APPENDIX H

Water Supply Source Study (April 2021) and Calverton Industrial Park Water Supply Wells Groundwater Modeling Report (April 2021), as prepared by P.W. Grosser Consulting

CALVERTON INDUSTRIAL PARK
4285 MIDDLE COUNTRY ROAD
CALVERTON, NY

CALVERTON INDUSTRIAL PARK
WATER SUPPLY SOURCE STUDY

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APRIL 2021

WATER SUPPLY SOURCE STUDY
4285 MIDDLE COUNTRY ROAD
CALVERTON, NY

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this water supply source study is to provide information on the existing hydrogeologic conditions and to assess the viable alternatives that would ensure a potable water supply to the proposed Calverton Industrial Park (CIP) development project located at 4285 Middle Country Road, Calverton, New York (the "Site" or "subject property").

1.2 General Site Description

The subject property consists of one parcel located at 4285 Middle Country Road in the Hamlet of Calverton, New York. The site is located in the Town of Riverhead, and Suffolk County. Refer to **Figure 1** in the Figures section of this report for a Site Location Map. The property is identified in the Suffolk County Tax Map as 0600-116.00-01.00-002.000. According to the Phase I Environmental Site Assessment (ESA) the subject property was historically used for agricultural purposes from at least the 1930s through approximately 1986 (H2M, 2019). Currently, the property is vacant and is comprised of a naturally vegetated undeveloped land with wooded areas along the northeast and southwest property boundaries.

The Site includes approximately 30.25 acres bordered by Middle Country Road and vacant land to the north, a wooded portion of the former Grumman property to the south, a sod farm to the east, and commercial properties to the west. The commercial properties to the west consist of a Tractor Supply Company retail store and Sky Materials. Sky Materials is an active New York State Department of Environmental Conservation (NYSDEC) Part 360 permitted solid waste management facility which, based on a visual observation from the public right-of-way, appears to engage in processing construction and demolition (C&D) debris and vegetative waste (mulching).

The surface elevations at the site range from an elevation of approximately 84 feet (NAVD 88 datum) in the northwest corner of the Site along Middle Country Road to approximately 67 feet (NAVD 88 datum) in the southwest corner of the Site, with an elevation in the center of the site of approximately 68 feet (NAVD 88 datum). In general, the Site gently slopes from the north side to south side of the Site. Refer to **Appendix A** for an existing Site Boundary & Topographic Survey.

1.3 Proposed Project

The proposed development of the Site will include the construction of eight (8) new multi-tenant industrial buildings and a commissary. The buildings will each consist of 75 percent warehouse space and 25 percent manufacturing space). The proposed buildings will range from approximately 44,000 to 57,000 square feet (SF). The remainder of the Site will generally consist of asphalt/concrete pavement with landscaped areas along each of the property boundaries and a recharge basin for stormwater recharge. Refer to **Appendix B** for a proposed Site Plan.

The Site proposes to receive potable water from the Riverhead Water District (RWD), as the Site is partially located within the District's boundaries, or via private supply wells, if connection to the RWD is not possible. Based upon the Suffolk County Department of Health Services (SCDHS)

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regulations the proposed sanitary flow exceeds the allowable sanitary flow for the property and therefore, an on-site sewage treatment plant (STP) is proposed. Additionally, the site has been designed to recharge stormwater on-site in a series of recharge basins, catch basins, and leaching pools, in accordance with Town of Riverhead regulations.

The proposed project will be completed in two (2) phases. Phase 1 will consist of Buildings 1-4, the commissary (commissary to be located adjacent to Building 2 and will only serve the development and will not be open to the public), as well the STP and Phase 2 will consist of Buildings 5-8. Phase 2 will begin once Phase 1 is completed and operational. Phase 1 is anticipated to be completed by 2023 and Phase 2 is anticipated to be completed in 2025.

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2.0 WATER SUPPLY

2.1 Existing Water Supply

There is no established water connection on-site. The subject property is partially located within the boundary of the RWD with a 12-inch potable water main located along Middle Country Road. Refer to **Figure 2** for a figure depicting the boundary of the RWD and the location of the Site.

2.2 Proposed Water Supply

The Site proposes to connect to the public water supply provided by the RWD. Per correspondence with the RWD, the site is located in the high-pressure zone of the district. The RWD operates a low-pressure zone and high-pressure zone due to the high changes in gradient across the service area. As the Site is only partially within the boundary of the RWD (the first 500 feet of the Site are within the RWD and the remainder of the Site is outside the RWD), an extension would be required due to the size and depth of the site.

In the event that a connection to the RWD is not possible, it is expected that potable water would be supplied to the Site via private supply wells located on the subject property. Per the SCDHS "Private Water System Standards" §406.4-10 (INTRODUCTION):

> *"No person may construct a private water system to serve new construction without first having applied for and received an approval from the department. An approval to construct will be granted only where the department has made a determination that no public water supply is available (see §406.4-11 ACCESS TO PUBLIC WATER)."*

Per §406.4-11 Access to Public Water (Community Water Supply) states the following:

> *"All applications to install or use a private water system must include evidence satisfactory to the department that a community waster system is not available. Connection to a community water system is required if the system has sufficient capacity to serve the applicant, and if any of the following apply:*
>
> 1. *Single-family residence, where water mains exist within 150 feet of the applicant's property line.*
> 2. *Single-family residence for which minimum well separation or depth requirements cannot be met, or untreated well water quality is unsatisfactory and water mains exist within 250 feet of the applicant's property line.*
> 3. *Multi-family residence where water mains exist within 250 feet of the applicant's property line.*
> 4. *Realty subdivision or development where water mains exist within a distance equivalent to 150 feet multiplied by the number of proposed lots, from the applicant's property line.*
> 5. *Commercial or industrial buildings where water mains exist within 500 feet of the applicant's property line. For proposed structures larger than 5,000 gross square feet, connection is required within a distance equivalent to the proposed gross*

square footage divided by ten, e.g., within 600 feet of a proposed 6,000 square foot building.

6. *Commercial or industrial subdivision or development where water mains exist within a distance equivalent to the maximum buildable square footage allowed divided by ten, when measured to the closest property line.*

If connection to a community water system becomes feasible (due to water main extensions or improved system capacity) prior to or during construction of a project previously approved by the department for a private water system, then the approval for the private water system is voided, and the applicant must file a revised plan with the department." (SCDHS, 1992).

The Site is located within the boundary of the RWD with a RWD water main located along Middle Country Road (within 50 feet of the property line). Pursuant to the above, Number 5 would apply to the Site as the Site's property line is located within 4,400± feet of the RWD water main, and the smallest structure is proposed to be 44,000 SF (a distance equivalent to the proposed gross square footage divided by 10). Therefore, it will be upon the RWD to determine if they have sufficient capacity to serve the proposed development. If sufficient capacity is not available at the time of construction, then a private water system will be constructed.

Refer to Section 5 of this report for a detailed discussion of these proposed alternatives.

2.3 Proposed Water Demands

2.3.1 Potable Water

The proposed development of the Site will include the construction of eight (8) new multi-tenant industrial buildings and a commissary (not open to the public). The proposed industrial buildings will total 411,129 SF and the proposed commissary will total 1,500 SF. Based on the current SCDHS Standards, the flow required for a general industrial building is 0.04 gallons per day per square foot (GPD/SF) and the flow required for the commissary is 0.04 GPD/SF. With a total floor area of 412,629 SF and a flow of 0.04 GPD/SF, the total flow for the proposed Site is 16,506 gallons per day (GPD).

The peak flow required for the proposed Site was calculated based on the 2020 New York State Plumbing Code (Table E103.3(3)). The peak flow is based on the number of fixtures located in each tenant space and the associated fixture units (Table E103.3(2)). The proposed fixture unit for each tenant unit and the commissary is outlined in the tables below.

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Table 1: Tenant Unit Fixture Units

Tenant Units			
Fixture Type	**# of Fixtures**	**Fixture Unit per TableE103.3(2)**	**Total Fixture Units**
Water Closet	2	10	20
Lavatories	2	2	4
Drinking Fountain	1	0.25	0.25
Service Sink	1	3	3
Kitchen Sink	1	1.4	1.4
Total Fixture Unit Per Tenant			28.65

Table 2: Commissary Fixture Units

Commissary			
Fixture Type	**# of Fixtures**	**Fixture Unit per TableE103.3(2)**	**Total Fixture Units**
Water Closet	4	10	40
Lavatories	2	2	4
Drinking Fountain	1	0.25	0.25
Service Sink	1	3	3
Kitchen Sink (Public)	4	4	4
Dishwasher	1	3	3
Total Fixture Unit Per Tenant			54.25

There is a total of 60 tenant units proposed and one (1) commissary, for a total of 1,773.25 fixture units (1,719 fixture units for the tenant units and 54.25 fixture units for the commissary). Based on Table E103.3(3), the peak flow associated with the fixture units for a supply system with predominantly flushometer valves, is 298 gallons per minute (GPM).

Alternatively, the peak flow was calculated based on the total sanitary flow for the proposed Site. Based on SCDHS standards, the total sanitary flow for the proposed Site is 16,506 GPD. To provide for flexibility with future tenants, the proposed STP will be designed to accommodate a flow of 20,000 GPD. In the United States, on average about 60 to 90 percent of water consumed becomes wastewater (Metcalf and Edy, 2003). For this analysis, the mean value of 75 percent will be utilized as a conservative measure, therefore the total water flow for the proposed site is 25,000 GPD. As the building will be for industrial use, it is assumed that the buildings will be occupied for approximately 10 hours per day, six (6) days per week, with the buildings occupancy anticipated to be at 50 percent on the sixth day.

On average, approximately 2,500 gallons of water will be utilized per hour while the buildings are fully occupied. As water demand varies with the time of day, a multiplier can be used to estimate the instantaneous (peak) demand from the average daily flow

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(Lindeburg, 2014). The maximum hourly multiplier ranges from 2.0 to 3.0. Using an average value of 2.5, the estimated peak flow rate is 104 GPM (hourly flow rate * multiplier / 60 minutes/hour).

For the purpose of this report and design estimates, a conservative potable water peak flow rate of 104 GPM will be utilized.

2.3.2 Building Fire Suppression and Hydrant Water

Per the "Engineer's Report for On-Site Water Supply" prepared for the subject property by Key Civil Engineering, P.C. in July 2020, based on the 2020 NYS Fire Code Table B105.2, the minimum building fire sprinkler flow required is 375 GPM assuming that the tenant dividing walls are fire rated and the building is Type IIA construction (Key Civil, 2020). This fire flow is for Type IIA and IIIA construction for spaces 0-12,700 SF in area. Currently, the largest individual tenant space is 11,137 SF.

Per the "Engineer's Report for On-Site Water Supply" prepared for the subject property by Key Civil Engineering, P.C. in July 2020, the fire hydrant flow required is 1,500 GPM and based on the 2020 NYS Fire Code Section 507.5.1, Exception 2, any portion of the building must be within 600 feet of a hydrant. Therefore, hydrants can be spaced 1,200 feet apart (Key Civil, 2020).

2.3.3 Irrigation Water

The proposed Site area to be irrigated, post-development, will be approximately 2.0 acres of landscaping. The application rate will be approximately ½ of an inch per week, applied over 7 days with an application of approximately 0.07 inches per day. The application period will take place over 3 hours and will typically occur between 3am and 6am. Therefore, over the duration of the irrigation period of mid-April to mid-October (26 weeks/year), a total of 13 inches of irrigation water will be applied to the post-development irrigated landscaping on the subject property. Refer to **Table 3** below for the tabulated data.

Table 3: Irrigation Water Demand Data

Parameter	Value
Irrigation Area	84,700 square feet
Application Rate	0.5 inches/week
Application Days	7 days/week
Application Rate	0.07 inches/day
Application Duration	3 hours/day
Application Hours	3am – 6am
Irrigation Period	April to October
Irrigation Duration	26 weeks/year
Total Application	13 inches/year

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The irrigation water demand analysis for the proposed project is as follows:

$$Pumping\ Duration: \frac{6\ months}{12\ months}\ x\ \frac{52\ weeks}{year} = 26\ \frac{weeks}{year}$$

$$Annual\ Application: 26\ \frac{week}{year}\ x\ 0.50\ \frac{inches}{week} = 13.0\ \frac{inches}{year}$$

$$Annual\ Volume: 13.0\ \frac{inches}{year}\ x\ \frac{1\ foot}{12\ inches}\ x\ 84{,}700\ ft^2 = 91{,}758\ \frac{ft^3}{year}$$

$$Annual\ Volume\ in\ Gallons: 91{,}758\ \frac{ft^2}{year}\ x\ 7.48052\ \frac{gallons}{ft^3} = 686{,}398\ \frac{gallons}{year}$$

$$Peak\ Daily\ Volume\ in\ Gallons: 686{,}398\frac{gallons}{year}\ x\ \frac{1\ year}{26\ weeks} x\ \frac{1\ week}{7\ days} = 3{,}771\ \frac{gallons}{day}$$

The pumping rate calculations for the required volume is as follows:

$$Annual\ Pumping\ Duration: 26\ \frac{week}{year}\ x\ 7\ \frac{day}{week}\ x\ 3\ \frac{hour}{day} = 546\ \frac{hours}{year}$$

$$Annual\ Pumping\ Duration\ in\ Minutes: 546\frac{hours}{year}\ x\ 60\ \frac{minutes}{hour} = 32{,}760\ \frac{minutes}{year}$$

$$Required\ Pumping\ Rate: \frac{686{,}398\ \frac{gallons}{year}}{32{,}760\ \frac{minutes}{year}} = 20.95\ \frac{gallons}{minute}$$

Therefore, an annual total volume of 686,398± gallons/year (or a peak rate of ±3,771 GPD) of water pumped at a rate of approximately 21 GPM is required for irrigation purposes. These values are conservative and do not account for precipitation that will occur during the irrigation season. As the irrigation system will be equipped with water conservation measures, such as rainfall sensors and smart controls, the annual total volume required for irrigation will likely be less than 686,398± gallons/year.

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3.0 GROUNDWATER SOURCES

3.1 Regional Hydrogeology

The hydrogeologic setting of Long Island is well documented and consists of bedrock composed of schist, gneiss, and granite, which is overlain by a series of unconsolidated deposits. The bedrock is immediately overlain by the Raritan Formation, which consists of the Lloyd Aquifer and the Raritan Clay Member. Above the Raritan Formation is the Magothy Aquifer, followed by the Monmouth Greensand and Gardiners Clay layer. Finally, the upper Pleistocene deposits forms the Upper Glacial Aquifer and the uppermost layer. Additional layers exist within the region in the upper Pleistocene deposits, such as the unidentified (clay) unit and the Clay at Manorville. A hydrogeologic cross-section that shows the various layers is included as **Figure 3** and the generalized description of the hydrogeologic units is listed in **Table 4**, below.

Table 4: Generalized Description of Hydrogeologic Units

Hydrogeologic Unit	Geologic Unit	Description and Hydraulic Characteristics
Upper Glacial Aquifer	Upper Pleistocene Deposits	Till and outwash deposits of sand, silt, and clay and boulders. Varied permeability with an average hydraulic conductivity of 270 feet per day and an anisotropy of 10:1. Outwash has the highest hydraulic conductivity.
Clay at Manorville	Upper Pleistocene Deposits	Silt and clay, laminated, gray and brown. Relatively impermeable local confining unit.
Unidentified Unit	Upper Pleistocene Deposits	Fine to coarse sand, greenish. Some silt and clay. Contains water under water table conditions.
Magothy Aquifer	Matawan Group – Magothy Formation, undifferentiated	Sand, fine to coarse, clayey lenses of clay, coarse basal zone containing gravel. Lignite is abundant. Light and dark gray are predominant colors. Low to high permeability with an average horizontal hydraulic conductivity of 50 feet per day and an anisotropy of 100:1.
Raritan Confining Unit (Raritan Clay)	Unnamed clay member of the Raritan Formation	Clay and silt. Dark and light gray, some red and white with some lenses of sand. Relatively impermeable. Confines water in underlying unit. Average hydraulic conductivity of 0.001 foot per day.
Lloyd Aquifer	Lloyd Sand Member of the Raritan Formation	Gray sand and gravel. Some beds of sandy clay and clay and silt. Moderately permeable with an average hydraulic conductivity of 40 feet per day and an anisotropy of 10:1.
Bedrock	Hartland Formation Crystalline Bedrock	Granitic-gneiss, upper 30-50 feet moderately to highly weathered. Relative impermeable.

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3.2 Local Hydrogeology

At the proposed Site, the surface of the bedrock occurs at an approximate depth of -1,174' AMSL or approximately 1,242' below grade surface (bgs) (McClymonds, 1972). Due to its crystalline nature, there is little or no groundwater flow in the bedrock.

Immediately overlying the bedrock is the Raritan formation, consisting of the Lloyd Aquifer and the Raritan Clay Member. The Lloyd Aquifer consists of discontinuous layers of gravel, sand, sandy and silty clay, and solid clay. The top of the Lloyd Aquifer at the site is approximately -882' AMSL or 950' bgs and is approximately 291 feet thick (McClymonds, 1972). The Raritan Clay appears to exist at the subject property between approximately -882' AMSL and -732' AMSL, or between 800' bgs and 950' bgs. The average thickness of the Raritan Clay in the vicinity of the site is approximately 150 feet (Soren, 1986). The Raritan Clay Member is relatively impermeable, effectively hydraulically isolating the Lloyd Aquifer from overlying aquifers. The Raritan Clay is solid and silty clay with few lenses of sand and gravel. The clay is lignite and pyrite and is gray, red or white in color.

Above the Raritan Clay lies the Magothy Aquifer. The Magothy Aquifer consists of fine to coarse sand of moderate to high permeability, with interbedded lenses of silt and clay of low permeability. In the vicinity of the Site, the Magothy Aquifer is comprised of the Reworked Magothy, the Upper Magothy, the Middle Magothy, and the Basal Magothy. Considering the unit as a whole, the top of the Magothy Aquifer at the site is approximately -55' AMSL or 123' bgs and is approximately 676 feet thick (McClymonds, 1972). The hydraulic conductivity of the Magothy Aquifer typically ranges from 270 to 870 GPD/SF (Swarzenski, 1963) in the horizontal direction and about 1/30 of the horizontal in the vertical direction. The large disparity between the vertical and horizontal hydraulic conductivities indicates that water preferentially flows in the horizontal direction in this aquifer. Therefore, the Magothy Aquifer generally becomes more confined with depth.

Within the vicinity of the subject property, and beneath the surrounding area of several square miles, there is a varved clay in the middle of the upper Pleistocene deposits. This clay layer is known as the Clay at Manorville (or Manorville Clay layer) and if laterally extensive, probably exerts a considerable influence on the movement of ground water in the upper Pleistocene deposits in the area where it occurs. Movement of water between the upper and lower strata will be considerably impeded by the clay and presumably artesian conditions will prevail in the lower strata. The Clay at Manorville separates the Magothy Aquifer and Upper Glacial aquifer in the vicinity of the Site, with the top of the clay estimated to be 90' bgs (-23' ASML) and the layer estimated to be approximately 33 feet thick (De Laguna, 1963).

Lastly is the Upper Glacial Aquifer which is the water table aquifer at this location. This aquifer is comprised of medium to coarse sand and gravel with occasional thin lenses of fine sand and brown clay. The aquifer extends from the water table surface (28'AMSL or 40' bgs) to the top of the Manorville Clay layer (-23' ASML or 90' bgs at the subject property) and is approximately 50 feet thick (Krulikas, 1986). The Upper Glacial Aquifer generally has greater water transmitting properties than the underlying Cretaceous age deposits with typical hydraulic conductivities ranging between 800 and 1,000 GPD/SF and may be as great as 2,000 GPD/SF (Swarzenski, 1963).

The vertical conductivity of the Upper Glacial Aquifer is typically 1/10 of the horizontal in the area of the subject property.

The hydrogeologic conditions are listed in **Table 5**.

Table 5: Hydrogeologic Conditions

Aquifer	Thickness	Interval (bgs)	Elevation (ASML)
Upper Glacial	50.51'	40' – 90.51'	27.86' – -22.65'
Manorville Clay	32.58'	90.51' – 123.09'	-22.65' - -55.23'
Reworked Magothy	103.18'	123.09' – 226.27'	-55.23' - -158.41'
Upper Magothy	190.07'	226.27' – 416.34'	-158.41' - -348.48'
Middle Magothy	193.69'	416.34' – 610.03'	-348.48' - -542.17'
Basal Magothy	190.07'	610.03' – 800.10'	-542.17' - -732.24'
Raritan Clay	150.24'	800.10' – 950.34'	-732.24' - -882.48'
Lloyd	291.44'	950.34' – 1241.78'	-882.48' - -1,173.92'
Bedrock	---	1241.78'	-1,173.92'

3.3 Depth to Groundwater

To determine the depth to groundwater beneath the site, the United Stated Geological Survey (USGS) Groundwater Conditions on Long Island Map (2016), USGS Topographic Map (Wading River Quadrangle), topographic survey and the on-site soil borings performed by Slacke Test Boring Co. were utilized. Based upon the USGS Groundwater Map, which depicts the water table elevation conditions across Long Island, the water table elevation beneath the site is approximately 26' to 27' ASML. As the subject property ranges in elevation from approximately 66.7' ASML the southwest portion of the site to approximately 83.7' ASML in the northwest corner of the site, the depth to groundwater beneath the site would be expected to range from 39.7'± bgs in the southwest portion of the site to 57.7'± bgs in the northwest corner of the site.

The depth to groundwater was generally confirmed during the soil borings, which soil boring B-3 (located near the central portion of the site along the west side of the subject property) encountered groundwater at a depth of 36.2'± bgs.

3.4 Groundwater Contours

Groundwater on Long Island results from precipitation that enters the soil in the form of recharge. This precipitation passes through an unsaturated zone to a level below where all the strata are saturated; this level is known as the water table. The main water-bearing layers beneath the subject site are the Upper Glacial, Magothy, and Lloyd Aquifers (Jensen, 1974). These three aquifers rest on the bedrock underlying Long Island. The groundwater table corresponds to the sea level on the north and south shores of Long Island and rises in elevation at the center of the Island. The groundwater high point is often referred to as the groundwater divide.

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A hydraulic gradient is produced by the changes in elevation of the water table, which causes groundwater to flow in a perpendicular direction to the contour lines of equal elevation. The USGS has a system of observation wells which are utilized to infer groundwater lines of equal elevation, often referred to as contour lines. The lines of equal elevation help in determining the general direction of groundwater flow within the aquifer. In an aquifer where the conductivity is the same in both the horizontal and vertical directions (known as an isotropic aquifer), groundwater moves perpendicular to the contour lines (Freeze, 1979). Despite the fact that the hydrogeologic units on Long Island are not isotropic, this principle may be used to determine the approximate direction of groundwater flow. The location of the groundwater divide and the configuration of the water table will change as the groundwater elevations vary.

Based on the USGS Groundwater Conditions on Long Island (from 2016) shown in **Figure 4**, the subject site is located directly to the north of the regional ground water divide and the movement of groundwater beneath the site appears to be to the northeast, where it discharges into the Long Island Sound.

3.5 Groundwater Budget

A groundwater budget is used to determine the total recharge volume that a site generates. The budget indicates that not all precipitation that falls onto land is recharged to groundwater, in fact less than 50 percent of the precipitation recharges to the groundwater system. The loss in recharge is represented by the sum of evapotranspiration (the sum of evaporation and plant transpiration from land and the ocean to the atmosphere) and overland runoff. The groundwater budget for an area is defined by the hydrologic budget equation, which states that recharge equals precipitation minus evapotranspiration minus overland runoff (Peterson, 1987). The equation is expressed as follows:

$$R = P - E - Q$$

Where:
R = Recharge
P = Precipitation
E = Evapotranspiration
Q = Overland (Direct) Runoff

The average precipitation rate for Brookhaven National Laboratory (located approximately 7 miles southwest of the Site) since 1949 is 49.01 inches (BNL, 2021). An accepted estimate of annual evapotranspiration in Riverhead for shallow root vegetation is 22.4± inches from the Thornthwaite and Mather water-balance calculation for mean weather data (Peterson, 1987). Overland runoff increases in areas of urbanization where there are increased amounts of land covered by impervious surfaces. Streamflow records have been used to calculate direct runoff to streams and when applied to the stormwater contributing areas that drain to the streams, an annual direct-runoff rate can be determined. For Suffolk County, the direct runoff rate is 0.3 inches (Peterson, 1987). For an average annual precipitation value of 49.01 inches, an estimated annual evapotranspiration rate of 22.4 inches, and an overland runoff value of 0.3 inches, the groundwater budget equation is:

R = 49.01 inches – 22.4 inches – 0.3 inches
R = 26.31 inches

Utilizing this equation, the Site currently generates a total recharge volume of 21.63 MGY (million gallons per year).

3.6 Groundwater Management Plan

In 1978, under a program funded by Section 208 of the 1972 Federal Water Pollution Control Act Amendments, the Long Island Regional Planning Board, in association with other agencies, prepared a management plan for Long Island groundwater resources, the Long Island Comprehensive Waste Treatment Management Plan (commonly referred to as the "208 Study"). The purpose of the 208 Study was to investigate best practices for groundwater and surface water protection and investigate waste disposal options. Based on the groundwater flow patterns and quality, the study formulated a management plan defined by Hydrogeologic Zones with a total of eight (8) zones identified. These definitions were the basis for the formation of Groundwater Management.

As a result of the 208 Study, in 1981 Article 6 was added to the Suffolk County Sanitary Code. This Article defined the means and methods for wastewater treatment in Suffolk County. Article 6 also delineated the boundaries of the eight (8) Groundwater Management Zones (GWMZ) for the protection of groundwater, each with differing hydrogeological and groundwater quality conditions. The goal of creating the different GWMZ was to limit groundwater nitrogen to 4 mg/l in GWMZ III, V, and VI and to 6 mg/l in the remaining zones (SCDHS, 2015).

The subject property is located within GWMZ III. Commercial/Industrial properties located in this GWMZ are limited to a total discharge of 300 GPD per acre when using a conventional on-site sewage disposal system and public water or private well. Projects that exceed this density requirement and do not meet an exemption, are required to connect the site to an existing or proposed STP for advanced treatment that is capable of reducing effluent nitrogen to 10 mg/l.

Based on the net lot size of the subject property (30.25 acres), the Site has an allowable sanitary flow of 9,084 GPD (300 GPD/acre x 30.25 acres = 9,076 GPD). Per the proposed design plans, the proposed development will require a flow of approximately 16,506 GPD. Therefore, since the project exceeds the allowable density, a STP will be constructed on Site.

The location of the proposed STP was evaluated with respect to the location of the public water supply wells and surface water contributing areas based on Guidance Memo Number 28 – STP Siting. Based upon a preliminary evaluation, the proposed STP would be within a known 100-year contributing area to the RWD's Well Field 16 but is not within a surface water contribution area. As the proposed STP is located within the contributing area of the RWD Well Field 16, a nitrogen mass balance was performed in accordance with Guidance Memo Number 28. The nitrogen mass balance is as follows:

As of Right Development – Allowable Sanitary Flow
Area = 30.25 acres
Flow = 9,076 GPD (0.00907 million gallons per day (MGD))
Total Nitrogen Effluent Concentration (TN) = 50 mg/l
Total Nitrogen Effluent Quantity = 50 mg/l * 8.34 * 0.00907 MGD = 3.78 lbs./day

Proposed Development with STP
Area = 30.25 acres
Flow = 16,506 GPD (0.016506 MGD)
Total Nitrogen Effluent Concentration (TN) = 10 mg/l
Total Nitrogen Effluent Quantity = 10 mg/l * 8.34 * 0.016506 MGD = 1.38 lbs./day

Proposed Development with STP at Design Flow
Area = 30.25 acres
Flow = 20,000 GPD (0.02 MGD)
Total Nitrogen Effluent Concentration (TN) = 10 mg/l
Total Nitrogen Effluent Quantity = 10 mg/l * 8.34 * 0.02 MGD = 1.67 lbs./day

Based on these calculations, the utilization of the proposed STP (at the design flow of 20,000 GPD) with an effluent of 10 mg/l would result in a nitrogen loading that is approximately 2.49 lbs./day less than the as-of-right development. This is equivalent to approximately 908 lbs./year less nitrogen then if the property were developed as-of-right without a STP.

3.7 Groundwater Wells

3.7.1 USGS Monitoring Wells

The USGS has four (4) monitoring wells located within a one (1) mile radius of the site. Measuring from the northwest corner of the site boundary line, one (1) active (Site Name S51579.1) and one (1) inactive well (Site Name S36149.1) are located 0.1 miles northwest of the site. One (1) inactive well (Site S3957.1) is located approximately 0.45 miles southeast of the site and one (1) inactive well (Site S3875.1) is located approximately 0.45 miles northeast of the site.

Each of the monitoring wells are in the Upper Glacial aquifer. Field groundwater-level measurements are available for monitoring wells S51579.1 and S36149.1. The remainder of the monitoring wells do not have available data. Refer to **Figure 5** for a plan showing the location of the USGS monitoring wells in the vicinity of subject property. Refer to **Figure 6** for a graph showing the groundwater elevation measured and recorded in the monitoring wells with available data.

Monitoring well S32466.4 (listed as inactive) was monitored from 1969 until 1993 with multiple measurements each year and monitoring well S51579.1 (listed as active) was monitored beginning in 1974 with the most recent measurement in September 2020 with multiple measurements each year. In both wells the groundwater elevation follows a

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sinusoidal trend that generally peaks in the winter and drops in the summer, which is anticipated considering Long Island's seasonal groundwater usage.

3.7.2 *Public Supply Wells*

The RWD currently utilizes 17 active groundwater wells located at ten (10) different sites (or plants) throughout the district (RWD, 2019). Based upon the Public Water Supply Well Maps published by SCDHS, no public water supply wells are located within a one-mile radius of the subject property. The nearest public water supply wells are RWD – Grumman, Plant 12 Well Field located approximately 1.6 miles to the southwest of the site, RWD – Edwards Avenue, Plant 16 Well Field, located approximately 1.85 miles northeast of the site, RWD – Fresh Pond, Plant 7 Well Field, located approximately 2 miles to the northwest of the site, and RWD – Middle Country Road, Plant 11 Well Field, located approximately 2.5 miles west of the site.

The Plant 12 Well Field is located within the high-pressure zone with an authorized capacity of 1.44 and a flow rate of 1,000 GPM, however due to contamination from volatile organic compounds (VOCs) and the potential for the wells at the plant to affect the habitat of Tiger Salamanders, Plant 12 does not supply any water to the system. The Plant 16 Well Field is located within the high-pressure zone with an authorized capacity of 3.43 MGD and a flow rate of 2,382 GPM. The Plant 7 Well Field is located in the high-pressure zone with two (2) wells, each with an authorized capacity of 1.73 MGD and a flow rate of 1,200 GPM. The Plant 11 Well Field is located in the high-pressure zone with an authorized capacity of 1.99 MGD and a flow rate of 1,380 GPM. The RWD operates a low-pressure zone and high-pressure zone due to the high changes in gradient across the service area (H2M, 2020).

As there are approximately four (4) public supply wells in the vicinity of the Site, the contributing area and groundwater travel times associated with these public supply wells are important to consider. **Figure 7** depicts the contributing areas or flowpath that leads to the public supply wells within the vicinity of the site. The contributing areas and the travel times associated with each area are unique for one specific flow rate and typically assume steady state conditions. As these conditions may vary over time, the contributing area is likely to change, however these areas provide insight for planning and design within the vicinity of the well sites (Franke, 1998). As shown in **Figure 7**, the Site is partially located within the 100-year contributing area for one (1) public supply well (Plant 16).

3.7.3 *Private Supply Wells*

Within a 500' radius of the subject property there are four (4) properties that were identified as not being connected to the public water supply. The RWD verified that public water is not available to these properties. According to publicly available aerial images, it appears that all four (4) of the lots are currently vacant and three (3) of the four (4) appear to be actively farmed, therefore it is assumed that there are private wells located on these sites. The current groundwater quality provided by each of the existing private wells is unknown, as private wells are not typically required to monitor their water supplies.

A Freedom of Information Law (FOIL) request was submitted to the NYSDEC on October 29, 2020 seeking records and locations of water wells located within the vicinity of the site. Records requested included the location of wells, completion reports of Long Island Wells, and drillers logs/soil borings for wells that are either publicly or privately owned. On November 3, 2020, a notification was received that the NYSDEC had completed the FOIL request and records identified as responsive to the request were uploaded in the NYSDEC's online FOIL request system.

