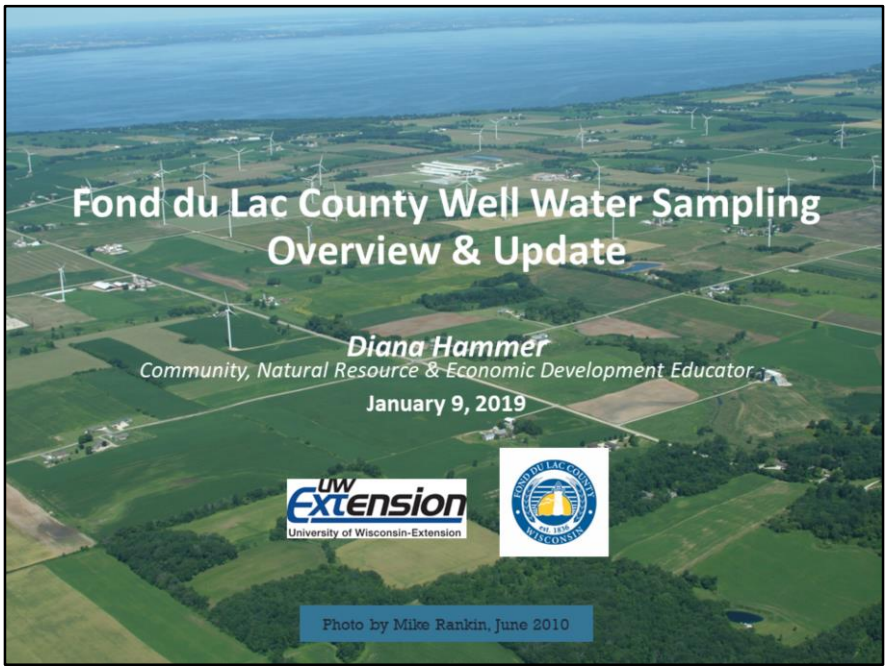
Fond du Lac County Well Water Sampling
Overview & Update
Diana Hammer
Community, Natural Resource & Economic Development Educator
January 9, 2019
UW Extension
University of Wisconsin-Extension
Photo by Mike Rankin, June 2010

Outline

- County Water Quality Efforts (2007 – present)
- Evaluation of sampling programs in 2015
- Results over time
- Maintaining healthy water

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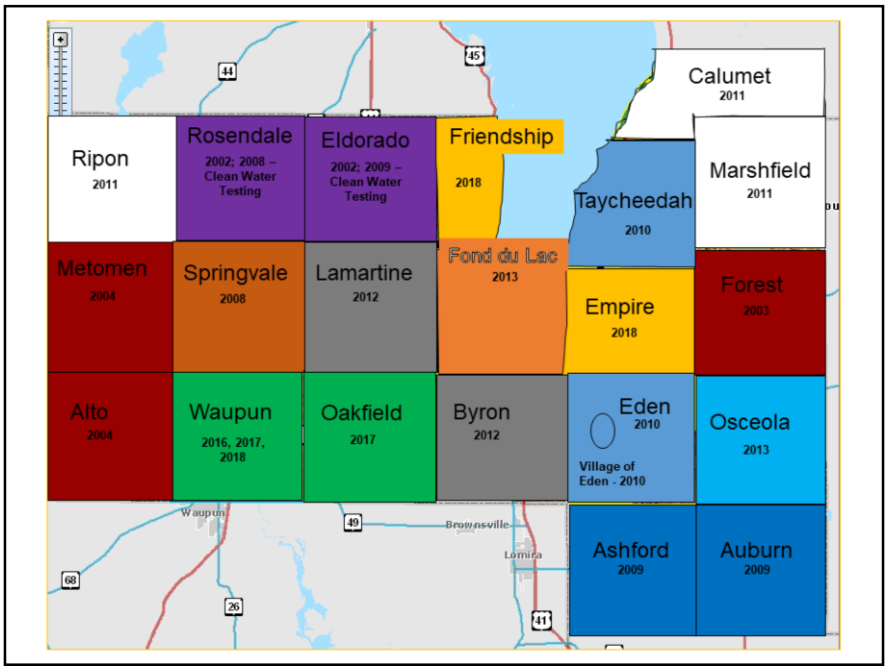
Photo by Leigh Kohlmann, Town of Oakfield, 5.4.17

Fond du Lac County Well Water Activities
(incomplete list)

- **2007:** E.coli in Town of Byron
  - County Departments: special sampling event & public meeting
  - County Executive assembles Groundwater advisory committee
- **2008:** Final Report of Advisory Committee
- **2008:** Special sampling in flood zones (Town of FDL)
- **Ongoing:** Reports to Board of Health; Township-wide sampling; individual sampling through Health Dept.; Transient, Non-Community well sampling on behalf of DNR
- **2010:** Protect the Water You Drink booklet
- **2010:** *A Community Resource* publication
- **2010:** Special sampling in flood zones (Town of FDL)
- **2014-16:** evaluation of sampling education
- **2016:** resume area sampling with focus on young families

Ongoing communication & collaboration amongst
Land & Water Conservation
Land Information
Code Enforcement
Planning
UW-Extension
Health Department
DNR
Geological & Natural History Survey
Town Boards



I inherited a popular and regular well water sampling educational program started by Jim Hovland in 1990 and have continued it. The Health Department also offers samples.

Township-wide Sampling Programs on a Rotating Basis since 1990
There was a pause in 2014-2016 while I did the evaluation of the program to see how well it works, if people are learning anything.

