

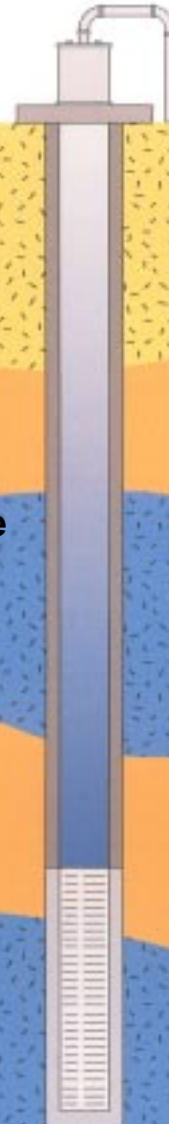


This 24 page booklet is available @ www.ewswater.com
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A Guide For The Private Well Owner

This Guide Contains:

- ◆ An Introduction to Well Water
- ◆ Well Owner Responsibilities
- ◆ Well Construction and Well Maintenance
- ◆ Protection of the Well Environment
- ◆ Septic Systems and the Environment
- ◆ Water Quality Sampling and Testing
- ◆ Common Well Water Problems
- ◆ Water Quality Treatment
- ◆ Resource Guide



*This guide has been compiled in order to empower consumers.
Information is essential to understanding your well and the water it will provide
for you, your family, and your home.*

This is your water.
You do not need to be an expert. Just informed.



Introduction:

This guide is intended to make private well ownership a little easier and is designed to:

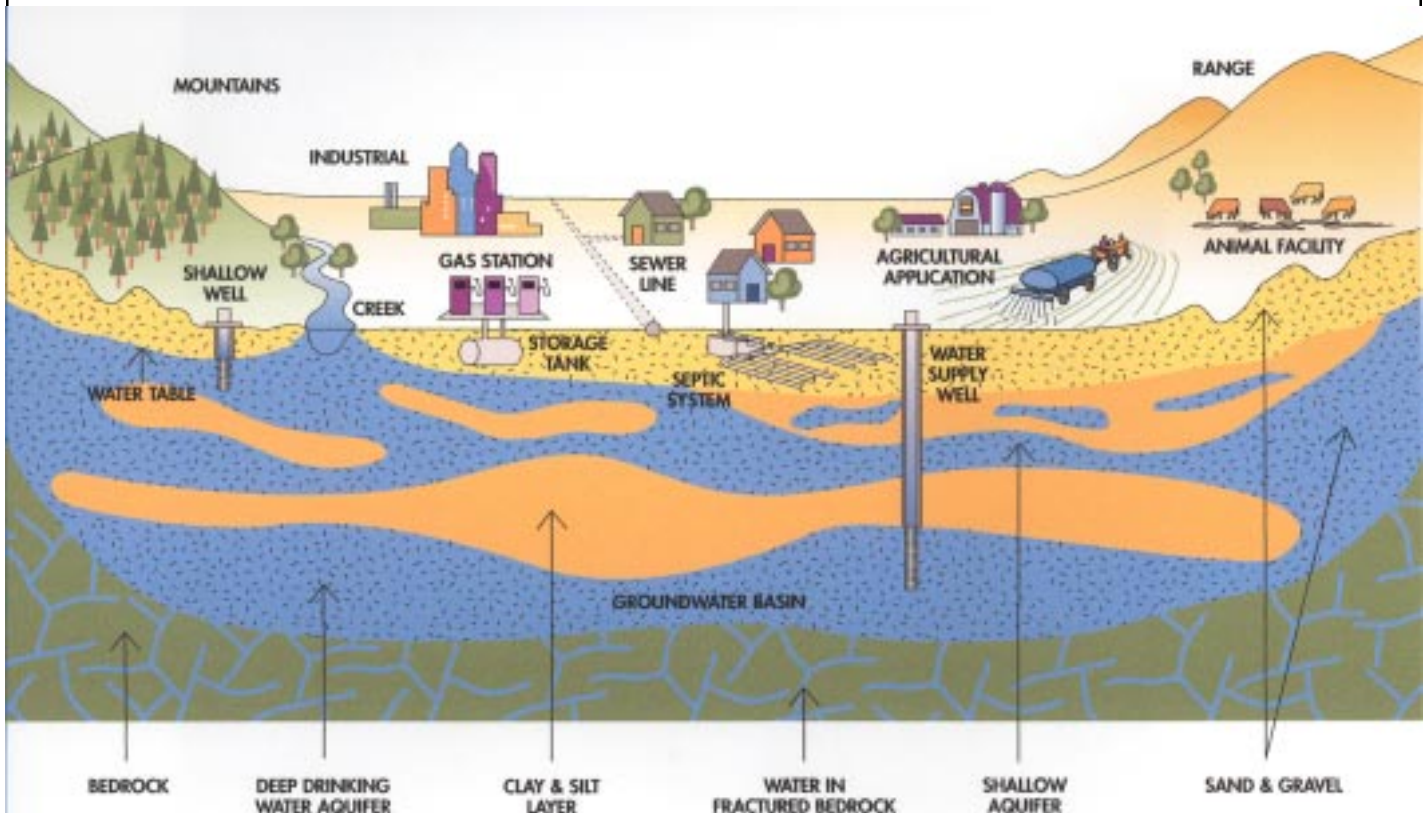
- Introduce well owners to the basics of proper well construction, destruction, and/or maintenance.
- Inform well owners of their responsibilities.
- Alert private well owners to the potential for contamination and the need for independent water-quality testing and if applicable, proper problem solving of water issues.

A percentage of all water used comes from below the ground, where layers of sand and gravel provide a natural storage basin for water in underground aquifers. In addition to being an extraordinary storage facility, the groundwater basin also serves as an inexpensive and efficient treatment and distribution system; as water percolates down, it is naturally purified and spreads out for miles to serve a wide area.

The thousands of water supply wells that draw water from these groundwater basins have traditionally produced very high quality drinking water. In recent years, however, our drinking water aquifers have been threatened by ordinary household chemicals and by-products, toxic chemicals from industrial spills, leaking underground storage tanks, and agricultural applications, as well as biological pathogens from sewers, septic systems and animal facilities. These contaminants can find their way through the natural protective layers of clay and silt and into our drinking water aquifers. The problem can be exasperated by the presence of improperly constructed wells, abandoned wells, or wells located too near to a potential contaminant source like a septic system. These wells can act as vertical pathways, allowing chemicals and pathogens on the surface or in shallow aquifers, to migrate into our deep drinking water aquifers. To help control and prevent the contamination of our groundwater storage basins and to protect public health, we need the cooperation of private well owners.

We have produced this guide to help you protect our groundwater resources and your health.

This guide is meant only as a guide for well owners. We do not claim that the recommendations made in this document will work in every situation. Nor do we claim to have covered every possible scenario or contaminant.





Well Owner Responsibilities:

To protect public health and to maintain the high quality of water in drinking water aquifers. Well owners are required to adhere to various state and local laws relating to wells.

In general, well owners are (depending on local, district and/or state regulations) required to:

- Obtain permits before any well construction, destruction, and/or modification.
- Complete any well construction, destruction, or modification according to your district and state well standards.
- Wells must be constructed so that they do not allow poor quality surface water or water from shallow aquifers to migrate into drinking water aquifers. There are specific well construction practices that must be followed to ensure that wells are constructed properly.
- Register all wells. Do not fear local requirements. These requirements, codes and laws are to protect you.
- Obtain well clearance before a well is used for drinking water purposes.
- Properly maintain the well so that it remains in compliance with your district and state well standards. Wells must be maintained so that they do not allow the introduction of surface waters or other materials into them through improperly sealed well casings or gravel fill/sounding tubes. Wells must be secured so that children or animals cannot enter them.
- Properly destroy any wells that are not being used. When no longer in use, wells must be destroyed so that they can never act as vertical conduits or endanger public health. Generally, wells must be completely filled with impervious sealing materials.

**According to any code, lack of knowledge is not an excuse.
This is the well providing your water to your home.
You don't need to be an expert - just informed.**

See the following pages for information on:

- Well construction well maintenance and record-keeping
- How to protect your environment and water quality
- Independent water sampling and testing
- Water quality problems and solutions
- Resources



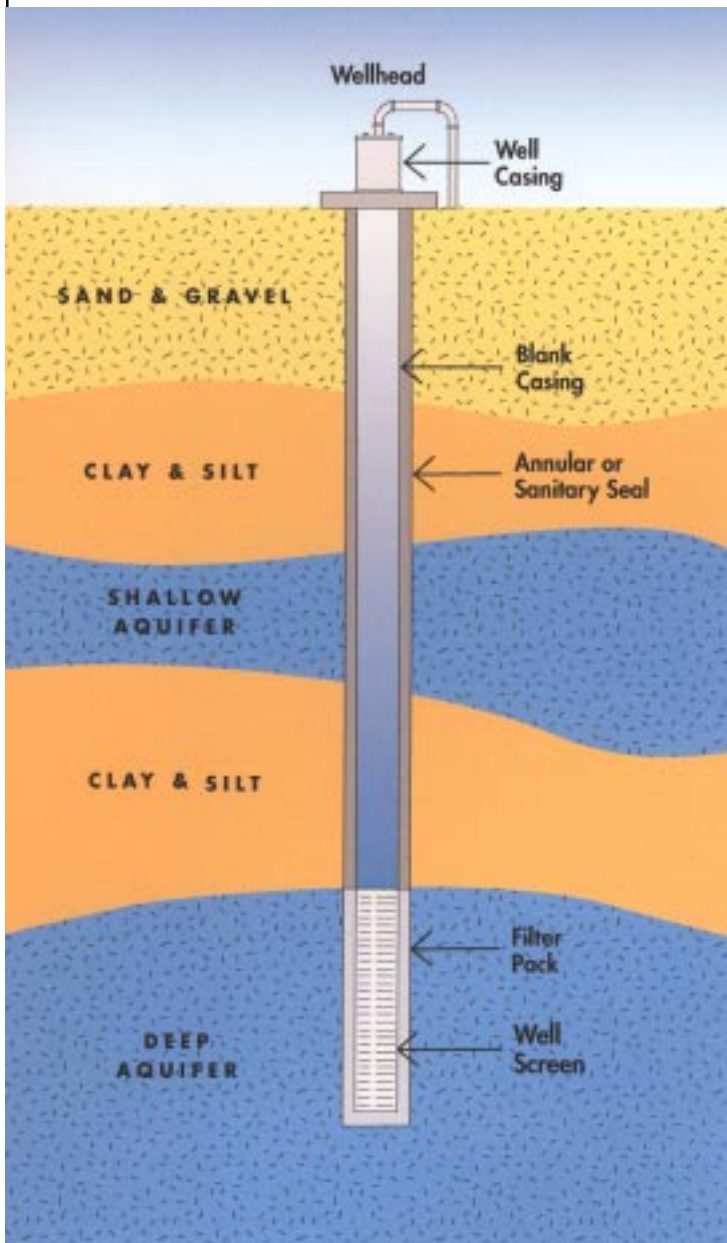


Well Construction

WELL CONSTRUCTION: UNDERSTANDING HOW YOUR WELL WORKS AND HOW YOU GET YOUR WATER.