A total of 29 Long Island Well Completion Reports were provided by the NYSDEC. Of the completion reports provided, the wells are located to the northwest of the site between Fresh Pond Avenue and Sunny Line Drive and South Path and Middle Country Road, with the majority of the wells located within the residential development. A total of 21 of the completion reports provided state that the wells are used for domestic use, four (4) of the completion reports state that the wells are monitoring wells, one (1) of the well reports state that the well is a test well, one (1) of the completion reports state that the well is for general purpose and two (2) of the completion reports do not state what the well is used for. One (1) of the reports that does not state what the well is used for has the same Site Name as an inactive USGS monitoring well. Based on this, it can be assumed that the well was used as a monitoring well and not for domestic purposes. Therefore, to be conservative, it is assumed that of the 29 wells, 23 of the wells are for domestic or potable water uses.

According to a RWD District Boundary map (see **Figure 2**), the residential properties located to the northwest of the subject property on Middle Country Road, Old Stone Road, Penny Drive, Timber Drive, Sunny Line Drive, Wildwood Drive, and Hidden Meadows are within the boundaries of the RWD. Therefore, these properties are likely connected to the public water system.

Refer to **Figure 8** for the well locations. These locations are approximate based on the Completion Reports and does not include the location of all 29 wells, as some locations could not be accurately determined based on the information provided.

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4.0 GROUNDWATER QUALITY

4.1 Regional Water Quality

In general, the water quality on Long Island has been found to be very good. Over time however, the water quality has begun to deteriorate in many areas across Nassau and Suffolk Counties. The deterioration began in the 1960's and was caused by the large increases in industrial chemical usage, leaking underground fuel storage tanks and unlined landfills, the increased use of pesticides and herbicides, and the lack of sewer systems in densely populated areas (Nemickas, 1989).

The deteriorating water quality has been attributed to large industrial and commercial centers neighborhood businesses, and agriculture. The main contaminants that are typically detected are nitrates, pesticides, microbials, and volatile organic compounds (VOCs). Regular water sampling is performed throughout each water district on Long Island to ensure health standards are being met. Measures, such as installing granular activated carbon filters or air strippers, have been taken to remove organic compounds from the public water supply system on Long Island.

Recently, emerging contaminants have become a great concern on Long Island. Particularly, the perfluorinated compounds PFOA (perfluorooctanoic acid) and PFOS (perfluorooctane sulfonate) and the synthetic compound 1,4-dioxane. PFOA and PFOS are part of a class of chemicals known as perfluorinated compounds (PFCs). PFCS are commonly found in commercial and industrial products such as firefighting foam, carpet, clothing treatments and coatings that repel water, oil, stains, and grease (Office of Land and Emergency Management, 2017). Alternatively, 1,4-dioxane was historically used as a solvent and solvent stabilizer for industrial chemicals and was also used as a wetting agent and dispersing agent in textile processing, dye baths, and stain and printing compositions. It is also used in cosmetics, deodorants, fumigants, automotive coolant liquid and in radiation detectors (SCDHS, 2015).

4.2 Local Water Quality

The subject property is located partially within the boundaries of the RWD. Per New York State regulations, the RWD routinely monitors the drinking water for over 135 different parameters including inorganic contaminants, nitrate, VOCs, synthetic organic contaminates. Water is supplied via 17 active wells located throughout the RWD (RWD, 2019).

The following are general characteristics of the water quality in the RWD (H2M, 2020):

> Low to moderate dissolved iron levels – Iron is naturally occurring in the environment, with high levels of iron prone to causing water discoloration and taste issues. The NYS secondary standard maximum contaminant levels (MCL) is 0.3 parts per million (ppm) for dissolved iron and the current levels range from non-detectable to 1.0 ppm. The RWD uses blended polyphosphates to sequester iron at all wells. Elevated levels of iron have also been found in private wells in the RWD, with values ranging from 0.1 ppm to 7.1 ppm and approximately 60 percent of the samples taken exceeded the secondary standard MCL of 0.3 ppm.

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pH of 5.8 to 7.1 – This can be categorized as corrosive and is expected to be aggressive and will generally cause corrosion to iron and copper piping. This can lead to red (due to iron) or blue water (due to copper) complaints. Lime is currently used by the RWD to adjust the pH.

Low in hardness – Overall hardness levels range from 9.2 ppm to 77 ppm. This will describe the water as being "soft" to "moderately hard" and is more corrosive towards metal piping than "hard" water.

Low in chlorides – Chloride levels range from 3.5 ppm to 37.1 ppm. This typically shows that the groundwater supply is not subjected to saltwater intrusion.

No levels of VOCs – With the exception of one (1) well, the RWD does not typically detect VOCs. The VOC detected is a known soil fumigant with a MCL of 5.0 ug/l and a maximum detection level of 0.75 ug/l in 2020, well below the MCL.

Low to moderate nitrate concentrations – The average nitrate concentration in the RWD is 2.0 ppm, with two (2) wells with concentrations around 5.0 ppm however none of the wells exceed the MCL of 10.0 ppm. Wastes generated by cesspool systems, septic tanks and the pre-sewer system can attribute to nitrates and other potential contaminants being released into the aquifer system.

Low perchlorate levels – Perchlorate is a man-made and naturally occurring chemical that is used to produce explosives, flares, fireworks, and rocket fuel. It can also be found in some fertilizers and bleach. With the exception of two (2) wells, perchlorate concentrations have been non-detect. New York State has a perchlorate action level of 18 ug/l. The maximum concentrations detected at the two (2) wells were 2.8 ug/l and 10.8 ug/l. These concentrations are likely due to fertilizer application in the vicinity of the wells.

Low 1,4-dioxane levels – With the exception of three (3) wells, concentrations of 1,4-dioxane were not-detected. New York State has a MCL of 1.0 ug/l and of the wells that had detected 1,4 dioxane, the levels ranged from 0.024 ug/l to 0.094 ug/l, well below the limit.

High PFC levels – Six (6) PFC's including PFOA and PFOA have been tested for and were detected in two (2) wells. In one well PFOA and PFOS levels were 8.4 ng/l and 15.9 ng/l, respectively and in the other well the levels were 2.6 ng/l and 3.3 ng/l, respectively. In 2020, NYS set the a MCL of 10 ng/l each for PFOA and PFOS, meaning that the one well will require future treatment. The concentrations of PFOA and PFOS were non-detect in the remainder of the wells. There have been detections of PFOA and PFOS in a few private wells located within the RWD. The detections ranged from 2.4 ng/l to 5.9 ng/l which is below the NYS MCL of 10 ng/l each for PFOA and PFOS. Although these values are within drinking water standards, they may require future treatment.

Detections of Methyl-tertiary-butyl-ether (MTBE) – MTBE is an additive for unleaded gasoline that has been used since the 1980s. In 2004, NYS banned the use of MTBE as an additive to gasoline, however it is still used in industrial practices. The NYS MCL for MTBE in public water supplies is 10 ug/l. MTBE had been detected in three (3) wells. In response, the RWD deepened two (2) of the wells and configured the system such that the third well is the last to come on. Since the two (2) wells have been deepened, there have not been detections of MTBE. In private wells located within the RWD, MTBE levels have been detected ranging from 1.0 ug/l to 240 ug/l and approximately 50 percent of the samples taking exceeding the NYS MCL of 10 ug/l. The samples with the exceedances were detected in properties located to the south, southwest, and west of the subject property (H2M, 2020).

4.3 Proximity to Contaminant Sources

4.3.1 Agricultural Facilities

A Phase I ESA was prepared for the subject property on December 9, 2019 by H2M architects + engineers. Per the Phase I ESA, the subject property was historically utilized for agricultural purposes from before 1938 until approximately 1986 (H2M, 2019). Historic usage for agricultural purposes is likely to be associated with the application of pesticides and herbicides at the site. During the period of time the subject site was used for agricultural purposes, pesticides used may have included now-banned chemicals (e.g., DDT), or metals-based compounds (e.g., lead arsenate). Such compounds may have been applied directly at the subject property, and/or may have migrated to the subject property from adjacent properties via surficial storm runoff or wind deposition. Compounds such as these, particularly metals-based compounds, tend to be immobile in the environment and remain in soil long after their application ceases.

Water quality sampling of the groundwater at the subject property has not been performed; however, the USGS performed a study relating the groundwater quality to differing land use in the late 1980's. An agricultural area that was 41.2 square miles in size and located just to the east of the subject property was included as part of the study. A total of 15 USGS groundwater monitoring wells screened within the Upper Glacial Aquifer and with depths ranging from 34 feet to 126 feet were sampled. The samples were analyzed for inorganic chemicals, volatile organic compounds, semi-volatile compounds, insecticides (including organochlorine, organophosphorus, and carbamate), and herbicides (including chlorophenoxy-acid and triazine). Additionally, one (1) well within the area was sampled monthly for 18 months after the initial sampling event to record the groundwater quality based on seasonal fluctuations. The monthly samples were also analyzed for major inorganic ions, trace inorganic compounds and VOC's (Leamond, 1992).

Organochlorine insecticides were detected in the 14 samples analyzed (one (1) sample was not received for analysis), with the most frequently detected compounds being heptachlor and epoxide, followed by dieldrin, endosulfan, and DDD. Chlorophenoxy-acid and organophosphorus insecticides (2,4-D and ethion, respectively) were each detected in one (1) sample from the area. Carbamate insecticides were detected in 10 of the 15 samples, with the most frequently detected compounds being aldicarb sulfoxide and aldicarb sulfone, and were also detected at higher concentrations than any of the other analyzed pesticides in the area. Chloroform was detected at the detection limit in one (1) sample, and aldicarb sulfoxide, aldicarb sulfone, and carbofuran were each detected in one (1) sample. No chlorophenoxy-acid herbicides, triazine herbicides or organophosphorus insecticides were detected (Leamond, 1992).

Therefore, based on the historical usage of the subject property and surrounding properties for agricultural purposes, there is the potential for shallow groundwater contamination in the Upper Glacial Aquifer due to pesticide application, with the types, concentrations, and extents of contamination unknown.

4.3.2 State Hazardous Waste Sites (SHWS)

Located approximately 0.6 miles to the east-northeast of the subject site at 4008 Middle Country Road is an SHWS site listed as Mackenzie Barn. The Site is listed as a State Superfund Site and the data is from the DEC Inactive Hazardous Waste Disposal Sites in New York State. A description of the site activities was not available in the EDR Report for the site. The site is located hydraulically downgradient of the subject property and therefore is not likely to pose an environmental threat to the subject property (H2M, 2019).

4.3.3 Solid Waste Facilities/ Landfill Sites (SWF/LF)

Directly to the west of the Site is Sky Materials (located at 4331 Middle Country Road), is an active NYSDEC Part 360 permitted solid waste management facility which is listed as having active registrations for construction and demolition (C&D) processing facility and an active composting/yard waste facility per the EDR Report for the site. The waste types listed for the C&D processing include asphalt, brick, concrete, gravel, rock, soil (clean), wood (unadulterated) and wood (brush/branches/trees/stumps). This site was formerly listed as a registered recycling facility under the name Island Shingle Recycling Corp with a reported waste type of asphalt shingles and a US Mines site under the name Calverton Industries LLC which mined construction sand and gravel. The mine was reported to be abandoned as of August 4, 2004, however there were multiple violations for the facility between 2002 and 2004 and the registered recycling facility is listed as inactive (H2M, 2019).

Located approximately 0.4 miles to the east-northeast of the subject property at 4083 Middle Country Road is a site listed as Green Meadows, LLC that has two active registrations. These registrations include C&D processing and composting/yard waste. The waste type of the C&D processing is listed as soil (clean), concrete, asphalt, wood (unadulterated), and wood (brush/branches/trees/stumps) and the waste type for composting is listed as yard waste (H2M, 2019).

Located approximately 0.13 miles to the northwest of the subject property is a site listed as East End Recycling and Composting Co. which has two inactive permits. The first is for composting (source separated organic waste) and the second permit is for a transfer station. The permit listings do not report the type of waste (H2M, 2019).

Environmental or water quality data was not available for review for these three (3) sites, nor is it known in what way the facilities are, or were, operated, maintained, or monitored. However, in 2016, the SCDHS released a report investigating the impacts of compost/vegetative organic waste management (VOWM) facilities on local groundwater quality. A total of 11 current or former VOWM sites were investigated with samples collected from 36 groundwater profile and monitoring wells located downgradient of the sites. The sites investigated were located in Speonk, Eastport, Manorville, Yaphank, Ronkonkoma, Farmingdale and Medford (SCDHS, 2016).

In this report, SCDHS found that elevated metals concentrations were detected in the groundwater downgradient of the VOWM sites that were investigated. According to the report, the primary parameter that most frequently exceeded groundwater and drinking water standards was manganese. Other metals including antimony, arsenic, beryllium, cadmium, chromium, cobalt, germanium, molybdenum, thallium, titanium and vanadium were also detected at rates that were twice what is typically seen in shallow private wells in Suffolk County. Additionally, there was an increase in metal concentrations and increased detections of radiological parameters (gross alpha and gross beta) observed downgradient of one facility and it was noted that the groundwater impacts observed at this facility did not appear to be unique to this facility (SCDHS, 2016). As similar groundwater impacts were observed at multiple VOWMs throughout Suffolk County, it can be inferred that these impacts are related to the operations taking place at these sites. Therefore, it is possible that there is shallow groundwater contamination in the vicinity of the Site due to these facilities.

4.3.4 Naval Weapons Industrial Reserve Plant (NWIRP)

The Naval Weapons Industrial Reserve Plant, also known as Grumman Aerospace and Northrop-Grumman is a 6,000-acre facility with the site located directly to the south of the subject property. NWIRP was a US Government owned and contractor operated facility that assembled and tested military aircrafts from 1956 to February 1996. The US Government transferred the majority of the property to the Town of Riverhead Community Development Agency (CDA) in September 1998 for economic development and is currently referred to the Enterprise Park Calverton (EPCAL). The majority of the buffer areas were transferred to the NYSDEC for conservation and public recreation and an additional parcel was transferred to the Veterans Administration (NAVFAC, 2019). The U.S. Navy still retains three (3) parcels totaling approximately 209 acres to continue environmental investigations and remedial activities at five (5) sites (Sites 2, 6A, 7, 10B, and the Southern Area). After these portions of the facility are remediated (as necessary), they would then be transferred to the CDA. (ERD Details, n.d.).

> Site 2 (Fire Rescue Training Area) - An 11-acre training area that was used to simulate plane crashes. Beginning in 1955 (and possibly as early as 1952), each year 450 gallons of waste solvents were mixed with up to 2,100 gallons of waste fuel and used for training exercises. After 1975, it was reported that waste solvents were no longer mixed with the waste fuels and oils that were ignited. In 1982, there was an accidental spill of

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solvents and fuel oil. The firefighting materials that were used in the training exercises include aqueous firefighting foam, gaseous Halon 1301, water, and dry chemical extinguishers (NWIRP, n.d.). In 1998, free floating product was removed from the wells and the site was partially remediated through an air sparging system. During 2009, the Navy removed an 80-foot diameter concrete ring used for fire training and contaminated soil above/below the ring as an interim corrective measure (ERD Details, n.d.).

Site 6A (Fuel Calibration Area) and Site 10B (Engine Test House) - Starting in 1956, the fuel calibration area was used for testing of aircraft engine and fuel systems. The area consisted of a cinder block building and associated fuel tanks. The entire complex was replaced in 1980 by the new fuel calibration area. As many as 230 gallons of fuel are recorded to have been spilled in these areas. Groundwater contaminants found included a free product layer and contaminated groundwater containing fuel-type and chlorinated VOCs. The chlorinated VOCs are believed to be from unreported spills of solvents used to clean the aircraft engines and fuel systems. A groundwater recovery unit was installed in 1987. This unit included a pumping well, an oil recovery well and an oil/water separator tank. Active groundwater and free product extraction continued until 1993. Passive product recovery completed the removal. Groundwater migrating from these Sites has been documented. Levels of VOCs including DCA exceed the 5-ppm level in the plume. An active groundwater extraction and treatment remedial system has been constructed at Navy property's fence and is currently operating. Additionally, the Navy has excavated and removed contaminated soil from these areas (ERD Details, n.d.).

Site 7 (Fuel Depot) - Constructed in 1953 to supply aircraft fuel, gasoline and diesel fuel for NWIRP operations. All the underground storage tanks have been removed. A full-scale Air Sparging/Soil Vapor Extraction Construction Work Plan was approved on December 12, 2005. Operation of the system began in 2006 (ERD Details, n.d.).

Site Investigations (SI), RCRA Facility Investigations (RFI), and Human Health Risk Assessments (HHRA) were conducted for the NWIRP/EPCAL property beginning in the 1990’s. During these investigations and assessments, both soil and groundwater contamination was found. The groundwater contaminants detected at levels higher than the drinking water standards and groundwater quality standards include a number of chlorinated and non-chlorinated solvents, dichlorobenzene, phenolics, PAHs, pesticides, PCBs, and metals (NWIRP, n.d.)

Investigations for poly- and perfluoroalkyl substances (PFAS) began in 2016 both on and off the NWIRP/EPCAL property. PFAS had been used in a number of different military actions, including as a component in aqueous film-forming foam (AFFF). AFFF was commonly used at fire-fighting training areas and equipment test areas, areas such as Site 2 and the Aircraft Paint Hangers on the NWIRP/EPCAL property. In addition, areas that stored or transferred AFFF are also areas of concern due to potential unreported releases to the environment. Based on historical records and interviews with personnel, AFFF was stored and either used or released at a number of locations through the NWIRP/EPCAL property (NAVFAC, 2019).

Sampling performed both on and off the NWIRP/EPCAL property detected PFOA and PFOS in the groundwater above the then United States Environmental Protection Agency (USEPA) Health Advisory Limit (HAL) of 70 ng/l (New York State has since established a more restrictive limit of 10 ng/l each for PFOA and PFOS). Sampling activities are currently continuing in order to further investigate and delineate the extent of PFAS in groundwater at the NWIRP/EPCAL property and surrounding area (within 1-mile of the site) (PFAS, 2021). Although the investigations are ongoing regarding the extend of the PFAS groundwater contamination in the vicinity of the subject property, based on the above referenced information, a conservative assumption is that there is a shallow PFAS groundwater contamination plume with unknown extents within the vicinity of the Site due to historical operations at the NWIRP facility.

Refer to **Figure 9** for the location of the above referenced sites of potential contaminant sources.

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5.0 WATER SUPPLY ALTERNATIVES

5.1 Public Water Connection (Proposed Action)

5.1.1 Riverhead Water District (RWD)

The RWD was consulted in January 2021 requesting information related to the capacity of the RWD to evaluate the proposed development of the subject property on the public water supply. Specifically, the information requested included the current capacity of all well fields in the RWD, the storage tank capacity and locations, information on all water services within the RWD, including types (i.e. domestic, fire, irrigation) and sizes of those connections, daily pumping records for the last 10 years, and any previous analysis or studies on the capacity of the RWD.

To date, the entirety of the above listed information has not been received; however a Draft Map & Plan Report for Proposed Water District Extension No. 94 Manorville was prepared for the Town of Riverhead by H2M architects + engineers in October 2020 (H2M, 2020). The Map & Plan Report provides a water system description of the RWD including the general service area, supply well facilities, storage facilities, and pumpage and demand, as well as the proposed extension of the RWD into Manorville, located to the southwest of the subject property.

5.1.1.1 RWD Supply and Storage Facilities

Per the Draft Map and Plan Report, the RWD has a combined NYSDEC approved pumping capacity of 16,690 GPM or the equivalent of 24.034 MGD. However due to various limitations, the combined actual pumping capacity is 13,930 GPM or the equivalent of 20.06 MGD. The limitations include the close proximity of Wells No. 11-1, 11-2, 12-1, and 12-2 to one another and minimizing the pumping rate to prevent negative impacts to the groundwater table, the presence of a groundwater contamination plume near Well No. 12-1, the capacity of the percolate treatment system at Well No. 16, the presence of chlorides at Well No. 17, the presence of manganese at Well No. 5-1, and the presence of iron at Well No. 2 and Well No. 4-2 (H2M, 2020).

The RWD has two (2) pending applications at the NYSDEC to increase the capacity at Well No. 2 and Plant No. 11. Well No. 2 proposes to extend the well deeper, which would increase the capacity by 300 GPM or 0.43 MGD. Plant No. 11 proposes to have the limitation lifted that prevents Well No. 11-1 and 11-2 from each operating at 1,380 GPM or 1.99 MGD. This restriction was placed on Plant No. 11 due to the close proximity of Plant No. 11 and 12 in order to prevent negative impacts to the groundwater table and surface water bodies. Since Well No. 12-1 is used sparingly and Well No. 12-2 is abandoned, these wells have a minimal impact on the groundwater table and surface water bodies. If the restriction is lifted, it would increase the capacity by 1,380 GPM or 1.99 MGD. Therefore, if both pending applications are approved, the RWD capacity would increase by 1,680 GPM or 2.42 MGD (H2M, 2020).

In addition to the wells, the RWD operates and maintains two (2) elevated steel storage tanks, two (2) ground storage tanks, and two (2) standpipes. Between these facilities, there is a storage capacity of 6.24 million gallons, with 4.41 million gallons in the low-pressure zone and 1.83 million gallons in the high-pressure zone (H2M, 2020).

As previously mentioned, the RWD operates a low-pressure zone and high-pressure zone due to the high changes in elevation across the service area. The low-pressure zone has an actual pumping capacity of 12.31 MGD and a storage capacity of 4.4 MG. The high-pressure zone has an actual pumping capacity of 7.75 MGD and a storage capacity of 1.83 MG. There are booster stations located through the RWD to maintain pressure during periods of high demand and to convey the water through the RWD (H2M, 2020).

The RWD also maintains four interconnections with the Suffolk County Water Authority (SCWA), two (2) of which provide water to the SCWA (the Peconic Boulevard interconnection) and two (2) of which can be used to receive water from the SCWA (the Dogwood Drive and Meroke Trail interconnections). Typically, these interconnections are utilized to meet peak demand and supplement water supplies as needed. The Peconic Boulevard interconnection can provide up to 750 GPM or 1.0 MGD to the SCWA, the Dogwood Drive interconnection can provide up to 800 GPM or 1.15 MGD to the RWD high zone, and the Meroke Trail interconnection can provide up to 500 GPM or 0.72 MGD to the RWD high zone (H2M, 2020).

5.1.1.2 RWD Pumpage and Demand

Per the Draft Map and Plan Report, between 2010 and 2019, there was an average annual pumpage rate of 2,637.1 MG, an average demand of 8.32 MGD, and a maximum peak demand of 22.53 MGD. **Table 6** depicts the pumpage and demand between 2010 and 2019 (H2M, 2020).

Table 6: RWD Pumpage and Demand

Year	Total Annual Pumpage (MG)	Average Day (MGD)	Maximum Day (MGD)
2010	2,834.0	7.76	22.53
2011	2,424.9	6.64	22.20
2012	2,604.5	7.14	19.67
2013	2,635.1	7.22	20.52
2014	2,645.9	7.25	17.50
2015	3,037.4	8.32	19.70
2016	2,876.8	7.88	20.36
2017	2,380.3	6.52	16.33
2018	2,437.4	6.68	18.69
2019	2,494.1	6.83	18.91

Over the course of the 10-year period, the pumpage remained relatively steady, however the RWD anticipates that annual pumpage will increase in the future due to commercial and residential development within the district (H2M, 2020).

Per the Draft Map and Plan Report, in order to meet the average day demand of future commercial and residential development projects that have submitted requests to the RWD, an estimated 287,000 GPD or 0.287 MGD will be required. The projected peak day demand associated with these requests is approximately 783,000 GPD or 0.783 MGD using a max-day to average-day ratio of 2.73. This does not include requests for projects with water demands less than 500 GPD, such as a residence or small commercial application (H2M, 2020).

5.1.1.3 RWD Proposed Extension

Per the Draft Map and Plan Report, there is a proposed RWD extension (No. 94) to service Manorville, which is located in southwest portion of the Town of Riverhead. The proposed extension is in the high-pressure zone and will provide potable water and fire protection to 62 single family homes, Swan Lake Golf Course, and Suffolk County parklands and commercial properties located along River Road, Line Road, and Grumman Boulevard. The projected demand to serve these properties is 24,400 GPD, assuming all properties in the extension area connect to the public water supply (H2M, 2020).

Irrigation water for these properties will be expected to be supplied by the private wells that are currently on the individual properties, therefore there is no anticipated water demand for irrigation from the public water supply (H2M, 2020).

5.1.1.4 RWD Capacity Analysis

The RWD must comply with the New York State Sanitary Code (NYSSC) Part 5 (Drinking Water Standards) and the Ten States Standards for Water Works (TSSWW), as they are part of the NYSSC. As such, the current and future supply and storage capacity needs of the RWD were analyzed in the Draft Map and Plan Report (H2M, 2020). The capacity analysis was performed utilizing the parameters provided in **Table 7.**

Table 7: RWD Capacity Analysis Parameters

Parameter	Demand / Capacity
Maximum Average Day (between 2010 and 2019)	8.32 MGD (2015)
Maximum Peak Day (between 2010 and 2019)	22.53 MGD (2010)
Peak Hour Demand (Estimated)	1.45 MG (2020)
Maximum Peak Day plus Fireflow[1]	23.16 MGD (2010)
Future Average Demand	0.278 MGD
Future Peak Demand	0.783 MGD
Future Maximum Peak Day	23.313 MGD
RWD Current Capacity	20.06 MGD
RWD Approved Pumping Capacity per NYSDEC	24.034 MGD
RWD Peak Hour Capacity	0.8358 MG (13,930 GPM)
RWD Largest Well	2.3 MGD (Well No. 16)

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RWD Current Capacity with Largest Well Out of Service[2]	17.76 MGD
Capacity Increase with Approved Pending Applications as NYSDEC	2.42 MGD (1,680 GPM)
[1] Fireflow rate of 3,500 GPM for 3-hours. [2] In accordance with TSSWW, the largest well is assumed to be out of service in order to perform the capacity analysis.	

Based on the information in the table above, the RWD has the capacity to meet the maximum average daily demand (8.32 MGD) with the largest well out of service (17.76 MGD) and without utilizing storage or interconnections. The RWD does not have the capacity to meet the maximum peak daily demand (22.53 MGD) with the largest well out of service (17.76 MGD) and would rely on the full capacity of the interconnections and storage. This deficit would be further reduced upon approval of the pending applications at the NYSDEC (20.18 MGD to be supplied by wells with the remainder from interconnections and storage). The RWD does not have capacity to meet the peak hour demand (1.45 MG) with the largest well out of service and accounting for interconnections and storage. This deficit would be eliminated upon approval of the pending applications at the NYSDEC. The RWD does not have capacity to meet the maximum peak day plus fireflow (23.16 MGD) with the largest well out of service (17.76 MGD). This deficit would be further reduced upon approval of the pending applications at the NYSDEC. To overcome this deficit the RWD would rely on the capacity of the interconnections and storage (H2M, 2020).

According to the Draft Map and Plan, to address the deficits referenced above, the RWD is actively addressing new sources of water and storage (H2M, 2020).

5.1.1.5 RWD Capacity Analysis with Proposed Development

As per Section 2.3.1 and Section 2.3.3 of this report, the proposed development is anticipated to utilize 25,000 GPD (0.025 MGD) of potable water, six (6) days per week, with the buildings occupancy anticipated to be at 50 percent for the sixth day. Between April and October of each year, the proposed development is anticipated to utilize an additional 3,771 GPD (0.0037 MGD) of water for irrigation, 7 days per week. In total, the site would have a peak demand of 28,771 GPD (0.028 MGD) once Phase 1 and Phase 2 are both completed. Phase 1 is anticipated to be completed by 2023 and would have a peak demand of 19,462 GPD (0.019 MGD) (including the water for irrigation) and Phase 2 is anticipated to be completed in 2025 and would have a peak demand of 9,309 GPD (0.009 MGD). Therefore, the proposed development would not have a peak demand of 28,771 GPD (0.028 MGD) until 2025.

The RWD would have capacity to supply water to the subject property on projected average daily demands (8.626 MGD which includes future developments that have submitted applications to the RWD, as well as the proposed development). However, the RWD would not have capacity to supply water to the subject property on the projected maximum peak daily demands (23.341 MGD which includes future developments that have submitted applications to the RWD, as well as the proposed development). Similarly, the RWD would not have capacity to supply water to the subject property on the projected maximum peak daily demand plus fireflow (23.971 MGD which includes future developments that have submitted applications to the RWD, as well as the proposed development). To overcome these capacity deficits for the projected future demands, the RWD would have to rely on interconnections and storage, as well as approval of the pending applications with the NYSDEC.

Based on consultations with the RWD, water supply to the proposed project would be possible with future planned infrastructure projects inclusive of new storage and supply wells. This Water Supply Source Report is expected to be used and incorporated into a larger Map and Plan report being prepared by RWD for several development projects in Calverton. It is anticipated that an impact fee or tax levy may be imposed for the completion of the future planned infrastructure projects. It is noted, however, that in the event such projects are not implemented by RWD, the feasibility of on-site supply has been evaluated in Section 5.2 below.

5.2 Private On-Site Wells (Alternate Plan)

5.2.1 Supply Wells

To supply potable, fire suppression, and hydrant water to the proposed Site, via on-site private wells, three (3) supply wells would need to be installed. Each well would serve to supply water to each application individually. The proposed wells would be screened below the Clay at Manorville layer in the Magothy Aquifer. Based on currently available information, the top of the clay layer is anticipated to be approximately 91’ bgs and the layer is estimated to be 33’ thick. The Clay at Manorville layer will act as an aquitard to slow shallow groundwater contamination from the adjacent NWIRP/EPCAL site from entering into the proposed supply wells. Additional information regarding contaminant migration can be found in the Groundwater Modeling Report prepared by PWGC.

The potable supply well is estimated to be a 130 GPM well that provides water for both potable and irrigation purposes. The well would be located on the northeast side of the Site, adjacent to the Site exit. The well will have a 6” diameter well casing with a 5.875” diameter wire wound screen located between approximately 139’ and 154’ bgs. The wells will have a 5’ stainless steel sump and will terminate at an estimated depth of 159’ bgs. The potable supply well will have a 10 horsepower (HP) submersible well pump and motor with a proposed pumping rate of 130 GPM.

The fire suppression supply well will be a 375 GPM well that provides water for building fire suppression purposes. The well would be located on the northeast side of the Site, adjacent to the Site exit. The well will have an 8” diameter well casing with a 7.875” diameter wire wound screen located between approximately 139’ and 169’ bgs. The wells will have a 5’ stainless steel sump and will terminate at an estimated depth of 174’ bgs. The fire suppression well will have a 30 HP submersible well pump and motor with a proposed pumping rate of 375 GPM.

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The hydrant supply well will be a 1,500 GPM well that provides water for the fire hydrants located on-site. The well would be located on the northwest corner of the Site. The well will have a 12” diameter well casing with a 11.75” diameter wire wound screen located between approximately 139’ and 239’ bgs. The wells will have a 5’ stainless steel sump and will terminate at an estimated depth of 244’ bgs. The hydrant well will have a 150 HP submersible well pump and motor with a proposed pumping rate of 1,500 GPM.

Refer to **Table 8** below for the potential on-site well details.

Table 8: Potential On-Site Well Details

Well ID	Aquifer	Type	Capacity (GPM)	Depth	Casing Dia.	Screen Material	Screen Dia. (ID)	Screen Length	Screen Interval (bgs.)
Supply 1	Magothy	Potable and Irrigation Supply	130	159’	6”	Type 316L S.S.	5.875”	15’	139’ – 154’
Supply 2	Magothy	Fire Suppression Supply	375	174’	8”	Type 316L S.S.	7.875”	30’	139’ – 169’
Supply 3	Magothy	Hydrant Supply	1,500	244’	12”	Type 316L S.S.	11.75”	100’	139’ – 239’

For each well, the submersible well pump shall discharge from piping located in a subgrade well vault located in the vicinity of the potential on-site wells. The water will be conveyed through high-density polyethylene (HDPE) pipe into the associated distribution system. The piping and associated valves will be located in a below-ground vault.

5.2.2 *Impacts Due to Drawdown*

In the immediate vicinity of the potential on-site wells, there will be a rapid drop of the water table due to the drawdown of the well. This area of drawdown will cause a cone of depression surrounding the well and will have a specific zone of influence to the area surrounding the well, which is the area (or radius) that is impacted due to the pumping of the well. As the well reaches steady-state pumping, the rate of drawdown will decrease and will stabilize. At a certain distance from the well, the drawdown will become negligible, as it will reach the existing water table elevation.

