97 Attachment 3

Town of Goshen

Appendix C: Water Testing Protocols
[Amended 2-23-2009 by L.L. No. 1-2009]

A. Protocols for Well Installation, Testing and Reporting of Private Well Supplies for Subdivisions

Introduction

The Town of Goshen undertook a Town-Wide Potable Water Planning Study that was completed in January of 2003. That study considered hydrogeologic conditions and limitations on development potential due to water supply and quality. The study concluded that the Town is dependent on bedrock aquifers due to constraints in the underlying aquifers. The Town then adopted revisions to the zoning to reflect appropriate limits on development that included minimum lot sizes to reflect the results of the study. Essentially, the Town was divided into two aquifer overlay districts, the AQ3 at one dwelling unit for every three acres and the AQ6 zone at one unit per six acres. Although the study established a basis for establishing minimum lot area requirements, the Town's experience has been that water supply quantity and quality can vary within subdivisions, even those with conforming lots. The Town desires to better assure each lot approved by the Planning Board will have the fundamental element of water supply, and has concluded that on-site water-testing is needed for all subdivisions. Therefore, all subdivisions involving three or more lots, which include lots with on-site private water wells, must perform a hydrogeological study and associated testing to confirm the availability of reliable on-site water and minimal impact on adjacent parcels. The study must be performed by a hydrogeological consultant approved by the Town of Goshen. This document provides an outline of the requirements of the hydrogeological study.

Purpose. The purpose of this document is to provide guidance to landowners who are planning to install private wells in the Town of Goshen to serve new residential subdivisions. For central water supply wells and commercial developments see Water Protocols in Section B below. These protocols are intended for use as prescribed in §§ 83-22C(2) and 97-43B. By following these procedures, the Town and the owner can:

Ensure that the new well(s) can provide enough water for the proposed development.

Ensure that the new well(s) will not adversely affect existing wells in the vicinity of the proposed wells.

These guidelines are based upon established principles and practices of hydrogeology. A licensed professional engineer must certify the work performed is as required herein.

Water Supply Capacity Determination - Procedures

The following items must be completed:

(1) Determine demand for groundwater.

(2) Establish water demand using New York State Department of Environmental Conservation (NYSDEC), New York State Department of Health (NYSDOH) or Orange County Health Department requirements, whichever is more stringent.

(3) Contact Town of Goshen.

(4) Notify the Town Building Inspector of intent to obtain the necessary approvals and/or to propose additional lots through this procedure. Complete a "Preliminary Application Form" as seen in Attachment 1.

(5) Test and observation well location and design.

The Aquifer Test shall be conducted using the number of appropriately sized wells as specified in the code. Essentially, this requires one drilled well for the first three lots and one additional well for each additional three lots or part thereof. As an example, two wells would be required for a four- to six-lot subdivision and three wells for a seven- to nine-lot subdivision and so on. If the landowner demonstrates to the Planning Board, upon the recommendation of the Town Engineer, that a lesser number of wells than that required herein is likely to provide sufficient quantity and quality data, then a reduction in the number of required wells may be permitted but the flow rate for test pumping shall be increased to 250% of the maximum day demand. The test and observation wells shall be designed and located so as to provide sufficient data for the landowner to adequately assess the groundwater system capabilities, limitations and capacity.

Test wells shall be standard private well design in accordance with Health Department requirements for conversion to a permanent well if successfully developed; well points are not acceptable for test wells but may be used for monitoring wells if desired.

The location and construction of wells must meet all New York State Department of Health and Orange County setback and construction requirements.

The following information will assist in the well site location and design. A well location map shall be prepared identifying all of the well sites and observation well sites.

1. Identify potential well site(s) based on distribution of wells in all geologic and divergent topographic formations on site to provide a broad representation of site variables to assess production capabilities and water quality.

   Conduct an initial investigation to select a desirable site based on the following:

   · Likelihood that groundwater contamination is low.

   · Depletion of nearby streams and wetlands is unlikely.

   · Interference with nearby wells is unlikely.

   Use published geological maps to assist in choosing well location.

2. Observation wells. Representative wells within 500 feet of the proposed subdivision shall be monitored. If existing wells cannot be monitored, observation wells must be installed at the property boundary to identify impacts. The number of monitoring wells will vary depending on the size and shape of the parcel for development and shall be submitted with the preliminary application form. The impact of all existing wells located along key fracture trends between 500 and 2,500 feet from the test well shall also be determined. Observation wells shall be shown on the well location plan.

