TCEQ REGULATORY GUIDANCE
Texas Groundwater Protection Committee
RG-347 ● Revised April 2021

Landowner's Guide to Plugging Abandoned Water Wells

Introduction 2
What Are the Hazards Associated with Abandoned Wells? 2
Personal Safety 2
Groundwater Contamination 3
When Is a Well Considered Abandoned? 3
How Can I Report an Abandoned Well? 3
What Are My Options if I Have an Abandoned Well? 4
Who Should Plug an Abandoned Well? 4
How Do I Plug My Own Well? 5
Steps to Follow Before Plugging Your Well 5
Step 1. Understand the regulations about plugging an abandoned water well. 6
Step 2. Obtain the water well report. 6
Step 3. Determine the depth of the well and height of the standing water in the well. 6
Plugging Materials 7
Steps to Follow in Plugging Your Well 8
Step 4. Remove all obstructing materials from the well. 8
Step 5. Disinfect the well by adding household bleach 8
Step 6. Remove as much casing from the borehole as possible. 9
Step 7. Fill the well with plugging materials. 9
Step 8. Complete and submit a state well plugging report. 13
How do I Calculate the Amount of Plugging Material I Will Need? 14
Making the Calculation 15
What are the Formulas for Calculating Volume? 15
How do I Calculate the Volume of Disinfectant? 16
Making the Calculations 17
Step 1. Measure the depth of the well and height of the standing water in the well. 17
Step 2. Calculate the amount of liquid chlorine product needed to disinfect the well. 18
Step 3. Apply the disinfectant. 19
Glossary of Selected Terms 20
Example of a Plugging Report 21
Well Plugging Resources 22
State Agencies, Programs, and Resources 22
Texas Department of Licensing and Regulation (TDLR) 22
Texas Commission on Environmental Quality (TCEQ) 22
Texas Groundwater Protection Committee (TGPC) 22
Texas Water Development Board (TWDB) 22
Texas State Soil and Water Conservation Board (TSSWCB) 22
Texas AgriLife Extension Service (TAES) 22
About Groundwater Conservation Districts 23
Publications 23
The Texas Groundwater Protection Committee 23

TCEQ is an equal opportunity employer. The agency does not allow discrimination on the basis of race, color, religion, national origin, sex, disability, age, sexual orientation, or veteran status. In compliance with the Americans with Disabilities Act, this document may be requested in alternate formats by contacting TCEQ at 512-239-0028, fax 512-239-4488, or 1-800-RELAY-TX (TDD), or by writing PO Box 13087, Austin TX 78711-3087. We authorize you to use or reproduce any original material contained in this publication — that is, any material we did not obtain from other sources. Please acknowledge TCEQ as your source.
Printed on recycled paper
www.tceq.texas.gov/goto/rg-347.html
How is our customer service? tceq.texas.gov/customersurvey

Introduction

Water is our state's most precious resource. It is crucial to all aspects of our economy and society. Groundwater derived from our 31 aquifers provides over half of the water used in the state. Protecting the quality of this vital resource is the responsibility of all Texans.

Since the 1800s, groundwater has been pumped through water wells. Over the years, thousands of wells around homes, farms, industrial sites, and urban areas have been abandoned without being properly plugged. Not only can these abandoned wells become potential conduits for groundwater-contamination, but they can also be a safety hazard for humans and animals. Plugging an abandoned well takes time and money, but these wells are a threat that cannot be ignored.

Texas law makes the landowner responsible for plugging abandoned wells. The landowner is also held responsible for injury or pollution related to the abandoned well. This publication is provided to help landowners understand how to plug a well properly. Before you begin the process of plugging a well, it is highly recommended that you seek advice from your local Groundwater Conservation District (GCD), a licensed water well driller or pump installer in your area, or the Well Driller/Pump Installer/Abandoned Well Referral Program of the Texas Department of Licensing and Regulation (TDLR).

Abandoned wells are regulated by TDLR and local GCDs through the Texas Occupations Code, sections 1901.255 and 1901.256 [1]. Well Plugging Information, starting on page 22 provides phone numbers and websites where you can find additional information.

What Are the Hazards Associated with Abandoned Wells?

Personal Safety

The hazard to personal safety that an unmarked and uncovered well presents is obvious to anyone who has ever encountered one. Accidents in which people or animals fall into abandoned wells have occurred, and they continue to occur. Even when a well is covered, the soil around it may be unstable and cave in. The liability associated with abandoned wells has not been fully tested in Texas. A landowner with an abandoned well should ask: "Do I want to be the first legal test case in Texas?"

[1] www.tdlr.texas.gov/wwd/wwdlaw.htm

Groundwater Contamination

An abandoned well is a direct conduit from the surface to the aquifer below. Contaminants that enter the well are introduced directly into the aquifer with no opportunity for natural filtration by soils or geologic materials. If a contamination incident involves a concentrated chemical, the potential for reaching health-threatening levels in the underlying aquifer is high. Just a small amount of chemicals (e.g., pesticides, solvents, and petroleum products) can contaminate millions of gallons of groundwater and spread out under acres of land.

Some contaminants break down very slowly and may affect the groundwater for decades. This puts other wells in the aquifer at risk, particularly those that are close by. Deterioration of the well casing can also allow the commingling of two chemically different aquifers.

When Is a Well Considered Abandoned?

According to state law a well is abandoned if it is not in use.

A well is **in** use if:

- The well is not a deteriorated well and contains the casing, pump, and pump column in good condition.
- The well is not a deteriorated well and has been capped.
- The water from the well has been put to an authorized beneficial use, as defined by the Texas Water Code.
- The well is used in the normal course and scope and with the intensity and frequency of other similar users in the general community.
- The owner is participating in the Conservation Reserve Program authorized by Sections 1231-1236, Food Security Act of 1985 (16 U.S.C. Sections 3831-3836), or a similar governmental program.

If you are uncertain whether your well is legally abandoned, consult a licensed water well driller, the Well Driller/Pump Installer/Abandoned Well Referral Program of the TDLR, or the local GCD (see page 22).

How Can I Report an Abandoned Well?

The TDLR Well Driller/Pump Installer/Abandoned Well Referral Program webpage[2] provides a wealth of useful information, including:

- Reporting an abandoned well online.

[2] www.tdlr.texas.gov/wwd/wwd.htm

- Reviewing the status of an abandoned well complaint.
- A checklist that can be used to determine whether a well is abandoned.
- The definition of an abandoned or deteriorated well.
- A link to Frequently Asked Questions (FAQs) about abandoned wells (complete with example photos).

What Are My Options if I Have an Abandoned Well?