The typical domestic well is constructed by drilling a hole in the ground to a depth of 100 to 300 feet. As the well driller is drilling the hole, the driller notes the type and depth of materials that the bit passes through. This information is recorded on the Driller Log that is submitted to the permitting agency and given to the homeowner. If a Driller Log is not applicable to your local code, insist on one as the homeowner. This information will be of utmost importance for future reference.

The well is constructed once the driller finds layers of sand or gravel that produce enough water to meet the well owner's needs. These water producing layers are called aquifers. To construct the well, the driller installs a length of plastic or steel pipe called the well casing into the hole. The well casing keeps the hole from collapsing and allows pumping equipment to be installed. By regulation, the well casing must have a diameter at least four inches smaller than the diameter of the hole.



Where the hole intersects the best water producing layers, the driller installs the well casing with thick cuts or perforations. This portion of the well is called the well screen. The well screen allows water to pass into the casing but keeps out sand and gravel. Where the hole intersects layers of clay or fine silt (layers that don't typically produce significant quantities of water), the driller installs un-perforated pipe called blank casing.

To keep fine sand, silt, and clay from entering the well screen, the driller installs a sand and gravel mix called the filter pack into the space between the casing and the larger diameter hole. To protect the water quality in the deeper, drinking water aquifers from poor quality surface water and shallow aquifer water, the driller also installs a concrete or cement seal (annular or sanitary seal) between the blank casing and the larger diameter hole. Typical well seal depths are 100 or 150 feet.

The annular seal extends upward to the ground surface where it is extended out to create a concrete pad with the well casing extending out of the middle of it. These surface features are called the wellhead. At the wellhead, the casing extends at least one foot above the ground surface and is securely capped to prevent anything, including surface water, from entering the well. The concrete pad is sloped away from the casing to protect the well from damage and from surface water contamination.

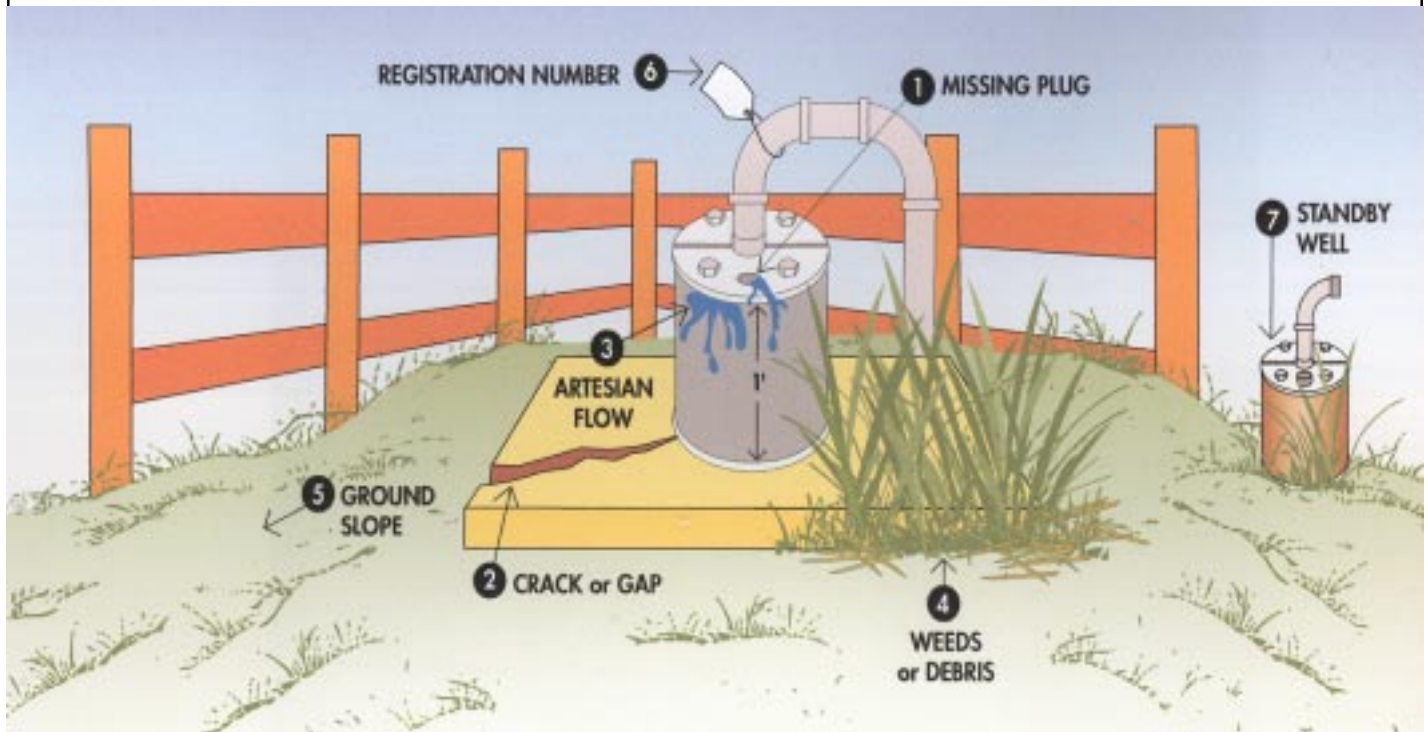
Remember, this may be a typical well application and yet, your conditions and situation may be different. However, whether or not your well is deeper or much more shallow - proper construction, maintenance and record-keeping will always be required. The information provided in this guide will provide you with the resources to be informed.



Well Maintenance

WELL MAINTENANCE: THE SIMPLE THINGS TO LOOK FOR AND THE MAINTENANCE NEEDED.

A poorly maintained well can lead to a variety of problems including poor water quality and reductions in the amount of water your well can produce. To minimize these potential problems, a well maintenance program is an important part of a well owner's responsibilities.



- 1** Look for openings that insects, rodents, water, or anything else can enter. Cap, seal, or otherwise plug them.
- 2** Look for cracks in the concrete pad that would allow water, and any contaminants it may be carrying, to follow the well casing down into your drinking water aquifer. Seal cracks, or re-pour a new concrete pad.
- 3** If water is flowing out the top of the well, call a licensed well contractor to stop the flow. In addition to being a waste of water, if water can leak out, contaminants can seep in.
- 4** Remove weeds, leaves, and other debris from around your well. These can create great homes for rodents and other pests. Remember, do not use herbicides or any other chemicals near the well.
- 5** Make sure the ground slopes or drains away from your well and that your well casing extends at least one foot above the ground to ensure that surface water does not collect or flow near the well.
- 6** Make sure your well registration number (if applicable to your local codes) is still visible on your well. This may be a local legal requirement. Call your local district for information.
- 7** If you have an inactive well, turn the pump on several times during the year to make sure that everything is functioning properly. Inspect and maintain your inactive well following the same guidelines as for your active well. If you never plan to use the well again, you may be legally required to properly destroy it. Properly destroying the well will prevent it from being an accidental pathway of contamination into your active well, your neighbor's well, or the groundwater.



Well Maintenance and Record Keeping

WELL MAINTENANCE AND THE ALL IMPORTANT RECORD KEEPING

Inspect Your Wellhead

Get in the habit of doing a visual check on your well at least once a year. More often is better.

Maintain Complete Well Records

Effective maintenance programs begin with complete records on the construction, testing, and maintenance of your well. You should work with your contractor to establish inspection and routine maintenance schedules based on the specific characteristics of your well and water supply needs.

Complete well records should include:

■ **The Driller Log:**

The document describing the construction of the well: how deep, what depth it draws water from (the perforated interval), pipng material, soil types encountered while drilling and the initial start-up date. This important information will help to trouble shoot problems, should they arise. The drilling contractor should provide you with a copy of the Driller Log following completion of the well construction and testing. If not a code requirement, you should request one as the consumer.

■ **Pump Test Data:**

The pump test gives information on how much water (GPM - gallons per minute) the well can produce and at what pressure (PSI). This information is also useful to assess well performance as the well ages.

■ **Distribution Map:**

Draw a map showing the location of all the buried pipes, the materials and line sizes used, connected to the well. If you share a well with adjacent properties, it is a good idea to have a map of all the plumbing on your neighbors' property as well. This information can be invaluable as the properties change hands and repairs need to be made, or as new wells are added.

■ **The Physical Location of the Well:**

Measure the distance to the well from permanent structures (e.g. the centerline of the road or corner of the house).

■ **Maintenance Records:**

Record whenever you have any maintenance done, such as replacing the pump or check valves. This is important information to keep track of, regarding the age of various components, what work was done, and who repaired them last.

■ **Water Quality Data:**

Keep all your past water quality testing information in one place. By comparing results from one year to the next you will be better able to detect changes which may indicate problems.

■ **Disinfection History:** If you disinfect your well, keep track of when, why, and how it was done.

Deteriorating Well Performance

The performance of all wells will deteriorate over time, but proper well construction and maintenance can delay this problem. The typical causes of performance deterioration include one or more of the following: mineral encrustation or biofouling (bacteriological encrustation) of the well screen, physical plugging of the well screen, filter pack, and/or surrounding soils by fine particles, corrosion of the well casing, and pump problems. Many of these problems can be prevented by proper well design and construction, proper pump sizing, proper operation and maintenance, or preventative well maintenance. If not allowed to progress too far, most well performance problems can be corrected. To prevent or correct performance problems, you should work with your Water Well and/or Pump Contractor.

Well Destruction

Any well that is no longer being used for its intended purpose is required by law to be properly destroyed. Because unused, abandoned wells can act as pathways that allow poor quality surface water or shallow groundwater to move into deeper drinking water aquifers, it is very important that they are properly destroyed. This is especially true if other water supply wells are operating in the area. When a well is being used in the vicinity of an abandoned well, the pumping activity in the operating well can actually pull poor quality water down the abandoned well, into the drinking water aquifers, and then into the operating well.

To eliminate these vertical pathways for contaminant migration, abandoned wells must be destroyed by filling the entire well casing with cement based sealing materials. As with all well construction, modification, or destruction, any well destruction work must be completed by a licensed contractor and a permit.



The Protection of Your Well Water Environment

Why should I protect the groundwater?

For most well owners, groundwater is their only source of water and should, therefore, be protected. Groundwater moves very slowly, often only a few feet per year, and because it moves so slowly, once it becomes polluted, it takes years for it to be naturally flushed clean. Manually cleaning pollutants out of groundwater can be extremely costly and difficult. Often, the only solution is to find a new source of water.

