



WATER LEVEL MEASUREMENT

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1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to set guidelines for the determination of the depth to water and floating chemical product (i.e., gasoline, kerosene) in an open borehole, cased borehole, monitoring well or piezometer.

Generally, water level measurements taken in boreholes, piezometers, or monitoring wells are used to construct water table or potentiometric surface maps and to determine flow direction as well as many other aquifer characteristics. Therefore, all water level measurements at a given site should be collected within a 24-hour period with a great deal of accuracy. Certain situations may necessitate that all water level measurements be taken within a shorter time interval. These situations may include:

1. The magnitude of the observed changes between wells appears too large.
2. Atmospheric pressure changes.
3. Aquifers which are tidally influenced.
4. Aquifers affected by river stage, impoundments, and/or unlined ditches.
5. Aquifers stressed by intermittent pumping of production wells.
6. Aquifers being actively recharged due to precipitation event.
7. Occurrence of pumping.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure or other procedure limitations. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

A survey mark should be placed on the casing for use as a reference point for measurement. Generally, the reference point is made at the top of casing or "stickup," but often the lip of the riser pipe is not flat. Another measuring reference should be located on the grout apron. The measuring point should be documented in the site logbook and on the groundwater level data form (Appendix A). Every attempt should be made to notify future field personnel of such reference point in order to ensure comparable data and measurements.

Prior to measurement, water levels in piezometers and monitoring wells should be allowed to stabilize for a minimum of 24 hours after well construction and development. In low yield situations, recovery may take longer. All measurements should be made to an accuracy of 0.01 feet.

In general, working with decontaminated equipment, proceed from least to most contaminated wells. Where many wells are to be sampled (i.e., greater than ten), measurements may be taken in a systematic manner to insure efficiency and accuracy. Open the well and monitor headspace with the appropriate monitoring instrument to determine the presence of volatile organic compounds. Lower water level measurement device into well until water surface or bottom of casing at least twice is encountered.

Measure distance from water surface to reference point on well casing at least twice and record in site logbook and/or groundwater level data form. Remove all downhole equipment, decontaminate as necessary, and replace casing cap. Note that if floating hydrocarbon product is present, a special dual liquid water level indicator is required.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

This section is not applicable to this standard operating procedure (SOP).

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

1. The chalk used on steel tape may contaminate the well.
2. Cascading water may obscure the water mark or cause it to be inaccurate.
3. Many types of electric sounders use metal indicators at five-foot intervals around a conducting wire. These intervals should be checked with a surveyor's tape (preferably with units divided in hundredths of a foot) to insure accuracy.
4. If there is oil present on the water, it can insulate the contacts of the probe on an electric sounder or give false readings due to thickness of the oil. It is recommended to determine the thickness and density of the oil layer in order to determine the correct water level. A special liquid water level indicator is required.
5. Turbulence in the well and/or cascading water can make water level determination difficult with either an electric sounder or steel tape.
6. An airline measures drawdown during pumping. It is only accurate to 0.5 foot unless it is calibrated for various drawdowns.

5.0 EQUIPMENT/APPARATUS

There are a number of devices which can be used to measure water levels. The device must be capable of attaining an accuracy of 0.01 feet, and calibrated on a regular basis.

Field equipment includes:

- C Air monitoring equipment

- C Well depth measurement device
- C Electronic water level indicator
- C Metal tape measure
- C Airline
- C Chalk
- C Ruler
- C Logbook
- C Paper towels
- C Groundwater water level data forms
- C pH meter (optional)
- C Specific conductivity meter (optional)
- C Thermometer (optional)

6.0 REAGENTS

No chemical reagents are used in this procedure; however, decontamination solutions may be necessary. If decontamination of equipment is required, refer to the SOP for Sampling Equipment Decontamination, and the site specific work plan.

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
6. Identify and mark all sampling locations.

7.2 Procedures

Procedures for determining water levels are as follows:

1. Make sure water level measuring equipment is in good operating condition.

2. If possible and when applicable, start at those wells that are least contaminated and proceed to those wells that are most contaminated.
3. Clean all equipment entering well by the following decontamination procedure:
 - C Triple rinse equipment with deionized water.
 - C Wash equipment with an Alconox solution which is followed by a deionized water rinse.
 - C Rinse with an approved solvent (e.g., methanol, isopropyl alcohol, acetone) as per the work plan, if organic contamination is suspected.
 - C Place equipment on clean surface such as a teflon or polyethylene sheet.
4. Remove locking well cap, note well ID, time of day, elevation (top of casing) and date in site logbook or an appropriate groundwater level data form.
5. Remove well casing cap.
6. If required by site-specific condition, monitor headspace of well with a photoionization detector (PID) or flame ionization detector (FID) to determine presence of volatile organic compounds, and record in site logbook.
7. Lower electric water level measuring device or equivalent (i.e., permanently installed transducers or airline) into the well until water surface is encountered.
8. Measure the distance from the water surface to the reference measuring point on the well casing or protective barrier post and record in the site logbook. In addition, note that the water level measurement was from the top of the steel casing, the top of the PVC riser pipe, the ground surface, or some other position on the well head.
9. The groundwater level data forms (Form 1, Appendix A) should be completed as

follows:

C Site Name: Site name

C Logger Name: Person taking field notes.

C Date: Date when the water levels are being measured.

C Location: Monitor well number and physical location.

C Time: Time (military time) at which the water level measurement was recorded.

C Depth to Water: Water level measurement in feet, tenths, or hundredths of feet, depending on the equipment used. Two measurements are required to insure accuracy.

C Comments: Any information the field personnel feels to be applicable may be included here.

C Measuring Point: Marked measuring point on PVC riser pipe, protective steel casing or concrete pad surrounding well casing from which all water level measurements for individual wells should be measured. This provides consistency in future water level measurements.

10. Measure total depth of well (at least twice to confirm measurement) and record in site logbook or on groundwater level data form.

11. Remove all downhole equipment, replace well casing cap and locking steel caps.

12. Rinse all downhole equipment and store for transport to next well. Decontaminate all equipment as outlined in Step 3 above.

13. Note any physical changes, such as erosion or cracks in protective concrete pad or variation in total depth of well, in field logbook and on groundwater level data form.

8.0 CALCULATIONS

To determine groundwater elevation above mean sea level, use the following equation:

$$E_w = E + D$$

where:

E_w	=	Elevation of water above mean sea level (ft) or local datum
E	=	Elevation above sea level or local datum at point of measurement (ft)
D	=	Depth to water (ft)

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

The following general quality assurance procedures apply:

1. All data must be documented on standard chain of custody forms, field data sheets, groundwater level data forms, or within personal/site logbooks.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.
3. Each well should be tested at least twice in order to compare results.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, or corporate health and safety practices.

12.0 REFERENCES

U.S. Environmental Protection Agency, 1986. RCRA Groundwater Monitoring Technical Enforcement Guidance Document, pp. 207.

U.S. Environmental Protection Agency, 1987, A Compendium of Superfund Field Operations Methods. EPA/540/p-87/001 Office of Emergency and Remedial Response Washington, D.C. 20460.

APPENDIX A

Groundwater Level Data Form

FORM 1. Groundwater Level Data Form

PAGE __ OF __

SITE NAME: _____

LOGGER NAME: _____

LOG DATE: _____

W.A #: _____

Well I.D.	TIME	Well Elevation (T.O.C.)	Depth to Bottom of Well (ft)	Depth to Water (ft)	COMMENTS (pH, temperature, specific conductance)

MEASUREMENT REFERENCE POINT FROM __ TOP OF GROUND OR __ TOP OF CASING

Weather Conditions:

Other significant observations: