THE AMERICAN WELL OWNER©

★ INFORMATION AND ADVICE ABOUT GROUND WATER, WELLS AND WATER SYSTEMS ★

A Quarterly Publication of the American Ground Water Trust - 2006 Number 2

Ground Water Information, Awareness & Education Since 1986

Free Flow—The Market Cost of Water

MESSAGE FROM THE PUBLISHER
Water is too cheap?

If you visit the EPA web site [http://www.epa.gov/water/infrastructure/pricing/index.htm] you will find the following information:

"…….. the American household spends, on average, only $474 per year on water and wastewater charges, in contrast to an average of $707 per year on carbonated soft drinks and other noncarbonated refreshment beverages. Compared with other developed countries, the United States has the lowest burden for water/wastewater bills when measured as a percentage of household income."

To some people, price indicates value. At $1.30 a day - per family, our water and waste water services in the US are greatly undervalued. Just compare daily water costs for a family with some of your other daily spending on items like soda or coffee. Water cost for households in the US is not a good index of water's value. To increase public awareness of the importance of water resources, especially the hidden ground water resources that supply 50% of our drinking water, we need to do more to promote its critical role in our daily lives. When water supply is disrupted by power cuts, our quality of life is immediately impacted and we are then reminded of the value of the professional services of our well contractors and water providers. Over one billion people in the world have no access to safe water. The price of water in the US is a bargain – its value is almost incalculable.

Andrew Stone

American Ground Water Trust

Water falls at no cost from the sky as rain and snow, yet there is a price for using water. Why is water not free?

Most citizens of the United States are fortunate to have access to potable water. Over half the population uses ground water as a drinking water source. Everyone uses products daily that require water during their creation. In most cases, we do not pay for the water itself, but rather, for the utility or well contractor's services that ensure its delivery to our homes 24 hours a day 7 days a week by pipeline or on-site well.

Obtaining water on demand at a satisfactory quantity and quality requires a designated and dependable water source and a delivery system infrastructure. The water source may be a surface water body or a ground water aquifer. The delivery system may be a public system of pipes and pumps or a private well and home plumbing. The cost of establishing and maintaining these requirements is the aggregate cost of four main components involving storage, withdrawal from storage, treatment and distribution.

Storing water in surface water reservoirs for public utility supplies requires large acreage and dams, which are expensive to purchase and construct. The capacity of the reservoir is diminished over time as sediment fills the basin, and seasonally through evaporation. Ground water storage requires a smaller acreage footprint for constructing wells, but still requires monitoring and perhaps restricting nearby land-use activities to ensure water capacity and quality. These property costs are frequently on the order of millions of dollars and are passed on to the water users accessing the supply.

Withdrawing the stored water to begin the distribution process by a public utility requires piping and pumping infrastructure that must large enough to have the capacity to meet peak demands during the day. Treatment of surface water is required of public utility systems before distribution to customers and some ground water sources also require treatment to improve the quality to drinking water standards. Some water sources are adequate "as is" for industrial uses such as non-contact cooling situations while other specific

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requirements such as for kidney dialysis and computer silicon chip manufacturing may require additional treatment to remove essentially all dissolved constitutions. These costs are ongoing and are required for each drop of water for a particular use. The costs may again rise into the millions of dollars for large capacity systems.

The piping system for a utility supply to distribute treated water to customers for drinking, commercial and industrial uses is commonly quite extensive. The San Antonio Water System in Texas for example supplies water and sewer service to over 1,000,000 people via a system of over 9,000 miles of pipe. Costs to build and maintain these piping systems require significant funding. Initial construction may be on the order of one million dollars per mile. The cost to replace the current aging distribution infrastructure in the US over the next two decades has been estimated at near 500 billion dollars.

These public utility water supply costs result in a monthly water bill that on average across the United States is on the order of $2.00 per thousand gallons on water. Depending on the particular water system, the cost may or may not include the full future cost of infrastructure replacement.

A private well has significant up front initial costs but in most cases requires a minimum of annual maintenance cost. The cost of water from a properly-constructed private well compares favorably with public utility water costs over the service life span of a residential well, which is commonly many generations. [The pump and tank will be probably have to be replaced about every 15 years]. Because of the small "environmental footprint" of the withdrawals from private residential wells for domestic water use, there are usually no mandated restrictions on use. Except for the variable price of electricity to run the well pump, there are no fees for withdrawals compared to public supply systems that may face water shortages due to drought or reaching a systems maximum capacity threshold.

Bottled water is usually much more expensive per gallon than "tap water." Much of the difference in consumer price results from the convenience and portability of the container. Bottled water companies are in the beverage business not the water business. The quality of the bottled water itself can be very similar (or identical) to the water from a private well or public utility source. Consumers concerned about water quality and taste should review the treatment options that can be installed in a home. In many cases, the cost of installing a water conditioning or treatment system to fix an in-home water issue will be very low when the long-time benefit of improvement is considered.

