Appendix J-4
Review of SONIR Model

FP&M, Inc.

June 29, 2017

NELSON POPE & VOORHIS, LLC
ENVIRONMENTAL • PLANNING • CONSULTING

FPM group Engineering and Environmental Science

FPM Group, Ltd.
FPM Engineering Group, P.C.
formerly Fanning, Phillips and Molnar

CORPORATE HEADQUARTERS
909 Marconi Avenue
Ronkonkoma, NY 11779
631/737-6200
Fax 631/737-2410

June 29, 2017

Mr. Mark Hissey, Executive Vice President
Discovery Land Company
14605 N. 73rd Street
Scottsdale, AZ 85260

Re: **Nitrogen Budget Review**
The Hills at Southampton, East Quogue, New York
FPM File No. 1269g-17-01

FPM Group (FPM) was retained by Discovery Land Company (DLC) to professionally peer-review the nitrogen budget developed for the above-referenced proposed Planned Development District (PDD) project. The review included a check of the inputs and results for the Simulation of Nitrogen in Recharge (SONIR) model runs, considering the available information concerning input values, existing groundwater quality, groundwater modeling results, proposed wastewater management, a contemplated irrigation water source, and related issues. The information reviewed includes data and SONIR information documented in the Draft Environmental Impact Statement (DEIS) prepared by Nelson, Pope & Voorhis, LLC (NP&V) and additional data and updated SONIR model runs provided by Charles Voorhis, CEP, AICP of NP&V, which we understand will be included in the Final EIS (FEIS) for the project.

We note that the nitrogen budget and related information have previously been reviewed by other peers, including Leggette, Brashears & Graham, Inc. (for the Group for the East End), P.W. Grosser Consulting, Inc. (for DLC), and Dr. A. Martin Petrovic on behalf of the Town of Southampton. These reviews supported the use of the SONIR model and resulted in some recommendations for minor changes to the input data. FPM used the reports from these earlier peer reviews during its evaluation of the SONIR model inputs.

FPM's evaluation was performed by Ms. Stephanie Davis, PG, with senior-level review by Dr. Kevin Phillips, PE. Ms. Davis is a licensed Professional Geologist in New York State, has both Bachelors and Masters degrees in geology, has been practicing professionally as a geologist since 1984, and has practiced professionally as a hydrogeologist focusing on soil and groundwater conditions in Suffolk County since 1993. Dr. Phillips is a licensed Professional Engineer in New York State (as well as nine other states) and has a Bachelor's degree in civil engineering, a Master's degree in Hydrodynamics, an engineering degree in water resources, and a Ph.D. in environmental engineering. Dr. Phillips has over 35 years of experience that includes groundwater hydrology, contaminant transport, environmental remediation, water quality evaluations, and wastewater management, with a focus on projects on Long Island and

in the greater New York metropolitan area. Both Ms. Davis and Dr. Phillips have previous experience with evaluation of SONIR model runs.

Project Conditions Considered

The SONIR model was used to evaluate nitrogen loading under several different property conditions, as follows:

- Existing conditions on the property, without the proposed development;
- A PDD of 117 resort homes (60-day and 183-day occupancies) and golf course, with a sewage treatment plant (STP), and a nitrogen leaching rate of 10% to 20% for turf;
- Development under existing zoning (Alternative 2a): 118 to 165 homes (year-round and seasonal occupancy), with either standard sanitary waste management systems or innovative alternative systems, and a nitrogen leaching rate of 30% for turf; and
- An equestrian facility with 88 homes, as suggested by the Group for the East End.

The model uses input parameters to first calculate the amount of groundwater recharge from the range of land uses and water sources on the property, and then uses a second set of input parameters to calculate the amount of nitrogen in the recharged water.

Model Inputs for Groundwater Recharge

Each model run was developed using input data to calculate the amount of groundwater recharge for each development scenario. The key input data for the recharge calculations were reviewed and are summarized as follows:

Area of Site - This represents the total area of the project, which is 591 acres. The same value was used for all model runs and is consistent with the overall size of the project area.

Precipitation Rate – This is the annual rainfall and snowmelt total for the project area. Precipitation data from the NOAA National Climatic Data Center was obtained for the 30-year period from 1981 to 2010 for the two closest weather stations: Bridgehampton, NY (30-year average = 50.1 inches) and Brookhaven, NY (30-year average = 49.9 inches). The value for Brookhaven (49.9 inches) was used for all model runs. This value is likely to best represent the precipitation rate for the project area, which is located slightly closer to Brookhaven.

Acreage of Fertilized – This is the area of the property that is planted in fertilizer-dependent vegetation (turf, crops, etc.) and is irrigated. If multiple areas of fertilizer-dependent vegetation are present, then these are input separately. The property conditions that were modeled, as noted above, include different areas and types of fertilizer-dependent vegetation. For example, the existing conditions include one farm and one tree nursery, while the PDD conditions include areas of golf course roughs, areas of landscaping, and areas of greens, tees, and fairways. Development under the existing zoning conditions is anticipated to include areas of fertilized and unfertilized landscaping. The acreage for each of these areas was checked for each model run and found to be generally consistent with the proposed conditions described in the DEIS (Table 5-1).

