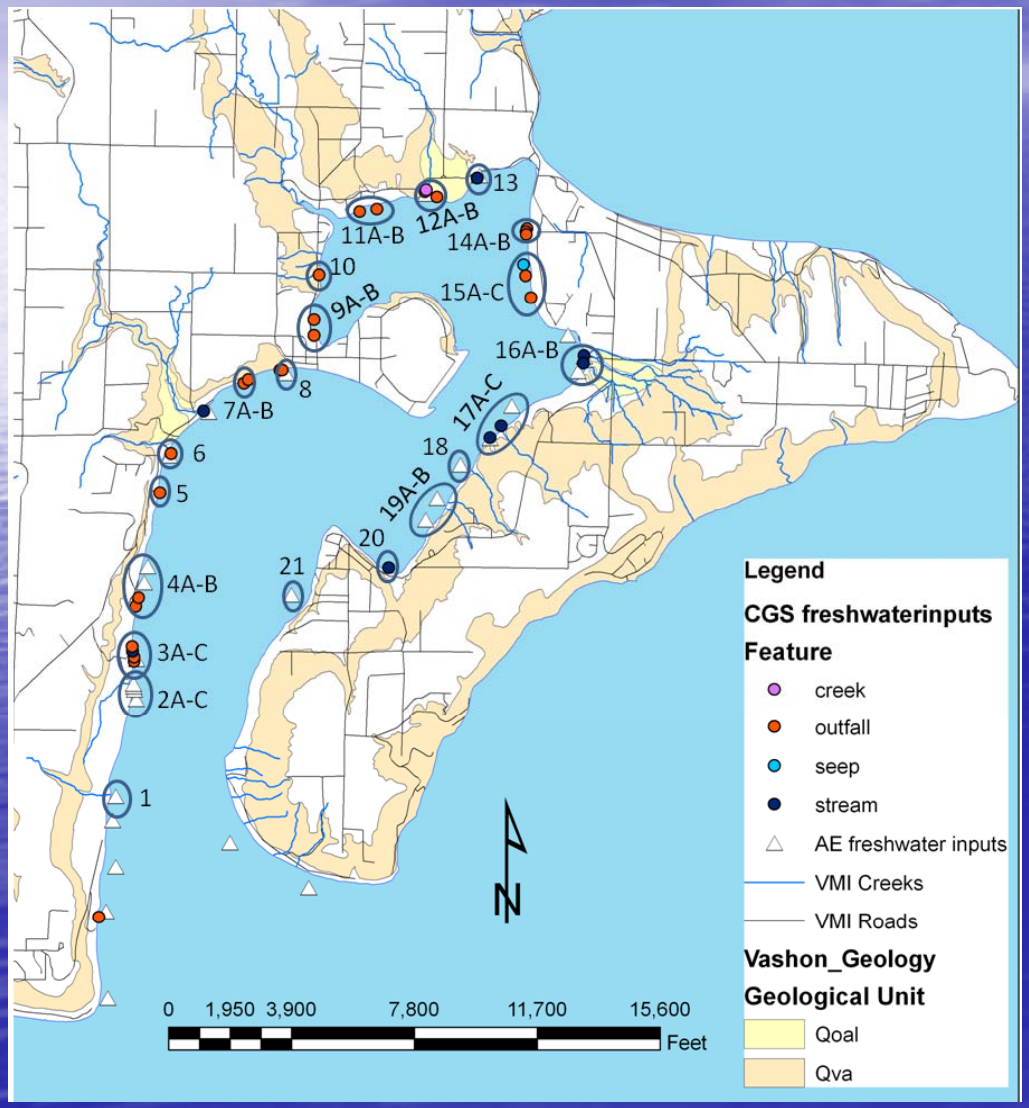


http://www.kingcounty.gov/environment/data-and-trends/monitoring-data.aspx

Mileta Creek Nitrogen Source Tracking Study

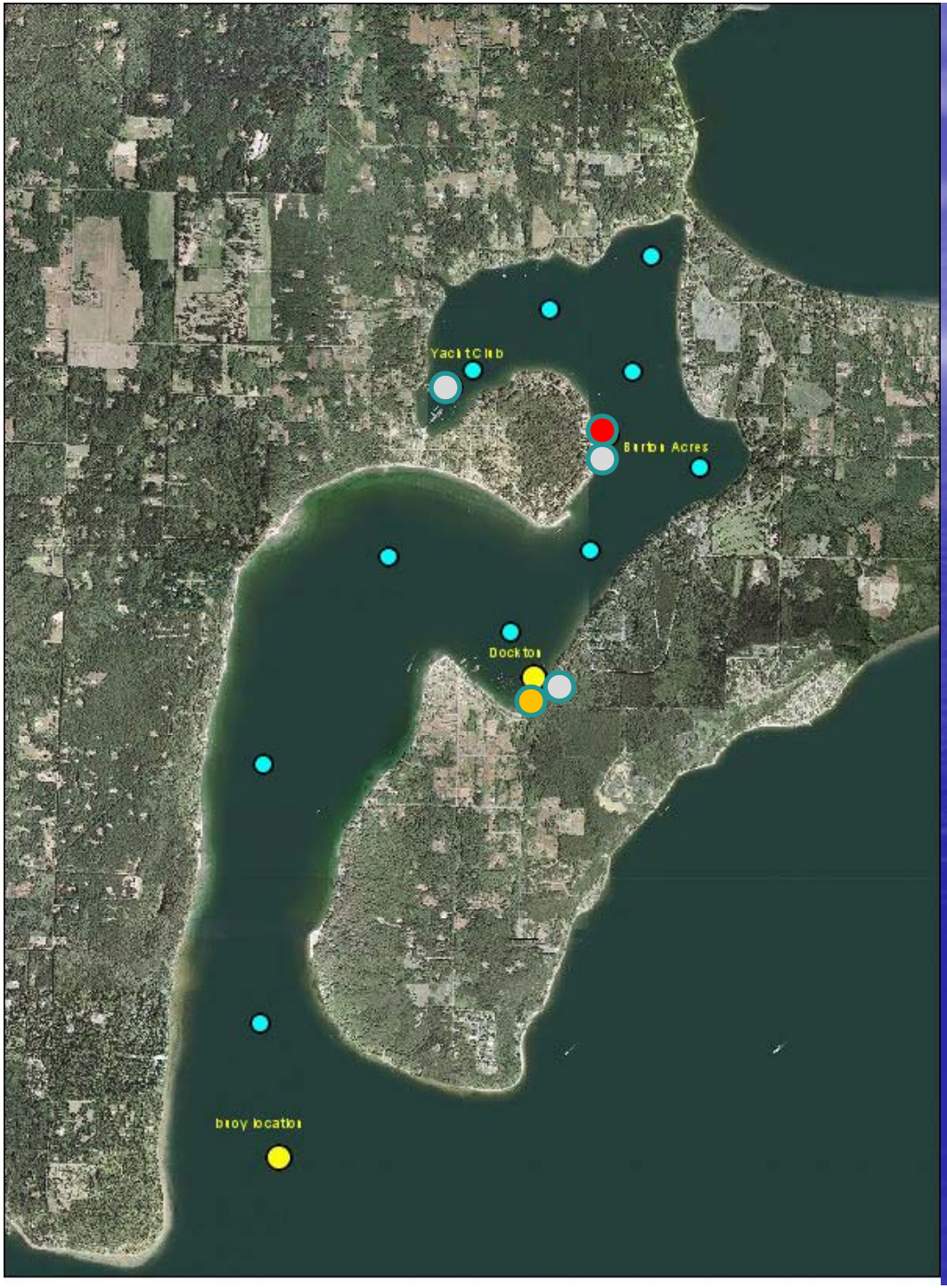


