



AMERICAN GROUND WATER TRUST

Ground Water Education Programs Since 1986

- ★ Protecting ground water & promoting resource sustainability
- ★ Communicating the environmental & economic value of ground water
- ★ Showcasing ground water science & technology solutions
- ★ Increasing citizen, community & decision-maker awareness
- ★ Facilitating stakeholder participation in water resource decisions

The American Ground Water Trust is a 501(c)(3) non-profit membership organization.

Individual, corporate and organization annual contributions help support the AGWT's operations and education programs. Information about how to become a supporter, our Ground Water Institute training programs for teachers, our calendar of workshop and conference events and our publications can be found on our website at www.agwt.org.

AMERICAN GROUND WATER TRUST

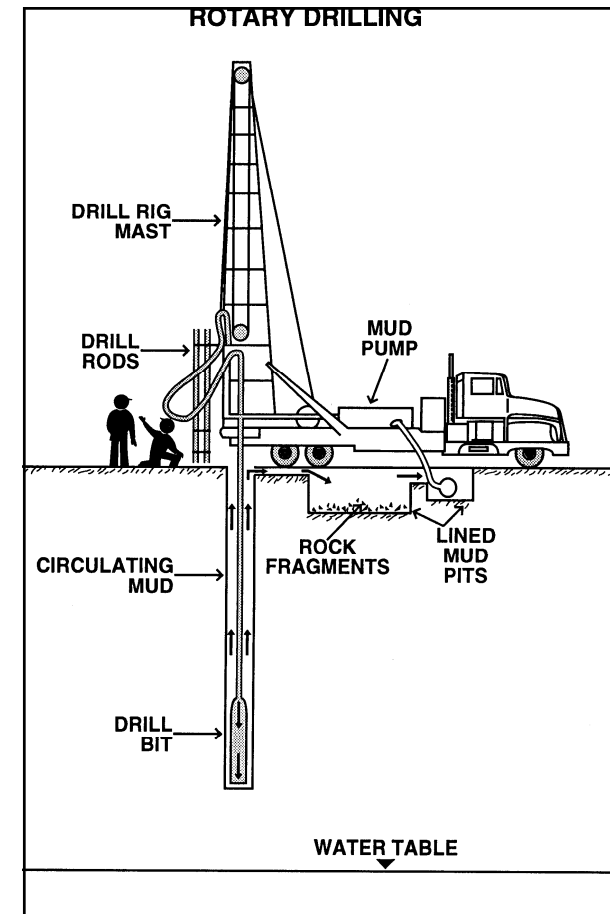
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Information in this pamphlet is provided in good faith to inform the public about water well drilling and water well drilling related problems. In all cases, the AGWT urges consumers to contact local experts, and, where appropriate, to refer to local codes, rules, regulations and laws.

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When You Need A Water Well



American Ground Water Trust

Consumer Awareness Information Pamphlet #8

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If Problems Occur ☹

Sometimes problems will occur. If this happens, first contact your contractor. Usually, problems can be solved and corrections will be made willingly:

- ➔ If you don't resolve the problem, contact your state ground water well association for advice about what to do.
- ➔ Contact your state or local department that has responsibility for private water wells.
- ➔ Contact the American Ground Water Trust at (603) 228-5444 (9:00am to 4:30pm EST) for state association phone numbers or for other information. [also: www.privatewell.com]

OTHER PUBLICATIONS OFFERED BY THE AMERICAN GROUND WATER TRUST:

America's Priceless Ground Water Resource - An introduction to the occurrence of ground water in the hydrologic system.

Domestic Water Treatment for Homeowners - Describes common problems and solutions for water quality problems.

Arsenic and Ground Water: Question, Answers and Solutions - Information about arsenic's geologic origins, its occurrence in ground water and the equipment available for treatment.

Water Conservation in the Home - Offers practical suggestions on water resources and reducing the use of energy.

Bacteria and Water Wells - Describes the natural occurrence of bacteria beneath the ground, how wells may be affected and how to fix the problem.

DVD/ VHS - Water Well Basics - a 15 minute educational video that shows, step by step, the processes of well drilling, well construction and equipment installation needed to provide a home water supply.

