ERM-014
03-15

TEXAS A&M AGRILIFE EXTENSION

Water Wells in Floodplains

What you need to know

Alyson K. McDonald, Assistant Professor and Extension Range Specialist
Diane E. Boellstorff, corresponding Author; Assistant Professor and Extension Water Resources Specialist
Drew M. Gholson, Extension Water Resource Program Specialist
` The Texas A&M University System

If your water well is shallow and located in the floodplain of a river or stream, pollutants from the stream can contaminate the well water. You can reduce the risk of well contamination by:

- Understanding the interactions between the stream and your well water
- Monitoring the conditions of both
- Taking action when needed

The two main sources of water for Texans are groundwater, which is the water stored underground in aquifers, and surface water, which includes streams, rivers, and lakes.

In Texas, these two types of water sources are managed separately:

- Surface water is publicly owned, and its use generally requires a permit from the state.
- Groundwater in Texas is private property. Landowners may put groundwater to beneficial uses within the rules of a local groundwater conservation district, if one has been established. Texas landowners are responsible for managing the water from their private wells.

Although groundwater and surface water may seem to be separate, they are physically linked. These linkages can become pathways for contamination of your well.

Water movement between streams and aquifers

As you drive along a river or creek in Texas, you may notice that the flow varies from place to place. The channel at one crossing may be dry; at another, the water may be deep and swift.

Changes in flow are sometimes caused by interactions between surface water and groundwater that cause the river to gain or lose flow. Some rivers have predominantly gaining reaches (sections); some have mostly losing reaches; others have both.

Gaining reach: Gaining streams receive water from nearby shallow aquifers when the water table is higher than the river surface; the hydraulic pressure causes the aquifer to discharge water to the river through the saturated streambed and banks (Fig. 1A).

Although you may not notice the increase in the amount of water in a gain-

ing stream, it will often have a distinct difference in temperature. Because the groundwater temperature is relatively constant, the groundwater inflow in the summer will be cooler than the water in the stream, and in the winter it will be warmer.

Losing reach: Losing streams supply water to aquifers, via seepage through the streambed and banks, when the river surface is higher than the water table in the aquifer (Fig. 1B).

Disconnected reach: In dry regions, rainfall and direct runoff into streams is small and infrequent and the water table is often below the stream channel.

Draws or arroyos may flow only during and after a rain. Although these ephemeral (short-term) channels are disconnected from the aquifer (Fig. 1C), they may help recharge (replenish) it with rainfall during storms.

Effects of pumping wells: Pumping wells located along a gaining reach withdraw water that would otherwise contribute to streamflow (Fig. 2). Excessive groundwater pumping in the river floodplain can actually reverse groundwater flowpaths near the river (Fig. 2C) by creating a cone of depression (Fig. 3).

A pumping well creates a zone around it that is cone shaped. The size and shape of the cone depends on the amount of water stored in the aquifer and the rate that water can move through the aquifer to the pumping well. With continued pumping, the cone will expand until it reaches a source of recharge such as a river.

