GROUNDWATER LEVEL MONITORING PROGRAM

1985

Introduction

A groundwater level monitoring program may be required to adequately indicate the impact of the proposed use on existing legal uses, water bodies, land uses, environmental features such as wetlands, saline water interface, or the aquifer. These guidelines are intended to help the Permittee in developing a groundwater level monitoring program.

Staff determines the scope of a Permittee's monitoring program by the size of the withdrawal, the hydrologic properties of the aquifer, the amount and type of other water use in the aquifer, and the land use surrounding the wellfield. The number of wells required for monitoring will normally be specified in the special conditions of the permit. For example, a water use of less than one million gallons per day in a relatively undeveloped inland area may require only one monitoring well, while a use of several million gallons per day from a highly-stressed coastal aquifer subject to salt water intrusion may require a number of monitoring wells at several depths located at various directions and distances from the wellfield.

The hydrologic aspects of each wellfield will differ; therefore, these guidelines are general in nature. A monitoring program for flowing wells will require a different methodology. Specific details and requirements for each program will be prepared on a case-by-case basis within the context of these guidelines. The Permittee must schedule a meeting with District Staff prior to observation well construction in order to review the design and scope of the monitoring program.

1.0 Definitions

1.1 General Terms

1.1.1 Annual Allocation: The permitted quantity of water approved by the Governing Board of the District for use on a yearly basis.

1.1.2 Area of Influence: The area of land surrounding a well or wellfield which may be impacted by the wellfield or, as a consequence of regional groundwater gradients, a land area which may impact the wellfield because groundwater flow under the land area is towards the wellfield. The area of influence of a wellfield may be determined on a case-by-case basis by defining either the drawdown or gradient of the drawdown induced by proposed withdrawals at the boundaries of the area of influence.

1.1.3 Cone of Depression: The conical shape taken by the potentiometric surface showing the variation of drawdown with distance due to pumping from a well (or wellfield) within its area of influence.

1.1.4 Interference: A condition occurring when the areas of influence of two or more wells overlap.

1.1.5 Potentiometric Surface: An imaginary surface representing the static head of groundwater and defined by the level to which water will rise in a well.

1.2 Terms Related to Groundwater Level Monitoring

1.2.1 Continuous Water Level Recorder: A device containing a movable pen which responds to water level changes in an observation well to produce a record of groundwater levels with respect to time.

1.2.2 Groundwater Level: For purposes of this report, the level to which water rises in an observation well, defining the potentiometric surface; throughout this report, the term "Groundwater Level" will mean the potentiometric level in an observation well, expressed in reference to NGVD, regardless of the type of aquifer in which the well is completed.

1.2.3 Hydrograph: A graph which shows changes in groundwater levels with respect to time; for purposes of this report, a graph of daily, weekly, or monthly groundwater levels, as compared to a graph produced by a water level recorder.

1.2.4 National Geodetic Vertical Datum (NGVD): Datum reference used by the District for reporting purposes; the elevation of groundwater levels or potentiometric surfaces above or below mean sea level.

1.2.5 Monitoring Well: A special well drilled in a selected location for the purpose of observing parameters such as groundwater levels and groundwater quality.

1.2.6 Potentiometric Surface Map: A map showing the elevation of the potentiometric surface of an aquifer, referenced to NGVD, by means of contour lines.

1.3 Terms Relating To Special Aquifer Types

1.3.1 Artesian Aquifer: An aquifer which is bounded on the top and bottom by confining layers of relatively impermeable material.

1.3.2 Multi-Depth Potentiometric Head Monitoring Program: A program to monitor potentiometric levels in a production zone and adjacent zones or aquifers with one or more clusters of observation wells completed in the various aquifers; the monitoring program is intended to determine the effects of withdrawals from the production zone in zones or aquifers.

1.3.3 Water Table Aquifer: An aquifer which does not have a confining upper boundary of impermeable material; in this type of aquifer, the potentiometric surface is generally referred to as the water table.

1.3.4 Water Table Monitoring Program: A program to monitor groundwater levels in a water table aquifer with one or more monitoring wells.

2.0 Monitoring Wells

2.1 Well Network Design

2.1.1 The specific number, depth, location and design specifications of monitoring wells are determined on a case-by-case basis.

