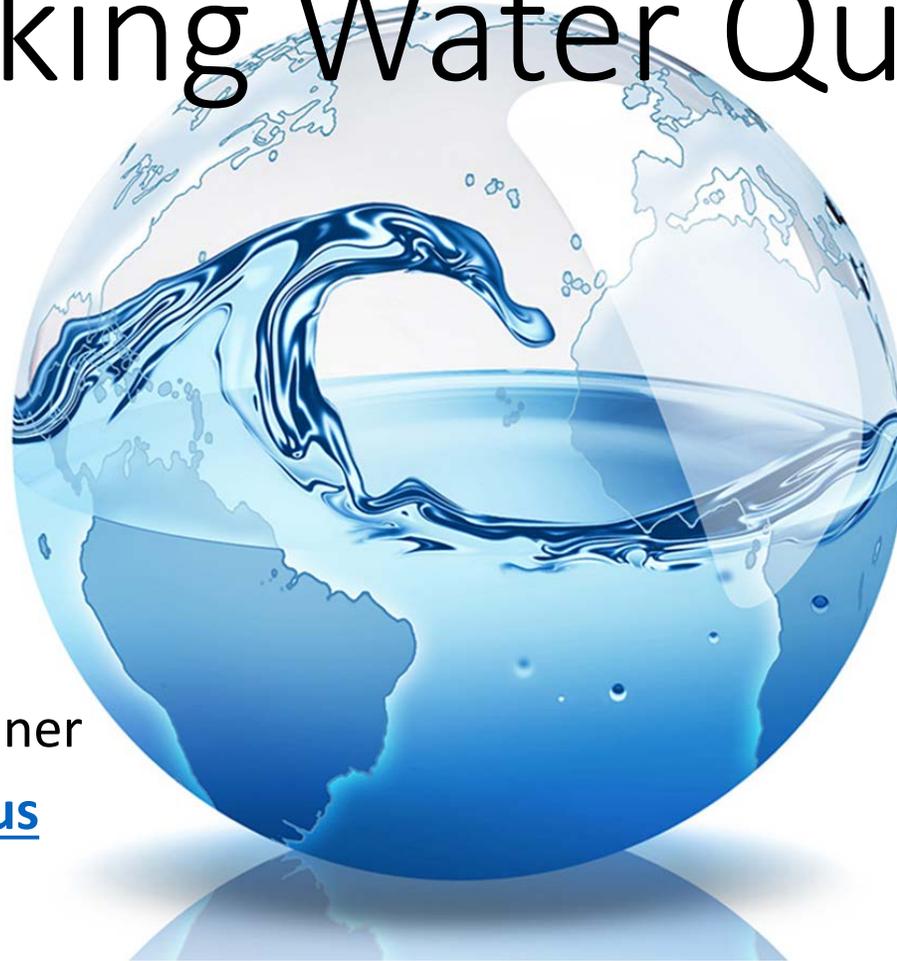


Drinking Water Quality



Chris Parthun, Principal Planner

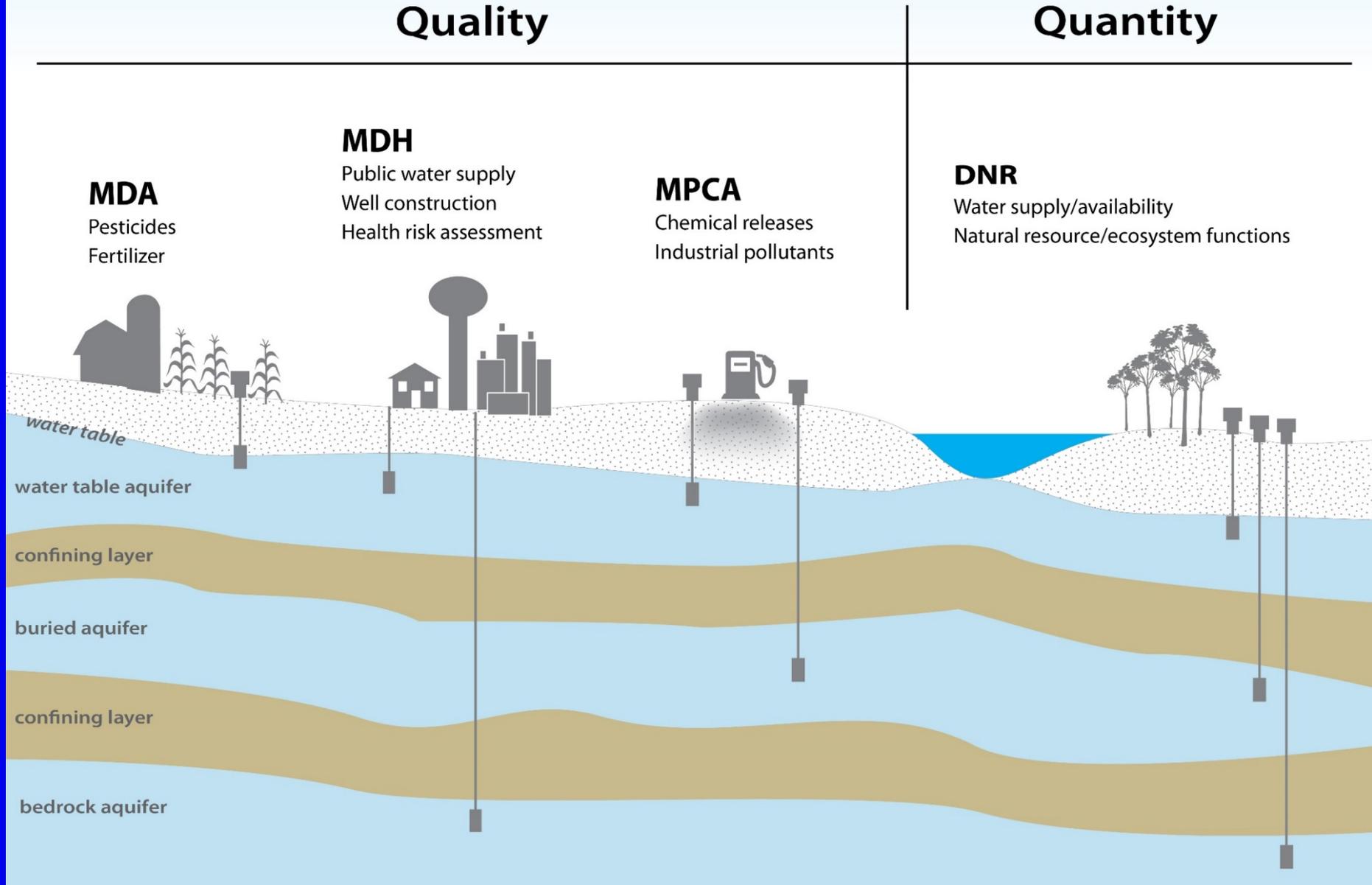
chris.parthun@state.mn.us

218-308-2109



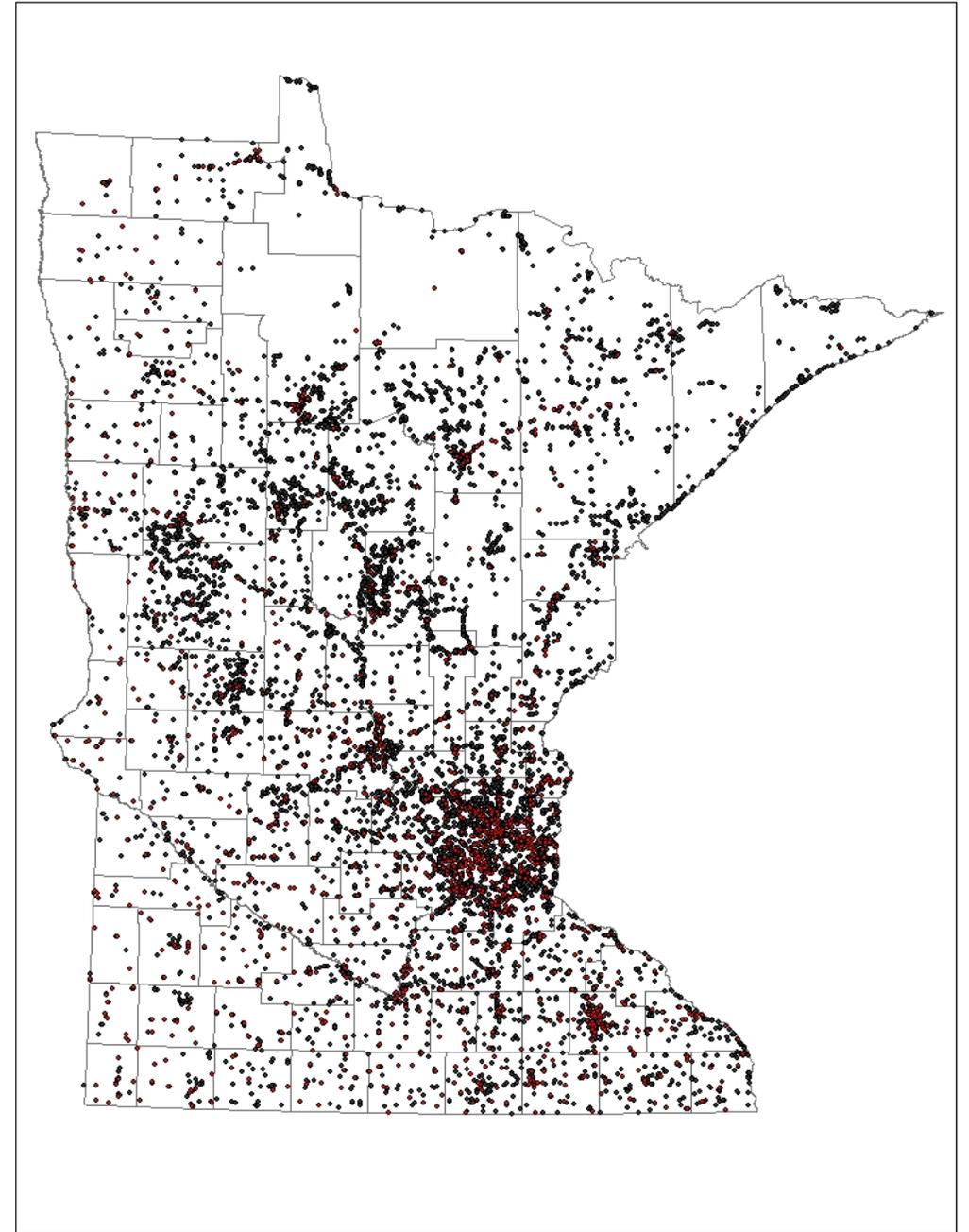
State Agency Water Roles

Minnesota State Agency Roles in Groundwater



There are more public water supply wells in Minnesota than the often-quoted 10,000 lakes.

