How Well Do You Know Your Water Well?

GROUNDWATER AND WATER WELLS IN NORTHEAST OHIO

Prepared by:

Michael Matheson, P.G.; Plateau Environmental Services, Inc.
Joe Bowden, PhD; CDS Environmental Services, LLC

In cooperation with the following agencies:
Ohio Department of Health
Ohio Department of Natural Resources – Division of Oil & Gas Resources Management and Division of Soil & Water Resources
Ohio Environmental Protection Agency
Trumbull County Soil & Water Conservation District
Trumbull County Farm Bureau
Trumbull County Planning Commission

AGENCY CONTACTS

Ohio Department of Health
www.odh.ohio.gov/
(614) 466-1390

Ohio Department of Natural Resources
www.dnr.state.oh.us/
Division of Oil & Gas Resources Management: (614) 265-6922
Division of Soil & Water Resources: (614) 265-6610

Ohio Environmental Protection Agency
www.epa.state.oh.us/
(330) 963-1200

Trumbull County Soil & Water Conservation District
www.swcd.co.trumbull.oh.us/
(330) 637-2056, ext.111

Trumbull County Farm Bureau
www.ofbf.org/counties/trumbull/

Trumbull County Planning Commission
www.planning.co.trumbull.oh.us/

US EPA Safe Drinking Water
www.water.epa.gov/drink/

Information considered accurate as of December, 2012.

Table of Contents

Introduction

Northeast Ohio is a unique mix of metropolitan, suburban, and rural environments. For many of us in rural areas, individual domestic water wells are a way of life. This informative booklet has been prepared as a reference guide for private water well owners. In it you will find basic information concerning the groundwater that is supplied to you from your private water well. It includes information about:

- the occurrence of groundwater and different types of aquifers;
- how recharge and use of groundwater can affect the amount and quality of water available to you;
- water well permitting and water testing;
- contamination sources and setbacks;
- typical components of a water well and distribution system;
- water quality standards and test result interpretation;
- methane in groundwater;
- information concerning well maintenance and disinfection.

Also included are some handy tools such as a water well troubleshooting guide, a water treatment decision guide, a glossary of terms, and links to helpful internet web sites that deal with water issues.

Finally, the guide also contains contact information for various government and private agencies that can help answer questions that this document does not cover. People at these agencies have a great deal of very specific information about drinking water, water wells, and springs. They may be able to help you investigate and resolve problems or concerns that you may have.

It is our hope that you will keep this guide handy and use it to record information about your well and answer basic questions about groundwater and your drinking water source for years to come.

Aquifers and Water Use Basics

Aquifers are porous and permeable sediment or rock. Water is stored in the small spaces between sediment or rock grains and particles and moves very slowly through these interconnected "pore spaces." Groundwater can also be stored and move through small, interconnected and naturally occurring fractures found in some rocks like sandstone, limestone, or shale. There is generally no such thing as "underground rivers or lakes" except in rare and special geologic conditions involving rocks known as karst limestone. Limestone aquifers are rare in northeast Ohio; however, they are common in the western and central portions of the State.

The figures to the right give an idea of how groundwater is found in different types of rock. Sand and gravel can hold lots of water because pore spaces are large and well connected. Glacial till is an unorganized mixture of clay, silt, sand and rock. The pore size and connection of pores can vary widely with clay sized material limiting water yield. In glacial till the interbedded sand and gravel are the main aquifers. Sandstone has smaller pores that are less well-connected so it often yields less water. Shale has very small pores that are not interconnected; therefore, shales normally yield very little water. Coal can yield large amounts of water, but will often contain some methane gas and hydrogen sulfide. Limestone often has no pores and water must be drawn from interconnected naturally occurring fractures.

Aquifers are replenished through a process called "recharge." Rain and snowmelt all soak into the ground and slowly move downward to the layer of saturated pore spaces. The upper surface of the layer of saturated pore spaces is called the "ground water table." Rivers, lakes, streams and drainage ditches can also recharge aquifers. When drought occurs, recharge is diminished. Shallow river valley aquifers can be recharged quickly, but recharge water may take many years to reach deep bedrock aquifers.

Pumping groundwater from a well can cause a decline in groundwater levels at and near the well. This decline in groundwater level near the well also can cause a diversion of groundwater from its natural, possibly distant area of discharge. Pumping of a single well typically has a local effect on the groundwater-flow system. Pumping of many wells (sometimes hundreds or thousands of wells) in large areas can have regionally significant effects on groundwater systems. Too much groundwater pumping can exceed the recharge rate and groundwater levels in a given area will decline. This is called "groundwater mining."

Sand and Gravel

Glacial Till

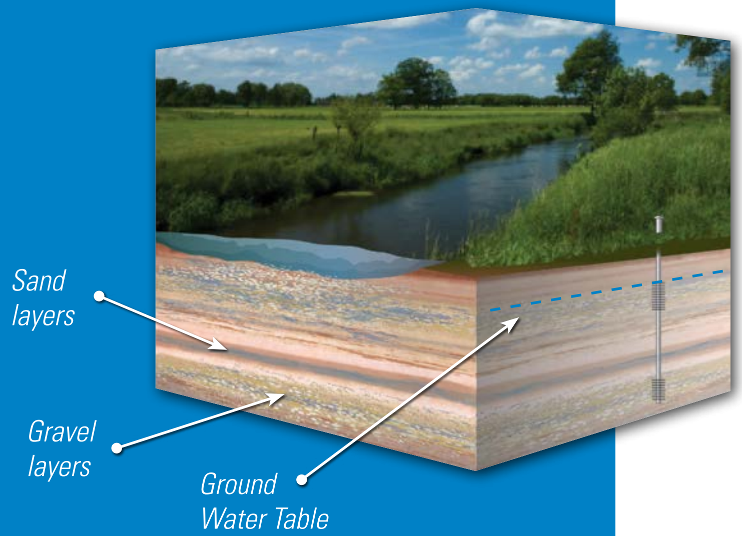
Sandstone

Shale and Coal

Limestone

NORTHEAST OHIO WATER WELLS TYPICALLY TAP INTO FOUR DIFFERENT KINDS OF AQUIFERS.

River Valley Aquifer



Glacial Till and Buried Valley Aquifers

River Valley Aquifer

River valley aquifers are found in shallow loose sediments like gravel and sand next to rivers, streams and lakes. They are usually of limited extent within the immediate river or stream valley. These aquifers are recharged by infiltration over the valley and by the river flow, and usually have good water quality and sustained yield because of the regular recharge over the valley and from the river or lake. However, the groundwater is often close to the ground surface and is therefore more susceptible to pollution from adverse surface conditions or improperly functioning sewage treatment systems.

Glacial Till and Buried Valley Aquifers

Glacial till and buried valley aquifers are varying thickness accumulations of unconsolidated sand, gravel, silt and clay deposited over large areas by glaciers when they advanced and retreated many thousands of years ago. Most of northeast Ohio is covered with glacial till that varies in thickness and its ability to yield water. The deposits of glacial till can be thin in some areas with relatively limited groundwater supply. Other areas have thick till and sand and gravel deposits that are filling buried valleys that were active river valleys prior to the last glaciation. An example would be the Tuscarawas River Valley Aquifer. Recharge to these aquifer types is primarily from infiltration of snowmelt, rainfall, and small streams, rivers, lakes, and ditches. The buried valley aquifer type typically has good water quality and fair to very good yield. However, as more water wells are drilled, the aquifers can become depleted in certain areas.

Bedrock Shale and Sandstone Aquifer

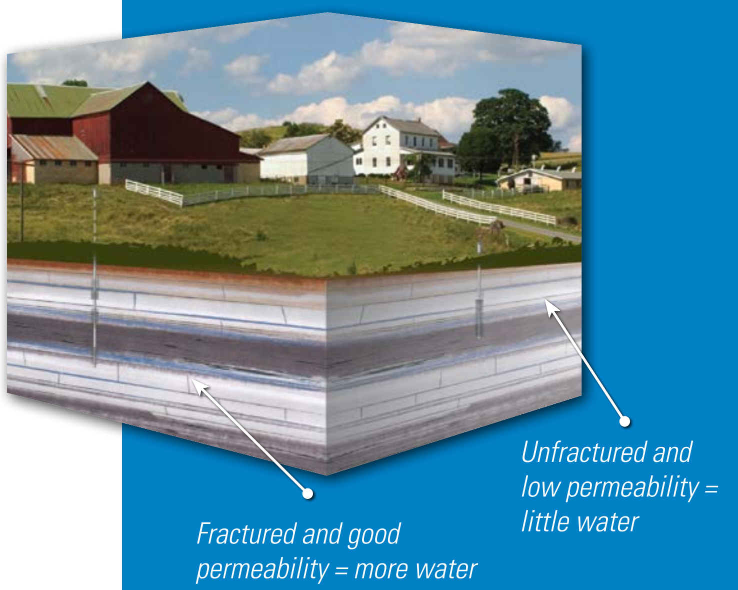
Bedrock shale and sandstone aquifers are often tapped in northeast Ohio as these are the most common rock types beneath glacial till. Most of these aquifers are made up of interbedded layers of sandstone and shale, and sometimes coal. More groundwater is generally found in sandstone and coal than in shale. The yield and quality of water removed from bedrock aquifers can vary widely. In some areas dominated by shale it may not be possible to develop a well with good yield and water quality. Because recharge into bedrock aquifers is usually very slow, bedrock aquifers can easily suffer from the effects of groundwater mining.

Fractured Aquifer

Areas with thick sandstone or limestone deposits can have their aquifer yield enhanced by natural fracturing. These types of rocks range from very good to very poor primary porosity and permeability. However, groundwater can be stored and transported in interconnected naturally occurring fractures among the rock. Wells that are drilled into a network of fractures can yield water, but, a nearby well that does not intercept fractures may yield no water at all.

Bedrock Shale and Sandstone Aquifer

Fractured Aquifer



"Most of northeast Ohio is covered with glacial till that varies in thickness and its ability to yield water."

Water Well Permitting, Construction and Recordkeeping

The early stage of planning a new or replacement water well includes several steps. These steps include selecting a registered, private water system contractor, selecting a well location that avoids contamination hazards, and obtaining a well permit from the local health department. The Ohio Department of Health requires that every new or replacement well have a permit before it is drilled, and that water wells must be drilled and constructed pursuant to Ohio Water System Rules (OAC, Ch. 3701-28). www.odh.ohio.gov/odhprograms/eh/water/PrivateWaterSystems/PWSRules.aspx

In general, the well permit application (www.odh.ohio.gov/~/media/ODH/ASSETS/Files/eh/water/application/permitapplication.ashx) asks for ownership and proposed well location information, water use, and sewage treatment system information, and the well driller's registration number.

