

§ 30-6.8. Aquifer Test and Analysis. [Ord. No. 99-14, § 12; Ord. No. 2003-20, §§ I, II]

- a. Intent. It is the intent of the requirements of this subsection that an Aquifer Test and Analysis as set forth in § 30-6.8e1 be provided as part of a preliminary plat application of a major subdivision which subdivision is to be served by on-site wells. It is the intent that an Aquifer Test and Analysis as set forth in § 30-6.8e2 be conducted as part of a submission of a minor site plan. It is the intent that an Aquifer Test and Analysis as set forth in § 30-6.8e3 be conducted as part of a submission of a preliminary site plan when the development proposed by such site plan is to be served by one or more onsite wells.
- b. Applicability. The deepening or replacement of a well that has the primary purpose of providing drinking water to a residence is exempt from the requirements of this subsection. However, the installation of a second well with the primary purpose of irrigation, filling of swimming pools, or any other purpose other than to serving as the sole source of drinking water for a residence must satisfy the requirements of § 30-6.8d and e1A well installed for irrigation, filling of swimming pools, or any purpose other than providing the sole source of drinking water is considered to serve a nonresidential use.
- c. Waiver. If an applicant can show that given the expected average daily demand and distance to other nearby wells, the subdivision will not induce drawdown in any existing or future wells adjacent to the subdivision boundaries or in existing or future wells within the subdivision, then the applicant can request a waiver from the Planning Board for all or some of the requirements of this subsection.
- d. Aquifer Test and Analysis. The testing procedures for a major subdivision shall be based on a hydrogeologic analysis and an aquifer test. The hydrogeologic analysis shall include the review of available information and design of the aquifer test. The data collection shall be designed and evaluated by a qualified hydrogeologist. A geological and hydrogeologic report containing appropriate maps, well logs, pump test data and monitoring well data and complying with the requirements of § 30-6.8e herein shall be prepared and submitted. Prior to conducting any aquifer test, a preliminary hydrogeologic evaluation and the design of the aquifer test(s) shall be submitted for review by the Township.

The aquifer test shall consist of at least one pumping test conducted at a sufficient rate and duration to be able to determine aquifer characteristics such as transmissivity and storage coefficient. As part of the aquifer test, observation wells are to be monitored to determine and evaluate the cone of depression, confirm aquifer parameters, and predict the effect of long term pumping on existing and future wells.

e. Aquifer Test and Analysis Required.

1. Aquifer Test and Analysis for Major Subdivisions.

- (a) The rate and duration of the aquifer test will depend upon the size of the proposed subdivision and expected average and peak daily demands for all wells. The aquifer test shall be conducted at a location most representative of site geologic conditions. For residential subdivisions, biasing of testing toward areas of increased fracture density may result in the Township requiring additional testing in areas of lower fracture density to ensure that adequate yield is available throughout the proposed subdivision.

If the proposed site is underlain by two or more geologic zones (Precambrian Metamorphic & Igneous Zone, Cambrian-Ordovician Limestone/Dolomite Zone, or Jurassic-Triassic Conglomerate Zone as defined in the "Evaluation of Groundwater Resources of Union Township, Hunterdon County, New Jersey"), then an aquifer test will be required for each zone. The test requirements for each zone will depend on the number of lots and size of units per zone.

In the event that the preliminary hydrogeologic evaluation indicates that a surface-water and/or groundwater divide separates the subdivision, an aquifer test will be required for each side of the divide.

The average daily, peak day, and average yearly water demand for the subdivision must be determined according to the guidelines in N.J.A.C. 7:10-12.7. The peak day demand is twice the average daily demand.

To ensure that the pumping test adequately stresses the aquifer, the length of the pumping test will be equal to the greater of the following: 1) the volume of water removed from the aquifer is equal to the number of dwelling units

multiplied by the peak day demand (e.g. 10 dwelling units times a peak day demand of 450 gallons equals 4,500 gallons); or b) four hours. At a minimum, the pumping rate for the test should be equivalent to 120% of the expected long-term rate (e.g. if the expected rate for a dwelling is five gallons per minute, then the minimum rate for the test is six gallons per minute).