Using Cooper-Jacobs unsteady state solution for well drawdown, the radius of the zone of influence for the potential on-site well was calculated for three different drawdown levels (denoted as s’). These levels are depicted in **Table 9** below.

The Cooper-Jacob method is a 2-D numerical model that is a simplification of the Theis method which accounts for unsteady drawdown around a pumping well. The Cooper-Jacob method is applicable for greater time values (i.e. the well is pumping for a longer period of time) and decreasing distances from the pumping well, as well as for wells that have a negligible or small well radius. Additionally, the method assumes that the aquifer

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is homogeneous, isotropic, and of a uniform thickness within the area that is influenced by pumping and that the value of "u" (which is a function of the radial distance, storativity and transmissivity of the aquifer and time) is very small (less than 0.01). The Cooper-Jacob method produces a semilogarithmic straight line as the drawdown varies linearly as a function of log t (time) or log t/r^2 (time/radius squared), therefore it can be used to make quick predictions of drawdown in an aquifer by extrapolating the data. The equation also shows that "s" (drawdown) is directly proportional to "Q" (pumping rate), assuming that the values of "t" (time), "r" (radial distance), "T" (transmissivity), and "S" (storativity) are all constant. Knowing this, if the pumping rate is constant, then the drawdown can be used to determine the radial distance or radius of the zone of influence of the well.

For the potable water supply well, it assumes a pumping rate of 78,000 GPD (assumes continuous pumping of 130 GPM for 10 hours) for 286 days, with the duration of pumping lasting for a maximum of 10 hours per day, 5.5 days per week. For the fire suppression supply well, it assumes a pumping rate of 45,000 GPD (assumes continuous pumping of 375 GPM for 2 hours) for 12 days, with the duration of pumping lasting for a maximum of 2 hours per day, 1 day per month. For the hydrant supply well, it assumes a pumping rate of 180,000 GPD (assumes continuous pumping of 1,500 GPM for 2 hour) for 12 days, with the duration of pumping lasting for a maximum of 2 hours per day, 1 day per month. These conditions are in excess of what is actually anticipated to occur at the proposed site (i.e. during a typical day, the potable water supply well pumping rate will not be sustained at 130 GPM for 10 hours straight, as the 130 GPM represents the peak flow rate anticipated).

Table 9: Potential Drawdown and Radius of the Zone of Influence

Drawdown (s') (feet)	Radius of the Zone of Influence (feet)		
	Potable Supply	Fire Suppression Supply	Hydrant Supply
10	0.01	1.70	23.37
5	0.81	9.75	36.16
1	45.68	39.47	51.29
0.5	75.61	47.00	53.58
0.1	113.16	54.05	55.49
0	125.16	55.97	55.97

The maximum drawdown occurs at the wells themselves and decreases at points further from the well. As depicted in the table above, the potential on-site wells will not have a drastic influence on the surrounding water table. The influences that will occur will be in the Magothy Aquifer and will be below the Clay at Manorville layer.

As per the available private well information and well logs, the wells within the vicinity of the Site are screened in the Upper Glacial Aquifer, with the exception of three (3) wells which are screened in the Magothy Aquifer. The wells that are screened in the Upper Glacial Aquifer in the vicinity of the subject property will not be influenced by the potential on-site wells. The wells that are screened in the Magothy aquifer are outside the maximum radius of the zone of influence (125 feet for the potable water well) and therefore will not be influenced by the potential on-site wells.

Per data provided by the RWD, the properties directly to the east and north of the subject site are not connected to the public water supply. Therefore, it is assumed that water is supplied to these lots via private supply wells. The location or data regarding these wells was not provided in the NYSDEC FOIL request so it is unknown as to what aquifer these wells are screened in. Based on the location of the potential on-site wells on the subject site, the maximum radius of the zone of influence (125 feet) will extend to the property to the east of the site, therefore regardless of the location of the well, it will not be effected by the potential on-site wells according to the Cooper-Jacobs unsteady state solution for well drawdown. For the property located to the north of the subject site, if the well on that site is located directly across from the potential on-site wells along the property line, then that well may experience a drawdown of 0.2 feet when the on-site well is pumping at 130 GPM. When the pumping rate is reduced during non-peak demand times or when the well is off (such as at night when the buildings are not occupied), the well will not be affected.

5.2.3 Private Well Regulatory Requirements

In order to install private wells on-site, an application for Long Island Well Permit would be filed with the NYSDEC. Along with the application, at a minimum, a Joint Application Form and Short Environmental Assessment Form (SEAF) will have to be submitted. In certain instances, the NYSDEC also requires that an Engineering Report be prepared and filed as part of the well permit application. Due to the proximity to contaminant sources and the subject site being located within the RWD boundary, it is anticipated that an Engineering Report will have to be prepared. If an Engineering Report is required, it will be formatted based on the NYSDEC 1990 memorandum – Division of Water Technical and Operational Guidance Series (3.2.2) ENGINEER'S REPORTS: APPLICATIONS FOR WATER SUPPLY AND LONG ISLAND WELL PERMITS.

The private wells on-site will be sited and installed as per the standards of the SCDHS, specifically the "Private Water System Standards", and New York State Department of Health (NYSDOH). A preliminary analysis was performed by Key Civil Engineering, to site the location of the wells on-site. According to the Alternate 3 (Water Source Plan) last revised on April 2, 2021, the wells can be installed on-site to meet the separation requirements of both the SCDHS and the NYSDOH. Refer to **Appendix C** for a copy of the Alternative Water Source Plan.

6.0 CONCLUSIONS

The subject property is anticipated to utilize a peak of 28,771 GPD of potable water, estimated to have a peak flow rate of 130 GPM, and will require both a fire suppression system (requiring a flow rate of 375 GPM) and on-site hydrants (requiring a flow rate of 1,500 GPM). Although the fire suppression system and hydrants will be utilized sparingly, the water supply needs to be accounted for in the Site design.

As the Site is partially located within the boundary of the RWD, the water supply can be provided via the public supply system. However, based on a supply capacity and analysis performed in the RWD Draft Map and Plan and in this report, it was determined that the RWD would have capacity to supply water to the subject property on projected average daily demands, however the RWD would not have capacity to supply water to the subject property on peak maximum daily demands with the largest well out of service without the reliance on interconnections and storage. The Draft Map and Plan indicated that the RWD is actively addressing new sources of water and storage at address the current deficits. Based on consultations with the RWD, water supply to the proposed project would be possible with future planned infrastructure projects inclusive of new storage and supply wells. It is anticipated that an impact fee or tax levy may be imposed for the completion of the future planned infrastructure projects. However, it will ultimately be up to the RWD to determine if they have sufficient capacity to serve the proposed project.

In the event that water cannot be supplied by the RWD, three (3) supply wells can be installed on Site to supply water to the potable water distribution system, fire suppression system and fire hydrants. The supply wells will be screened in the Magothy Aquifer below the Clay at Manorville layer such that the clay layer can act as an aquitard to slow shallow groundwater contamination from the adjacent NWIRP/EPCAL site from entering into the potential on-site supply wells.

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7.0 LIMITATIONS

The information provided in this report are based on field observations, present knowledge of the construction site, publicly available information, and documentation provided by the Client.

This report may only be used by the client and for the purposes stated within a reasonable time from its issuance. If the information is to differ from what was provided or if any information is to be updated, PWGC should be notified so that the changes can be reviewed to determine if the information presented in this report are still applicable. No warranty is expressed or implied.

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FIGURES

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Bohemia, NY 11716
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pwgc.info@pwgrosser.com

SITE LOCATION

4285 Middle Country Road
Calverton, NY

0 ¼ ½ ¾ 1 Miles

Project:	TPO2001
Date:	6/10/2020
Designed by:	TM
Drawn by:	TS
Approved by:	TM
Figure No:	1

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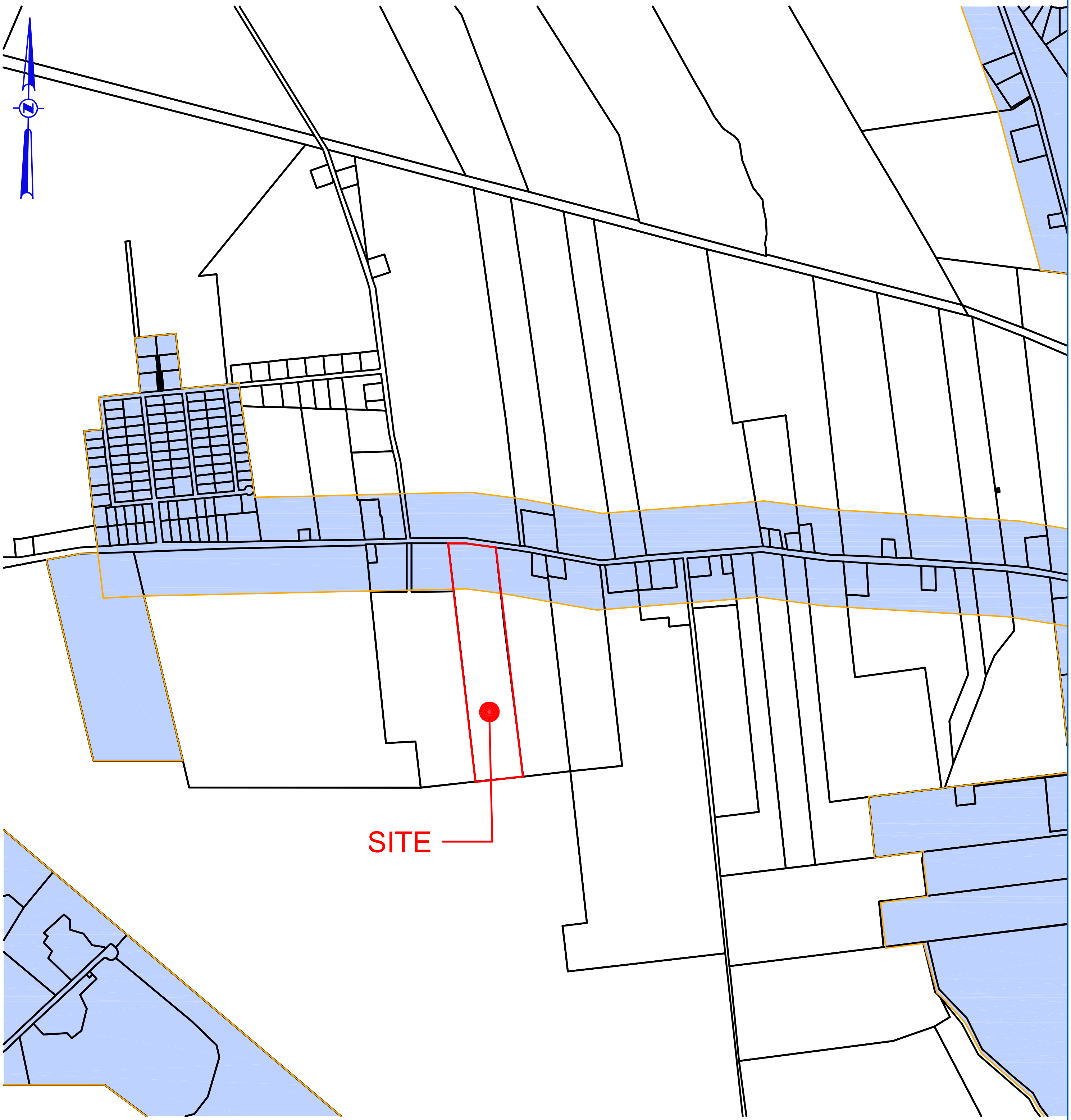

SOURCE: DRAFT MAP & PLAN REPORT for PROPOSED WATER DISTRICT EXTENSION No. 94, MANORVILLE, RIVERHEAD WATER DISTRICT. PREPARED BY H2M ARCHITECTS + ENGINEERS, OCTOBER 2020.

Legend

- TownBoundary
- Riverhead Water District

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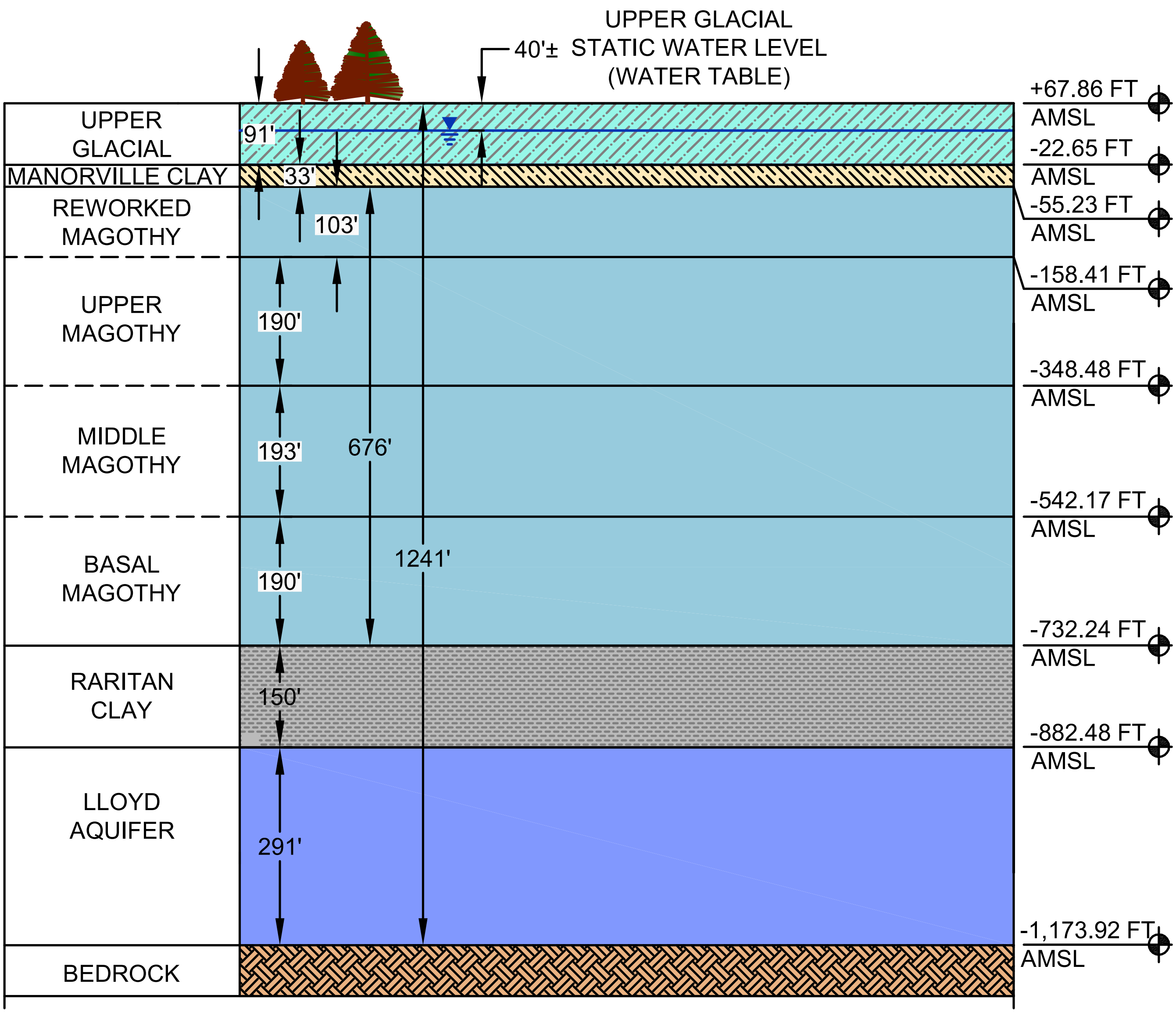
RIVERHEAD WATER DISTRICT BOUNDARY MAP

1" = 1,500'

4285 OLD COUNTRY ROAD, MANORVILLE, NY
WATER SUPPLY STUDY REPORT

Project:	TPO2001
Designed by:	JML
Approved by:	PKB
Drawn by:	JML
Date:	3/19/2021
Figure No:	2



SOURCE: USGS GROUNDWATER CONDITIONS ON LONG ISLAND - SURFACE OF THE WATER TABLE AQUIFER

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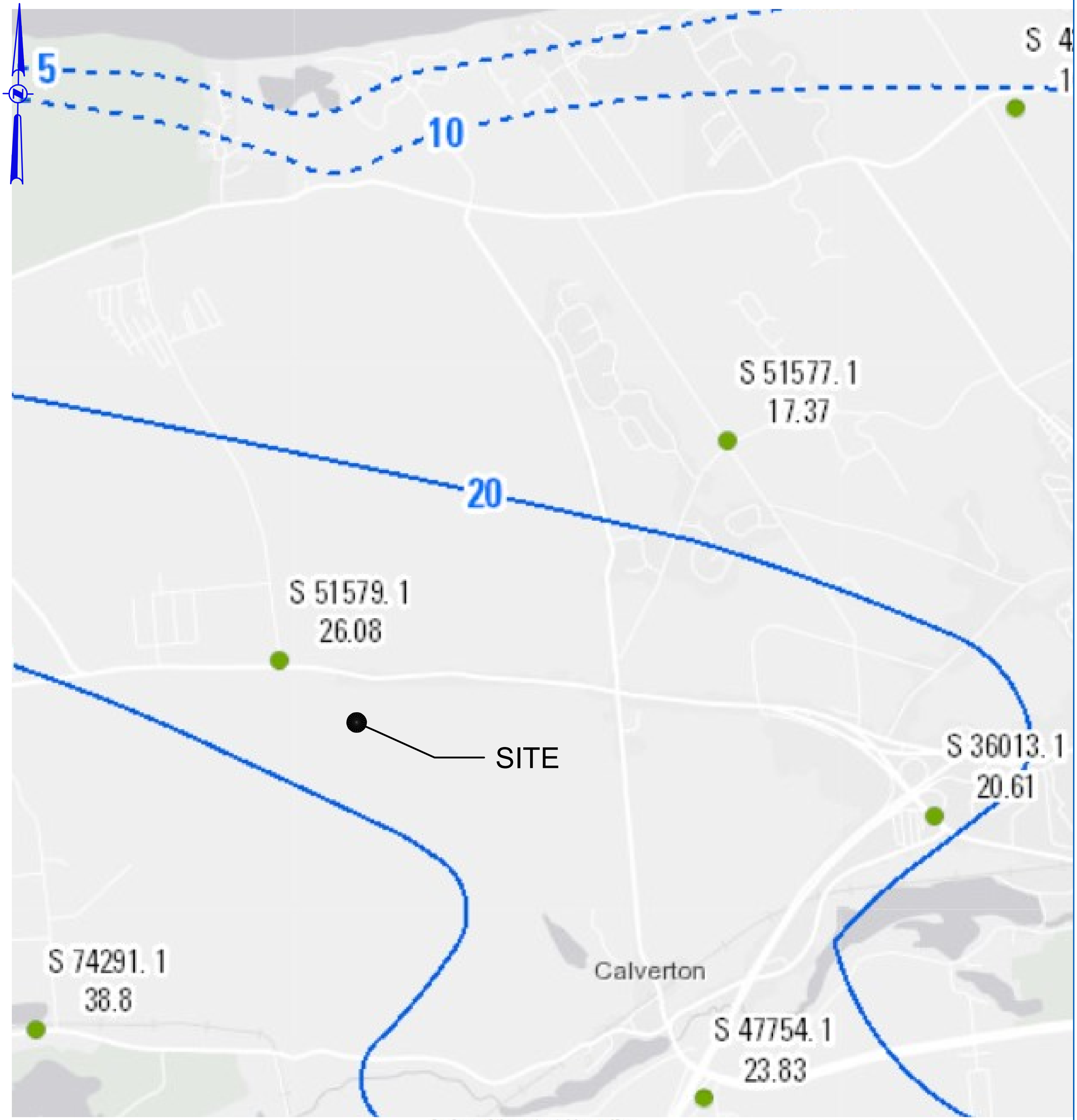
HYDROGEOLOGIC CROSS SECTION

NOT TO SCALE

4285 OLD COUNTRY ROAD, MANORVILLE, NY
WATER SUPPLY STUDY REPORT

Project:	TPO2001
Designed by:	JML
Approved by:	PKB
Drawn by:	JML
Date:	03/12/2021
Figure No:	3



SOURCE: USGS GROUNDWATER CONDITIONS ON LONG ISLAND - SURFACE OF THE WATER TABLE AQUIFER

Surface of the water-table aquifer

Line of equal water-table altitude (contour interval 10 feet)

— Solid where approximately known

- - Dashed where inferred

Monitoring Well (upper number is station name; lower number is water-surface altitude, in feet)

● Upper Glacial aquifer well

● Magothy aquifer well

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WATER TABLE CONTOUR MAP

NOT TO SCALE

4285 OLD COUNTRY ROAD, MANORVILLE, NY

WATER SUPPLY STUDY REPORT

Project:	TPO2001
Designed by:	JML
Approved by:	PKB
Drawn by:	JML
Date:	03/12/2021
Figure No:	4

SOURCE: USGS NATIONAL WATER INFORMATION SYSTEM: MAPPER

LEGEND:
- ACTIVE SITE
- INACTIVE SITE

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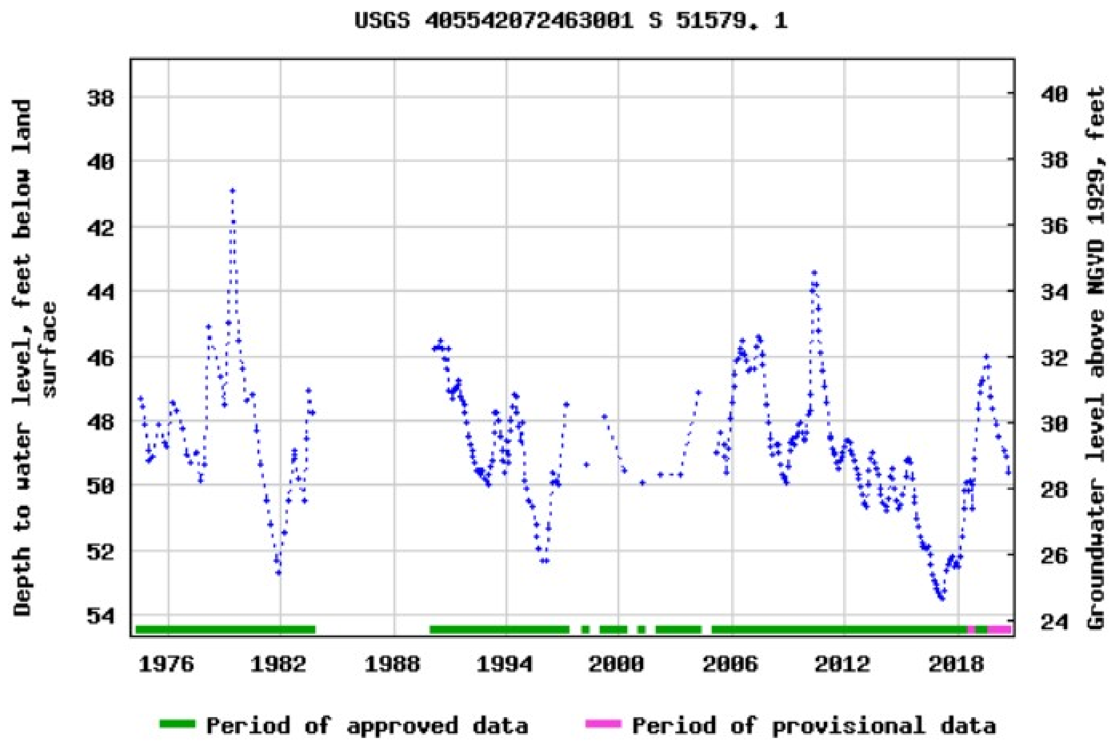
USGS MONITORING WELL LOCATION MAP

SCALE: 1' = 1,000'

4285 OLD COUNTRY ROAD, MANORVILLE, NY
WATER SUPPLY STUDY REPORT

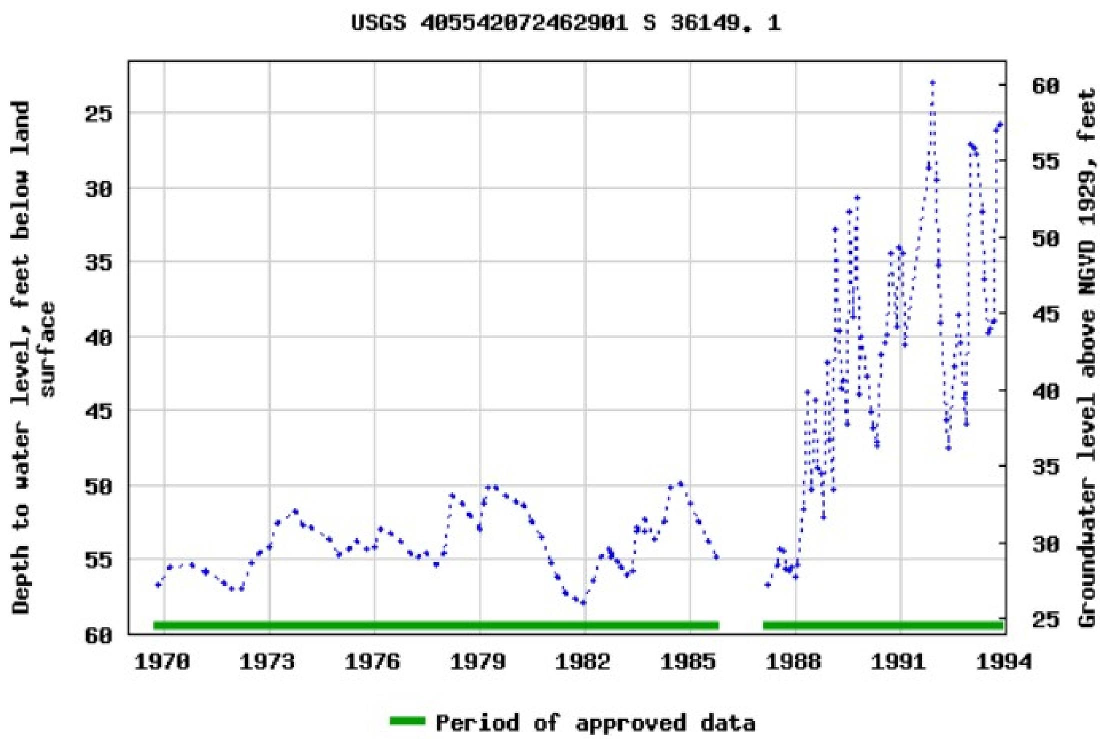
Project:	TPO2001
Designed by:	JML
Approved by:	PKB
Drawn by:	JML
Date:	03/12/2021
Figure No:	5



UPPER GLACIAL AQUIFER

LAND SURFACE - 78.0 NGVD29

DEPTH OF WELL - 87 FEET BGS



UPPER GLACIAL AQUIFER

LAND SURFACE ELEVATION - 83.5 ABOVE NGVD29

DEPTH OF WELL - 87 FEET BGS

SOURCE: USGS NATIONAL WATER INFORMATION SYSTEM: WEB INTERFACE

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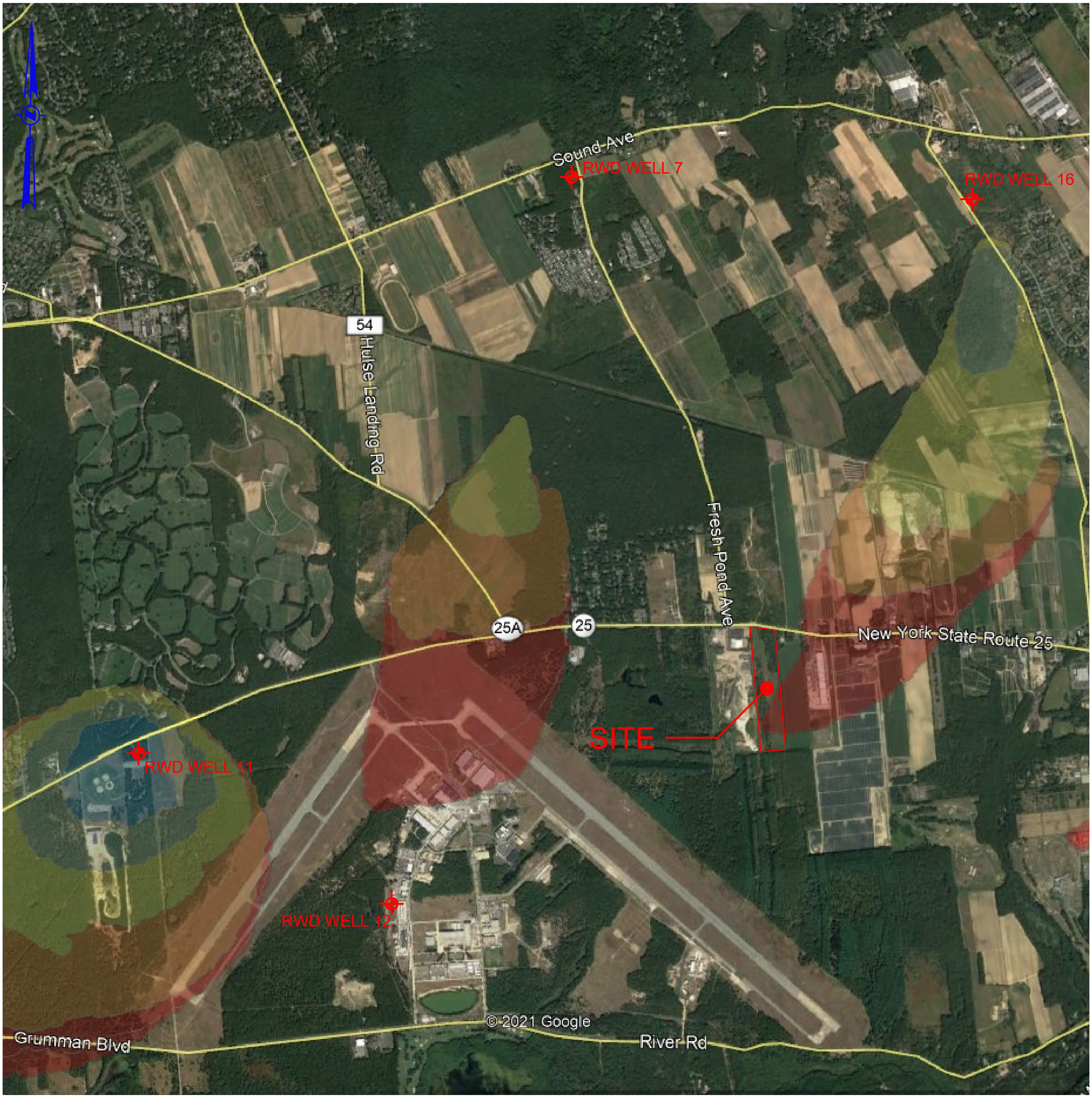
MONITORING WELLS POTENTIOMETRIC SURFACE

NOT TO SCALE

4285 OLD COUNTRY ROAD, MANORVILLE, NY
WATER SUPPLY STUDY REPORT

Project:	TPO2001
Designed by:	JML
Approved by:	PKB
Drawn by:	JML
Date:	03/12/2021
Figure No:	6



SOURCE: GOOGLE EARTH WITH "SUFFOLK_WT_CONTRIB_AREAS_2015_FINAL" FILE

NOTE:
RIVERHEAD WATER DISTRICT (RWD) WELL LOCATIONS APPROXIMATE

LEGEND:

- 5-YEAR
- 10-YEAR
- 25-YEAR
- 50-YEAR
- 100-YEAR

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WELL CONTRIBUTION AREA MAP

1" = 3,000'

4285 OLD COUNTRY ROAD, MANORVILLE, NY
WATER SUPPLY STUDY REPORT

Project:	TPO2001
Designed by:	JML
Approved by:	PKB
Drawn by:	JML
Date:	3/19/2021
Figure No:	7

Well Location Map

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630 Johnson Ave., Suite 7
Bohemia, NY 11716
Ph: 631-589-6353 • Fax: 631-589-8705
pwgc.info@pwgrosser.com

Site Address: 4285 Middle Country Rd. Riverhead, NY	Project: TPO2001	Drawn by: HS	
	Date: 3/22/2021	Approved by:	
	Coord: NAD83 StatePlane NY - Long Island		
Client:	Figure No: 8		

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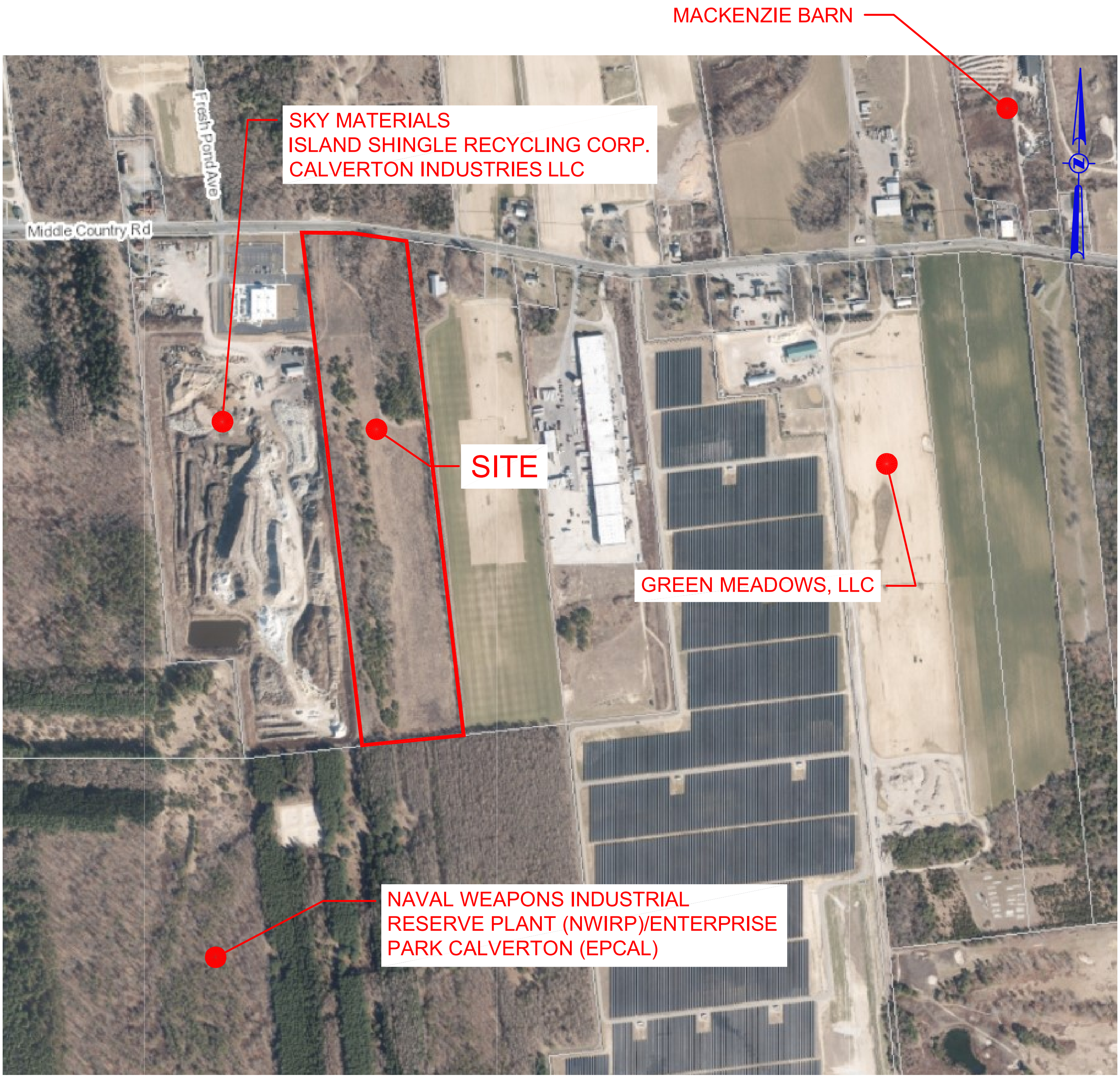

NOTE:
ADDRESS OF "EAST END RECYCLING AND COMPOSTING CO." NOT REPORTED. SITE LISTED TO BE LOCATED ON MIDDLE COUNTRY ROAD APPROXIMATELY 0.135 MILES TO THE NORTHWEST OF THE SITE.