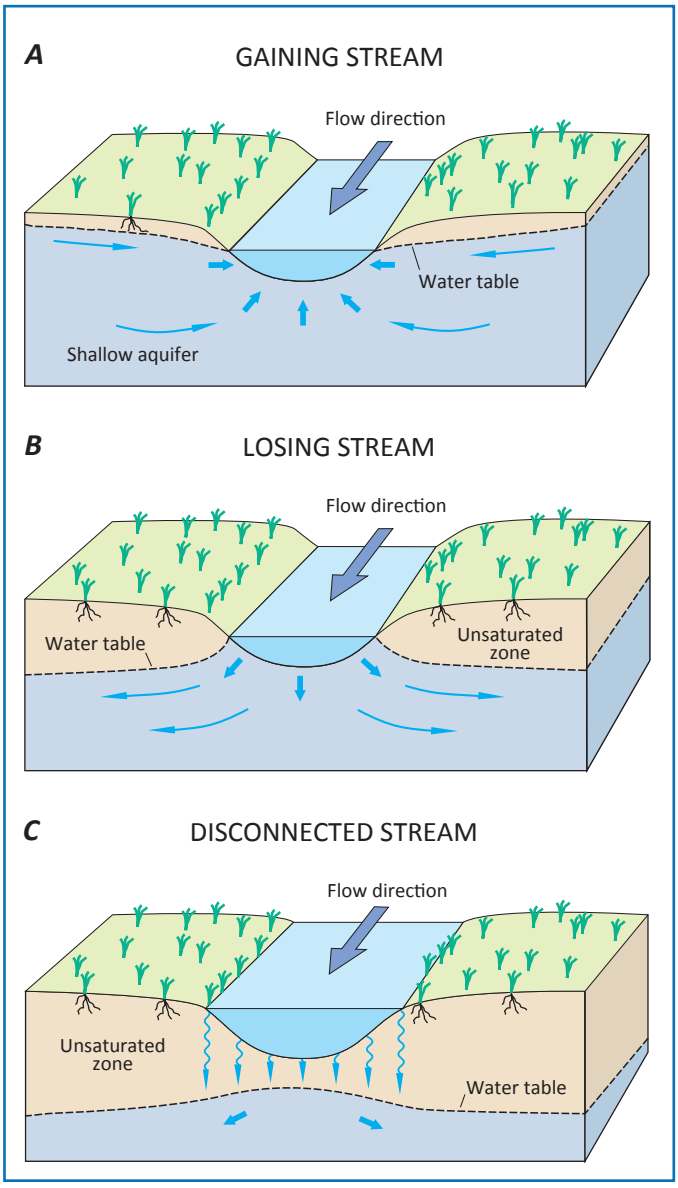
Conditions to monitor

Keep an eye out for any changes in the quality or quantity of water from the well and in the nearby stream.

Well water quality: Changes in the water's color, taste, or odor could indicate contamination in the well. Also take note if anyone who drinks the well water experiences a suspicious illness.

Reduced streamflow: If your water well is located near a losing reach, you are essentially pumping river water that has seeped into the aquifer. The well may produce less water if the streamflow has been reduced by a dam, drought, or both. You may notice air bubbles in the water or hear the pump sucking air.

If this occurs, shut down pumping to prevent damage to the pump and the well, and monitor the streamflow or river stage upstream from your property. You can monitor the streamflow of many Texas rivers via the U.S. Geological Survey (USGS) website.



Source: Modified from Winter and others, 1998

Figure 1. Interaction between streams and groundwater. Gaining streams receive water from the groundwater system (A); losing streams lose water to the groundwater system (B); and disconnected streams are separated from the groundwater system by an unsaturated zone (C).

The USGS measures streamflow at 509 gage stations in Texas. To view current streamflow data (Fig. 4) at each of these gauges, visit http://waterdata.usgs.gov/tx/nwis/current/?type=flow.

