PROPOSED
PUMP TEST PROTOCOL

FOR

PUBLIC WATER SUPPLY WELLS

TO SERVE

Sheffield Gardens

NYS Route 17K

TOWN OF MONTGOMERY
ORANGE COUNTY, NEW YORK

PREPARED BY

ENGINEERING & SURVEYING PROPERTIES
Achieving Successful Results with Innovative Designs

AUGUST 2023

W.O. 103.0301

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1.0 SITE DATA

1.1 Site Location

The Sheffield Gardens Site is located on the south side of NYS Route 17K and adjacent to Montgomery Heights in the Town of Montgomery, Orange County, New York. See Figure #1 for a Project Location Map.

1.2 Site Description

The subject parcel is identified on Town of Montgomery Tax Maps as Section 29 Block 1 Lots 5.1, 5.2, 5.3, 5.4 & 5.5. The Project Site is a 53.04± acre parcel located in zoning districts; RM-1, RA-1. & B-2. The Site is mostly wooded with New York State Department of Environmental Conservation (NYSDEC) wetlands on the east side of the site and Army Corps of Engineers (ACOE) wetlands on the west side of the site. The existing land use surrounding the Project Site consists of residential homes, Richard's Dairy Shed Ice Cream Stand and the Valley Central School District.

1.3 Location of Wells

There are three existing wells on site. Well #1 is located on the east side of the project site. Well #2 & #3 are located on the west side of the site. The on-site well locations are shown on Figure #2.

2.0 WELL DATA

2.1 Pumping Wells

The Project is proposing to pump test the three existing on-site wells. There are no known driller's well logs for the existing wells. Therefore, a camera investigation was completed in March 2023 on each well to develop well logs. The following table summarizes the features of each well according to the well logs from the camera investigation, which are included as Appendix B.

Existing Well Features				
ID #	Diameter of Casing (inches)	Depth of Casing (feet)	Total Depth of Well (feet)	Static Water Level (feet)
Well #1	8	50	500+	8
Well #2	8	32	500+	2
Well #3	8	21	219*	4

*Prior to deepening Well #3 to 310 feet in June 2023

2.2 Observation Wells

The nearest observation wells are the existing on-site wells that are located within 1,000 feet of each other. Property owners within a 1,000-foot-radius surrounding the Site will be sent a letter offering to monitor their well during the pump tests. A minimum of two and a maximum of five off-site wells will be monitored during the pumping test, subject to obtaining permission from the property owners.

3.0 PUMPING TEST DESCRIPTION

The system will be regulated as a Community Water Supply (CWS) and therefore the testing program will be a 72-hour pumping test of the existing wells. The goal of the test will be to demonstrate the available yield of the wells. The test duration will be a minimum of 72 hours. Every effort will be made to achieve stabilized drawdown, defined as a water level that does not fluctuate 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 4-hour period of constant pumping flow rate. In addition, plotted measurements must not show a trend of decreasing water level for the same 4 hours of stabilized yield and drawdown.

The pumping test is anticipated to be completed in September 2023. The flow rates of the pumping well will be monitored with a flow meter. The measured flow rates will be confirmed with a measured bucket and stopwatch every hour during the first 12 hours of the test, and every 4 hours thereafter during the pump test.

Prior to pump shutdown, water quality samples will be collected from the pumping well and analyzed for all chemicals listed in the New York State Sanitary Code, Subpart 5-1 for community water supplies.

4.0 EXTERNAL INFLUENCES

4.1 Precipitation

Precipitation data will be measured by an onsite rain gauge. Precipitation shall be measured to the nearest 0.01 inch and will be collected hourly during background, test and recovery periods.

4.2 Barometric Pressure

Barometric pressure for background, test and recovery periods will be measured with a barometer. Barometric Pressure will be measured to the nearest 0.01 inch and will be collected hourly.

4.3 External Pumpages

In addition to the existing on-site wells, a minimum of two and a maximum of five offsite private water supply wells located near the test property will also be measured if permission is granted.

4.4 Surface Waters

It is unlikely that there is a direct hydraulic connection between the well and the adjacent wetlands features. However, the water surface height will be measured hourly during the test and at six-hour intervals during the background and recovery period to the nearest 0.01 foot.

5.0 PRE-PUMPING (BACKGROUND) PERIOD MONITORING

5.1 Precipitation Data

Rainfall data will be collected from a nearby weather station off of Bailey Road in Montgomery, NY. The data will be logged one week prior to the pumping test, during the test and during the recovery period.

5.2 Length of Period

Background data collection of external influences will begin a minimum of 48 hours prior to the start of the test.

5.3 Monitoring of Relevant External Influences

The external influences that will be measured are precipitation, barometric pressure and wetland water surface level.

5.4 Monitoring Frequency

External influences will be monitored every 6 hours during the 48-hour background period with the last measurement immediately preceding the start of the test.

6.0 MONITORING SCHEDULE FOR PUMPING WELL

6.1 Monitoring Schedule

Water level readings in the pumping well will be conducted in accordance with New York State Department of Environmental Conservation Appendix 10, TOGS 3.2.1 which is attached as Appendix B. Static water level in the pumping well shall be measured each hour during 24 hours prior to the test. The observation schedule during the test will generally follow the table below.