2207 samples for bacteria
2794 samples for nitrate
991 samples for arsenic

Photo Credit: Wendy Giese

Well Water User Study 2016

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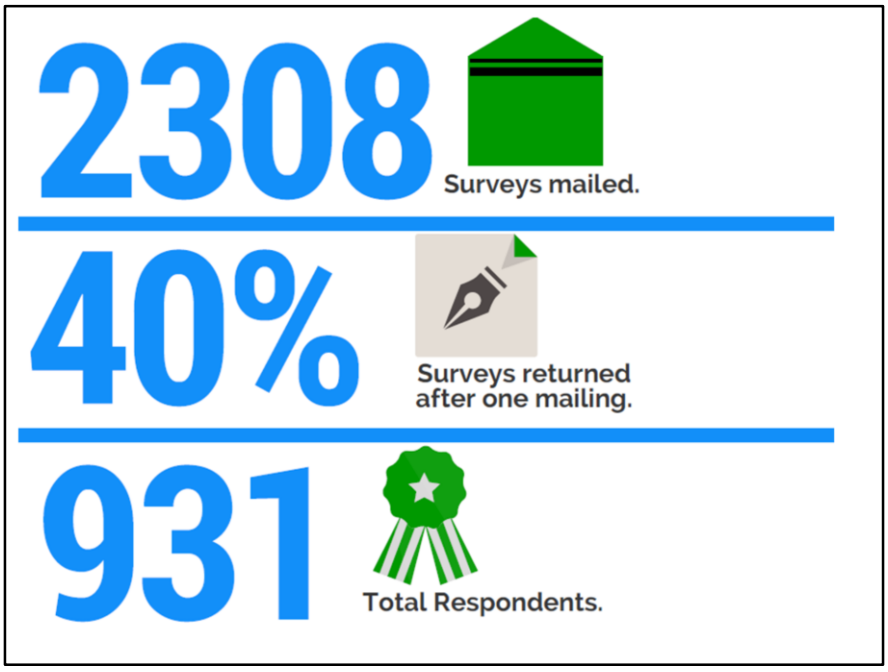
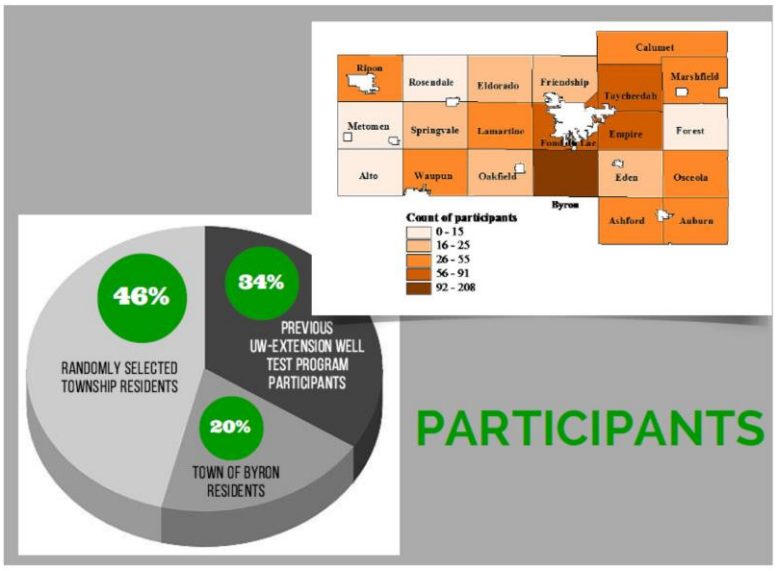
Produced under a 2015-2016 grant from the **Wisconsin Environmental Education Board.**

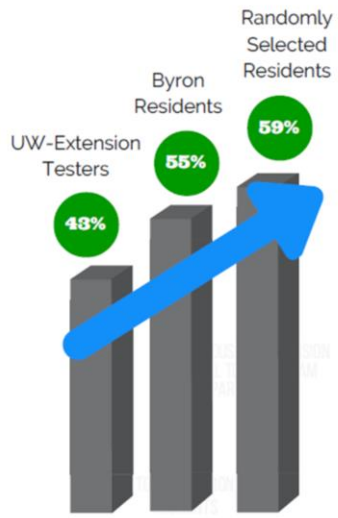
Additional financial support was provided by the **Center for Watershed Science and Education**

and the Towns of **Empire**
Byron
Fond du Lac
Oakfield
Ripon in Fond du Lac County.


2308
Surveys mailed.
40%
Surveys returned
after one mailing.
931
Total Respondents.


Calumet
Ripon
Rosendale
Eldorado
Friendship
Marshfield
Taycheedah
Metomen
Springvale
Lamartine
Empire
Forest
Alto
Waupun
Oakfield
Eden
Osceola
Byron
Ashford
Auburn
Count of participants
0 - 15
16 - 25
26 - 55
56 - 91
92 - 208
46%
RANDOMLY SELECTED TOWNSHIP RESIDENTS
34%
PREVIOUS UW-EXTENSION WELL TEST PROGRAM PARTICIPANTS
20%
TOWN OF BYRON RESIDENTS
PARTICIPANTS

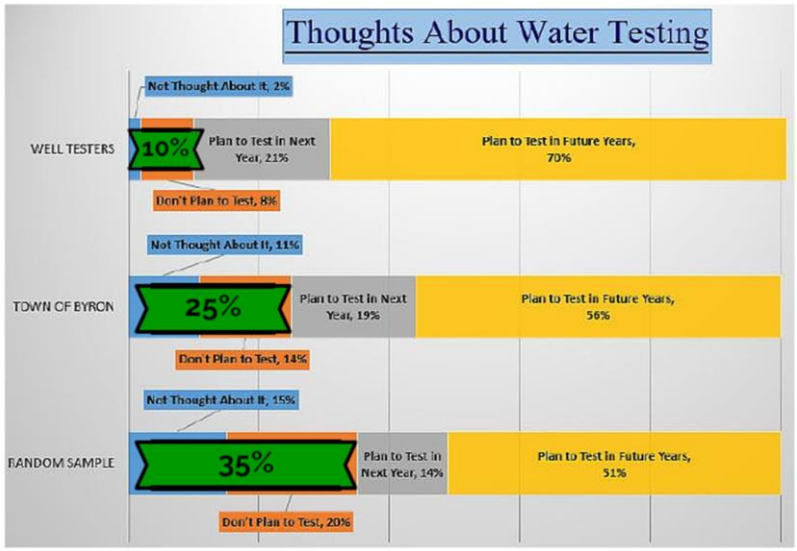
Many
LACK
INFORMATION
on
maintaining
their well
water's
safety.



Women

- **Twice** as likely to list the presence of children or pregnant women in the home as a motivation to test.
- **More likely** to say they didn't know which specific contaminants were tested for last time.
- Viewed their well water as **Less Safe.**

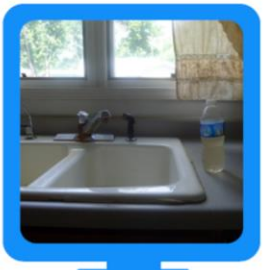
Photo Credit: WI Dept. of Natural Resources on Flickr.com


Thoughts About Water Testing
WELL TESTERS
Not Thought About It, 2%
10%
Plan to Test in Next Year, 21%
Plan to Test in Future Years, 70%
Don't Plan to Test, 8%
TOWN OF BYRON
Not Thought About It, 11%
25%
Plan to Test in Next Year, 19%
Plan to Test in Future Years, 56%
Don't Plan to Test, 14%
RANDOM SAMPLE
Not Thought About It, 15%
35%
Plan to Test in Next Year, 14%
Plan to Test in Future Years, 51%
Don't Plan to Test, 20%