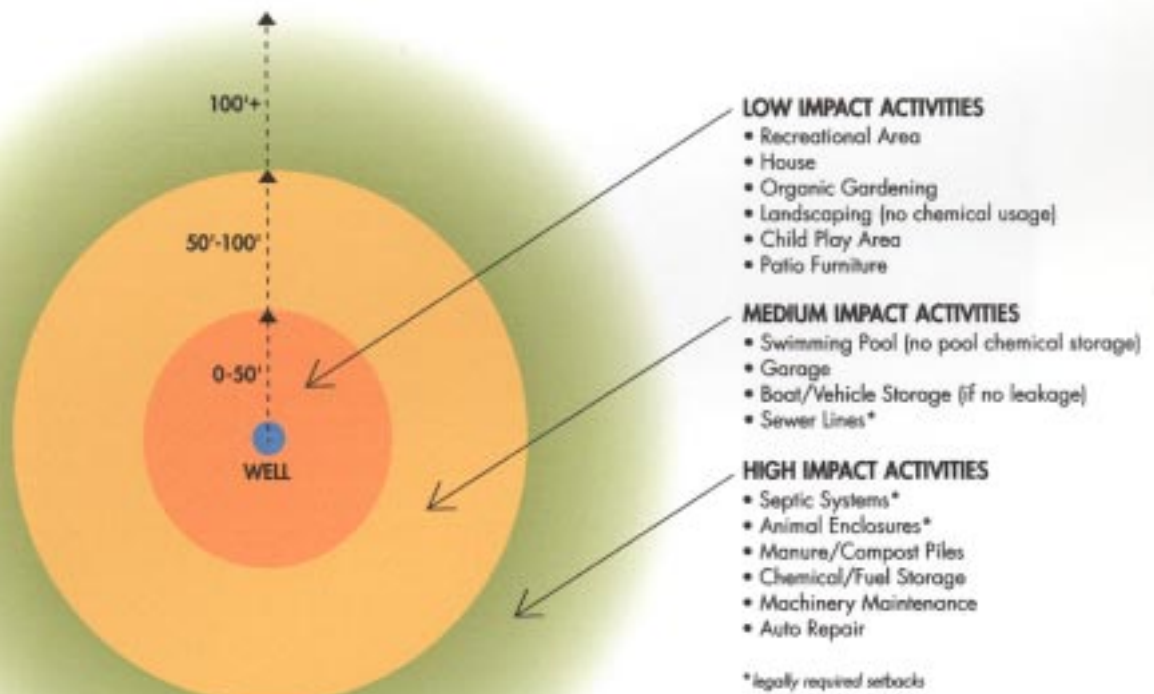
What can I do to protect the quality of my water?

Always keep in mind that you live on top of your drinking water. The layer of earth between you and the water provides some protection from contamination, but it is not perfect. The safest way to protect your water supply is to teach your family, friends, and neighbors: **If you don't want to drink it, don't put it on, or, in the ground!**

Create a Zone of Protection Around Your Well

Your well is a direct connection between you and your water supply. Contaminants can flow down your well as easily as water flows up it. The farther away from your well you are, the more sand, gravel, and clay there is to filter out contaminants before they reach your water supply. So create a circle at least 50 feet in diameter around your well where you don't store, mix, spray, spill, bury or dump anything that you don't want to drink. Don't forget to look out for your neighbor's well if it is near your property line. Any contamination in your neighbor's well can travel into your well.

Some activities legally require more than a 50-foot zone of protection. For example, septic tanks, leach fields, and animal enclosures need to be at least 100 feet away from any well to ensure that no waste products reach your drinking water. There are many activities that do not have formal, legal setback requirements. Use your common sense. For example, don't tie animals to the well structure--not only do you risk breaking the casing, piping, or electrical connection, you risk contamination from urine and feces.





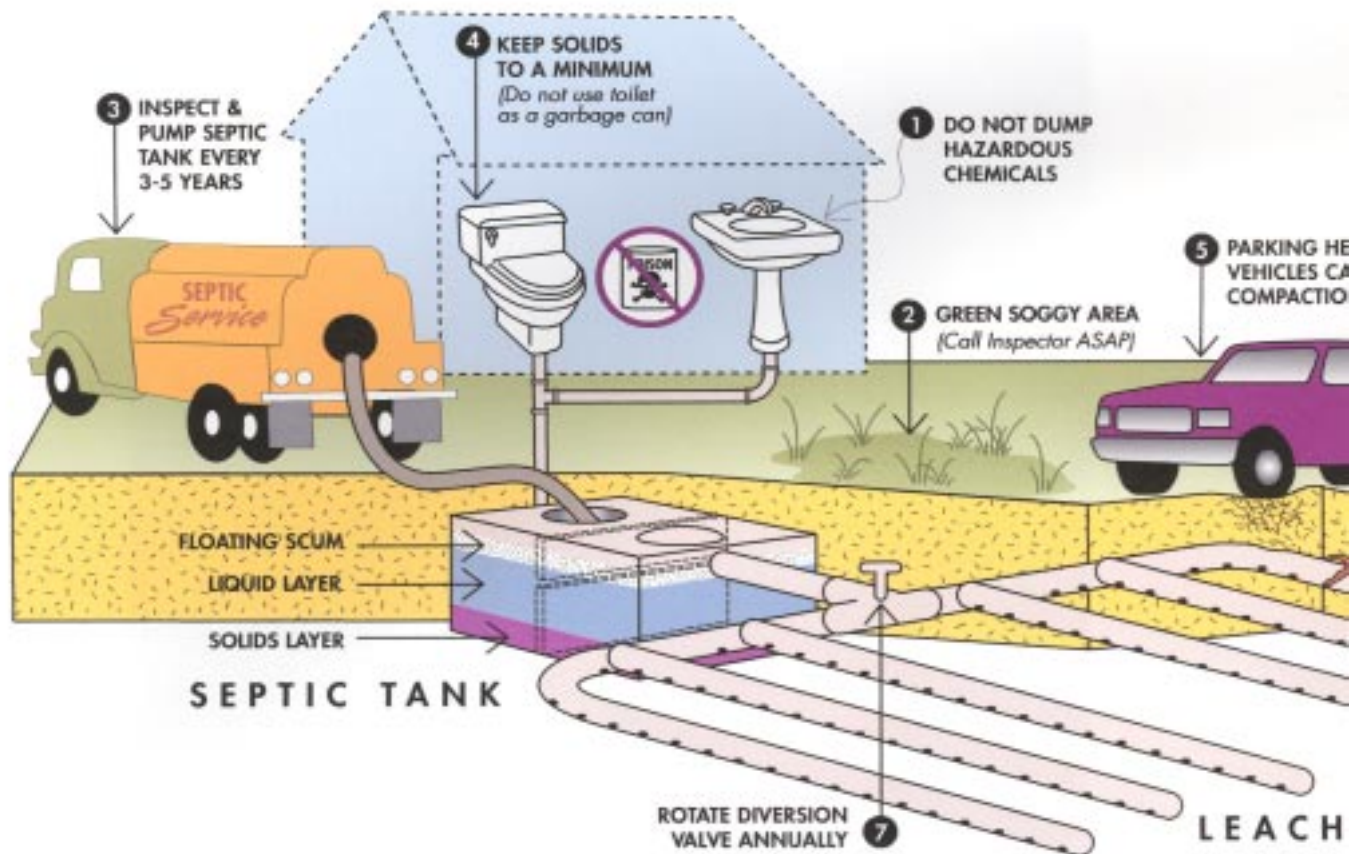
Water Quality Protection and the Maintenance of Your Septic System

A septic system consists of a tank and a leach or drain field. All the solid/liquid waste from inside the home flows into the septic tank. The septic tank is composed of two compartments. The waste is deposited in the first compartment where the solids settle to the bottom and the liquid and scum float above it. Bacteria and other microorganisms break down the solid materials. These microorganisms are important to the process of your septic system.

As the liquid separates from the solids, it overflows into the second compartment where more separation and decomposition occur before it flows into the leach/drain field. The leach/drain field is a network of perforated pipes within a trench of washed drain rock buried about two to three feet deep. The liquid waste flows out of the perforated pipe and into the soil where more pollutants are removed. By the time the wastewater reaches the groundwater, few impurities should remain.

If you have a septic system, keep in mind that whatever goes down the drain may find its way into your drinking water. The required 100-foot setback between your well and your septic system provides relatively good protection against bacteria and viruses when it is working properly. However, this setback was not designed to protect against things like photographic processing chemicals, hazardous art supplies, hazardous household cleaners, paint and paint cleaners, automotive wastes, pesticides, by-products from soaps, detergents, shampoos and conditioners, and other hazardous chemicals that may not break down and filter out as easily.

Either from you, your neighbor, or any groundwater - these are the volatile organic contaminants (VOC's) that are generally odorless, colorless and/or tasteless; difficult and expensive to test for - but relatively easy to reduce and safeguard from. See below and the next page for some of the things to be aware of, and look out for.





Inspect Your Wellhead On a Regular Basis

It is very important to keep any foreign materials, including surface water, out of your well. Therefore, it is important that your well is free from opening and that your concrete well pad is structurally sound. Your well should be inspected annually to be sure that there are no openings in the wellhead or cracks in the well pad. Any openings or cracks should be secured or sealed. Refer to pages 4, 5 and 6 in this Guide for more information on how to complete an inspection.

Protect The Well Structure

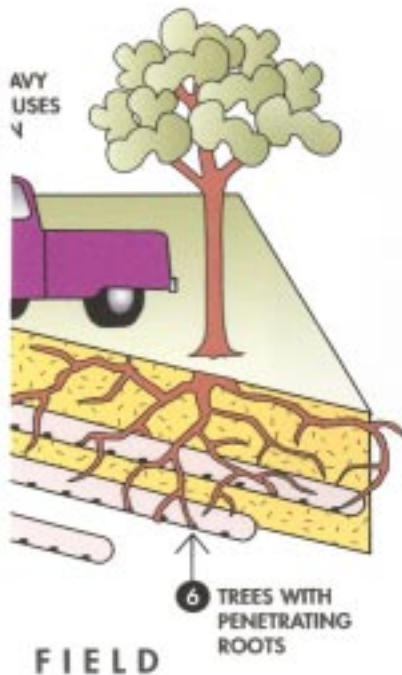
Many well repairs can be very costly, so it pays to protect your well from any physical damage.

- The safest way to protect your well from being damaged or lost is to build a small structure or fence around it. Keep in mind that you will need easy access to the well for maintenance and repairs. If you don't have a structure around your well, then clearly mark it so when vegetation grows up, it doesn't become buried and lost.
- Lock the well enclosure to minimize the chance of vandalism.

A Word About The Brine Discharge From Softeners - Some Restrictions May Apply To Their Use.

- Brine discharge may be a problem for your septic application. The brine discharge kills the microorganisms necessary for the septic process to function. Some states or local agencies have already banned the use of softeners and their brine discharge to septic and even to municipal supplies due to the problems created with wastewater treatment and ground water contamination. Some restrictions require softeners to have metered valves to prevent excessive brine discharge, hot-side only applications, or salt-exchange tanks and services.
- Local water dealers and other organizations do not inform consumers of these issues and believe these rules are unenforceable, however the consumer is ultimately responsible. These restrictions apply to both sodium and potassium chloride, since both are salts.
- Softeners may also provide warranty issues with pools and spas, certain other products and finishes.
- Softened water should not be used for drinking, cooking, pets or plants and is usually bypassed or "looped away" from the cold side of the kitchen sink. Reverse Osmosis, which also has its' drawbacks, may be sold to remove the salt from the water that the softener put in at the kitchen sink, yet may be misapplied for your local water conditions.

Septic System Health, Hazards and Maintenance



- 1** Do not dump hazardous chemicals down the drain. If your drain is plugged try using boiling water or a drain snake instead of chemical drain cleaners. Use less toxic cleaning supplies whenever possible. Take all hazardous chemicals to a hazardous waste drop-off for disposal.
- 2** If you notice a sewage smell, a continuously wet area in your yard, lush vegetation around the septic tank or leach field, or liquid waste backing up through your drains, then something is not working properly. Call a licensed septic tank inspector immediately.
- 3** Have your septic tank inspected and pumped every three to five years (more often if you have a garbage disposal). If the solid waste in the tank builds up too high, it can flow into the leach lines, plug them, and cause your system to fail.
- 4** Keep the solids in your system to a minimum. Do not use your toilet as a garbage can. Food wastes, feminine hygiene products, and other household solids are better placed in the garbage.
- 5** Do not park or drive heavy equipment over your leach lines. This may compact the soil around the lines and prevent adequate percolation of the liquid waste, causing your system to fail.
- 6** Do not plant trees near your leach line. Tree roots often seek out the moist environment inside your leach lines and plug them, causing your system to fail.
- 7** If you have a dual leach field system, change the diversion valve setting once a year.
- 8** Be cautious of septic tank additives, yeast, bacteria, enzymes, or other products to enhance the system. None of these products have been proven to be beneficial and some can cause permanent damage.



Water Quality and What You Need To Know

As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and can pick up substances resulting from the presence of animals and human activity.

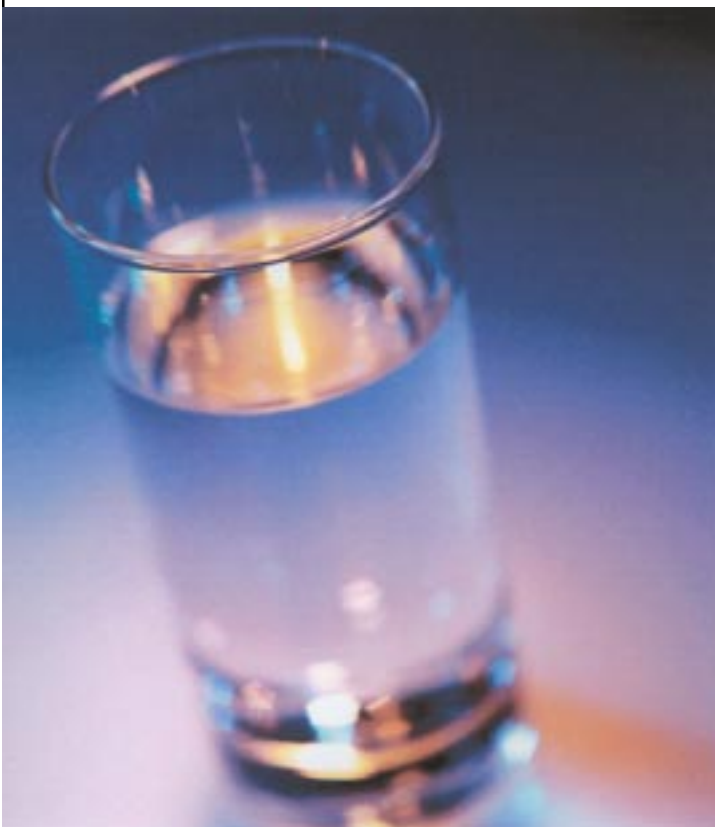
Contaminants that may be present include:

- Microbial contaminants, such as viruses and bacteria, that may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- Inorganic contaminants, such as salts and metals, that can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, animal facility waste generation, mining, or farming.
- Pesticides and herbicides, that may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.
- Organic chemical contaminants, including synthetic and volatile organic chemicals, that are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, agricultural application, and septic systems.
- Radioactive contaminants that in our area are typically naturally occurring.

Drinking water, including bottled water, may reasonably be expected to contain small amounts of some contaminants and does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the USEPA's Safe Drinking Water Hotline (1-800-426-4791) or by contacting your local municipal water district.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS, diabetes, lupus, or other immune system disorders, some elderly, and infants, can be particularly at risk from infections. These people should seek advice from their health care providers about their drinking water supply, and is a standard statement among all municipal water districts.

Be aware your health care provider may be not relate water conditions and your health, and more then likely, are not informed on water issues and may make incorrect water treatment recommendations (it's just not their expertise). For example; most dermatologists do not connect our chlorinated water supplies and problems with dry or sensitive skin.



Bacteriological quality of drinking water is determined by analyzing for coliform bacteria. These bacteria occur naturally in the intestinal tracts of humans and animals and in the soil. Although coliform bacteria normally do not cause illness, they should not be present in drinking water. The presence of these bacteria in the drinking water indicates that the water may be contaminated with other organisms that can cause disease. Disease symptoms may typically include diarrhea, cramps, nausea, and any associated headaches and fatigue. Bacteria levels can fluctuate seasonally with wet and dry periods.

Nitrate is a naturally occurring compound, but high amounts of nitrate in groundwater are typically due to human activity such as fertilizer applications, septic systems, and animal enclosures. Nitrate in drinking water at levels above 45 milligrams per liter (mg/L) NO_3^- or 10 mg/L $\text{NO}_3^- \cdot \text{N}$ is a health risk for infants of less than six months of age, pregnant women and people with specific enzyme deficiencies. Nitrate concentrations in groundwater may rise quickly for short periods of time because of rainfall or agricultural activity. If you are caring for an infant or are pregnant, you should seek advice about your drinking water from your health care provider.



Water Quality Sampling and Testing

Why should I test my water?

People must recognize that drinking water contamination is a serious problem. It is a problem that is constantly being addressed by government officials, public interest groups, and the scientific community. Since this is a complex and multi-faceted problem, it will take years of research and testing before resolution may be found.

While we wait for the numerous sources of contamination to be cleaned up, we must live with these unsatisfactory conditions. We can live with contaminated water supplies if we address the following questions:

- **What form of contamination, if any, is present in my water?**
- **What is the source of contamination?**
- **Does this contamination pose a health hazard to me?**
- **How can the contaminant(s) be removed from my drinking water supply?**
- **What is contamination?**

Pure water (H₂O) consists of 11.1888% hydrogen and 88.812% oxygen by weight. Although the term “pure water” is used commonly, it is virtually a non-existent liquid due to its aggressive nature. Water is often referred to as a “universal solvent” because of its ability to dissolve almost anything it comes in contact with. The superior solvent action of water allows it to be easily contaminated by water soluble materials. For example, well water typically contains minerals such as calcium, magnesium, iron, and manganese due to its contact with rock formations containing these minerals. Water also dissolves metals from pipes and plumbing fixtures which may contain lead, copper, iron, etc. Gases and dusts from the atmosphere and any other water soluble compounds may also be dissolved by water as they come in contact with it. Water is considered to be “contaminated” when it contains harmful or objectionable substances which may be dissolved, suspended, or biological.

Where did this problem originate and why now?

Water pollution and contamination are issues that have been attracting more and more attention since the beginning of America's industrial revolution. The Industrial Revolution prompted a rise in the manufacturing of goods. This increased manufacturing led to the creation of new synthetic materials. The U.S. chemical industry produced 11 trillion pounds of synthetic organic chemicals between 1945 and 1991, most of which has ended up in our environment: soil, air, and/or water.

In mankind's efforts to improve the quality of life, many different chemicals have been developed. Some of the numerous uses include: food preservation; sprays for personal hygiene; pet care; and cleaning homes and automobiles. Over a thousand new chemicals are created each year to meet demands in the marketplace.

In the past, these chemicals were developed and released into the environment with little thought given to the potential dangers they might present. Environmental activists have forced industry and government agencies to become more conscious of waste disposal and its impact on the environment. Traditionally, hazardous waste has been disposed of via deep-well injection, surface impoundments, and landfills. Current regulations for deep-well injections do not require long-term monitoring of the sites, which allows waste to contaminate the soil and water long after monitoring periods have passed. According to the U.S. Environmental Protection Agency (EPA), approximately 70% of surface impoundments (pits, ponds, and lagoons) that are used for hazardous waste disposal do not have liners and as many as 90% may threaten ground water. The Office of Technology Assessment has determined that eventually even the best designed and secured landfills will leak hazardous waste into nearby surface and groundwater. Past hazardous waste management practices have allowed thousands of chemical compounds to find their way into many drinking water supplies.

When is a contaminant considered harmful?

In 1974, Congress passed the Safe Drinking Water Act, which authorized the EPA to establish safety levels for certain contaminants in public water supplies. These safety levels are referred to as Maximum Contaminant Levels (MCL's), which are the maximum allowable amounts of the regulated compounds in drinking water.

The EPA has divided the standards for drinking water into primary and secondary standards. Primary drinking water standards regulate contaminants that are health related. Secondary standards, may or, may not be health related and indicate aesthetic issues such as taste, odor, color, and appearance.

The original list of inorganic and organic contaminants with established MCL's has grown from 18 in 1975 to 94 in 1999, additional contaminants are constantly being considered for future regulations.

How small is one contaminant?

Very small! The standard units for measuring contaminants include milligrams per liter (mg/l), parts per million (ppm), and parts per billion (ppb). The maximum contaminant levels are written in mg/l. The units mg/l and ppm are interchangeable. To give you an idea of how small these measurements are, one part per billion is equivalent to one second in 32 years. 16 parts per million (or mg/l) equals 1,600 parts per billion. Very small quantities of toxic contaminants usually do not cause immediate health problems, but if consumed over a long period of time they can cause serious and possibly irreversible health complications.



Water Quality Sampling and Testing

What is the risk to us?

Unfortunately, chemicals are being introduced into the environment faster than we can calculate their risks and benefits. There are currently an excess of 70,000 chemicals in commercial use. According to the National Academy of Sciences only 10% of these have been tested for toxicity.