For nonresidential use, demand should be determined based on N.J.A.C. 7:10-12.6. If the demand exceeds 100,000 gallons per day, a New Jersey Water Allocation Permit must be obtained from the New Jersey Department of Environmental Protection. For demands less than 100,000 gallons per day, the length of the pumping test will equal the greater of the following: a) the volume of water removed from the aquifer is equal to the peak demand; or b) four hours. The peak demand should be assumed to equal twice the average daily demand. At a minimum, the pumping rate for the test should equal 120% of the expected long-term rate.

For mixed developments containing both residential and nonresidential properties, the residential portion will be tested as described above for residential developments. Each proposed well for the commercial portions will be tested as described in § 30-6.8e3(a) for nonresidential use. In addition, wells installed for the residential portion should be used as observation wells for the nonresidential testing and wells installed for nonresidential use should be used as observation wells for the residential testing.

The number of observation wells required per aquifer test will depend on the number of dwelling units and/or commercial units for the subdivision. New and existing monitoring wells may be located such that they can be used as future water-supply wells but they shall be located in such a manner that will yield the most accurate information concerning the aquifer. Observation wells should be located parallel and perpendicular to strike of the primary fractures intersected by the tested well.

All wells must be located in accordance with the minimum distances required by N.J.A.C. 7:10-12.12. For nonresidential developments with an expected average daily demand less than 2,000 gallons per day, one observation well is required. This well should be within

500 feet of the pumping well. For all other nonresidential developments, two or more observation wells are required. At a minimum, one of these observation wells must be within 200 feet of the pumping well. A second observation well must be within 200 feet and 500 feet of the pumping well. These two wells should be located along strike of the major water-bearing fractures intersected by the well. If additional observation wells are necessary, these wells should be located parallel to secondary and tertiary fracture sets.

Major subdivisions of five lots or less to be used for single-family dwelling purposes shall conduct a pumping test on each well as outlined in § 30-6.8e2. All the wells in a major subdivision of five lots or less shall be installed and used as observation wells as each individual well test is conducted. For major subdivisions of six or more lots to be used for single-family homes, the recommended number of observation wells shall be as shown in Table 1.

Table 1: Number of Observation Wells Required for Residential Subdivisions	
No. of Proposed Lots	No. of Observation Wells
5 or less	1 adjacent well
6 to 25	(minimum of 2 new wells within proposed subdivision)
25 to 49	(minimum of 4 new wells within proposed subdivision)
50 or more	Test proposal submitted to Board and NJDEP for review and approval

The observation wells and test well must have a geologic log describing the depth and types of soils and rocks encountered and the depth and approximate yields of water-bearing fracture zones. The observation wells should be completed to a similar depth as the test well. At least one of the observation wells shall be within 200 feet of the test well and at least one observation well must be located along the preferential fracture direction between 200 feet and 500 feet of the pumping well. Additional observation wells should be located to evaluate potential secondary fractures and impacts to adjacent properties.

The design of the aquifer test shall be developed using the applicable guidance from "Guidelines for Preparing Hydrogeologic Reports for Water Allocation Permit Application with an Appendix on Aquifer - Test analysis Procedures" NJGS GSR 29, 1992. The aquifer test shall be conducted according to the following procedures:

- (1) Owners of existing wells on lots located within 500 feet of the subdivision boundary shall be given an opportunity to have their wells monitored during the aquifer test. Such opportunity shall be given by the applicant by notice via certified mail and shall give the time and place of the well pumping test. Furthermore, the notice shall indicate that such existing well may be monitored if agreed to by the well owner provided the well is readily accessible. Such notice shall indicate that the existing well owner must respond within seven days and the applicant's responsibility is to monitor up to three wells on properties within 500 feet of the subdivision boundaries. If the owner of the lot within 500 feet of the subdivision boundaries decides to participate by agreeing to have their existing well monitored, they shall notify the applicant by certified mail. Such response shall be provided within seven days of receipt of the certified notice from the applicant. If the applicant receives no response within the time provided, the response shall be deemed to be negative.
- (2) If the owner of a lot within 500 feet of the subdivision boundaries is to have his existing well monitored, such lot owner shall, if requested by the applicant,

the applicant's hydrogeologist, and/or well driller, provide in writing a hold harmless agreement to applicant, the applicant's hydrogeologist, and/or well driller. All reasonable efforts shall be made to protect the potability of water from the monitored well.

- (3) In the case when more than three property owners within 500 feet of the subdivision boundaries decide to participate to have their existing wells monitored, only the three nearest the test well need be monitored.
- (4) Prior to conducting an aquifer test, the applicant shall submit the design of such aquifer test including the location of wells to be monitored on adjacent lots and qualifications of the persons and firm who will be performing the test for review by the Township. The applicant shall submit the application fees and escrow deposits in accord with § 30-11.5d, along with the proposed design of the aquifer test. The purpose of the escrow deposit is to cover the cost of Township review of the proposed aquifer test. Such review may include submission of such design to a qualified hydrogeologist representing the Township for review and recommendation.
- (5) The pumping test will be comprised of three phases. The first phase will involve the collection of background water levels prior to the start of the test. The second phase will involve the pumping of water from the well and the monitoring of water-level drawdown in the observation and pumping wells. The third phase will involve the recovery of water levels in the observation and pumping well after the pump has been shutdown. This third phase of the test should be the same length as the pumping phase.
- (6) If at all possible, the pumping test (all three phases) should not be conducted during precipitation events.
- (7) The background phase includes allowing the test well and observation wells to stabilize for a minimum of three days before the test. Water levels shall be collected from the test well and observation well 24 hours before the test. Barometer measurements and additional water-level measurements can be made by

the applicant to evaluate the change in water levels resulting from barometric pressure changes.

- (8) On the day of the test, water levels shall be collected from all wells. For those wells showing a change of more than 0.1 foot, a second round of measurements shall be collected before starting the test. Additional rounds of measurements may be necessary to determine that the well is in equilibrium. However, if the applicant has barometric pressure and water-level data to indicate that the change in static levels is due to changes in barometric pressure, the applicant can submit these data in lieu of delaying the pumping test.
- (9) The pump and discharge pipe shall be equipped with a flow meter and the discharge shall be directed so that it leaves the site without infiltrating to the aquifer. Any and all permits required by the NJDEP for the discharge of water must be obtained prior to starting the test.
- (10) When the pump is started the flow rate shall be adjusted immediately to a uniform pumping rate as required for a constant rate test so that the flow rate varies less than 10% throughout the test. If the flow rate fluctuates more than 10%, the test may be deemed invalid and the applicant required to repeat the notification and testing process. At a minimum, the flow rate for the test should be equal to 120% of the flow rate required to satisfy the average daily demand.
- (11) Water-level measurements during the pumping phase of the test shall be collected in accordance with Table 2. This same schedule shall be followed for the recovery phase of testing upon shut down of the pump in the test well.

Table 2: Frequency of Water-Level Measurements in Wells During and After Aquifer Testing

Time Since Pumping Began or Stopped	Test Well	Observation Wells
0 to 5 minutes	0.5 minutes	0.5 minutes
5 to 10 minutes	1 minute	1 minute
10 to 30 minutes	2 minutes	2 minutes
30 to 60 minutes	5 minutes	5 minutes
60 to 120 minutes	10 minutes	10 minutes
2 to 8 hours	30 minutes	30 minutes
8 to 24 hours	60 minutes	60 minutes
24 or more hours	120 minutes	120 minutes

