Nebraska Department of Environment and Energy
Standard Operating Procedure (SOP)

Water Quality Division
Water Quality Assessment Section – GW

SOP Number: GW-072
Title: Determining Depth to Groundwater and Depth of a Water Well
Written Date: July 2024

Purpose:
This document describes procedures, methods and considerations to be used and observed when determining water levels and depths of wells.

Scope/Application:
The procedures contained in this document are to be used by field investigators to measure water levels and depths of wells. Water levels are used in determining groundwater elevations. These measurements are often collected in conjunction with groundwater sampling. Groundwater elevations are primarily used to determine groundwater flow direction.

On the occasion that field investigators determine that any of the procedures described in this section are either inappropriate, inadequate or impractical and that another procedure must be used for water level or depth determination, the variant procedure(s) should be documented in the field data sheets or field log book, along with a description of the circumstances requiring its use.

There are numerous methods that can be used for water level determination. These include, but are not limited to, the following: electric water level indicators or interface probes, chalked steel tapes, tapes with ploppers, pressure transducers, float type recorders, airline and sonic/ acoustic probes.

For the purposes of this SOP the electric water level indicator and the chalked steel tape methods will be discussed in greater detail.

Equipment/Materials Needed:

- Electronic water level indicator or
- Weighted steel tape with chalk (blue carpenters chalk), and cleaning cloth
- And field data sheets or field log book to record notes and measurements.

Procedures:

1. General

1.1. The measurement of the groundwater level in a well is frequently conducted in conjunction with groundwater sampling to determine the water table/ phreatic water surface. This potentiometric surface measurement can be used to establish groundwater flow direction and gradients. Groundwater level and well depth measurements are needed to determine the volume of water or drawdown in the well casing for proper purging.

2. One-time procedures, to be done prior to first water level measurement.

2.1. Determine or establish the top of casing measuring point (TOC) for each well. The TOC measuring point should be clearly marked on the well and may also be described on the field sheet or field log book so a person who has not previously measured the well will know where to measure.

2.1.1. This reference point is usually identified by the well installer using a permanent marker for PVC wells, or by notching the top of casing with a chisel for stainless steel wells. By convention, this marking is usually placed on the north side of the top of casing. Sometimes the TOC measuring point for PVC wells is the highest point of the casing. If no mark is apparent, the person performing the measurements can mark the measuring point on the casing, generally the north side of the top of casing, and note this procedure in with the field sheet or field log book. Then both water level and depth measurements may proceed.

2.2. Determining the relative or absolute elevation for all wells. To be useful for establishing a groundwater gradient, the TOC points have to be tied to a common local (site) datum or to a national datum (such as the North American Vertical Datum 88 (NAV88)).

2.2.1. The relative TOC elevation can be determined by surveying all of the wells relative to a common point (local datum). The common point should be assigned a relative elevation (i.e. 1000.00 ft.). The common point can be some part of permanent structure, such as a building corner or concrete driveway. The point should be easily found, easily accessible, stable, and as permanent as possible. Record the location of the common point on the site plan and field book.

2.2.2. Alternatively, the site may be surveyed to a national datum. National elevation datums are in feet above mean sea level (AMSL). Survey-grade GPS using Real-time kinematic (RTK) positioning are able to achieve centimeter accuracy with ideal conditions. Also, the site may be surveyed to an existing national datum control point such as a National Geodetic Survey marker (marker locations can be found online at: https://www.ngs.noaa.gov/NGSDataExplorer/).

2.2.2.1. The survey measurements should be made and recorded to the nearest 0.01 foot.

2.3. Determine land surface elevation at all wells.

2.3.1. The land surface elevation = TOC elevation – the distance to land surface.

3. **Open Wells.**

3.1. Open all of the wells to be measured. Water levels should be allowed to equilibrate prior to measurement after removing sealing caps. There are no set guidelines and appropriate equilibration times can range from minutes to hours depending on well recharge, local geology and topography, and project objectives.

3.2. If site contamination is a potential concern, the appropriate SOP(s) for cleaning and decontamination should be followed to minimize the risk of cross contamination (such as cleaning any non-dedicated equipment that is to enter the well with water and Alconox and rinsing before and after each use).