The effects of some toxic substances on human life have been understood for some time. For instance, arsenic studies have indicated that arsenic is a potent carcinogen (India). The effects of mercury poisoning became apparent in the early 1950's in Japan where eating mercury-contaminated fish crippled and killed thousands of people. There have been significant numbers of studies conducted, which have determined that even small amounts of lead can have adverse health consequences, especially in infants and small children. According to the EPA almost 1 in 5 Americans drink tap water containing excess levels of lead (including 7 million children).

THE THREAT IS REAL

According to the National Water-Quality Assessment Program, an on-going study by the U.S. Geological Survey, about fifty percent (50%) of wells sampled contained one or more pesticides and more than fifty percent of streams sampled contained five or more pesticides.

According to studies conducted by the Environmental Working Group, between 1994 and 1995 (the most recent federal data available) over 45 million Americans were supplied drinking water that violated federal health standards for fecal matter, parasites, disease-causing microbes, radiation, toxic chemicals, lead, and other pollutants.

There are approximately 1.4 million underground storage tanks containing petroleum products or other hazardous chemicals in the United States. The EPA estimates about 20% of these are leaking, which breaks down to 280,000 tanks.

According to another study conducted by the Environmental Working Group in 1999, Atrazine, a toxic weed killer, was found in the drinking water of 796 towns throughout the Midwest.

Many contaminants are colorless, tasteless, and odorless, which leads people to believe they have safe drinking water. This may not be a safe assumption. Analysis by a qualified laboratory is the only way to accurately determine the presence or absence of true contaminants. National Testing Laboratories, Ltd. offers comprehensive analyses to ensure water is free of various types of contamination.

COMPLIANCE TESTING vs. INFORMATIONAL TESTING

What do you really need?

When choosing a test package for water analysis, consider your needs and how you will use the data. Is the testing strictly for your own information? Is a regulatory agency requiring that testing be performed? Will the results be used to configure a water treatment system? Addressing these questions will help determine the most suitable test and if the testing should be compliance or informational.

When is a compliance test needed?

Compliance testing is required when testing must meet local, state, or federal regulations, or when results are to be used in a court of law. Compliance testing is most often performed for public water supplies and bottled water producers. Once it has been established that a compliance test is required, the laboratory selected must be certified by the state(s) in which results will be submitted to a regulatory agency. A laboratory does not need to be certified for all regulated contaminants to be considered certified; therefore, a list of required contaminants should be submitted to the laboratory prior to analysis for verification of certification for each contaminant. Additionally, some states certify laboratories for specific parameters based on the methods used to run the samples. This must also be reviewed if the regulatory agency specifies that the samples are to be run by a particular method.

When can an information test be used?

An accurate informational test is an excellent choice if the above criteria for compliance testing does not apply. Since informational testing is not regulated, a laboratory is free to use any analytical method suitable for the tests required. Informational testing is often acceptable for applications such as: monitoring home water quality, water treatment diagnosis, monitoring drinking or process water quality in businesses, preliminary testing for new water sources, real estate transactions, and new well drilling/development.

How accurate is an informational test?

A competent laboratory with experienced analysts can provide an informational test with a high level of accuracy. Informational tests are performed by the same analysts, using the same laboratory equipment that is used to meet the high standards required for compliance testing. Certain variations in methodology can reduce costs without reducing accuracy. These tests are designed to give an overall picture of water quality. They include a number of contaminants that are regulated by the EPA under the Safe Drinking Water Act.



Water Quality Sampling and Testing

This is a process that begins here!

The following pages of this guide pertain to the proper testing of your water, common problems and the proper treatment of water issues based on the application. This information should be provided to any consumer and/or contractor dealing with a well water application. Well water can be wonderful or miserable, with many variables in-between however, you do not know what you have until you properly test the water.

Testing by an independent lab.

Have the well water sampled and tested by an independent lab. Testing should be based on consumption and quality of water and then the aesthetics. This process better informs the consumer and provides for the correct solution and care of the water to the home or facility, now and for many years to come.

Beware of the door-to-door salesperson!

A door-to-door salesperson will perform a basic test to sell the limited product that he has available. Usually a softener based on the evidence of naturally found calcium and magnesium minerals. These minerals, also known as the hardness minerals are found in all your spring waters and bottled water manufacturers add them back into the water to provide flavor and taste. Be aware that testing your water is far more complex than a simple sales tactic and should be taken more seriously. Softeners, although having certain benefits with regards to problems associated with hardness, do not provide any benefits (and can be a detriment) regarding the actual drinking quality of your water. Information on softeners is included in this guide along with other treatment options available, based actual water issues and/or consumer preference.

What Should I Test My Water For?

There are dozens of tests that can be performed on drinking water and no one analysis can assure that your water is "safe to drink." We have tried to compile the most commonly performed tests and their recommended testing frequencies. The tables in this guide should be used for general guidance only. Observe and be aware of the environment, local water conditions and issues not usually tested for; (ie: silica, particulates such as silt or sand, tannins).

Mandatory Health Related - Primary Standards

■ **Coliform bacteria** must be absent to provide the basis of healthy, potable water. No water treatment system should be on an application that does not provide water that is microbiologically safe. If present, the occasional or residual disinfection of the water supply must provide a negative or absent result.

■ **Nitrate** is a commonly found contaminant, and a test is recommended as a window to other potential issues.

■ **Electrical conductivity (EC)** is a measure of all the dissolved ions in your water. By itself, EC does not tell you if your water is safe to drink. However, since the electrical conductivity test is the cheapest and easiest, it can be used as an indicator of changing conditions that may require further testing.

■ **Inorganic Contaminants or the Metals** are recommended in order to establish a baseline understanding of the water quality in your well and as a mechanism to indicate water quality changes. High levels are significant problems.

■ **Radioactivity** should be part of the testing package as an indicator of water problems and health issues not associated with other categories.

■ **Organic Chemicals or the Volatile Organic Contaminants (VOC's)**. A test for total trihalomethanes (THM's) is an indicator of the presence of this category which is a modern world water problem. Whether or not, the test shows a presence or "non-detected" (N/D), this and other VOC's are in virtually all our water in trace amounts, too low for equipment to detect unless it reaches a maximum contamination level (MCL). A test is important to indicate any significant issues.

Non-Health Related - Secondary Standards

■ **Iron and Manganese**. Even though not contaminants within normal ranges, the red/pink (iron) or black/brown (manganese) are aesthetic problems and a nuisance for other water treatment systems, as well as, for plumbing and fixtures. Test as part of the test package because a small amount, whether visibly present or not, can effect other treatment solutions

■ **Total Dissolved Solids (TDS)**. Even though not a contaminant within normal ranges this item is hotly debated by people trying to sell product improperly. TDS is part of most spring, mineral or bottled waters.

Non-Health Related - Additional Constituents Analyzed, No Standards Set

■ **pH, Alkalinity and Hardness (calcium and magnesium)**. These items create a balance of water and are familiar to people who take care of pools and spas. Like anything else, there are acceptable ranges and problems if these items are too low or too high.

• **pH** is great between 7.2-7.6 and acceptable between 6.8-8.2. pH lower then 6.8 can be corrosive or acidic to pipes and fixtures, while above 8.2 may appear chalky and basic.

• **Alkalinity** also has acceptable ranges between 60 and 240, lower is acidic, higher is basic.

• **Hardness** is the common reference to the naturally found calcium and magnesium minerals in the water. Not a health issue if ingested, the only issue is aesthetics in the home and use of certain household appliances. Too low the water can be leaching and corrosive, too high is a build-up issue. Softening, the replacement of these minerals with a salt, is a tradeoff - not a solution, greatly misapplied, oversold, and has many other issues. *Water treatment is not based on this item alone.*



Water Testing - What?, How Often?, Interpretation and Treatment Options

Recommended Test		Interpreting Your Results	
PRIMARY STANDARDS - Mandatory Health-Related Standards			
Test	Recommended Frequency	If the Lab Report Shows:	Then you may want to consider one or more of the following options:
<p>MICRO-BIOLOGICAL: Total Coliform Bacteria</p> <p>General test to determine the health of your water</p>	<p>Twice per year: Wet season Dry season</p> <p>Cost \$20 - 50 some local agencies may perform this test for free</p>	<p>Present (absent is the only acceptable result)</p>	<ul style="list-style-type: none"> •Eliminate the cause, disinfect the well and retest. •Results should always be absent. Problems with any micro-biological issues will affect all other water treatment options. See information in this guide for problems/corrective actions. •Find an alternative water supply •Install a treatment system such as chlorination or ozonation to treat all the water •Consider a drinking water system that can safeguard for cryptosporidium and giardia, and bacterial, viral, e-coli and other microorganisms. (UU250, RU300C18w/UV or RU400T35w/UV)
Nitrate (NO ₃)	<p>Annually Cost \$25 - 45</p>	<p>≥ 45 mg/l NO₃ or ≥ 10 mg/l NO₃-N</p>	<ul style="list-style-type: none"> •Find an alternative water supply. •Install the correct reverse osmosis system for drinking uses.
Electrical Conductance (EC)	<p>Annually Cost \$12 - 20</p>	<p>≥ 1600 μmhos/cm or significantly different from previous year result</p>	<ul style="list-style-type: none"> •Conduct further testing for nitrates and other inorganics to determine cause for a high EC or any change in this EC value from year to year.
INORGANICS:			Problems with one or more Inorganic Compounds
Aluminum (Al) Arsenic (As) Barium (Ba) Cadmium (Cd) Chromium (Cr) Chloride (Cl) Copper (Cu) Fluoride (F) Lead (Pb) Mercury (Hg) Selenium (Se) Silver (Ag) Sulfate (SO ₄) Zinc (Zn)	<p>Every 5 - 10 years or test: If EC changes significantly, or If taste, color, odor or surrounding land use change.</p> <p>Cost: package up to \$155 individual \$20 - 30</p>	Al ≥ 0.2 mg/l As ≥ 0.05 mg/l Ba ≥ 1.0 mg/l Cd ≥ 0.005 mg/l Cr ≥ 0.05 mg/l Cl ≥ 500 mg/l Cu ≥ 1.0 mg/l F ≥ 2.0 mg/l Pb ≥ 0.015 mg/l Hg ≥ 0.002 mg/l Se ≥ 0.05 mg/l Ag ≥ 0.1 mg/l SO ₄ ≥ 500 mg/l Zn ≥ 5.0 mg/l	<ul style="list-style-type: none"> •Find an alternative water supply. •An appropriate treatment system is dependent on your overall water chemistry and what needs to be removed or reduced. •An effective removal system for this classification of contaminants is a properly specified reverse osmosis system. These systems should be specified properly for chlorinated (RU300C18 series) or non-chlorinated (RU400T35 series) water. Heavier particulate water or excessive levels of total dissolved solids would require an upgrade to the RU500T35 series and may require a booster pump (RU500T35w/BP) to provide the 40 psi needed for the reverse osmosis unit to function properly. All units available with ultraviolet (UV) options for the safeguard of bacterial, viral, e-coli and other microorganisms. <p>If a reverse osmosis system is not applicable, then a drinking water system (FUGAC250, UU250) or whole home (CWL/EWS) appliance would be applicable for removal of VOC's without the disadvantages of a reverse osmosis system.</p>

KEY TO UNDERSTANDING THIS CHART:

≥ is greater than or equal to.

mg/l is milligrams per liter and 1mg/l = 1 part per million(ppm).

