APPENDIX E

WATER RESOURCES-RELATED DOCUMENTS

Appendix E-1
SONIR Computer Model User's Guide

SONIR MODEL USER'S GUIDE

Simulation of Nitrogen in Recharge (SONIR)
Nelson, Pope & Voorhis, LLC Microcomputer Model

November 26, 2018

INTRODUCTION

SONIR is a microcomputer model developed by Charles J. Voorhis, CEP, AICP and copyrighted with the Library of Congress for exclusive use by Nelson, Pope & Voorhis, LLC (NP&V) in order to simulate the hydrologic water budget of a site and determine total nitrogen and nitrogen present in recharge in connection with land use projects. The model was developed on the Microsoft Excel Spreadsheet (trademark of Microsoft Products) for IBM (trademark of International Business Machines, Inc.) or compatible Personal Computers capable of running Excel. SONIR is updated periodically by NP&V to account for updated references and data in keeping with industry standards and environmental changes. NP&V is a professional environmental planning consulting firm with expertise in water resource management and impact assessment, nitrogen budget modeling, watershed management plans, and groundwater, soil and air sampling and environmental monitoring. Firm qualifications are provided in **Attachment A**.

Nitrogen has been identified as a source of contamination primarily from sanitary discharge and lawn fertilization. Nitrogen is of concern as a drinking water contaminant, and there is an established health limit of 10 milligrams per liter (mg/l) in drinking water. Nitrogen is also of concern in surface water, as it is a nutrient that when present in high concentrations can cause algal blooms (including harmful algal blooms, HABs), resulting in biological oxygen demand as algae is biologically decomposed as well as unsafe and potentially toxic conditions in the case of cyanobacteria. Depleted oxygen in surface waters causes conditions unfavorable to fish species and can result in extremely undesirable aesthetic impacts, primarily related to odors. Accordingly, it is necessary to understand the concentration of nitrogen in recharge as well as nitrogen load, as related to a proposed site development, examination of mitigation measures and comparison of alternatives.

Utilizing a mass-balance concept, and applying known hydrologic facts and basic assumptions, it is possible to predict the concentration of nitrogen in recharge to the shallow aquifer underlying a given site. This prediction can in turn be used to determine impacts and significance of impacts in consideration of hydrogeologic factors. Similar techniques have been used to simulate nitrogen in recharge as published by the New York State Water Resources Institute, Center for Environmental Research at Cornell University, Ithaca, New York (**Hughes and Pacenka, 1985**). SONIR is intended to provide a more versatile model based upon the BURBS Mass-Balance concept. SONIR allows for use of the model to predict nitrogen impact from many sources including sewage treatment plants, and further allows for determination of a wider variety site coverage and recharge components under the hydrologic water budget section. SONIR has more versatility in the input of information, and also provides a printout of each step performed by the model, in order for regulatory agencies and review entities to understand how values are derived.

This text describes in detail the definition of terms, supported by referenced information regarding input of data for the simulation. The concept of determining the concentration of nitrogen in recharge involves a predication of the weight (mass) of nitrogen introduced to the site, as compared to the quantity of recharge resulting from precipitation and wastewater water discharge. Losses due to evapotranspiration and runoff must be accounted for in the simulation. The values and relationship associated with these parameters determines the quantity of recharge which enters the site. The prediction is generally annualized due to the availability of average annual hydrologic data; however, data input can be determined on a seasonal basis if information is available.

The model includes four (4) data sheets identified as follows:

Data Input Field - Sheet 1
Site Recharge Computations - Sheet 2
Site Nitrogen Budget - Sheet 3
Nitrogen in Recharge Output Field - Sheet 4

All information required by the model is input in Sheet 1- Data Input Field. Sheets 2 and 3 utilize data from Sheet 1 to compute the Site Recharge and the Site Nitrogen Budget. Sheet 4 utilizes the total values from Sheets 2 and 3 to perform the final Nitrogen in Recharge computations. Sheet 4 also includes tabulations of all conversion factors utilized in the model.

It should be noted that the simulation is only as accurate as the data which is input into the model. An understanding of hydrologic principles is necessary to determine and justify much of the data inputs used for water budget parameters. Further principles of environmental science and engineering are applied in determining nitrogen sources, application and discharge rates, degradation and losses, and final recharge. Users must apply caution in arriving at assumptions in order to ensure justifiable results.

Since the preparation of the Draft EIS, information has become available from the Long Island Nitrogen Action Plan (LINAP), which is useful updating nitrogen budget model assumptions. LINAP included a metadata analysis of all available information to establish recommended nitrogen application rates, leaching rates, population data, pet waste assumptions and updated methods to determine atmospheric deposition. LINAP assumptions were received from the Suffolk County Department of Health Services and the New York State Department of Environmental Conservation as of January, 2017, and are used where appropriate for many updated nitrogen budget analyses in SONIR. A copy of the LINAP assumptions is included as **Attachment B** to this SONIR Model User's Guide.

SITE RECHARGE COMPUTATIONS

Overview

SONIR utilizes the basic hydrologic equation for determining the quantity of recharge anticipated by subtracting recharge losses from total precipitation. The quantity of recharge resulting from a given site is determined using the hydrologic budget equation **(Koszalka, 1984; p. 19):**

$$R = P - (E + Q)$$

where:

R = recharge
P = precipitation
E = evapotranspiration
Q = overland runoff

The quantity of recharge must be determined for each type of land use existing on a site, in order to determine the resultant site recharge. Surfaces commonly considered include: impervious surfaces; turfed areas; and natural areas; however, SONIR allows for a variety of land cover types to be considered in the model. In addition, site recharge occurs as a result of irrigation and wastewater discharge. In cases where water is imported to a site via a public water system, this quantity of recharge must be considered as additional water recharged on site. SONIR allows for all of these recharge components to be included in the simulation. Many sites have fresh surface water in the form of lakes and ponds. Precipitation falls upon these surfaces; however, such features generally act as a mechanism for water loss as a result of evaporation. SONIR includes a Water Area Loss component in determining the site Hydrologic Water Budget and in computing recharge nitrogen.

Data Input - Sheet 1

The following provides a discussion of data sources and assumptions associated with the hydrologic water budget, corresponding to the Data Input Field in Sheet 1 of SONIR:

1. *Area of Site* - The total area of the site (in acres) that is capable of recharging precipitation is entered in this data cell. For sites that include tidal wetlands, the area that is inundated by tidal waters should be excluded, as recharge from these areas should not be considered in the context of nitrogen simulation. For sites that include fresh surface water, the area can be included, provided evaporative water loss from surface water is considered by entering the acreage of surface water in Data Cell 15 noted below.

2. *Precipitation Rate* - Precipitation in the form of rainfall and snowmelt is determined using long-term recorded values from local weather stations. Cornell University maintains the Northeast Regional Climate Center, from which long-term precipitation data for Long Island weather stations is available. Monthly precipitation averages are published for the period 1951-1980 in Thornthwaite and Mather's Climatic Water Budget

Method **(Snowden and Pacenka, 1985).** More updated precipitation data from the NOAA National Climatic Data Center for the period 1981 to 2010 was obtained from http://www.currentresults.com/Weather/New-York/average-yearly-precipitation.php. The nearest precipitation monitoring stations included Bridgehampton and Brookhaven, NY. Bridgehampton is listed as 50.1 inches per year and Brookhaven is listed as 49.9 inches/year. Data entry is in inches. The more conservative lower value for Brookhaven, NY was used in this simulation.

3. *Acreage of Fertilized (SONIR allows multiple categories of fertilizer dependent vegetation to be entered)* - The total area fertilized (in acres) is entered in this Data Cell. This area includes all lawn/turf area that is irrigated and fertilized. If there is no lawn area, a value of zero (0) is entered.

4. *Fraction of Land in Fertilized* - No entry need be made in this Data Cell. SONIR will compute the Fraction of Land in Fertilized by dividing the lawn area by total area.

5. *Evapotranspiration from Fertilized* - Evapotranspiration is the natural water loss attributed to evaporation and plant utilization. Rainwater that is evaporated and transpired by plants is returned to the atmosphere as vapor. There are various methods for determining evapotranspiration, including direct measure and calculation. A commonly recognized method is the Thornthwaite and Mather Climatic Water Budget Method. Evapotranspiration rates for various locations on Long Island have been determined by the U.S. Geological Survey, as documented in: "Ground-Water-Recharge Rates in Nassau and Suffolk Counties, New York" **(Peterson, 1987; p. 10).** The following general rates as a percent of total precipitation are excerpted from that reference:

Location	Soil Type	Vegetation	ET (in)	ET (%)
Bridgehampton	sandy loam	shallow root	21.2	46.6
	silt loam	shallow root	21.4	47.2
LaGuardia	sand	shallow root	24.2	52.9
	clay loam	shallow root	25.4	55.5
	sandy loam	moderate root	26.2	57.2
JFK Airport	sand	shallow root	22.5	53.8
	clay loam	shallow root	23.9	57.3
	sandy loam	moderate root	25.0	60.0
Mineola	sand	shallow root	22.4	47.8
	sand-silt	shallow root	23.8	51.0
	sandy loam	moderate root	25.1	53.7
	sandy loam	orchards	25.5	54.5
Patchogue	fine sand	mature forest	25.5	53.5
Riverhead	sandy loam	shallow root	22.4	49.3
		orchards	24.8	54.7
Setauket	sandy loam	mature forest	26.8	57.9
Upton	silt loam	deep root	23.9	48.4
	sandy loam	moderate root	23.0	46.5

The most applicable rate for this project is 25.5 inches per year, based on the soils and land cover associated with Patchogue, NY.

6. *Runoff from Fertilized* - Runoff is the quantity of water that travels overland during a precipitation event. Soil infiltration capacity is the critical factor in determining runoff; however, factors such as slope and vegetation also determine runoff characteristics to a lesser extent on Long Island because of soil conditions. Less urbanized areas of Long Island with characteristically dry soils with groundcover will have a low runoff percentage as a function of total precipitation, as compared to the more urbanized portions of western Long Island. Peterson **(1984; p. 14)** estimates runoff as a percent of total precipitation for Nassau County (2.1 %); Suffolk County (0.7 %), and Long Island in general (1.0 %). If an average precipitation rate of 45-50 inches per year is assumed, runoff will vary from 0.31 to 0.94 inches. Fertilized areas would be expected to be in the higher end of the range. Judgements of higher and lower runoff can be made on a site-specific basis depending upon slope and groundcover types.

7. *Acreage of Unvegetated* - The total acreage of unvegetated area is entered in this Data Cell. This area includes sand, barren soils, and porous drives and trails. If there is no unvegetated area, a value of zero (0) is used.

8. *Fraction of Land Unvegetated* - No entry need be made in this Data Cell. SONIR will compute the Fraction of Land Unvegetated by dividing the unvegetated area by total area.

9. *Evapotranspiration from Unvegetated* - Evapotranspiration from Unvegetated areas is determined to be 30% of the evapotranspiration for vegetated surfaces due to lack of groundcover vegetation.

10. *Runoff from Unvegetated* - The runoff coefficients noted in the discussion for Data Cell 6 above, are applied to unvegetated areas on a site-specific basis. Runoff in the middle to the higher end of the range (2.1% of precipitation) is expected due to lack of groundcover vegetation.

11. *Acreage of Water (this category could include irrigation ponds and/or other surface water features)* - SONIR considers evaporation from surface water in the computation of site recharge. Surface water, particularly groundwater fed lakes and ponds are a source of water loss in the water budget. The quantity of fresh surface water (in acres) is entered in this Data Cell.

12. *Fraction of Land in Water* - No entry need be made in this Data Cell. SONIR will compute the Fraction of Water on the site by dividing the water area by total area.

13. *Evaporation from Water* - Surface water features will cause evaporation of water in excess of normal evapotranspiration as documented by **Warren et al, 1968,** Hydrology of Brookhaven National Laboratory and Vicinity Suffolk County, New York. It is estimated that the upper limit of evaporation from a large free-water surface is approximately 30.00

inches per year **(Warren et al, 1968; p. 26).** This value is entered in Data Cell 17 as the most accurate approximation.

14. *Makeup Water* - SONIR allows for consideration of the impact of man-made lakes on site recharge. Lakes are generally lined with an impermeable material. Evaporation occurs from the surface of the lake at a rate of 30.00 inches per year. In order to maintain a constant water level, an on-site well is generally installed to provide make-up water to the lake or pond. The quantity of make-up water is equivalent to the quantity of evaporation, given the fact that the function of the well is to replace water that is evaporated. Therefore, for cases where make-up water is used to maintain a constant water level, a value of 30.00 inches per year is entered in Data Cell 18.

15. *Acreage of Natural* - The total quantity of natural area (in acres) is entered in this Data Cell. This area includes naturally vegetated areas such as woodland, meadow, etc. If there is no natural area, a value of zero (0) is entered.

16. *Fraction of Land Natural* - No entry need be made in this Data Cell. SONIR will compute the Fraction of Land Natural by dividing the natural area by total area.

17. *Evapotranspiration from Natural* - Evapotranspiration from Natural areas is determined in the same manner as described for Data Cell 5 above.

18. *Runoff from Natural* - The runoff coefficients noted in the discussion for Data Cell 6 above, are applied to natural areas on a site specific basis. Generally lower values in the range of 0.7 % of precipitation are expected due to groundcover and canopy vegetation.

19. *Acreage of Impervious* - The total area of impervious surface (in acres) is entered in this Data Cell. This area includes paved driveways, parking areas, roofs, roads, etc. If there are no impervious surfaces, a value of zero (0) is entered.

20. *Fraction of Land Impervious* - No entry need be made in this Data Cell. SONIR will compute the Fraction of Land in Impervious by dividing the impervious area by total area.

21. *Evaporation from Impervious* - Impervious surfaces will allow water to evaporate, particularly during summer months. There is no vegetation; therefore there is no transpiration by plants. Evaporation from Impervious is estimated to be approximately 10 % of total precipitation **(Hughes and Porter, 1983; p. 10).** This value accounts for evaporation from parking lots and other surfaces during summer months, averaged over the entire year. This indicates that recharge/runoff would comprise the remaining 90% of precipitation. This assumption coincides with most drainage computations required by Code Subdivision Regulations for determined leaching pool capacity.

22. *Runoff from Impervious* - The approximation of Evaporation from Impervious would indicate that recharge/runoff would comprise the remaining 90% of precipitation, as there are no other losses from impervious surfaces. In consideration of paved areas, runoff is not transported off the site or to surface water as a loss. Runoff is diverted to leaching

pools and allowed to re-enter the hydrologic system beneath a given site. Therefore, in terms of site recharge computations, the value for Runoff from Impervious is zero (0).

23. *Acreage of Other Area (SONIR provides this portion of the model to customize additional cover types)* - This is a general category which can be used to include additional groundcover types in the simulation. Acreage of Other Area is entered (in acres). This Data Cell can be used to include site recharge considerations from a portion of the site that has different hydrologic properties, such as rain gardens, a moist hardwood forest or vegetated freshwater wetland, where evapotranspiration would be high and runoff would be extremely low or is a placeholder to customize data input/analysis.

24. *Fraction of Land in Other Area* - No entry need be made in this Data Cell. SONIR will compute the Fraction of Land in Other Area by dividing the land in other area by total area.

25. *Evapotranspiration from Other Area* - Evapotranspiration from Other areas is determined in the same manner as described for Data Cell 5 above. Value can be varied depending upon the hydrologic properties of the groundcover type. For rain gardens, this value would be high and similar to wetlands and surface water at 30 inches/year.

26. *Runoff from Other Area* - The runoff coefficients noted in the discussion for Data Cell 6 above, are applied to Other Areas on a site-specific basis. Value can be varied depending upon the hydrologic properties of the groundcover type. For rain gardens, no runoff would be expected.

27. *Acreage of Land Irrigated* – Use of water for irrigation purposes is an additional site recharge component not considered in any of the Data Cells above. The quantity of land irrigated on a given site is entered in this Data Cell (in acres).

28. *Fraction of Land Irrigated* - No entry need be made in this Data Cell. SONIR will compute the Fraction of Land Irrigated by dividing the Land Irrigated area by total area.

29. *Irrigation Rate* - The rate of irrigation must be entered in this Data Cell (in inches). Hughes and Porter **(1983; p. 19)** indicated that lawn irrigation is estimated to be about 5.5 inches per year; however, many sources recommend that irrigation be used to supplement natural rainfall to ensure that at least 1 inch of water is applied per week (http://www.gardening.cornell.edu/homegardening/scene7866.html). Assuming a growing season after spring when rainfall is more abundant and summer is hotter with typically less rainfall than spring, a 16-24 week period from May through October is used, with an irrigation rate of 1 inch per week. This value (16-24 inches) is entered in Data Cell 29 as the most accurate approximation for subdivision use.

30. *Number of Dwellings* - The number of dwellings is entered in this Data Cell in order to allow for computation of wastewater disposal from residential use. Wastewater imported to a site, or even withdrawn from on-site wells and recharged through sanitary effluent is an additional recharge component that must be considered. If the project is for a

commercial use or utilizes a denitrification system, the number of dwellings should not be entered in the Data Entry Field, as the wastewater flow will include recharge and nitrogen components.

31. *Water Use per Dwelling* - The water use should correspond to the total site non-irrigation water use, divided by the number of units.

32. *Wastewater Design Flow (units)* - No entry need be made in this Data Cell. SONIR will compute the Wastewater Design Flow by multiplying the Number of Dwellings by the Water Use per Dwelling.

33. *Wastewater Design Flow* - SONIR permits the consideration of recharge and nitrogen input based on wastewater design flow if this is more appropriate than a determination based on number of units. This could include residential wastewater flow (e.g., combined units and clubhouse), commercial projects, denitrification systems and sewage treatment plants. SCDHS design flow factors are typically used to determine wastewater design flow. Once computed, the anticipated wastewater flow is entered in this Data Cell.

Site Recharge Computations - Sheet 2

Once data entry is complete for Site Recharge Parameters, SONIR will complete a series of detailed Water Budget computations for the overall site. The following describes the computations that are performed by the model:

A. *Fertilizer Area Recharge* - Fertilizer Area Recharge is determined by use of the basic Hydrologic Budget Equation [R = P - (E + Q)] as defined previously. The quantity of recharge determined by this method is then multiplied by that portion of the site occupied by Lawn Area to determine the component of Lawn Area Recharge in overall site recharge.

B. *Unvegetated Area Recharge* - Unvegetated Area Recharge is determined by use of the basic Hydrologic Budget Equation. The quantity of recharge determined by this method is then multiplied by that portion of the site occupied by Unvegetated Area to determine the component of Unvegetated Area Recharge in overall site recharge.

C. *Water Area Loss* - The Hydrologic Budget Equation is modified to consider Water Area Loss. This is particularly useful in water quantity stressed areas of Long Island. If runoff (Q) is considered be zero (0), then lake storage/recharge without make-up water would be Precipitation minus Evaporation (P - E). The resultant quantity of lake storage/recharge is then reduced by the amount of make-up water (M). The final quantity of loss is then multiplied by that portion of the site occupied by water to determine the component of water loss as related to the overall site water budget.

D. *Natural Area Recharge* - Natural Area Recharge is determined by use of the basic Hydrologic Budget Equation. The quantity of recharge determined by this method is then multiplied by that portion of the site occupied by Natural Area to determine the component of Natural Area Recharge in overall site recharge. This area can also include land that is revegetated to natural conditions.

E. *Impervious Area Recharge* - Impervious area recharge is also determined using the Hydrologic Budget Equation; however, the value for runoff is zero (0) due to the fact that runoff is controlled by conveyance to on site leaching facilities or is allowed to runoff into depressions where runoff is recharged on site.

F. *Other Area Recharge* - Other Area Recharge is determined by use of the basic Hydrologic Budget Equation. The quantity of recharge determined by this method is then multiplied by that portion of the site occupied by Other Area to determine the component of Other Area Recharge in overall site recharge.

G. *Irrigation Recharge* - Irrigation recharge is an additional recharge component artificially added on sites where irrigation occurs. This quantity is determined in the same manner as the Hydrologic Water Budget except that the irrigation rate (in inches) is substituted for precipitation. The resultant recharge is multiplied by the area of the site that is irrigated, in order to determine the Irrigation Recharge in overall site recharge.

H. *Wastewater Recharge* - Wastewater is also a recharge component artificially added to a site. SONIR annualizes the wastewater design flow and assumes it is applied over the entire by multiplying Wastewater Design Flow by the Area of the Site, resulting in a per foot measure of wastewater over the site. This is converted to inches to be included in overall site recharge.

Once the eight (8) series of Site Recharge Computations are complete, SONIR totals each individual component to determine Total Site Recharge. The sum of these recharge contributions, is that quantity of water that is expected to enter the site on an annual basis due to precipitation, after the development is completed. This value is important in determining the concentration of nitrogen in recharge, and is important as a means of determining hydrologic impacts of a project in terms of changes to site recharge.

SITE NITROGEN BUDGET

Overview

The total nitrogen released on a given site must be determined in order to provide a means of simulating nitrogen in recharge. Nitrogen sources include: sanitary nitrogen; fertilizer nitrogen; pet waste nitrogen; precipitation nitrogen; and water supply nitrogen (wastewater and irrigation). The total of these quantities represents total site nitrogen.

Data Input - Sheet 1

The following provides a discussion of data sources and assumptions associated with the nitrogen budget, corresponding to the Data Input Field in Sheet 1 of SONIR:

1. *Persons per Dwelling* – For residential projects the number of persons per dwelling is a demographic multiplier used in the determination of human population of a site. The US Census Bureau publishes data for household population. The average population per household for the proposed project based on the Fiscal and Economic Impact Summary is 1.98 persons per dwelling. Additional sources can be consulted depending on site specific data sources.[1]

2. *Nitrogen per Person per Year* **–** For untreated wastewater, annual nitrogen per person is a function of nitrogen bearing waste in wastewater. For residential land use the population of the development is determined and the nitrogen generated is assumed to be 10 pounds per capita per year **(Hughes and Porter, 1983; p. 8).** This value is also consistent with LINAP assumptions.

3. *Sanitary Nitrogen Leaching Rate* - For normal residential systems, Porter and Hughes report that 50% of the nitrogen entering the system is converted to gaseous nitrogen and the remainder leaches into the soil **(Porter and Hughes, 1983; p. 14).** LINAP provides updated values for leaching from a conventional sanitary system, finding that there is 6% loss/attenuation from the septic tank and 10 percent attenuation from leaching rings/plume, indicating an 84% leaching rate. This rate is used for conventional sanitary system leaching.

4. *Area of Land Fertilized 1* - The area of land fertilized is input in Data Cell 4. This value may correspond to the Acreage of Lawn and/or the Acreage of Land Irrigated, but is not necessarily the same value. This entry should be determined on a site-specific basis.

5. *Fertilizer Application Rate 1* - Fertilizer nitrogen is determined by a fertilizer application rate over a specified area of the site. The fertilizer application rates vary depending upon the type of use. The following table indicates the rate of fertilization as a function of use as excerpted from the Non-Point Source Management Handbook **(Koppelman, 1984; Chapter 5, p.6):**

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[1] http://www.census.gov/quickfacts/table/ y

Residential (contract)	1.5 lbs/1000 sq ft
Residential (unmanaged)	2.3 lbs/1000 sq ft
Commercial	3.5 lbs/1000 sq ft
Golf Course	3.5 lbs/1000 sq ft
Sod Farms	4.0 lbs/1000 sq ft
Recreational Lands	0.2 lbs/1000 sq ft

If a use has a Fertilizer Management Plan then the plan should be consulted for application rates. In addition, a commercial landscaping firm has been interviewed to determine trends in commercial fertilizer application. Various fertilizer formulations are used including 10-6-4, 16-4-8 and 20-10-5 (nitrogen-phosphate-potash) depending upon season. Heavier nitrogen application rates are generally used in the spring. Fertilizer used is 50% organic nitrogen. This is applied in a dry form approximately 2-3 times per year, and a 50-pound bag is applied over approximately 16,000 square feet. Based on this rate if 20-10-5 nitrogen were applied in the spring, and 16-4-8 were applied during summer and fall, this would result in an application rate of 1.5-2.1 pounds per 1000 square feet. The high of this range is a conservative value based on three applications of relatively high nitrogen fertilizer. Judgment must be used to determine the application rates per above and further review of references as appropriate or for specific instances. LINAP fertilization rates are found in **Attachment B**; however, there is no rate for commercial application.

For agricultural use, Porter & Hughes **(1983)** provides information on N-fertilizer application rates that were researched for the study "Land Use and Groundwater Quality in the Pine Barrens of Southampton." Various farm uses were assessed and it was found that nurseries fertilized at a rate of 168.3 lbs/acre of nitrogen (or 3.86 lbs/1000 SF), potato forms applied 175 lbs/acre of nitrogen (4.02 lbs/1000 SF) and vegetable crops applied 140 lbs/acre of nitrogen (3.21 lbs/1000 SF). Other advancements in farming practice are expected to have occurred, such that application rates are less than what was found in 1983.