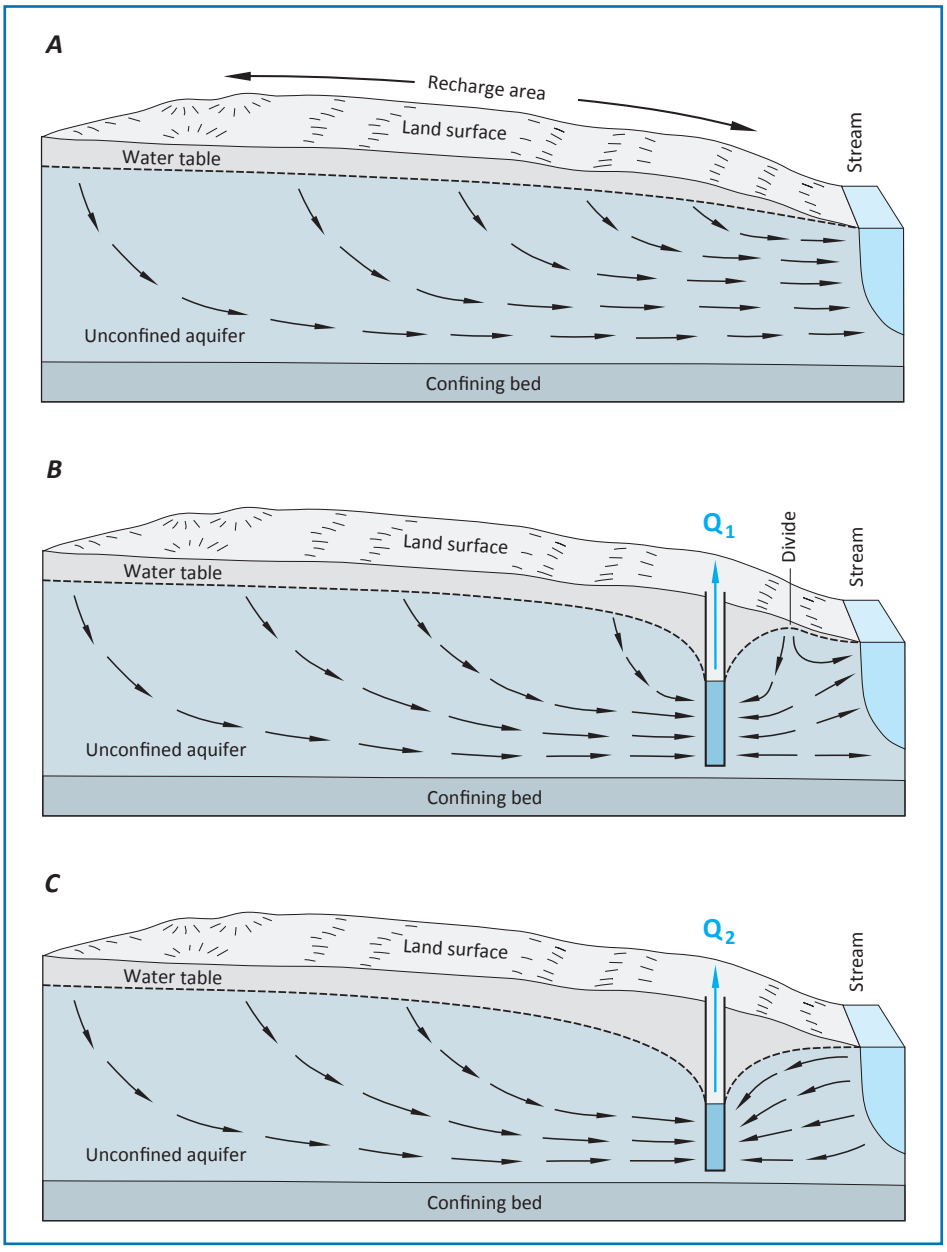
Stream pollution: About 10 percent of Texas streams are sampled and analyzed to detect pollutants each year by the Texas Commission on Environmental Quality (TCEQ). Results are available through the TCEQ surface water quality viewer at https://www.tceq.texas.gov/gis/segments-viewer or the Texas Integrated Report of Surface Water Quality at https://www.tceq.texas.gov/waterquality/assessment/305_303.html.

Flooded wells: Flooding streams can affect water wells in floodplains. Texas state law addresses construction of wells in flood-prone areas [16 Texas Administrative Code, section 76.100(a)(5)]:

> *A well shall be located at a site not generally subject to flooding; provided, however, that if a well must be placed in a flood prone area, it shall be completed with a watertight sanitary well seal, so as to maintain a junction between the casing and pump column, and a steel sleeve extending a minimum of thirty-six (36) inches above ground level and twenty-four (24) inches below the ground surface.*

If your well has been flooded, it needs to be decontaminated. For instructions on how to decontaminate a flooded well, see AgriLife Extension publication ER-011, *Decontaminating Flooded Wells,* which is available at agrilifebookstore.org.

Shallow wells: Water from shallow (especially hand-dug) wells, particularly if it is derived from a river or stream, is likely to contain disease-causing bacteria and may need to be treated to meet recommended drinking water standards.



Source: Modified from Winter and others, 1998

Figure 2. Effects of pumping from a hypothetical groundwater system that discharges to a stream. Where groundwater discharges to a stream under natural conditions (A), placement of a well pumping near the stream will intercept part of the groundwater that would have discharged to the stream (B). If the well is pumped at an even greater rate, it can intercept additional water that would have discharged to the stream in the vicinity of the well and can draw water from the stream to the well (C).