The Ohio Department of Natural Resources, Division of Soil & Water Resources (DSWR) has detailed Ground Water Resource Maps on-line of each county in Ohio that indicate approximate well yields and pollution potential of ground water that will be encountered when drilling a well. These maps can be downloaded at: www.dnr.state.oh.us/tabid/3629/Default.aspx

DNR 7802.96

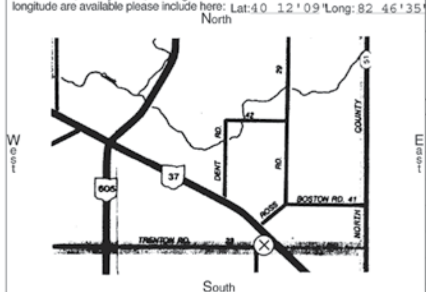
TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT
Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

WELL LOCATION

County Delaware Township Trenton
Owner/Builder (Circle One or Both) E. J. Fudd (First / Last)
Address of Well Location 181 Green Cook Rd. (Number / Street Name)
City Sunbury Zip Code +4 43074-9761
Permit No. 960.95 Section/Lot No (Circle One or Both) 20
Location of Well in State Plane coordinates, if available: Use of Well Residential
N ☒ X 195339 . 425 +/- 20 ft or m
S ☐ Y 1922944 . 533 +/- 20 ft or m
Elevation of Well 1084 . +/- 5 ft or m
Datum Plain: ☒ NAD27 ☐ NAD83 Elevation Source Topo map
Source of Coordinates: ☒ GPS ☐ Survey ☐ Other

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: 40 12'09" Long: 82 46'35"



WELL TEST*

Pre-Pumping Static Level 20 ft. Date 12/10/95
Measured from: ☒ Top of Casing ☐ Ground Level ☐ Other
☒ Air ☐ Bailing ☐ Pumping* ☐ Other
Test Rate 35 gpm Duration of Test 1 hrs.
Feet of Drawdown 20 ft. Sustainable Yield 25 gpm
*(Attach a copy of the pumping test record, per section 1521.05, ORC)
Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No
Quality Clear, 1ppm Fe, 30 gpg hardness, pH 7

PUMP/PITLESS

Type of pump Submersible Capacity 10 gpm
Pump set at 65 ft. Pitless Type Adapter
Pump installed by Acme Drilling Co.

I hereby certify the information given is accurate and correct to the best of my knowledge.
Drilling Firm Acme Drilling Co.
Address 1234 Main St.
City, State, Zip Anytown, Ohio 56789
Signed W.E. Coyote Date 1/23/96
ODH Registration Number 1111

CONSTRUCTION DETAILS

☒ Rotary ☐ Cable ☐ Augered ☐ Driven ☐ Other
BOREHOLE/CASING (measured from ground surface)
1☒ Borehole Diameter 7 7/8 inches Depth 127 ft.
Casing Diameter 5 in. Length 20 ft. Thickness .327 in.
2☐ Borehole Diameter inches Depth ft.
Casing Diameter 5 in. Length 102 ft. Thickness .265 in.
Casing Height Above Ground 1 ft.
Type: 1 ☐ 2 ☐ Steel; 1 ☐ 2 ☐ Galv.; 1 ☒ 2 ☒ PVC; 1 ☐ 2 ☐ Other
Joints: 1 ☐ 2 ☐ Threaded; 1 ☐ 2 ☐ Welded; 1 ☒ 2 ☒ Solvent; 1 ☐ 2 ☐ Other

SCREEN
Diameter 5 in Slot Size .050 in Screen Length 5 ft.
Type Machine-slotted Material PVC
Set Between 122 ft. and 127 ft.

GRAVEL PACK (Filter Pack)
Material/Size #4 Parry sand Volume/Weight Used 400 lbs
Method of Installation Gravity pour
Depth: Placed FROM 118 ft. TO 127 ft.

GROUT
Material Benseal/EZ Mud Volume/Weight Used 175 gal
Method of Installation Pumped through 1" tremie tube
Depth: Placed FROM 118 ft. TO surface ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Brown clay	0	15
Gray sandy clay	15	20
Sand & gravel (dry)	20	22
Gray clay w/gravel	22	33
Sand & gravel (dry)	33	39
Gray clay	39	119
Coarse sand & gravel	119	127
Water encountered at 122'		

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 12/10/95 Total Depth of Well 127 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971
Blue - Customer's copy Pink - Driller's copy Green - Local Health Dept. copy

Sample Well Construction Report

"Have the water from your new well tested by a qualified analytical laboratory. Record the results for future reference."

Another early step in the well drilling process is planning for your water analysis and treatment. In Ohio, private well owners are responsible for the quality and quantity of their water supply. They are also responsible for working with a registered private water system contractor to determine what treatment equipment may be necessary for their well water. Before drilling a new well or sampling your existing well or spring, you should contact your local health department or a qualified analytical laboratory to discuss the appropriate analytical testing to be performed on your drinking water. New well construction or alteration requires a coliform count, E. coli test, and a nitrate screen. The fee for these three tests are included in your well permit fee. Samples for these three tests are collected by your local health department. You are responsible for any additional testing and you should contact a certified laboratory for bottles to collect and preserve the additional water samples. Then, after the well is drilled, fully developed and disinfected, you will be ready to collect your water sample and deliver it to the laboratory. Based on the analytical results, you can select appropriate treatment equipment (see Water Treatment Decision Guide on page 22).

As part of the well drilling process, the driller must record certain data that will be reported to the Ohio Division of Soil and Water Resources (DSWR). This includes a record of the geologic formations penetrated (the well log), an as-built well construction record and diagram, and an accurate water level and well yield test. It is very important that the driller collects and records this information accurately. You may wish to ask the driller to collect and save samples of all the different soil and rock formations that were penetrated so that they can be examined later by a geologist. You will also want the registered private water system contractor to provide you with copies of all the diagrams and reports that must be submitted to DSWR.

If you have an existing well with no records, DSWR may be able to provide you with copies of the reports that were submitted by the driller when the well was drilled. You can find permit and basic construction information about the well at the DSWR website Well Log Search function (www.dnr.state.oh.us/water/maptechs/wellogs/app/default.asp). This web site will have all of the available documents that have been submitted for your well.

Keep these records in a safe place along with this booklet. You will need to refer to these documents in the future when performing well maintenance or while evaluating well problems. Always keep detailed records of any maintenance or testing that is performed on the well.

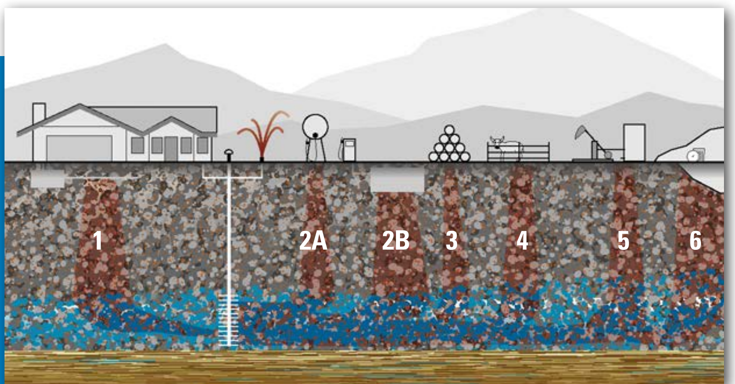
A section is provided on page 32 in the back of this booklet that lets you record some of the basic construction and permit information for your well for your easy future reference.

Water Well Protection and Pollution Sources

MAN-MADE POLLUTANTS

Groundwater pollution occurs when man-made products such as gasoline, oil, road salt, fertilizer, and chemicals get into the groundwater and cause it to become unsafe or unfit for human use. Some of the most common sources of pollutants are chemical spills, contaminated runoff from impervious surfaces, failing sewage treatment systems, animal holding pens (corrals), leaking fuel storage tanks, inappropriate chemical storage sites, landfills, trash piles and the widespread use of road salt and agricultural chemicals. In general, keep these facilities and materials as far away from your water well as possible. If possible, your well should be placed uphill of any potential contaminant source.

A domestic well can easily be polluted if it is not properly constructed or if unsafe materials are released into the ground near a well. Toxic materials spilled or dumped near a well can leach into the aquifer and pollute the groundwater drawn from that well, making polluted wells used for drinking water very dangerous.



Common Man-Made Pollutants

"A domestic well can easily be polluted if it is not properly constructed or if unsafe materials are released into the ground near a well."

Individual sewage treatment systems, or those not connected to a city sewer system, can also be a serious pollution source. Sewage treatment systems are designed to slowly drain away human waste underground at a harmless rate. An improperly designed, located, constructed, or maintained sewage treatment system can leak bacteria, viruses, or household chemicals into groundwater causing serious problems. New sewage treatment system rules are currently being drafted in Ohio. Information about sewage treatment systems can be viewed at www.odh.ohio.gov/odhprograms/eh/sewage/sewage1.aspx. In general, a property owner is responsible for proper installation and maintenance of the system and for abatement of any nuisance arising from its failure. Contact your local or regional health department for more information on local sewage treatment system rules (including design and setbacks).

Landfills are another source of pollution. When properly constructed, contemporary landfills have a protective bottom layer to prevent pollutants from getting into our groundwater. However, if this protective layer fails, pollutants from the landfill can make their way down into the groundwater.

Finally, chemicals including fertilizers, insecticides, and pesticides are washed into the ground by irrigation and precipitation and eventually end up in the groundwater if they are improperly applied.

Sources of Man-Made Pollutants Discussion below refers to figure on the left.

1. Sewage treatment systems leach household waste into soil and neutralize many types of contaminants. However, a sewage treatment system should be at least 50 feet away and preferably down hill from a drinking water well/spring. Chemicals should not be poured down the drain as these may not be effectively neutralized by the soil, and can kill the bacteria community that is critical to proper septic system operation.

2. (A and B) Fuel Tanks and fueling operations can be a source of contamination of groundwater if there are leaks or spills. This can happen with both aboveground and underground tanks and pipelines. Do not store fuel or transfer fuel near a water well or spring. Fix leaks and cleanup spills immediately.
3. Chemical storage, leaks or spills and improper chemical use can all be sources of groundwater contamination. Typical chemicals stored in a household may include paint, solvents, fertilizer, herbicides, pesticides, cleaners, and oil. Always use chemicals as instructed on the label. Do not store or use chemicals near (or in the same building as) your water well. Fix leaks and cleanup spills immediately.
4. Animal holding pens tend to become areas of concentrated animal waste. Rain water and snowmelt can carry these wastes into groundwater. Do not situate animal holding pens near your water well. Contact your local health department for the recommended distance. This distance is based on the type and quantity of animals and can be as far as 1000 feet. Use a minimum 50 foot downhill offset as you should with your sewage treatment system. Also, do not bury a dead animal within 150 feet of a water well or spring (preferably further and downhill).
5. Oil and gas production facilities can be a source of contaminants such as oil, condensate, and produced water. Oil and gas facilities must be sited a minimum of 100 feet from residences and other occupied structures. Keep your water well at least that far from an oil and gas production facility. Also, if you notice anything leaking from an oil and gas facility immediately call the operator of the facility (there should be a sign at the facility with an emergency contact number) or 911 so that trained professionals can respond to correct the problem.
6. Landfills can be a source of contaminants that can leach into groundwater. All current municipal and county landfills must meet stringent requirements for construction and monitoring. However, historic landfills, trash piles, and private "farm or family" landfills (dumps) can be an unmonitored source of contaminants. Do not dispose of chemicals, petroleum products and other potential contaminants in private landfills. Information concerning disposing of your solid waste is available from your local solid waste management district. Find your district at: www.ohiodnr.com/tabid/15382/Default.aspx

NATURAL CONTAMINANTS

Contamination of groundwater is not always a result of the introduction of pollutants by human activities. Possible natural contaminants include trace elements such as arsenic and lead, dissolved gases like methane and radon, and high concentrations of commonly occurring dissolved salts.

