



SIERRA CLUB
LONE STAR CHAPTER

FACTS ABOUT **TEXAS WATER**

And Simple Steps
to Appreciate,
Conserve and Protect
Our Most Valuable Resource

2nd Edition



ACKNOWLEDGEMENTS


This second edition of *Facts About Texas Water* was produced by the Sierra Club, Lone Star Chapter and is a publication of the Texas Living Waters Project.

The Texas Living Waters Project is a collaborative effort of the Sierra Club, Lone Star Chapter, National Wildlife Federation and our regional partner, the Galveston Bay Foundation.

The goals of the Texas Living Waters Project include:

- 1) Ensure adequate water supplies for all Texans and our environment,
- 2) Support healthy wildlife habitats through balanced management of rivers, bays and other water resources,
- 3) Reduce demand for water by informing the public and decision makers about the high cost of inefficient water use and the benefits of conservation, and
- 4) Involve citizens in the decision-making process for water management.



 You can learn more about the Texas Living Water Project at www.texaslivingwaters.org.

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Introduction

Water is an essential part of our everyday life. Yet for most of us, especially those living in urban areas, we probably do not think about water very often. We have come to expect that water will be there when we turn on our faucet. Only if we turn on our tap and nothing comes out, or if the water tastes bad or smells strange, or if we find our home flooded by a nearby creek during a heavy rain, do we give much thought to water:

Our relative lack of attention to water is rapidly becoming a luxury that we in Texas cannot afford. The population of our state is expanding dramatically. Many of our underground water sources are being depleted. Our fish and wildlife populations dependent upon water are struggling to survive in various parts of the state. Much of the water is being wasted (along with the tax and consumer dollars that paid for the water) through inefficient use and infrastructure. For these reasons, and many more, we need to inform ourselves about water and take action to assure a dependable and safe water supply for the future for both people and the environment.

Facts About Texas Water was prepared to aid Texans in this endeavor. This publication is created out of a desire to educate, and a commitment to fulfill a conservation mission.

Facts About Texas Water is intended to give all Texans—young and old, urban and rural—basic information about water that will help us understand this important resource and how to use and protect it.

We hope that you find this publication useful and inspiring. The water future of Texas is in your hands, and your action to determine that future has never been more important than it is now.

Acronym Guide

- GCD** Groundwater Conservation District
- EPA** Environmental Protection Agency
- MUD** Municipal Utility District
- PUC** Public Utility Commission
- TCEQ** Texas Commission on Environmental Quality
- TWDB** Texas Water Development Board



Water Basics

1. Why do I need to know where my water comes from?

If you know where the water that you use in your house comes from, you will be able to keep tabs on the quality and quantity of that water source and take steps to protect it. For example, you wouldn't want to accidentally pollute your own water source, someone else's water source downstream from you, or the aquatic habitat or wildlife that depend on clean water.

In addition, knowing where your water comes from, or what new sources are being considered, may help you make decisions about how much water you use, or what actions you should encourage your water supplier to take. For example, if your water comes from an aquifer that is in danger of depletion (low underground water levels from pumping more water than is being replenished by rainwater), you may choose to reduce the amount of water you use so that your water supply will last longer. If your water supplier proposes to build a new reservoir that would reduce the amount of freshwater flowing into the bay where you fish, you may decide to encourage that supplier to first explore potential water savings from conservation.

2. How many different sources of water are there?

You can collect water from surface water (in other words, rivers, lakes, streams), groundwater (wells that tap into aquifers) or a mix of surface and groundwater; rainwater; or springs. The types of treatment needed for making water safe for drinking varies according to the region and method of collection. In some areas ocean water or brackish groundwater (lower salt content than seawater) is treated to create drinking water through a process called desalination.

3. Does it matter whether my water comes from surface sources, an aquifer, or a combination of both?

All three of these sources have to meet federal drinking water quality standards if the water is provided through a public or private water system. Regulations are very strict for surface water, and testing occurs frequently. However, groundwater is not tested with the same intensity as surface water because it generally does not get exposed to as many contaminants and pollutants as surface water. If you have groundwater under the influence of surface water or a mix of surface and groundwater as a source, that water must be treated like surface water. Surface water goes through several treatment steps, many more than groundwater. If you get all of your water from an aquifer the TCEQ recommends just chlorinating it and doing a bacteriological test once a month. Fractured aquifers like the Edwards and Trinity have to meet federal standards.

Also, using a particular source of water may have environmental and economic impacts. For example, if your water comes from an aquifer, and pumping exceeds what is being replenished by rainfall travelling down through the soil to the aquifer; this may result in a lowering of underground water levels. This, in turn, could lead to increased energy costs for pumping water; intrusion of salt water into freshwater aquifers, or a reduction or elimination of flows from springs that are the natural points of discharge from the aquifer. Those springs may provide aquatic habitat for fish and wildlife and provide flow to streams.

If your source of water is a surface reservoir or lake, that reservoir affects and may reduce important downstream water flows that fish and wildlife need to survive. The reservoir may also reduce freshwater inflows to the bays and estuaries upon which shrimp, fish, and oysters depend.

For related information on water and wildlife, see section 5

4. What is the water cycle? What is the hydrologic cycle, and are they the same thing?


Yes. One is just a fancier name. Basically, the water cycle is an illustration of the natural cycle of water moving from the atmosphere to the earth and back to the atmosphere. Think of it as nature's way of recycling water: It begins with water evaporating from bodies of water (rivers, oceans, or aquifers, etc.) and land surfaces, then condensing into clouds, falling as rain and flowing back into rivers, streams, or aquifers, etc. Water that is not absorbed into the ground runs off into streams and rivers. When the streams and rivers reach the ocean and some of the water evaporates, the cycle begins again. The water cycle also acts as a filter, purifying and removing salts from the water:



Water Cycle or Hydrologic Cycle

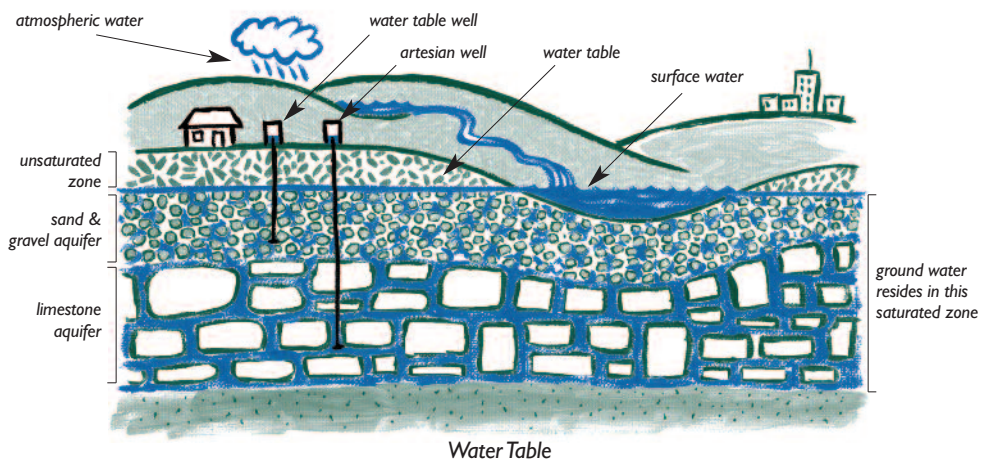
5. What is a watershed? Do I live in a watershed?