- Serve 4.2 million people
- ~11,000 Public Wells
- ~960 systems that provide water to people where they live
- ~6,000 systems that provide water to people where they work or play



Groundwater is a drinking water source for:

- 98 percent of public water supplies
- 75 percent of the citizens of Minnesota

Area Community Public Water Supplies Using Surface Water Appropriation:

Beaver Bay, Duluth, Grand Marais, Silver Bay, Two Harbors – Lake Superior

Aurora, Biwabik, Chisholm, McKinley, Virginia

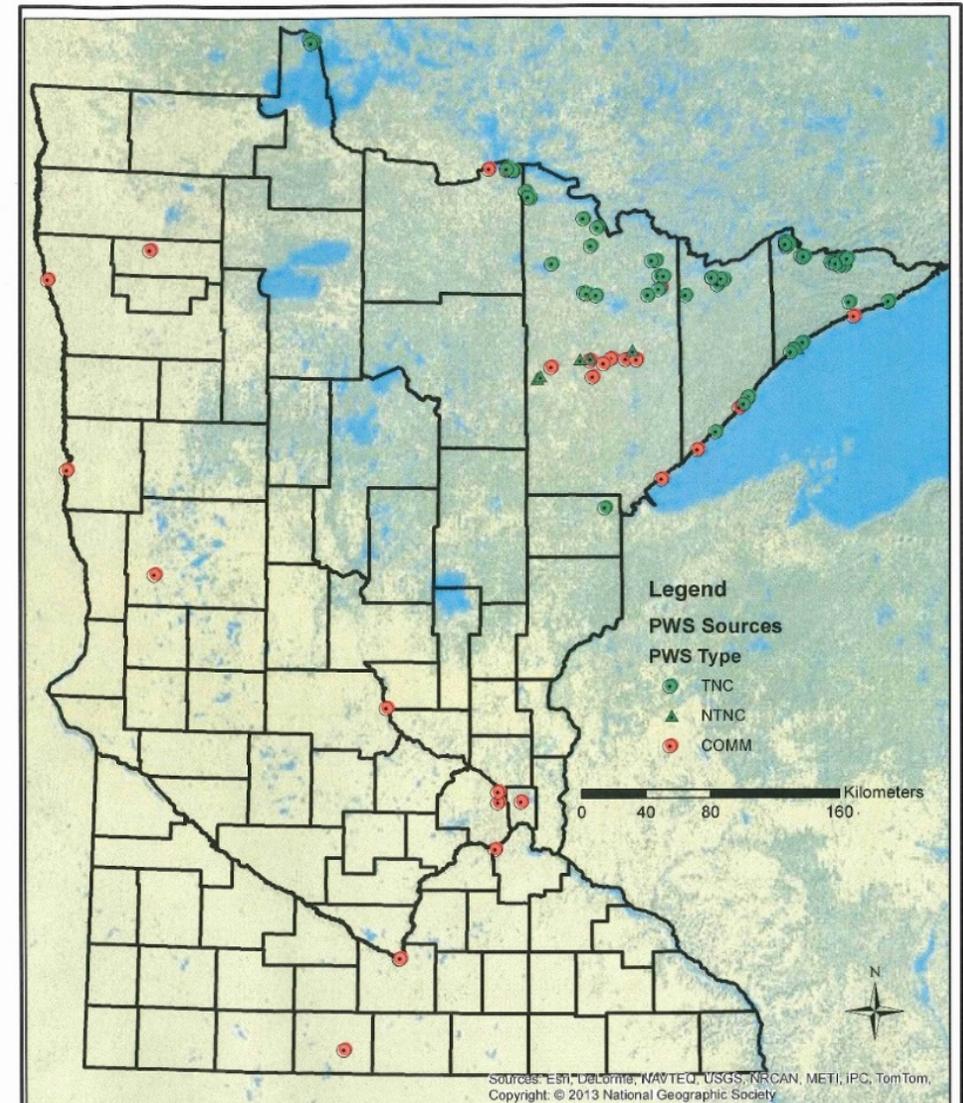
- Mining Pits

Ely – Burntside Lake

Eveleth – St. Mary's Lake

Hoyt Lakes – Colby Lake

International Falls – Rainy River



Community and noncommunity public water systems with surface water sources

Minnesotans' Drinking Water is Regularly Tested for Contaminants

- Organic Chemicals (e.g. Fuels, Solvents, Pesticides)
- Inorganic Chemicals (e.g. Nitrate, Lead, Arsenic)
- Microbiological Parameters (e.g. Bacteria, Viruses, Parasites)
- Radiological Parameters (e.g. Radon, Radium)
- Samples are analyzed in MN laboratories
- Public water supplies publish the results in an annual Consumer Confidence Report

Drinking Water Quality Testing for Public Water Systems

- Mandated Under the Federal Safe Drinking Water Act (1974)
- Transient Noncommunity Public Water Supply (PWS)
 - Tested for Bacteria and Nitrate
 - Includes restaurants, motels, golf courses, churches, etc.
- Community and Nontransient Noncommunity PWS
 - Tested for Bacteria, Nitrate, Organic Chemicals, (VOCs, Pesticides), Inorganic Chemicals, and Disinfection By-Products
 - Includes cities, schools, factories, office buildings, etc.

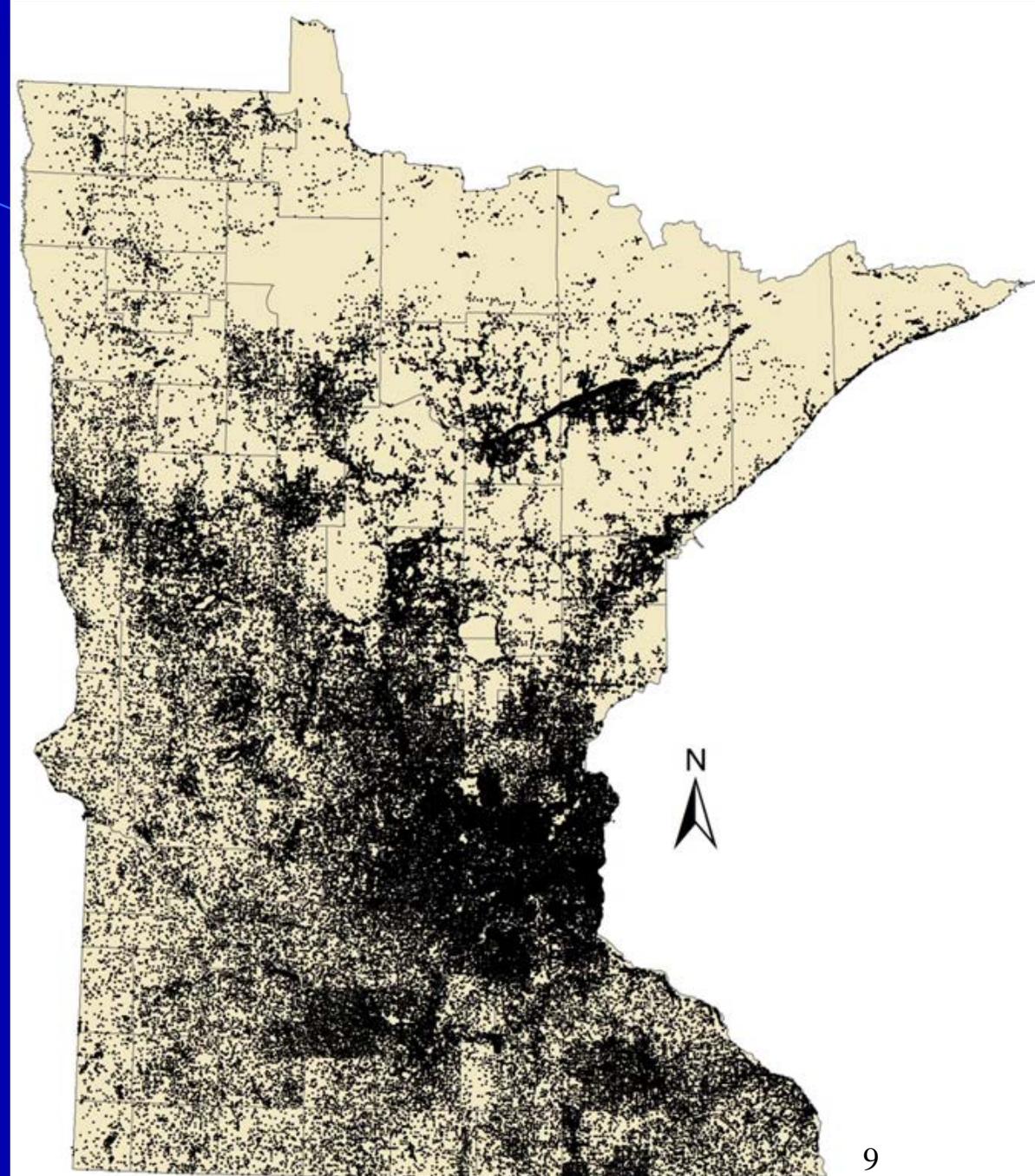
Drinking Water Quality Testing for Private Wells

- Required by State Law at the time of well construction
- Tested for Bacteria, Nitrate, and Arsenic
- Annual testing is recommended

