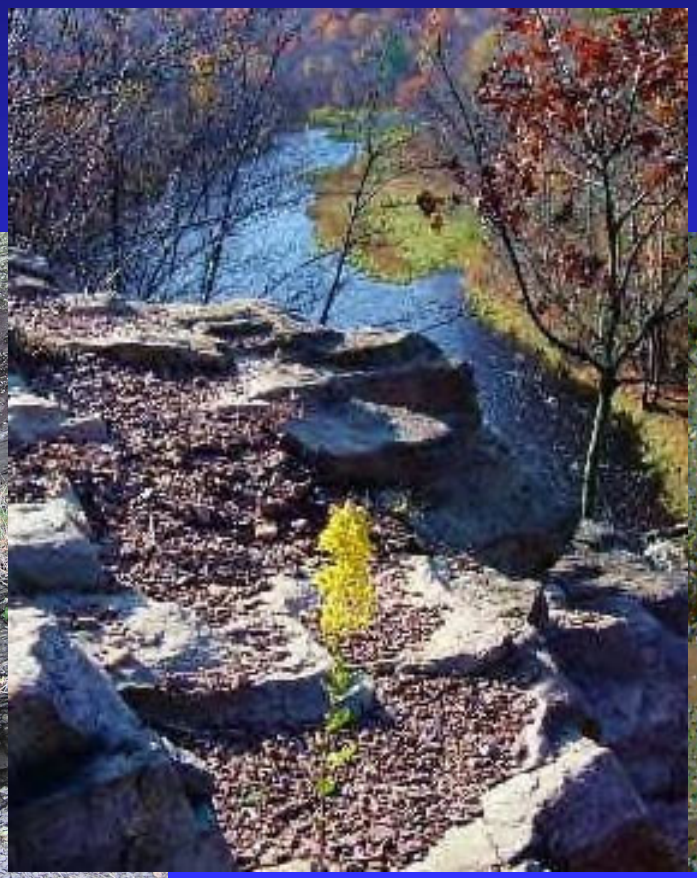
ENVIRONMENTAL CONSULTANTS, INC

KEYSTONE
Clean Water Team

Private Water Supply
A Pennsylvania Perspective
Big Bass Lake Community



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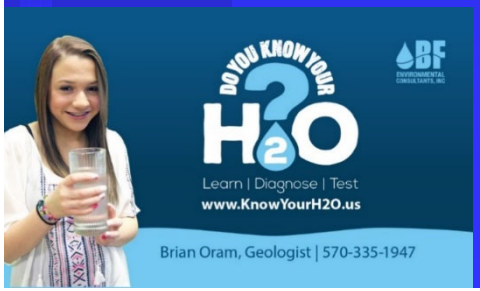
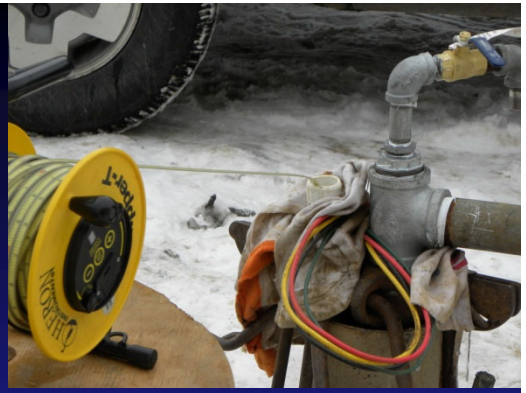
- For permission – Contact Mr. Brian Oram, PG
- bfenviro@ptd.net
- 570- 335-1947

http://www.bfenvironmental.com

http://www.water-research.net
http://www.knowyourh20.com



B.F. Environmental Consultants Inc.



- Professional Consulting Services in the areas of water quality, soils, stormwater, geology, aquifer analysis, and land-development.
- Baseline – Chain-of-Custody
- Expert Testimony
- Water Treatment Process/ Product Development
- http://www.bfenvironmental.com

Know Your H20

Education and Outreach Program funded by

B.F. Environmental Consultants Inc.

Outreach Programs

- Environmental and Professional Education and Training for Citizens and Local Municipalities
- Water Quality Help Guides – Information Library
- Community and Business Outreach Programs
- Low Cost – Informational Water Testing Program with National Laboratory
- Citizen Monitoring Programs- Developing Low Cost Water Quality Sensors

Website: http://www.knowyourh2o.com

KEYSTONE Clean Water Team

The Path to Clean Water™

Keystone Clean Water Team (501 c3)

The organizations mission includes:

Private Well Owner Education Outreach

Encourage Grassroots Efforts To Encourage Private Well Testing, Well Water Construction Standards, and aid Watershed Organizations

Develop Tools to Educate and Inform the Public (Presentations, Videos, Web Apps)

Go to: http://www.pacleanwater.org

Our Program: Know Your H20

https://www.knowyourh2o.com/

Why Test My Water ?

A USGS survey found that 70% of private wells were contaminated. This contamination could result in acute or chronic health concerns.

In general, there are no regulations related to well construction, placement, or required testing in Pennsylvania. It is up to you to determine the safety of your water.

EPA recommends, at minimum, an annual water test for private wells.

Private Well Water Quality
What was the Quality of Private Well Water?

A USGS survey found that 70% of private wells were contaminated. This contamination could result in acute or chronic health concerns (1996).

Sixty-Four Percent of the identified waterborne disease outbreaks in the United States during 1999 and 2000 occurred in unregulated private water Wells. Lee et al. (2002). - **HOW MUCH DOES THIS ADD to Health Care Cost – DO WE CARE??**

Testing Conducted by Wilkes University and the Know Your H20 Program throughout the United States indicates that 30 to over 50% may be contaminated – Mostly by Total Coliform Bacteria – 30% of these E. coli. Positive (1989 – 2023).

PSU – Master Well Owner Network suggests that 33 to 50 % of Private Well Owners in PA may have some form of contamination.

Primary Standards (NPDWR)

National Primary Drinking Water Regulations

Primary standards protect drinking water quality by limiting the levels of specific contaminants that can adversely affect public health and are known or anticipated to occur in water. They take the form of Maximum Contaminant Levels or Treatment Techniques.

There are over 100 chemical and biological primary drinking water standards, which include: trace metals, disinfection agents, disinfection by-products, radiological, microbiological agents, and organic chemicals.

Examples: Arsenic, Lead, MTBE, total coliform, *Giardia*, Trihalomethanes, Asbestos, Copper, Benzene, Trichloroethane, etc.