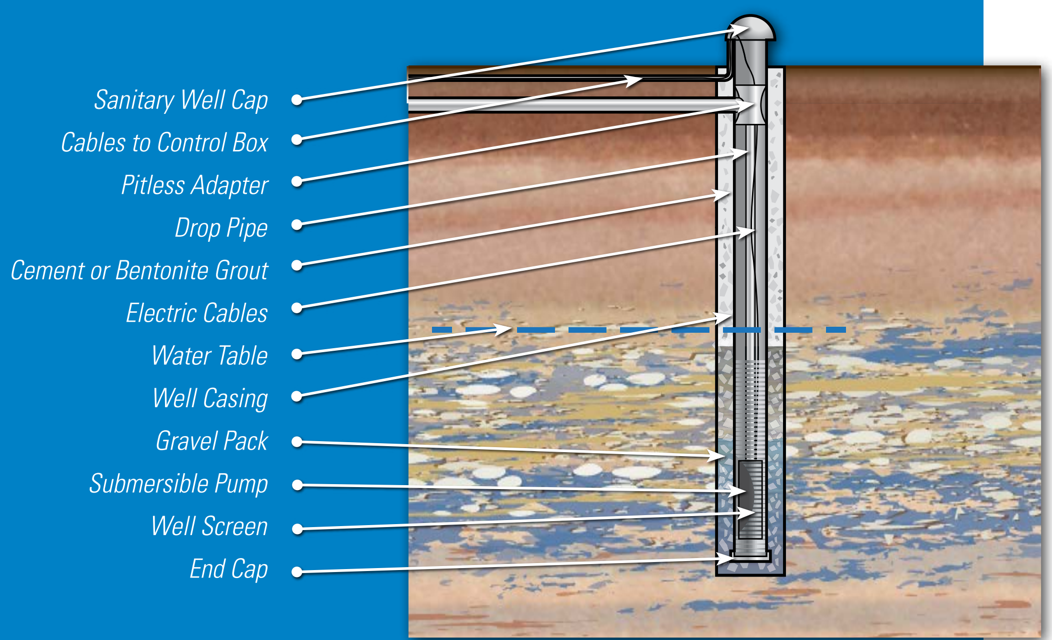
In Ohio, groundwater naturally contains arsenic, chloride, dissolved salts, fluoride, iron, magnesium, manganese, sulfate, radon, and other trace metals in concentrations exceeding recommended or mandatory standards for public drinking water established by the U.S. EPA and the U.S. Public Health Service. Ohio has adopted the EPA regulations as Health Based Standards for private water systems.

Anatomy of a Water Well

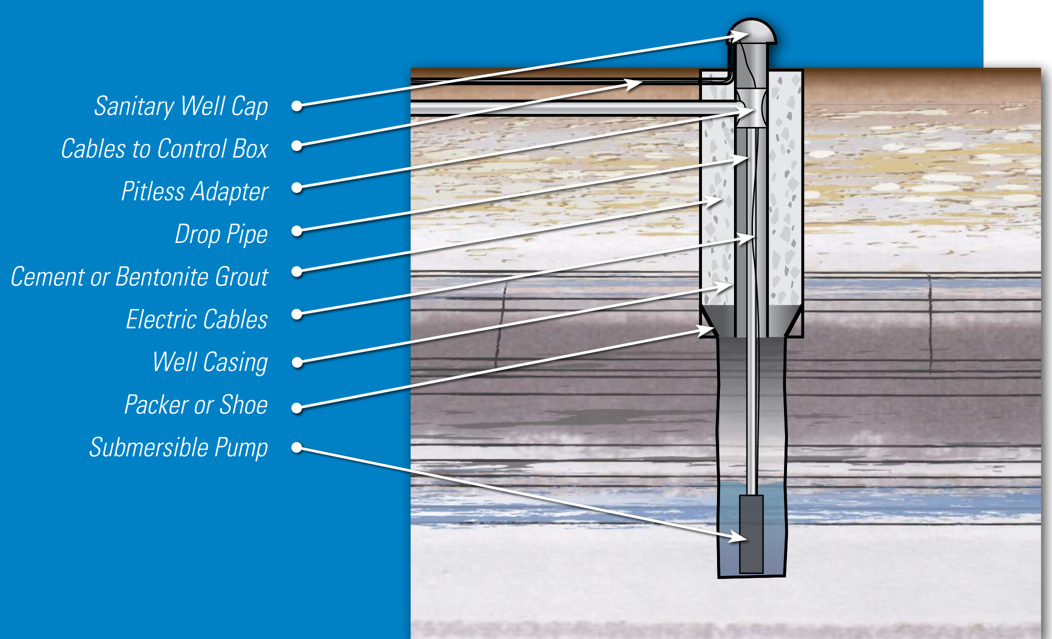
COMPONENTS OF A TYPICAL WATER WELL

These schematic diagrams represent typical water wells as constructed in two very distinctly different common aquifers in Ohio; sand and gravel, and bedrock. While most wells are much deeper than illustrated here, all of the individual components are shown and labeled. Your well may not have all of the listed components. The following list of water well terms helps explain the well components and other useful terms.

Knowing about the different components of a water well, and their function, will allow you to more effectively discuss your well with your registered private water system contractor.



Typical fully cased construction technique for a well installation in a sand and gravel aquifer.



Typical open hole construction technique for a well installation in a bedrock aquifer.

TYPICAL WATER SYSTEM TERMINOLOGY

Aquifer – A water bearing layer of sediment or rock with interconnected pore spaces or fractures that can store and deliver water to a well or spring.

Borehole – The cylindrical hole drilled into the ground and aquifer.

Casing – Steel or PVC pipe placed in the borehole to keep the borehole open and to allow room to store water and install a pump. Casing must be a minimum of 25 feet in length.

Casing Stickup – The amount of casing that sticks up above the ground surface. This should be at least 1 foot.

Cement or Bentonite – Placed between the wall of the borehole and the casing and surface casing to prevent surface contamination from reaching the aquifer.

Cistern – A vented water holding tank, usually underground, used for storage of water before being delivered to the pressure tank and home. A cistern will be vented to allow gases such as methane and radon to escape. Water from a cistern or rain barrel requires filtration and continuous treatment before being used as drinking water.

Control Box – Electrical switch box that turns the well pump on and off.

Drop Pipe – Pipe placed in the casing to connect the pump to the surface.

Electrical Cable – Wiring from the pump control box to the pump that supplies power for the pump and command signals.

End Cap – Cap placed on the bottom of the casing to prevent sediment from flowing into the casing on a screened well.

Gravel Pack – Gravel or sand placed between the borehole wall and the well screen to keep the borehole open and filter water before it enters the well.

Groundwater – Water stored beneath the surface of the earth that is transmitted through small, interconnected pores and fractures in sediment and rock.

Pitless Adapter – A device placed in the well casing that allows water to be diverted from the drop pipe to piping on the exterior of the well below the frost line.

Pressure Tank – A water holding tank equipped with an air bladder that regulates water pressure into the home and demand to the pump.

Pumping Water Level – The depth below the ground surface of the water level in the well when the pump is operating. This is always deeper than the static water level.

Sanitary Well Cap – A weather tight, vented and vermin proof cap on the top of the well casing that prevents surface contaminants from entering the inside of the well. The Water Systems Council publishes a listing of approved products [PAS-97(2012) - Updated 2012]. www.watersystemscouncil.org/standards_products.php?std=2

Spring – Water flowing directly from an aquifer on to the surface. For drinking water the spring is usually surrounded by a spring house which protects the spring from outside contamination.

Submersible Pump – The most common type of water well pump includes the pump and pump motor placed at the bottom of the drop pipe below the pumping water level.

Static Water Level – The depth below ground surface of water when the pump is not operating. This level will vary seasonally and over longer time periods due to recharge, drought or groundwater mining.

Treatment Equipment – Can include a variety of equipment designed to remove various water contaminants and purify groundwater before use.

Water Table – The upper surface of the zone where pore spaces are saturated as indicated by the static water level in an un-pumped well.

Well Screen – Steel or PVC perforated pipe that water from the aquifer flows through to enter the well and pump. In wells completed in bedrock there may not be a well screen or gravel pack.

Water Well Maintenance

Properly constructed private water supply systems require routine maintenance. These simple steps will help protect your system, your water source and your investment.

- Always use registered private water system contractors when a well is constructed, a pump is installed, a cistern or spring house is installed, or the system is serviced. Always ask to have a copy of their registration, insurance and proof of bonding before they start any work or system or before you sign any contract. A reputable professional will gladly provide you copies of these documents.
- An annual water supply maintenance check, including a water chemistry and bacterial test, a check of the static water level, and water yield test is recommended. Any source of drinking water should be checked any time there is a change in taste, odor or appearance, or anytime a water supply system is serviced.
- Keep livestock, hazardous chemicals, such as paint, solvents, fertilizer, pesticides, herbicides, fuel, and motor oil far away from your well, pump house or spring.
- Periodically check the well cover or well cap on top of the well casing to ensure it is in good repair and the vent is clear. If you have a spring, check for leaks in your spring house seal, clean its vent and insure all equipment is in good working order.
- Always maintain proper separation between your well or spring and buildings, waste systems, chemical storage facilities, and livestock corrals.
- Do not allow back-siphonage. When mixing pesticides, fertilizers or other chemicals, do not put the hose inside the tank or container.
- When landscaping, keep the top of your well at least one foot above the ground. Slope the ground away from your well or spring for proper drainage.
- Take care in working or mowing around your well. A damaged casing could jeopardize the sanitary protection of your well. Do not pile snow, leaves, or other materials around your well or spring house.
- Keep your well or spring records in a safe place. These include the construction report, as well as annual water system maintenance, water testing results, routine measurements of water yield and static water level. A section is provided in the back of this booklet on Page 32 where you may record basic information about your well or spring.
- Be aware of changes in your water source, the area around your well or spring, or the water it provides.
- A registered private water system contractor can periodically measure the water level in your well and its production rate. They can also clean your well screen if there are indications of it becoming plugged by mineralization or bacteria. They can also clean and maintain your cistern if you have one.
- When your well has come to the end of its serviceable life (usually more than 20 years), have your registered private water system contractor properly seal and abandon your well.

“Periodically maintaining your water well and protecting it from external contamination will help ensure the quality of your water for the life of the system.”