Evapotranspiration from Fertilized – This is the rate of natural water loss (in inches per year) from both evaporation and plant transpiration in the project areas that are fertilized. Evapotranspiration (ET) rates are dependent on climate, soil type, and the type of vegetation present. The ET rates used in the model were based on ET rates determined by the USGS, as documented in their publication concerning groundwater recharge rates in Suffolk and Nassau counties (USGS WRI Report 86-4181), and were selected to be consistent with the soil types at the property, which include primarily Carver Plymouth Sands, Plymouth Loamy Sand, and Riverhead Sandy Loam, and the types of vegetation either present (existing conditions) or contemplated (PDD or Alternative 2a existing zoning). The selected ET rates were reviewed and appeared to be consistent with the published rates.

Runoff from Fertilized – This is the rate (in inches per year) of precipitation that runs off of the ground surface from the project areas that are fertilized. Runoff rates are dependent on surface slope, vegetation type, and soil infiltration capacity. The runoff rates used in the model were based on runoff rates estimated by the USGS (USGS WRI Report 86-4181) for Nassau County (2.1% of precipitation), Suffolk County (0.7% of precipitation) and Long Island in general (1% of precipitation), as modified by professional judgement based on slope and vegetation types. Based on the precipitation rate of 49.9 inches per year, generalized runoff rates of 0.35 inches per year to 0.5 inches per year may be calculated, assuming that the Suffolk County and overall Long Island runoff rates are most applicable to the project area. We noted that a slightly higher runoff rate (1.05 inches per year, the same as for unvegetated areas) was used for the fertilized areas associated with the model runs for the PDD development scenarios, while 0.35 inches per year was used for the fertilized areas for all other model runs. NP&V was informed of this issue and the runoff rates were adjusted to 0.5 inches per year for all turf and agriculture (fertilized areas) and the models were re-run with the adjusted values, with no significant change noted.

Acreage of Unvegetated – This is the area of unvegetated and unpaved surfaces, including unvegetated soils, dirt roads, and unpaved trails. In all of the model runs, this was taken to be the acreage of unvegetated dirt roads. The acreage for each of these areas was checked for each model run for the PDD and Alternative 2a scenarios and found to be consistent with the proposed conditions described in the DEIS (Table 5-1).

Evapotranspiration from Unvegetated – This is the rate of natural water loss (in inches per year) from evaporation from unvegetated and unpaved surfaces and was reported to have been estimated at 30% of the ET from vegetated surfaces. We noted that an ET rate of 6.36 inches per year was used model runs for the PDD development scenarios, while 21.20 inches per year was used for all other model runs. This issue was reported to NP&V and the ET rate for unvegetated surfaces was adjusted to 6.36 inches per year for all of the development scenarios. The models were re-run by NP&V using the adjusted values, with no appreciable change noted.

Runoff from Unvegetated - This is the rate (in inches per year) of precipitation that runs off of unpaved and unvegetated ground surfaces. The runoff rate for unvegetated surfaces used in all of the model runs was based on the runoff rate estimated by the USGS (USGS WRI Report 86-4181) for Nassau County (2.1% of precipitation) and was calculated to be 1.05 inches per year.

Acreage of Water - This is the total area of all surface water features (ponds, wetlands) in the project area. The acreage of surface water was checked for each model run for the PDD and Alternative 2a scenarios and found to be generally consistent with the proposed conditions described in the DEIS (Table 5-1).

Evaporation from Water – This is the rate of natural water loss (in inches per year) from evaporation from surface water features. The value of 30.00 inches per year was obtained from the USGS, which has estimated local surface water evaporation rates at Brookhaven National Laboratory and vicinity (USGS Bulletin 1156); this value was used in all of the model runs.

Acreage of Natural - This is the total area of the project that includes natural vegetation and areas that are to be revegetated with natural vegetation. The acreage of natural vegetation was checked for each model run and found to be generally consistent with the proposed conditions described in the DEIS. A minor difference was noted for the PDD scenarios and is likely due to some site plan changes since the DEIS was prepared.

Evapotranspiration from Natural – This is the rate of natural water loss (in inches per year) from both evaporation and plant transpiration in the project areas that are naturally vegetated. The ET rate used in the model was determined by the USGS, as described above, and was assumed to be the same for natural vegetation in each of the model runs, and comparable to the ET rate used for landscaped, non-turf areas.

Runoff from Natural – This is the rate (in inches per year) of precipitation that runs off of the ground surface from the project areas that are naturally vegetated. The runoff rate for natural vegetation used in all the model runs (0.35 inches per year) is based on the runoff rate estimated by the USGS (USGS WRI Report 86-4181) for Suffolk County (0.7% of precipitation) and the precipitation rate of 49.9 inches per year. This relatively low runoff rate is typical under natural conditions.

Acreage of Impervious – This is the total area of impervious surfaces (pavement, building roofs, etc.) in the project area for each proposed scenario. The acreage of impervious surfaces was checked for each model run for the PDD and Alternative 2a scenarios and found to be consistent with the proposed conditions described in the DEIS.

Evaporation from Impervious - This is the rate of water evaporation from impervious surfaces and is estimated to be approximately 10% of total precipitation on impervious surfaces in the Pine Barrens of Southampton (Cornell Center for Environmental Research, 1983). This value (4.99 inches per year) was used in each of the model runs.

