PENNSTATE
College of Agricultural Sciences • Cooperative Extension
School of Forest Resources

Water Facts #6

Protecting Wells with Sanitary Well Caps and Grouting

Pennsylvania is one of only a few states that do not have mandatory statewide construction standards for private water wells. (A few counties and townships have passed well construction ordinances—check with your local government office to determine if they are required in your area.) As a result, some important components of a properly constructed drinking water well are often not installed in an effort to reduce the cost of the well to the homeowner. The most important features missing from most private wells are a sanitary well cap and a grout seal. These components are required by most states because they help protect groundwater by sealing the well from potential surface contamination.

Types of Well Caps

Most existing and new wells in Pennsylvania have a standard well cap similar to the one shown in Figure 1. Standard well caps usually have bolts around the side of the cap that loosely hold the cap onto the top of the casing. The small airspace between the well cap and the casing can allow for insects, small mammals, or surface water to enter the well.

Figure 1. A standard well cap similar to those found on most Pennsylvania wells (note the bolts around the outside of the well cap).

A "sanitary" well cap (sometimes referred to as a "vermin-proof" well cap) looks similar to a standard well cap but usually has bolts on the top of the well cap as shown in Figure 2. Most sanitary well caps include an airtight rubber gasket seal to prevent insects, small mammals, or surface water from entering the well and a small, screened vent to allow for air exchange (Figure 3).

Figure 2. A sanitary well cap installed on a well casing. Note the bolts on the top rather than around the sides of the cap.

Figure 3. A sanitary well cap showing the rubber gasket, hole for electrical conduit, and screen holes for ventilation.

What Is a Grout Seal?

Grout is usually neat cement (no aggregate) that is pumped into the space between the drilled hole and the casing—called the *annular space* (Figure 4). Bentonite, a clay material that expands when wet, is also often used for grouting a well. The grout is

pumped into the annular space starting from the bottom of the casing using a tremie pipe until it appears at the surface of the ground (Figure 5). Grout is usually not used on private wells in Pennsylvania unless it is required by local ordinances or requested by the homeowner.

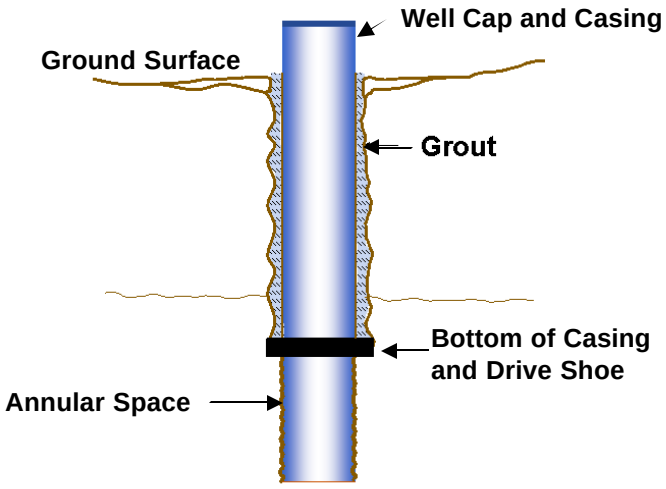

Figure 4. Cross-section of a well casing showing the grout used to seal the annular space around the casing.

Figure 5. Well drillers use a tremie pipe to pump grout into the well. Note that the grout is now appearing at the surface of the ground around the well casing—see arrow (Photo by Dr. Todd Giddings).

Can an Existing Well Be Grouted?

In general, it is not possible to grout an existing well. In rare cases, it may be possible to install a smaller-diameter casing inside the old casing and grout between the casings. Another method used on existing wells is to pour a concrete slab around the existing well casing. However, these concrete slabs often crack and provide minimal protection from surface contamination. The best protection for an existing well is to make sure that the ground surface slopes away from the well casing in all directions to direct surface water away from the wellhead area.

Bacterial Contamination

Sanitary well caps and grout seal are primarily installed to prevent surface contamination, especially bacterial contamination. Bacterial contamination is a common problem that occurs in about 50 percent of the private water wells in Pennsylvania. Drinking water is typically tested for *total coliform bacteria*, which includes a large number of different species of bacteria, some of which can cause illnesses or diseases. For this reason, all drinking-water supplies should be free of coliform bacteria. See the Penn State Cooperative Extension fact sheet entitled *Treating Coliform Bacteria in Drinking Water* for more information on coliform bacteria.