Water Quality Standards and Interpretation

INTERPRETING YOUR WATER TEST REPORT

Obtaining a water analysis from a testing laboratory is a necessary first step toward solving household water quality problems. For a list of Ohio certified laboratories go to: www.epa.ohio.gov/ddagw/labcert. Before testing, you may have had concerns about the safety of the water used in the household. You may have noticed objectionable symptoms such as odor or color changes when using the water for drinking, cooking, or other household purposes. Perhaps you have routinely monitored your household water quality through periodic testing and have recently noticed differing results between tests for one or more indicators. To identify the source of contamination problems, as well as to determine the type of corrective action, a properly interpreted water analysis report is essential.

Testing laboratories typically provide a basic report with the analysis for naturally occurring constituents and pollutants or contaminants if present. Each lab report is unique to the water being tested, and will only show results for the constituents, pollutants, or contaminates which are tested for in your water sample. The information provided here, along with the following glossary of water testing terms, may assist you in understanding a water analysis report for some common household water contaminants.

WHAT DO THE NUMBERS MEAN?

Once a water testing laboratory has completed the analysis of your water, you will receive a report. It will contain a list of the natural constituents, possible contaminants and physical characteristics for which your water was tested and the measured concentration of each. The concentration is the amount of a given substance (weight) in a specific amount of water (volume). The most common concentration unit used is milligrams per liter (mg/L) which, is approximately equal to one part per million (ppm), or one part contaminant to one million parts water.

ABC Laboratory ID# 12-258-120
Date Sampled 10/05/2012
Date Received 10/05/2012
Date Reported 10/15/2012

Well owner: Ohio Well Owner
Somewhere Road
Rural, OH 43123

Sample ID: Domestic well south of creek
Sample Matrix: water, unfiltered

Laboratory Report

Results

Parameter	Method	Report Limit	Result	Units	MCL
Alkalinity, Total	2320B	10	384	mg/L	
Alkalinity, Bicarbonate	2320B	10	384	mg/L	
Alkalinity, Carbonate	2320B	10	20	mg/L	
Alkalinity, Hydroxide	2320B	10	<10	mg/L	
Barium	200.7	0.05	0.07	mg/L	2.0
Calcium	200.7	0.5	18.1	mg/L	
Chloride	4500CL	10	40	mg/L	
Conductivity @ 25° C	120.1	1	1040	µS/cm	
Fluoride	4500F C	0.2	0.4	mg/L	4.0
Hardness	Calc	14	50	mg/L	
Iron	200.7	0.05	<0.05	mg/L	
Magnesium	200.7	0.5	1.2	mg/L	
Methane	BLM	0.5	<0.5	mg/L	
Nitrate/Nitrite as N	353.2	0.05	0.5	mg/L	
pH	150.1	NA	8.05	Std Units	
Potassium	200.7	0.5	0.7	mg/L	
Sodium	200.7	0.5	237	mg/L	
TDS	160.1	10	800	mg/L	
Uranium	200.7	0.01	<0.01	mg/L	0.03

Report Approved By:
Good Guy Ph.D.
Laboratory Manager
ABC Laboratories LLC

Date: 10/15/2012

Notes: Chain-of-custody attached

Sample received at 5° C – four bottles, one nitric acid preserved, one sulfuric acid preserved, one methane bottle and one unpreserved and unfiltered bottle.

Sample Water Quality Analysis Report (Your report may reflect different constituents.)

HOW MUCH IS TOO MUCH?

"Pure" water does not exist in nature and all natural water contains some dissolved metals, mineral and salt constituents. In most cases, the levels of these naturally occurring constituents are beneficial or minimal and of little consequence. However, when certain constituent levels in household water are excessive, they may affect household activities and/or be detrimental to human, animal and plant health. Evaluating what levels of constituents are acceptable, and understanding the nature of problems caused when the concentration is excessive and would be considered a contaminant of concern, are the basic considerations in interpreting a household water analysis report.

Acceptable limits for evaluating the suitability and safety of your water supply are established for many contaminants. Some established standards are set by nuisance considerations (taste, odor, staining, etc.) while many are based on health implications and are legally enforceable with respect to public water systems. The State of Ohio has adopted many of these standards as Health Based Standards for private drinking water systems. These Health Based Standards are to be used when evaluating your drinking water test results.

Whether you have the results of tests that you specifically requested, or you simply instructed the laboratory to conduct general or routine household water quality tests, you can use the following tables as a general guideline for the most common household water quality contaminants. These are divided into three categories: general indicators, nuisance impurities, and health contaminants. (Note: Some contaminants are listed for both nuisance and health criteria.)

GENERAL INDICATORS

General water quality indicators are parameters used to indicate the possible presence of harmful contaminants. Testing for indicators may eliminate the need for costly tests for specific contaminants. Generally, if an indicator is excessive, the water supply may contain other contaminants as well, and further testing is recommended. For example, you are probably familiar with coliform bacteria. These harmless bacteria are present in the air, soil, vegetation, and all warm-blooded animals. A total coliform bacteria test result of greater than four colonies/100 mL may be followed by tests for E. coli bacteria and nitrates which, if present, would confirm that sewage or animal waste is contaminating the water. Total dissolved solids (TDS) and pH are considered general water quality indicators, and may vary over time depending on well recharge characteristics. The tests listed in Table 1, along with a test for nitrate/nitrite (see Table 4), provide a good routine analysis (as often as once a year) for most rural water supplies, unless there is a reason to suspect other contaminants.

Table 1: General Water Quality Indicators

Indicator	Acceptable Limit	Indication
Coliform Bacteria	4 colonies/100 mL	Any one of a number of non-pathogenic bacteria such as sulfate reducing, slime formers, iron, methanogenic, etc.
E. coli Bacteria	zero	Possible bacterial or viral contamination from human sewage, animal waste or surface water infiltration.
pH Value	6.5 to 8.5	An important overall measure of water quality, pH can alter corrosivity and solubility of contaminants. Low pH will cause pitting of pipes and fixtures and/or metallic taste. This may indicate that metals are being dissolved. At a high pH, the water will have a slippery feel or soda taste.
Total Dissolved Solids (TDS)	500 mg/L*	Dissolved minerals, like sodium, calcium, magnesium, iron or manganese. High TDS also may indicate excessive hardness (scaly deposits) and cause iron or mineral staining, or a salty, bitter taste.
Odor/Color		Can be indicative of high mineral content such as iron (red staining) or manganese (black staining). Rotten egg odor is indicative of hydrogen sulfide. Both color and odor indicate that your water should be tested.
Gas Bubbles		Can be indicative of dissolved gas such as methane. Sometimes is indicative of low water levels and air being trapped by the pump.

** TDS levels greater than 500 mg/L are found naturally in many water wells and public drinking water systems. Water with higher than 500 mg/L may cause mild and transient gastric upset and still be safe to drink. In many cases it is the only source of water.*

NUISANCE IMPURITIES

Nuisance impurities are another category of contaminants. While these have no adverse health effects at low levels, they may make water unsuitable for many household purposes. Nuisance impurities may include iron, bacteria, chloride, and hardness. Table 2 lists some typical nuisance impurities you may see on your water analysis report. Acceptable limits for nuisance impurities come from the EPA Secondary Drinking Water Standards for public drinking water systems. The State of Ohio has adopted the EPA Standards as Health Based Standards for private water sources. Note: some nuisance impurities are also health concerns, such as hydrogen sulfide [rotten egg gas].

Table 2: Common Nuisance Impurities and Their Effects

Contaminant	Acceptable Limit	Indication
Chlorides (Cl)	250 mg/L	Salty or brackish taste; corrosive; blackens and pits stainless steel and can cause green plants to yellow.
Copper (Cu)	1.3 mg/L	Blue-green stains on plumbing fixtures; bitter, metallic taste.
Iron (Fe)	0.3 mg/L	Metallic taste; discolored beverages; yellowish stains on laundry, reddish brown stains on fixtures.
Manganese (Mn)	0.05 mg/L	Black specks on fixtures or black sand-like grains in bottom of toilet tank; bitter taste.
Sulfates (SO4)	250 mg/L	Bitter, medicinal taste; corrosive; may cause gastric upset and diarrhea.
Iron Bacteria		Orange to brown-colored slime in water, can cause an oil-like film on standing water, black-brown sludge in toilet tank.
Slime Bacteria		Jelly-like slime deposits in toilet tank, bottom of cisterns.
Sulfate Reducing Bacteria		Rotten egg or sewer-like smell. If present, a test for hydrogen sulfide gas is recommended. Chronic exposure at low levels have known health effects.*
Zinc (Zn)	5 mg/L	Zinc is an essential element in our diet. Too little zinc can cause problems, but too much zinc is also harmful. Indication of galvanized pipe corrosion in older homes.

**People with certain pre-existing health conditions need to pay attention to the air quality in their homes because long term exposure to low levels of hydrogen sulfide can aggravate problems already affecting their health such as eye irritations, breathing problems like asthma, bronchitis and emphysema and some heart diseases. Additional information is available from the CDC and can be found at: www.odh.ohio.gov/~/media/ODH/ASSETS/Files/eh/HAS/hydrogensulfide.ashx*

WATER HARDNESS

Hardness is one contaminant you will also commonly see on the report. Hard water causes white, scaly deposits on plumbing fixtures and cooking appliances and decreased cleaning action of soaps and detergents. Hardness is the sum of the calcium and magnesium levels found in your water. Hard water can also cause buildup in hot water heaters and reduce their effective lifetime. Table 3 will help you interpret your water hardness parameters.

Hardness may be expressed in either milligrams per liter (mg/L) or grains per gallon (gpg). A gpg is used exclusively as a hardness unit by water treatment personnel and equals approximately 17 mg/L or ppm. Those water supplies falling in the hard-to-very hard categories may need to be softened. However, as with all water treatment, you should carefully consider the advantages and disadvantages of softening before making a decision on how to proceed.

Advantages of softening your water include:

- increased effectiveness of detergents and soaps;
- increased life of hot water heater elements.

Disadvantages of softening your water include:

- increased levels of sodium or potassium in softened water (depending on which type of salt is used in your softener system);
- increased potential for pipe corrosion;
- negative impact on houseplants.

Since the levels of sodium and potassium can affect your health, consult your health professional about any impacts that softening your water may have on your health. If you have a heart condition or high blood pressure, you must consult your health professional before drinking softened water.

Table 3: Hardness Classifications (Concentration of Hardness)

In Grains per Gallon	In Milligrams per Liter (mg/L)	Relative Hardness Level
Below 3.5	Below 60	Soft
3.5 to 7.0	60 to 120	Moderately Hard
7.0 to 10.5	120 to 180	Hard
10.5 and above	180 and above	Very Hard

HEALTH CONTAMINANTS

The parameters outlined in Table 4 are some common contaminants that have known health effects. The table lists acceptable limits, potential health effects, and possible sources of the contaminant in public water systems. These contaminants are regulated under the EPA Primary Drinking Water Standards and have been adopted by the State of Ohio as Health Based Standards for private water sources. You may want to test for these contaminants in your private water well to determine the quality of your water.