MOTIVATIONS TO TEST

WELL TEST PROGRAM IN THE AREA

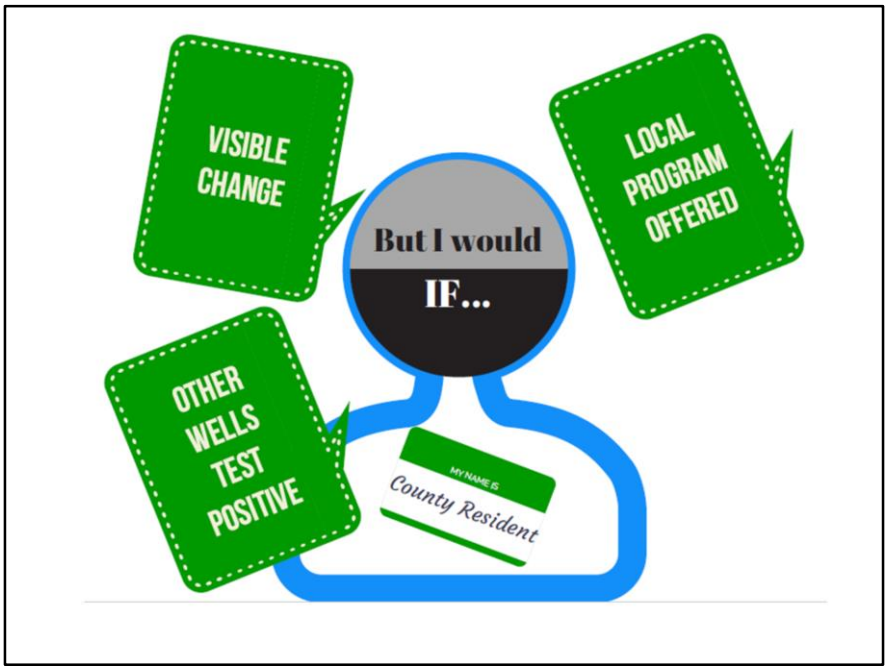
Photo Credit: Diana Hammer



TO KNOW IF IT'S SAFE TO DRINK

Photo Credit: "Drinking Water in Wedron" by WBEZ on Flickr.com


FINE SO FAR!
Why Not
TESTING?
HOW?
WHAT?
MY NAME IS
County Resident


VISIBLE CHANGE
LOCAL PROGRAM OFFERED
But I would
IF...
OTHER WELLS TEST POSITIVE
MY NAME IS
County Resident

3 Most Common Contaminants

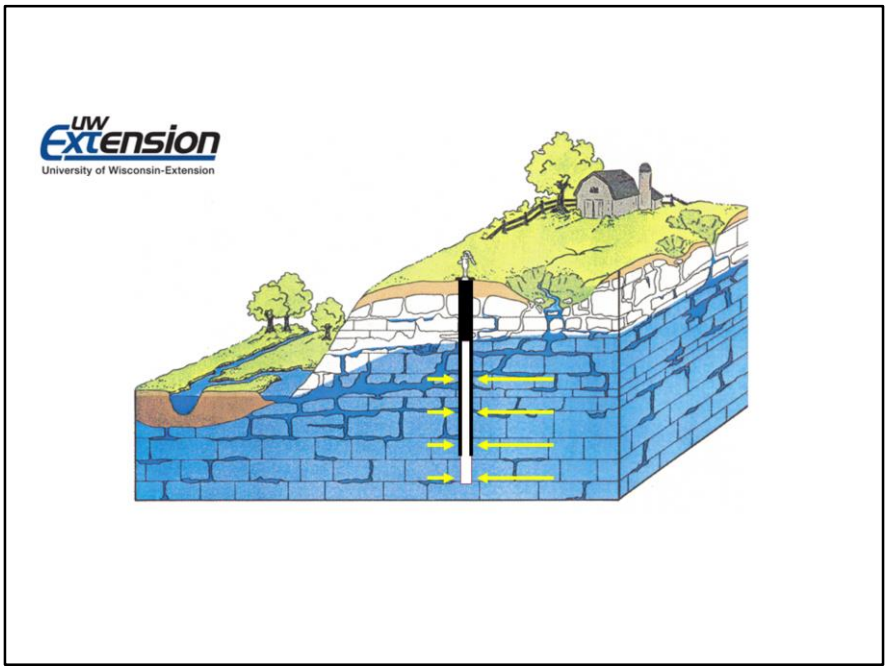
- Bacteria
- Nitrates
- Arsenic

Drinking water by Wisconsin Department of Natural Resources on flickr.com

What are they?
Why?

One of the best views we have in daily life of the geology of our area is looking at karst topography like this.

This is limestone.



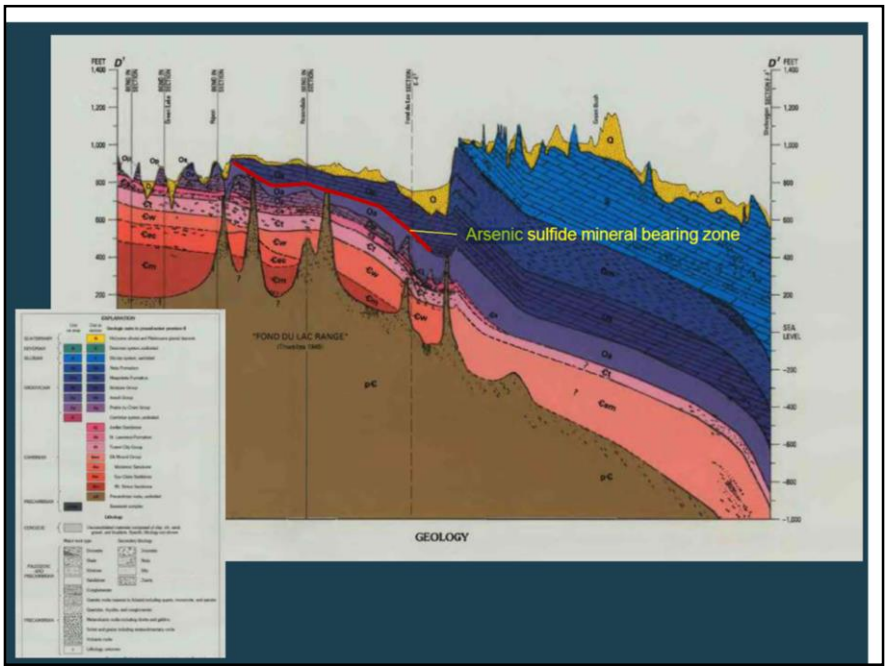
Here is a view of what that looks like underground where our drinking water wells are and a way to see how human behavior and natural causes work together to impact water quality.

What could go on with the water in this well since it is drilled through karst?

- It would pick up minerals in the limestone.
- It could channel contamination more quickly and easily from farther away.

Next clicks show how to protect the well more in a karst zone: case it deeper so there's less opportunity for contaminants (and shallow water) to show up there.

So that's an example of how the naturally-occurring geology and the human actions in the area work together to impact water contamination.



Arsenic is naturally found in certain bedrock layers as seen in this cross-section of the region.

The markers say Green Lake, Ripon, Rosendale, Fond du Lac, Green Bush, Sheboygan
From Kevin:

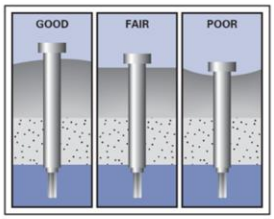
The likely source of the arsenic is the St. Peter Sandstone. Due to the presence of the Precambrian highs from the underlying Fond du Lac Range, it would not be practical to have a deeper casing depth/deeper well requirement. (Set your casing and then hit granite--no water!)