A watershed is the area of land where all of the water on the land flows to a common point, such as a reservoir, a bay, or any point along a stream channel. Watersheds are the link between our land, our water and our communities. Because of this, any pollution on the land will eventually negatively affect the quality of the water in our rivers and aquifers. Although watershed boundaries don't follow city or state lines, we all live in a watershed.

 **Locate your watershed using the SurfYour Watershed tool:**
<http://cfpub.epa.gov/surf/locate/index.cfm>

6. Is the water table the same thing as an aquifer?

No, think of the water table as the area below the ground that is saturated with water in all pore spaces, this is referred to as the saturation zone. The top of this saturated zone is the water table. Think of an aquifer as a porous rock formation usually made of limestone, sandstone, or gravel that holds underground water below the top of the water table. Water can move through these porous rock formations, which vary in shape and sizes. So the water table can be thought of as the line that defines the top of the groundwater in an aquifer.



7. I keep seeing the term “groundwater”. Is this simply all water that is underground?

You’d think so, but all water found underground isn’t necessarily defined as groundwater. Here’s what you need to know. Beneath the surface, the earth has layers, like a cake. In those layers there are two water areas, or strata, known as the unsaturated and saturated zones. The unsaturated zone is higher up and its pore spaces—the pockets between soil or rock—are filled with both water and air. In the saturated zone, all of the pockets are filled with water, and this water is defined as groundwater.

Groundwater is the major source of drinking water in most rural areas and especially in San Antonio and Lubbock. You have to drill a well to get to it, and in most cases you have to pump it out. Groundwater is generally cleaner than surface water because the earth through which the water moves acts as a filter. The problem with groundwater is that some aquifers are being drained faster than rainfall can replenish them. This is called depletion or mining, and it is a major concern in many areas that rely on groundwater.

 **More Groundwater information:**
<http://water.usgs.gov/edu/earthgw.html>

8. I’m hearing the term water rights more and more. Is there an easy explanation of what this is?

In short, water rights refer to a legally protected right to use surface water, to divert or store the surface water, and put it to use. In Texas, surface water is owned by the state, but allocated to different water users through the issuance of water rights permits. Many different entities may hold surface water rights, including irrigators, cities, businesses, and individuals.

The right to pump or use groundwater is another matter. Texas courts have established the “rule of capture” that allows landowners to pump as much water as they like from aquifers beneath their land. The Texas Legislature has modified the rule of capture in certain areas of the state by creating government entities such as Groundwater Conservation Districts (GCD), for the management of groundwater in those areas. Groundwater Conservation Districts are allowed to regulate the withdrawal of water from aquifers.

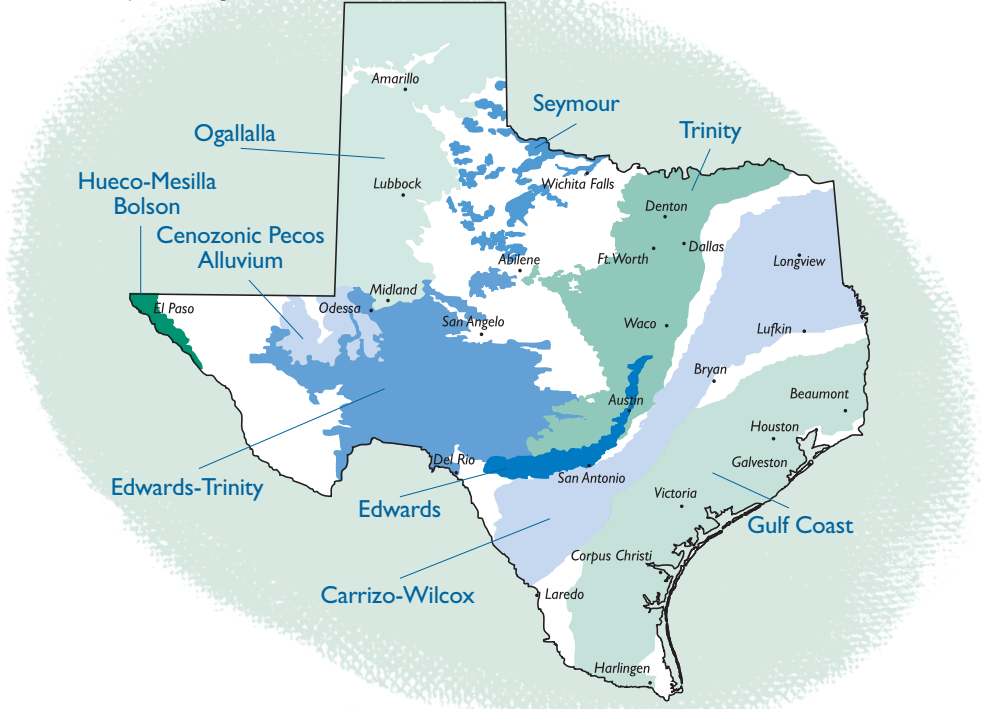
9. So what about springs? Are they considered a separate source of water?

Not really. Springs are simply where a groundwater source naturally meets the surface, and the water bubbles up out of the ground because the level of groundwater is high enough to emerge through an opening.

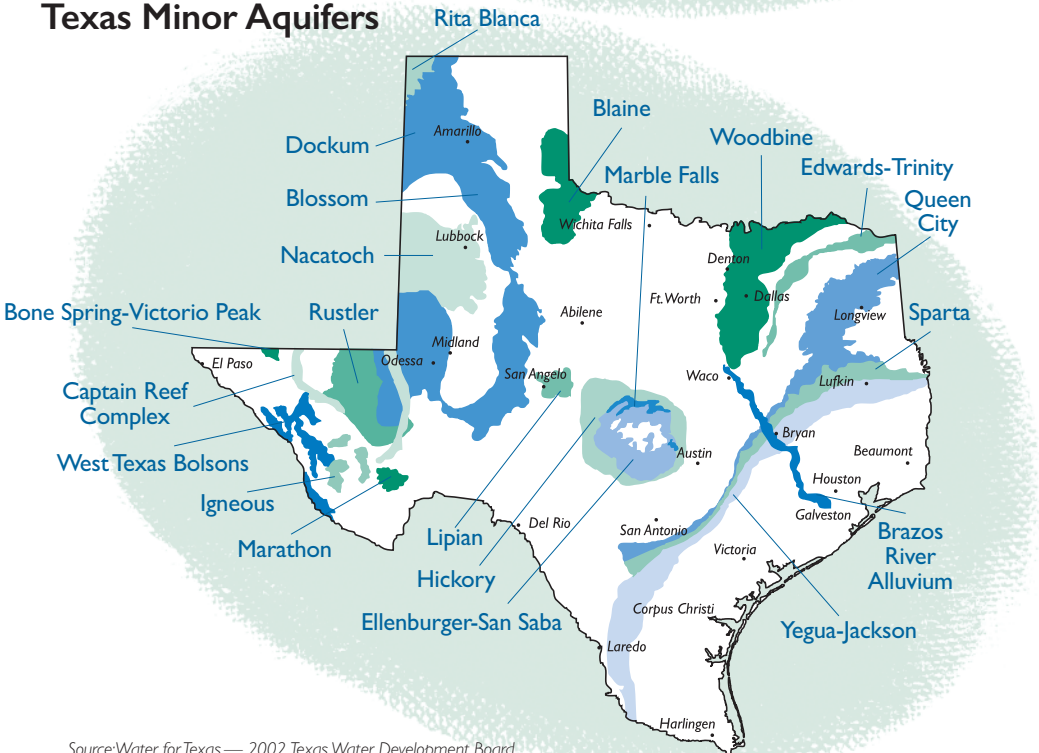
During dry times, springs may continue to flow and become a critical source of water for rivers and creeks.