There are three different courses of action that can be taken to eliminate the hazards of an abandoned well:

- Return the well to an operable state by making sure the casing, pump, and pump column are in good condition and the well is sealed at the surface to prevent surface water or contaminates from entering the well.
- Cap the well to prevent surface water or contaminants from entering it. The cap must be able to support 400 pounds and prevent easy removal by hand. For more information, see the Texas AgriLife Extension Service publication L-5490, Capping of Water Wells for Future Use[3], or call 888-900-2577).
- Plug the well from the bottom to the top with bentonite chips, bentonite grout, or cement. Large-diameter wells can also be filled with clay-based soils, compacted clay, or caliche. Details on what you should do prior to plugging your well, as well as on the well plugging operation itself, are provided on page 5 under "How Do I Plug My Own Well?"

Who Should Plug an Abandoned Well?

As the landowner, you may do the work necessary to plug an abandoned well on your property or hire a licensed well contractor to do the work for you. If you plan to do the work yourself, or if you have any questions about plugging your well, contact the Well Driller/Pump Installer/Abandoned Well Referral program of the TDLR or your local GCD. Well construction and plugging specifications[4] can be found on TDLR's website.

Request a state well plugging report form from TDLR (see page 21 "Example of a Well Plugging Report") or download it from the TDLR forms webpage[5]. Within 30 days after the well is plugged; you must

[3] www.agrilifebookstore.org
[4] www.tdlr.texas.gov/wwd/wwdspecs.htm
[5] www.tdlr.texas.gov/wwd/wwdforms.htm

enter the plugging report online or send a copy of the completed form to TDLR. You must also send a copy to the local GCD (see page 22).

To enter your report online, you will need a login name, a password, and GPS coordinates (latitude and longitude). Call TDLR (512-334-5540) to obtain your landowner temporary license number and PIN then go to the Texas Well Report Submission and Retrieval System website[6], to enter your plugging report.

Some areas of Texas have assistance programs for the plugging of abandoned water wells. Contact your local GCD or Texas State Soil and Water Conservation Board representative to see if an assistance program is available in your area.

How Do I Plug My Own Well?

Well plugging may appear to be a simple process—just dump something into the open well until it's full. That might take care of the safety hazard—people, animals and children could no longer fall into the well. However, unless you use the right plugging materials and methods, you will end up with a poorly sealed well, one that will continue to allow contaminants to enter the groundwater.

To do the job right, you must use the correct plugging materials and install them properly, as per state regulations and any local GCD specifications. State regulations outline the procedures and materials to use for plugging abandoned wells and are reflected in this document. Find these standards in Texas Administrative Code, Title 16, Section 76.104[7] at TDLR's website.

You can also obtain these rules by contacting the organizations listed in "Well Plugging Information," later in this document. If the well is located within a GCD, consult with the district to determine if they have any additional specifications.

Steps to Follow Before Plugging Your Well

You can hire a licensed water well driller or pump installer to plug an abandoned well. In some cases, this is recommended because a well contractor has the equipment needed for the job and an understanding of local conditions that affect how the well should be properly plugged. As the landowner, you may also plug an abandoned well yourself. Before beginning the plugging operation, take the following three steps.

[6] www.twdb.texas.gov/groundwater/data/drillersdb.asp
[7] www.tdlr.texas.gov/wwd/wwdrules.htm

Step 1. Understand the regulations about plugging an abandoned water well.

Contact your local GCD, or a licensed well contractor to help you understand the local and state regulations for water well plugging. Learning about the rules and regulations will also help you decide if you want to plug your well yourself or hire a licensed well contractor.

Step 2. Obtain the water well report.

Since 1965, water well drillers have been required to submit water well reports to the State of Texas. The water well driller's report includes details on your well's construction and the local geology. If you don't have this report, you may be able to obtain it from one of the following:

- Water Well Report Viewer[8]
- Texas Water Development Board's State of Texas Well Report Submission and Retrieval System[9], 512-936-0871
- Submitted Drillers Reports (SDR) Database[10], 512-334-5540
- Texas Alliance of Groundwater Districts (TAGD)[11], 512-596-3101

If you are unable to obtain the report, you should hire a licensed well contractor to plug the well for you—they have the tools and experience to properly assess your abandoned well.

If your water well report indicates that the well was drilled through a confining layer that separates two different aquifers, you should have the well plugged by a licensed well contractor—they will be able to plug this special type of well safely and correctly.

Licensed well contractors will also be familiar with completing and submitting the required paperwork after the well is plugged.

Step 3. Determine the depth of the well and height of the standing water in the well.

If you know the details of your well's construction and the local geology from your water well driller's report, or you have been able to measure the depth of the well and the height of standing water in the well on your own, you can follow the well plugging steps outlined below.

Take accurate measurements (not estimates) of the depth of the well and height of standing water in the well. This will allow you to correctly calculate

[8] www.tceq.texas.gov/gis/waterwellview.html
[9] www.twdb.texas.gov/groundwater/data/drillersdb.asp
[10] www.twdb.texas.gov/groundwater/data/drillersdb.asp
[11] www.texasgroundwater.org

the volume of the well and the volume of the water in the well. These volumes are needed for determining the correct amounts of disinfection and plugging materials.

Have extra disinfection and plugging material on hand, in case there were any errors in the measurements or calculations. Refer to "How do I Calculate the Amount of Plugging Material I Will Need," on page 14, "What are the Formulas for Calculating Volume," page 15, and "How do I Calculate the Volume of Disinfectant I Will Need," on page 16, for more information.

Plugging Materials

You can use several materials to plug an abandoned well. These materials form an impermeable plug that prevents water flow. These materials include cement, bentonite, and bentonite grout.

- Cement. A Portland or construction cement mixture of not more than seven gallons of water per 94-pound sack of dry cement, or a cement slurry that contains cement along with bentonite, gypsum, or other additives, mixed to the manufacturer's recommendations.
- Bentonite. A sodium hydrous aluminum silicate clay mineral (montmorillonite) commercially available in powdered, granular (chips), or pellet form, which is mixed with potable (drinkable) water and used for a variety of purposes, including to stabilize borehole walls during drilling, to control potential or existing high fluid pressures encountered during drilling below a water table, and to provide a seal in the annular space between the well casing and the borehole wall.
- Bentonite Grout. A fluid mixture of sodium bentonite and potable water mixed at manufacturer's specifications to a slurry consistency that can be pumped through a pipe (tremie tube) directly into the annular space between the casing and the borehole wall. Its primary function is to seal the borehole in order to prevent the subsurface migration or communication of fluids.

Bentonite has unique characteristics when used as a plugging material. The clay swells to about 10 times its original size when in contact with water. The swollen clay forms a dense, virtually-impermeable putty—water can take up to 80 years to penetrate one (1) inch of swollen bentonite.