Quartermaster Harbor Nearshore Freshwater Assessment Study

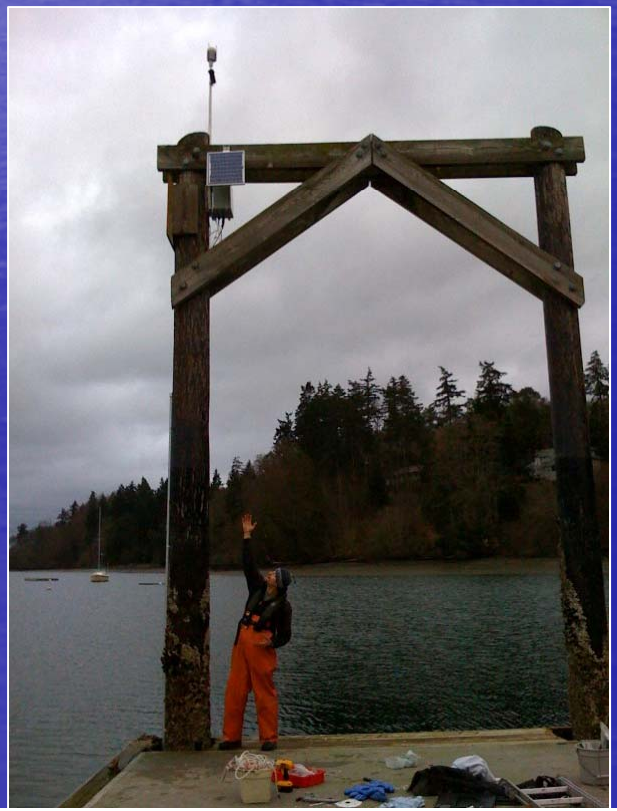


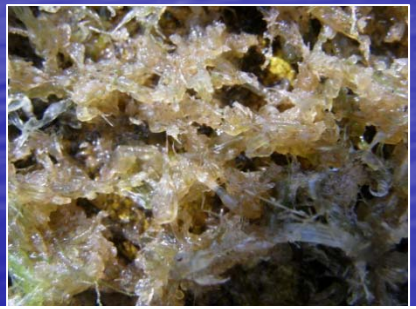
Proposed to collect 40 samples from 21 areas.

