Apr 27th, 11:00 AM - 12:00 PM

2018 Establishing groundwater Nitrate / Nitrite levels In Hamilton, Montana & local areaMarch

Dillon L. Lewis
dillonlewis1023@gmail.com

James Baggett
Bitterroot College

Aldo Rodriguez

Kendra Norton

Broc Perkins

See next page for additional authors

Presenter Information
Dillon L. Lewis, James Baggett, Aldo Rodriguez, Kendra Norton, Broc Perkins, Donald Jordan, Kathleen Cox, Gavin Nuttall, and Thomas Dowdy

James Baggett, Dillon Lewis, Broc Perkins, Donald Jordan, Tommy Dowdy, Aldo Rodriguez, Kathleen Cox , Kendra Norton, Gavin Nutall
Mentor: George Furniss
BITTERROOT COLLEGE
UNIVERSITY OF MONTANA

ESTABLISHING GROUNDWATER NITRATE / NITRITE LEVELS IN HAMILTON, MONTANA & LOCAL AREA MARCH 2018

ABSTRACT

We propose to collect emergent groundwater around Hamilton, using standardized collection methods that include quality and control samples with analysis performed at a certified drinking water testing laboratory (Energy Labs). Nitrate background in natural groundwater systems should contain less that's 1 mg/L nitrates (U.S. Geological Survey) but in our aquifer, nitrates/nitrites should be less than 0.25 mg/L based on previous sampling.

We will map the locations of the samples and use local hydrology data to help determine the source and flow direction of the groundwater.

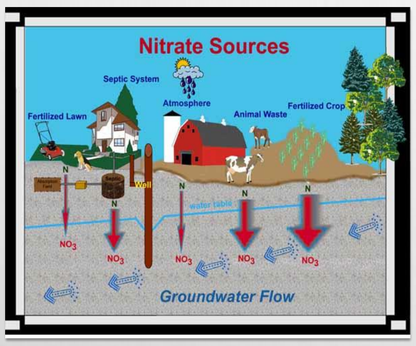
Routine testing and reporting of groundwater quality in our community will help protect our health and the economy of our river.

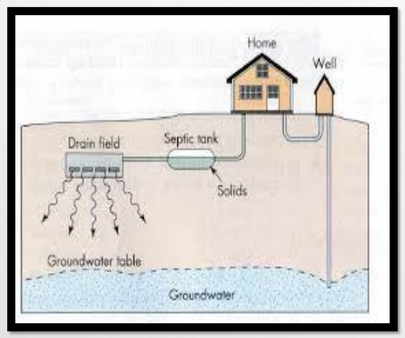
Groundwater in sand and gravel aquifers from shallow wells supplies all the Hamilton area drinking water.

The aquifers receive recharge from streams and ditches flowing in from he sides of the valley and the shallow aquifers discharge to the Bitterroot River and to ditches that flow past the West and north edge of Hamilton. we plan to collect about a dozen samples in an arc around the down gradient edge of Hamilton from these groundwater discharges.

Nitrates are tasteless and odorless, and are often the first sign of deterioration of groundwater quality. Nitrates are a health threat because they can cause "blue baby syndrome" and may function as initiators of human carcinogenesis. Nitrates are also an environmental threat because they cause eutrophication damage to surface water aquatic environments in the Bitterroot River.

High densities of private septic systems, and large acreages that receive fertilizer or that support farm animals are located up gradient to the south and eats of Hamilton. these are probable sources of pollution to shallow groundwater.





Health Effects of Nitrates in Water

The most commonly known health concern of high nitrate levels is methemoglobinemia, or better known as blue baby syndrome. The name blue baby syndrome is used because the baby actually starts to turn blue from not having enough oxygenated blood in circulation. Babies under six months of age are sensitive to nitrates and therefor cannot deal with them as older humans do. As the nitrites circulate in the babies body it produces methemoglobin. Hemoglobin is what carries oxygen through our body via our blood stream. Methemoglobin as well as hemoglobin both contain iron, however unlike hemoglobin methemoglobin contains the Fe3+ state of iron. Hemoglobin contains the Fe2+ state. This difference in charge is what makes oxygen unable to bond with methemoglobin, and when methemoglobin is produced in excess this can lead to poorly oxygenated blood. Nitrates could also be considered as carcinogens to humans.