1 gm/l = 1000 micrograms per liter (μg/l) and 1 μg/l = 1 part per billion.

nss = no standards set. Test for aesthetics or non-health related effects such as undesirable taste, odor, or potential plumbing problems and/or water balance.

RESOURCES FOR INDEPENDENT LABORATORY TESTING:

■ Analytical Process Laboratories: website: www.apl-inc.net or toll free: 800-236-3909

■ S-F Analytical Laboratories: website: www.sflabs.com or toll free: 800-300-6700

■ National Testing Laboratories: website: www.ntllabs.com or toll free: 800-458-3330

Look in your local Yellow Pages for "analytical services, labs, laboratories, environmental services" or any heading that will direct you to an independent lab. The three listed above are not an endorsement and can be used as a basis of information.

A simple test by a salesperson is not complete, nor independent. ***This is your water - and your responsibility. Be informed***



Recommended Test **Interpreting Your Results**

PRIMARY STANDARDS - Mandatory Health-Related Standards

Test	Recommended Frequency	If the Lab Report Shows:	Then you may want to consider one or more of the following options:
RADIOACTIVITY: Gross Alpha Activity Gross Beta Activity Tritium Strontium Radium Uranium	Every 5 - 10 years Individual \$20 - 35	15 pCi/l 50 pCi/l 20,000 pCi/l 8 pCi/l 5 pCi/l 15 pCi/l	<ul style="list-style-type: none"> •Find an alternative water supply. •An appropriate treatment system is dependent on your overall water chemistry and what needs to be removed or reduced. •An effective removal system for this classification of contaminants is a properly specified reverse osmosis system. These systems should be specified properly for chlorinated, non-chlorinated water and water of a very particulate nature.
Radon	\$25 - 35	present	<ul style="list-style-type: none"> •An effective removal system for this classification of contaminants is a properly specified drinking water system incorporating granular activated carbon.
ORGANIC (VOC's) CHEMICALS Total Trihalomethanes (THM's) General test to determine issues with this category of over 200 tested items	Every 5 - 10 years Part of Package for \$155	Testing is only sensitive enough to indicate when a problem exists at the maximum level acceptable - however - VOC's are in all our water in trace amounts.	<ul style="list-style-type: none"> •An effective removal system for this classification of contaminants is a properly specified drinking water system incorporating granular activated carbon. FUGAC200 for taste and odor, chlorine and VOC's; upgrade to the FUGAC250 to safeguard against lead and cysts (cryptosporidium and giardia) or to the UU250 with ultraviolet (UV) disinfection for the additional safeguard against bacterial, viral, e-coli and other microorganisms. •Whether or not any problems or issues exist in the water, a carbon based drinking water system for a sink and/or a CWL/ EWS Whole Home Appliance is a good compliment as a safeguard to our modern chemicals and their by-products in our water supplies without the disadvantages of other systems

Recommended Test **Interpreting Your Results**

SECONDARY STANDARDS - Non-Health Related, Aesthetic Standards

Test	Recommended Frequency	If the Lab Report Shows:	Then you may want to consider one or more of the following options:
Iron (Fe) Manganese (Mn) Hydrogen Sulfide Color Odor-Threshold Chloride Total Dissolved Solids (TDS)	If taste, color, odor or surrounding land use change All Part of a Package for \$155	Fe \geq 0.3 mg/l Mn \geq 0.05 mg/l 15 units 3 units 500 mg/l 1,000 mg/l	<ul style="list-style-type: none"> •Find an alternative water supply. •An appropriate treatment system is dependent on your overall water chemistry and what needs to be removed or reduced •An effective removal system at the point of entry (whole home) for this group of constituents is the pyrolox iron removal system for the effective removal of iron, manganese and/or hydrogen sulfide. Iron can be replaced by salts using a softener, is ineffective with manganese and only masks the rotten egg smell of hydrogen sulfide. •Color and odor depending on other test results to specify the correct treatment, usually only carbon based needed. •Also related to salts or sodium, proper removal by reverse osmosis. •TDS is naturally occurring, found in Spring Water, and under normal circumstances not harmful, excessive levels reduced with reverse osmosis.

Additional Constituents Analyzed - Non-Health Related, Aesthetic, No Standards Set

pH	If blue-green staining occurs or taste changes.	nss	<ul style="list-style-type: none"> •Acceptable pH range between 6.8 and 8.2, best 7.2-7.6 Too low water is acidic and corrosive, too high is basic and chalky. Use pH increaser or decreaser as needed.
Hardness (CaCO3) Calcium Magnesium (Mg)	Excessive build-up for higher levels or blue-green staining for low levels	nss nss nss	<ul style="list-style-type: none"> •Hardness is the measure of the naturally found calcium and magnesium in the water. Measured in mg/l or ppm, the common reference to grains (per gallon (gpg)) is derived by dividing the mg/l or ppm by 17.1. Not a contaminant and very misunderstood, please see additional information on this subject within this guide.



Common Water Problems, Possible Causes and Health Risks

What do I test for when my water has specific taste, odor, or appearance problems?

Below is a guide for some potential problems in drinking water and substances you can test for (in bold). Not all of the problems and possible causes pose a health risk to the consumer.

Problem	Possible Cause	Health Risk Category**
Water is orange or reddish brown	This may be due to high levels of iron (Fe) .	1
Porcelain fixtures or laundry are stained brown or black	This is commonly a result of high manganese (Mn) and/or iron (Fe) levels. As little as 50 parts per billion (ppb) manganese and 300 ppb iron can cause staining.	1
White spots on the dishes or white encrustation around fixtures	High levels of calcium (Ca) and manganese (Mn) can cause hard water, which leaves spots. Hardness can also be measured directly.	1
Water is blue	Blue water or blue deposits may be due to high levels of copper (Cu) , especially if coupled with corrosive water.	2
Water smells like rotten eggs	This is most likely caused by hydrogen sulfide (H₂S) .	1
Water heater is corroding	Water can be corrosive, neutral, or noncorrosive. Water that is very corrosive can damage metal pipes and water heaters. The lab can calculate the corrosivity of your water by measuring calcium , pH , total dissolved solids (TDS) , and alkalinity .	1
Water appears cloudy, frothy, or colored	Suspended particulates , measured directly or as turbidity , can cause the water to appear cloudy, frothy, or colored. Detergents and/or sewage waste may also be the culprit.	2
Home's plumbing system has lead pipes, fitting, or solder joints	Corrosive water can cause lead (ppb) , copper (Cu) , cadmium (Cd) , and/or zinc (Zn) to be leached from lead pipes, fittings, and solder joints.	2
Water has a turpentine odor	This may be due to methyl tertiary butyl ether (MTBE) .	2
Water has a chemical smell or taste	This may be due to volatile or semivolatile organic compounds (VOCs) or pesticides .	2

Are you concerned that a nearby activity may be contaminating your well?

Here are some land uses and possible contaminants to test for.

Land Use	Possible Contaminants	Health Risk Category**
Landfill, industry, or dry cleaning operation	Consider testing for volatile organic compounds (VOCs) , pH , total dissolved solids (TDS) , chloride (Cl) , sulfate (SO₄) , and metals .	2
Agricultural crop production	Consider testing for pesticides commonly used near the well (consult the farmer or Department of Agriculture for a list), nitrate (NO₃) , pH , and total dissolved solids (TDS) .	2
Livestock enclosure, manure, or compost storage area	Consider testing for bacteria , nitrate (NO₃) , and total dissolved solids (TDS) .	2
Gas station or automobile repair shop	Consider testing for total petroleum hydrocarbons (TPHg) , total oil and grease (TOG) , benzene , toluene , ethylbenzene , xylene (BTEX) , MTBE , and ethylene dibromide (EDB) .	2

****1 - NO KNOWN HEALTH RISK AT COMMONLY FOUND CONCENTRATIONS**
2 - SOME OF THE POSSIBLE CAUSES CAN HAVE A DETRIMENTAL EFFECT ON HEALTH EVEN IF PRESENT IN LOW CONCENTRATIONS

**Common Water Problems, Possible Causes and Treatment Options**

SYMPTON	PROBLEM	CAUSE	TREATMENT
white deposits, scale in pipes, water heater	Hard Water	calcium and magnesium (not contaminants)	**not necessary w/ maintenance or conditioning/softening to assist
corrosivity to pipes, heaters, faucets - very aggressive	Soft Water	lack of calcium and magnesium, low/no hardness, low pH	non-metal pipes or chemical adjustments to well
abrasive water, residual grit, left in sink or tub	Grittiness	fine sand, silt, particulate material	repair well screen; install pre-filter; sand filter; see well info
fishy, musty or earthy smell	Odors	organic matter, algae	GAC filter, chlorination
chlorine		chlorination disinfection	GAC filter
rotten egg, sulfurious smell		hydrogen sulfide sulfur or iron bacteria	pyrolox media filtration chlorination/disinfection
gasoline smell		leaking underground or surface tank spills	GAC filter for short term seek new water supply
chemical odor		Industrial wastes	GAC filter for short term seek new water supply
blue/green stains on sinks; blue- green cast to water	Acid Water or Low pH	Low pH, acid or carbon dioxide reacting with copper pipes	install pH neutralizer; make well deeper and/or use other piping materials
salty or brackish water	Taste	high chloride or magnesium content	reverse osmosis; distillation
metallic taste		low pH or high metals and/or inorganic contaminants	pH neutralizer; and/or filters
yellowish cast to water; stains on clothes and fixtures	Yellow Water	tannins created from decaying vegetation	chlorinate then GAC filter
brown-red stains on fixtures, clothes; water turns red when heated, darkens beverages	Red Water Iron Water	dissolved iron; water appears clear when water first drawn precipitated iron; water not clear when drawn iron bacteria	pyrolox media filtration
reddish-colored water with settling particles			pyrolox media filtration
black stains; fixtures, clothes	Black Water	carbon dioxide; organic matter with manganese	disinfect well and plumbing then pyrolox media filtration

The charts on this page and the previous page provide the most common symptoms of problems found in well water applications, as well as, some regulated water systems. All the information provided allows you to determine what is a health risk and what may simply be an annoyance. Issues of bacterial, pH ranges, discolored water, and other problems may require pre-treatment prior to any additional point of entry and/or point of use filtration. Concerns for, or actual issues of contamination may require the proper application of a point of entry and/or point of use filtration system.