Sampling for nitrogen compounds – Total Nitrogen, Nitrate and Ammonia

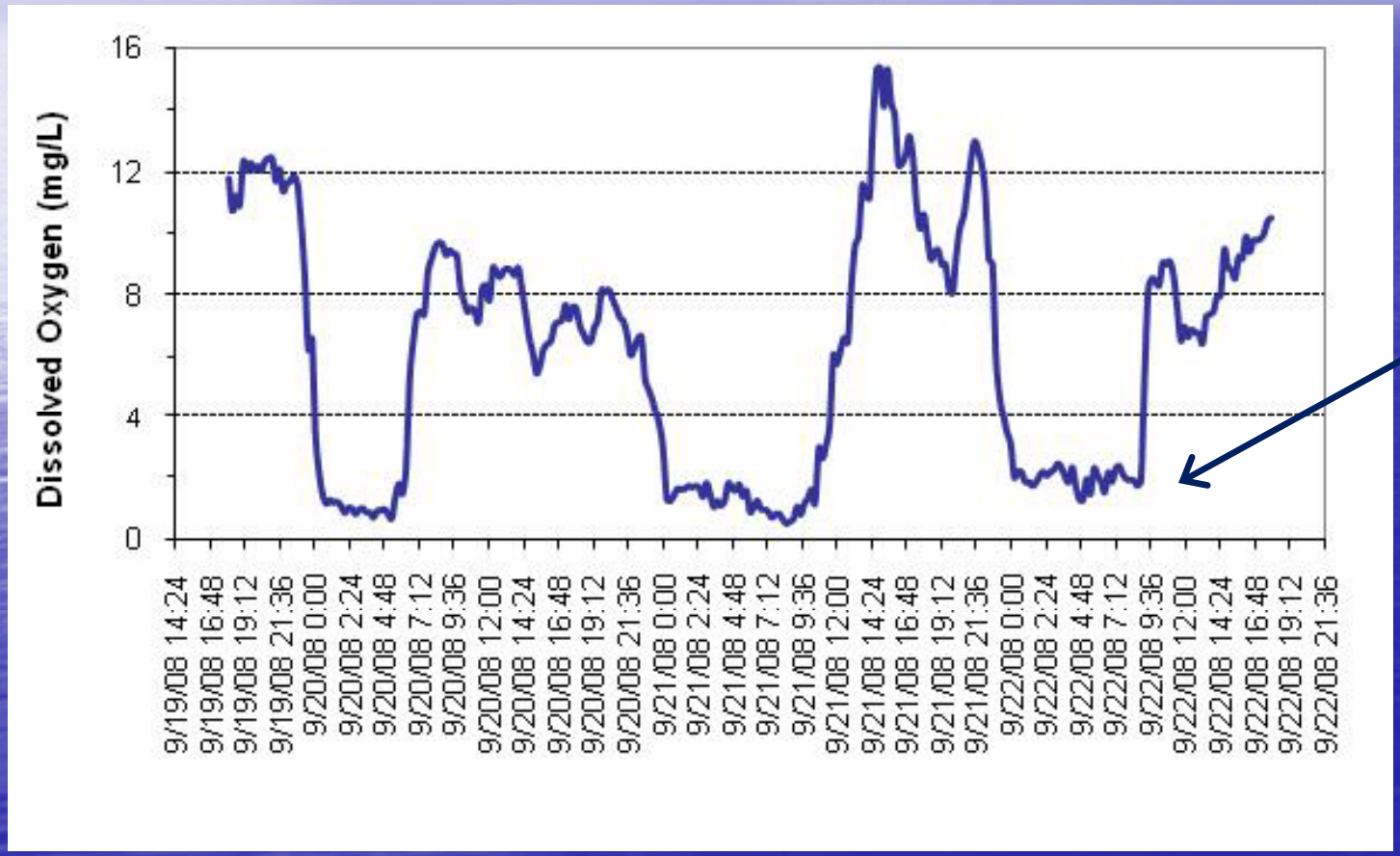


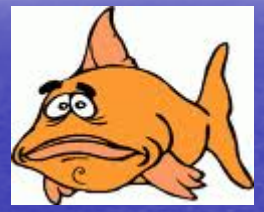
- Moorings
- Water
- Sediment
- Phytoplankton
- Clams





