

Water WELLness

Monroe County



Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin - Stevens Point



Extension
UNIVERSITY OF WISCONSIN-MADISON

Goals for the presentation:

- Groundwater Basics: Where does my water come from
- Well Construction
- What do my individual test results mean?
- General groundwater quality in Monroe County
- Improving your water quality

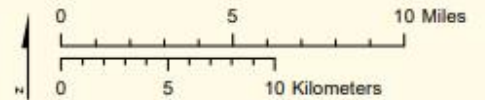


Monroe County

2020, 2021 & 2023



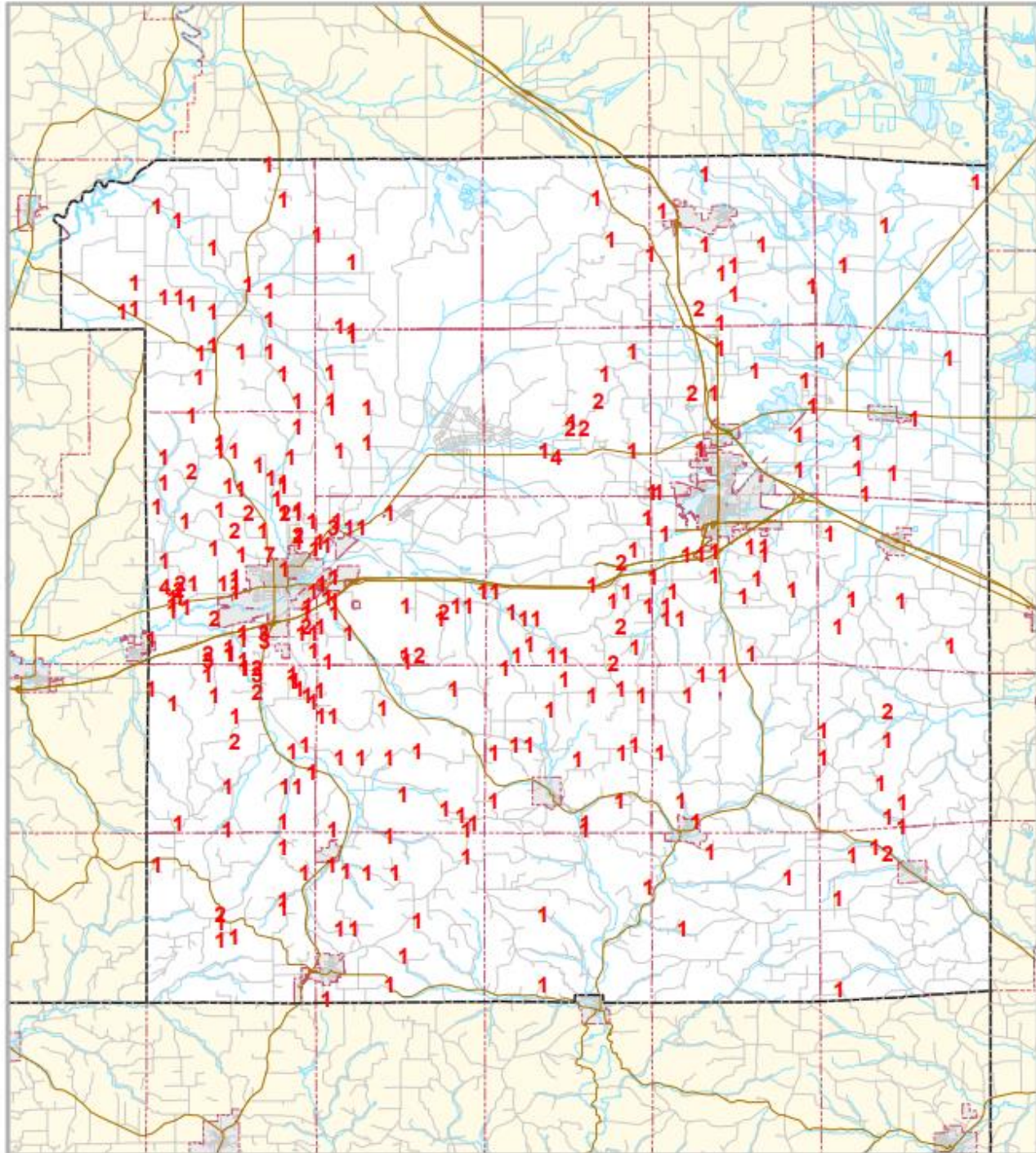
-  Watershed Boundary
-  Streams
-  Lakes/Reservoirs
-  Wetlands
-  State/US Highways
-  Other Roads
-  Town Boundaries
-  Municipalities



Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin-Stevens Point

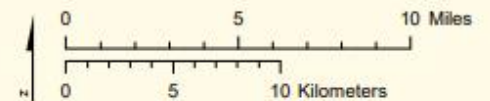
Monroe County

2020, 2021, 2023 & 2024



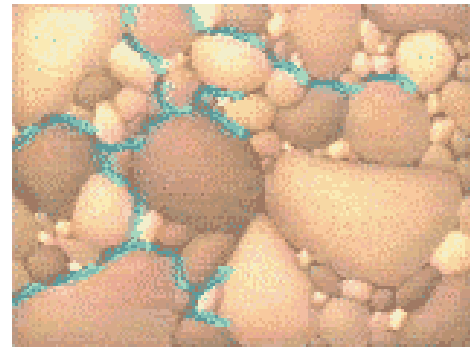
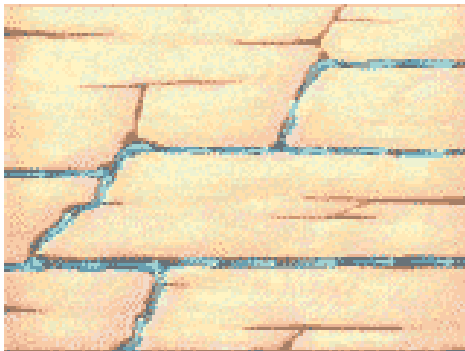
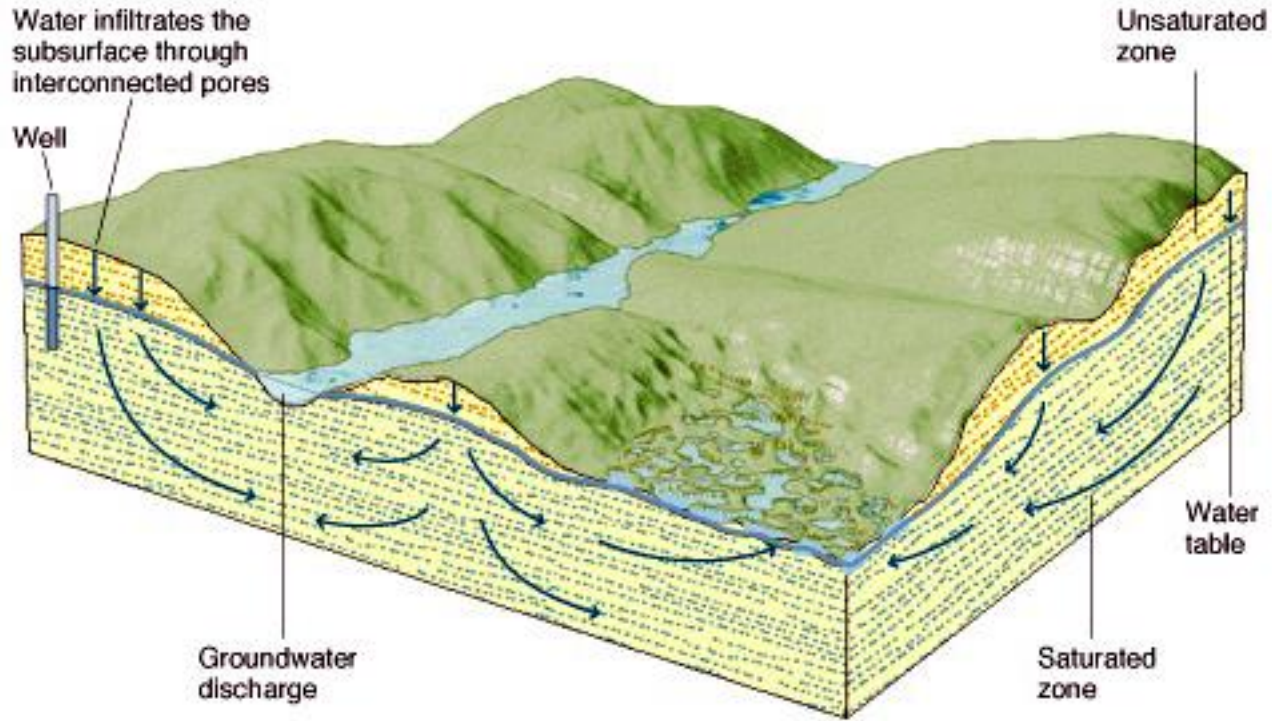
SAMPLE DISTRIBUTION