2.1.2 Individual well locations are determined after the consideration of factors such as saline water bodies, potential pollution sources, nearby wells, surface water bodies and wetlands, and the boundary of the cone of depression.

2.1.3 Design and construction specifications for each well, to include drilling method, total depth, casing depth and type, and well finish, will consider factors such as local geology, drilling conditions, nearby wells completed either in the production zone or adjacent zones or aquifers, and the parameters to be monitored from the well.

2.2 Well Construction Guidelines

2.2.1 All monitoring wells shall be installed by a registered well driller working under the direction of a licensed contractor.

2.2.2 All materials and equipment shall be clean and free from oil, grease, solvents, or other contaminants.

2.2.3 Upon completion, the monitoring well shall be capable of producing water substantially free of sand and completely free of drilling fluids, and responsive to water level changes in the aquifer.

2.2.4 Sampling: Formation samples shall be collected during drilling every five (5) feet or change of formation, whichever occurs first. Samples shall be representative of the formation materials encountered at the depths at which they naturally occur in the borehole. Samples shall be clearly and indelibly labeled with the well identification and depth interval represented by the sample. A detailed driller's report shall be maintained and shall include, but not be limited to, a description of all formations encountered, depths at which the formations are encountered, and the number of feet drilled.

2.2.5 Casing: Well casing shall be new, schedule 40 pvc pipe or its equivalent, with a minimum 2 inch nominal diameter. The casing shall be assembled with threaded couplings, slip couplings, or flush joint threaded ends. If couplings are used, they may be secured to the casing with stainless steel screws that do not penetrate the PVC casing. Solvents and/or glue shall not be used to join casing. The well casing may extend above or below the protective steel casing. The top of the casing shall be fitted with a removeable, vented cap.

2.2.6 Screen: Well screen shall be new, schedule 40 PVC slotted pipe or its equivalent, 3 to 5 feet long with a minimum 2 inch nominal diameter. Slot size shall be compatible with formation materials and artificial gravel pack. It shall be fitted with a tail pipe of new, schedule 40 PVC pipe or its equivalent, 2 feet long with a minimum 2 inch nominal diameter. The bottom of the tail pipe shall be sealed with a blank cap. The screen, tail pipe, and cap shall be assembled and attached to the casing in a manner similar to the assembly of the casing. The casing and screen shall be plumb and centralized within the borehole.

2.2.7 Gravel Pack: An artificial gravel pack of washed, well rounded, well sorted, silica gravel of a size compatible with formation materials and screen slot size shall be used. The gravel shall have a minimum thickness of 2 inches and shall be placed in the borehole in such a manner as to completely fill the annular space. The gravel pack shall extend from the bottom of the tail pipe to 2 feet above the top of the screen.

2.2.8 Sand Cap: A sand cap consisting of clean washed quartz (silica) filter sand having a diameter of approximately 0.04 inches (1 mm) shall be used. The sand cap shall extend from the top of the gravel pack to 2 to 3 feet above the top of the gravel pack. The sand cap shall be placed in the borehole in such a manner as to completely fill the annular space. The sand cap shall have a minimum thickness of 2 inches. Bentonite or similar clay materials shall not be used as a substitute for the sand cap.

2.2.9 Grout: Neat cement grout shall be placed in the borehole from the top of the sand cap to ground surface. No more than 6 gallons of water per cubic foot of cement shall be used. The grout shall have a minimum thickness of 1 inch and shall be placed in the borehole in such a manner as to completely fill the annular space.

2.2.10 Well Casing Protection: A protective steel casing or equivalent shall be placed around the well casing a minimum of 2 feet below land surface to a minimum of 2 feet above land surface. The protective steel casing shall be of a diameter that allows access to the well casing for water level measurements and water sampling. A cement or concrete pad with minimum dimensions of 2 feet on each side, 4 inches thick, shall be placed around the protective steel casing. The pad shall be sloped in such a manner as to convey water away from the protective steel casing. The protective steel casing shall be fitted with a cap or locking cap. A hole must be drilled in the protective steel casing near the top of the pad to prevent the accumulation of water in the protective steel casing. The monitoring well identification must be clearly and indelibly marked on the protective steel casing.