- damage to your property
- damage to the property of others

Proof of worker’s compensation insurance to protect the contractor’s employees or sub-contractors while working on your job.

Be careful not to base your selection of contractor on price alone. The well system you purchase is permanent, and future changes may be much more expensive in the long run. Make sure that the bids and estimates are for comparable materials, service and guarantee. The contractor may not have included all the work quoted by competitors.

Your Well Record

Well ID# Date Drilled

Drilling Company

.....

Depth Drilled Standing (static) water level

Pumping Level Feet @gallons/minute

Pump Installation Company

.....

Pump Make and Model

Pump Voltage

Pump Set at feet below ground level

Tank/ Equipment Installation Company

.....

Tank: Make and Model

.....

Conditioning Equipment: Make and Model

.....

Service work on system, date and details

.....

.....

PURPOSE OF THIS PAMPHLET

The American Ground Water Trust has prepared this consumer information pamphlet to help people throughout the United States make good economic and environmental decisions about water wells. Securing a safe water supply for a home is an important responsibility for home owners. There are many water supply specialists who provide water supply products and services; this pamphlet will assist you to obtain the professional help that you need.

GROUND WATER BASICS

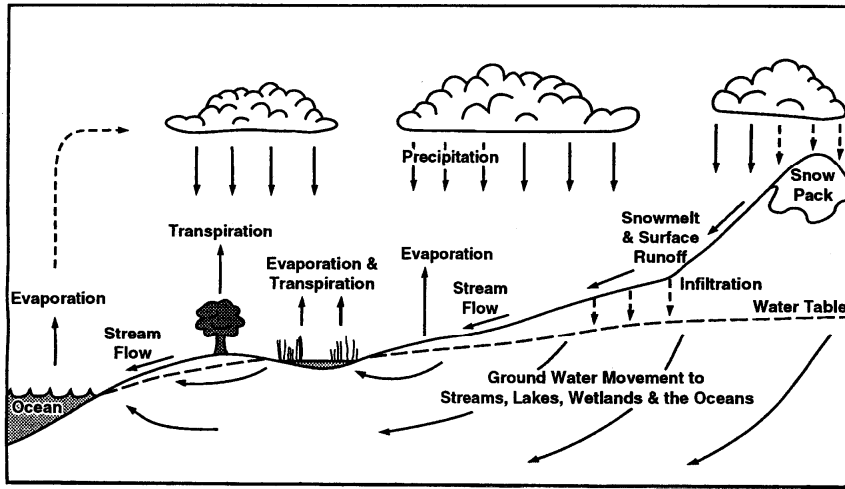
What Is Ground Water?

Ground water is water below the land surface that fills the spaces between grains of sediment and rocks, or fills cracks and fractures in the rock. Saturated zones in sediment such as sand and gravel, and in fractured rock formations, that receive, store and transmit water to wells and springs are called aquifers.

Clean and plentiful ground water is a vital resource for personal and economic health everywhere in the United States. Each day, over 150 million Americans get their drinking water from ground water. About 40 million are supplied from individual home wells.

The Hydrologic Cycle

Water in aquifers comes from rain and melted snow that filters through the soil. As the water moves down, plants consume a portion, some is evaporated, and some is retained by the soil. The rest seeps downwards, usually very slowly, to add water to the aquifer. This process is part of the hydrologic cycle. The amount and quality of ground water varies from place to place both within individual states, and from state to state, because geology, climate and land use are different.



The quality of water from wells can be influenced by:

- natural factors, such as the type of rock, gravel, sand or soil
- or by pollution, for example, from poorly managed agriculture, individual septic systems or community waste disposal sites.

Public education about contamination, and community involvement in protecting aquifers, can help ensure safe drinking water throughout the United States.

Potential Threats to Ground Water

Most well water is good quality because of the filtering process in the soil and the long travel time underground between the water occurring as rain and eventually reaching a well. However, in addition to possible pollution from agriculture, industry and transportation, even contamination sources in our homes can pose threats

Incorrect disposal of common household chemicals (polish, thinners, paints, etc.) excess use of lawn and garden chemicals, faulty or overloaded septic tanks, or an accidental spill during an automobile driveway oil change, can wreak havoc with drinking water safety. The more informed that residents are, the better are the prospects for protecting ground water.