Test annually for the next couple of years to see if concentration is going up.

What should I do if coliform bacteria was present?

1. **Use alternative source of water for drinking**
2. **Retest**
3. **Try to identify any sanitary defects**
   - Loose or non-existent well cap
   - Well construction faults
   - A nearby unused well or pit
   - Inadequate filtration by soil
4. **Disinfect the well**
5. **Retest to ensure well is bacteria free.**

- **For reoccurring bacteria problems the best solution may be a new well.**



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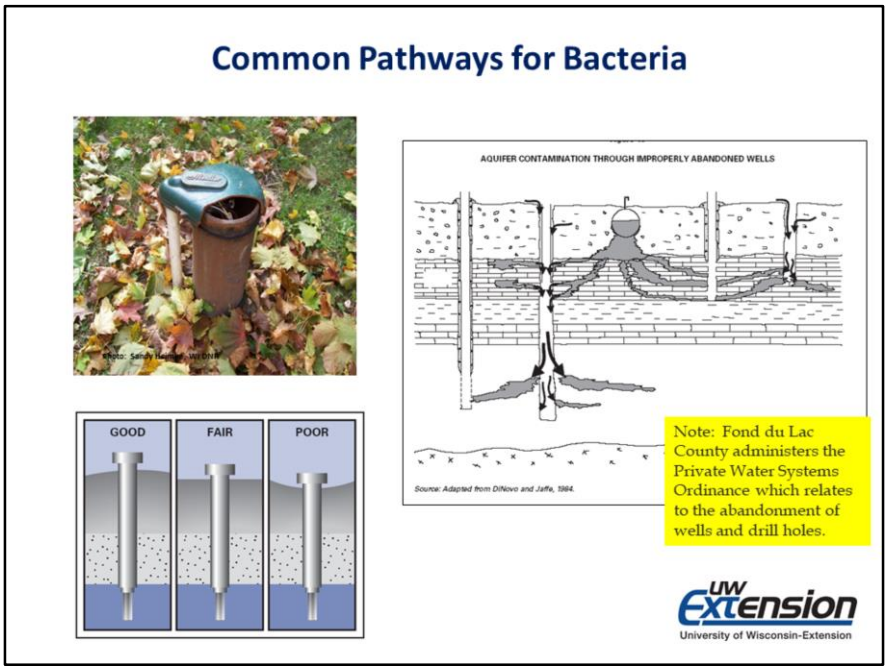


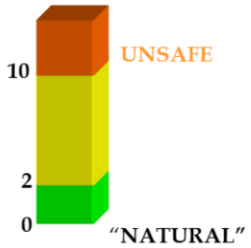
These are all signs that something could be happening to the water quality.

- **Upper left:** cap is cracked and open
- **Lower left:** ponding around the well
- **Lower right:** sewage leaking underground from the tank into the yard over to the area the well is drawing from

If coliform is present, e. coli is tested for. This comes from fecal contamination and could make you immediately sick.

Nitrate Nitrogen

- Greater than 10 mg/L *Exceeds State and Federal Limits for Drinking Water*
- Between 2 and 10 mg/L *Some Human Impact*
- Less than 2.0 mg/L *"Transitional"*
- Less than 0.2 mg/L *"Natural"*



Health Effects:

- Methemoglobinemia (blue baby disease)
- Possible links to birth defects and miscarriages (humans and livestock)
- Indicator of other contaminants

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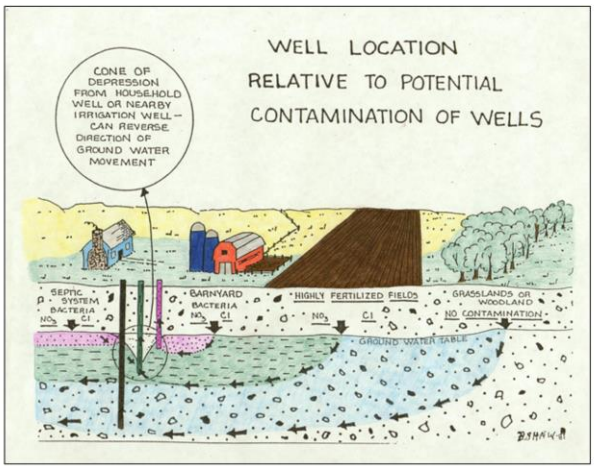
What can I do to reduce my nitrate levels?

- Eliminate contamination source or reduce nitrogen inputs
- Change well depth or relocate well
- Carry or buy water
- Water treatment
  - Reverse osmosis
  - Distillation
  - Anion exchange



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Sources:
Agricultural fertilizer
Lawn fertilizer
Septic systems
Animal wastes

Arsenic

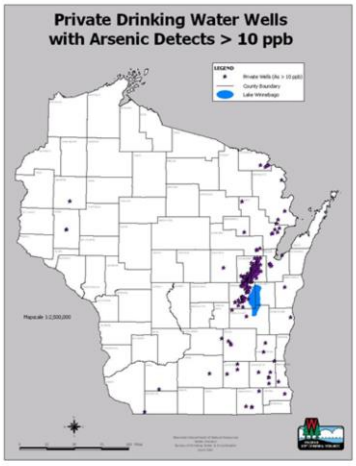
- Naturally occurring in mineral deposits
- Health Standard: 0.010 mg/L (10 ppb)

Health Effects:

- Increased risk of skin cancers as well as lung, liver, bladder, kidney, and colon cancers.
- Circulatory disorders
- Stomach pain, nausea, diarrhea
- Unusual skin pigmentation

Treatment:

- Water Softener + Reverse Osmosis
- Iron Filter + Reverse Osmosis.



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out of 918 well samples analyzed from 2001 thru 2015 from Fond du Lac county, approximately six percent of samples showed levels of arsenic above that recommended for drinking water. This is slightly higher than the approximately three percent of samples statewide that exceed the standard for arsenic.

Town of Empire: 2018 Sampling Results

Bacteria (positive or negative):

55 tests	None detected
19 tests (26%)	Positive for coliform
2 tests	Positive for E. coli

Nitrates (health standard is 10ppm):

38 tests	None detected
6 tests	< 2 ppm
19 tests	2 – 9.9 ppm
11 tests (15%)	10 ppm or greater

Arsenic (health standard is 10ppb):

51 tests	None detected
16 tests	< 5 ppb
0 tests	5.1 – 10 ppb
0 tests	10 ppb or greater