Runoff from Impervious – This is the rate (in inches per year) of precipitation that runs off of the ground surface from the project areas that are impervious. Runoff from impervious surfaces is, or will be, diverted to leaching structures for recharge under all of the scenarios considered and, therefore, the value for runoff is appropriately set at 0 inches for all of the model runs.

Acreage of Other Area – This input includes the total area of other types of surfaces that may be included in the project area that are not otherwise categorized and may have somewhat different evapotranspiration and runoff properties. For all of the development scenarios considered, it is planned to include 1.4 acres of Other Area: in the case of the PDD scenarios there are planned to be rain gardens to manage a portion of the stormwater, in the case of the Alternative 2a scenarios there would be recharge basins to manage a portion of the stormwater, and in the case of the equestrian scenarios there would be wetlands. The acreage of rain gardens, recharge basins, and wetlands is consistent for each development scenario.

Evaporation from Other Area – Under the PDD scenarios the Other Area includes rain gardens, which are estimated to have an evaporation rate somewhat higher than natural vegetation (due to the presence of some free water surface), but a lower evaporation rate than that for surface water (due to the presence of some vegetation). An evaporation rate of 23.90 inches per year was used for the rain garden areas and appears to be reasonable. Under the Alternative 2a and equestrian scenarios the Other Area includes recharge basins and wetlands, which are anticipated to have an evaporation rate comparable to the evaporation rate for surface water. An evaporation rate of 30.00 inches per year was used for the recharge basin and wetland areas and appears to be reasonable.

Runoff from Other Area – This is the rate (in inches per year) of precipitation that runs off of the Other Area, which includes either rain gardens or recharge basins in all of the development scenarios. As these features are intended to recharge stormwater and no runoff is anticipated, the value for runoff is appropriately set at 0 inches for all of the model runs.

Acreage of Land Irrigated – This input accounts for areas where irrigation is used – this input is in addition to the precipitation-derived water considered in the inputs described above. For the Existing Conditions scenario, this area includes the acreage of the existing farm and nursery. For the proposed PDD, this acreage includes all of the landscaped areas (golf course, landscaping, etc.). For the Alternative 2a analyses, this acreage includes all of the landscaped areas. For the equestrian analyses, this acreage is variable.

Irrigation Rate – The irrigation rates used in the model runs were based on information provided from several sources, including the Cornell University Center for Environmental Research for a range of residential irrigation rates (16 to 24 inches per year) and a site-specific irrigation rate for the proposed golf course (21.40 inches per year) developed by golf course hydrologist Paul Granger. The input rates used in the model runs were reviewed and found to be consistent with the provided information.

Number of Dwellings – The number of proposed dwellings was checked for each modeled scenario and found to be consistent with the number of dwellings under consideration in that scenario.

Water Use per Dwelling - A value of 300 gallons per day of water use per dwelling was used for all of the model runs and is consistent with the SCDHS wastewater design flow for single-family homes (SCDHS, 1984).

Wastewater Design Flow/Adjusted Wastewater Design Flow – These values were reviewed and found to be consistent with the calculated wastewater flow from the proposed numbers of residences, as adjusted by consideration of the additional flow from the clubhouse and other community buildings, and consideration of flow reductions due to seasonal occupancy.

Model Calculations for Recharge

The SONIR model uses the input recharge parameters to calculate the amount of groundwater recharge from each portion of the property. These calculations are performed for all of the land uses applicable to each development scenario, including fertilized areas, unvegetated areas, surface water areas, natural areas, etc. The calculations in the SONIR model runs were spot-checked to confirm that the appropriate input parameters for recharge were applied during the

calculation stage and it was found that the input parameters had been applied in the correct areas of the calculations.

Model Inputs for Nitrogen

The nitrogen in recharge to groundwater is calculated based on the amount of nitrogen in each component of recharged water. The amount of nitrogen in each recharge component is calculated based on nitrogen data inputs, similar to the recharge components discussed above. The key input data for the nitrogen calculations were reviewed and are summarized as follows:

Persons per Dwelling - The Long Island Nitrogen Action Plan, or LINAP (SCDHS and NYSDEC, January 2017, not yet published) contains the most recent demographic information for the project area. An average household size of 2.9 persons was reported for East Quogue and is used for each of the model runs.

Nitrogen per Person per Year – Both the USGS and the LINAP report 10 pounds of nitrogen per person per year – this value is used for each of the model runs.

Sanitary Nitrogen Leaching Rate – This is the amount of nitrogen in sanitary waste that leaches into the soil from a sanitary waste disposal system. The Cornell University Center for Environmental Research reports a 50% nitrogen leaching rate from conventional sanitary waste disposal systems (Hughes and Porter, 1983), while the more recent LINAP (SCDHS and NYSDEC, January 2017, not yet published) reports an 84% leaching rate. The LINAP rate was used for all of the model runs reviewed and, therefore, the resulting calculations are anticipated to be conservative (high) with respect to the amount of nitrogen in recharge from the sanitary systems. However, we understand that an advanced sanitary waste treatment system (Baswood BioVore system) is presently under consideration for the PDD. This system is reported to reduce the amount of nitrogen in sanitary wastewater to less than 10 milligrams per liter (mg/l) consistent with effluent discharge limitations. If this system is used and functions as designed, then the sanitary wastewater nitrogen leaching rate used in the model runs is high relative to the actual amount of nitrogen that will be recharged by sanitary wastewater.