Yacht Club: September 2008





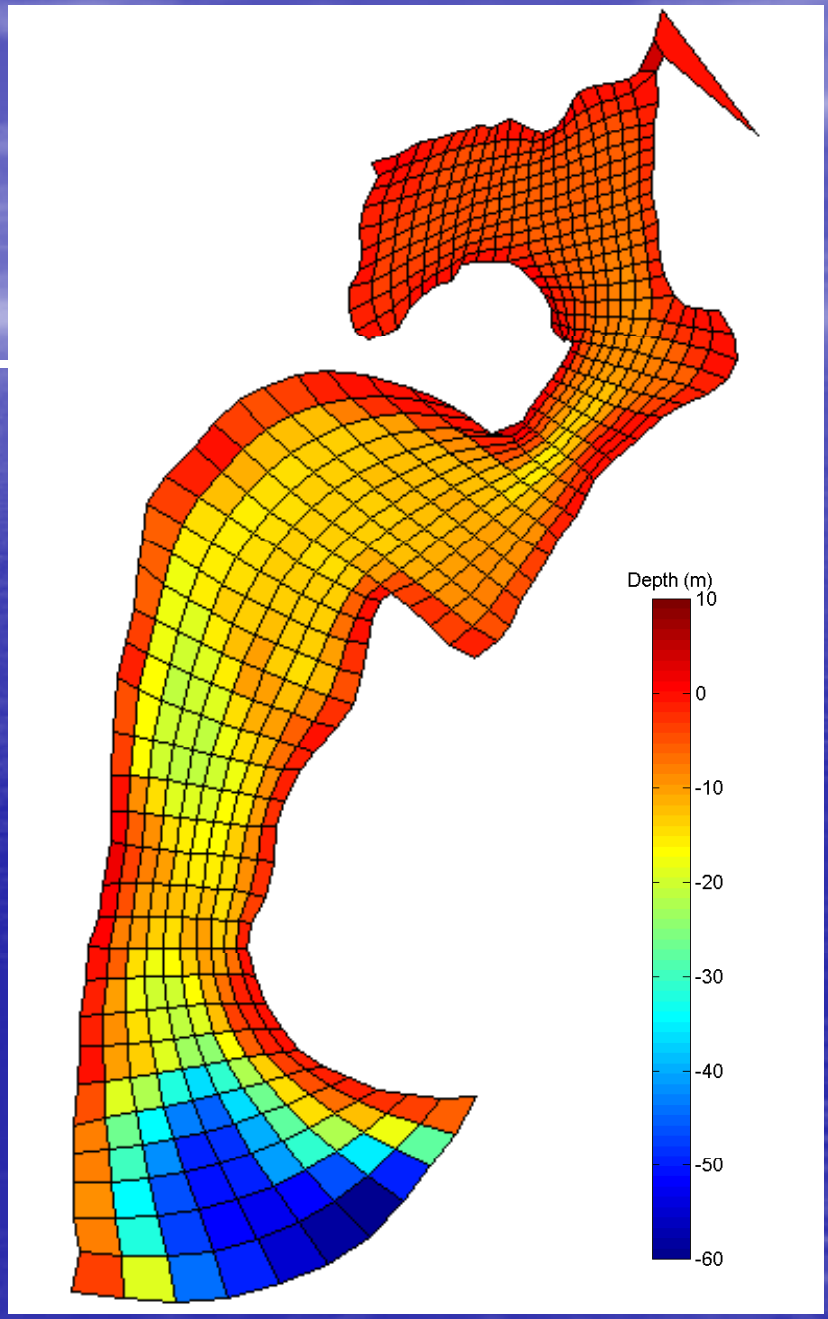
< 1 mg/L

DEPARTMENT OF ECOLOGY
State of Washington

-Skip Albertson, (360) 407-6676

Developing a harbor model –

- Create horizontal and vertical geometry