TOWN OF Empire

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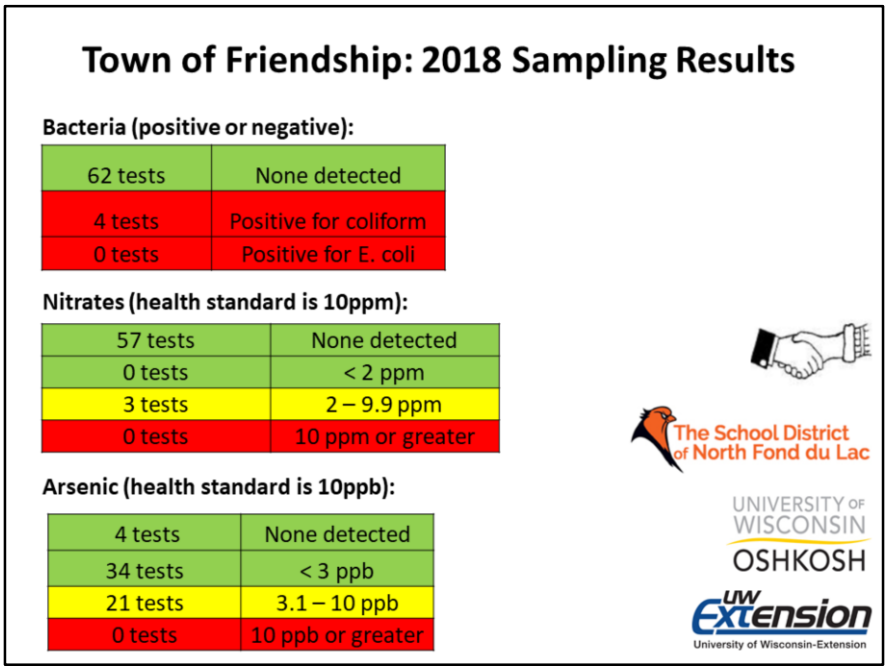
P 9, 16, 18 in your bound report gives more background and history on the geology and past results for context



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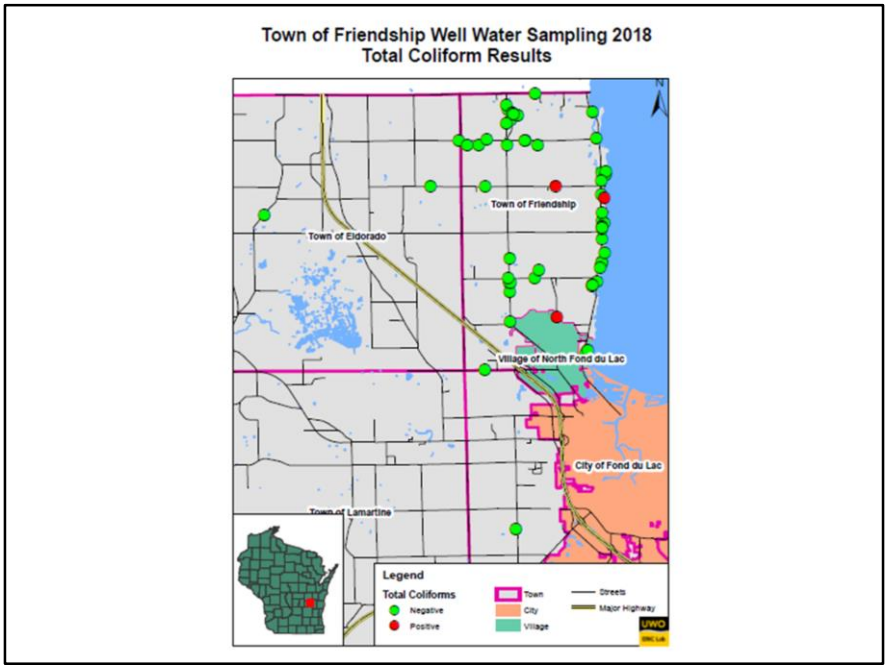
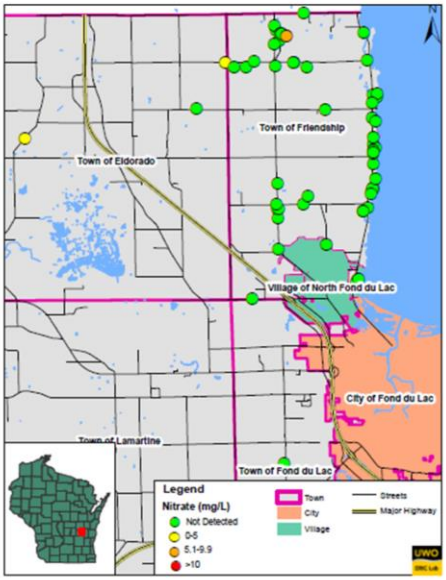
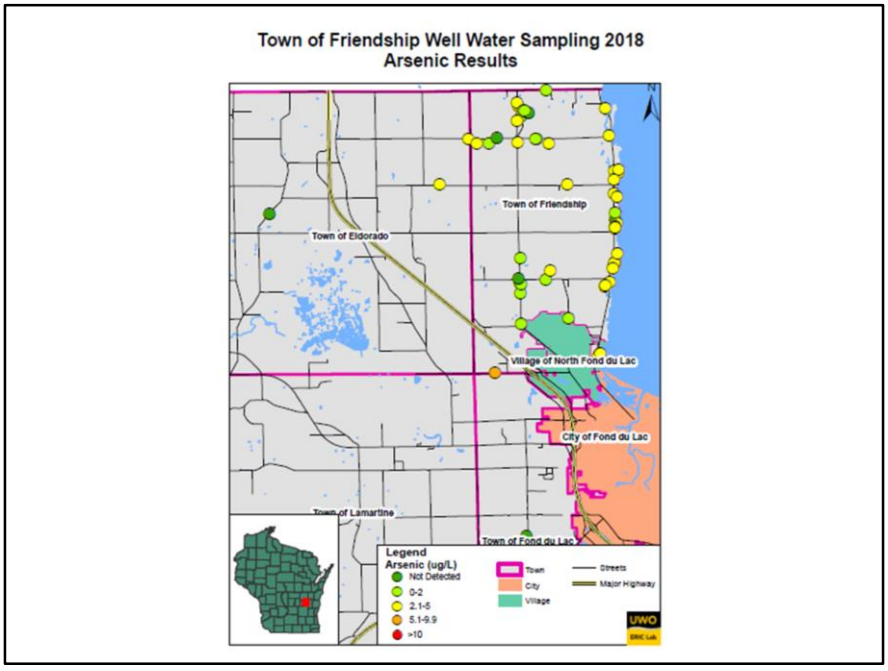
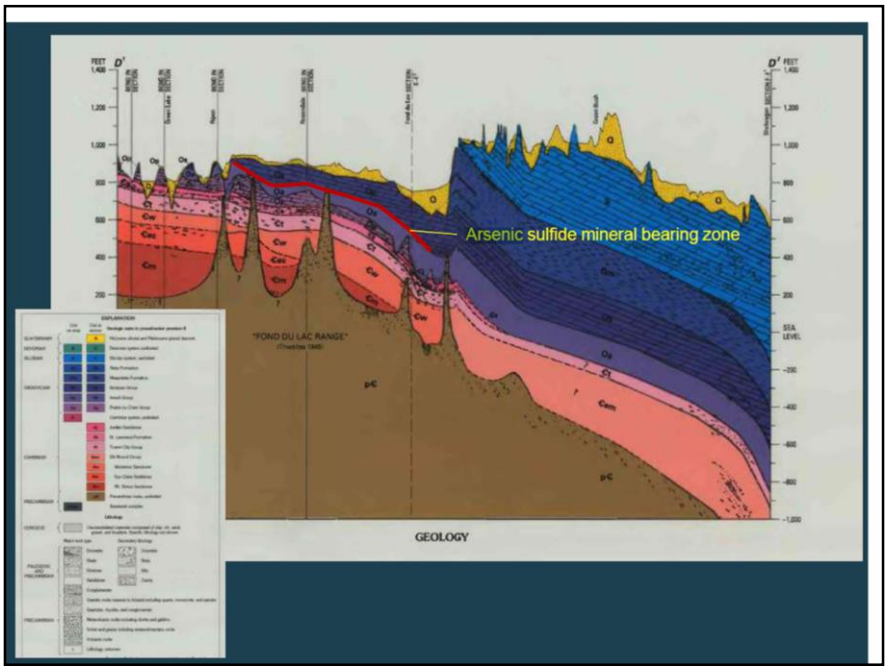