NUMBER OF SAMPLES
per 1/4 1/4 SECTION



Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin - Stevens Point

Groundwater Movement

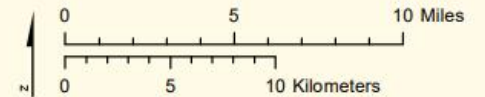
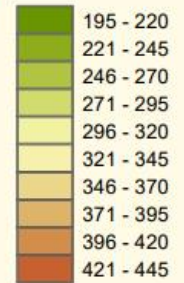


Monroe County

2020, 2021 & 2023



Elevation:
(meters)



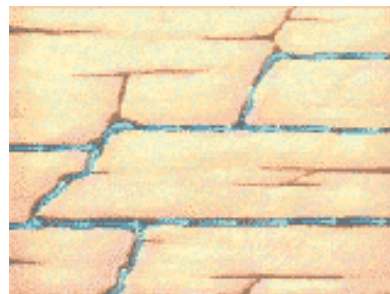
Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin-Stevens Point

Aquifers: Our groundwater storage units

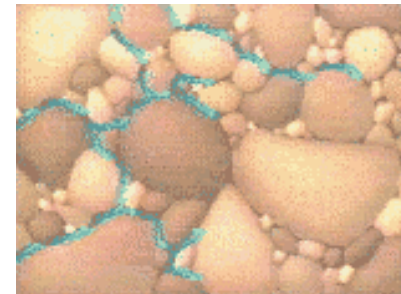
Aquifers are geologic formations that store and transmit groundwater.

The aquifer properties determine how quickly groundwater flows, how much water an aquifer can hold and how easily groundwater can become contaminated. Some aquifers may also contain naturally occurring elements that make water unsafe.

Wisconsin's geology is like a layered cake. Underneath all of Wisconsin lies the Crystalline bedrock which does not hold much water. Think of this layer like the foundation of your house. All groundwater sits on top of this foundation. Groundwater is stored in the various **sandstone, dolomite and sand/gravel** aquifers above the **crystalline bedrock** layer. The layers are arranged in the order which they formed, oldest on the bottom and youngest on top.

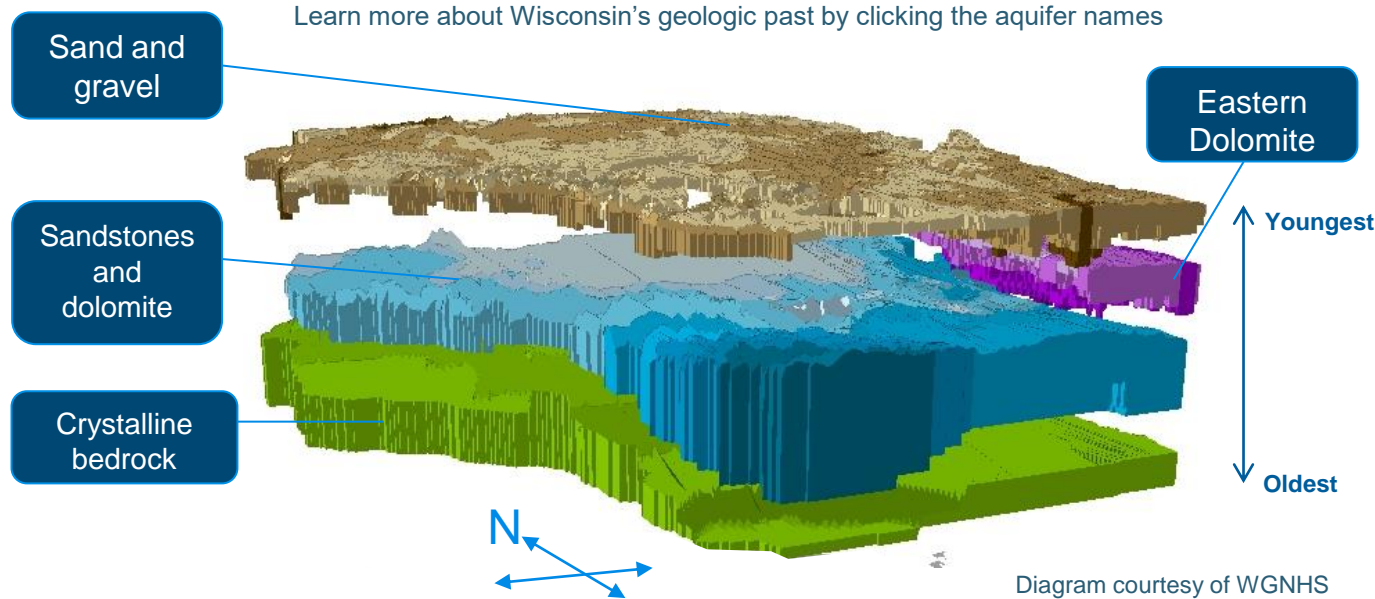


Water and contaminants can move quickly through cracks and fractures.



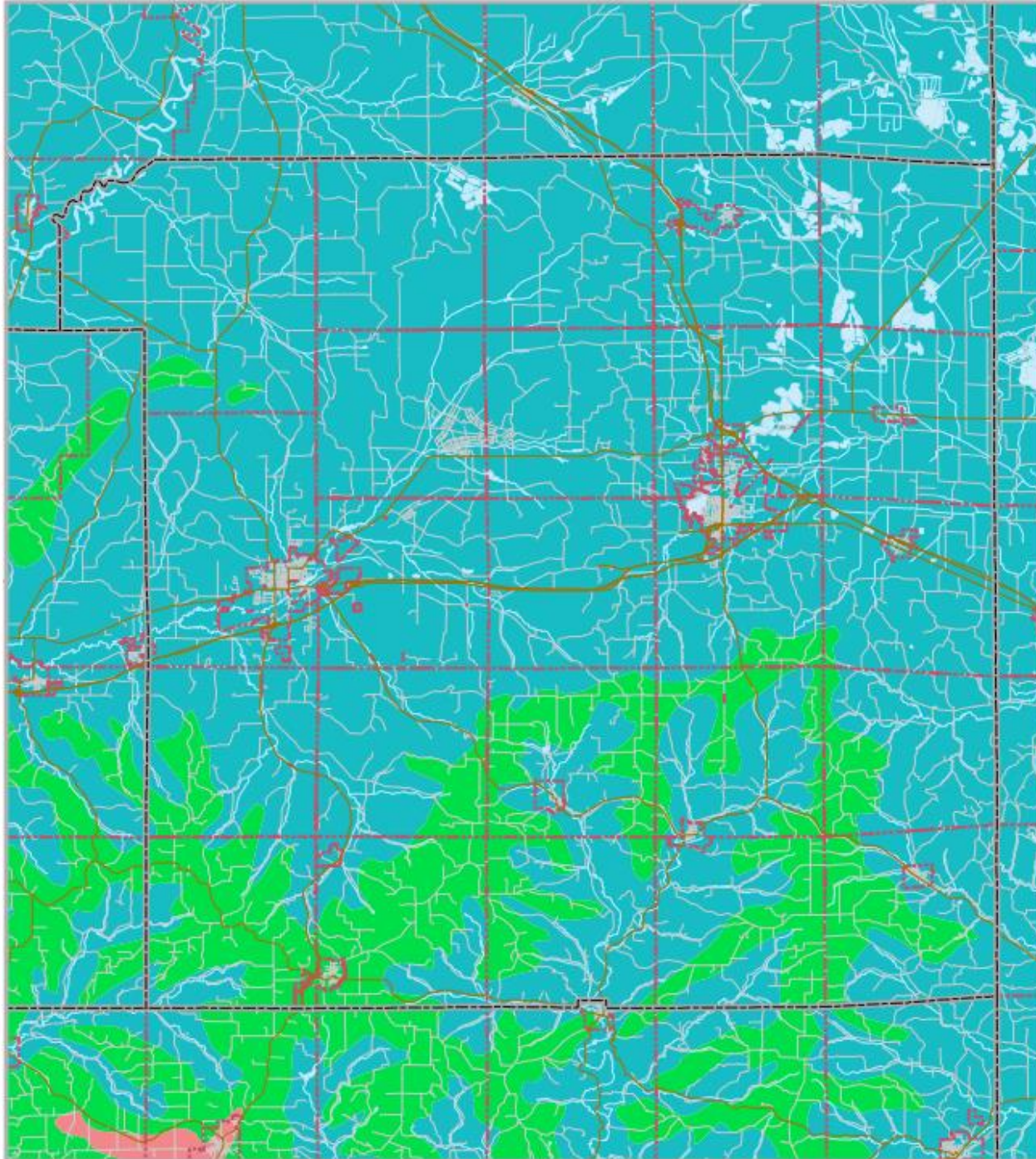
Water moving through tiny spaces in between sand particles or sandstone moves slower and allows for filtration of some contaminants.