Pumping Day	Time After Pumping Start (min)	(hr)	Measurement Interval (min)	(hr)
Day 1	0 – 2	0 – 0.03	0	0
	2 – 5	0.03 – 0.08	0.5	0.008
	5 – 15	0.08 – 0.25	1	0.017
	15 – 60	0.25 – 1	5	0.08
	60 – 120	1 – 2	10	0.17
	120 – 480	2 – 8	30	0.5
	480 – 1440	8 – 24	60	1
Day 2 & 3	1440 – 4320	24 – 72	120	2

The recovery readings will begin one minute prior to shutdown of the pumping well and will continue to be collected using the same procedure and time pattern followed during the test for at least 12 hours or extended until the water level in the pumping well has recovered to within 90 percent of the drawdown.

6.2 Monitoring Techniques

The pumping well will be monitored using a dedicated pressure transducer with periodic manual readings collected as a back-up during the 72-hour testing program.

6.3 Planned Pumping Rate

Although the Maximum Daily Demand is 72.11 GPM per well, a proposed conservative pumping rate of 80 GPM for Well #1 per NYSDOH standards (See Calculations on the following page) and a pumping rate of 40 GPM simultaneously for wells #2 & #3.

6.4 Pumping Requirements

- Pumping rate must be maintained throughout the test. The rate must not vary by more than 10% from the initial rate.
- If the pump is turned off during the test, it must be restarted within 10 mins.
- No more than one ten-minute break shall be allowed for every six hours of pumping.
- The pump is not allowed to stop during the first two hours of the test. If stopped during this period, the test must be restarted after allowing water levels in the test and observation wells to return to 95% pretest levels.

ESTIMATED WATER DEMAND						
USE	**# OF UNITS**	**DEMAND RATE (GPD)**		**AVG. DAILY DEMAND (GPD)**	**AVG. DAILY DEMAND (GPM)**	**MAX. DAILY DEMAND (GPM)**
Apartments						
1-Bedroom	36	110	Per Unit	3,960	2.75	4.95
2-Bedroom	225	220	Per Unit	49,500	34.38	61.88
Commercial						
Retail	27,375	0.1	Per Square Foot	2,738	1.90	1.90
	35	15	Per Employee	525	0.36	0.36
20% Reduction for Retail water saving fixtures				(653)	(0.45)	(0.45)
Landscaping Irrigation	1	5,000	Lump Sum	5,000	3.47	3.47
Totals				**61,070**	**42.41**	**72.11**

6.5 Pumping Discharge

The pumping rate for the well will be measured using flow meters. Manual back-up data will be collected periodically at the discharge point using a

pre-measured bucket and stopwatch as discussed in Section 3.0. The discharge flow rate will be monitored and recorded manually at least once every 10 minutes during the first hour and every 60 minutes thereafter.

The ground water discharge from the Existing Well will be directed north away from the onsite wetlands. The discharge location is shown in Figure 2.

7.0 POST-PUMPING (RECOVERY PERIOD) MONITORING

7.1 Length of Period

The post pumping period will last a minimum of twelve hours after pumping ceases or until the water-level in the pumping well has recovered to within 90 percent of the drawdown.