6. *Fertilizer Nitrogen Leaching Rate 1* - Nitrogen applied as fertilizer is subject to plant uptake (20 to 80%; 50% on average) and storage in thatch and soils (36 to 47%), thereby reducing the total amount of nitrogen leached. The percentage of plant uptake and storage are based on studies cited in the LIRPB's Special Groundwater Protection Area Plan. Those studies estimated a conservative nitrogen leaching rate of 14-15%. Further work by the Cornell University School of Integrative Plant Science, Horticulture Section was consulted as well as references from A. Martin Petrovic, Ph.D. at Cornell University. References specifically note that nitrogen leaching from turfgrass ranges were generally less than 10% **(1990, Petrovic, A.M.).** Further review of references from this source finds a useful comparison of turfgrass fertilizer leaching rates from various land cover types including golf courses and lawns. When considering four (4) field studies of golf course fertilizer nitrogen leaching, the leaching rates ranged from 0.02% to 13.2% and averaged 3%. When considering field studies for lawn nitrogen leaching rates, the average was 9.61% **(2008, Petrovic, A.M.)**. The purpose of the document was to advise the Massachusetts Estuary Program on appropriate turfgrass leaching rates for the

Pleasant Bay Region on Cape Cod.[2] A previously used leaching rate of 20% was found to be excessive by a factor of 2. Though lawn and golf course leaching rates were not substantially different, the results did identify residential lawns as having a higher leaching average leaching rate based on field studies. Local conditions should be considered in terms of the level of detail needed for nitrogen budget analysis; however, a range of 5% for golf courses (noted to be greater than the average of 3% from field studies) and 10% for general lawn turf is supported by field studies researched. LINAP leaching rates are found in **Attachment B**; however, there is no rate for commercial leaching.

7. *Area of Land Fertilized 2* - More than one fertilizer nitrogen input is provided in order allow consideration of mixed use and/or golf course projects where land is fertilized at different rates.

8. *Fertilizer Application Rate 2* - Fertilizer Application Rates for this entry can be determined based upon Data Cell 5 above.

9. *Fertilizer Nitrogen Leaching Rate 2* - Fertilizer Nitrogen Leaching Rates can be determined based upon Data Cell 6 above.

10. *Outdoor Cat Population* – This section of SONIR considers LINAP information for pet waste nitrogen. Pet waste nitrogen results from the excretion of domestic pets in the outside environment. There is relatively little definitive information concerning this nitrogen source; however, several references were located and are analyzed herein. The 208 Study provides a table of nitrogen concentration in manure for various animals, not including dogs or cats. Total nitrogen values in the range of 0.30-0.43 lbs/day/1000 lbs live weight are reported for cattle, sheep and horses **(Koppelman, 1978; Animal Waste report p. 3).** It is assumed that dogs constitute the major source of animal waste that would be present in the yards of residential developments. Cat waste would be significantly less due to the lesser live weight of cats and the fact that many cat owners dispose of cat waste in solid waste by using an indoor litter box. If an average of 0.35 lbs of nitrogen is assumed for dogs, and an average of 25 pounds live weight is assumed per dog, then the total annual nitrogen per pet would be 3.19 lbs/year. The only other reference identified for this User Manual that approximates nitrogen in pet waste is Land Use and Ground-Water Quality in the Pine Barrens of Southampton **(Hughes and Porter, 1983; p. 10).** This reference assumed an application rate of 6.5 lbs/acre of nitrogen. Pet waste was assumed to be deposited evenly over all turf. This assumption was not correlated to population density or pet density, but only to turfed acreage. In comparison of the two values, the per pet value corresponds to approximately 2 turfed acres. For the purpose of this model, the value of 3.19 lbs/pet/year is considered to be the most justifiable value for pet waste and is entered in this Data Cell.

[2] Hydrogeologic conditions on Cape Cod are similar to Long Island due to glacial origin, bays and estuaries.

Pet waste is also subject to a leaching rate factor. Pet waste is generally found to be a minor contributor of nitrogen in an overall nitrogen budget. A conservative leaching rate of 50% of the nitrogen applied to the ground to be removed through N reduction processes.

LINAP examined pet waste and has revised some of the assumptions that came from prior reports based on a metadata search of available literature through January 2017. LINAP estimates indoor and outdoor cat populations at 1.16 cats/household and 0.74 cats/household, respectively, and an outdoor dog population of 1.4 dogs/household. LINAP further estimates the pounds of nitrogen per year at 3.22 lbs/year for cats and 4.29 lbs/year for dogs, and further estimates a volatilization rate of 75% or a leaching factor 25%. These updated assumption values are used in this document, subject to consideration of the type of land use anticipated. Single family residential use would be expected to have a higher population of cats, and greater potential for outdoor occupancy. Multiple family use would be expected to have a lower population of cats and a lower likelihood of outdoor occupancy, with more indoor cats and therefore greater use of litter boxes and alternative disposal of cat waste (i.e., landfill disposal as compared to land surface defecation). For multiple family use, a lower cat population would be expected, and some uses may prohibit cats. Adjustments can be made as needed to reflect practical rates and expected conditions.

11. *Cat Waste Nitrogen Load* - This is quantified as 3.22 lbs/year of nitrogen per cat for outdoor cats per LINAP. This would apply to single family residential use. For multiple family use, indoor cats are assumed.

12. *Outdoor Dog Population* – This is quantified as 1.4 dogs/household per LINAP. This would apply to single family residential use. For multiple family use, a lower dog population would be expected, and some uses may prohibit dogs. Adjustments can be made as needed to reflect practical rates and expected conditions.

13. *Dog Waste Nitrogen Load* – This has been updated to 4.29 lbs/year of nitrogen per dog per LINAP. This would apply to single family residential use. For multiple family use, less dogs as well as effective “pick up after your pet” programs are assumed, resulting in one-half the expected Dog Waste Nitrogen Load, or 2.15 lbs/year.

14. *Pet Waste Nitrogen Leaching Rate* – This has been updated to 25% based on LINAP assumptions, which seem reasonable due to waste deposited on the ground and subject additional “weathering” and volatilization in the surface environment prior to recharge.

15. Adjusted Pet Waste (if applicable)(days/year occupied) – This entry allows for an adjustment for seasonal communities where year round occupancy is not expected. An estimated occupancy rate is inserted in this cell.

16. *Area of Land Irrigated* - No entry need be made in this Data Cell. This value is the same as Data Cell 27 of the Site Recharge Parameters and SONIR will transfer the data entry to this Cell.

17. *Irrigation Rate* - No entry need be made in this Data Cell. This value is the same as Data Cell 29 of the Site Recharge Parameters and SONIR will transfer the data entry to this Cell.

18. *Irrigation Nitrogen Leaching Rate* - Hughes and Porter **(1983; p. 10)** states "plant uptake and gaseous losses are assumed to remove at least 85% of the nitrogen entering in precipitation." Irrigation nitrogen would be expected to be subject to the same losses as applied to fertilizer leaching; therefore, a leaching rate in the range of 10-15% can be assumed and entered in this Data Cell.

19. *Atmospheric Nitrogen Application/Load* – This section of SONIR is changed from the Draft EIS, based on LINAP information. The Draft EIS assessed Precipitation Nitrogen using the concentration of Nitrogen in Precipitation and the Precipitation Nitrogen Leaching Rate described in the Draft EIS as follows: "*Nitrogen in Precipitation* - Groundwater nitrogen is partially derived from rainwater. Nitrate-nitrogen concentrations in precipitation have been reported to be on the order of 1-2 mg/l in Nassau and Suffolk Counties **(SCDHS, 1987; p. 6-4)**, with some evidence of decrease since preparation of the SCCWRMP. A conservative value of 0.75 mg/l was used." "*Precipitation Nitrogen Leaching Rate*, which was described as follows: "A slightly higher nitrogen leaching rate may be appropriate for precipitation which falls generally on natural as well as turfed surfaces. While turfgrass leaching has been extensively documented and found to reduce leaching as a result of plant uptake and thatch/root zone processes, natural areas in sandy soils may result in less uptake. A factor of 15% is applied to precipitation nitrogen as based on Hughes and Porter) **(1983; p. 10)**." For the Draft EIS, there was also a *Nitrogen in Water Supply* factor, described as follows: "The concentration of Nitrogen in Water Supply determines the quantity of nitrogen that enters the site as a result of irrigation nitrogen and wastewater flow. Local water supply data should be utilized if available, otherwise a value of between 1 and 2 mg/l could be utilized."

    LINAP has conducted more updated research regarding Atmospheric Deposition. An Atmospheric Deposition Application/Load is assumed to be 0.041 lbs/1000 SF of land area. This is then subject to various leaching rates depending on the type of groundcover.

20. *Atmospheric N Leaching Rate (Natural/Wetlands)* – The estimated leaching rate value for natural area/wetlands is 25% per LINAP.

21. *Atmospheric N Leaching Rate (Turf 30%/Golf 20%)* – The estimated leaching rate value for turfed areas is 30% and for golf course turfed areas is 20% per LINAP.

22. *Atmospheric N Leaching Rate (Agriculture; Impervious; Other)* - Agricultural land leaching is estimated to be 40% as are other surfaces not specifically identified as natural, wetlands, turf or golf turf.

23. *Nitrogen in Water Supply* – An entry cell for nitrogen in water supply is provided if this is needed for analysis.

24. *Nitrogen in Commercial/STP Flow 1* - This data entry allows SONIR to compute the quantity of nitrogen resulting from commercial discharge, denitrification systems and/or sewage treatment plants. Total nitrogen in community wastewater is identified as having a total nitrogen concentration of 20 mg/l in weak effluent; 40 mg/l in medium strength effluent, and 85 mg/l in strong effluent **(Metcalf & Eddy, Inc, 1991).** . For comparison purposes, it is recommended that a value of 50 mg/l be used for total nitrogen concentration in sanitary systems.[3] Properly functioning denitrification systems and sewage treatment plants are capable of reducing total nitrogen to less than 10 mg/l in accordance with discharge limitations. A value of 10 mg/l can be entered in this data cell for such systems or other applicable value dependent on specific treatment efficiencies. A value of 8 mg/l is commonly used to demonstrate improved treatment efficiencies. Alternative wastewater systems for single family homes are being considered in Suffolk County; such systems are achieving treatment to reduce nitrogen to the range of 19 mg/l. The SONIR model computes the number of pounds of nitrogen in sanitary discharge as a function of concentration. The absolute nitrogen is utilized in the model; however, it must recognized that from the discharge point, nitrogen is nitrified through conversion of ammonia to nitrate in the leaching area beneath the discharge point. Further, natural transformation in the form of denitrification occurs as a result of bacteria. This causes release of nitrogen gas and may account for further reduction of 50% or more subsequent to discharge **(Canter and Knox, 1979; pp. 77-78; Hughes and Porter, 1983; p. 14).** As a result SONIR is conservative in predicting the concentration of nitrogen in recharge, and when natural denitrification of sanitary effluent is considered, actual concentration would be less.

25. *Nitrogen in Commercial/STP Flow 2* – An additional entry cell is provided for an alternative concentration should this be needed for analysis.

Site Nitrogen Budget - Sheet 2

Once data entry is complete for Nitrogen Budget Parameters, SONIR will complete a series of detailed computations to determine the individual component of nitrogen from each source and the total nitrogen for the overall site and use. The following describes the computations that are performed by the model:

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[3] SCDHS General Guidance Memo #28 includes guidelines for siting proposed or expanded STPs; this memo indicates: "A total nitrogen concentration of 50 mg/l may be used when calculating the equivalent mass loadings."

A. *Sanitary Nitrogen - Residential* - SONIR establishes the site population using the number of units on the site, and the demographic multiplier. The nitrogen load factor is then applied and reduced by the leaching rate, resulting in the total residential nitrogen component. If the project is for a commercial use or residential sanitary wastewater flow is used to determine nitrogen from residential, then the resultant value should be zero (0).

B. (B) *Cat Waste Nitrogen* **–** The pet waste nitrogen was determined on a per pet basis; however, the number of pets for a given residential project must be determined. In order to correlate the number of pets to human population, a ratio was determined using information contained in the 208 Study, wherein it was estimated that there is 1 dog per 5 residents in suburban areas and 1 dog per 7 residents in urban areas **(Koppelman, 1978; Animal Waste Report, pp. 6).** This results in an average number of dogs based upon of 17% of the human population. Accordingly, this multiplier is used based upon the population of a land use project in order to estimate the nitrogen waste from pets. The pet waste nitrogen is subject to reduction as a function of the leaching rate, leading to the total pet waste nitrogen in pounds."

Updated analysis s provided based on LINAP assumptions which determine both Cat Waste and Dog Waste Nitrogen by using an updated pet population (number of pets per dwelling), an updated pet waste nitrogen load and an updated leaching rate. Cat Waste Nitrogen uses the numbers inserted in the Nitrogen Budget Parameter sheet in SONIR as described above.

(B') *Dog Waste Nitrogen* - Dog Waste Nitrogen is also determined by using an updated pet population (number of pets per dwelling), an updated pet waste nitrogen load and an updated leaching rate. Dog Waste Nitrogen uses the numbers inserted in the Nitrogen Budget Parameter sheet in SONIR as described above.

C. *Sanitary Nitrogen (Commercial/STP)* - SONIR utilizes the Commercial/STP Flow that is converted to liters and multiplied by the nitrogen concentration in waste. This provides a weight of nitrogen in milligrams, which is converted to pounds for the total nitrogen from this component.

D. *Water Supply Nitrogen* (other than wastewater, if applicable) - SONIR utilizes the residential wastewater design flow to compute the weight of nitrogen contributed from the water supply. The method of calculation is the same as Sanitary Nitrogen (Commercial/STP). For commercial projects, this value is accounted for in the Commercial/STP Flow and as a result, the value is zero (0).

E. *Fertilizer Nitrogen 1 (Fertilized Landscaping)* - This calculation utilizes data entry from the Area of Land Fertilized 1, in the Data Input Field, to determine the weight of fertilizer nitrogen applied to the area. The area is multiplied by the application rate and reduced by the leaching rate documented previously to arrive at total weight.

F. *Fertilizer Nitrogen 2 (Optional Fertilization Rate)* - If fertilization rates vary, the Area of Land Fertilized 2, is utilized to determine nitrogen from this source.

G. *Atmospheric Nitrogen* – Updated analysis is provided based on LINAP assumptions which determine Atmospheric Deposition using the Nitrogen Budget Parameters outlined above. The deposition rate of 0.041 lbs/1000 SF is multiplied by the square footage of each cover type, and then subject to an individual leaching rate based on the cover type. Section G computes the resultant Atmospheric Deposition.

H. *Irrigation Nitrogen* - Although a very small component, the Irrigation Nitrogen is determined using the Irrigation Recharge R(irr) computed in the Site Recharge Computations, over the irrigated area of the site to produce a volume of irrigation recharge. The Irrigation Recharge value is used in order to account for reduction of recharge due to evapotranspiration, since this component is only intended to determine nitrogen leaching into soil as a result of irrigation nitrogen in the water supply. This value is converted to liters and multiplied by the concentration of nitrogen in irrigation water supply. The Irrigation Nitrogen Leaching Rate (expected to the same as for precipitation) is applied to the weight to determine the total nitrogen from this source.

Once the eight (8) series of Site Nitrogen Budget computations are complete, SONIR totals each individual component to determine the Total Site Nitrogen. This value is used in determining the weight per volume ratio of nitrogen in recharge as computed in Sheet 4 of the SONIR model.

FINAL COMPUTATIONS, SUMMARY AND MITIGATION

SONIR utilizes data generated in Sheets 2 and 3 of the model to compute a mass/volume ratio for nitrogen in recharge. Nitrogen in recharge is converted from pounds to milligrams in order to provide units compatible for mass/volume concentration. Likewise, the quantity of site recharge is applied over the site in order to determine an overall volume number for site recharge. This is then converted to liters. The final computation divides the total weight of nitrogen in milligrams, by the total volume of recharge in liters, to arrive at the Nitrogen in Recharge ratio in milligrams per liter (mg/l). This concentration represents the Final Concentration of Nitrogen in Recharge, which is highlighted on Sheet 4.

Sheet 4 also provides a site recharge summary in order to compare recharge between natural conditions, a proposed project and/or alternatives. Total Site Recharge is presented in both inches, and as a volume in cubic feet/year, gallons/year and million gallons/year (MGY). The final sheet also summarizes the Conversions Used in SONIR. Conversions are standard conversion multipliers as found in standard engineering references.

An additional function of SONIR is to estimate potential nitrogen reduction strategies through mitigation which may be employed through project design. Mitigation computations may include: off-site treatment, reuse of irrigation water, rain gardens, etc.

Mitigation noted above is totaled and compared between unmitigated and mitigated nitrogen load.

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SONIR is a valuable tool allowing for versatile determination of site recharge as determined from many components of site recharge. SONIR determines the weight of nitrogen applied to a site from a variety of sources as well. SONIR is a fully referenced model utilizing basic hydrologic and engineering principals, in a simulation of nitrogen in recharge. Input data should be carefully justified in order to achieve best results. SONIR can be used effectively in comparing land use alternatives and relative impact upon groundwater due to nitrogen. By running the model for Existing Conditions, Proposed Project conditions and/or alternative land uses, comparison of impacts can be made and mitigation can be evaluated for consideration in land use decision-making. Questions, comments or suggestions concerning this model should be addressed to: Nelson, Pope & Voorhis, LLC, 572 Walt Whitman Road, Melville, New York 11747.

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

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ATTACHMENT A

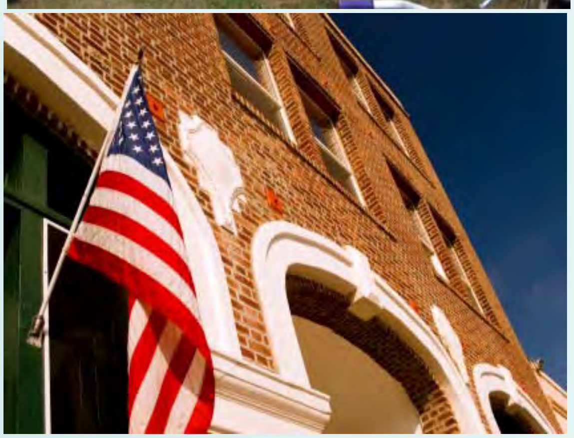
NP&V QUALIFICATIONS

NELSON, POPE & VOORHIS, LLC

WATERSHED ANALYSIS, SEQRA & PHASE I/II TESTING

QUALIFICATIONS STATEMENT






Nelson, Pope & Voorhis, LLC
572 Walt Whitman Road
Melville, New York 11747
Phone: (631) 427-5665
Fax: (631) 427-5620
Email: npv@nelsonpopevoorhis.com

www.nelsonpopevoorhis.com

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Environmental Science & Analysis
Wetland Permitting
Storm Water Management Plans
Waterfront & Coastal Zone Projects
Mapping
Watershed Management & Water Supply
Permitting & Processing
Sustainability & LEED
Project Planning & Support

Nelson, Pope & Voorhis, LLC (NP&V) was formed in 1997 and has grown in capabilities and size since that time. The merging of Charles Voorhis & Associates (13 year history) with Nelson & Pope (a 50-year tradition in engineering and related services) created an environmental planning firm with a wealth of experience to bring to complex environmental problem solving, planning and feasibility, resource assessment and site investigations.

NP&V serves governmental and private sector clients in preparing creative solutions in the specialized area of complex environmental project management and land use planning and analysis.

Nelson, Pope & Voorhis has the benefit of knowledge of local issues, local resources, and the passion to provide the very best solutions and strategies for the local area. This provides unparalleled knowledge of the application of the community planning process, comprehensive planning and SEQRA/NEPA Administration. The result is a team of highly compatible land use professionals that will get the job done in a manner that ensures real and implementable solutions.

NP&V employees are recognized as experts in environmental, land use and planning issues and have provided consulting services to various municipalities. NP&V encourages continuing education through participation in conferences and seminars for all staff and holds regular training luncheons utilizing APA and other training packages.

Nelson, Pope & Voorhis has a capable staff of professionals, including planners and economic analysts, ecologists, hydrologists, wetlands specialists and environmental professionals. When integrated with technical staff of Nelson & Pope, the team is expanded to include civil, sanitary and transportation engineers and land surveyors.

Nelson, Pope & Voorhis would appreciate the opportunity to discuss how we can assist you in achieving your goals. We are committed to providing quality environmental, planning and consulting services to all clients. This statement of qualifications is an introduction to the many services we provide with a focus on municipal services; the following pages contain a more detailed presentation of services offered by Nelson, Pope & Voorhis, as well as a sampling of completed projects and key staff resumes.

Call us at (631) 427-5665. We welcome the opportunity to serve your environmental, planning and consulting needs.

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Melville, New York
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Phone: 631-427-5665
Fax: 631-427-5620
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572 Walt Whitman Road
Melville, New York
11747

Phone: 631-427-5665
Fax: 631-427-5620
npv@nelsonpope.com

Charles Voorhis is managing partner and is a member of the American Institute of Certified Planners (AICP) and is a Certified Environmental Professional (CEP), having over 30 years of experience in environmental planning on Long Island and the New York area. Mr. Voorhis oversees the business in terms of management, marketing and expertise, provides expert testimony in hearings and court proceedings, and ensures that client needs are served to the best of the firm's ability.

The firm has significant expertise in applied use of the State Environmental Quality Review Act (SEQRA) and National Environmental Policy Act (NEPA) with understanding of the practical and legal use of these laws from both the private and municipal perspective. Staffing includes environmental professionals assembled to work together as a team with complementary expertise and interests. NP&V personnel maintain wildlife collection permits in New York State, and are active contributors to the Long Island Geographic Information System (GIS) user group meetings and publications.

The firm has developed a number of copyright protected computer models for environmental analysis in the areas of: wildlife and ecology; water budget analysis and groundwater impacts; economic and market analysis; and stormwater impact prediction. The reports and graphics generated for projects are high in quality and professionally prepared through the use of state-of-the-art technology in digital aerial photography, geocoding and mapping of site features using differential global positioning systems (GPS), AutoCAD analysis/mapping, ESRI geographic information systems (GIS) programs including ArcMap and 3D Analyst and Spatial Analyst, custom spreadsheet models for regional land use impact assessment, and related technological tools for advanced data management and word processing. The seamless integration of environmental and engineering services with Nelson & Pope is accomplished by direct communication and computer networking to ensure that projects are managed through the review process to the development stage.

NP&V features three divisions, created to better serve clients with high quality, innovative and responsive consulting

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572 Walt Whitman Road
Melville, New York
11747

PHONE: 631-427-5665
FAX: 631-427-5620
NPV@NELSONPOPE.COM

The division of **ENVIRONMENTAL & COMMUNITY PLANNING** specializes in comprehensive local and regional planning. Technology is key in today's planning field and NP&V continues to keep pace with the most current tools available for planning applications. Use of Geographic Information System (GIS) software, 3D Analyst, ArcScene and Spatial Analyst, as well as CommunityViz (3-D simulation and analysis software), architectural SketchUp (modeling software), AutoCAD, and planning and analysis software and spreadsheets, results in rapid, accurate and high quality data, analysis, illustration and reporting. This division conducts planning studies, revitalization plans, community development/public participation activities, and human resource analysis including noise, air, demographic, socio-economic and visual resource assessment (including 3D simulations, photo simulations and shadow studies). The division is directed by Kathryn Eiseman, AICP and includes planners, economic analysts and GIS specialists with environmental, planning and architectural backgrounds.

The division of **ENVIRONMENTAL RESOURCE & WETLANDS ASSESSMENT** provides quality services in the preparation of Environmental Impact Statements (EIS's), Environmental Assessments (EA's), planning and zoning law review and preparation, stormwater permitting and erosion control compliance, and wetland delineation, assessment, mitigation and permitting. This division is headed by Carrie O'Farrell, AICP and has a capable staff including environmental scientists, wetland ecologists and environmental professionals to ensure timely delivery of quality products.

The division of **PHASE I/II ASSESSMENTS & REMEDIATION** performs Phase I and II Environmental Site Assessments (ESA's), voluntary cleanup, brownfields cleanup, RI/FS and all aspects of site remediation and investigation. The division is headed by Steven McGinn, CEI a member of Nelson & Pope's environmental services branch for 13 years with significant experience in preparation of Phase I/II ESA's field investigations and remediation. This division includes a staff of hydrogeologists and environmental professionals and coordinates required field equipment and laboratory services. NP&V has performed large and small assessments and provides the fastest possible turnaround to meet due diligence periods and deadlines which are often a factor in real estate transactions. NP&V Phase I/II ESA services are known and accepted by lending institutions throughout the tri-state area. NP&V owns, maintains and operates GPR (Ground Penetrating Radar) and PowerProbe units to provide expanded services in site investigations. A description of NP&V qualifications and resumes of personnel proposed for the project and specific project experience is included in the

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572 Walt Whitman Road
Melville, New York
11747

Phone: 631-427-5665
Fax: 631-427-5620
npv@nelsonpope.com

What we do at Nelson, Pope & Voorhis...

- **SEQRA/NEPA Compliance and Environmental Analysis:** Environmental impact statements (EIS); assessment forms (EAF); ecological and wildlife studies; noise and air emission impact studies; and compliance with Federal, State & local environmental regulations & laws.

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- **Feasibility and Due Diligence Assistance:** Comprehensive research into site development related issues affecting project implementation, timing and costs.

- **Economic Planning:** Fiscal and economic impact analyses, market analyses & feasibility studies, economic development strategies, niche market and branding planning, tax base analysis, housing incentives and programs and community development.

- **Grants Administration:** Preparation of federal and state funded municipal grant applications, project management; including the preparation of all reporting documents.

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WETLAND PERMITTING
STORM WATER MANAGEMENT PLANS
WATERFRONT & COASTAL ZONE PROJECTS
MAPPING
WATERSHED MANAGEMENT & WATER SUPPLY
PERMITTING & PROCESSING
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- **Storm Water Management Plans (SWPPPS):** Design of management plans for storm water and erosion control compliance with latest Federal and State regulations; preparation and processing of NOI; and site compliance during construction…
- **Waterfront and Coastal Zone Projects:** Planning; permitting of waterfront improvement projects; water quality data management and studies; and docking facilities…
- **Mapping:** Inventory of physical features; GIS mapping; data management and analysis; and ground penetrating radar for identification of subsurface conditions…
- **Watershed Management and Water Supply:** Comprehensive regional watershed and water supply management and planning studies…
- **Permitting and Processing:** Preparation and processing of environmental applications for submittal; client representation before municipal agencies and departments and expert testimony for legal support and hearings…
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Nelson, Pope & Voorhis has the benefit of knowledge of local issues, local resources, and the passion to provide the very best solutions and strategies for the local area. This provides unparalleled knowledge of the application of the community planning process, comprehensive planning and SEQRA Administration. The result is a team of highly compatible land use professionals that will get the job done in a manner that ensures real and feasible solutions.

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572 Walt Whitman Road
Melville, New York
11747

PHONE: 631-427-5665
FAX: 631-427-5620
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PROJECTS

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NORTH SHORE EMBAYMENTS WATERSHED MANAGEMENT PLAN SUFFOLK COUNTY

ENVIRONMENTAL PLANNING CONSULTING

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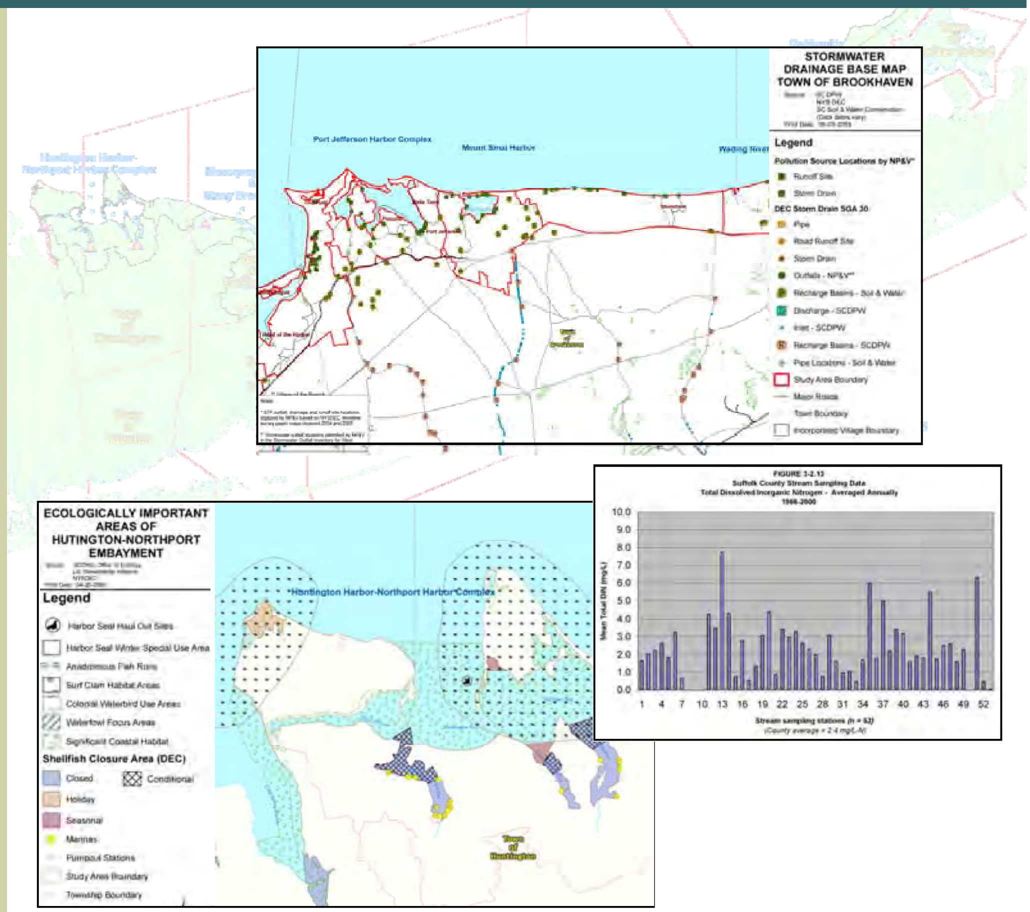
ECONOMIC PLANNING
ENVIRONMENTAL SITE ASSESSMENT
ENVIRONMENTAL SCIENCE & ANALYSIS
WETLAND PERMITTING
STORM WATER MANAGEMENT PLANS
WATERFRONT & COASTAL ZONE PROJECTS
MAPPING
WATERSHED MANAGEMENT & WATER SUPPLY
PERMITTING & PROCESSING



Completed an intensive watershed study for the north shore of Suffolk County to estimate existing pollution loads and develop a plan that would allow Suffolk County to reduce 58.5 % of its nitrogen load to Long Island Sound by 2014. Nelson, Pope & Voorhis (NP&V) used GIS technology to collectively look at decades of surface and ground water quality data, consider sensitive natural resource areas, land use and soils, storm drainage systems, sewered vs. non-sewered areas, population growth, and ultimately determine point and nonpoint source pollution loads from priority subwatersheds. NP&V developed a tax parcel-based spatial model to estimate past, current and future nitrogen loads from individual pollution sources (i.e. sewage treatment plants, septic systems, lawn fertilizers, agricultural fertilizers, road runoff etc.) and determine the sources of nitrogen that could most effectively and economically be managed.

NELSON POPE & VOORHIS

572 Walt Whitman Road
Melville, New York
11747

PHONE: 631-427-5665
FAX: 631-427-5620
NPV@NELSONPOPE.COM

Nelson Pope & Voorhis

NYSDOS
South Shore Estuary Reserve
Fish Barrier Inventory

Environmental Planning Consulting

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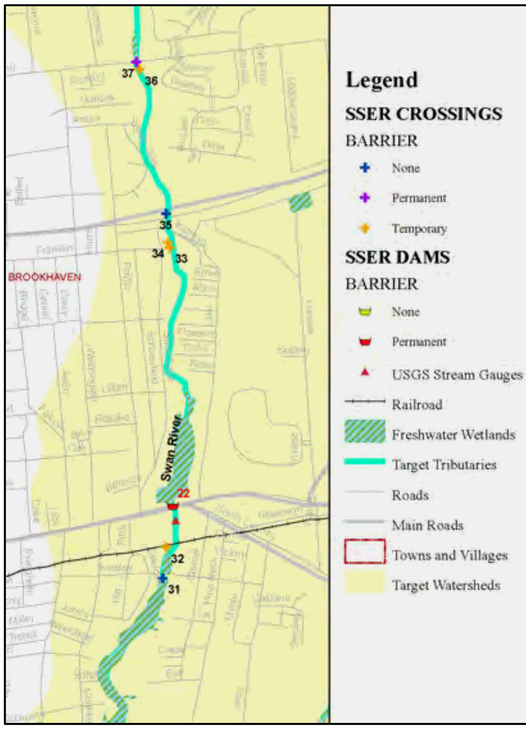

NP&V has inventoried and assessed potential barriers to fish passage as part a study funded by the NYS Department of State and South Shore Estuary Reserve (SSER) through the Environmental Protection Fund. In an effort to restore the historic habitats of diadromous fish (such as alewife, American eel and sea-run trout) in the tributaries of Great South Bay, the project goal was to inventory stream crossings and barriers such as dams to develop a prioritization strategy for the removal or modification of structures which inhibit fish passage to their spawning grounds. Stream assessments (e.g. crossing & dam location/size, in-stream and riparian habitat assessments) and related information (e.g. watershed land use, barrier owner information) were incorporated into a GIS database to aid this prioritization assessment. The fish barrier database can now be easily expanded to include inventories of additional streams within the region, as well as to track the progress of habitat restoration initiatives, including dam removals and installation of fish ladders. Streams evaluated include: Carll's River, Brown's River, Swan River, Mud Creek, Beaver Dam Creek and the Carman's River.

Additionally, NP&V prepared a Watershed Management Plan for Beaver Dam Creek.

Nelson & Pope

Nelson Pope & Voorhis

572 Walt Whitman Road
Melville, New York
11747

Phone: 631-427-5665
Fax: 631-427-5620
npv@nelsonpope.com

Nelson Pope & Voorhis

Great Cove Watershed Management Plan & Stormwater Improvements
Town of Islip

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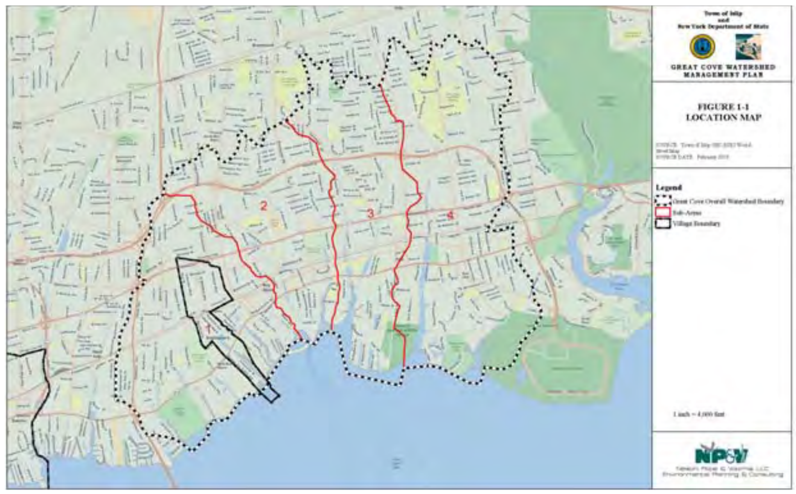

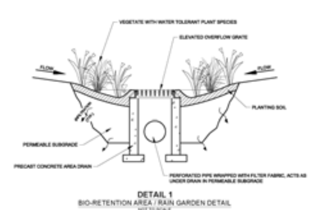

NP&V prepared the Great Cove Watershed Management Plan for the Town of Islip (funded by the NYSDOS). Great Cove includes the western half of the Town's frontage on the Great South Bay, with a 16,000+ acre drainage contributing area comprised of industrial, commercial and higher population suburban areas constructed prior to 1970. Many areas within the watershed have high groundwater conditions, extensive impervious cover and drainage infrastructure and collection systems that discharge directly to Great Cove and the creeks tributary to it. The Management Plan focuses on improvement of water quality through the identification, control and reduction of non-point source pollution. Sixteen conceptual designs for drainage improvement projects within the watershed were prepared. Drainage improvement designs included use of green infrastructure techniques such as bio-retention areas, vegetated swales, pervious pavement, and various infiltration designs. Conceptual designs and estimated construction costs were prepared for each location. Additionally, the project included a review of municipal operations and best management practices identified for salt storage, truck washing, roadway and stormwater system maintenance, and highway yard storage and drainage.

NELSON POPE & VOORHIS

LAKE MONTAUK
WATERSHED MANAGEMENT PLAN
TOWN OF EAST HAMPTON

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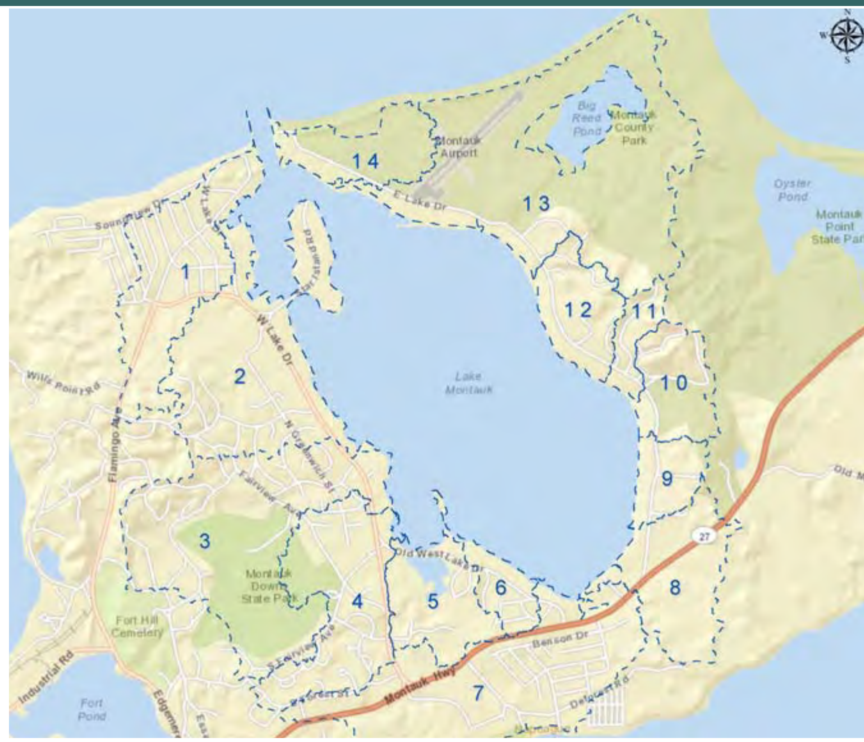
FAX: 631-427-5620
NPV@NELSONPOPE.COM



NP&V completed the Lake Montauk Watershed Management Plan for the Town of East Hampton (funded by the New York State Department of State). NP&V worked with the Town and CCE (who conducted surface water sampling and DNA analysis, as well as eel grass surveys and habitat assessments) to prepare a complete characterization of the Lake, gather input from the WMP advisory committee and furnish recommendations for watershed management. The upland contributing drainage areas to Lake Montauk are comprised of primarily residential uses with some commercial uses, marinas and yacht clubs located along or in immediate proximity to the waterfront. Many areas within the watershed have high groundwater conditions, poorly draining soils, and aged sanitary systems that impact the health of the Lake. The Management Plan focuses on improvement of water quality through the identification, control and reduction of non-point source pollution. Additionally, recommendations considered potential direct sanitary discharge to the Lake as evidence suggested contribution of coliform due to sanitary system failure. An implementation matrix that included sources of grant funding was prepared to aid in simple and rapid implementation of recommendations by the Town. The project was completed in July 2014.

NELSON POPE & VOORHIS

PECONIC ESTUARY INTER-MUNICIPAL STORMWATER MANAGEMENT SERVICES (MS4) SUFFOLK COUNTY

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Melville, New York
11747

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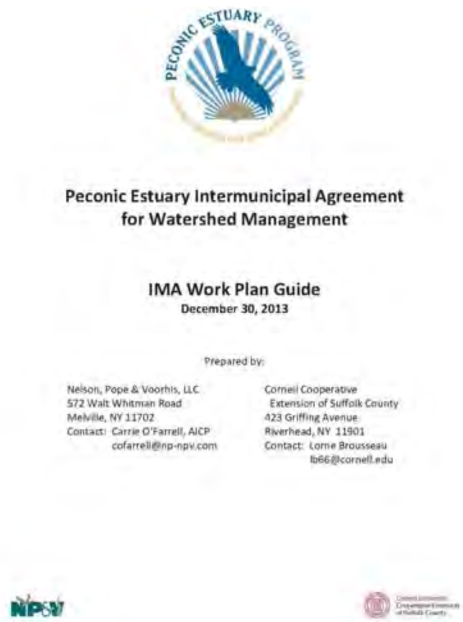
FAX: 631-427-5620
NPV@NELSONPOPE.COM



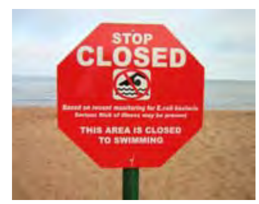
Peconic Estuary Intermunicipal Agreement for Watershed Management

IMA Work Plan Guide
December 30, 2013

Prepared by:

Nelson, Pope & Voorhis, LLC
572 Walt Whitman Road
Melville, NY 11702
Contact: Carrie O'Farrell, AICP
cofarrell@np-npv.com

Cornell Cooperative Extension of Suffolk County
423 Griffing Avenue
Riverhead, NY 11901
Contact: Lorne Brousseau
lb66@cornell.edu



The Peconic Estuary Program (PEP) retained NP&V, working with Cornell Cooperative Extension of Suffolk County (CCE), to establish an inter-municipal agreement (IMA) to establish collaboration efforts of 12 east end municipalities, Suffolk County and the NYS Department of Transportation to work together towards water quality improvements in the Peconic Estuary. The intention of the IMA was to establish a collective effort to secure funding and provide cost-saving implementation of water quality improvement programs and projects to benefit the Peconic Estuary. This effort involved regular meetings with representatives from all the municipalities/entities within the surface water contributing area of the Peconic Estuary, as well as meetings with each of the municipal governing boards.

NP&V and CCE drafted the IMA, established priority actions and programs with the IMA participants, established a Work Plan outlining various priority projects and actions, and completed several implementation products including: a grant application to establish funding for an estuary coordinator and three on-line training modules with supporting checklists and materials to assist participates with MS4 Stormwater Permit training requirements (illicit discharge detection, goose management and facility best management practices).

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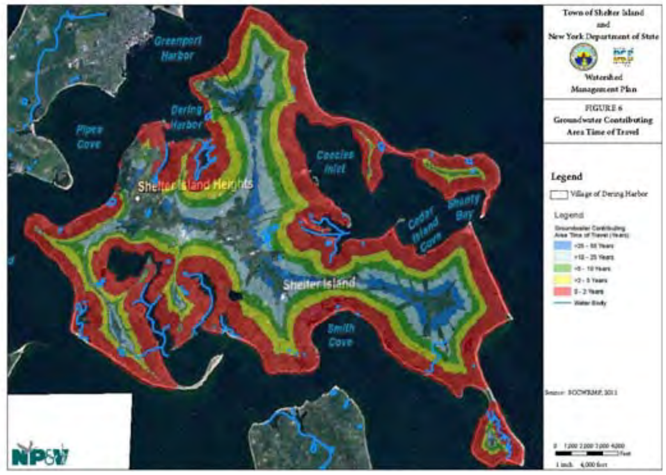
TOWN OF SHELTER ISLAND WATERSHED MANAGEMENT PLAN



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The Town of Shelter Island and Village of Dering Harbor retained NP&V to prepare a watershed management plan for the entirety of the island. The plan was funded by a grant from the NYSDOS and developed according to NYSDOS guidelines for watershed management plans. This document characterizes the watershed's natural resources, identifies known impairments, inventories existing land uses and open space, provides a comprehensive stormwater infrastructure inventory, determines critical stormwater runoff areas, identifies gaps in existing local laws, programs and practices, recommends actions to prevent further degradation, as well as identifies an implementation strategy to restore the watershed. Recommendations considered non-point source pollution from runoff and sanitary systems, as well as methods for remediation of a phosphorus impaired pond. Development of the plan included public participation and outreach to the local community. The project was completed in July 2014.

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572 Walt Whitman Road
Melville, New York
11747

PHONE: 631-427-5665
FAX: 631-427-5620
NPV@NELSONPOPE.COM

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ENVIRONMENTAL IMPACT STATEMENTS & NEPA/SEQRA ADMINISTRATION

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- MAPPING
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- PERMITTING & PROCESSING

EIS CONSULTING SERVICES:

- LANDSCAPE AND ENVIRONMENTAL DESIGN
- ECOLOGICAL & WILDLIFE STUDIES
- LOCAL/REGIONAL PLANNING STUDIES
- ECONOMIC & MARKET IMPACT STUDIES
- HISTORIC & CULTURAL RESOURCE STUDIES
- HYDROLOGIC AND SOIL SUITABILITY STUDIES
- NOISE IMPACT AND AIR EMISSION STUDIES
- VISUAL IMPACT ANALYSIS STUDIES & 2/3-D MODELS
- GEOGRAPHIC INFORMATION SYSTEM (GIS) SERVICES

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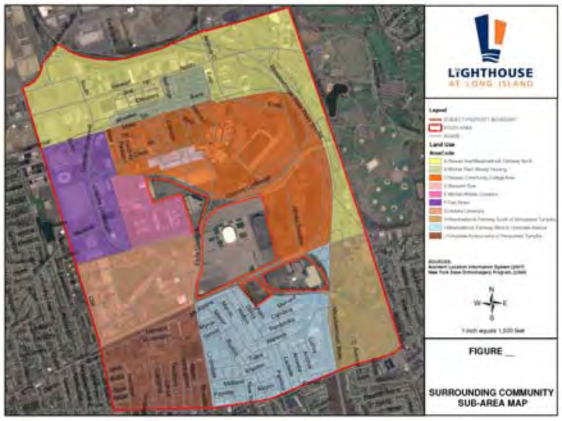

Environmental review pursuant to State Environmental Quality Review Act (SEQRA)/National Environmental Policy Act (NEPA) is required for any project of consequence proposed by private interests or government. NP&V excels at implementation of NEPA/SEQRA and performs NEPA/SEQRA review of proposed projects for government and private clients. We prepare all NEPA/SEQRA documents and ensure correct processing by agencies on behalf of our clients. NP&V has the experience and knowledge to navigate through this process to ensure that NEPA/SEQRA decisions which are made as a result of our consult are technically and administratively correct.

Sample Projects:

- **The Lighthouse @ Long Island, Nassau Coliseum EIS:** Draft and Final GEIS for a proposed 8 million square foot mixed-use development on 150-acres at the Nassau Veterans Memorial Coliseum site and adjacent commercial properties. NP&V was responsible for preparing the GEIS analysis for soils, topography, ecology, nitrogen analysis and water budget, aesthetics and visual resources, which included a regional visual analysis, air and noise sections. NP&V also delineated wetlands along the extent of the Meadowbrook Parkway to assist in evaluating potential impacts of possible roadway improvements.
- **Heckscher Museum of Art, Environmental Assessment**: NP&V completed NEPA administration and environmental consulting services for the proposed expansion and rehabilitation of the existing Heckscher Art Museum, listed on the National Register of Historic Places. Services involved the preparation of an Environmental Assessment Report for review by the National Park Service. Impact issues assessed as part of this review included coordination and Section 106 review by the State Office of Parks and Historic Preservation for historic compatibility and integrity, alienation and conversation of park lands, groundwater and drainage design and freshwater wetlands.
- **Brookhaven Walk, Town of Brookhaven, EIS**: Prepared an EIS for an innovative 850,000 SF regional shopping destination on a 150-acre site in Yaphank. NP&V worked closely and effectively in advising the applicant as to overall application strategies and provision of background information on the site, as well as input in relation to applicable land use plans and development restrictions in determining overall project uses, yields and site design. During the review period, the Town Board revised its Zoning Code, which necessitated a substantial revision of the project's site plans, particularly with respect to sanitary wastewater treatment.

Downtown Overlay Zones - DGEIS
City of New Rochelle, Westchester County

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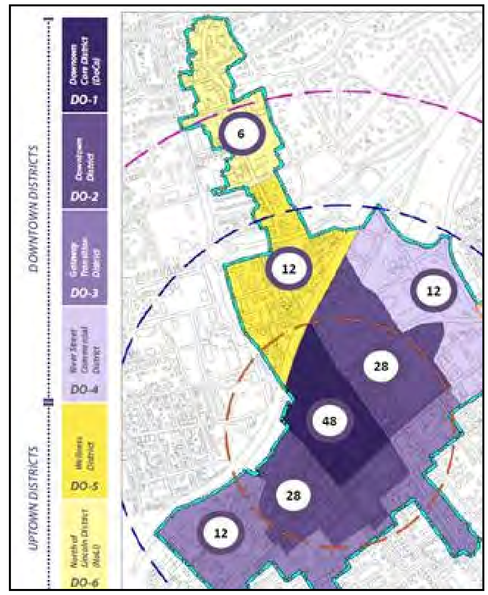

Above: Sample Illustration of a Significant Corner. Below: Projected improved streetscape & building design in a mixed-use setting.

NP&V worked with Renaissance Downtowns, the Master Developer, and the City of New Rochelle in preparing a Generic Environmental Impact Statement (GEIS) for the proposed adoption of a Downtown Overlay Zone (DOZ) for a 279-acre area of the downtown, centered around the New Rochelle train station. The DOZ is optional, whereby landowners can choose to opt into development under the proposed DOZ requirements. The intent of the Downtown Overlay District is to encourage downtown redevelopment through the creation of an active, mixed-use district with convenient, safe and pleasant access to the train station. The proposed DOZ would standardize uses to encourage the development of economically diverse high quality housing, modern retail, commercial, office, hotel space and civic uses integrated with well-designed pedestrian friendly streetscapes, and appropriately placed open and green spaces. The GEIS evaluated the specific code amendments to establish downtown overlay districts, as well as site specific impact analysis of the development scenario pursuant to the zoning amendments. The development scenario evaluated such key issues including traffic, system wide sewer and water infrastructure improvements, historic resources, community character, shadows, construction phasing, parking, air and noise. NP&V also prepared an economic impact analysis, which identified and quantified economic impacts on output, employment and labor income, as well as tax revenues.