SOURCE: GIS VIEWER SUFFOLK COUNTY, NY
2020 AERIALS

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E-mail: INFO@PWGROSSER.COM

PROXIMITY TO CONTAMINANT SOURCES

SCALE: 1" = 750'

4285 OLD COUNTRY ROAD, MANORVILLE, NY
WATER SUPPLY STUDY REPORT

Project:	TPO2001
Designed by:	JML
Approved by:	PKB
Drawn by:	JML
Date:	03/12/2021
Figure No:	9

APPENDIX A
Site Boundary & Topographic Survey

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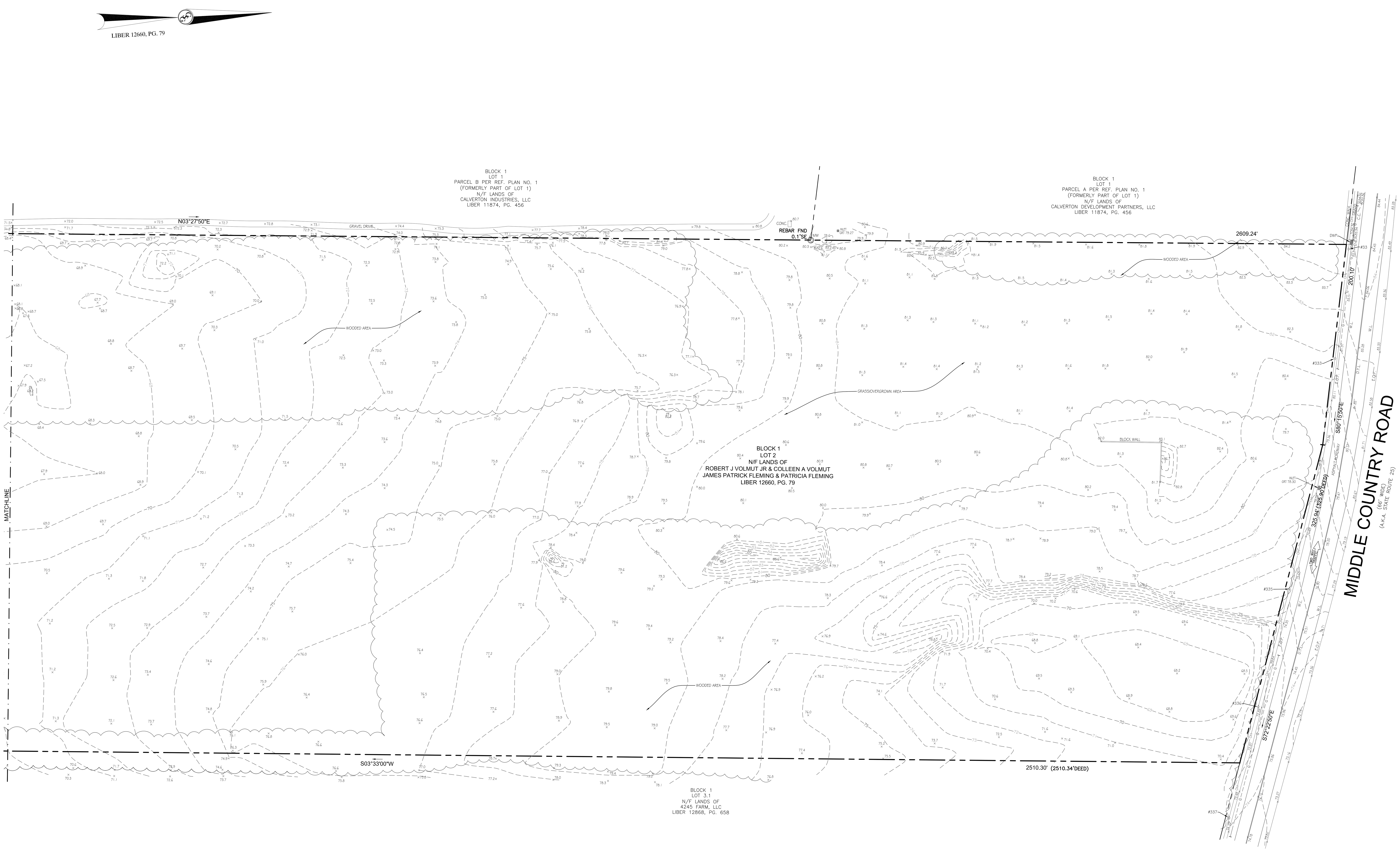
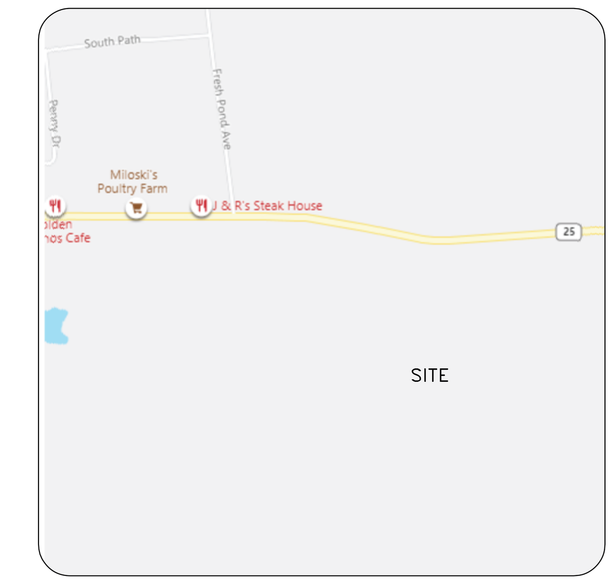




VICINITY MAP

NOTES:

1. PROPERTY KNOWN AND DESIGNATED AS LOT 2, IN BLOCK 1, SECTION 116, DISTRICT 600 ON THE OFFICIAL TAX MAP FOR THE TOWN OF RIVERHEAD, SUFFOLK COUNTY, NEW YORK.

2. AREA: 1,317,884 S.F. OR 30.2545 AC.

3. LOCATION OF UNDERGROUND UTILITIES ARE APPROXIMATE. LOCATIONS AND SIZES ARE BASED ON PRIOR UTILITY MARK-OUTS, ABOVE GROUND STRUCTURES THAT WERE VISIBLE & ACCESSIBLE IN THE FIELD, AND THE MAPS AS LISTED IN THE REFERENCES AVAILABLE AT THE TIME OF THE SURVEY. AVAILABLE ASBUILT PLANS AND UTILITY MARKOUT DOES NOT ENSURE MAPPING OF ALL UNDERGROUND UTILITIES AND STRUCTURES. BEFORE ANY EXCAVATION IS TO BEGIN, ALL UNDERGROUND UTILITIES SHOULD BE VERIFIED AS TO THEIR LOCATION, SIZE AND TYPE BY THE PROPER UTILITY COMPANIES.

4. **THIS SURVEY WAS PREPARED WITHOUT BENEFIT OF A TITLE COMMITMENT REPORT AND IS SUBJECT TO THE COVENANTS, RESTRICTIONS AND EASEMENTS THAT MAY BE CONTAINED THEREIN.**

5. ELEVATIONS ARE BASED UPON NAVD 88.

6. BY GRAPHIC PLOTTING, PROPERTY IS LOCATED IN FLOOD HAZARD ZONE X (AREA OF MINIMAL FLOOD HAZARD) PER NATIONAL FLOOD INSURANCE PROGRAM FLOOD INSURANCE RATE MAP NO. 36103C0442H, EFFECTIVE DATE: SEPTEMBER 25, 2009, OBTAINED FROM FEMA NFHL WEB SERVICE ON OCTOBER 14, 2019.

7. THE LOCATION AND EXTENTS OF UNDERGROUND TANKS AND VAULTS, IF ANY EXIST, HAVE NOT BEEN DETERMINED BY THE SURVEYOR.

REFERENCES:

1. SUBDIVISION PLANS FOR NERP HOLDING & ACQUISITIONS COMPANY, LLC, PROPOSED DEVELOPMENT, 4331 MIDDLE COUNTRY ROAD, CALVERTON, TOWN OF RIVERHEAD, SUFFOLK COUNTY, NY 11933, PREPARED BY BOHLER ENGINEERING, DATED FEBRUARY 22, 2017, LAST REVISED APRIL 3, 2019, SHEET NOS. 1 & 2 OF 2, FILED IN THE COUNTY CLERKS OFFICE ON APRIL 12, 2019 AS FILE NO. 12161, ABS NO. 17390.

2. MAP OF PROPERTY SITUATE AT CALVERTON, TOWN OF RIVERHEAD L.I., OWNED BY EDWIN H. BROWN, SURVEYED JULY 1919, FILED IN THE COUNTY CLERKS OFFICE ON MARCH 31, 1920 AS FILE NO. 761, ABS NO. 24.

3. SURVEY OF JAMES M. SMITH'S FARM, TOWN OF RIVERHEAD, DATED NOVEMBER 1894, FILED IN THE COUNTY CLERKS OFFICE ON DECEMBER 15, 1894 AS FILE NO. 491.

4. PLANS SHOWING THE LOCATION OF UNDERGROUND ELECTRIC LINES PROVIDED BY P.S.E.&G. LONG ISLAND, MAP NOS. 08233 & 08242, DATED OCTOBER 14, 2019.

MAP LEGEND

— — —	PROPERTY LINE
-----123-----	EXISTING CONTOUR
x 12.34	EXISTING SPOT ELEVATION
x TC12.34	EXIST. TOP OF CURB ELEVATION
x BC12.34	EXIST. GUTTER ELEVATION
----G----	APPROX. LOCATION U.G. GAS LINE PER UTILITY MARKOUT
	INLET
—OH—	OVERHEAD WIRES
	UTILITY POLE
	SIGN
D.C.	DEPRESSED CURB
C.C.	CONCRETE CURB
E.O.P.	EDGE OF PAVEMENT
C.L.F.	CHAIN LINK FENCE
DWP	DETECTABLE WARNING PAD
W.L.	WHITE LINE
D.Y.L.	DOUBLE YELLOW LINE
1.0'	DENOTES OFFSET OF STRUCTURE AT GROUND LEVEL RELATIVE TO PROPERTY LINE

UTILITIES:
THE FOLLOWING COMPANIES WERE NOTIFIED BY NEW YORK STATE ONE-CALL SYSTEM (1-800-272-4480) AND REQUESTED TO MARK OUT UNDERGROUND FACILITIES AFFECTING AND SERVICING THIS SITE. THE UNDERGROUND UTILITY INFORMATION SHOWN HEREON IS BASED UPON THE UTILITY COMPANIES RESPONSE TO THIS REQUEST. SERIAL NUMBER(S): 192870091

UTILITY COMPANY	PHONE NUMBER
NATIONAL GRID	800-262-8600
LONG ISLAND POWER AUTHORITY	800-545-7068
TOWN OF RIVERHEAD	631-727-3200
VERIZON COMMUNICATIONS	855-661-6323

NOTE: ALL UTILITY COMPANIES DID NOT RESPOND TO MARKOUT REQUEST

Dig Safely. New York
800-962-7962
www.digsafelynewyork
Call Before You Dig
Wait The Required Time
Confirm Utility Response
Respect the Marks
Dig With Care

THE STATE OF NEW YORK REQUIRES NOTIFICATION BY EXCAVATORS, DESIGNERS, OR ANY PERSON PREPARING TO DISTURB THE EARTH'S SURFACE ANYWHERE IN THE STATE.

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

UNAUTHORIZED ALTERATION OR ADDITION TO A SURVEY MAP BEARING A LICENSED LAND SURVEYOR'S SEAL IS A VIOLATION OF SECTION 7209, SUB-DIVISION 2, OF THE NEW YORK STATE EDUCATION LAW.

BOUNDARY & TOPOGRAPHIC SURVEY
LOT 2, BLOCK 1
SECTION 116, DISTRICT 600
MIDDLE COUNTRY ROAD (NYSR 25) BETWEEN
FRANCES BOULEVARD & FRESH POND AVENUE
HAMLET OF CALVERTON (TOWN OF RIVERHEAD)
SUFFOLK COUNTY
STATE OF NEW YORK

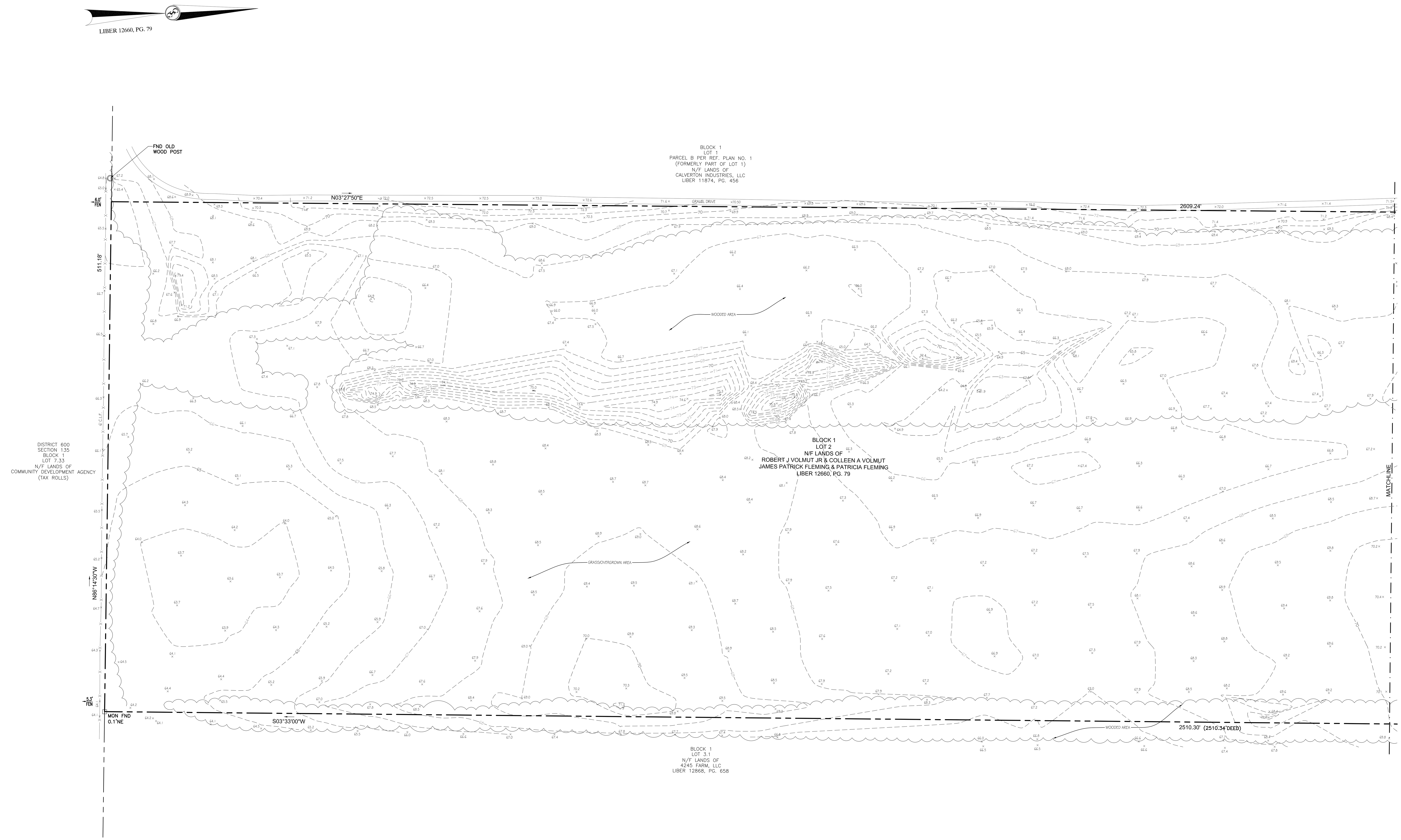
GALLAS SURVEYING GROUP
2865 US ROUTE 1
NORTH BRUNSWICK, NJ 08902
TELE: 732-422-6700
FAX: 732-940-8786
www.gallassurvey.com

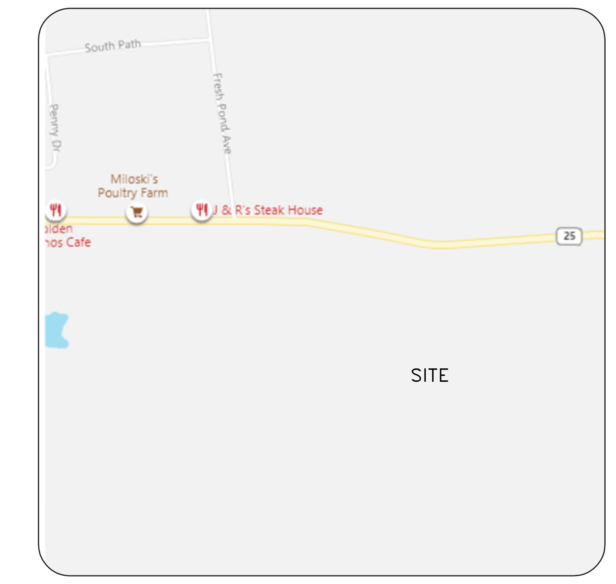
DATE	SCALE	DRAWN:	CHECKED:
11-15-2019	1"=40'	K.G.G.	J.R.T./C.J.O.
FIELD DATE	FIELD BOOK	PAGE	FIELD CREW
10-24 - 11-08-19	128	58, 66, 74, 80	S.G./L.R./A.S.
FILE NO.:		DRAWING NAME/SHEET NO.	
G19227		G19227.DWG	1 OF 2

NOT VALID UNLESS EMBOSSED WITH RAISED IMPRESSION OR BLUE INK SEAL

GREGORY S. GALLAS
NEW YORK PROFESSIONAL LAND SURVEYOR #50124

DATE





VICINITY MAP

NOTES:

1. PROPERTY KNOWN AND DESIGNATED AS LOT 2, IN BLOCK 1, SECTION 116, DISTRICT 600 ON THE OFFICIAL TAX MAP FOR THE TOWN OF RIVERHEAD, SUFFOLK COUNTY, NEW YORK.
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4. **THIS SURVEY WAS PREPARED WITHOUT BENEFIT OF A TITLE COMMITMENT REPORT AND IS SUBJECT TO THE COVENANTS, RESTRICTIONS AND EASEMENTS THAT MAY BE CONTAINED THEREIN.**
5. ELEVATIONS ARE BASED UPON NAVD 88.
6. BY GRAPHIC PLOTTING, PROPERTY IS LOCATED IN FLOOD HAZARD ZONE X (AREA OF MINIMAL FLOOD HAZARD) PER NATIONAL FLOOD INSURANCE PROGRAM FLOOD INSURANCE RATE MAP NO. 36103C0442H, EFFECTIVE DATE: SEPTEMBER 25, 2009, OBTAINED FROM FEMA NFHL WEB SERVICE ON OCTOBER 14, 2019.
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2. MAP OF PROPERTY SITUATE AT CALVERTON, TOWN OF RIVERHEAD L.I., OWNED BY EDWIN H. BROWN, SURVEYED JULY 1919, FILED IN THE COUNTY CLERKS OFFICE ON MARCH 31, 1920 AS FILE NO. 761, ABS NO. 24.
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BOUNDARY & TOPOGRAPHIC SURVEY

LOT 2, BLOCK 1
SECTION 116, DISTRICT 600

MIDDLE COUNTRY ROAD (NYSR 25) BETWEEN
FRANCES BOULEVARD & FRESH POND AVENUE
HAMLET OF CALVERTON (TOWN OF RIVERHEAD)
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DATE	SCALE	DRAWN:	CHECKED:
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FILE NO.:		DRAWING NAME/SHEET NO.	
G19227		G19227.DWG	2 OF 2

GREGORY S. GALLAS
NEW YORK PROFESSIONAL LAND SURVEYOR #50124
DATE

GRAPHIC SCALE
40 0 20 40 80 160
(IN FEET)
1 inch = 40 ft.

MAP LEGEND

—— — — ——	PROPERTY LINE
-----123-----	EXISTING CONTOUR
x 12.34	EXISTING SPOT ELEVATION
x TC12.34	EXIST. TOP OF CURB ELEVATION
x BC12.34	EXIST. GUTTER ELEVATION
----G----	APPROX. LOCATION U.G. GAS LINE PER UTILITY MARKOUT
	INLET
—OH—	OVERHEAD WIRES
	UTILITY POLE
	SIGN
D.C.	DEPRESSED CURB
C.C.	CONCRETE CURB
E.O.P.	EDGE OF PAVEMENT
C.L.F.	CHAIN LINK FENCE
DWP	DETECTABLE WARNING PAD
W.L.	WHITE LINE
D.Y.L.	DOUBLE YELLOW LINE
1.0'	DENOTES OFFSET OF STRUCTURE AT GROUND LEVEL RELATIVE TO PROPERTY LINE

UTILITIES:
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UTILITY COMPANY	PHONE NUMBER
NATIONAL GRID	800-262-8600
LONG ISLAND POWER AUTHORITY	800-545-7068
TOWN OF RIVERHEAD	631-727-3200
VERIZON COMMUNICATIONS	855-661-6323

NOTE: ALL UTILITY COMPANIES DID NOT RESPOND TO MARKOUT REQUEST

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APPENDIX B
Proposed Site Plan

P.W. GROSSER CONSULTING, INC.
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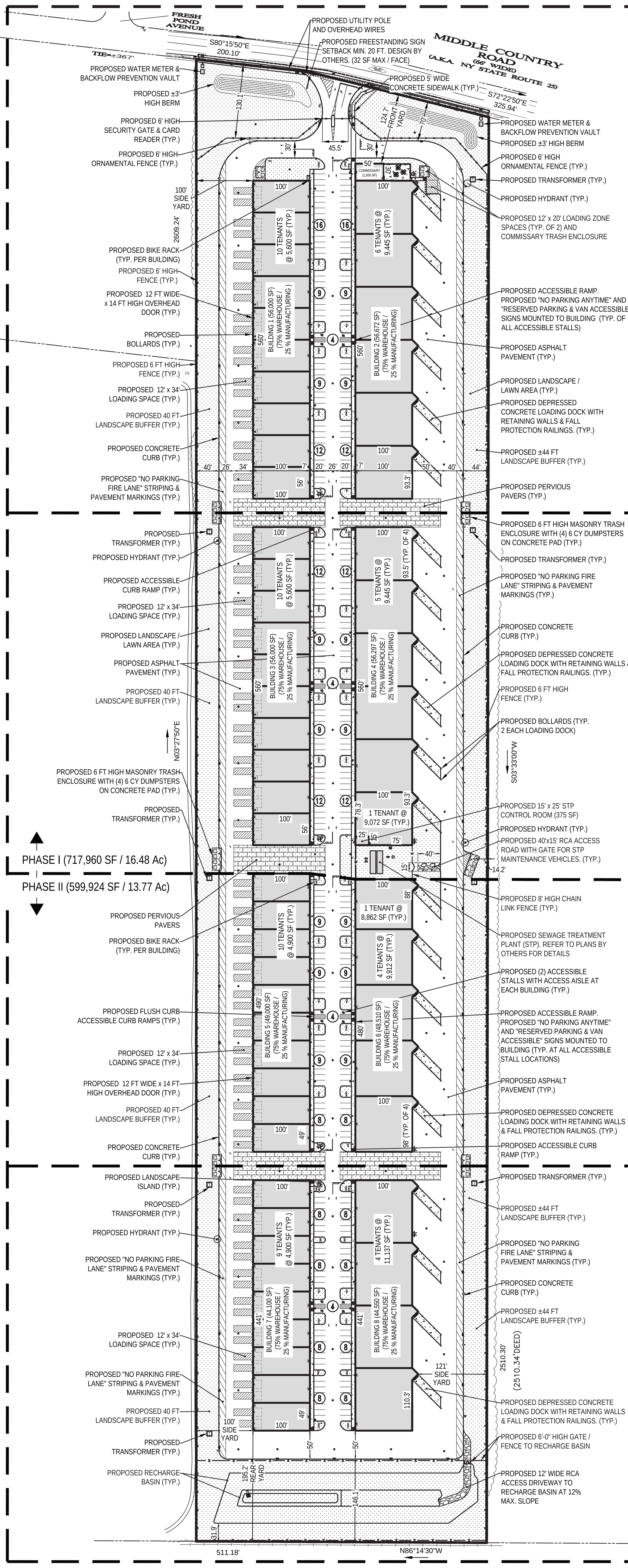
BOHEMIA, NY 11716
LONG ISLAND • MANHATTAN • SARATOGA SPRINGS • SYRACUSE • SEATTLE • SHELTON



REFER TO PARTIAL SITE PLAN SECTION A - PHASE I (SHEET C-4)

REFER TO PARTIAL SITE PLAN SECTION B - PHASE I (SHEET C-5)

REFER TO PARTIAL SITE PLAN SECTION C - PHASE II (SHEET C-6)

REFER TO PARTIAL SITE PLAN SECTION D - PHASE II (SHEET C-7)

SANITARY DENSITY CALCULATIONS

SITE IS LOCATED IN GROUNDWATER MANAGEMENT ZONE III = 300 GPD/ACRE

PERMITTED DENSITY = 30.2545 ACRES x 300 GPD/ACRE = 9,076 GPD

PHASE I
PROPOSED COMMISSARY FLOW (COMMISSARY NOT OPEN TO PUBLIC) - 0.04 GPD / SF x 1,500 SF = 60 GPD
PROPOSED BUILDING 1 FLOW (GENERAL INDUSTRIAL) - 0.04 GPD / SF x 56,000 SF = 2,240 GPD
PROPOSED BUILDING 2 FLOW (GENERAL INDUSTRIAL) - 0.04 GPD / SF x 56,672 SF = 2,267 GPD
PROPOSED BUILDING 3 FLOW (GENERAL INDUSTRIAL) - 0.04 GPD / SF x 56,000 SF = 2,240 GPD
PROPOSED BUILDING 4 FLOW (GENERAL INDUSTRIAL) - 0.04 GPD / SF x 56,297 SF = 2,252 GPD
PHASE I TOTAL = 9,059 GPD

PHASE II
PROPOSED BUILDING 5 FLOW (GENERAL INDUSTRIAL) - 0.04 GPD / SF x 49,000 SF = 1,960 GPD
PROPOSED BUILDING 6 FLOW (GENERAL INDUSTRIAL) - 0.04 GPD / SF x 48,510 SF = 1,941 GPD
PROPOSED BUILDING 7 FLOW (GENERAL INDUSTRIAL) - 0.04 GPD / SF x 44,100 SF = 1,764 GPD
PROPOSED BUILDING 8 FLOW (GENERAL INDUSTRIAL) - 0.04 GPD / SF x 44,550 SF = 1,782 GPD
PHASE II TOTAL = 7,447 GPD

PHASE I + PHASE II TOTAL = 16,506 GPD

7,430 GPD OVER PERMITTED DENSITY. SEWAGE TREATMENT PLANT (STP) PROPOSED. REFER TO PLANS BY OTHERS FOR STP DETAILS.