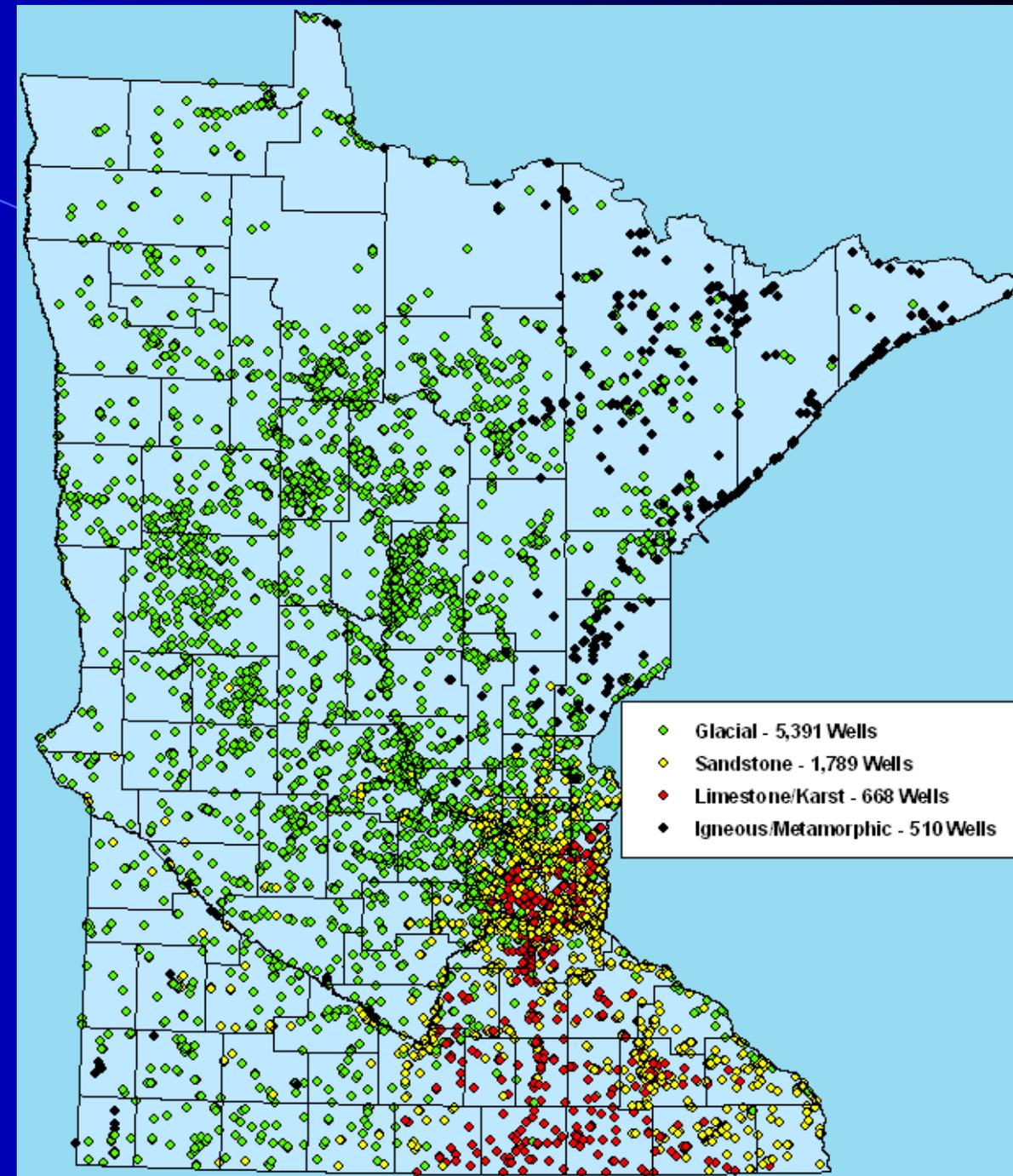
Testing at Well Construction

- Nitrate since 1975
<1% exceed drinking water standard (10 mg/L)
- Bacteria since 1975
must test negative before well can be used
- Arsenic since 2008
~ 10% exceed drinking water standard (10 ug/L)

No additional testing
or treatment is required

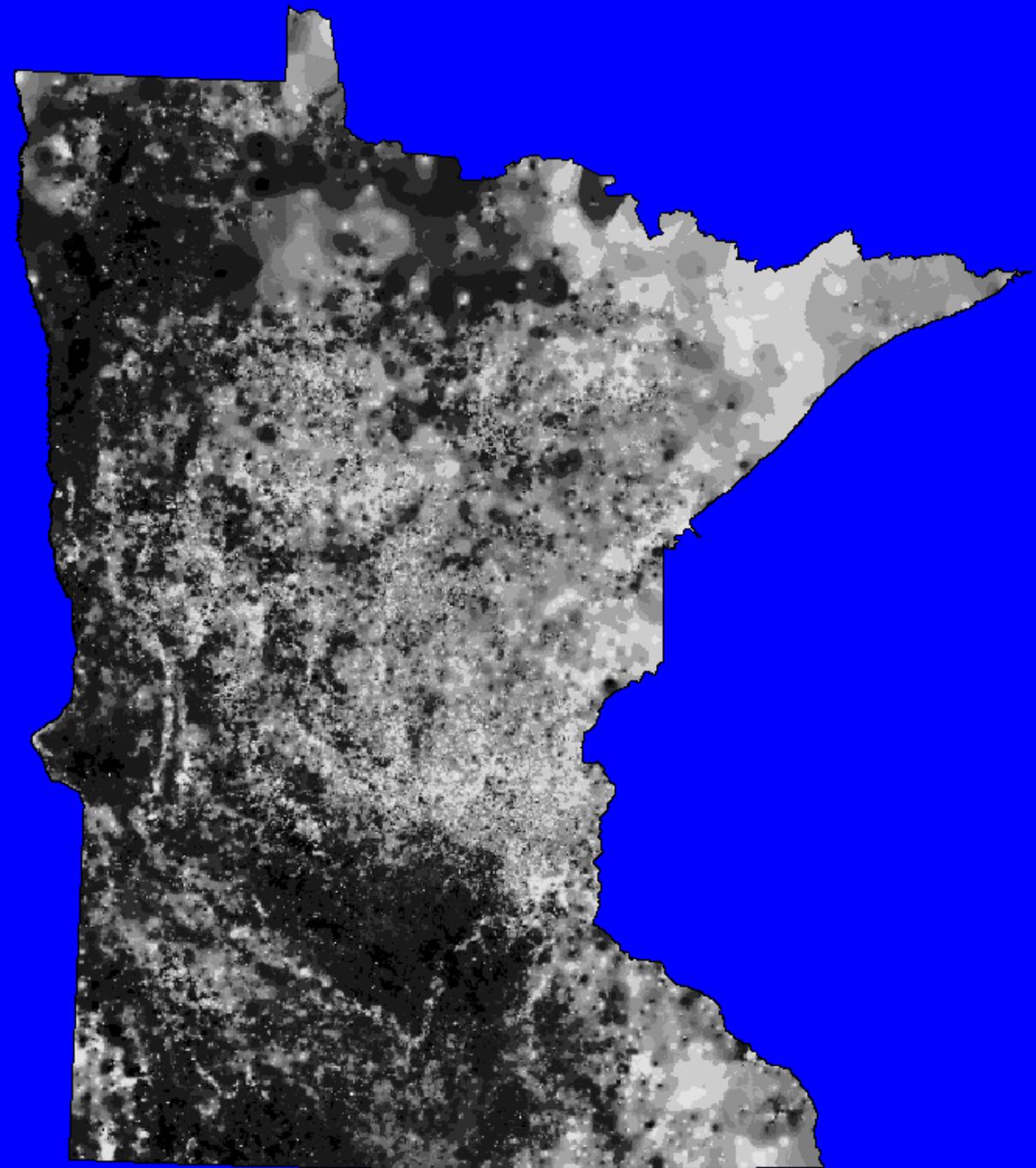


Distribution of Wells and MN Aquifers



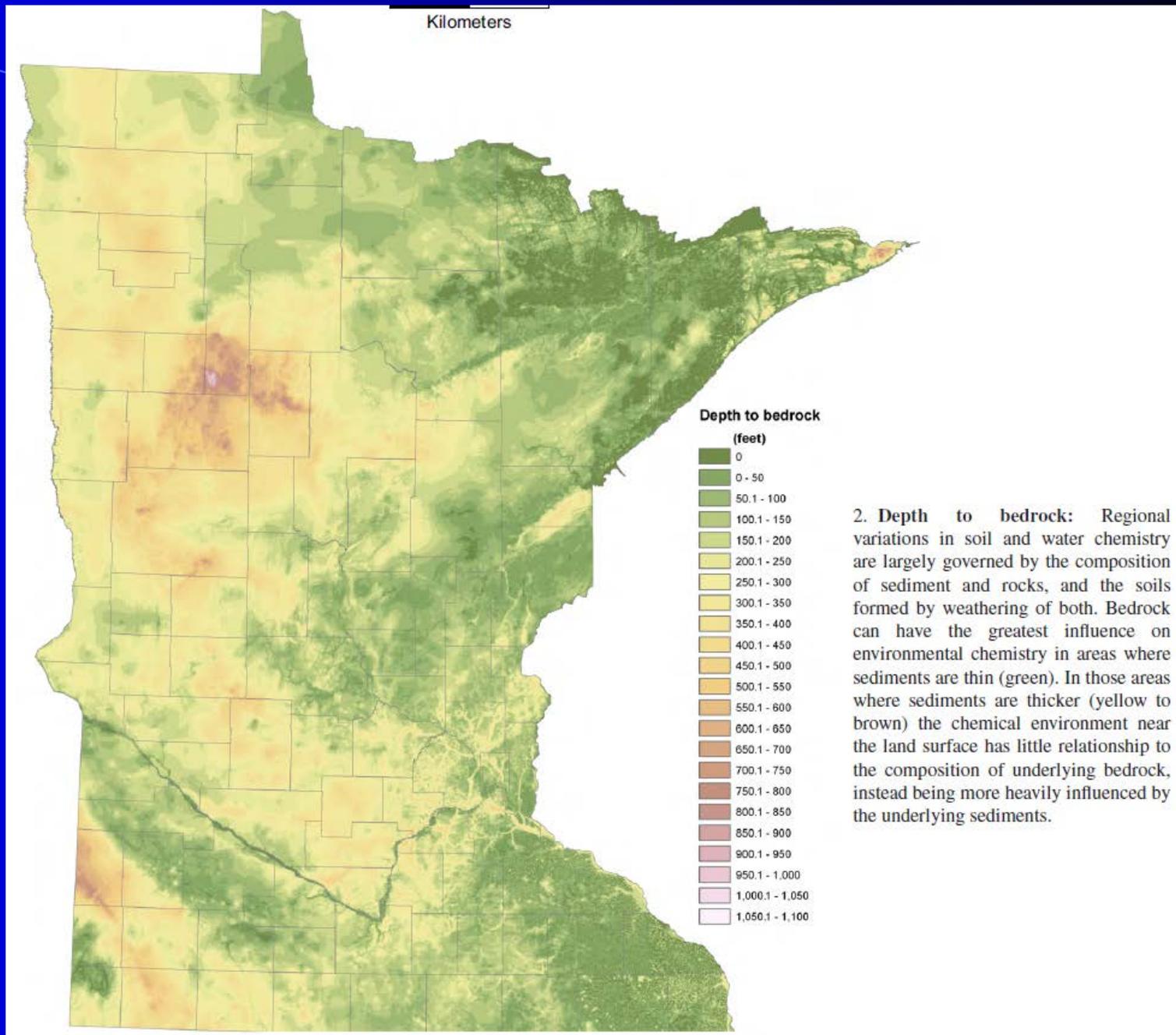
Grid Clay Thickness

1 km
Grid Clay
Thickness
> 100 Ft.