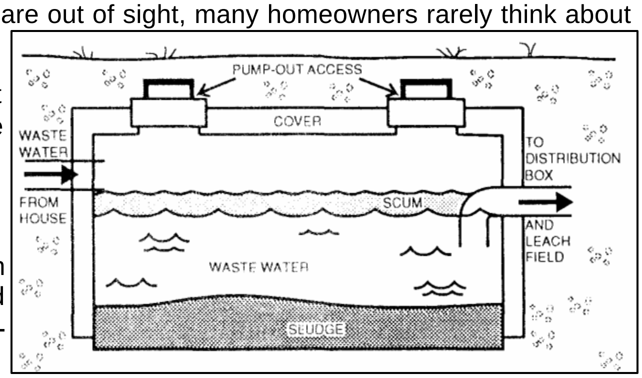
Everyone has a right to an adequate sustainable supply of safe drinking water, but there are costs to access the supply and ensure its safety. Water is not free. Compared with other routine monthly costs for a typical family, (cable, cell phone, gasoline, entertainment etc) the cost of reliable, dependable water from our taps is an ABSOLUTE BARGAIN!

Onsite Waste Water Disposal

Part I – The Septic Tank (Waste Water Storage Tank)

This is the first of two articles describing the basic aspects of onsite waste water disposal on residential properties. There are many different types of septic system design. The most frequently used design for single family homes has two parts: 1) Waste water storage and treatment tank and 2) The soil absorption and filter part (leach field). The next issue of *THE AMERICAN WELL OWNER* will discuss the soil absorption field where final treatment occurs before the water is released to infiltrate through the subsurface where it will eventually be added to the ground water system.

Over 20 million American homes use on-site waste water treatment systems. When they are properly designed, installed and maintained, septic tanks and similar on-site disposal systems are effective from an engineering perspective, economic for home owners and friendly to the environment. Because septic systems are out of sight, many homeowners rarely think about them.



All states have septic system regulations that are intended to protect ground water. Approximately 75% of on-site waste water systems in the US are used for homes that also have their water supply from a well.

In some rural and suburban areas, sewer lines would have to stretch great distances to connect homes with a centralized treatment plant, making the connection to such systems impractical. Fortunately, in many rural areas, natural soils can treat waste water as thoroughly and safely using an on-site disposal system, as can be achieved by municipal sewage treatment systems.

Disposal systems remove waste water (effluent) from the home, treat it, and return effluent to the soil. Each American produces at least 50 gallons (about 200 liters) of waste water per day from water use in the kitchen, baths, showers, toilets and laundry. This waste water includes suspended solids, dissolved organic and inorganic materials, and microorganisms such

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ONSITE WASTE WATER DISPOSAL. . . continued from page 2

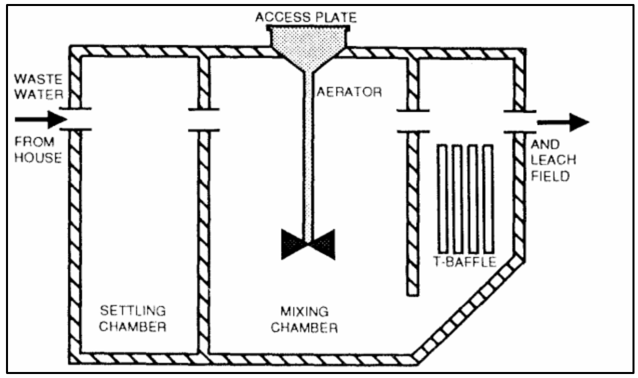
as viruses and bacteria. An on-site waste water treatment system treats this waste on the property where the waste water originated.

The Septic Tank
The waste water tank separates out the large solids, and the soil filter removes the fine solids and allows natural biological and biochemical processes to destroy accompanying bacteria. The only maintenance required by a properly operating system is the removal of accumulated solids from the waste water tank every few years.

A waste water tank may be a septic tank (anaerobic) or an aerobic tank (with an air agitator). In both, the large solids are separated and partially decomposed by bacteria. Bacteria also digest some of the solids and grease. The digestive (septic) processes release a smelly gas that moves back through the sewer pipes and is discharged by a vent through the roof of the house. The liquid out-flow from the waste water tank (effluent) contains disease-causing bacteria and nutrients and must have further treatment through a soil absorption system. The laws of most states and counties prohibit the direct discharge of septic system effluent onto the ground surface or into surface waters.

Septic tanks may have one or several chambers where solids are separated from waste water. The biological action of bacteria compacts the heavier solids causing them to settle at the bottom of the chamber; lightweight compounds such as waxes and grease drift to the surface forming the "scum" layer. Any indigestible solids must be periodically removed from the tank. Even after the septic tank has separated sludge and other solids, its clarified effluent is not yet purified. For example, the effluent is likely to contain high levels of bacteria and phosphorus, which must be removed or inactivated before reaching the water table.