Downtown Overlay Zones & Map Amendments
Supplemententtal GEIS
Incorporated Village of Hempstead, Nassau County

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Melville, New York
11747

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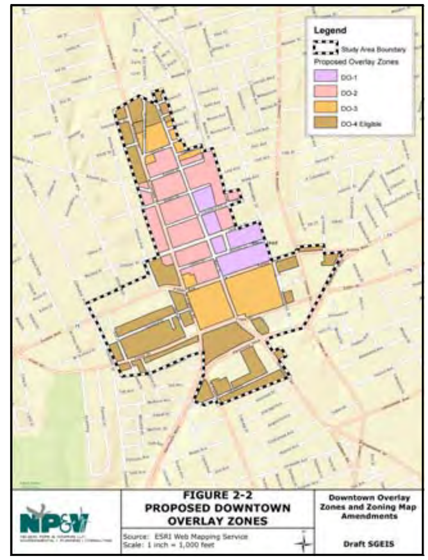
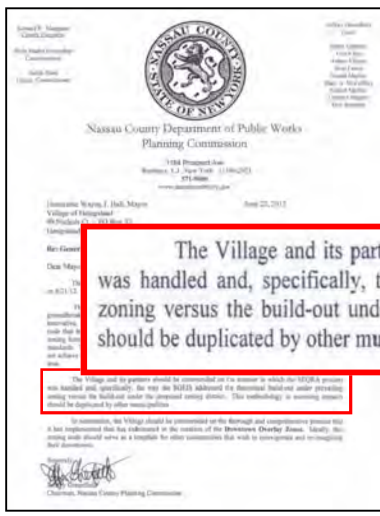
Image courtesy of Renaissance Downtowns, LLC





Nassau County Department of Public Works
Planning Commission

The Village and its partners should be commended on the manner in which the SEQRA process was handled and, specifically, the way the SGEIS addressed the theoretical build-out under prevailing zoning versus the build-out under the proposed zoning district. This methodology in assessing impacts should be duplicated by other municipalities.

NP&V worked with Renaissance Downtowns, the Village's Master Developer, and the Village of Hempstead to prepare a Supplemental Generic Environmental Impact Statement (GEIS) for the proposed adoption of Downtown Overlay Zones and Zoning Map amendments for a 279 acre area of downtown Village of Hempstead. The Supplemental GEIS evaluated the specific code amendments to establish downtown overlay districts, as well as site specific impact analysis of the development scenario pursuant to the zoning amendments. The development scenario evaluated included over five million square feet of mixed use residential, commercial and institutional uses within a 0.5 mile radius of the Hempstead train station. Key issues evaluated include traffic, system wide sewer and water infrastructure improvements, historic resources, community character, shadows, construction phasing, parking, air and noise. NP&V also prepared an economic impact analysis, which identified and quantified economic impacts on output, employment and labor income, as well as tax revenues. Nelson & Pope completed the Traffic Impact Study for the downtown area, including 40 area intersections, an assessment of trip generation accounting for the transient oriented design of the project and shared parking. The project was completed under an expedited timeframe and complimented by the Nassau County Planning Commission for the manner in which the SEQRA process was completed, and in particular, the analysis methodologies used.

Town of Smithtown Continuing Care Retirement Community (CCRC) Zoning Ordinance & The Uplands at St. Johnland EIS

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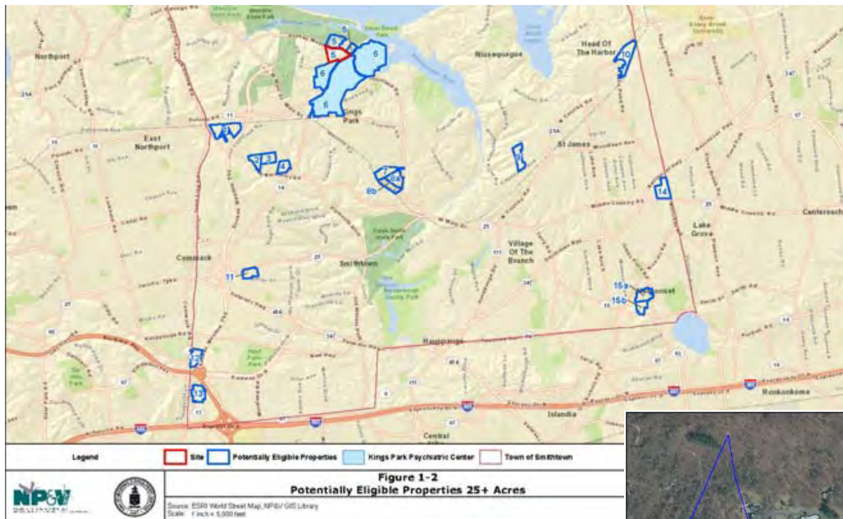

NP&V was retained by the Town of Smithtown to evaluate zoning requirements and options for a proposed Continuing Care Retirement Community (CCRC) use in the Town Code. This analysis included examining various code requirements for similar uses throughout the country. NP&V also prepared a Market Analysis to evaluate the demand for CCRC uses in the Town and vicinity.

NP&V also prepared an Environmental Impact Statement (EIS) for the proposed CCRC Code amendments, which included a Town-wide analysis of all potentially qualifying parcels meeting the proposed CCRC zoning criteria and analysis of a site-specific development project proposed under the proposed CCRC district (The Uplands at St. Johnland). The Uplands project included 199-unit Continuing Care Retirement Community (CCRC) of approximately 430,000 gross square feet consisting of 22 townhouse units, 153 independent living units and 24 assisted living units. The site specific analysis involved a 50-acre site with a number of environmental constraints, including wetlands, slopes, confining soil/perched water conditions, and sanitary flow limitations. Both natural and human resources were assessed for the project, including the verification of a wetland delineation for a NYS regulated pond on the parcel to be developed. Compliance with both the Wild, Scenic and Recreational River corridor regulations and the Local Waterfront Revitalization Program policies were analyzed for the proposed development.

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Brookhaven Town Center EIS

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EIS Consulting Services:

Landscape and Environmental Design
Ecological & Wildlife Studies
Local/Regional Planning Studies
Economic & Market Impact Studies
Historic & Cultural Resource Studies
Hydrologic and Soil Suitability Studies
Noise Impact and Air Emission Studies
Visual Impact Analysis Studies & 2/3-D Models
Geographic Information System (GIS) Services

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572 Walt Whitman Road
Melville, New York

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NP&V prepared the Draft and Final EIS for an 850,000 square foot regional retail center on a 150-acre site. Project also included supplemental SEQRA documents for project design changes to address all natural and human resource impacts including land use, traffic, air quality, noise, wetlands, pine barrens habitats, community services and community character. Additionally, NP&V obtained Development of Regional Significance approval from the Central Pine Barrens Joint Policy and Planning Commission, as well as all necessary freshwater wetland permits from the NYSDEC and the Town of Brookhaven. A central factor in connection with the project was the availability of sanitary wastewater treatment, and the effect on yield associated with the specific type of treatment system required by County regulations.

Nelson Pope & Voorhis

Phase I Environmental Site Assessments

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Melville, New York
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Fax: 631-427-5620
NPV@nelsonpope.com

Nelson, Pope & Voorhis completes over 100 Phase I Environmental Site Assessments (ESA) every year on average in locations from Montauk to Manhattan and throughout the Tri-State Area. Phase I ESA's performed by NP&V involve everything from small to large commercial and industrial buildings to multiple blocks of mixed uses as a predecessor to major revitalization projects. A recent major project involved multiple Phase I ESA's for a Village of Hempstead Urban Renewal Project. Specifically, all of the properties and buildings located within the Urban Renewal Project boundary were inspected for the presence of potential recognized environmental conditions using specially designed comprehensive identification, inventory, database and graphic presentation system devised by NP&V for the project. Customized field inspection forms were completed for all of the properties and buildings to outline the use and contents of the properties and buildings, and to provide recommendations regarding potential recognized environmental conditions towards further investigation and cleanup needed to facilitate the renewal project.

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Phase II Environmental Site Assessments

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Nelson, Pope & Voorhis completes over 50 Phase II Environmental Site Assessments (ESA) every year in locations from Montauk to Manhattan and throughout the Tri-State Area. Phase II ESA's performed by NP&V involve a variety of sampling techniques and mediums including: hand auger and Power Probe soil and groundwater sampling, Ground Penetrating Radar (GPR), Photo Ionization Detection of field samples, methane monitoring, groundwater monitoring, determination of groundwater flow direction and all phases of site investigation and cleanup. Based on the results of Phase II ESA investigations, numerous site remediations have been completed under our supervision and in coordination with County, State and Federal environmental and health agencies. Over the years, NP&V has established an excellent working relationship with personnel of these agencies. This relationship allows us to obtain direct input from the regulatory agencies to promptly and properly coordinate and implement complex sampling and remedial tasks. We look forward to designing a program that fits your needs.

Nelson Pope & Voorhis

572 Walt Whitman Road
Melville, New York
11747

Phone: 631-427-5665
Fax: 631-427-5620
NPV@nelsonpope.com

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REMEDIATION, VCPS AND SITE CLOSURE

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Nelson, Pope & Voorhis implemented, coordinated and supervised the completion of a Voluntary Clean Up Plan (VCP) for the Coral Graphics site located in Hicksville on New South Road. This project involved the compilation of a sampling and analysis work plan reviewed and approved by New York State Department of Environmental Conservation (NYSDEC) and designed to identify the presence of contamination at the site. Based on the sample results, a remedial action plan was compiled for review and approval by NYSDEC. Once the remedial action plan was completed and accepted, NP&V personnel coordinated and supervised the remedial activities outlined for the project. At the conclusion of the remedial activities, endpoint samples were collected by NP&V personnel and submitted to a certified laboratory for analysis. The sample results were compiled and submitted to NYSDEC for review and closure of the NYSDEC file.

NP&V specializes in Phase I and Phase II Environmental Site Assessments, RI/FS projects, VCP projects and site cleanup on behalf of municipal and private clients.

NELSON POPE & VOORHIS

572 Walt Whitman Road
Melville, New York
11747

PHONE: 631-427-5665
FAX: 631-427-5620
NPV@NELSONPOPE.COM

NP&V

RESUMES

Charles J. Voorhis, AICP, CEP

PERSONAL PROFESSIONAL QUALIFICATIONS

Licensing and Certification:

- Certified Environmental Professional (CEP)
- American Institute of Certified Planners (AICP)
- Certified Environmental Inspector, Environmental Assessment Association
- US Coast Guard Master Steam and Auxiliary Sail Vessels

Experience:

- Managing Partner of Firm, Nelson, Pope & Voorhis, LLC; Melville, New York (1/97-Present)
- Principal of Firm, Charles Voorhis & Associates, Inc.; Miller Place, New York (8/88-1/97)
- Director, Division of Environmental Protection, Department of Planning, Environment and Development; Town of Brookhaven, New York (3/86-8/88)
- Environmental Analyst, Division of Environmental Protection, Department of Planning, Environment and Development; Town of Brookhaven, New York (8/82-3/86)
- Private and Public Consultant, Planning and Environmental Issues (8/82-3/87)
- Public Health Sanitarian, Suffolk County Department of Health Services; Hauppauge, New York (1/80-8/82)
- Environmentalist I, Suffolk County Department of Environmental Control, Central Islip, New York (2/78- 8/79)

Education:

- SUNY at Stony Brook; Master of Science in Environmental Engineering, concentration in Water Resource Management, 1984
- Princeton Associates; Groundwater Pollution and Hydrology Short Course, Princeton, New Jersey, 1983
- New York State Health Department, Environmental Health Training Course, Hauppauge, New York, 1982
- Southampton College of Long Island University; Bachelor of Science in Environmental Geology, 1977

Significant Professional Achievements:

- Great Cove Watershed Management Plan, 2011
- Town of Southold Comprehensive Plan Update, Economic Chapter, 2010
- Beaver Dam Creek Watershed Management Plan, 2009
- Lake Agawam Comprehensive Management Plan, 2009
- Southold TDR Planning Report and GEIS, 2008
- Suffolk County North Shore Embayments Watershed Management Plan, 2007
- Mt. Sinai Harbor Management Plan, 2006
- The Residences at North Hills, DEIS and FEIS, 2005-06
- Shelter Island Water Supply Study, 2005
- Town of Southold Comprehensive Implementation Strategy, 2003
- Lower Port Jefferson Harbor Action Plan, 2002
- Setauket Fire District Needs Analysis, 2001
- Southampton Agricultural Opportunities Subdivision, DEIS, FEIS and Findings, 2001
- Old Orchard Woods, DEIS and FEIS, 2000
- Town of Smithtown Armory Park, DEIS, 2000
- Town of Southold Water Supply Management & Water Protection Strategy, 2000
- CVS @ Greenlawn, DEIS and FEIS, 1998
- Knightsbridge Gardens, DEIS and FEIS, 1997
- Camelot Village @ Huntington, DEIS, 1997
- Airport International Plaza, DEIS and FEIS, 1996
- Price Club @ New Rochelle, DEIS and FEIS, 1995
- Commack Campus Park @ Commack DEIS and FEIS, 1994
- Water Mill Shops @ Water Mill DEIS, 1993
- PJ Venture Wholesale Club @ Commack DEIS and FEIS, 1993
- Dowling College NAT Center DEIS and FEIS, 1992
- Final EIS Angel Shores @ Southold, 1991
- Town of Brookhaven Boat Mooring Plan, 1991
- Draft EIS Round Hill @ Old Westbury, 1990
- Draft EIS St. Elsewhere @ Nesconset, 1989
- EQBA, Acquisition Study for Brookhaven Town, 1987
- Award for Environmentally Sensitive Land Design, Pine Barrens Review Comm., 1988
- Town of Brookhaven Land Use Plan, 1987
- Discussion of Hydrogeologic Zone Boundaries in the Vicinity of S. Yaphank, LI, NY, 1986
- Comprehensive Review of Industrial Zoned Land in the Sensitive Hydrogeologic Zone, Brookhaven, 1983

Professional & Other Organizations (past and present):

- American Planning Association, Washington, D.C.
- National Association of Environmental Professionals, Alexandria, VA
- Environmental Assessment Association, Scottsdale, Arizona
- American Water Resources Association, Syracuse, New York
- New York Water Pollution Control Association, Riverdale, NY
- Water Pollution Control Federation, Washington, D.C.
- Long Island Seaport & EcoCenter, Inc., Director, Port Jefferson, NY
- Boy Scouts of America, Trained Scoutmaster, Nathanial Woodhull District, NY
- Historical Society of Port Jefferson, Trustee, Port Jefferson, NY
- Environmental Conservation Board, Village of Port Jefferson, NY
- Port Jefferson Village, Waterfront Advisory Committee, Port Jefferson, NY
- Town of Brookhaven Mount Sinai Harbor Advisory Committee, Medford, NY
- Brookhaven Conservation Advisory Council, Medford, NY

Steven J. McGinn, CEI

PERSONAL PROFESSIONAL QUALIFICATIONS

Licensing and Certification:

- Licensed Asbestos Inspector
- OSHA 40 Hour HAZWOPER
- Certified Environmental Inspector, Environmental Assessment Association (CEI)
- Lead Based Paint Risk Assessor
- Radon Measurement Specialist

Experience:

- Partner/Division Manager, Nelson, Pope & Voorhis, LLC (July 2005 to Present)
- Senior Environmental Analyst, Nelson, Pope & Voorhis, LLC (January 1997 to July 2005)
- Environmental Analyst, Nelson & Pope, LLP (July 1989 to January 1997)
- Project Manager, Middleton Kontokosta & Associates (May 1988 to July 1989)
- Planning Aide, Town of Huntington Planning Department (January 1987 to May 1988)

Education:

- 8-Hour HAZWOPER Refresher Course
- 40-Hour Course Hazardous Materials Training
- Performing Phase I Environmental Inspections, Environmental Assessment Association, Sept. 1997
- Environmental Regulations Course, Executive Enterprises, June 1996
- Environmental Impact Statements, Cook College/Rutgers University, December 1994
- State University of New York at Cortland - Bachelor of Science in Geography, January 1986

Significant Professional Achievements:

- Village of Hempstead Urban Renewal Project - Phase I ESA
- Coram Plaza, Coram - Phase I, II & III ESA and Asbestos Survey
- 744 Clinton Street, Brooklyn - Phase I & II ESA
- Middle Island Country Club, Middle Island - Phase I & II ESA
- Tyrolean Auto Sport, Northport - Phase II & III ESA
- Long Island Children's Museum, Westbury - Phase I & II ESA
- 940 Bryant Avenue, Bronx - Phase I ESA
- 1345 Seneca Avenue, Bronx - Phase I ESA
- Red Roof Farms, Rye Brook - Phase I & II ESA
- Thomas Dodge Subaru, Port Jefferson - Phase I & II ESA
- 221 Skip Lane, Bay Shore - Phase I & II ESA
- 950 West Main Street, Riverhead - Phase I ESA
- Long Island Galleria/Price Club Plaza, Westbury - DEIS & FEIS
- Currans Road Development, Middle Island - DEIS & FEIS
- Timber Ridge at the Plains, Greenlawn - DEIS & FEIS
- Greene's Creek Marina, Sayville - DEIS
- Town of Brookhaven Marine Reconstruction Projects, Patchogue, Blue Point, Port Jefferson, Mount Sinai, - Tidal Wetland Permits
- Village of Lake Success, Lake Success - Land Use and Zoning Analyses

Professional Responsibilities:

- Division Manager for Phase I and Phase II Environmental Site Assessments, Site Remediation Coordination and Supervision, Lead-Based Paint sampling and Asbestos Surveys for lending institutions
- Author of numerous Phase I & II ESA reports, remediation & brownfield projects work plans, and closure reports in both draft and final formats for major large scale, high-profile projects.
- Other responsibilities include the preparation of various environmental, planning and zoning studies and the preparation of various state and federal applications such as: land use and zoning studies, noise and air quality assessments, feasibility studies, economic analyses, freshwater and tidal wetland permits, etc.
- Interaction with various Town, County, State and Federal officials, attorneys, developers, engineers, Town Boards, Planning Boards, and Zoning Boards of Appeals.

Professional & Other Organizations (past and present):

- American Planning Association, Washington, D.C.
- National Association of Environmental Professionals, Alexandria, VA
- Environmental Assessment Association, Scottsdale, Arizona
- National Groundwater Association, Assoc. of Groundwater Scientists and Engineers

Carrie O'Farrell, AICP

PERSONAL PROFESSIONAL QUALIFICATIONS

Experience:

- Partner/Division Manager of the Environmental Resource & Wetland Assessment Division, Nelson, Pope & Voorhis, LLC Melville, New York (3/2005 - present).

- Environmental Planner; Nelson, Pope & Voorhis, LLC, Melville, NY (10/2002 to 2/2005). Preparation of environmental assessments, environmental impact statements and various other land use and feasibility studies. Development of land use plans for town zoning and planning purposes, and coordinate reviews with various town and state officials. Preparation of freshwater & tidal wetlands permits & permit plans, NYSDEC Stormwater Pollution Prevention Plans and Stormwater General Permit filings.

- Consultant and Environmental Policy Analyst, Booz Allen Hamilton, Inc., Washington, D.C. (1999 to 2002). Provide program management, planning, on-site support, and data analysis for various federal agency environmental programs including U.S. Department of Energy, Federal Aviation Administration (FAA), and U.S. Department of Defense. Prepared policy recommendations, program information briefings, Congressional testimony, and various program support activities. Reviewed and prepared sections of environmental impact analyses, policy language, responses to public comments, press releases, and fact sheets; and coordinated interagency meetings and comment resolution between various federal offices.

Education:

- Bachelor of Science: University of Rochester, Environmental Science, May 1999

Significant Professional Achievements:

- Environmental Impact Statements (EIS): Downtown Hempstead Rezoning, Village of Hempstead; The Uplands at St. Johnland, Kings Park; Lighthouse @ Long Island, Kensington Estates, Woodbury; Roslyn Landing @ Roslyn; Glen Harbor Partners Town of N. Hempstead; The Residences @ North Hills, Village of North Hills; Lands End, Village of Sands Point; Korean Church of Long Island, Village of Lake Success; Sandy Hills, Town of Brookhaven;
- Draft Generic EIS and Mixed Use Planned Development District legislation: Gabreski Airport PDD; North Sea Mixed Use Development District, Southampton, NY.
- Planned Development District Master Plan & Planned Development District (PDD) Legislation: Gabreski Airport Master Plan, Town of Southampton; North Sea PDD, Town of Southampton; Poxabogue Golf Course PDD, Town of Southampton
- Expanded Part I & Part III Environmental Assessments: Williams Estate, Cold Spring Harbor; Parrish Art Museum, Town of Southampton; Cenacle Manor, Ronkonkoma; The Seasons at East Meadow; Laurel Hollow Subdivision; Greenport Marina, Greenport, NY; Engel Burman @ Plainview; Shaw Estates, Manorville
- NYC CEQR Environmental Assessments: Briarwood Plaza Bell Boulevard Rezoning; Hatzolah of Boro Park
- DEC SPDES Phase II Permits & Municipal Compliance: Village of Poquott, Village of Port Jefferson, & Village of Bellport Stormwater Management Plans; Completion of DEC annual reports; completion of 100+ Stormwater Pollution Prevention Plans for Stormwater Discharges from Construction Activity (GP-0-10-001) for construction sites throughout Nassau & Suffolk Counties.
- Municipal Planning Studies: Great Cove Watershed Management Plan, Town of Islip; Mount Sinai Harbor Management Plan, Town of Brookhaven; NYSDOS Beaver Dam Creek Watershed Management Plan; NYSDOS Barriers to Fish Passage in six South Shore Estuary Reserve Tributaries; Town of North Hempstead, North Sheets Creek Beach Shoreline & Park Improvements; Town of Shelter Island Water Supply Study;
- Wetlands Permits & Feasibility Studies: Fire Island Pines Property Owner's Association, Brookhaven; Bedford Ponds, Bedford, NY; Kismet Walks, Town of Islip; Mooney Pond, Coram, Town of Brookhaven; Port Washington Yacht Club, Port Washington.
- Site plan/subdivision review: Village of Lake Success, Town of Southampton, Town of Southold and Villages of Poquott and Southampton.
- US Department of Energy (DOE) Yucca Mountain Project Draft, Supplemental, and Final EIS. Conducted DOE headquarters policy review, prepared draft language, and coordinated inter- agency comment/review of documents for nationwide NEPA project.
- U.S. Department of Energy Yucca Mountain Site Recommendation. Assisted in the development and review of U.S. Secretary of Energy's Yucca Mountain Site Recommendation Decision and Congressional approval.
- NEPA Environmental Assessment: Heckscher Museum, Huntington, NY.

Eric C. Arnesen, LPG

PERSONAL PROFESSIONAL QUALIFICATIONS

Experience:

- Project Manager/Hydrogeologist, Nelson, Pope & Voorhis, LLC, Melville, NY (2014-Present)
- Hydrogeologist, Nelson, Pope & Voorhis, LLC, Melville, NY (1999-2014). Responsible for providing technical and professional expertise for Phase I, II, III, RI/FS studies, ESAs, EISs and EAFs regarding groundwater, surface water, soil and solid waste issues, and performs Stormwater Pollution Prevention Plan inspections and site monitoring.
- Hydrogeologist, Fanning, Phillips and Molnar, Ronkonkoma, NY (1998-1999). Field coordination and management of delineation and long-term monitoring programs for Air Force Center for Environmental Excellence (AFCEE) at United States Air Force Bases.
- Hydrogeologist, ERM-Northeast, Woodbury, NY (1993-1998). Field coordination and management of Phase I and II Investigation studies. Field Manager of RI/FSs, removal actions and plume delineation studies under jurisdiction of USEPA, USDOE and NYSDEC.
- Geologist/Hydrogeologist Roux Associates, Huntington, NY (1988-1993). Involved in over 30 Phase I and II investigations in all aspects of participation.

Education:

- State University of New York at Stony Brook, Masters of Science, Hydrogeology (2000).
- State University of New York at Cortland Bachelors of Science, Geology (1988).

