

**STANDARD OPERATING PROCEDURE No. 22.0
PURGING AND SAMPLING MONITORING WELL**



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1.0 PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) describes the method by which a groundwater monitoring well is to be evacuated and sampled to obtain a representative sample of formation water. Wells are purged to remove stagnant water from the casing but excessive purging can also yield non-representative results. Wells with slow recovery rates create a logistical problem because of the time required for purging. Wells with slow recovery rates (low-yield) create a logistical problem because of the time required for purging; where as a high-yield well is defined as one in which the water level recovers almost immediately after water is removed. The procedure addresses the types of equipment, field purging and sampling procedures, field data collection and personnel responsibilities needed to ensure representative data.

2.0 RESPONSIBILITIES AND QUALIFICATIONS

The project manager or their designated representative will be responsible for implementing this SOP.

3.0 EQUIPMENT LIST

- Teflon bailer/ pump (Grundfos or ProActive)
- Tubing for pump
- Nylon rope for bailer
- Water level indicator
- Water quality meter (YSI 556) to collect the following field parameters: temperature, conductivity, pH, oxygen-reduction potential and dissolved oxygen.
- Sample bottles/ 40-ml vials
- Knife
- Sample gloves
- Paper towels
- Waste containers (gallon jug and trash bag)
- Pump and suction hose

4.0 RELATED STANDARD OPERATING PROCEDURES

SOP No. 6.0	Water Table Elevation
SOP No. 8.0	Field Equipment Calibration
SOP No. 10.0	Decontamination of Sampling Equipment
SOP No. 20.0	Sample Shipping Methods
SOP No. 21.0	Well Recovery Rate Determination
SOP No. 32.0	Well Casing Volume Determination

- SOP No. 52.0 Note Taking and Log Book Entries
SOP No. 66.0 Well Development

5.0 PROCEDURES

1. Verify locations of wells, media to be sampled, and parameters to be analyzed for as specified in the sampling plan.
2. Confirm that the wells to be sampled have been developed (refer to SOP “Well Development”).
3. Prepare field log book with description of site, weather, participants, and other relevant observations, including all sampling data necessary to complete the groundwater monitoring data log (refer to SOP “Note Taking and Log Book Entries”). Inspect the well for soundness of protective casing and surface ground seal.
4. Measure the casing inside diameter (CID) and record in inches. From the top of the casing, measure the depth (in feet) to water (DTW) with an electronic water level indicator and record in the field log book. Static water level measurements must be recorded from the surveyor’s mark at the top of the casing, if present. If no mark is present, mark a location with a metal file or indelible marker to the north on the casing for future reference. Measure and record the total depth (in feet) (TD) of the well once a quarter.
5. Monitoring wells should be sampled by starting with the upgradient (or clean wells) and proceeding downgradient (in the order from most to least contaminated wells) for the remaining monitoring wells.
6. Determine the volume of water in gallons in one well casing:

For a 2-inch well:

$$\text{Vol} = [(TD - DTW) * 0.16]$$

For a 4-inch well:

$$\text{Vol} = [(TD - DTW) * 0.65]$$

For a 5-inch well:

$$\text{Vol} = [(TD - DTW) * 1.03]$$

For a 6-inch well:

$$\text{Vol} = [(TD - DTW) * 1.48]$$

Or calculate the volume using the following formula:

$$\text{Vol} = (TD - DTW)(CID)^2(0.041)$$

Where TD = total well depth (ft), DTW = depth to water (ft), CID = casing inner diameter (in).

7. To determine the number of gallons required to purge the well, multiply the number of gallons in one well volume (calculations above) by three. Record the minimum purge volume in the field log book.
8. Purge the well using either a clean disposable bailer or a decontaminated pump (see below for equipment-specific instructions).
9. Affix a sample label to each sample container and complete all required information (sample no., date, time, sampler's initials, analysis, preservatives). Place clear tape over label. Record sample number, well number, date, time, and the sampler's initials in the field book.
10. Collect the groundwater samples after purging is complete.
11. Complete chain-of-custody forms with appropriate sampling information.
12. Complete both front and back of the groundwater monitoring data log (attachment) for each monitoring well or sampling point upon return from the field, using data from the field book.