Depth to Bedrock GEOCHEMICAL LANDSCAPE OF MINNESOTA

R.S. Lively and
L.H. Thorleifson
2009



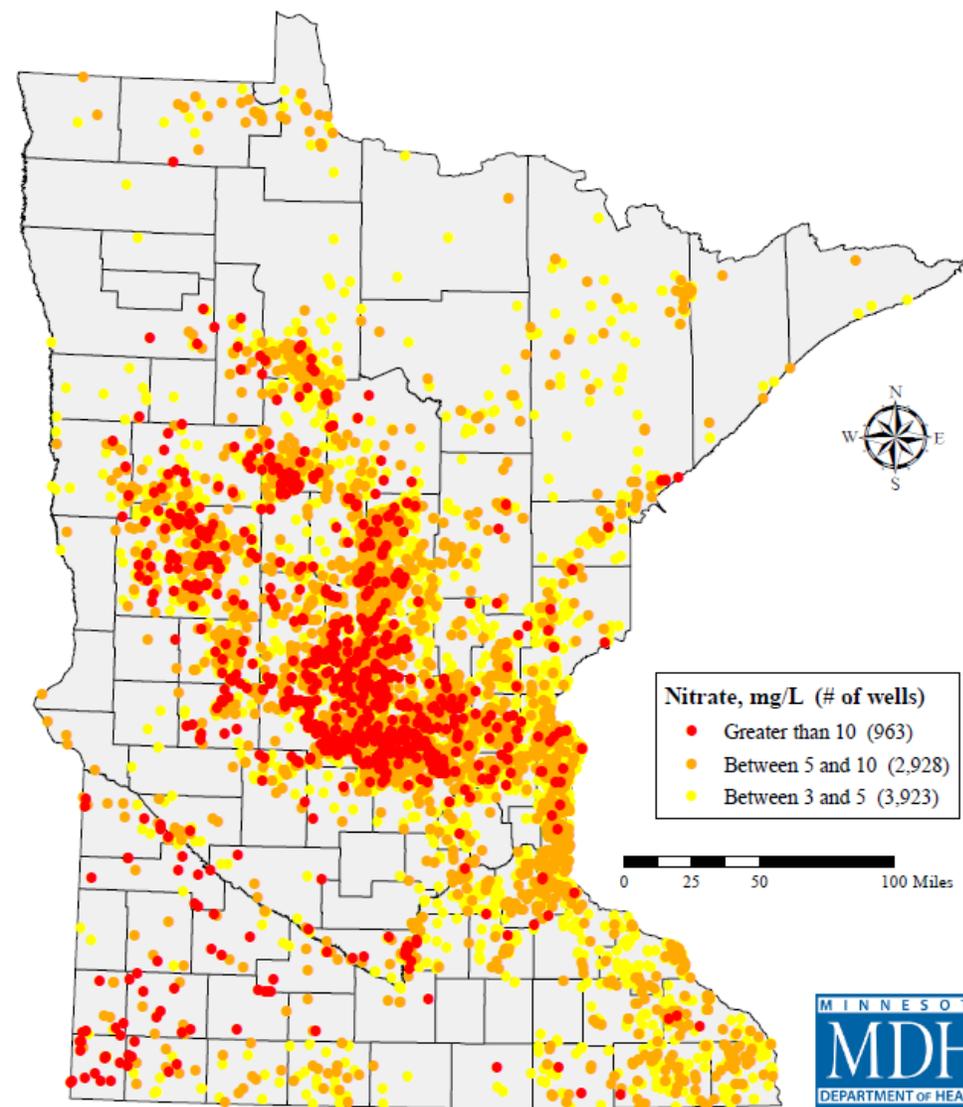
Nitrate in Private Wells

7,814 Domestic Wells
with concentrations
> 3.0 mg/l

sample size = 222,341

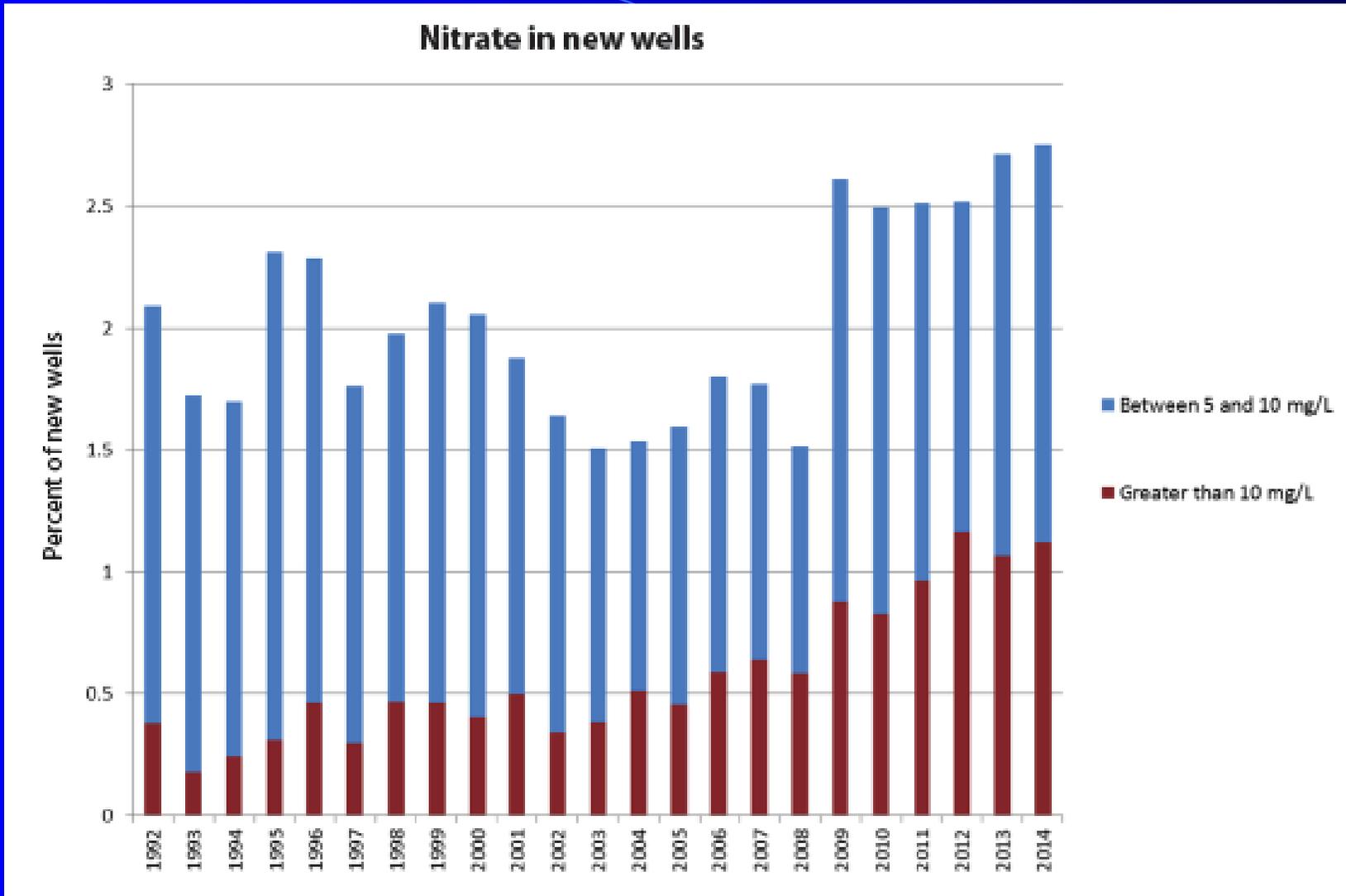
Nitrate in Private Wells 1990-2015

Map prepared by Minnesota Department of Health, May 2015



This map shows 7,814 domestic wells where the nitrate concentration was at least 3.0 mg/L. The source of these data is the MDH WELLS database, which includes results of 222,341 water samples collected at the time of well construction for wells drilled since 1990. Each well is represented by a single sample result. In the few instances where there were multiple sample results for a well, the maximum nitrate value was used.