- (12) If the water levels in the observation wells and test well do not fully recover to static (pre-pumping) levels within a length of time since pumping stopped equal to the length of pumping, the test will be deemed to have failed unless adequate data can be provided to ensure the aquifer is of sufficient extent to prevent the mining of groundwater.
- (13) Groundwater samples should be collected during the pumping test from the pumping well. The samples should be collected in accordance with the NJDEP Field Procedures Manual. At a minimum, the samples should be analyzed by a NJDEP certified laboratory for pH (field determined), hardness, iron, manganese, nitrate, chloride, and coliform bacteria. If site conditions indicate potential historic uses of pollutants such as, heavy metals, pesticides, herbicides, volatile organic compounds, and/or semivolatile organic compounds, these analyses should be conducted. The results of the water sample analyses will be used to assess background water quality.
- (14) The Township may choose to have a person of its choosing monitor the aquifer test.

- (b) Adjacent properties. The observation wells shall be placed to determine whether the cone of depression from the pumping well will extend beyond the subdivision boundary in any direction. This shall be determined by actual measurements or from projecting the drawdown based on observation well data. If the wells are in use, they should be disconnected and allowed to stabilize before the pumping test begins. One water level measurement shall be collected from each well before the test. For any observation well which has been pumped within 24 hours preceding the test, two depth to water measurements at least one hour apart shall be collected.
- (c) Hydrogeologic report. A hydrogeologic report shall be provided with each major subdivision application. The report shall document the design and implementation of the aquifer test. The report shall include all water-level data collected during the three phases of testing, the calculations of aquifer characteristics such as transmissivity and storage coefficient, calculations of the cone of influence, potential impacts to adjacent well owners, and the long-term sustained yield for the wells. The report shall also evaluate and draw conclusions from the aquifer test based on data collected and evaluation of available information concerning geologic conditions. The report shall include a detailed hydrogeologic description of the aquifers encountered beneath the site and adjacent properties. An inventory of all wells within 1,000 feet of the proposed subdivision boundaries should be appended. Figures depicting site geology, topography, water-level elevations, and plans shall be included.

In addition, all water-quality sampling data including copies of the laboratory reports should be provided with the hydrogeologic report. Tables summarizing the analytical results should be included.

The hydrogeologic report shall be prepared and signed by a qualified hydrogeologist using applicable sections of GSR 29 as a guide. A qualified hydrogeologist shall be an individual who has received a minimum of a bachelor's degree in geology at an accredited institution or has completed an equivalent of 30 semester hours of geological education while obtaining a Bachelor's or Master's degree in a related field of engineering or science at an accredited institution. Such a person must

also demonstrate five years of professional work experience in the practice of applying geologic principals to interpretation of groundwater conditions. The individual should provide a resume or curriculum vitae to document education and experience requirements.

The hydrogeologic report shall include the name and license number of the well driller and pump installer. The report should include the names of the persons and firm responsible for collecting the water-level measurements. In addition, the report should include copies of the completed NJDEP Well Record.

The Aquifer Test and Analysis shall be deemed to have failed if such test cannot demonstrate to the satisfaction of the Planning Board that sufficient groundwater supply exists to supply water via wells at a rate meeting at least the average daily demand for the proposed development. If the drawdown is measured or projected to be more than one foot at any existing adjacent property well or along the subdivision boundary, the applicant's hydrogeologist must evaluate the impact on adjacent properties based on the actual condition of wells in that zone.

If a drawdown of five feet or more is noted in any existing adjacent property well, or is projected at any property boundary then the proposed subdivision shall have failed the aquifer test. In the event of a failed aquifer test, because a drawdown of five feet or more is noted in any existing adjacent property well or is projected at any property boundary, either the applicant should decrease the number of lots to lessen demand or demonstrate to the satisfaction of the Planning Board that the impacts will not significantly reduce yields to existing and future wells.

