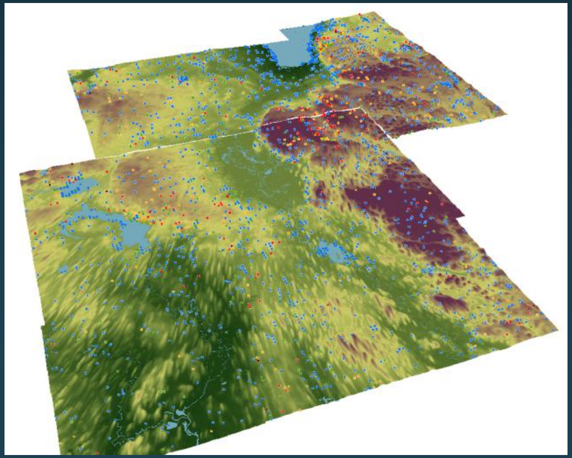
Community Drinking Water Education Program



Kevin Masarik

Today’s presentation

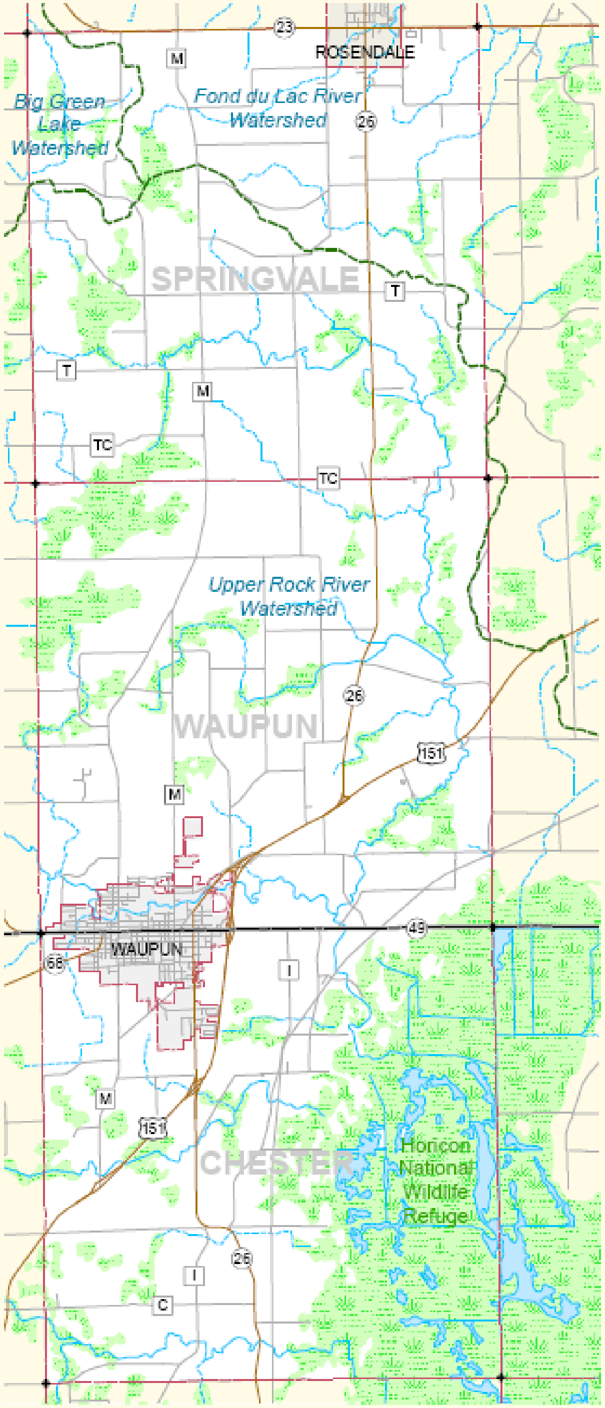
- Groundwater and water well basics
- What do my individual test results mean?
- General groundwater quality in the Towns of Chester, Springvale and Waupun
- Improving your water quality

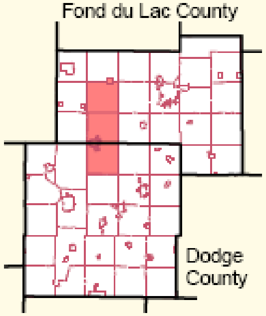
Springvale
Waupun
Chester

Fond du Lac County

Dodge County

November 2008





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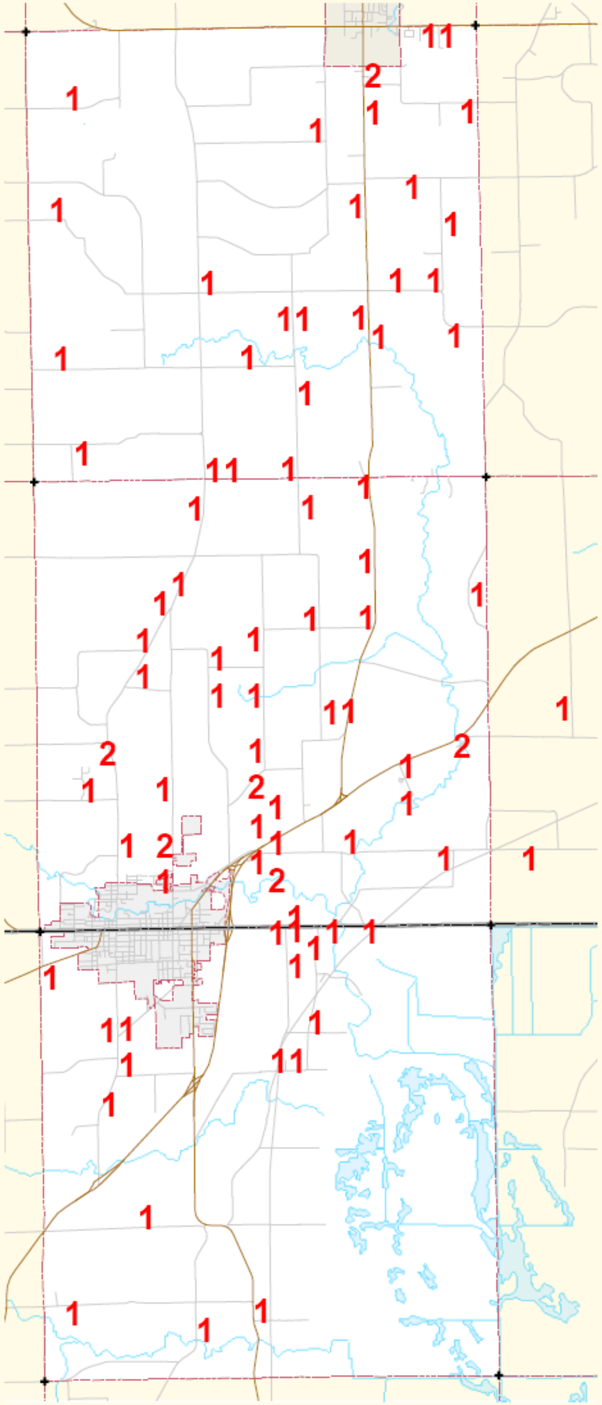
Center for Watershed Science and Education

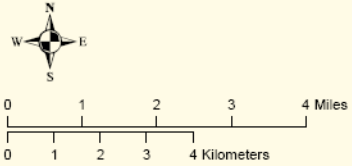


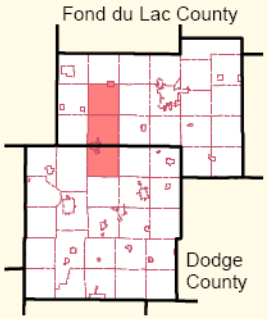
Springvale **Fond du Lac County**
Waupun
Chester **Dodge County**

November 2008

SAMPLE DISTRIBUTION

NUMBER OF SAMPLES per 1/4 1/4 SECTION





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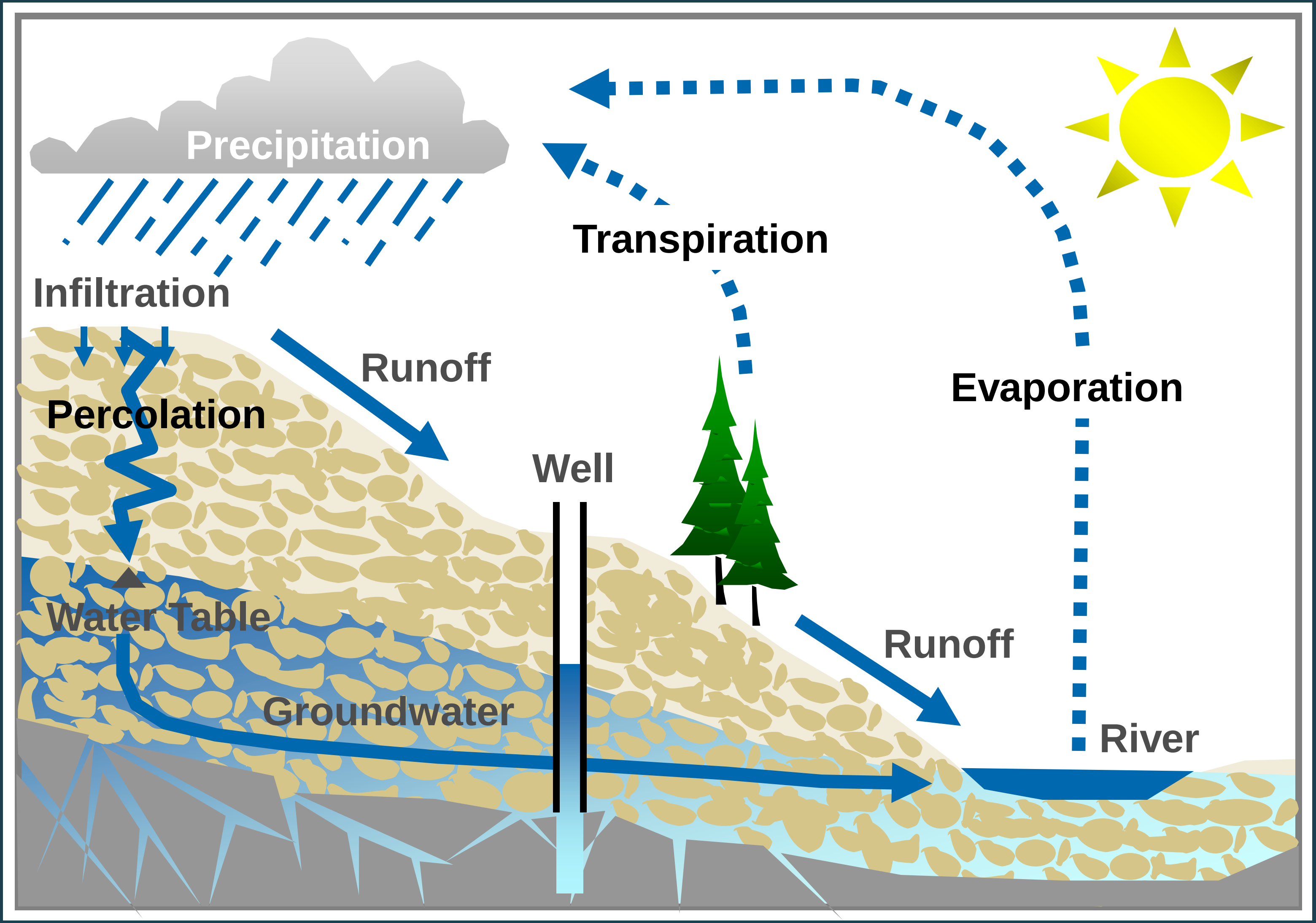
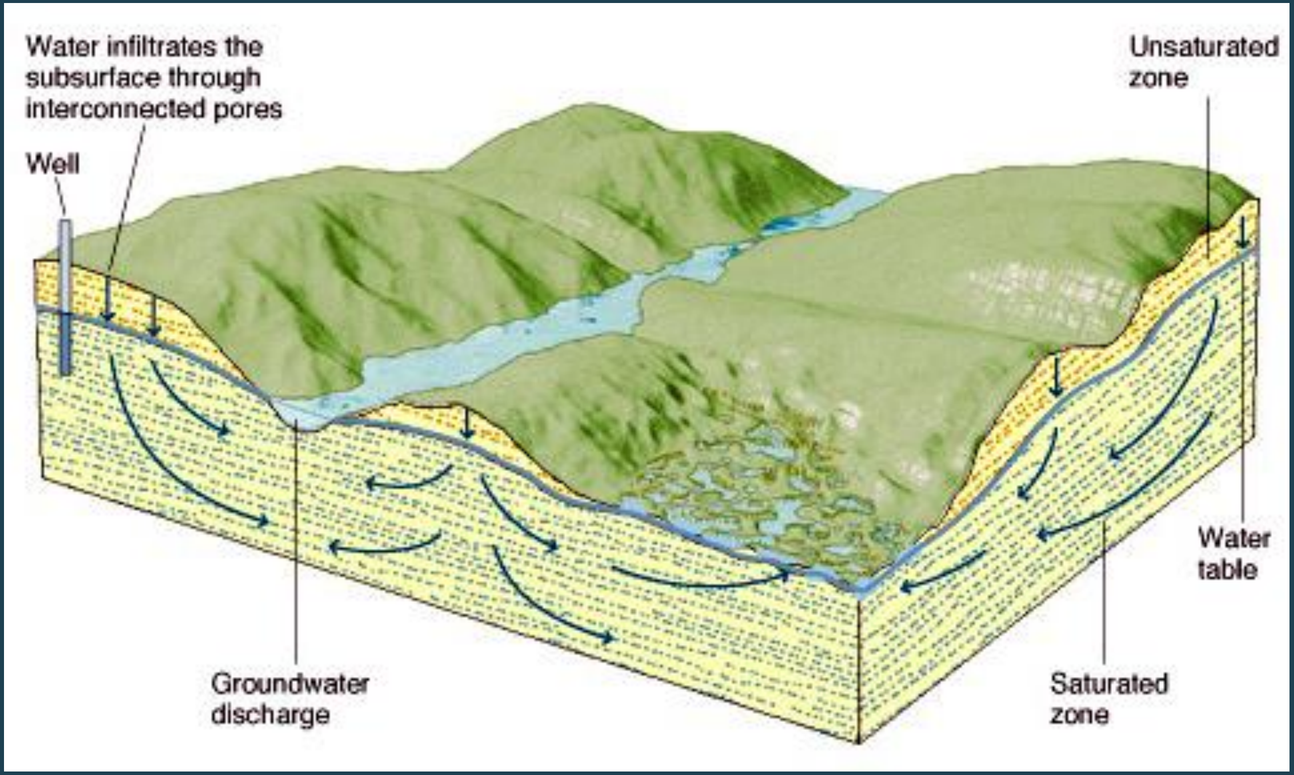
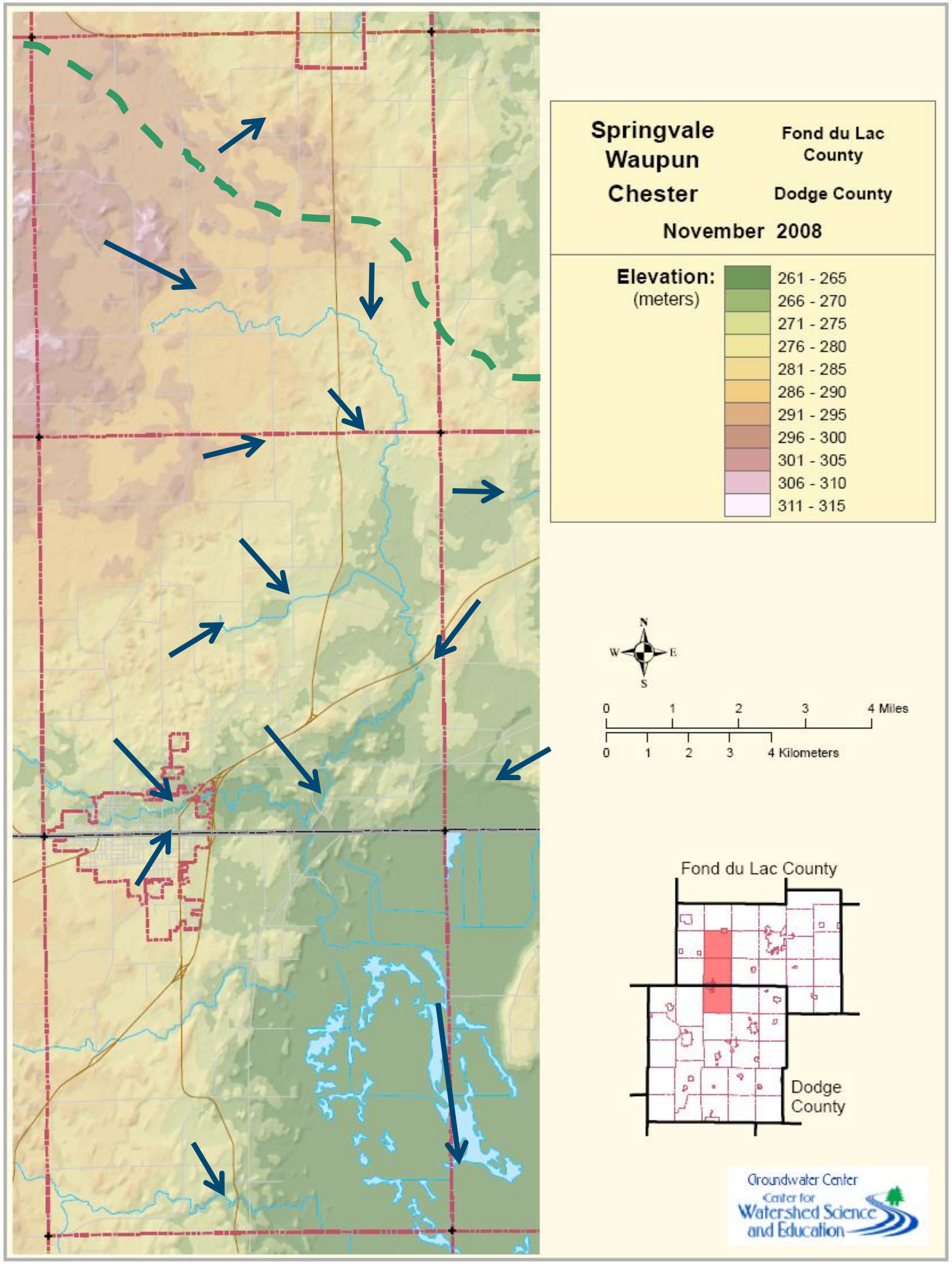
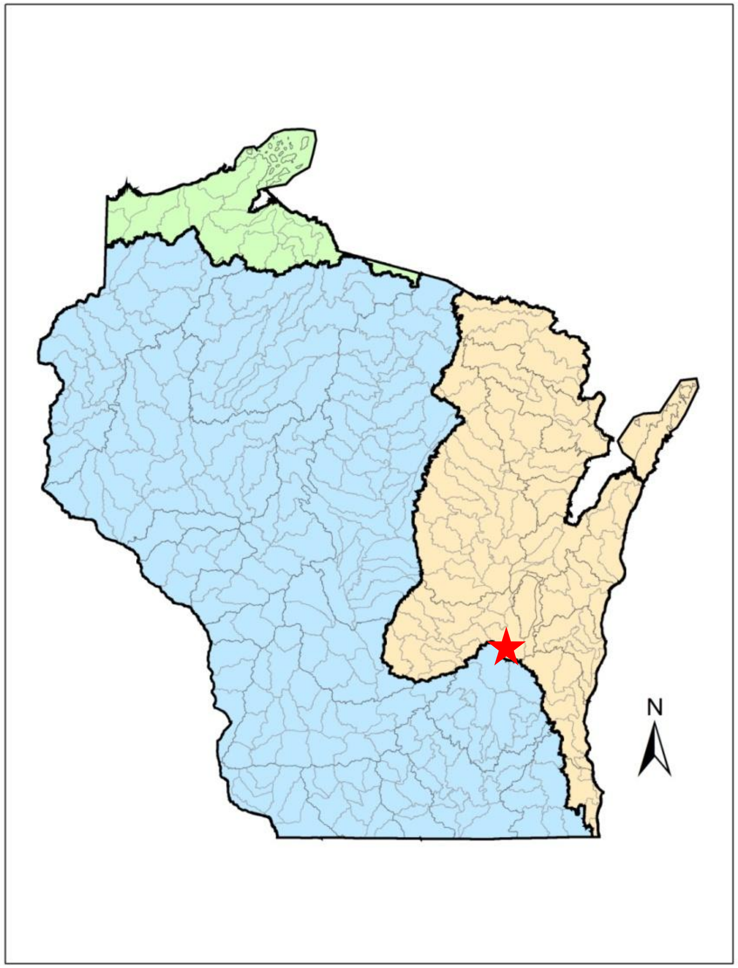
The Water Cycle