Nitrate in New Wells



Nitrate Hot Spots: Community Systems

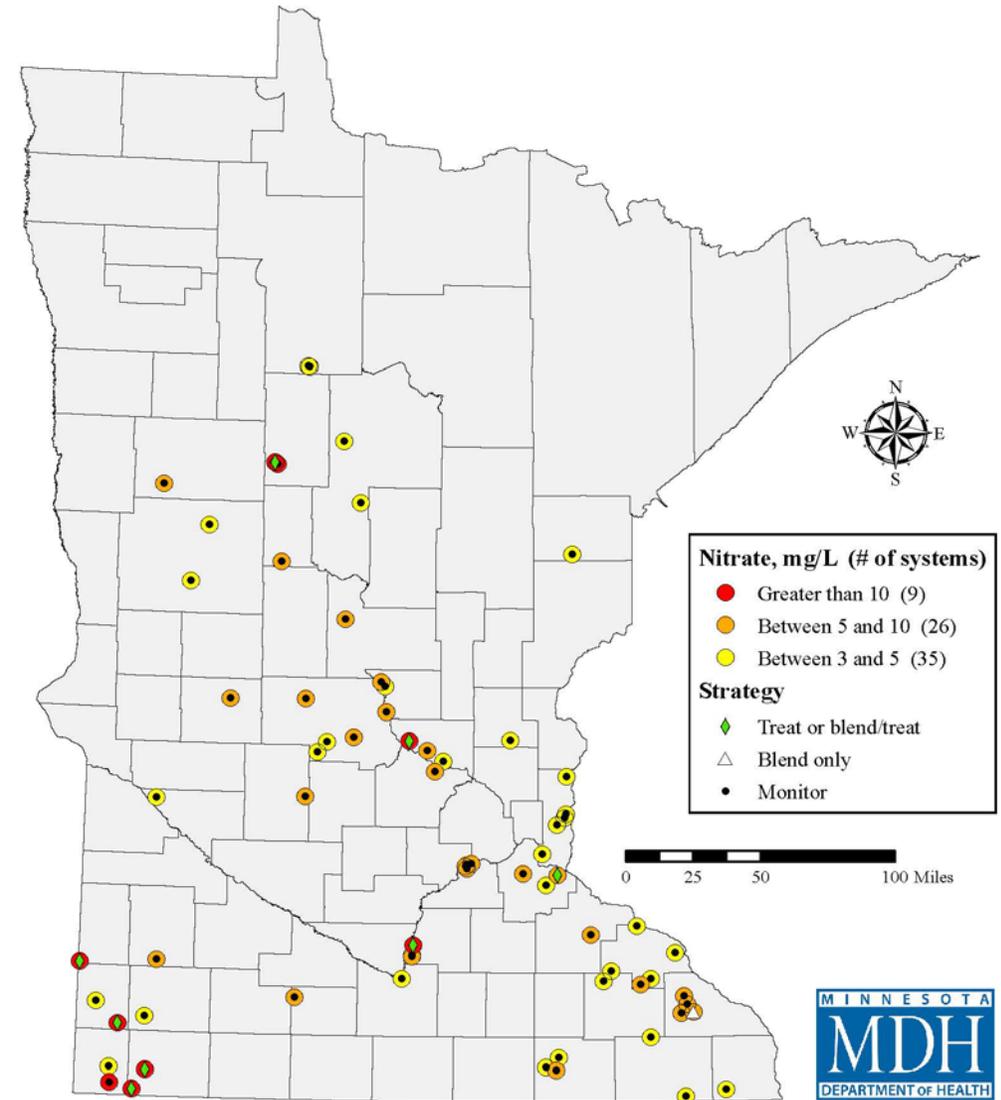
Central MN Sand Plain Areas

SE MN Karst Areas

SW MN Outwash Areas

Nitrate Management in Community Public Water Systems, 2014

Map prepared by Minnesota Department of Health, May 2015



This map shows 70 community public water supply systems where source (raw) water nitrate concentration was at least 3.0 mg/L in 2014. Nitrate monitoring is conducted at all systems shown. Eight public water supply systems treat to reduce nitrate concentrations in their source water. A total of 969 community public water systems exist in Minnesota.

Water Pollutants and Sources

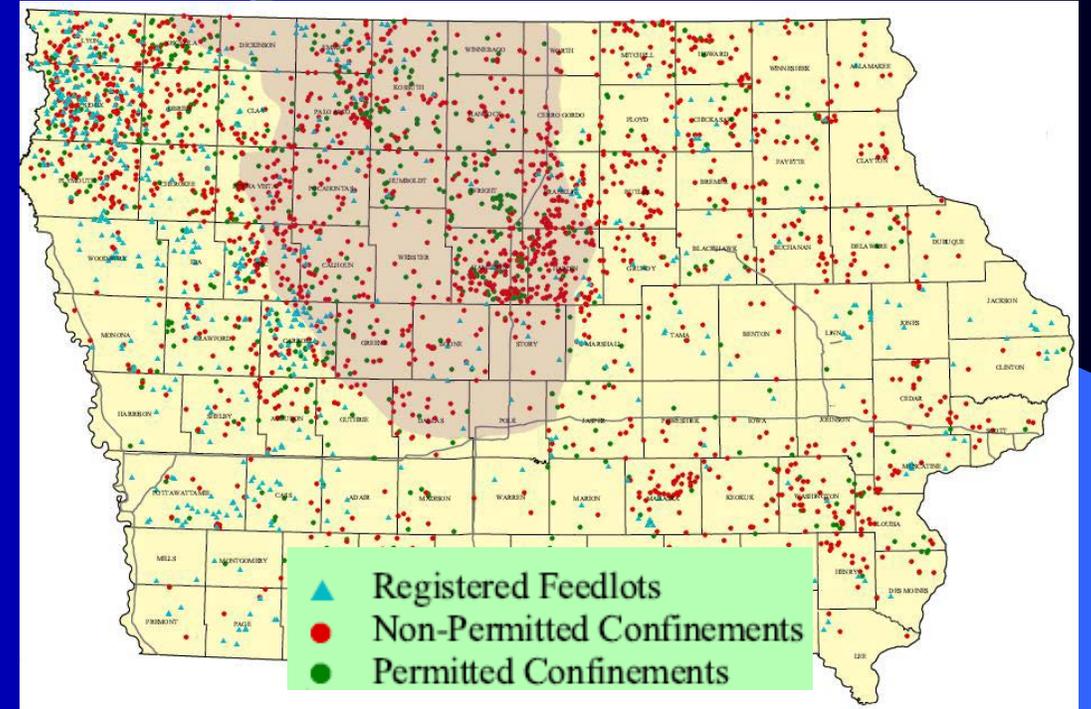
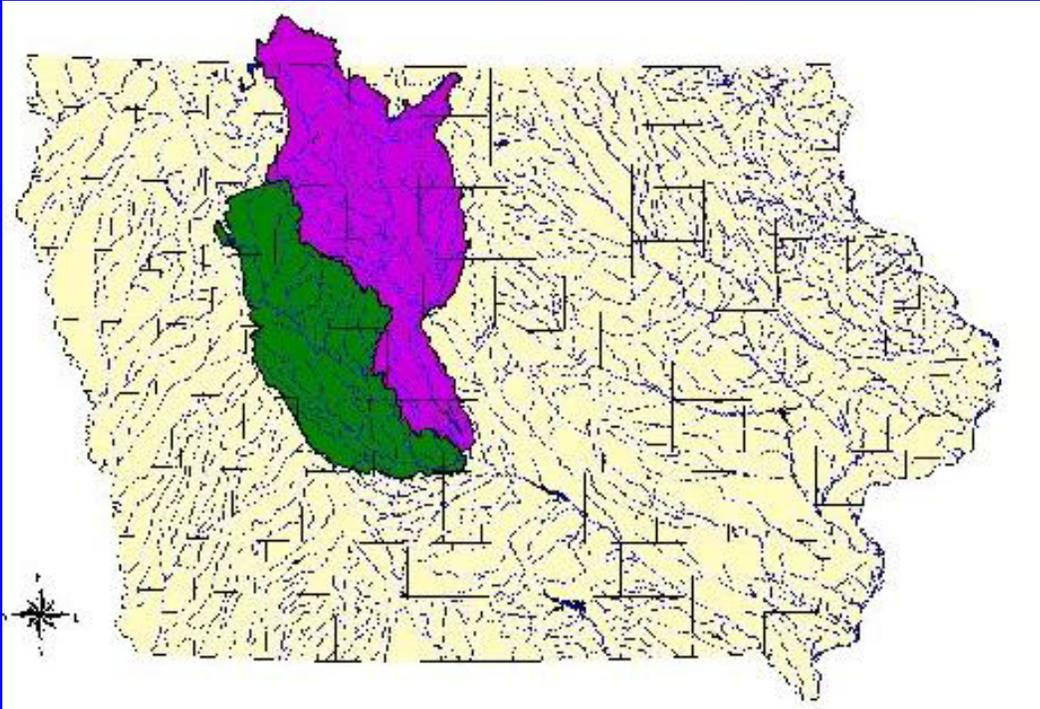
Water / How's the water? / Water pollutants and sources

Nonpoint source issues

Pollution from nonpoint sources — storm sewers, failing septic systems, and runoff from construction sites, animal feedlots, paved surfaces, and lawns — contribute huge quantities of phosphorus, bacteria, sediments, nitrates, and other pollutants to our lakes and streams. Nonpoint sources represent the largest combined threat (an estimated 86%) of the state's water pollution.

From MPCA Website September 2017

Des Moines Lobe: Raccoon River & Des Moines River Watersheds



Drainage Tile Increases Water Quantity While Reducing Water Quality



From a 2015 presentation titled “Regulating for Drinking Water Protection in Iowa’s Watersheds” by Bill Stowe CEO & General Manager Des Moines Water Works

Non-Point Source Pollution?

Earlier this year, Des Moines Water Works sued three counties that oversee agricultural drainage from tile underneath farm fields. The practice, widespread in Iowa and Minnesota, can make fields more productive. But the lawsuit contends that water emerging from the underground system of pipes is high in nitrates.

"These tile lines were from four to seven times the safe human level of consumption," Des Moines Water Works CEO Bill Stowe said. "That is absolutely unacceptable from our view."

To address the problem, he advocates a solution that makes farmers throughout the Midwest uncomfortable — regulating agricultural drainage systems just like factories and sewage treatment systems are regulated now.

