



## Managing Your Well During a Drought

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In recent years, frequent droughts have caused severe water shortages in parts of Pennsylvania. Droughts can be especially stressful for the one million rural homeowners who rely on private wells for their water supply. These individual wells tap groundwater aquifers that cannot easily be seen or monitored. Among homeowners relying on wells the invisible nature of groundwater leads to an uneasy feeling that their water supply could dry up without warning during a drought. This fact sheet explains the typical variation of water in wells and gives some hints on estimating groundwater levels near your well and managing your water usage during drought.

### The Normal Cycle of Groundwater Levels

The water level in a groundwater well will fluctuate naturally during the year (see Figure 1). Groundwater levels tend to be highest during March and April in response to winter snowmelt and spring rainfall. The movement of rain and snowmelt into groundwater is known as recharge. Groundwater levels usually begin to fall in May and continue to decline during the summer. Groundwater recharge is limited during late

spring and summer because trees and other plants use the available water to grow. Natural groundwater levels usually reach their lowest point in late September or October. In late fall, after trees and plants have stopped growing and before snow begins to fall, groundwater levels may rise in response to rainfall and recharge. Groundwater recharge persists through the fall until cold temperatures produce snowfall and frozen soil that limit the ability of water to infiltrate into the ground. Groundwater levels during winter may be stable or fall slightly until spring snowmelt and rainstorms start the annual cycle again. Given this natural cycle of groundwater, most problems with wells tend to occur in late summer or early fall when groundwater levels naturally reach their lowest levels.

The natural fluctuation of groundwater levels illustrated in Figure 1 tends to be most pronounced in shallow wells. As a result, shallow wells are usually more susceptible to drought than deeper wells. Shallow, hand-dug wells, for example, are often the first wells to dry up during drought. Although deeper wells may be slower to suffer from drought conditions, they may also take longer to recover after a drought has occurred.

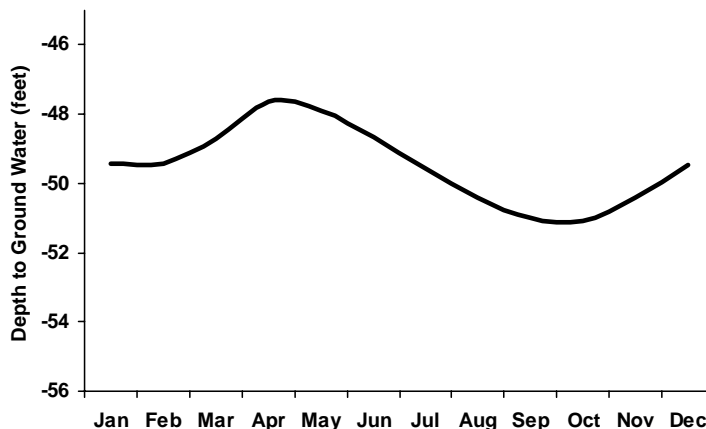


Figure 1. The natural annual fluctuation of groundwater levels in a typical Pennsylvania well.

## **Can Land Use Changes Affect the Susceptibility of my Well to Drought?**

Dramatic changes have occurred to the landscape in many rural areas of Pennsylvania. Increasing development and rural population growth will likely continue in the future. Existing rural residents often worry that these changes may create competition for groundwater that might increase the susceptibility of their well to drought. It is unlikely that small numbers of new homes will cause significant changes in groundwater levels. However, more dramatic changes in land use that tap large amounts of groundwater or prevent recharge from occurring over a wide area could make existing wells more susceptible to drought. This is especially true in areas where mining is occurring or where large paved areas prevent rainfall and snowmelt from recharging groundwater.

## **How Can I Monitor Groundwater Levels?**

Direct determination of the groundwater level in your well is difficult and usually requires the use of a water level meter. These meters are comprised of an electrical probe attached to the end of a measuring tape. The probe is lowered into the well until a display or light indicates that it has reached water. The depth to water is then read directly from the measuring tape. These instruments generally cost \$300 or more depending on the anticipated length of tape needed.