Texas Major Aquifers



Texas Minor Aquifers




Source: Water for Texas — 2002, Texas Water Development Board

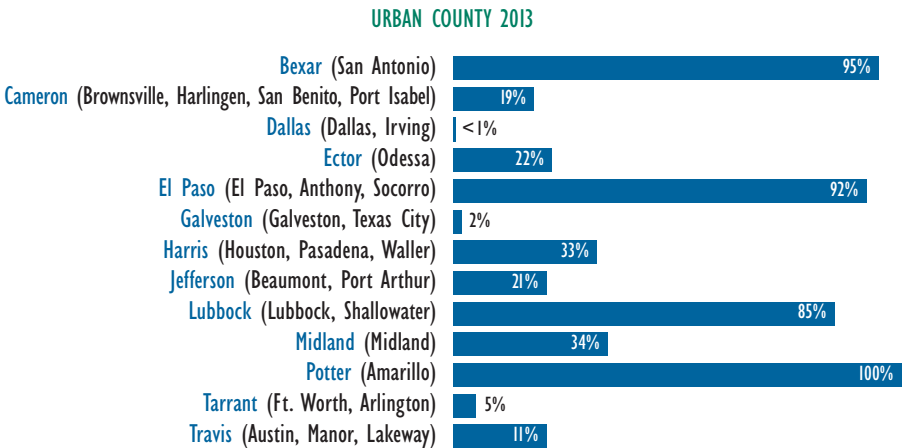
How Does Water get to My Home?

I. Where does the water that I use in and around my home come from?

In general, your water will come from either surface sources like lakes, rivers or streams. Your water can also come from underground aquifers (also known as groundwater). Think of aquifers as underground porous rocks through which water can flow. Then again, your water might come from a combination of ground and surface water sources. If you live in the Austin area, your water comes from Lake Travis and Lake Austin, which are water storage reservoirs built on the Colorado River. A reservoir is a man-made lake generally built for the purpose of storing and supplying water. However, if you live in the San Antonio area, 93% of your water comes from an underground aquifer, specifically from the Edwards Aquifer. If you live in Houston, the majority of your water comes from a reservoir, either Lake Houston or Lake Conroe on the San Jacinto River or Lake Livingston on the Trinity River; and the remaining 37% comes from groundwater:

 To find your local source of water, contact either your water supplier or the Texas Commission on Environmental Quality (TCEQ) regional office. A listing of these offices can be found at www.tceq.state.tx.us/about/directory/region/reglist.html. It's important to note, however, that it's rainwater that replenishes both our surface and ground water sources. The effects of drought conditions and water use can greatly affect water availability.

PERCENTAGE OF TOTAL MUNICIPAL USE SUPPLIED BY GROUNDWATER IN MAJOR URBAN COUNTIES



Source: Texas Water Development Board, Water Use Survey Historical Summary Estimates By County 2013 (Accessed 2/8/2016)

2. If I have a problem or question about my water, whom do I contact?

It is confusing deciding whether you contact your local water supplier, a plumber, or a state agency staff member. In general, you'll want to contact your water supplier first if you are having problems. If they are not responsive, then call the Texas Commission on Environmental Quality (TCEQ). You can call them about problems with pressure, chlorine, taste, odor, water quantity, or water quality, or if you are having problems getting service. You'll want to contact a plumber if you are having issues with a leaky faucet, clogged pipes, broken pipes or fixtures.

3. Is the water that fills my toilet bowl the same as the water coming through my kitchen tap?

You may be surprised to know that the water that fills your toilet bowl is the same water that comes out of your kitchen and bathroom faucets and the same water that flows through your garden hose. All water that comes to your home travels through the same pipes and is required to be "potable," meaning that it is treated or cleaned to a level that you and your pets can drink safely. That means the water used to flush your toilet and irrigate your lawn is clean enough to drink.

Even though all of the water coming into your home is safe to drink, once the water leaves the tap it may become contaminated. For example, backflow conditions, where water flow is reversed and contaminated water flows back into the pipe can be a big problem. Because of this, it is important to make sure that your toilet is approved and legally installed to prevent contamination. It is also important that you check your lawn sprinkler system to ensure no water is pulled back into the pipes. Avoid using attachments on hoses to spray fertilizers, since these can be pulled back into the pipes and affect your water quality.

4. Where does all the water go when I'm done with it?

In most cases, the water used inside of your home (water draining from your shower, flushed down the toilet, or washed down the kitchen sink), goes to a wastewater treatment plant where it is cleaned and released back into a body of water as effluent. Effluent is a term for different kinds of liquid waste. The effluent normally is released downstream of the intake at your local drinking water treatment plant. Keep in mind, however, that although it is downstream from your water source, it will almost always be released upstream of someone else's drinking water source, and vice versa.

On the other hand, the water used outside of your home (sprinkler system or running through your garden hose) does *not* go to a wastewater treatment plant. Water used outside either slowly soaks into the ground to eventually recharge the groundwater supply, or if used in excess, the water runs off of the land and into storm drains that are directly connected to your local river, bayou, and bay (there is no filtration system on stormwater drains so the water isn't cleaned or treated before it empties into a watercourse).

It is important to make sure that the water that soaks into our aquifers or that runs off the land and into our creeks and rivers is clean and does not create or contribute to water quality or pollution problems. Make sure to pick up after your pet and dispose of

WATER WORDS OF THE WISE

**"When the well is dry,
we know the worth of water."**

— Ben Franklin —

the pet waste properly, do not apply excessive lawn or garden fertilizer or weed control and do not litter. Make an effort to participate in creek, beach and other litter cleanups on a regular basis.

5. Are there different pipes for the water that is going into my home and water that is leaving?

Water coming into the house goes through one set of pipes, and water leaving the house passes through a different set of pipes known as your sewer line. Regulations stipulate that when the lines initially are being laid down, the potable water line has to be above the wastewater line and in separate trenches. All potable water distribution systems must be designed, installed and constructed in accordance with American Water Works Association standards (as defined in the Texas Administrative Code (30 TAC), Chapter 290, Subchapter D: Rules and Regulations for Public Water Systems, which covers the requirements for water treatment plant design, operation, and maintenance for water systems that supply potable water to the citizens of Texas, section 290.44).



6. Do people in rural areas get their water the same way as people living urban areas?

In general, city (urban) residents get their water from a public water system, meaning water is piped to residences through a common system. Public water systems are defined as those serving 25 or more people at least 60 days of the year OR having at least 15 customer connections. Folks living in the country (rural areas) are often on a private water system, i.e. individual wells. Public water systems are regulated for safety by federal laws such as the Safe Drinking Water Act and state drinking water rules which are enforced in Texas by the TCEQ. For instance, a public water system must maintain a certain level of chlorine, which helps control growth of micro-organisms. Private water systems, like wells, are not regulated by TCEQ. Private well owners are responsible for monitoring the quality of their well water.