Purging with a Bailer

1. Ensure that fine sediment has been removed by well development.
2. Determine the volume of water in well casing.
3. Tie a slip knot around the neck of the Teflon bailer. This should be done with clean sample gloves.
4. Release the bailer down into the well until the bailer is completely submerged below the water surface. Loop free end of bailer rope around wrist to prevent bailer loss down well.
5. When the bailer is full, retrieve it from the well. Do not allow bailer or bailer rope to come into contact with the ground surface. Place plastic sheeting around the well if necessary.
6. Measure water quality parameters after the first well volume has been removed (see SOP "Field Parameter Measurements"). Record water color, smell, suspended particulates, discoloration of casing, casing diameter and material, any unusual occurrences during sampling, and any pertinent weather details in the field log book.
7. Bail the well at a uniform rate, measuring water quality parameters after the collection of each original casing volume.
8. Dispose of the contents of the bailer in an appropriate container for later disposal in compliance with federal and state laws.
9. Attempt to remove a minimum of three well volumes before sampling.
 - a. If unable to remove 3 well volumes, purge until well is dry, or as nearly dry as possible.
 - b. Measure the field parameters again as soon as enough water has returned to measure.
 - c. Bail the well down again when it has recovered at least one half of the original casing volume.

- d. Re-measure the field parameters each time another full casing volume has been removed, and just before sampling.
 - e. Bail a maximum of three full casing volumes in 4 hours. Do not bail more than three casing volumes from a low or moderate yield well, as the time required would be excessive.
 - f. If the well has produced only two full casing volumes at the end of 4 hours, proceed to sample.
 - g. If the well has not produced two full casing volumes after 4 hours, bail the well dry one more time. Return to sample in 4 more hours (total time from first bailing until sampling equals 8 hours).
 - h. If the well has not recovered at all within 4 hours, do not sample.
10. After the minimum purge volume has been removed, review the geochemical measurements to ensure the readings have stabilized. Readings should be within 10% of the previous reading. If the geochemical parameters have not stabilized, continue to purge the well until the monitoring parameters do not vary more than 10 percent between two successive well volumes removed.
 11. Collect the groundwater samples after purging is complete (see above). When collecting samples, lower the bailer slowly to avoid agitating the water.
 12. Once the sample has been taken, properly dispose the used string, gloves, and paper towels.

Purging with a Pump

1. Ensure that fine sediment has been removed by well development.
2. Determine the volume of water per well casing.
3. Refer to the user's manual for pump operating instructions. Users manuals for the Grundfos Redi-flo 3 and the ProActive Hurricane are included in Attachment 1.
4. Assemble pump, tubing or hoses and safety cable.
5. Do not allow pump, pump lead, tubing, or hoses to come into contact with the ground surface. Place plastic sheeting around the well if necessary.
6. Slowly lower the pump and tubing to a depth approximately 10 ft below the water level. Make sure the pump is deep enough so that purging does not evacuate all the water. (Running the pump without water may cause damage.)
 - a. Attach pump power supply.
 - b. Begin pumping.
 - c. Collect water quality parameters.
 - d. As pumping continues, take water level readings periodically and lower pump as necessary to ensure the pump does not run dry.
7. Dispose of the pumped water in an appropriate container for later disposal in compliance with federal and state laws.

8. Attempt to remove a minimum of three well volumes before sampling. Record the minimum purge volume in the field log book. Record water color, smell, suspended particulates, discoloration of casing, casing diameter and material, any unusual occurrences during sampling, and any pertinent weather details in the field log book.
9. After the minimum purge volume has been removed, review the geochemical measurements to ensure the readings have stabilized. Readings should be within 10% of the previous reading. If the geochemical parameters have not stabilized, continue to purge the well until the monitoring parameters do not vary more than 10 percent between two successive well volumes removed.
10. Collect the groundwater samples after purging is complete (see above).

Filtering of Metal Samples

1. Assemble peristaltic pump per operating manual instructions.
2. At the pump intake, attach polyethylene tubing to the tubing at the head of the peristaltic pump. The polyethylene tubing should be long enough to extend to the bottom of the bailer. At the pump discharge end, attach a clean 0.45-micron filter to the Teflon tubing.
3. Turn on the pump and draw the water through the bailer, through the pump and filter, and into the sample container.
4. Disassemble the pump head and discard the polyethylene and Teflon tubing and filter in a plastic bag.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

All activities conducted under this SOP are subject to quality assurance and quality control audits. Corrective action will be implemented immediately.

7.0 DOCUMENTATION

All actions will be documented in accordance with SOP 52 "Note Taking and Log Book Entries.

8.0 REFERENCES

EPA, March 2001, Guidance for Preparing Standard Operating Procedures (SOPs) EPA QA/G-6, EPA/240/B-02/004, Office of Environmental Information, Washington, D.C.

EPA, March 2001, EPA Requirements for Quality Management Plans, EPA A/R-2, EPA/240/B-02/002, Office of Environmental Information, Washington, D.C.

EPA, November, 2002, Guidance on Environmental Verification and Data Validation, EPA QA/G-8, EPA/240/R-02/004, Office of Environmental Information, Washington, D.C.

EPA, December 2002, Guidance for Quality Assurance Project Plans, EPA AQ/G-5, EPA/240/R-2/009, Office of Environmental Information, Washington, D.C.