(6) Aquifer Test Plan Proposal.

Prepare and submit an Aquifer Test Plan Proposal to the Town of Goshen. The aquifer test shall be conducted at a flow rate of at least 200% of the total maximum day demand of the subdivision. If the landowner demonstrates that a lesser number of wells than that required under the code are likely to provide sufficient quantity and quality data, then the percentage of maximum flow rate for test pumping shall be increased to 250% of the maximum day demand. An outline of the mandatory items for the Aquifer Test Plan Proposal is included in Appendix 2.

The Town may approve, reject or request more information after receipt of the Aquifer Test Plan.

(7) Obtain permits. Prior to installing test wells and conducting any hydrogeologic tests, any required applicable permits must be obtained.

(8) Install wells.

Install appropriately sized test wells and observation wells as needed per the guidance above and the approved plan at the locations selected. Well(s) shall not be installed until the Town of Goshen has approved the aquifer test plan.

Review the geologic log and yield during drilling to determine if the well(s) will be suitable for further investigation. Record field data during drilling, particularly fissure location, to facilitate analyses. Complete and file a Well Completion Report.

(9) Conduct hydrogeologic tests. The following is required:

1.0 Determine all external influences and methods for observation. There are several external influences that must be monitored during background, testing and recovery. The following influences must be observed. A description of the method to monitor each of these influences is described below.

1.1 Test well(s) pumping rate.

Each well shall be tested to confirm that there is a minimum yield of five gallons per minute (gpm) as required by 10 NYCRR Part 74, Section 74.5(c). A test pump capable of providing a minimum of five gpm at the required head must be used to perform the test.

If a sustainable yield of five gpm at a stabilized drawdown is not possible, the yield test may be performed at a rate between two and five gpm; however, an overdrilled borehole or enclosed storage structure (tank) of at least 400 gallons may be required.

Measure the pumping rate via flow using an approved method as listed in the aquifer test plan [typically an automatic data recorder (ADR)]. The discharge flow rate shall be monitored and recorded manually at least once every 10 minutes during the first hour of the test and every 60 minutes thereafter.

1.2 Test well(s) drawdown.

Measure the test well drawdown using an approved method as listed in the aquifer test plan [typically an automatic data recorder (ADR)]. Levels must be measured in decimal feet with an accuracy of 0.05 foot. Use the same reference point (relative to mean sea level) for each measurement.

Water level measurements during the hydrogeologic tests shall be taken as follows or as agreed in the aquifer test plan: **[Amended 1-22-2018 by L.L. No. 1-2018]**

Time Since Pumping Began	**Time Between Measurements**
0 - 2 minutes	0 seconds
2 - 5 minutes	30 seconds
5 - 15 minutes	1 minute
15 minutes - 1 hour	5 minutes
1 - 2 hours	10 minutes
2 - 8 hours	30 minutes
8 - 24 hours	1 hour
24 - 72 hours	2 hours

1.3 Observation wells drawdown.

Measure the observation well drawdown using an approved device per the aquifer test plan [typically an automatic data recorder (ADR)]. Levels must be measured in decimal feet with an accuracy of 0.05 foot. Use the same reference point (relative to mean sea level) for each measurement. Backup manually monitored data shall be collected as well.

Water level measurements shall be taken as follows or as agreed in the aquifer test plan:

Time Since Pumping Began	Time Between Measurements:
0 - 2 minutes	10 seconds
2 - 5 minutes	30 seconds
5 - 15 minutes	1 minute
15 minutes - 1 hour	5 minutes
1 - 2 hours	10 minutes
2 - 8 hours	30 minutes
8 - 24 hours	1 hour
24 - 72 hours	2 hours

1.4 Barometric pressure. Measuring air pressure and correcting water level data for observed changes will increase the accuracy of the water-level data. Measure barometric pressure hourly during the hydrogeologic test and at four-hour intervals during the background and recovery period.

1.5 Precipitation. Manually record precipitation during the hydrogeologic test at one-hour intervals and provide local weather station precipitation data for the background, test and recovery periods.

1.6 Surface waters.

Two monitoring procedures can be used for wetland and surface water measurements for water bodies and wetlands within 500 feet of the test well.

The first method involves installing two very shallow well points, with short (less than one foot) screens centered approximately three and six feet into the saturated zones, in or next to the surface water body. These well points shall be measured hourly during the test and at six-hour intervals during background and recovery.