7. How do I know if I'm part of a Public Water System or a Private Water System?

Are you paying a water bill? If so, then you are part of a public water system. There are nearly 7,000 public water systems in Texas. A public water system is defined as water piped into residences with at least 15 connections or serving 25 or more people for 60 days or more.

8. I live in a mobile park, and I don't pay a separate bill for water that comes with the home. Am I on a public water system?

It is best to ask your landlord. If water is going to at least 15 different homes or providing for 25 or more people, you are on a public water system, thus safeguarded by federal water quality laws and state regulations. If you suspect a problem with your water quality, talk to your landlord first, and then contact your local regional office of the TCEQ.



A listing of these offices can be found at:
www.tceq.state.tx.us/about/directory/region/reglist.html

9. I live in something called a MUD. Do I get my water the same way as everyone else?

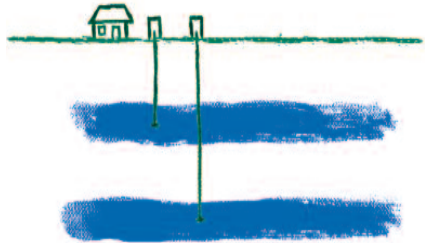
People who live in suburban areas outside the boundaries of a city may get their water and other important services from a Municipal Utility District (MUD). There are around 900 Municipal Utility Districts in Texas (Source: TCEQ Water District Database, accessed 2/9/2016).

A Municipal Utility District (MUD) engages in the supply of water; conservation, irrigation, drainage, firefighting, garbage collection and disposal, recycling, wastewater (sewage) treatment, and recreational facilities. A MUD is a special governmental entity of the State of Texas. All MUDs provide water and wastewater services, and are governed by an elected board of directors.

WELL WATER FOCUS

How exactly is water pumped out of a well?

A well is a hole drilled into the ground to access water contained in an aquifer. A pipe and a pump are used to pull water out of the ground, and a screen filters out unwanted particles that could clog the pipe. Wells come in different shapes and sizes, depending on the type of material the well is drilled into and how much water is being pumped out.



Source: www.groundwater.org

10. Where does the water for industrial use come from?

Industrial water users relying on surface water need to get a water rights permit from TCEQ or they may buy or lease water from a wholesale supplier, like a city, water authority, or river authority. Depending on what their permit allows, an industry may take saline water from coastal areas or divert freshwater from rivers, streams, or reservoirs. If industrial users pump groundwater, they require a permit from the local groundwater conservation district, if there is one. Industrial users may also contract with municipalities to use treated effluent, also known as recycled water.

Water Quality & What You Will Find in Your Water

1. How clean is my drinking water?

Every public water system customer in Texas should receive a copy of the Drinking Water Quality Report or Consumer Confidence Report once a year. Your water supplier should mail this document to you automatically. If you have not received a copy, call your local water supplier and they should provide you with one. The Drinking Water Quality Report has information on the source of drinking water for your area, what body or bodies of water they take the water from, a detailed report on the quality of your water, and any violations the water system has had. If you are unable to obtain a copy of this report from your water supplier, call the Texas Commission on Environmental Quality (TCEQ) 512-239-1626.



You can also search your water supplier online through Texas Drinking Water Watch, <http://dww2.tceq.texas.gov/DWWW/>.

Public water systems are required to use a multi-barrier system to clean and protect drinking water. The combination of barriers is intended to ensure that all contaminants are caught and eliminated from the water system. In general, all water being treated for drinking purposes in Texas will go through five barriers, or stages of treatment:

1. Pre-treatment (addition of chlorine)
2. Addition of chemicals to sink sludge (solid materials) to the bottom
3. Skimming the clean water off the top
4. Passage of the water through settling basins to allow any remaining small solids to be removed from the water
5. Distribution to filters

2. I get my water from a well. How clean is this water?

Generally speaking groundwater sources, like wells, are less susceptible to pollution, and therefore should be cleaner than surface water sources. The Environmental Protection Agency (EPA) recommends that well water users have their wells tested yearly for nitrate and bacteria levels. If you suspect that your well might be contaminated with pesticides, radon or some other pollutant, test more often. Your local groundwater conservation district may perform water tests for free or for a nominal fee.



You can find information about your groundwater well and testing resources at <http://tgpc.state.tx.us/water-wells/>

3. How clean is my bath water?

It is the same quality as the water that comes out of all faucets in your home. That means it is potable, or in other words, safe to drink. That is, until you take a bath in it.

4. How susceptible is my water to contamination?

This is where it is really helpful to know the *SOURCE* of your drinking water. If your water supply is surface water, try to determine what the potential sources of pollution are upstream from your water supply. Pollution sources can be non-point sources, meaning the pollution may come from many small, non-specific sources rather than one identifiable source. Examples of non-point sources are pesticides, herbicides, leaky septic systems, animal waste, oil, and grease. Point source pollution comes from a specific, identifiable source, and can include wastewater treatment plant discharges, factories, confined animal feeding operations (CAFOs), and oil and gas production.

If your water supply is groundwater, try to determine whether there are pollution sources on the surface that might be transmitted into the aquifer when it rains through sinkholes, abandoned but unplugged oil and gas or water wells, seepage through sandy soils, or other means. In portions of the Edwards Aquifer region, where water flows directly from the surface into the aquifer very quickly, special efforts have been made to restrict certain actions on the surface that might result in groundwater contamination. In other aquifers, the movement of contaminants into and through the aquifer may be much slower. In almost all cases, once an aquifer is contaminated it is difficult, if not impossible to clean it up, and the cost of cleaning it can be prohibitive.

WATER WORDS OF THE WISE

“Children of a culture born in a water-rich environment, we have never learned how important water is to us.”

— William Ashworth —

5. Who sets the standards for the amount of pollutants in my water?

The EPA sets standards for drinking water. These are known as the Federal Drinking Water Standards. The TCEQ is responsible for enforcing these and any other drinking water standards.



You can learn more about drinking water standards at www.epa.gov/dwstandardsregulations

6. If the pipes in my home are old and gross, how clean is my water?

The State of Texas requires that chlorine residual be present in your water when it comes out of your pipes into your home or yard. This means that even though your water may pass through old pipes, the chlorine will act as a disinfectant, keeping the water clean and drinkable.

7. What causes water from the tap to smell sometimes?

Cross-contamination, algae, methane, chlorine, musty leaves, seasonal turnovers in bodies of water, and lots of other things can cause funny smells in your water. If you get your water from surface sources, the odd smell could be caused by an organic source like an algae bloom. If it is persistent you should call your water supplier first, not a plumber. If they are unresponsive, then call your regional TCEQ office.



To find your regional TCEQ office, visit www.tceq.texas.gov/about/directory/region/reglist.html

8. If water comes from lakes, streams and rivers, how does all that junk get out of it?

WATER WORDS OF THE WISE

“The frog does not drink up the pond in which he lives.”

— American Indian Saying —

Water from lakes, streams, rivers and other sources will come into a drinking water treatment plant where it is treated in the multi-barrier system described in the answer to question 1 in this section. This includes adding chlorine, chemicals to sink sludge to the bottom, skimming the clean water off the top, passing it through settling basins, and finally through various filters.

Performing all the steps ensure that your water is safe and clean to drink.

9. I live in the city, but plan on retiring to the country (a rural area). What do I need to know about what might be in my private well water?