Aeration systems are “cousins” to septic tanks; they use bacteria that live only in the presence of air. The purification process in an aeration system is generally similar to a septic tank in its initial stages. Following treatment in the first chamber, incoming waste water forces effluent into a second chamber, through a pipe equipped with a filter or baffle. Next, fine bubbles of air are blown into the effluent, encouraging the growth of aerobic bacteria, which feed on the organic nutrients and decompose them. The partially treated effluent then flows into a settling chamber. Bacteria fall to the bottom of the chamber, where a sloping floor returns them to the first chamber to continue biodegradation.



Aeration systems can purify waste water much more thoroughly than septic tanks. Sometimes they can remove as much as 90 percent of organic material and suspended solids. However, aeration systems have disadvantages too; they require servicing and maintenance more frequently than septic tanks. An aeration system uses electricity to operate the mixing mechanism and therefore is vulnerable to power failures. Aeration tanks are usually more expensive to purchase and install than septic tanks.

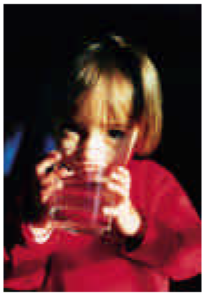
Deciding which system design is right for your property will depend on several factors: the soil and slope of the site, proximity to environmental features such as wetlands and streams, proximity to roads and buildings, the projected daily and peak waste water volume, your budget, and state and local building codes and regulations in your area.

AQUIFER STORAGE AND RECOVERY. . . continued from back page

water standards before the injection process. Other concerns revolve around the chemical reactions that may occur once the water mixes with the existing ground water and aquifer rock minerals. Research seems to show that with each injection and recovery cycle the quality of the recovered water improves. Investigations of the mixed-water indicate that the quality is often not degraded and may be improved (e.g., removal of disinfection byproducts that result from the pre-injection chlorination process).

The quantity of injected water retained in the aquifer as measured during the subsequent recovery by pumping indicates that a high percentage of the recharge water can be recovered. The recovery percentage can vary widely (From 20 to 95 percent) depending on geology, the shape (geometry) of the aquifer, background salinity of the existing aquifer water and the permeability of the aquifer. The recovery percentage usually increases with each ASR cycle. Collecting and storing the excess surface flow quantities generated during spring snow melt or intense rain events using ASR methods creates an opportunity to retain, manage and use water later in the year that would otherwise be lost to the region.

City and town water utilities are finding find that ASR is an efficient and cost effective alternative to building new surface reservoirs or buying large tracts of scarce land for new well fields and buffer zones. Municipal ASR may serve to stabilize the water levels in currently “fully tapped” aquifers and prevent adjacent residential water wells from going dry.



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TOPICS IN UPCOMING ISSUES

- Onsite Waste Water Disposal - Part 2
- What is Water Well Grout?
- Water Quality Issues - Silica

Aquifer Storage and Recovery

Figure 1

Aquifer storage and recovery is commonly referred to as ASR or water banking and is a technique used to more effectively manage water resources. It is an emerging technology by which surface water is collected and injected through wells into the ground. The injected water is stored in geologic rock formations known as aquifers during wet seasons and then pumped out of the ground through the same well during dry months to meet water demand in the region (Figure 1: ASR Well, Cocoa Beach, FL). In some places artificial recharge (spreading surface water out over permeable areas) is used to increase infiltration to aquifers. ASR refers only to recharge via a well.

ASR was studied by the US Geological Survey in the 1940s through several small tests although none of the test wells was used for supply. The first ASR project to supply water to a municipality was constructed in Wildwood, New Jersey in 1968. Only three ASR projects were operating by 1983. As of 2006 there over 69 ASR systems providing water on a commercial basis in the US. Most of the active ASR facilities are in Florida, California, the Northwest and the Mid-Atlantic states. ASR facilities are also established in Europe, Africa, the Middle East, Australia and Asia. Current system sizes vary from a single well to over 30 wells. The number of wells required depends on many factors including aquifer characteristics, anticipated water demands and the stage of project development. Unlike a surface reservoir system that has to be completely constructed before it can be operational, ASR wells can be brought on line one at a time.

Water quality and effective storage capacity are topics of investigation for most of the ASR projects to date. The US Environmental Protection Agency (EPA) has controlled for many years the injection of liquids into the ground through Underground Injection Control (UIC) regulations. These regulations were passed to protect ground water from industries that wished to inject certain waste products into the ground as a disposal option. The UIC regulations are now used to monitor the quality of the source water injected at ASR sites.

In most cases, the ASR source water is storm water runoff. It is usually treated to EPA primary or secondary drinking

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