2. Aquifer Test and Analysis for Individual Lots in a Major Subdivision of five or Fewer Lots and Minor Site Plans.
 - (a) The procedure for testing wells for subdivisions of five or fewer lots shall consist of pumping each of the subdivision wells individually for two hours at a minimum of five gallons per minute (gpm). During the testing of a well, no other subdivision wells shall be operating. After pumping for two hours, the pump shall be shut down and the rate of recovery measured. For the well to pass the test, a

recovery rate of one gpm must be achieved over the first 30 minutes following shut-off of the pump. In order to provide the necessary data to evaluate the pump test results, the following conditions shall be met:

- (1) The well shall remain undisturbed for three days following drilling to allow aquifer conditions to stabilize.
- (2) Water level measurements shall be collected from the well and accessible adjacent wells (within 500 feet) before starting the pumping test.
- (3) When the pump is turned on, the discharge rate shall be monitored and maintained at a minimum of five gpm. Although a water meter is preferable for measuring discharge, a five gallon bucket and a stopwatch may be employed.
- (4) Water levels in the pumping well and adjacent observation wells shall be collected according to the schedule in Table 2.¹
- (5) Near the conclusion of the pumping portion of the test, groundwater samples should be collected from the discharge in accordance with the NJDEP Field Procedures Manual. At a minimum, the samples should be analyzed by a NJDEP certified laboratory for pH (field determined), hardness, iron, manganese, nitrate, chloride, and coliform bacteria. If site conditions indicate potential historic uses of pollutants such as, heavy metals, pesticides, herbicides, volatile organic compounds, and/or semivolatile organic compounds, these analyses should be conducted. The results of the water sample analyses will be used to assess background water quality.
- (6) Immediately after the pump is shut off, water-level recovery shall be measured in accordance with Table 2.² The recovery rate shall be determined from these water-level recovery measurements for the first 30 minutes after the pump is shut down. The

1. **Editor's Note: Table 2, referred to herein may be found following Subsection e1(a)(11) of this subsection.**

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measurements should indicate a flow into the well of at least one gpm over this interval.

- (7) In the event that the well shows little drawdown (less than two feet) during the two hours pumping portion of the test, pumping may continue in lieu of the recovery rate portion of the test. The minimum requirement for pumping after two hours is that a minimum rate of one gpm be maintained for an additional hour with no increase in drawdown. The recovery of the water level shall still be monitored after the shut-off of the pump.
- (8) A report summarizing the well construction and aquifer testing shall be submitted to the Planning Board. The report should include the water-level measurements and recovery rate calculations.
- (9) The report should include the well driller's and pump installer's name and license numbers. In addition, the names of the person and firm that measured the water level drawdown and recovery data, and calculated the recovery rate shall be provided. The report should include a copy of the completed NJDEP Well Record for all wells within the subdivision.
- (10) Based on the results of the testing and report, the Township may request additional analyses of the pumping test data to evaluate aquifer characteristics, the potential cone of influence, and potential impacts to other nearby groundwater users.
- (11) If after two hours of recovery, the water-levels in the observation wells and pumping well have not returned to the static (prepumping) levels, then the well or wells will have failed the test.

If the test well fails any part of the above test either by failing to maintain a pumping rate of five gpm for two hours, failing to recover at a rate of one gpm, or failing to recover to the static level within two hours after pumping stopped, the well shall be considered marginal and shall be deepened to intercept additional fractures and to add additional well storage. After well deepening, the entire test procedure shall be repeated. If the well fails again, the well will be classified as marginal.

If a well is classified as marginal the Township shall be notified to evaluate the conditions of nearby wells. If a well is deemed marginal, then as a condition of approval, the Township may choose to deed restrict the lot to prevent heavy water uses such as swimming pools or landscape irrigation systems.

- (b) Adjacent wells. Existing wells within 500 feet of the test well on adjacent lots shall be identified as observation wells for the test. The applicant shall notify the owners of adjacent lots which contain wells within 500 feet of the test well and such owners shall be given an opportunity to have their wells monitored following the same procedures set forth in § 30-6.8d through e1(a) of this chapter. In the case where more than three existing wells are located within 500 feet of the well to be tested, only the three nearest accessible wells need to be monitored. If the wells are in use, they should be disconnected and allowed to stabilize before the pumping test begins. One water level measurement shall be collected from each well before the test. For any observation well which has been pumped within the 24 hours preceding the test, two depth to water measurements at least one hour apart shall be collected.