BULK ZONING TABLE

ZONING DISTRICT: INDUSTRIAL C

ITEM	SECTION	PERMITTED/REQUIRED	PROPOSED
PERMITTED USES	§ 301-122.A (2), (4), & (12)	(2) WAREHOUSE & (12) MANUFACTURING (INDOOR)	(2) WAREHOUSE & (12) MANUFACTURING (INDOOR)
ACCESSORY USES	§ 301-122.C.1	COMMISSARY FOR OTHER BUILDING	COMMISSARY FOR BUILDINGS PROVIDED (1,500 SF)
ACCESSORY USES	§ 301-122.C.2.B	PARCEL SHALL HAVE FRONTAGE ON AN ARTERIAL ROAD	FRONTAGE ALONG MIDDLE COUNTRY ROAD (NYS ROUTE 25)
PROHIBITED USES	§ 301-122.D.3	OUTDOOR STORAGE	NO OUTDOOR STORAGE OF VEHICLES. ALL VEHICLES SHALL BE STORED INSIDE.
LOT, YARD, & BULK REQUIREMENTS	§ 301-123.B	20% OF LOT SHALL BE CONTIGUOUS OPEN SPACE AREAS WHICH SHIELD VIEWS OF THE DEVELOPMENT FROM ARTERIAL ROADS 0.20 x 1,317,884 SF = 263,577 SF	305,561 SF (23.19%) OF LANDSCAPE AREA WITH FRONT YARD LANDSCAPE BUFFER OPEN LANDSCAPE PROVIDED. DENSE LANDSCAPE BUFFER IN FRONT YARD TO SHIELD DEVELOPMENT PROVIDED
SUPPLEMENTARY GUIDELINES	§ 301-124.A.1	DEVELOPMENT OF MULTIPLE BUILDINGS IN THE INDUSTRIAL C DISTRICT SHALL BE PLANNED IN A CAMPUS LAYOUT	CAMPUS LAYOUT NOT ACHIEVABLE DUE TO SITE GEOMETRY [R]
SUPPLEMENTARY GUIDELINES	§ 301-124.A.2	CONTINUOUS SIDEWALKS, AND BIKE RACKS CLOSE TO BUSINESS ENTRANCES SHALL BE PROVIDED FOR PROPERTIES FRONTING ROUTE 25	CONTINUOUS SIDEWALKS AND BIKE RACKS PROVIDED
SUPPLEMENTARY GUIDELINES	§ 301-124.A.4.A	DUMPSTER AREAS SHALL BE SCREENED BY WOOD FENCES OR LANDSCAPING	DUMPSTERS SHALL BE IN 6 FT HIGH WOOD FENCE ENCLOSURES
DUMPSTERS	§ 245-8	DUMPSTER SCREENING OF 5 FT MIN / 6 FT MAX HEIGHT	DUMPSTERS SHALL BE IN 6 FT HIGH WOOD FENCE ENCLOSURES
SCREENING AND BUFFER REGULATIONS SETBACK	§ 301-124.A.4.B	20 FT OF PLANTING BUFFER ALONG FRONTAGE & 10 FT PLANTING BUFFER ALONG ALL OTHER PROPERTY LINES	70 FT MINIMUM PLANTED BUFFER ALONG FRONT YARD, 14.2 FT MINIMUM BUFFER ON SIDE YARDS, & 31.9 FT MINIMUM BUFFER IN REAR YARD
PARKING STANDARDS	§ 301-124.B.2	PLANTED BERMS SHALL BE USED TO SCREEN AUTOMOBILES FROM PUBLIC R.O.W.	LANDSCAPE & PLANTED BERMS PROVIDED
PARKING STANDARDS	§ 301-124.B.3	OFF-STREET PARKING PROHIBITED IN FRONT YARD, WITHIN 20 FT OF SIDE YARD, AND 10 FT OF REAR YARD	NO PARKING IN FRONT YARD PROPOSED 20 FT OR GREATER FROM PROPOSED PARKING TO SIDE YARD PROPERTY LINE NO PARKING IN REAR PROPOSED
MINIMUM LOT AREA	§ 301-ATTACHMENT 3	80,000 SF	± 1,317,884 SF
MINIMUM LOT WIDTH	§ 301-ATTACHMENT 3	300 FT	511.18 FT
BUILDING COVERAGE (FOOTPRINT) (WITHOUT SEWER)	§ 301-ATTACHMENT 3	40% ±1,317,884 SF x 0.40 = 527,154 SF	31.31% 412,629 SF / ±1,317,884 SF = 0.3131
MAXIMUM IMPERVIOUS SURFACE	§ 301-ATTACHMENT 3	60% ±1,317,884 SF x 0.60 = 790,730 SF	936,645 SF / 1,317,884 SF = 0.7107 71.07% [V]
MAXIMUM HEIGHT OF BUILDINGS	§ 301-ATTACHMENT 3	30 FT	29 FT
MINIMUM FRONT YARD DEPTH	§ 301-ATTACHMENT 3	30 FT	124.7 FT
MINIMUM SIDE YARD DEPTH	§ 301-ATTACHMENT 3	30 FT / 60 COMBINED FOR BOTH SIDES	100 FT / 221 FT
MINIMUM REAR YARD DEPTH	§ 301-ATTACHMENT 3	50 FT	195.2 FT

[R] - PLANNING BOARD RELAXATION REQUIRED. CAMPUS LAYOUT NOT ACHIEVABLE DUE TO SITE GEOMETRY
[V] - VARIANCE REQUIRED

PARKING CALCULATIONS

ITEM	SECTION	PERMITTED/REQUIRED	PROPOSED
MINIMUM STALL SIZE	§ 301-231.E.2	10 FT x 20 FT	10' x 20' (8' x 20' ACCESSIBLE STALLS)
MINIMUM AISLE WIDTH	§ 301-231.E.1	24' (TWO WAY) WITH 90° PARKING 18' (ONE WAY) WITH 60° PARKING 12' (ONE WAY) WITH 45° PARKING	26' (TWO-WAY MIN.)
NUMBER OF LOADING SPACES REQUIRED	§ 301-232.A	FLOOR AREAS PER BUILDING 15,000 TO 25,000 = 1 SPACES 25,001 TO 40,000 = 2 SPACES 40,001 TO 100,000 = 3 SPACES +60,000 SF = 1 ADDITIONAL SPACE 3 SPACES REQUIRED PER BUILDING x 8 BUILDINGS = 24 SPACES REQUIRED	101 SPACES PROVIDED
MINIMUM LOADING SPACE SIZE	§ 301-232.B	12 FT WIDE x 14 FT LONG	(78) 12 FT WIDE x 34 FT LONG (2) 12 FT WIDE x 20 FT LONG (21) 13 FT WIDE x 55 FT LONG TOTAL PROVIDED = 101 SPACES
MINIMUM NUMBER OF PARKING STALLS REQUIRED	§ 301 ATTACHMENT 1	BUILDINGS 1 & 3 (56,000 SF) *PARKING PER BUILDING 25% MANUFACTURING SPACE (14,000 SF) 75% WAREHOUSE SPACE (42,000 SF) * MANUFACTURING ESTABLISHMENT (14,000 SF / BUILDING) 1 STALL PER 400 SF OF GFA 14,000 SF / 400 SF = 35 STALLS * WAREHOUSE (42,000 SF / BUILDING) 1 STALL PER 1,000 SF UP TO 5,000 SF + 1 STALL PER 10,000 SF 5,000 SF x 1 STALL PER 1,000 SF = 5 STALLS 37,000 SF x 1 STALL / 10,000 SF = 3.7 STALLS TOTAL PARKING FOR BUILDINGS 1 & 3 2 BUILDINGS x (35 + 5 + 3.7) STALLS = 87.4 STALLS	326 STALLS (INCLUDES 16 ACCESSIBLE STALLS)
MINIMUM NUMBER OF PARKING STALLS REQUIRED	§ 301 ATTACHMENT 1	BUILDING 2 (56,672 SF) *PARKING PER BUILDING 25% MANUFACTURING SPACE (14,168 SF) 75% WAREHOUSE SPACE (42,504 SF) *MANUFACTURING ESTABLISHMENT (14,168 SF) 1 STALL PER 400 SF OF GFA 14,168 SF / 400 SF = 35.4 STALLS * WAREHOUSE (42,504 SF) 1 STALL PER 1,000 SF UP TO 5,000 SF + 1 STALL PER 10,000 SF 5,000 SF x 1 STALL PER 1,000 SF = 5 STALLS 37,504 SF x 1 STALL / 10,000 SF = 3.8 STALLS TOTAL PARKING FOR BUILDING 2 = 44.2 STALLS	
MINIMUM NUMBER OF PARKING STALLS REQUIRED	§ 301 ATTACHMENT 1	BUILDING 4 (56,297 SF) *PARKING PER BUILDING 25% MANUFACTURING SPACE (14,074 SF) 75% WAREHOUSE SPACE (42,223 SF) *MANUFACTURING ESTABLISHMENT (14,074 SF) 1 STALL PER 400 SF OF GFA 14,074 SF / 400 SF = 35.2 STALLS * WAREHOUSE (42,223 SF) 1 STALL PER 1,000 SF UP TO 5,000 SF + 1 STALL PER 10,000 SF 5,000 SF x 1 STALL PER 1,000 SF = 5 STALLS 37,223 SF x 1 STALL / 10,000 SF = 3.7 STALLS TOTAL PARKING FOR BUILDING 4 = 43.9 STALLS	
MINIMUM NUMBER OF PARKING STALLS REQUIRED	§ 301 ATTACHMENT 1	BUILDING 5 (49,000 SF) *PARKING PER BUILDING 25% MANUFACTURING SPACE (12,250 SF) 75% WAREHOUSE SPACE (36,750 SF) *MANUFACTURING ESTABLISHMENT (12,250 SF) 1 STALL PER 400 SF OF GFA 12,250 SF / 400 SF = 30.6 STALLS * WAREHOUSE (36,750 SF) 1 STALL PER 1,000 SF UP TO 5,000 SF + 1 STALL PER 10,000 SF 5,000 SF x 1 STALL PER 1,000 SF = 5 STALLS 31,750 SF x 1 STALL / 10,000 SF = 3.2 STALLS TOTAL PARKING FOR BUILDING 5 = 38.8 STALLS	
MINIMUM NUMBER OF PARKING STALLS REQUIRED	§ 301 ATTACHMENT 1	BUILDING 6 (48,510 SF) *PARKING PER BUILDING 25% MANUFACTURING SPACE (12,128 SF) 75% WAREHOUSE SPACE (36,382 SF) *MANUFACTURING ESTABLISHMENT (12,128 SF) 1 STALL PER 400 SF OF GFA 12,128 SF / 400 SF = 30.3 STALLS *WAREHOUSE (36,382 SF) 1 STALL PER 1,000 SF UP TO 5,000 SF + 1 STALL PER 10,000 SF 5,000 SF x 1 STALL PER 1,000 SF = 5 STALLS 31,382 SF x 1 STALL / 10,000 SF = 3.1 STALLS TOTAL PARKING FOR BUILDING 6 = 38.4 STALLS	
MINIMUM NUMBER OF PARKING STALLS REQUIRED	§ 301 ATTACHMENT 1	BUILDING 7 (44,100 SF) *PARKING PER BUILDING 25% MANUFACTURING SPACE (11,025 SF) 75% WAREHOUSE SPACE (33,075 SF) *MANUFACTURING ESTABLISHMENT (11,025 SF) 1 STALL PER 400 SF OF GFA 11,025 SF / 400 SF = 27.6 STALLS *WAREHOUSE (33,075 SF) 1 STALL PER 1,000 SF UP TO 5,000 SF + 1 STALL PER 10,000 SF 5,000 SF x 1 STALL PER 1,000 SF = 5 STALLS 28,075 SF x 1 STALL / 10,000 SF = 2.8 STALLS TOTAL PARKING FOR BUILDING 7 = 35.4 STALLS	
MINIMUM NUMBER OF PARKING STALLS REQUIRED	§ 301 ATTACHMENT 1	BUILDING 8 (44,550 SF) *PARKING PER BUILDING 25% MANUFACTURING SPACE (11,137 SF) 75% WAREHOUSE SPACE (33,413 SF) *MANUFACTURING ESTABLISHMENT (11,137 SF) 1 STALL PER 400 SF OF GFA 11,137 SF / 400 SF = 27.8 STALLS *WAREHOUSE (33,413 SF) 1 STALL PER 1,000 SF UP TO 5,000 SF + 1 STALL PER 10,000 SF 5,000 SF x 1 STALL PER 1,000 SF = 5 STALLS 28,413 SF x 1 STALL / 10,000 SF = 2.8 STALLS TOTAL PARKING FOR BUILDING 8 = 35.6 STALLS	
TOTAL NUMBER OF PARKING STALLS REQUIRED FOR LOT	§ 301 ATTACHMENT 1	87.4 + 44.2 + 43.9 +38.8 + 38.4 + 35.4 + 35.6 = 323.7 STALLS TOTAL STALLS REQUIRED = 324 STALLS	
ACCESSIBLE PARKING STALLS	§ 301-232.M.1	301 TO 400 TOTAL PARKING STALLS REQUIRED = 8 8 ACCESSIBLE PARKING STALLS	16 ACCESSIBLE STALLS

GRAPHIC SCALE

120 0 60 120 240 480

(IN FEET)
1 inch = 120 ft.

LEGEND

SCALE OF SYMBOLS = 1" = 120'

EXISTING	ITEM	PROPOSED
	PROPERTY LINE	
	BUILDING	
	CONCRETE CURB	
	CONCRETE SIDEWALK	
	LANDSCAPE AREA	
	PERVIOUS PAVERS	
	DUMPSTER ENCLOSURE	
	12' x 34' LOADING SPACE	
	LOADING DOCK RETAINING WALLS	
	PARKING COUNT	9
	OVERHEAD DOOR	
	DOOR	
	FENCE	
	BIKE RACK	
	HYDRANT	

PROJECT DATA

SITE ADDRESS	4285 MIDDLE COUNTRY ROAD CALVERTON, NY 11933
OWNER / APPLICANT	HK VENTURES, LLC 147 STEAMBOAT ROAD GREAT NECK, NY 11024 c/o URI HASON
TAX MAP NUMBER	DISTRICT: 600, SECTION: 116, BLOCK: 1, LOT: 2
SITE AREA	1,317,884 SF (30.2545 Ac)
CURRENT ZONING	INDUSTRIAL C
EXISTING USE	VACANT
PROPOSED USE	PRIMARY USES: WAREHOUSE & MANUFACTURING (INDOOR)
PROPOSED BUILDING AREA (GFA)	PHASE I BUILDING 1 = 56,000 SF BUILDING 2 = 56,672 SF BUILDING 3 = 56,000 SF BUILDING 4 = 56,297 SF COMMISSARY = 1,500 SF TOTAL = 226,469 SF PHASE II (TO BE CONSTRUCTED ONCE PHASE I IS COMPLETED AND OPERATING) BUILDING 5 = 49,000 SF BUILDING 6 = 48,510 SF BUILDING 7 = 44,100 SF BUILDING 8 = 44,550 SF TOTAL = 186,160 SF PHASE I + PHASE II = 412,629 SF (31.31%)
PERVIOUS PAVERS / LANDSCAPE AREA	381,239 SF (28.93%)
IMPERVIOUS / PAVEMENT / CONCRETE AREA (EXCLUDES BUILDING AREAS)	524,016 SF (39.76%)

LEGEND

SCALE OF SYMBOLS = 1" = 30' (REFER TO PARTIAL SITE PLANS)

EXISTING	ITEM	PROPOSED
	PROPERTY LINE	
	BUILDING	
	CONCRETE CURB	
	EDGE OF PAVEMENT	
	CONCRETE SIDEWALK	
	LANDSCAPE AREA	
	PERVIOUS PAVERS	
	TRASH ENCLOSURE	
	PARKING COUNT	9
	ACCESSIBLE STRIPING SYMBOL	
	BIKE RACK MOUNTED ON CONCRETE PAD	
	OVERHEAD DOOR	
	LOADING STALL STRIPING	
	LOADING DOCK WALL WITH FALL PROTECTION RAILING	
	CROSSWALK	
	FIRE LANE STRIPING	
	DOOR	
	SIGN	
	FIRE HYDRANT	
	UTILITY POLE	
	GROUND SIGN	
	FENCE	
	POLE MOUNTED LIGHTING	

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No.	DATE	BY	DESCRIPTION
4	04/02/2021	LC	RESUBMISSION TO TOWN
3	06/22/2020	LC	MISCELLANEOUS COORDINATION
2	06/03/2020	LC	ISSUED FOR TOWN SUBMISSION
1	05/15/2020	LC	ISSUED FOR REVIEW

REVISIONS

ALTERATION OR ADDITION TO THIS DOCUMENT EXCEPT BY A LICENSED PROFESSIONAL ENGINEER IS A VIOLATION OF SECTION 7209, SUB-DIVISION 2, OF THE NEW YORK STATE EDUCATION LAW.

SEAL & SIGNATURE:

NOT VALID UNTIL SEALED

JACLYN PERANTEAU, P.E.
NEW YORK STATE PROFESSIONAL ENGINEER #083937

DATE:	01/24/2020
SCALE:	1" = 120'
PROJECT No.:	19026
DRAWING BY:	LC
CHECKED BY:	YT
APPROVED BY:	JP

KEY CIVIL ENGINEERING
664 BLUE POINT ROAD, UNIT B
HOLTSVILLE, NEW YORK 11742
(631) 961-0506
www.KeyCivilEngineering.com

PROJECT NAME:

HK VENTURES, LLC INDUSTRIAL PARK

4285 MIDDLE COUNTRY ROAD
CALVERTON, NY 11933
TOWN OF RIVERHEAD, COUNTY OF SUFFOLK
DIST.: 600, SECT.: 116, BLOCK: 1, LOT: 2
ZONE: INDUSTRIAL C

DRAWING TITLE:

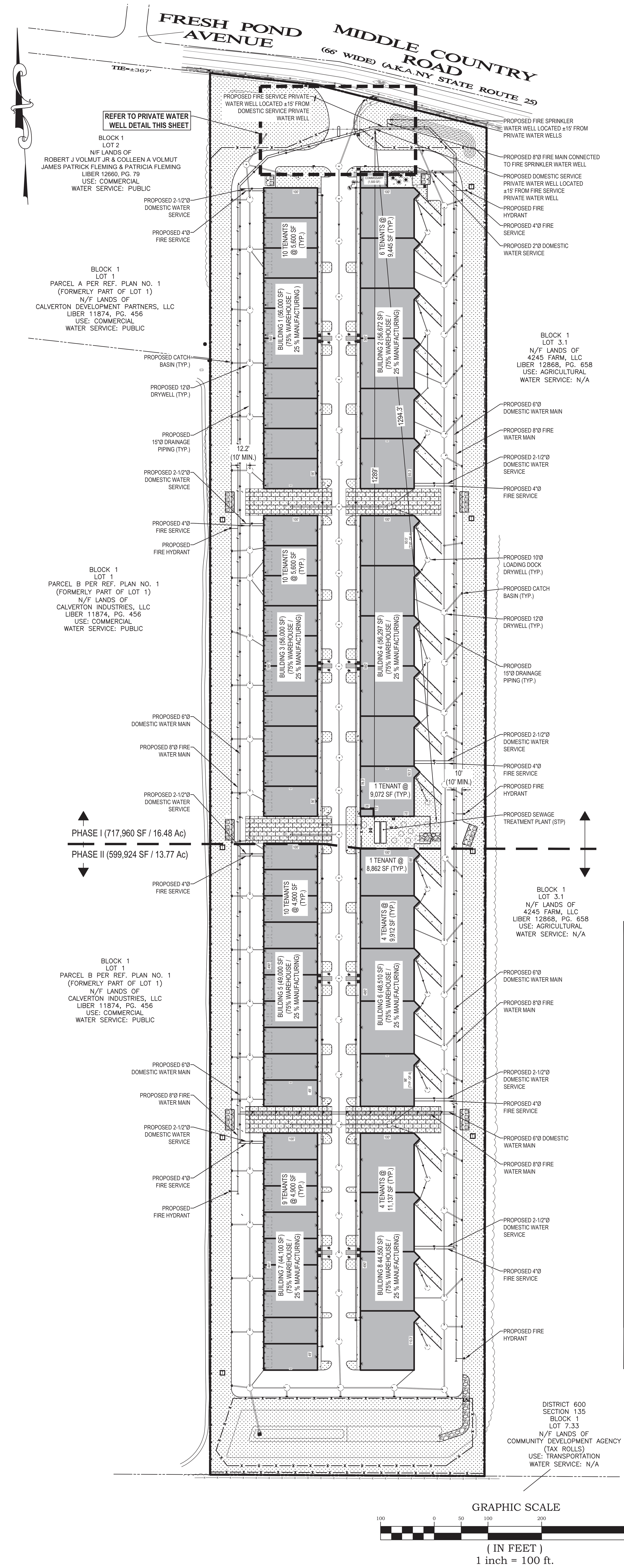
OVERALL SITE PLAN

DRAWING No.: C-3

Y:\Key Civil\Projects\2019\19026_Pinewood Grp_Calverton\Drawings\Key Civil\19026_2021.04.02_SP#4.dwg

APPENDIX C
Alternative Water Source Plan

P.W. GROSSER CONSULTING, INC.
P.W. GROSSER CONSULTING ENGINEER & HYDROGEOLOGIST, P.C.
PHONE: 631.589.6353
PWGROSSER.COM
630 JOHNSON AVENUE, STE 7
BOHEMIA, NY 11716
LONG ISLAND • MANHATTAN • SARATOGA SPRINGS • SYRACUSE • SEATTLE • SHELTON



SUFFOLK COUNTY DEPARTMENT OF HEALTH SERVICES

PRIVATE WATER SYSTEMS STANDARDS, DATED 07/1992

TABLE 1 - SEPARATION REQUIREMENTS

ITEM	PERMITTED/REQUIRED	PROPOSED
FOUNDATIONS [1]	10 FT	79 FT
SANITARY LEACHING POOLS (ON & OFF-SITE)	150 FT	1,294.3 FT
PROPERTY LINES	1 FT	52.7 FT
SEPTIC TANKS	75 FT	102.1 FT
SEWER LINES & SEPTIC SYSTEM MAIN LINES	50 FT	112.8 FT
STORM DRAINS, CATCH BASINS, SUMPS, RECHARGE BASINS, DRAINAGE DITCHES, STORMWATER DRYWELLS, DRAINAGE INLETS	50 FT	55.1 FT
WASHING MACHINE DRYWELLS	100 FT	N / A

NOTES:

1. ALL PRIVATE WATER SYSTEM WELLS MUST BE LOCATED OUTSIDE OF BUILDINGS AT LEAST FIVE FEET BEYOND ANY ROOF OVERHANG AND TEN FEET FROM FOUNDATION WALLS. NYSDEC REGULATIONS ON TERMITICIDE APPLICATIONS PROHIBIT TREATMENT WHERE WELLS ARE LESS THAN 10 FEET FROM FOUNDATION WALLS, AND RESTRICT TREATMENT WHERE WELLS ARE LOCATED 10 TO 25 FEET THEREFORE, A DISTANCE OF 25 FEET BETWEEN WELLS AND FOUNDATION WALLS IS RECOMMENDED, ALTHOUGH NOT STRICTLY REQUIRED.

SUFFOLK COUNTY DEPARTMENT OF HEALTH SERVICES

STANDARDS FOR APPROVAL OF PLANS AND CONSTRUCTION FOR SEWAGE DISPOSAL SYSTEMS FOR OTHER THAN SINGLE-FAMILY RESIDENCES

TABLE 2 - MINIMUM HORIZONTAL SEPARATION DISTANCES

ITEM	PERMITTED/REQUIRED	PROPOSED
PRIVATE WELL TO SEPTIC TANK, I/A OWTS, PUMP STATION, GREASE TRAP, OR MANHOLE [1]	100 FT	102.1 FT TO GREASE TRAP
PRIVATE WELL TO LEACHING STRUCTURE [2]	150 FT	1,294.3 FT TO SANITARY LEACHING POOL
PRIVATE WELL TO SEWER LINE, FORCE MAIN	50 FT	112.8 FT TO SEWER LINE

NOTES:

1. INCREASED DISTANCE BETWEEN LEACHING POOLS AND PRIVATE WELLS MAY BE REQUIRED BASED UPON THE DEPTH OF THE WELL(S) INVOLVED AND THE DIRECTION OF GROUNDWATER FLOW. REFER TO STANDARDS FOR THE DESIGN OF INDIVIDUAL WATER SUPPLY SYSTEMS. DISCHARGES FROM TREATMENT WORKS SHALL BE LOCATED DOWN GRADIENT OF THE WELL OR OUT OF THE GROUNDWATER FLOW PATH TOWARDS THE WELL. PRECISE GROUNDWATER FLOW DIRECTION MEASUREMENTS MAY BE REQUIRED.

2. LEACHING POOLS FOR TREATMENT WORKS HAVE DIFFERENT DISTANCE REQUIREMENTS. SEE APPENDIX A AND APPENDIX B FOR DISTANCE REQUIREMENTS FOR LEACHING POOLS OR RECHARGE BEDS ASSOCIATED WITH MODIFIED SUBSURFACE SEWAGE DISPOSAL SYSTEMS AND TREATMENT WORKS, RESPECTIVELY.

NEW YORK STATE DEPARTMENT OF HEALTH

PART 5, SUBPART 5-1, PUBLIC WATER SYSTEMS - APPENDIX 5D

TABLE 1 - REQUIRED MINIMUM SEPARATION DISTANCES TO PROTECT PUBLIC WATER SUPPLY WELLS FROM CONTAMINATION

ITEM	PERMITTED/REQUIRED	PROPOSED
CHEMICAL STORAGE SITES NOT PROTECTED FROM THE ELEMENTS (I.E. SALT AND SAND / SALT STORAGE)	300 FT	N / A
LANDFILL WASTE DISPOSAL AREA, OR HAZARDOUS OR RADIOLOGICAL WASTE DISPOSAL AREA	300 FT	N / A
LAND SURFACE APPLICATION OR SUBSTANCE INJECTION OF EFFLUENT OR DIGESTED SLUDGE FROM A MUNICIPAL OR PUBLIC WASTEWATER TREATMENT FACILITY	300 FT	N / A
LAND SURFACE APPLICATION OR SUBSURFACE INJECTION OF SEPTAGE WASTE	300 FT	1,294.3 FT
LAND SURFACE SPREADING OR SUBSURFACE INJECTION OF LIQUID OR SOLID MANURE	200 FT	N / A
STORAGE AREAS FOR MANURE PILES	200 FT	N / A
BARNYARD, SILO, BARN GUTTERS AND ANIMAL PENS	200 FT	N / A
CESSPOOLS (I.E. PITS WITH NO SEPTIC TANK PRETREATMENT)	200 FT	N / A
WASTEWATER TREATMENT ABSORPTION SYSTEMS LOCATED IN COARSE GRAVEL OR IN THE DIRECT PATH OF DRAINAGE TO A WELL	200 FT	N / A
FERTILIZER AND OR PESTICIDE MIXING AND OR CLEAN UP AREAS	200 FT	N / A
SEEPAGE PIT (FOLLOWING SEPTIC TANK)	200 FT	1,294.3 FT
UNDERGROUND SINGLE WALLED CHEMICAL OR PETROLEUM STORAGE VESSELS	200 FT	N / A
ABSORPTION FIELD OR BED	200 FT	1,294.3 FT
CONTAINED CHEMICAL STORAGE SITES PROTECTED FROM THE ELEMENTS (I.E. SALT AND SAND/SALT STORAGE WITHIN COVERED STRUCTURES)	200 FT	N / A
SEPTIC SYSTEM COMPONENTS (NON-WATERTIGHT)	200 FT	N / A
INTERMITTENT SAND FILTER WITHOUT A WATERTIGHT LINER	200 FT	N / A
SANITARY PRIVY PIT	200 FT	N / A
SURFACE WASTEWATER RECHARGE ABSORPTION SYSTEM FOR STORM WATER FROM PARKING LOTS, ROADWAYS, OR DRIVEWAYS	200 FT	200.1 FT
CEMETERIES	200 FT	N / A
SANITARY PRIVY WITH A WATERTIGHT VAULT	200 FT	N / A
SEPTIC TANK, AEROBIC UNIT, WATERTIGHT EFFLUENT LINE TO DISTRIBUTION BOX	100 FT	102.1 FT
SANITARY SEWER OR COMBINED SEWER	50 FT	112.8 FT
SURFACE WATER RECHARGE ABSORPTION SYSTEM WITH NO AUTOMOTIVE-RELATED WASTES (I.E. CLEAR-WATER BASIN, CLEAR-WATER DRYWELL)	NONE [5]	N / A
STREAM, LAKE, WATERCOURSE DRAINAGE DITCH, OR WETLAND	NONE [5]	N / A
ALL KNOWN SOURCES OF CONTAMINATION OTHERWISE NOT SHOWN ABOVE	200 FT	N / A

NOTES:

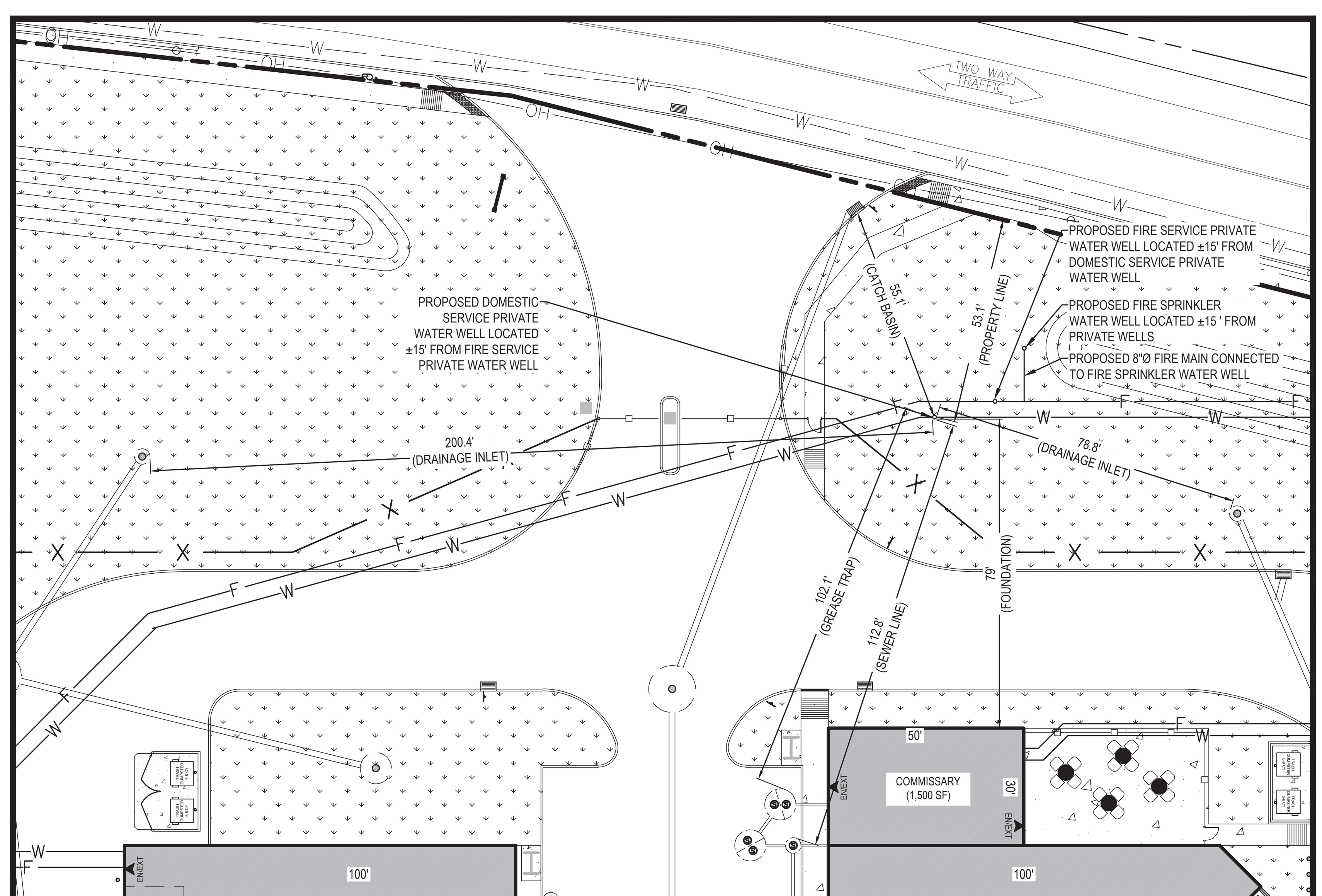
1. THE LISTED WATER WELL SEPARATION DISTANCES FROM CONTAMINANT SOURCES SHALL BE INCREASED BY 50% WHENEVER AQUIFER WATER ENTERS THE WATER WELL AT LESS THAN 50 FEET BELOW GRADE. IF A 50% INCREASE IN SEPARATION DISTANCES CAN NOT BE ACHIEVED, THEN THE GREATEST POSSIBLE INCREASE IN SEPARATION DISTANCE SHALL BE PROVIDED WITH SUCH ADDITIONAL MEASURES AS NEEDED TO PREVENT CONTAMINATION.

2. WATER WELLS SHALL NOT BE LOCATED IN A DIRECT LINE OF FLOW FROM THESE ITEMS, NOR IN ANY CONTAMINANT PLUME CREATED BY THESE ITEMS, EXCEPT WITH SUCH ADDITIONAL MEASURES (E.G., SENTINEL GROUNDWATER MONITORING, HYDRAULIC CONTAINMENT, SOURCE WATER TREATMENT) AS NEEDED TO PREVENT CONTAMINATION.