A general complaint by families using well water is the abundance of minerals. Some people find it necessary to take steps to reduce the mineral content of their well water (i.e. water softener). In general, an annual water test for primary drinking water contaminants (bacteria and nitrates) is recommended.

10. What is hard water?

Water is considered to be hard, as defined by the EPA, if it contains a large amount of dissolved minerals, such as calcium or magnesium. Hard water is not a health hazard, and you will usually find groundwater to be harder than surface water.

11. How do I know if my water is hard?

Hard water will make it difficult to lather up with soap. Your skin may feel dry after showering, and you'll need more laundry detergent to wash your clothes. Some cities, like Austin, soften their drinking water supply by adding lime to reduce the components causing hardness in the water.

“Final hardness” is the indicator of water hardness resulting from the treatment process aimed at softening water. In Austin, the final hardness target is a level around 100 milligrams/liter as calcium carbonate or 100 parts per million (ppm). Typically soft water contains 0 to 75 ppm of hardness, moderately hard water contains 75 to 150 ppm hardness, hard water contains 150 to 300 ppm hardness, and very hard water contains more than 300 ppm of hardness.

12. Why do some people have hard water?

If you live in Central Texas, your water tends to be hard because we have limestone aquifers that contain an abundant supply of calcium.

13. How do authorities treat hard water?

Since it's a very expensive process to treat hard water, and because it does not pose a health hazard, many cities choose not to treat it. Some cities, like Austin, however, do soften the water by adding lime.

14. What is wastewater?

Wastewater is the dirty water that leaves your home after it is used for showers, toilet flushing, laundry, dishwashing and other purposes and travels through pipes to a wastewater treatment plant or into your home septic system. That water is then cleaned and released into a body of water and is referred to as “effluent”.

15. What is blackwater?

In general, blackwater is defined as the wastewater from toilets, food preparation, or washing clothing exposed to human waste such as diapers.

WATER WORDS OF THE WISE

“We forget that the water cycle and the life cycle are one.”

— Jacques Cousteau —

16. What is graywater?

Graywater is wastewater that is not blackwater. It is wastewater from showers, bathtubs, handwashing lavatories and sinks that are not used for disposal of hazardous or toxic ingredients, sinks not used for food preparation or disposal and clothes-washing machines (unless used to wash things like diapers).



Information on graywater can be found in the Texas Administrative Code (Chapter 210, Subchapter F: Use of Graywater Systems).

17. What is recycled water?

Recycled water is wastewater effluent that has traveled through the sewer to the wastewater treatment plant and has then been treated (cleaned up) with a specialized process for reuse. This water is then used directly or indirectly for industrial uses, landscaping, and other non-consumptive uses. Recycled water is also referred to as water reuse.

18. What is direct reuse?

Direct reuse is recycled water that is piped directly from a wastewater treatment facility to a distribution system. For example, direct reuse could mean pumping recycled water through a pipe from the wastewater treatment plant to a golf course for landscape irrigation. Another example of potable direct reuse is pumping recycled water from the wastewater treatment plant to a drinking water purification plant.

19. What is indirect reuse?

Indirect reuse refers to use of recycled water that is released from a wastewater treatment plant into a lake, river, or aquifer to be taken out for use downstream. An interesting example of indirect reuse is the Tarrant Regional Water District Wetland Reuse project where treated water is diverted and filtered through a series of manmade wetlands and then returned to a water supply reservoir.

20. What is sludge?

Sludge is the solid material remaining after the wastewater treatment process (this is different from the sludge that is chemically separated from the water early in the treatment process). Some municipalities use composted sludge as fertilizer, such as the Dillo Dirt program in Austin.



For more information visit: www.austintexas.gov/dillodirt.

How Much Does Water Cost?

I. How does water affect my pocketbook?

Water is going to affect your pocketbook whether you are paying a water bill, getting your water from a private well, or buying bottled water. The financial impact on your pocketbook will differ according to your situation. For most of us, regardless of the source, water is very inexpensive, particularly compared to its importance to our well-being.

For those paying a water bill (i.e. on a public water system):

Fortunately, water suppliers are beginning to price water to encourage conservation. Ideally, there should be a low rate for the minimum amount of water needed, and then the rates increase in graduated steps from there. That means if you don't use much water you would pay less (per 1,000 gallons of water) than people that use more. The concept is that people that use excessive amounts of water would pay more. This is referred to as a tiered water rate structure or "conservation rate structure".

If we do not have a tiered system, then there is less financial incentive to conserve water. Water infrastructure has to be built with enough capacity to meet maximum use, even if that extra capacity is only used for a few months in the summer for outdoor irrigation. A conservation rate structure is one way to pass some of the additional cost for the extra capacity to the highest volume users that drive the demand for the capacity. To find out if your water supplier bills you based upon a tiered approach, simply contact them and ask.

Both the City of Houston and City of Austin use a tiered rate structure. For a homeowner using 4,000 gallons in a month, the rate in Houston would be about \$22 (\$265 annually) while the rate in Austin would be about \$30 (\$360 annually).

In addition to paying for water to be delivered to your house, you also pay for the water that you used in your home to be returned to the wastewater treatment plant and cleaned up so that it can be released back into the environment. The rates for this service are usually based upon the amount of water you use in the winter. Winter use is a good indication of the amount of water that goes to the wastewater treatment plant because homeowners generally don't put much water on their landscapes in the winter.

In Houston, if you use 4,000 gallons of water during a winter month, your wastewater rate is about \$26 (\$312 annually). In Austin, the rate would be \$50 monthly, or about \$600 annually.

TIERED WATER RATE STRUCTURE EXAMPLES				
City	Gallons Water Per Month	Delivery Rate Monthly/Annually	Wastewater Rate Monthly/Annually	Annual Water Expenditure
Houston	4,000	\$22 / \$265	\$26 / \$312	\$577
Austin	4,000	\$30 / \$360	\$50 / \$600	\$960

Developers of newly constructed homes also pay a fee to connect to established drinking water and wastewater infrastructure. This cost is generally passed on to the homebuyer as part of the cost of the home. To promote conservation, some water suppliers will discount connection fees if the developers implement conservation practices, such as approved drought tolerant landscaping, limiting the amount of turf grass, or installing drip irrigation.

WATER WORDS OF THE WISE

“Throughout the history of literature, the guy who poisons the well has been the worst of all villains...”

— Author unknown —

For those getting water from a private well:

Although you don't have a monthly water bill, there are still substantial costs. Even if a well was already in place when you moved in, a family of four should expect to eventually spend thousands in maintenance and replacement costs. To drill a new well costs \$15-30 per foot for drilling at least 800 feet. Add \$200-\$400 for a pressure tank, \$300-\$800 for a pump, and \$1500 for labor, and the cost of a new well can approach or exceed \$10,000. Pumps have to be replaced on average every 15 years. There is also the cost for the power to run the pump.

Folks that have a private well usually have their own wastewater system or septic tank. The average price to install a septic system is \$4,500. The average cost to pump out a septic system, which is recommended every 1-3 years, is \$350.

2. Who decides how much I pay for water, and how do they do this?

Most water users are served by a city owned water system that sets its own rates. These rates are based on the cost of service of providing water to their customers. Usually these costs include the expense of treating (including chemicals and filters) and delivering the water (including pipes and energy used to pump the water). This means that in most cases your local elected officials will ultimately approve any water rates changes.