If drawdown is measured or projected to be more than one foot at any existing adjacent property well or along the subdivision boundary, the applicant must notify the Township and evaluate the impact on adjacent properties based on the actual condition of wells, the static water level, and the depth of the pump in the existing well. The potential for adverse impacts needs to be evaluated by a hydrogeologist who will investigate the depth, yield, and pumping level of the affected well.

If a drawdown of five feet or more is noted in any existing adjacent property well, or is projected at any property boundary then the proposed subdivision shall have failed the aquifer test. In the event of a failed aquifer test, because a drawdown of five feet or more is noted in any existing adjacent property well or is projected at any property boundary, either the applicant should decrease the water-supply demand or demonstrate to the satisfaction of the Planning Board that the impacts will not significantly reduce yields to existing and future wells.

3. Aquifer Test and Analysis for Nonresidential Use Site Plan.
 - (a) An aquifer pump test shall be conducted when a nonresidential use is intended to be served by on-site ground water supply. The pumping rate and total gallons pumped during the pumping test should demonstrate that the needed water is available without detrimental impact on the aquifer or nearby wells.

Demand shall be based on N.J.A.C. 7-10.12.6. If the demand exceeds 100,000 gallons per day, a New Jersey Water Allocation Permit must be obtained from the New Jersey Department of Environmental Protection. For demands less than 100,000 gallons per day, the length of the pumping test will equal the greater of the following: a) the volume of water removed from the aquifer is equal to the peak demand; or b) four hours. The peak demand should be assumed to equal twice the average daily demand. The average daily demand shall be calculated from the projected maximum monthly usage. At a minimum, the pumping rate for the test should be equivalent to 120% of the expected long-term rate.

For nonresidential developments with an expected average daily demand less than 2,000 gallons per day, one observation well is required. This well should be within 200 feet of the pumping well. For developments with expected daily demands from 2,000 to 9,999 gallons per day, two observation wells are required. One of these observation wells must be within 200 feet of the pumping well. A second observation well must be within 200 feet and 500 feet of the pumping well. These two wells should be located along strike of the major water-bearing fractures intersected by the well. If a well(s) on one or more adjacent properties are located within the distance limits above, and these wells can be disconnected for a period of 24 hours prior to and during the entire pumping and recovery phase, these wells can be used for observation in lieu of installing new observation wells.

For all other nonresidential developments, two or more observation wells are required. Two of these wells should be located along strike of the major water-bearing fractures intersected by the well. Additional observation wells should be located to evaluate potential secondary fractures and impacts to adjacent properties.

The number of observation wells should be in accordance with Table 3.

Table 3: Aquifer Test Requirements for Nonresidential Developments	
Average Demand (gallons per day)	No. of Observation Wells
1,999 or less	1
2,000 to 9,999	2
10,000 to 99,999	5 (at least 2 on-site observation wells)
100,000 or more	Obtain NJDEP Water Allocation Permit

The observation wells and test well must have a geologic log describing the depth and types of soils and rocks encountered and the depth and approximate yields of water-bearing fracture zones. The observation wells should be completed to a similar depth as the test well.

The design of the aquifer test shall be developed using the applicable guidance from "Guidelines for Preparing Hydrogeologic Reports for Water Allocation Permit Application with an Appendix on Aquifer - Test analysis Procedures" NJGS GSR 29, 1992. The aquifer test shall be conducted according to the following procedure:

- (1) Owners of existing wells on lots located within 500 feet of the nonresidential development boundary shall be given an opportunity to have their wells monitored during the aquifer test. Such opportunity shall be given by the applicant by notice via certified mail and shall give the time and place of the well pumping test. Furthermore, the notice shall indicate that such existing well may be monitored if agreed to by the well owner provided the well is readily accessible. Such notice shall indicate that the existing well owner must respond within seven days and the applicant's responsibility is to monitor up to three wells on properties within 500 feet of the subdivision boundaries. If the owner of the lot within 500 feet of the subdivision boundaries decides to participate by agreeing to have their existing well monitored, they shall notify the applicant by certified mail. Such

response shall be provided within seven days of receipt of the certified notice from the applicant. If the applicant receives no response within the time provided, the response shall be deemed to be negative.

