	OFFICE OF DRINKING WATER AND MUNICIPAL ASSISTANCE POLICY AND PROCEDURE		DEPARTMENT OF ENVIRONMENTAL QUALITY
Original Effective Date: December 1, 1997	Subject: Aquifer Test Requirements for Public Water Supply Wells		Category: <input type="checkbox"/> Internal/Administrative <input type="checkbox"/> External/Noninterpretive <input checked="" type="checkbox"/> External/Interpretive
Revised Date: April 14, 2004	Division/Office and Program Names: ODWMA-Field Operations Section and Environmental Health Section		
Reformatted Date: January 14, 2013	Number: ODWMA-399-003	Page: 1 of 6	

A Department of Environmental Quality (DEQ) Policy and Procedure cannot establish regulatory requirements for parties outside of the DEQ. This document provides direction to DEQ staff regarding the implementation of rules and laws administered by the DEQ. It is merely explanatory; does not affect the rights of, or procedures and practices available to, the public; and does not have the force and effect of law.

INTRODUCTION, PURPOSE, OR ISSUE:

The goal of this policy and procedure is to establish standards for the acquisition of information used in implementing sound groundwater resource management practices. The Office of Drinking Water and Municipal Assistance (ODWMA) has established the following requirements and evaluation criteria for yield tests and hydrogeological assessments on wells serving public water supply systems. The requirements for a yield test are based upon widely accepted practices for conducting an aquifer test for the purpose of estimating potential yields from an aquifer and wells, characterizing the groundwater resource, and managing the groundwater resource.

AUTHORITY:

R 325.10807 (Rule 807), R 325.10809 (Rule 809), R 325.10812 (Rule 812), R 325.10813 (Rule 813), R 325.10814 (Rule 814), and R 325.10830 (Rule 830) of the administrative rules adopted under the Safe Drinking Water Act, 1976 PA 399, as amended, covering the location of wells, isolation area modification, location of wells with respect to major sources of potential contamination, studies of hydrogeological conditions by suppliers of water to Type I and Type IIa public water supplies, studies of suppliers of water of Type IIb and Type III public water supplies, and yield or performance testing requirements.

STAKEHOLDER INVOLVEMENT:

This policy and procedure was vetted before the consulting community through a public meeting in 1995. There were no objections to the policy and procedure. Language was added, such as the requirements for obtaining static water elevations and the determination of the groundwater gradient and direction of flow, at the recommendation of the consulting community.

DEFINITIONS:

High Capacity Well: a well or combination of wells that is or will be equipped with a pump of 70 gallons per minute (gpm) or greater capacity intended to serve a Type I public water supply

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system, or a Type II or Type III public water supply system with a pump of 70 gpm or greater capacity where the projected water withdrawal is over 100,000 gallons per day average for any 30 consecutive days.

Hydrogeologic Assessment: a study of hydrogeologic conditions, including a yield test, conducted for the purpose of determining an isolation area or assessing the acceptability of a well location.

Low Capacity Well: a well or combination of wells intended to serve a Type I, Type II, or Type III public water supply system that does not meet the definition of high capacity.

Yield Test: a test completed to determine the long-term production capability and/or drawdown of an aquifer or well.

POLICY:

1. Yield Tests for High Capacity Wells: High capacity wells shall be subject to the requirements of this policy and procedure.
2. Yield Tests for Low Capacity Wells: The requirements of this policy and procedure may apply to a low capacity well where deemed necessary by the ODWMA. Yield tests on low capacity wells may be required to fulfill all or a portion of this policy and procedure as deemed necessary by the ODWMA.
3. Hydrogeological Assessments: Yield tests conducted as part of a hydrogeologic assessment, such as those required under R 325.10830 on a Type I, Type II, or Type III well or a Wellhead Protection Area delineation, shall conform to the requirements of this policy and procedure. Waiver of the requirements for a yield test shall be contingent upon the availability of information on the aquifer necessary to completing the assessment using existing sources of information.
4. Replacement of Well Capacity: The requirements of this policy and procedure may be waived where a well intended to serve an existing Type I, Type II, or Type III public water supply is being constructed for the sole purpose of replacing previously existing capacity. Waiver of the requirements shall be contingent upon the availability of existing information that fulfills the requirements and intent of this policy and procedure.

PROCEDURES:

The purpose of an aquifer test is to define aquifer hydraulic characteristics and determine the ability of the aquifer to yield water. Data from an aquifer test shall be subject to a suitable mathematical analysis to predict the effects of continuous pumping with no recharge and determine a safe withdrawal rate from the aquifer. In certain instances, an aquifer test may be required to assess the effects of well interferences, determine if groundwater recharge or barrier boundaries exist, or assess the aquifer's vulnerability to contamination.

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Observation Well Requirements – Aquifer tests shall be conducted using a minimum of two observation wells. The observation wells may consist of adjacent wells terminated in the same aquifer and not in service during the aquifer test, or wells constructed for the sole purpose of obtaining drawdown measurements during the aquifer test. Observation wells shall be completed in the same aquifer and screened at or near the depth of the production well. If the production well terminates in the bedrock, the observation wells shall terminate in the same bedrock formation at approximately the same depth and exhibit a similar interval of open borehole. It is recommended observation wells be located at distances from the production well one to five times the thickness of the aquifer and at right angles to each other. The observation wells shall be located at different distances from the production well.