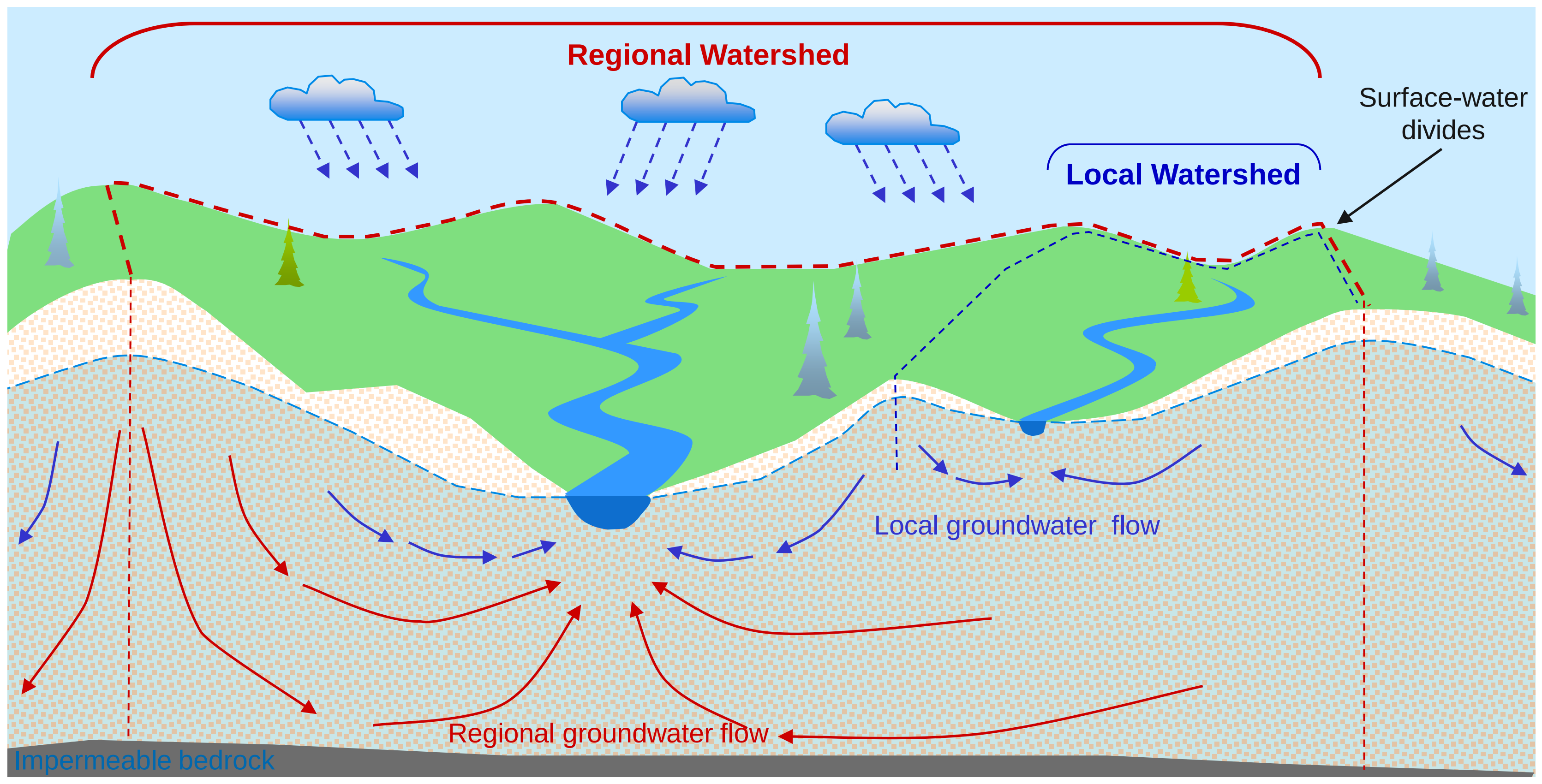


Groundwater Movement



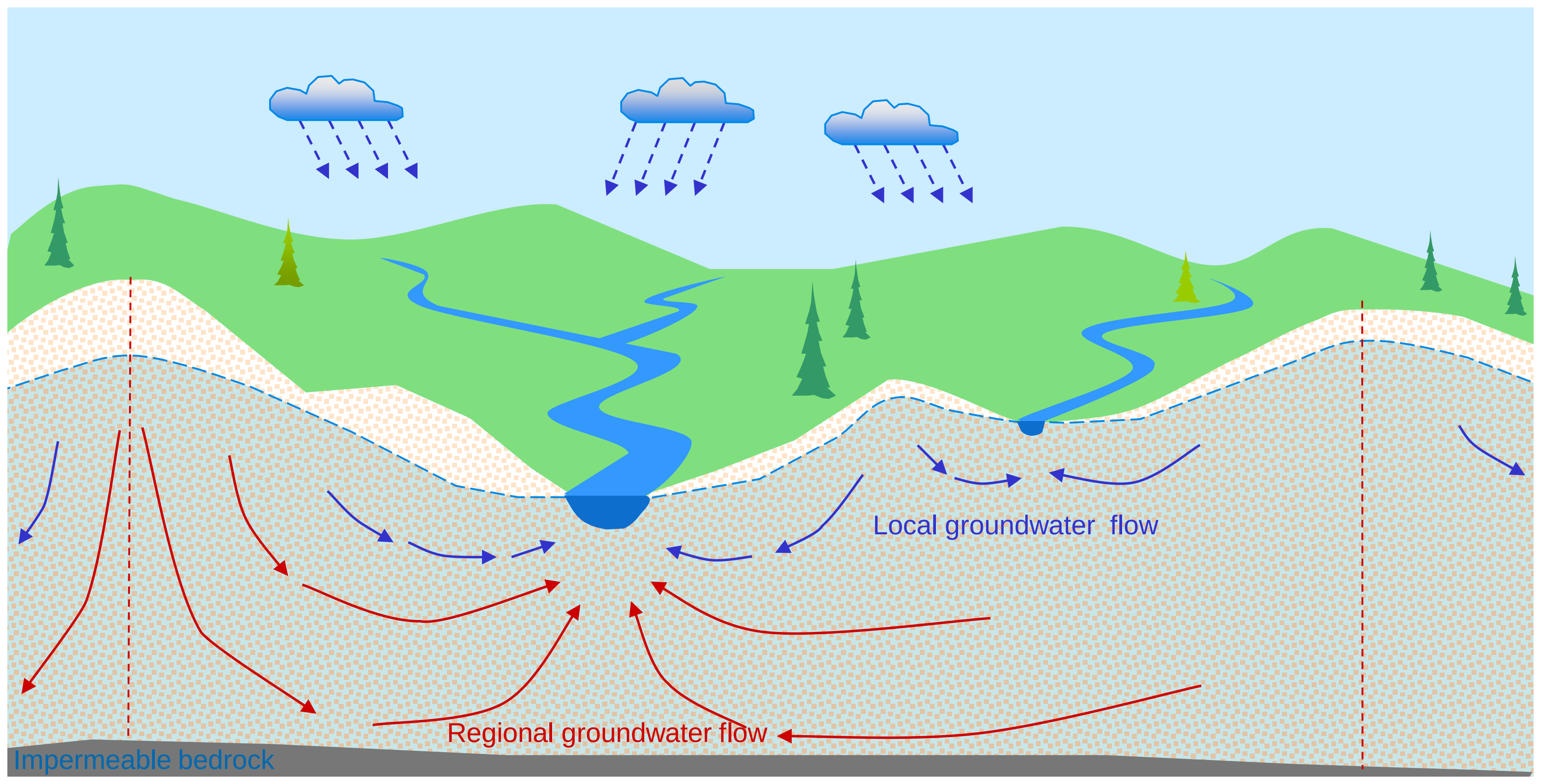

Springvale
Waupun
Chester
Fond du Lac County
Dodge County
November 2008
Elevation: (meters)
261 - 265
266 - 270
271 - 275
276 - 280
281 - 285
286 - 290
291 - 295
296 - 300
301 - 305
306 - 310
311 - 315
N
W
E
S
0 1 2 3 4 Miles
0 1 2 3 4 Kilometers
Fond du Lac County
Dodge County
Groundwater Center
Center for Watershed Science and Education


N

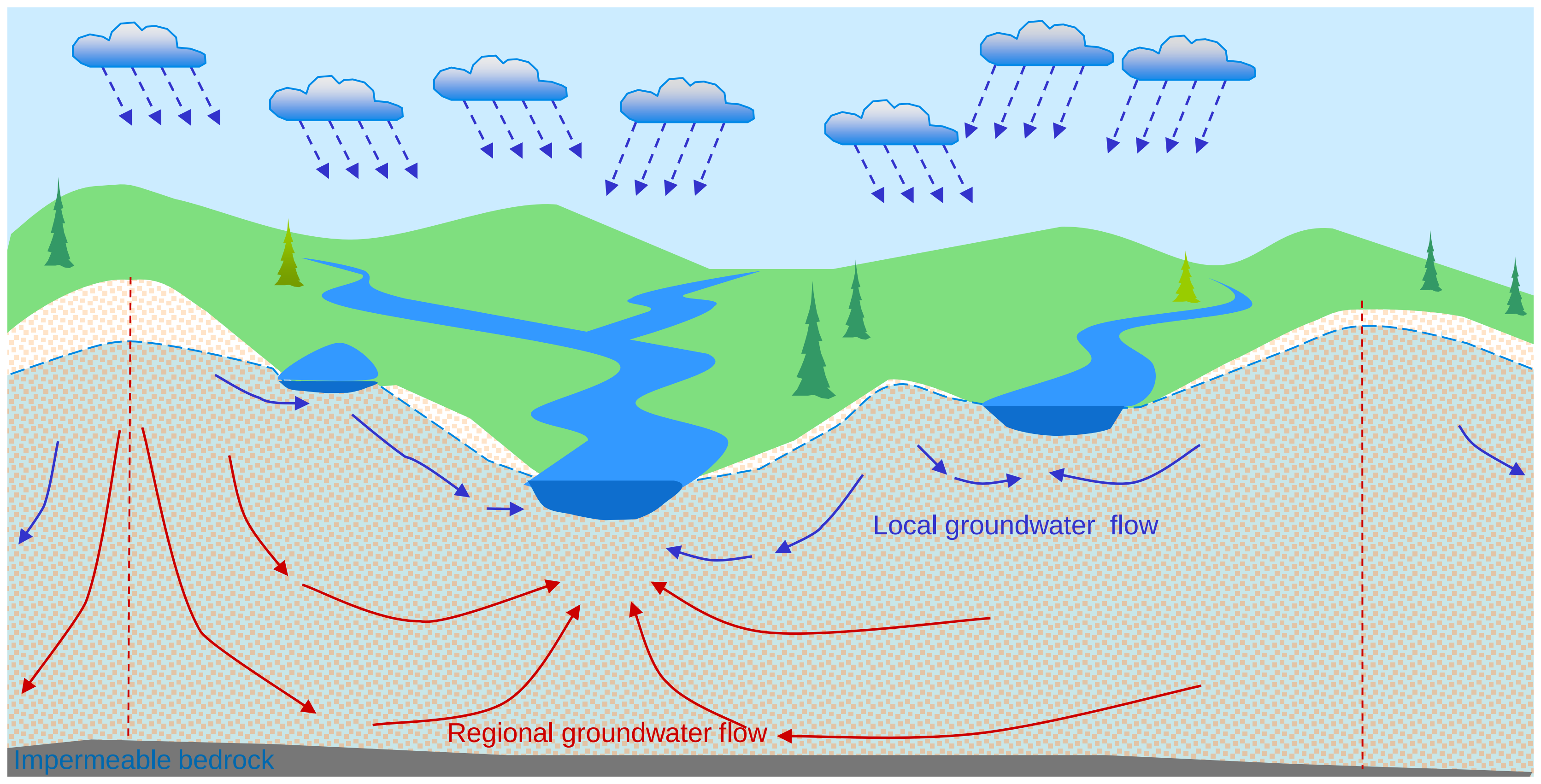


- Water converges at discharge locations
- Rivers and streams act like a drain for water to exit a watershed

What happens when we have more rain?

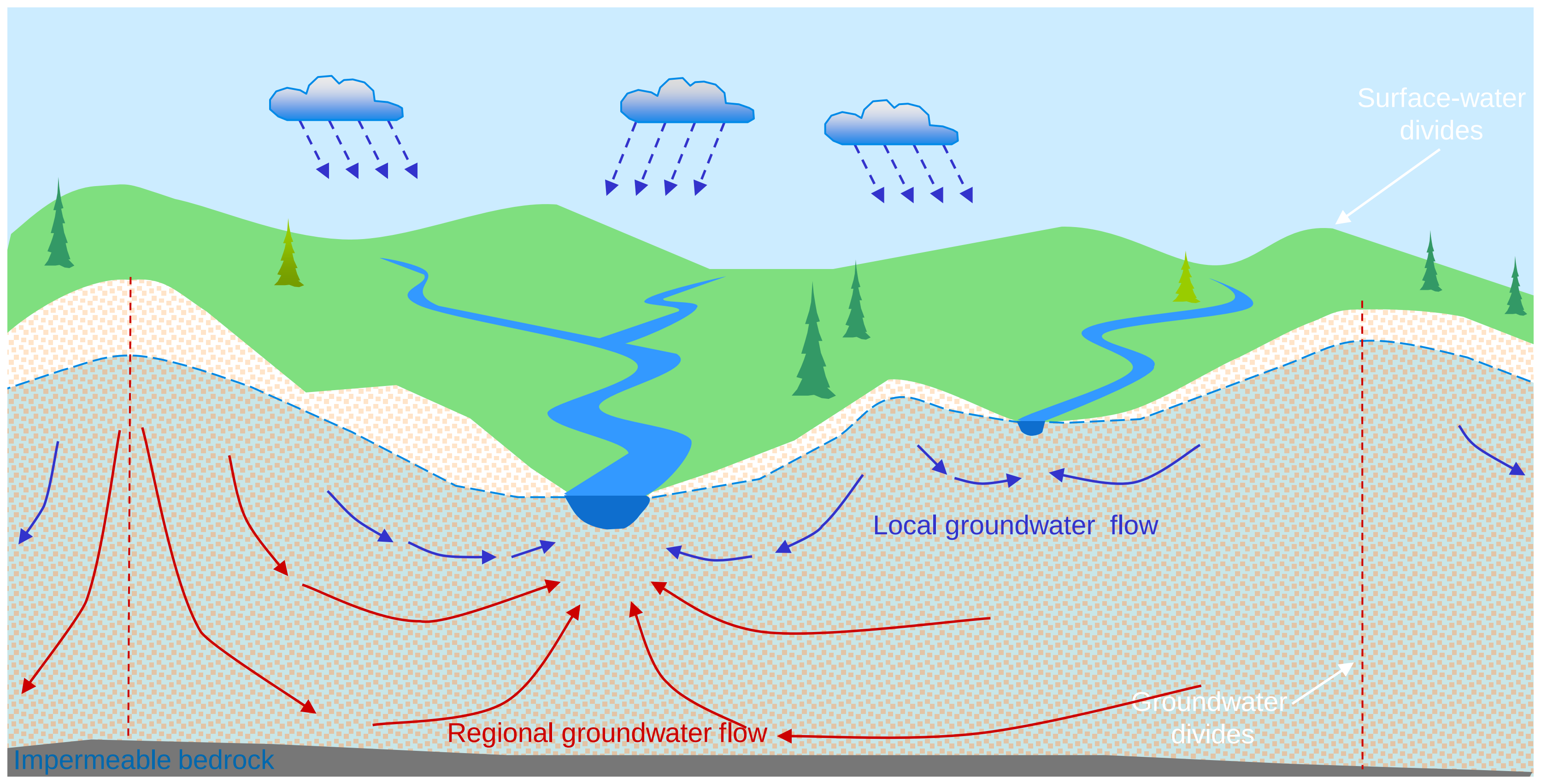


What happens when we have more rain?