Actions to take

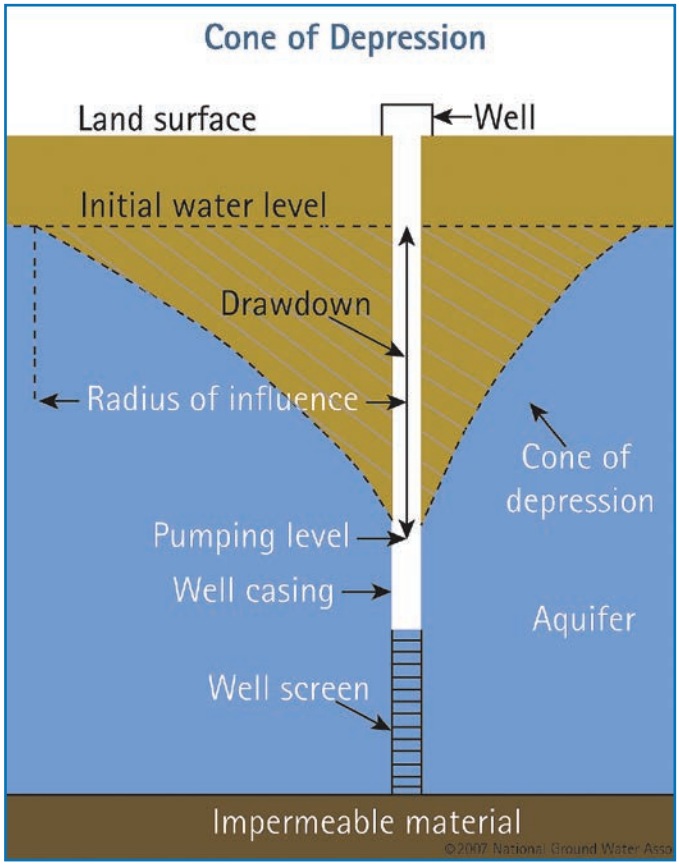
To protect your water supply, you need to:

- Keep records on each well for information such as location, maintenance and water test results. Manage potential sources of contamination such as septic systems, hazardous materials used or stored near the well, animal feedlots and dog runs, and stored animal wastes.
- Monitor the quality of your well water and of the nearby stream.
- If you use the well for drinking water, have the water tested for the contaminants that are most likely to be in it. At a minimum, test it **every year** for nitrate, total dissolved solids (TDS), and *E. coli* or fecal coliform (bacteria from human or animal waste).
- Have the water tested whenever you suspect contamination; when you notice a change in the water's color, taste, or odor; after the pump or well is maintained; and after anyone who drinks the well water experiences a suspicious illness.

To find a laboratory, call your county health department or choose a certified drinking water laboratory from the National Environmental Laboratory Accreditation Program at http://www.tceq.texas.gov/goto/certified_labs.