Town of Friendship Well Water Sampling 2018
Total Coliform Results
N
Town of Friendship
Town of Eldorado
Village of North Fond du Lac
City of Fond du Lac
Town of Lamartine
Legend
Total Coliforms
Negative
Positive
Town
City
Village
Streets
Major Highway
UWO
GIS Lab

Town of Friendship Well Water Sampling 2018
Nitrate Results




Town of Friendship Well Water Sampling 2018
Arsenic Results
Town of Friendship
Town of Eldorado
Village of North Fond du Lac
City of Fond du Lac
Town of Lamartine
Town of Fond du Lac
Legend
Arsenic (ug/L)
Not Detected
0-2
2.1-5
5.1-9.9
>10
Town
City
Village
Streets
Major Highway
UWO



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From Kevin:

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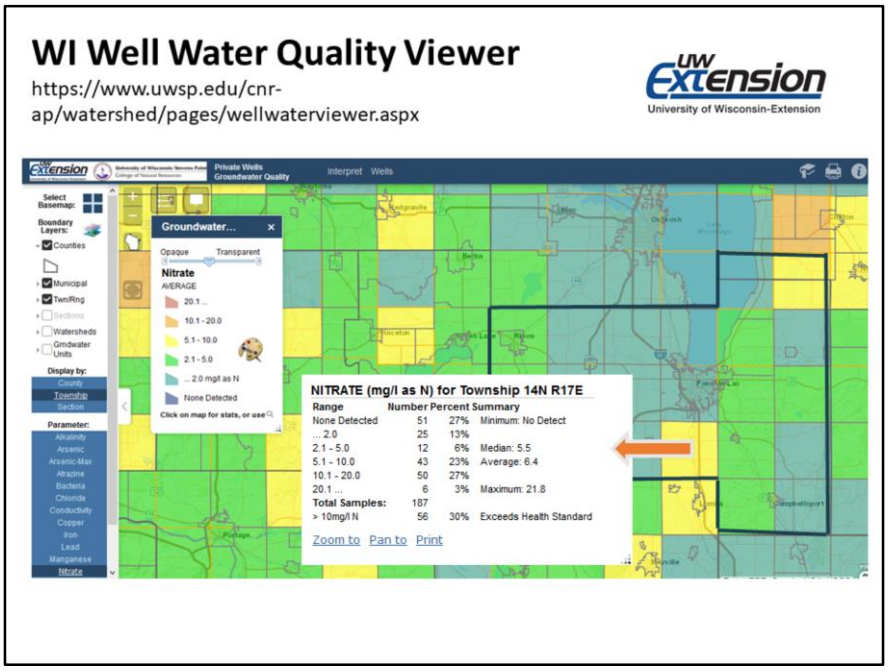
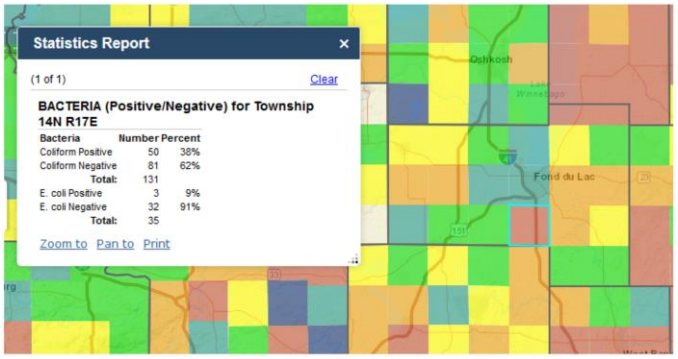
Test annually for the next couple of years to see if concentration is going up.



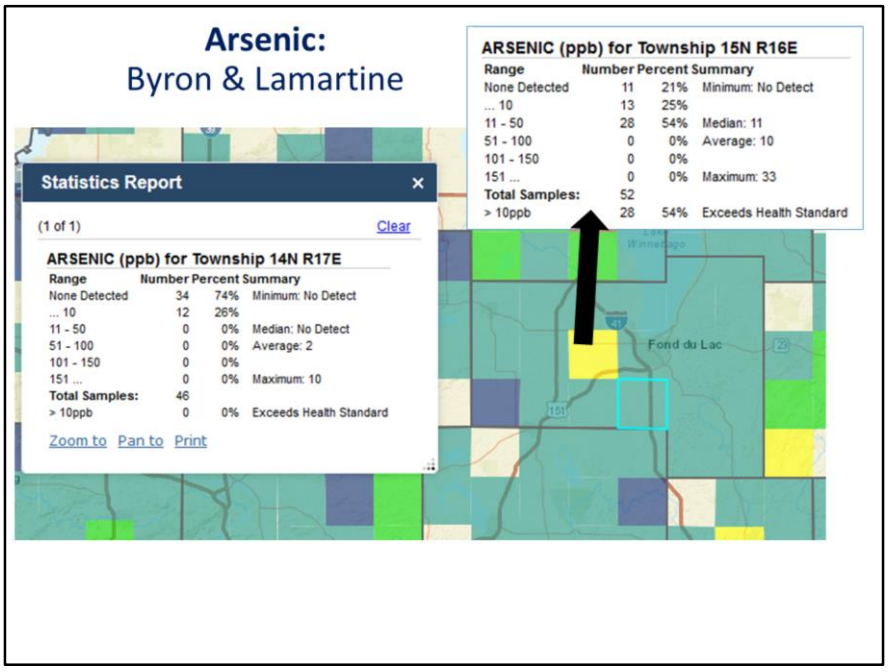
All the samples that have been done through UWSP in town-wide programs or individually; can be viewed at quarter-quarter section detail