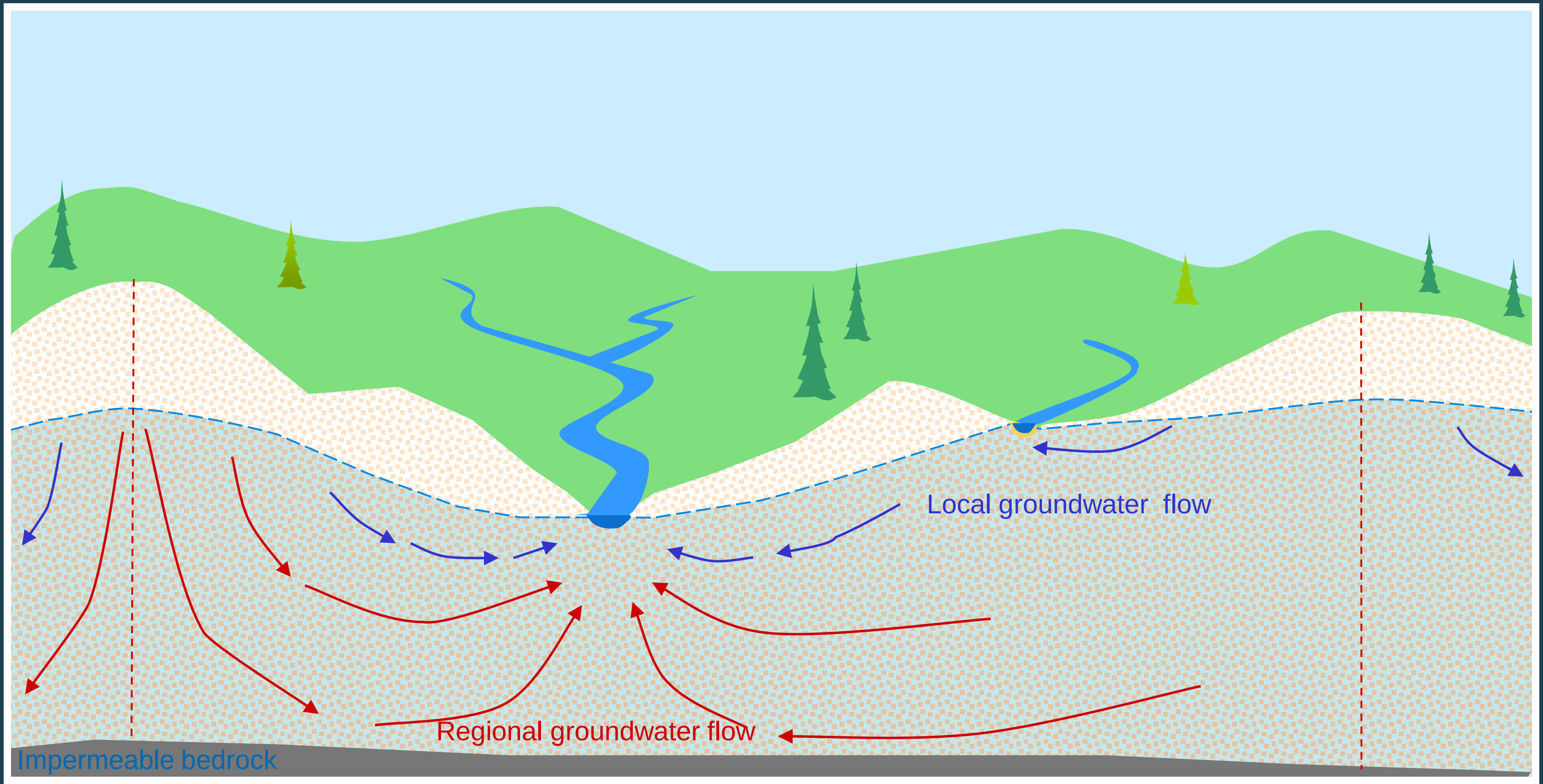


- More infiltration
- Groundwater levels rise
- More water in rivers, lakes and streams

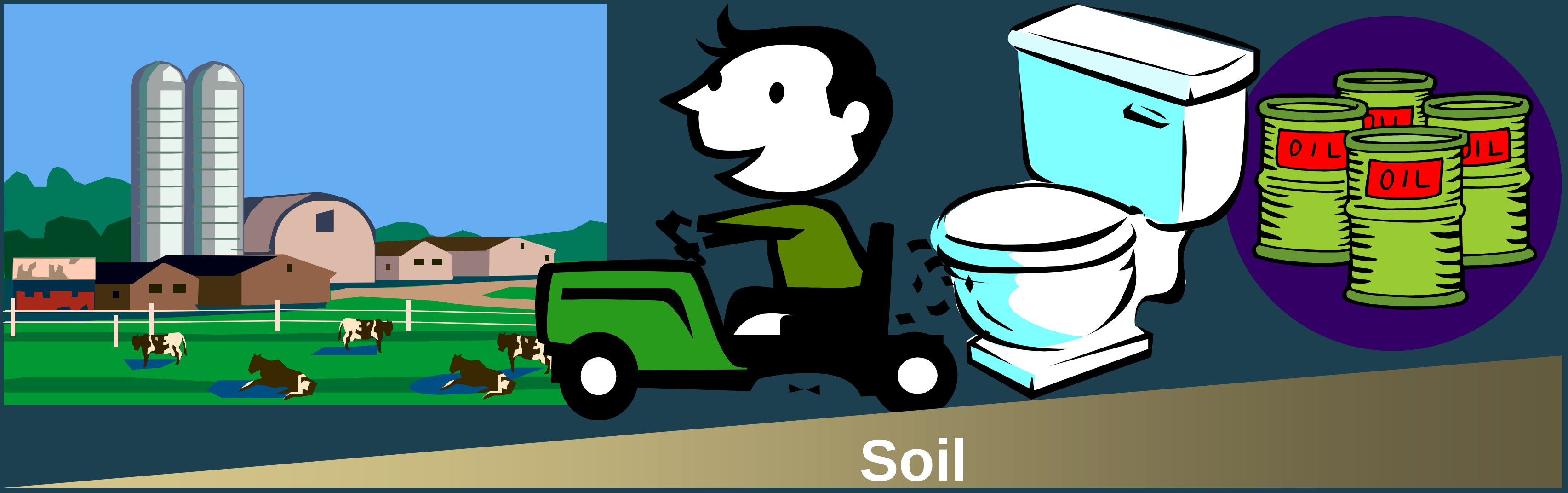
What happens when we have less rain?



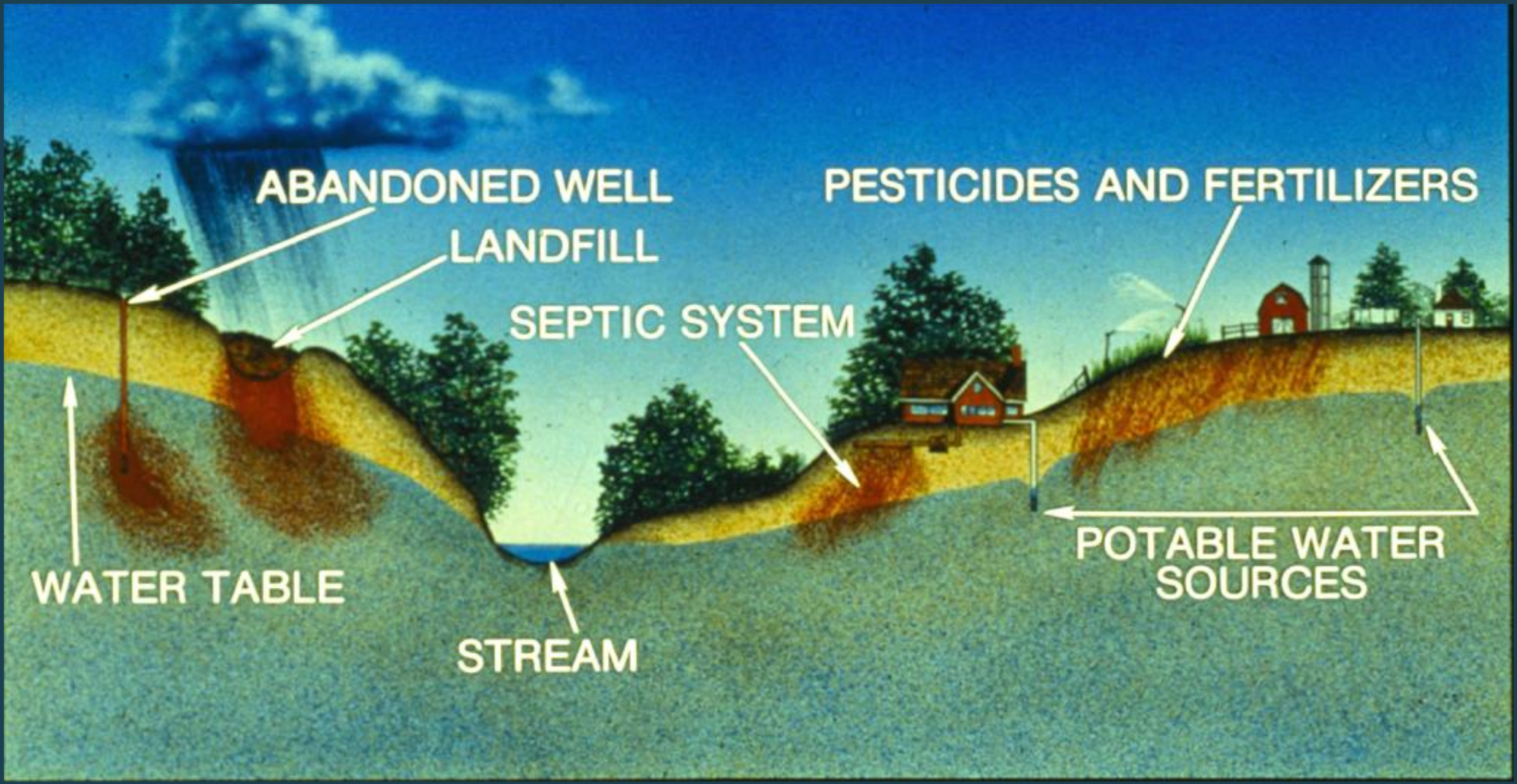
What happens when we have more rain?



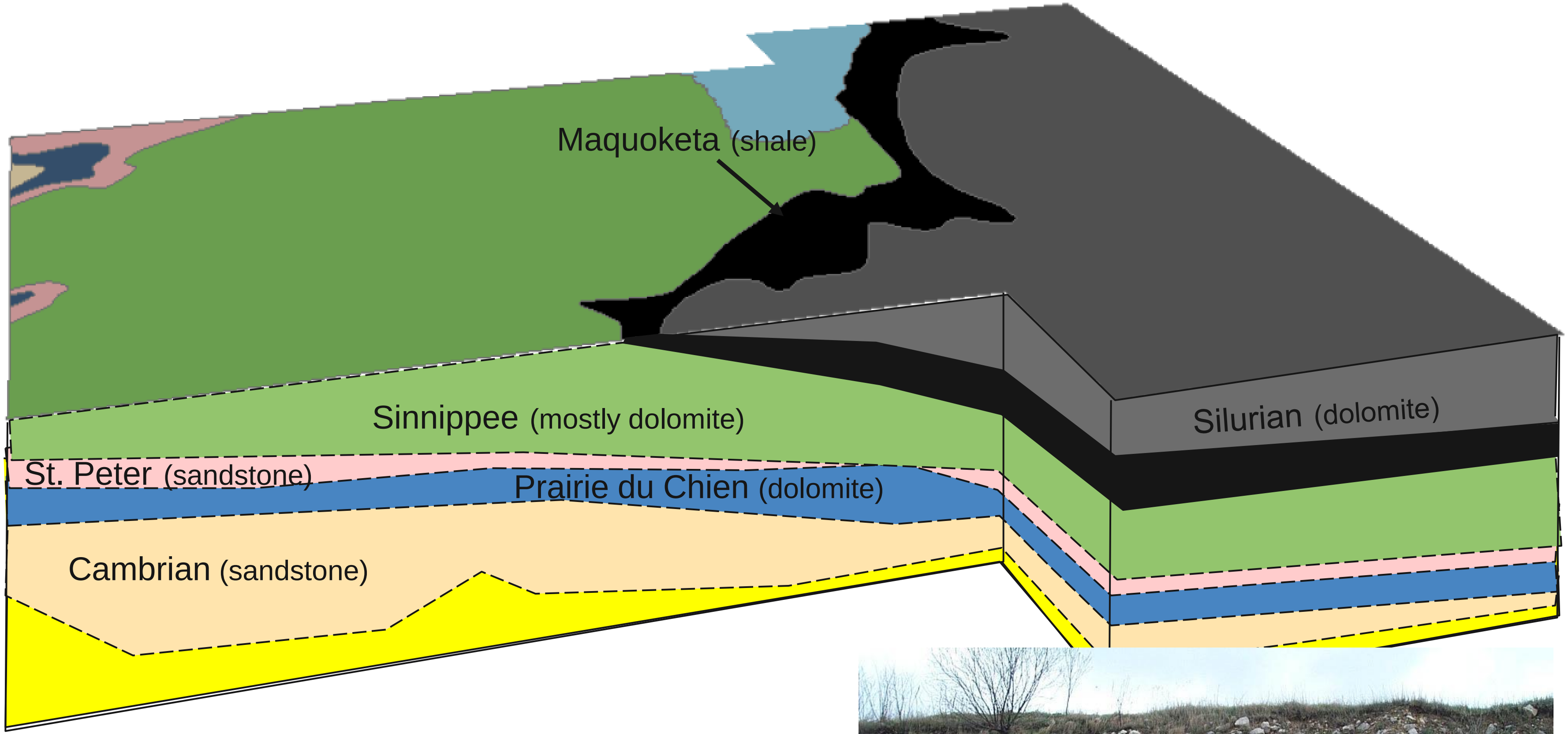
- Less infiltration
- Groundwater levels start to go down
- Less water in rivers, lakes and streams


OIL
OIL
OIL
OIL

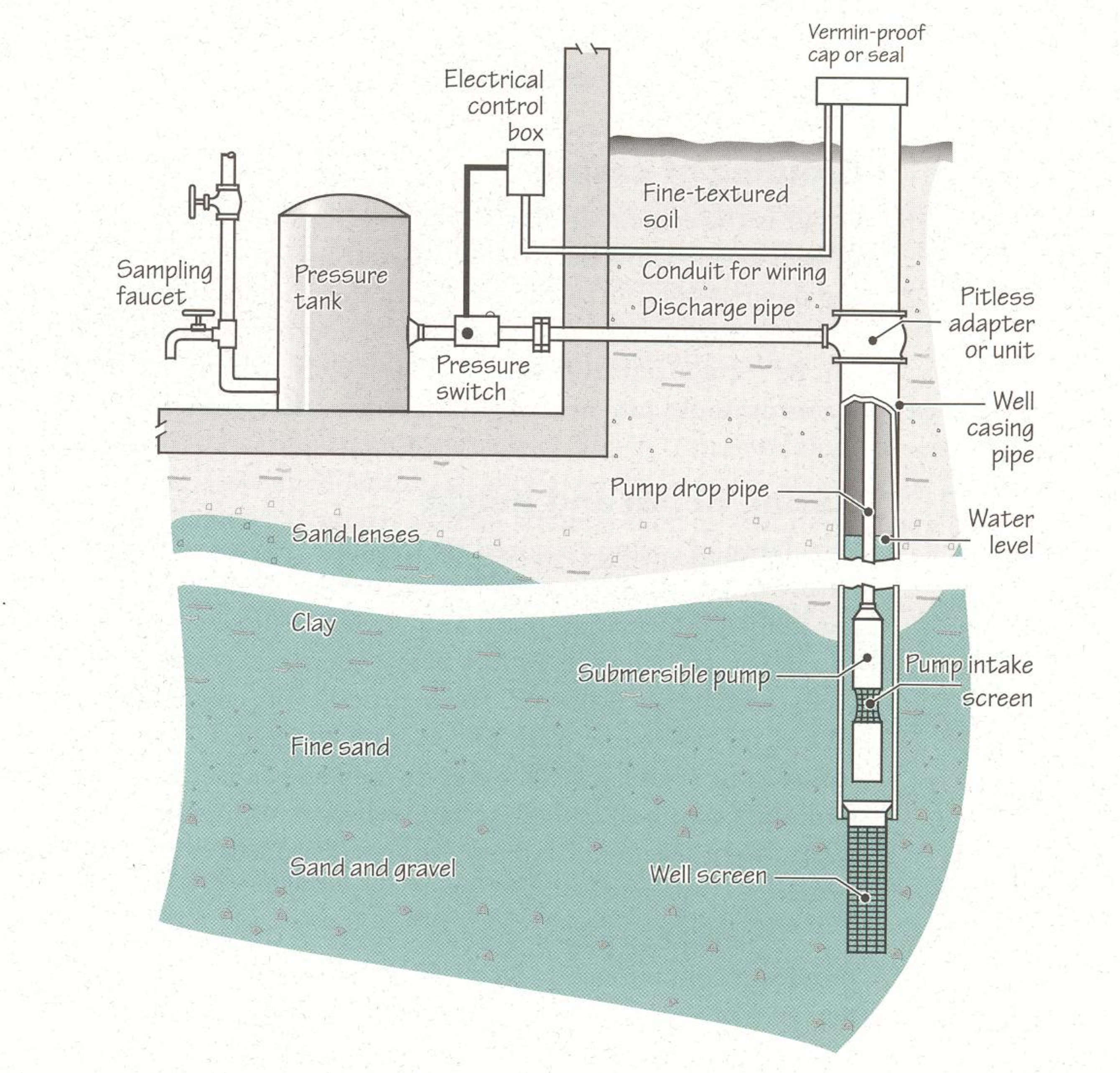
Soil

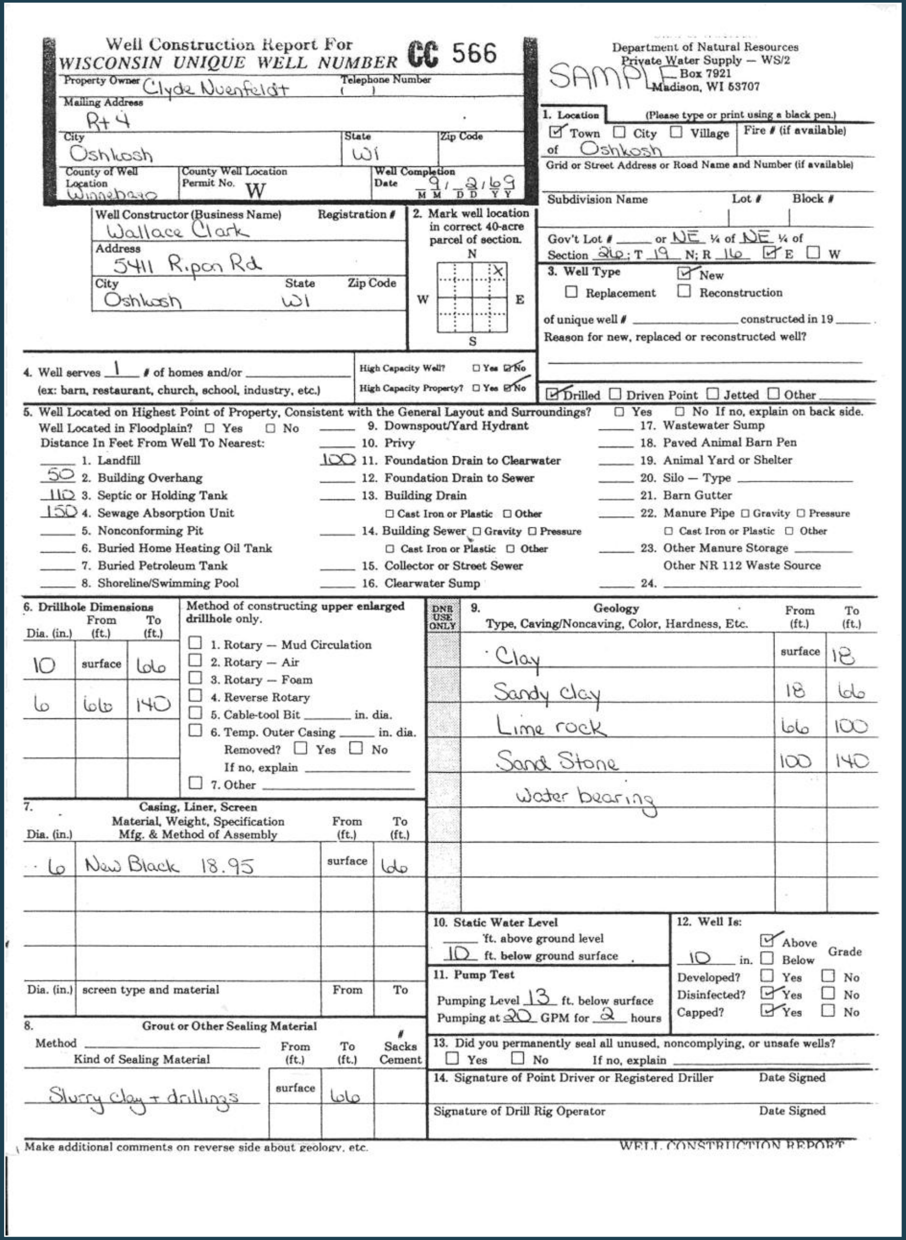

ABANDONED WELL
LANDFILL
SEPTIC SYSTEM
PESTICIDES AND FERTILIZERS
WATER TABLE
STREAM
POTABLE WATER SOURCES

Fond du Lac County Geology



Not to scale


Vermin-proof cap or seal
Electrical control box
Fine-textured soil
Sampling faucet
Pressure tank
Conduit for wiring
Discharge pipe
Pitless adapter or unit
Pressure switch
Well casing pipe
Pump drop pipe
Water level
Sand lenses
Clay
Submersible pump
Pump intake screen
Fine sand
Sand and gravel
Well screen