4. **Electric Tape Method**

4.1. Electronic Water Level Indicators – These types of instruments consist of a spool of dual conductor wire, a probe attached to the end and an indicator. When the probe comes in contact with the water, the circuit is closed and a meter light and/or audible buzzer attached to the spool will signal contact. (batteries are normally used as a power source.) Measurements should be made and recorded to the nearest 0.01 foot.

4.2. Calibration is generally not applicable, but check with the manufacturer's instructions for your particular instrument model.

4.3. Check the circuitry and batteries of the electric tape by dipping the probe into water and checking its operation prior to putting it in the well.

4.4. Prior to lowering the electric tape into the well, for measuring the bottom of well depth, note the sensor zero point relative to the end of the probe. Different water level indicators have different sensor zero points. This must be considered to obtain an accurate bottom of well depth. If the sensor zero point of the water level indicator is not at the end of the probe; the distance from the sensor to the end point of the probe is added to obtain an accurate bottom of well depth.

4.5. Lower the electrode probe slowly into the well to prevent splashing. When the probe sensor point comes in contact with water an electrical circuit is closed and the tape buzzes, beeps or the light goes on, indicating you have reached the water level surface. Hold the tape to the top of casing measuring point. Record the depth to water from the tape.

4.6. Turn off the electric tape and lower the tape until the weighted end is felt resting on the bottom of the well. It may be necessary to lift and lower the weighted tape several times to find the bottom of well. In deep wells it may be difficult to determine an accurate bottom depth. Hold the tape to the top of casing measuring point, record the measurement, adding the sensor zero point to bottom of probe measurement, if applicable. Record the bottom of well measurement. Remove the tape from the well. Decontaminant if appropriate.

4.7. Record other important information, such as time, date, weather, and person doing the work.

4.8. Replace cap and secure the well when the work is completed.

5. Chalked Steel Tape Method

5.1. Calibration: none. Steel tapes are commonly marked in increments of 0.01 foot.

5.2. Prior to lowering the steel tape a weight should be attached. Measure the distance from the bottom of the weight to the start of the graduated tape. This distance is added to obtain an accurate bottom of well depth.

5.3. Locate the top of casing measuring point.

5.4. Prepare tape. The steel tape must have a weight attached to the end. If the steel tape is new, the black sheen must be dulled in order for the chalk to stick (steel wool or fine sandpaper). Wipe the tape clean with a clean rag. Chalk the tape to a distance above where you expect the water level to be.