The second method for standing bodies of water involves placing a staff gauge or measuring stake into the water and measuring the water height hourly during the test and at six-hour intervals during the background and recovery period.

1.7 Streamflow.

Streamflow measurements must be taken if the effect of the proposed diversion on nearby streamflow is of concern. Streams within 500 feet of the test well shall be evaluated.

The first method involves installing two very shallow well points, with short (less than one foot) screens centered approximately three and six feet into the saturated zones, in or next to the streamflow. These well points shall be measured hourly during the test and at six-hour intervals during background and recovery.

The second method is performed by gauging streamflow. It is normally expected that the diversion's effect on streamflow will be such a small percentage of total streamflow that this method is likely inaccurate for measuring stream depletion.

1.8 External pumpages. External pumpages during background, testing and recovery shall be quantified.

2.0 Background monitoring period. All external influences shall be monitored at six-hour intervals during a forty-eight-hour background period just prior to the start of pumping.

3.0 Hydrogeologic tests. Once the approval is obtained to proceed with testing of the proposed wells, the full-scale aquifer test of multiple wells shall begin.

3.1 General requirements for hydrogeologic test.

The test wells shall be pumped at the required withdrawal rate of 200% of maximum day conditions of such flow rate as agreed in the aquifer test plan. The pumpage rate shall not be allowed to vary by more than 10% from the initial rate (unless otherwise specified below). If a pump is turned off during the test, it must be restarted within 10 minutes. No more than one ten-minute break shall be allowed for every six hours of pumping. Because of the extreme importance of the early-time data for the analysis, the pump is NOT allowed to stop during the first two hours of an acceptable test. If a pump is stopped during this time, the test must be restarted after allowing for water levels in the test and observation wells to return to within 95% of pretest levels.

Water pumped from wells during testing shall be discharged to points where it cannot infiltrate into the ground and flow back to any test or observation well during the test.

The pump test shall not be performed when the prior 30 days precipitation is greater than 3.7 inches. The precipitation shall be calculated based on the gauge at the Middletown, New York climate station.

The test shall be designed to identify any impact to neighboring wells. It is the responsibility of the applicant to substantiate capacity through sufficient field data and hydrogeologic analyses.

3.2 Multiple-well (aquifer-stress) test.

The purpose of a multiple-well test is to determine the effect of the proposed withdrawals when more than one well is being proposed for a site. The goal of the multiple-well test is to determine groundwater levels under multiple-well pumping conditions and to examine its impact.

Background monitoring as described in Section 2 shall be conducted. After the background period, the proposed wells will be pumped at their maximum allowable pumpage rate for 72 hours for the ‘stress’ period. After the ‘stress’ period, the proposed well is shut off and allowed to recover. During this recovery, measurements are taken at all points every two hours.

(a) A minimum of six hours of stabilized drawdown must be displayed at the end of the test. Stabilized drawdown is defined as a water level that has not fluctuated by

more than plus or minus 0.5 foot for each 100 feet of water in the well (i.e., static water level to bottom of well) over at least a six-hour period of constant pumping flow rate. The plotted measurements shall not show a trend of decreasing water level.

(b) If stabilized drawdown is not achieved, the test period shall be extended to 96 hours or more at the discretion of the Town Engineer in consultation with the developer's representatives. If it appears stabilized drawdown is not achievable, a semi-log extrapolation of drawdown versus time (or other similar methods) may be employed to project the ability of the aquifer to supply a pumping rate equal to the desired yield (which must be equal to or less than the pump test yield) on a long-term basis. Normally, an extrapolation of six months of pumping with no assumed recharge must be compared against the level of water remaining above the pump intake at the end of the period. The use of extrapolated data will be considered by the Town but will need to be weighed with other factors, including the expected reliability of the projection and the option of lowered demand by reduced development density or other controls.

4.0 Recovery monitoring period. Water level recovery in the pumping and observation wells must be measured. Unless otherwise specified, the recovery-monitoring period must last a minimum of eight hours or until water levels have recovered within 95% of drawdown. Recovery shall be monitored intensely immediately after the test well pump has been turned off. All observation points shall be observed at six-hour intervals or shorter where appropriate. If recovery is less than 90% within 24 hours, safe yield must be scaled back or the test rerun at a reduced rate as required by the Town Engineer.

(10) Water quality testing.

