

Report summarizes 30 years of nitrate studies in the Sumas-Blaine Aquifer

Since the 1980s, several studies have been conducted by the Washington State Department of Ecology (Ecology) and the U.S. Geological Survey (USGS) indicating that the Sumas-Blaine Aquifer has some of the most widespread and elevated nitrate contamination in Washington State.

This is problematic because groundwater from the Sumas-Blaine Aquifer is the main drinking water source for roughly 18,000 to 27,000 people in northern Whatcom County.

Ecology recently compiled a report summarizing the results of past studies to (1) assist in revising the state Confined Animal Feeding Operations (CAFO) permit and (2) inform Ecology managers, stakeholders, and others interested in Whatcom County groundwater (See Resources).

The Sumas-Blaine Aquifer is part of the larger Abbotsford-Sumas Aquifer that extends into British Columbia, Canada. The Sumas-Blaine Aquifer is the portion of the aquifer in Washington.

Findings

Studies of the aquifer include nitrate data collected over 30 years from 515 wells. Nitrate concentrations exceeding the nationally acceptable limit for safe drinking water (10 mg/L-nitrogen or parts per million) have been documented throughout the Sumas-Blaine Aquifer for at least 24 years.

We found that 29% of sampled wells have exceeded the acceptable concentration, and 14% were at least double that limit, as shown in Figure 1.

The number of wells exceeding the drinking water limit was higher in shallow wells (less than 40 feet depth) than in deeper wells.

In addition to aquifer-wide assessments, Ecology's Environmental Assessment Program has conducted site-specific field studies to evaluate how applying manure to fields and storing manure in lagoons affects groundwater quality.

Why do we care about nitrate contamination?

High nitrate concentrations can lead to methemoglobinemia (blue baby syndrome) in infants. Nitrate prevents hemoglobin from carrying oxygen in the blood which leads to oxygen deprivation.

Health risks for adults who drink water with more than 10 mg/L nitrate-nitrogen are less clear. Some evidence suggests an increased risk of spontaneous abortions in pregnant women, while other studies have found no link.

Residents outside the City of Lynden rely on the Sumas-Blaine Aquifer as their only available water supply. The aquifer is relatively thin, and there is not a good supply of groundwater beneath the aquifer. Therefore drilling wells deeper is not a long-term solution.

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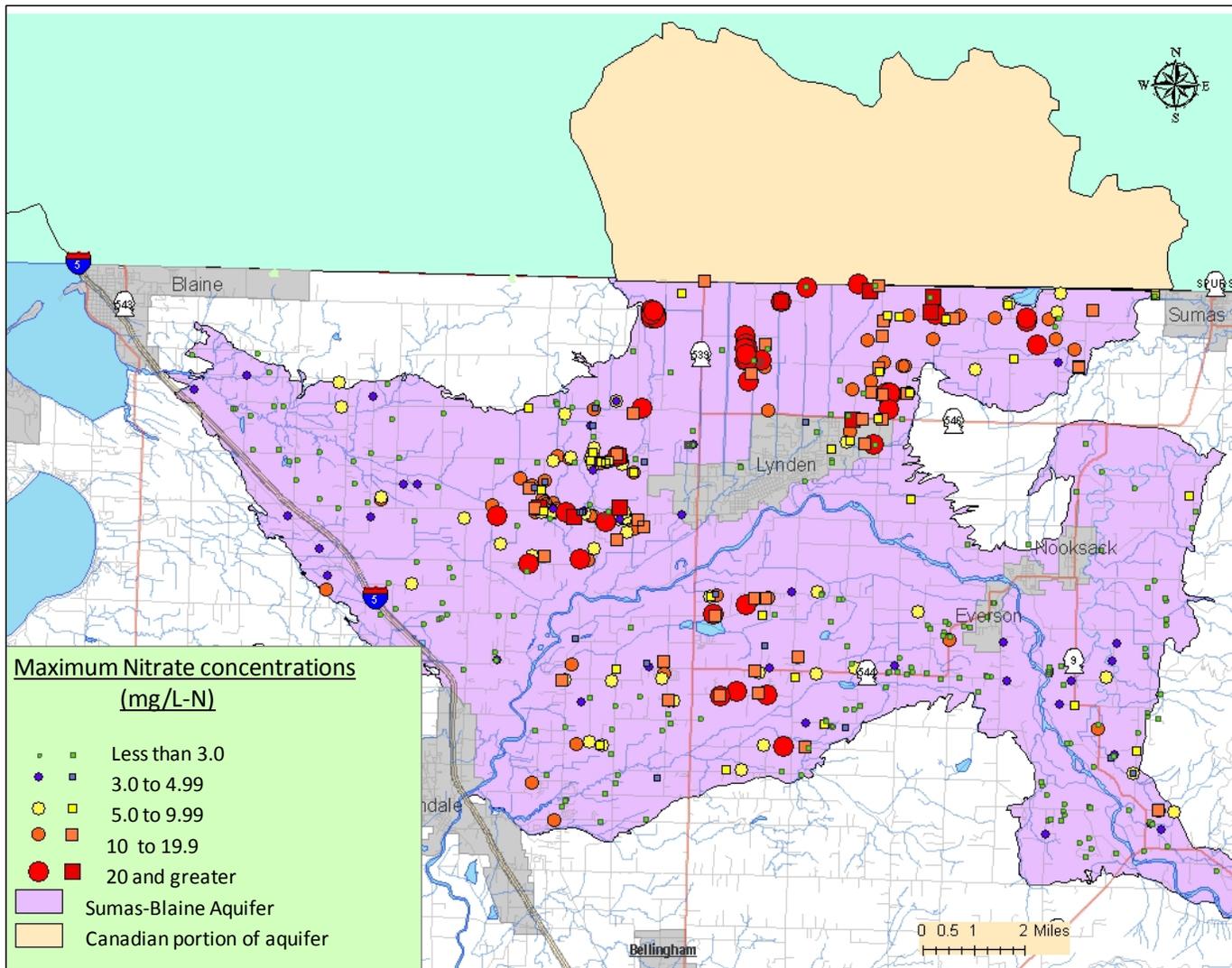