Bentonite grout may not be used if a water zone contains chlorides above 1,500 parts per million (ppm) or if hydrocarbons are present. Bentonite also requires a two-foot-thick cement cap, which acts as an atmospheric barrier to prevent the clay from drying out.

Gravel is sometimes used to fill the bottom of certain types of wells. Local soils can also be used for the upper four feet of the well to complete the plugging operation. Clay-based soils can be used to plug large-diameter wells; however,

you must obtain a variance from TDLR before using clay-based soils or gravel to plug small-diameter wells.

Landowners who wish to do their own work should consider using coarse-grade bentonite chips or pellets (average size of 3/8 to 3/4 inches). The chips or pellets are easy to handle and are less likely to form a bridge within the well casing. If a bridge forms, the well will not plug properly (see Figure 4). This mistake would be expensive, requiring that the borehole be bored out and the plugging procedure repeated.

Steps to Follow in Plugging Your Well

Step 4. Remove all obstructing materials from the well.

It is critical that fill materials do not slump or settle; therefore, obstructions that may cause incomplete filling of the voids must be removed. Remove the pump, pump rods, pipes, wiring, any other equipment, and as much trash as possible from the well.

Remove floating debris, such as wood staves. One method you can use to remove debris is flushing. If water is pumped into bottom of the well, floating debris will move to the top as the well fills with water. Flushing may not be possible with larger-diameter wells, due to the volume of water required. In any event, you must remove as much obstructing material as possible from the well before plugging. If the obstruction cannot be removed, you must submit a variance request form [12] to TDLR.

Step 5. Disinfect the well by adding household bleach.

It is recommended that all wells containing standing water be disinfected prior to plugging the well to kill existing microorganisms. Disinfection can be accomplished by adding liquid chlorine product (do not use any scented or solid products!) at the rate of one (1) gallon of bleach for every 500 gallons of water—this is equivalent to a "shock" chlorination concentration of 100 parts per million chlorine.

The chlorination process ensures that disease-causing microorganisms are not sealed in the aquifer. Disinfect the well for eight (8) to ten (10) hours prior to plugging. For more information, refer to "How do I Calculate the Amount of Disinfectant I Need," on page 16.

[12] www.tdlr.texas.gov/wwd/wwd023.pdf

Step 6. Remove as much casing from the borehole as possible.

State plugging specifications require that you remove all removable casing from the well. You must attempt to pull the casing out of the well. However, if the casing cannot be pulled out, you are required to cut it below the ground surface (i.e., "plowable" depth), or as far below the ground surface as possible.

Step 7. Fill the well with plugging materials.

Plugging procedures vary depending on which of the following categories you well fall under:

- Large-diameter wells less than100 feet deep.
- Large-diameter wells more than 100 feet deep.
- Small-diameter wells with less than100 feet of standing water.
- Small-diameter wells with more than 100 feet of standing water.

Large-diameter wells

Large-diameter wells are defined as being 36 inches or more in diameter.

Large-diameter wells less than 100 feet deep

Completely fill the well from the bottom to the ground surface with clay-based soils, compacted clay, caliche, or cement (see Figure 1), or with bentonite chips or bentonite grout (cement cap required; see Figure 2).

- You may not use bentonite grout or clay if a water zone contains chlorides above 1,500 ppm or if hydrocarbons are present.
- If using clay-based soils, compacted clay, or caliche, mound the plugging material above the ground surface to compensate for settling.
- If you use bentonite chips, alternate pouring in equal amounts of chips and water to properly hydrate the bentonite as the well is filled.
- If using bentonite grout or cement, completely pressure-fill the well by using a tremie tube (see Figure 3). When the well is pressure-filled with a tremie tube, some plugging material may also enter any annular space that may exist outside of any non-removable casing.
- If using bentonite chips or bentonite grout, the plug must be capped with cement at least two feet thick. The cement cap acts as an atmospheric barrier (see Figure 2) and can be positioned in either of two ways:
    - It can be set at the ground surface.
    - It can terminate within four feet of the ground surface and then be topped off with local soils. In this case, you must mound the local soils above the ground surface to compensate for settling.

Large-diameter wells more than 100 feet deep

Using a tremie tube, completely pressure-fill the well with bentonite grout or cement from the bottom of the well to the ground surface (see Figure 3). When the well is pressure-filled with a tremie tube, some plugging material may also enter any annular space that may exist outside of any non-removable casing.

- Bentonite grout may not be used if a water zone contains chlorides above 1,500 ppm or if hydrocarbons are present.
- Alternatively, pressure-fill the well with cement to within 100 feet of the ground surface, and then finish the plugging operation by following the directions above for a large-diameter well that is up to 100 feet deep.

