

An Analysis of Nitrogen Loading to Hood Canal

U.S. Geological Survey
Tacoma, WA
August 11, 2004

Preliminary results, subject to revision

Objective

Assess pathways and determine loads of nitrogen compounds discharged to Hood Canal

General Approach

- Make initial estimates of nitrogen loading using available data and information
- Design and conduct focused studies to better quantify loading from major sources and/or to sensitive areas of Hood Canal
- Improve the initial load estimates using the results of the focused studies

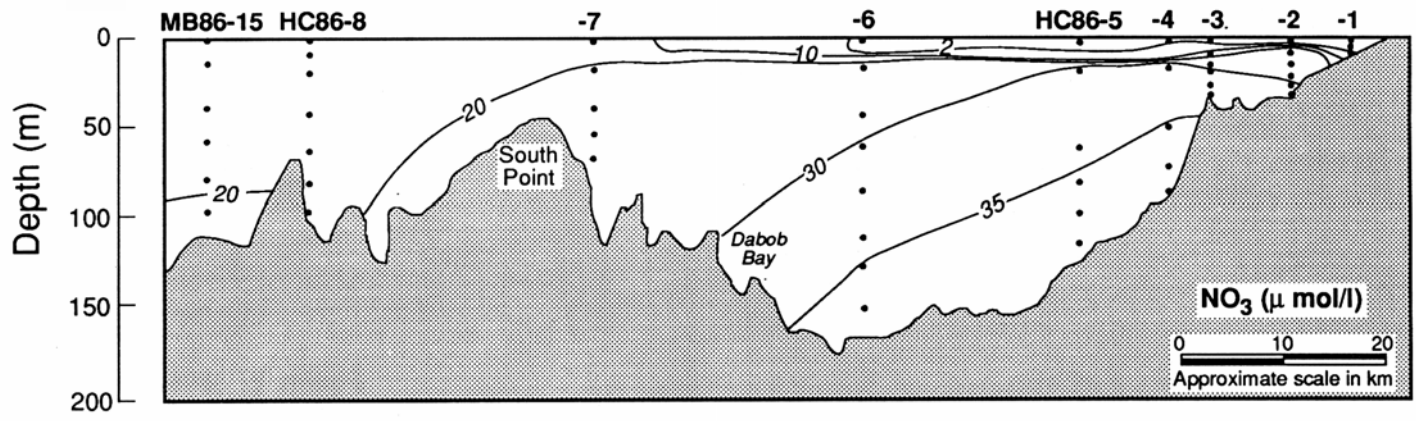
Initial Nitrogen Load Estimates to Hood Canal

River and stream basins (including natural and anthropogenic sources)
Regional ground water (including natural and anthropogenic sources)
Near-shore septic systems
Atmospheric
Other (direct point source discharges, salmon carcass disposal)
Marine

Input Source	Hood Canal	Lynch Cove only
River and Stream Basins	421 ± 162	64 ± 25
Regional Ground Water	56 ± 30	7 ± 4
Near-Shore Septic Systems	28 ± 15	8 ± 5
Atmospheric	30 ± 11	4 ± 2
Other	20 ± 5	2 ± 1
Marine	8,700 – 31,200*	Unknown