A water quality sample shall be taken within the last two hours of the hydrogeologic testing for contaminants in the water. The contaminants to be tested shall be in compliance with federal, state and local requirements for potable water use. Consideration shall be given to incorporate additional contaminants in locations where a known contamination site exists proximate to the property boundaries. Testing shall include all parameters in the NYSDOH Individual Water Supply Wells-Fact Sheet #3, Recommended Residential Water Quality Testing. Additionally a representative number of wells shall be tested for Arsenic, barium, fluoride, methane, radium, radon, uranium, MTBE, pesticides and POCs (EPA method 502.2) as agreed in the aquifer test plan based on the location of the subdivision in relation to known sources of pollution, farming operations and other factors.

Perform hydrogeologic analysis. After the hydrogeologic tests have been completed, the results must be analyzed. A description of information needed in the analysis is located below.

1. Multiple-well test analysis. A multiple-well test analysis is conducted by evaluating the total drawdown at the observation points to determine the drawdown attributable to the proposed pumpage from multiple withdrawal points. A radius of influence shall be calculated using the data collected from this test.

2. Hydrogeologic report. A hydrogeologic report prepared by a licensed professional engineer according to the outline in Attachment 3 shall be submitted to the Town. The hydrogeologic report shall be certified by the landowner to be a complete analysis and an accurate representation of the hydrogeologic condition. The report, data and certification shall be submitted to the Town of Goshen for review. The raw test data shall be submitted in Excel® or text format electronically on either a 3.5" diskette or CD ROM or other format as agreed in the aquifer test plan. The test or observation wells may be converted to production wells for the proposed development, provided they were properly constructed and meet NYSDEC requirements. The well location plan shall be included.

B. Protocols for Well Installation, Testing and Reporting - Community Water Supplies. **[Amended 1-22-2018 by L.L. No. 1-2018]**

Purpose

The purpose of this document is to provide guidance to landowners who are planning to install water production wells in the Town of Goshen to serve new residential or commercial development. These protocols are intended for use as prescribed in § 97-27 of the Town of Goshen Zoning Law for applicants seeking densities higher than those otherwise permitted by the AQ Overlay Zone. By following these procedures, the Town and the owner can:

- Ensure that the new well(s) can provide enough water for the proposed development.
- Ensure that the new well(s) will not adversely affect existing wells in the vicinity of the proposed wells.

These guidelines are based upon established principles and practices of hydrogeology. A New York State licensed professional engineer must certify the work performed is as required herein.

Water Supply Capacity Determination - Procedures

The following items must be completed.

Determine Demand for Groundwater

Establish water demand using New York State Department of Environmental Conservation (NYSDEC), New York State Department of Health (NYSDOH) or Orange County Health Department requirements, whichever is more stringent. Fire protection must meet at least the minimum requirements of the National Fire Protection Association (NFPA) for building interior fire protection and Insurance Services Office (ISO), as applicable, for exterior fire protection. The Building Inspector shall be consulted to ensure enough water is available for fire protection needs.

Contact Town of Goshen

Notify the Town Building Inspector of intent to propose additional lots through this procedure. Complete a "Preliminary Application Form" as seen in Attachment 1.

Test and Observation Well Location and Design

The Aquifer Test shall be conducted using one or more appropriately sized wells as the pumping wells (test wells) with at least four observation wells located at optimal locations. The test and observation wells shall be designed and located so as to provide sufficient data for the landowner to adequately assess the groundwater system capabilities, limitations and capacity.

The following information will assist in the well site location and design. A well location map shall be prepared identifying all of the well sites and observation well sites.

1. Identify Potential Well Site(s).

   Conduct an initial investigation to select a desirable site based on the following:

   - Reasonably uniform geology.
   - Likelihood that groundwater contamination is low.
   - Depletion of nearby streams and wetlands is unlikely.
   - Interference with nearby wells is unlikely.

   Use published geological maps to assist in choosing well location.

2. Observation wells.

   All wells within 500 feet of the proposed well shall be monitored. If existing wells cannot be monitored, then observation wells must be installed to identify any impact. At least four monitoring wells are required for all hydrogeologic tests. The impact of all existing wells located along key fracture trends between 500 and 2,500 feet from the test well shall also be determined. Observation wells shall be shown on the well location plan.