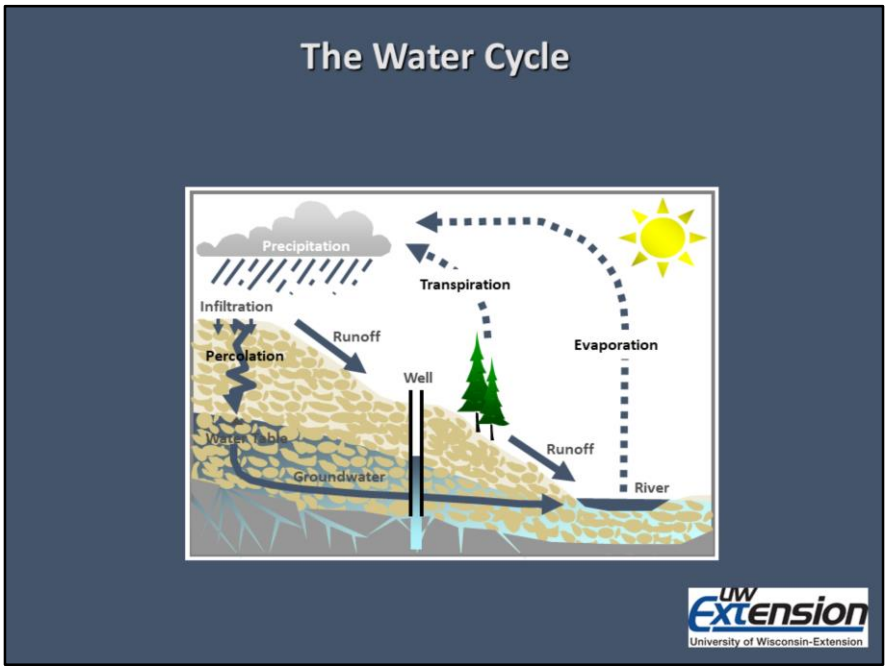
Bacteria Results:
Town of Byron



The yellow is 15-18% positive;
Orange is 20-24% positive

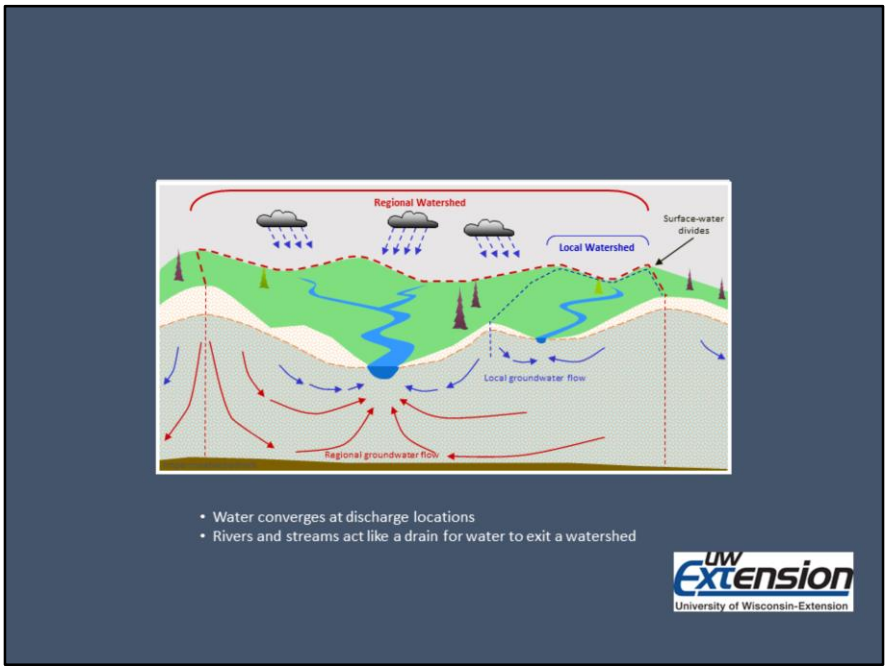
SW WI is seeing 40% of tested wells bacteria positive, so that is similar to Byron's results over time.


Arsenic:
Byron & Lamartine
ARSENIC (ppb) for Township 15N R16E
Range Number Percent Summary
None Detected 11 21% Minimum: No Detect
... 10 13 25%
11 - 50 28 54% Median: 11
51 - 100 0 0% Average: 10
101 - 150 0 0%
151 ... 0 0% Maximum: 33
Total Samples: 52
> 10ppb 28 54% Exceeds Health Standard
Statistics Report
(1 of 1) Clear
ARSENIC (ppb) for Township 14N R17E
Range Number Percent Summary
None Detected 34 74% Minimum: No Detect
... 10 12 26%
11 - 50 0 0% Median: No Detect
51 - 100 0 0% Average: 2
101 - 150 0 0%
151 ... 0 0% Maximum: 10
Total Samples: 46
> 10ppb 0 0% Exceeds Health Standard
Zoom to Pan to Print
Fond du Lac



Wisconsin receives **about 32 inches of rain and snow per year** (of course this can vary… from less than 25 to more than 45 inches / year), on average perhaps about 22 inches/year is used by plants or evaporates, **leaving about 10 inches per year that moves through and across the land and eventually leaves the state in streams and lakes***. The fraction which passes through groundwater varies with soil type, topography and land cover. **For Fond du Lac County, reasonable numbers for the amount that moves into groundwater might be 5 to 6 inches annually** (I wonder if it's not a little more just because of the difficulty of measuring it in those areas)**. Think about that water moving through the aquifer (the geologic formations below the water table where water fills the spaces not occupied by rock), if the rock occupies about 90% of the space*****, 5 inches on the ground would be about 50 inches (more than 3 or 4 feet) underground**. Of course, this water is replacing the water that is draining to lakes and streams, setting up **a flow-through system** within which are wells are withdrawing their water (there is a depth dimension to this where deeper water generally originates from further away, and fractures and casing that doesn't extend below the water table etc. open up some complex possibilities for where the water in you well comes from—while not unimportant, I suggest these are nuances on the flow-through fundamentals).

*Gebert, W.A., Walker, J.F., Hunt, R.J. 2011. Groundwater recharge in Wisconsin—Annual Estimates for 1970-99 Using Streamflow Data. USGS Fact Sheet 2009-3092.
**Gebert (above) and Neff, B.P., Piggott, A.R., Sheets. R.A. 2005. Estimation of shallow ground-water recharge in the Great Lakes Basin. USGS Scientific Investigations Report 2005-5284.
*** https://wgnhs.uwex.edu/maps-data/data/rock-properties/understanding-porosity-density/