Areas of Land Fertilized and Fertilizer Application Rates – The Areas of Land Fertilized correspond to the fertilized areas defined in the recharge input parameters; these were spot checked and found to be consistent for each of the model runs. The Fertilizer Application Rates correspond to the amount of nitrogen anticipated to be applied to each fertilized area. Fertilizer application rates used in the model runs were derived from several studies (Non-Point Source Management Handbook, LINAP, USGS), consultation with a local commercial landscaping firm, site-specific data from local golf courses (Golf at the Bridge and Sebonack Golf Course by A. Martin Petrovic, PhD., Cornell University), and project-specific information in the Integrated Turf Health Management Plan (ITHMP) developed for the proposed golf course (East Quogue Golf Corporation, June 2016). The application rates used in the model runs for the PDD were consistent with the rates in the ITMHP for the proposed golf course, the application rates used in the Alternative 2a and equestrian model runs were consistent with the Non-Point Source Management Handbook (LIRPB, 1983) and local contractor information, and the application rates for the existing agricultural conditions were consistent with USGS information for the Pine Barrens area of Southampton.

Fertilizer Nitrogen Leaching Rates - The Fertilizer Nitrogen Leaching Rates correspond to the amount of nitrogen in fertilizer that is not taken up by plants or stored in thatch or soil and, therefore, is anticipated to leach in recharged water. Fertilizer nitrogen leaching rates used in the model runs were derived from several studies (LI Regional Planning Board Special Groundwater Protection Plan, Cornell University School of Integrative Plant Science, LINAP), and site-specific data from local golf courses (Golf at the Bridge and Sebonack Golf Course by A. Martin Petrovic, PhD., Cornell University). The ranges of leaching rates have also been discussed in technical meetings (February 1, 2017) and subject to other peer review (P.W. Grosser Consulting, Inc.). While there seems to be agreement about the nitrogen leaching rate (30%) from fertilized areas that are not managed under an ITHMP, there is less agreement about the amount of nitrogen that is leached from turf and other fertilized areas managed under an ITHMP (10% to 20%). Therefore, the model runs for the Alternative 2a scenarios were run assuming a 30% leaching rate, while the PDD scenarios (where an ITHMP will be used) were run at both 10% and 20% nitrogen leaching rates to evaluate the potential range of nitrogen loads. The model run for the equestrian scenario that includes a fertilized area was run with a 30% leaching rate.

Cat and Dog Outdoor Populations, Waste Nitrogen Loads, and Nitrogen Leaching Rates – These model inputs account for the anticipated nitrogen loads resulting from household pets that are not solely indoor pets and where the outdoor pet waste is not removed from the ground surface. Values for these parameters were derived from values available in the LINAP and published by the USGS and in the LI Regional 208 Study. The values were checked and found to be consistent for each of the model runs. An adjustment was made for the model scenarios where the residences were to be occupied seasonally or part-time; this adjustment reflected the contemplated occupancy duration.

Area of Land Irrigated and Irrigation Rate – These values are transferred directly from the input recharge parameters as noted above. These values were checked and all found to correspond accurately to the recharge inputs.

Irrigation Nitrogen Leaching Rate - The Irrigation Nitrogen Leaching Rate corresponds to the amount of nitrogen in irrigation water that is not taken up by plants or stored in thatch or soil and, therefore, is anticipated to leach in recharged water. Irrigation nitrogen leaching rates used in the model runs were reported to have been derived from a study published by the Cornell University Center for Environmental Research (Hughes and Porter, 1983), which noted irrigation nitrogen leaching rates in the range of 10% to 15%. We note that the irrigation nitrogen leaching rate used in the model runs for the PDD and equestrian scenarios was 10%, while the irrigation nitrogen leaching rate used in the model runs for the Alternative 2a scenarios was 30%. This difference was reported to be supported by the LINAP.

Atmospheric Nitrogen Application/Load – This input parameter reflects the amount of nitrogen that will be recharged due to nitrogen in natural precipitation. A value of 0.041 pounds per 1,000 square feet, which is based on the most recent data (LINAP, January 2017) is used for each of the model runs.

Atmospheric Nitrogen Leaching Rate – This input parameter reflects the amount of nitrogen from rainfall that will be recharged through each type of surface (natural/wetlands, turf/golf course, or agricultural/impervious/other). The leaching rates for each surface type are reported to be based on the most recent data (LINAP, January 2017). We note that a leaching rate of 25% was used for the natural/wetlands surface type for all of the model runs and a leaching rate of 40% was used for agricultural/impervious/other for all of the model runs. A leaching rate of 20% was used for the golf course surfaces for the PDD model runs, while a leaching rate of 30% (consistent with the irrigation nitrogen leaching rate) was used for the turf areas under Alternative 2a model runs; this difference was reported to be supported by the LINAP (January 2017).

Nitrogen in Water Supply – This input parameter reflects the amount of nitrogen in the potable water supply for the project. The value of 2.00 mg/l per liter was used for all model runs and reflects the amount of nitrogen reported by the SCWA for public water supplied in the project vicinity (average of 2.02 mg/l in 2015 and 1.88 mg/l in 2016).