Significant Professional Achievements:

- Prepared several Draft EISs for major development projects on Long Island which included the development of a 600,000 sq ft industrial facility on a 78 acre parcel within the Central Pine Barrens Compatible Growth Area in Yaphank, New York; a PRC complex on a 74 acre parcel within the Central Pine Barrens Compatible Growth Area in Eastport, New York and for a proposed home improvement center in Rocky Point, New York. Considered variety of environmental resources including water, geology, soils ecology community, aesthetics, transportation, cultural, zoning, land use and planning. Evaluated impacts developments may have on these resources and proposed mitigation measures to reduce impacts. Also evaluated alternatives to proposed project to determine most appropriate and feasible development approach. Presented finding during public information meetings sponsored by the Town planning board.
- Prepared several Draft EISs for the State Education Department (SED) related to the expansion and/or construction of educational facilities. Specifically, conducted an environmental review and authored the Draft EIS related to the proposed construction of a new Middle School for the Hewlett-Woodmere School District; High School expansion for the Center Moriches School District; construction for a proposed new public libraries in South Huntington, West Hempstead and Merrick and expansion of the Baldwin Public Library. Reviewed and analyzed potential project impacts on environmental resources, demography, public services, traffic patterns, cultural resources, aesthetics and surrounding land use. Outlined measures to be undertaken to mitigate any negative impact which may have resulted from each project.
- Prepared Part III EAF's for several development proposals including PRCs, multiple retail outlets, restaurants and apartment complexes. Addressed issues outlined in scoping documentation which include groundwater, topography, ecology, transportation cultural resources, aesthetic resources, community services, community character, sanitary disposal, etc. Analyzed impact development has on these resources and proposed mitigation measures to alleviate negative effects.
- Prepared multiple Phase I studies for a variety of industrial, commercial and residential facilities for the purpose of facilitating property transfer. Also prepared Phase I ESA's for County & Town agencies related to Land Preservation Acquisition.
- Conducted compliance inspections for several construction sites as per the requirements outlined under the NYSDEC SWPPP (GP-0-08-001).

Significant Professional Achievements:

- Conducted groundwater mounding hydrogeological studies as well as groundwater flow assessment studies to assess the potential impacts related to discharges from proposed new or expanded Sewage Treatment Plants (STP) within multi-family residential communities. The studies included the collection of geologic and hydrogeologic data which was incorporated into a numerical groundwater mounding model.
- Prepared Compatible Growth Area Application package for a Development of Regional Significance related to the construction of a light industrial facility in the Central Pine Barrens Region on Long Island, New York. Provided information requested by Central Pine Barrens Commission to ensure compliance with the standards and guidelines outlined in the Central Pine Barrens Comprehensive Land Use Plan.
- Conducted RI/FS for an electroplating facility in Farmingdale, New York. Prepared RI/FS report in accordance with NYSDEC requirements for the evaluation of remedial alternatives related to impacts to soils and groundwater. Evaluated technical data for the proposal of several remedial alternatives which included groundwater pump and treat, capping, excavation and encapsulation.
- Supervised and conducted field activities related to several RI/FS and Phase II studies for a variety of facilities which include government installations, dry cleaners, and industrial facilities. Oversaw all aspects of field investigation including well and boring installations, sampling activities, geophysical studies, air quality studies and hydrogeological studies (pump tests, step tests, stratigraphic mapping, etc.).

Professional & Other Organizations (past and present):

- Licensed Professional Geologist, Tennessee Department of Commerce, License # 4471
- OSHA 40 Hour HAZWOPER and 8 hour HAZWOPER refresher
- Geophysical Survey Systems, Inc., Theory and Practice of Applying Subsurface Interface Radar in Engineering and Geophysical Investigations Training Course, March 2004
- National Highway Institute, FHWA-NHI-132079 Subsurface Investigation Qualification, October, 2009.
- SUNY, Stormwater Management Program, Erosion & Sediment Control Site Design Training, May, 2008.

PHILLIP A. MALICKI, CEP, AICP, LEED® AP

PERSONAL PROFESSIONAL QUALIFICATIONS

Experience:

- Senior Environmental Planner, Nelson, Pope & Voorhis, LLC, (2/05 - present)
- Senior Planner, AKRF, Inc., (6/04 - 2/05)
- Senior Environmental Scientist, Nelson, Pope & Voorhis, LLC, (4/97 - 6/04)
- Senior Environmental Scientist, Ethan C. Eldon Associates, Uniondale, New York (6/95 - 4/97)
- Senior Environmental Analyst, Nelson & Pope, Melville, New York (2/90 - 3/95)
- Environmental Analyst, Nelson & Pope, Melville, New York (7/85 - 2/90)

Education:

- Master of Science, Earth Sciences, Adelphi University, Garden City, New York, 1984
- Bachelor of Science, Astrophysics, Indiana University, Bloomington, Indiana, 1979
- Visualizing Density, Lincoln Institute of Land Policy, Cambridge, Massachusetts, 2003
- Hydrology of Wetlands, Cook College/Rutgers University, 1998
- Methodology for Delineating Wetlands, Cook College/Rutgers University, 1994
- Environmental Impact Statements, Cook College/Rutgers University, 1994
- Introduction to Freshwater Wetland Delineation, Cook College/Rutgers University, 1993
- New York State Professional Engineer Review Course, Hofstra University, Uniondale, New York, 1988-89
- New York State Engineer in Training Review Course, Hofstra University, Uniondale, New York, 1987-88

Significant Professional Achievements:

- Tall Grass at Shoreham, DEIS & FEIS, Shoreham
- The Hamptons Club at Eastport, DSEIS, Eastport
- The Hamptons Club at Eastport, CPBJPPC Hardship Application
- Hess/Manorville, CPBJPPC Hardship Application
- Kuchtuk Property, PDD, Draft EIS, North Sea
- Blue Point Fire Department EAF Part III, Blue Point
- Headriver DEIS and FEIS, Riverhead
- The Hamlet at Willow Creek DSGEIS and FSGEIS, Mt. Sinai
- Narragansett Villas EAF Part III, Amityville
- Huntington Harbor Estates EAF Part III, Huntington
- Red Creek PDD GEIS, Hampton Bays
- Nesconset Armory Park DEIS, Smithtown
- Brookhaven Town Center/ Brookhaven Walk DEIS & FEIS, Yaphank
- Computer Associates Phase III Supplemental Generic EIS, Islandia
- Old Orchard Woods DEIS, Eatons Neck
- The Meadows at Mitchel Field DEIS, Uniondale
- North Shore Properties GEIS, Yaphank
- Brooklyn Hospital Center DEIS, Brooklyn
- Brooklyn Junction Shopping Center DEIS, Brooklyn
- Kiruv Estates DEIS, Huntington
- Adelphi University Campus Improvements Program EAF Part III, Garden City
- Commack Campus Park DSEIS, Commack
- Bethel Pentecostal Church DEIS, Old Westbury
- The Lighthouse DEIS (part), Uniondale
- RB Industrial Subdivision EAF Part III, Yaphank
- Mount Sinai PDD, DEIS, Mount Sinai
- Tall Grass Village Center PDD Application, Shoreham
- Fairfield at Rocky Point PDD Application, Rocky Point
- Five Towns College DEIS and FEIS, Dix Hills
- Fairfield at Rocky Point PDD DEIS, Rocky Point
- Crown Recycling Facility DEIS and FEIS, Riverhead
- LIRR Huntington/Port Jefferson Branch Train Yard DEIS (part)
- Pilgrim Inter-Modal Facility DEIS (part), Brentwood
- NYS Route 110 Road Widening Program DEIS (part), Melville
- Southold Solid Waste Management District Recycling Facility EAF Part III
- Southold Comprehensive Implementation Strategy Draft GEIS
- Southampton Agricultural Opportunities Subdivision Draft and Final GEIS
- Southampton Critical Wildlands and Groundwater Protection Plan Draft GEIS (part)
- Hauppauge Green Demographic & Tax Impact Analysis, Hauppauge

Professional Organizations & Certifications:

- Certified Environmental Professional (CEP)
- American Institute of Certified Planners (AICP)
- LEED Accredited Professional
- Member, American Planning Association
- Member, National Association of Environmental Professionals

ATTACHMENT B

LINAP ASSUMPTIONS – JANUARY 2017

Attachment C LINAP Assumptions

N Source	Application Load (lb-N/1,000sf/yr)	% of Parcel Fertilized	Leaching Rate (%) / Soil	Vadose Zone Loss	Aquifer Loss	Notes	Reasoning
Fertilizer	2.04	20-60%	30%	0%	0-15%	Residential; 1 lb-N/1,000 sf per application; 49% > 1 application per year (3-4); 31% 1 application per year; 4.5% 1 application every 3 years; 15.5% No fertilizer; Represent averages. Vaudrey gives average, low and high values	Modified from Vaudrey. 40% leaching rate is double the leaching rate used by MEP and between that and the NLM values. Leaching rate doubled due to age of turf and irrigation practices in Suffolk County. No strong evidence for vadose zone losses. Aquifer denitrification potential will be tested in sensitivity simulationsm as will a range of leaching rates (20 to 61%). Use Cornell % Turf for residential. Golf course application consistent with Cornell/Porter.
	3.89	Greens and Fairways	20%	0%	0-15%	golf courses	
	0.92	75%	30%	0%	0-15%	Parks and athletic fields; Assumes 50% of parks use fertilizer; Assumes 75% of the land is fertilized	
	0.46	90%	40%	0%	0-15%	Pasture/hay	Generally a permanent, non-rotating form of ag
	1.61	90%	40%	0%	0-15%	Orchards	Generally a permanent, non-rotating form of ag
	0.34	90%	40%	0%	0-15%	Vineyards (vinifera grapes)	Generally a permanent, non-rotating form of ag
	5.74	90%	40%	0%	0-15%	Sod	Generally a permanent, non-rotating form of ag
	2.53	90%	40%	0%	0-15%	Other Crops	Rotating crops. This represents the weighted average of the other crop types.

N Source	Application Load (lb-N/1,000sf/yr)	Leaching Rate (%) / Soil	Vadose Zone Loss	Aquifer Loss	Notes	Reasoning
Atmospheric	0.041	25%	0%	0-15%	Natural vegetation	Application load reduced to correspond with Southold Cedar Beach data and CASTNET data from surrounding stations. Leaching rates from TNC (2016).
		30%	0%		Turf	
		40%	0%		Agriculture	
		25%	0%		Wetlands	

N Source	Load (lbs-N/person/yr)	Attenuation Factors			Reasoning
		Septic Tank (Suffolk)	Leaching Ring & Plume	Aquifer	
On-Site Wastewater Systems (Residential)	**10**	**6%**	**10%**	**0-15%**	**This loading estimate is consistent with what was used on Long Island and the NLM but slightly reduced from the 10.58 (NLM) and the 11 lbs/person/yr mentioned by the Chesapeake report to account for additional N load from non-residential sources. The 6% lost in the septic tank from NLM. 10% from leaching rings and plume. 15% from aquifer as per Young, Kroeger and Hanson (2013), but this is likely the high end for Long Island. This will be evaluated with sensitivity simulations. For residential developments served by STPs, use County DMR data (No individual load appied to parcels served by STPs). People per household supplied by the Towns / Census**

Population (people per household)
See Population_EastEnd and Population_WestEnd
Eastern towns will be weighted for seasonal population (assuming July and August)

	Approach		
On-Site Wastewater Systems (Non-Residential)	Use County DMR data. For sites without DMR data, use Suffolk County Commercial Sewer Standards (flow per unit area), building footprints and an assumed effluent of 60 mg-N/L.		
	Land Use Type	Flow (gpd/sf)	
	Commercial	0.07	
	Industrial	0.04	
	Institutional	0.06	
	Downtown Commercial	0.07	PLUS an assumed 2 dwelling units
	For Parks		
	Number of cars/trucks per park per year (from SCDHS) x 4 people per vehicle (SCHDS) x 5 gallons per person (SCDHS) x 60 mg-N/L		

Animal N Load (lbs-N/animal/yr)	Cats	Dogs	% Lost to Volatilization	Geese & Ducks	Deer
	3.22	4.29	75%	*	*

Cat & Dog Population (number per household)		
	Indoor	Outdoor
Cats	1.16	**0.74**
Dogs	0	**1.4**

Appendix E-2
SONIR Model Results-Prior and Existing Conditions/Alternative 1

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT — **Alternative 1 - Pre-Existing Conditions (golf)**
Sayville, NY

DATA INPUT FIELD

A	Site Recharge Parameters	Value	Units
1	Area of Site	114.34	acres
2	Precipitation Rate	49.90	inches
3	Acreage of Fertilized Landscaping	90.56	acres
4	Fraction of Land in above	0.792	fraction
5	Evapotranspiration from above	25.50	inches
6	Runoff from above	0.50	inches
7	Acreage of Unfertilized Landscaping	0.00	acres
8	Fraction of above	0.000	fraction
9	Evapotranspiration from above	25.50	inches
10	Runoff from above	0.50	inches
11	Acreage of Unvegetated/Dirt Roads	3.86	acres
12	Fraction of above	0.034	fraction
13	Evapotranspiration from above	0.00	inches
14	Runoff from above	0.00	inches
15	Acreage of Water/Ponds	0.15	acres
16	Fraction of Site in above	0.001	fraction
17	Evaporation from above	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreage of Natural	14.94	acres
20	Fraction of above	0.131	fraction
21	Evapotranspiration from above	25.50	inches
22	Runoff from above	0.50	inches
23	Acreage of Impervious/Paved/Bldgs	5.34	acres
24	Fraction of Land in above	0.047	fraction
25	Evapotrans. from above	4.99	inches
26	Runoff from Impervious	0.00	inches
23	Acreage of Other	0.00	acres
24	Fraction of Land in above	0.000	fraction
25	Evapotrans. from above	25.50	inches
26	Runoff from above	0.00	inches
27	Acreage of Land Irrigated	90.56	acres
28	Fraction of Land Irrigated	0.792	fraction
29	Irrigation Rate	24.00	inches
30	Number of Dwellings	0	units
31	Water Use per Dwelling	225	gal/day
32	Wastewater Design Flow (units)	3,000	gal/day

B	Nitrogen Budget Parameters	Value	Units
1	Persons per Dwelling	1.98	persons
2	Nitrogen per Person per Year	10.0	lbs
3	a. Sanitary Nitrogen Leaching Rate	84%	percent
3	b. Treated Sanitary Nitrogen Leaching Rate	100%	percent
4	Fertilized Landscaping	90.56	acres
5	Fertilizer Application Rate (for above)	3.00	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent
7	Fertilized Land (other, if applicable)	0.00	acres
8	Fertilizer Application Rate (for above)	0.00	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate (for above)	0%	percent
10	Outdoor Cat Population	0.19	pets/dwelling
11	Cat Waste Nitrogen Load	3.22	lbs/pet/year
12	Outdoor Dog Population	0.35	pets/dwelling
13	Dog Waste Nitrogen Load	4.29	lbs/pet/year
14	Pet Waste Nitrogen Leaching Rate	25%	percent
15	Area of Land Irrigated	90.56	acres
16	Irrigation Rate	24.00	inches
17	Irrigation Nitrogen Leaching Rate	10%	percent
18	Atmospheric Nitrogen Application/Load	0.04	lbs/1000 sq ft
19	Atmos. N Leaching Rate (Natural/Wetlands)	25%	percent
20	Atmos. N Leaching Rate (Turf/Landscaped)	20%	percent
21	Atmos. N. Leaching Rate (Ag; Imperv; Other)	40%	percent
22	Nitrogen in Water Supply	2.00	mg/l
23	Nitrogen in Sanitary Flow	50.00	mg/l

C	Comments		
1)	Please refer to user manual for data input instructions; updated per LINAP.		
	Developed Area	96.05	84%
	Natural/Unvegetated/Revegetated Area	18.29	16%
	Total Acreage Check	114.34	100%

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 2

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 1 - Pre-Existing Conditions (golf)

SITE RECHARGE COMPUTATIONS

A	Fertilized Landscaping	Value	Units
1	A = Fraction of Land in Cover Type	0.792	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(a) = P - (E + Q)	23.90	inches
6	R(A) = R(a) x A	18.93	inches

B	Unfertilized Landscaping	Value	Units
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(b) = P - (E + Q)	23.90	inches
6	R(B) = R(b) x A	0.00	inches

C	Unvegetated/Dirt Roads	Value	Units
1	A = Fraction of Land in Cover Type	0.034	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	0.00	inches
4	Q = Runoff Rate	0.00	inches
5	R(c) = P - (E + Q)	49.90	inches
6	R(C) = R(c) x A	1.68	inches

D	Water/Ponds		
1	A = Fraction of Site in Water	0.001	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evaporation Rate	30.00	inches
4	Q = Runoff Rate	0.00	inches
5	M = Makeup Water	0.00	inches
6	R(d) = {P - (E+Q)} - M	19.90	inches
7	R(D) = R(d) x A	0.03	inches

E	Natural		
1	A = Fraction of Land in Cover Type	0.131	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(e) = P - (E + Q)	23.90	inches
6	R(E) = R(e) x A	3.12	inches

F	Impervous/Paved/Roads	Value	Units
1	A = Fraction of Land in Cover Type	0.047	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	4.99	inches
4	Q = Runoff Rate	0.00	inches
5	R(f) = P - (E + Q)	44.91	inches
6	R(F) = R(f) x A	2.10	inches

G	Other		
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.00	inches
5	R(g) = P - (E + Q)	24.40	inches
6	R(G) = R(g) x A	0.00	inches

H	Irrigation Recharge		
1	A = Fraction of Land Irrigated	0.792	fraction
2	I = Irrigation Rate	24.00	inches
3	E = Evaptranspiration Rate	21.40	inches
4	Q = Runoff Rate	0.00	inches
5	R(h) = I - (E + Q)	2.60	inches
6	R(H) = R(H) x A	2.06	inches

I	Wastewater Recharge		
1	WDF = Wastewater Design Flow	3,000	gal/day
2	WDF = Wastewater Design Flow	146,402	cu ft/yr
3	A = Area of Site	4,980,650	sq ft
4	R(j) = WDF/A	0.03	feet
5	R(I) = Wastewater Recharge	0.35	inches

J	Runoff Recharge		
1	Q(A) = Runoff from Landscaped	0.396	inches
2	Q(B) = Runoff from Unfertilized Landscaping	0.000	inches
3	Q(C) = Runoff from Unvegetated	0.000	inches
4	Q(E) = Runoff from Natural	0.065	inches
5	Q(H) = Runoff from Other	0.000	inches
6	Q(I) = Runoff from Irrigation	0.00	inches
7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.46	inches

Total Site Recharge		
R(T) =	R(A)+R(B)+R(C)+R(D)+R(E)+R(F)+R(G)+R(H)+R(I)+R(J)+Q(tot)	
R(T) =	**28.73**	**inches**

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 3

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 1 - Pre-Existing Conditions (golf)

SITE NITROGEN BUDGET

A	*Sanitary Nitrogen-Residential*	Value	Units
1	Number of Dwellings	0	units
2	Persons per Dwelling	1.98	capita
3	P = Population	0.00	capita
4	N = Nitrogen per person	10	lbs
6	N = (total; pre loss/removal)	0	lbs
7	LR = Leaching Rate	84%	percent
8	N(S) = P x N x LR	0.00	lbs
9	N = loss/removed	0.00	lbs

B	*Cat Waste Nitrogen*	Value	Units
1	Number of Cats per Dwelling	0.19	cats/dwelling
2	Number of Cats (Cats/dwelling x dwellings)	0	cats
3	Cat Waste Nitrogen Load	3.22	lbs/cat/year
4	N(p) = AR x cats x Adjustment (if applicable)	0.00	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	0.00	lbs
7	N = (loss/removed)	0.00	lbs

B'	*Dog Waste Nitrogen*	Value	Units
1	Number of Dogs per Dwelling	0.35	dogs/dwelling
2	Number of Dogs (Dogs/dwelling x dwellings)	0	dogs
3	Dog Waste Nitrogen Load	4.29	lbs/dog/year
4	N(p) = AR x dogs x Adjustment (if applicable)	0.00	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	0.00	lbs
7	N = (loss/removed)	0.00	lbs

C	*Sanitary Nitrogen (Wastewater Design Flow)*		
1	CF = Commercial/STP Flow	3,000	gal/day
2	CF = Commercial/STP Flow	4,144,575	liters/yr
5	N =Nitrogen	50.00	mg/l
6	N = Nitrogen	456.94	lbs
7	LR = Leaching Rate	100%	percent
8	N(S) = CF x N x LR	207,228,750	milligrams
9	N(S) = Sanitary Nitrogen	456.94	lbs
10	N = loss/removed	0.00	lbs

D	*Water Supply Nitrogen (other than wastewater, if applicable)*		
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	50.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

E	*Fertilized Land (Fertilized Landscaping)*		
1	A = Area of Land Fertilized	3,944,794	sq ft
2	AR = Application Rate	3.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	11834.38	lbs
4	LR = Leaching Rate	30%	percent
5	N(F1) = A x AR x LR	3550.31	lbs
6	N = loss/removed	8284.07	lbs

F	*Fertilized Land (Unfertilized Landscaping)*		
1	A = Area of Land Fertilized 2	0	sq ft
2	AR = Application Rate	0.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	0.00	lbs
4	LR = Leaching Rate	0%	percent
5	N(F2) = A x AR x LR	0.00	lbs
6	N = loss/removed	0.00	lbs

G	*Atmospheric Nitrogen (existing condition)*		
1	Application Load	0.041	lbs/1000 sf
2	Area of Natural/Wetlands/1000 sf	657	1000 sf
3	Leaching Rate	25%	percent
4	Atmos. N Load-1 (natural/wetlands)	6.74	lbs/year
5	Area of turf/landscaped/1000 sf	3,945	1000 sf
6	Leaching Rate	20%	percent
7	Atmos. N Load-2 (golf/turf)	32.35	lbs/year
8	Area of Impervious/Agricult/1000 sf	233	1000 sf
9	Leaching Rate	40%	percent
10	Atmos. N Load-3 (ag; imperv; other)	3.81	lbs/year
11	N(at) = N Load 1 + 2 +3	42.90	lbs
12	N = loss/removed	155.32	lbs

H	*Irrigation Nitrogen*		
1	R = Irrigation Recharge (inches)	2.06	inches
2	R = Irrigation Rate (feet)	0.1716	feet
3	A = Area of Land Irrigated	1,045,440	sq ft
4	R(I) = R(irr) x A	179,403	cu ft
5	R(I) = Site Irrigation (liters)	5,080,690	liters
6	N = Nitrogen in Water Supply	2.00	mg/l
7	N(T) = Nitrogen (total applied)	22.41	lbs
8	LR = Leaching Rate	10%	percent
9	N(irr) = R(I) x N x LR	1,016,138	milligrams
10	N(irr) = Irrigation Nitrogen	2.24	lbs
11	N = loss/removed	20.17	lbs

Total Site Nitrogen		
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)	
N=	**4,052.39**	lbs

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 4

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

Alternative 1 - Pre-Existing Conditions (golf)
Sayville, NY

FINAL COMPUTATIONS

A	***Nitrogen in Recharge (concentr.)***	***Value***	***Units***
1	N = Total Nitrogen (lbs)	4,052.39	lbs
2	N = Total Nitrogen (milligrams)	1,839,786,817	milligrams
3	R(T) = Total Recharge (inches)	28.73	inches
4	R(T) = Total Recharge (feet)	2.39	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	11,926,022	cu ft
7	R = Site Recharge Volume	337,744,931	liters
9	NR = N/R	5.45	mg/l

CONCENTRATION OF
NITROGEN IN RECHARGE

5.45

A	***Nitrogen in Recharge***	***Value***	***Units***
1	N = Total Nitrogen (lbs)	4,052.39	lbs
2	N = Total Nitrogen (milligrams)	1,839,786,817	milligrams
3	R(T) = Total Recharge (inches)	28.73	inches
4	R(T) = Total Recharge (feet)	2.39	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	11,926,022	cu ft
7	R = Site Recharge Volume	337,744,931	liters
9	NR = N/R	5.45	mg/l

Conversions used in SONIR	
Acres x 43,560 = Square Feet	Gallons x 0.1337 = Cubic Feet
Cubic Feet x 7.48052 = Gallons	Gallons x 3.785 = Liters
Cubic Feet x 28.32 = Liters	Grams / 1,000 = Milligrams
Days x 365 = Years	Grams x 0.002205 = Pounds
Feet x 12 = Inches	Milligrams / 1,000 = Grams

B	***Site Recharge Summary***	***Value***	***Units***
1	R(T) = Total Site Recharge	28.73	inches/yr
2	R = Site Recharge Volume	11,926,022	cu ft/yr
3	R = Site Recharge Volume	89,212,843	gal/yr
4	R = Site Recharge Volume	89.21	MG/yr

Nitrogen Load Summary - On-Site	**Load**	**Percent**
Sanitary Nitrogen (On-Site Wastewater)	456.94	11.28%
Fertilized Landscaping	3550.31	87.61%
Dog Waste Nitrogen	0.00	0.00%
Cat Waste Nitrogen	0.00	0.00%
Atmospheric Nitrogen	42.90	1.06%
Irrigation Nitrogen	2.24	0.06%
Total Pounds Nitrogen	4,052.39	100.00%

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 1

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT **Alternative 1 - Existing Conditions (no golf)**
Sayville, NY