Secondary Standards

National Secondary Drinking Water Regulations

These standards were established more for cosmetic Effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor or color) in drinking water.

These are not regulated standards, but recommended limits.

The secondary standards include: aluminum, chloride, color, corrosivity, fluoride, foaming agents, iron, manganese, odor, pH, silver, sulfate, total dissolved solids, and zinc.

What Should I Test

The Selection of the Appropriate Testing Parameters Depends on YOUR Water

- How does it taste?
- Do you have odor problems ?
- Are there any aesthetic problems, such as: color, turbidity, grittiness, or staining ?
- Where are you located ?
- How much do you want to spend ?

Comprehensive certified testing can cost over $2500.00

Well Construction Options for Private Wells

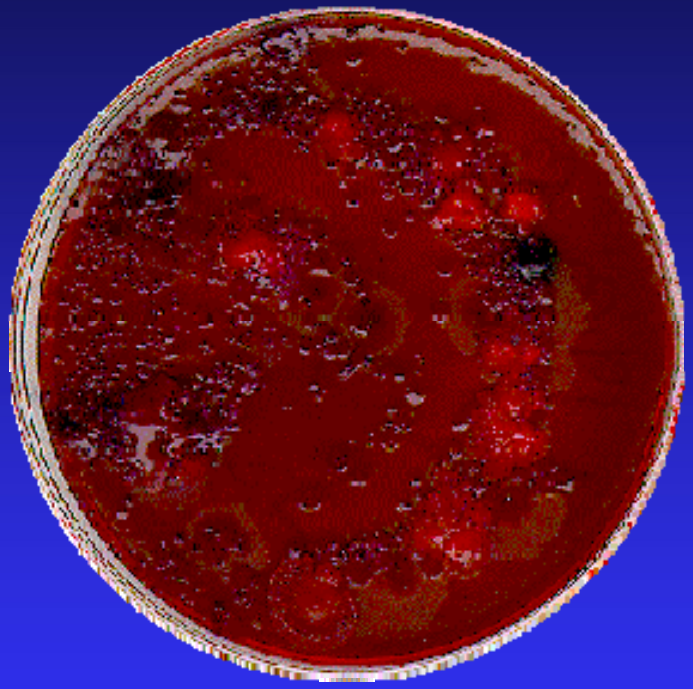
Standard Well Cap

Allow entry for insects, small animals

Sanitary Well Cap

Sealed to prevent contamination

Based on the geology of the NEPA and my 20 years experience, the common water quality problems are as follows:



Corrosive Water

Low pH

Soft Water (low hardness) to Moderate Hardness

Iron and Manganese

Total Coliform Bacteria

Sulfur Odors

Contamination by VOCs, SOCs,
Glycols, Saline Water, and Radionuclides are NOT COMMON, but saline water may influence 1 to 3 % of wells – This is 12,000 to 36,000 households in PA!

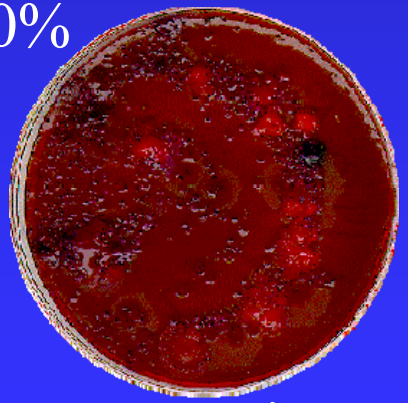
This is Drinking Water in PA?

50%

Iron / Manganese

Sediment / Gases

Other 50%



Bacteria

Corrosion

Historic Testing in Big Bass Lake

- Since 2015, we have been involved with 3 private well sampling and testing events in Big Bass Lake.
- During the period from 2015 to 2017, a total of 54 private well samples were tested for a range of parameters.
- During homeowner interviews, the primary concerns that were reported were discolored water, strange odors, taste issues, staining, and corroding plumbing and piping.
- My favorite – My Bourbon tastes BAD ! When I use ice from my refrigerator.

Parameters of Concern

Concern	Exceed	Qualifier	% of
Total Number of Samples	54		Population
pH	15	< 6.5	27.8
Total Coliform	21	Positive	38.9
E. Coli	2	Positive	3.7
Manganese	4	> 0.05 mg/L	7.4
Lead	2	> 0.005 mg/L	3.7
Corrosion Index	20	< -2	37.0

pH, Manganese, and Corrosion – Typically caused by water quality within the aquifer.

Total Coliform / E Coli – Well Placement, Construction, Septic

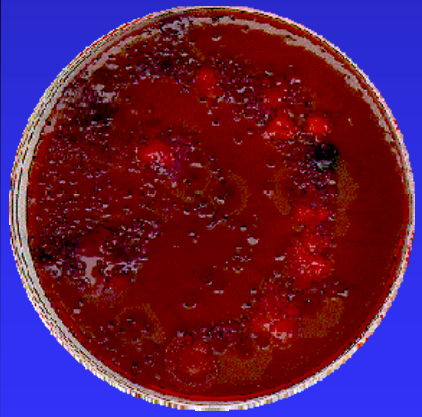
Lead – Reaction of Water with fixtures and household piping.

Parameters to Monitor

Monitor	Detects	Qualifier	Percent
Arsenic	1 (0.003 mg/L)	Detected	2.2
Iron	11	Detected	20.4
Nitrate	30	> 0.5 mg/L	55.6
Copper	26	Detected	48.1
Zinc	4	Detected	7.4

Iron and Arsenic – aquifer properties and if you have an iron or Manganese problem you may have an arsenic issue.
Nitrate – Land-use (Septic / Agriculture)
Copper and Zinc – Water quality and corrosive water