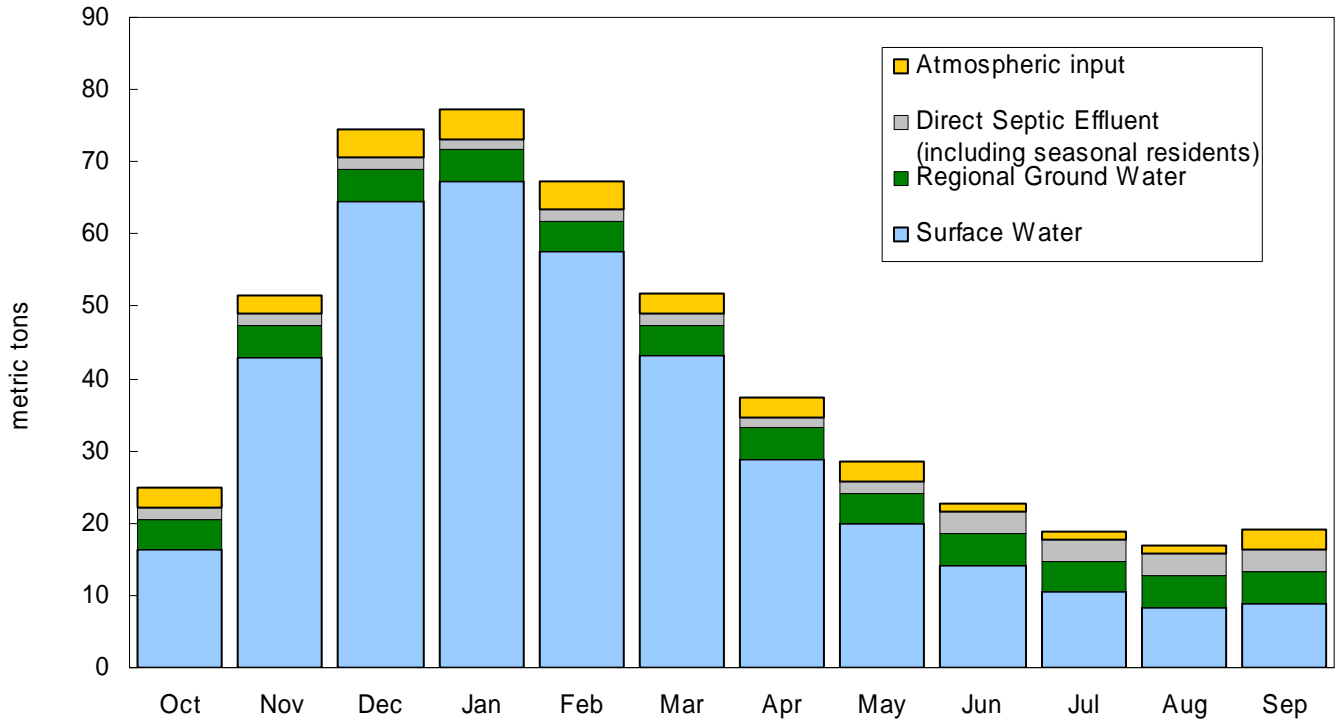
Inputs of Nitrogen to Hood Canal and Lynch Cove, in metric tons per year

***Note:** The large input of nutrients from marine sources is a result of the large input of seawater (i.e. flushing) at the measurement point near the sill in the northern part of Hood Canal. No data are available to estimate marine inputs at other locations in Hood Canal



Depth profile of Hood Canal (from Paulson and others 1993).