DATA INPUT FIELD

A	*Site Recharge Parameters*	*Value*	*Units*
1	Area of Site	114.34	acres
2	Precipitation Rate	49.90	inches
3	Acreage of Fertilized Landscaping	90.56	acres
4	Fraction of Land in above	0.792	fraction
5	Evapotranspiration from above	25.50	inches
6	Runoff from above	0.50	inches
7	Acreage of Unfertilized Landscaping	0.00	acres
8	Fraction of above	0.000	fraction
9	Evapotranspiration from above	25.50	inches
10	Runoff from above	0.50	inches
11	Acreage of Unvegetated/Dirt Roads	3.86	acres
12	Fraction of above	0.034	fraction
13	Evapotranspiration from above	0.00	inches
14	Runoff from above	0.00	inches
15	Acreage of Water/Ponds	0.15	acres
16	Fraction of Site in above	0.001	fraction
17	Evaporation from above	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreage of Natural	14.94	acres
20	Fraction of above	0.131	fraction
21	Evapotranspiration from above	25.50	inches
22	Runoff from above	0.50	inches
23	Acreage of Impervious/Paved/Bldgs	5.34	acres
24	Fraction of Land in above	0.047	fraction
25	Evapotrans. from above	4.99	inches
26	Runoff from Impervious	0.00	inches
23	Acreage of Other	0.00	acres
24	Fraction of Land in above	0.000	fraction
25	Evapotrans. from above	25.50	inches
26	Runoff from above	0.00	inches
27	Acreage of Land Irrigated	0.00	acres
28	Fraction of Land Irrigated	0.000	fraction
29	Irrigation Rate	24.00	inches
30	Number of Dwellings	0	units
31	Water Use per Dwelling	225	gal/day
32	Wastewater Design Flow (units)	3,000	gal/day

B	*Nitrogen Budget Parameters*	*Value*	*Units*
1	Persons per Dwelling	1.98	persons
2	Nitrogen per Person per Year	10.0	lbs
3	a. Sanitary Nitrogen Leaching Rate	84%	percent
3	b. Treated Sanitary Nitrogen Leaching Rate	100%	percent
4	Fertilized Landscaping	90.56	acres
5	Fertilizer Application Rate (for above)	0.00	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent
7	Fertilized Land (other, if applicable)	0.00	acres
8	Fertilizer Application Rate (for above)	0.00	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate (for above)	0%	percent
10	Outdoor Cat Population	0.19	pets/dwelling
11	Cat Waste Nitrogen Load	3.22	lbs/pet/year
12	Outdoor Dog Population	0.35	pets/dwelling
13	Dog Waste Nitrogen Load	4.29	lbs/pet/year
14	Pet Waste Nitrogen Leaching Rate	25%	percent
15	Area of Land Irrigated	0.00	acres
16	Irrigation Rate	24.00	inches
17	Irrigation Nitrogen Leaching Rate	10%	percent
18	Atmospheric Nitrogen Application/Load	0.04	lbs/1000 sq ft
19	Atmos. N Leaching Rate (Natural/Wetlands)	25%	percent
20	Atmos. N Leaching Rate (Turf/Landscaped)	20%	percent
21	Atmos. N. Leaching Rate (Ag; Imperv; Other)	40%	percent
22	Nitrogen in Water Supply	2.00	mg/l
23	Nitrogen in Sanitary Flow	50.00	mg/l

C	*Comments*		
1)	Please refer to user manual for data input instructions; updated per LINAP.		
	Developed Area	96.05	84%
	Natural/Unvegetated/Revegetated Area	18.29	16%
	Total Acreage Check	114.34	100%

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 2

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 1 - Existing Conditions (no golf)

SITE RECHARGE COMPUTATIONS

A	***Fertilized Landscaping***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.792	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(a) = P - (E + Q)	23.90	inches
6	R(A) = R(a) x A	18.93	inches

B	***Unfertilized Landscaping***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(b) = P - (E + Q)	23.90	inches
6	R(B) = R(b) x A	0.00	inches

C	***Unvegetated/Dirt Roads***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.034	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	0.00	inches
4	Q = Runoff Rate	0.00	inches
5	R(c) = P - (E + Q)	49.90	inches
6	R(C) = R(c) x A	1.68	inches

D	***Water/Ponds***		
1	A = Fraction of Site in Water	0.001	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evaporation Rate	30.00	inches
4	Q = Runoff Rate	0.00	inches
5	M = Makeup Water	0.00	inches
6	R(d) = {P - (E+Q)} - M	19.90	inches
7	R(D) = R(d) x A	0.03	inches

E	***Natural***		
1	A = Fraction of Land in Cover Type	0.131	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(e) = P - (E + Q)	23.90	inches
6	R(E) = R(e) x A	3.12	inches

F	***Impervous/Paved/Roads***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.047	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	4.99	inches
4	Q = Runoff Rate	0.00	inches
5	R(f) = P - (E + Q)	44.91	inches
6	R(F) = R(f) x A	2.10	inches

G	***Other***		
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.00	inches
5	R(g) = P - (E + Q)	24.40	inches
6	R(G) = R(g) x A	0.00	inches

H	***Irrigation Recharge***		
1	A = Fraction of Land Irrigated	0.000	fraction
2	I = Irrigation Rate	24.00	inches
3	E = Evaptranspiration Rate	21.40	inches
4	Q = Runoff Rate	0.00	inches
5	R(h) = I - (E + Q)	2.60	inches
6	R(H) = R(H) x A	0.00	inches

I	***Wastewater Recharge***		
1	WDF = Wastewater Design Flow	3,000	gal/day
2	WDF = Wastewater Design Flow	146,402	cu ft/yr
3	A = Area of Site	4,980,650	sq ft
4	R(j) = WDF/A	0.03	feet
5	R(I) = Wastewater Recharge	0.35	inches

J	***Runoff Recharge***		
1	Q(A) = Runoff from Landscaped	0.396	inches
2	Q(B) = Runoff from Unfertilized Landscaping	0.000	inches
3	Q(C) = Runoff from Unvegetated	0.000	inches
4	Q(E) = Runoff from Natural	0.065	inches
5	Q(H) = Runoff from Other	0.000	inches
6	Q(I) = Runoff from Irrigation	0.00	inches
7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.46	inches

Total Site Recharge		
R(T) =	R(A)+R(B)+R(C)+R(D)+R(E)+R(F)+R(G)+R(H)+R(I)+R(J)+Q(tot)	
R(T) =	**26.67**	**inches**

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 3

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 1 - Existing Conditions (no golf)

SITE NITROGEN BUDGET

A	*Sanitary Nitrogen-Residential*	*Value*	*Units*
1	Number of Dwellings	0	units
2	Persons per Dwelling	1.98	capita
3	P = Population	0.00	capita
4	N = Nitrogen per person	10	lbs
6	N = (total; pre loss/removal)	0	lbs
7	LR = Leaching Rate	84%	percent
8	N(S) = P x N x LR	0.00	lbs
9	N = loss/removed	0.00	lbs

B	*Cat Waste Nitrogen*	*Value*	*Units*
1	Number of Cats per Dwelling	0.19	cats/dwelling
2	Number of Cats (Cats/dwelling x dwellings)	0	cats
3	Cat Waste Nitrogen Load	3.22	lbs/cat/year
4	N(p) = AR x cats x Adjustment (if applicable)	0.00	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	0.00	lbs
7	N = (loss/removed)	0.00	lbs

B'	*Dog Waste Nitrogen*	*Value*	*Units*
1	Number of Dogs per Dwelling	0.35	dogs/dwelling
2	Number of Dogs (Dogs/dwelling x dwellings)	0	dogs
3	Dog Waste Nitrogen Load	4.29	lbs/dog/year
4	N(p) = AR x dogs x Adjustment (if applicable)	0.00	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	0.00	lbs
7	N = (loss/removed)	0.00	lbs

C	*Sanitary Nitrogen (Wastewater Design Flow)*		
1	CF = Commercial/STP Flow	3,000	gal/day
2	CF = Commercial/STP Flow	4,144,575	liters/yr
5	N =Nitrogen	50.00	mg/l
6	N = Nitrogen	456.94	lbs
7	LR = Leaching Rate	100%	percent
8	N(S) = CF x N x LR	207,228,750	milligrams
9	N(S) = Sanitary Nitrogen	456.94	lbs
10	N = loss/removed	0.00	lbs

D	*Water Supply Nitrogen* ***(other than wastewater, if applicable)***		
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	50.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

E	*Fertilized Land (Fertilized Landscaping)*		
1	A = Area of Land Fertilized	3,944,794	sq ft
2	AR = Application Rate	0.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	0.00	lbs
4	LR = Leaching Rate	30%	percent
5	N(F1) = A x AR x LR	0.00	lbs
6	N = loss/removed	0.00	lbs

F	*Fertilized Land (Unfertilized Landscaping)*		
1	A = Area of Land Fertilized 2	0	sq ft
2	AR = Application Rate	0.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	0.00	lbs
4	LR = Leaching Rate	0%	percent
5	N(F2) = A x AR x LR	0.00	lbs
6	N = loss/removed	0.00	lbs

G	*Atmospheric Nitrogen (existing condition)*		
1	Application Load	0.041	lbs/1000 sf
2	Area of Natural/Wetlands/1000 sf	657	1000 sf
3	Leaching Rate	25%	percent
4	Atmos. N Load-1 (natural/wetlands)	6.74	lbs/year
5	Area of turf/landscaped/1000 sf	3,945	1000 sf
6	Leaching Rate	20%	percent
7	Atmos. N Load-2 (golf/turf)	32.35	lbs/year
8	Area of Impervious/Agricult/1000 sf	233	1000 sf
9	Leaching Rate	40%	percent
10	Atmos. N Load-3 (ag; imperv; other)	3.81	lbs/year
11	N(at) = N Load 1 + 2 +3	42.90	lbs
12	N = loss/removed	155.32	lbs

H	*Irrigation Nitrogen*		
1	R = Irrigation Recharge (inches)	0.00	inches
2	R = Irrigation Rate (feet)	0.0000	feet
3	A = Area of Land Irrigated	1,045,440	sq ft
4	R(I) = R(irr) x A	0	cu ft
5	R(I) = Site Irrigation (liters)	0	liters
6	N = Nitrogen in Water Supply	2.00	mg/l
7	N(T) = Nitrogen (total applied)	0.00	lbs
8	LR = Leaching Rate	10%	percent
9	N(irr) = R(I) x N x LR	0	milligrams
10	N(irr) = Irrigation Nitrogen	0.00	lbs
11	N = loss/removed	0.00	lbs

Total Site Nitrogen		
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)	
N=	**499.84**	lbs

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 4

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

Alternative 1 - Existing Conditions (no golf)
Sayville, NY

FINAL COMPUTATIONS

A	Nitrogen in Recharge (concentr.)	Value	Units
1	N = Total Nitrogen (lbs)	499.84	lbs
2	N = Total Nitrogen (milligrams)	226,926,927	milligrams
3	R(T) = Total Recharge (inches)	26.67	inches
4	R(T) = Total Recharge (feet)	2.22	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	11,071,316	cu ft
7	R = Site Recharge Volume	313,539,677	liters
9	NR = N/R	0.72	mg/l

CONCENTRATION OF
NITROGEN IN RECHARGE

0.72

A	Nitrogen in Recharge	Value	Units
1	N = Total Nitrogen (lbs)	499.84	lbs
2	N = Total Nitrogen (milligrams)	226,926,927	milligrams
3	R(T) = Total Recharge (inches)	26.67	inches
4	R(T) = Total Recharge (feet)	2.22	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	11,071,316	cu ft
7	R = Site Recharge Volume	313,539,677	liters
9	NR = N/R	0.72	mg/l

B	Site Recharge Summary	Value	Units
1	R(T) = Total Site Recharge	26.67	inches/yr
2	R = Site Recharge Volume	11,071,316	cu ft/yr
3	R = Site Recharge Volume	82,819,203	gal/yr
4	R = Site Recharge Volume	82.82	MG/yr

Conversions used in SONIR	
Acres x 43,560 = Square Feet	Gallons x 0.1337 = Cubic Feet
Cubic Feet x 7.48052 = Gallons	Gallons x 3.785 = Liters
Cubic Feet x 28.32 = Liters	Grams / 1,000 = Milligrams
Days x 365 = Years	Grams x 0.002205 = Pounds
Feet x 12 = Inches	Milligrams / 1,000 = Grams

Nitrogen Load Summary - On-Site	Load	Percent
Sanitary Nitrogen (On-Site Wastewater)	456.94	91.42%
Fertilized Landscaping	0.00	0.00%
Dog Waste Nitrogen	0.00	0.00%
Cat Waste Nitrogen	0.00	0.00%
Atmospheric Nitrogen	42.90	8.58%
Irrigation Nitrogen	0.00	0.00%
Total Pounds Nitrogen	499.84	100.00%

Appendix E-3
SONIR Model Results-Proposed Project

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT — **Proposed Project - Greybarn at Sayville**
Sayville, NY

DATA INPUT FIELD

A	*Site Recharge Parameters*	*Value*	*Units*
1	Area of Site	114.34	acres
2	Precipitation Rate	49.90	inches
3	Acreage of Fertilized Landscaping	12.02	acres
4	Fraction of Land in above	0.105	fraction
5	Evapotranspiration from above	25.50	inches
6	Runoff from above	0.50	inches
7	Acreage of Unfertilized Landscaping	46.53	acres
8	Fraction of above	0.407	fraction
9	Evapotranspiration from above	25.50	inches
10	Runoff from above	0.50	inches
11	Acreage of Unvegetated/Dirt Roads	2.25	acres
12	Fraction of above	0.020	fraction
13	Evapotranspiration from above	0.00	inches
14	Runoff from above	0.00	inches
15	Acreage of Water/Ponds	3.46	acres
16	Fraction of Site in above	0.030	fraction
17	Evaporation from above	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreage of Natural	5.12	acres
20	Fraction of above	0.045	fraction
21	Evapotranspiration from above	25.50	inches
22	Runoff from above	0.50	inches
23	Acreage of Impervious/Paved/Bldgs	44.96	acres
24	Fraction of Land in above	0.393	fraction
25	Evapotrans. from above	4.99	inches
26	Runoff from Impervious	0.00	inches
23	Acreage of Other	0.00	acres
24	Fraction of Land in above	0.000	fraction
25	Evapotrans. from above	25.50	inches
26	Runoff from above	0.00	inches
27	Acreage of Land Irrigated	12.02	acres
28	Fraction of Land Irrigated	0.105	fraction
29	Irrigation Rate	24.00	inches
30	Number of Dwellings	1365	units
31	Water Use per Dwelling	225	gal/day
32	Wastewater Design Flow (units)	370,000	gal/day

B	*Nitrogen Budget Parameters*	*Value*	*Units*
1	Persons per Dwelling	1.98	persons
2	Nitrogen per Person per Year	10.0	lbs
3	a. Sanitary Nitrogen Leaching Rate	84%	percent
3	b. Treated Sanitary Nitrogen Leaching Rate	100%	percent
4	Fertilized Landscaping	12.02	acres
5	Fertilizer Application Rate (for above)	1.00	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent
7	Fertilized Land (other, if applicable)	0.00	acres
8	Fertilizer Application Rate (for above)	0.00	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate (for above)	0%	percent
10	Outdoor Cat Population	0.19	pets/dwelling
11	Cat Waste Nitrogen Load	3.22	lbs/pet/year
12	Outdoor Dog Population	0.35	pets/dwelling
13	Dog Waste Nitrogen Load	4.29	lbs/pet/year
14	Pet Waste Nitrogen Leaching Rate	25%	percent
15	Area of Land Irrigated	12.02	acres
16	Irrigation Rate	24.00	inches
17	Irrigation Nitrogen Leaching Rate	10%	percent
18	Atmospheric Nitrogen Application/Load	0.04	lbs/1000 sq ft
19	Atmos. N Leaching Rate (Natural/Wetlands)	25%	percent
20	Atmos. N Leaching Rate (Turf/Landscaped)	20%	percent
21	Atmos. N. Leaching Rate (Ag; Imperv; Other)	40%	percent
22	Nitrogen in Water Supply	2.00	mg/l
23	Nitrogen in Treated Sanitary Flow	8.00	mg/l

C	*Comments*		
1)	Please refer to user manual for data input instructions; updated per LINAP.		
2)	Fertilized landscape is managed at 1.0 lbs/1000 SF per landscape contractor.		
	Developed Area	106.97	94%
	Natural/Unvegetated/Revegetated Area	7.37	6%
	Total Acreage Check	114.34	100%

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 2

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Proposed Project - Greybarn at Sayville

SITE RECHARGE COMPUTATIONS

A	***Fertilized Landscaping***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.105	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(a) = P - (E + Q)	23.90	inches
6	R(A) = R(a) x A	2.51	inches

B	***Unfertilized Landscaping***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.407	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(b) = P - (E + Q)	23.90	inches
6	R(B) = R(b) x A	9.73	inches

C	***Unvegetated/Dirt Roads***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.020	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	0.00	inches
4	Q = Runoff Rate	0.00	inches
5	R(c) = P - (E + Q)	49.90	inches
6	R(C) = R(c) x A	0.98	inches

D	***Water/Ponds***		
1	A = Fraction of Site in Water	0.030	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evaporation Rate	30.00	inches
4	Q = Runoff Rate	0.00	inches
5	M = Makeup Water	0.00	inches
6	R(d) = {P - (E+Q)} - M	19.90	inches
7	R(D) = R(d) x A	0.60	inches

E	***Natural***		
1	A = Fraction of Land in Cover Type	0.045	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(e) = P - (E + Q)	23.90	inches
6	R(E) = R(e) x A	1.07	inches

F	***Impervous/Paved/Roads***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.393	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	4.99	inches
4	Q = Runoff Rate	0.00	inches
5	R(f) = P - (E + Q)	44.91	inches
6	R(F) = R(f) x A	17.66	inches

G	***Other***		
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.00	inches
5	R(g) = P - (E + Q)	24.40	inches
6	R(G) = R(g) x A	0.00	inches

H	***Irrigation Recharge***		
1	A = Fraction of Land Irrigated	0.105	fraction
2	I = Irrigation Rate	24.00	inches
3	E = Evaptranspiration Rate	21.40	inches
4	Q = Runoff Rate	0.00	inches
5	R(h) = I - (E + Q)	2.60	inches
6	R(H) = R(H) x A	0.27	inches

I	***Wastewater Recharge***		
1	WDF = Wastewater Design Flow	370,000	gal/day
2	WDF = Wastewater Design Flow	18,056,185	cu ft/yr
3	A = Area of Site	4,980,650	sq ft
4	R(j) = WDF/A	3.63	feet
5	R(I) = Wastewater Recharge	43.50	inches

J	***Runoff Recharge***		
1	Q(A) = Runoff from Landscaped	0.053	inches
2	Q(B) = Runoff from Unfertilized Landscaping	0.203	inches
3	Q(C) = Runoff from Unvegetated	0.000	inches
4	Q(E) = Runoff from Natural	0.022	inches
5	Q(H) = Runoff from Other	0.000	inches
6	Q(I) = Runoff from Irrigation	0.00	inches
7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.28	inches

Total Site Recharge		
R(T) =	R(A)+R(B)+R(C)+R(D)+R(E)+R(F)+R(G)+R(H)+R(I)+R(J)+Q(tot)	
R(T) =	**76.61**	**inches**

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 3

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Proposed Project - Greybarn at Sayville

SITE NITROGEN BUDGET

A	*Sanitary Nitrogen-Residential*	*Value*	*Units*
1	Number of Dwellings	0	units
2	Persons per Dwelling	1.98	capita
3	P = Population	0.00	capita
4	N = Nitrogen per person	10	lbs
6	N = (total; pre loss/removal)	0	lbs
7	LR = Leaching Rate	84%	percent
8	N(S) = P x N x LR	0.00	lbs
9	N = loss/removed	0.00	lbs

B	*Cat Waste Nitrogen*	*Value*	*Units*
1	Number of Cats per Dwelling	0.19	cats/dwelling
2	Number of Cats (Cats/dwelling x dwellings)	253	cats
3	Cat Waste Nitrogen Load	3.22	lbs/cat/year
4	N(p) = AR x cats x Adjustment (if applicable)	813.13	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	203.28	lbs
7	N = (loss/removed)	609.85	lbs

B'	*Dog Waste Nitrogen*	*Value*	*Units*
1	Number of Dogs per Dwelling	0.35	dogs/dwelling
2	Number of Dogs (Dogs/dwelling x dwellings)	478	dogs
3	Dog Waste Nitrogen Load	4.29	lbs/dog/year
4	N(p) = AR x dogs x Adjustment (if applicable)	2049.55	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	512.39	lbs
7	N = (loss/removed)	1537.16	lbs

C	*Sanitary Nitrogen (Wastewater Design Flow)*		
1	CF = Commercial/STP Flow	370,000	gal/day
2	CF = Commercial/STP Flow	511,164,250	liters/yr
5	N =Nitrogen	8.00	mg/l
6	N = Nitrogen	9016.94	lbs
7	LR = Leaching Rate	100%	percent
8	N(S) = CF x N x LR	4,089,314,000	milligrams
9	N(S) = Sanitary Nitrogen	9016.94	lbs
10	N = loss/removed	0.00	lbs

D	*Water Supply Nitrogen (other than wastewater, if applicable)*		
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	8.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

E	*Fertilized Land (Fertilized Landscaping)*		
1	A = Area of Land Fertilized	523,591	sq ft
2	AR = Application Rate	1.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	523.59	lbs
4	LR = Leaching Rate	30%	percent
5	N(F1) = A x AR x LR	157.08	lbs
6	N = loss/removed	366.51	lbs

F	*Fertilized Land (Unfertilized Landscaping)*		
1	A = Area of Land Fertilized 2	0	sq ft
2	AR = Application Rate	0.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	0.00	lbs
4	LR = Leaching Rate	0%	percent
5	N(F2) = A x AR x LR	0.00	lbs
6	N = loss/removed	0.00	lbs

G	*Atmospheric Nitrogen (existing condition)*		
1	Application Load	0.041	lbs/1000 sf
2	Area of Natural/Wetlands/1000 sf	2,401	1000 sf
3	Leaching Rate	25%	percent
4	Atmos. N Load-1 (natural/wetlands)	24.61	lbs/year
5	Area of turf/landscaped/1000 sf	524	1000 sf
6	Leaching Rate	20%	percent
7	Atmos. N Load-2 (golf/turf)	4.29	lbs/year
8	Area of Impervious/Agricult/1000 sf	1,958	1000 sf
9	Leaching Rate	40%	percent
10	Atmos. N Load-3 (ag; imperv; other)	32.12	lbs/year
11	N(at) = N Load 1 + 2 +3	61.02	lbs
12	N = loss/removed	139.17	lbs

H	*Irrigation Nitrogen*		
1	R = Irrigation Recharge (inches)	0.27	inches
2	R = Irrigation Rate (feet)	0.0228	feet
3	A = Area of Land Irrigated	1,045,440	sq ft
4	R(I) = R(irr) x A	23,812	cu ft
5	R(I) = Site Irrigation (liters)	674,358	liters
6	N = Nitrogen in Water Supply	2.00	mg/l
7	N(T) = Nitrogen (total applied)	2.97	lbs
8	LR = Leaching Rate	10%	percent
9	N(irr) = R(I) x N x LR	134,872	milligrams
10	N(irr) = Irrigation Nitrogen	0.30	lbs
11	N = loss/removed	2.68	lbs

Total Site Nitrogen		
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)	
N=	**9,951.00**	lbs

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT — **Proposed Project - Greybarn at Sayville**
Sayville, NY

FINAL COMPUTATIONS

A	*Nitrogen in Recharge (concentr.)*	*Value*	*Units*
1	N = Total Nitrogen (lbs)	9,951.00	lbs
2	N = Total Nitrogen (milligrams)	4,517,753,927	milligrams
3	R(T) = Total Recharge (inches)	76.61	inches
4	R(T) = Total Recharge (feet)	6.38	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	31,796,035	cu ft
7	R = Site Recharge Volume	900,463,707	liters
9	NR = N/R	5.02	mg/l

CONCENTRATION OF
NITROGEN IN RECHARGE

Pre-Mitigation **5.02**

A	*Nitrogen in Recharge*	*Value*	*Units*
1	N = Total Nitrogen (lbs)	2,713.84	lbs
2	N = Total Nitrogen (milligrams)	1,232,083,999	milligrams
3	R(T) = Total Recharge (inches)	76.61	inches
4	R(T) = Total Recharge (feet)	6.38	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	31,796,035	cu ft
7	R = Site Recharge Volume	900,463,707	liters
9	NR = N/R	1.37	mg/l

CONCENTRATION OF
NITROGEN IN RECHARGE

With Mitigation (See Summary Below) **1.37**

B	*Site Recharge Summary*	*Value*	*Units*
1	R(T) = Total Site Recharge	76.61	inches/yr
2	R = Site Recharge Volume	31,796,035	cu ft/yr
3	R = Site Recharge Volume	237,850,875	gal/yr
4	R = Site Recharge Volume	237.85	MG/yr

M3	*Reuse of Irrigation Water (optional)*	*Value*
1	IW = Reused Irrigation Water	0
2	IW = Reused Irrigation Water	0
3	N = Nitrogen in Aquifer	6.00
4	AF = Additional Factor (n/a)	100%
5	N(IW) = IW x N x AF	0
6	N(IW) = Irrigation N Reduction	0.00