✓ **WELL-ESTABLISHED.** A professional drilling and pump contractor will have a permanent place of business, a telephone number, a tax ID number and, where appropriate, a business license.

✓ **EXPERIENCED and KNOWLEDGEABLE.** Drilling or water system installation skills cannot be learned overnight. A professional drilling, pump and water conditioning contractor is familiar with all kinds of ground water situations. The contractor you select should be able to provide a list of customer references.

✓ **INSURED and COMMITTED TO SAFETY.** There are inherent dangers in drilling a well or installing a water system. The contractor who carries both worker's compensation insurance and liability insurance has protected you in the event of damage to your property and injury to his workers while work is being performed on your property.

WATER WELL CONTRACTOR CHECK LIST

Does the Contract Contain:

- The Contractor's business address and State license number (if applicable).
- A written proposal that details:
 - responsibility for obtaining all necessary permits
 - what work is to be done
 - materials to be used (casing type, drilling muds, etc.)
 - the charge for drilling (cost per foot)
 - type of equipment to be installed
 - the terms of any contractor or manufacturer guarantee on the well and well equipment
 - the expected date for starting and completing the work
 - payment schedule
 - details of client and contractor responsibility for site access and site cleanup
- Proof of the contractor's liability insurance while working on your job, to protect against:
 - personal injury to you or others

DO I NEED A CONTRACT?

Be Aware of Inexperienced Contractors!

It is recommended that a written contract be prepared and signed prior to starting any construction. This will provide the property owner with a itemized list of expected costs. Most contractors will have a printed form which can be completed for each well. The contract will reduce the chance of misunderstandings and include legal phrases to identify liabilities and responsibilities.

In the past, too many home owners have paid dearly for using amateurs or part-time, non-specialists for water well work. Check that your contractor is licensed (if your state has a licensing requirement), insured and experienced. Beware of high pressure or scare tactics, and “bonus” offers to get your business.

Property owners can become involved in litigation involving uninsured contractors. If an employee of an uninsured contractor is injured on the premises of your home or building, you may be responsible for his injuries or disabilities. In addition, you probably have no protection in the event of damage to your property or the property of others by the driller or pump installer during the course of the work.

Professional Contractor Check List Is Your Contractor:

✓ **A TRADE ASSOCIATION MEMBER.** A good basis to select a contractor is to choose one that has declared his commitment to the mission and ideals of the state ground water (or water well) association and/or the National Ground Water Association.

✓ **LICENSED.** Many states (but not all) have adopted standards for the licensing of drilling contractors. Only those who meet the standards of testing quality for a state license.

GROUND WATER PROTECTION

A Consumer Guide Summary

With your help, the professional work of ground water specialists and the regulation and technical work of government agencies can ensure safe drinking water. What you know, and what you do about contamination risks are important for the safety of water in homes and communities throughout the United States.

What people should know

- Where their drinking water comes from
- How contamination occurs
- What they can do to prevent problems

What every person should do

- Handle domestic chemicals responsibly
- Protect water and earth from automotive fluids
- Maintain septic systems properly
- Use lawn and garden fertilizers and pesticides sparingly
- Safeguard the area around wells
- Always use licensed contractors for water wells

What communities should have

- Land-use policies, such as zoning
- Agricultural best management practices (BMP)
- Water resource management plans
- Programs protecting aquifers and wells
- Education & consumer awareness programs

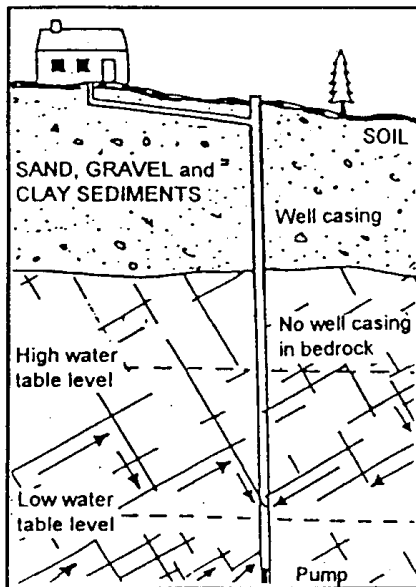
HOW DO WE GET GROUND WATER?