7.2 Monitoring of Relevant External Influences

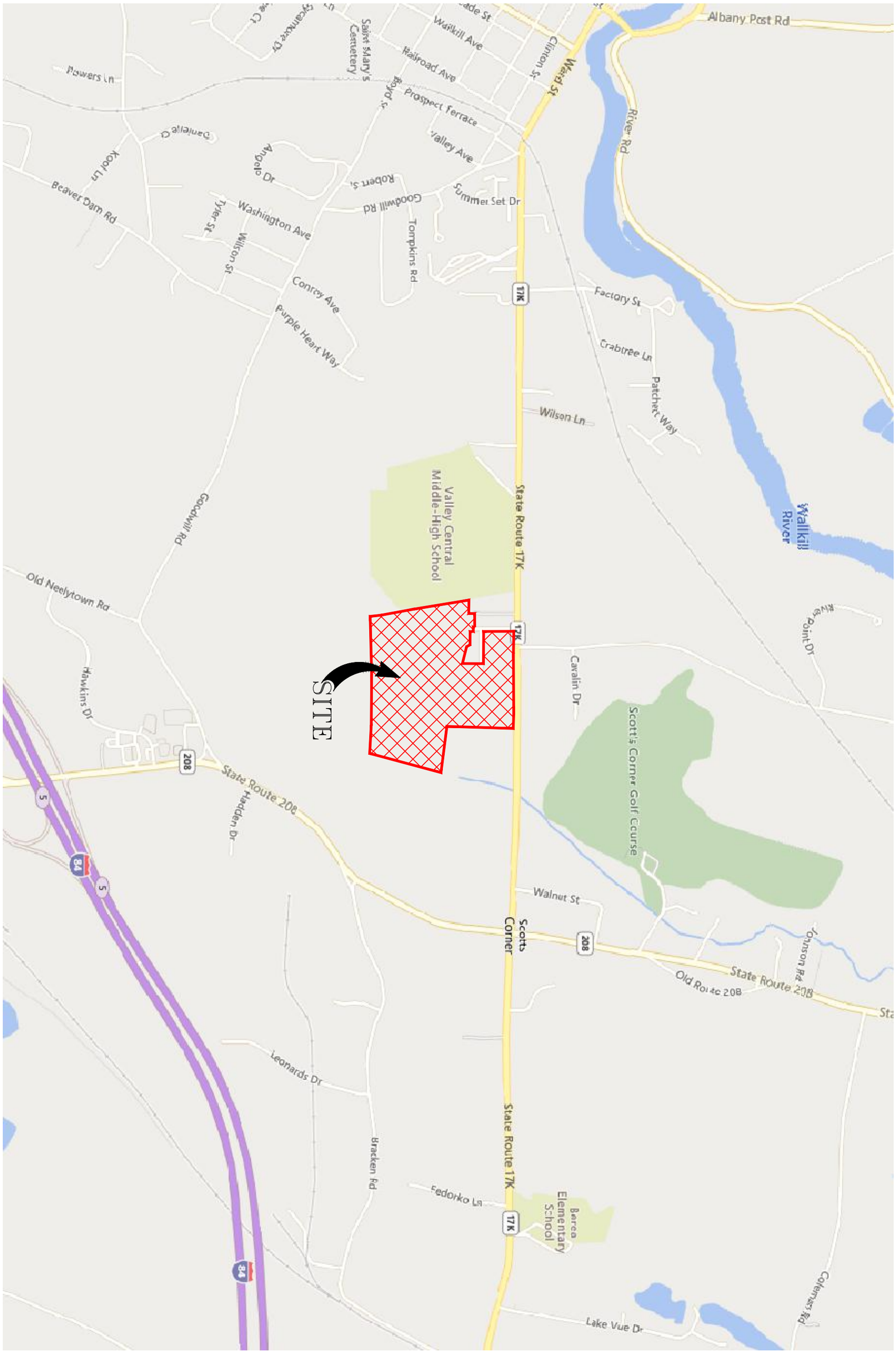
The external influences that will be measured are precipitation, barometric pressure and wetland water surface level.

7.3 Monitoring Frequency

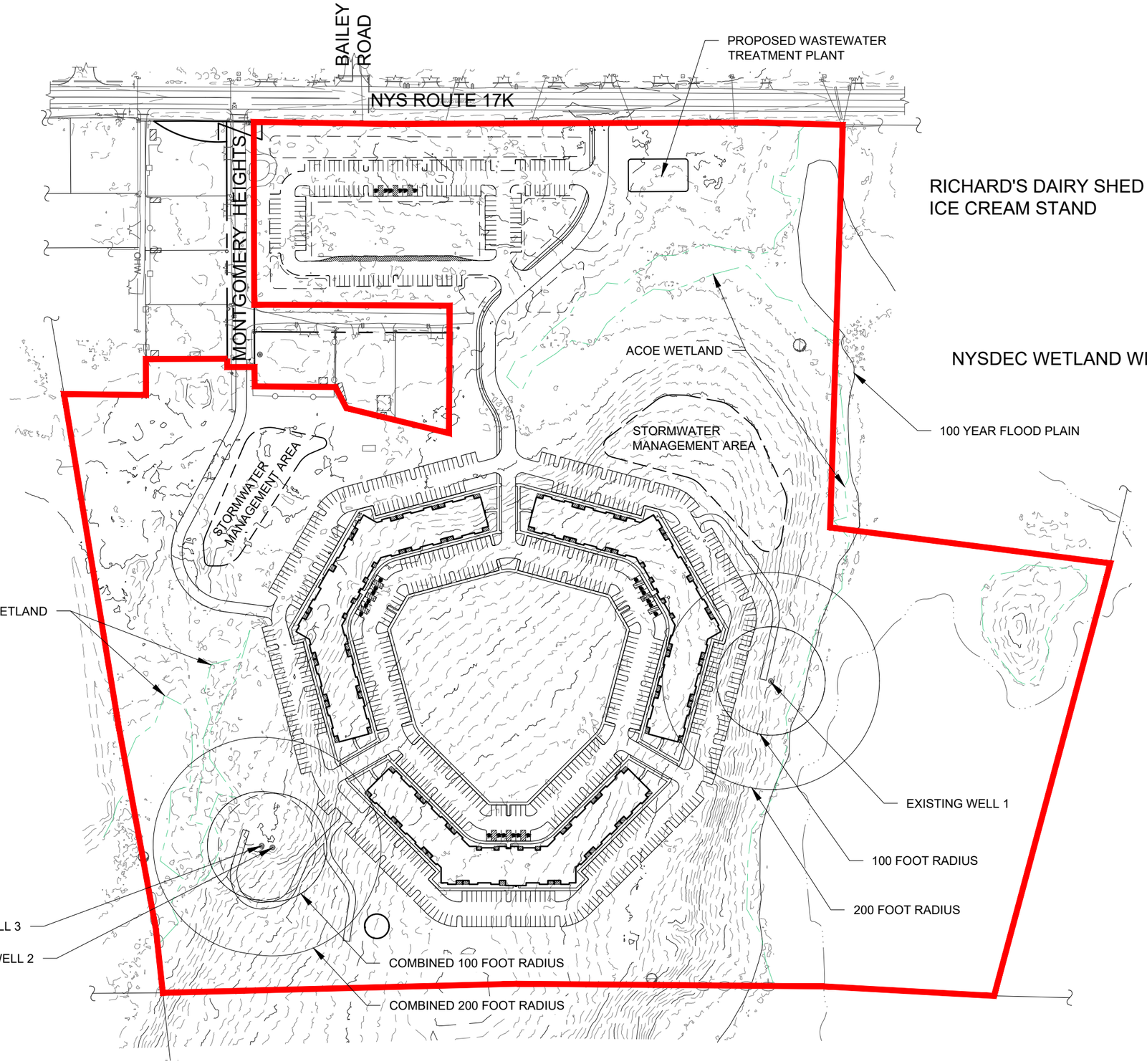
Water levels will be measured every hour for the first three hours and every 6 hours at a minimum thereafter. External influences will be measured as noted in section 4.0.

Appendix A

Figures



SITE LOCATION MAP	SHEFFIELD GARDENS NYS ROUTE 17K TOWN OF MONTGOMERY ORANGE COUNTY, NEW YORK	DATE: 08/24/2023	JOB # 103.0301	ENGINEERING & SURVEYING PROPERTIES Achieving Successful Results with Innovative Designs	MONTGOMERY OFFICE 71 CLINTON STREET MONTGOMERY, NY 12549 Ph: (845) 457-7727 WWW.EP-PC.COM
		SCALE: 1"=200'	SHEET # F-1		



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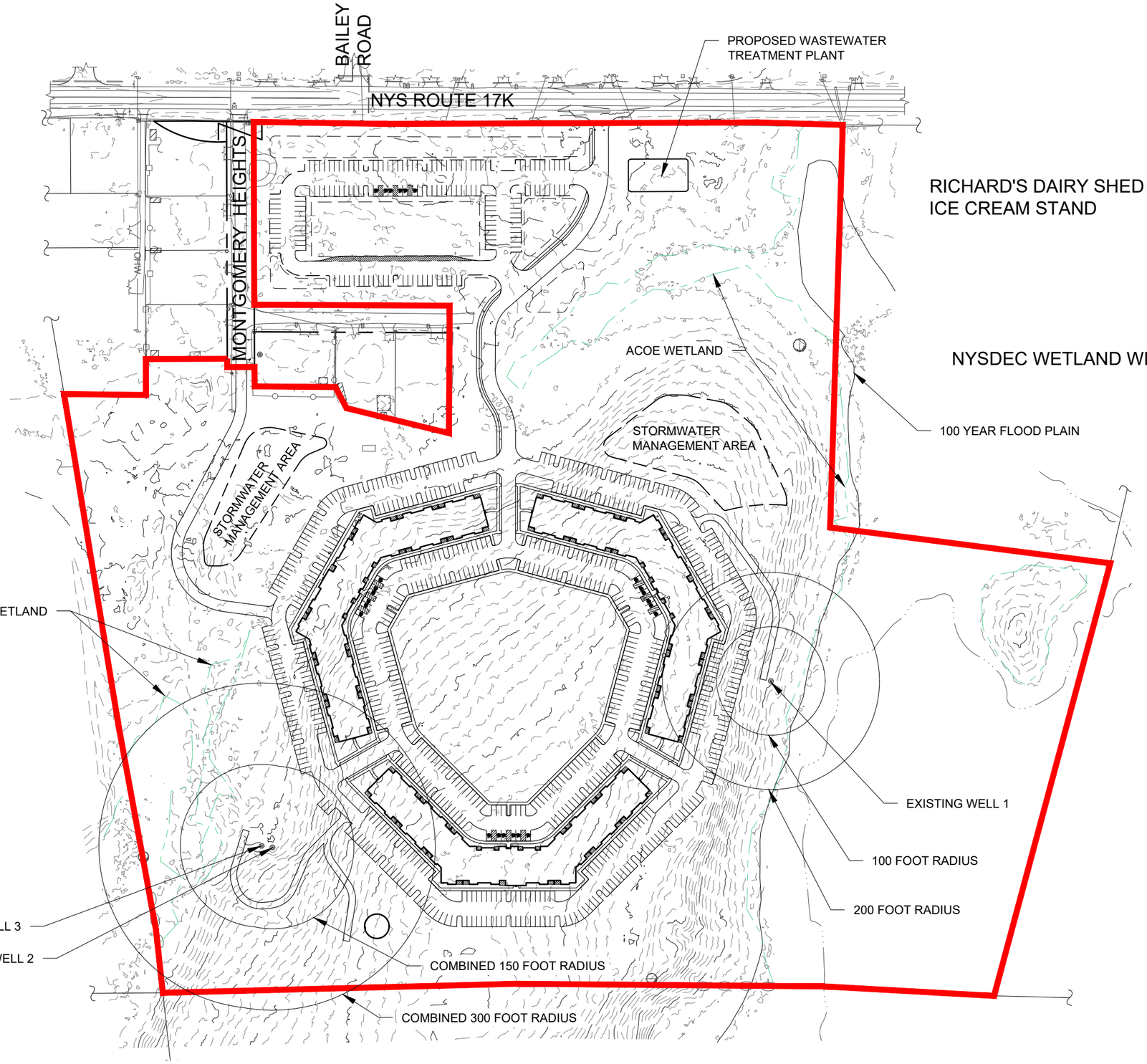
SCALE: 1"=200'
SHEET # F-2