Coliform Bacteria



Coliform Bacteria
- Absent or < 1 colony/100 ml

Testing Purpose
- Used as an Indicator of Sanitary Condition of Water Source

Sources
- Natural Soil Bacteria
- Human and Animal Waste
- Insect Waste

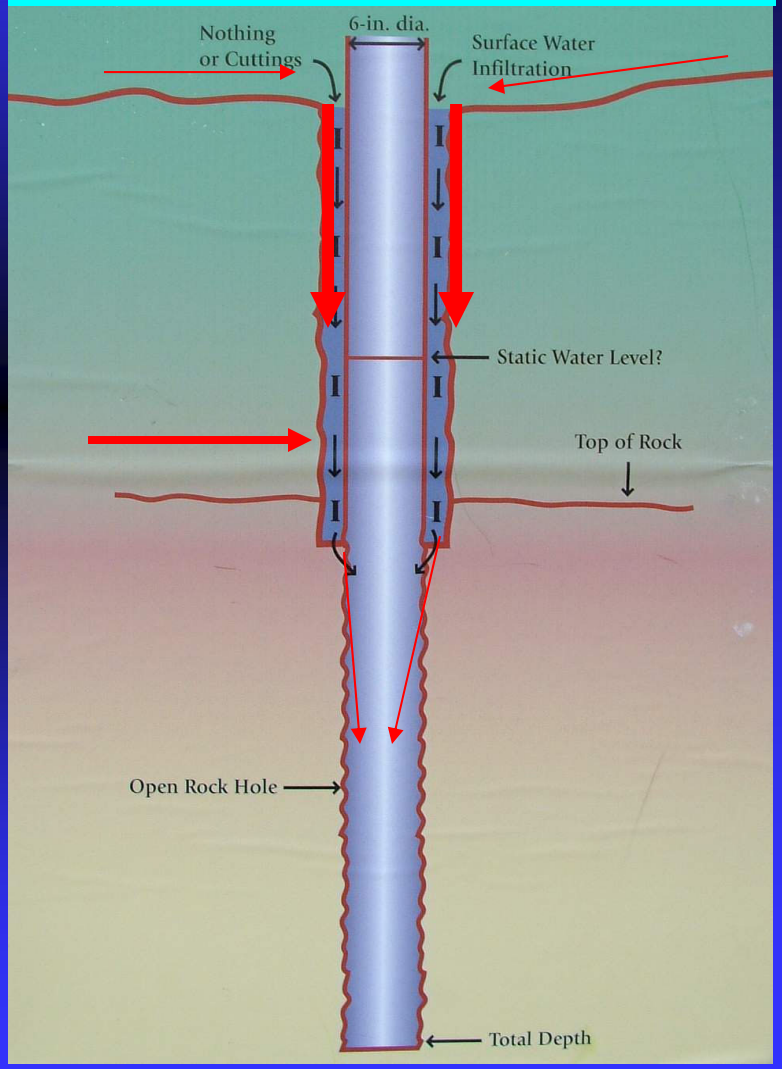
Unsanitary Well Cap

- Insects, Larvae and Nests / Egg Masses
- Mouse Colonies
- Snakes
- Beehives
- Mud - when casing to close to ground

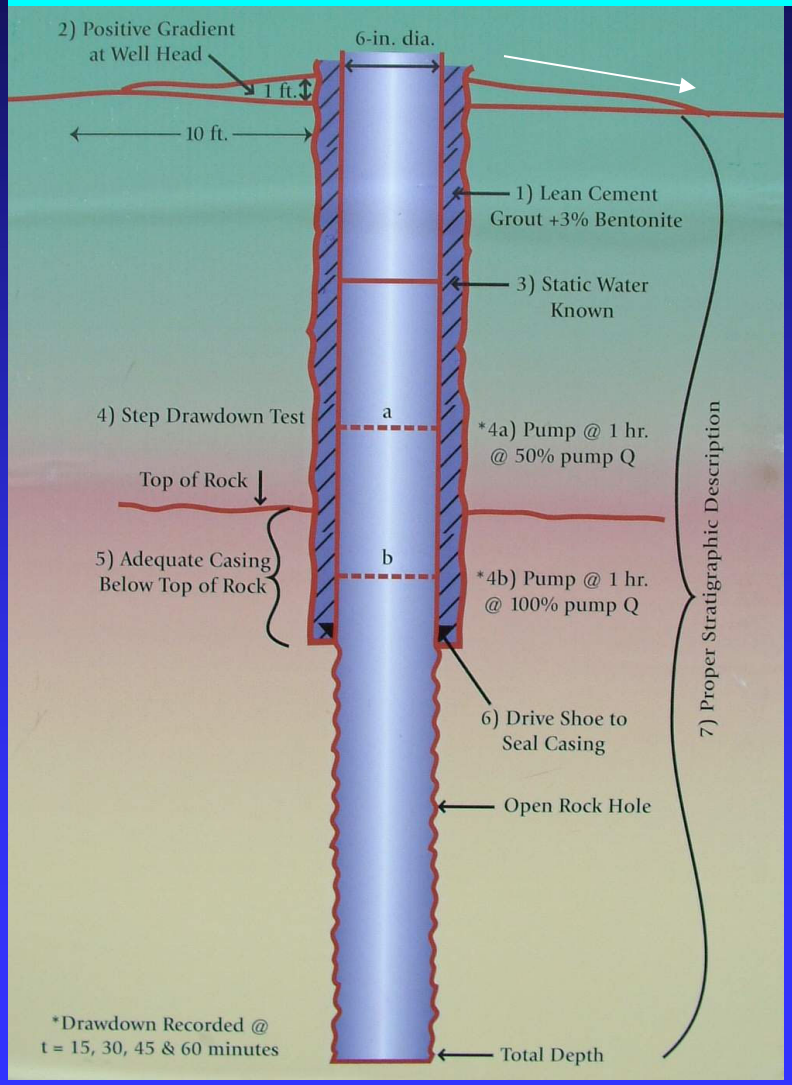
Types of Contamination - Bacteria, Pathogens, Sediment
Subject to Vandalism, Salts, and Flooding