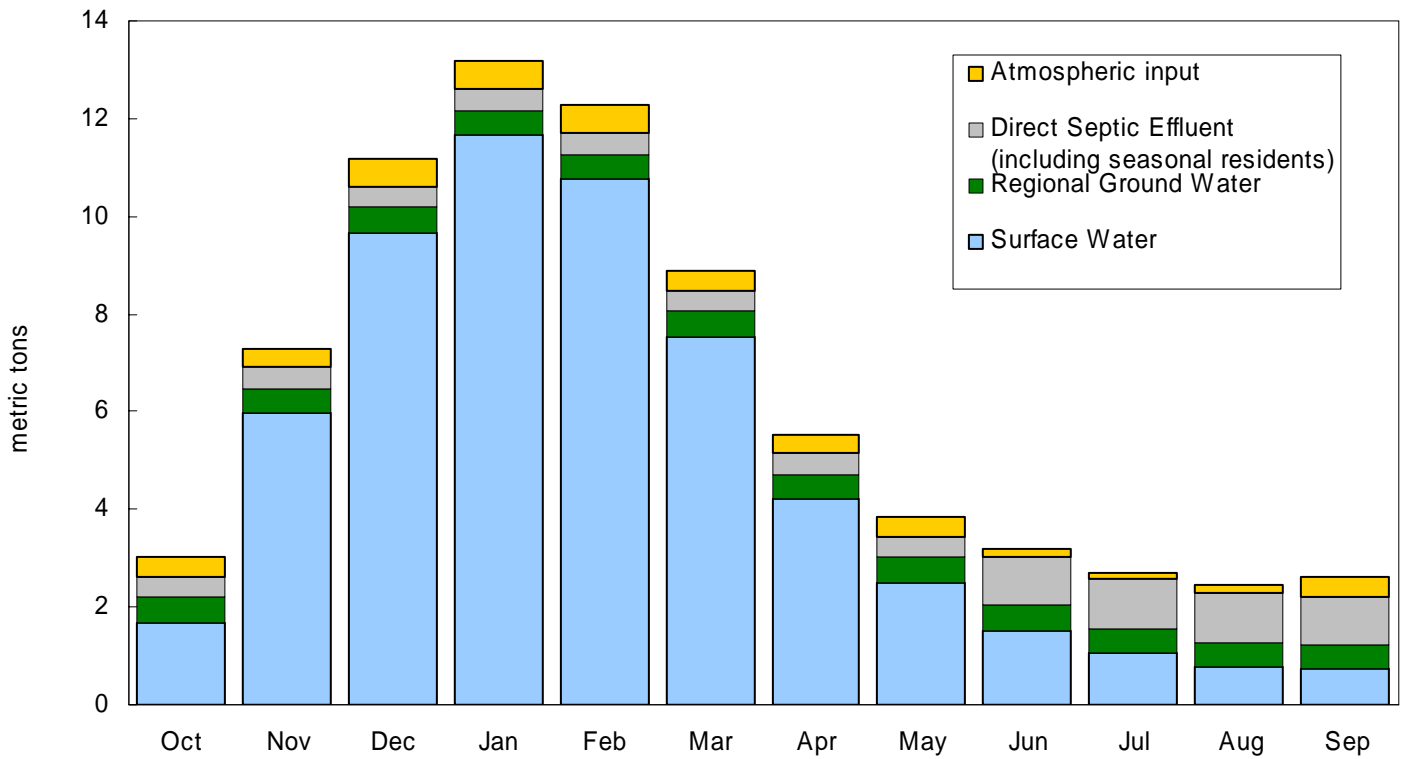
Station 7, near the sill is the point of estimation for marine inputs of nitrogen to all of Hood Canal. Station 3, east of the Skokomish River, is the approximate location of this summer's current measurements by USGS.



Preliminary results, subject to revision

Estimated monthly inorganic nitrogen input for all of Hood Canal, excluding marine inputs.

Surface water is the major nitrogen input during all seasons. If estimated marine inputs are included, they dwarf all other inputs.



Preliminary results, subject to revision

Estimated monthly inorganic nitrogen input to Lynch Cove, excluding marine inputs.

In most seasons surface water is the major nitrogen input, but in summer months near-shore septic inputs are significant. If inputs entering Lynch cove from the rest of Hood Canal turn out to be small, near-shore septic inputs could still be significant

Focus Studies

- 1) Relate nitrogen concentrations in streams to land use. This will help better understand how land use affects nitrogen inputs from rivers to Hood Canal

Approach:

- Conduct studies in three basins: Skokomish, Union, and Tahuya
- Collect samples along the length of the rivers at 8-10 points where land use changes
- Look at nutrient concentrations, nitrogen isotopes
- One sampling effort, in the summer during low flow

Status:

The samples have been collected; we are waiting for the results of the chemistry analyses.

- 2) Measure current velocities in Hood Canal at the Great Bend. This information is critical to developing an estimate of nitrogen inputs from marine sources farther into the canal, in the areas where the low dissolved-oxygen events are prevalent. The data will be used to estimate summer-time loading for Lynch Cove, and can be used for the calibration of any current or circulation models of the canal.

Approach:

- Deploy two Acoustic Doppler Current Profilers (ADCPs) in about 50 meters of water in the vicinity of Great Bend. Measure current velocities at 1-5 meter intervals, continuously for a period of at least one month
- Collect nutrient samples at 1-5 meter intervals biweekly, to coincide with the velocity measurements

Status:

Necessary arrangements are in place to deploy the ADCPs on August 25, recover them in late October.

- 3) Refine input estimates from septic systems

Approach:

- Use same methods as for initial estimates, only with plat data for Mason County

Status:

Will do this when data from Mason County are available