   In addition, observation wells shall be situated and installed in the following manner:

Observation Well No.	Distance from Pumping Well	Vertical Placement of Screen Opening
1	Ideally 1.5x saturated aquifer thickness; in any case > 50 feet away and < 200 feet away	In aquifer being pumped
2	Ideally 5x saturated aquifer thickness; in any case < 1,000 feet away	In aquifer being pumped
3	Within 10 feet of pumping well	Shallower than pumping well to estimate vertical leakage from above
4	Within 10 feet of pumping well	Deeper than pumping well to estimate vertical leakage from below
5*	Same distance as first	In aquifer being pumped but perpendicular to a line drawn between the pumping well and the first observation well

Observation Well No.	Distance from Pumping Well	Vertical Placement of Screen Opening
6	As needed to investigate any hydrogeologic boundaries	Where needed
* Well No. 5 is mandatory if test well is a rock well		

Aquifer Test Plan Proposal

Prepare and submit an Aquifer Test Plan Proposal to the Town of Goshen. The aquifer test shall be conducted at the proposed maximum withdrawal rate. An outline of the mandatory items for the Aquifer Test Plan proposal is included in Attachment 2.

The Town may approve, reject or request more information within 45 days of receipt of Aquifer Test Plan.

Obtain Permits

Prior to installing test wells and conducting any hydrogeologic tests, the following permits must be obtained, if and when applicable:

- Well drilling permit for each test and observation well [with Well Completion Report in compliance with New York State Department of Environmental Conservation (NYSDEC) regulations, Environmental Conservation Law (ECL) § 15-1525];
- Discharge permit;
- Wetlands permit; and
- Other permits as may be necessary in accordance with federal, state and local regulations.

Install Wells

Install one or more appropriately sized test wells based on water demands and hydrogeologic conditions at the location selected. Install an appropriate number of observation wells (but not less than four) to adequately characterize site hydrogeologic conditions. Well(s) shall not be installed until the Town of Goshen has approved the aquifer test plan.

Review the geologic log and yield during drilling to determine if the well(s) will be suitable for further investigation. Record field data during drilling, particularly fissure location, to facilitate analyses. Complete and file a Well Completion Report in compliance with NYSDEC.

Conduct Hydrogeologic Tests

The hydrogeologic tests that must be completed include a step-drawdown test and/or an aquifer test and/or the multiple-well stress test as the geological conditions warrant. A description of how to conduct these tests and what information must be recorded is included below.

1.0 Determine all External Influences and Methods for Observation.

There are several external influences that must be monitored during background, testing and recovery. The following influences must be observed. A description of the method to monitor each of these influences is described below.

1.1 Test Well(s) Pumping Rate.

Measure the pumping rate via flow using an automatic data recorder (ADR). Manually monitored data shall be collected for backup. The discharge flow rate shall be monitored and recorded manually at least once every 10 minutes during the first hour of the test and every 60 minutes thereafter.

1.2 Test Well(s) Drawdown.
Measure the test well drawdown using an automatic data recorder (ADR). Levels must be measured in decimal feet with an accuracy of 0.05 foot. Use the same reference point (relative to mean sea level) for each measurement. Backup manually monitored data shall be collected as well.

Water level measurements during the hydrogeologic tests shall be taken as follows:

Time Since Pumping Began	**Time Between Measurements**
0 - 5 minutes	30 seconds
5 - 15 minutes	1 minute
15 minutes - 1 hour	5 minutes
1 - 2 hours	10 minutes
2 - 8 hours	30 minutes
8 - 24 hours	1 hour
24 - 72 hours	2 hours

1.3 Observation Wells Drawdown.

Measure the observation well drawdown using an automatic data recorder (ADR). Levels must be measured in decimal feet with an accuracy of 0.05 foot. Use the same reference point (relative to mean sea level) for each measurement. Backup manually monitored data shall be collected as well.

Water level measurements shall be taken as follows:

Time Since Pumping Began	**Time Between Measurements**
0 - 5 minutes	30 seconds
5 - 15 minutes	1 minute
15 minutes - 1 hour	5 minutes
1 - 2 hours	10 minutes
2 - 8 hours	30 minutes

Time Since Pumping Began	Time Between Measurements
8 - 24 hours	1 hour
24 - 72 hours	2 hours

1.4 Barometric Pressure.

Measuring air pressure and correcting water level data for observed changes will increase the accuracy of the water-level data. Measure barometric pressure hourly during the hydrogeologic test and at four-hour intervals during the background and recovery period.

1.5 Precipitation.

Manually record precipitation during the hydrogeologic test at one-hour intervals and provide local weather station (see 3.1) precipitation data for the 30-day background, test and recovery periods.

1.6 Surface Waters.

Two monitoring procedures can be used for wetland and surface water measurements for water bodies and wetlands within 500 feet of the test well.