Well Cap Not Secure

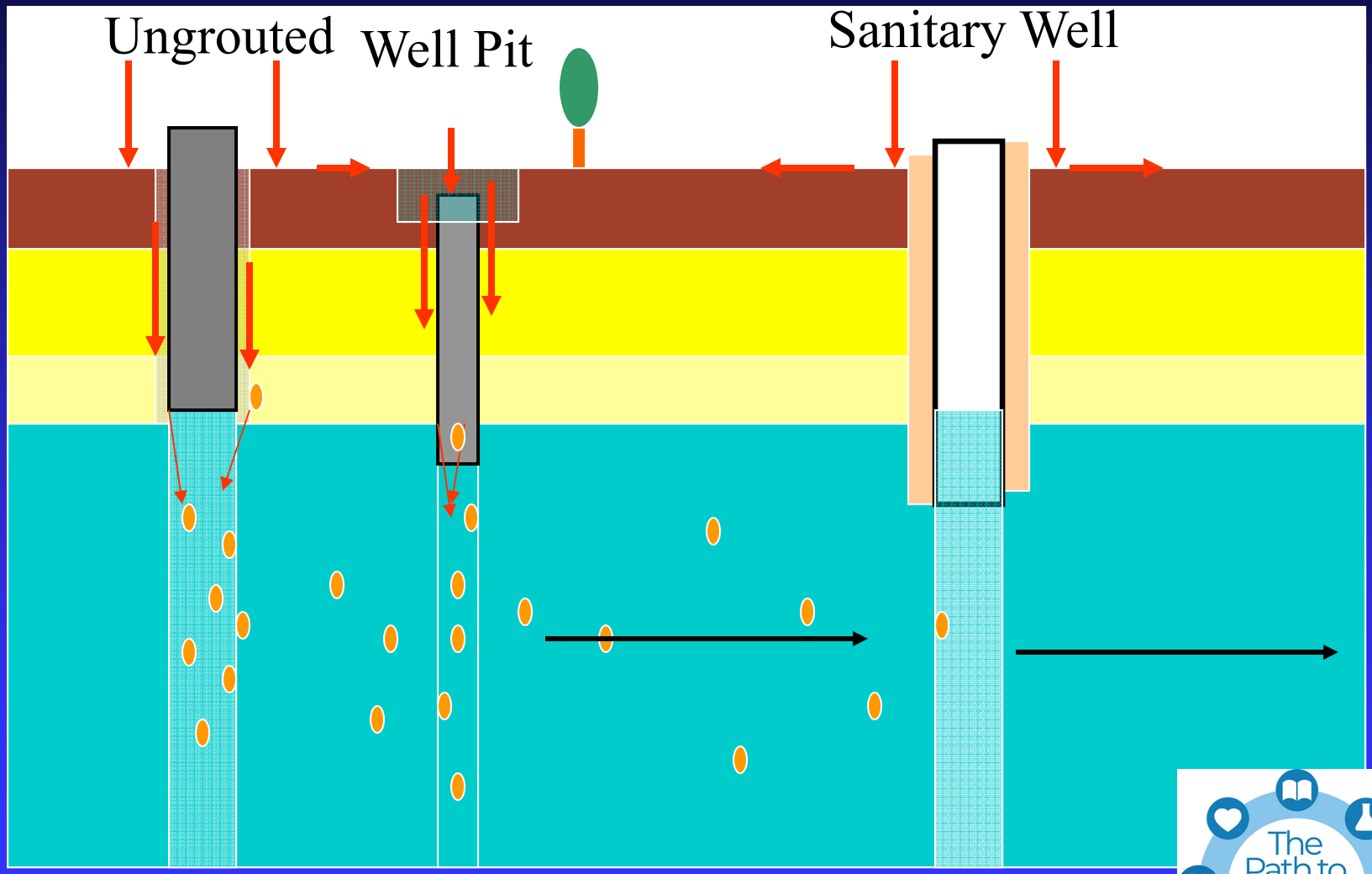
An Ungrouted Residential Well



A Properly Grouted Well



How Contaminants Can Get In to the Aquifer (Surface)



pH

pH < 7 acidic

a pH > 7 basic

NSDWR – 6.5 – 8.5

Problems

- Bitter or Alkali Taste

- Corrosion
- Scale Formation
- Leaching Metals- Copper, Lead, Zinc, and Aluminum

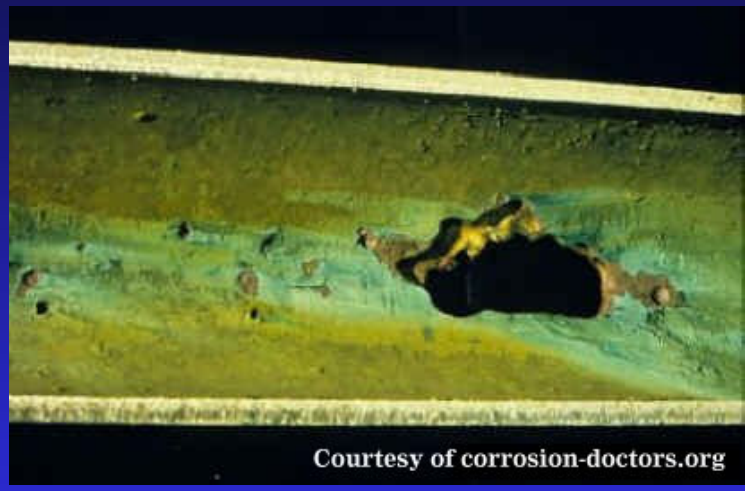
Corrosive Water

- **Chemical or Biochemical Reaction between the water and metal surfaces.**

- **The corrosion process is an oxidation/reduction reaction that returns refined or processed metal to their more stable ore state.**

- **Corrosion can also be accelerated by:**

- **1) low pH and high pH;**
- **2) high flow rate within the piping;**
- **3) high water temperature;**
- **4) chemistry of the water; and**
- **5) presence of suspended solids, such as sand.**



Copper – Typically Blue or Blue-Green Staining

May also have elevated levels of Lead and Zinc.

Water Hardness, Iron, Manganese

- **The hardness of a water is a measure of the concentration of the multivalent cations (Ca, Mg, Fe, Mn, etc) associated with carbonates (CO3) .**
- **Hardness is typically reported as mg /L as CaCO3 (calcium carbonate)**
- **Grains per gallon (1 gpg (US) = 17.12 mg CaCO3/L).**
- **Hardness Classification:**
  - **Soft: 0 to 17 mg CaCO3/L**
  - **Slightly Hard: 17 to 60 mg/L;**
  - **Moderately Hard 60 to 120 mg/L**
  - **Hard 120 to 180 mg/L**
  - **Very Hard > 180 mg/L**

Secondary Drinking Water Standard
Iron – 0.30 mg/L (red or black)
Manganese – 0.05 mg/L (black)

Big Bass Lake Well Water - Total Hardness

Hardness	mg CaCO3/L	Number	Concern
Soft	< 17	8	To Soft
Sl. Hard	17 to 60	9	Nuisance
Mod. Hard	> 60 to 120	29	Ok
Hard	> 120 to 180	7	Nuisance
V. Hard	> 180	1	To Hard

Samples that were consider “To Soft” – Typically associated with water that had been treated using a softener.

Protect Your Water Source

Things You or Your Community Can Do

- Periodically Inspect
- Drain Surface Water and Runoff Away
- **Install Sanitary Seal**
- Annual Testing
- Maintain Records
- Start a Community Based Groundwater Education Program
- Keystone Clean Water Team (Host an Event)
- Proper Abandonment
- Chemical Storage, Disposal and Use
- Keep Wellhead Above Grade
- Proper Well Location
- Septic System Maintenance
- Recycle used Oil and Participate in Hazardous Chemical Disposal Programs
- Well Ordinance

Well Isolation Distances

MONTGOMERY COUNTY HEALTH DEPARTMENT

INDIVIDUAL WATER SUPPLY WELL CONSTRUCTION SPECIFICATIONS (partial listing)

Delineated wetlands or floodplains (25 feet)

Surface waters (25 feet) Storm water Systems (25 feet)

Spray Irrigation/ Septage Disposal (100 feet)

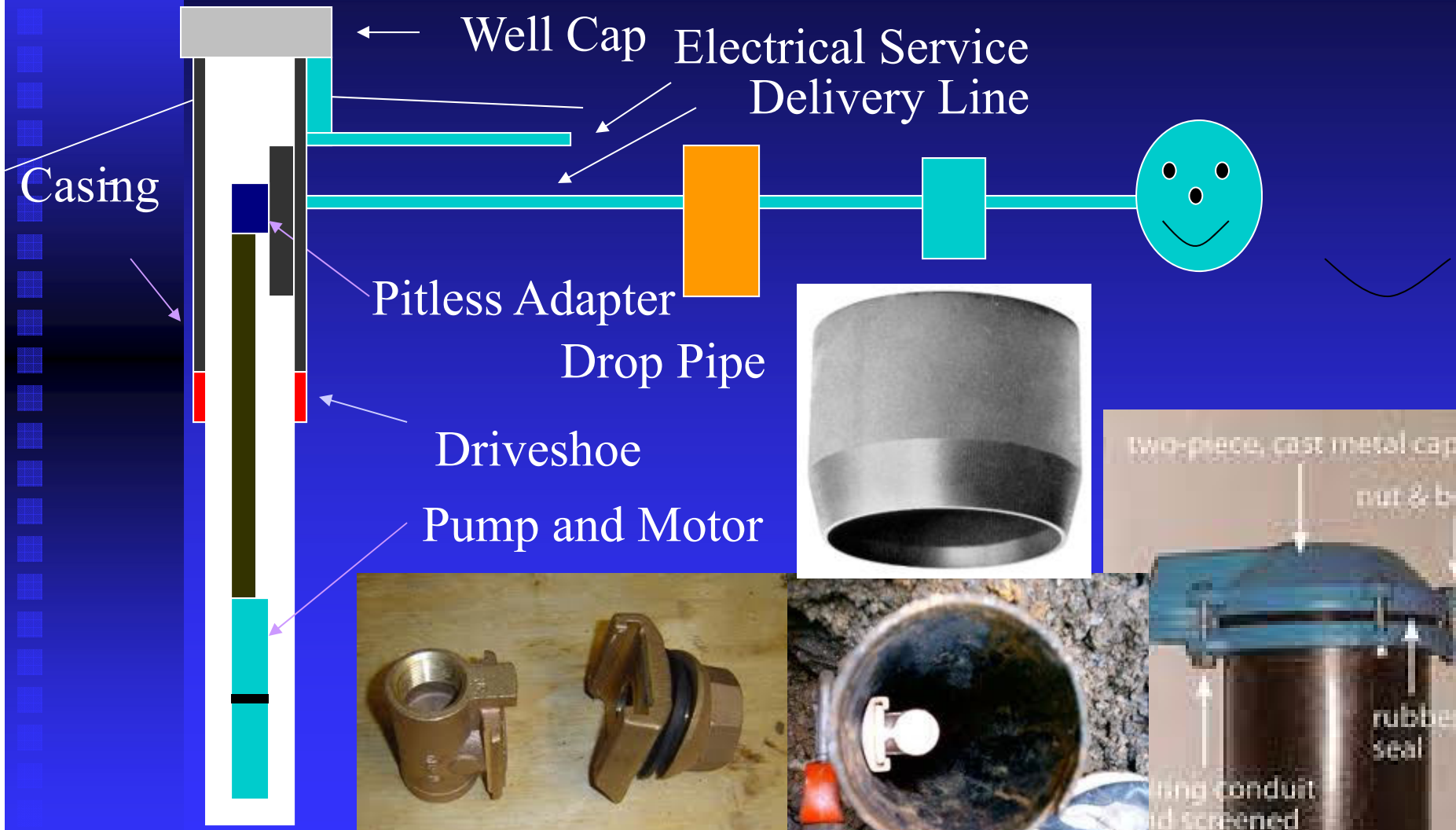
Farm silos / manure storage (200 feet)

Septic Tanks/Holding Tanks (50 feet)

Chemical Storage/Preparation Area (300 feet)


Bentonite Grout

Components of a Well



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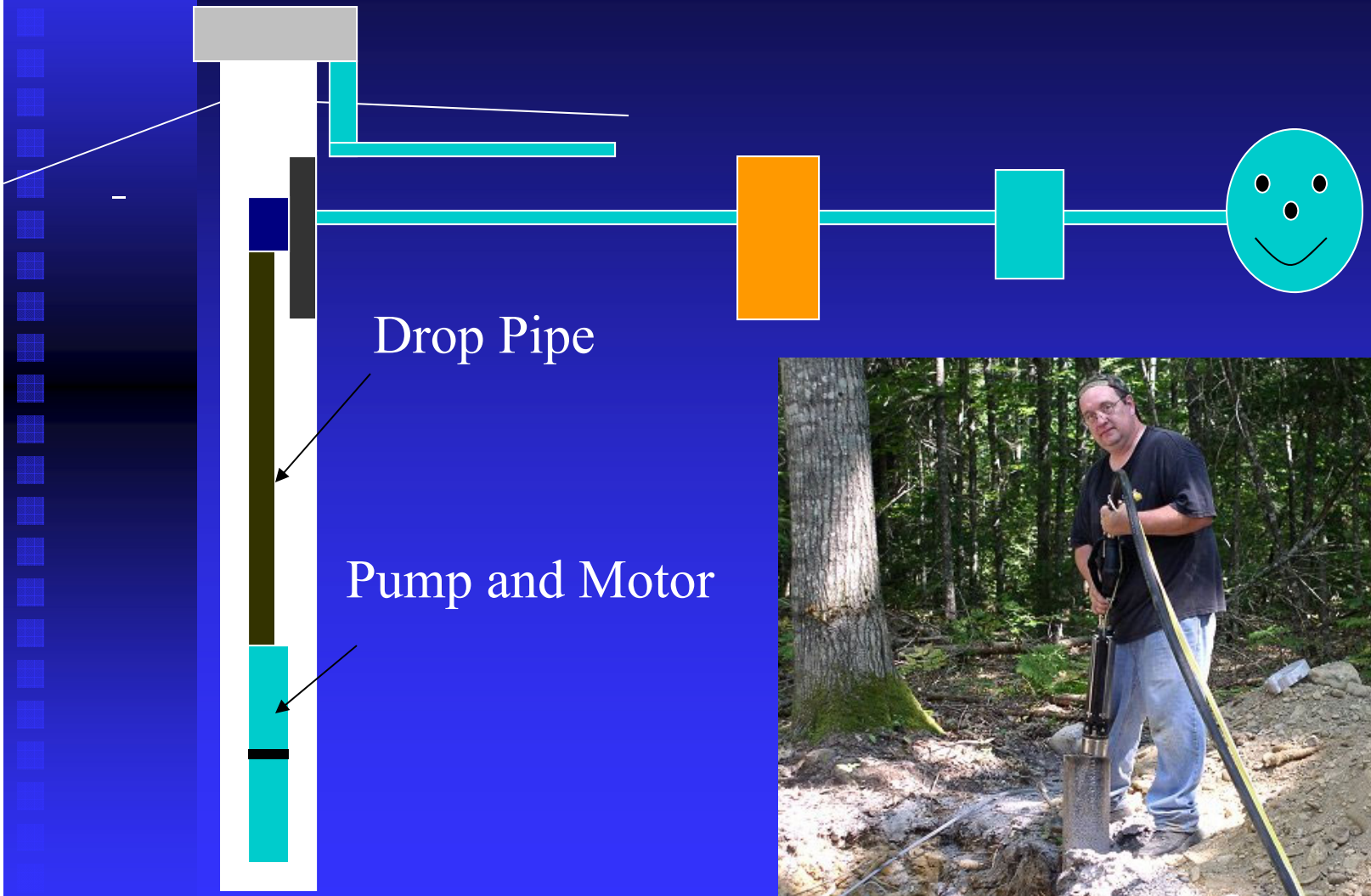