SHEFFIELD GARDENS
NYS ROUTE 17K
TOWN OF MONTGOMERY
ORANGE COUNTY, NEW YORK

WELL TESTING LOCATION PLAN

Drawing Name: Z:\103.0301 – Sheffield Apartments\103.0301 – Site Plan.dwg Date Printed: Aug 24, 2023, 4:31pm



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SHEET # F-3

SHEFFIELD GARDENS
NYS ROUTE 17K
TOWN OF MONTGOMERY
ORANGE COUNTY, NEW YORK

WELL TESTING LOCATION PLAN
50% INCREASE

Appendix B

Well Logs from Camera Investigation

DNA WATER WELL MAINTENCE
82 Livingston Road,
Lake Carmel, NY, 10512

Date: 3/27/23
Price: 4.

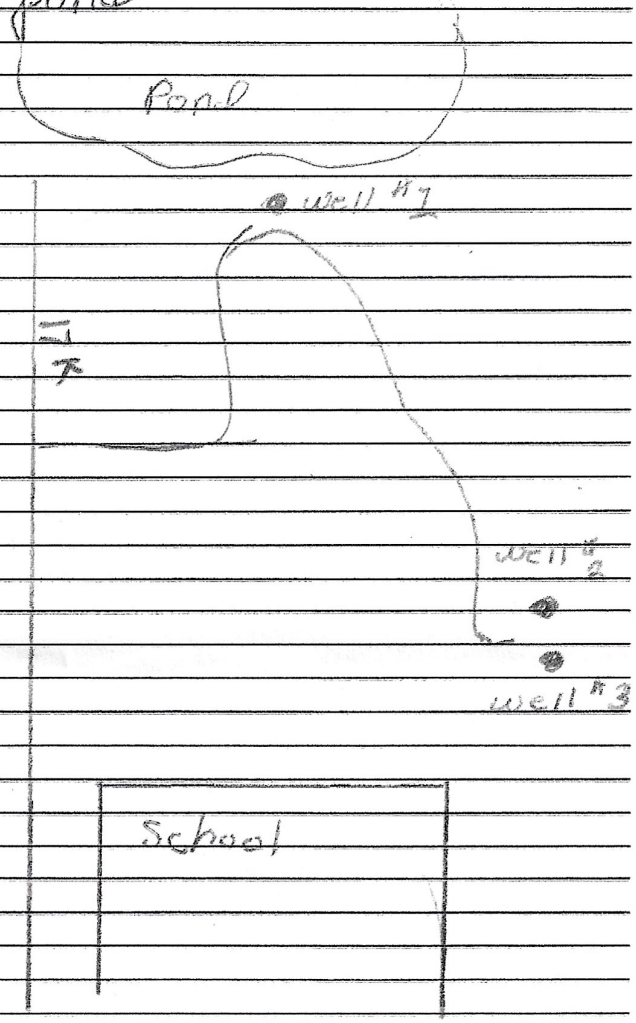
Name Reliable pumps and Well
Address Drilling
Job Reference Montgomery, N.Y

Hole Depth: 500 plus
Hole Size: 8"
Casing Depth: 50' 6"
Well Yield: ?
Static Level: 8'
Bedrock. Gravel

Pre_____Post_____
Pre_____Post_____

Well #1 NEXT To The pond.

66' FRACTORE
69' FRACTURE
116' SMALL FRACTORE
138 - SMALL FRACTORE
157 - FRACTORE
160 - FRACTORE
166 SMALL FRACTURE
168 SMALL FRACTORE
194 FRACTORE
201 SMALL FRACTURE
203 SMALL FRACTORE
205 FRNATORE
213 FRACTORE
225 SMALL FRACTURE
227 FRACTURE
243 SMALL FRACTORE
249 FRACTURE
258 FRACTORE
265 FRACTURE
269 Big FRACTURE
317 Big FRACTURE
338 FRACTORE
356 - 358 - CAVITY
386 FRACTORE
435 FRACTORE
460 FRACTORE
473 SMALL FRACTORE
481 SMALL FRACTORE



DNA WATER WELL MAINTENCE
82 Livingston Road,
Lake Carmel, NY, 10512

Date: 3/27/23

Price: /

Name Reliable pumps and Well Drilling
Address 3 Montgomery RD Montgomery, N.Y
Job Reference
Hole Depth: 500 plus
Hole Size: 8"
Casing Depth: ?
Well Yield: ? Pre_____ Post_____
Static Level: 2' Pre_____ Post_____
(Bedrock) Gravel

Well # 2 Located 10' To the Left of Well # 3
Water is To Dirty To See bottom of the Casing