Well Construction Report For
WISCONSIN UNIQUE WELL NUMBER **CC** 566

Property Owner Clyde Nuenfeldt
Telephone Number ( )
Mailing Address Rt 4
City Oshkosh
State WI
Zip Code
County of Well Location Winnebago
County Well Location Permit No. W
Well Completion Date 9 / 2 / 69 (M M / D D / Y Y)

Well Constructor (Business Name) Wallace Clark
Registration #
Address 5411 Ripon Rd
City Oshkosh
State WI
Zip Code

2. Mark well location in correct 40-acre parcel of section.
N
W E
S
X

SAMPLE

Department of Natural Resources
Private Water Supply — WS/2
Box 7921
Madison, WI 53707

1. Location (Please type or print using a black pen.)
☑ Town ☐ City ☐ Village of Oshkosh
Fire # (if available)
Grid or Street Address or Road Name and Number (if available)
Subdivision Name
Lot #
Block #
Gov't Lot # ____ or NE ¼ of NE ¼ of Section 26; T 19 N; R 16 ☑ E ☐ W

3. Well Type ☑ New ☐ Replacement ☐ Reconstruction
of unique well # ____________ constructed in 19 ____.
Reason for new, replaced or reconstructed well?

☑ Drilled ☐ Driven Point ☐ Jetted ☐ Other ______

4. Well serves 1 # of homes and/or ____________
(ex: barn, restaurant, church, school, industry, etc.)
High Capacity Well? ☐ Yes ☑ No
High Capacity Property? ☐ Yes ☑ No

5. Well Located on Highest Point of Property, Consistent with the General Layout and Surroundings? ☐ Yes ☐ No If no, explain on back side.
Well Located in Floodplain? ☐ Yes ☐ No
Distance In Feet From Well To Nearest:

___ 1. Landfill
50 2. Building Overhang
110 3. Septic or Holding Tank
150 4. Sewage Absorption Unit
___ 5. Nonconforming Pit
___ 6. Buried Home Heating Oil Tank
___ 7. Buried Petroleum Tank
___ 8. Shoreline/Swimming Pool
___ 9. Downspout/Yard Hydrant
___ 10. Privy
100 11. Foundation Drain to Clearwater
___ 12. Foundation Drain to Sewer
___ 13. Building Drain ☐ Cast Iron or Plastic ☐ Other
___ 14. Building Sewer ☐ Gravity ☐ Pressure ☐ Cast Iron or Plastic ☐ Other
___ 15. Collector or Street Sewer
___ 16. Clearwater Sump
___ 17. Wastewater Sump
___ 18. Paved Animal Barn Pen
___ 19. Animal Yard or Shelter
___ 20. Silo — Type ______
___ 21. Barn Gutter
___ 22. Manure Pipe ☐ Gravity ☐ Pressure ☐ Cast Iron or Plastic ☐ Other
___ 23. Other Manure Storage ______ Other NR 112 Waste Source
___ 24. ______

6. Drillhole Dimensions

Dia. (in.)	From (ft.)	To (ft.)
10	surface	66
6	66	140

Method of constructing upper enlarged drillhole only.
☐ 1. Rotary — Mud Circulation
☐ 2. Rotary — Air
☐ 3. Rotary — Foam
☐ 4. Reverse Rotary
☐ 5. Cable-tool Bit ______ in. dia.
☐ 6. Temp. Outer Casing ____ in. dia. Removed? ☐ Yes ☐ No If no, explain ______
☐ 7. Other ______

7. Casing, Liner, Screen

Dia. (in.)	Material, Weight, Specification Mfg. & Method of Assembly	From (ft.)	To (ft.)
6	New Black 18.95	surface	66
Dia. (in.)	screen type and material	From	To

9. Geology

DNR USE ONLY	Type, Caving/Noncaving, Color, Hardness, Etc.	From (ft.)	To (ft.)
	Clay	surface	18
	Sandy clay	18	66
	Lime rock	66	100
	Sand Stone	100	140
	Water bearing		

8. Grout or Other Sealing Material
Method ______

Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
Slurry clay + drillings	surface	66	

10. Static Water Level
___ ft. above ground level
10 ft. below ground surface

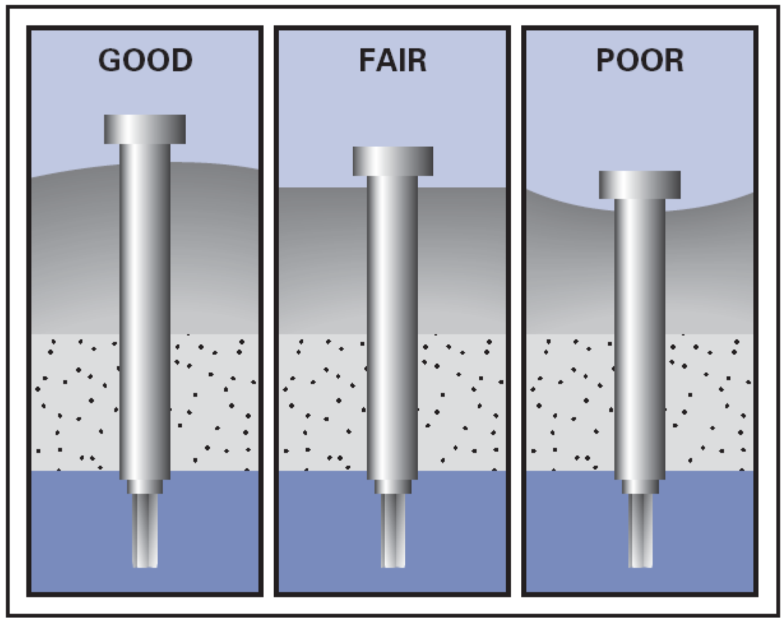
11. Pump Test
Pumping Level 13 ft. below surface
Pumping at 20 GPM for 2 hours

12. Well Is:
10 in. ☑ Above ☐ Below Grade
Developed? ☐ Yes ☐ No
Disinfected? ☑ Yes ☐ No
Capped? ☑ Yes ☐ No

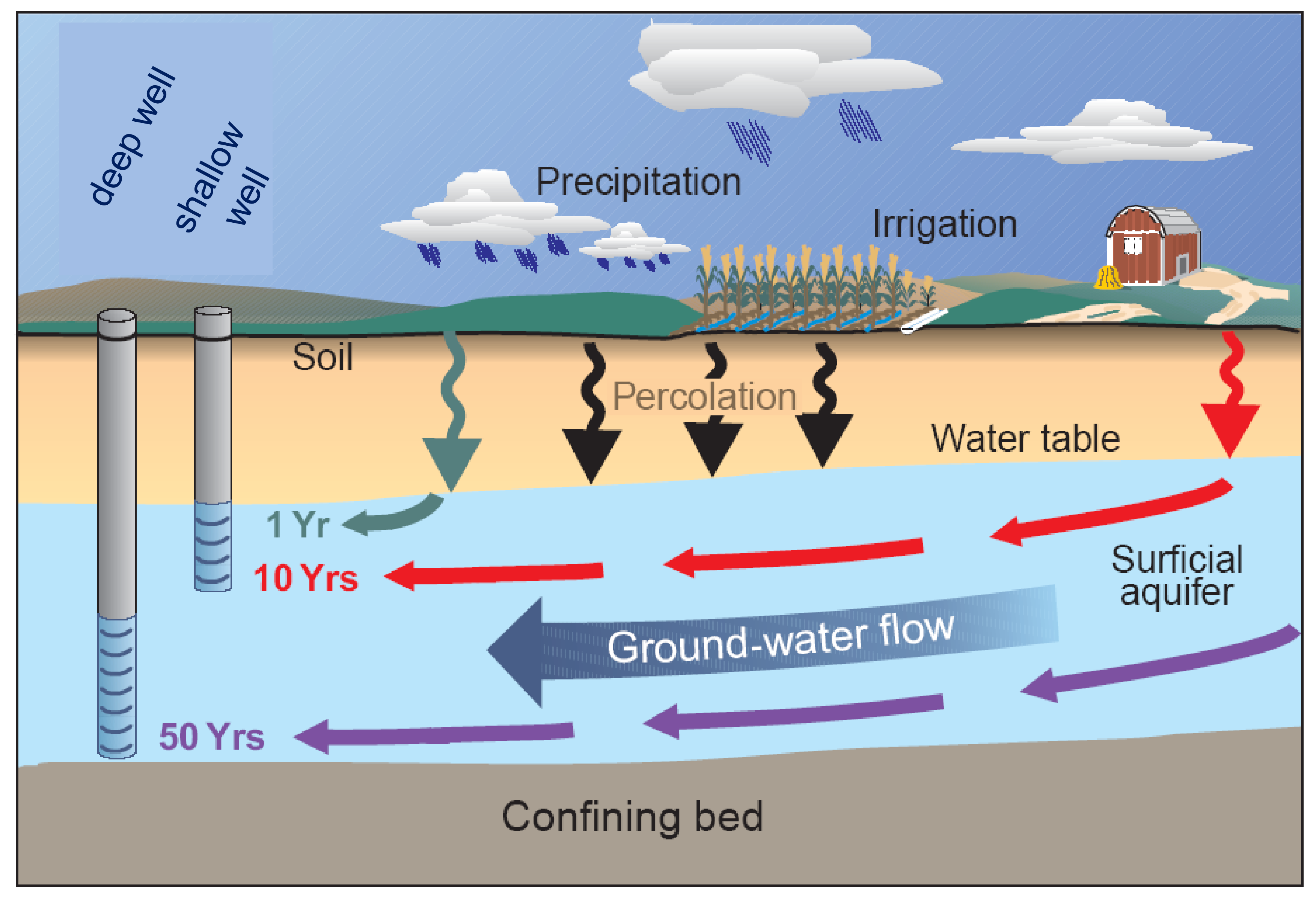
13. Did you permanently seal all unused, noncomplying, or unsafe wells? ☐ Yes ☐ No If no, explain ______

14. Signature of Point Driver or Registered Driller
Date Signed
Signature of Drill Rig Operator
Date Signed

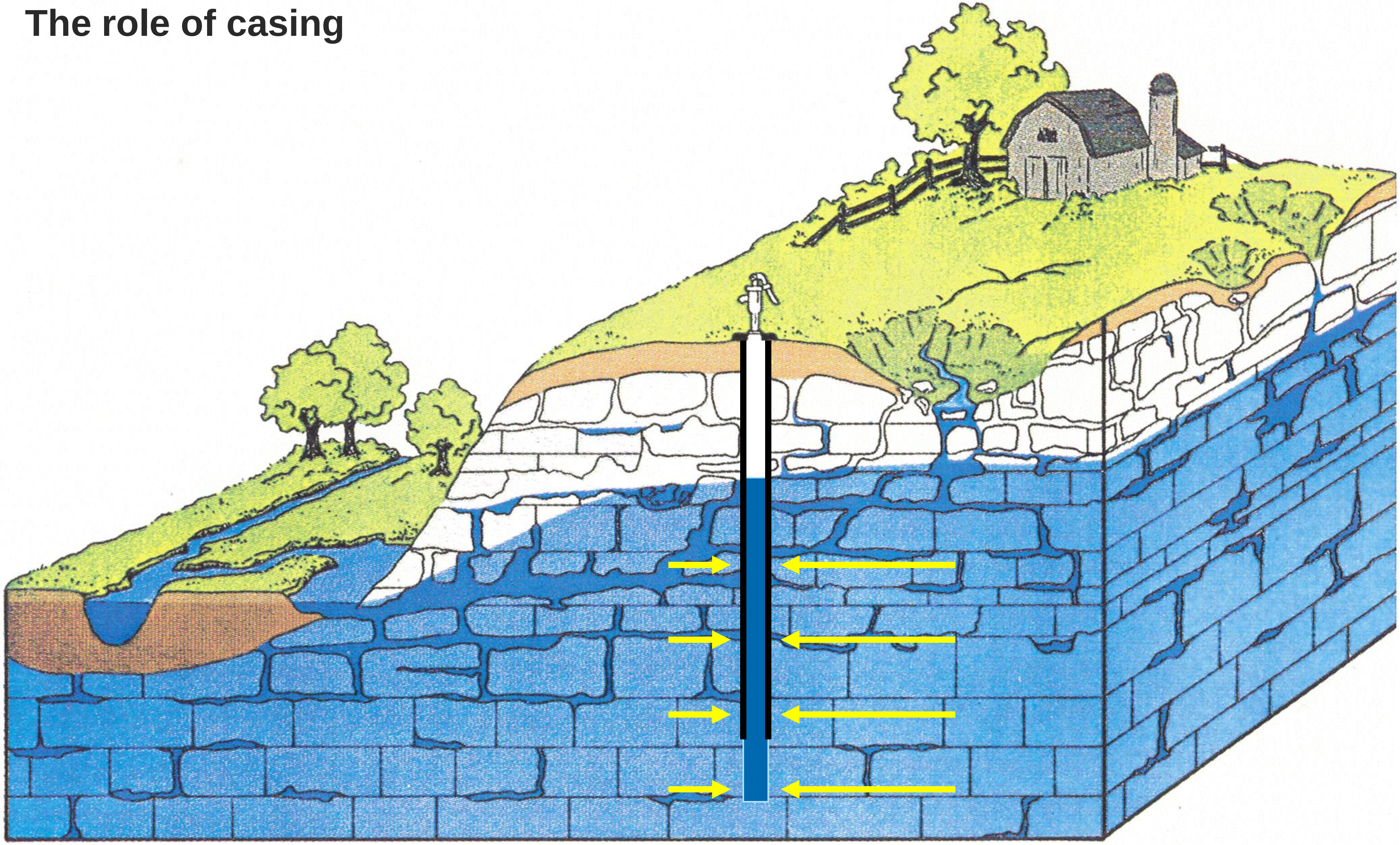
Make additional comments on reverse side about geology, etc.
WELL CONSTRUCTION REPORT



Do deeper wells mean better water?



The role of casing



Private vs. Public Water Supplies

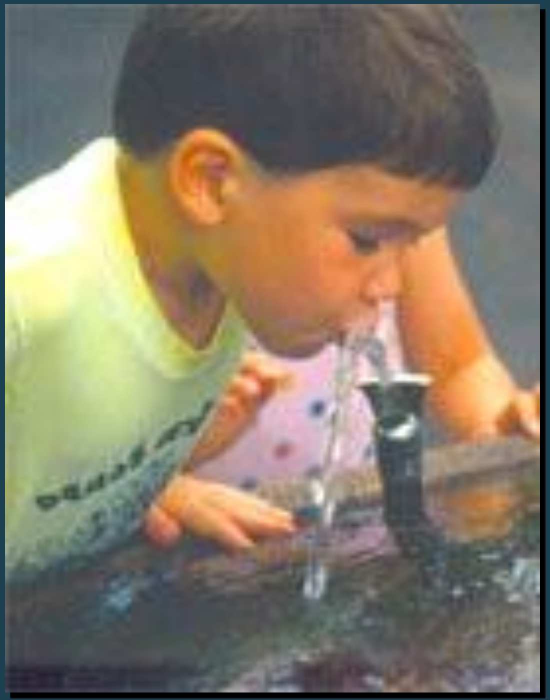
Public Water Supplies

- 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
- Change in taste or odor
- Buying or selling their home
- Plumbing issues
- Want to know if it’s safe to drink.

What are the Health Concerns?

- **Acute Effects** – Usually seen within a short time after exposure to a substance.

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

- **Chronic Effects** – Results from exposure to a substance over a long period of time.