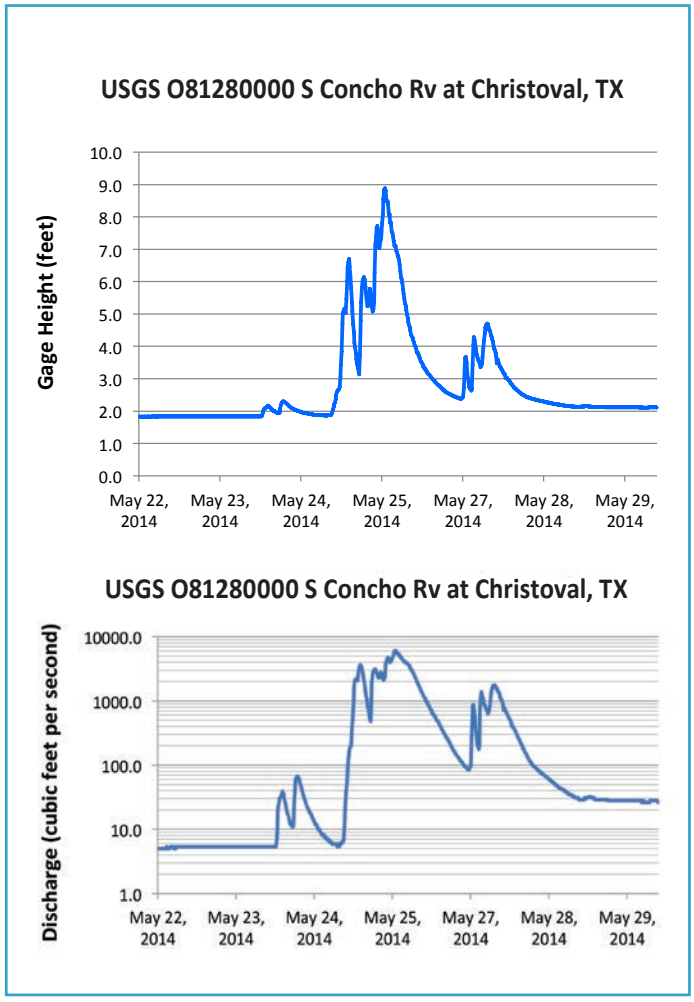
Irrigation water testing: The Texas A&M AgriLife Extension Soil, Water, and Forage Testing Laboratory (SWFTL) can test irrigation water for irrigation and livestock purposes. Forms and information for water sampling and testing are available at http://soiltesting.tamu.edu. Commercial laboratories are also available.

- If the well has been flooded, or if tests show that the water contains fecal coliform or *E. coli* bacteria:
  - Decontaminate the water using a distillation, ozone, ultraviolent (UV), or continuous chlorination treatment method.
  - Or, find another source of water, such as by drilling a deeper well or using bottled water.



Source: National Groundwater Association 2007 at http://www.ngwa.org/Fundamentals/hydrology/Pages/Unconfined-or-water-table-aquifers.aspx

Figure 3. Cone of depression created by a pumping well in an unconfined aquifer. Pumping a well in an unconfined aquifer causes actual dewatering of the material within an inverted, roughly cone-shaped volume, called a cone of depression.



Source: U.S. Geological Survey National Water Information System

Figure 4. Stream hydrographs of gage height and estimated discharge, May 22–29, 2014, South Concho River near Christoval, TX.

For more information

- Local county Extension office: http://counties.agrilife.org/
- Alyson McDonald (akmcdonald@ag.tamu.edu, 432-336-8585).
- Diane Boellstorff (dboellstorff@tamu.edu, 979-458-3562).
- Drew Gholson (dgholson@tamu.edu, 979-845-1461).

Decontaminating Flooded Wells. By M. L. McFarland, D. E. Boellstorff, T. L. Provin, M. C. Dozier and N. J. Dictson. 2006. Texas A&M AgriLife Extension publication ER-011, 2 pp.

Ground Water and Surface Water A Single Resource. By T. C. Winter, J. W. Harvey, O. L. Franke and W. M. Alley. 1998. U.S. Geological Survey Circular 1139, 87 pp.

Texas Well Owner Network: http://twon.tamu.edu/

Texas Well Owner Network: Texas Well Owner's Guide to Water Supply. By K. Uhlman, D. Boellstorff, M. L. McFarland, B. Clayton, and J. W. Smith. 2013. Texas A&M AgriLife Extension publication B-6257, 96 pp.

Texas Groundwater Protection Committee: General information on water wells: http://tgpc.state.tx.us/water-wells/

Acknowledgment

Support for this publication is provided through Clean Water Act§319(h) Nonpoint Source funding from the Texas State Soil and Water Conservation Board and the U.S. Environmental Protection Agency under Agreement No. 13-08.

Photo by Kristine Uhlman, former Texas A&M AgriLife Extension Program Specialist–Water Resources

Texas A&M AgriLife Extension Service

AgriLifeExtension.tamu.edu

More Extension publications can be found at *AgriLifebookstore.org*

The Texas A&M University System, U.S. Department of Agriculture, and the County Commissioners Courts of Texas Cooperating.

Produced by Texas A&M AgriLife Communications

New