Water is Very Important to You!

The body is composed of 70-80% water. Water is one of the four main nutrients of the body. A healthy human being can go without food for two weeks but only three days without water. Many vital functions and all chemical reactions in the body take place in the medium of water. Water aids in all bodily processes - assimilation of nutrients, digestion, circulation and elimination. Water lubricates the joints of the body and helps regulate its' temperature. Drinking sufficient quantities of water helps flush out impurities, discourages bloating and the retention of water, and helps restore moisture to the skin and hair, while discouraging wrinkles and dryness.

You Know there are Several Ways to Intake Water!

- Drinking:** Water may be ingested, ie: water, coffee, tea, ice and mixes.
- Absorption:** Taking a shower exposes you to the equivalent of consuming an additional 1/2 gallon of water each day. After soaking in a bath tub or spa for ten minutes, you may be up to 4 lbs. heavier upon your exit.
- Inhalation and absorption:** The greatest intake may be your shower, where gases are vaporized. Inhalation exposure was found to be comparable to direct ingestion. Steam and sauna are included.

Concerns With the Water?

Chlorine is used almost universally in the treatment of public drinking water because of its toxic effect on harmful bacteria and other waterborne, disease-causing organisms. But there is a growing body of scientific evidence that shows chlorine in drinking water may actually pose greater long-term dangers than those for which it was used to eliminate. These effects of chlorine may result from either ingestion or absorption through skin. Scientific studies have linked chlorine and chlorination by-products to cancer of the bladder, liver, stomach, rectum and colon, as well as, heart disease, anemia, high blood pressure, and allergic reactions and skin sensitivities. We know chlorine has issues with protein in our body and that of the skin and hair, just remember the last time you were in a pool.

Problems also arise from other chemical compounds. These compounds include, but are not limited to, chemicals associated with various pesticides, herbicides, fuels, dyes, solvents, and industrial and agricultural by-products. Misuse of these materials and/or improper storage and disposal has allowed drinking water supplies, both municipally-treated or individual wells, to become suspect. Trace elements of these chemicals may be within acceptable limits, however their long-term effects are unknown. Since disinfectants, their by-products, and other chemical compounds, and volatile organic compounds (VOC's) are present in all our water supplies, one might want to remove these substances at the point of entry.

What Can I Do About Problems With My Water?

If you have had your water tested and found a problem that you want to treat, there are many different types of treatment available. Not all water treatment systems work for every contaminant or for every water type. Once installed, most systems require routine maintenance to continue performing properly. Improperly maintained systems can cause more damage than having no system at all. You need to know what you want to remove and if you will be able to perform the routine maintenance before you invest any money in a system. See the guide provided for the options available for your particular problem(s). Some options remove a greater percent of the concentration than other options listed for the same substance. We highly recommend that you visit our website, talk with us corporately, or with a factory representative, or with an informed sales associate at any of our distribution outlets to find out what will work for your specific situation. Some water may need to be conditioned or pre-filtered or the pH may need to be adjusted prior to treatment.

What is Water Hardness?

Water hardness is caused by naturally found minerals in water, usually calcium and magnesium, derived from water naturally filtering through the earth's strata and dissolving rocks. While not a health hazard (80-90% of fresh water is hard), hard water has its aesthetic disadvantages, as well as, problems with scale build-up. Most problems are easy to maintain. Conditioning/softening devices can offer assistance but nothing eliminates spots or the need for routine maintenance or clean-up. Softeners exchange these minerals for sodium or potassium chloride and effect quality and taste. Softeners create soft water or a low mineral content which can be highly corrosive and the brine discharge adversely effects septic and municipal waste water treatment systems. Refer to restrictions on softeners' brine discharge and other product warranty issues. Calcium and magnesium are measured in grains per gallon (gpg) or parts per million (ppm). Please refer to the section on conventional Softening product or the Environmental Water Systems to condition hardness minerals (as an alternative to softening) and GAC filtration for the entire home or facility.

What is Iron Water? (red water and/or brown or blackish water)

These problems are caused by water passing through iron bearing strata and is seen in sitting water at 0.3 mg/l. Iron bacteria is a bacteria that thrives on iron in water and is not harmful for health purposes. The same issues result when manganese is found above 0.3 mg/l and water is brown or blackish. See Pyrolox Media Systems and their capabilities to remove iron, manganese and hydrogen sulfide.

What is Acid Water?

Caused by water passing through impervious rocks and not dissolving minerals, this leaves water, which is a natural solvent, very aggressive. Measured by pH - a pH under 6.8 is becoming acidic; above 8.2 is becoming alkaline. See pH Increasing Reagent System to raise and balance pH.

What are Actual Contamination Problems?

Contamination issues are actual water quality issues as they relate to human health. Please refer to pages in this guide for actual issues that are health risks and then filter as necessary. GAC filtration and its' upgrade options are very effective at handling a wide variety of contaminants. Reverse osmosis also has its' capabilities. Refer to our complete catalog of product from the sink (for oral intake) to the entire home (for absorption, inhalation and/or plumbing issues) for the correct product(s); for you, your family and your home.



WATER QUALITY TREATMENT

What If My Total Coliform Test Results Are Positive?

Step 1.

First, try to determine where the contamination came from. The table below lists some possible problems and some recommended corrective actions. Some problems you may be able to fix yourself, while others, marked by an asterisk (*), may legally require the assistance of a licensed well contractor. Contact your district for a list of licensed professionals.

Problem	Recommended Corrective Action
The well is newly constructed, or maintenance or repair was recently done. The pump was primed with impure water.	Go to Step 2 below.
There is standing water around the well or water draining toward the well.	Re-grade around the well so the ground slopes away from your well.
The concrete well pad is cracked or separated from the well casing.	Re-pour pad or fix and seal all cracks and gaps.
The well is not completely sealed against surface water, insects, or other foreign matter.	Replace any missing plugs, cap any open pipes, and seal any openings, gaps, or cracks. *Contact a licensed well contractor to replace or install a new wellhead gasket.
The storage tank is dirty or unprotected.	Contact a contractor to clean and seal.
There are cross-connections in the plumbing system.	Make sure that your plumbing is not connected to another source of water that may be contaminated (e.g. a defunct community water system).
There is not adequate back-flow protection.	Install a back-flow prevention device on every outdoor faucet (available at most hardware/plumbing supply stores). *Contact a licensed well contractor to ensure that there is proper back-flow protection within the well.
There are dead-end or unused water lines connected to your plumbing system.	Flush lines regularly or remove any unused lines or sections of the water system.
The well casing is corroded. There is sediment at the bottom of the well.	*Contact a licensed well contractor to assess and repair.
The well casing is perforated too high or the sanitary seal is not adequate.	*Contact a licensed well contractor to drill a new well and to properly destroy to old well.

Step 2.

Once you have located and eliminated the source of the bacteria, disinfect the system. For instructions on how to properly disinfect your well and distribution system, contact your district, call a licensed well contractor, or visit www.ewswater.com/techandspec.html and see a complete procedure to disinfect your system.

Step 3.

IMPORTANT: Before drinking the water, test a new sample for total coliform bacteria. If the results are still positive, start at Step 1 again.



SCHEMATIC FOR VARIED OR DIFFICULT WELL-WATER CONDITIONS

CONDITIONS

APPLICATIONS

Source water - Test Results

Based on Test Results

Pre-Treatment:

Coliform/Bacterial/E-Coli microorganism problems, decaying vegetation, organic bonding, Iron/manganese bacteria
Tannins (yellow)

Chlorination/Chemical Feed (as needed)
Ozonation

Oxidation/aeration (as needed)
location or sequence of tank may vary
Low supply water flow and/or pressure

Storage tank and Pipe length

Iron Removal (as needed):

Iron (red or pinkish)
Manganese (black or brownish)
Hydrogen sulfide (rotten egg smell)

Booster Pump Package (as needed)

Pyrolox
High Purity
Media Systems

Pre-Sediment Filtration (as needed):

Silt, dirt, heavy particulate matter
location or sequence of unit may vary

5-micron Pre-Sediment Filter (not a whole home filter)

pH Balancing (as needed):

Low pH, less than 6.6, corrosive, acidic water
High pH, more than 8.6, corrosive, basic water
location or sequence of unit may vary

Custom Blended
pH Increasing Reagent System
pH Decreasing Ion-Exchange

Point of Entry Filtration (as needed):

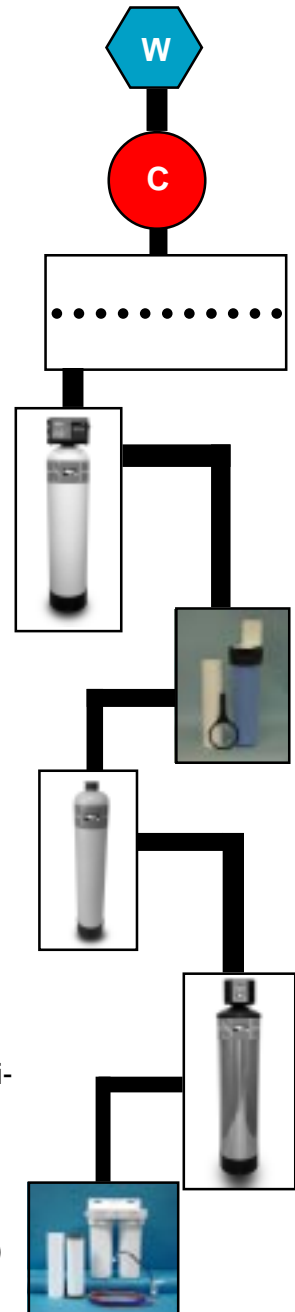
Chlorine, VOC's, herbicides, pesticides, solvents, dyes, fuels, odor, taste, clarity

CWL Series - Filtration only
EWS Series - Filtration and Conditioning vs. Softening

Point of Use Filtration (as needed):

Dependent upon test results, removal and/or safeguard, as applicable

Various Drinking Water Systems
FUGAC250 (better), UU250 (best) or Reverse Osmosis Units



■ **Pre-Treatment:**

The need to disinfect, remove iron, manganese, pre-filter, balance pH and/or generally prepare the water for consumption, additional filtration and/or to minimize water issues for use in the home.