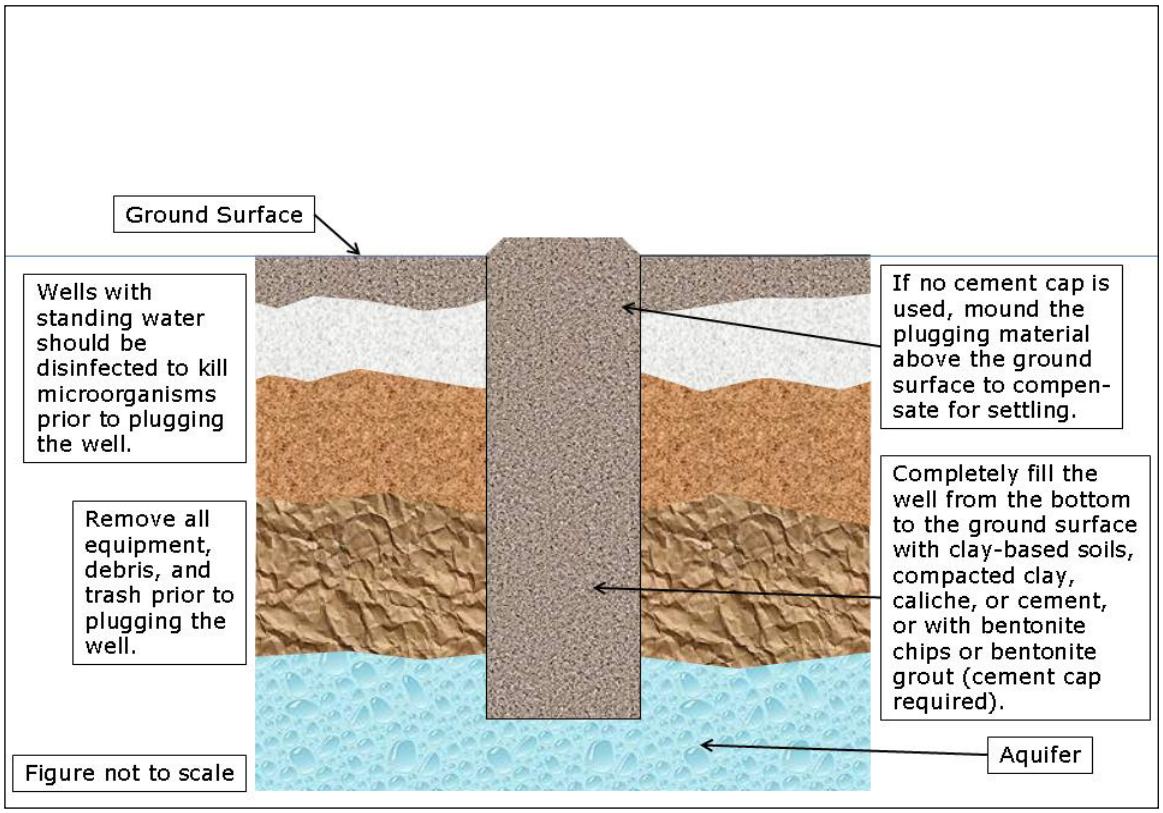

Figure 1. Plugged Large-Diameter Well

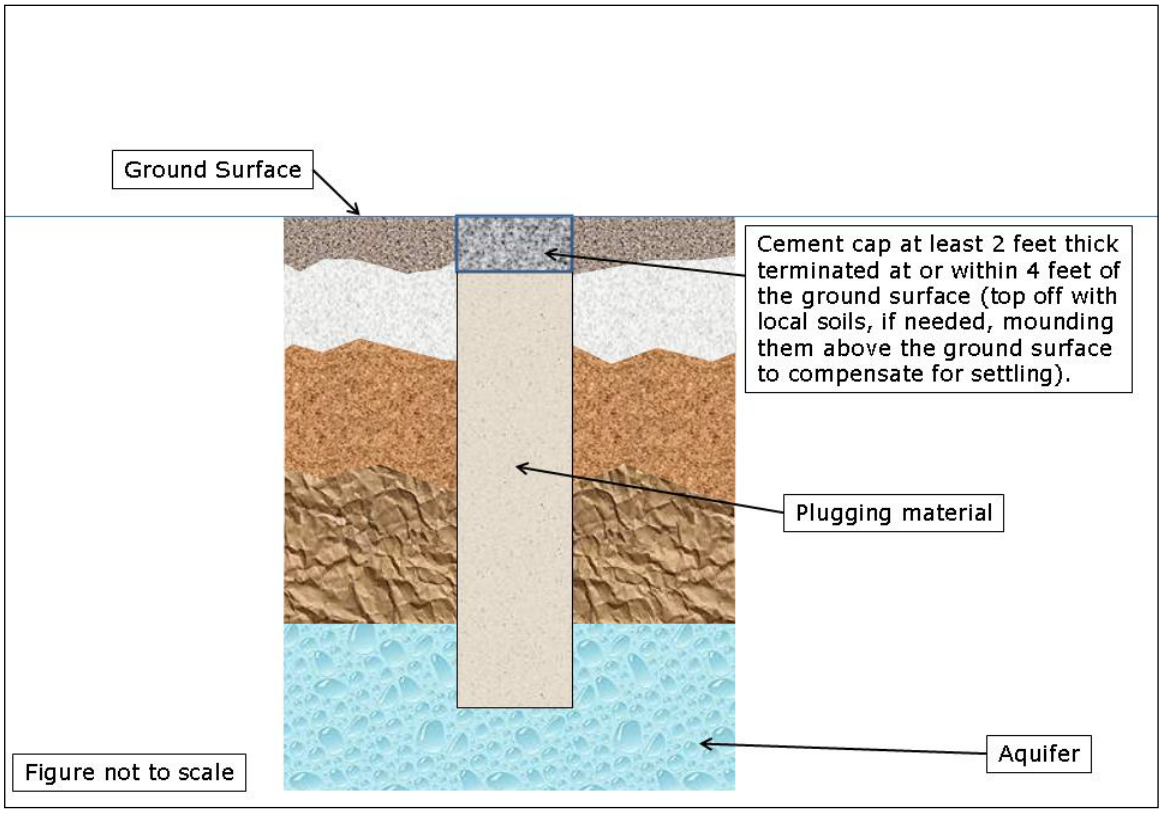

Figure 2. Plugged Well Using Bentonite Chips or Bentonite Grout

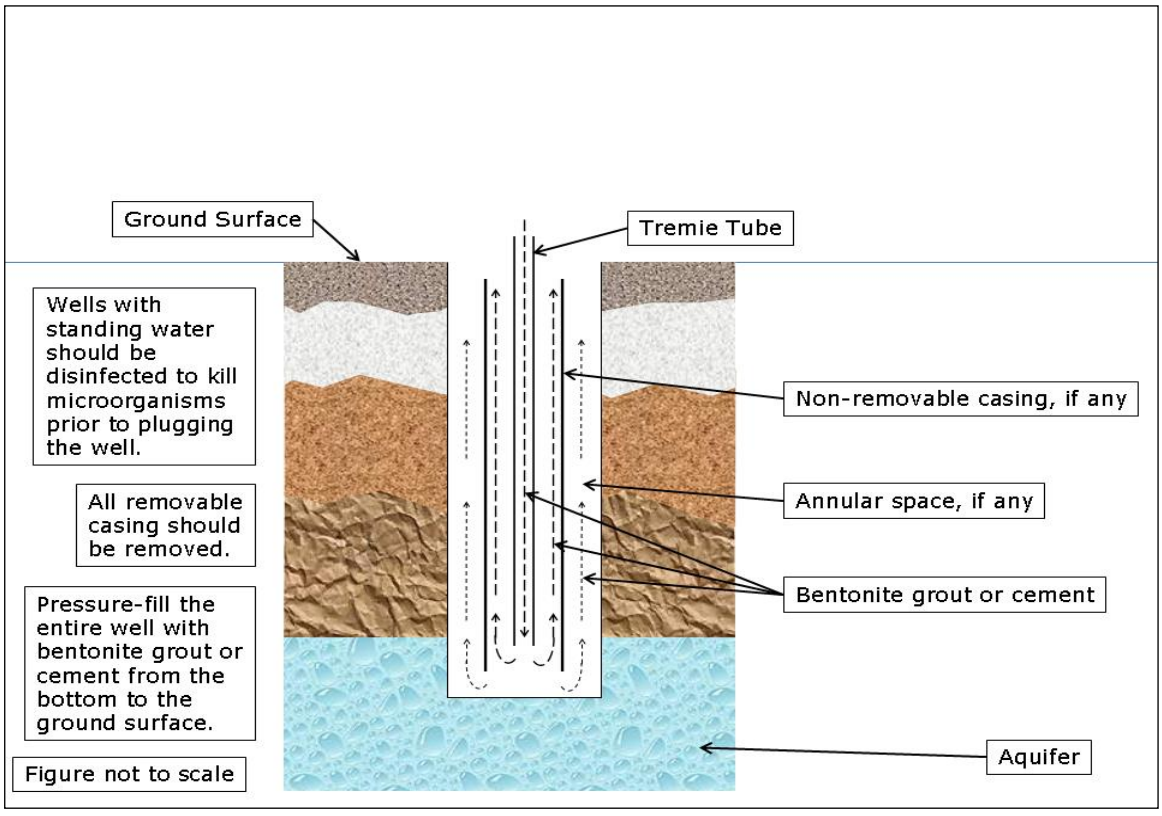

Figure 3. Plugging a Well with Bentonite Grout or Cement Using a Tremie Tube

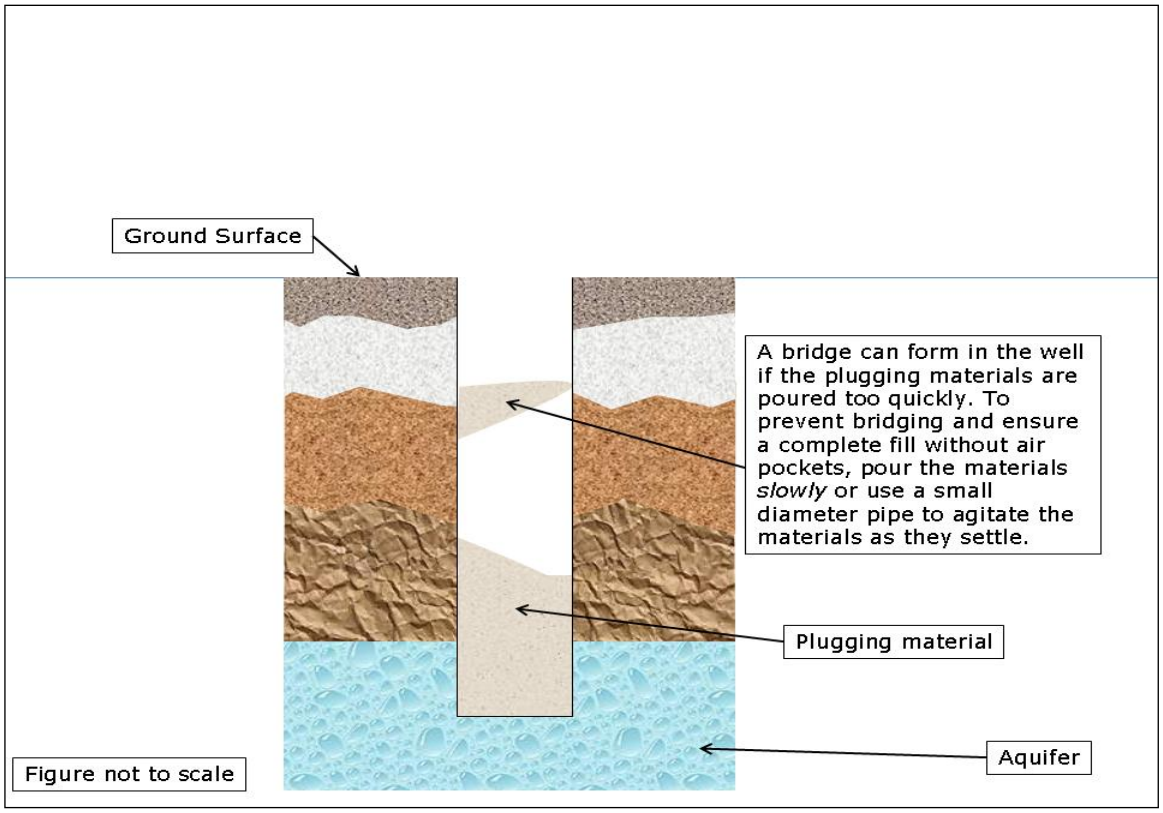

Figure 4. Bridging Within a Small-Diameter Well

Small-diameter wells

Small-diameter wells are defined as being less than 36 inches in diameter. A bridge can form in a small diameter well if the plugging materials are poured too quickly (see Figure 4). To prevent bridging and ensure a complete fill without air pockets, pour the materials *slowly* or use a small-diameter pipe to agitate the materials as they settle. In addition, floating bentonite fines can also contribute to a bridging situation within a small-diameter hole—these fines can be separated from the chips by using a screen.

Small-diameter wells with up to 100 feet of standing water

Completely fill the well with bentonite chips, bentonite grout, or cement from the bottom of the well to the ground surface.

- You may not use bentonite grout if a water zone contains chlorides above 1,500 ppm or if hydrocarbons are present.
- If using bentonite chips, alternate pouring in equal amounts of chips and water in order to properly hydrate the bentonite as the well is filled.
- If you use bentonite grout or cement, completely pressure-fill the well by using a tremie tube (see Figure 3). When the well is pressure-filled with a tremie tube, some plugging material may also enter any annular space that may exist outside of any non-removable casing.

- If using bentonite chips or bentonite grout, the plug must be capped with cement at least two feet thick. The cement cap acts as an atmospheric barrier (see Figure 2), and can be positioned in either of two ways:
  - It can be set at the ground surface.