The first method involves installing two very shallow well points, with short (< one foot) screens centered approximately three and six feet into the saturated zones, in or next to the surface water body. These well points shall be measured hourly during the test and at six-hour intervals during background and recovery.

The second method for standing bodies of water involves placing a staff gauge or measuring stake into the water and measuring the water height hourly during the test and at six-hour intervals during the background and recovery period.

1.7 Streamflow.

Streamflow measurements must be taken if the effect of the proposed diversion on nearby streamflow is of concern. Streams within 500 feet of the test well shall be evaluated.

The first method involves installing two very shallow well points, with short (< one foot) screens centered approximately three and six feet into the saturated zones, in or next to the streamflow. These well points shall be measured hourly during the test and at six-hour intervals during background and recovery.

The second method is performed by gauging streamflow. It is normally expected that the diversion's effect on streamflow will be such a small percentage of total streamflow that this method is likely inaccurate for measuring stream depletion.

1.8 External Pumpages.

External Pumpages during background, testing and recovery shall be quantified.

2.0 Background Monitoring Period.

All external influences shall be monitored at six-hour intervals during a 48-hour background period just prior to the start of pumping.

3.0 Hydrogeologic Tests.

Once the approval is obtained to proceed with testing of the proposed production well, the step-drawdown test is done first, followed by the full-scale aquifer test or multiple-well test.

3.1 General Requirements for All Hydrogeologic Tests.

The test well shall be pumped at the maximum anticipated withdrawal rate under normal operation. The pumpage rate shall not be allowed to vary by more than 10% from the initial rate (unless otherwise specified below). If the pump is turned off during the test, it must be restarted within 10 minutes. No more than one ten-minute break shall be allowed for every six hours of pumping. Because of the extreme importance of the early-time data for the analysis, the pump is NOT allowed to stop during the first two hours of an acceptable test. If the pump is stopped during this time, the test must be restarted after allowing for water levels in the test and observation wells to return to within 95% of pretest levels.

Water pumped from a well during any of the hydrogeologic tests shall be discharged to a point where it cannot infiltrate into the ground and flow back to the well during the test.

The pump test shall not be performed when the prior 30 days precipitation is greater than 3.7 inches. The precipitation shall be calculated based on the gauge at the Middletown, New York, climate station.

The test shall be designed to identify any impact to neighboring wells. It is the responsibility of the applicant to substantiate capacity through sufficient field data and hydrogeologic analyses.

3.2 Step-Drawdown Test.

A step-drawdown test is intended to provide information on the relationship between yield and drawdown in a well. A step-drawdown test involves increasing pumpage from a well in successive equal steps or stages. Pumping begins at a low rate then increases in successive steps. For wells in an unconsolidated formation the well shall be pumped at a minimum of five different rates or steps: 50%, 75%, 100%, 150% and

200%. At each step the pumpage rate is held constant for one hour or longer. If the highest pumping rate cannot be achieved, then a rate as high as possible shall be used.

Water levels in the pumping well shall be measured as frequently as necessary to observe significant changes in water levels. At a minimum, they shall be monitored every five minutes.

If the aquifer test is run immediately after the step-drawdown test, the water levels must be allowed to fully recover after the first test before running the second. The aquifer test may not be a continuation of the last pumping step of the step-drawdown test.

3.3. Aquifer Test.

An aquifer test is designed to yield information on the hydrogeologic parameters of the groundwater system. Water is withdrawn from one well and drawdown is measured in several observation wells, including the pumping well. Measurements shall be taken for all of the observation points before the test (background), during the test, and during the recovery period. Wells shall be pumped at 100% of the maximum rate demand.

This test shall last for a minimum of 72 hours. At the end of 72 hours, the data shall be analyzed to determine if the well has stabilized at an equilibrium-type situation (this is less than 0.25 foot of drawdown between observations). If not, the test shall be extended.

A full-scale aquifer test requires careful planning. Field personnel must install, service, and monitor all observation devices during the background, testing, and recovery periods. Backup equipment may be needed to insure an uninterrupted test. Planning for adverse weather conditions and mid-test interruptions is advised.

3.4. Multiple-Well (Aquifer-Stress) Test.

The purpose of a multiple-well test is to determine the effect of the proposed withdrawals when more than one well is being proposed for a site. The goal of the multiple-well test is to determine groundwater levels under multiple well pumping conditions and to examine its impact.