Location Information – Locations for all wells at the well site or used in the aquifer test (production well and observation wells) shall be obtained. Locations shall be obtained using a global positioning system and reported as latitude and longitude in degrees-minutes-seconds or in degrees to an accuracy of 0.00001 of a degree.

Water Well Records – Water well records for all wells at the site shall be entered into Wellogic or copies of the water well records transmitted to the ODWMA for entry into Wellogic. The water well records shall include complete and accurate location information, which at a minimum is to include the latitude and longitude of the well, the township name, township number, range number, section number, and county name where the wells are located. (Note: Transmittal of water well records to the ODWMA does not preclude the responsibility on the part of the water well driller to retain a copy and transmit a copy of the water well record to the local health department and the owner of the well in accordance with the Michigan Water Well Construction and Pump Installation Code, Part 127, Water Supply and Sewer Systems, of the Public Health Code, 1978 PA 368, as amended, and the administrative rules promulgated thereunder).

Static Water Elevations, Groundwater Gradient, and Direction of Flow – Static water elevations shall be obtained in all wells constructed at the well site or utilized in the aquifer test. Static water elevations shall be provided in feet above mean sea level (ft AMSL) with reference to the National Geodetic Vertical Datum of 1929 or the North American Vertical Datum of 1988. Static water elevations shall be determined by surveying the top-of-casing (ft AMSL), measuring the depth from the top-of-casing to the static water level in the well, and subtracting this depth from the top-of-casing elevation to determine the static water elevation in the wells. All surveyed elevations, depth from the top-of-casing to the static water level, and static water elevations shall be reported to an accuracy of 0.01 feet.

The static water elevations shall be used to determine the groundwater gradient and the direction of groundwater flow. The gradient and direction of groundwater flow shall be determined by "triangulation," at a minimum, on three static water elevations (one from the production well and one each from the two observation wells). Wells may be in such close proximity that obtaining an accurate groundwater gradient and direction of groundwater flow is

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not possible. In such instances the top-of-casing elevation, depth from the top-of-casing to the static water level, and static water elevation shall be provided.

Prior to the Aquifer Test – The collection of background static water levels is required to account for any natural or manmade trends in groundwater level that might impact the outcome of the aquifer test. Before beginning the aquifer test, static water level measurements shall be obtained from the production well and observation wells. Static water level measurements shall be taken at a minimum of one reading every hour for a period of time equal to at least 1/3 of the anticipated length of the aquifer test.

Pumping Rate and Duration – The production well shall be set up and equipped to discharge at or above the desired production rate for the duration of the aquifer test. Provisions shall be made to maintain a constant flow rate from the production well over the course of the aquifer test. Periodic measurement of the flow rate should be made to ensure a constant discharge. Water from the production well shall be discharged in a manner that will not impact water levels in the aquifer or the outcome of the aquifer test. Provisions shall be provided to control or precisely know the time and magnitude of groundwater withdrawals from the aquifer as a result of nearby large capacity wells producing from the same aquifer.

Where a production well is completed in a confined aquifer, the duration of the aquifer test shall be a minimum of 24 hours. Where hydrogeologic data suggests the aquifer is unconfined, the duration of the aquifer test shall be a minimum of 72 hours.

Drawdown and Recovery Measurements – During the aquifer test, drawdown measurements shall be recorded in the production well and observation wells to an accuracy of 0.01 feet. Drawdown measurements shall be made in the production well and observation wells, at a minimum, in accordance with the following schedule:

<u>ELAPSED TIME</u>	<u>MEASUREMENT FREQUENCY</u>
0 to 10 minutes	1 per minute
10 to 20 minutes	Every 2 minutes
20 to 60 minutes	Every 5 minutes
60 to 180 minutes	Every 15 minutes
180 to 360 minutes	Every 30 minutes
360 minutes to completion	Every 60 minutes

Upon completion of pumping, measurements of water level recovery shall be obtained from the production and observation wells for a period of time not less than 1/3 the length of the period of pumping. During recovery, measurements shall be made in accordance with the schedule as noted above for drawdown measurements.

The pretest, time-drawdown, and recovery data that is collected shall be provided in both hard copy and digital form to the ODWMA. Where data has been automatically collected in digital form at a frequency greatly in excess of the aforementioned elapsed time and measurement frequency, the data shall be reduced to a reasonable and manageable size and form prior to submittal of the data to the ODWMA.

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Analysis of Data – At a minimum, the aquifer hydraulic characteristics transmissivity and storage coefficient shall be determined employing the methods of Cooper and Jacob (1946) or Theis (1935). More complex methods of analysis, including but not limited to the following, should be used where appropriate to the area hydrogeology and response of the aquifer to the withdrawal of groundwater:

- Hantush and Jacob, 1955 – leaky-confined conditions
- Hantush, 1960 – leaky-confined conditions
- Neuman, 1972 – unconfined conditions and/or delayed yield
- Neuman, 1974 – unconfined conditions and partial penetration
- Hantush, 1961 – partial penetration
- Ferris, et al., 1962 – the presence of boundaries

The analysis of data shall include a prediction of the effects of 100 days pumping at the maximum pumping rate of the permanent pump. The predictions shall include the following:

- Maximum safe withdrawal rate for the production well.
- Projected drawdown in the production well (corrected for well losses where necessary).
- Projected drawdown throughout the aquifer (i.e., distance-drawdown or plan review).

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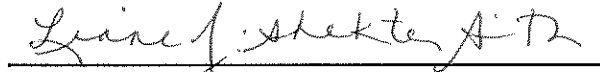
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OFFICE CHIEF APPROVAL:



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Date