Table 4: Standards, Sources, and Potential Health Effects of Common Regulated Contaminants

Contaminant	Acceptable Limit	Sources	Potential Health Affects at High Concentration
E. coli	Zero	Human sewage and animal wastes leaking into well or from groundwater contamination.	Gastrointestinal distress, shock. Infants, elderly, individuals with a compromised immune system and the sick are especially susceptible.
Fluoride (F)	4.0 mg/L	Fluoride is leached from natural deposits.	Mottling of teeth and brittle bones. If less than 0.7 mg/L, contact your doctor or dentist for recommendations about the need for additional fluoride for small children and the elderly.
Barium (Ba)	2.0 mg/L	Barium is leached from natural deposits.	If barium is detected in your well water, contact your local health department for assistance.
Lead (Pb)	0.015 mg/L	Used in batteries; may be leached from brass faucets, lead caulking, lead pipes and lead soldered joints. Is also leached from natural deposits.	Nervous disorders and mental impairment especially in fetuses, infants, and young children. Also, kidney damage, blood disorders and hypertension, or low birth weights.
Arsenic (As)	0.01 mg/L	Arsenic is leached from natural deposits.	Dangerous to humans and animals alike. May cause skin damage, circulatory system problems, and an increased risk of cancer.
Nitrates and Nitrites	10 mg/L as nitrate-N (1.0 mg/L as nitrite-N)	By-product of agricultural fertilization; human and animal waste leaching to groundwater also leached from natural deposits.	Nitrate/Nitrites are a serious health threat for infants (birth to 6 months). Symptoms include shortness of breath and blue-baby disease; lower health threat to children and adults.
Radon (Rn)	300 pCi/L	Naturally-occurring radioactive gas formed from uranium decay can seep into well water from surrounding rocks and be released in the air as it leaves the faucet.	Continued breathing of radon gas increases chances of lung cancer; may increase risk of stomach, colon, and bladder cancers.
Uranium (U)	0.03 mg/L	Uranium is leached from natural deposits.	High levels suggest the presence of Radon gas. Increased risk of cancer and kidney toxicity.

METHANE IN GROUNDWATER

Methane is a colorless, odorless and tasteless gas, which is produced by biological decay of organic materials or by high temperatures and pressures acting on organic materials. These materials include coal beds, organic rich shales, landfill materials, compost piles, and other accumulations of organic materials both above and underground. Methane can also come from abandoned coal mines and legacy oil and gas wells. Methane is also produced in the digestive system of humans and animals, and has no known direct health effect. The specific source of methane found in groundwater in Ohio can generally be determined by detailed and relatively expensive laboratory analysis.

Methane in water wells becomes a potential safety hazard problem when it is allowed to build up in confined spaces. These high concentrations of methane can displace oxygen, or in the presence of a spark, can explode. Extensive testing for methane in water wells has been conducted during the past twenty years. As a result of this testing, many believe that methane concentrations below 1 mg/L are considered harmless. Methane levels in the range of 7 to 10 mg/L usually are not a concern, but should be monitored for changes. Also, care should be taken to ventilate confined spaces where well water is used. Above 10 mg/L treatment is to be implemented. Treatment for removing or lowering the concentration of methane in the water delivered into a house is relatively simple and includes vented wellhead caps, or some form of aeration and ventilation to allow the methane to safely dissipate outdoors rather than accumulate within your home, well house or other confined space. When you find methane in your well water, additional regular testing and monitoring should be performed since methane levels can fluctuate over time. Methane levels above 28 mg/L have an explosive or flammable potential. Contact your local health department immediately for additional assistance.

Figures 1 and 2 on page 20 demonstrate two types of methane treatment; one a small aeration treatment unit or tank method, and the other a more aggressive two chambered larger aeration treatment unit. Details of their operation are found with the figures. In addition, for lower levels of methane, a vented well cap may be a sufficient treatment. As a general rule, the higher the methane level the more aggressive the removal system must be. The system in Figure 1 is suitable for low to medium levels of methane, whereas Figure 2 describes a system for higher levels of methane.

SMALL AERATION TREATMENT UNIT

This small treatment system can be installed in a basement, garage, utility room or pump house. The active removal of methane is achieved by spraying the water into the open space of the tank and allowing the escaped gas to vent out. Since methane is lighter than air, it will rise to the top of the tank and vent. The gas must be vented outside of any structure and never allowed to accumulate inside. Remember that this system should be installed by a registered private water system contractor. The state of Ohio has published a venting rule for methane gas: www.odh.ohio.gov/~/media.ODH/ASSETS/files/final/3701-20%OTO%20-29/3701-28/3701-28-10/ashx.

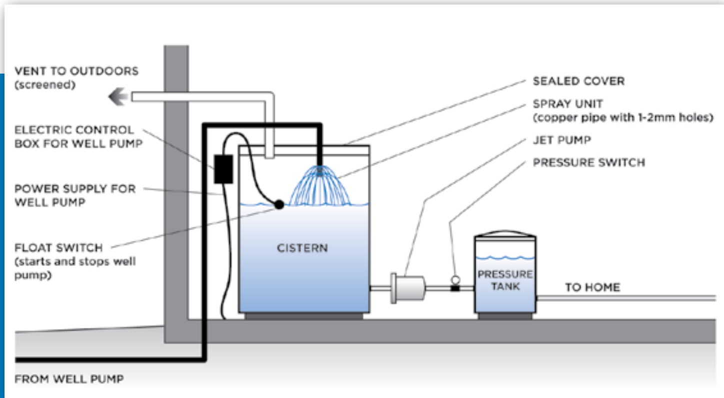


Figure 1: Small Cistern for Methane Treatment

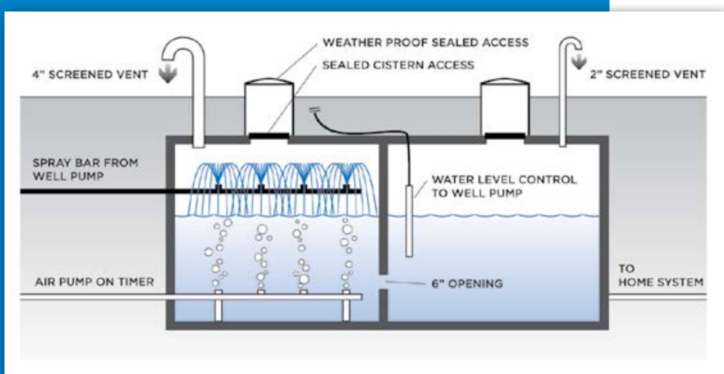


Figure 2: Large Cistern for Methane Treatment

LARGE AERATION TREATMENT UNIT

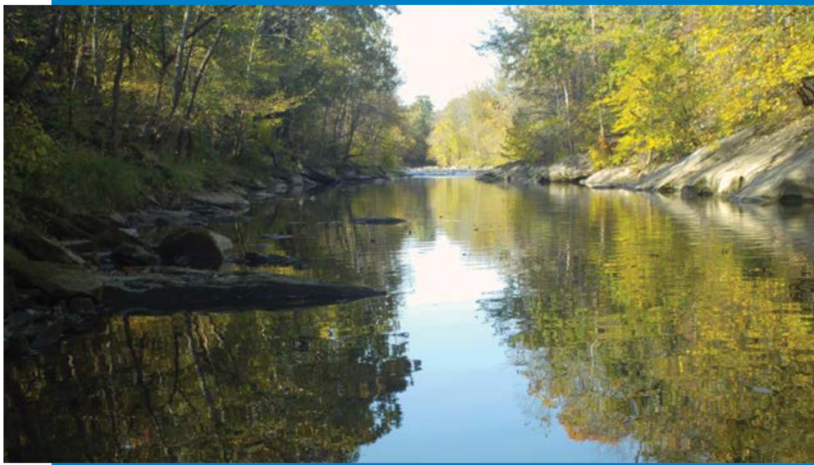
This system is an aggressive system and is usually installed outside and underground. In the active chamber one or two spray bars are installed about 15 – 20 inches below the top. One or two aeration bars are set about 12 inches above the bottom.

When the water in the passive chamber is low enough the controls turn on the well pump and the air pump (Jacuzzi type). The water sprays upward allowing much of the trapped methane to escape into the air (see air venting rule noted above). At the same time, the aeration pump is blowing filtered air into the water further driving off any residual dissolved methane. When the pump refills the treatment unit (200 to 300 gallons), the air pump continues to blow for an additional 10 to 30 minutes to assure that all of the methane is removed. The methane-free water moves into the passive (storage) side of the tank which is also vented. The methane must be vented outside of any structure and never allowed to accumulate inside. For additional information go to: www.odh.ohio.gov/odhprograms/eh/water/PrivateWaterSystems/

Because of the complexity of systems like this, they should be installed by a registered private water system contractor familiar with control systems.

WHERE CAN I GET ADDITIONAL INFORMATION?

Further assistance with interpretation of your household water quality test report is available. If you have any problems understanding the way the information is presented on the report, you should contact the testing laboratory directly for explanation. For further information on contaminants not discussed in this publication, you may want to contact your local Health Department, order the booklet “Drinking Water from Household Wells” from www.epa.gov or speak with an environmental professional. If you wish to obtain more background information about the occurrence of contaminants and their effects on household water quality, particularly as it pertains to established drinking water standards, call the EPA Safe Drinking Water Hotline at (800) 426-4791 or



www.water.epa.gov/drink/hotline/index.cfm. Or you can explore sites on the internet starting with one or more of the web sites listed in this booklet.

WHERE CAN I GET ADDITIONAL HELP FOR WATER TREATMENT?

Sources for water treatment assistance are usually found in most Yellow Pages under the headings of "Water Purify & Filter Equipment" or "Water Treatment Equipment, Service and Supplies." Additional assistance can often be found by talking to the local Health Department and in some cases the laboratory that analyzed your water. Care should be taken when a professional offers to test your water or demonstrates in-home water quality tests. Many of these in-home tests are difficult to perform and can provide misleading information. If possible, use a certified independent testing laboratory. For a list of Ohio certified laboratories go to: www.epa.ohio.gov/ddagw/labcert

As with the use of any technical service, care should be taken to assure yourself that the registered private water system contractor you have chosen has specific experience in the treatment of your water's problems. The State of Ohio registers water supply contractors who treat for regulated contaminants, but do not register contractors who simply treat your water for aesthetic reasons, such as water softeners. Ask for references, certifications, training credentials, and the names of others who have used their services. Check with the Better Business Bureau for consumer complaints. Ask how long the professional has been performing his services. Don't be shy. Obtain recommendations and quotations from more than one professional. Verify the terms of warranty claims on both equipment and installation. Ask to see the technical information on your proposed system before signing any contract. If you have any doubts about the contract drawn up by the registered private water system contractor, seek legal assistance BEFORE signing. Look up web sites on the specific types of equipment that your registered private water system contractor recommends, talk to your friends, ask a lot of questions, and if you don't get answers, don't buy until your questions are answered. If you can't afford the entire system ask for a recommendation on a basic system to treat the major problem(s) to start with, and make sure that it will be compatible with any upgrades in the future.