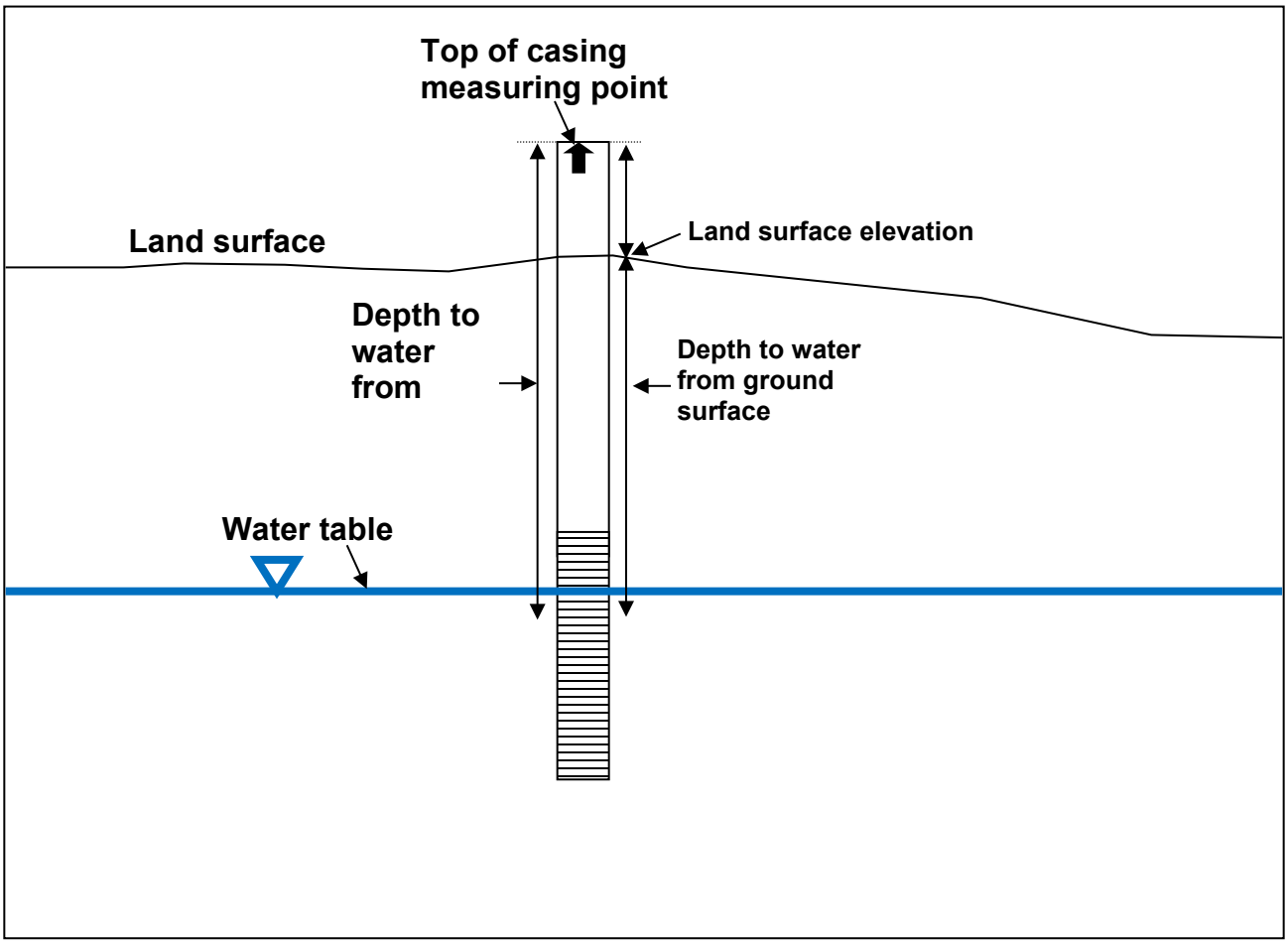
5.5. Lower the weighted steel tape into the well until the lower end of the tape is submerged below the water. Do this slowly to prevent splashing. Continue to lower the end of the tape into the well until the next graduation (a whole foot mark) is at the TOC measuring point. Record this number.

5.6. Carefully and quickly pull the tape out of the well before the wetted mark on the chalk can dry and can become difficult to read. Calculate the depth to water by subtracting the submerged length, as indicated by the wetted chalk, from the value observed at the TOC measuring point. Record the depth to water.

5.7. Lower the weighted steel tape into the well again until the weighted end is felt resting on the bottom of the well. It may be necessary to lift and lower the weighted tape several times to find the bottom of well. In deep wells it may be difficult to determine an accurate bottom depth. Hold the tape to the top of casing measuring point, record the measurement, adding the distance from the bottom of the weight to the start of the graduated tape. Record the bottom of well measurement. Remove the tape from the well. Decontaminant if appropriate.

5.8. Record other important information on table, such as time, date, weather, and person doing the work.

Monitoring well schematxeic



References:

1. Groundwater Level and Well Depth Measurement, LSASDPROC-105-R4, May 15, 2020. USEPA Region 4, Laboratory Services and Applied Science Division, Athens, GA, p 1-7.
2. Measuring Groundwater by use of a Graduated Steel Tape, 2010. USGS GWPD-1. Pages 1-4.
3. Measuring Groundwater by use of an Electrical Tape, 2010. USGS GWPD-4. Pages 1-6.
4. The Complete Ground-Water Sampling Field Course, Sept. 19-21, 2011, Lincoln, NE. The Nielson Environmental Field School. Instructed by David Nielson and Gillian Nielson.