Learn more about Wisconsin's geologic past by clicking the aquifer names





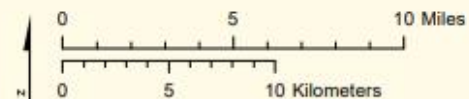
Monroe County

2020, 2021 & 2023



Bedrock Units:

-  Cambrian Sandstone
-  Prairie du Chien Dolomite
-  St Peter Sandstone








Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin - Stevens Point

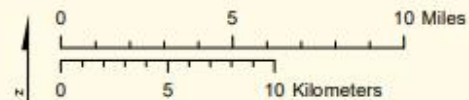
Monroe County

2020, 2021 & 2023



Depth to Bedrock:

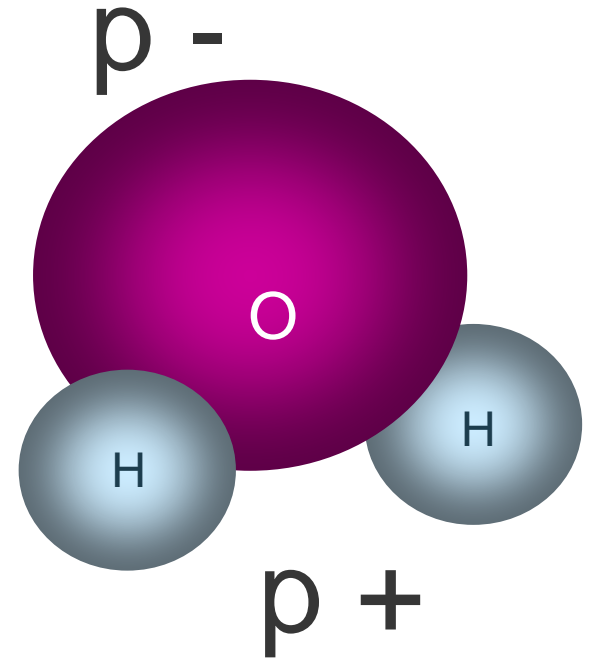
-  within 5 ft - more than 70% of area
-  within 5 ft - 35 to 70% of area
-  5 to 50 ft
-  50 to 100 ft
-  greater than 100 ft



Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin - Stevens Point

water basics

- “Universal Solvent”
- Naturally has “stuff” dissolved in it.
 - Impurities depend on rocks, minerals, land-use, plumbing, packaging, and other materials that water comes in contact with.
- Can also treat water to take “stuff” out



Interpreting Drinking Water Test Results

Tests important to health:

- Bacteria
- Sodium
- Nitrate
- Copper
- Lead
- Triazine
- Zinc
- Sulfate
- Arsenic

Tests for aesthetic (taste,color,odor) problems:

- Hardness
- Iron
- Manganese
- Chloride

Other important indicator tests:

- Saturation Index
- Alkalinity
- Conductivity
- Potassium

Red = human-influenced **Blue** = naturally found

Health Concern Categories

Acute Effects

- Usually seen within a short time after exposure to a particular contaminant or substance.

(ex. Bacteria or viral contamination which may cause intestinal disease)

Chronic Effects

- Result from exposure to a substance over a long period of time.
- Increase risk of developing health complications later in life.

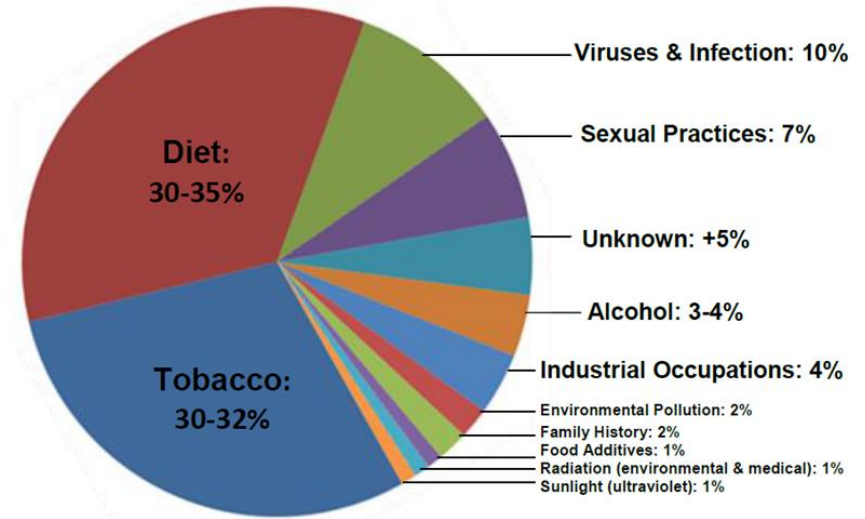
(ex. Arsenic or pesticides can increase the risk of developing certain cancers)



Chronic related health concerns are generally about risk management

National Cancer Risk Factors with Percentages

Adapted from *Everyone's Guide to Cancer Therapy*



Being struck by lightning	0.16 in 1,000 chance.
0.010 mg/L of arsenic in drinking water.	3 out of 1,000 people likely to develop cancer.
2 pCi of indoor radon level.	4 out of 1,000 people likely to develop lung cancer. ¹
2 pCi of indoor radon combined with smoking.	32 out of 1,000 people could develop lung cancer. ¹

Drinking water quality is only one part of an individual's total risk.

¹<http://www.epa.gov/radon/healthrisks.html>

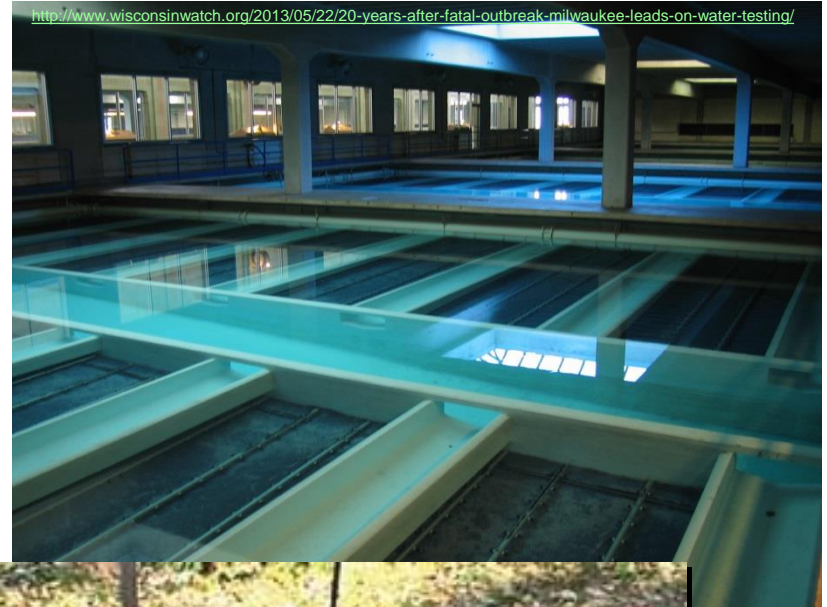
Private vs. Public Water Supplies

Public Water Supplies

- Regularly tested and regulated by drinking water standards.

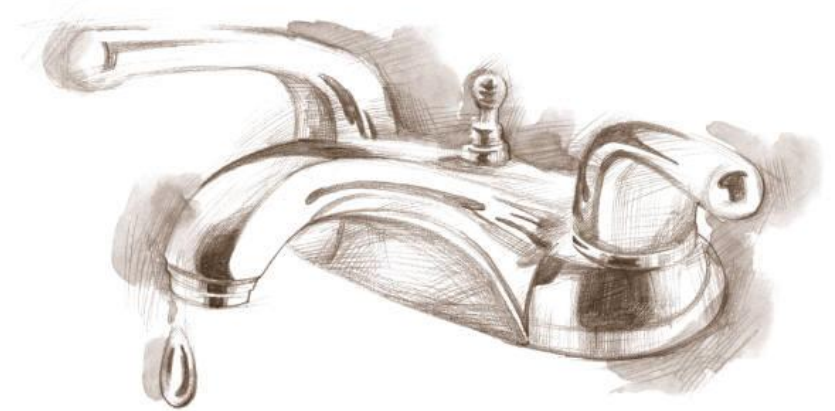
Private Wells

- Not required to be regularly tested.
- Not required to take corrective action
- Owners must take special precautions to ensure safe drinking water.



Why do people test their water?

- Installed a new well*
- Well or pump work**
- Change in taste or odor
- Buying or selling their home
- Plumbing issues
- Want to know if it's safe to drink.