Background monitoring as described in Section 2 shall be conducted. After the background period, the proposed wells will be pumped at their maximum allowable pumpage rate for 72 hours for the “stress” period. After the “stress” period, the proposed well is shut off and allowed to recover. During this recovery, measurements are taken at all points every two hours.

4.0 Recovery Monitoring Period.

Water level recovery in the pumping and observation wells must be measured. Unless otherwise specified, the recovery-monitoring period must last a minimum of eight hours and up until water levels have recovered to within 90% of drawdown within 24 hours.

Recovery shall be monitored intensely immediately after the test well pump has been turned off. All observation points shall be observed at six-hour intervals or shorter where appropriate.

Water Quality Testing.

A water quality sample shall be taken within the last two hours of the hydrogeologic testing for contaminants in the water. The contaminants to be tested shall be in compliance with federal, state and local requirements for potable water use. Consideration shall be given to incorporate additional contaminants in locations where a known contamination site exists or likely exists proximate to the property boundaries.

Perform Hydrogeologic Analysis

After the hydrogeologic tests have been completed, the results must be analyzed. A description of information needed in the analysis is located below.

1. Step-Drawdown Analysis.

   The results of the step-drawdown test shall be analyzed to compute the well-loss coefficient and the well efficiency. The well efficiency is the ratio between the theoretical and actual specific capacity of the well.

2. Aquifer Test Analysis.

Aquifers can generally be grouped as the following types:

- Confined (artesian)
- Unconfined (water table)
- Semiconfined (leaky artesian)

Aquifer tests are divided into unsteady-state (before drawdown has stabilized) and steady-state (after drawdown has stabilized). Analytical techniques exist to analyze this data based on the prevailing hydrogeologic conditions.

The aquifer storativity and transmissivity shall be calculated using Aqtesolv or an approved equivalent program.

3. Multiple-Well Test Analysis.

A multiple-well test analysis is conducted by evaluating the total drawdown at the observation points to determine the drawdown attributable to the proposed pumpage from multiple withdrawal points. A radius of influence shall be calculated using the data collected from this test.

Hydrogeologic Report

A hydrogeologic report prepared by a licensed New York State professional engineer according to the outline in Attachment 3 shall be submitted to the Town. The hydrogeologic report shall be certified by the engineer or certified professional geologist to be a complete analysis and an accurate representation of the hydrogeologic condition. The report, data and certification shall be submitted to the Town of Goshen for review. The raw test data shall be submitted in Excel or text format electronically. The test or observation wells may be converted to production wells for the proposed development provided they were properly constructed and meet NYSDEC and NYSDOH/OCDOH requirements. The well location plan shall be included.

ATTACHMENT 1 - PRELIMINARY APPLICATION FORM

GOSHEN CODE

ATTACHMENT 1 - PRELIMINARY APPLICATION FORM

HYDROGEOLOGIC TESTING & REPORTING
PRELIMINARY APPLICATION FORM

A. WELL LOCATION
Name of Proposed Development:

_____

Street Address/Location (cross streets):

_____

Section _____ Block _____ Lot _____

B. PROPERTY/LAND OWNER INFORMATION
Name _____ Telephone _____
Mailing Address _____
City _____ State _____ Zip _____

C. APPLICANT INFORMATION
Name _____ Telephone _____
Organization _____
Mailing Address _____
City _____ State _____ Zip _____

D. DIVERSION REQUEST
2. Requested Allocation:
a. Groundwater: _____ MG of water per month at a maximum rate of _____ gallons per minute.
b. Surface water: _____ MG of water per month at a maximum rate of _____ gallons per minute.
c. All sources: _____ MG of water per month at a maximum rate of _____ gallons per minute.
d. All sources: _____ million gallons per year.
NOTE: Monthly allocations are established based upon the maximum withdrawal expected during any one month (31 days) of the calendar year.