2.3 Well Construction and Documentation

2.3.1 The District may require the collection of drill cuttings or cores, and the submittal of lithologic or geophysical logs, obtained during the drilling of observation wells.

2.3.2 A completion report should be submitted pursuant to Chapter 40.E-3, Florida Administrative Code (F.A.C.)

2.3.3 An accurate site map of the location of each monitoring well is required giving specific directions from landmarks to the well.

2.4 Water Level Recorders

2.4.1 Water level recorders which produce a page-type chart or a roll-type chart are recommended.

2.4.2 Recorders which produce circular charts or digital-coded punched paper tapes are not acceptable. A digital-coded type recorder would be considered only if the data has been decoded with the levels referenced to NGVD and then the data submitted.

3.0 Data Collection and Submittal

3.1 Establishment of Datum Reference for Monitoring Wells

3.1.1 A measuring point (MP) is established for each well and used as a reference point for all groundwater levels measurements. Normally, the measuring point is the top of the well casing.

3.1.2 The datum reference is established by surveying the elevation of the measuring point above mean sea level. (0.0' NGVD)

3.2 Groundwater Level Measurements

3.2.1 Wetted Tape Measurement: This method uses a steel measuring tape or surveyor's chain, preferably graduated into hundredths of a foot. The bottom portion of the tape is coated with carpenter's chalk or fluid-level paste and the tape is lowered into the well a sufficient depth to allow part of the chalked portion of the tape to be below the water level. At this point, find a footage marker on the tape, hold it against the measuring point, and record that footage (HOLD). Withdraw the tape from the well, determine the footage at which the water level CUT the tape as indicated by the line between wet and dry chalk or paste, and subtract the CUT footage from the HOLD footage to obtain the groundwater level (GWL) below the measuring point. To express the water level in terms of NGVD reference, subtract the GWL measurements from the elevation of the measuring point.

3.2.2 Electric Probe Measurement: An electric probe is a device in which contact with the top of the water column in a well completes a circuit and sends a signal, usually through an ammeter on the device. The point at which the probe first

touches water is determined, the probe cable is held against the measuring point, and the length of cable below the hold point is measured to determine the groundwater level. Subtract that level from the elevation of the measuring point to express the water level in NGVD reference.

3.2.3 Other Observations: Along with the groundwater level, the date and time of the measurement are recorded. It may also be useful to note items such as weather and precipitation, number of wells operating, etc.

3.3 Water Level Recorder Operation

3.3.1 Starting a Continuous Recorder Measurement: Measure the potentiometric level with steel tape or electric probe. Note the groundwater level (referenced to NGVD), date, time, and the initials of the person starting the record on the chart. Adjust the chart for the proper time of day and the recorder pen for the proper water level. Check the movement of the recorder float to be sure as upward movement in the well is shown as upward movement on the recorder.

3.3.2 Ending a Continuous Recorder Measurement: Measure the groundwater level (referenced to NGVD). If there is a large difference between the measured level and the level showing on the recorder, perform the measurement again. Note the level, date, time and inspector's initials on the chart. Also note any level discrepancy of 0.1 foot or more, and any time discrepancy of 1 hour or more per seven-day period.

3.4 Monthly Data Submittal Requirements

3.4.1 Groundwater Levels: Field measurements of groundwater levels are submitted to the District during the month following the month in which the measurements were made. If any monitoring wells are equipped with water level recorders, the recorder charts are submitted with the field measurements.

3.4.2 Documentation: The project name and permit number must accompany all data submittals to the District.

3.5 Annual Reporting Requirements

3.5.1 Hydrographs: The District may require that a hydrograph for each observation well be prepared at the end of each calendar year. The graph shall be prepared from the field groundwater level measurements taken in wells without water level recorders, or from the lowest water level occurring on the 5th, 10th, 15th, 20th, 25th and last day of the month in wells equipped with recorders. The water level scale on the hydrographs shall be held constant throughout the year.

3.5.2 Potentiometric Surface Map: For larger groundwater level monitoring networks, the District may require the submittal of wet season and dry season potentiometric surface maps. The maps shall be based on the May and November water level

measurements. A separate map should be prepared for each monitored aquifer.

3.5.3 Documentation: The project name and permit number must accompany all data submittals to the District.