3. WATER WELLS MAY BE LOCATED 100 FEET FROM TEMPORARY (30 DAYS OR LESS) MANURE PILES/STAGING AREAS THAT ARE CONTROLLED TO PRECLUDE CONTAMINATION OF SURFACE OR GROUNDWATER OR 100 FEET FROM OTHERWISE MANAGED MANURE PILES THAT ARE CONTROLLED PURSUANT TO REGULATION IN A MANNER THAT PREVENTS CONTAMINATION OF SURFACE OR GROUNDWATER. WELLS SERVING PUBLIC WATER SYSTEMS MAY BE LOCATED 100 FEET FROM TEMPORARY BARNYARDS, SILOS, BARN GUTTERS, OR ANIMAL PENS THAT ARE SIMILARLY CONTROLLED TO PREVENT CONTAMINATION OF SURFACE OR GROUND WATER.

4. CHEMICAL STORAGE SITES AS USED IN THIS ENTRY DO NOT INCLUDE PROPERLY MAINTAINED STORAGE AREAS OF CHEMICALS USED FOR WATER TREATMENT.

5. WELLS SERVING PUBLIC WATER SYSTEMS MAY BE LOCATED NEAR WATER BODIES OR SURFACE WATER RECHARGE SYSTEMS BUT ARE SUBJECT TO MONITORING TO DETERMINE IF GROUNDWATER AT THE POINT OF WITHDRAWAL IS DIRECTLY INFLUENCED BY SURFACE WATER AND CORRESPONDING TREATMENT REQUIREMENTS. SUCH WELLS MUST ALSO BE PROTECTED FROM FLOODWATER PURSUANT TO SUBDIVISION 5-B.2(B) OF THIS PART.



PRIVATE WATER WELL DETAIL

SCALE: 1" = 30'

LEGEND

EXISTING	ITEM	PROPOSED
	PROPERTY LINE	
	BUILDING	
	CONCRETE CURB	
	CONCRETE SIDEWALK	
	LANDSCAPE AREA	
	PERVIOUS PAVERS	
	DUMPSTER ENCLOSURE	
	12' x 34' LOADING SPACE	
	LOADING DOCK RETAINING WALLS	
	OVERHEAD DOOR	
	DOOR	
—X—X—	FENCE	
	BIKE RACK	
	HYDRANT	
	DRYWELL	
	CATCH BASIN	
	WATER SERVICE / MAIN	—W—
	FIRE SERVICE / MAIN	—F—

REFERENCES

THIS PLAN REFERENCES:

BOUNDARY & TOPOGRAPHICAL SURVEY PREPARED BY:
GALLAS SURVEYING GROUP
2865 US ROUTE 1
NORTH BRUNSWICK, NY 08902
DATED: 11/08/2019

VICINITY MAP BACKGROUND DATA PROVIDED BY MAPS.GOOGLE.COM

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No.	DATE	BY	DESCRIPTION
1	04/02/2021	LC	ISSUE TO TOWN

REVISIONS

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SEAL & SIGNATURE:

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JACLYN PERANTEAU, P.E.
NEW YORK STATE PROFESSIONAL ENGINEER #083937

DATE:	03/23/2021
SCALE:	1" = 100'
PROJECT No.:	19026
DRAWING BY:	LC
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PROJECT NAME:

HK VENTURES, LLC INDUSTRIAL PARK

4285 MIDDLE COUNTRY ROAD
CALVERTON, NY 11933
TOWN OF RIVERHEAD, COUNTY OF SUFFOLK
DIST.: 600, SECT.: 116, BLOCK: 1, LOT: 2
ZONE: INDUSTRIAL C

DRAWING TITLE:

ALTERNATE 3
(WATER SOURCE PLAN)

DRAWING No.: ALT - 3

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4285 MIDDLE COUNTRY ROAD
CALVERTON, NEW YORK 11933

CALVERTON INDUSTRIAL PARK
WATER SUPPLY WELLS
GROUNDWATER MODELING

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4285 MIDDLE COUNTRY ROAD, CALVERTON, NY
WATER SUPPLY WELL
GROUNDWATER MODELING

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1.0 INTRODUCTION

The property located at 4285 Middle Country Road in Calverton, NY (the site) is currently a 30.25-acre parcel that previously was used for agricultural purposes and contains some wooded areas. The proposed site development is to be a light industrial park that would include several buildings and an on-site sewage treatment plant (STP). The site is presently located only partially within the boundaries of the Riverhead Water District (RWD) and as such public water is not available without going through the water district extension process. As an alternative to public water consideration is being given to developing an on-site water supply well system, this entails installing a domestic or potable supply well on-site, as well as separate fire protection and hydrant wells. Evaluation of the potential environmental impacts of these wells is being conducted through the use of a three-dimensional (3-D) numerical groundwater model. The evaluation takes into consideration the effects on nearby or neighboring wells, drawdown effects on nearby surface water bodies and investigation into potential contaminant migration.

1.1 Background

The site is located approximately one-half mile northeast of the former Naval Weapons Industrial Reserve Plant (NWIRP) in Calverton, Suffolk County, New York. The property is presently undeveloped and vacant and was formerly used as agricultural land and has a few partially wooded areas located on it. Partially situated within the Peconic River watershed, a few surface water bodies are located in proximity to the site. The site and numerous surrounding properties are either located outside the present boundaries of the RWD or only partially within, as public water is currently unavailable and many of these surrounding properties are supplied water via on site private wells. Additionally, groundwater contamination is known to exist in the area. Prior to installing water supply wells at the site, an analysis needs to be performed to determine if withdrawing groundwater from beneath the site will have negative impacts on the nearby existing wells and the local surface water bodies, or if it would have any influence on areas of known groundwater contamination. The analysis has been conducted through the use of numerical groundwater modeling. A 3-D sub-regional numerical groundwater model was constructed, calibrated, and employed to run simulations that would mimic the pumping of on-site supply wells being giving consideration for the light industrial park being proposed.

1.2 Objectives

The objectives of the groundwater modeling effort were as follows –

- Construct and calibrate an accurate numerical groundwater that could reliably be used to mimic pumping conditions produced from the three (3) proposed on-site wells, a potable water supply well, a fire protection well and a hydrant well.

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- Estimate drawdown or water level effects under pumping conditions that are likely to be experienced at nearby existing wells and surface water bodies.

- Investigate if the potential for contaminant migration exists or could be influenced as a result of the proposed three (3) on-site wells.

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2.0 MODEL CONSTRUCTION

A finite difference method (FDM) model was utilized to predict aquifer pumping responses under steady state and transient conditions for the three (3) proposed wells to be located at the Calverton Industrial Park at 4285 Middle Country Road, Calverton, NY. The modeling platform was run using the latest version of the USGS program MODFLOW. The software package used to run the model code was Groundwater Vistas Version 7.24 (GV7) Build 255 by Environmental Simulations, Inc.

A 3-Dsub-regional numerical groundwater flow model was constructed to represent a portion of the Peconic River watershed located west of Peconic Lake, north of the Long Island Expressway, east of Wading River Manor Road and south of the Long Island Sound, essentially centered around the proposed industrial park site location in Calverton. The model was constructed using standard modeling methodology which consisted of:

- Identify model areal extents based on critical features and boundary conditions
- Formulate finite difference grid, import background maps, etc.
- Establish layers and zones based on area hydrogeology
- Adjust model geometry to approximate known conditions
- Input model properties such as aquifer parameters, boundary conditions, recharge, etc.
- Conduct initial model test runs
- Input calibration targets such as groundwater heads at known locations (targets)
- Calibrate the model using sensitivity analyses and calibration methods
- Refine model grid in areas of interest, recalibrate model as necessary
- Input pumping and recharge wells
- Conduct groundwater pumping scenarios using calibrated model
- Analyze and review modeling run results to predict aquifer responses under various pumping schemes.

2.1 Model Extents/Limits

The model was built using a 3-D framework by creating a grid or mesh of evenly spaced nodes in both the directions of the horizontal plane (x and y). The proposed Calverton Industrial Park site was chosen to be roughly near the center of the mesh and the mesh was extended outward 10,000 ft in both the east and west directions and 15,000 feet in both the north and south directions producing a rectangular area that measures 20,000 ft by 30,000 ft (see **Figure No. 1a** for a regional map showing the sub-regional model extents in relation to the whole of Long Island). These distances were selected because they capture key features of the area such as major surface water bodies, and is believed to extend far enough away from the area of focus (the proposed Calverton Industrial Park and surrounding area) to reasonably establish sub-regional

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boundary conditions such as constant and general head boundaries. A 100 by 150 grid with nodes spaced 200 feet apart was selected and as mentioned above centered around the proposed Calverton Industrial Park.

2.2 Background Map

A scaled GIS background map was imported into the groundwater model software from AutoCAD as a DXF file to visually depict the outline of the Long Island coast and other prevalent water bodies in the model area, as well as represent where the site is positioned and the other important features such as major roadways, streets and lot lines (see **Figure No. 1b**).

2.3 Layers

The model was initially constructed with four (4) layers to represent the four (4) major hydrogeological units on Long Island, the Upper Glacial Aquifer, the Magothy Aquifer the Raritan Clay and the Lloyd Aquifer. The base of the model is the surface of the bedrock, which for the purposes of the modeling exercise is assumed to be an impermeable surface (no flow boundary). The top two layers (the Upper Glacial and Magothy Aquifers) were modeled as unconfined layers and the lower two layers (the Raritan Clay and Lloyd Aquifer) were modeled as confined aquifers. The Magothy Aquifer layer was subsequently further divided in multiple sub-layers, which included from bottom to top, the Basal Magothy, the Middle Magothy, the Upper Magothy, the Reworked Magothy and the Manorville Clay. This sub-layering is consistent with the Suffolk County regional groundwater model and similar to other models prepared by P.W. Grosser Consulting for the area.

2.3.1 Layer Geometry

Once the layers were created, the model then basically resembled a cube shape. The model geometry was then adjusted so that layers had shapes, sizes, thicknesses, and orientations that approximated actual known or inferred hydrogeological conditions. Layer top and bottom elevations were sloped and pitched to produce varying thicknesses and inclines or declines that reflected more realistic aquifer conditions. All geometry adjustments were made using available published USGS information. **Figure No. 2** is a typical cross-sectional depiction of the model layering.

2.4 Boundary Conditions

Boundary conditions were then assigned to the areas of the model to represent as close as possible the natural conditions of the study area. Boundary conditions are typically located at the edges of the model and are used to control heads and allow/compute the flux of water into and out of the model. Boundary conditions were assigned in layer 1 of the model (the top layer of the model or the Upper Glacial Aquifer). The north side of the model was assigned as a constant head boundary with a head equal to 0 feet to represent the Long Island Sound, with an average surface elevation of mean sea level (0 ft AMSL). Constant head boundaries do not change throughout model simulations and, therefore, usually represent infinite quantities of water, as would be the case for large surface water bodies such as the Long Island Sound or other significant surface water bodies like bays or the ocean.

The southern portion of the model area is where the Peconic River and the associated lakes, ponds and streams are located. The Peconic River was created as a drain boundary condition, meaning it is removing water from the system or model. The river transects the model area starting in the in the extreme southwest portion of the region and meanders in a northeasterly direction to about one third of the way up the eastern boundary of the model.

The eastern and western sides/extents of the model were also both set as constant head boundaries to match local groundwater conditions based on USGS groundwater maps.

2.5 Aquifer Parameters

With the model framework roughed out, the next step was to input numerical values for key parameters and establish a set of consistent units for the inputs that included:

- Horizontal hydraulic conductivity - $K_{x,y}$ (ft/day)
- Vertical hydraulic conductivity - K_z (ft/day)
- Specific storage – S_s (1/ft)
- Specific yield – S_y (unitless)
- Porosity – n (unitless)
- Recharge – R (ft/day)

Every zone of all the layers of the model had each of the above parameters assigned to it based on published USGS values, with the exception of recharge. Recharge was only applied to layer 1 of the models where it is introduced (the uppermost layer of the model). **Table 1** below is a summary of the model inputs based upon available published USGS values for the study area.

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Table 1 - Groundwater Model - Initial Input Parameter Values

Hydrogeologic Unit	Model Layer Number	$K_{x,y}$ (ft/day)	K_z (ft/day)	S_s (1/ft)	S_y	n	*R (ft/day)
Upper Glacial	1	250	25	0.000001	0.24	0.3	0.005
Manorville Clay	2	20	2.0	0.000001	0.24	0.3	---
Reworked Magothy	3	40	0.4	0.000001	0.24	0.3	---
Upper Magothy	4	65	1.0	0.000001	0.24	0.3	---
Middle Magothy	5	65	1.0	0.000001	0.24	0.3	---
Basal Magothy	6	125	1.25	0.000001	0.24	0.3	---
Raritan Clay	7	0.3	0.001	0.000001	0.24	0.3	---
Raritan Clay North	7	3	0.02	0.000001	0.24	0.3	---
Lloyd	8	35	3.5	0.000001	0.24	0.3	---

- *Recharge was only applied to Layer 1 of the model.

2.6 Preliminary Model Runs

Initial test runs to generate graphical output were run once the model framework was constructed, the aquifer parameters and model inputs were entered, and the boundary conditions established. This was done to identify problems such as significantly incorrect model geometry, input values, or boundary conditions. These initial uncalibrated model runs often generate groundwater head contours that are far from the actual or known conditions, but at least allow the modeler to determine if the model is headed in the right direction as far as its initial development and where to look for major problems. Model simulation criteria such as

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selection of which solver package to use and when convergence is reached between consecutive iterations are selected at this point as well.

The initial test runs for the sub-regional model fared reasonably well. The model was able to converge and generate groundwater head contours that at least appeared to represent the general shape and orientation of the contours depicted on historical USGS maps for the study area (USGS Groundwater Conditions on Long Island, 2016). Though not completely 100% accurate, but off by only about a few feet or so in portions of the upper layer, the model was able to produce output that from a starting point was usable and allowed for progression to the calibration phase of the model development without significant structural modifications to the model framework.

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3.0 MODEL CALIBRATION

The calibration process is often the most complex portion of groundwater modeling. The vast array of inputs, geometry and boundary conditions that can be adjusted to manipulate the model output can be significant and daunting. Additionally, the number of combinations of any of the above-mentioned variables can quickly become overwhelming even for experienced modelers. Groundwater Vistas has several means to simplify the process such as automated sensitivity analyses and calibration procedures.

3.1 Calibration Target

The calibration process began by identifying known points of groundwater elevation within the model framework. Due to the size or extents of the model (20,000 ft x 30,000 ft), several known USGS groundwater monitoring wells were able to be located or identified that coincided with the model grid. A total of six (6) active USGS monitoring wells were located and included five (5) wells installed in the Upper Glacial Aquifer and one (1) in the Magothy Aquifer. The monitoring wells were subsequently used as calibration targets in order to adjust model parameters to get a best match or fit between actual water level values and modeled ones.

The purpose of calibration targets is to use them to assess model adjustments. The closer target residuals (i.e., the difference between the target value and model predicted groundwater heads) get to zero, the better the model is calibrated. The raw uncalibrated model was run with the initial inputs all unadjusted and the residual sum of squares was approaching 30. The residual sum of squares is a summation of the squared value of all the calibration target residuals. The squared value is used because a residual can be positive or negative, thus by squaring, all values become positive. The squared residuals when summed produce a positive value that is the starting point in the calibration process. The idea is to adjust model parameters to result in a lower residual sum of squares value. The lower this number is driven the better the calibration of the model is considered. A model with six (6) calibration targets and a starting value of 30 for the residual sum of squares is actually not bad based on past modeling experience. This indicates that the average initial uncalibrated residual was just under 2.24 ft. The target residuals were both positive and negative, meaning that in some areas they overpredicted and in others they underpredicted the actual or observed water level values. Generally, for sub-regional models of this scale, the aim is to get the residuals all to be on the order of 1 ft, if possible.

3.2 Automated Sensitivity Analysis

Automated sensitivity analyses were performed to determine which model inputs would have the greatest influence on model results. Using the built-in auto-sensitivity analysis features of GV7, it became obvious fairly quickly that the most sensitive model parameters were the horizontal and vertical hydraulic conductivities of layer 1 and recharge. By using the automated features such as PEST (parameter estimation) the modeling software does a numerical analysis to derive optimum parameter values to calibrate the model. Fortunately, the starting input values produced a fairly reasonable model and the auto-calibration process yielded results that did not vary by much and were within acceptable ranges for the various aquifers. **Table 2** below highlights the aquifer parameters that were adjusted following the calibration process.

Assuming reasonable aquifer parameters were identified and input the next set of variables considered were the boundary conditions. These were essentially the pond/lake stage elevations and the drains stages representing the Peconic River. Historical values for the pond/lake stage elevations were used in the model development so these were essentially left unchanged. The river or drain stages were varied on a trial and error basis to help produce a lower residual sum of squares value and to generate groundwater contours that more accurately matched the ones depicted on the USGS maps. Once the various inputs and boundary conditions were calibrated a new residual sum of squares value was calculated to 10.1 equating roughly to an average absolute residual of around 1.4 ft a decent improvement over the uncalibrated model and within the range of what the intended calibration accuracy was sought to be, around 1 ft. **Figure No. 3** depicts the calibrated model showing the water table contours in layer 1, or the Upper Glacial Aquifer.

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Table 2 - Groundwater Model - Calibrated Parameter Values

Hydrogeologic Unit	Model Layer Number	$K_{x,y}$ (ft/day)	K_z (ft/day)	S_s (1/ft)	S_y	n	*R (ft/day)
Upper Glacial	1	324	14.8	0.000001	0.24	0.3	0.0037
Manorville Clay	2	20	3.0	0.000001	0.24	0.3	---
Reworked Magothy	3	40	1.4	0.000001	0.24	0.3	---
Upper Magothy	4	65	1.0	0.000001	0.24	0.3	---
Middle Magothy	5	65	1.0	0.000001	0.24	0.3	---
Basal Magothy	6	125	1.25	0.000001	0.24	0.3	---
Raritan Clay	7	0.3	0.001	0.000001	0.24	0.3	---
Raritan Clay North	7	3	0.02	0.000001	0.24	0.3	
Lloyd	8	35	3.5	0.000001	0.24	0.3	---

- *Recharge was only applied to Layer 1 of the model.
- Highlighted values represent parameters that were modified from initial input following calibration.

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4.0 MODEL SIMULATIONS

Once the model was calibrated some refinements were made to enhance the resolution of the graphical output in the vicinity of interest (at and around the site). The model grid spacings for both the rows and columns were reduced from 200 ft to 100 ft to produce a more refined grid right around the proposed Calverton Industrial Park site and the nearby surface water bodies (**see Figure No. 4**). Once the refinements were made the model calibration was rechecked to ensure the modifications did not affect the model accuracy.

4.1 Steady State Scenario – Potable Supply Well

The first model simulation to be investigated was the steady state case for the proposed on-site potable supply well. This case was investigated to look at local water level effects on nearby or neighboring wells and wetlands and to evaluate the well capture zone with regards to possible sources of contamination. The site is estimated to use 16,506 gpd based on sanitary flow calculations and be provided with a sewage treatment plant that has a peak operating or design flow of 20,000 gpd. The site is anticipated to be used 5.5 days per week with the bulk of the site activities or water usage related to sanitary purposes occurring over an 8 to 12 hr period each day. Annualizing the maximum daily sanitary flow rate is done as follows:

20,000 gpd x (1 ft^3 / 7.48052 gal) x (5.5 days/wk / 7 days/wk) = 2,100.69 ft^3/day

Assuming that the sanitary load accounts for 75% of the actual water usage, the daily potable flow rate then becomes:

2,100.69 ft^3/day / 0.75 = 2,800.93 ft^3/day

The other principle water usage component would be irrigation. The currently proposed irrigation rate is ½” per week for the six-month period between April 15 and October 15. Irrigation watering is anticipated to occur over approximately 84,700 square feet. The daily annualized rate for the steady state model conditions is calculated as follows:

½”/wk x (1 ft/12 in) x 84,700 ft^2 x (1 wk/7 day) x (6 mon/yr / 12 mon/yr) = 252.09 ft^3/day

Combining the potable and irrigation flow rates into a single daily pumping rate the following steady state rate is obtained:

2,800.93 ft^3/day + 252.09 ft^3/day = 3,053.02 ft^3/day

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The potable water supply well is proposed to be installed just below the Manorville Clay layer, which in the model is layer 3, or what is commonly referred to in terms of hydrogeologic units as the "Reworked Magothy". **Figure No. 5** depicts the proposed supply well location on site and also depicts static groundwater conditions (i.e., no pumping). Under this scenario additional calibration targets were added to the water table aquifer of the model (layer 1) at the two (2) nearby wetlands areas, which are located approximately 2,600 ft southwest of the proposed well location (target WT1 and WT2). The target values input at these locations were set at zero (0) so that when the model posts a residual its absolute value will be the predicted groundwater elevation at that location. Additionally, one of the model original calibration targets, USGS monitoring well S52579.1, located on the order of 740 ft west of the proposed potable supply is also shown in **Figure No. 5**. This is another water table target and is located between the proposed supply well and a residential area to the northwest of the site that has several private supply wells located within it (depicted as small gray circles or dots in **Figure No. 5**). Though this target is shown with its calibration residual it can be used when comparing static to pumping conditions to observe if significant drawdown is experienced and would be indicative of impacts that could be expected to be experienced by the private supply wells in the residential area. **Figure No. 6** depicts the water table conditions under steady state pumping conditions in the vicinity of the site. **Table 3** below compares static conditions to pumping conditions using the three (3) targets mentioned above.

Table 3 – Static and Steady State Target Values

Target Id	Distance from Supply Well (ft)	Static Value (ft)	Steady State Pumping Value (ft)	Drawdown (ft)
S51579.1	740	-1.31	-1.28	0.03
WT1	2,595	-29.10	-29.08	0.02
WT2	2,550	-29.27	-29.26	0.01

The wetlands are expected to see a lowering of the water table of approximately 0.02 ft or less than 1/4th of an inch under steady state pumping conditions from the proposed supply well at the site. The residential area to the northwest of the site is expected to see a water table decline of 0.03 ft or a little over 1/3rd of an inch under the same steady state pumping conditions. Impacts at both locations are relatively minor and will have negligible to insignificant effects in terms of water levels.

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A particle tracking analysis was performed to analyze the potential capture zone of the proposed potable supply well for the site. This entailed placing a ring of particles about the mid-point of the screen zone and reverse tracking them back to their origin under steady state conditions. **Figure No. 7** is the output from the MODPATH particle track analysis and depicts a particle trajectory that tracks in a north easterly direction with the origin at the former Naval Weapons Industrial Reserve Plant (NWIRP). Travel times are plotted along the particle tracks in 5-year intervals starting with t = 0 right at the mid-point of the screen zone of the proposed supply well and running out to between 22 to 23 years at the NWIRP. This means that under steady pumping conditions groundwater at the water table beneath the NWIRP would be expected to take between 22 to 23 years to reach the proposed on-site potable supply well. The significance of this is that the NWIRP site is known to be contaminated with PFOA/PFOS compounds. PFOA and PFOS will travel slower than the groundwater due to several phenomena, one of which is retardation. This is a function of the organic carbon content of the soil and chemical properties of the contaminants and is detailed below.

$R = 1 + (K_d \rho_b)/n$
R = retardation factor (unitless)
K_d = distribution coefficient (ml/g) = $K_{oc}f_{oc}$
K_{oc} = partition coefficient (ml/g)
f_{oc} = organic carbon content of soil expressed as a decimal percent (unitless)
ρ_b = bulk density of soil (g/ml)
n = porosity of soil (unitless)

$\log(K_{oc})_{PFOA} = 2.06$ (Ferrey, et al, 2012)
$(K_{oc})_{PFOA} = 10^{2.06} = 114.82$ ml/g

$\log(K_{oc})_{PFOS} = 2.57$ (Ferrey, et al, 2012)
$(K_{oc})_{PFOS} = 10^{2.57} = 371.54$ ml/g

$f_{oc} = 0.0002$ (Long Island sand – Schwazenbach, et al, 1993)
$\rho_b = 110$ lb/ft^3 = 1.76 g/ml (typical Long Island sand value)
n = 0.3 (typical Long Island sand value)

$(K_d)_{PFOA}$ = 114.82 ml/g x 0.0002 = 0.0230 ml/g
$(K_d)_{PFOS}$ = 371.54 ml/g x 0.0002 = 0.0743 ml/g

R_{PFOA} = 1 + [(0.0230 ml/g x 1.76 g/ml) / 0.3] = 1.13

$R_{PFOS} = 1 + [(0.0743 \text{ ml/g} \times 1.76 \text{ g/ml}) / 0.3] = 1.44$

This means PFOA and PFOS could be expected to travel slower than the actual groundwater velocity by 13 and 44 percent respectively. This equates to travel times of 24.9 to 26.0 years for PFOA and 31.7 to 33.1 years for PFOS.

Another aspect that further acts to retard the groundwater flow and contaminant migration is the presence of the Manorville Clay. Though not considered a true confining layer it is a layer of reduced hydraulic conductivity and acts like a leaky confining layer or an aquitard. **Figure No. 8** is a closeup representation showing the particle tracks from the 15-year travel time to the well. As the particles migrate downward through the layers of the model different colors are assigned to better visualize the progression. Red represents layer 1 (the Upper Glacial aquifer), fuchsia represents layer 2 (the Manorville Clay) and the lime green color represents layer 3 (the Reworked Magothy). Based on the model output it is clear that once the particles reach layer 2 (the fuchsia color) they slow down considerably. The 5-year period between 10 and 15 years the particles move approximately 1,500 ft, or about 0.82 ft/day, this is in layer 1 of the model or the Upper Glacial aquifer. The 5-year period between 5 and 10 years the particles are within layer 2 of the model, the Manorville Clay, and advance on average about 150 ft horizontally for an average velocity of 0.082 ft/day.

Static conditions were also evaluated in terms of particle tracks or potential contaminant migration from the NWIRP. The proposed supply well at the site was turned off or its pumping rate was set to 0 ft^3/day and a line of particles was released at the NWIRP site and allowed to tack forward under non-pumping conditions. Under this case, groundwater originating at the NWIRP reaches the proposed well screen location in layer 3 of the model (the Reworked Magothy) in about 27 to 28 years. Assuming the same PFOA/PFOS contaminants are present and they are retarding at the rates indicated above, travel times of 30.5 to 31.6 years for PFOA and 38.9 to 40.3 years for PFOS could be expected. This would mean if the PFOA/PFOS contamination existed beneath the NWIRP back between 1981 and 1989 (or earlier), it could possibly be beneath the proposed Calverton Industrial Park site today (2021). **Figure No. 9** depicts the static or non-pumping steady state conditions with particle tracks color coded as they migrate between layers of the model or the various hydrogeologic units.

Based on what is known, it can be reasonably expected that should a supply well be installed at the site, the possibility exists that PFOA/PFOS contamination from the NWIRP site may eventually be detected in the groundwater withdrawn by the site's potable supply well.

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4.2 Transient Conditions Scenario – Fire Protection Well

A fire protection well is also proposed for the site to meet NYS Fire Code requirements for sprinkling the buildings. A design flow rate of 375 gpm has been deemed required based on the building types, construction, and sizes. This flow rate is required to be sustained for a 2-hour period and will only be experienced in the case of a fire. Thus, it is highly transient and would not be seen to have long term local effects on water levels or capture zones. It will cause short term infrequent effects only for a period of hours. Recovery of water levels is investigated using a transient model and the fire protection well. A short duration transient model was setup using 30 stress periods broken down as follows:

Stress Periods 1 – 24 = 1-hour periods (0.04167 days), each with 2 time steps except stress periods 2 and 4 which have 10 time steps each (stress periods when pumping first begins and right after it ends)
Stress Period 25 = 3-hour period (0.125 days) with 2 time steps
Stress Period 26 = 6-hour period (0.25 days) with 2 time steps
Stress Period 27 = 12-hour period (0.5 days) with 2 steps
Stress Period 28 = 1-day period with 2 time steps
Stress Period 29 = 2-day period with 2 time steps
Stress Period 30 = 3-day period with 2 time steps

Total model duration = 7.875 days

The model was run under no pumping conditions for the first hour to generate steady state or static conditions. The fire protection well was then pumped at 375 gpm for 2 consecutive hours to mimic fire pumping conditions. After 2 hours of pumping (or at t = 3 hours) the fire protection well pumping ceases and the model is then allowed to continue under recovery conditions. **Figure No. 10** shows static steady state non-pumping conditions in layer 3 of the model, the Reworked Magothy where the fire protection well is proposed to be screened. **Figure No. 11** depicts conditions in the same hydrogeologic unit after 2 hours of pumping the fire protection well at 375 gpm. Right at the well approximately 8.5 feet of drawdown is predicted to be experienced. Beyond the third hour of the model recovery begins to occur. Full recovery is predicted to occur in a little over 1.5 hours. **Figure No. 12** is a plot of water level conditions right at the fire protection well. This is an extremely temporary condition and is not expected to occur unless a fire breaks out. Thus, the effects will be limited and localized, last a short while (a period of hours) and will dissipate quickly upon termination of pumping (1.6 hours).

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4.3 Transient Conditions Scenario – Hydrant Well

Similar to the fire protection well for the site buildings, a fire hydrant well is also proposed. This well will be required to supply 1,500 gpm of water to the site fire hydrants for a 2-hour consecutive period. This is again similar to the fire protection well and would have the same short period duration, happen very infrequently, and be limited to impacting the local area around the site. A similar transient modeling scenario was developed for the hydrant well as was for the fire protection well and is as follows:

Stress Periods 1 – 24 = 1-hour periods (0.04167 days), each with 2 time steps except stress periods 2 and 4 which have 10 time steps each (stress periods when pumping first begins and right after it ends)
Stress Period 25 = 3-hour period (0.125 days) with 2 time steps
Stress Period 26 = 6-hour period (0.25 days) with 2 time steps
Stress Period 27 = 12-hour period (0.5 days) with 2 steps
Stress Period 28 = 1-day period with 2 time steps
Stress Period 29 = 2-day period with 2 time steps
Stress Period 30 = 3-day period with 2 time steps

Total model duration = 7.875 days

The model was run under no pumping conditions for the first hour to generate steady state or static conditions. The hydrant well was then pumped at 1,500 gpm for 2 consecutive hours to mimic fire pumping conditions. After 2 hours of pumping (or at t = 3 hours) the hydrant well pumping ceases and the model is then allowed to continue under recovery conditions. **Figure No. 13** shows static steady state non-pumping conditions in layer 3 of the model, the Reworked Magothy where the hydrant well is proposed to be screened. **Figure No. 14** depicts conditions in the same hydrogeologic unit after 2 hours of pumping the hydrant well at 1,500 gpm. Significant drawdown is predicted at and around the hydrant well when pumping at 1,500 gpm after a 2-hour duration. Right at the well a drawdown of over 34 feet is expected to occur and at USGS monitoring well S51579.1 a drawdown of 2.31 feet in layer 3 of the model is estimated, which is approximately 740 feet from the proposed hydrant well location (see **Figure No. 13** for USGS MW location). Recovery happens relatively quickly again, and near full recovery is predicted to occur within 3 hours after pumping stops (right at the hydrant well location). **Figure No. 15** is a plot of head at the hydrant well versus time. Pumping stops at t = 3 hours or 0.125 days and recovery is essentially complete by t = 6 hours or 0.25 days. Just as with the fire protection well the effects created by pumping of the hydrant well are very short term, happen infrequently (i.e., only if and when a fire occurs requiring the use of hydrants) and conditions recover quickly (on the order of hours).

Also, it is worth noting that even though the drawdown or head effects in layer 3 of the model are significant while pumping the hydrant well at 1,500 gpm, the effects in layer 1, the water table layer, are greatly reduced because of the presence of the Manorville Clay. **Figure No. 16** is a depiction of static conditions in layer 1 with the calibration target reset to a target value of zero (0) so that the absolute value of the posted residual plots as the groundwater elevation. The static groundwater elevation at the monitoring well location is 27.3648 feet. **Figure No. 17** is plot of the layer 1 groundwater elevations when the USGS monitoring well sees it lowest value which occurs at t = 21 hours or 0.875 days, a value of 27.3480 feet is predicted, a total drawdown or difference from static of 0.0168 feet, a significantly lower difference from what is experienced in layer 3. Further noted is the time lag to the maximum drawdown experienced at the monitoring well in layer 1 as compared to layer 3 - in layer 3 the maximum drawdown effect occurs at t = 3 hours (at the end of the 2 hour pumping duration) while in layer 1 it occurs at t = 21 hours. **Figure No. 18** is a plot of water levels versus time at the monitoring well in layer 1 of the model. Here it can be seen that recovery takes longer again due to the presence of the Manorville Clay.