3. Diversion to be used for _____

4. Complete the following for each existing and proposed diversion source on site:

a. Groundwater:

State Well Permit No.	Well Local Name	Location Description	Existing (E) Proposed (P)	Proposed Maximum Withdrawal Rate (million gallons)	
				Per Month	Per Year

ATTACHMENT 2 - AQUIFER TEST PLAN
Aquifer Test Plan Proposal Outline

1.0 Site data
- 1.1 Location of all wells (Proposed Well Location Plan)
- 1.2 Location of pertinent features
- 1.3 Maps at appropriate scales (USGS topographic map, detailed site map at 1:6,000 or larger)

2.0 Hydrogeologic data
- 2.1 Estimates of transmissivity, storage, and other aquifer hydraulic characteristics from nearby wells or from published data
- 2.2 Hydrogeologic setting of area
- 2.3 Local recharge/discharge estimates
- 2.4 Nearby wells and their pumpage within 2,500 feet of subdivision

3.0 Well data (pumping and observation wells)
- 3.1 Construction details
- 3.2 Screened intervals and formation(s) tapped
- 3.3 Well logs

4.0 Test description
- 4.1 Multiple-well

5.0 Identification of external influences
- 5.1 Precipitation
- 5.2 Barometric pressure
- 5.3 Tidal influences
- 5.4 External pumpages
- 5.5 Surface waters

6.0 Monitoring schedule for pre-pumping (background) period
- 6.1 Length of period
- 6.2 Monitoring of relevant external influences
- 6.3 Monitoring frequency

7.0 Monitoring schedule for observation wells
- 7.1 Background, test and recovery-period monitoring schedules
- 7.2 Monitoring techniques

8.0 Monitoring schedule for pumping well
- 8.1 Monitoring schedule
- 8.2 Techniques for measuring water levels
- 8.3 Planned pumping rate
- 8.4 Discharge-measuring method and frequency
- 8.5 Discharge locations and description

9.0 Monitoring schedule for relevant external influences and concerns
- 9.1 Precipitation
- 9.2 Barometric pressure
- 9.3 Tidal influences
- 9.4 External pumpages
- 9.5 Surface waters
- 9.6 Monitoring techniques

10.0 Monitoring schedule for post-pumping (recovery period)
- 10.1 Length of period
- 10.2 Monitoring of relevant external influences
- 10.3 Monitoring frequency

11.0 Applicable federal, state and local regulations and permits
- 11.1 List of necessary permits
- 11.2 Status of permit applications

ATTACHMENT 3 - HYDROGEOLOGIC REPORT
Hydrogeologic Report Outline

1.0 Executive Summary

2.0 Summary of Proposed Diversion
- 2.1 Total yearly pumpage
- 2.2 Maximum monthly pumpage
- 2.3 Proposed pumpage schedule
- 2.4 Additional detail (add section if necessary)

3.0 Site Data
- 3.1 Well location(s) – Well Location Plan
- 3.2 Roads, property lines, buildings
- 3.3 Nearby environmentally sensitive areas
- 3.4 Nearby surface-water bodies, streams, and wetlands
- 3.5 Nearby pollution sites
- 3.6 Additional detail (add section if necessary)

4.0 Hydrogeologic Data
- 4.1 Thickness, areal extent, and recharge areas of aquifer
- 4.2 Thickness and areal extent of any confining units
- 4.3 Thickness, areal extent and recharge area of any other aquifers at the site
- 4.4 Hydrogeologic parameters of all aquifers pertaining to the diversion
- 4.5 Hydrogeologic parameters of all confining units pertaining to the diversion
- 4.6 Discussion of generalized flow path in aquifer
- 4.7 Recharge/discharge estimates
- 4.8 Pertinent water-quality data
- 4.9 Additional detail (add section if necessary)

5.0 Nearby Pumpage
- 5.1 Domestic wells within one mile
- 5.2 Water withdrawal permits within one mile
- 5.3 Public-supply wells within five miles
- 5.4 Additional detail (add section if necessary)

6.0 Pumping and Observation Well Information
- 6.1 Drilling method
- 6.2 Casing details (diameter, type, and depth)
- 6.5 Well development method
- 6.6 Additional detail (add section if necessary)

7.0 Test Description
- 7.1 Type of test(s)
- 7.2 Summary of field test procedures
- 7.3 Additional detail (add section if necessary)

8.0 Test Data
- 8.1 Measurements during background period
- 8.2 Measurements during test period
- 8.3 Measurements during recovery period
- 8.4 Additional detail (add section if necessary)

9.0 Test Analyses
- 9.1 Calculated hydrogeologic values
- 9.2 Discussion of data and anomalies
- 9.3 Additional detail (add section if necessary)

10.0 Regional Effects
- 10.1 Other ground and surface water users
- 10.2 Environmentally sensitive areas
- 10.3 Dependable yield of the aquifer
- 10.4 Surface water, streams, wetlands
- 10.5 Groundwater pollution sites
- 10.6 Additional detail (add section if necessary)

Overall Analyses Test and Proposed Withdrawal