Remember that you are the owner of a small domestic water treatment system; essentially a small version of the public systems in nearby cities and towns. *Consequently, it will need to be maintained on a regular basis. Make sure that you are provided with the technical manuals for your system and ask your registered private water system contractor to set up a regular maintenance schedule for you to follow, including follow-up and annual visits by your registered private water system contractor. Record all system maintenance in the Basic Well Data section on Page 32 at the end of this booklet.*

Water Treatment Decision Guide

Are there bacteria in your well water or does your water smell bad?

NO → Do bacteria keep coming back after disinfection of your well?

YES

Have your water well disinfected. See Section 9 for precautions and recommendations. Contact your local Health Department for a list of registered private water system contractors.

ALSO

The well may require testing more often. Try to find the source of contamination. Check the well cap, water piping system, and hot water heater. Have a local registered private water system contractor check for contamination. Shallow wells may need additional treatment.

ALSO

See Section 9 for warnings and precautions before disinfecting your well.

ALSO

Other types of bacteria may be present such as slime bacteria, sulfate reducing bacteria, etc. which are difficult to remove with a single disinfecting of your well.

Do bacteria keep coming back after disinfection of your well?

NO → Is the pH of your water between 6.5 and 8.5?

YES

Have a registered private water system contractor disinfect the well again and wait a full 24 hours before flushing the system. If your coliform test is still above 4 CFU's per 100mL, have your contractor inspect for defects, damage or wear and tear that may cause leaks and repair and clean the well. If the retest is still above 4 CFU's/100 mL have your contractor install a disinfection system such as chlorination, ozone, or the use of ultraviolet (UV) light, to name a few. Make sure you are trained how to use the system and have a full set of instructions.

ALSO

The well may require testing more often. Your disinfection system requires additional maintenance and care. Remember you are operating a small water treatment system and must put in the time to assure its proper operation. Request an annual inspection from the registered private water system contractor that installed your system and keep records in the pocket in the back of this booklet.

Is the pH of your water between 6.5 and 8.5?

YES → Is the TDS (total dissolved solids) of your well water above 500mg/L?

NO

pH adjustment of your well will require the services of a registered private water system contractor familiar with pH adjustment methods.

ALSO

A test for lead and copper is suggested if the pH is below 6.5.

ALSO

A test for zinc is suggested if the pH is below 6.5 and you have galvanized piping. Test for iron if there is a metallic or bitter taste to the water.

ALSO

Inspect your water piping system on a regular basis since acidic water will erode metal piping.

Is the TDS (total dissolved solids) of your well water above 500mg/L?

NO → Is the hardness of your well water above 180 mg/L?

YES

May require the installation of RO unit if the taste of the water is a problem.

ALSO

If the hardness is above 120 mg/L the water may have to be pre-softened. Soft water should be only for the RO unit and the hot water system. Soft water can harm plants and lawns. It is corrosive to uncoated copper and galvanized pipe, so inspect your system on a regular basis.

Is the hardness of your well water above 180 mg/L?

NO →

YES

May require softening of the hot water side of your system.

Above 200 mg/L?

YES

Treated water may have a salty taste.

Above 300 mg/L?

YES

Seek the advice of an experience professional, such as a registered private water system contractor. Contact your local Health Department for additional assistance.

ALSO

May require RO treatment to remove a salty taste if the water has been softened.

Note: Pregnant women and children under the age of 6 months can be harmed by drinking water with nitrate levels above 10 mg/L or nitrite levels above 1.0 mg/L. If in doubt about the effectiveness of your treatment system, drink bottled water until testing confirms reduction of nitrate/nitrite.

Is the nitrite-N or total nitrate/nitrite-N in your well 1.0 mg/L or above?

NO → Is the iron in your well water above 0.3 mg/L?

YES → Lower than 10 mg/L?

- YES → The well may require testing more often. Try to find the contamination source. Check the well seal, water piping system, and hot water heater. Have a professional check for surface water contamination. Shallow wells may need additional treatment technologies.
- ALSO → If the total nitrate/nitrite-N is 5 mg/L or higher stop drinking the water and contact your local health department and retest more often.
- ALSO → Test for nitrite-N and if the total is 1.0 mg/L or above do not drink the water without treatment. *See note to the left.*
- NO → Above 10 mg/L?
  - YES → Seek the assistance of a registered private water system contractor for assistance in choosing a treatment method such as RO, or specific ion exchange.

Is the iron in your well water above 0.3 mg/L?

NO → Is there a rotten egg smell in your well water or does it contain methane gas?

YES → Does the water turn red or black after standing in a glass?

- YES → Seek the assistance of a registered private water system contractor. Contact your local Health Department for additional assistance.
- NO → May require any one of several types of iron filters. These systems include a simple water softener (for Iron below 1-3 mg/L), green sand type filters, back-washable filters, etc.

Is there a rotten egg smell in your well water or does it contain methane gas?

NO → Is the fluoride in your well water higher than 2.0 mg/L?

YES → Does the water smell like rotten eggs?

- YES → You can smell rotten egg gas (hydrogen sulfide) at a lower concentration than a laboratory can analyze. However, a little and a lot both smell the same. If you have hydrogen sulfide it must be removed by treatment. Even low levels over a long period of time may cause health problems. If you have hydrogen sulfide in your well and you detect a strong sweet odor get out of the dwelling and contact the local fire department since this may be a sign of very high and dangerous levels of the gas.
- ALSO → Seek the assistance of a registered private water system contractor. Also you may contact your local Health Department for additional assistance.
- NO → Does the well contain methane gas?
  - YES → Below 1 mg/L there is usually no concern. Up to 10 mg/L you may want to test for value changes. 10 mg/L and above monitor the well regularly and implement methane mitigation measures. See page 20 for two typical treatment options.

Is the fluoride in your well water higher than 2.0 mg/L?

NO → Is the barium value above 2.0 or any trace metals in your water greater than the EPA Guidelines?

YES → Between 2.0 mg/L and 4.0 mg/L? (see note below)

- YES → May require the installation of RO unit if the taste of the water is a problem or directed by your health care provider.
- ALSO → If the hardness is above 120mg/L the water may have to be pre-softened. Soft water should only be for the RO unit and the hot water system. Soft water can harm plants and lawns. Also soft water is corrosive to uncoated copper and galvanized pipe so inspect your system on a regular basis.
- NO → Above 4.0 mg/L?
  - YES → Stop drinking the water. Call your local Health Department.
  - ALSO → Seek the assistance of an experienced and registered water system contractor or contact your local Health Department for additional assistance.

Note: Fluoride levels below 0.7 mg/L may require supplements in growing children. Contact your dentist or health care professional.

Is the barium value above 2.0 or any trace metals in your water greater than the EPA Guidelines?

YES → Barium, if detected, should be treated before drinking. Contact your local health department for assistance and information concerning barium and small children.

- ALSO → If other metals are detected in your well water contact your local health department for guidance.
- ALSO → Seek the assistance of a registered private water system contractor for possible treatment options.

Chlorination Information

WHEN TO TREAT YOUR WELL WITH CHLORINE.

You should have your well disinfected if your test for coliform bacteria is greater than four colonies (CFU's) per 100 mL, or following any construction, alteration, installation, maintenance, or repair of your well and/or your water system. Disinfecting is essential if there has been flooding or other obvious signs of contamination in or around well. Disinfection is a process by which wells are sanitized using household chlorine bleach or dry chlorine and is effective in home water systems such as wells, spring houses, and cisterns. Routine disinfection is NOT recommended for treating recurring bacteria problems. A registered private water systems contractor has the tools and expertise to effectively clean and disinfect water wells. ODH has basic disinfection fact sheets for well owners that want to disinfect their wells. For these continuing chronic bacteria problems, contact a reputable registered water system contractor who is familiar with your area for assistance in the installation of a continuous disinfection system. For a list of registered water system contractors, contact your local health department.

WHEN TO TREAT YOUR SPRING WITH CHLORINE.

As a general rule springs are considered surface water sources and are often difficult to maintain free of bacterial contamination. Spring water is often treated by continuous disinfection using chlorine, ozone or ultra-violet systems and cyst filtration as part of your overall water treatment system. Since each spring is different, this booklet will assume that if your drinking water source is a spring, you will contact your local health department for a list of registered water system contractors specializing in spring systems for assistance. The State of Ohio requires spring and surface water to be filtered and continuously disinfected/treated to serve as a drinking water source.

WHEN TO TREAT YOUR CISTERN OR RAIN BARREL WITH CHLORINE.

If you use a cistern or rain barrel as part of your water system, you should have it inspected at least once a year. If slime bacteria are building up on its sides, or if your annual test for coliform bacteria is greater than four colonies (CFU's) per 100 mL, you should contact your local health department for a list of registered water system contractors who clean cisterns or rain barrels. Cleaning of this type requires special cleaning procedures such as mechanical brushing, power washing, etc. to remove and disinfect these systems. Piping, valves and pumps also need to be cleaned during this process. In many cases, like springs, continual disinfection of cistern or rain barrel water is needed.

PRECAUTIONS TO TAKE PRIOR TO CHLORINATION.

Make sure that everyone in your home is warned not to use the water during the treatment process. Arrange for an alternative source of drinking water. Special care should be taken to ensure that children and older adults do not consume tap water during the treatment process. If you use your water source to water pets and/or animals, set aside sufficient water for 24 to 36 hours until your system is "normal" again.

Make sure that your contractor uses personal protection equipment, such as rubber gloves, a splash apron, and eye protection. Also make sure your contractor has at least 5 gallons of clean water set aside in case there is an accidental spill of the chlorine chemicals. Areas of accidental contact with chorine must be quickly washed.

It is strongly suggested that you arrange for a registered water system contractor to chlorinate your well or springhouse. Chlorination is performed using strong chemicals and should be mixed and dispensed by those trained in this process.

The Ohio Department of Health provides for the registration and bonding of water system contractors. Prior to having your well disinfected, contact your local Department of Health for the current list of registered water system contractors in your area. Determine if your contractor is registered and can show proof of their registration, insurance and bonding. Additional information can be obtained from:

Residential Water and Sewage Program
Bureau of Environmental Health
216 North High Street
Columbus, Ohio 43266-0118
(614) 644-7558
Email: BEH@odh.ohio.gov
www.odh.ohio.gov/odhPrograms/eh/water/water1.aspx

If you are familiar with the mixing and use of chlorine based chemicals and feel that you are qualified to perform this task yourself, a detailed process including safety procedures is outlined by the State of Ohio Department of Health.

OPTIONAL PROCEDURE TO TRY BEFORE CHLORINATION.