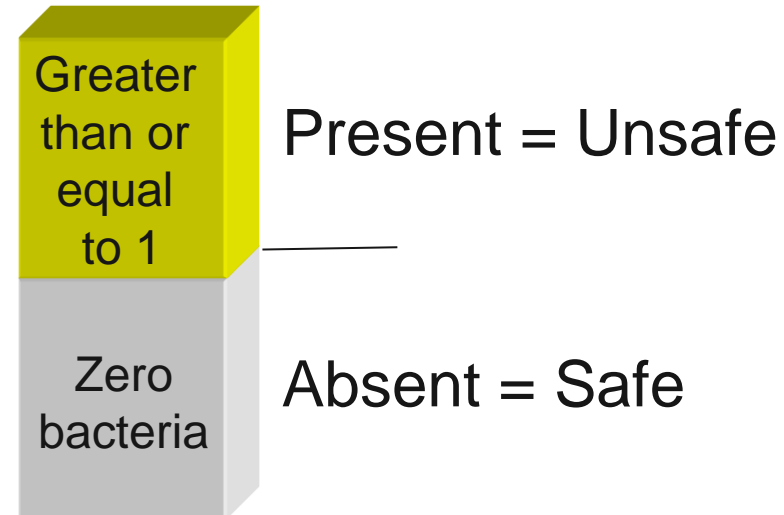
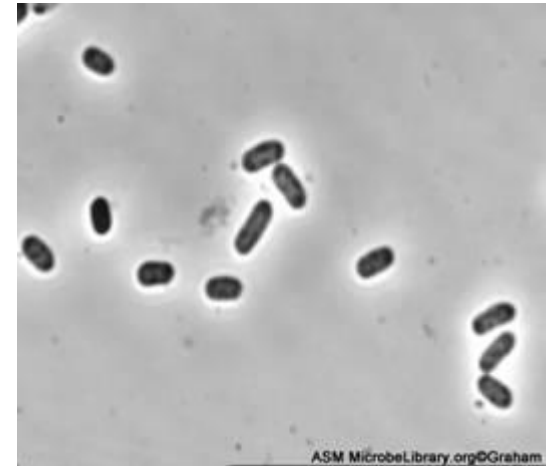


*Required to be tested by well driller for bacteria and *nitrate* (since 2014)

** Required to be tested by well driller/pump installer for bacteria, *nitrate*, and *arsenic*

Coliform bacteria

- Generally do not cause illness, but indicate a pathway for potentially harmful microorganisms to enter your water supply.
 - Harmful bacteria and viruses can cause gastrointestinal disease, cholera, hepatitis
- Well Code: “Properly constructed well should be able to provide bacteria free water continuously without the need for treatment”
- Recommend using an alternative source of water until a test indicates your well is absent of coliform bacteria
- Sources:
 - Live in soils and on vegetation
 - Human and animal waste
 - Sampling error



If coliform bacteria was detected, we also checked for e.coli bacteria test

- Confirmation that bacteria originated from a human or animal fecal source.
- E. coli are often present with harmful bacteria, viruses and parasites that can cause serious gastrointestinal illnesses.
- Any detectable level of E.coli means your water is unsafe to drink.

Information Sources: United States Department of Health and Human Services – Centers for Disease Control and Prevention (www.cdc.gov) and United States Environmental Protection Agency (www.epa.gov)

Contaminants	Sources	Symptoms
BACTERIA		
<p><i>Escherichia coliform (E. coli)</i> <i>Salmonella</i> <i>Campylobacter</i> <i>E. coli O157</i> (Requires a special water test for detection. Causes similar, but more serious illness than other E.coli strains. Requires medical treatment.)</p> <hr/> <p><i>Leptosporidia</i></p>	<ul style="list-style-type: none"> • Infected human and animal feces • Manure • Septic systems • Sewage <hr/> <ul style="list-style-type: none"> • Urine of livestock, dogs and wildlife • Manure 	<ul style="list-style-type: none"> • Gastrointestinal illness • Low-grade fever • Begins 12 hrs - 7 days after exposure <hr/> <ul style="list-style-type: none"> • High fever, severe headache and red eyes • Gastrointestinal illness • Begins 2-28 days after exposure
MICROSCOPIC PARASITES		
<p><i>Cryptosporidia</i> <i>Giardia</i></p>	<ul style="list-style-type: none"> • Infected human and animal feces • Manure • Septic systems • Sewage 	<ul style="list-style-type: none"> • Gastrointestinal illness • Begins 2-14 days after exposure
VIRUSES		
<p>Norovirus</p>	<ul style="list-style-type: none"> • Infected human feces and vomit • Septic systems • Sewage 	<ul style="list-style-type: none"> • Gastrointestinal illness • Low-grade fever & headache • Begins 12-48 hrs after exposure
CHEMICALS		
<p>Nitrate</p> <hr/> <p>Atrazine (trade-name herbicide for control of broadleaf and grassy weeds)</p>	<ul style="list-style-type: none"> • Fertilizers • Manure • Bio-solids • Septic systems <hr/> <p>Estimated to be most heavily used herbicide in the U.S. in 1987/89, with its most extensive use for corn and soybeans in the Midwest, including WI. In 1993, it became a restricted-use herbicide nationally. U.S. EPA set a max. contaminant level (MCL) at 3 parts per billion for safe drinking water.</p>	<p>Methemoglobinemia or "Blue Baby Syndrome" – No documented cases in Door County, but elevated nitrate levels in well water may indicate risk of contamination by additional pathogens.</p> <hr/> <p>Short-term exposure above the MCL may cause: congestion of heart, lungs and kidneys; low blood pressure; muscle spasms; weight loss; damage to adrenal glands.</p> <p>Long-term exposure above MCL may cause: weight loss, cardiovascular damage, retinal and some muscle degeneration; cancer.</p>

Well Construction Defects



- Is the well cap or casing cracked?

Well Construction Defects



- Does your well have a vermin-proof cap?



Well Construction Defects

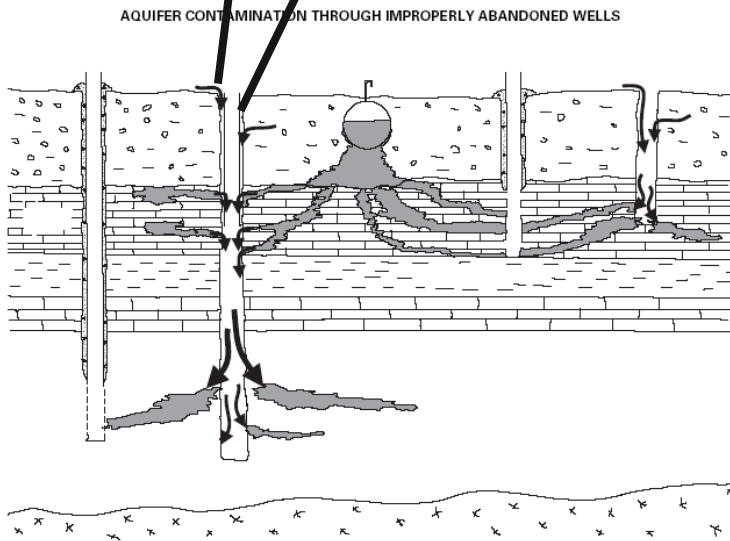


- Non-vermin proof cap
- Electrical conduit not installed correctly
- Don't leash pets within 10 feet of the well
- Avoid bird feeders and other decorations directly above the well

Well Construction Defects



- Are there old wells on the property?
 - Wells are a direct conduit to groundwater
 - Consider having them properly filled and sealed



Well Construction Defects



- Do yard hydrants, livestock waterers, and service to outbuildings have proper backflow prevention?

HOW BACKFLOW CAN HAPPEN

- 1** **Stage 1:** Your home or business has a connection to the public water system not protected by a backflow device.
- 2** **Stage 2:** Water pressure is reduced because of a break in the water main or a fire event using a lot of water suddenly.
- 3** **Stage 3:** The sudden drop in water pressure creates a reverse pressure situation.



- 4** **Stage 4:** Dangerous contaminants from the unprotected connection can now potentially enter the drinking water supply.



What makes a good well.....