There are other, less direct, but more practical methods to determine the status of your well water supply. In recent years, the U.S. Geological Survey (USGS) has developed a web-based system to access water levels from a group of monitoring wells in Pennsylvania. The USGS presently measures 67 wells in nearly every county of the state. They have developed a web page that allows viewers to access water levels over the past two years from 40 of these wells. In addition to the actual water level, different shaded areas are provided to illustrate the normal conditions as well as drought watch, warning, and emergency water levels. This information, although not specific to your well, will allow you to observe the general trend in groundwater levels in your area. The web page for this system is: [http://pa.water.usgs.gov/durplots/well\\_duration.html](http://pa.water.usgs.gov/durplots/well_duration.html)

Once you access this page, choose the well nearest to your house and select the "30-day graph" to view the up-to-date groundwater conditions in your area. The graphs are color coded to easily show when a particular well is experiencing drought conditions and the severity of the conditions. An example graph is shown in Figure 2.

You can also view up-to-date groundwater levels and other information for all 67 monitoring wells, including the water levels over the past seven days, at the following USGS web site: <http://water.usgs.gov/pa/nwis/current?type=gw>

You may also be able to learn more about your local groundwater conditions by contacting local well drillers and neighbors. Well drillers are continually drilling new wells and, therefore, may have knowledge of groundwater levels near your well. They may also have installed new submersible pumps in nearby wells that would allow them to document the existing groundwater level. Similar discussions with neighbors that have had new pumps installed or had new wells drilled may provide valuable information about the groundwater level.

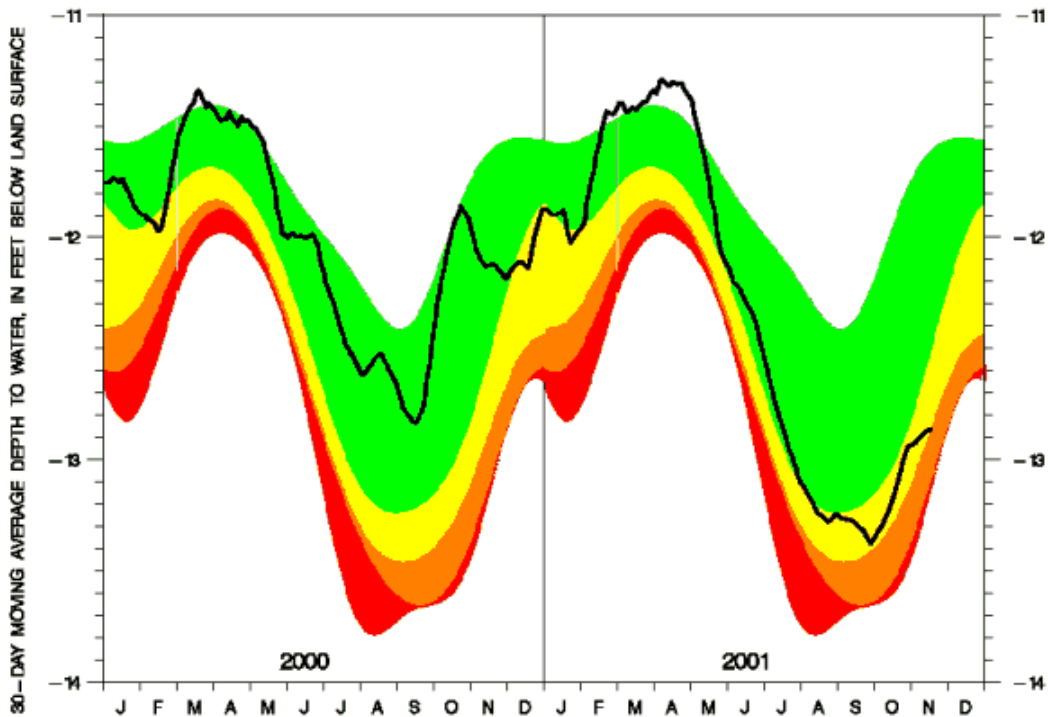
## **How Can I Conserve Water?**

Water conservation measures become critical during times of drought. Homeowners relying on private wells should begin to conserve water as soon as drought conditions occur. Water use within the home can be significantly reduced through changes in habits and by installing water-saving devices. In emergency situations, changes in water use habits can provide quick reductions in water use. Examples might include flushing the toilet less often, taking shorter showers, only washing full loads of dishes or laundry and collecting water from roof gutters for outside use. It is also important to note that certain drought declarations may also require water use reductions or restrictions on water use. For example, a "drought emergency" declaration bans the nonessential use of water such as car washing and lawn watering. These regulations apply to everyone, including homeowners with private wells. For more information on ways to save water around the home, consult the Penn State Cooperative Extension publications entitled "22 Ways to Save Water in an Emergency" and "A Guide to Designing a Community Water Conservation Program." These publications are available free-of-charge from your local Cooperative Extension office or can be ordered from the College of Agricultural Sciences, Publication Distribution Center at (814) 865-6713.