4.4 Scenarios Summary

The steady state modeling scenario for the proposed potable supply well predicted relatively minor drawdown effects would occur in the water table layer of the model (layer 1), or the Upper Glacial aquifer. The nearby residential area to the west-northwest with private wells is predicted to experience less than 0.02 feet of drawdown and the closest wetland areas to the southwest of the potable supply well are anticipated to see up to 0.01 feet of drawdown.

Particle tracking modeling indicated that groundwater being captured by the potable supply well is predicted to originate at the water table beneath the NWIRP, a site known to be contaminated with PFOA and PFOS compounds. Under steady state pumping conditions groundwater originating beneath the NWIRP could take between 22 to 22 years to reach the proposed potable supply well. Under non-pumping steady state conditions, the same groundwater is predicted to take 27 to 28 years to reach the potable supply well. Also considered is the retardation of the contaminants which would cause them to travel more slowly than the groundwater - PFOA generally traveling 13% slower and PFOS traveling up to 44% slower. Depending on how long the contamination existed beneath the site at the NWIRP, the possibility exists that it may have reached the proposed Calverton Industrial Park site already or it is well on its way to reaching it.

Two separate transient modeling runs were conducted to analyze the effects of the proposed fire protection and hydrant wells. The fire protection well is intended to be utilized only in extreme

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emergencies, such as a structure fire on site and only for non-potable purposes. The building code requires a flow rate of 375 gpm that is to be sustained for a 2-hour duration. After 2 hours of pumping, localized drawdown effects occur around the fire protection well and full recovery occurs in a little over 1.5 hours following cessation of pumping.

The hydrant well is to be used in a similar manner to the fire protection well, only under an extreme emergency such as when a fire breaks out on site. The hydrant well will be designed for a pumping rate of 1,500 gpm only for non-potable uses and a sustained pumping duration of 2 hours as per the NYS Fire Code. Similar short-term effects are expected, but to a higher degree. Greater drawdowns are predicted at the 1,500 gpm pumping, but again are fairly localized and last only on the order of hours once pumping ceases.

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5.0 CONCLUSION

Numerical groundwater modeling was performed to evaluate the potential effects of three groundwater supply wells at the proposed Calverton Industrial Park to be located at 4285 Middle Country Road in Calverton, NY. The three (3) wells include a potable supply well (120 gpm pumping rate), a fire protection well (375 gpm pumping rate) and a hydrant well (1,500 gpm pumping rate). Steady state modeling conditions were utilized to simulate the long-term effects of the daily operation of the potable supply well, while transient modeling scenarios were employed to analyze the short term effects of the fire protection and hydrant wells.

The proposed potable supply well was found to have relatively minor effects on local water levels with respect to drawdown. The capture zone of the well was found to extend back to the water table and originated beneath the NWIRP site, an area known to be contaminated with PFOA and PFOS. Based on particle tracking and travel time analysis, the possibility exists that the PFOA/PFOS contamination may either be beneath the Calverton Industrial Park site presently or is well on its way there. A test well and groundwater profiling are recommended to confirm whether or not PFOA/PFOS contamination exists beneath the site and to what extent. Though not within the scope of the current modeling exercise, a detailed fate and transport model should be developed if a source and/or plume are thoroughly delineated. This will better help predict if and when the site might experience an issue with PFOA/PFOS contamination and could also help direct treatment options like the installation of granular activated carbon (GAC) filters. Hydraulically, the proposed potable supply well is predicted to have minimal effects on the local aquifer system. From a potential contamination standpoint, the well is proposed to be located downgradient of a known contaminated area and could be impacted in time. Based on concentrations, treatment may be necessary to supply potable water.

The transient modeling performed to evaluate the impacts of both the fire protection well and hydrant well demonstrated both wells have fairly significant localized hydraulic effects while pumping (i.e., large drawdowns at and around the wells). The effects are very short term and recovery once pumping ends happens quickly as well (on the order of hours). The wells would be used very infrequently and though while in operation would generate noticeable localized effects would not be for prolonged periods. Pumping of these wells could, however, further exacerbate drawing potential contamination from the NWIRP site towards the potable supply well, but again the limited, infrequent use of these wells will aide in minimizing that effect. As they are non-potable wells, treatment would not be required.

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FIGURES

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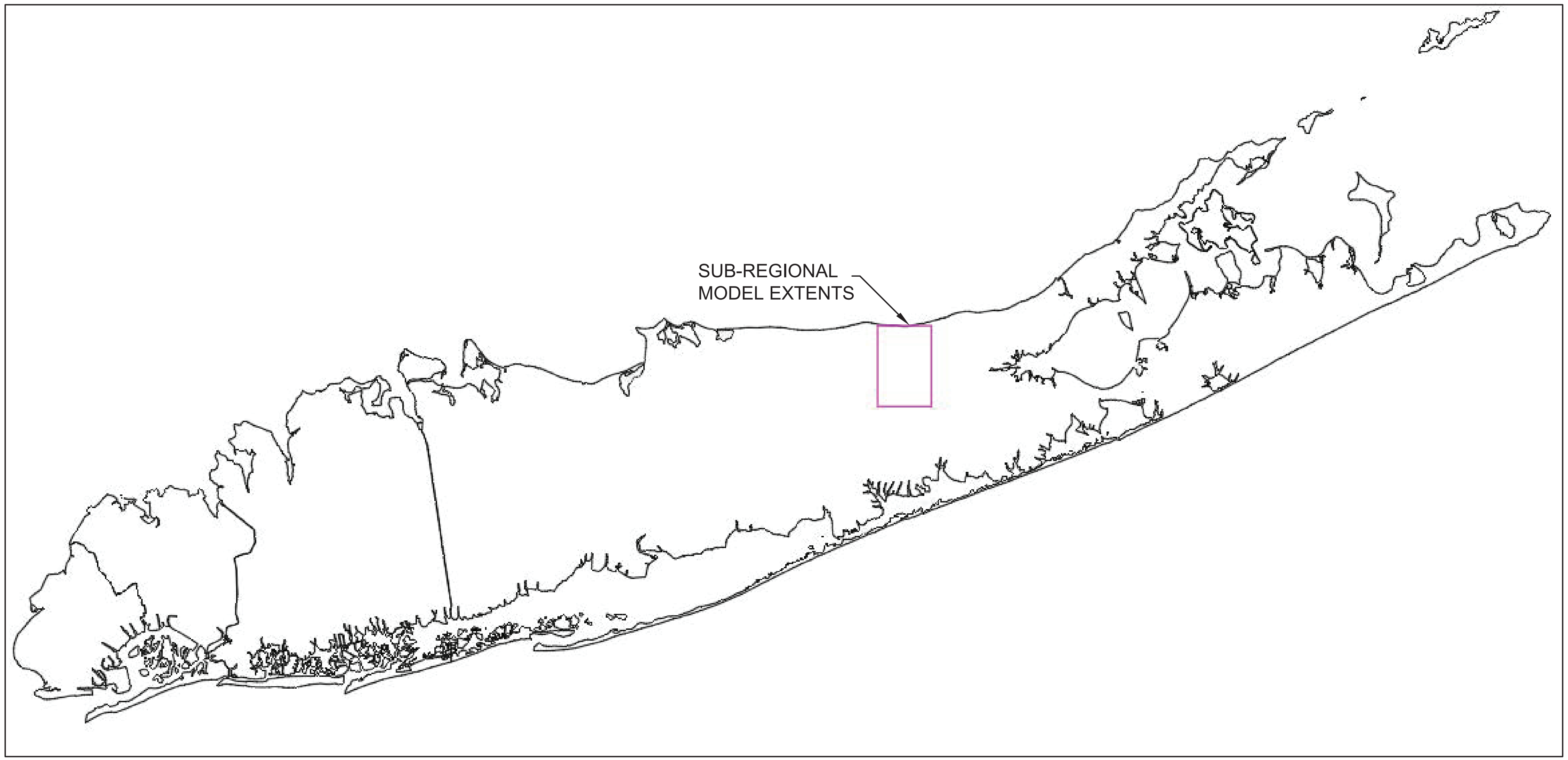

NOTE:
- MAGENTA RECTANGLE REPRESENTS SUB-REGIONAL AREA OF GROUNDWATER MODEL EXTENTS.
- NOT TO SCALE

REGIONAL MAP SHOWING SUB-REGIONAL EXENTS

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1		

Designed By: PKB	Date Submitted: 3/29/2021
Drawn By: HS	Date Created: 3/29/2021
Approved By: PKB	Scale: NTS

Client:
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SUFFOLK COUNTY, NEW YORK

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REGIONAL MAP SHOWING SUB-REGIONAL EXTENTS

Drawing Number:
FIGURE 1A

Sheet 1 of 19

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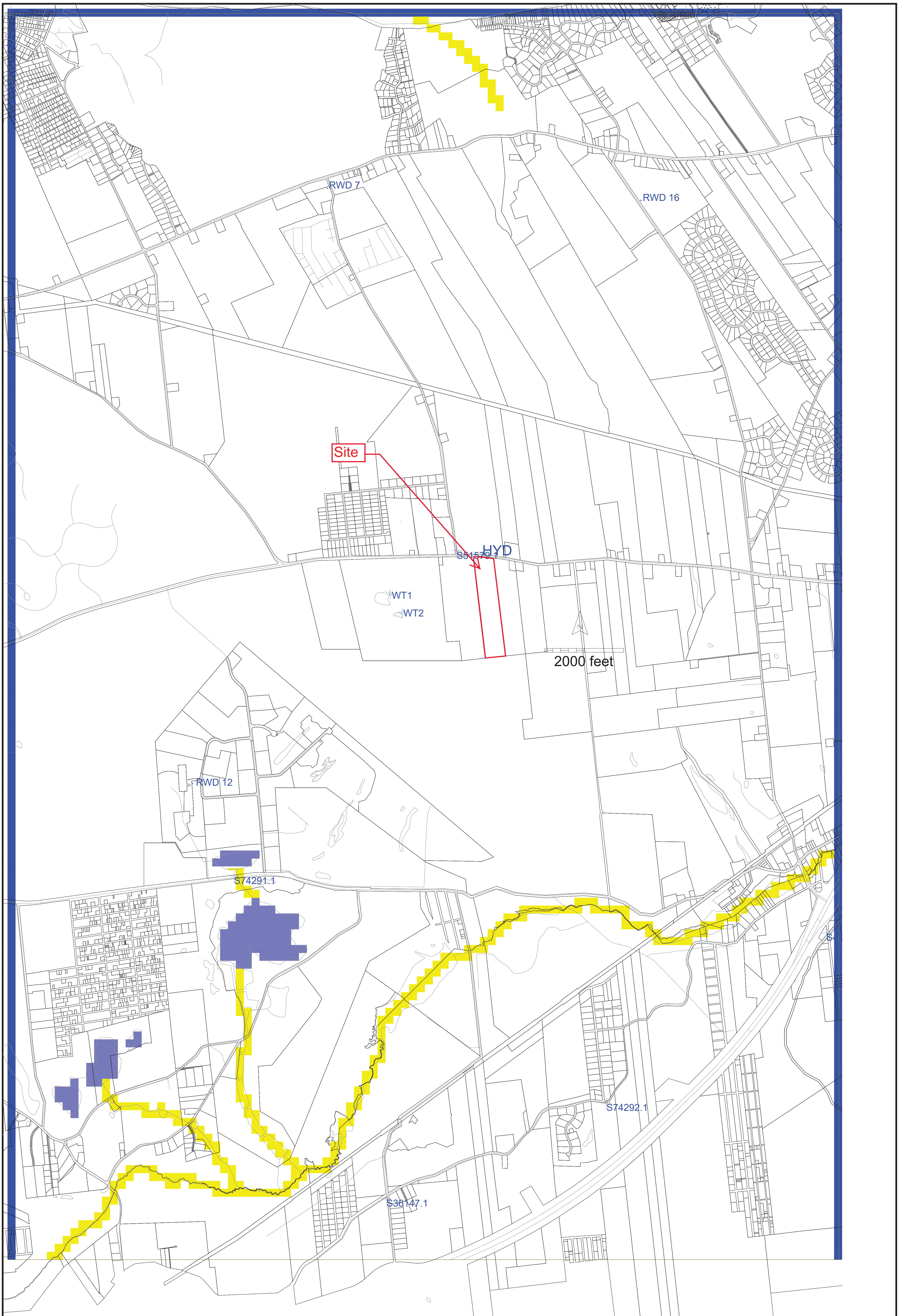

Figure No. 1B - Sub-Regional Model Extents

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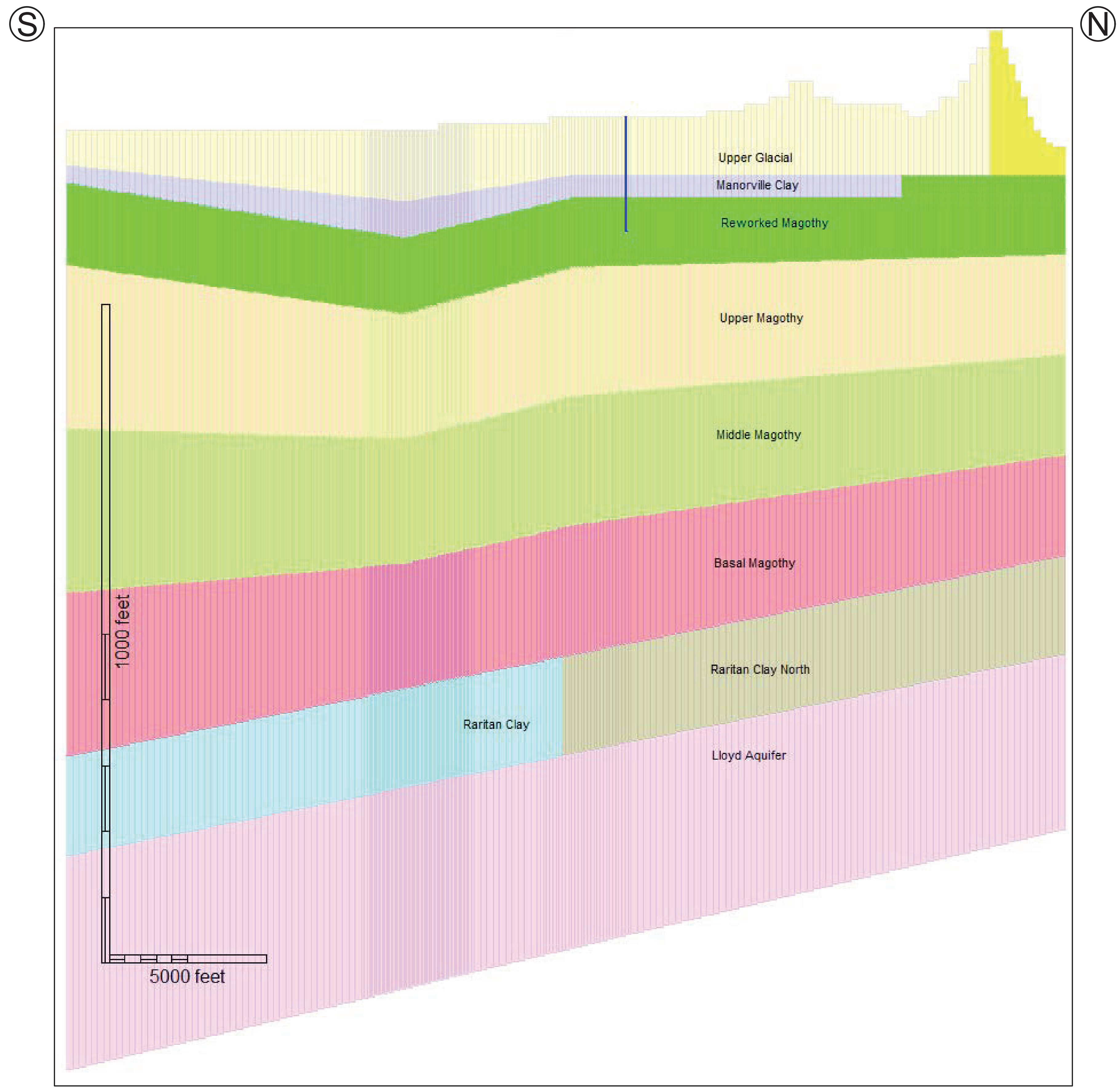

MODEL CROSS SECTION

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FIGURE 2

Sheet 3 of 19

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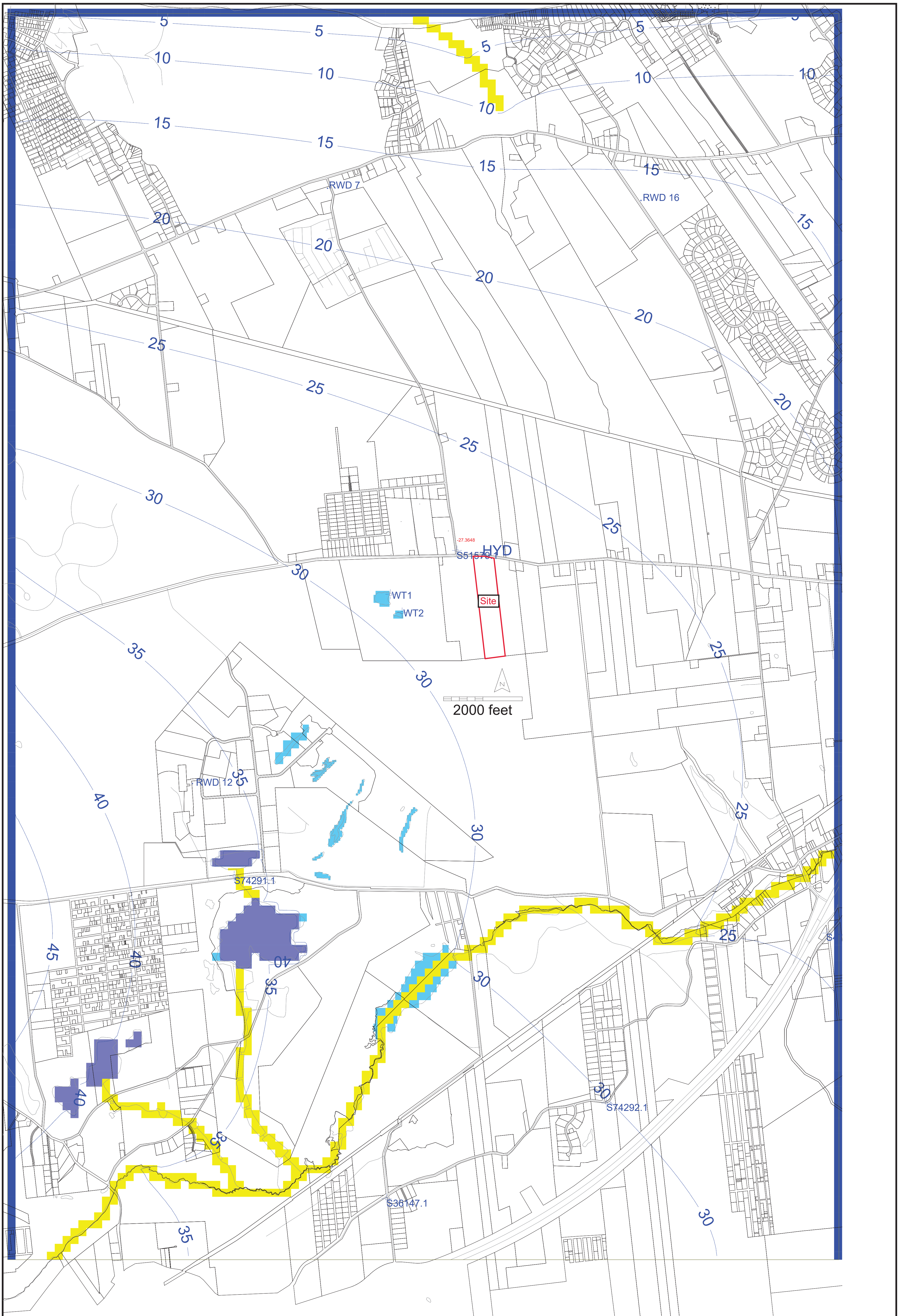

Figure No. 3 - Calibrated Model - Layer 1 - Water Table Groundwater Contours

30 — Groundwater Contour (feet)

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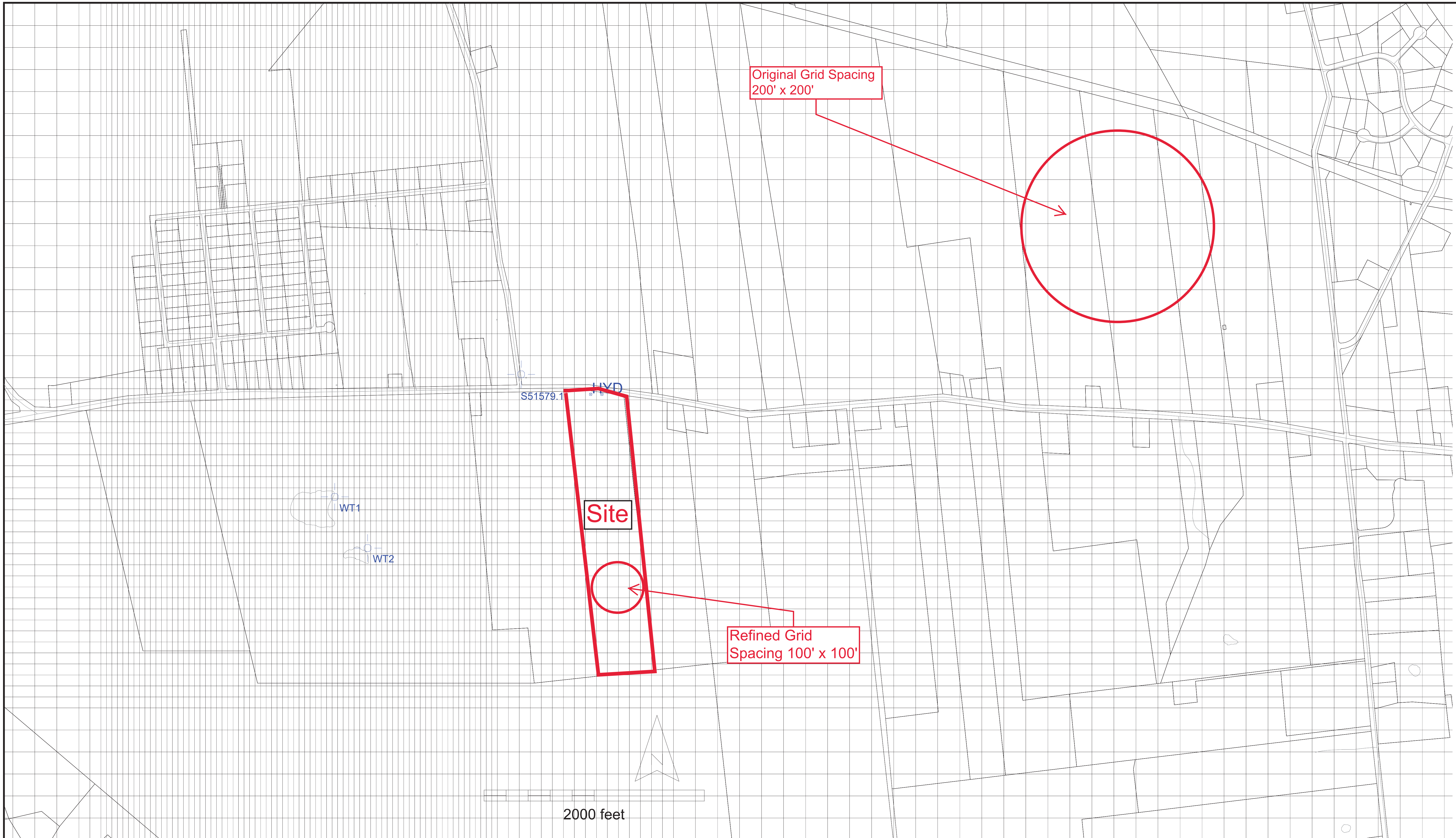

Figure No. 4 - Model Grid Refinements

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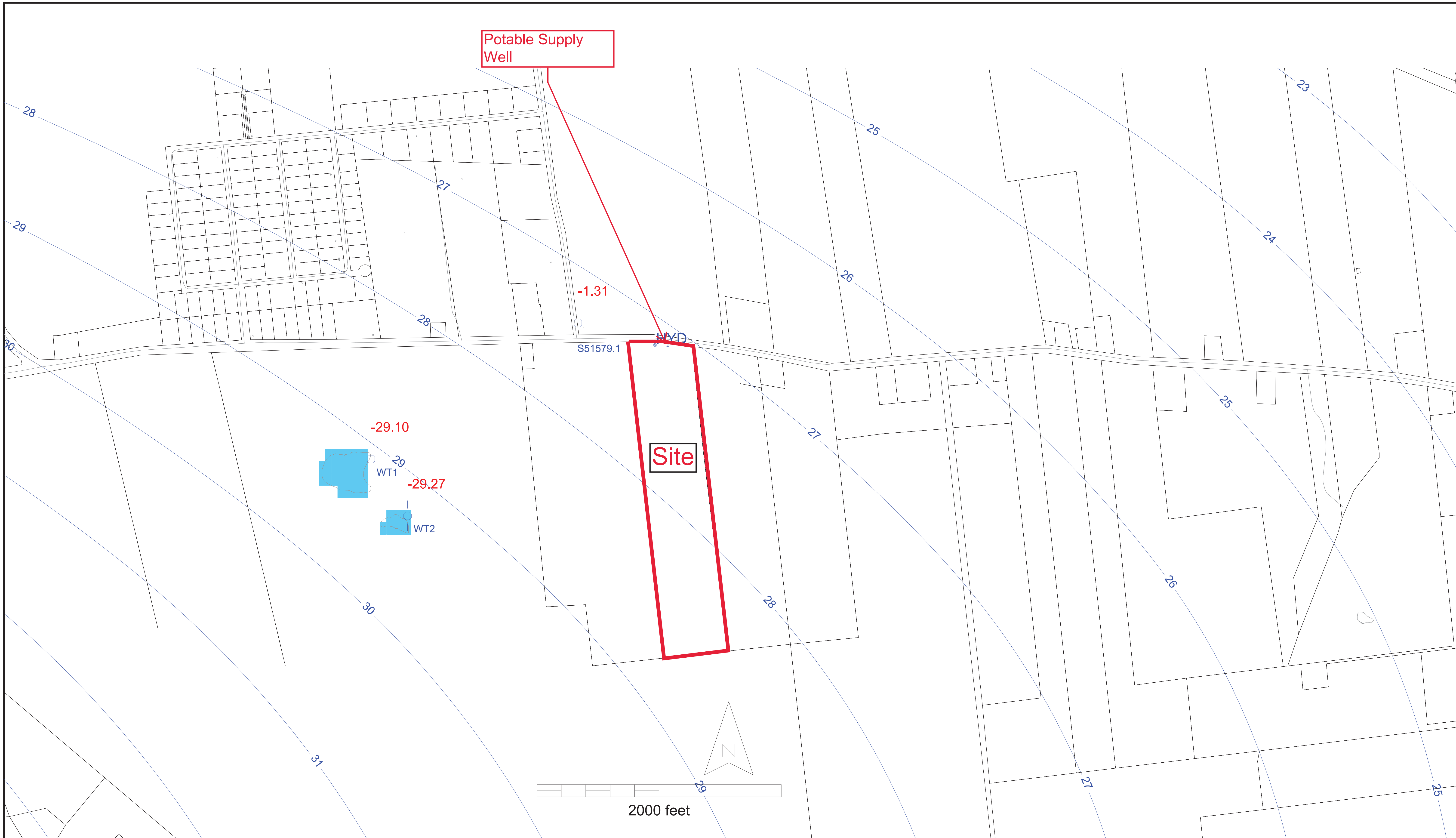

Figure No. 5 - Potable Supply Well - Static Conditions

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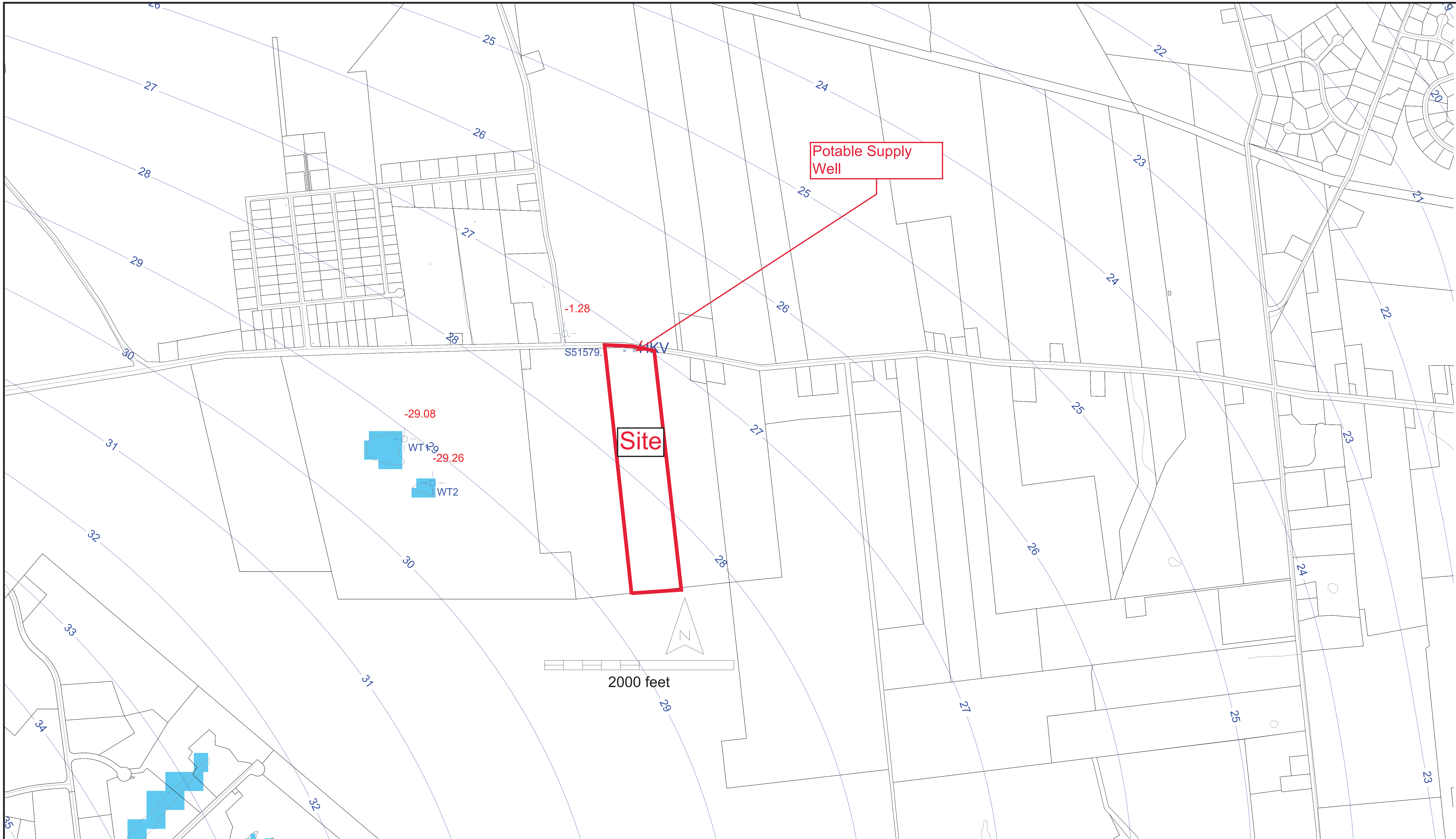