  (ex. Arsenic or pesticides can increase the chance of developing certain types of cancer)

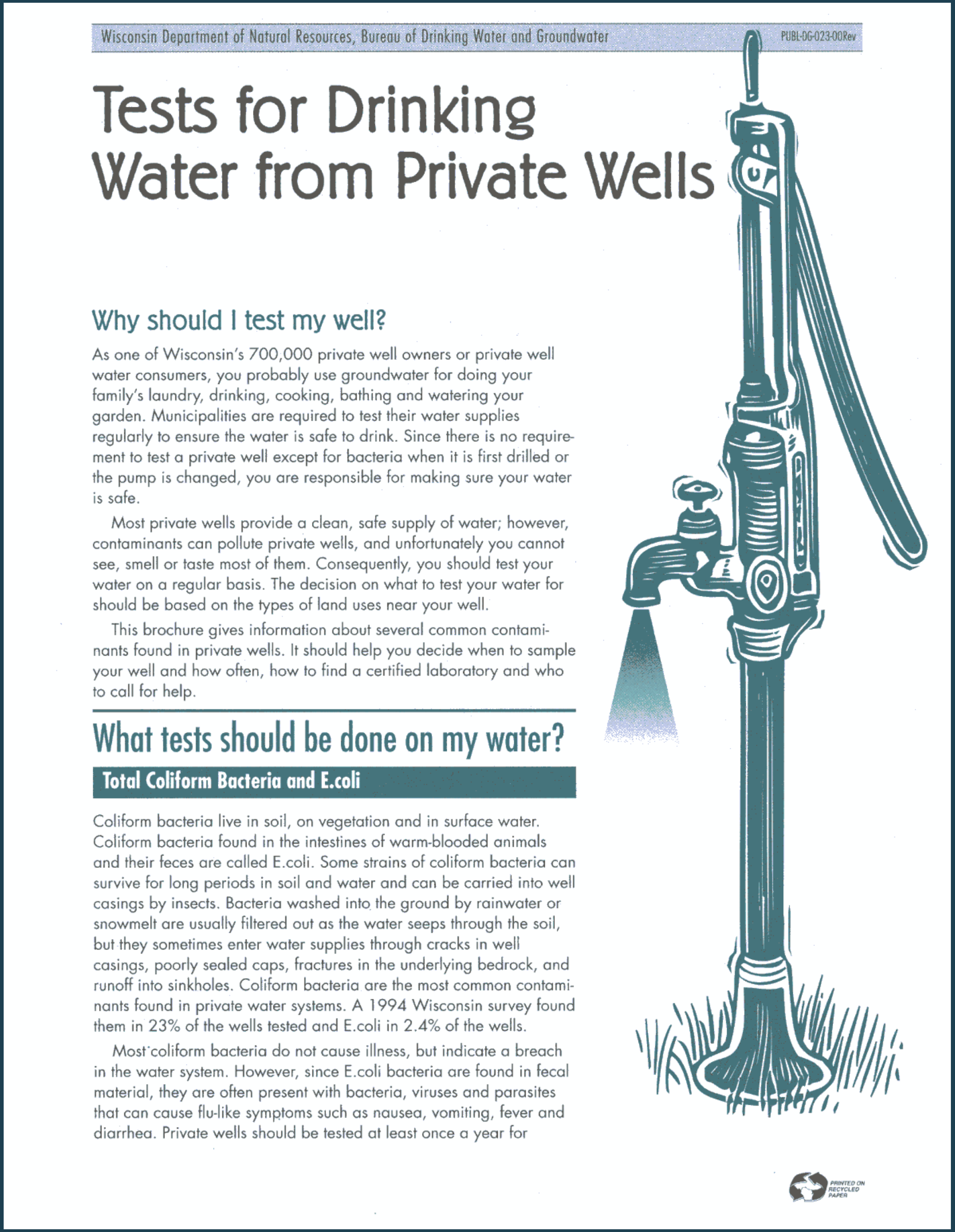
Understanding Risk…?

Dying from a lightning strike.	0.013 in 1,000 chance.
0.010 mg/L of arsenic in drinking water.	3 out of 1,000 people likely to develop a form of cancer.
2 pCi of indoor radon level.	4 out of 1,000 people likely to develop lung cancer.[1]
Dying in a car accident.	4 in 1,000 chance.
2 pCi of indoor radon combined with smoking.	32 out of 1,000 people likely to 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

No one test tells us everything we need to know about the safety and condition of a water supply



Wisconsin Department of Natural Resources, Bureau of Drinking Water and Groundwater

PUBL-DG-023-00Rev

Tests for Drinking Water from Private Wells

Why should I test my well?

As one of Wisconsin's 700,000 private well owners or private well water consumers, you probably use groundwater for doing your family's laundry, drinking, cooking, bathing and watering your garden. Municipalities are required to test their water supplies regularly to ensure the water is safe to drink. Since there is no requirement to test a private well except for bacteria when it is first drilled or the pump is changed, you are responsible for making sure your water is safe.

Most private wells provide a clean, safe supply of water; however, contaminants can pollute private wells, and unfortunately you cannot see, smell or taste most of them. Consequently, you should test your water on a regular basis. The decision on what to test your water for should be based on the types of land uses near your well.

This brochure gives information about several common contaminants found in private wells. It should help you decide when to sample your well and how often, how to find a certified laboratory and who to call for help.

What tests should be done on my water?

Total Coliform Bacteria and E.coli

Coliform bacteria live in soil, on vegetation and in surface water. Coliform bacteria found in the intestines of warm-blooded animals and their feces are called E.coli. Some strains of coliform bacteria can survive for long periods in soil and water and can be carried into well casings by insects. Bacteria washed into the ground by rainwater or snowmelt are usually filtered out as the water seeps through the soil, but they sometimes enter water supplies through cracks in well casings, poorly sealed caps, fractures in the underlying bedrock, and runoff into sinkholes. Coliform bacteria are the most common contaminants found in private water systems. A 1994 Wisconsin survey found them in 23% of the wells tested and E.coli in 2.4% of the wells.

Most coliform bacteria do not cause illness, but indicate a breach in the water system. However, since E.coli bacteria are found in fecal material, they are often present with bacteria, viruses and parasites that can cause flu-like symptoms such as nausea, vomiting, fever and diarrhea. Private wells should be tested at least once a year for

Interpreting Drinking Water Test Results

Tests important to health:

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

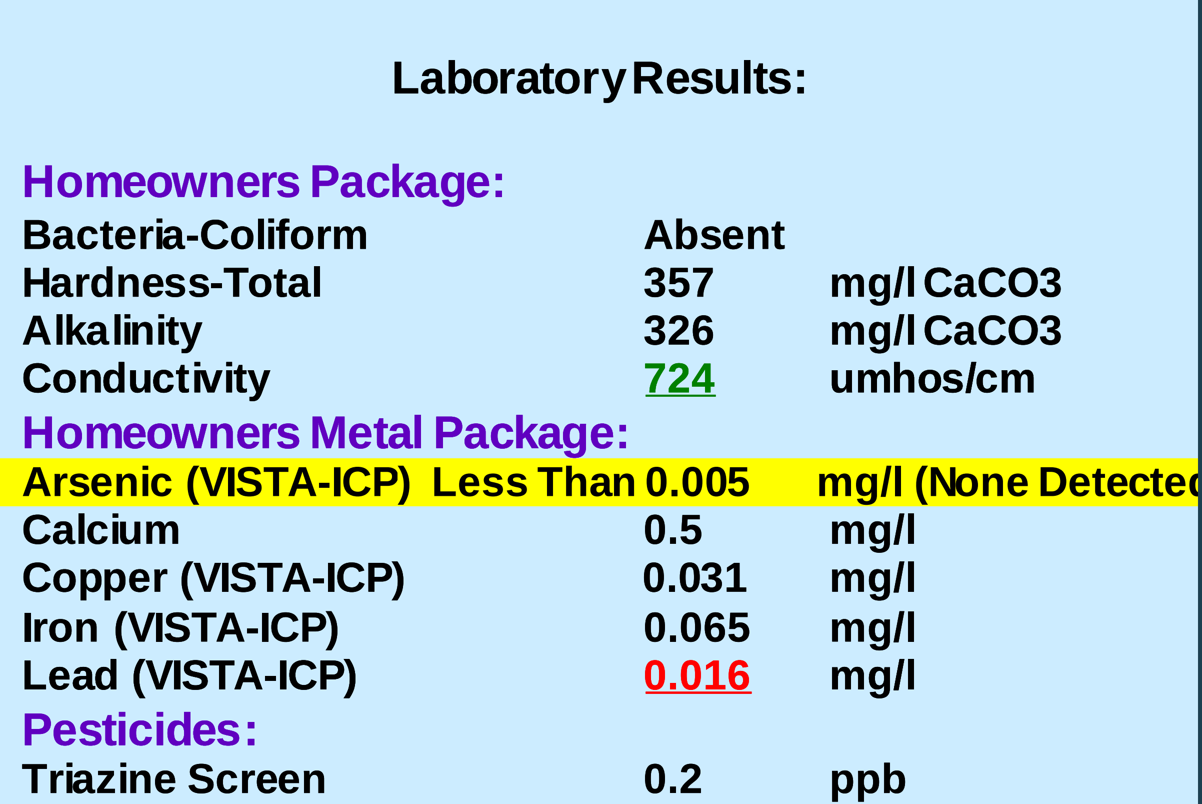
Tests for aesthetic (taste,color,odor) problems:

- Hardness
- Iron
- Manganese
- Chloride

Other important indicator tests:

- Saturation Index
- Alkalinity
- Conductivity
- Potassium

Red = human-influenced, Blue = naturally found



Laboratory Results:

Homeowners Package:		
Bacteria-Coliform	Absent	
Hardness-Total	357	mg/l CaCO3
Alkalinity	326	mg/l CaCO3
Conductivity	724	umhos/cm
Homeowners Metal Package:		
Arsenic (VISTA-ICP) Less Than	0.005	mg/l (None Detecte
Calcium	0.5	mg/l
Copper (VISTA-ICP)	0.031	mg/l
Iron (VISTA-ICP)	0.065	mg/l
Lead (VISTA-ICP)	0.016	mg/l
Pesticides:		
Triazine Screen	0.2	ppb

milligrams per liter (mg/l) = parts per million (ppm)

1 mg/l = 1000 parts per billion (ppb)

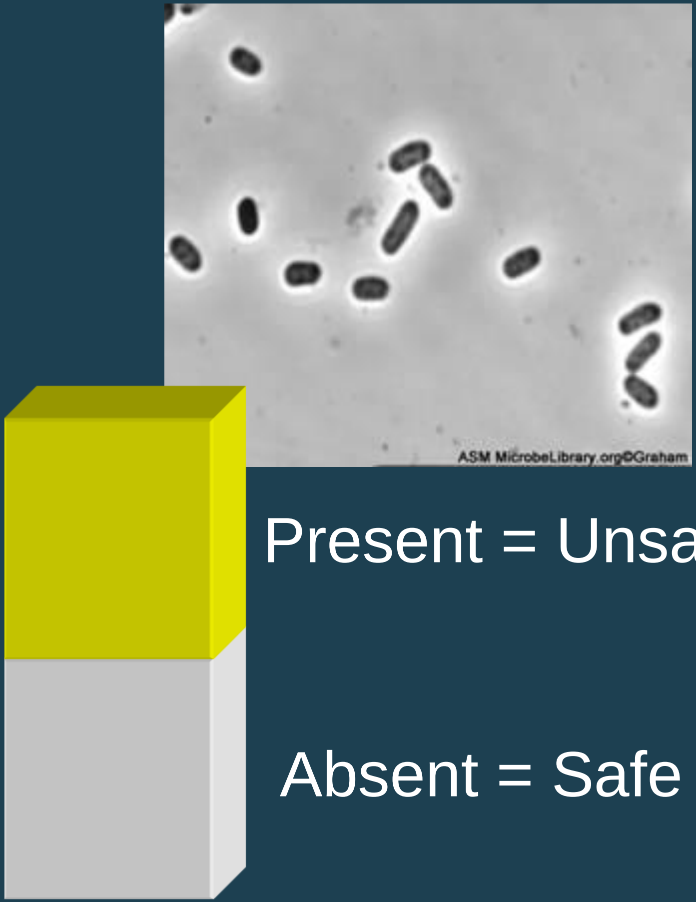
Coliform bacteria

- Grow in soil, on vegetation, or in the intestines of warm-blooded animals and though it doesn't cause illness can be an indicator of changing water quality and potential contamination of more harmful microorganisms.

- Harmful bacteria and viruses can cause gastrointestinal disease, cholera, hepatitis

- If any is present assume that the water is unsafe

- Sources:
  - Live in soils and on vegetation
  - Human and animal waste
  - Sampling error

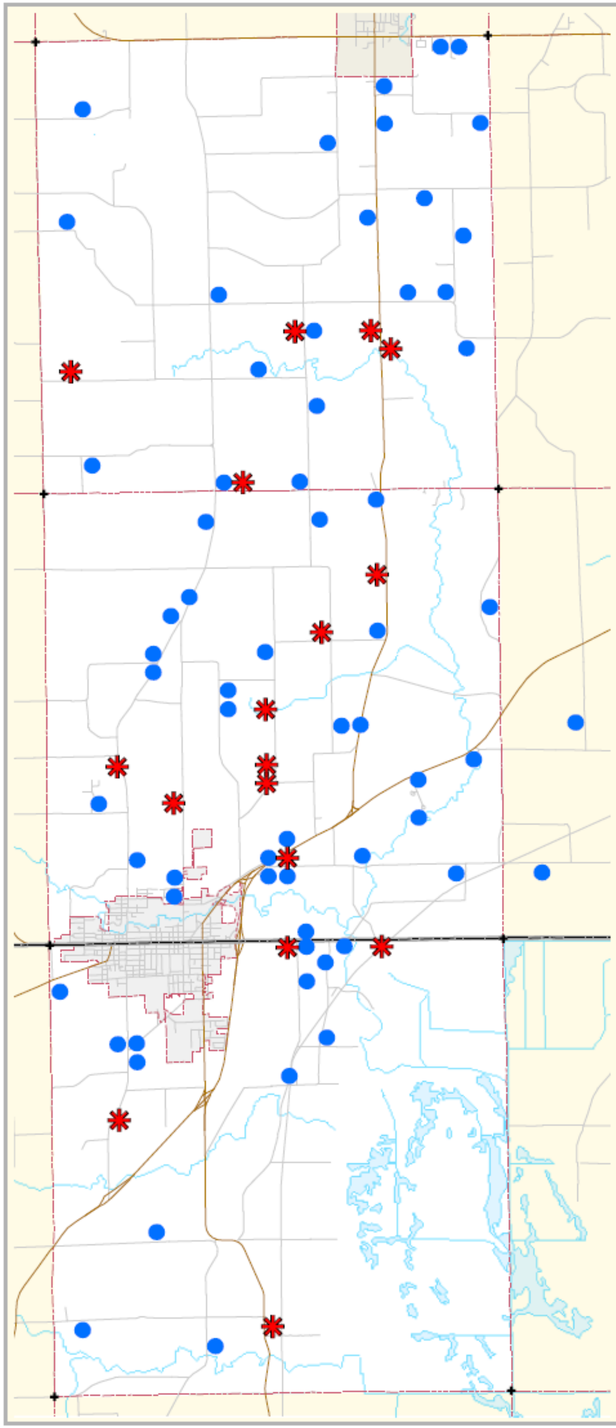

ASM MicrobeLibrary.org©Graham

Present = Unsafe

Absent = Safe

E.coli bacteria

- 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.



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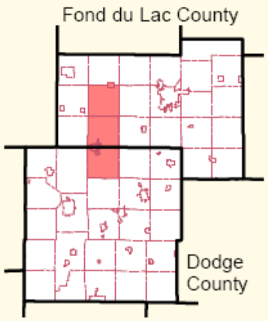
✱ **BACTERIA POSITIVE**

Any sample in the 1/4 1/4 section.



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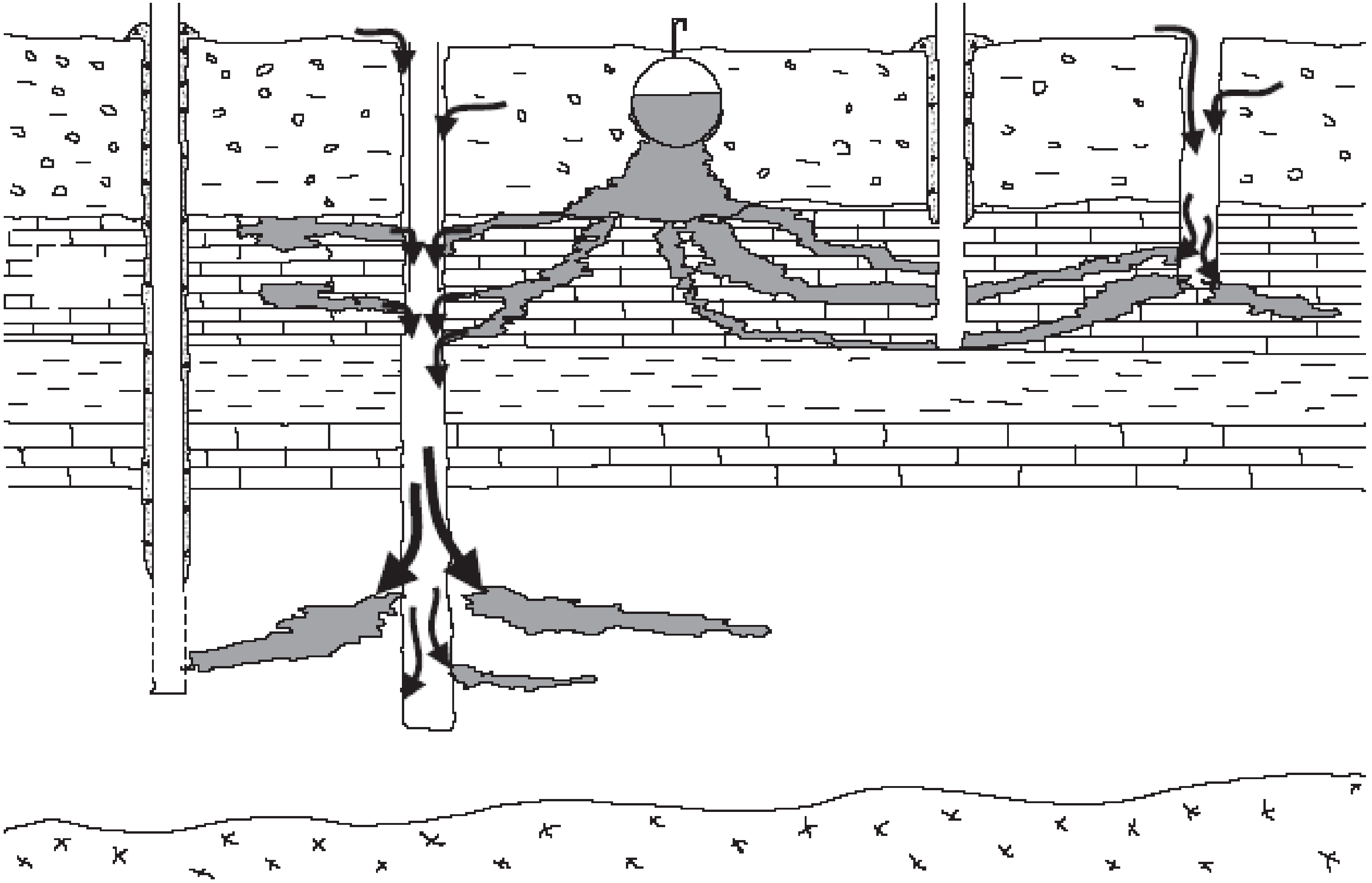
Properly fill and seal unused wells



Source: Adapted from DiNovo and Jaffe, 1984.