Nitrogen in Commercial/STP Flows – These input parameters allow for computation of nitrogen inputs from recharge from one or more community-type sewage treatment systems. Total nitrogen in community wastewater is reported to range from 20 to 85 mg/l, depending on the strength of the effluent entering the system. A value of 50 mg/l was used to represent conditions associated with a typical commercial sanitary waste management system. Denitrification systems and sewage treatment plants (STPs) may reduce nitrogen to 10 mg/l; this value was used for those model runs that incorporate an STP or denitrification system. Alternative wastewater treatments systems now approved for use for single-family homes in Suffolk County are reported to reduce nitrogen in their effluent to 19 mg/l; this value was used for those model runs under Alternative 2a that include such alternative systems. As discussed above, an advanced sanitary waste treatment system (Baswood BioVore system) is presently under consideration for the PDD. This system is reported to reduce the amount of nitrogen in sanitary wastewater to less than 10 mg/l. We understand that the SONIR model runs may be updated to reflect this lower amount of nitrogen in its effluent.

Horse Manure Nitrogen - Several additional input parameters were included in the two equestrian scenarios considered to account for the added nitrogen impact from horse manure. These input parameters, where comparable to the other parameters, appeared to be consistent with the other model inputs and supported by the Summary of Environmental Issues for Hills at Southampton Proposed Equine Alternative, J.L. Seeman, CEP/CGCS & E.M. Toth, Equestrian Trainers, dated June 29, 2017 included as Appendix T in the Final EIS.

Model Calculations for Nitrogen Budget

The SONIR model uses the input nitrogen parameters together with the results from the recharge calculations to calculate the amount of nitrogen that will result from each source and then the total nitrogen in recharge in units of pounds per year for the overall site under each use scenario. The calculations in the SONIR model runs were spot-checked to confirm that the appropriate input parameters for nitrogen in recharge were applied during the calculation stage and it was found that the input parameters had been correctly applied.

The total nitrogen loads were calculated to be as follows: 995 pounds per year for the existing conditions, 1,164 to 1,817 pounds per year for the range of PDD scenarios considered, 3,985 to

7,013 pounds per year for the range of existing zoning (Alternative 2a) scenarios considered, and 2,908 to 5,369 pounds per year for the range of equestrian facility alternatives considered, as shown on the attached Nitrogen Load Comparison chart. Although there may be some variation in the values of some of the input parameters, overall, the difference between the calculated nitrogen loads for the PDD development scenarios and the existing zoning and equestrian development scenarios is significant, with the PDD scenarios resulting in much lower nitrogen loads (over 50% lower) than the lowest existing zoning scenario, even when seasonal occupancy and use of innovative alternative wastewater treatment systems are considered, and almost 40% lower than the lowest equestrian scenario.

Additional Considerations

Additional measures are contemplated to provide for further reductions in nitrogen load for the PDD scenarios. The most significant of these measures is the proposed use of existing nitrogen-impacted groundwater that flows beneath the southern portion of the project area for irrigation purposes, also known as fertigation.

Groundwater quality in the Upper Glacial Aquifer in the southern portion of the project area is impacted by nitrogen from upgradient sources. Groundwater from the SCWA Spinney Road well #2, which is located near the southwestern portion of the property, shows an average nitrate level of 12.90 mg/l over the past 7 years, as demonstrated on the attached graph. Shallow monitoring wells installed on this area of the property demonstrate that total nitrogen levels are as high as 28.7 mg/l (TW-1 location) in this area, as shown on the attached shallow well location map. A vertical profile through much of the Upper Glacial Aquifer in this area demonstrates that the average nitrate concentration in the uppermost 65 feet of the aquifer is about 14.26 mg/l (see attached vertical profile well results). It is proposed to use groundwater from this area to provide irrigation water for a portion of the golf course, thereby removing nitrogen from the aquifer and reducing the need for fertilizer, both actions which will reduce the nitrogen load to the aquifer. Based on the existing data, a conservative nitrate value of 10 mg/l was used to calculate the anticipated nitrogen reduction from use of the nitrogen-impacted groundwater for fertigation. The results from these calculations are depicted graphically on the attached Nitrogen Load Comparison chart and demonstrate that a reduction of approximately 1,876 pounds on nitrogen per year is anticipated to be achieved through fertigation.

Use of a fertigation well was modeled by P.W. Grosser Consulting, Inc, and the results were included as Appendix L-5 of the DEIS. The model results were used to optimize the location of the fertigation well to most effectively intercept the nitrogen-impacted groundwater. The potential impacts of the fertigation well on nearby SCWA supply wells and on the overall conditions in the Upper Glacial Aquifer were also evaluated and it was concluded that these impacts would be minor and transient.

Additional potential reductions in nitrogen loading are contemplated through funding for existing sanitary waste disposal system upgrades, purchase of Pine Barrens Credits, and a land purchase. The estimated nitrogen reductions via these measures are shown graphically on the attached Nitrogen Load Comparison chart and the quantity calculations were verified during our review.

If implemented, the reduction of nitrogen loading on the aquifer via fertigation and these additional measures would be significant and is calculated to exceed the load that would be

placed on the aquifer via the PDD development scenarios. Overall, these additional measures that are proposed to be implemented under the PDD development scenarios are calculated to result in a net negative nitrogen load on the aquifer, and the result is that the proposed PDD will have a lower nitrogen load than the existing conditions, development under the existing zoning, or development with an equestrian facility.