30 Fracture
33 Fractures
34 Fracture / Cavern
37 Fractures
37 Fracture
40 Fracture
57 Fractures
58-59 Void
82 Fracture
91 Fracture
105 Busted up Fractures
106 108 Big Cavern
121-122 Busted up Fractures
126 Fractures
131 Big Fractures
133-136 Vertical
138-140 Multiple Fractures
144 Fractures
148 Fracture
167 Fracture
171 Fracture
179-181 Cavern
188 Fractures
196 Fracture
205 Fracture
208 Fracture
215 Fracture
222 Fractures
228-230 Major Fractures
234 Fractures
247 Fracture
249 Fracture
260 Fracture
265 Fracture
273 Fracture
275-277 Cavern
280 Fractures
288 Fracture
289 Fracture
309 Fracture
310-313 Huge Cavern
320 Fracture
336-338 Vertical Fractures
348 351 Vertical Fracture
363 Fracture
354-356 Huge Cavern
372 Fracture
385 Fracture
388 Cavern
400 Fracture
403 Fracture
422-424 Big Fractures
443 Fractures
455-457 Big Fractures
469-470 Big Fractures
480 Fracture
481-483 Busted up Fracture
489 Fracture

DNA WATER WELL MAINTENCE
82 Livingston Road,
Lake Carmel, NY, 10512

Date: 3/27/23

Price: $ --

Name Reliable pump and Well Drilling
Address _____
Job Reference Montomery, RD
Montgomery, N.Y
Hole Depth: 219'
Hole Size: 8"
Casing Depth: ~~Non~~ ?
Well Yield: ? Pre_____Post_____
Static Level: 4' Pre_____Post_____
(Bedrock) Gravel

Well #3 · well closest To the School
Well CAVED in AT 219' -

25 FRACTURE.
27 FRACTORE
36-40 HUGE CAVERN
46 SMALL 3 FRACTORES
49 FRACTORES
58-61 HUGE FRACTORE
84 FRACTORE.
100 FRACTORES
108 FRACTORE.
126 FRACTORE
128 FRACTORE.
154 FRACTORE.
157 FRACTORE
163 FRACTORE
174 BIG FRACTORE
176-179 CAVERN
184-186 BROKEN UP LEDGE
188-189 HUGE FRACTORES
190-191 HUGE FRACTORES
193-196 FRACTORES
200-202 HUGE FRACTORES
219- WELL IS CAVED IN

Appendix C

NYSDEC Appendix 10

TOGS 3.2.1

New York State Department of Environmental Conservation
Division of Water
Bureau of Water Permits, 4th Floor
625 Broadway, Albany, New York 12233-3505
Phone: (518) 402-8099 FAX: (518)402-9029
Website: www.dec.state.ny.us

Denise Sheehan
Commissioner

Appendix 10, TOGS 3.2.1
(Public Water Supply Permit Program Application Processing)

August 31, 2005

RECOMMENDED
PUMP TEST PROCEDURES FOR WATER SUPPLY APPLICATIONS

Department regulations require that pump test results be submitted as part of any Water Supply Application involving a new or additional groundwater source (6 NYCRR 601.5(f)(12)). To approve any such application, the Department must determine that the proposed well or wells will adequately meet the needs of the applicant without adversely affecting others who may rely on the same aquifer. The recommendations that follow have been designed to produce the accurate and complete information that is vital to these determinations.

APPLICANTS ARE ADVISED TO SUBMIT THEIR PUMP TEST PLANS TO DEC PRIOR TO CONDUCTING A PUMP TEST, PARTICULARLY IF THE PROPOSED TEST PROCEDURES WILL DEVIATE FROM THESE RECOMMENDATIONS.

FOR INFORMATION AND ASSISTANCE
Call the Public Water Supply Program in the Bureau of Water Permits:
James Garry (518) 402-8101 or Michael Holt (518) 402-8099

NOTE: Before starting construction, it is advisable to submit a location map of the proposed new wells and any related construction to the Division of Environmental Permits in the appropriate DEC Regional office for a determination as to whether that construction requires any other DEC permits, such as for disturbance of protected streams, protected freshwater wetlands, or for storm water runoff from a construction site. Other factors to consider when siting a project include flood plain location, agricultural districts, conceptual wellhead protection/recharge areas, existing or potential groundwater contamination sources, and existing sub-surface utility corridors (whose bedding might provide a preferential path for groundwater flow or contamination).

1. **TIME OF YEAR -** The pump test of unconfined sand and/or gravel aquifer wells should be conducted during a period of time of average or below average seasonal stream flow conditions; that is, when "normal" groundwater gradients have not been reversed or significantly altered. (Typically, this eliminates the months of March, April, and May.) Pump tests for rock wells or confined sand and/or gravel wells not significantly influenced by overlying unconsolidated ground or surface water may be conducted during any month of the year. The applicant should demonstrate that the test well(s) will not be affected by spring recharge.

2. **TEST PUMPING RATE -** The pump test must be performed at or above the pumping rate for which approval will be sought in the water supply application. If multiple wells are to be pumped simultaneously to achieve the necessary yield, the test should incorporate such a pumping plan. To reproduce the anticipated stress on the aquifer, the pump test should be done when nearby wells normally in operation are running. Pumping of other wells in the test area should be monitored.

3. **LENGTH OF TEST -** Regardless of the type of aquifer, pump tests shall be conducted for a minimum of 72 hours at a constant pumping rate.