What should I do if I have bacteria problems?

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
   - Properly fill and seal unused wells
   - Inadequate filtration by soil
4. Disinfect the well
5. Retest to ensure well is bacteria free.

➢ For reoccurring bacteria problems it may be necessary to look into drilling a new well.

Rock and Soil Impacts on Water Quality

Tests for Aesthetic Problems

Hardness

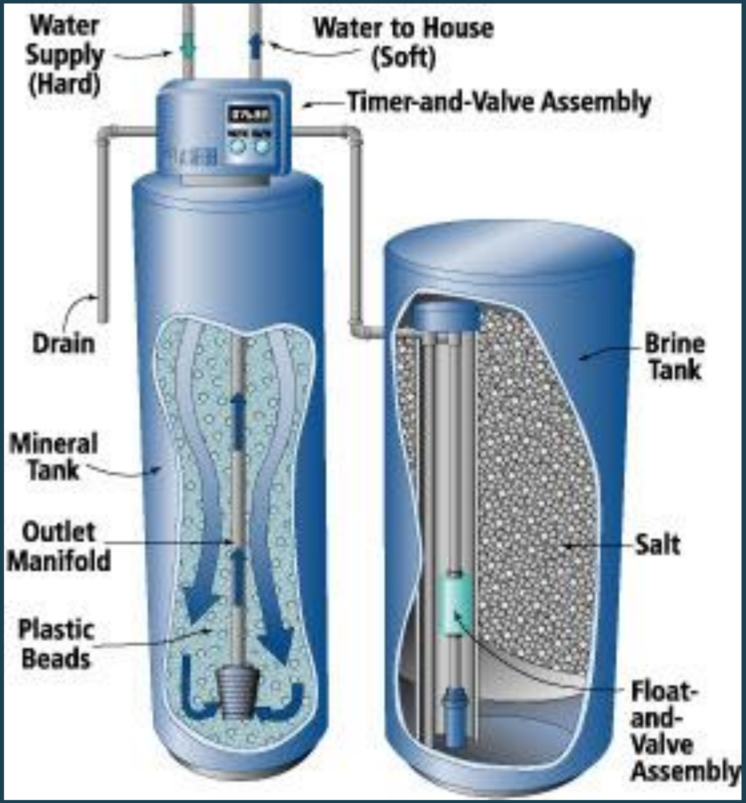
- Natural (rocks and soils)
- Primarily calcium and magnesium

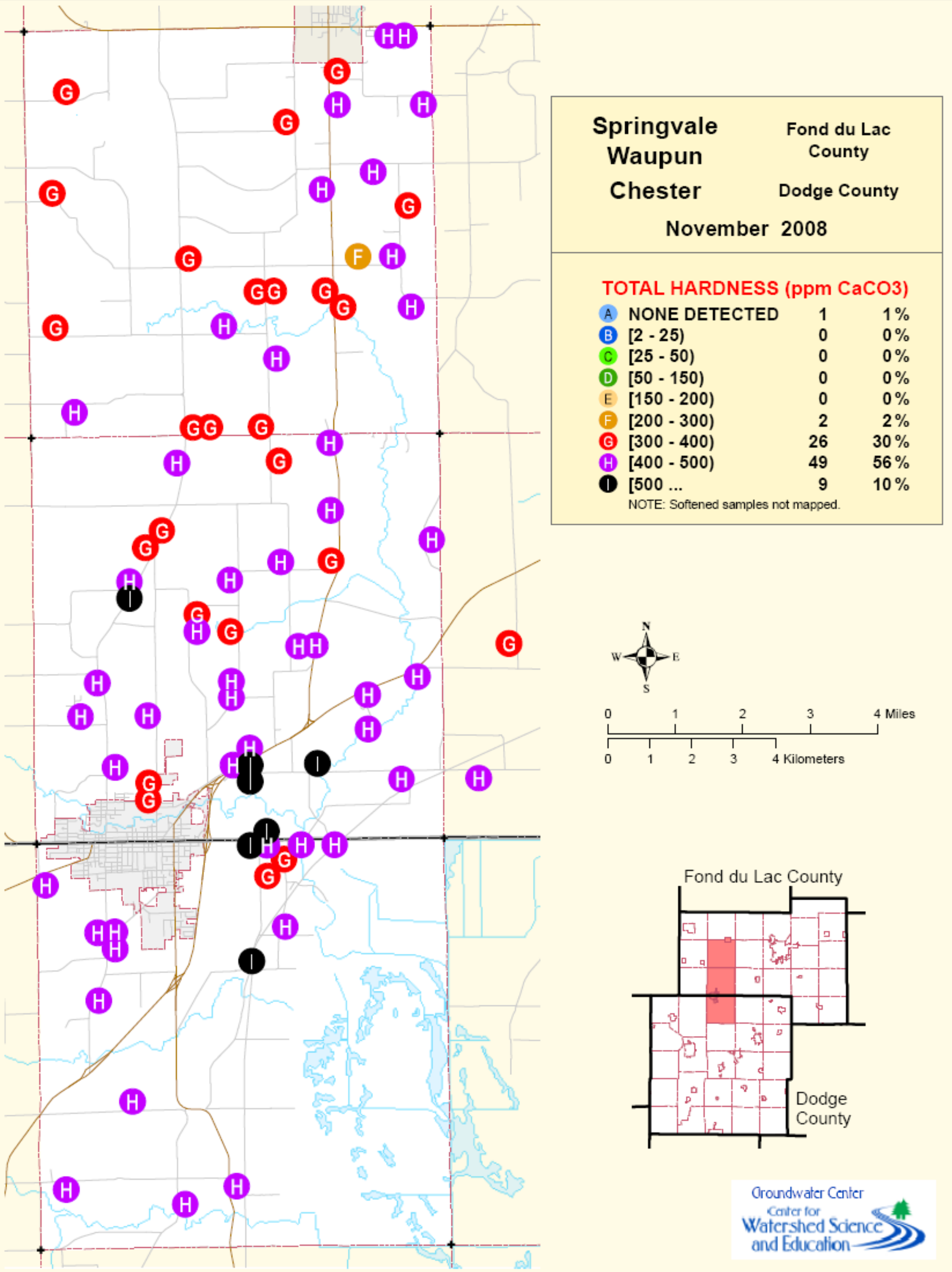
- Problems: scaling, scum, use more detergent, decrease water heater efficiency

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 drink softened water and are concerned about sodium levels – use potassium chloride softener salt.





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TOTAL HARDNESS (ppm CaCO3)

A	NONE DETECTED	1	1 %
B	[2 - 25)	0	0 %
C	[25 - 50)	0	0 %
D	[50 - 150)	0	0 %
E	[150 - 200)	0	0 %
F	[200 - 300)	2	2 %
G	[300 - 400)	26	30 %
H	[400 - 500)	49	56 %
I	[500 ...	9	10 %

NOTE: Softened samples not mapped.

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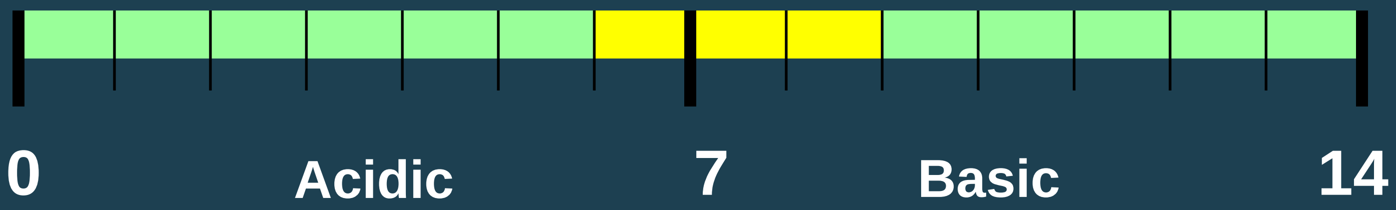
Center for Watershed Science and Education

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



Tests for Overall Water Quality

Saturation Index

(-3) (-2) (-1) (0)(+0.5)(+1) (+2) (+3)

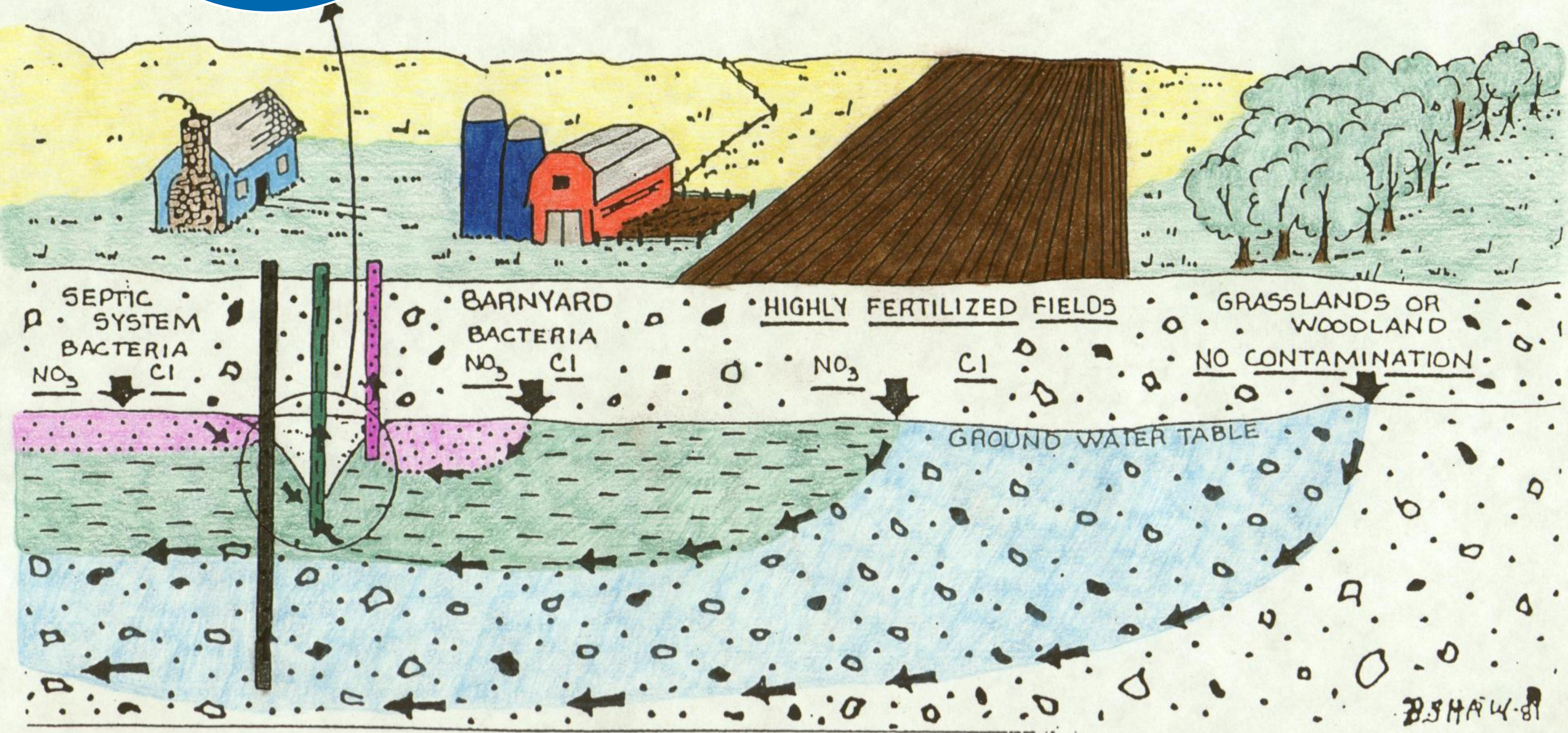
Severe Moderate Slight Ideal Slight Moderate Severe

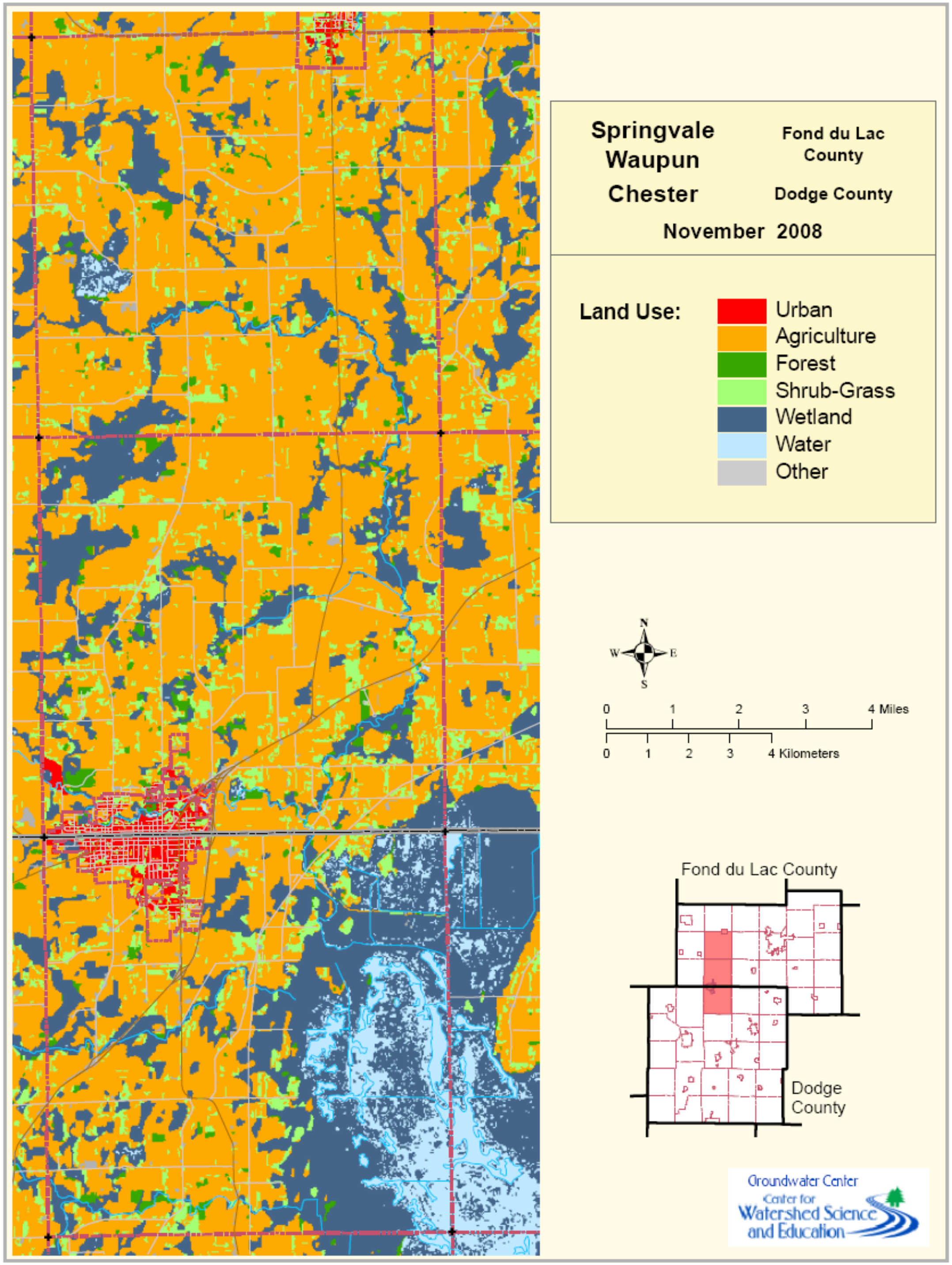
Corrosion occurs

Scaling occurs

Land Use and Water Quality

Well pumping water

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November 2008
Land Use:
Urban
Agriculture
Forest
Shrub-Grass
Wetland
Water
Other
N
W
E
S
0
1
2
3
4 Miles
0
1
2
3
4 Kilometers
Fond du Lac County
Dodge County
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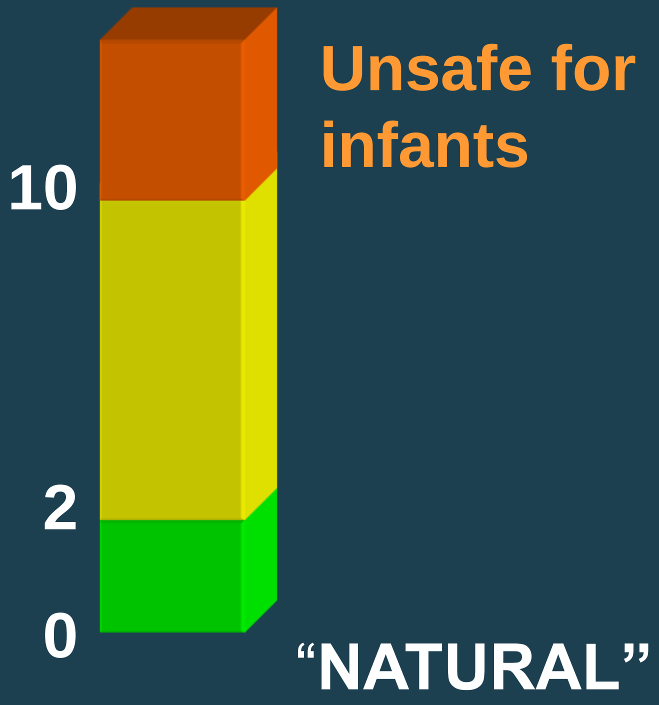
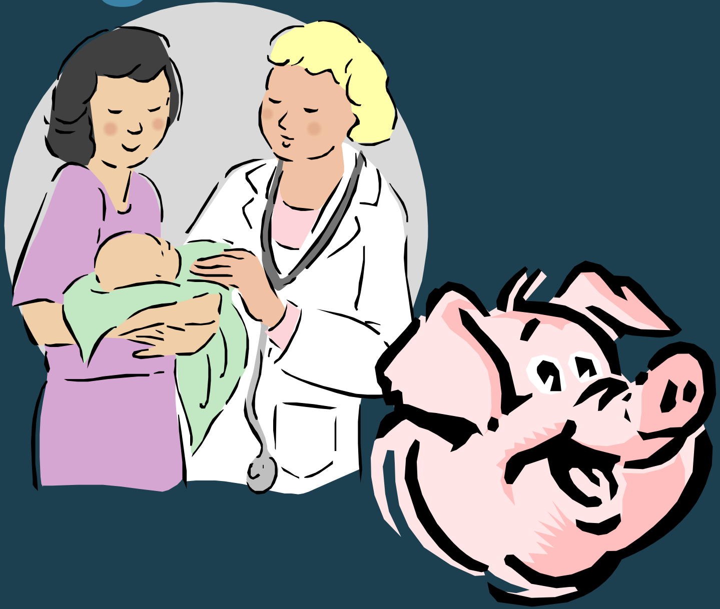
Test Important to Health