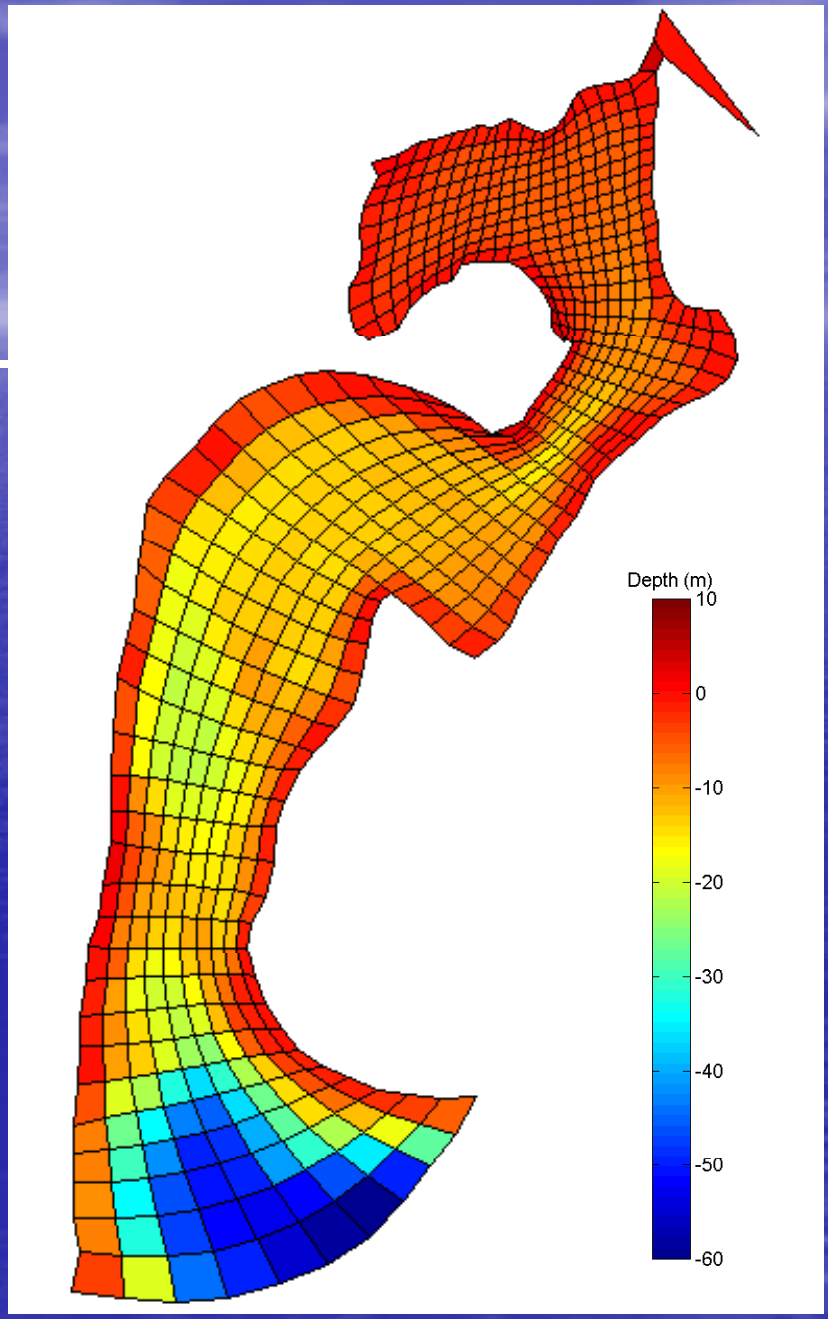


DEPARTMENT OF ECOLOGY
State of Washington

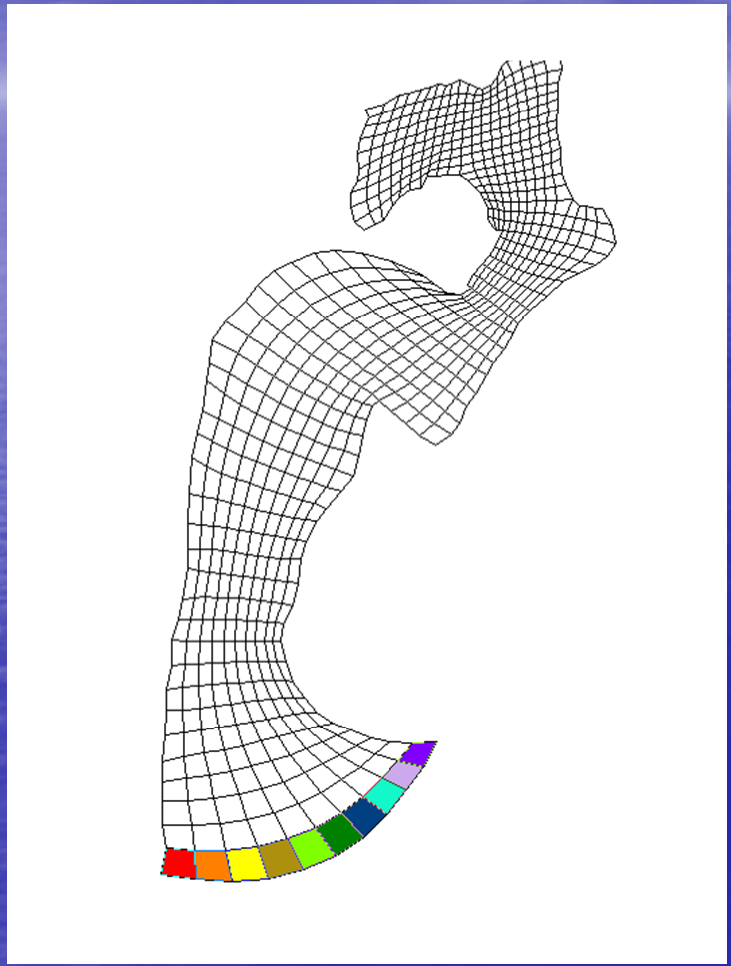
-Skip Albertson, (360) 407-6676

Developing a harbor model –

- Create horizontal and vertical geometry
- F=ma, F = Forcings (as follows):