  - It can terminate within four feet of the ground surface and then be topped off with local soils. In this case, you must mound the local soils above the ground surface to compensate for settling.

Small-diameter wells with more than 100 feet of standing water

Using a tremie tube, completely pressure-fill the well with bentonite grout or cement from the bottom of the well to the ground surface (see Figure 3).

- Bentonite grout may not be used if a water zone contains chlorides above 1,500 ppm or if hydrocarbons are present.
- If using bentonite grout, the plug must be capped with cement at least two feet thick. The cement cap acts as an atmospheric barrier (see Figure 2), and can be positioned in either of two ways:
  - It can be set at the ground surface.
  - It can terminate within four feet of the ground surface and then be topped off with native soils. In this case, you must mound the local soils above the ground surface to compensate for settling.

Step 8. Complete and submit a state well plugging report.

Within 30 days after the well is plugged, you must enter the plugging report online or send a copy of the completed form to TDLR. To enter your report online you will need a log-in name, a password, and GPS coordinates (latitude and longitude). Call TDLR (the phone number is listed in the next section) to obtain your log-in name and password, and then go to the Texas Well Report Submission and Retrieval System[13], to enter your plugging report. You can either order or download a plugging report form[14] from TDLR and then mail the completed form to TDLR at this address:

Water Well Driller and Pump Installer Program
Texas Department of Licensing and Regulation
P.O. Box 12157
Austin TX 78711
512-334-5540

If the well is located within a GCD (see page 22) you must also comply with that GCD's reporting requirements. You can find an example of a completed state well plugging report form in "Example of a Well Plugging Report" on page 21.