Bacterial contamination of groundwater wells can occur from both above and below the surface. Pollution of entire groundwater aquifers affecting many wells may occur from failing septic systems or animal wastes. Similarly, individual wells may be contaminated from the surface if contamination sources are near the wellhead. Surface contamination of individual wells is usually caused by surface water flowing down the outside of a well casing through the annular space and/or from a loose-fitting or absent well cap that allows insects, animals, or surface water to directly enter the well. Sanitary well caps and a grout seal can help prevent this type of contamination from occurring.

Do a Grout Seal and Sanitary Cap Prevent Contamination?

A 2002 study by the U.S. Geological Survey of more than 100 private wells in Pennsylvania studied the importance of grout in preventing bacterial contamination. This study found that ungrouted wells were three times more likely to be contaminated with *E. coli* bacteria compared to grouted wells. This same study, however, found that coliform bacteria were still quite common in grouted wells. Since the wells used in this study did not have sanitary well caps, the authors theorized that coliform bacteria were entering the well from the well cap area. This was supported by their visual assessment that found nearly 50 percent had obvious insect infestations under the well cap. Insects were found inside the well cap, on the wiring or plumbing, or inside the casing. Another study by the Wisconsin Department of Natural Resources found that insects could be a source of coliform bacteria in wells.

A recently completed study by Penn State documented the effect of installing a sanitary well cap on existing water wells. Sixteen private wells that contained coliform bacteria were disinfected with chlorine and fitted with a sanitary well cap. Of these wells, 44 percent did not contain coliform bacteria one month later and 19 percent did not contain bacteria after one year. The sanitary well caps were most successful in eliminating bacteria from wells that previously contained small numbers of coliform bacteria (< 3 colonies per 100 mL of water), compared to those that had more gross contamination. This Penn State study also looked at bacterial contamination in new wells that were constructed with a sanitary well cap and a grout seal. Only 29 percent of these new wells contained coliform bacteria, suggesting that proper well-construction practices can reduce but not completely eliminate bacterial contamination. Wells drilled into aquifers that are contaminated by animal wastes, septic systems, or surface water can contain coliform bacteria regardless of well-construction practices.

What About Costs?

Sanitary well caps and a grout seal are generally not used on private wells due to the added cost. Sanitary well caps typically cost $40 to $50 compared to $20 to $30 for a standard well cap. A sanitary well cap can be installed by a homeowner with some basic knowledge of electrical wiring, or the cap can be installed by a well driller. In the recent Penn State study, the average cost for disinfection and installation of a sanitary well cap by a well driller was about $100 per well. Grouting of a new well typically adds $500 to $1,000 to the cost of the well. The cost of grouting will depend on the well depth, diameter, and type of bedrock in the area.

What Can You Do?

Contamination related to an inadequate well cap or missing grout seal would most likely result in the presence of coliform bacteria in your well water. Thus, the first step in proper management of an existing private well is an annual test for total coliform bacteria. This test can be arranged through a local certified laboratory (www.dep.state.pa.us/labs) or your regional Department of Environmental Protection office. If your well tests positive for coliform bacteria, a sanitary well cap may help solve the problem, especially if your well contains small numbers of bacteria. Even if your well is currently free of bacteria, a sanitary well cap will help ensure that it does not become contaminated in the future by insects or other contaminants around the wellhead. Sanitary well caps can usually be purchased from a local water well contractor. Consult www.wellowner.org to find a local water well contractor certified by the National Ground Water Association. The contractor can also be hired to disinfect the well and install the sanitary well cap if you desire. If you do the work yourself, the existing well cap should be removed and any obvious insects, nests, or small mammals should be removed from inside the well casing. Existing bacteria in the well water can be killed using a chlorine solution as described in the Penn State Cooperative Extension fact sheet entitled *Shock Chlorination of Wells and Springs* before installing the new well cap.

If you are having a new well drilled or you are deepening an existing well, you should request that the well be grouted to prevent surface contamination. If you have an existing grouted or ungrouted well, make sure the ground surface is sloped away from the casing in all directions to direct surface water away from the well.

Additional Resources

For the fact sheets referenced above as well as further information on management of wells and springs in Pennsylvania, visit our Web page at:

www.sfr.cas.psu.edu/water

or contact your local cooperative extension office.

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