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

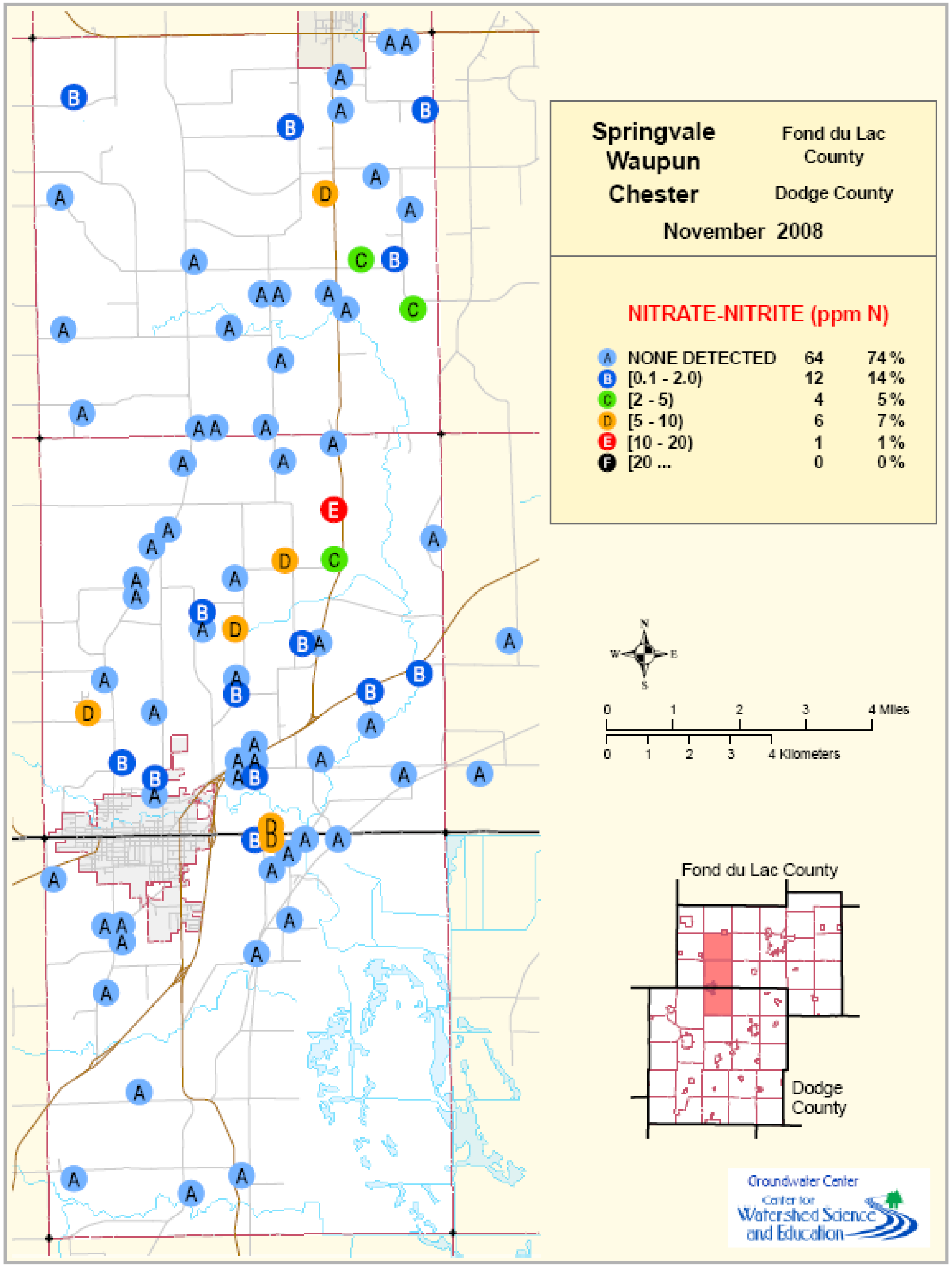


Health Effects:

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

Sources:

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


Springvale
Waupun
Chester
Fond du Lac County
Dodge County
November 2008
NITRATE-NITRITE (ppm N)
A NONE DETECTED 64 74 %
B [0.1 - 2.0) 12 14 %
C [2 - 5) 4 5 %
D [5 - 10) 6 7 %
E [10 - 20) 1 1 %
F [20 ... 0 0 %
N
S
E
W
0 1 2 3 4 Miles
0 1 2 3 4 Kilometers
Fond du Lac County
Dodge County
Groundwater Center
Center for Watershed Science and Education

Nitrogen Budget

Inputs

Outputs

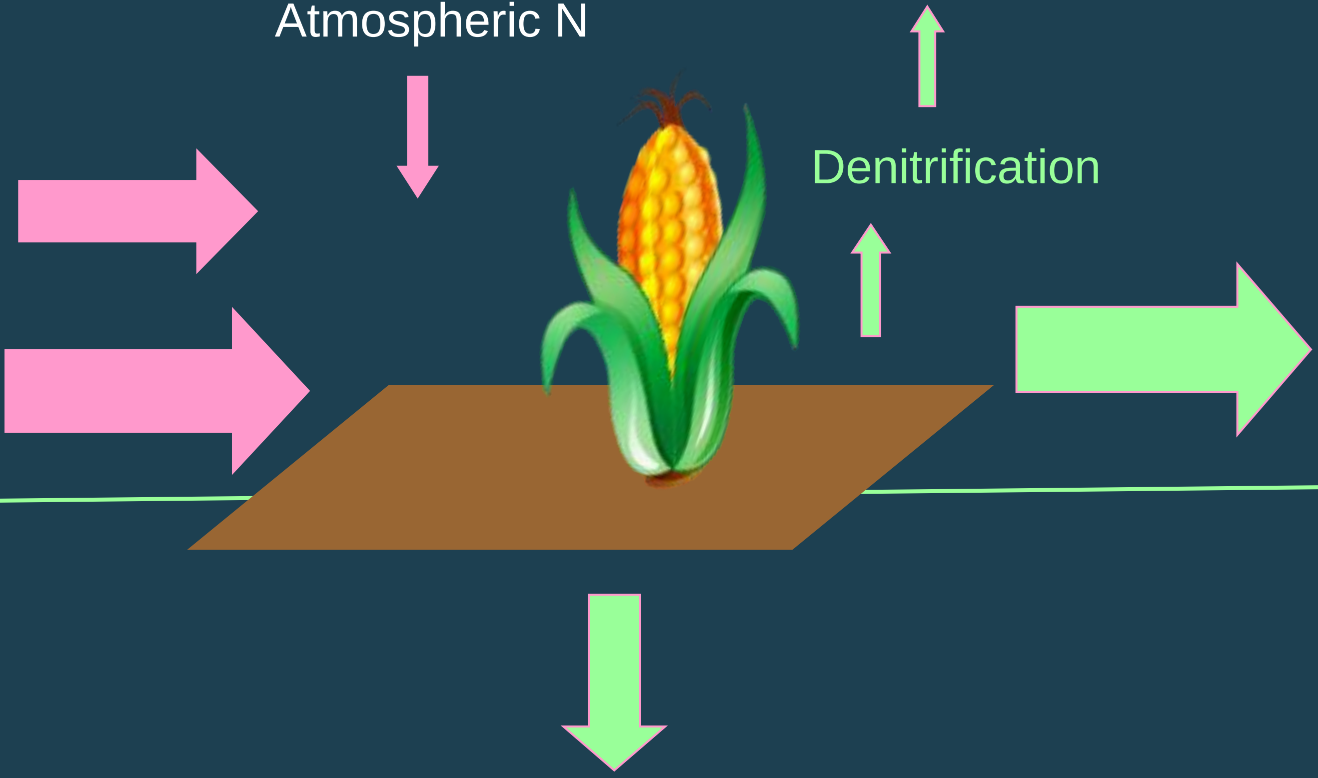
Atmospheric N

Manure

Nitrogen
Fertilizer

Nitrogen
Crop Removal

Nitrogen Budget



Inputs

Outputs

Atmospheric N

Manure

Nitrogen Fertilizer

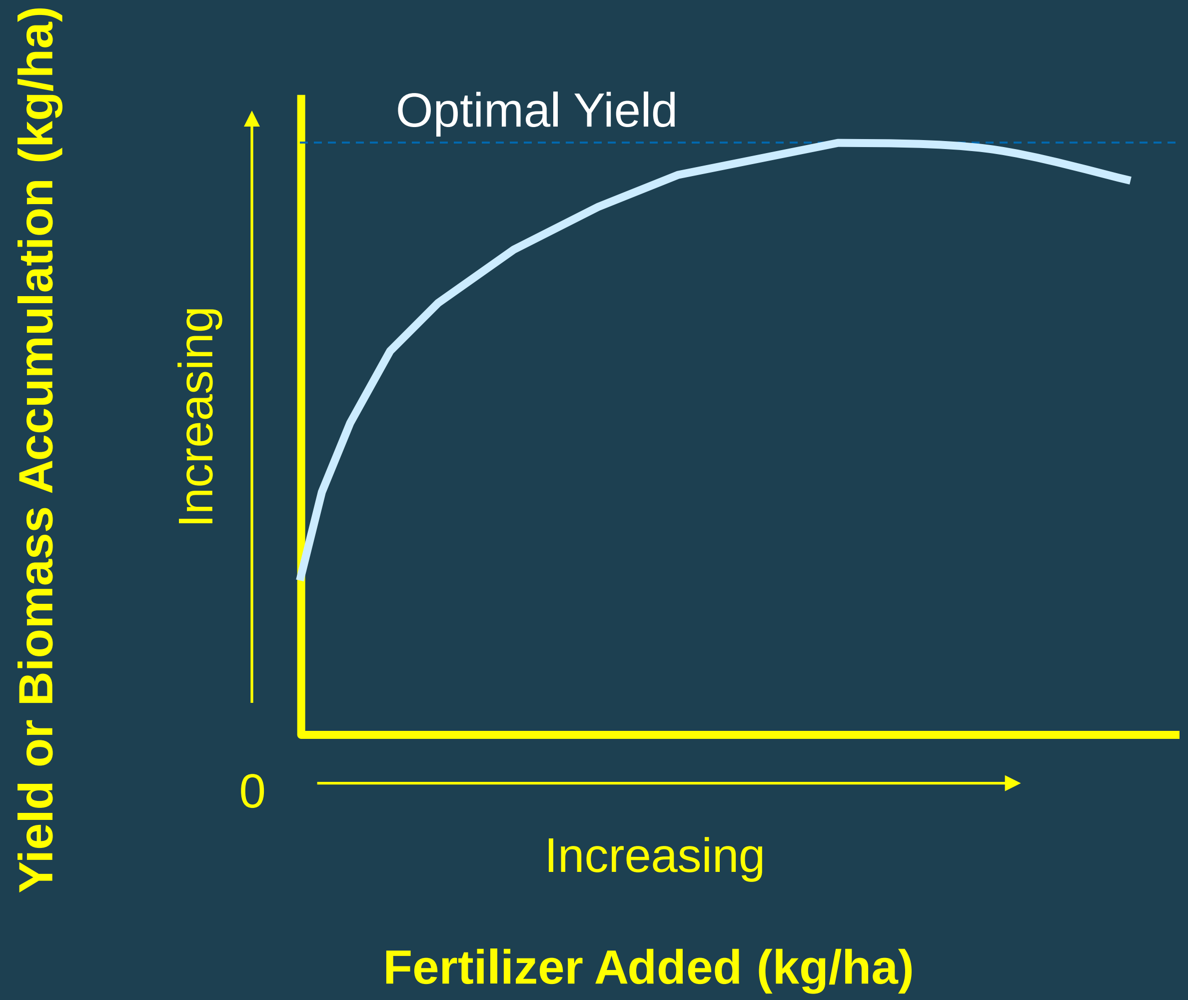
Volatilization

Denitrification

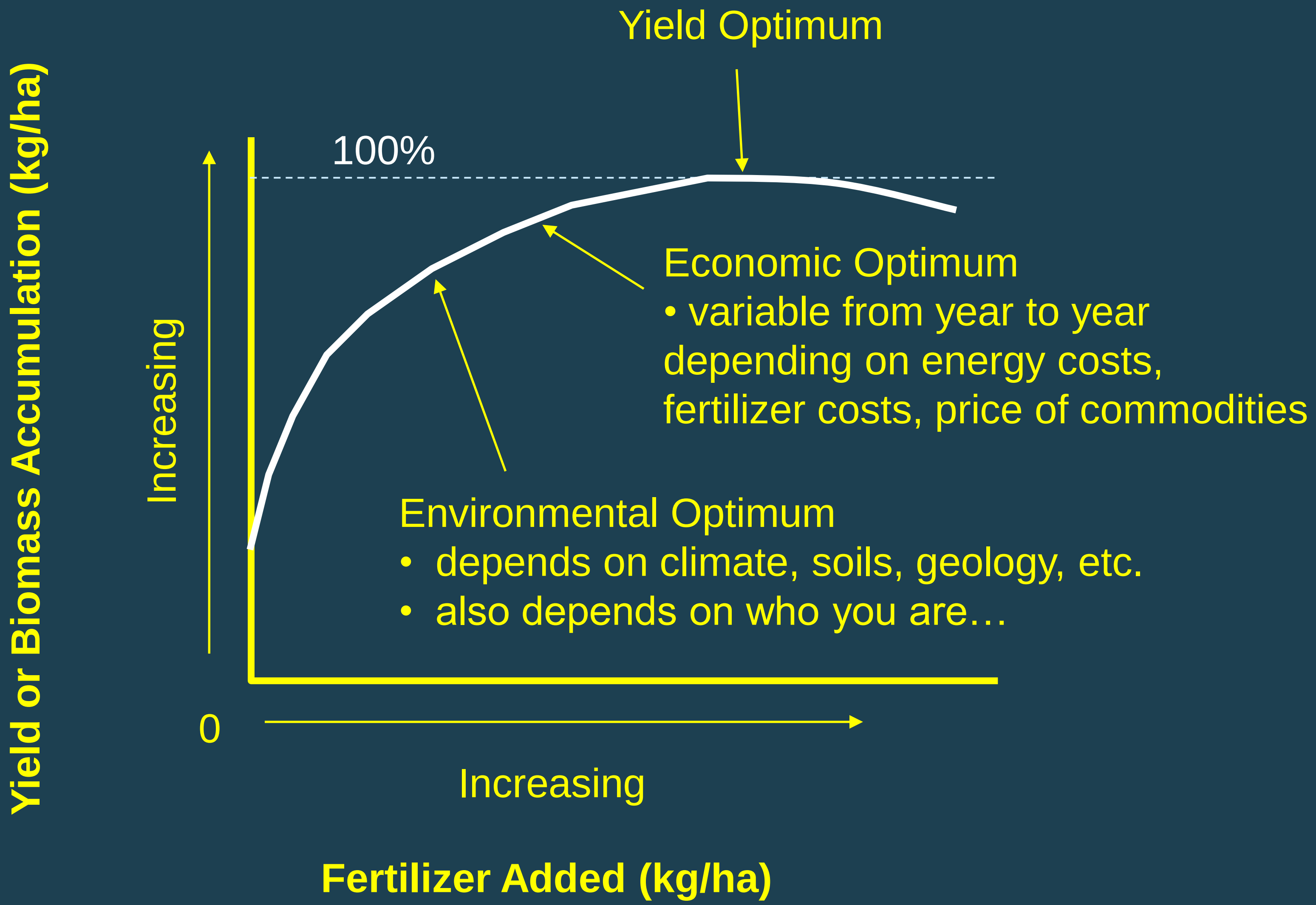
Nitrogen Crop Removal

Nitrate to groundwater

Fertilizer Response Curve



Fertilizer Response Curve



Yield Optimum

Economic Optimum

- variable from year to year depending on energy costs, fertilizer costs, price of commodities

Environmental Optimum

- depends on climate, soils, geology, etc.
- also depends on who you are…

What can I do to reduce my nitrate levels?