Quoted from mprnews.org 5-12-2015

Denitrification Costs

Additional cost to meet EPA drinking water standard

2013 Costs

Total 2013 Treatment Expense \$908,700

2014-2015 Costs

Treatment Cost \$540,000

Total 2014-2015 Treatment Expense \$540,000

Estimated Cost for New Denitrification Facility

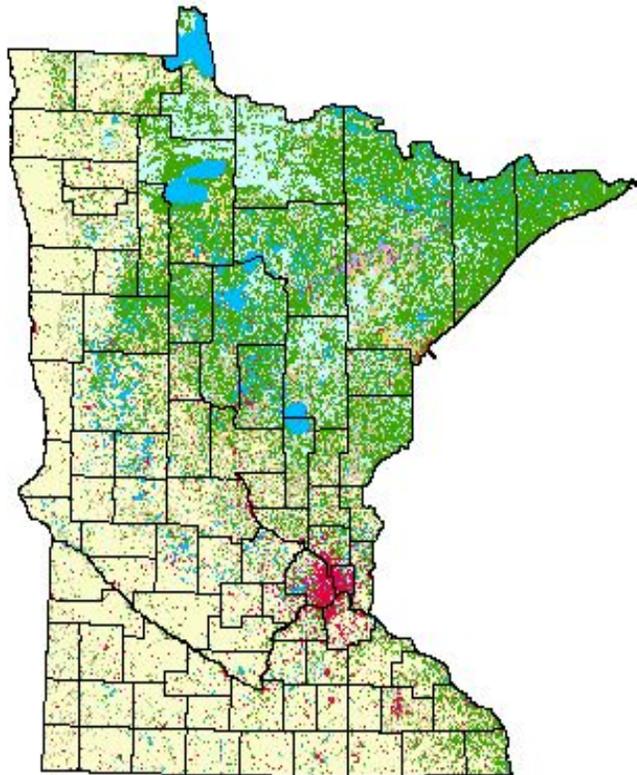
\$76 million – \$183 million

Bill Stowe CEO & General Manager Des Moines Water Works

Estimated Cost for Nitrate Treatment in a PWS

Minnesota Land Use and Cover 1990s Census of the Land

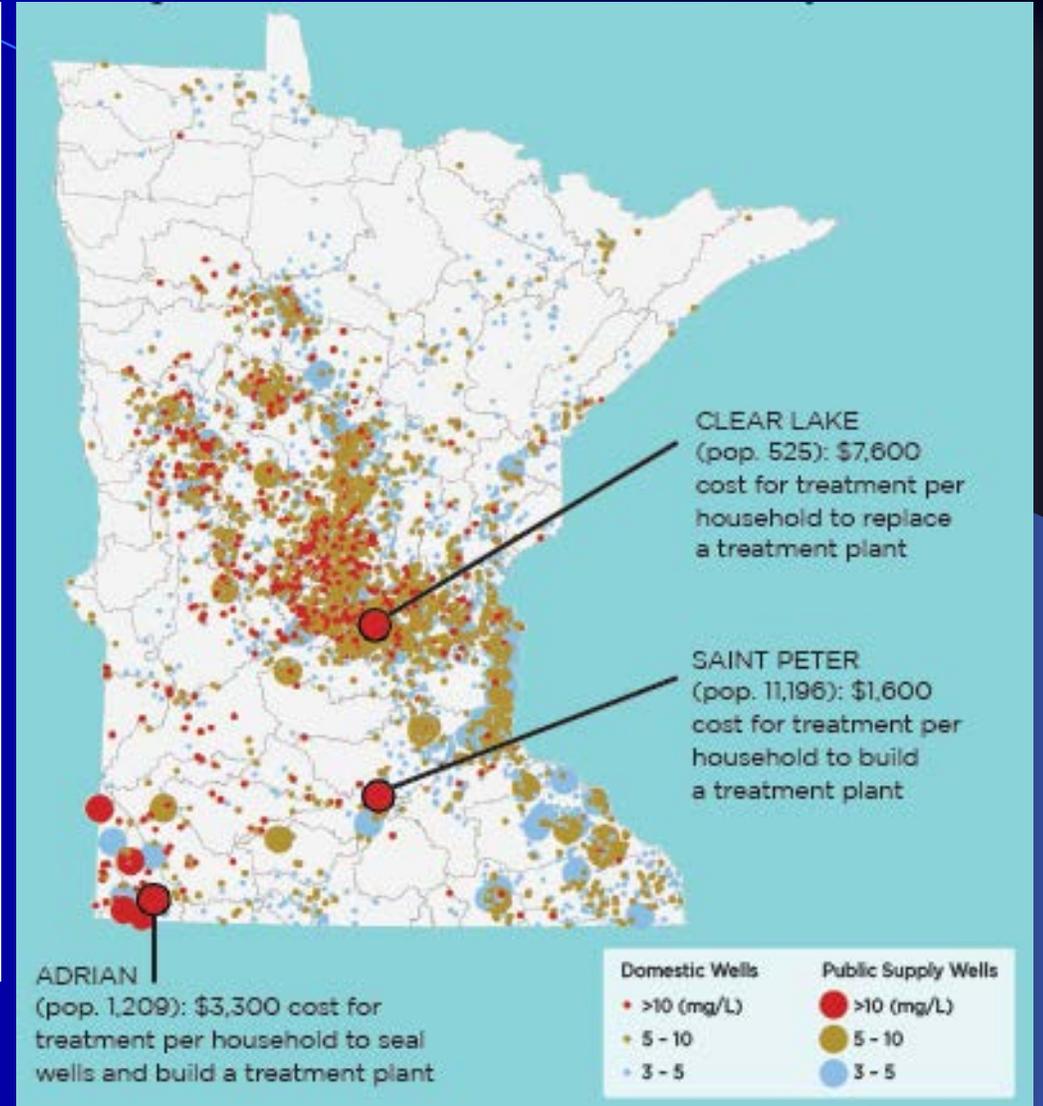
Begin by clicking on the map



Legend

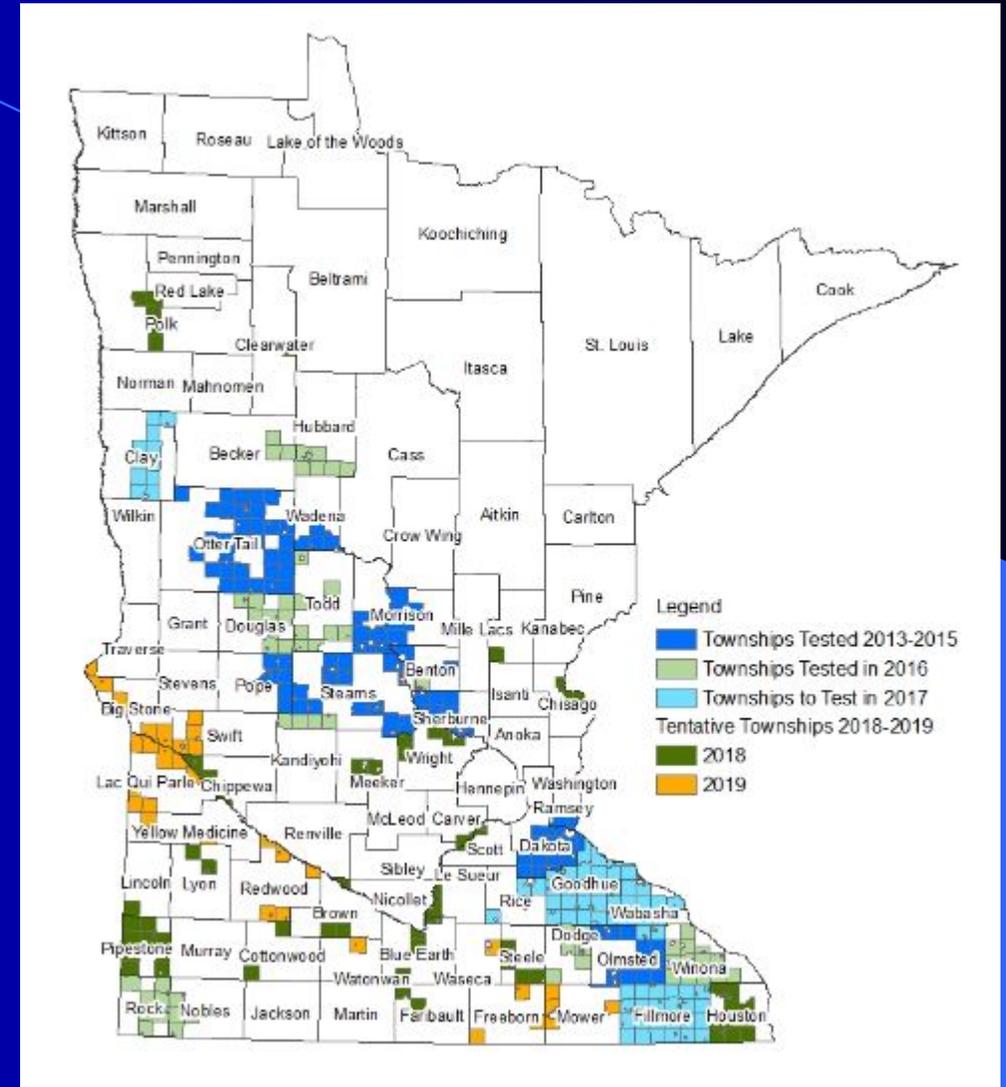
- Urban and rural development
- Cultivated land
- Hay/pasture/grassland
- Brushland
- Forested
- Water
- Bog/marsh/fen
- Mining

[Printable county maps \(pdf\)](#)
[About the data and application](#)



MN Department of Agriculture

- In March 2015, the MDA conducted a major revision to the Nitrogen Fertilizer Management Plan (NFMP).
- The MDA identified townships throughout the state that are vulnerable to groundwater contamination and have significant row crop production.
- More than 70,000 private well owners will be offered nitrate testing in over 300 townships by 2019. This work will be done in partnership with local governments across the state.



2016 MDA Nitrate Testing Results

Table: Hubbard County Initial Well Dataset Results, 2016.

Township	Number of Wells Tested	Min	Max	Mean	Median	Percent of Wells ≥ 10 mg/L
		Nitrate-N mg/L or PPM				
Badoura	41	<0.03	32.8	3.8	<0.03	17.1%
Crow Wing Lake	208	<0.03	32.6	2.0	<0.03	8.7%
Henrietta	259	<0.03	20.2	1.5	0.1	3.5%
Hubbard	241	<0.03	46.3	5.2	0.3	19.5%
Straight River	137	<0.03	26.1	2.6	<0.03	10.2%
Todd	220	<0.03	26.9	2.7	<0.03	9.5%
Total	1,106*	<0.03	46.3	2.9	<0.03	10.5%

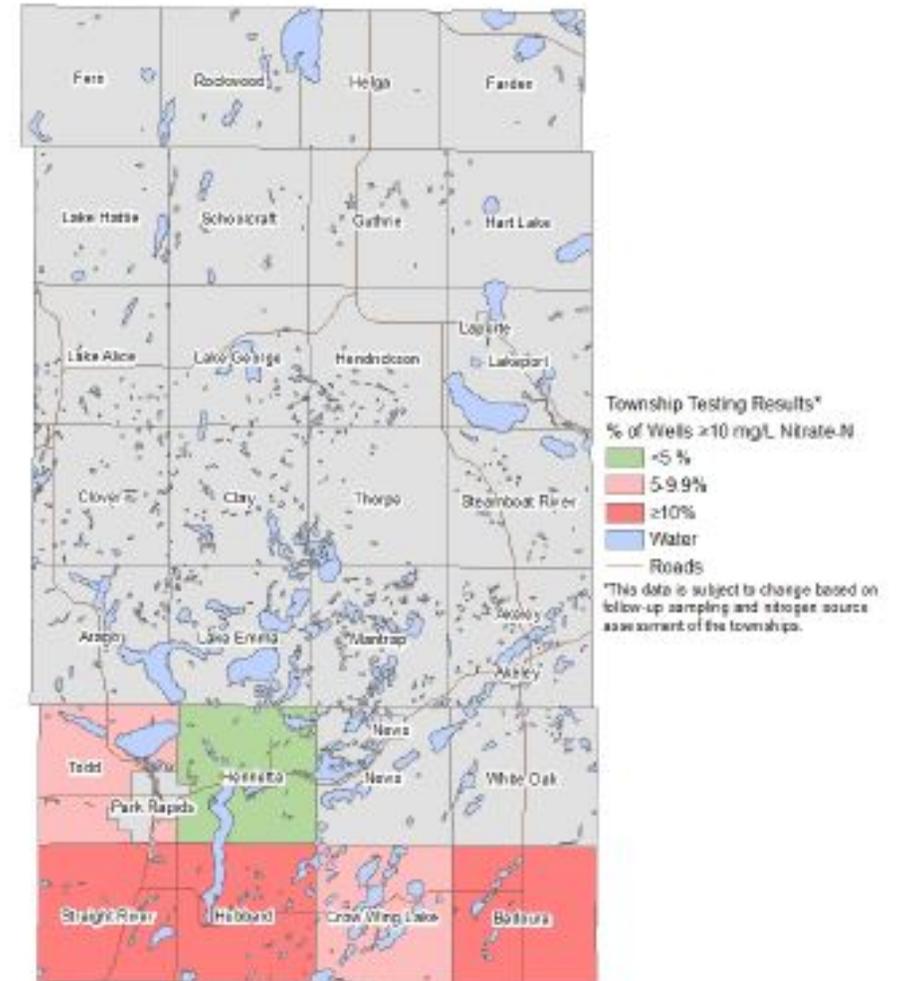
*All well types included.