- (2) If the owner of a lot within 500 feet of the development boundaries decides to have their existing well monitored, such lot owner shall, if requested by the applicant, the applicant's hydrogeologist, and/or well driller, provide in writing a hold harmless agreement to applicant, the applicant's hydrogeologist, and/or well driller. All reasonable efforts shall be made to protect the potability of water from the monitored well.
- (3) In the case when more than three property owners within 500 feet of the nonresidential development boundaries decide to participate to have their existing wells monitored, only the three nearest the test well need be monitored.
- (4) Prior to conducting an aquifer test, the applicant shall submit the design of such aquifer test including the location of wells to be monitored on adjacent lots and qualifications of the persons and firm who will be performing the test for review by the Township. The applicant shall submit the application fees and escrow deposits in accord with § 30-11.5d, along with the proposed design of the aquifer test. The purpose of the escrow deposit is to cover the cost of Township review of the proposed aquifer test. Such review may include submission of such design to a qualified hydrogeologist representing the Township for review and recommendations.
- (5) The pumping test will be comprised of three phases. The first phase will involve the collection of background water levels prior to the start of the test. The second phase will involve the pumping of water from the well and the monitoring of water-level drawdown in the observation and pumping wells. The third phase will involve the recovery of water levels in the observation and pumping well after the pump has been shut down. This third phase of the test should be the same length of the pumping phase.

- (6) If at all possible, the pumping test (all three phases) should not be conducted during precipitation events. In addition, if adjacent property wells are used instead of new observation wells, then the pumping test should not be started until the water levels in the adjacent property wells stabilize and an accurate static water level can be measured.
- (7) The background phase includes allowing the test well and observation wells to stabilize for a minimum of three days before the test. Water levels shall be collected from the test well and observation well 24 hours before the test. Barometer measurements and additional water-level measurements can be made by the applicant to evaluate the change in water levels resulting from barometric pressure changes.
- (8) On the day of the test, water levels shall be collected from all wells. For those wells showing a change of more than 0.1 foot, a second round of measurements shall be collected before starting the test. However, if the applicant has barometric pressure and water-level data to indicate that the change in static levels is due to changes in barometric pressure, the applicant can submit these data in lieu of delaying the pumping test.
- (9) The pump and discharge pipe shall be equipped with a flow meter and the discharge shall be directed so that it leaves the site without infiltrating to the aquifer. Any and all permits required by the NJDEP for the discharge of water must be obtained prior to starting the test.
- (10) The flow rate shall be adjusted immediately upon starting the test to a uniform pumping rate as required for a constant rate test so that the flow rate varies less than 10% throughout the test. If the flow rate fluctuates more than 10%, the test may be deemed invalid and the applicant required to repeat the testing process. At a minimum, the flow rate for the test should be equal to 120% of the flow rate required to satisfy the average daily demand.
- (11) Water-level measurements during the pumping phase of the test shall be collected in accordance with Table

4. This same schedule shall be followed for the recovery phase of testing upon shut down of the pump in the test well.

Table 4: Frequency of Water-Level Measurements in Wells During and After Aquifer Testing

Time Since Pumping Began or Stopped	Test Well	Observation Wells
0 to 5 minutes	0.5 minutes	0.5 minutes
5 to 10 minutes	1 minute	1 minute
10 to 30 minutes	2 minutes	2 minutes
30 to 60 minutes	5 minutes	5 minutes
60 to 120 minutes	10 minutes	10 minutes
2 to 8 hours	30 minutes	30 minutes
8 to 24 hours	60 minutes	60 minutes
24 or more hours	120 minutes	120 minutes