Very truly yours,

Senior Project Manager
Vice President

Dr. Kevin Phillips, PE
Principal

SOD:sod
Attachments

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References

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Koppelman, Lee, 1978. *208 Areawide Waste Treatment Management Handbook.* Nassau-Suffolk Regional Planning Board, Hauppauge, NY.

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SCDHS, 1984. *Standards for Subsurface Sewage Disposal System for Other than Single-Family Residences.* Division of Environmental Quality, Hauppauge, NY.

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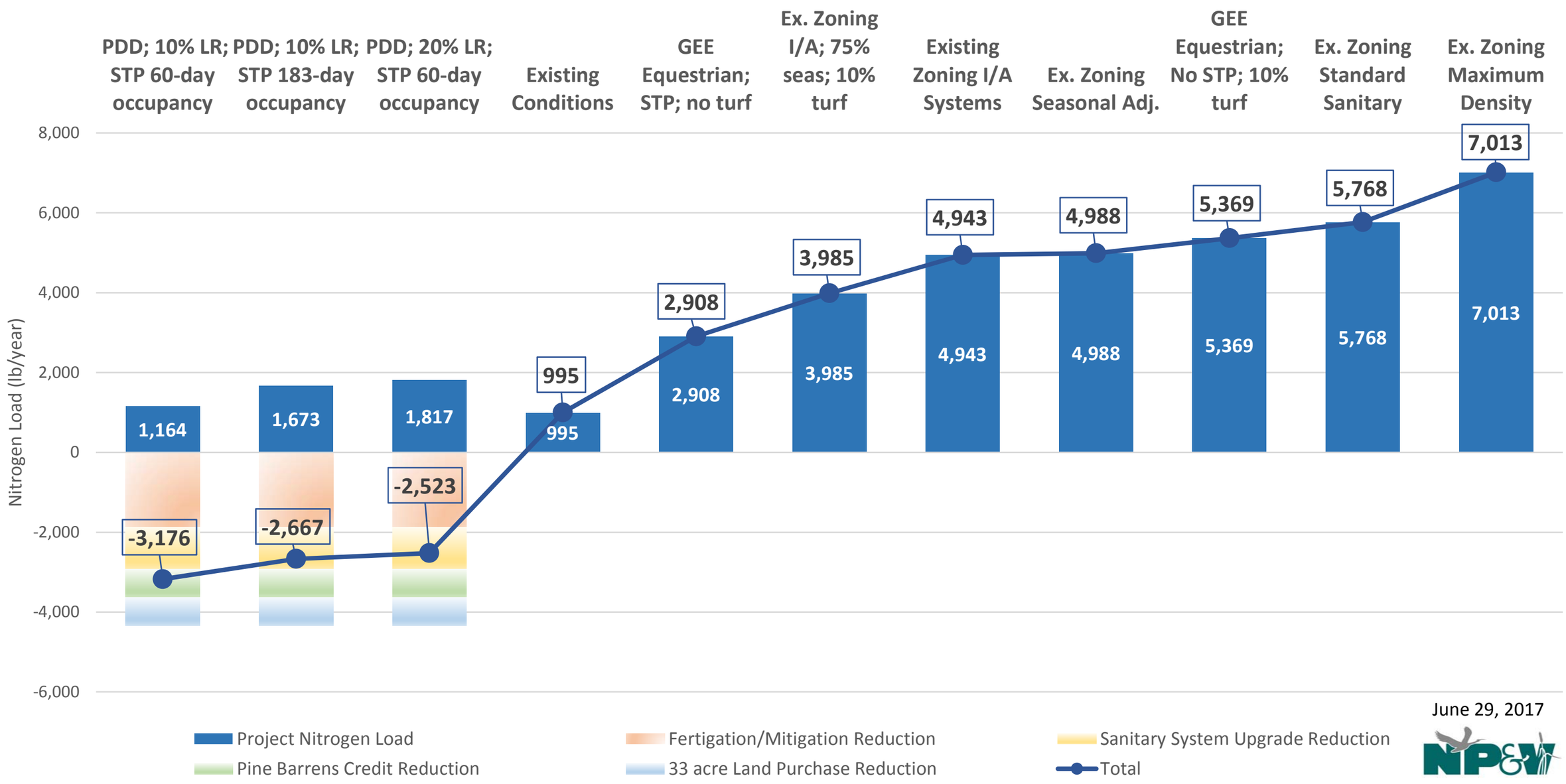
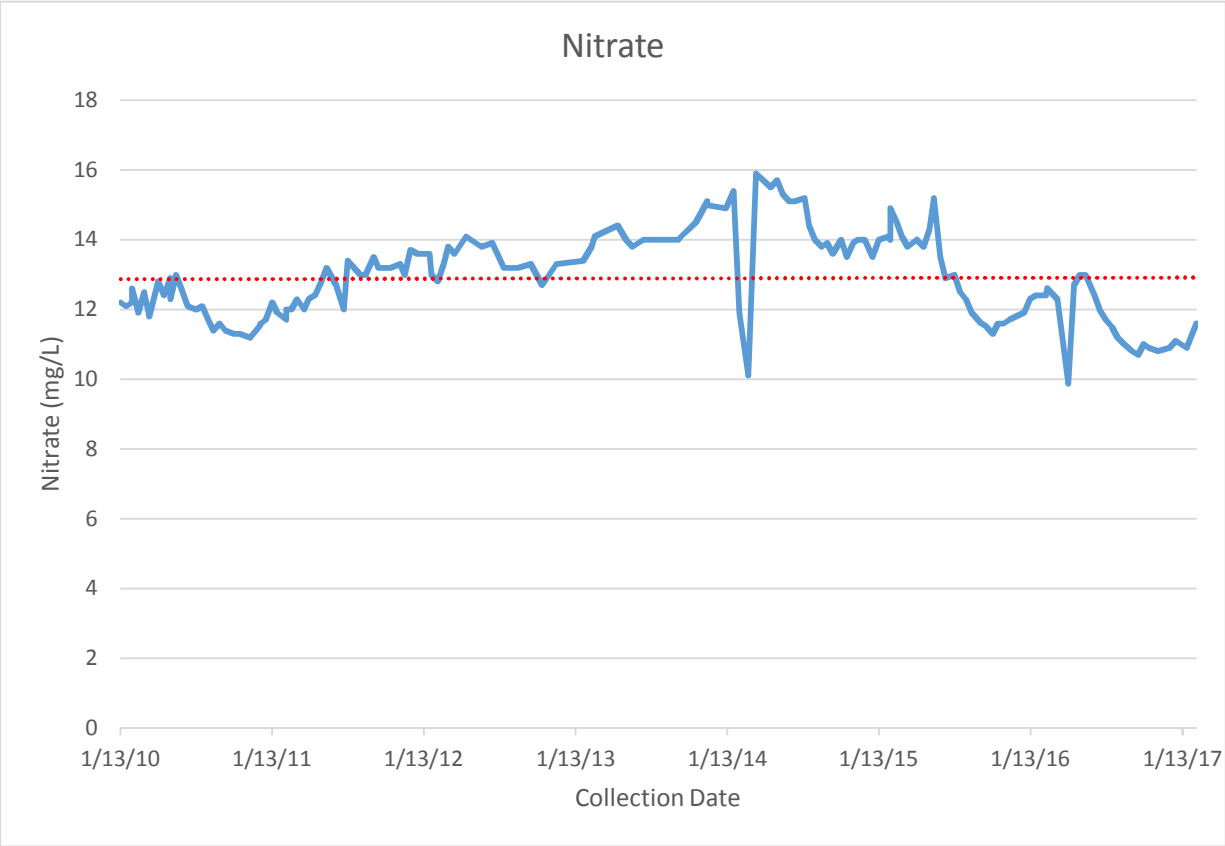
Nitrogen Load Comparison Accounting for Reductions