Privately owned utilities may set their own rates as well. However, if 10% of their customers protest the rate change, the utility then has to go before the Public Utility Commission (PUC) to get their rate changes approved. This means that the PUC has regulatory oversight on this kind of rate change.

3. I live in an apartment. How am I charged for the water I use?

This can be done in one of four ways. The tenant can have an individual account with the water utility. The apartment can be “all bills paid,” which means that your water costs are rolled into your rent. These first two examples are pretty rare. Apartment dwellers are more commonly charged for their water by submetering, or allocation. Submetering determines your actual water usage; the landlord then pays the bill for the whole building and bills you for your portion according to your submeter. Allocation is based on one meter on the whole building and the landlord allocates the bill to the renters based on square footage of their apartments and other factors. Allocation does not encourage conservation. For instance, if your neighbor uses lots of water, and you, on the other hand try to use it wisely, your respective bills do not reflect this.

Water Conservation

I. What is water conservation and why is it important?

Water conservation is a pretty simple concept. It means that you and your community do what you can to prevent water waste. Turning the water off when you brush your teeth, taking shorter showers, installing low-flow toilets and shower heads, putting aerators on faucets, and reducing the amount of water you put on your lawn are all water conservation techniques.

There are a variety of factors that affect how much water is used in your home and community such as climate, affluence, and household size.

Water conservation is an important method to manage water supplies sustainably. It protects the environment and allows water utilities to better meet current and future water needs.

Water conservation is important because it...

- Ensures water for future growth and future generations
- Reduces costs to water customers since conservation is almost always less expensive than other water supply options
- Reduces the need for additional water since removing water from a river can impact fish and wildlife habitat
- Conserves energy since treating, moving, and cleaning water used in cities is energy intensive

2. How much water does my community use?

The Texas Water Development Board (TWDB) collects water use data for many Texas communities.

One acre-foot is about the size of a football field covered with one foot of water and is equal to 325,851 gallons.



You can find that information here:

www.twdb.texas.gov/waterplanning/waterusesurvey/estimates/index.asp

Use the table below to see how your county compares with others in Texas. If your county is not listed, check out the TWDB Water Use Database for a complete list.

URBAN COUNTY	TOTAL WATER USE IN 2012 (ACRE-FEET)	STATE RANK
Harris (Houston, Pasadena, Waller)	971,168	1
Dallas (Dallas, Irving)	484,857	2
Tarrant (Ft. Worth, Arlington)	336,286	10
Cameron (Brownsville, Harlingen, San Benito, Port Isabel)	321,297	11
Bexar (San Antonio)	317,585	12
Jefferson (Beaumont, Port Arthur)	231,992	17
El Paso (El Paso, Anthony, Socorro)	226,109	83
Lubbock (Lubbock, Shallowater)	207,764	20
Travis (Austin, Manor, Lakeway)	193,035	24
Galveston (Galveston, Texas City)	87,448	46
Potter (Amarillo)	36,134	73
Midland (Midland)	29,345	83
Ector (Odessa)	25,963	90

Source: Texas Water Development Board Water use survey historical summary estimates by county (2013)

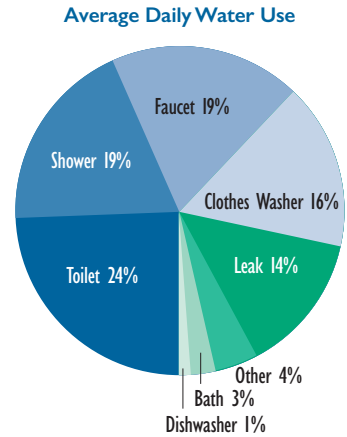
3. How much water do I consume per day?

Americans, on average, use 80 to 100 gallons of water in direct use each day. About 70 percent of this water use occurs indoors. The remaining 30 percent is used outdoors, but can be much higher in drier parts of the country. A 2012 study by the Texas Water Development Board estimated outdoor water use in Texas at about 31%.

By taking some measures to conserve water you can easily reduce your consumption by 30 percent. For instance, install a low-flow showerhead and a water-efficient toilet, choose a car wash that recycles water, water your lawn in the early morning or evening, plant water-saving plants, and cover your pool or spa to reduce evaporation.

(Source: US Environmental Protection Agency Water Sense Program).

We also use large amounts of water to make and grow the things that we use everyday. This is referred to as indirect or imbedded water use. Some estimates indicate that only about 5% of our total water use occurs in our homes. For example, according to a U.S. Geological Survey website, it may take about 3 gallons of water to produce one sheet of paper, 500 gallons of water to produce a pound of chicken, and 700 gallons to produce a T-shirt.



Source: DeOrea, W. and P. Mayer, et. al. 2016. Residential End Uses of Water Version 2. Water Research Foundation. Denver, Colorado

 You can take a quiz and find more information about your Water Footprint at <http://water.usgs.gov/edu/activity-watercontent.html>.

4. How much water is lost due to leaky pipes in the water distribution system of public water suppliers?

The American Water Works Association recommends a goal of no more than 10% loss through leakage, but some water supply systems lose as much as 20% or more of their water through leaks in their pipes. Municipalities are required to report their water loss to TWDB annually.

It is important for water suppliers to fix their distribution systems in order to minimize water lost due to leaky pipes. The water that is lost is water that you can use in your home or could be used for fish and wildlife habitat.

5. What is a drought and how do droughts affect my water supply and me?

Drought, unlike a hurricane or flood, doesn't have a distinct beginning or end. Drought is a creeping phenomenon that is, in the most basic terms, defined by the lack of precipitation, which results in a water shortage causing adverse impacts on plants, animals, and people. The definition of drought in a wet and dry climate are different. Also, human factors, such as increased water demand, can worsen or intensify the impact of drought.

The most common way for residential water users to be affected by a drought is through outdoor watering restrictions. During a drought, water supplies are low and these restrictions help to preserve the water we have on hand. Other watering restriction measures could be washing cars less often, and filling swimming pools less frequently.

Water demand tends to increase during dry periods because of increased levels of outdoor watering for lawns and gardens. With less rainfall to replenish streams, rivers, lakes, and aquifers, water processing and distribution systems often cannot handle the increased demand during these times.

6. Why do we have water restrictions during the summer?

During non-drought times, water restrictions are generally used to reduce peaks in water use that strain water supplies and water treatment capacity. There is usually a large spike in water use during the summer in Texas. This is largely due to people watering their lawns and gardens during the hot, dry summer. Water treatment plants often cannot keep up with this additional demand.

Shouldn't we just build more water treatment plants, then?

The answer is no. Water treatment plants are very expensive and it does not make sense financially to build additional treatment facilities that likely would be used a couple of months to cover increased demand due to lawn watering. Reducing peak water use makes more sense.

Summer is tough for people, fish and animals.

Summer is also the time of the year when should not take additional water out of our rivers and streams. Fish and wildlife are generally the most stressed at this time of the year (just like us) and they need what little water is available in our rivers and streams.

Another reason for water restrictions is that communities are encouraging (and some are requiring) their customers to be mindful of outdoor water use and have put in place programs that restrict outdoor watering to a certain number of days per week. These are generally ongoing restrictions that are intended to reduce waste and stretch water supplies so that there is enough to go around for all the people and businesses in a community.