   (a) A minimum of six hours of **stabilized drawdown** must be displayed at the end of the test. Stabilized drawdown is defined herein 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 achievable**, the test period may be extended or semi-log extrapolation of drawdown versus time (or other similar methods) may be employed to demonstrate 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 (see paragraph No. 14). This type of evaluation may be used in lieu of satisfying the objectives of section 3.(a) of this document at the discretion of NYSDEC.

   (c) If positive (recharge) or negative (barrier) **boundary conditions** are encountered during the test, they must have a record of at least 24 hours.

   (d) Excessive **rainfall** may require extension of the test or a rescheduling of the test.

4. **PRE-TEST CONDITIONS -** No pumping should be conducted at or near the test site for at least 24 hours prior to the test. Static water levels at the pumping well and

observation wells should be measured at least daily for one week prior to the start of the test and again immediately prior to the start of the test. If on site or nearby pumping cannot be curtailed due to system supply needs or other factors, DEC should be consulted prior to the start of the test.

5. **PUMPING RATE -** A constant pumping rate should be maintained throughout the test. The pumping rate should be measured accurately and recorded at least as often as water level measurements (see No. 7). It should be noted that a decrease in discharge from the pump will normally occur with increasing drawdown, as the pump works against a greater hydraulic head and increasing friction in the system. These effects should be compensated for during the test. The flow rate should be held to within 5 percent of the of the design pump rate.

   During the first hour of the test, any **failure to pump within 10 percent of the test pump rate** for any reason will require termination of the test, recovery of water levels to static, and a restart of the test. Later pump failures must have no significant effect on the data or a similar termination and restart is necessary

6. **DISCHARGE OF WATER -** Water discharged during the pump test should be conducted away from the pumping well in a down gradient direction and at sufficient distance to eliminate recharge of this water to the aquifer. The discharge line and discharge point must be shown on the site plan referenced in paragraph No. 15. If the aquifer is confined or if it can be otherwise demonstrated that discharged water will not recharge the aquifer being tested, a more convenient method of discharge can be used (within caveats of paragraph No. 16).

7. **MEASURING SCHEDULE -** Water levels in observation wells and at the pumping well should be measured to give at least ten observations of drawdown within each log cycle of time, beginning one minute after the start of pumping. A suggested schedule of measurements at all wells is as follows:

Time After Pumping Started	Time Intervals
O to 15 minutes	1 minute
15 to 50 minutes	5 minutes
50 to 100 minutes	10 minutes
100 to 500 minutes	30 minutes
500 to 1000 minutes	1 hour
1000 to 5000 minutes	4 hours

8. **OBSERVATION WELLS -** At least three observation wells should be monitored during the pump test. The horizontal distance between each observation well and the pumping well should be measured to the nearest 0.1 foot. The vertical elevation of a fixed reference point on each observation well and on the pumping well (e.g., "top of casing") should be established to the nearest 0.01 foot and reported in NAD 1983 (or in NGVD of 1929 if this is the standard at the test site). One observation well should be located outside of the expected influence of the pumping well; this observation well should serve to monitor background conditions during the pump test. The remaining observation wells should be placed so as to best define the

hydrogeologic characteristics of the aquifer with respect to the pumping well. In some cases the Department may recommend that a representative sample of nearby homeowner wells be monitored during the pump test, regardless of whether the anticipated zone of influence will extend to those wells.

Observation wells should be just large enough to allow accurate and rapid measurement of the water levels. **Small diameter wells are recommended** because the volume of water contained minimizes time lag in drawdown changes. Existing wells can be utilized if they are in good condition and were properly installed.

For **unconfined aquifers**, at least two observation wells should generally be placed no farther than 300 feet from the pumping well and at least one additional observation well should be placed beyond the 300 foot radius. For thick confined aquifers that are considerably stratified, at least two observation wells should be placed within 700 feet of the pumping well and at least one observation well located further than 700 feet from the pumping well.

Observation wells should be screened in, or open to, the same formation as the pumping well. Additional observation wells beyond the specified minimum number may be screened in, or open to, formations above or below the one tapped by the pumping well to determine if there is any hydraulic connection between formations.

Water levels in nearby water bodies should be measured prior to and during the test.

9. **RECOVERY PERIOD -** Water level measurements should be collected during the recovery period for all wells using the same procedure and time pattern followed at the beginning of the pump test (see No. 7). Measurement should commence at least one minute prior to shutdown of the pumping well and continue for at least 12 hours. Water level measurements should be made to the nearest 0.01 foot. To obtain accurate data during the recovery period, a check valve must be installed at the base of the pump column pipe in the pumping well to eliminate backflow of water into the well. Water level measurements should also be collected during the recovery period in all off-site monitoring wells, such as homeowners private wells.

10. **RAINFALL MEASUREMENT-** Rainfall should be measured to the nearest 0.01 inch and recorded daily at or near the site for one week preceding the pump test, during the test, and during the recovery period. A log of weather conditions during this period should also be kept, including barometric pressure recorded on the same schedule as rainfall. Weather station data available from within a reasonable distance of the test site can be utilized.