Some ground water occurs at the surface as springs, but in most cases, a water well is needed to reach the aquifer where ground water is found. Today, most wells are made by drilling into the rock layers using drilling machines (rigs) to access water deep beneath the surface. In most cases electric pumps are used to raise the water to the surface.

The creation of a water well (a specially engineered hole in the ground) consists of several elements. After selecting the site to drill the well, (local codes and set-back requirements may limit choice), the process usually includes drilling, development, testing and equipment installation.

Drilling

The actual hole for most home wells is usually drilled at a diameter of between six to twelve inches. The drilling method that the contractor decides as most appropriate will depend on the geologic formations, the required water yield and the type of drilling equipment available.



Drill rigs are expensive (often up to \$500,000) and the use of the equipment, often hundreds of feet beneath the surface, requires considerable skill. All wells require casing to protect the well from possible contaminants at or near the ground surface. Casing may not be needed for the full depth of the well in solid rock. Wells in alluvial sands and gravels will need casing to prevent cave-in. There may be a need for a well screen, or perforated casing, specially designed to keep sand out, but let water into the well.

How Much Will a Well Cost?

Some contractors may offer a fixed price. Others will charge according to the depth drilled and the materials used. Wells of the same size in the same locality usually do not vary much in cost. You can obtain a rough estimate of drilling costs in your area by consulting neighboring well owners or local contractors. The total cost of installing a well and water system is often itemized in estimates as follows:

- Cost of permits
- Mobilization cost
- Drilling, cost per foot (will vary with diameter, some drilling costs may increase with increased depth)
- Casing, cost per foot (depends on type used)
- Cost of other materials (such as, screens, seals, etc.)
- Grouting, cementing (often included in drilling cost)
- Developing (usually based on a per hour charge)
- Test pumping (usually based on a per hour charge)
- Pumping equipment, pipes, valves, controls, etc. (the cost of bringing electric power to the well head is not usually included)
- Water quality laboratory analysis
- Water treatment, conditioning equipment such as a softener (this part of the water system is often quoted separately, after the water quality has been analyzed)

No ground water contractor wants to drill a "dry" hole, but when dealing with subsurface geology, it is difficult to guarantee finding water or to predict its quantity. Consumers should keep in close touch with the contractor during the drilling process so that they are available to discuss matters such as the need for extra depth to increase yield or well storage.

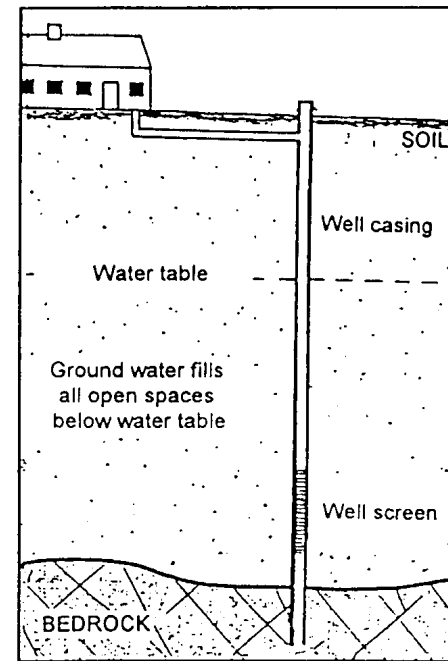
- Depth of ground water below the surface (in some geologic conditions water levels will drop in drought conditions and the pump will therefore need to be placed deep in the well)
- Distance and elevation of the home above the well

Most home well pumps, unless used to irrigate gardens or paddocks, will only be used for a few minutes at a time or perhaps an hour or two each day. These days, many contractors can either provide a complete well-to-faucet water system or they will refer you to trusted specialists. There are often consumer advantages in purchasing a system from a single contractor. When you buy a complete installation, you are in effect giving the contractor the responsibility for your home water supply. If there is ever a problem, you just need to make one phone call.

If your drilling contractor does not sell or install pumps, he may arrange to sub-contract the work to a dependable installation specialist. All technical water well installation work, including wiring and plumbing should be performed by licensed contractors who will guarantee their work and render quick service when needed. If you need to save money, do such work as trenching etc., yourself, but don't sacrifice quality and efficiency. For example, using an oversized or undersized pump, however cheaply you buy it, will not be as efficient in water production, energy cost or reliability, than installing the correct pump, wiring and tank for the job.