Off-Site Treatment Benefit - Sewering Downtown Sayville

M1	*Sanitary Nitrogen (Wastewater Design Flow)*		
1	CF = Commercial/STP Flow	69,875	gal/day
2	CF = Commercial/STP Flow	96,534,059	liters/yr
5	N =Nitrogen (2)	50.00	mg/l
6	N = Nitrogen (2)	10642.88	lbs
7	LR = Leaching Rate	84%	percent
8	N(S) = CF x N x LR	4,054,430,494	milligrams
9	N(S) = Sanitary Nitrogen	8940.02	lbs
10	N = loss/removed	-1702.86	lbs

M2	*Sanitary Nitrogen (Wastewater Design Flow)*		
1	CF = Commercial/STP Flow	69,875	gal/day
2	CF = Commercial/STP Flow	96,534,059	liters/yr
5	N =Nitrogen (2)	8.00	mg/l
6	N = Nitrogen (2)	1702.86	lbs
7	LR = Leaching Rate	100%	percent
8	N(S) = CF x N x LR	772,272,475	milligrams
9	N(S) = Sanitary Nitrogen	1702.86	lbs
10	N = loss/removed	0.00	lbs

Conversions used in SONIR	
Acres x 43,560 = Square Feet	Gallons x 0.1337 = Cubic Feet
Cubic Feet x 7.48052 = Gallons	Gallons x 3.785 = Liters
Cubic Feet x 28.32 = Liters	Grams / 1,000 = Milligrams
Days x 365 = Years	Grams x 0.002205 = Pounds
Feet x 12 = Inches	Milligrams / 1,000 = Grams

Nitrogen Load Summary - On-Site	**Load**	**Percent**
Sanitary Nitrogen (On-Site Wastewater)	9,016.94	90.61%
Fertilized Landscaping	157.08	1.58%
Dog Waste Nitrogen	512.39	5.15%
Cat Waste Nitrogen	203.28	2.04%
Atmospheric Nitrogen	61.02	0.61%
Irrigation Nitrogen	0.30	0.00%
Total Pounds Nitrogen	9,951.00	100.00%

N Load Mitigation Summary		
Net Downtown Sewering N Load Reduction	**7237.16**	**lbs**
Reuse of Irrigation Water	**0**	**lbs**
Rain Garden N Load Reduction (Attachment C)	**0**	**lbs**
Total N Load Reduction	**7237.16**	**lbs**

Nitrogen Load Summary - With Mitigation	**Load**	**Percent**
Sanitary Nitrogen (On-Site + Off-Site Load Reduction)	2,713.84	74.39%
Fertilized Landscaping	157.08	4.31%
Dog Waste Nitrogen	512.39	14.05%
Cat Waste Nitrogen	203.28	5.57%
Atmospheric Nitrogen	61.02	1.67%
Irrigation Nitrogen	0.30	0.01%
Total Pounds Nitrogen	3,647.90	36.66%

Appendix E-4
SONIR Model Results-Alternative 2

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 1

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT **Alternative 2 - Residential (single family)**
Sayville, NY

DATA INPUT FIELD

A	*Site Recharge Parameters*	*Value*	*Units*
1	Area of Site	114.34	acres
2	Precipitation Rate	49.90	inches
3	Acreage of Fertilized Landscaping	71.73	acres
4	Fraction of Land in above	0.627	fraction
5	Evapotranspiration from above	25.50	inches
6	Runoff from above	0.50	inches
7	Acreage of Unfertilized Landscaping	0.00	acres
8	Fraction of above	0.000	fraction
9	Evapotranspiration from above	25.50	inches
10	Runoff from above	0.50	inches
11	Acreage of Unvegetated/Dirt Roads	0.00	acres
12	Fraction of above	0.000	fraction
13	Evapotranspiration from above	0.00	inches
14	Runoff from above	0.00	inches
15	Acreage of Water/Ponds	0.00	acres
16	Fraction of Site in above	0.000	fraction
17	Evaporation from above	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreage of Natural	0.00	acres
20	Fraction of above	0.000	fraction
21	Evapotranspiration from above	25.50	inches
22	Runoff from above	0.50	inches
23	Acreage of Impervious/Paved/Bldgs	42.61	acres
24	Fraction of Land in above	0.373	fraction
25	Evapotrans. from above	4.99	inches
26	Runoff from Impervious	0.00	inches
23	Acreage of Other	0.00	acres
24	Fraction of Land in above	0.000	fraction
25	Evapotrans. from above	25.50	inches
26	Runoff from above	0.00	inches
27	Acreage of Land Irrigated	71.73	acres
28	Fraction of Land Irrigated	0.627	fraction
29	Irrigation Rate	24.00	inches
30	Number of Dwellings	98	units
31	Water Use per Dwelling	300	gal/day
32	Wastewater Design Flow (units)	29,400	gal/day

B	*Nitrogen Budget Parameters*	*Value*	*Units*
1	Persons per Dwelling	3.29	persons
2	Nitrogen per Person per Year	10.0	lbs
3	a. Sanitary Nitrogen Leaching Rate	84%	percent
3	b. Treated Sanitary Nitrogen Leaching Rate	100%	percent
4	Fertilized Landscaping	71.73	acres
5	Fertilizer Application Rate (for above)	2.04	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent
7	Fertilized Land (other, if applicable)	0.00	acres
8	Fertilizer Application Rate (for above)	0.00	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate (for above)	0%	percent
10	Outdoor Cat Population	0.74	pets/dwelling
11	Cat Waste Nitrogen Load	3.22	lbs/pet/year
12	Outdoor Dog Population	1.40	pets/dwelling
13	Dog Waste Nitrogen Load	4.29	lbs/pet/year
14	Pet Waste Nitrogen Leaching Rate	25%	percent
15	Area of Land Irrigated	71.73	acres
16	Irrigation Rate	24.00	inches
17	Irrigation Nitrogen Leaching Rate	10%	percent
18	Atmospheric Nitrogen Application/Load	0.04	lbs/1000 sq ft
19	Atmos. N Leaching Rate (Natural/Wetlands)	25%	percent
20	Atmos. N Leaching Rate (Turf/Landscaped)	20%	percent
21	Atmos. N. Leaching Rate (Ag; Imperv; Other)	40%	percent
22	Nitrogen in Water Supply	2.00	mg/l
23	Nitrogen in Sanitary Flow	50.00	mg/l

C	*Comments*		
1)	Please refer to user manual for data input instructions; updated per LINAP.		
	Developed Area	114.34	100%
	Natural/Unvegetated/Revegetated Area	0.00	0%
	Total Acreage Check	114.34	100%

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 2

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 2 - Residential (single family)

SITE RECHARGE COMPUTATIONS

A	***Fertilized Landscaping***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.627	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(a) = P - (E + Q)	23.90	inches
6	R(A) = R(a) x A	14.99	inches

B	***Unfertilized Landscaping***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(b) = P - (E + Q)	23.90	inches
6	R(B) = R(b) x A	0.00	inches

C	***Unvegetated/Dirt Roads***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	0.00	inches
4	Q = Runoff Rate	0.00	inches
5	R(c) = P - (E + Q)	49.90	inches
6	R(C) = R(c) x A	0.00	inches

D	***Water/Ponds***		
1	A = Fraction of Site in Water	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evaporation Rate	30.00	inches
4	Q = Runoff Rate	0.00	inches
5	M = Makeup Water	0.00	inches
6	R(d) = {P - (E+Q)} - M	19.90	inches
7	R(D) = R(d) x A	0.00	inches

E	***Natural***		
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(e) = P - (E + Q)	23.90	inches
6	R(E) = R(e) x A	0.00	inches

F	***Impervous/Paved/Roads***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.373	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	4.99	inches
4	Q = Runoff Rate	0.00	inches
5	R(f) = P - (E + Q)	44.91	inches
6	R(F) = R(f) x A	16.74	inches

G	***Other***		
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.00	inches
5	R(g) = P - (E + Q)	24.40	inches
6	R(G) = R(g) x A	0.00	inches

H	***Irrigation Recharge***		
1	A = Fraction of Land Irrigated	0.627	fraction
2	I = Irrigation Rate	24.00	inches
3	E = Evaptranspiration Rate	21.40	inches
4	Q = Runoff Rate	0.00	inches
5	R(h) = I - (E + Q)	2.60	inches
6	R(H) = R(H) x A	1.63	inches

I	***Wastewater Recharge***		
1	WDF = Wastewater Design Flow	29,400	gal/day
2	WDF = Wastewater Design Flow	1,434,735	cu ft/yr
3	A = Area of Site	4,980,650	sq ft
4	R(j) = WDF/A	0.29	feet
5	R(I) = Wastewater Recharge	3.46	inches

J	***Runoff Recharge***		
1	Q(A) = Runoff from Landscaped	0.314	inches
2	Q(B) = Runoff from Unfertilized Landscaping	0.000	inches
3	Q(C) = Runoff from Unvegetated	0.000	inches
4	Q(E) = Runoff from Natural	0.000	inches
5	Q(H) = Runoff from Other	0.000	inches
6	Q(I) = Runoff from Irrigation	0.00	inches
7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.31	inches

Total Site Recharge		
R(T) =	R(A)+R(B)+R(C)+R(D)+R(E)+R(F)+R(G)+R(H)+R(I)+R(J)+Q(tot)	
R(T) =	**37.13**	**inches**

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 3

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 2 - Residential (single family)

SITE NITROGEN BUDGET

A	Sanitary Nitrogen-Residential	Value	Units
1	Number of Dwellings	98	units
2	Persons per Dwelling	3.29	capita
3	P = Population	322.42	capita
4	N = Nitrogen per person	10	lbs
6	N = (total; pre loss/removal)	3224.2	lbs
7	LR = Leaching Rate	84%	percent
8	N(S) = P x N x LR	2708.33	lbs
9	N = loss/removed	515.87	lbs

B	Cat Waste Nitrogen	Value	Units
1	Number of Cats per Dwelling	0.74	cats/dwelling
2	Number of Cats (Cats/dwelling x dwellings)	73	cats
3	Cat Waste Nitrogen Load	3.22	lbs/cat/year
4	N(p) = AR x cats x Adjustment (if applicable)	233.51	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	58.38	lbs
7	N = (loss/removed)	175.14	lbs

B'	Dog Waste Nitrogen	Value	Units
1	Number of Dogs per Dwelling	1.40	dogs/dwelling
2	Number of Dogs (Dogs/dwelling x dwellings)	137	dogs
3	Dog Waste Nitrogen Load	4.29	lbs/dog/year
4	N(p) = AR x dogs x Adjustment (if applicable)	588.59	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	147.15	lbs
7	N = (loss/removed)	441.44	lbs

C	Sanitary Nitrogen (Wastewater Design Flow)		
1	CF = Commercial/STP Flow	0	gal/day
2	CF = Commercial/STP Flow	0	liters/yr
5	N =Nitrogen	50.00	mg/l
6	N = Nitrogen	0.00	lbs
7	LR = Leaching Rate	100%	percent
8	N(S) = CF x N x LR	0	milligrams
9	N(S) = Sanitary Nitrogen	0.00	lbs
10	N = loss/removed	0.00	lbs

D	Water Supply Nitrogen (other than wastewater, if applicable)		
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	50.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

E	Fertilized Land (Fertilized Landscaping)		
1	A = Area of Land Fertilized	3,124,559	sq ft
2	AR = Application Rate	2.04	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	6374.10	lbs
4	LR = Leaching Rate	30%	percent
5	N(F1) = A x AR x LR	1912.23	lbs
6	N = loss/removed	4461.87	lbs

F	Fertilized Land (Unfertilized Landscaping)		
1	A = Area of Land Fertilized 2	0	sq ft
2	AR = Application Rate	0.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	0.00	lbs
4	LR = Leaching Rate	0%	percent
5	N(F2) = A x AR x LR	0.00	lbs
6	N = loss/removed	0.00	lbs

G	Atmospheric Nitrogen (existing condition)		
1	Application Load	0.041	lbs/1000 sf
2	Area of Natural/Wetlands/1000 sf	0	1000 sf
3	Leaching Rate	25%	percent
4	Atmos. N Load-1 (natural/wetlands)	0.00	lbs/year
5	Area of turf/landscaped/1000 sf	3,125	1000 sf
6	Leaching Rate	20%	percent
7	Atmos. N Load-2 (golf/turf)	25.62	lbs/year
8	Area of Impervious/Agricult/1000 sf	1,856	1000 sf
9	Leaching Rate	40%	percent
10	Atmos. N Load-3 (ag; imperv; other)	30.44	lbs/year
11	N(at) = N Load 1 + 2 +3	56.06	lbs
12	N = loss/removed	148.15	lbs

H	Irrigation Nitrogen		
1	R = Irrigation Recharge (inches)	1.63	inches
2	R = Irrigation Rate (feet)	0.1359	feet
3	A = Area of Land Irrigated	1,045,440	sq ft
4	R(I) = R(irr) x A	142,100	cu ft
5	R(I) = Site Irrigation (liters)	4,024,270	liters
6	N = Nitrogen in Water Supply	2.00	mg/l
7	N(T) = Nitrogen (total applied)	17.75	lbs
8	LR = Leaching Rate	10%	percent
9	N(irr) = R(I) x N x LR	804,854	milligrams
10	N(irr) = Irrigation Nitrogen	1.77	lbs
11	N = loss/removed	15.97	lbs

Total Site Nitrogen		
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)	
N=	**4,883.92**	lbs

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 4

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT **Alternative 2 - Residential (single family)**
Sayville, NY

FINAL COMPUTATIONS

A	*Nitrogen in Recharge (concentr.)*	*Value*	*Units*
1	N = Total Nitrogen (lbs)	4,883.92	lbs
2	N = Total Nitrogen (milligrams)	2,217,299,486	milligrams
3	R(T) = Total Recharge (inches)	37.13	inches
4	R(T) = Total Recharge (feet)	3.09	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	15,411,415	cu ft
7	R = Site Recharge Volume	436,451,268	liters
9	NR = N/R	5.08	mg/l

CONCENTRATION OF
NITROGEN IN RECHARGE

5.08

A	*Nitrogen in Recharge*	*Value*	*Units*
1	N = Total Nitrogen (lbs)	4,883.92	lbs
2	N = Total Nitrogen (milligrams)	2,217,299,486	milligrams
3	R(T) = Total Recharge (inches)	37.13	inches
4	R(T) = Total Recharge (feet)	3.09	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	15,411,415	cu ft
7	R = Site Recharge Volume	436,451,268	liters
9	NR = N/R	5.08	mg/l

B	*Site Recharge Summary*	*Value*	*Units*
1	R(T) = Total Site Recharge	37.13	inches/yr
2	R = Site Recharge Volume	15,411,415	cu ft/yr
3	R = Site Recharge Volume	115,285,397	gal/yr
4	R = Site Recharge Volume	115.29	MG/yr

Conversions used in SONIR	
Acres x 43,560 = Square Feet	Gallons x 0.1337 = Cubic Feet
Cubic Feet x 7.48052 = Gallons	Gallons x 3.785 = Liters
Cubic Feet x 28.32 = Liters	Grams / 1,000 = Milligrams
Days x 365 = Years	Grams x 0.002205 = Pounds
Feet x 12 = Inches	Milligrams / 1,000 = Grams

Nitrogen Load Summary - On-Site	**Load**	**Percent**
Sanitary Nitrogen (On-Site Wastewater)	0.00	0.00%
Fertilized Landscaping	1912.23	39.15%
Dog Waste Nitrogen	147.15	3.01%
Cat Waste Nitrogen	58.38	1.20%
Atmospheric Nitrogen	56.06	1.15%
Irrigation Nitrogen	1.77	0.04%
Total Pounds Nitrogen	4,883.92	100.00%

Appendix E-5
SONIR Model Results-Alternative 3

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT — **Alternative 3 - Mixed Residential (single-family & townhouses)**
Sayville, NY

DATA INPUT FIELD

A	Site Recharge Parameters	Value	Units
1	Area of Site	114.34	acres
2	Precipitation Rate	49.90	inches
3	Acreage of Fertilized Landscaping	53.70	acres
4	Fraction of Land in above	0.470	fraction
5	Evapotranspiration from above	25.50	inches
6	Runoff from above	0.50	inches
7	Acreage of Unfertilized Landscaping	0.00	acres
8	Fraction of above	0.000	fraction
9	Evapotranspiration from above	25.50	inches
10	Runoff from above	0.50	inches
11	Acreage of Unvegetated/Dirt Roads	0.00	acres
12	Fraction of above	0.000	fraction
13	Evapotranspiration from above	0.00	inches
14	Runoff from above	0.00	inches
15	Acreage of Water/Ponds	0.00	acres
16	Fraction of Site in above	0.000	fraction
17	Evaporation from above	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreage of Natural	0.00	acres
20	Fraction of above	0.000	fraction
21	Evapotranspiration from above	25.50	inches
22	Runoff from above	0.50	inches
23	Acreage of Impervious/Paved/Bldgs	60.64	acres
24	Fraction of Land in above	0.530	fraction
25	Evapotrans. from above	4.99	inches
26	Runoff from Impervious	0.00	inches
23	Acreage of Other	0.00	acres
24	Fraction of Land in above	0.000	fraction
25	Evapotrans. from above	25.50	inches
26	Runoff from above	0.00	inches
27	Acreage of Land Irrigated	53.70	acres
28	Fraction of Land Irrigated	0.470	fraction
29	Irrigation Rate	24.00	inches
30	Number of Dwellings	1039	units
31	Water Use per Dwelling	228	gal/day
32	Wastewater Design Flow (units)	236,700	gal/day

B	Nitrogen Budget Parameters	Value	Units
1	Persons per Dwelling	2.00	persons
2	Nitrogen per Person per Year	10.0	lbs
3	a. Sanitary Nitrogen Leaching Rate	84%	percent
3	b. Treated Sanitary Nitrogen Leaching Rate	100%	percent
4	Fertilized Landscaping	53.70	acres
5	Fertilizer Application Rate (for above)	2.04	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent
7	Fertilized Land (other, if applicable)	0.00	acres
8	Fertilizer Application Rate (for above)	0.00	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate (for above)	0%	percent
10	Outdoor Cat Population	0.25	pets/dwelling
11	Cat Waste Nitrogen Load	3.22	lbs/pet/year
12	Outdoor Dog Population	0.47	pets/dwelling
13	Dog Waste Nitrogen Load	4.29	lbs/pet/year
14	Pet Waste Nitrogen Leaching Rate	25%	percent
15	Area of Land Irrigated	53.70	acres
16	Irrigation Rate	24.00	inches
17	Irrigation Nitrogen Leaching Rate	10%	percent
18	Atmospheric Nitrogen Application/Load	0.04	lbs/1000 sq ft
19	Atmos. N Leaching Rate (Natural/Wetlands)	25%	percent
20	Atmos. N Leaching Rate (Turf/Landscaped)	20%	percent
21	Atmos. N. Leaching Rate (Ag; Imperv; Other)	40%	percent
22	Nitrogen in Water Supply	2.00	mg/l
23	Nitrogen in Treated Sanitary Flow	8.00	mg/l

C	Comments		
1)	Please refer to user manual for data input instructions; updated per LINAP.		
	Developed Area	114.34	100%
	Natural/Unvegetated/Revegetated Area	0.00	0%
	Total Acreage Check	114.34	100%

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 2

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 3 - Mixed Residential (single-family & townhouses)

SITE RECHARGE COMPUTATIONS

A	***Fertilized Landscaping***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.470	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(a) = P - (E + Q)	23.90	inches
6	R(A) = R(a) x A	11.22	inches

B	***Unfertilized Landscaping***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(b) = P - (E + Q)	23.90	inches
6	R(B) = R(b) x A	0.00	inches

C	***Unvegetated/Dirt Roads***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	0.00	inches
4	Q = Runoff Rate	0.00	inches
5	R(c) = P - (E + Q)	49.90	inches
6	R(C) = R(c) x A	0.00	inches

D	***Water/Ponds***		
1	A = Fraction of Site in Water	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evaporation Rate	30.00	inches
4	Q = Runoff Rate	0.00	inches
5	M = Makeup Water	0.00	inches
6	R(d) = {P - (E+Q)} - M	19.90	inches
7	R(D) = R(d) x A	0.00	inches

E	***Natural***		
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(e) = P - (E + Q)	23.90	inches
6	R(E) = R(e) x A	0.00	inches

F	***Impervous/Paved/Roads***	***Value***	***Units***
1	A = Fraction of Land in Cover Type	0.530	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	4.99	inches
4	Q = Runoff Rate	0.00	inches
5	R(f) = P - (E + Q)	44.91	inches
6	R(F) = R(f) x A	23.82	inches

G	***Other***		
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.00	inches
5	R(g) = P - (E + Q)	24.40	inches
6	R(G) = R(g) x A	0.00	inches

H	***Irrigation Recharge***		
1	A = Fraction of Land Irrigated	0.470	fraction
2	I = Irrigation Rate	24.00	inches
3	E = Evaptranspiration Rate	21.40	inches
4	Q = Runoff Rate	0.00	inches
5	R(h) = I - (E + Q)	2.60	inches
6	R(H) = R(H) x A	1.22	inches

I	***Wastewater Recharge***		
1	WDF = Wastewater Design Flow	236,700	gal/day
2	WDF = Wastewater Design Flow	11,551,078	cu ft/yr
3	A = Area of Site	4,980,650	sq ft
4	R(j) = WDF/A	2.32	feet
5	R(I) = Wastewater Recharge	27.83	inches

J	***Runoff Recharge***		
1	Q(A) = Runoff from Landscaped	0.235	inches
2	Q(B) = Runoff from Unfertilized Landscaping	0.000	inches
3	Q(C) = Runoff from Unvegetated	0.000	inches
4	Q(E) = Runoff from Natural	0.000	inches
5	Q(H) = Runoff from Other	0.000	inches
6	Q(I) = Runoff from Irrigation	0.00	inches
7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.23	inches

Total Site Recharge		
R(T) =	R(A)+R(B)+R(C)+R(D)+R(E)+R(F)+R(G)+R(H)+R(I)+R(J)+Q(tot)	
R(T) =	**64.33**	**inches**

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 3

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 3 - Mixed Residential (single-family & townhouses)

SITE NITROGEN BUDGET

A	*Sanitary Nitrogen-Residential*	*Value*	*Units*
1	Number of Dwellings	0	units
2	Persons per Dwelling	2.00	capita
3	P = Population	0.00	capita
4	N = Nitrogen per person	10	lbs
6	N = (total; pre loss/removal)	0	lbs
7	LR = Leaching Rate	84%	percent
8	N(S) = P x N x LR	0.00	lbs
9	N = loss/removed	0.00	lbs

B	*Cat Waste Nitrogen*	*Value*	*Units*
1	Number of Cats per Dwelling	0.25	cats/dwelling
2	Number of Cats (Cats/dwelling x dwellings)	256	cats
3	Cat Waste Nitrogen Load	3.22	lbs/cat/year
4	N(p) = AR x cats x Adjustment (if applicable)	824.42	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	206.10	lbs
7	N = (loss/removed)	618.31	lbs

B'	*Dog Waste Nitrogen*	*Value*	*Units*
1	Number of Dogs per Dwelling	0.47	dogs/dwelling
2	Number of Dogs (Dogs/dwelling x dwellings)	484	dogs
3	Dog Waste Nitrogen Load	4.29	lbs/dog/year
4	N(p) = AR x dogs x Adjustment (if applicable)	2078.00	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	519.50	lbs
7	N = (loss/removed)	1558.50	lbs

C	*Sanitary Nitrogen (Wastewater Design Flow)*		
1	CF = Commercial/STP Flow	236,700	gal/day
2	CF = Commercial/STP Flow	327,006,968	liters/yr
5	N =Nitrogen	8.00	mg/l
6	N = Nitrogen	5768.40	lbs
7	LR = Leaching Rate	100%	percent
8	N(S) = CF x N x LR	2,616,055,740	milligrams
9	N(S) = Sanitary Nitrogen	5768.40	lbs
10	N = loss/removed	0.00	lbs

D	*Water Supply Nitrogen* ***(other than wastewater, if applicable)***		
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	8.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

E	*Fertilized Land (Fertilized Landscaping)*		
1	A = Area of Land Fertilized	2,339,172	sq ft
2	AR = Application Rate	2.04	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	4771.91	lbs
4	LR = Leaching Rate	30%	percent
5	N(F1) = A x AR x LR	1431.57	lbs
6	N = loss/removed	3340.34	lbs

F	*Fertilized Land (Unfertilized Landscaping)*		
1	A = Area of Land Fertilized 2	0	sq ft
2	AR = Application Rate	0.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	0.00	lbs
4	LR = Leaching Rate	0%	percent
5	N(F2) = A x AR x LR	0.00	lbs
6	N = loss/removed	0.00	lbs

