Quartermaster Harbor Nitrogen Management Study Workshop
LOCATION: Vashon High School Commons (20120 Vashon Highway SW)
AGENDA – October 12, 2011

6:30 – 8:30 pm (Presentation will start at 7:00 pm)

6:30-7:00 Open House Poster Session / Meet and Greet – All

7:00-7:05 1. Getting Started - Curtis DeGasperi
   a. Introductions
   b. General updates since last meeting

7:05-7:15 2. Freshwater Monitoring - Eric Ferguson
   a. Overview of monitoring program
      o Seasonal variation in stream nitrate levels
      o Spatial variation in groundwater nitrate levels

7:15-7:30 3. Marine Monitoring – King County/UWT - Kim Stark / Cheryl Greengrove
   a. Overview of monitoring program / 303(d) listing
   b. Nitrate, phytoplankton and DO patterns
   c. Relationship to Alexandrium

7:30-7:45 4. Special Studies - Curtis DeGasperi
   a. Overview of N Sources to Harbor
   b. Mileta Creek N Source Tracking
   c. Nearshore Freshwater N
   d. Benthic Flux Study
   e. Updated loading estimates

7:45-7:55 5. Harbor Model - Skip Albertson
   a. Hydrodynamic model
   b. Water quality model status

   a. 2012 KC Comp Plan recommendations / schedule
   b. Next steps
      o N management alternatives analysis spring 2012
      o Correction activities
      o Community interest / support will play key role

8:10-8:30 8. Questions and Answers - All

Adjourn at 8:30 pm
Quartermaster Harbor Nitrogen Management Study

Public Workshop

October 12, 2011
Study Team

- Jill Gable – Grant Project Officer, EPA
- 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 – Policy & Public Outreach, KC
Quartermaster Harbor Nitrogen Management Study

- Problem: Low dissolved oxygen levels observed in harbor
- Low oxygen can be harmful to fish and other aquatic life like in South Puget Sound embayments
Quartermaster Harbor Nitrogen Management Study

http://www.kingcounty.gov/qmhnitrogenstudy
Sources of Nitrogen on VMI

- Atmosphere
- Septics
- Livestock
- Fertilizer
- Alders
Sources of Nitrogen to Quartermaster Harbor

- Streams
- Boats
- Atmosphere
- Nearshore Septics
- Sediment
- Groundwater
- Marine Boundary
Special Studies

Curtis DeGasperi
Mileta Creek N Source Tracking

- Mileta Creek (VA45A)
- Judd Creek (VA42A)
- Fisher Creek (VA41A)
- Shingle Mill Creek (VA12A)
Mileta Creek N Source Tracking

November 17, 2010
**Nearshore Freshwater Inputs**

**October 6, 2010**

**Nitrate + Nitrite Nitrogen**

2.24 mg/L
Nearshore Freshwater Inputs

Nitrate Concentrations

Nitrate Loadings

Legend
Nearshore Nitrate Concentrations
mg N per Liter
- 0.20
0.21 - 0.50
0.51 - 0.75
0.76 - 1.00
1.01 - 2.00

Legend
Nearshore Nitrate Loading
kg N per day
- 0.05
0.06 - 0.25
0.26 - 0.75
0.76 - 1.5
1.51 - 4.0
Benthic Flux Study

Quartermaster Harbor
Benthic Flux Study

September 1-2, 2010
External N inputs assessed

- Atmospheric deposition
- Stream inputs
- Groundwater
- Shoreline septic systems
- Benthic flux

![Pie chart showing N inputs]

- Atmospheric Flux: 5%
- Nearshore Septic Systems: 20%
- Submarine Groundwater: 29%
- Surface Streams: 46%
Seasonal Load (late summer)?
Uncertainty in Nitrogen Loading Estimates
Buildout Analysis

- Identify Buildable Residential Lands
- Exclude
  - Commercial/Industrial
  - Critical Areas
  - Market Reserve
Quartermaster Harbor Harbor Nitrogen Management Study

Vashon-Maury Island
Public Workshop
Wednesday, October 12, 2011
Quartermaster Harbor Nitrogen Management Study

http://www.kingcounty.gov/qmhnitrogenstudy
Sources of Nitrogen to Quartermaster Harbor

- Streams
- Boats
- Atmosphere
- Nearshore Septics
- Sediment
- Groundwater
- Marine Boundary
Streams Sampling Locations

4 - Water Quality Sites
- 3 within study area
- sampled monthly

5 – Stream Gauging Sites
- 3 within study area

Additional Freshwater Sampling events
- Oct 2010 - Nearshore
- Nov 2010 – Mileta Creek
Nitrate data from Stream Sites

Nitrate data from Stream Sites

- Shinglemill Crk
- Fisher Crk
- Judd Crk
- Mileta Crk

Date

Oct-06
Oct-07
Oct-08
Oct-09
Oct-10
Oct-11

Nitrate+Nitrite (mg/L) Ax:

0
1
2
3
4
5
6
7
8
9
10

Date
Groundwater Sampling Locations

- 10 Monitoring Wells
- 18 Long-term Water Quality Sites
- 7 of each type of WQ sites are within study area
Nitrate data from QMH Groundwater Sites
On to next segment – Marine Monitoring
Moorings
continuous

Water
monthly

Phytoplankton
bi-weekly Apr-Oct
What’s Sampled

**Moorings**
- fixed depths
- salinity, temp, DO, turbidity, chlorophyll, pH
- nitrate at outer harbor site
- meteorological data at Dockton