[13] www.twdb.texas.gov/groundwater/data/drillersdb.asp
[14] www.tdlr.texas.gov/wwd/wwdforms.htm

Some areas of Texas have assistance programs for the plugging of abandoned water wells. Contact your local GCD (see page22) or a Natural Resources Conservation Service representative[15] to see if an assistance program is available in your area.

How do I Calculate the Amount of Plugging Material I Will Need?

Use Table 1, below, to help you calculate the amount of material (cement or bentonite chips) that you will need to plug a well. For example:

- For a well with a diameter of two inches, one (94-pound) sack of cement will plug 50.3 linear feet, while one (50-pound) bag of bentonite chips will plug 31.3 linear feet.
- For a well with a diameter of 16 inches, one sack of cement will plug one linear foot, while one bag of bentonite chips will plug 0.48 linear feet.

Table 1. The amount of plugging material required, based on the diameter of the well

Well or hole diameter (inches)[1]	Cement – Linear feet of well that one 94-lb. sack of cement will plug[2]	Bentonite chips – Linear feet of well that one 50-lb. bag of bentonite chips will plug[3]
2	50.3	31.3
3	28.8	13.9
4	16.2	7.9
5	10.4	5.0
6	7.2	3.5
7	5.3	2.6
8	4.0	2.0
9	3.2	1.5
10	2.6	1.3
12	1.8	0.86
14	1.3	0.63
16	1.0	0.48
18	0.8	0.38
20	0.6	0.31
24	0.4	0.21
36	0.2	0.097
40	0.16	0.078
44	0.13	0.065
48	0.11	0.054

[15] https://offices.sc.egov.usda.gov/locator/app?state=TX

Notes:

1. If the measured well diameter falls between two listed diameters, use the larger diameter to ensure that adequate amounts of plugging material.
2. The mixing ratio for the cement slurry is seven gallons of water for each 94-pound sack of cement.
3. Use coarse-grade bentonite chips (average size of 3/8 to 3/4 inches).

Making the Calculation

To calculate the number of 94-pound sacks of cement (or 50-pound bags of bentonite chips) you will need to plug a well, divide the depth of the well by the linear feet indicated in Table 1 for that well diameter. For example, if a well is four inches in diameter and 100 feet deep, and you are plugging it with cement:

- 100 ft ÷ 16.2 ft = 6.17 sacks of cement

If you are plugging the well with bentonite chips:

- 100 ft ÷ 7.9 ft = 12.66 bags of bentonite chips

What are the Formulas for Calculating Volume?

The following formulas are provided for reference, if needed.

Area of a Circle = $\pi \times r^2$

Volume = area × depth

Volume of a Circular Cylinder = $\pi \times r^2 \times d$

Where:

π : approximately 3.1416
r: radius of the circle
d: depth

How do I Calculate the Volume of Disinfectant?

Before conducting plugging operations, disinfect or "shock" chlorinate the well, to kill existing microorganisms in the well water. Use Table 2, below, to help calculate the volume of liquid chlorine product needed to disinfect a well.

Table 2. Volume of chlorine required, based on the diameter of the well

Well or hole diameter (inches)[1]	Volume of standing water in the well (gallons per linear foot of well)	Volume of liquid chlorine product required (ounces per linear foot of well)[2,3]	Volume of liquid chlorine product required (approx. std. measure per linear foot of well)[2,3,4]
2	0.16	0.041	1/4 t
3	0.37	0.094	1/2 t
4	0.65	0.165	1 t
5	1.02	0.259	1 1/2 t
6	1.50	0.381	2 1/4 t
7	2.00	0.508	1 T
8	2.61	0.660	1 T + 1 t
9	3.30	0.838	1 T + 2 t
10	4.08	1.036	2 T + 1/4 t
12	5.88	1.490	3 T
14	8.00	2.031	1/4 C
16	10.44	2.650	1/3 C
18	13.22	3.354	1/3 C + 1 T
20	16.32	4.145	1/2 C
24	23.50	5.966	3/4 C
36	52.88	13.430	1 1/4 C
40	65.28	16.579	2 C
44	78.99	20.061	2 1/2 C
48	94.00	23.873	3 C

Notes:

1. The listed diameters are for cylindrical wells only.
2. Typical 5.25–6.00% liquid chlorine product. Some common product brands are Clorox, Purex, Sno-White, Kandu, and Topco. Do not use any scented or solid products!
3. Added volume produces an equivalent concentration of 100 parts per million of chlorine per linear foot of water.

Making the Calculations

Step 1. Measure the depth of the well and height of the standing water in the well.

If you are unable to obtain the water well report for your well, you can measure the depth of the well and height of the standing water in the well using the following procedure.

1. Obtain a measuring tape with a metal-sounding weight ("popper"), or an electrical water level measuring device ("e-line") (a weighted fishing line will work too), from a water well supply company or an environmental equipment supply company.
2. Set a reference point at the top of the borehole or well casing.
   a. Measure the height of the reference point from the ground surface (A).
3. Lower the tape or probe (with the audible signal turned on) into the well until the splash or signal is heard.
   a. Record the reading on the tape or probe at the reference point (B). This is the distance from the reference point to the top of the standing water in the well.
4. Continue lowering the tape or probe (with the audible signal turned off) into the well until the line goes slack.
   a. Record the reading on the tape or probe at the reference point (C). This is the distance from the reference point to the bottom of the well.
5. The depth of the well = C – A
6. The height of the standing water in the well = C – B
7. For increased accuracy, you can repeat steps 3 and 4 several times and average the readings.

Example

Referring to Figure 5, if:

1. the height of the reference point from the ground surface (A) is 1 foot,
2. the distance from the reference point to the top of the standing water in the well (B) is 45 feet, and
3. the distance from the reference point to the bottom of the well (C) is 100 feet, then:

Depth of well (C – A) = 100 feet – 1 foot = 99 feet below the ground surface

Height of standing water in well (C – B) = 100 feet – 45 feet = 55 feet

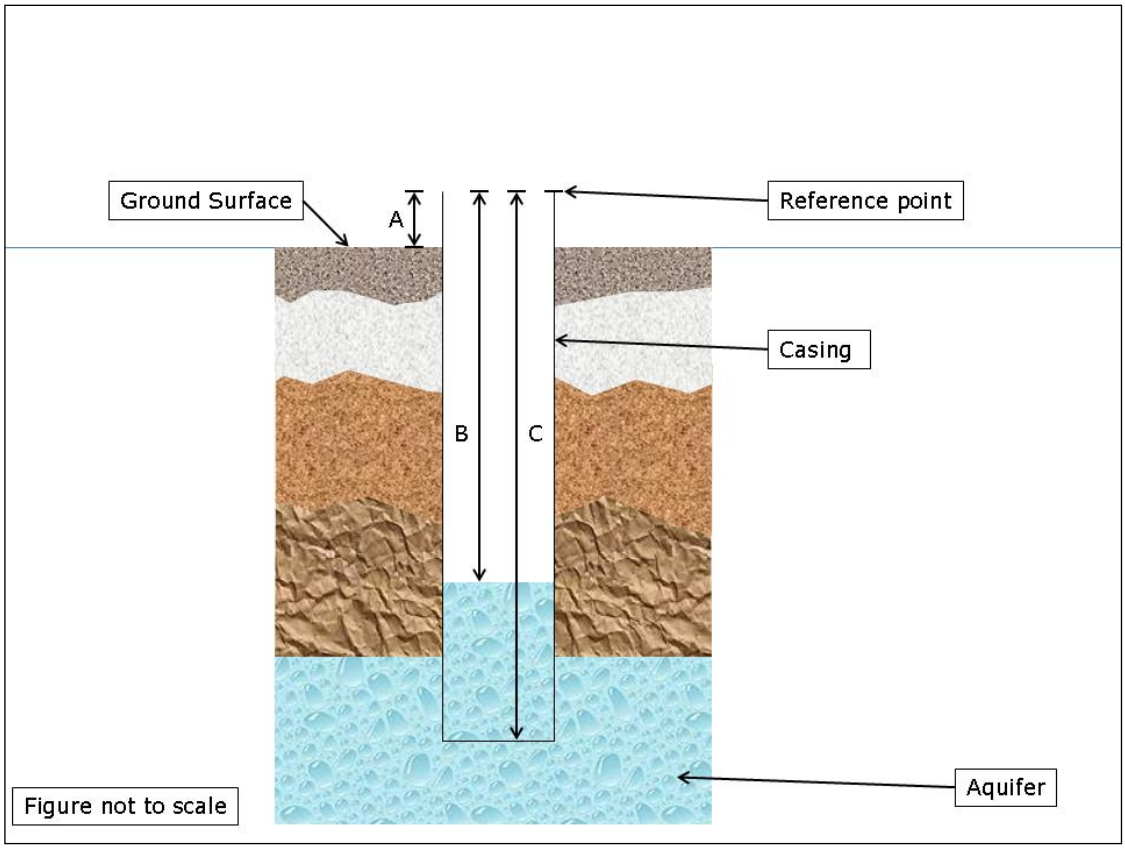

Figure 5. Measuring the Depth of the Well and Height of Standing Water in the Well

Step 2. Calculate the amount of liquid chlorine product needed to disinfect the well.

The formula for the amount of liquid chlorine product that you will need to disinfect a well is as follows:

height of standing water in the well
×
volume of liquid chlorine product required per linear foot of well (from Table 2)
=
total volume of liquid chlorine product required to disinfect the well

Example

If the height of standing water in the well is 55 feet and the well or hole diameter is 12 inches, then:

55 feet of standing water in the well
×
1.490 ounces of liquid chlorine product required per linear foot of well (from Table 2)
=
81.95 ounces of liquid chlorine product required to disinfect the well

Use table 3, below, to help you convert from ounces to cups, pints, quarts, and gallons, and from cups to pints and quarts.

Table 3. Liquid Conversions

1 ounce = **1/8 cup**
2 ounces = 1/4 cup
8 ounces = 1 cup
16 ounces = 1 pint
32 ounces = 1 quart
128 ounces = 1 gallon
2 cups = 1 pint
4 cups = 1 quart

82 ounces
=
2 quarts, 1 pint, and 1/4 cup of liquid chlorine product,

OR:

82 ounces
=
0.64 gallons of liquid chlorine product required to disinfect the well

Step 3. Apply the disinfectant.

Using appropriate precautions for handling chemicals (e.g., wearing safety glasses and protective gloves), pour the calculated amount of liquid chlorine product into the well and allow the mixture to stand (disinfect) for 8 to 10 hours prior to plugging.

Glossary of Selected Terms

Annular space – The space between the casing and borehole wall.

Borehole – the drilled hole.

Aquifer – A geological stratum or zone below the surface of the earth capable of producing groundwater.

Bentonite – A sodium hydrous aluminum silicate clay mineral (montmorillonite) commercially available in powdered, granular (chips), or pellet form.

Bentonite grout – A fluid mixture of sodium bentonite and potable water mixed at the manufacturer's specifications to a slurry consistency that can be pumped through a pipe.

Bridge – Plugging materials that lodge partway down a well borehole so as to obstruct passage of subsequent plugging materials, preventing them from reaching the bottom of the well.

Capped well – A well that is closed or capped with a covering capable of preventing surface pollutants from entering the well and sustaining weight of at least 400 pounds and constructed in such a way that the covering cannot be easily removed by hand.

Casing – A watertight pipe which is installed in an excavated or drilled hole, temporarily or permanently, to maintain the hole sidewalls against caving, advance the borehole, and in conjunction with cementing and/or bentonite grouting, to confine the ground waters to their respective zones of origin, and to prevent surface contaminant infiltration.

Commingling – The mixing, mingling, blending or combing through the borehole casing annulus or the filter pack of waters that differ in chemical quality, which causes quality degradation of any aquifer or zone.

Confining layer – A geological stratum or zone below the surface of the earth that impedes the movement of groundwater.

Deteriorated well – A well that, because of its condition, will cause or is likely to cause pollution of any water in this state, including groundwater.

Portland cement – A finely ground, carefully proportioned mixture of limestone and shale (sold commercially).

ppm – parts per million

Surging – Alternately raising and lowering a column of water in a well to induce water movement into and out of the well borehole and aquifer.

Tremie Tube – A tube or pipe running to the bottom of a well (after removal of the casing) that is used to transport plugging materials to the bottom of the well. The tube is raised as the bottom of the well is filled.

Example of a Plugging Report

Texas Department of License and Regulation
Water Well Driller/Pump Installer Program
P.O. Box 12157 Austin, Texas 78711 (512)334-5540 FAX (512)463-8616
Email address: water.well@tdlr.texas.gov

This form must be completed and filed with the department within 30 days following the plugging of the well.

PLUGGING REPORT

A. WELL IDENTIFICATION AND LOCATION DATA

1) OWNER

Name	Address	City	State	Zip
John J. Jones	100 main st.	Houston	Tx	75111

2) WELL LOCATION

County	Physical Address	City	State	Zip
Harris	Same			

3) Owner's Well No.	4) Lat. 00.00.00	5) Long. 00.00.00	Well Tracking# #####

6) Type of Well [X] Water [ ] Monitor [ ] Injection [ ] De-Watering [ ] Other:

Driller, Pump Installer, or Landowner performing the plugging operations must locate and identify the location of the well using a Global Positioning System (GPS) or Internet Mapping Website and provide the accurate Latitude and Longitude Coordinates in sections 4 and 5 above.