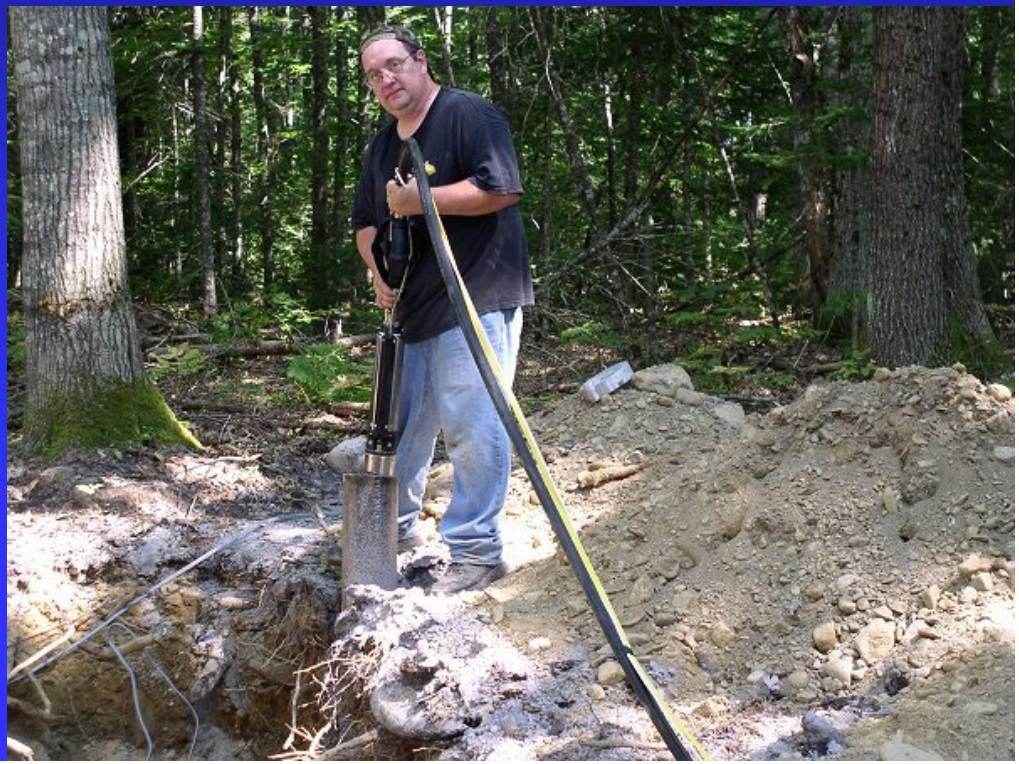

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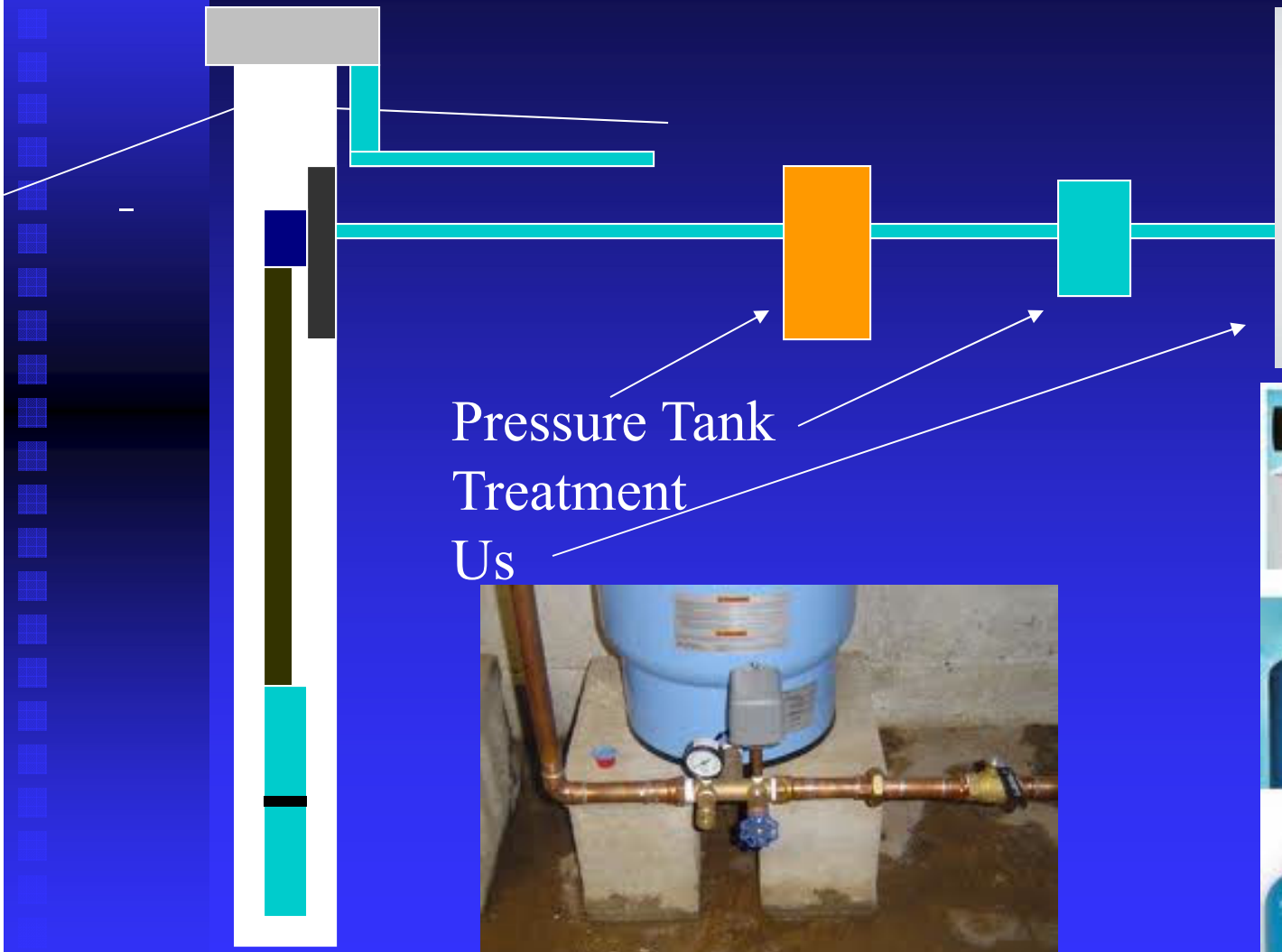
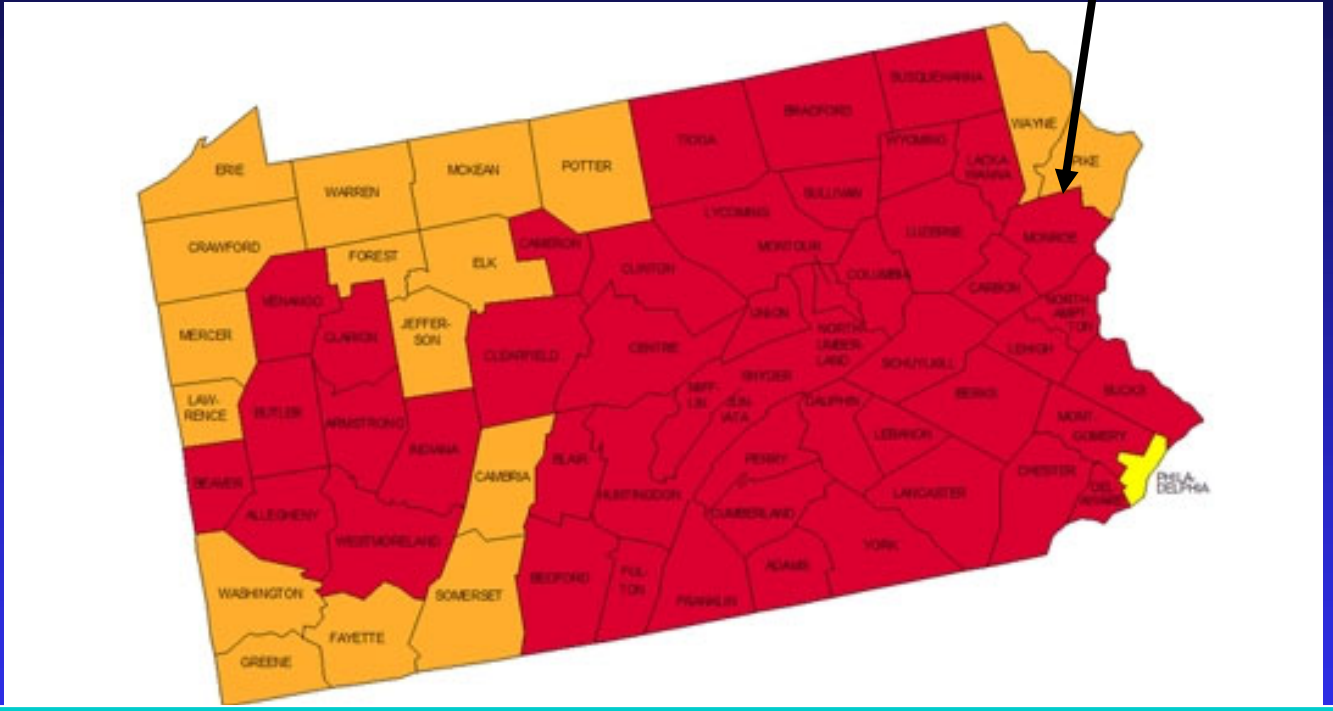


