GWPD 9—Recording minimum and maximum water levels

VERSION: 2010.1

PURPOSE: To determine the minimum and maximum water level in a well between site visits.

Materials and Instruments

1. Plastic spool of nylon fishing leader, 15- or 18-pound test
2. Standard 2 1/2-inch water-level float
3. Transparent 3/8-inch polyethylene tubing
4. Powdered cork
5. Brass tubing, 1/4-inch inside diameter
6. Non-lead shot pellets
7. Hammer, nails, and screw-eye hooks
8. Hacksaw
9. Graduated steel tape
10. Permanent, water-resistant marker
11. Field notebook
12. Pencil or pen, blue or black ink. Strikethrough, date, and initial errors; no erasures
13. Safety equipment: gloves, safety glasses, first-aid kit

Data Accuracy and Limitations

1. Devices were tested in a well having a continuous recorder and found to measure water levels to an accuracy of 0.1 foot.
2. Use should be limited to wells with water-level depths of 50 feet or less.
3. The well diameter is limited to 3 inches or larger with a standard 2 1/2-inch water-level float. In smaller diameter wells, a weighted dowel could be used in place of the standard float.

Advantages

1. Three water-level measurements can be obtained for each visit to the site regardless of the length of time between visits.
2. Devices are inexpensive and easy to install.
3. Devices can last indefinitely.

Disadvantages

1. If kinks occur in the polyethylene tubing, they may prevent the movement of the powdered cork and could cause anomalous readings.
2. If these devices are used in wells with water levels deeper than 50 feet, the nylon leader may stretch and give anomalous readings.
3. Dates of the minimum and maximum water levels cannot be determined.

Assumptions

1. No continuous recorder is available or necessary.
2. Dates of the maximum and minimum water levels are not critical.
3. The well has a shelter that contains a wooden base or subfloor.

Instructions

1. Construct the device for measuring maximum water levels (fig. 1, items 1–4).

   a. The maximum water-level device consists of a length of transparent 3/8-inch polyethylene tubing, two lengths of 1/4-inch inside diameter brass tubing, non-lead shot, powdered cork, and a nail.

   b. Crimp one end of an 8- to 12-inch length of brass tubing, slot the brass tubing with a hacksaw over the lower 3/4 of its length, fill the brass tubing with non-lead shot, and attach it to the lower end of the polyethylene tubing. Be sure to place enough non-lead shot in the polyethylene tubing so that the tubing hangs taut in the well and contains no kinks. The length of polyethylene tubing selected must be long enough to keep the lower 12 inches of the brass tubing submerged below the water surface at all times.

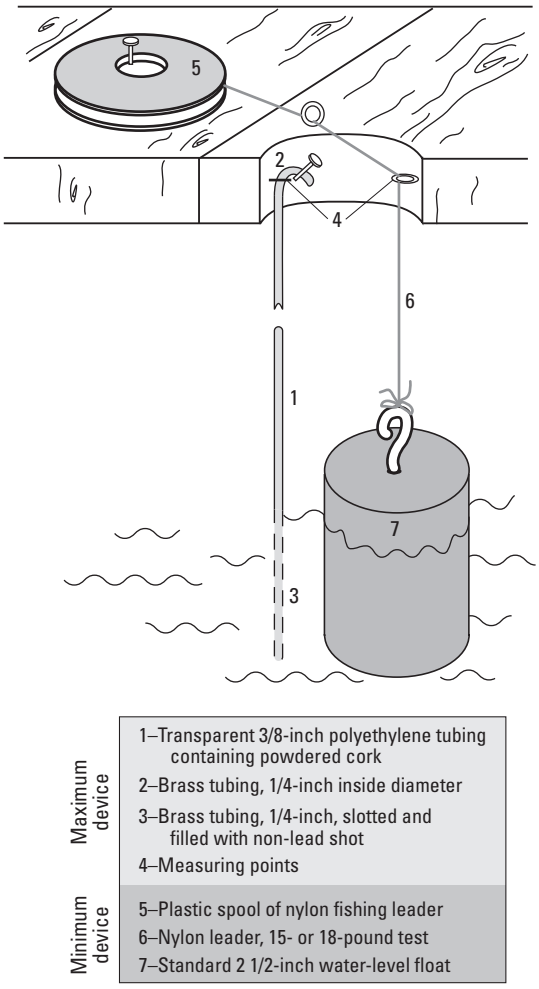

Figure 1. Devices for measuring maximum and minimum water levels in wells (modified from Kelly, 1968).

   c. Put several pinches of powdered cork in the polyethylene tubing.

   d. Bend a short length of brass tubing to form an elbow and insert the brass elbow into the upper end of the polyethylene tubing.

   e. Insert a nail in the wood base or subfloor of the well shelter to use as a measuring point. Mark the measuring point on the tubing with the permanent marker.

   f. Suspend the maximum water-level device in the well by hanging the brass elbow over the measuring point nail.

2. Determine the maximum water level for the well. The powdered cork adheres to the walls of the polyethylene tubing as the water level in the well rises, thereby marking the maximum water level. The maximum water-level device is a modification of a crest-stage gage.

   a. Gently withdraw the tubing assembly from the well.

   b. Measure the distance between the measuring point and the top of the powdered cork with a graduated steel tape.

   c. Record the maximum water level in the field notebook.

   d. Shake the powdered cork to the bottom of the device and re-install the maximum water-level device.

3. Construct the device for measuring minimum water levels (fig. 1, items 5–7).

   a. The minimum water-level device consists of nylon fishing leader wound on a disc-shaped spool, a standard 2 1/2-inch water-level float, a nail, and two screw-eye hooks.

   b. Attach the disc-shaped spool to the wooden base or shelter subfloor with a nail.

   c. Attach the two screw-eye hooks to the subfloor as shown in figure 1. The lower eye hook is used as a measuring point.

   d. Thread the nylon fishing leader from the disc-shaped spool through the screw-eye hooks and secure the nylon leader to the top of the float.

   e. Mark the waterline on the float with a permanent, water resistant marker before installing the float in the well.

4. Determine the minimum water level for the well. The water-level float pulls the nylon fishing leader from the spool as the water level declines and the nylon leader becomes slack. Spool friction prevents the nylon leader from rewinding.

    a. Place the nail of the index finger on the nylon leader at the eye hook measuring point to mark the leader.

    b. Hold your index finger on the leader mark and gently withdraw the nylon leader from the well.

    c. Measure the amount of nylon leader between the measuring point and the float plus the distance from the float-leader connection to the float waterline with a graduated steel tape.

    d. Record the minimum water level in the field notebook.

    e. Rewind the spool and re-install the minimum water-level device.

Data Recording

Record minimum and maximum water levels in the field notebook.

References

Kelly, T.E., 1968, Minimum and maximum water-level recording devices, *in* Chase, E.B., and Payne, F.N., comps., Selected techniques in water resources investigations, 1966–67: U.S. Geological Survey Water-Supply Paper 1892, p. 83–86.