B) HISTORICAL DATA ON WELL TO BE PLUGGED (if available)

7) Driller: License No.:

8) Drilled / / **9)** Diameter of hole_____Inches **10)** Total depth of well_____ feet.

C. CURRENT PLUGGING DATA

11) Date well plugged: 4 / 4 / 2004

13) Name of Licensee or Well Owner performing the plugging: Will Dreller

License No. 10000 WI **Variance #**

14) CASING AND CEMENTING DATA RELATIVE TO THE PLUGGING OPERATIONS.

CASING LEFT IN WELL

DIAMETER (inches)	FROM (feet)	TO (feet)
7 7/8	0	200

CEMENT/BENTONITE PLUG(S) PLACES IN WELL

FROM (feet)	TO (feet)	SACKS
2	200	25 Bentonite
2	0	2 Cement

12) REMOVE ALL REMOVEABLE CASING

Please check box beside the method of plugging used

[ ] Tremie pipe cement from bottom to top.

[X] Tremie pipe bentonite from bottom to 2 feet from surface, cement top 2 feet.

[ ] Pour in 3/8 bentonite chips when standing water in well is less than 100 feet depth, cement top 2 feet.

[ ] Large diameter (36 inches or greater) well filled with clay material from top to bottom.

[ ] Other describe in comments below

COMMENTS

D. VALIDATION OF INFORMATION INCLUDED IN FORM

I certify that I plugged this well (or the well was plugged under my supervision) and that all of the statements herein are true and correct. I understand that failure to complete items 1 through 14 will result in the report(s) being returned for completion and resubmitted.

Company or individual's Name (type or print) Dreller Drilling

Address Rt 1 Box 1 City Wellville State Tx Zip 78787

Signature Will Dreller	4 / 4 / 2004	Signature	/ /
Licensed Driller/Pump Installer	Date	Apprentice or Unlicensed Assistant	Date

TDLR FORM WWD004N 04/20 *White - TDLR* *Yellow - Owner* *Pink - Driller/Pump Installer*

Well Plugging Resources

State Agencies, Programs, and Resources

Texas Department of Licensing and Regulation (TDLR)

Well Driller/Pump Installer/Abandoned Well Referral Program
www.tdlr.texas.gov/wwd/wwd.htm, 800-803-9202

State of Texas Well Report Submission and Retrieval System
www.twdb.texas.gov/groundwater/data/drillersdb.asp

Well Construction and Plugging Specifications
www.tdlr.texas.gov/wwd/wwdspecs.htm

Frequently Asked Questions (FAQs) on Abandoned Wells
www.tdlr.texas.gov/wwd/wwdfaq.htm

Texas Commission on Environmental Quality (TCEQ)

Groundwater Planning and Assessment
www.tceq.texas.gov/goto/groundwaterplanning, 512-239-4600

Groundwater Conservation District Contact List and Map
https://www.tceq.texas.gov/groundwater/groundwater-planning-assessment/districts.html

Water Well Report Viewer
https://www.tceq.texas.gov/gis/waterwellview.html

Texas Groundwater Protection Committee (TGPC)

Abandoned Wells
www.tgpc.state.tx.us/water-wells/abandoned-wells/

Texas Water Development Board (TWDB)

Submitted Drillers Reports (SDR) Database
www.twdb.texas.gov/groundwater/data/drillersdb.asp

Texas State Soil and Water Conservation Board (TSSWCB)

www.tsswcb.texas.gov/tsswcb-home-page>, 800-792-3485, 254-773-2250

Texas AgriLife Extension Service (TAES)

www.agrilifeextension.tamu.edu/, 979-845-7800

About Groundwater Conservation Districts

Texas Alliance of Groundwater Districts (TAGD)
TAGD represents the majority of the GCDs in the state.
www.texasgroundwater.org, 512-596-3101

TCEQ's Groundwater Conservation District (GCD) Webpage
TCEQ's GCD webpage has links to a map of GCDs,
a description of GCDs, an interactive online viewer and a Contact List for created and confirmed GCDs. www.tceq.texas.gov/goto/gcd

Publications

What Is a Groundwater Conservation District (GCD)? Texas Groundwater Protection Committee.
www.tgpc.texas.gov/POE/FAQs/GCDs_FAQ.pdf

How Do You Form a Groundwater Conservation District (GCD)? Texas Groundwater Protection Committee.
www.tgpc.texas.gov/POE/FAQs/FormingGCDs_FAQ.pdf

Questions about Groundwater Conservation Districts in Texas, by Bruce J. Lesikar, Valeen Silvy, and Ronald A. Kaiser. Texas AgriLife Extension Service, pub. no. B-6120.
www.agrilifebookstore.org

The Texas Groundwater Protection Committee

Created in 1989 by the Texas Legislature, the Texas Groundwater Protection Committee (TGPC) is the primary coordinating mechanism for nine state agencies and one statewide association with groundwater-related responsibilities.

This *Landowner's Guide to Plugging Abandoned Water Wells* was originally developed and produced by the Abandoned Water Well Closure Task Force of the TGPC in fulfillment of requirements given in Section 26.405 of the Texas Water Code. The effort was partially funded by the U.S. Environmental Protection Agency. Subsequent revisions have been developed through the TGPC's Public Outreach and Education (POE) Subcommittee and approved by the TGPC.

While the information contained in the publication represents the contribution of each individual participating agency and group, the report as a whole is the work of the TGPC and does not necessarily reflect all of the views and policies of each participating organization.

TGPC Members:

- Texas Commission on Environmental Quality (*Chair*)
- Texas Water Development Board (*Vice Chair*)
- Railroad Commission of Texas
- Department of State Health Services
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board
- Texas Alliance of Groundwater Districts
- Texas AgriLife Research
- University of Texas Bureau of Economic Geology
- Texas Department of Licensing and Regulation

With assistance from:

- Texas AgriLife Extension Service
- Texas Water Well Drillers Advisory Council
- Texas Rural Water Association
- Texas Farm Bureau

Texas Groundwater Protection Committee
MC-147
Texas Commission on Environmental Quality
P.O. Box 13087
Austin TX 78711-3087
www.tgpc.texas.gov
512-239-4506

Published and distributed by:

Texas Commission on Environmental Quality
P.O. Box 13087
Austin TX 78711-3087

TCEQ Publications
https://www.tceq.texas.gov/publications
512-239-0028

We authorize you to use or reproduce any original material contained in this publication (i.e., not obtained from other sources). Please acknowledge TCEQ and TGPC as your source.