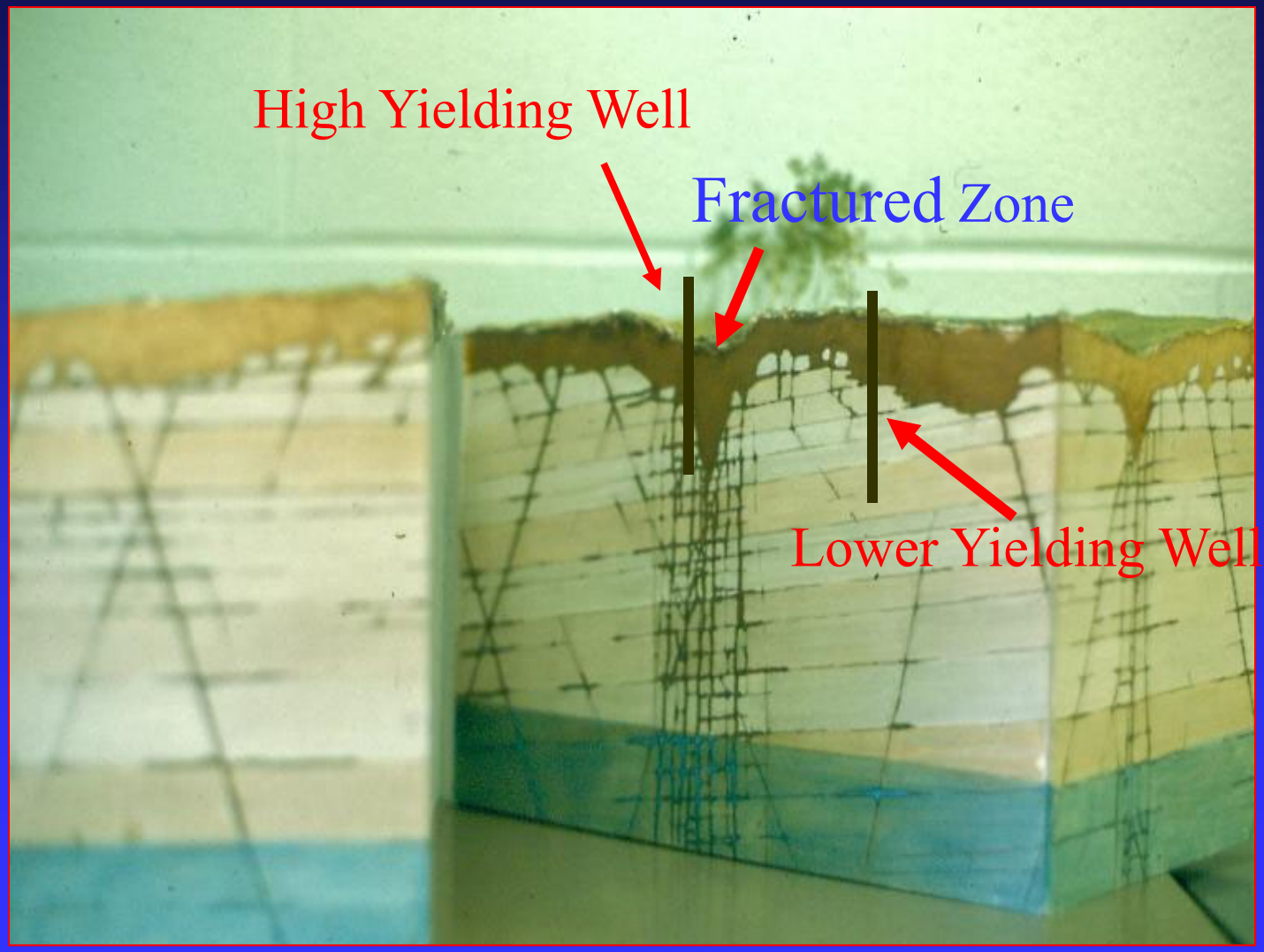
Pressure Tank
Treatment
Us

Radon (In Air): Monroe County, PA



Monroe County in the Red Zone –
Suggests indoor air radon levels are greater than 4 pCi/L
If you have a radon system for your home, you radon in the well water should be tested.
https://www.knowyourh2o.com/indoor-6/radon-220-222

Bedrock Fractures and Fractured Zones



Groundwater Moves

1. Which ways can groundwater move?

a. Up

b. Down

c. Sideways

d. All of the above

1. d. All of the above

Although most movement is lateral (sideways), it can move straight up or down. Groundwater simply follows the path of least resistance by moving from higher pressure zones to lower pressure zones.

Groundwater Moves

2. How is the speed of groundwater movement measured?

a. Feet per day
b. Feet per week
c. Feet per month
d. Feet per year

2. d. Feet per year

Groundwater movement is usually measured in feet per year. This is why a pollutant that enters groundwater requires many years before it purifies itself or is carried to a monitored well.

Surface Water Moves

3. How is stream flow usually measured?
a. Feet per second
b. Feet per minute
c. Feet per hour
d. Yards per hour

3. a. Feet per second
Water flow in streams/rivers is measured in feet per second.

Groundwater Moves

4. What determines how fast groundwater moves?
a. Temperature
b. Air pressure
c. Depth of water table
d. Size of materials

4. d. Size of materials
Coarse materials like sand and gravel allow water to move rapidly. (They also form excellent aquifers because of their holding capacity.) In contrast, fine-grained materials, like clay or shale, are very difficult for water to move through. Thus, water moves very, very slowly in these materials.

Groundwater Moves

5. Can the water table elevation change often?

a. Yes

b. No

5. a. Yes

Water table elevations often fluctuate because of recharge and discharge variations. They generally peak in the winter and spring due to recharge from rains and snow melt. Throughout the summer the water table commonly declines due to evaporation, uptake by plants (transpiration), increased public use, industrial use, and crop, golf course and lawn irrigation. Elevations commonly reach their lowest point in early fall.

Groundwater Moves

6. Does aquifer storage capacity vary over time naturally?

a. Yes

b. No

6. a. Yes

Just like the water level in rivers and streams, the amount of water in the groundwater supply can vary due to seasonal, weather, use and other factors.

Regular Maintenance

- Divert Surface Water Runoff Away from Wellhead
- Annual Water Test
- Annual Maintenance on Water Treatment Systems
- Conserve Water/ Fix Leaks
- Proper Use and Storage of Chemicals and other Hazards
- Maintain your septic system.

Remember We ALL Live Downstream

Get Your Water Tested for What YOU Need

- Use eyes, nose, and mouth to identify problems
- Get the water tested and Inspect the Well
- Identify Problems and Take Action
- Action Does not always mean long-term treatment.
- If necessary install treatment and maintain.
- Annual Water Test - https://www.knowyourh2o.com/

Summary

Keys to Safe Drinking Water (Private Well)

- Proper Handling of Chemicals and Waste
- Development of Local Standards
- Understand Your Source
- Annual Water Testing
- Public Education
- Work as a Community

Our Program: Know Your H20

Big Bass Lake – Page

Go To: https://www.knowyourh2o.com (Projects) or visit the BBLCA Website (Water Quality Testing)

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Mr. Brian Oram, PG
Professional Geologist, PASEO, Licensed Well Driller

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