7. How much water does it take to have a swimming pool?



The average swimming pool takes 18,000-20,000 gallons of water to fill. Pools do not need to be refilled very often. After initially filling your pool you need to add water to it to replace water lost to evaporation, water splashing out, and routine maintenance. Make sure that your pool does not have any leaks and consider using a pool cover when the pool is not in use. During the summer in Texas, pools can lose several inches of water due to evaporation every couple of days (about 120 gallons of water).

To figure out how many gallons of water it takes to fill your pool, use this equation:


Length (in feet) x Width x Average Depth x 7.5 = Gallons of water to fill pool

8. I know about low flow showerheads, xeriscaping, and the best times of days to water plants, but what other things can I do to help stretch our water supply?

Besides the familiar ways of conserving water, you could research and try constructing a rain garden or installing a rainwater collection system as a family project. Many families use this water, unfiltered, to supply lawns and gardens with water. Other families rely solely on rainwater, ditching their wells that have gone dry. The purchase of rainwater harvesting equipment and supplies is tax exempt in Texas. Check with your city and county to see what other tax incentives may be available to you.

9. Water is a precious resource. Why do we waste it?

Most people just don't know any better and do not intend to waste water. By informing yourself and those you know, we will be better off. Water is everywhere and it appears to be a limitless resource; the reality is much different.

 For more information on water issues, or for suggestions on how you can get involved, check out the website for the Texas Living Waters Project at www.texaslivingwaters.org

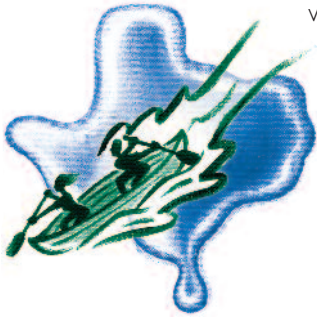


Water for People and the Environment

1. How does water affect my health?

You need water in order to live. Without it, we would dehydrate and die fairly quickly. Two-thirds of our body mass is water. If your local water source has poor water quality, it will affect not only your health, but that of every other living organism in your area and downstream. The quantity and quality of water can have a direct effect on your health. You really are what you drink.

2. How does water affect my family?



Water affects just about every aspect of your family's life—health, wealth, and quality of life. In addition to needing water for drinking, cooking, bathing and many other important uses, we also need it for growing food. Under drought conditions, crop production is down, which drives food prices up, and this affects your pocketbook, and availability of the food you and your family want and need. Beyond your health and wealth, Texas families enjoy many water recreational activities: fishing, boating, swimming, skiing, sailing, kayaking/canoeing, tubing, rafting, and just plain “hanging out at the beach.” In fact, fishing, swimming, and boating are among the top outdoor recreational activities important to Texans. Water quantity and quality can affect all of these activities.

3. How does water affect fish and other wildlife? What are the environmental implications?

Fish and other wildlife need water to survive, just like all living organisms—plants, animals, and microorganisms alike. In addition, wildlife needs water in sufficient quality and quantity. We call this type of water need “environmental flows.” Environmental flows are made up of both “instream flows”—flows in a river or stream—and “freshwater inflows”—the flows of freshwater that make it down the river or stream and into an estuary system. Estuaries are where fresh water and saltwater mix and they are among the most productive natural systems on Earth. Everything in nature is connected, and should be considered as a system. For instance, if we received inadequate rain, certain plants would die or their overall numbers would decline. As a result, plant-eating animals that depend on that particular plant would be affected, as would the omnivores and carnivores that depend on that plant-eating animal for survival. When drought is combined with human impact, like mining aquifers without adequate conservation precautions, water quantity and quality problems are compounded.

WATER WORDS OF THE WISE

“The river is the center of the land, the place where the waters, and much more, come together. Here is the home of wildlife, the route of explorers, and recreation paradise....these streams are more valuable than ever”.

— Tim Palmer, 1986 —

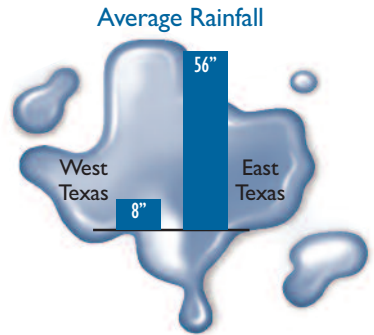
AQUATIC LIFE & WATER IN WEST TEXAS



In West Texas, the number of desert spring fishes like the Comanche Spring Pupfish, Leon Springs Pupfish, Pecos Gambusia, and Big Bend Gambusia are declining and many are listed as Endangered Species. One reason for their decrease includes habitat loss from declining spring flows. Human impact appears to be taking its toll as more water is being pumped from aquifers than being replaced by rainfall.

West Texas sees an average rainfall of 8 inches a year compared to East Texas that gets 56 inches annually.

According to Linda Campbell, author of "Endangered and Threatened Animals of Texas," this continued mining of the aquifers could eventually cause the demise of spring systems throughout West Texas, and with them the extinction of a whole array of unique fishes, aquatic plants, and animals. If aquatic life cannot be sustained this could very well be an indication that our water quality and quantity are in jeopardy.



4. How much water does wildlife need anyway?

It is important to remember that prior to humans coming along, wildlife had ALL of the water. Fortunately, there is enough water for them to share with us. As humans use more and more water there WILL BE FEWER fish and wildlife.

The amount of water is not the only factor that impact fish and wildlife. Many species rely on the timing of instream flows or freshwater inflows to estuaries to know when it is time to reproduce. Dams and increased water use alter those natural patterns and species may be adversely affected by those changes.

In 2007, the Texas Legislature established a process to help protect water for the environment with Senate Bill 3. The resulting process attempted to address three key issues:

1. How much water is needed (and when it is needed) to keep the state's rivers and coastal estuaries healthy?
2. How much of that water, if available, should be protected. That means that water would not be available for new water rights.
3. If adequate water for healthy rivers and estuaries is not currently available, how do we go about making it available so we can pass a rich natural heritage along to future generations of Texans?

Although this process is a step in the right direction to protect water for the environment, the final protections adopted by the TCEQ are inadequate to maintain a sound ecological environment for many rivers and bays. Senate Bill 3 does recognize the need to reconsider the level of flow protections periodically to incorporate new information.

 Visit the Texas Living Waters Project website at www.texaslivingwaters.org for up-to-date information.

5. What happens to the wastewater from my home once it goes down the drain?

This depends on what kind of water system you are on and where you live. Cities tend to have wastewater treatment plants. After wastewater is treated (or cleaned) at a wastewater treatment plant, it is known as effluent. The quality of the effluent (treated wastewater) varies city by city. It is not cleaned completely and we rely on the river, stream, or body of water that the effluent is released into to finish the job of cleaning it. This is why it is so important to have sufficient flow to maintain healthy stream and river systems. A healthy flowing river does a better job of cleaning effluent.



An area of concern and research is undetected chemicals that pose a risk to human health have been discovered in water supplies across the globe. These include pharmaceuticals, personal care products (such as fragrances in lotions and soaps and the ultraviolet filters in sunscreens), herbicides, and pesticides.

6. Why can't we just get water from the oceans and desalinate it?

Desalination (desal) is the removal of mineral and/or salts from saline water. Different sources of water have varying amounts of minerals that may make it unsuitable for human consumption. Cost is the main impediment to desalination. One of the biggest costs in desalination is energy. It takes a lot of energy to push the saline (salty) water through the membranes required to remove salt from the water and make it drinkable. While advancements in membrane technology and brine disposal have made desalination more affordable, it is still the most expensive water supply option.