In some cases heavy continuous pumping of your water well may result in an acceptable total coliform test result. In these cases the simple act of "washing" all surfaces may remove bacterial contamination. To perform this *optional* process, turn on at least one outside spigot and run the water for several hours (no longer than 24 hours) to your yard or other drainage, but not to your sewage treatment system, as it will cause the system to become overloaded. Monitor the rate of flow and if it falls off, or starts pumping a lot of air/bubbles, or if you know that you have a low yielding well, be careful not to allow the

pump to run dry as this could damage the pump. You will want to re-sample your well for total coliform after this optional pumping process. If you still have a coliform test greater than four colonies (CFU's) per 100 mL, you should proceed with chlorination of your well. Again, unless you are very familiar with water wells, and are comfortable working with chemicals, the well chlorination should be performed by a registered water system contractor.

WHAT IF THE WELL HAS UNACCEPTABLE LEVELS OF TOTAL COLIFORM AFTER DISINFECTION PROCEDURES?

There are many instances where basic disinfection procedures may not work sufficiently in reducing the levels of bacteria in the water well. An enhanced disinfection process may be necessary to effectively remove built up bacteria in wells. In some cases the pH of the water may need further adjustment in order to get the optimum disinfection from the enhanced disinfection methods. The well casing may also need a thorough scrubbing or cleaning to remove non-pathogenic slime forming or iron bacteria that can build up on the well casing, pump/wiring, delivery tubing and borehole walls. Removal of this type of bacteria often requires the use of specially formulated well cleaning products, mechanical scrubbing/drilling equipment or high pressure jet cleaners. These are best performed by registered, insured and bonded water system contractors. If total coliform levels persist above four colony forming units (CFUs)/100 mL, or if E. coli bacteria persist in water samples, or the condition and stability of the well is questionable, then contact an experienced registered private water systems contractor to professionally clean and disinfect your well. Persistent bacteria problems may also indicate that your well has deteriorated or that there is an existing issue with the aquifer. Contact your local health department when you experience any problems with your well or for additional assistance on private well issues. The Ohio Department of Health registers and bonds private water

"Contact your local health department when you experience any problems with your well or for additional assistance on private well issues."

systems contractors. Please contact your local health department or check for the most current list of registered contractors and other information at the Ohio Department of Health's Private Water Systems Program by going to: www.odh.ohio.gov/odhprograms/eh/water/water1.aspx.

OVERSIGHT OF YOUR DISINFECTION CONTRACTOR.

If you choose to hire a private water systems contractor to disinfect your well, there are a few steps and procedures that you should review with the contractor. If you have water treatment devices such as filtration units, softeners, etc., by-pass these before allowing the water system contractor to treat your well/spring house or cistern. If you are unfamiliar with your devices, have a registered water system contractor isolate or by-pass all sensitive water treatment devices. In some cases the contractor will disinfect these systems separately. Provide your contractor with a copy of your well's drill log. If you do not have a copy of your well log, you may call the Ohio Department of Natural Resources Division of Water at (614) 265-6740 or search their website at: www.dnr.state.oh.us/water/maptechs/wellogs/app/. Make sure your contractor knows the depth of your well and the amount of standing water from an onsite measurement.

Verify that your contractor is using only fresh generic bleach [no nice smell, added ingredients, etc.] or water grade dry chlorine, not swimming pool grade.

Make sure all of your faucets have been turned on and run until the chlorine smell is detected or a positive test for chlorine is seen. Make sure your contractor knows about rarely or never used faucets, such as yard or animal watering hydrants, outside spigots or faucets in closed out buildings. Don't forget washing machines and your hot water heater.

Allow the bleach/chlorine to remain in the entire system for 24 hours (at least overnight). During this wait period, do not use the water for any purpose. This is to allow the disinfectant to kill all the bacteria within the system. After the overnight or 24 hour wait, your contractor will flush out the remaining chlorine by turning on outside faucets, letting them run until the chlorine smell dissipates, or a test for chlorine is negative. Finally your contractor will run the indoor faucets. Do not discharge chlorinated water into your sewage treatment system as it will overload the system and kill off beneficial bacteria in your septic tank! Also avoid discharge into streams, rivers, ponds or lakes as the chlorine/bleach may kill wildlife. Wait a few days, and then contact your local health department to have another sample collected for total coliform bacteria. Make sure that the water is tested for chlorine before collecting the water sample. If there is any indication of chlorine in the water, the sample should not be collected. This helps avoid getting an indication of a safe sample that may be due only to the continuing activity of leftover chlorine and may not reflect the true condition of the water. Do not replace carbon filters or filter elements until an acceptable total coliform result [less than 4 CFU's/100 mL] has been achieved. If a positive test is still found, have your contractor re-treat your system or have it cleaned. Repeat positive bacteria results may indicate construction problems with the well. Contact a registered private water systems contractor to perform an evaluation of your water system.

Trouble Shooting Guide

Q – Why does water not come from my well anymore?

A – There may be several reasons why water is not delivered from a well. First check your breaker box to see if the breaker is tripped. You should call a registered private water system contractor to check the pump and pump control equipment, which may have failed. The pump installer can also check the water level in the well. Overuse of the aquifer may have dropped the static groundwater level below the depth of your well or pump. The pump may have to be reset at a lower level or the well replaced with a deeper well.

Q – Why does my well seem to pump less water than it used to?

A – Over time minerals or bacteria can constrict your water well screen, borehole or your water system pump or piping. Overuse or seasonal lack of recharge of the aquifer can also cause the static groundwater level to drop and thus decrease the amount of water that can enter the well. A registered private water system contractor can clean your well screen and check your pump, piping and water level. They can also measure the yield of your well and compare it to the yield when the well was drilled. Keep good records of all of these checks and maintenance activities as they can be used in the future to help diagnose problems. Record these in the Data section at the end of this booklet.

Q – Why does my pump seem to run every time I turn on the tap?

A – The pressure in your water system is regulated by a pressure tank so that the pump does not have to be run every time there is demand for water. The tank has an air bladder in it that can rupture. Have a registered private water system contractor check the pressure tank and the pump control unit.

Q – Why does my water leave stains on fixtures and clothes?

A – Your water likely has lots of dissolved minerals or bacteria in it. Have the water tested by a laboratory to determine its chemical composition. You can then use the Water Treatment Decision Guide in this booklet, or call a licensed pump installer to help you decide what treatment equipment may be appropriate for your well and water.

Q – Why is there a lot of sediment in my water?

A – Your well may have been improperly developed to remove excess drilling fluids and sediment when it was drilled. Or your well casing or well seals may have failed. Your cistern (if you have one) may also need cleaning or is damaged. Have a registered private water system contractor inspect the system and determine the source of the sediment.

Q – Why does my water smell like sulfur or have a sewer-like smell.

A – Your well probably has bacteria in it. Have the water tested for bacteria immediately. The local Health Department or a registered private water system contractor can help disinfect the well and find the source of the bacteria.

Q – Why does my water smell or taste like chemicals?

A – Your well may be polluted with chemicals. Stop using the water immediately. Call the Health Department to help you find out where the source of the chemical contamination may be and what to analyze your water for. Have the water tested by a laboratory for likely chemical pollutants.

Q – Why does my water fizz?

A – Your well water has gas dissolved in it. This gas may be harmless air or carbon dioxide. It may also be methane or radon. Have the water tested by a laboratory to determine what the gas is and whether or not a treatment system is necessary. A registered private water system contractor can find air leaks in the water system if that is the indicated problem. The pump installer can also help with the appropriate treatment system.

Water Testing Glossary

Acidic – descriptive term used in reference to water having a pH of less than 7; pertains to the corrosiveness of water.

Acute Health Effects (acute toxicity) – Any poisonous effect with a sudden and/or severe onset produced within a short period of time after using contaminated water, resulting in mild to severe biological harm or illness. Acute symptoms include, but are not limited to, upset stomach, loose stool, bowel upset, and gastrointestinal difficulties. If symptoms occur as a result of drinking contaminated water, medical attention should be sought promptly.

Aesthetic Characteristics – The non-health related characteristics of water that make it desirable for human use. Generally taste, color, odor, and turbidity are considered to be aesthetic characteristics.

Alkaline – A water sample having a pH greater than 7 is alkaline (non-acidic).

Certified Testing Laboratory – A laboratory certified by the Ohio Environmental Protection Agency (OEPA) as qualified to test drinking water. Information about local state-approved laboratories is available from the OEPA. See the web site list at the end of this booklet for a list of certified laboratories.

Chronic Health Effects – Chronic means long-term. Health effects which occur and persist as a result of repeated or long term use of contaminated water. Often, it takes many months or years of exposure for chronic health effects to occur. Chronic health effects may include irreversible damage to internal organs, and changes to our gene structure, which can result in cancer, birth defects, disabilities, and other problems.

Coliform Bacteria – A type of bacteria that is found in the intestinal tract of all animals, including humans. These bacteria are used as an indicator of well cleanliness. If the disinfection of your well does not remove the coliform bacteria seek the assistance of your local Health Department. Unacceptable coliform tests are usually seen on your report as greater than 4 CFU's/100 mL. You may need to call a registered private water system contractor to assist in treating chronic bacteria problems.

Concentration – The amount of a given substance (weight) in a specific amount of water (volume) and is often expressed as mg/L or ppm.

Contaminants – Naturally occurring or man-made substances when present in high enough levels make water unfit for drinking and/or other household uses. Some contaminants are man-made or come from human activities such as farming, mining, livestock, etc.

Corrosive Water – Water that is acidic or "soft" may be corrosive and may deteriorate plumbing and leach toxic metals such as lead, zinc and copper from pipes.

Corrosivity Index – One of the methods for assessing the scale dissolving (corrosive) or scale forming potential of water. A positive number indicates a tendency to deposit calcium and magnesium carbonates. If the result is negative, it is an indication that the water will dissolve carbonates and enhance corrosion.

Detection or Report Limit – The minimum concentration of a substance that may be measured in the laboratory and reported in the given testing method. Many laboratory reports will state what the detection limit is for each contaminant.

Disinfection – The destruction of all pathogenic organisms, with chlorine, ozone, ultraviolet "UV" light or heating.

EPA – The abbreviation for the Environmental Protection Agency, properly called, "the United States Environmental Protection Agency ." This agency has the responsibility of developing and enforcing Primary Drinking Water Standards for public drinking water systems. EPA does not regulate private wells or cisterns. The EPA also develops, but does not enforce, Secondary Drinking Water Standards. See the web site list at the end of this booklet for a link to EPA.

Grains per Gallon (gpg) – Apothecaries' weight of a chemical substance in one gallon of water used in the water-conditioning trade to indicate hardness of water. One gpg equals approximately 17 mg/L of hardness.

Hardness – A water quality problem in many areas in Ohio. Hardness is a relative term. It describes the content of the dissolved minerals, calcium and magnesium, and is reported as grains per gallon or mg/L. Water with less than 3.5 grains per gallon (60 mg/L) is considered "soft"; while hard water above 7 grains per gallon (120 mg/L) may affect the appearance of plumbing fixtures, the lifespan of water heaters, and the effectiveness of detergents.

Health Risk – The risk or likelihood that a chemical will adversely affect a person's health. Estimating health risks is a complex and inexact science.

