Construction Techniques for a Safer Bored Well

A Cooperative Project
of
Royall Pump and Well Company, Inc.
and
SAIF Water Wells, Inc.

Bored and hand dug wells frequently test positive for coliform bacteria. The following improvements in bored well construction and maintenance were identified in an effort to improve the ability of the well to keep water sanitary.

In addition to sealing the points where contaminants enter bored wells, this design assures that service personnel will not have to go into the well. It also makes it easy for homeowners to chlorinate the well, or check for low water levels—without opening the well.

1.

The casings (also called curbs, tiles, or pipes), although hand-picked, had ragged edges, which were knocked off with a hammer.

2.

Each curb was fitted by hand with a concrete sealant, which effectively sealed the joints from the top to two feet below the water table. (CS-665 from ConSeal was used.)

3.

After the curbs were in place they were pressed with the weight of the well rig to help dislodge sediment between the curbs and tighten up the fit.

4.

A ten-foot sleeve was placed through the well curb,
slanted down into the trench for the plumbing,
and triple sealed to the plumbing line
so there is no possibility of sediment feeding back into the well through the sleeve in between the waterline and electrical lines that go through the sleeve.

The sleeve was put in place before grouting so that the grout would form a seal around it at the curb/casing.

5.

The top edge of the annular space was beveled so that, when the grout was poured, the apron would be an extension of the grout itself and not likely to crack with freezing.

6.

Any mud on the sides of the well was gently washed off with water from a pump so that it would not interfere with a smooth grout.

7.

The grout (6-8 slump with aggregate) was poured on the middle of the well cap with two men with shovels watching to make sure that the annular space was evenly filling.

This method causes the well to vibrate the concrete to prevent voids in the grout. The vibration is essential to a good grout job.

8.

The grout was smoothed by hand and the homeowner summoned to record anything they wished while the cement was wet.

9.

The cap contained a port hole in the center. This one was 4 inches, but we would prefer bigger in the future. (A hole was cut in the cap and the port hole glued in.)

10.

The pump was installed on a pitless adapter and a pipe/handle inserted in the top socket. If the pump needs to be serviced in the future, the service person can simply unscrew the lid on the port hole and pull the pump straight up--without going in the well or taking the cap off!

11.

Because there is a porthole and pitless adapter the cap could be sealed with a concrete sealant.

12.

The well was chlorinated, using the amount required by state regulations. The chlorine was circulated in the well water for 30 minutes by attaching a hose to an outside faucet and running it back into the well. (Just dumping the chlorine in the well is not adequate.)

13.

The well was chlorinated a second time after it became necessary to pump silt out from a cave in. (Wells need to be chlorinated after any work on the well or the distribution system.)

14.

Time was spent helping the homeowner understand their well and the necessity for good maintenance such as chlorinating after work is done on the plumbing.

A Safer Bored Well:

Safer for the people who work on it.
Safer for the people who drink from it.

The Need. SAIF Water Wells has hundreds of laboratory reports on file showing bacteria in hand dug and bored water table wells. A long search for causes led us to suspect construction standards. A list was presented to Robert Royall of Royall Pump and Well Company in Powhatan of the construction problems which we felt were entry ways for bacteria. Mr. Royall took up the challenge to apply his expertise and also try some suggestions of SAIF Water to develop a well that would be a model for construction standards.

Project Design. The well was bored near Kilmarnock, Virginia in August of 2008. Each stage of the construction process was documented, photographed, and observed by Health Department officials, a hydrogeologist, a microbiologist, a building contractor, an environmental health specialist, and Board members of SAIF Water. Soil samples were taken at each scoop of the boring rig. SAIF Water has conducted a series of follow-up samples for total and fecal coliform bacteria.

This site was chosen because there were no environmental hazards such as nearby trees and because the old hand dug well on the property had failed several coliform bacteria analyses in spite of upgrades to the well. The water distribution system was equipped with an Ultra-Violet treatment system prior to construction.

Driller's Completion Report. The original depth of the experimental well was 56 feet. But on the second day the sediment filled in, changing the floor to 46 feet with the water table at 29 feet 9 inches. The final flow rate was two gallons per minute. (It would take 6 hours to completely refill the well). The water was crystal clear.

Laboratory Analyses. The well is not perfect. In the six months following construction there has been no fecal coliform. Total coliform readings have normally been very low—between <1 to 29.4 MPN/100 ml. (Most Probable Number of bacteria per 100 milliliters estimated by laboratory). But following a major storm which dumped 4 inches of water on the area, there was a spike of 95.9 MPN/100ml.

Discussion of Laboratory Results. Virginia requires zero total and fecal coliform bacteria for the water to be considered potable. If the standard test were used showing only presence/absence of coliform bacteria this well would be considered contaminated and possibly condemned. However, the laboratory readings in Most Probable Number estimates show that, under Health Department regulations, the well would be considered acceptable for use with a treatment device. It is a dramatic improvement over the scores which SAIF Water had found for hand dug wells in the area which are frequently higher than the laboratory can estimate. Soil scientists suggest that the sandy soil which goes the entire depth of the well does not allow enough residence time for bacteria from rainfall to be oxidized before reaching the water table. The first tests were taken shortly after a storm dumped 4 inches of water in the area. This may exceed the natural treatment capacity of any bored well.

(Some scientists feel that the total coliform standard is not a good measuring device and prefer to use fecal coliform analyses. Coliform bacteria is not harmful in itself but it is a convenient indicator organism which suggests the presence of other types of bacteria.)

SAIF Water Wells, Inc. is a nonprofit church-related organization that has helped people without water since 1989, primarily in Virginia's Northern Neck Counties. SAIF Water has felt the need for research, community education and attention to the public policies that are related to our drinking water.

Both Royall Pump and Well Company and SAIF Water Wells are members of the Virginia Water Well Association.

A video of the project is available on the SAIF Water website at www.saifwater.org.

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