Hubbard County Highlights

- # of Vulnerable Townships Tested: 6
- Households Receiving Kits: 2,899
- # of Wells Tested: 1,106
- % of Wells Over the Health Standard: 10.5%

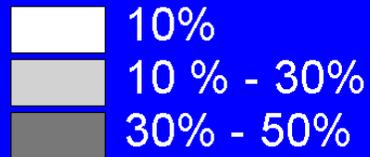


Figure: Hubbard County Initial Well Dataset Map, 2016.



Arsenic Test Results

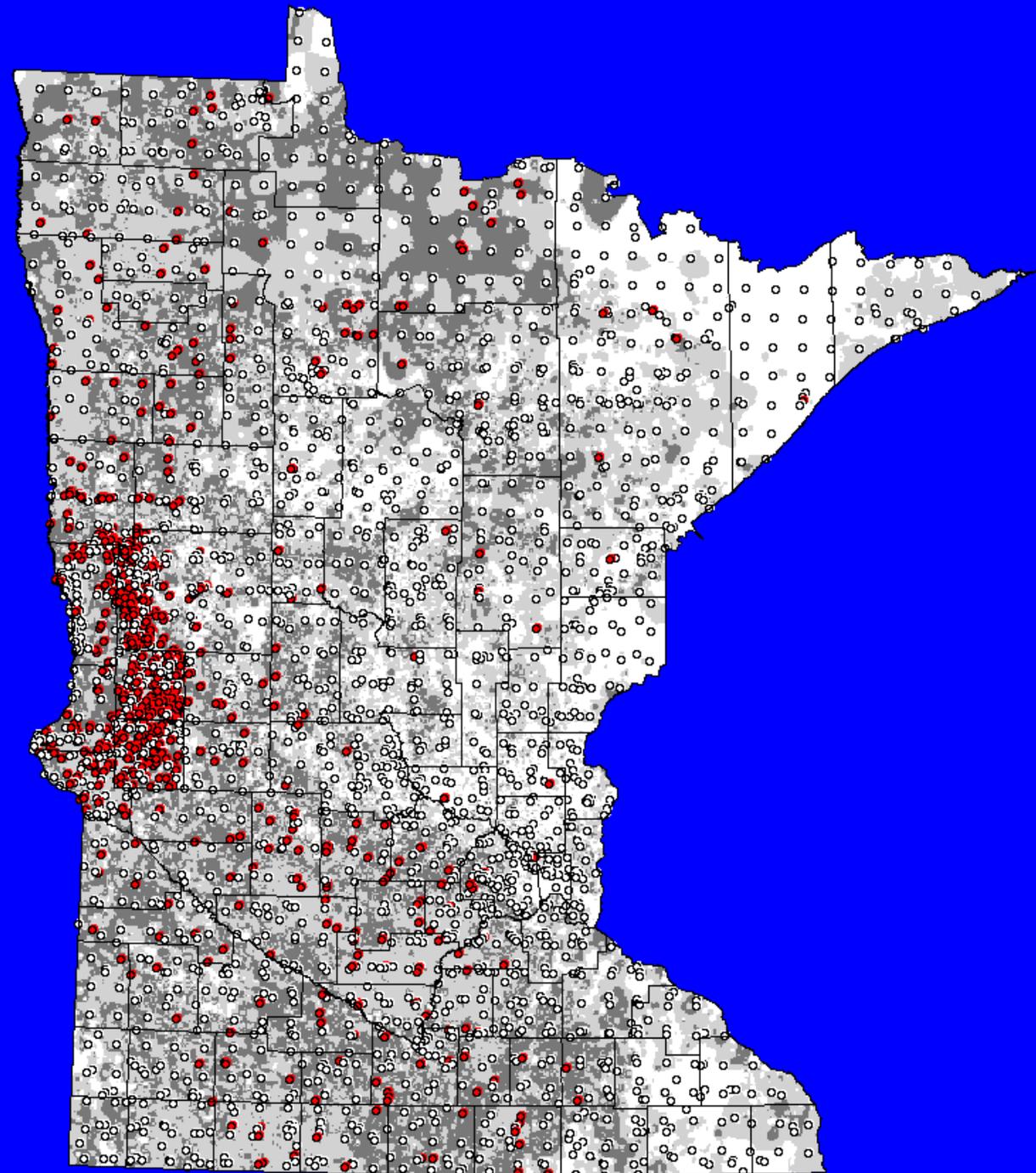
Probability of As > 10 ppb



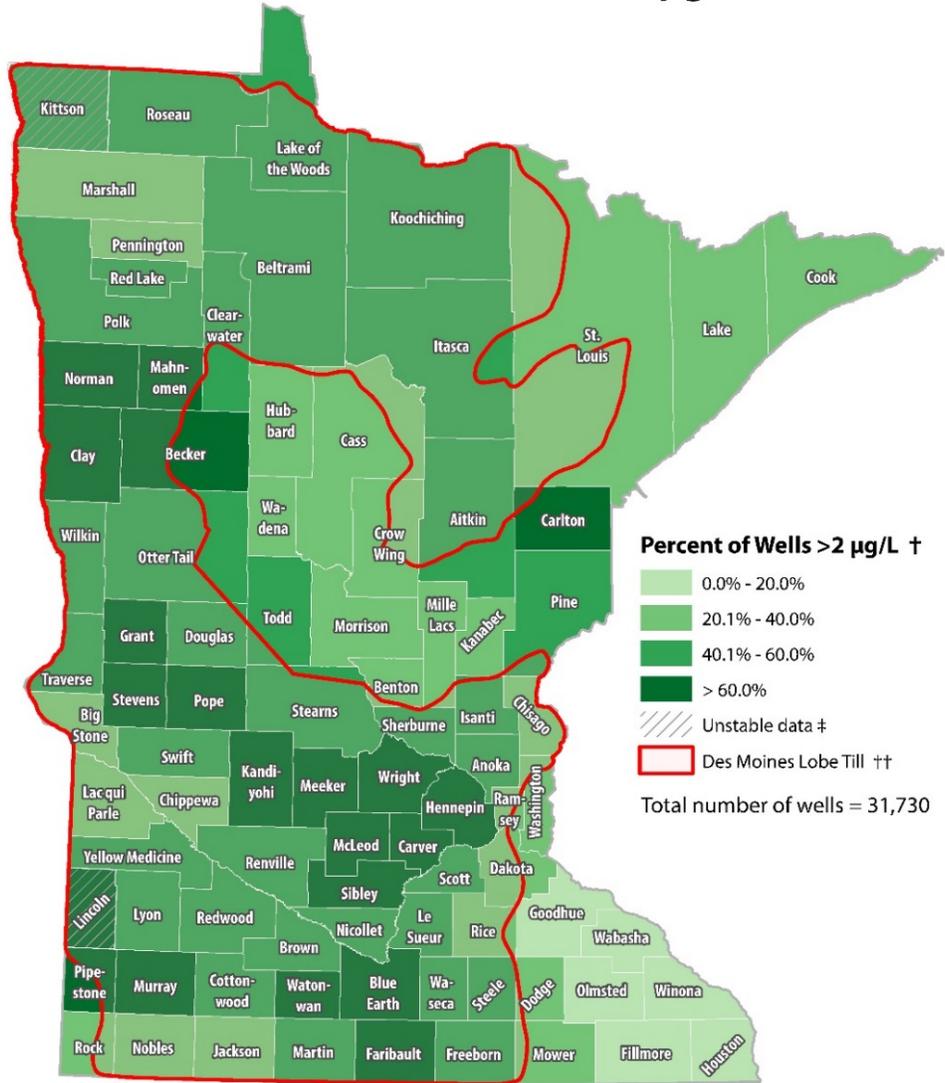
Arsenic Concentration



- ❑ Naturally present and occurs as an agricultural and industrial by-product
- ❑ Excess amounts can cause skin damage, circulatory system problems, and cancer



Private Wells: Arsenic > 2 µg/L



† The displayed results are for new private wells constructed and sampled for arsenic between August 2008 and February 2015.