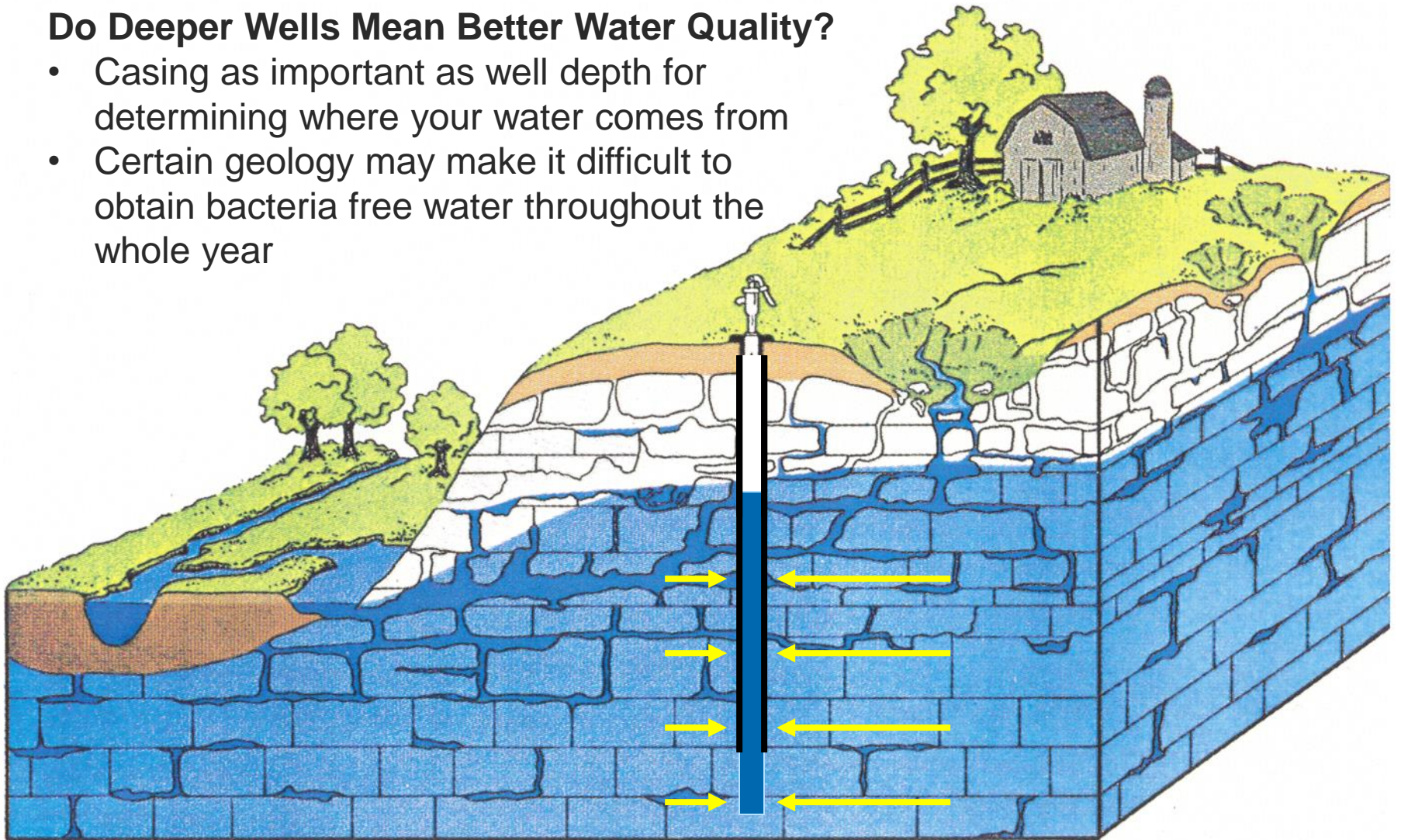


- Vermin proof cap
- Casing extends at least 12" above grade
- Area around well free and clear of debris or other obstructions
- Down spouts or runoff from driveways/other surfaces not directed towards the well

08/29/2014 10:05AM

Do Deeper Wells Mean Better Water Quality?

- Casing as important as well depth for determining where your water comes from
- Certain geology may make it difficult to obtain bacteria free water throughout the whole year



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
 - Cross connection
 - 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 or if new well is unlikely to remedy the problem because of geology, may seek approval for treatment.*



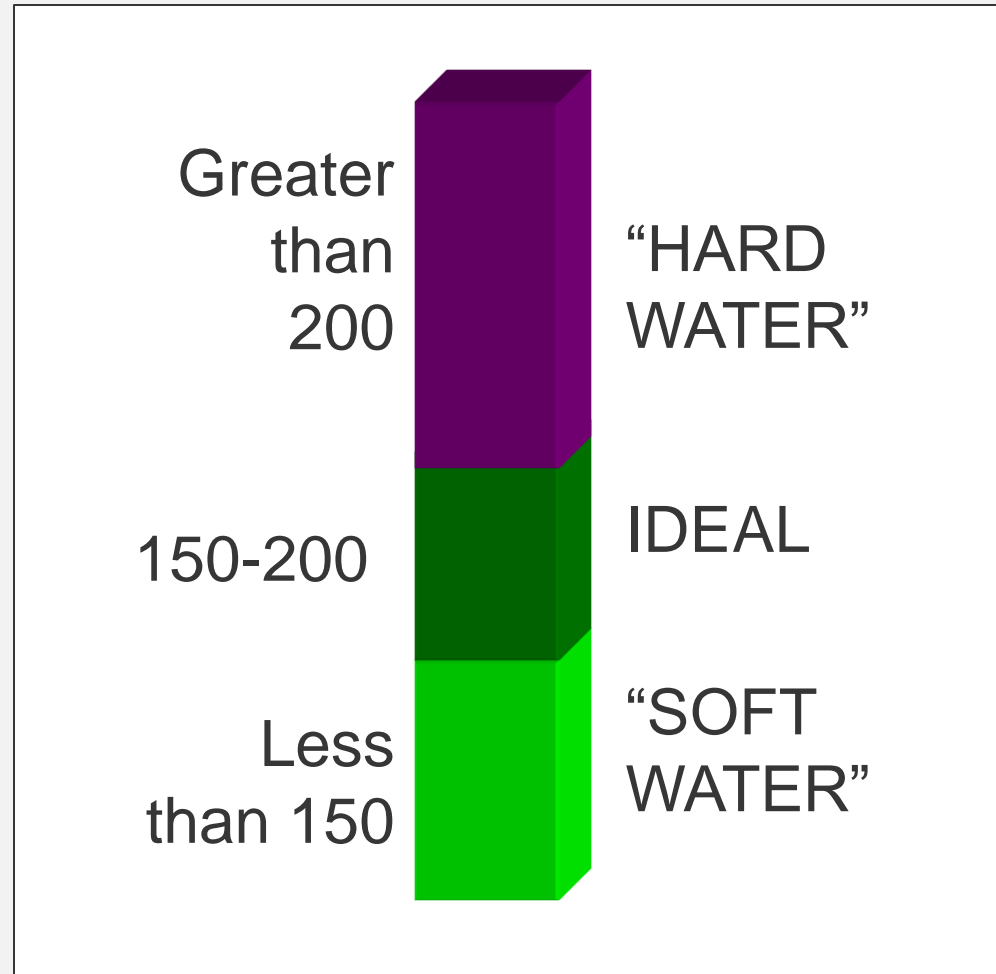
Rock and Soil Impacts on Water Quality

Tests for Aesthetic Problems

Hardness

- Natural (rocks and soils)
- Primarily calcium and magnesium

- Problems: scaling, scum, use more detergent, decrease water heater efficiency



Monroe County

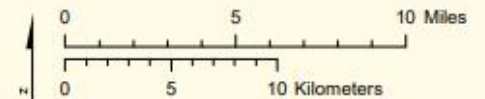
2020, 2021, 2023 & 2024



TOTAL HARDNESS (ppm CaCO₃)

A ... 50	115	33%
B 51 - 100	58	17%
C 101 - 200	93	27%
D 201 - 300	66	19%
E 301 - 400	11	3%
F 401 ...	5	1%

Mapped value is the average for the 1/4 1/4 section
Treated samples not mapped

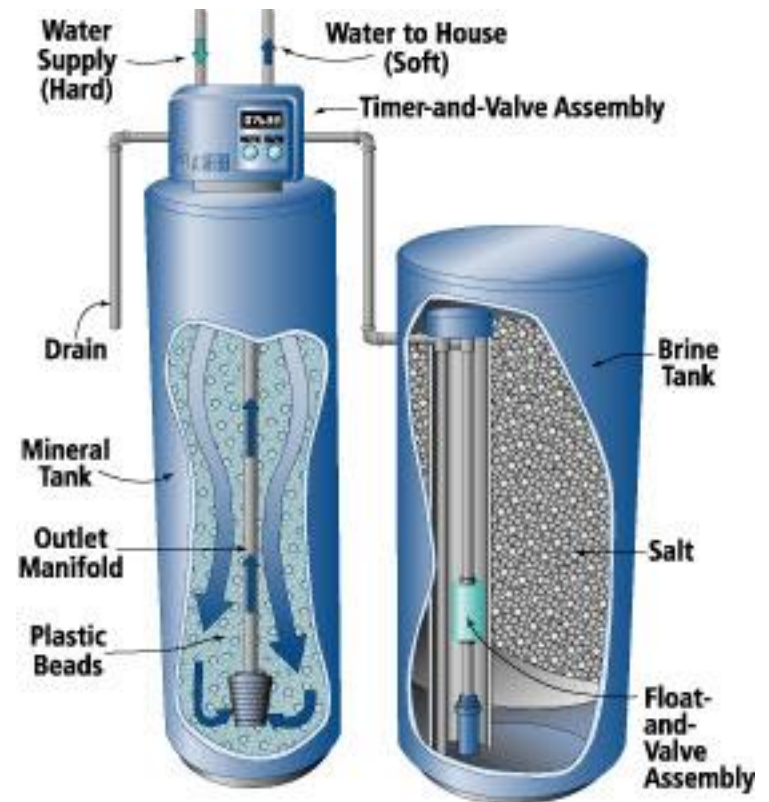


Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin - Stevens Point

Water Softening

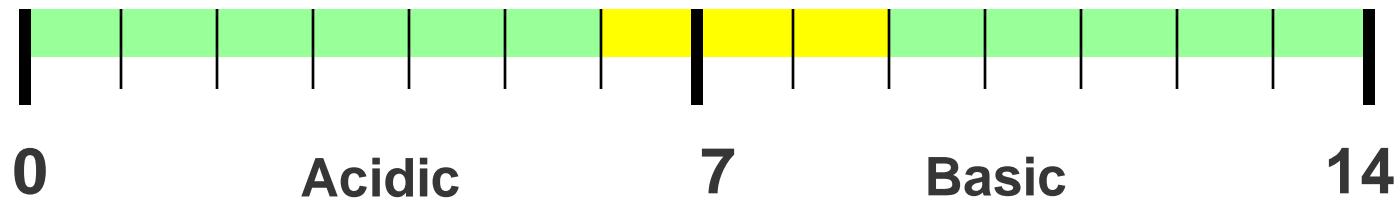
Water softeners remove calcium and magnesium which cause scaling and exchange it for sodium (or potassium).