Additional information about permanent reductions in water use through installation of water-saving devices, such as low-flush toilets and front-loading washers, is available at the following U.S. Environmental Protection web page: <http://www.epa.gov/seahome/watcon.html>

## ADAMS COUNTY OBS WELL AD-146

US GEOLOGICAL SURVEY PROVISIONAL DATA - SUBJECT TO CHANGE  
30-DAY MOVING AVERAGE DAILY DEPTH TO WATER  
NUMBER OF YEARS=0.0 DATE OF PLOT=11/14/01



ALL DATA SHOWN ARE BASED ON 30-DAY MOVING AVERAGES; PERCENTILE BANDS HAVE BEEN SMOOTHED.

SOLID LINE = 30-DAY MOVING AVERAGE OF CURRENT DAILY DEPTH TO WATER

GREEN (TOP) BAND = 25- TO 75-PERCENTILE DEPTHS (NORMAL CONDITIONS)

YELLOW BAND = 10- TO 25-PERCENTILE DEPTHS (DROUGHT WATCH CONDITIONS)

ORANGE BAND = 5- TO 10-PERCENTILE DEPTHS (DROUGHT WARNING CONDITIONS)

RED (BOTTOM) BAND = 0- TO 5-PERCENTILE DEPTHS (DROUGHT EMERGENCY CONDITIONS)

Figure 2. An example graph of groundwater level data for the Adams County well from the USGS web page ([http://pa.water.usgs.gov/durplots/w30\\_ad146.gif](http://pa.water.usgs.gov/durplots/w30_ad146.gif)).

### What Can I Do if my Well Runs Dry?

There are a number of reasons why a well may quit producing water. The most frequent cause is a malfunctioning or worn-out submersible pump. Other electrical problems, such as a malfunctioning electrical switch at the pressure tank, may also cause a loss of water. Pressure tanks also need to be replaced from time to time. Water quality problems, like iron bacteria and sediment, may also clog the well and severely restrict water flow from the well. A well driller or competent plumber should be consulted to determine the exact cause of the problem.

Under persistent dry weather conditions, the water level in your well may drop below the submersible pump causing a loss of water. In some cases, the water level may only temporarily drop below the pump when water

is being frequently pumped from the well during showers or laundry. Under these conditions, you may be able to continue using the well by initiating emergency water conservation measures and using water only for essential purposes.

If the water level permanently drops below the submersible pump, it may be possible to lower the submersible pump within the existing well. In most cases this will only provide a short-term solution to the problem. More permanent solutions require either deepening of the existing well or drilling of a new well. Be aware that deepening an existing well may not increase the well yield and could produce water of different water quality characteristics. You should consult with a local well-driller or a professional hydrogeologist to determine the best solution for your situation.

Proper management of private wells during droughts will become more important as competition for water in rural areas of Pennsylvania increases. By monitoring nearby groundwater levels on-line you may be able to detect potential problems early and implement water conservation strategies that may prevent your well from going dry.

### **Other Helpful Web Addresses**

Consult these web pages to learn more about drought, water supply, and private water system management.

U.S. Environmental Protection Agency

<http://www.epa.gov>

Publications on water quality, private wells, and water conservation.

The Penn State Water Quality Extension web page

<http://wqext.psu.edu>

Fact sheets and other publications and resources related to private water systems and septic system management.

The Pennsylvania Department of Environmental Protection Drought Information Center

<http://www.dep.state.pa.us/dep/subject/hottopics/drought/>

Drought statistics, regulations, news updates, and water conservation ideas.

Pennsylvania Water Watch

[http://pasc.met.psu.edu/PA\\_Climatologist/PAH20/PAH20.html](http://pasc.met.psu.edu/PA_Climatologist/PAH20/PAH20.html)

Maps and other graphics of the drought status in Pennsylvania.

The Middle Atlantic River Forecasting Center

<http://crab.met.psu.edu/>

Graphs and tables of precipitation, stream flow, and other drought indicators.

U.S. Geological Survey

<http://www.pah2o.er.usgs.gov/>

Many publications and access to stream flow and groundwater data for Pennsylvania.

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