Keep in mind, that when making the decision to go with desalination, you need to consider the possible negative environmental impacts of brine disposal. Brine is the super salty byproduct of the desalination process. Generally speaking, for a seawater desalination plant, the farther out to sea (or in the case of Texas, the Gulf of Mexico) you dispose of the brine the better, because the impact of the brine will be less in an area with high salt concentration. If the brine is disposed of closer to shore, in a bay for example, you run the risk of upsetting the delicate freshwater/saline water balance needed for the production of certain marine organisms such as shrimp and the smaller organisms that serve as their food supply. Transporting the brine farther out in the water for disposal (through a pipeline, for example) does increase the cost of disposal, however, which may affect the economics of doing desalination.

Seawater is not the only possibility for desalination. Our state has large quantities of brackish groundwater and some brackish surface water—water that is considered to be too saline to qualify as drinking water, but much less saline than seawater. There are several projects in operation in various parts of Texas that treat this brackish water to drinking water standards and more projects getting underway, or are on the drawing table. Because of the much lower saline content of this brackish water, it is more amenable to treatment and potentially less costly to treat. Brine disposal remains a significant issue that must be addressed even in treating inland brackish water, however. While desalination may make sense in some communities, the first and most economical source of water that should be considered is to use the water that you already have as efficiently as possible. Water conservation makes sense.

Rainwater Harvesting

A growing number of urban and rural Texans are also getting a portion of their water through rainwater collection.

1. What are rainwater catchment/containment/collection systems? Is it safe to drink water from them?

Rainwater catchment systems are constructions of storage tanks, PVC pipes, and guttering used to collect water off of rooftops. The water will be as pure and clean to drink as your rooftop, collecting pipes and storage tanks. Just be aware that small wildlife like squirrels may be able to get inside the tanks unless you have protective screens. Most families use the rainwater they collect for watering lawns and gardens, rather than for drinking. To use rainwater for human consumption you will need a purification system.

2. What are the top four things I should know before I start collecting rain?

Top four tips for someone considering rainwater harvesting:

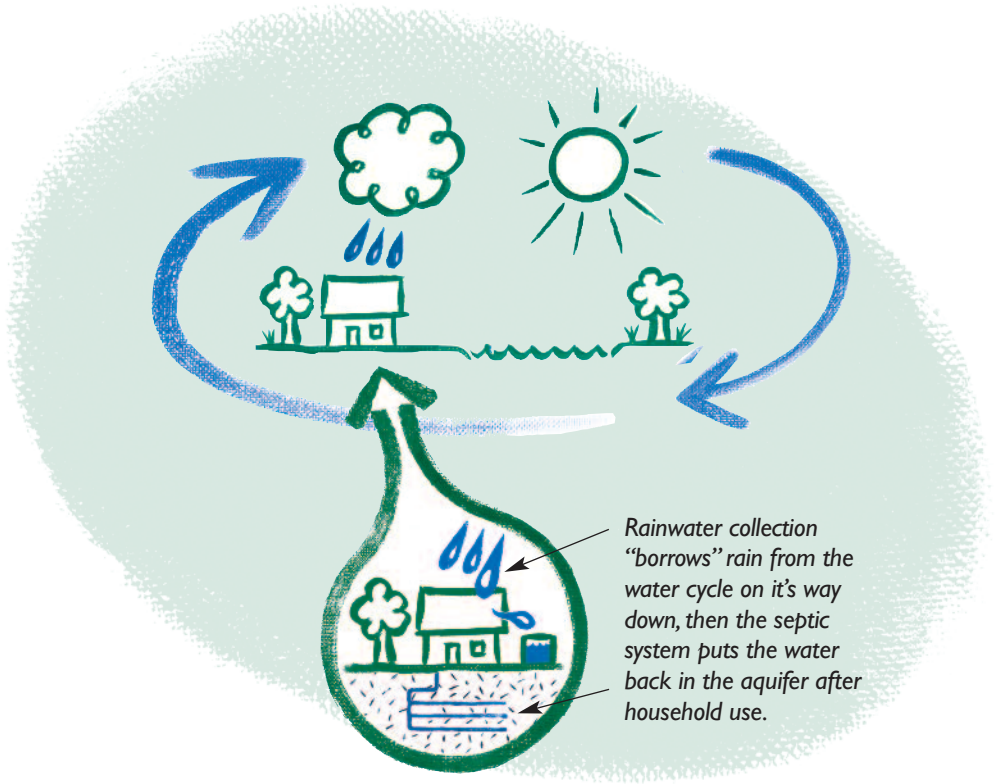
1. Decide what you are going to do with it (i.e. water yard, drink, laundry, etc.).
2. Determine how much water you can collect. About 600 gallons of water will be collected from a one-inch rain on a 1,000 square foot roof.
3. Be aware that installing a rainwater system for drinking water is more expensive and requires more maintenance than one just for irrigation.
4. If you plan to use soaker hoses, you may want to add a pump so water will exit the hose with enough force.

3. What's the biggest cost associated with rainwater collection?

Cost of storage, especially if you are not using the water for human consumption. Tanks are generally the greatest expense for collection systems and range from 50 cents per gallon for a fiberglass tank to \$4.00 per gallon for a welded steel tank.

4. If a large number of folks are using rainwater containment systems wouldn't this reduce the amount of water available to flow into rivers and streams?


"A good way to think about a rain collection system is to think of it as a way of borrowing water on its way to the ground," explains Larry Foster of Rainwater Collection Over Texas. "In Texas most rain collection systems serve residences that have septic fields as well, thus, any water used in the home is 'borrowed' only until it enters the aquifers via the septic field. For larger commercial systems or governmental systems, e.g. the J.J. Pickle School at The University of Texas, the rain collected and used for cooling towers is water NOT pulled from the rivers, streams, and lakes in the first place. Where rain is used for irrigation and landscaping, as with septic systems, it returns to the soil as normal runoff and thus here again we are only 'borrowing' the water on its way to the streams and rivers."



4. Where do I go for more information on rainwater collection?

Although there are many sources, the following publications are good resources.

1. *Rainwater Collection For the Mechanically Challenged* by Suzy Banks with Richard Heinichen, Tank Town Publishing, Dripping Springs TX, Cost is about \$20.
2. *Texas Manual on Rainwater Harvesting, Third Edition*, Texas Water Development Board It's free, and can be downloaded from https://www.twdb.texas.gov/publications/brochures/conservation/doc/RainwaterHarvestingManual_3rdedition.pdf.
3. *Rainwater Harvesting* by Russell A. Persyn, Dana Porter, and Valeen Silvy, Texas AgriLife Extension. Free to download or visit www.agrilifebookstore.org to purchase a printed version for \$4.50.

 Rainwater collection supplies can be purchased throughout the state. For a list of Houston area suppliers, visit <http://galvbay.org/root/htdocs/galvbay/httdocs/wp-content/uploads/2014/05/Distributor-List.pdf>.



Additional copies of this book may be obtained from Sierra Club, Lone Star Chapter by calling 512-477-1729, e-mailing lonestarchapter@sierraclub.org. Visit our website at <http://sierraclub.org/texas>.

This document is also available online at www.texaslivingwaters.org.