This project was supported by:

Dr. Jay Johnson
Patti Furniss Education Memorial Fund
Energy Labs institutional discount

Research Methods

We followed best practices and protocols for water quality sampling

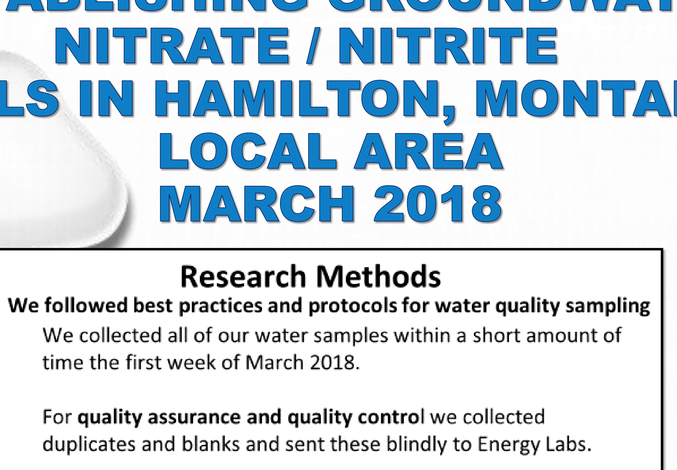
We collected all of our water samples within a short amount of time the first week of March 2018.

For **quality assurance and quality control** we collected duplicates and blanks and sent these blindly to Energy Labs.

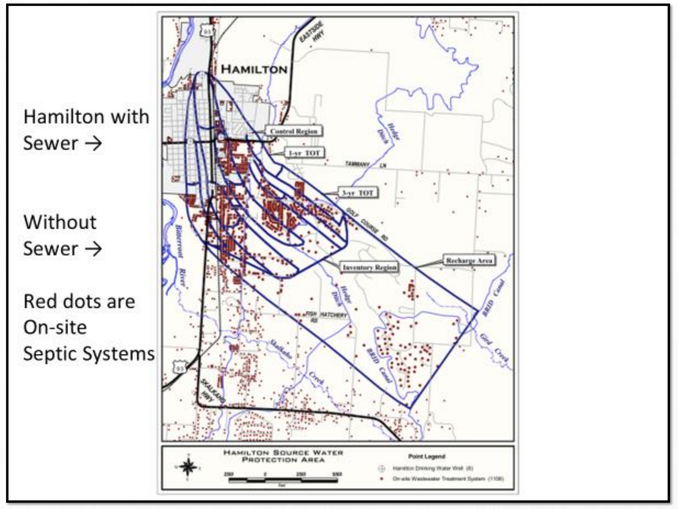
All of our duplicates were closely identical and all of our blanks were less than 0.05 mg/L; these were ten percent of our samples.

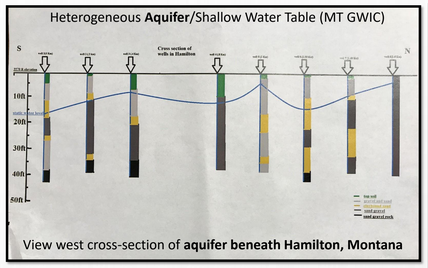
We collected background stream water flowing into the Valley from the Bitterroot Wilderness at Sheafman Creek and it was non-detectable for nitrate/nitrite.

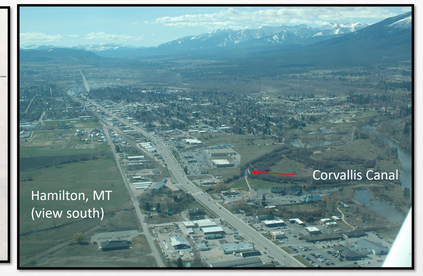
We collected Bitterroot River water and it was 0.02 mg/L nitrate/nitrite, a lower level than our blank distilled water.