**Water**
- multiple depths
- salinity, temp, DO, chlorophyll, nutrients, TSS, bacteria

**Phytoplankton**
- species and relative abundance
Sampling Program

Monthly Sampling
Oct. ’06 – present

- Temperature
- Salinity
- Density
- Oxygen
- Chlorophyll
- Transmissivity
- Licor
- Nutrients
- Plankton

Moored Timeseries
- Temperature
- Salinity
- Density
- Oxygen
METHODS
CTD & Water Sampling
METHODS

Moored Instrumentation
Seasonal Patterns in Nutrients & Phytoplankton

**Surface DO (ml/L)**

- 3.5 ml/L DOE

**Bottom DO (ml/L)**

- Presence of *A. catenella*
  - *A. Catenella* most abundant

**Surface Nitrate (µM)**

**Bottom Nitrate (µM)**

- 2007
- 2008
- 2009

**Photos**

- *Rhizosolenia setigera*
- *Chaetoceros debilis*
- *Heterosigma akashiwo*
- *Diatoms – Spring/Early Summer*
- *PSP*

**Species Distribution**

- *Chaetoceros eibenii*
- *Prorocentrum gracile*
- *Coscinodiscus wailesii*
- *Alexandrium catenella*

**Diagrams**

- *Dinoflagellates – Summer/Early Fall*
  - *Prorocentrum gracile*
  - *Alexandrium catenella*

**All Photos by G. Hannach King County**
Harmful Algal Bloom (HAB)
http://www.whoi.edu/redtide/
Quartermaster Harbor model

-Skip Albertson
(360) 407-6676
Generalized Environmental Modeling System for Surfacewaters (GEMSS®)

Quartermaster Harbor (QMH) application --

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Vertical layers = 37
Total grid cells = 9798
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\[ D(I,J,t) = D_0 e^{-t/\tau(I,J)} \]
$$D(I,J,t) = D_0 e^{-t/\tau(I,J)}$$
Results

Flushing Time (day)

- baywide
- outer-inner
- inner-inner

Model spin-up
Results

PUYALLUP RIVER AT USGS 12101500

Flow (cfs/1000)

Flushing Time (day)

Model spin-up
inner-inner
outer-inner
baywide

snow melt

Tacoma, Quarter master Harbor, AM flight Track [2]

Courtesy: Eyes Over Puget Sound
Summary --

• Flushing time varies by location and is highest in the inner bay
• Flushing time varies seasonally and between years
• Greatest apparent factor controlling flushing time is the Puyallup River
• What events happening during the longer flushing times of May/April affect WQ in August/September?
Parallel Efforts

- South Puget Sound Dissolved Oxygen Study

http://www.ecy.wa.gov/puget_sound/dissolved_oxygen_study.html
“Wicked” Problem

• No silver bullet
• Multiple nitrogen sources
• Puget Sound wide perspective forthcoming
• EPA working on national policy for nutrients
Near Term Strategy Options

• Today education backed with regulations
• Update based on final study outcomes
• Near term outline improved strategies to improve implementation of existing rules
• Longer term limit Total Maximum Daily Loading (TMDL)
• Goal to protect water quality in streams, ground (sole source aquifer) and Harbor
Clean Water Act
Section 303(d) List

• Ecology 2010 Draft Assessment of Quartermaster Harbor
  – Category 5: Polluted waters that require a TMDL for Dissolved Oxygen

• Draft Assessment Public Comment Period
  – June 16 – August 16, 2011

Total Maximum Daily (TMDL)

- The Water Quality Improvement Project (TMDL) establishes limits on pollutants that can be discharged to the waterbody and still allow state standards to be met.

http://www.ecy.wa.gov/programs/wq/tmdl/
Comprehensive Plan 2012

• Focus existing outreach education and incentives to implement best management practices designed to reduce excessive nutrient and bacterial contaminate loading within the Quartermaster Harbor drainage.

• Seek grants to enhance existing outreach education and incentives when funding opportunities occur.
Comprehensive Plan 2012

- If the final study demonstrates it would significantly reduce future nitrogen loading in the harbor, then consider revising code to require new on-site sewage systems within the drainage area meet nitrogen reduction treatment standard established by DOH, where feasible.
Comprehensive Plan 2012

• If Quartermaster Harbor listed as a Category 5 polluted water body on Water Quality Assessment 303(d) list, request Ecology assistance to develop a Total Maximum Daily Load pollutant limit for point source discharges and guidance to enhance non-regulatory pollution reduction programs for nonpoint sources.
Comprehensive Plan 2012

- Evaluate need and potential sources of funding for an enhanced management program for existing on-site sewage systems on Vashon-Maury Island to ensure they receive routine inspection, maintenance and repair if necessary to protect water quality.
Next Steps...

- Complete/return survey to help inform Co./State efforts to manage Quartermaster H.
- Review/comment on the draft Comp Plan policies between now and Dec. 23, 2011
- QHN study to compare benefits of nitrogen management reduction options
- Community interest/direction will guide future agency efforts to reduce N loading!
Questions?

Curtis DeGasperi
King County Water and Land Resources
(206) 684-1268
curtis.degasperi@kingcounty.gov
Water Quality Phone Numbers

- KC Stormwater Service Drainage Complaint Line 206-296-1900
- KC Lab Water Quality Trouble/Spills sampling 206-684-2328
- Ecology spill response hotline 1-800-258-5990 -OR- 1-800-OILS-911