- Negative: Increases sodium content of water.
- Suggestions:
 - Bypass your drinking water faucet.
 - Do not soften water for outdoor faucets.
 - If you are concerned about sodium levels – use potassium chloride softener salt.



Tests for Overall Water Quality

- **Alkalinity** – ability to neutralize acid
- **Conductivity** –
 - Measure of total ions
 - can be used to indicate presence of contaminants (~ twice the hardness)
- **pH** – Indicates water's acidity and helps determine if water will corrode plumbing



Monroe County

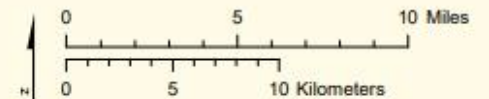
2020, 2021, 2023 & 2024



ALKALINITY (ppm CaCO₃)

A	... 50	137	39 %
B	51 - 100	53	15 %
C	101 - 200	102	29 %
D	201 - 300	47	14 %
E	301 - 400	8	2 %
F	401 ...	1	<1 %

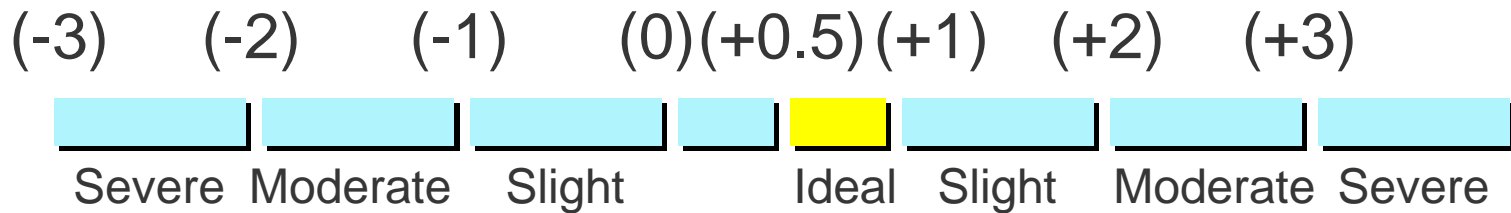
Mapped value is the average for the 1/4 1/4 section
Treated samples not mapped



Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin - Stevens Point

Tests for Overall Water Quality

Saturation Index



Corrosion occurs



Scaling occurs



Monroe County

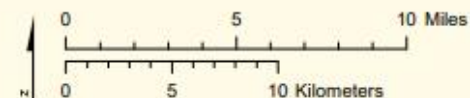
2020, 2021, 2023 & 2024



SI (Saturation Index)

A	... -3.0	66	19%
B	-2.9 - -2.0	51	15%
C	-1.9 - -1.0	55	16%
D	-0.9 - 0.0	69	20%
E	0.1 - 1.0	107	31%
F	1.1 ...	0	0%

Mapped value is the average for the 1/4 1/4 section
Treated samples not mapped



Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin-Stevens Point

Test Important to Health

Copper

- **Sources:** Copper water pipes
- **Standard:** Less than 1.3 mg/L is suitable for drinking

Health Effects:

- Some copper is needed for good health
- Too much may cause problems:
 - Stomach cramps, diarrhea,
 - vomiting, nausea
 - Formula intolerance in infants



Test Important to Health

Lead

Sources: Lead solder joining copper pipes (pre-1985) or brass fixtures

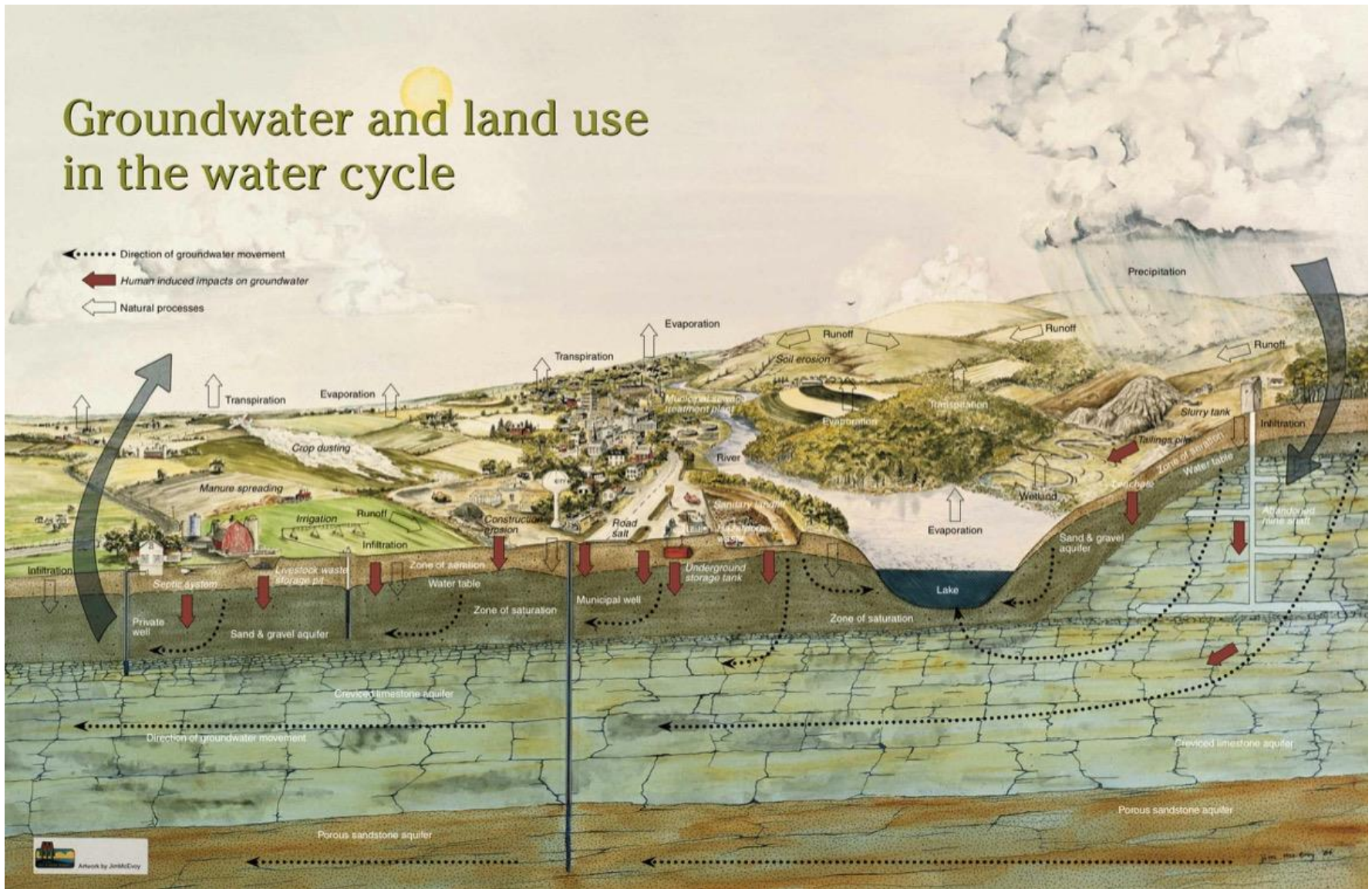
Standard: 0.015 mg/L (15 ppb)

Health Effects:

- Young children, infants and unborn children are particularly vulnerable.
- Lead may damage the brain, kidneys, nervous system, red blood cells, reproductive system.