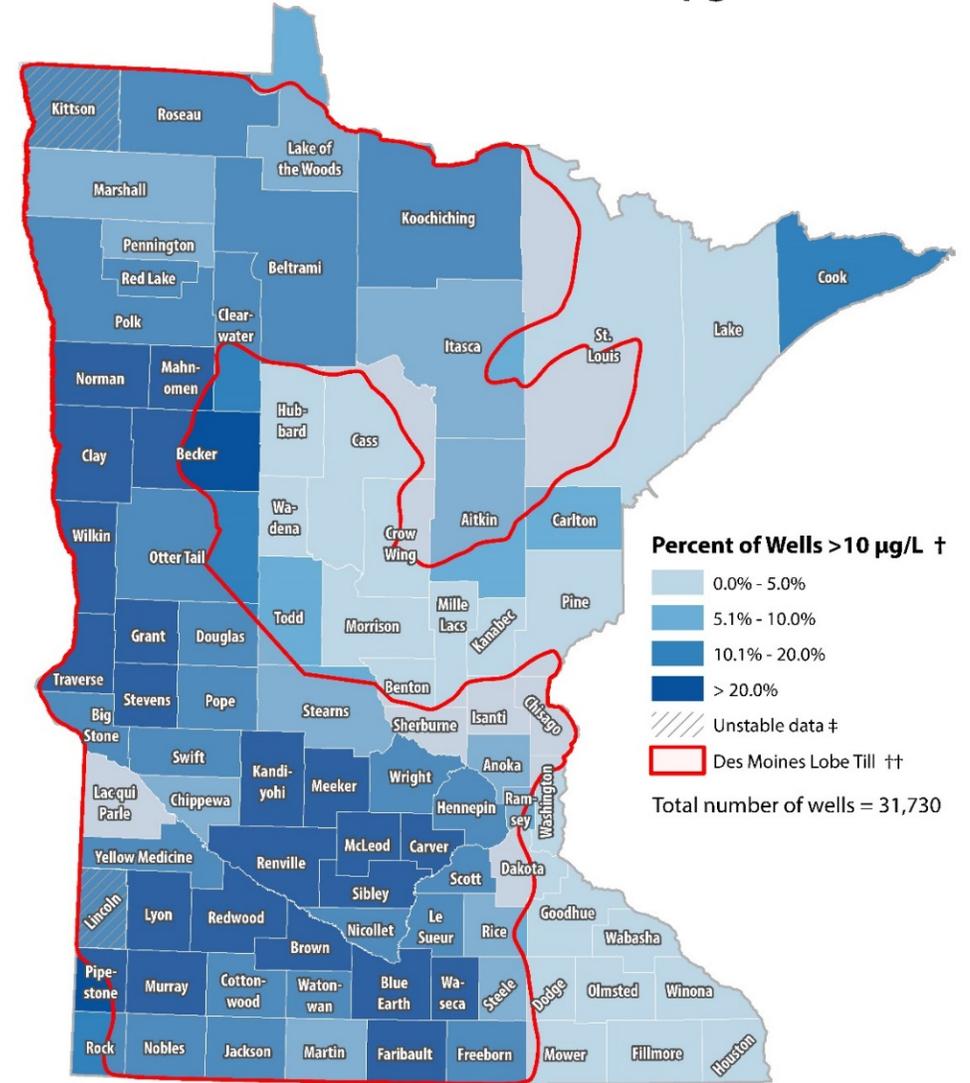
‡ Data based on counts less than or equal to 20 should be interpreted with caution; the data may be unstable because it can change dramatically with the addition or subtraction of one case.

†† The source of most arsenic in Minnesota is a result of clay-rich geological material called the Des Moines Lobe Till, which was deposited by glaciers 14,000 years ago. Wells located within the till are more likely to have arsenic levels above 10 µg/L.

MDH Minnesota Department of Health

Minnesota Environmental Public Health Tracking Program
Minnesota Public Health Data Access
<https://apps.health.state.mn.us/mndata>
12/30/2015

Private Wells: Arsenic > 10 µg/L



† The displayed results are for new private wells constructed and sampled for arsenic between August 2008 and February 2015.

‡ Data based on counts less than or equal to 20 should be interpreted with caution; the data may be unstable because it can change dramatically with the addition or subtraction of one case.

†† The source of most arsenic in Minnesota is a result of clay-rich geological material called the Des Moines Lobe Till, which was deposited by glaciers 14,000 years ago. Wells located within the till are more likely to have arsenic levels above 10 µg/L.

MDH Minnesota Department of Health

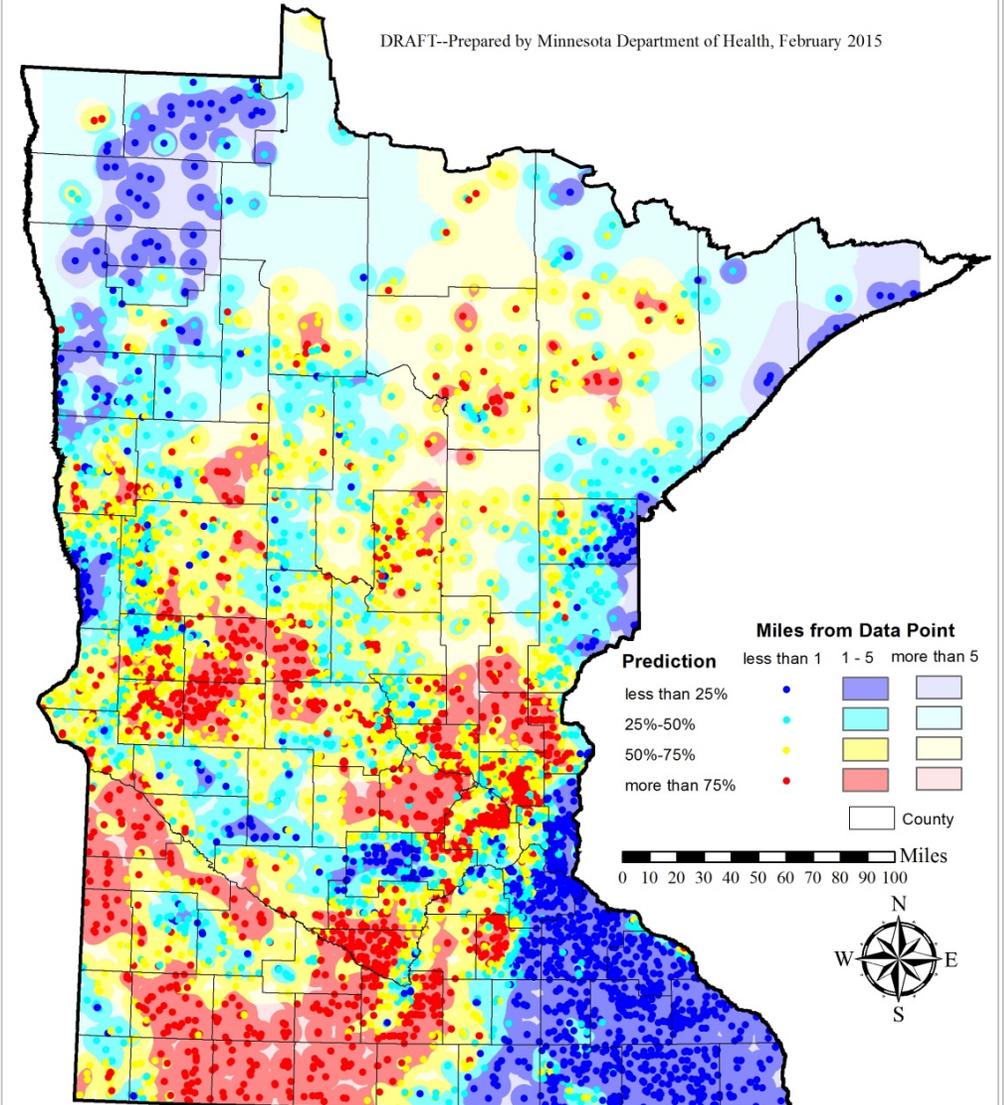
Minnesota Environmental Public Health Tracking Program
Minnesota Public Health Data Access
<https://apps.health.state.mn.us/mndata>
12/30/2015

Manganese

- Naturally present
- Need small amounts to maintain human health
- Consistent levels in GW over time
- Excess amounts can cause nervous system damage

Estimated Probability of Manganese Over 100 ug/L

DRAFT--Prepared by Minnesota Department of Health, February 2015



Contaminants of Emerging Concern

A contaminant is generally a substance that is in a place where it doesn't belong.

Contaminants of emerging concern (CEC) are substances that have been released to, found in, or have the potential to enter Minnesota waters (groundwater or surface water) and:

- do not have Minnesota human health-based guidance (how much of a substance is safe to drink);
- pose a real or perceived health threat; or
- have new or changing health or exposure information.

CECs can include pharmaceuticals, pesticides, industrial effluents, personal care products that are washed down drains and processed by municipal wastewater treatment plants, and others.

New contaminants are being found in Minnesota waters, partly because:

- there are better methods for finding substances at lower levels;
- additional substances are being looked for;
- new substances are being used; and
- old substances are being used in new ways.

Contaminants of Emerging Concern

Under the US Safe Drinking Water Act (SDWA), the EPA is required to publish a Contaminant Candidate List (CCL) at least every five years. Contaminants on the CCL cannot be subject to any proposed or promulgated standard, must be “known or anticipated to occur” in public drinking water, and they must “present the greatest public health concern.”

EPA must review at least five CCL contaminants every five years and determine if a water quality standard should be promulgated. EPA has set regulatory standards for 94 contaminants under the SDWA; most were finalized between 1975 and 1992, and **only 12 have been added in the last 20 years.**

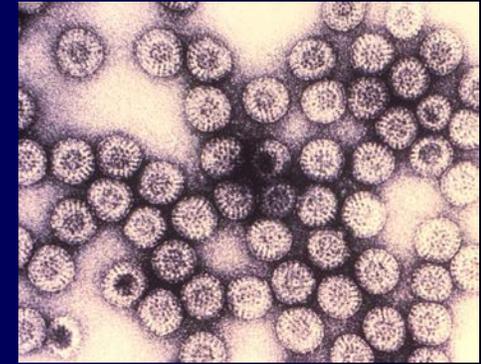
EPA has required public water systems to monitor for unregulated contaminants under three different rulemakings published in 1999, 2007, and 2012, each of which required monitoring for 25 to 30 contaminants.

Contaminants of Emerging Concern

Rapid Assessment Method developed for pharmaceuticals in drinking water.

- 119 active pharmaceutical ingredients (API) have been assessed.
- The main outcome was the development of water screening values. A water screening value is the amount of an API in water that can be consumed daily with no expected health risk to humans. The water screening values developed are intended to be lower (more protective of health) than values that result from an in-depth assessment.
- The water screening values are tools that can be used to assist risk assessors, risk managers, and others in determining whether the level of an API in sources of drinking water warrants further evaluation, including monitoring. They are not designed or intended to be used to provide definitive estimates of risk.

MDH Virus Study



- Phase 1 monitoring was completed in April, 2015
 - 37% of 82 systems and 7.5% of 477 samples analyzed detected at least one human enteric virus
 - Similar levels to other national studies
 - Occurrence seems to be tied to recharge events
- Phase 2 monitoring was completed in May, 2016
 - Targeted microbial risk evaluation
 - Evaluate and fine-tune MDH/SWP Groundwater Assessment Monitoring Scoring Tool
- Epidemiological study also completed May 2015-April 2016

Water Quality Information Sources

Source Water Assessments

- Over 7,000 assessments that provide a concise description of the water source (well, lake, river) that is used by a PWS and describes how susceptible it is to contamination.
- Search for an assessment by name or county.
 - <http://www.health.state.mn.us/divs/eh/water/swp/swa/>

Wellhead Protection Plans

- Wellhead Protection is a method to prevent drinking water from becoming unhealthy by managing potential sources of contamination in the area which supplies water to a public well.

Intake Protection Plans

- Developed for St. Cloud, St. Paul, and Minneapolis.

Consumer Confidence Reports

- Water suppliers that serve the same people year-round must prepare annual water quality reports (consumer confidence reports) for their customers.
- These are publicly available at each PWS.

Questions?



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