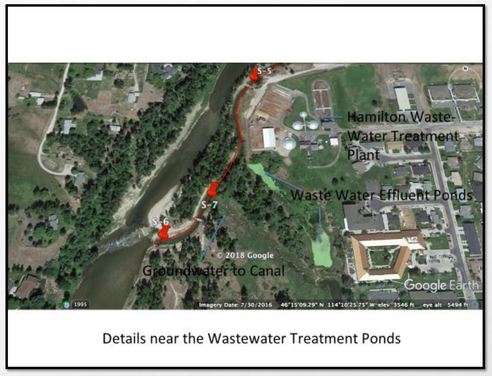


Sample # Lab	Sample # Map	Nitrogen Mg/L	Flow	Loading Lbs/day
18cc1	S-1	0.52 canal	3 cfs	8.409
18cc2	S-2	0.46 canal	2.429 cfs	6.0
18cc3	S-3	0.46 canal	2.3 cfs	5.7
18cc4	S-4	0.36 canal	2.1 cfs	4.06
18cc5	S-5	0.31 canal	2 cfs	3.35
18cc6	S-6	0.02 river	0.5 cfs	0.05
18cc7	S-7	0.79 canal	359 gpm	3.4
18cc8	S-8	0.15 river trib	2.5 cfs	2.0
18Dspr9	Darby	0.24 spring	75 gpm	0.2162
18Pdw10	Sheafman Ck	NonDetectable		
18cd-20	City discharge	0.94	Duplicate of 21	
18cd-21	City discharge	0.93	Duplicate of 20	
18w-23	Distilled Water	0.05	Blank	

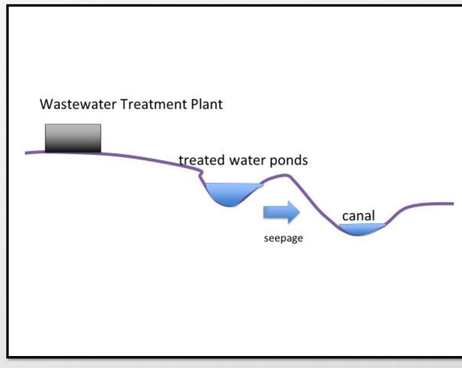








Details near the Wastewater Treatment Ponds



Results:

Our results show that low levels of nitrate/nitrite can be detected flowing into the Bitterroot River at S-8 (0.15 mg/L, 2.5 cfs).

The Bitterroot River has nitrate/nitrite levels comparable to distilled water at S-6, (0.02 mg/L).

A tributary flowing into the Corvallis Canal at S-7 has the highest concentration levels of nitrates/nitrites in the canal at 0.79 mg/L. This tributary arises in an old oxbow river channel very close to the City Wastewater Treatment Ponds (0.94 mg/L and 0.93 mg/L), which we believe are the source.

We show that the inflows into Corvallis Canal from S-7 to S-1 increase continuously, which we believe is coming from various sources beneath Hamilton. The load increased to over 8 pounds per day nitrate/nitrite (0.52 mg/L, 3 cfs) at our farthest downstream S-1 sample location. Our method detects nitrogen pollution.

Conclusions

All the nitrate/nitrite loading that we found are at low levels, however this can be a cause for concern in the future because plumes of nitrate/nitrite can sometimes take years to travel distances in groundwater and when plumes do reach a well these plumes can quickly become an urgent health concern.

Nitrates/nitrites are tasteless and odorless, and are often the first sign of deterioration of groundwater quality.

Given the pristine quality of the water flowing into the Bitterroot Valley from the wilderness (nitrates non-detectable) and the quality of the Bitterroot River (nitrates at or below distilled water), we believe that nitrates in groundwater should be at lower concentrations than we found.