11. **SURFACE WATER MEASUREMENTS -** Fluctuations in surface water stages (or flow) for all surface waters within 500 feet of the pumping well should be measured to the nearest 0.01 foot. Measurements should be made using, as appropriate: weirs, staff gages (with stilling wells as necessary), nested piezometers, etc. The horizontal distance between each observation point and the pumping well should be

measured to the nearest 0.1 foot. The vertical elevation of a fixed reference point on each observation point should be established to the nearest 0.01 foot and reported in NAD 1983 (or in NGVD of 1929, if this is the standard at the test site). Measurements should be read and recorded at least once daily for one week prior to the start of the test and at least twice per log cycle, after the first ten minutes, for the duration of the test. Measurements should be made more frequently if surface water levels are changing rapidly. The degree and nature of hydraulic connection with the surface water body should be quantified.

12. **WATER QUALITY SAMPLES -** Comprehensive (per NYS DOH requirements) water samples should be obtained from the pumping well during the last hour of pumping. Samples should be analyzed to establish acceptable quality as per NYSDOH requirements.

13. **WELLS UNDER THE INFLUENCE OF SURFACE WATER -** Additionally, If the pumping well is, or may be, hydraulically connected to a surface water body, water samples from the well should be analyzed in the field at least once every four hours for the following parameters: pH, temperature, conductivity, and hardness. Further, representative water samples from the surface water body should be taken at both the beginning and the end of the pump test and analyzed for the same parameters. The NYS DOH should be consulted on all issues related to groundwater under the influence of surface water.

14 **ANALYSIS OF PUMP TEST DATA -** In order to accurately analyze pump test data, it is necessary to use the methods and formulae appropriate for the hydrogeologic and test conditions encountered at, and specific to, the pump test site. Knowledge of the hydrogeologic conditions of the area is necessary in order to ensure the use of appropriate techniques of analysis. Accordingly, analysis of pump test data should be carried out by a hydrogeologist, professional engineer with hydrogeologic training, or other appropriately trained evaluator.

(a) **DATA CORRECTIONS -** Water level data, graphs, and interpretations should be corrected, as appropriate or deemed significant, for the effects of: ambient water level trends; partially penetrating production well(s); partially penetrating observation wells; delayed yield from unconsolidated aquifers; aquifer thickness, recharge and/or impermeable boundaries; barometric pressure changes; changes in stage in nearby surface water bodies; recharge events (rainfall, snow melt) during the week preceding the test, during the test, or during the recovery period; influence from nearby pumping wells; and any other hydrogeologic influences. All such data and calculations should be included in the test information package.

(b) Theoretical **time-drawdown graphs** should be prepared from the recorded drawdown graphs. The graphs should be derived from the pump test data, setting time equal to 180 days and groundwater withdrawal equal to the pump test production rate. Based on these graphs and the remaining standing water in the well at the end of the pump test, a maximum safe pumping rate (yield) should be established for each production well or for the

well field if simultaneous pumping of multiple production wells is planned (taking into account well interference).

(c) Theoretical **distance-drawdown graphs** should be prepared. The graphs should be derived from the pump test data, setting time equal to 180 days and groundwater withdrawal equal to the pump test production rate. The theoretical cone of depression so determined should be used to establish the area of influence of the well(s). It is highly recommended that the following **wellhead protection areas** be delineated using all available information (e.g., published hydrogeologic information, local knowledge, pump test results, etc.) and best professional judgement: 60-day time-of-travel area, zone-of contribution area or recharge areas (for confined or bedrock aquifers), and aquifer boundary area.

(d) **Recovery data** should be analyzed in a similar manner to drawdown data.

15. **SUBMISSION OF DATA -** Data submitted in support of a requested groundwater withdrawal should include:

- the raw pump test data (legible) with: date, clock time, elapsed time (minutes), measuring point (top of casing) elevation, static water level, water level measurements, and calculated drawdown [an "Excel" or "Quattro Pro" spreadsheet file may be submitted with this data in place of a written record];
- engineering diagrams showing construction details (e.g. well casing, screen setting and casing stickup, etc.) and depths of pumping wells and observation wells;
- geologic logs (completed well registration reports);
- graphs, formulae and calculations used to estimate transmissivity, storage coefficient, and safe yield;
- scaled site plan showing water level elevation controls (e.g., top of casing) and grade elevation for all wells, staff gages and other water measuring points, pump test discharge piping and discharge point, the location of nearby surface water bodies, and, if applicable, the 100-year flood plain and elevation;
- latitude and longitude (in degrees, minutes, seconds, tenths of second) or UTMs for all production wells and any observation wells which are to remain, preferably in NAD83 (specify the method and datum used to locate the wells);
- a topographic map showing wellhead protection areas and the locations of existing or potential groundwater contamination threats; and
- interpretations including methodology, geologic sections of the area, references, and rationale.

All documentation submitted must be legible. Plans and maps should use shading, cross-hatch patterns, symbology, etc., such that features are readily distinguishable and remain readable when photocopied in black and white.

16. **DISCHARGE OF WATER -** Please note, it is not legal to discharge water into any water body or wetland if such discharge results in turbidity or erosion leading to turbidity or down stream flooding. Accordingly, if it is anticipated that discharged water will create flooding, erosion and/or turbidity, water must be directed to a holding area and released in a controlled manner to prevent such problems.