June 29, 2017

SCWA - Spinney Road Well # 2 - Nitrate Sample Results



AVG	12.90
MAX	15.90
MIN	9.88

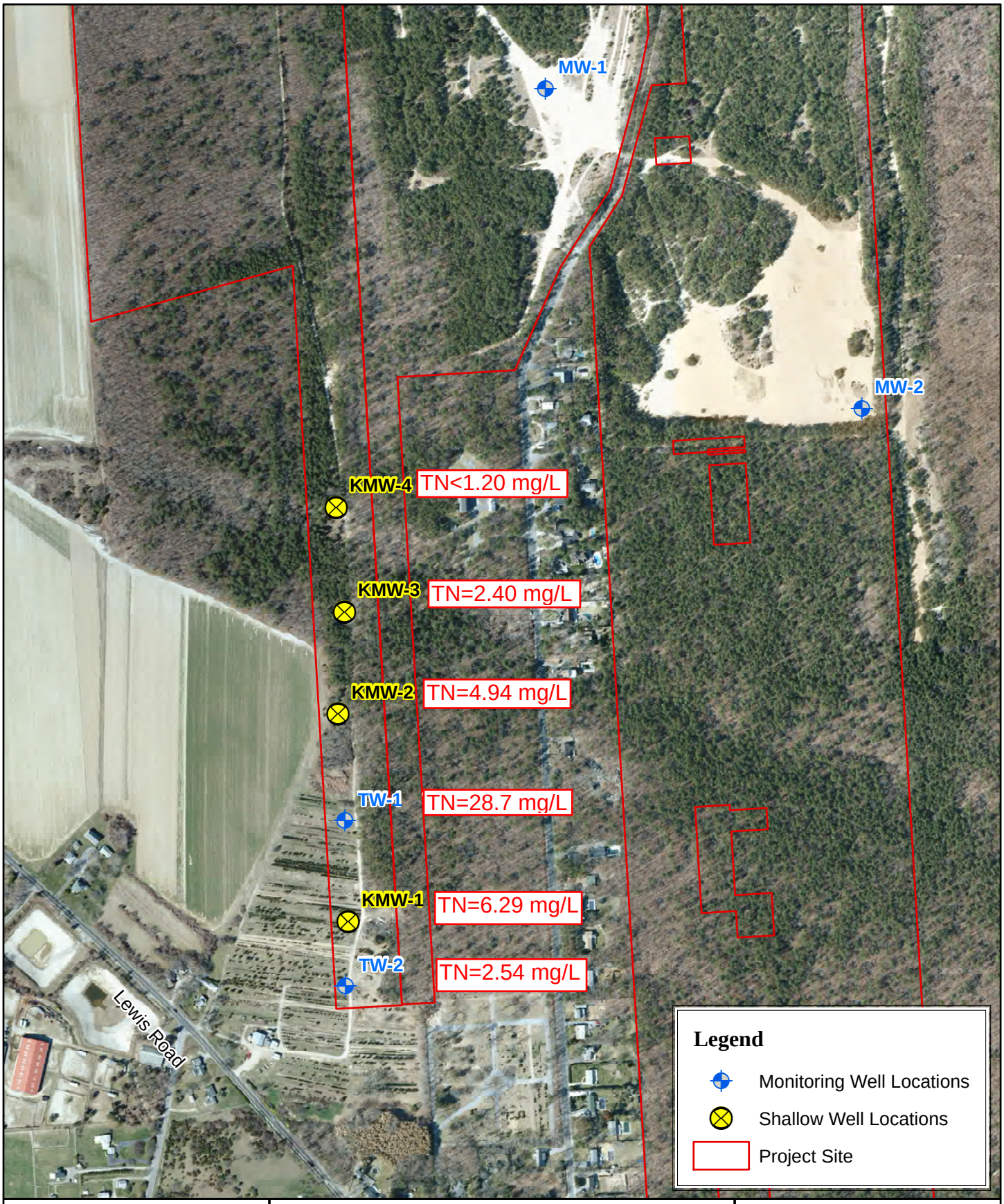


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FIGURE
SHALLOW WELL LOCATION MAP

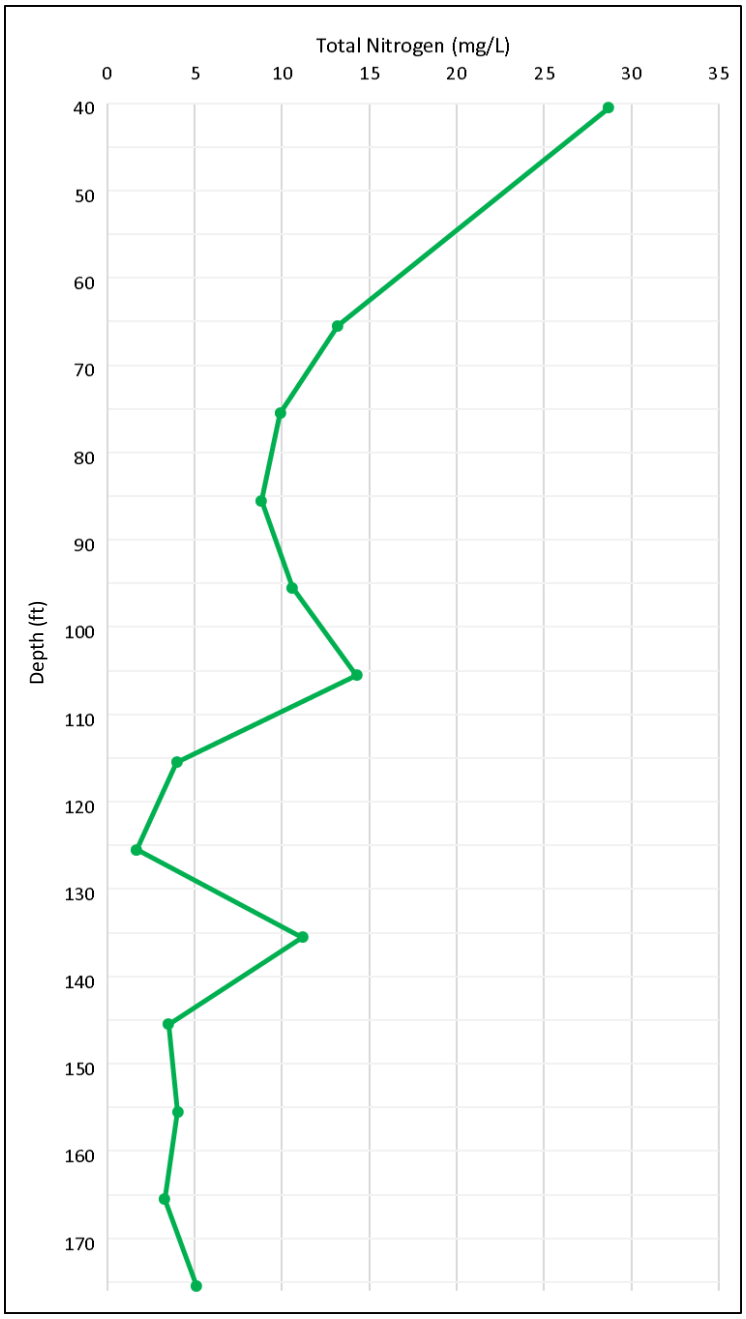
Source: NYSGIS Orthoimagery Program, 2013

Scale: 1 inch = 500 feet

N

The Hills at Southampton

Hills Vertical Profile Well Results	
Depth Interval (ft)	**Total Nitrogen (mg/L)**
40	28.7
65	13.20
75	9.92
85	8.85
95	10.60
105	14.30
115	4.00
125	1.71
135	11.20
145	3.52
155	4.06
165	3.29
175	5.13

Average* = 14.26

*Based on depths of 40-105 ft.