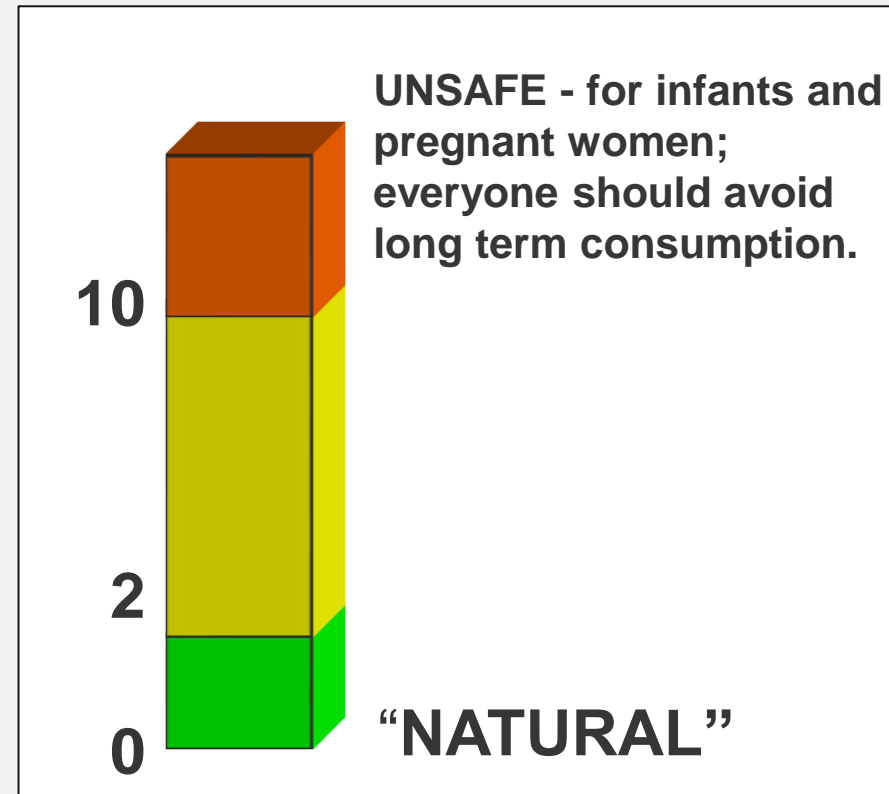
Groundwater and land use in the water cycle



Test Important to Health

Nitrate Nitrogen

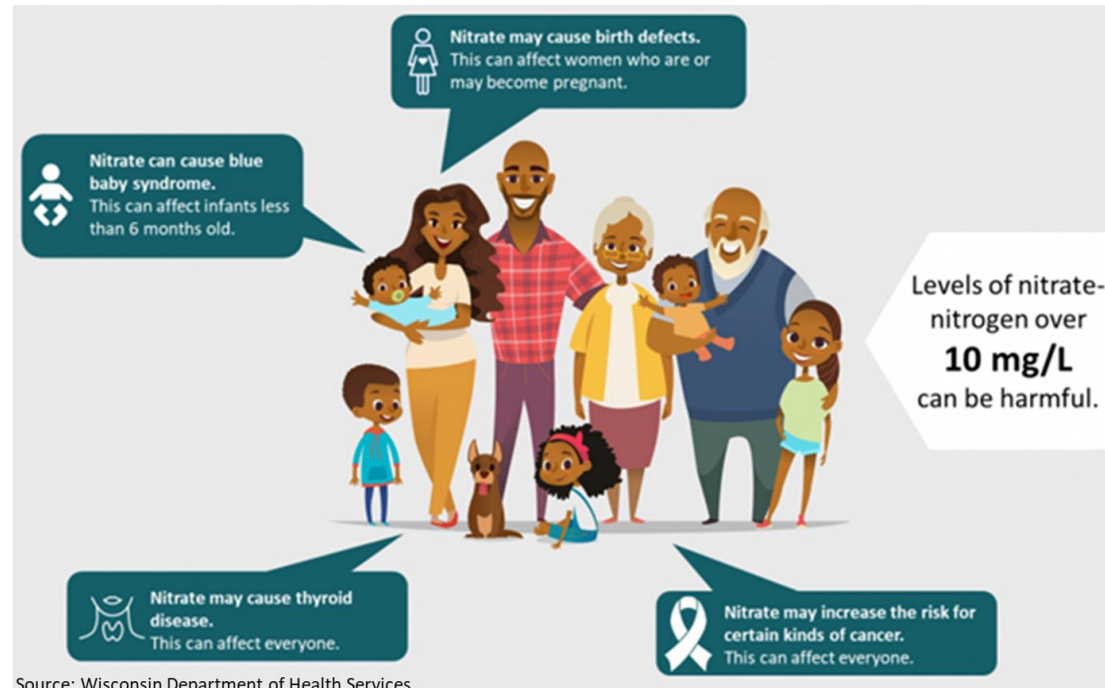
- **Greater than 10 mg/L**
Exceeds State and Federal Limits for Drinking Water
- **Between 2 and 10 mg/L**
Some Human Impact
- **Less than 2.0 mg/L**
“Transitional”
- **Less than 0.2 mg/L**
“Natural”



Nitrate-Nitrogen

Health Effects:

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



Source: Wisconsin Department of Health Services

Sources:

- Agricultural fertilizer
- Lawn fertilizer
- Septic systems
- Animal wastes



Monroe County

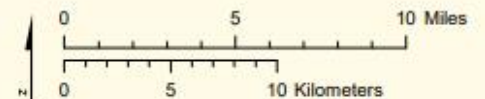
2020, 2021, 2023 & 2024



NITRATE-NITRITE (ppm N)

A	None Detected	23	7 %
B	... 2.0	116	33 %
C	2.1 - 5.0	91	26 %
D	5.1 - 10.0	89	26 %
E	10.1 - 20.0	20	6 %
F	20.1 ...	9	3 %

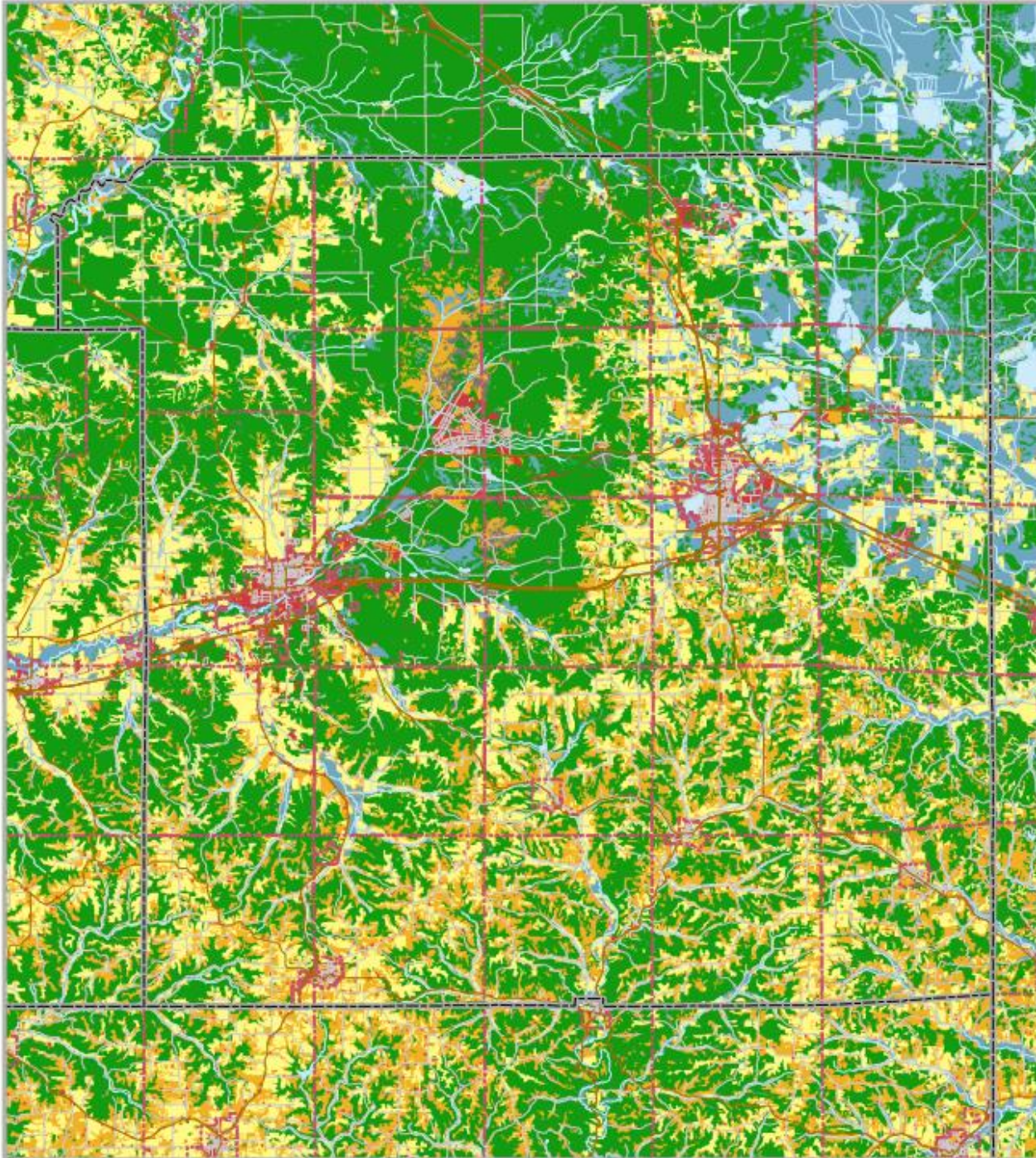
Mapped value is the average for the 1/4 1/4 section
Treated samples not mapped



Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin-Stevens Point

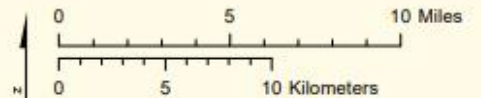
Monroe County

2020, 2021 & 2023



Land Use:

-  Urban
-  Agriculture
-  Forest
-  Shrub-Grass
-  Wetland
-  Water
-  Barren



Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin - Stevens Point

What can I do to reduce my nitrate levels?