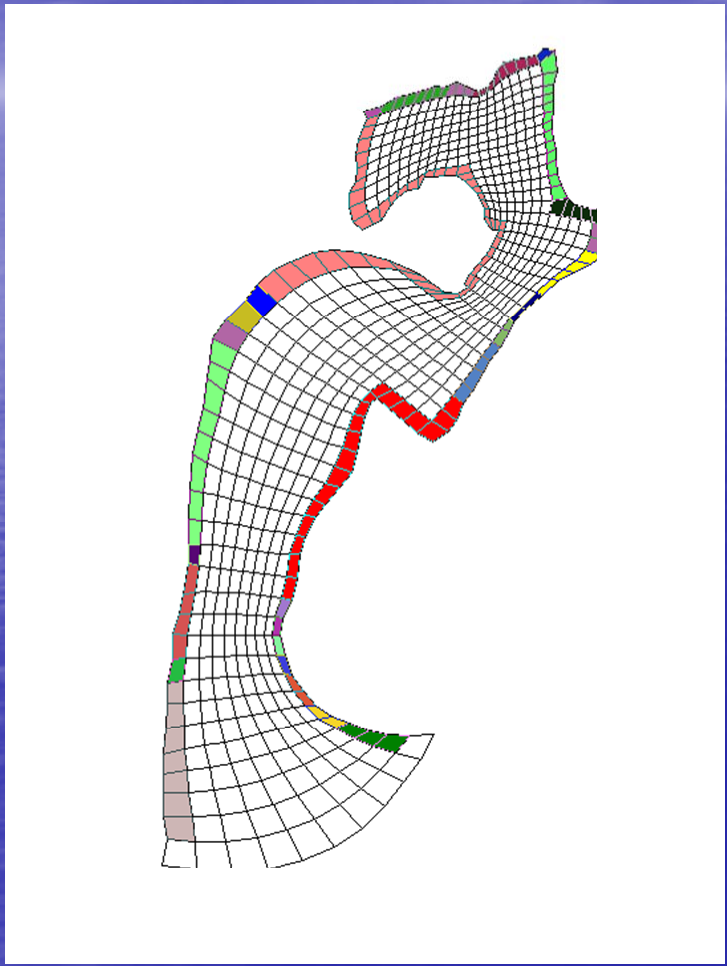
Boundary Conditions:



Temperature,
Salinity,
Oxygen,
Nitrate,
etc.

Tide forcing (slightly different in each cell)

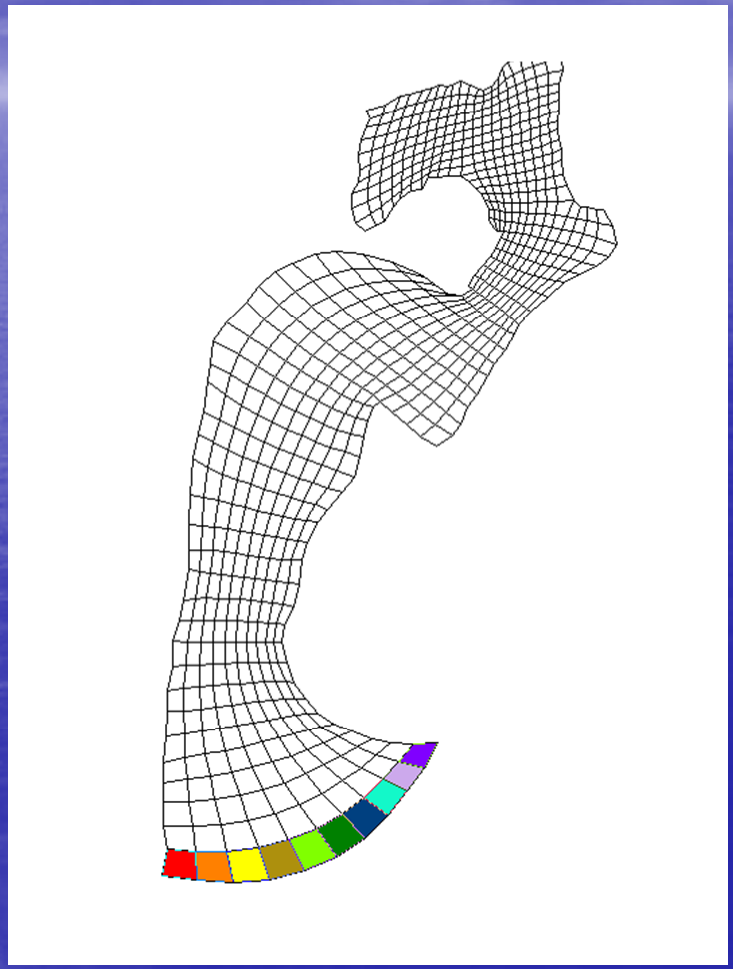
Boundary Conditions:



Flow,
Temperature,
Nitrate, etc.