Testing Water Quality for Health and Safety

All new wells should be tested for bacteria and nitrate. In deciding whether or not water conditioning equipment is needed, tests should be made for acidity (pH), hardness and iron. Many laboratories offer a homeowner package deal for water analyses. In addition to checking health aspects for human use, remember that some plants have very specific water quality tolerances.



Wells screens can be expensive, but in some situations they are needed to ensure good yield and long term use of the well.

Well Development

The drilling process often uses specially formulated drilling mud to help carry the drilled pieces to the surface. Most drilling also creates finely ground rock material. All fine particles need to be removed from a well in order that it may effectively produce water.

The process of removing fine particles is called well development. Drillers usually do this by using compressed air or a

bailer to agitate and remove water in the well until it runs clear.

Yield Tests

For most home wells it is not necessary to undertake extensive testing. Experienced drillers will have a good idea of the well's performance from the drilling and development process. The yield potential is important for selecting the right pump and for advising the well owner about maximum yield. It is very important to know the well's limitations. Ideally, water will flow into the well at the same rate that it is removed by the pump. There are three important pieces of information needed for designing an efficient water system: the static water level, the water level after pumping a known volume of water and the time it takes for the well water level to recover after pumping stops. For low yield wells a long term well test of eight hours or more is recommended.

Low-Yield Wells

In some areas of the United States, wells are not capable of producing the amount of water normally expected for domestic supply (4-10 gallons per minute). However, with an adequate storage tank, a well producing as little as one g.p.m. (gallons per minute) can be sufficient for domestic needs. In many wells, several hundreds of gallons of water are already stored in the well column! For every foot of a six inch diameter well below water level, there are 1½ gallons of water.

When properly designed and managed, low-yield water wells can provide a viable supply for a home.

Example: There are 1440 minutes in every day. If a well produces one gallon a minute of water throughout the day, 1440 gallons of water could be pumped into the storage tank. Assume that a family of four is served by the well, and that each family member uses 75 gallons of water a day, or 300 gallons. Total consumption for the entire family would be less than 21% of the water stored in the tank. The well would be required to produce water for a total of only five hours a day in order to replenish the water used.

(Note - Check locally - some local rules may require a higher well yield to obtain approval for a home supply.)

Hydrofrac techniques are often used to improve the yield of wells. The process involves down-hole equipment that creates great pressure in selected parts of the well to create and open up fractures.

HOW MUCH WATER - HOW MUCH MONEY?

How Much Water Do You Need?

If you plan wisely, a good, dependable water well can supply you with all the water you need now and in the future. A rule of thumb is to allow for between 75 and 150 gallons per person per day. You need to take into account the peak demand, for example, when there may be extra guests at holidays or week-ends. Outside use of water can pose much greater demands. You need to calculate the required well yield if your well is needed for additional water uses such as:

- Swimming pool
- Heating and cooling
- Lawn and garden irrigation
- Fire protection

For agricultural needs, dairy, irrigation etc., refer to a farm expert.

Where Should the Well Be Located?

There are three important considerations for siting a home water well:

- Away from sources of contamination
- Convenient for power supply and close to the home
- Accessible for drilling and pump installation equipment (most wells will have to be serviced from time to time)

On large property lots it may be necessary to obtain advice from a hydrogeologist. In most cases, the driller's local experience will enable a site to be chosen. Local setback codes must be obeyed. If possible, always locate the well at a higher elevation than the waste water septic system or other drainage systems. Local rules will specify minimum acceptable distances between wells and other structures. County health officers, sanitarians and ground water contractors can give you advice on well location.

Correct water well design and casing installation is important to protect against contamination risks. Old and abandoned wells can pose particular risks and such wells must always be decommissioned and sealed by a professional.

Pump Selection

There are many different water pumps on the market. Most ground water contractors sell, install and service pumps. Before you and your contractor can decide on the appropriate pump, you need to know the following:

- How much water will be needed at peak demand
- The well's yield potential (g.p.m)
- Diameter of well at pumping level (the well diameter at this depth may be smaller than at ground level)
- Water level drawdown at given pumping rates