- (12) If the water levels in the observation wells and test well do not fully recover to static (pre-pumping) levels within a length of time since pumping stopped equal to the length of pumping, the test will be deemed to have failed unless adequate data can be provided to ensure that the aquifer is of sufficient extent to prevent the mining of groundwater.
- (13) Groundwater samples should be collected during the pumping test from the pumping well. The samples should be collected in accordance with the NJDEP Field Procedures Manual. At a minimum, the samples should be analyzed by a NJDEP certified laboratory for pH (field determined), hardness, iron, manganese, nitrate, chloride, and coliform bacteria. If site conditions indicate potential historic uses of pollutants such as, heavy metals, pesticides, herbicides, volatile organic compounds, and/or semivolatile organic compounds, these analyses should be conducted. The results of the water sample analyses will be used to assess background water quality.

- (14) The Township may choose to have a person of its choosing monitor the aquifer test.
- (b) Adjacent properties. The observation wells shall be used to determine whether the cone of depression from the pumping well will extend beyond the nonresidential development boundary in any direction. This shall be determined by actual measurements or from projecting the drawdown based on observation well data. If the adjacent property wells are in use, they should be disconnected and allowed to stabilize before the pumping test begins. One water level measurement shall be collected from each well before the test. For any adjacent not designated as an observation well and which has been pumped within the 24 hours preceding the test, two depth to water measurements at least one hour apart shall be collected.
- (c) Hydrogeologic report. A hydrogeologic report shall be provided with each major subdivision application. The report shall document the design and implementation of the aquifer test. The report shall include all water-level data collected during the three phases of testing, the calculations of aquifer characteristics such as transmissivity and storage coefficient, calculations of the cone of influence, potential impacts to adjacent well owners, and the long-term sustained yield for the well or wells. The report shall also evaluate and draw conclusions from the aquifer test based on data collected and evaluation of available information concerning geologic conditions. The report shall include a detailed hydrogeologic description of the aquifers encountered beneath the site and adjacent properties. An inventory of all wells within 1,000 feet of the proposed subdivision boundaries should be appended. Figures depicting site geology, topography, water-level elevations, and plans shall be included.

In addition, all water-quality sampling data including copies of the laboratory reports should be provided with the hydrogeologic report. Tables summarizing the analytical results should be included.

The hydrogeologic report shall be prepared and signed by a qualified hydrogeologist using applicable sections of GSR 29 as a guide. A qualified hydrogeologist shall be an

individual who has received a minimum of a Bachelor's degree in geology at an accredited institution or has completed an equivalent of 30 semester hours of geological education while obtaining a Bachelor's or Master's degree in a related field of engineering or science at an accredited institution. Such a person must also demonstrate five years of professional work experience in the practice of applying geologic principals to interpretation of groundwater conditions. The individual should provide a resume or curriculum vitae to document education and experience requirements.

The hydrogeologic report shall include the name and license number of the well driller and pump installer. The report should include the names of the persons and firm responsible for collecting the water-level measurements. In addition, the report should include copies of the completed NJDEP Well Record.

The Aquifer Test and Analysis shall be deemed to have failed if such test cannot demonstrate to the satisfaction of the Planning Board that sufficient groundwater exists to supply water via wells at a rate meeting at least the average daily demand for the proposed development. If drawdown is measured or projected to be more than one foot at any existing adjacent property well or along the nonresidential development boundary, the applicant's hydrogeologist must evaluate the impact on adjacent properties based on the actual condition of wells in that zone.

If a drawdown of five feet or more is noted in any existing adjacent property well, or is projected at any property boundary then the proposed subdivision shall have failed the aquifer test. In the event of a failed aquifer test, because a drawdown of five feet or more is noted in any existing adjacent property well or is projected at any property boundary, either the applicant should decrease the average daily demand or demonstrate to the satisfaction of the Planning Board that the impacts will not significantly reduce yields to existing and future wells.