Freshwater input from streams and tributaries

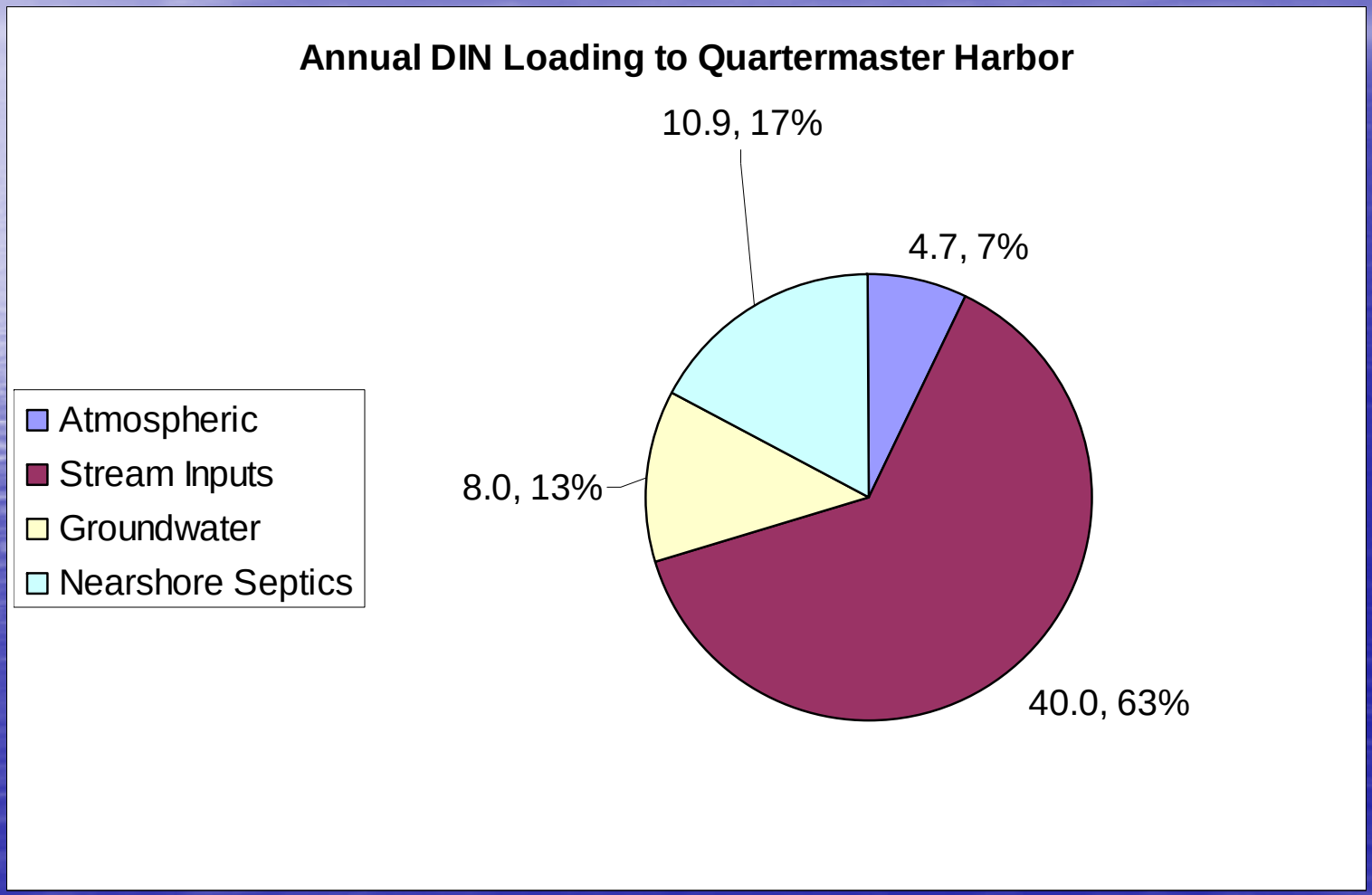
Some results: salinity (psu)



Nitrogen Management Strategies

- Today education backed with regulations
- Update based on loading study outcomes
- Near term outline improved strategies to improve implementation of existing rules
- Longer term consider option to limit **T**otal **M**aximum **D**aily **L**oading (TMDL)
- Goal to protect water quality in streams, ground (sole source aquifer) and Harbor