Solution:

- **Eliminate contamination source or reduce nitrogen inputs**

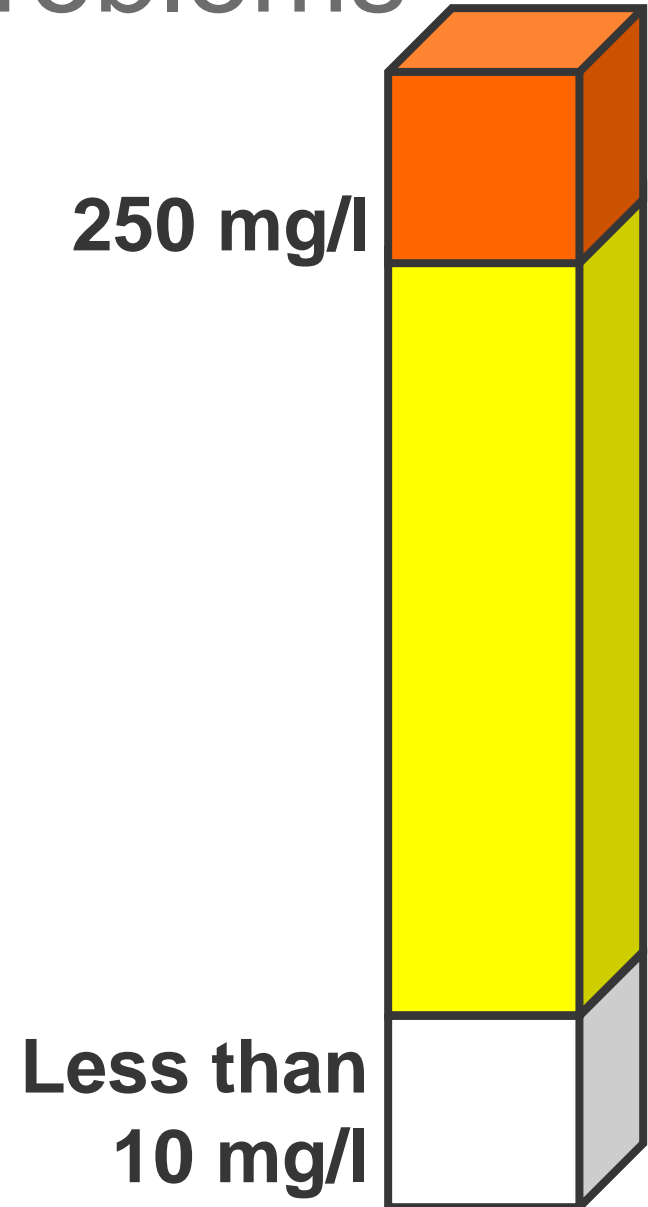
Short term:

- **Change well depth or relocate well**
- **Carry or buy water**
- **Water treatment devices**
 - **Reverse osmosis**
 - **Distillation**
 - **Anion exchange**

Tests for Aesthetic Problems

Chloride

- Greater than 250 mg/l
 - No direct effects on health
 - Salty taste
 - Exceeds recommended level
- Greater than 10 mg/l may indicate human impact
- Less than 10 mg/l considered “natural” in much of WI
- **Sources:** Fertilizers, Septic Systems and Road Salt



Monroe County

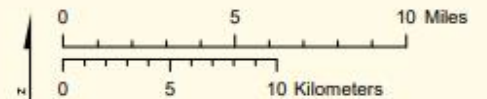
2020, 2021, 2023 & 2024



CHLORIDE (ppm)

A None Detected	6	2%
B ... 10	198	57%
C 11 - 50	125	36%
D 51 - 100	14	4%
E 101 - 200	5	1%
F 201 ...	0	0%

Mapped value is the average for the 1/4 1/4 section
Treated samples not mapped



Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin - Stevens Point

Operating your private water utility:

- ***Periodically inspect and maintain*** the area around your well
- ***Test your water regularly*** to evaluate common water quality concerns
- ***If necessary, take corrective actions****



*Know when to call a licensed well driller or pump installer

Recommendations for testing private wells

1. Bacteria

Every well should be tested once a year, and when you notice a change in taste, color, or smell.

2. Nitrate

Every well should be tested once a year, and before the well will be used by a woman who is or may become pregnant.

3. Arsenic

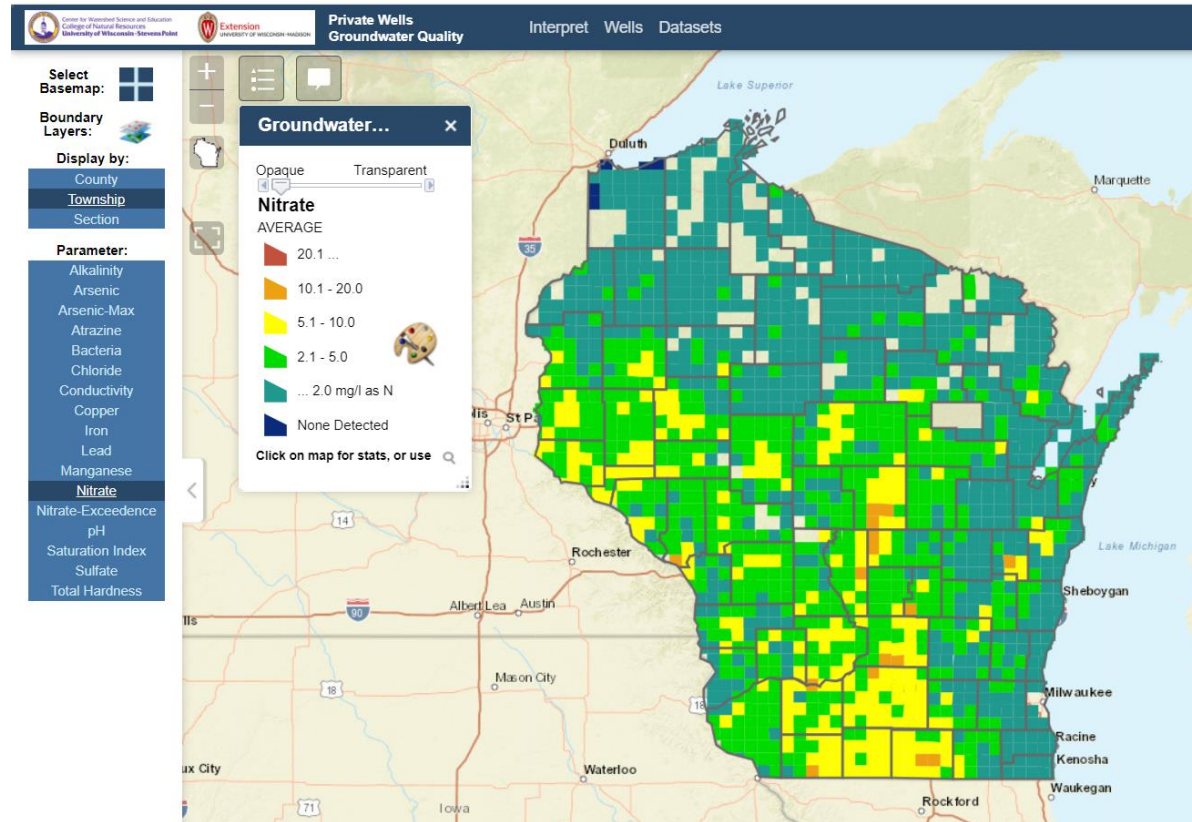
Every well should be tested once. If arsenic was present in previous tests, you should test once a year.

You may consider additional testing to look for:

- Naturally occurring contaminants in the rock and soil that may enter your well (ex. Manganese)
- Human caused contaminants from land-use, your plumbing materials, or other sources of pollution near your well (pesticides, PFAS, lead/copper etc.)

WI Well Water Viewer

- Find out more about well water quality in your area
- Interactive online dashboard



**Thanks to you and the following for helping sponsor
this program:**

- **Monroe County**
- **Monroe County Land Conservation Department**
- **Monroe County Health Department**

Contact Info:

Kevin Masarik, Center for Watershed Science and Education

800 Reserve St., Stevens Point, WI 54481

715-346-4276, kmasarik@uwsp.edu

www.uwsp.edu/cnr/watersheds



Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin - Stevens Point



Extension
UNIVERSITY OF WISCONSIN-MADISON