Heavy Metals – Elements with higher molecular weights, which are generally toxic in low concentrations to plant and animal life. Examples include mercury, chromium, cadmium, arsenic, selenium, and lead.

Hydrogen Sulfide – A hazardous, poison gas that smells like rotten eggs at low levels. At higher levels it has a slight sweet odor or will overwhelm your nose and appear to be odorless. It is sometimes produced by bacteria in well waters. However, in high concentrations the gas can accumulate in low areas and become toxic and/or explosive. Care should be taken when you smell hydrogen sulfide. Long term exposure to even low levels can cause health problems.

Iron Bacteria – Microorganisms that feed on iron in the water. They may appear as a slimy rust-colored coating on the interior surface of a toilet flush tank or as a dark colored glob of gelatinous material or sand-like lumps of black sediment in the water. Iron bacteria colonies will sometimes float on the surface of a standing body of water and have an iridescent sheen that is often mistaken for an oil spill.

Maximum Contaminant Level (MCL) – The maximum level of a contaminant which is permitted in public water supplies. Maximum contaminant levels are specified in the Primary Drinking Water Standards set by EPA and the Ohio Department of Health for contaminants that affect the safety of public drinking water.

Methane – A colorless, odorless, flammable, lighter-than-air gas that can be found in water wells which are completed in coal seams, or other zones that contain trapped gasses. Although methane is not a poison, if it is allowed to accumulate in confined spaces it can pose a risk for explosion or fire. Methane is easily removed by proper venting.

Milligrams per Liter (mg/L) – Metric weight of a substance in a liter of water. 1 mg/L = 1 ounce per 7,500 gallons. (1 mg/L = approximately 1 ppm in water).

Nitrate/nitrite – A salt form of the element nitrogen. The presence of nitrates and /or nitrites in a water supply generally indicates pollution by human or animal waste, and/or commercial fertilizer. These materials are very dangerous for children below the age of six months.

Nuisance Contaminants – Contaminants that affect aesthetic or functional aspects of water quality and have little or no impact on health. They are managed in public drinking water systems as Secondary Maximum Contaminant Level [MCL] Standards.

ODH – Ohio Department of Health is responsible for the enforcement of private drinking water regulations within the State of Ohio. ODH works with EPA and local health departments. See the web site list at the end of this booklet for a link to ODH.

Organic Chemicals – Those chemicals that contain carbon. If not properly handled, stored, transported, and disposed, organic chemicals can pollute water supplies. These can include trihalomethanes, pesticides, volatile organic compounds such as benzene, toluene, ethylbenzene, and xylenes (constituents of crude oil, condensate, and gasoline) and in some areas pharmaceuticals.

Parts per Million (ppm) – Concentration of a substance on a weight basis in water. 1 ppm = 1 pound of a contaminant per million pounds of water (1 ppm in water = approximately 1 mg/L).

Pathogens – Live organisms that contaminate water such as bacteria, viruses, and parasites such as Giardia.

Percolation – The downward and outward movement of water into soil. In general, sandy soils will absorb more water than high clay soils or where the water table is close to the surface. Because water in leach fields moves down and outward it is important that your water well/spring be located uphill from your leach field, to avoid contamination.

pH – A factor used to measure the acidity and alkalinity of water. Values for pH fall on a scale ranging from 0 to 14. Water that has a pH of 7 is neutral; water that is acid has a pH lower than 7 and water that is alkaline has a pH greater than 7. The secondary standard for drinking water is a pH between 6.5 and 8.5.

Pollutants – Man-made substances introduced to the environment that at high enough levels can make water unfit for human, animal, or plant consumption or use.

Potable Water – Water fit for drinking.

Primary Drinking Water Standards – The Primary Drinking Water Standards for public water supplies are published by the EPA and monitored, and enforced the Ohio Environmental Protection Agency (OEPA). Primary standards regulate contaminants which pose serious health risks to the water user. The State of Ohio has adopted the EPA standards as health based standards for private water systems and these and should be used as a guide for your personal drinking water well. For a link to these standards see the web site list in this booklet for a link to ODH or the EPA.

Private Water Systems – Any systems which do not meet the definition of public water systems, for example, a private individual water source, such as a residential water well. The State of Ohio has adopted the EPA standards as health based standards for private water systems.

Public Water System – A public water system is defined as a system that provides water for human consumption to at least 15 service connections or serves an average of at least 25 people for at least 60 days each year.

Pure – Without contaminants or pollutants.

Radon – A tasteless, odorless, colorless radioactive gas formed from decay of uranium in rocks. Radon has been found dissolved in some groundwater supplies. Activities that release radon as vapor from water include showering, bathing, and cooking. High concentrations of radon are known to be carcinogenic and are linked with increased risk of lung and other cancers. Radon is easily removed from water by purging with air and venting.

Reverse Osmosis (RO) – A process whereby water is purified using pressure and semipermeable membranes that filter out unwanted salts and other minerals.

Safe – The level of a contaminant or pollutant is low enough that no health problems will occur.

Scale – Mineral deposits which build up on the inside of water pipes and water-using appliances, like coffee pots and hot water heaters. It is primarily made of calcium and magnesium carbonates and usually associated with hard water. Small amounts of scale are helpful in preventing leaching of metal from pipes.

Secondary Drinking Water Standards – The Secondary Drinking Water Standards are published by the EPA. Secondary Standards set desirable/acceptable levels for nuisance contaminants, which affect taste, odor, color, and other aesthetic and functional qualities of the water supply. These secondary standards are not enforced by law, but rather are guidelines for public water treatment plants and state governments. These guidelines are helpful as you read the laboratory results from your well. For a link to these standards see the web site list in this booklet for a link to ODH or the EPA.

Total Dissolved Solids (TDS) – A good general indicator of water quality, which measures the total amount of dissolved minerals, metals, and salts. Water with more than 500 milligrams per liter TDS is of marginal quality and may contain undesirable amounts of calcium, magnesium, sulfates, chlorides, or other salts for human consumption. Many wells produce water that has much higher levels of TDS and in many areas may be the only source of water. High levels of TDS are often safe to drink, but may cause transient gastric problems. These higher levels of TDS can be removed, but often at a higher cost than routine water treatment.

Toxic Metals – Arsenic, barium, chromium, mercury, selenium, lead, and other toxic metals are regulated by EPA Primary Drinking Water Standards. Toxic metals may be naturally occurring in rock and soil, or may pollute water as a result of runoff or leaching from industrial or agricultural sites, mining activities or hazardous waste disposal.

Toxicity – The toxicity (poisonous effect) of a water contaminant depends on the concentration of the contaminant in the water and the period of time the contaminated water is consumed. Any chemical can be toxic, if you swallow enough of it. Also, people react differently to different toxic substances; some people may be harmed more than others. Pregnant and nursing women, the elderly, infants, ill or malnourished people, and people taking medication or that have a compromised immune system may be especially vulnerable to certain contaminants.

Turbidity – A cloudy condition in water due to suspended clay or organic matter. Turbidity can be treated with filters.

Volatile Organic Chemicals (VOCs) – Hydrocarbon containing compounds which evaporate readily and are expensive to analyze. Primary Drinking Water Standards set limits for several volatile organic chemicals, including the solvents such as trichloroethylene and carbon tetrachloride, and the gasoline component, benzene. Tests for VOC compounds are not routine and tend to be fairly expensive because of the difficult and precise laboratory work involved. Low levels of VOC's can be treated with activated charcoal filter systems. Treated water must be tested to assure that the treatment has reduced the VOC's to a safe level before using as drinking water. Filters must be replaced often.

Water Quality – In general is determined by these characteristics: safety, taste, color, smell, corrosivity, staining, pH, hardness, and chemical composition of dissolved solids.

Text and glossary are freely adapted from publications provided by various federal, state and local agencies and the Ohio Department of Health.

Record of Basic Well Data

USE THIS FORM TO HELP DOCUMENT THE HISTORY OF YOUR WELL.

Permit #: ____________________

Driller Name: ____________________ Phone #: ____________________

Pump Installer Name: ____________________ Phone #: ____________________

Date Drilled: ____________________

Well Depth: ____________________

Surface Casing Depth ____________________

Production Casing Diameter: ____________________

Cement Interval: ____________________

Well Screen Interval: ____________________

Pump Size & Type: ____________________

Pump Depth: ____________________

Initial Static Water Level (feet bgs): ____________________

Initial Yield Rate (gpm): ____________________

Initial Static Water Level in feet below ground surface (bgs):

Feet bgs: __________ Date: __________ Feet bgs: __________ Date: __________

Feet bgs: __________ Date: __________ Feet bgs: __________ Date: __________

Feet bgs: __________ Date: __________ Feet bgs: __________ Date: __________

Initial Yield Rate in gallons per minute (gpm):

gpm: __________ Date: __________ gpm: __________ Date: __________

gpm: __________ Date: __________ gpm: __________ Date: __________

gpm: __________ Date: __________ gpm: __________ Date: __________

Well Maintenance (include who performed the work)

Date: __________ Work Performed: ____________________

Date: __________ Work Performed: ____________________

Date: __________ Work Performed: ____________________

“Ground water in Northeast Ohio is an abundant resource. Protect it and your health by learning about your water well, and factors that ensure your safety.”

Helpful Water Web Sites

US Environmental Protection Agency

- www.epa.gov
- www.water.epa.gov/drink/
- www.water.epa.gov/lawsregs/rulesregs/sdwa/currentregulations.cfm
- www.water.epa.gov/learn/kids/drinkingwater/index.cfm
- www.water.epa.gov/drink/info/well/index.cfm

Radon

- www.epa.gov/radon/

US Geological Survey

- www.usgs.gov/water/
- www.water.usgs.gov/ogw/

Ohio Department of Health

- www.odh.ohio.gov/
- www.odh.ohio.gov/odhprograms/eh/water/PrivateWaterSystems/main.aspx

Ohio EPA

- www.epa.state.oh.us/nedo
- www.epa.state.oh.us/
- www.epa.ohio.gov/ddagw/DrinkingandGroundWaters.aspx
- www.epa.ohio.gov/dsw/SurfaceWater.aspx
- www.epa.ohio.gov/MarcellusandUticaShale.aspx
- www.epa.ohio.gov/ddagw/pws/advisory_maps.aspx

Ohio Department of Natural Resources

- www.dnr.state.oh.us/
- www.dnr.state.oh.us/tabid/21817/Default.asp
- www.ohiodnr.com/mineral/tabid/10352/Default.aspx
- www.dnr.state.oh.us/geosurvey/default/tabid/7105/default.aspx

Ohio State University Extension

- www.extension.OSU.edu/topics/environment

The Groundwater Foundation

- www.groundwater.org/gi/gi.html

National Groundwater Association

- www.ngwa.org/Fundamentals/Pages/default.aspx

Water Quality Association

- www.wqa.org/landing.cfm?section=3

Web Sites for Kids

- www.discoverwater.org
- www.disney.go.com/wheresmywater/
- www.groundwater.org/kc/kc.html