■ **Point of Entry: Whole-Home Filtration and Conditioning vs. Softening**

Softeners strictly soften water and have their application. However, softeners replace valuable calcium and magnesium minerals (non-contaminants) with sodium or potassium chloride. The resultant water may be of lesser water quality, has warranty issues with other products and may be legally restricted due to the damaging brine discharge. The EWS Series of appliances keeps the calcium and magnesium minerals (refer to all bottled spring waters) instead of replacing them with salts. Minerals are attracted to each other, not the hard surfaces. The result; easier wipe off of water spots, no sediment build-up in water heater and pipes, use less soaps with no slippery/slimy feeling, no brine discharge or salt bags to lift. Most importantly, the water is drinkable.

■ **Point of Use: Drinking Water Filtration Systems vs. Reverse Osmosis Systems**

Both types of systems have their advantages, capabilities, and in the case of reverse osmosis, some disadvantages. EWS, Inc. can provide either system with UV disinfection options.

All systems should be correctly applied based on water issues, concerns and/or consumer preference.



A Quick Reference of Systems and Combinations for Various Applications

Point of Entry (Incoming Home Water) Treatment

Helpful Hints: Test the water completely and specify the correct systems, first to provide healthy water to the consumer, and then water to minimize damage to the home. Specify disinfection, iron removal, pH balancing and/or sediment filtration, if needed. Specify the CWL or EWS Series at the main water supply and/or a softener on the hot side only (water heater inlet) if the softener is needed or desired. This will restrict the softeners harmful effects and still provide filtered water to the rest of the home. Specify specific sink filtration systems for oral intake (drinking, cooking, etc.) based on water results and a needed application.



Pyrolox High Purity Media Systems

For the removal of iron, manganese and hydrogen sulfide. Installed at the point of entry, this is a removal of these problems, not the trade-offs of ion-exchange. Automatic backwash with no brine discharge, no chemicals to add, and years between any maintenance (media replacement) make these systems a must with wells having these pre-treatment issues.

pH Increasing Reagent or pH Decreasing Resin Systems

Custom blended calcite/corsex media to balance low pH to prevent the corrosivity of this acid type water and custom blended resin based ion-exchange systems to lower very high pH and alkaline water.



Pre-Sediment Filtration

For the removal of actual materials, such as; dirt, silt, rust, sand, and/or particulate matter. Installed at various locations to protect other systems, this is not the cheap whole home filter others pass this off to be. It is a pre-sediment filter.

CWL Series - Whole Home Filtration Appliance

Tanks contain a High Grade of Granular Activated Carbon (GAC) Media for the removal of Chlorine and Volatile Organic Compounds (VOC's). Great for filtration to the whole home of chlorinated water supplies, for drinking, cooking, showering, and bathing (great for hair and skin) - all uses. Also used for non-chlorinated applications to safeguard water from VOC's due to ground water contamination. Upgrade option: EWS Series to filter and physically condition water, if water hardness is an issue. Required or chosen upgrade options: Point of use, drinking water system, or reverse osmosis for limited sink applications based on water conditions or additional water concerns for drinking use.



EWS Series - The Environmental Water System Whole Home Filtration and Physical Conditioning

Filters to the whole home like the CWL Series of appliances and offers the consumer an alternative to harsh salt softening. EWS conditioning causes a physical change in how naturally found calcium and magnesium minerals react in the water and on surfaces. EWS keeps these minerals in the water for a pure, fresh taste while helping solve those problems associated with hard water. The result: less spotting, easier clean up, and prevents scale build-up in pipes and water heaters without the damaging effects of salts. No slippery feeling. No brine discharge. The best combination of whole home filtration and the alternative to salts and softening. Required or chosen upgrade options: Sink units for specific removal needs or concerns.



Softeners

If water hardness is an issue, water softeners will soften the water through ion-exchange. This process substitutes naturally found calcium and magnesium (hardness) minerals for sodium or potassium chloride (salts) and does not filter the water. Water will spot less, wipe off easier, and prevent lime scale in pipes and water heaters. However, restrictions on softeners due to brine discharge into your septic tank, salts, and wasted water are growing. Softeners may also void warranties on other household products (ie: pools, spas, special finishes, etc.) Once softened, many people do not like the slippery feeling of the water and reverse osmosis becomes necessary to remove the salt from drinking water that the softener put in. If a softener is chosen, application on the hot side only is recommended. Ironically, we make some of the most efficient metered softeners in the industry. Consider on hardness above 20 grains and use on excessive hardness above 40 grains. Alternative: EWS Series to filter and physically condition water below 30 grains.



Point of Use (Sink Location) Filtration Product

Helpful Hints: Choose as a drinking water upgrade based on tested results, needs or concerns. Select either a drinking water filtration system or reverse osmosis system based on the needed application, consumer's needs, concerns and/or preferences. Add an EWS heater and/or chiller and one of our upgraded dispensing faucets to complete the sink package.

Drinking Water Systems



Sink filtration product for oral intake, drinking, cooking, ice-making, etc., to protect consumer against known or unknown water issues or concerns. **FUGAC250** ("better") for carbon block filtration of chlorine and VOC's, lead, and cysts. **UU250** ("best") for the additional safeguard from bacterial, viral, e-coli and microorganisms. No storage tanks, no limited supply, and no wasted water associated with reverse osmosis systems. These units are pass-through systems and can be connected to our heaters/chillers and all faucet upgrades.

Reverse Osmosis Systems



Sink filtration product for oral intake, drinking, cooking, ice-making, etc., to protect consumer against known or unknown water issues or concerns. **RU300** series for chlorinated municipal water. **RU400** series for potable non-chlorinated, well or municipal supplies. **RU500** series optional for harsh well water. Add UV module for the additional safeguard from bacterial, viral, e-coli and microorganisms. Be aware that RO has specific issues and drawbacks (ie: wasted water, limited production, storage tank space, very aggressive water), and has specific applications, making these systems widely misapplied. Our reverse osmosis systems can be connected to our heaters/chillers and all faucet upgrades, including required air gap.



Resource Guide

RESOURCES FOR INDEPENDENT LABORATORY TESTING



Analytical Process Laboratories:

www.apl-inc.net or toll free: 800-236-3909

Offers an affordable, complete and comprehensive EWS Well Water Test Kit with qualified technicians available in customer service

- S-F Analytical Laboratories: www.sflabs.com or toll free: 800-300-6700
They offer a complete test kit to properly sample and test well water with options, if needed
- National Testing Laboratories: www.ntllabs.com or toll free: 800-458-3330
They offer a "Watercheck" package with options that test for most or all of the items in this guide
- Look in your local Yellow Pages for "analytical services, labs, laboratories, environmental services" or any heading that will direct you to an independent lab. The two listed above are not an endorsement and can be used as a basis of information.

A simple test by a salesperson is not complete, nor independent.

This is your water - and your responsibility. Be informed

Look in the yellow pages for you local, regional, and/or state government contact information.

FEDERAL GOVERNMENT

USEPA's Safe Drinking Water Hotline

The U.S. Environmental Protection Agency's Safe Drinking Water Hotline is available to help the public, drinking water stakeholders, and state and local officials understand the regulations and programs developed in response to the Safe Drinking Water Act. More information about contaminants and potential health effects can be obtained by calling the USEPA's Safe Drinking Water Hotline. The hotline and web page also provide information on testing and protecting private well water and where to find more information.

(800) 426-4791

<http://www.epa.gov/safewater/pwells1.html>

Food and Drug Administration (FDA)

Among other things, the Food and Drug Administration regulates the bottled water industry. Contact the FDA if you have questions about the safety or regulation of bottled water.

(800) 532-4440

<http://www.fda.gov>

PRIVATE ORGANIZATIONS

The Groundwater Foundation (GWF)

The Groundwater Foundation is a not-for-profit organization that is dedicated to informing the public about groundwater resources. They provide numerous educational programs and publications for all ages on the importance of groundwater and groundwater protection. THE GWF also offers recognition and support for Groundwater Guardian Communities and Affiliates.

(800) 858-4844

<http://www.groundwater.org>

National Groundwater Association (NGWA)

The National Groundwater Association is a not-for-profit organization whose mission is to enhance the skills and credibility of all ground water professionals, develop, and exchange industry knowledge, and promote the ground water industry and understanding of ground water resources. Contact the NGWA for information on ground water studies and publications nationwide, for answers to frequently asked questions about groundwater, and for the latest groundwater news and legislation.

(800) 551-7379

<http://www.ngwa.org>

National Small Flows Clearinghouse (NSFC)

The National Small Flows Clearinghouse is funded by the U.S. Environmental Protection Agency to provide small communities with technical assistance on wastewater issues. Contact the NSFC if you have questions about septic system design, installation, or maintenance.

(800) 624-8301

http://www.estd.wvu.edu/nsfc/NSFC_homepage.html

National Well Owner Association (NWOA)

The National Well Owners Association is an online association providing comprehensive and up-to-date information on the purchase and maintenance of water wells. Created by the NGWA, the NWOA site features information on how to own a private water system, how to maintain a well, and how to protect the water supply. Visitors to the site can also find a searchable list of water well contractors and information on the nature of groundwater resources.

<http://www.wellowner.org>

Be cautious and aware of those private organizations that are trade organizations. They will lead you to or away from a product depending on who's paying them.



NOTES:



Providing Specifications to Correct Well Water Problems

FAX our offices at 702-256-3744
the results of your well water sample (*do not send us water*),
or
e-mail us at customerservice@ewswater.com

As discussed in this guide, we require complete and independent results much like a doctor requires results from a lab to make any determinations.

Our offices will FAX back the potential solution(s), or a request for additional information, and specifications on the unit(s) to be applied. We advise you to make a copy of your results and any information provided and keep updated records as discussed in this guide (see: Record Keeping).

Be aware - not all well water problems or a combination of problems can be satisfactorily solved. Our sole intention is to do it right or not at all. Knowing that your water is "hard" is not enough (up to 90% of all fresh water is hard). Remember this is a process. Door to door salesmen and other organizations will test for and apply only what they have available to sell. As a manufacturer of a complete line of filtration and conditioning product, represented throughout the USA. by Building Wholesale Suppliers, Kitchen & Bath Showrooms and Appliance Distributors, we can provide to the consumer the correct product based on the consumer's needs, and not that of a commissioned sales individual. Be informed and not sold.



EWS, Inc. and Environmental Water Systems
9101 W. Sahara Ave., Suite 105-J8
Las Vegas, NV. 89117

Office: 702-256-8182 Available Monday through Friday, 8:30 - 4:30 Pacific Standard Time
Fax: 702-256-3744 Dedicated and Available 24/7
E-Mail: customerservice@ewswater.com
Web Site: www.ewswater.com

**EWS, Inc. and Environmental Water Systems can provide solutions
to common well water problems.**

**From sink to the whole home;
learn about the correct systems for your application
that will provide less maintenance and less impact on your environment.**

**A free or simple test is a sales pitch by the local door-to-door salesperson or a company
trying to sell you something. It is unethical and the incorrect approach.**

**This guide is something they would not want you to see or understand.
Be Informed, not sold.**