Figure No. 6 - Potable Supply Well - Steady State Conditions

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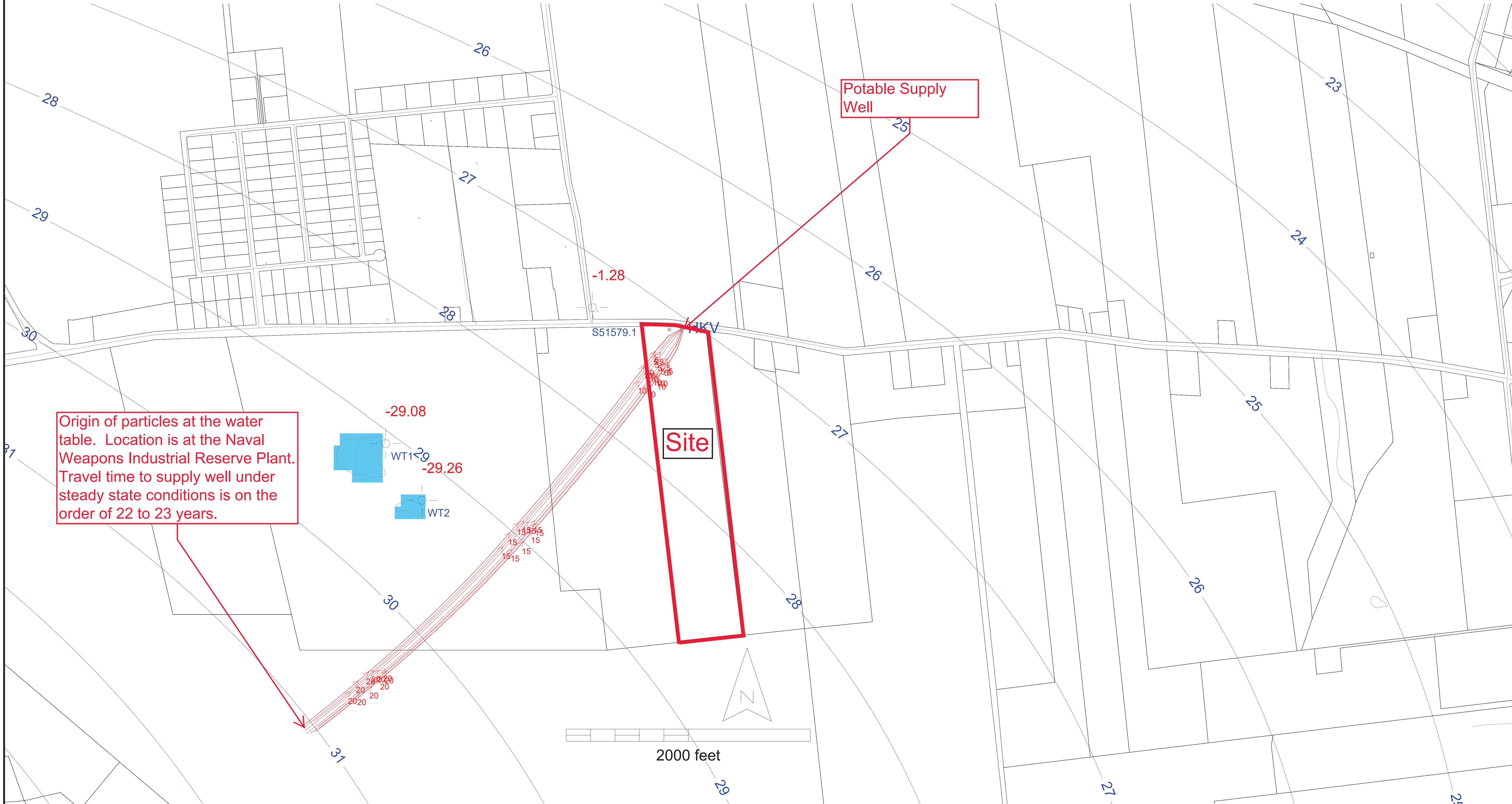

Figure No. 7 - Potable Supply Well - Steady State Particle Tracks - Capture Zone

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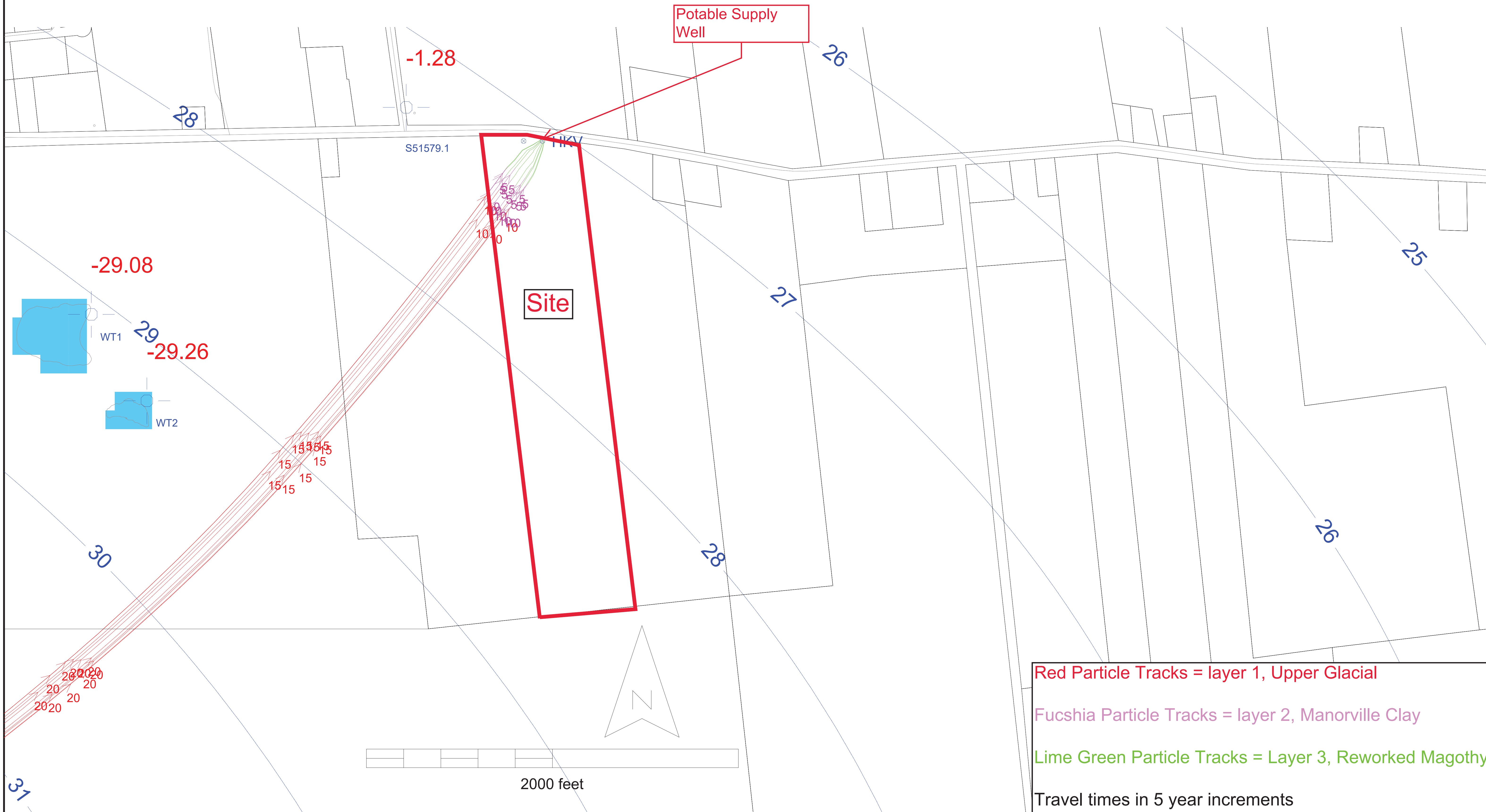

Figure No. 8 - Closeup of Particle Tracks for Layer Delineation

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30 Groundwater Contour (feet)

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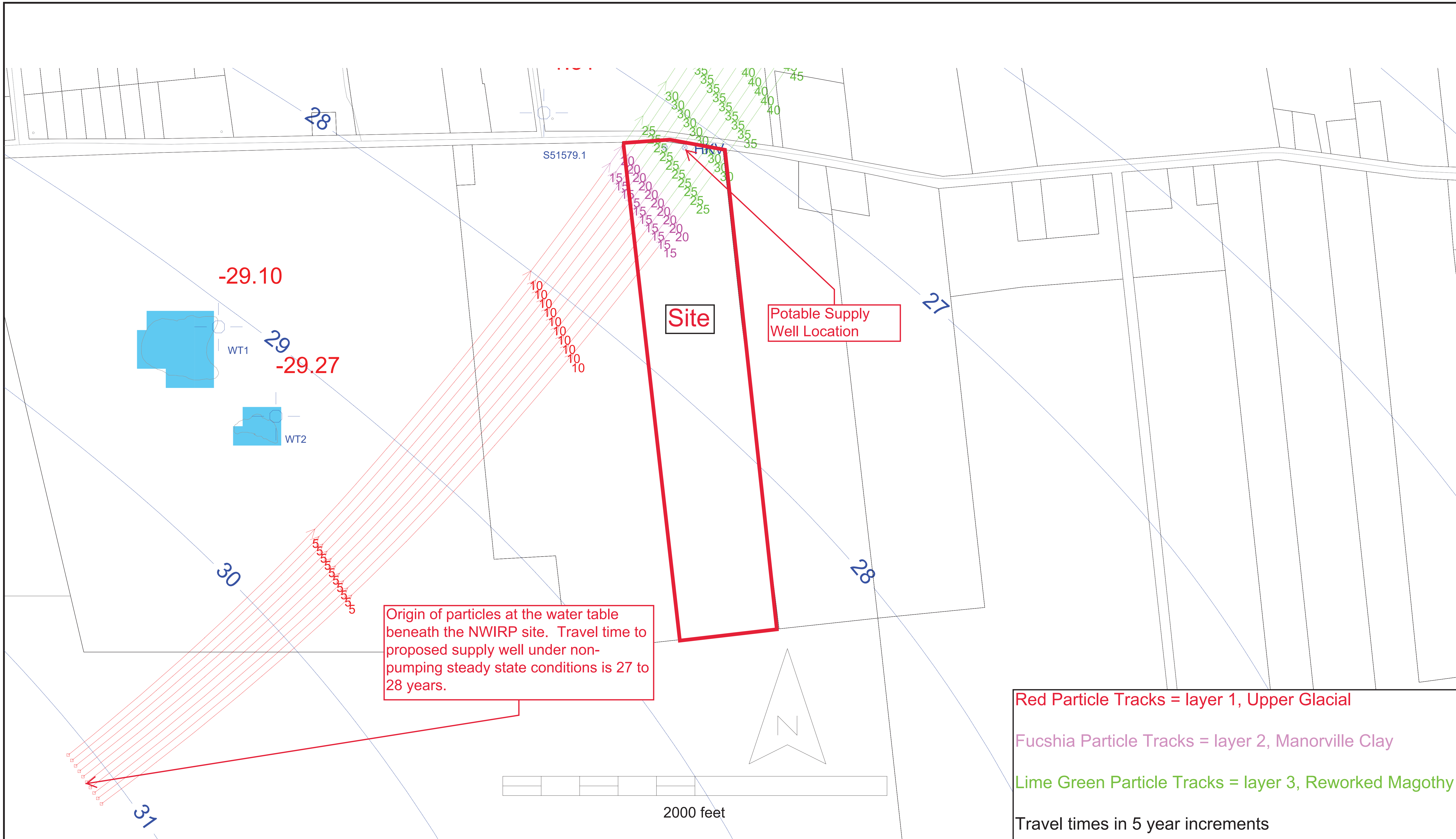

Figure No. 9 - Particle Tracks Under Non-Pimping Steady State Conditions

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Figure No. 10 - Static Conditions at Fire Protection Well - Layer 3 - Reworked Magothy

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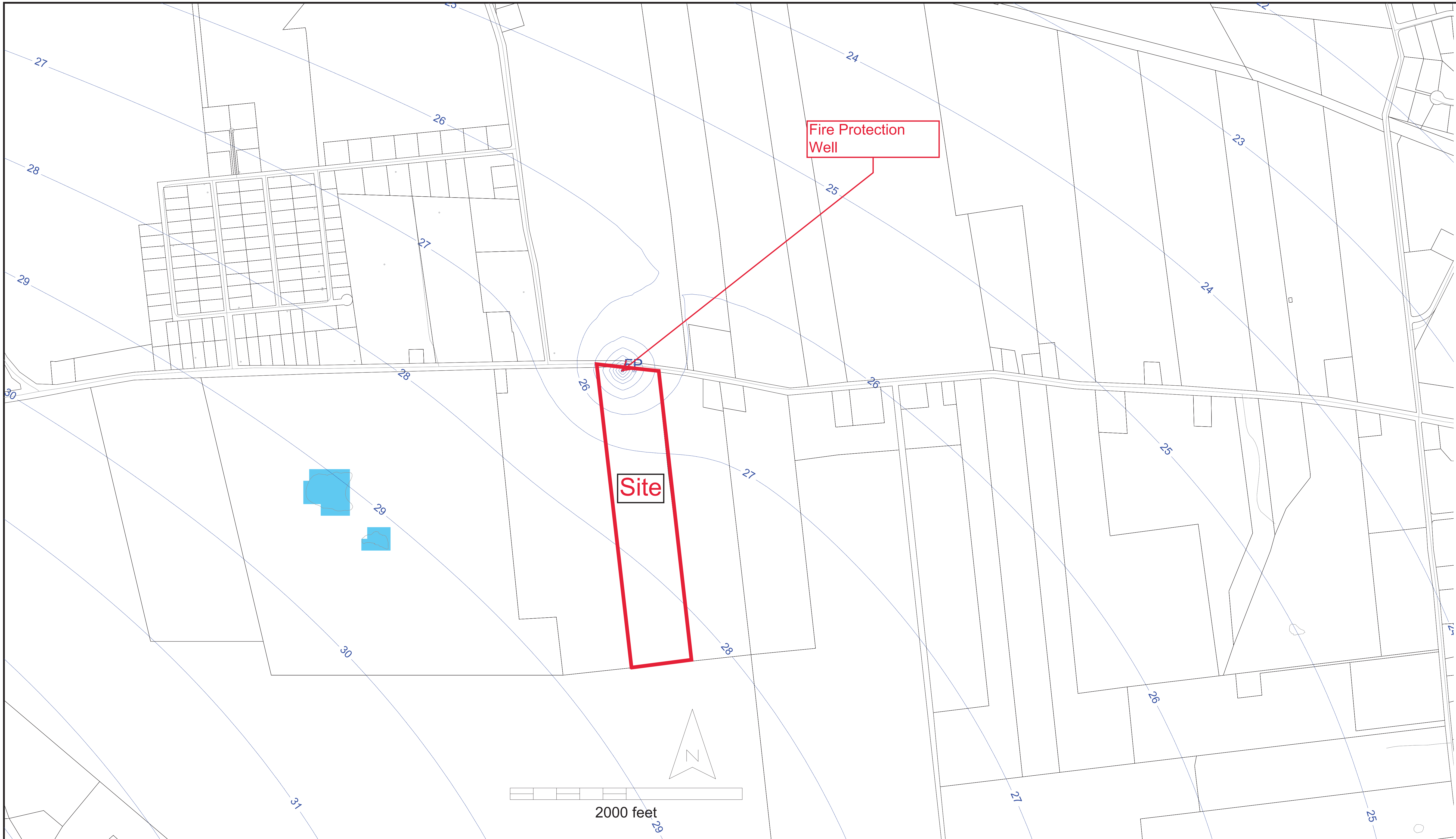

Figure No. 11 - 2 Hours of Pumping at 375 GPM - Fire Protection Well - Layer 3 - Reworked Magothy

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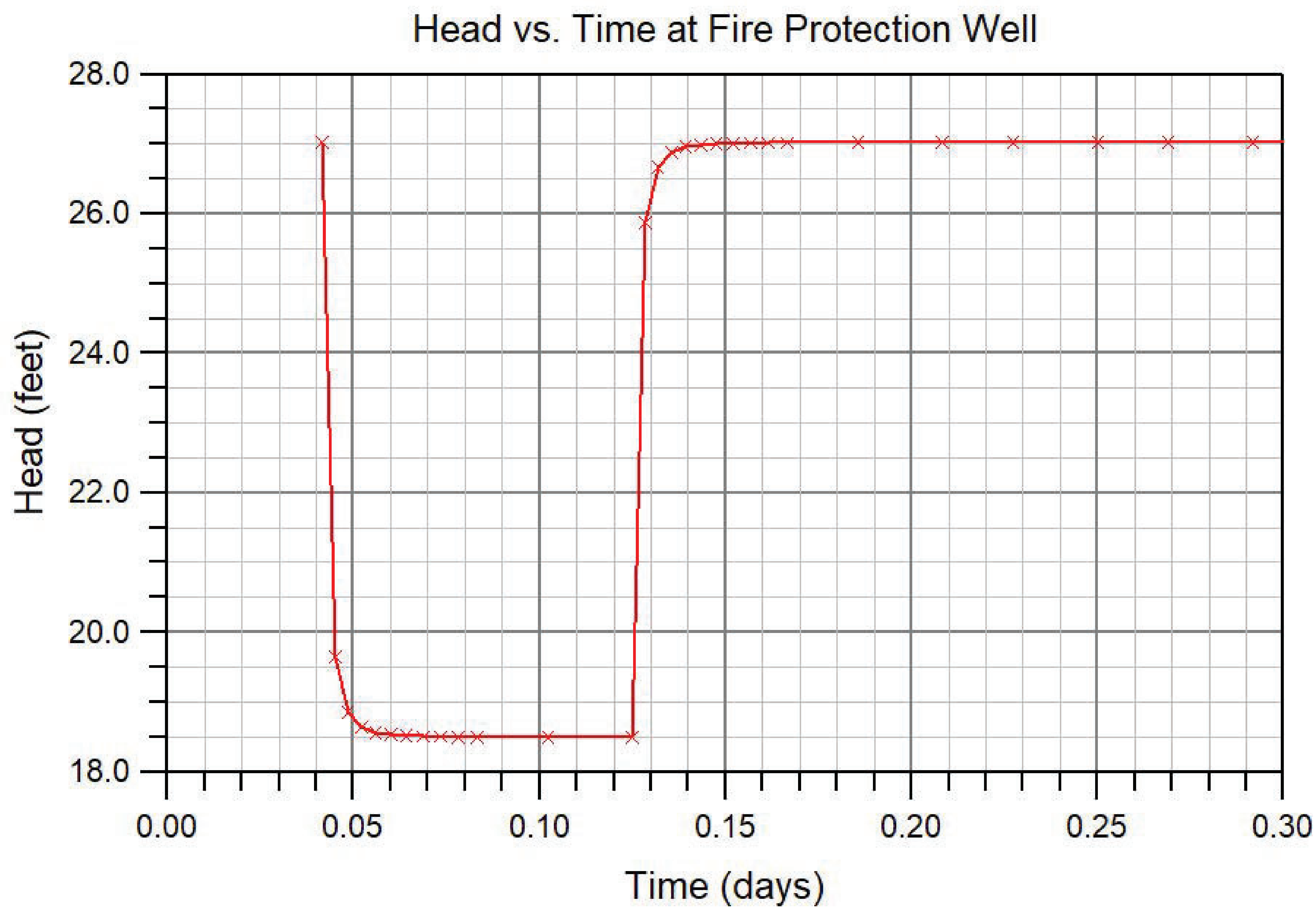

TRANSIENT CONDITIONS FIRE PROTECTION WELL - PUMPING WATER LEVELS AT FIRE PROTECTION WELL

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TRANSIENT CONDITIONS FIRE PROTECTION WELL - PUMPING WATER LEVELS AT FIRE PROTECTION WELL

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FIGURE 12

Sheet 13 of 19

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Figure No. 13 - Static Conditions at Hydrant Well - Layer 3 - Reworked Magothy

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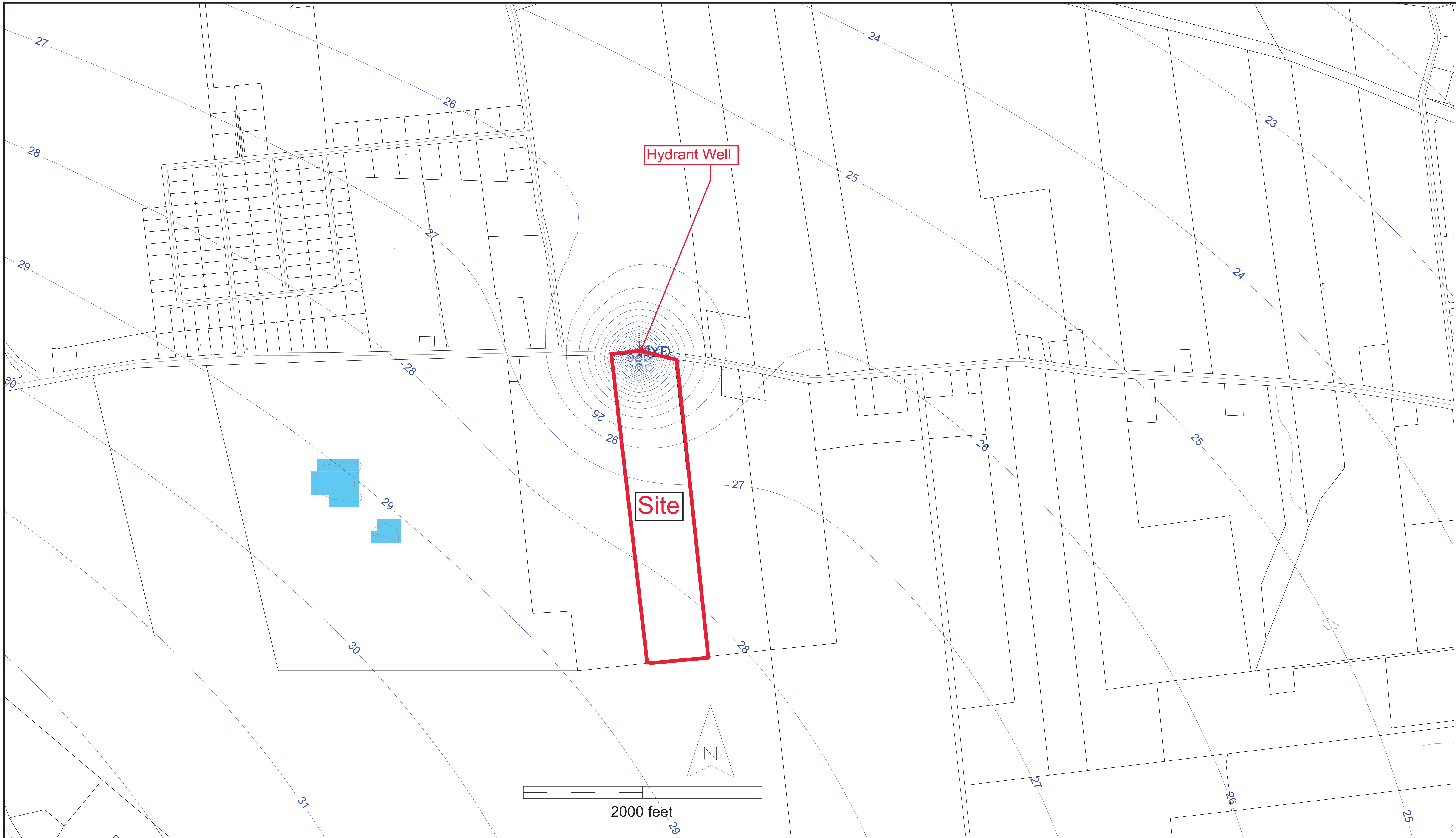

Figure No. 14 - Hydrant Well - 2 Hours Pumping at 1,500 GPM - Layer 3 - Reworked Magothy

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30 Groundwater Contour (feet)

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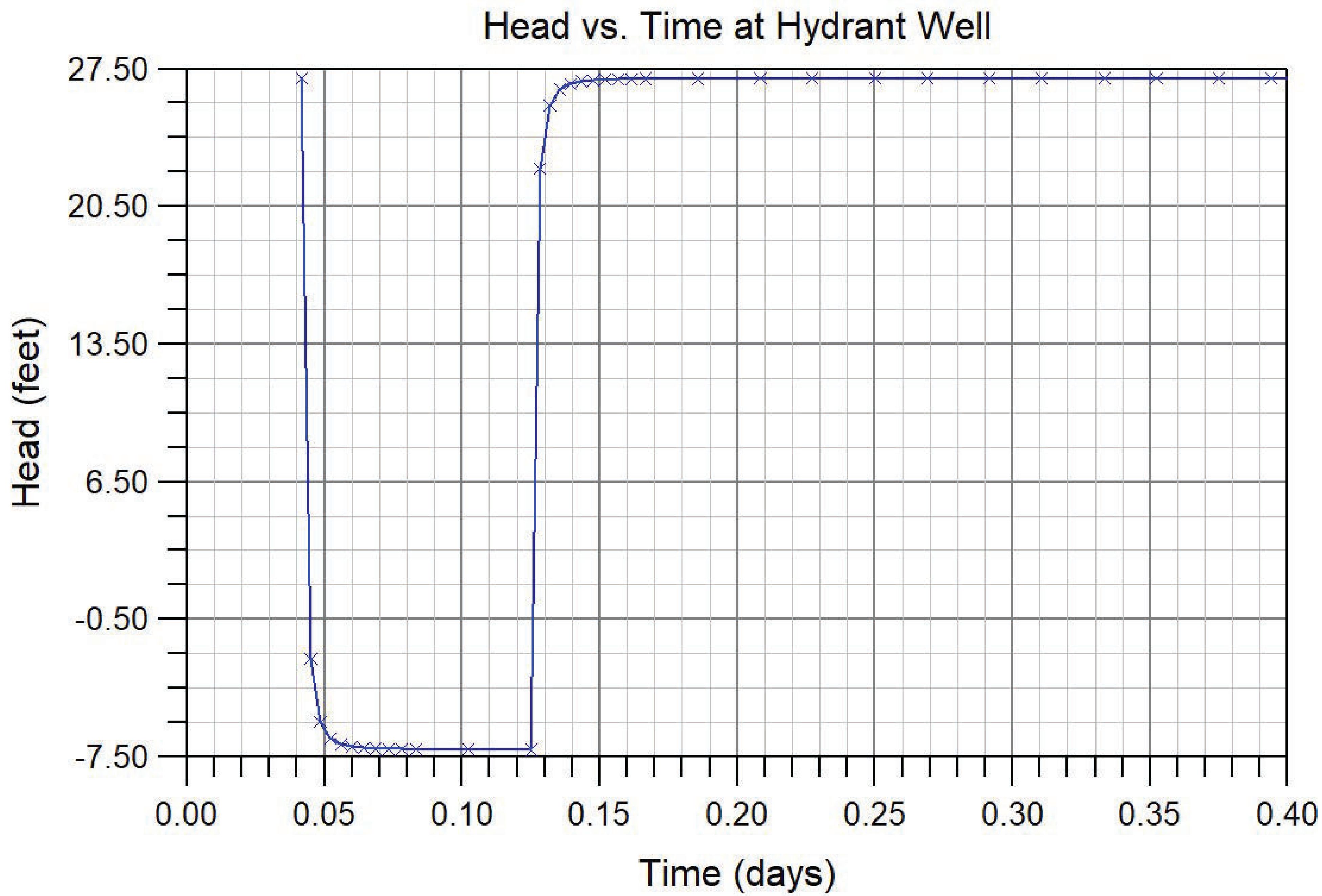

WATER LEVEL CONDITIONS AT HYDRANT WELL

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Regulatory Reference Number:

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WATER LEVEL CONDITIONS AT HYDRANT WELL

Drawing Number:
FIGURE 15

Sheet 16 of 19

PWGC Project Number:
TPO2001

Figure No. 16 - Static Conditions - Layer 1

4285 Middle Country Road, Calverton, NY

Groundwater Modeling Report

P.W. Grosser Consulting, Inc. Project No. TPO2001 - 04/01/2021

30 Groundwater Contour (feet)

PWGC
CLIENT DRIVEN SOLUTIONS
P.W. Grosser Consulting, Inc.

Figure No. 17 - Hydrant Well Pumping at 1,500 GPM in Layer 3 - Water Table Conditions in Layer 1

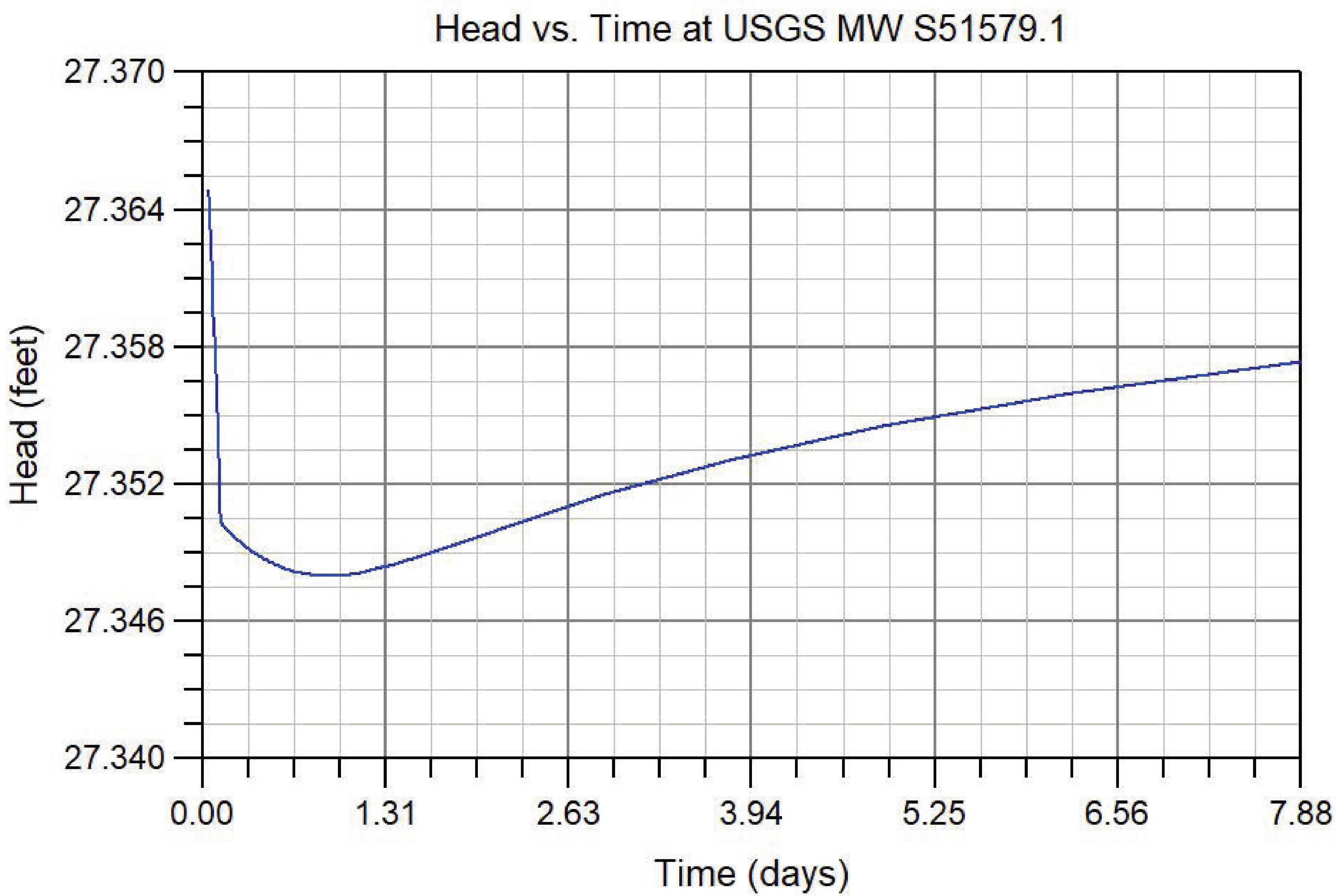
4285 Middle Country Road, Calverton, NY

Groundwater Modeling Report

P.W. Grosser Consulting, Inc. Project No. TPO2001 - 04/01/2021

30 Groundwater Contour (feet)

PWGC



USGS MW 51579.1 - LAYER 1 - HEAD VS TIME

PWGC
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CONSULTANTS

Number	Revision Description	Revision Date
7		
6		
5		
4		
3		
2		
1		

Designed By	PKB	Date Submitted	3/29/2021
Drawn By	HS	Date Created	3/29/2021
Approved By	PKB	Scale	NTS

Client:
HK VENTURES, LLC
399 WEST JOHN STREET
HICKSVILLE, NY 11801

Project:
4285 MIDDLE COUNTRY RD
GROUNDWATER MODELING

Project Address:
4285 MIDDLE COUNTRY ROAD
CALVERTON, TOWN OF RIVERHEAD
SUFFOLK COUNTY, NEW YORK

County Tax Map Number:

Contract Number:

Regulatory Reference Number:

Title of Drawing:

USGS MW 51579.1 - LAYER 1 - HEAD VS TIME

Drawing Number:
FIGURE 18

Sheet 19 of 19

PWGC Project Number:
TPO2001