Figure 1. Maximum nitrate concentrations (mg/L-N) in drinking water wells sampled by Ecology and the USGS from 1981 to 2010.

Red and orange symbols indicate drinking water that exceeds maximum contaminant levels.

Circles represent Ecology data. *Squares* represent USGS data.

Causes for high groundwater nitrate

The Sumas-Blaine Aquifer is particularly vulnerable to nitrate contamination due to its shallow depth (mostly less than 10 feet to the top of the water table), limited thickness, and the area's heavy rainfall from October through March.

Based on a Geographic Information System (GIS) land-use analysis and nitrogen application rates for each land use, most of the nitrogen loading to the ground overlying the aquifer is from agriculture (97%). (See Figure 2.)

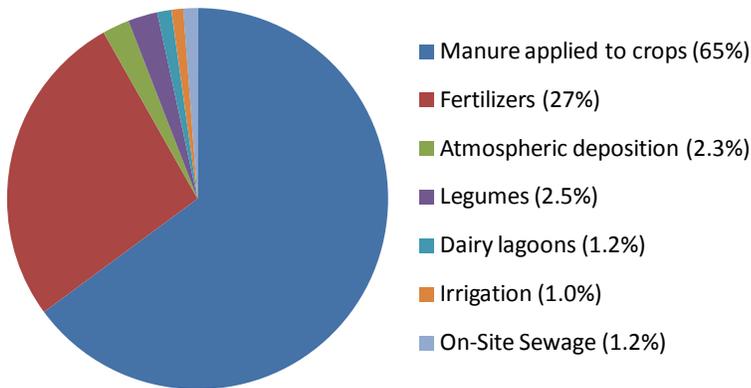


Figure 2. Distribution of estimated annual nitrogen inputs to the land and subsurface overlying the Sumas-Blaine Aquifer (Redding et al., 2011).

Within the agriculture category, about 66% of the nitrogen applied to the land is from manure applied to crops, while 27% is from inorganic fertilizer. On-site sewage systems account for about 1% of the nitrogen, while atmospheric deposition accounts for about 2% of the total loading.

Groundwater flowing south from British Columbia, Canada also contains nitrate which may contribute to problems in Whatcom County.

Recommendations

- Encourage residents who obtain their water from private wells to have their drinking water tested for nitrate.
- Provide public education and outreach to residents whose well water exceeds 10 mg/L-nitrogen.
- Continue cooperative work among government agencies responsible for agriculture, the environment, and human health to ensure that residents above the Sumas-Blaine Aquifer are not harmed by drinking water with nitrate concentrations in excess of the maximum acceptable limit.
- Intensify best management practices to decrease nitrate leaching. For example:
 - Apply only as much nitrogen as crops can take up and only at times when crops are actively growing.
 - Measure and track field-scale nitrogen balances (inputs and outputs) on agricultural land.
 - Curtail fall nitrogen application.
 - Account for groundwater and drinking water standards when developing nutrient application strategies.
- Conduct groundwater monitoring to:
 - Track effects of changes in management practices
 - Compare aquifer-wide nitrate concentrations with 1997 results.
 - Evaluate nitrate trends in 25 private wells sampled since 2003. Add additional wells to the network.
 - Evaluate the vertical extent of nitrate contamination in the aquifer.
- Coordinate with Canadian federal, provincial, and academic groups conducting monitoring and research on nitrate contamination in the Abbotsford-Sumas Aquifer.

Resources

Bibliography

Carey, B. and R. Cummings, 2012. Sumas-Blaine Aquifer Nitrate Contamination Summary. Washington State Department of Ecology, Olympia, WA. Publication No. 12-03-026. www.ecy.wa.gov/biblio/1203026.html

Cox, S. E. and S. C. Kahle, 1999. Hydrogeology, ground water quality, and sources of nitrate in lowland glacial aquifers of Whatcom County, Washington, and British Columbia, Canada. U.S. Geological Survey Water-Resources Investigations Report 98-4195. 251 pages, 5 plates.

Redding, M., B. Carey, and K. Sinclair, 2011. Poster: Nitrate Contamination in the Sumas-Blaine Aquifer, Whatcom County, Washington. Presented at the Eighth Washington Hydrogeology Symposium on April 26, 2011, in Tacoma WA. Washington State Department of Ecology, Olympia, WA. Publication No. 11-03-027. www.ecy.wa.gov/biblio/1103027.html

Additional Resources

Information on health effects of nitrate is available from the Washington State Department of Health, Division of Environmental Health, Office of Drinking Water: www.doh.wa.gov/ehp/dw/Programs/nitrate.htm

Information on having your well tested is available from the Whatcom County Health Department: www.co.whatcom.wa.us/health/environmental/drinking_water/wellwater.jsp Phone: (360) 676-6724.

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