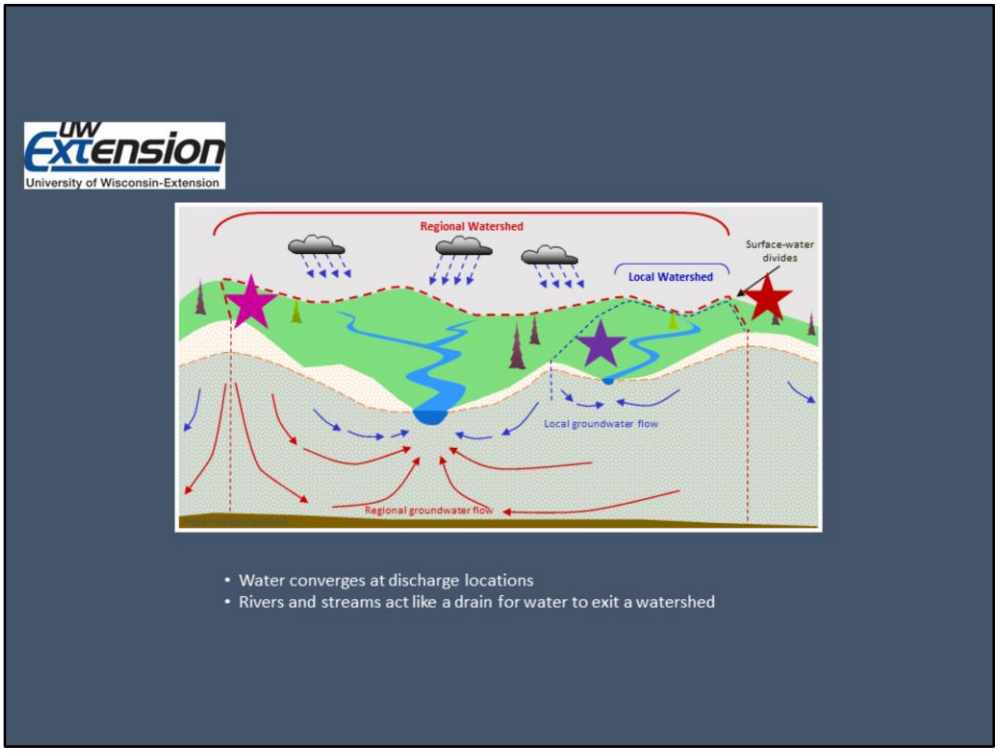
And on an actual landscape, here is how it looks.

Things to notice:

How many different watersheds are shown?

- 2 (a regional one in red and a local one in blue)

What difference does it make where you might live on this landscape? (click to show X's)



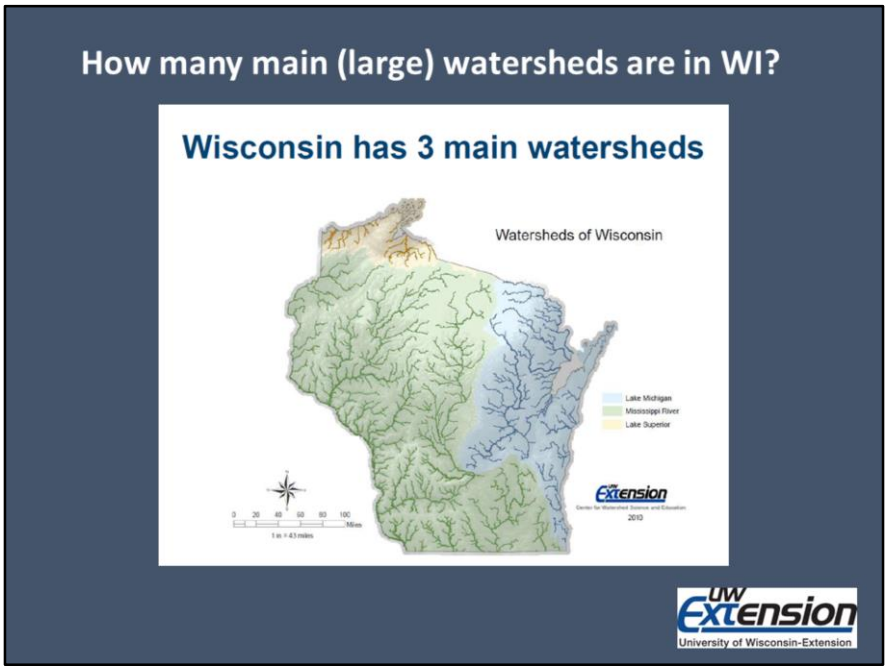
And on an actual landscape, here is how it looks.

Could testing the water from a well at the pink star tell you the quality of the water at the purple star?

- No, even though they are close,
    - the water underneath is moving in different directions from different surface area zones.
    - They could also be drilled at different depths meaning the minerals in the water could be different

What about the red star? That's closer to the purple star. Could testing at the red star tell you the purple's water quality?

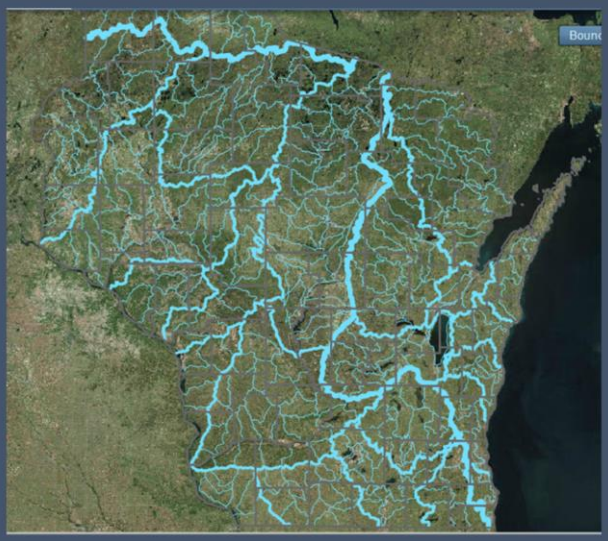
- No, because even though they are closer still, the red star's watershed is totally separate. Water is moving in a different direction off the land and underground.



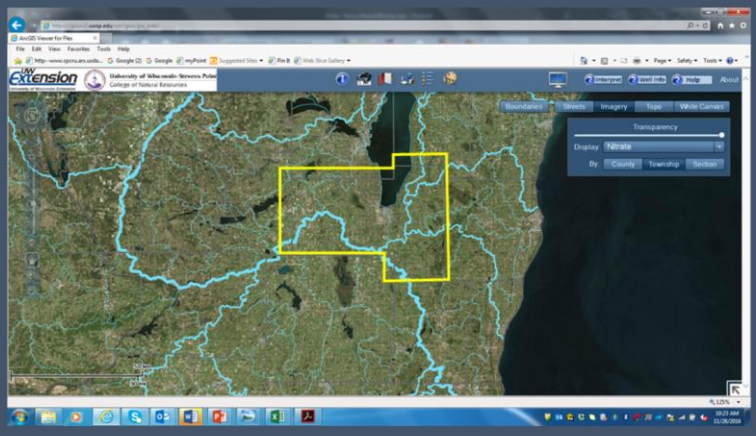
THREE is correct.

Back to the last slide, remember each of these corresponds to a river. Think bigger than that now. What are the 3 biggest bodies of water that WI surface water could run into?

Regional WI Watersheds



Watersheds of Fond du Lac County



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How many Fond du Lac County residents drink well water?

All of them

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Spreading the Word

- Who is a younger woman you can talk to about this?
- When will you next see her?
- What is the most important thing you'd like her to know?

Thank You!

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