Ideal solution:

- Eliminate contamination source or reduce nitrogen inputs

Short term:

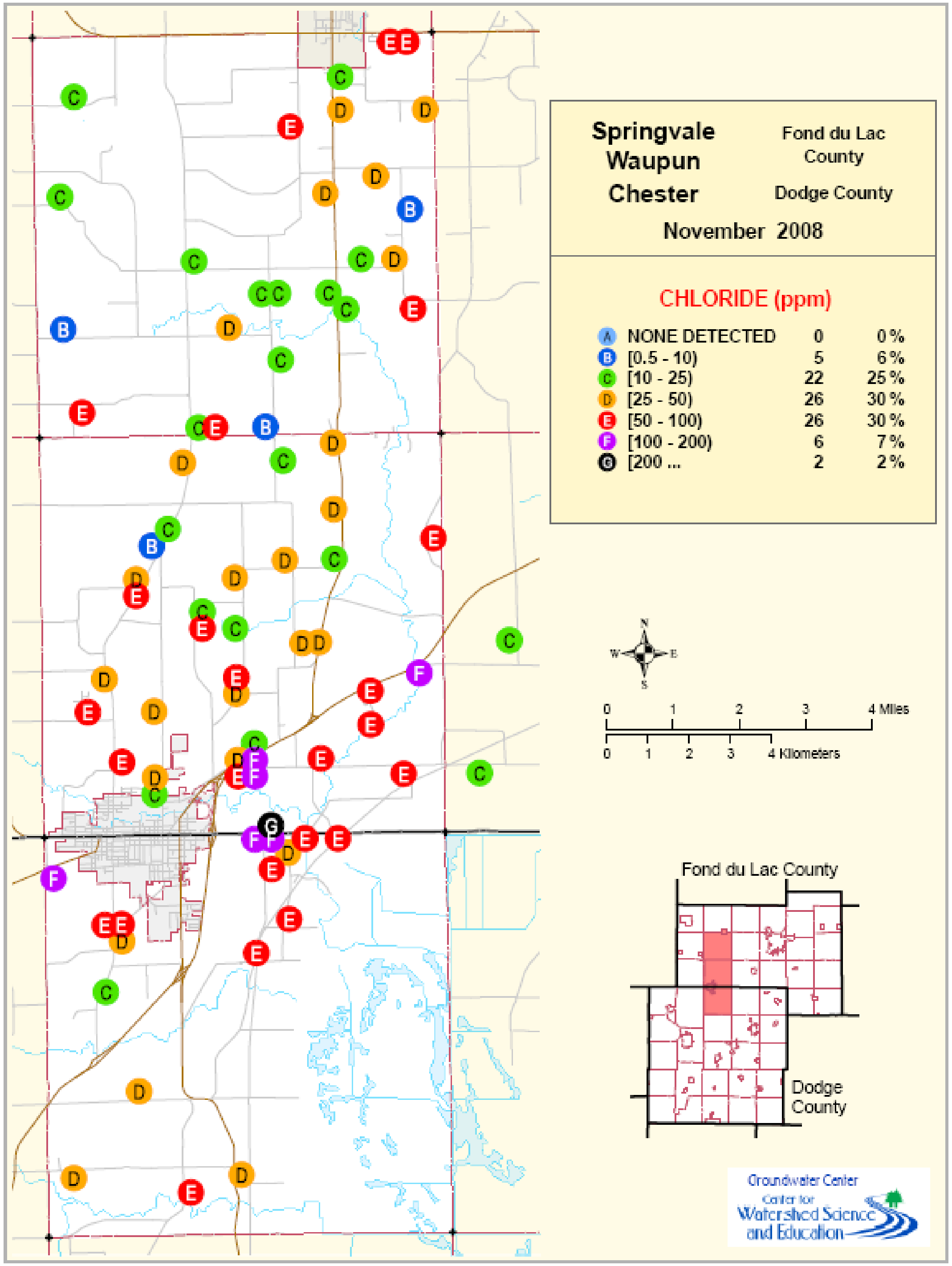
- Change well depth or relocate well
- Carry or buy water
- Water treatment devices
  - Reverse osmosis
  - Distillation
  - Anion exchange

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

  "Natural" in much of WI



Springvale Fond du Lac County
Waupun
Chester Dodge County

November 2008

CHLORIDE (ppm)

A	NONE DETECTED	0	0 %
B	[0.5 - 10)	5	6 %
C	[10 - 25)	22	25 %
D	[25 - 50)	26	30 %
E	[50 - 100)	26	30 %
F	[100 - 200)	6	7 %
G	[200 ...	2	2 %

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and Education

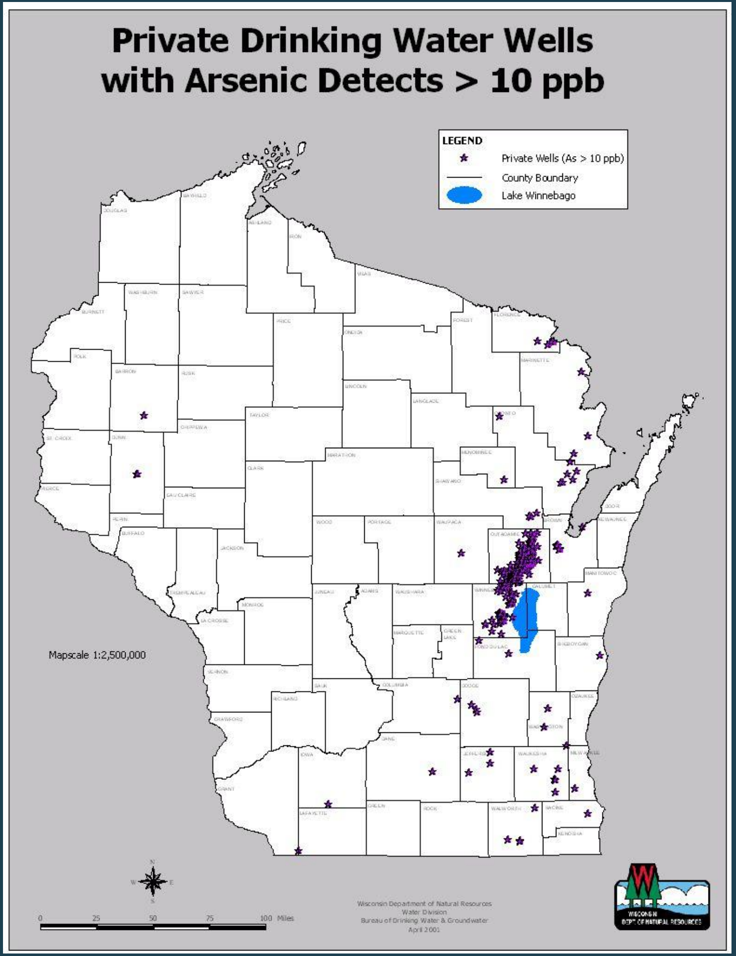
Test Important to Health

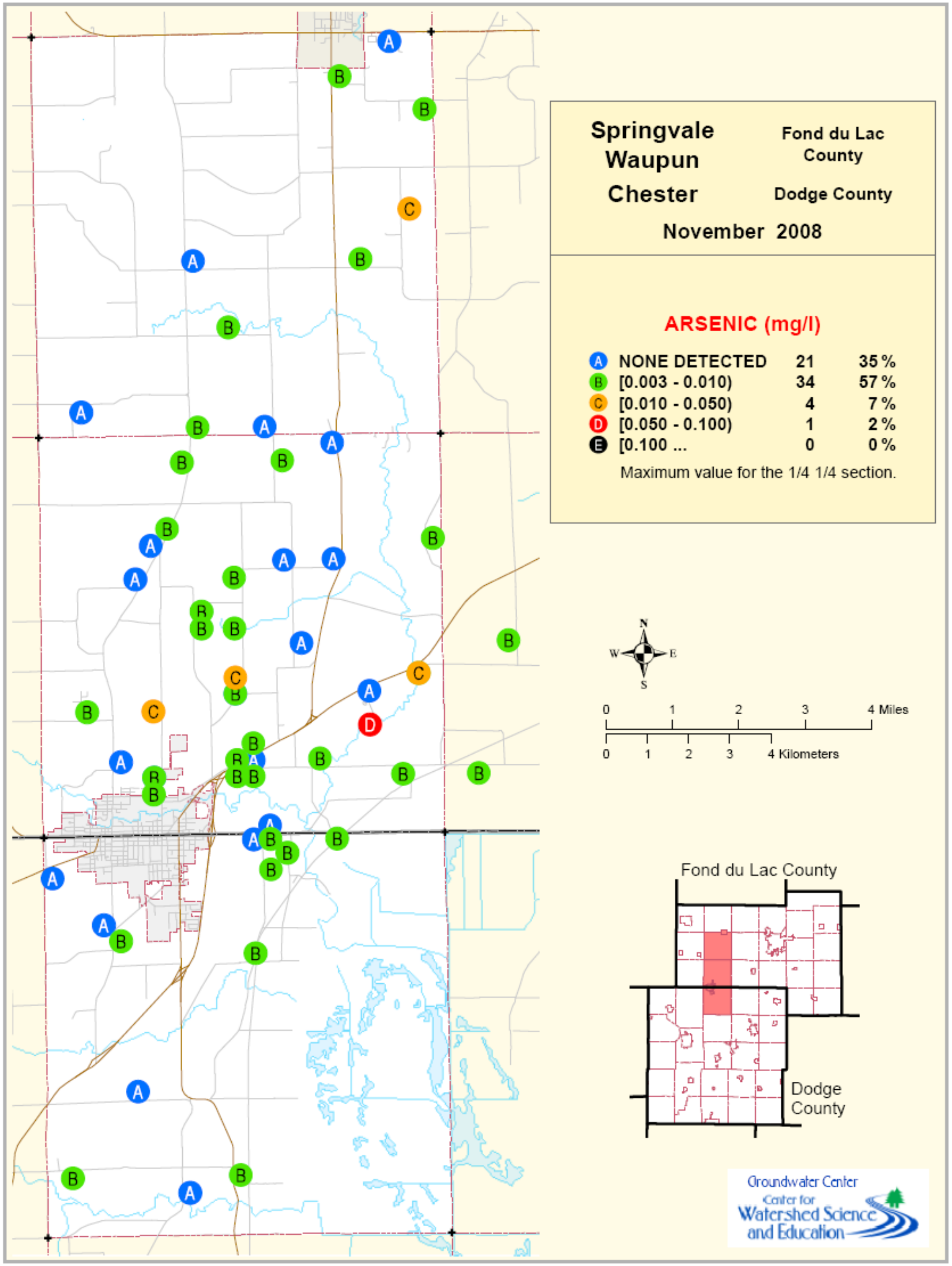
Arsenic

- Sources: Naturally occurring in mineral deposits
- 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





A	NONE DETECTED	21	35 %
B	[0.003 - 0.010)	34	57 %
C	[0.010 - 0.050)	4	7 %
D	[0.050 - 0.100)	1	2 %
E	[0.100 ...	0	0 %

If your arsenic concentration is:

0.010 mg/L

0.003 mg/L

0 mg/L

Recommend not using water for drinking

Water okay to drink

Consider testing again in a year to see if levels have changed

Water okay to drink

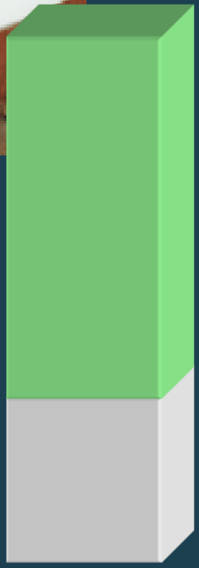
No further action needed.

Tests for Aesthetic Problems

Iron

- Natural (rocks and soils)
- May benefit health
- Red and yellow stains on clothing, fixtures

- Potential for iron bacteria
  - Slime, odor, oily film



Test Important to Health

Copper

- **Sources: Copper water pipes**
- **Standard: 1.3 mg/L**

Health Effects:

- **Some copper is needed for good health**
- **Too much may cause problems:**

  Stomach cramps, diarrhea,

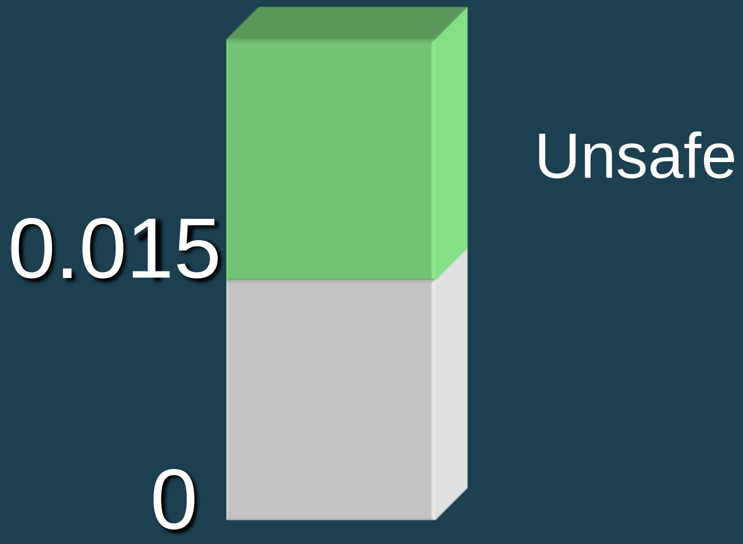
  vomiting, nausea

  Formula intolerance in infants

Test Important to Health

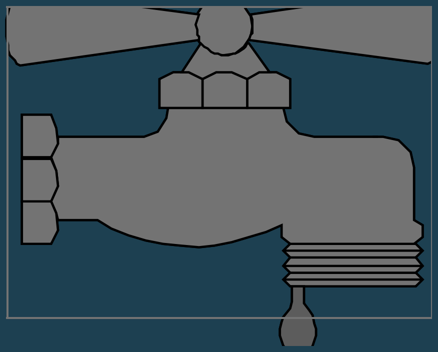
Lead

- Sources: Lead solder joining copper pipes (pre-1985)
- Standard: 0.015 mg/L (15 ppb)



Health Effects:

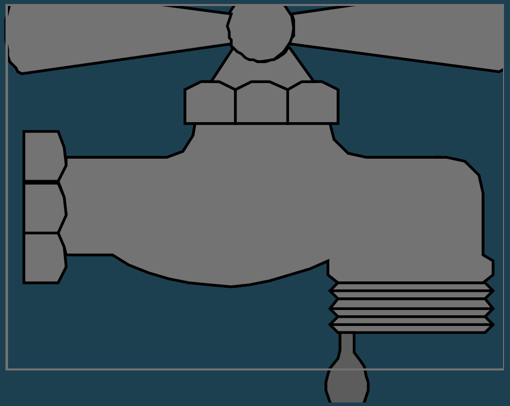
- Young children, infants and unborn children are particularly vulnerable.
- Lead may damage the brain, kidneys, nervous system, red blood cells, reproductive system.



Lead and Copper

Solutions:

- Run water until cold before drinking.
- Use a treatment device.



Pesticides in Drinking Water

- Insecticides, herbicides, fungicides and other substances used to control pests.
- Health standards usually only account for parent compound.
- Parent compounds breakdown over time.
- May be additional effects from combination of chemicals to consider.

- Most frequently detected pesticides in WI:
  - Alachlor* and its chemical breakdown products
  - Metolachlor and its chemical breakdown products
  - Atrazine** and its chemical breakdown products
  - Metribuzin
  - Cyanazine and its chemical breakdown products.

- * WI public health groundwater standard for breakdown component Alachlor ESA.
- ** WI public health groundwater standard is for the total chlorinated atrazine residue

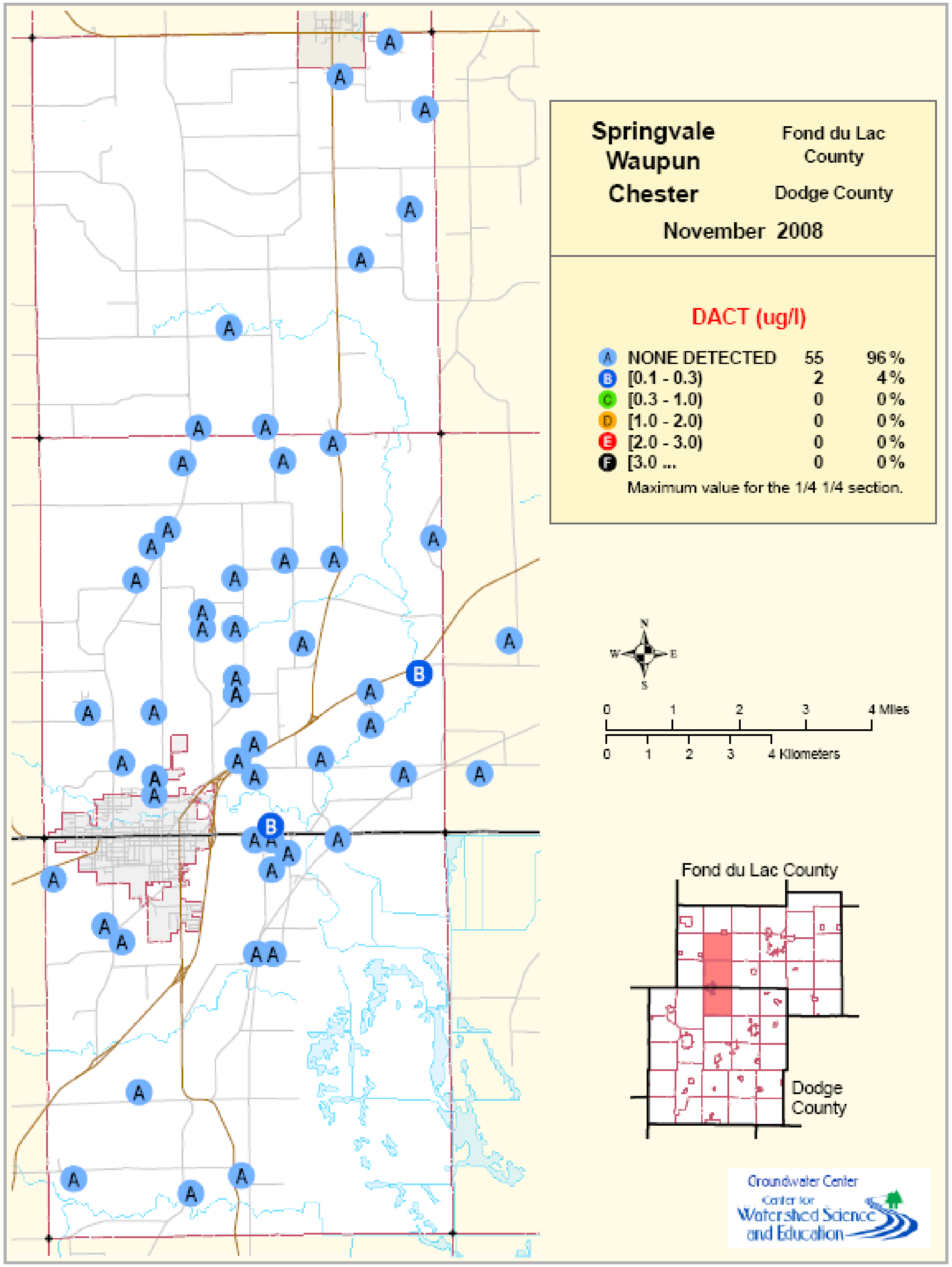
Tests Important to Health

DACT Screen

- Measures a particular breakdown component of triazine type pesticides (mainly atrazine used on corn crops, also simazine, propazine, cyanazine, etc)

- Specific to diaminochlorotriazine (DACT) underestimates the amount of total atrazine

- Groundwater Enforcement Standard: 3 ppb for total atrazine residue


Springvale
Waupun
Chester
Fond du Lac County
Dodge County
November 2008
DACT (ug/l)
A NONE DETECTED 55 96 %
B [0.1 - 0.3) 2 4 %
C [0.3 - 1.0) 0 0 %
D [1.0 - 2.0) 0 0 %
E [2.0 - 3.0) 0 0 %
F [3.0 ... 0 0 %
Maximum value for the 1/4 1/4 section.
N
W
E
S
0
1
2
3
4 Miles
0
1
2
3
4 Kilometers
Fond du Lac County
Dodge County
Groundwater Center
Center for
Watershed Science
and Education

A word about water treatment…

- Test water at a certified lab
- Know the types and amounts of contaminants you need to remove
- Choose a device approved by the Wisconsin Department of Commerce for the problems found in your water
- Maintenance and testing necessary to ensure proper treatment.

Next Steps

- Test well annually for bacteria, or if water changes color or clarity.
- If levels are elevated, test again in 15 months for nitrate.
- If arsenic was detected, consider testing again in a year to see if levels have changed.

Next Steps

- Test for known or potential contaminants in your neighborhood
  - Gasoline?
  - Pesticides?
  - Solvents?

Check for known contamination sites in Fond du Lac County at:
http://dnr.wi.gov/org/aw/rr/gis/index.htm

UW Extension

University of Wisconsin Stevens Point

Center for Watershed Science and Education

Thanks to the following for helping sponsor this program:

- Rising Sun Grange
- Town of Chester
- Town of Springvale
- Town of Waupun
- Fond du Lac County UW-Extension
- Dodge County UW-Extension
- Center for Watershed Science and Education

Questions?