Dissolved Inorganic Nitrogen Load



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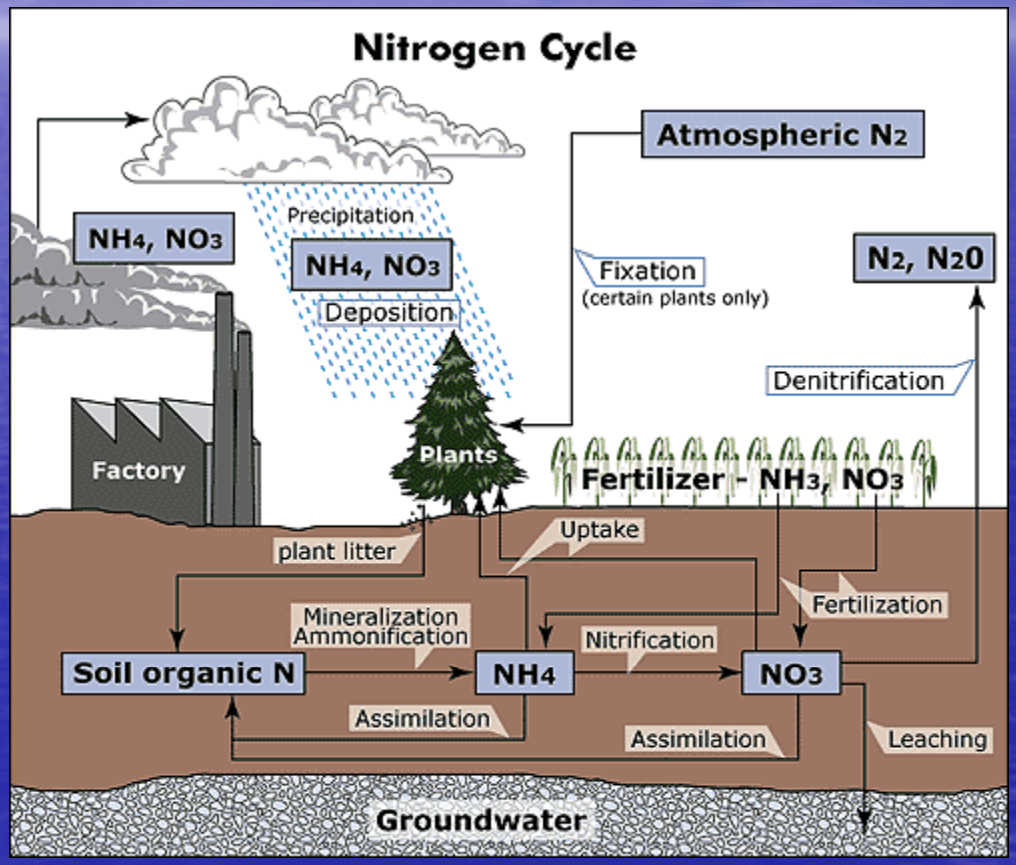


Nitrogen Management Code

Critical

Aquifer

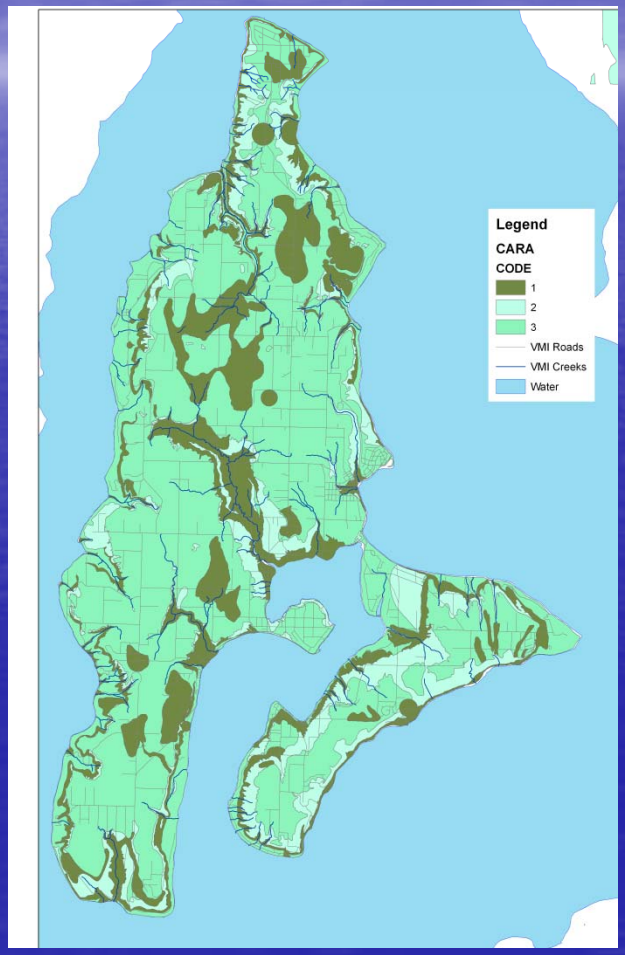
Recharge

Areas 1&2

N Reduction

For OSS

< ½ Acre



Other Codes affecting N loading

- **O**n-**S**ite **S**ewage
- Livestock
- Stormwater
- **P**ublic
  Benefit
  Rating
  System

Near Term Strategy Options

- Revise CARA to require N reduction in category 1,2 and 3 and/or lots > ½ acre
- Monitor OSS Operation and Maintenance inspection (**M**arine **R**ecovery **A**rea model)
- Monitor Farm Plan implementation
- Enhance outreach, education & incentives
- Other????

Next Steps to Develop Strategy

- Refine loading study
- Identify other near term options
- Evaluate potential benefits of actions
- Work with community via Groundwater Protection Committee to define preferred strategies
- Identify major elements by June 2011

Follow on QMH N Study Website

- Documents – QAPP, Preliminary N Load
- Monitoring – Links to collected data
- Project partners – Links to agencies
- *Public Participation – Involvement sign-up*
- www.kingcounty.gov/qmhnitrogenstudy

Questions?