G	*Atmospheric Nitrogen (existing condition)*		
1	Application Load	0.041	lbs/1000 sf
2	Area of Natural/Wetlands/1000 sf	0	1000 sf
3	Leaching Rate	25%	percent
4	Atmos. N Load-1 (natural/wetlands)	0.00	lbs/year
5	Area of turf/landscaped/1000 sf	2,339	1000 sf
6	Leaching Rate	20%	percent
7	Atmos. N Load-2 (golf/turf)	19.18	lbs/year
8	Area of Impervious/Agricult/1000 sf	2,641	1000 sf
9	Leaching Rate	40%	percent
10	Atmos. N Load-3 (ag; imperv; other)	43.32	lbs/year
11	N(at) = N Load 1 + 2 +3	62.50	lbs
12	N = loss/removed	141.71	lbs

H	*Irrigation Nitrogen*		
1	R = Irrigation Recharge (inches)	1.22	inches
2	R = Irrigation Rate (feet)	0.1018	feet
3	A = Area of Land Irrigated	1,045,440	sq ft
4	R(I) = R(irr) x A	106,382	cu ft
5	R(I) = Site Irrigation (liters)	3,012,732	liters
6	N = Nitrogen in Water Supply	2.00	mg/l
7	N(T) = Nitrogen (total applied)	13.29	lbs
8	LR = Leaching Rate	10%	percent
9	N(irr) = R(I) x N x LR	602,546	milligrams
10	N(irr) = Irrigation Nitrogen	1.33	lbs
11	N = loss/removed	11.96	lbs

Total Site Nitrogen		
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)	
N=	**7,989.41**	lbs

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 4

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT **Alternative 3 - Mixed Residential (single-family & townhouses)**
Sayville, NY

FINAL COMPUTATIONS

A	*Nitrogen in Recharge (concentr.)*	*Value*	*Units*
1	N = Total Nitrogen (lbs)	7,989.41	lbs
2	N = Total Nitrogen (milligrams)	3,627,192,221	milligrams
3	R(T) = Total Recharge (inches)	64.33	inches
4	R(T) = Total Recharge (feet)	5.36	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	26,699,948	cu ft
7	R = Site Recharge Volume	756,142,535	liters
9	NR = N/R	4.80	mg/l

CONCENTRATION OF
NITROGEN IN RECHARGE

4.80

A	*Nitrogen in Recharge*	*Value*	*Units*
1	N = Total Nitrogen (lbs)	7,989.41	lbs
2	N = Total Nitrogen (milligrams)	3,627,192,221	milligrams
3	R(T) = Total Recharge (inches)	64.33	inches
4	R(T) = Total Recharge (feet)	5.36	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	26,699,948	cu ft
7	R = Site Recharge Volume	756,142,535	liters
9	NR = N/R	4.80	mg/l

Conversions used in SONIR	
Acres x 43,560 = Square Feet	Gallons x 0.1337 = Cubic Feet
Cubic Feet x 7.48052 = Gallons	Gallons x 3.785 = Liters
Cubic Feet x 28.32 = Liters	Grams / 1,000 = Milligrams
Days x 365 = Years	Grams x 0.002205 = Pounds
Feet x 12 = Inches	Milligrams / 1,000 = Grams

B	*Site Recharge Summary*	*Value*	*Units*
1	R(T) = Total Site Recharge	64.33	inches/yr
2	R = Site Recharge Volume	26,699,948	cu ft/yr
3	R = Site Recharge Volume	199,729,497	gal/yr
4	R = Site Recharge Volume	199.73	MG/yr

Nitrogen Load Summary - On-Site	Load	Percent
Sanitary Nitrogen (On-Site Wastewater)	5,768.40	72.20%
Fertilized Landscaping	1431.57	17.92%
Dog Waste Nitrogen	519.50	6.50%
Cat Waste Nitrogen	206.10	2.58%
Atmospheric Nitrogen	62.50	0.78%
Irrigation Nitrogen	1.33	0.02%
Total Pounds Nitrogen	7,989.41	100.00%

Appendix E-6
SONIR Model Results-Alternative 4

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 1

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT **Alternative 4 - Mixed Residential (single-family,duplex & golf)**
Sayville, NY

DATA INPUT FIELD

A	*Site Recharge Parameters*	*Value*	*Units*
1	Area of Site	114.34	acres
2	Precipitation Rate	49.90	inches
3	Acreage of Fertilized Landscaping	89.76	acres
4	Fraction of Land in above	0.785	fraction
5	Evapotranspiration from above	25.50	inches
6	Runoff from above	0.50	inches
7	Acreage of Unfertilized Landscaping	0.00	acres
8	Fraction of above	0.000	fraction
9	Evapotranspiration from above	25.50	inches
10	Runoff from above	0.50	inches
11	Acreage of Unvegetated/Dirt Roads	0.00	acres
12	Fraction of above	0.000	fraction
13	Evapotranspiration from above	0.00	inches
14	Runoff from above	0.00	inches
15	Acreage of Water/Ponds	0.00	acres
16	Fraction of Site in above	0.000	fraction
17	Evaporation from above	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreage of Natural	0.00	acres
20	Fraction of above	0.000	fraction
21	Evapotranspiration from above	25.50	inches
22	Runoff from above	0.50	inches
23	Acreage of Impervious/Paved/Bldgs	24.58	acres
24	Fraction of Land in above	0.215	fraction
25	Evapotrans. from above	4.99	inches
26	Runoff from Impervious	0.00	inches
23	Acreage of Other	0.00	acres
24	Fraction of Land in above	0.000	fraction
25	Evapotrans. from above	25.50	inches
26	Runoff from above	0.00	inches
27	Acreage of Land Irrigated	89.76	acres
28	Fraction of Land Irrigated	0.785	fraction
29	Irrigation Rate	24.00	inches
30	Number of Dwellings	181	units
31	Water Use per Dwelling	300	gal/day
32	Wastewater Design Flow (units)	54,300	gal/day

B	*Nitrogen Budget Parameters*	*Value*	*Units*
1	Persons per Dwelling	2.50	persons
2	Nitrogen per Person per Year	10.0	lbs
3	a. Sanitary Nitrogen Leaching Rate	84%	percent
3	b. Treated Sanitary Nitrogen Leaching Rate	100%	percent
4	Fertilized Landscaping	89.76	acres
5	Fertilizer Application Rate (for above)	2.04	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent
7	Fertilized Land (other, if applicable)	0.00	acres
8	Fertilizer Application Rate (for above)	0.00	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate (for above)	0%	percent
10	Outdoor Cat Population	0.37	pets/dwelling
11	Cat Waste Nitrogen Load	3.22	lbs/pet/year
12	Outdoor Dog Population	0.70	pets/dwelling
13	Dog Waste Nitrogen Load	4.29	lbs/pet/year
14	Pet Waste Nitrogen Leaching Rate	25%	percent
15	Area of Land Irrigated	89.76	acres
16	Irrigation Rate	24.00	inches
17	Irrigation Nitrogen Leaching Rate	10%	percent
18	Atmospheric Nitrogen Application/Load	0.04	lbs/1000 sq ft
19	Atmos. N Leaching Rate (Natural/Wetlands)	25%	percent
20	Atmos. N Leaching Rate (Turf/Landscaped)	20%	percent
21	Atmos. N. Leaching Rate (Ag; Imperv; Other)	40%	percent
22	Nitrogen in Water Supply	2.00	mg/l
23	Nitrogen in Treated Sanitary Flow	8.00	mg/l

C	*Comments*		
1)	Please refer to user manual for data input instructions; updated per LINAP.		
	Developed Area	114.34	100%
	Natural/Unvegetated/Revegetated Area	0.00	0%
	Total Acreage Check	114.34	100%

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 2

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 4 - Mixed Residential (single-family,duplex & golf)

SITE RECHARGE COMPUTATIONS

A	*Fertilized Landscaping*	Value	Units
1	A = Fraction of Land in Cover Type	0.785	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(a) = P - (E + Q)	23.90	inches
6	R(A) = R(a) x A	18.76	inches

B	*Unfertilized Landscaping*	Value	Units
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(b) = P - (E + Q)	23.90	inches
6	R(B) = R(b) x A	0.00	inches

C	*Unvegetated/Dirt Roads*	Value	Units
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	0.00	inches
4	Q = Runoff Rate	0.00	inches
5	R(c) = P - (E + Q)	49.90	inches
6	R(C) = R(c) x A	0.00	inches

D	*Water/Ponds*		
1	A = Fraction of Site in Water	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evaporation Rate	30.00	inches
4	Q = Runoff Rate	0.00	inches
5	M = Makeup Water	0.00	inches
6	R(d) = {P - (E+Q)} - M	19.90	inches
7	R(D) = R(d) x A	0.00	inches

E	*Natural*		
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(e) = P - (E + Q)	23.90	inches
6	R(E) = R(e) x A	0.00	inches

F	*Impervous/Paved/Roads*	Value	Units
1	A = Fraction of Land in Cover Type	0.215	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	4.99	inches
4	Q = Runoff Rate	0.00	inches
5	R(f) = P - (E + Q)	44.91	inches
6	R(F) = R(f) x A	9.65	inches

G	*Other*		
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.00	inches
5	R(g) = P - (E + Q)	24.40	inches
6	R(G) = R(g) x A	0.00	inches

H	*Irrigation Recharge*		
1	A = Fraction of Land Irrigated	0.785	fraction
2	I = Irrigation Rate	24.00	inches
3	E = Evaptranspiration Rate	21.40	inches
4	Q = Runoff Rate	0.00	inches
5	R(h) = I - (E + Q)	2.60	inches
6	R(H) = R(H) x A	2.04	inches

I	*Wastewater Recharge*		
1	WDF = Wastewater Design Flow	54,300	gal/day
2	WDF = Wastewater Design Flow	2,649,867	cu ft/yr
3	A = Area of Site	4,980,650	sq ft
4	R(j) = WDF/A	0.53	feet
5	R(I) = Wastewater Recharge	6.38	inches

J	*Runoff Recharge*		
1	Q(A) = Runoff from Landscaped	0.393	inches
2	Q(B) = Runoff from Unfertilized Landscaping	0.000	inches
3	Q(C) = Runoff from Unvegetated	0.000	inches
4	Q(E) = Runoff from Natural	0.000	inches
5	Q(H) = Runoff from Other	0.000	inches
6	Q(I) = Runoff from Irrigation	0.00	inches
7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.39	inches

Total Site Recharge		
R(T) =	R(A)+R(B)+R(C)+R(D)+R(E)+R(F)+R(G)+R(H)+R(I)+R(J)+Q(tot)	
R(T) =	**37.23**	**inches**

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 3

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 4 - Mixed Residential (single-family,duplex & golf)

SITE NITROGEN BUDGET

A	Sanitary Nitrogen-Residential	Value	Units
1	Number of Dwellings	0	units
2	Persons per Dwelling	2.50	capita
3	P = Population	0.00	capita
4	N = Nitrogen per person	10	lbs
6	N = (total; pre loss/removal)	0	lbs
7	LR = Leaching Rate	84%	percent
8	N(S) = P x N x LR	0.00	lbs
9	N = loss/removed	0.00	lbs

B	Cat Waste Nitrogen	Value	Units
1	Number of Cats per Dwelling	0.37	cats/dwelling
2	Number of Cats (Cats/dwelling x dwellings)	67	cats
3	Cat Waste Nitrogen Load	3.22	lbs/cat/year
4	N(p) = AR x cats x Adjustment (if applicable)	215.64	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	53.91	lbs
7	N = (loss/removed)	161.73	lbs

B'	Dog Waste Nitrogen	Value	Units
1	Number of Dogs per Dwelling	0.70	dogs/dwelling
2	Number of Dogs (Dogs/dwelling x dwellings)	127	dogs
3	Dog Waste Nitrogen Load	4.29	lbs/dog/year
4	N(p) = AR x dogs x Adjustment (if applicable)	543.54	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	135.89	lbs
7	N = (loss/removed)	407.66	lbs

C	Sanitary Nitrogen (Wastewater Design Flow)		
1	CF = Commercial/STP Flow	54,300	gal/day
2	CF = Commercial/STP Flow	75,016,808	liters/yr
5	N =Nitrogen	8.00	mg/l
6	N = Nitrogen	1323.30	lbs
7	LR = Leaching Rate	100%	percent
8	N(S) = CF x N x LR	600,134,460	milligrams
9	N(S) = Sanitary Nitrogen	1323.30	lbs
10	N = loss/removed	0.00	lbs

D	Water Supply Nitrogen (other than wastewater, if applicable)		
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	8.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

E	Fertilized Land (Fertilized Landscaping)		
1	A = Area of Land Fertilized	3,909,946	sq ft
2	AR = Application Rate	2.04	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	7976.29	lbs
4	LR = Leaching Rate	30%	percent
5	N(F1) = A x AR x LR	2392.89	lbs
6	N = loss/removed	5583.40	lbs

F	Fertilized Land (Unfertilized Landscaping)		
1	A = Area of Land Fertilized 2	0	sq ft
2	AR = Application Rate	0.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	0.00	lbs
4	LR = Leaching Rate	0%	percent
5	N(F2) = A x AR x LR	0.00	lbs
6	N = loss/removed	0.00	lbs

G	Atmospheric Nitrogen (existing condition)		
1	Application Load	0.041	lbs/1000 sf
2	Area of Natural/Wetlands/1000 sf	0	1000 sf
3	Leaching Rate	25%	percent
4	Atmos. N Load-1 (natural/wetlands)	0.00	lbs/year
5	Area of turf/landscaped/1000 sf	3,910	1000 sf
6	Leaching Rate	20%	percent
7	Atmos. N Load-2 (golf/turf)	32.06	lbs/year
8	Area of Impervious/Agricult/1000 sf	1,071	1000 sf
9	Leaching Rate	40%	percent
10	Atmos. N Load-3 (ag; imperv; other)	17.56	lbs/year
11	N(at) = N Load 1 + 2 +3	49.62	lbs
12	N = loss/removed	154.59	lbs

H	Irrigation Nitrogen		
1	R = Irrigation Recharge (inches)	2.04	inches
2	R = Irrigation Rate (feet)	0.1701	feet
3	A = Area of Land Irrigated	1,045,440	sq ft
4	R(I) = R(irr) x A	177,818	cu ft
5	R(I) = Site Irrigation (liters)	5,035,807	liters
6	N = Nitrogen in Water Supply	2.00	mg/l
7	N(T) = Nitrogen (total applied)	22.21	lbs
8	LR = Leaching Rate	10%	percent
9	N(irr) = R(I) x N x LR	1,007,161	milligrams
10	N(irr) = Irrigation Nitrogen	2.22	lbs
11	N = loss/removed	19.99	lbs

Total Site Nitrogen	
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)
N=	**3,957.82** lbs

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 4

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT **Alternative 4 - Mixed Residential (single-family,duplex & golf)**
Sayville, NY

FINAL COMPUTATIONS

A	*Nitrogen in Recharge (concentr.)*	*Value*	*Units*
1	N = Total Nitrogen (lbs)	3,957.82	lbs
2	N = Total Nitrogen (milligrams)	1,796,851,050	milligrams
3	R(T) = Total Recharge (inches)	37.23	inches
4	R(T) = Total Recharge (feet)	3.10	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	15,454,357	cu ft
7	R = Site Recharge Volume	437,667,403	liters
9	NR = N/R	4.11	mg/l

CONCENTRATION OF
NITROGEN IN RECHARGE

4.11

A	*Nitrogen in Recharge*	*Value*	*Units*
1	N = Total Nitrogen (lbs)	3,957.82	lbs
2	N = Total Nitrogen (milligrams)	1,796,851,050	milligrams
3	R(T) = Total Recharge (inches)	37.23	inches
4	R(T) = Total Recharge (feet)	3.10	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	15,454,357	cu ft
7	R = Site Recharge Volume	437,667,403	liters
9	NR = N/R	4.11	mg/l

B	*Site Recharge Summary*	*Value*	*Units*
1	R(T) = Total Site Recharge	37.23	inches/yr
2	R = Site Recharge Volume	15,454,357	cu ft/yr
3	R = Site Recharge Volume	115,606,630	gal/yr
4	R = Site Recharge Volume	115.61	MG/yr

Conversions used in SONIR	
Acres x 43,560 = Square Feet	Gallons x 0.1337 = Cubic Feet
Cubic Feet x 7.48052 = Gallons	Gallons x 3.785 = Liters
Cubic Feet x 28.32 = Liters	Grams / 1,000 = Milligrams
Days x 365 = Years	Grams x 0.002205 = Pounds
Feet x 12 = Inches	Milligrams / 1,000 = Grams

Nitrogen Load Summary - On-Site	Load	Percent
Sanitary Nitrogen (On-Site Wastewater)	1,323.30	33.43%
Fertilized Landscaping	2392.89	60.46%
Dog Waste Nitrogen	135.89	3.43%
Cat Waste Nitrogen	53.91	1.36%
Atmospheric Nitrogen	49.62	1.25%
Irrigation Nitrogen	2.22	0.06%
Total Pounds Nitrogen	3,957.82	100.00%

Appendix E-7
SONIR Model Results-Alternative 5

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT — **Alternative 5 - Multi-Generational Residential**
Sayville, NY

DATA INPUT FIELD

A	*Site Recharge Parameters*	*Value*	*Units*
1	Area of Site	114.34	acres
2	Precipitation Rate	49.90	inches
3	Acreage of Fertilized Landscaping	69.22	acres
4	Fraction of Land in above	0.605	fraction
5	Evapotranspiration from above	25.50	inches
6	Runoff from above	0.50	inches
7	Acreage of Unfertilized Landscaping	0.00	acres
8	Fraction of above	0.000	fraction
9	Evapotranspiration from above	25.50	inches
10	Runoff from above	0.50	inches
11	Acreage of Unvegetated/Dirt Roads	0.00	acres
12	Fraction of above	0.000	fraction
13	Evapotranspiration from above	0.00	inches
14	Runoff from above	0.00	inches
15	Acreage of Water/Ponds	1.78	acres
16	Fraction of Site in above	0.016	fraction
17	Evaporation from above	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreage of Natural	0.00	acres
20	Fraction of above	0.000	fraction
21	Evapotranspiration from above	25.50	inches
22	Runoff from above	0.50	inches
23	Acreage of Impervious/Paved/Bldgs	43.34	acres
24	Fraction of Land in above	0.379	fraction
25	Evapotrans. from above	4.99	inches
26	Runoff from Impervious	0.00	inches
23	Acreage of Other	0.00	acres
24	Fraction of Land in above	0.000	fraction
25	Evapotrans. from above	25.50	inches
26	Runoff from above	0.00	inches
27	Acreage of Land Irrigated	69.22	acres
28	Fraction of Land Irrigated	0.605	fraction
29	Irrigation Rate	24.00	inches
30	Number of Dwellings	1529	units
31	Water Use per Dwelling	197	gal/day
32	Wastewater Design Flow (units)	301,350	gal/day

B	*Nitrogen Budget Parameters*	*Value*	*Units*
1	Persons per Dwelling	1.98	persons
2	Nitrogen per Person per Year	10.0	lbs
3	a. Sanitary Nitrogen Leaching Rate	84%	percent
3	b. Treated Sanitary Nitrogen Leaching Rate	100%	percent
4	Fertilized Landscaping	69.22	acres
5	Fertilizer Application Rate (for above)	2.04	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent
7	Fertilized Land (other, if applicable)	0.00	acres
8	Fertilizer Application Rate (for above)	0.00	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate (for above)	0%	percent
10	Outdoor Cat Population	0.07	pets/dwelling
11	Cat Waste Nitrogen Load	3.22	lbs/pet/year
12	Outdoor Dog Population	0.14	pets/dwelling
13	Dog Waste Nitrogen Load	4.29	lbs/pet/year
14	Pet Waste Nitrogen Leaching Rate	25%	percent
15	Area of Land Irrigated	69.22	acres
16	Irrigation Rate	24.00	inches
17	Irrigation Nitrogen Leaching Rate	10%	percent
18	Atmospheric Nitrogen Application/Load	0.04	lbs/1000 sq ft
19	Atmos. N Leaching Rate (Natural/Wetlands)	25%	percent
20	Atmos. N Leaching Rate (Turf/Landscaped)	20%	percent
21	Atmos. N. Leaching Rate (Ag; Imperv; Other)	40%	percent
22	Nitrogen in Water Supply	2.00	mg/l
23	Nitrogen in Treated Sanitary Flow	8.00	mg/l

C	*Comments*		
1)	Please refer to user manual for data input instructions; updated per LINAP.		
	Developed Area	114.34	100%
	Natural/Unvegetated/Revegetated Area	0.00	0%
	Total Acreage Check	114.34	100%

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 2

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 5 - Multi-Generational Residential

SITE RECHARGE COMPUTATIONS

A	Fertilized Landscaping	Value	Units
1	A = Fraction of Land in Cover Type	0.605	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(a) = P - (E + Q)	23.90	inches
6	R(A) = R(a) x A	14.47	inches

B	Unfertilized Landscaping	Value	Units
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(b) = P - (E + Q)	23.90	inches
6	R(B) = R(b) x A	0.00	inches

C	Unvegetated/Dirt Roads	Value	Units
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	0.00	inches
4	Q = Runoff Rate	0.00	inches
5	R(c) = P - (E + Q)	49.90	inches
6	R(C) = R(c) x A	0.00	inches

D	Water/Ponds		
1	A = Fraction of Site in Water	0.016	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evaporation Rate	30.00	inches
4	Q = Runoff Rate	0.00	inches
5	M = Makeup Water	0.00	inches
6	R(d) = {P - (E+Q)} - M	19.90	inches
7	R(D) = R(d) x A	0.31	inches

E	Natural		
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(e) = P - (E + Q)	23.90	inches
6	R(E) = R(e) x A	0.00	inches

F	Impervous/Paved/Roads	Value	Units
1	A = Fraction of Land in Cover Type	0.379	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	4.99	inches
4	Q = Runoff Rate	0.00	inches
5	R(f) = P - (E + Q)	44.91	inches
6	R(F) = R(f) x A	17.02	inches

G	Other		
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.00	inches
5	R(g) = P - (E + Q)	24.40	inches
6	R(G) = R(g) x A	0.00	inches

H	Irrigation Recharge		
1	A = Fraction of Land Irrigated	0.605	fraction
2	I = Irrigation Rate	24.00	inches
3	E = Evaptranspiration Rate	21.40	inches
4	Q = Runoff Rate	0.00	inches
5	R(h) = I - (E + Q)	2.60	inches
6	R(H) = R(H) x A	1.57	inches

I	Wastewater Recharge		
1	WDF = Wastewater Design Flow	301,350	gal/day
2	WDF = Wastewater Design Flow	14,706,031	cu ft/yr
3	A = Area of Site	4,980,650	sq ft
4	R(j) = WDF/A	2.95	feet
5	R(I) = Wastewater Recharge	35.43	inches

J	Runoff Recharge		
1	Q(A) = Runoff from Landscaped	0.303	inches
2	Q(B) = Runoff from Unfertilized Landscaping	0.000	inches
3	Q(C) = Runoff from Unvegetated	0.000	inches
4	Q(E) = Runoff from Natural	0.000	inches
5	Q(H) = Runoff from Other	0.000	inches
6	Q(I) = Runoff from Irrigation	0.00	inches
7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.30	inches

Total Site Recharge		
R(T) =	R(A)+R(B)+R(C)+R(D)+R(E)+R(F)+R(G)+R(H)+R(I)+R(J)+Q(tot)	
R(T) =	**69.11**	**inches**

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 3

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 5 - Multi-Generational Residential

SITE NITROGEN BUDGET

A	***Sanitary Nitrogen-Residential***	***Value***	***Units***
1	Number of Dwellings	0	units
2	Persons per Dwelling	1.98	capita
3	P = Population	0.00	capita
4	N = Nitrogen per person	10	lbs
6	N = (total; pre loss/removal)	0	lbs
7	LR = Leaching Rate	84%	percent
8	N(S) = P x N x LR	0.00	lbs
9	N = loss/removed	0.00	lbs

C	***Sanitary Nitrogen (Wastewater Design Flow)***		
1	CF = Commercial/STP Flow	301,350	gal/day
2	CF = Commercial/STP Flow	416,322,559	liters/yr
5	N =Nitrogen	8.00	mg/l
6	N = Nitrogen	7343.93	lbs
7	LR = Leaching Rate	100%	percent
8	N(S) = CF x N x LR	3,330,580,470	milligrams
9	N(S) = Sanitary Nitrogen	7343.93	lbs
10	N = loss/removed	0.00	lbs

E	***Fertilized Land (Fertilized Landscaping)***		
1	A = Area of Land Fertilized	3,015,223	sq ft
2	AR = Application Rate	2.04	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	6151.06	lbs
4	LR = Leaching Rate	30%	percent
5	N(F1) = A x AR x LR	1845.32	lbs
6	N = loss/removed	4305.74	lbs

G	***Atmospheric Nitrogen (existing condition)***		
1	Application Load	0.041	lbs/1000 sf
2	Area of Natural/Wetlands/1000 sf	78	1000 sf
3	Leaching Rate	25%	percent
4	Atmos. N Load-1 (natural/wetlands)	0.79	lbs/year
5	Area of turf/landscaped/1000 sf	3,015	1000 sf
6	Leaching Rate	20%	percent
7	Atmos. N Load-2 (golf/turf)	24.72	lbs/year
8	Area of Impervious/Agricult/1000 sf	1,888	1000 sf
9	Leaching Rate	40%	percent
10	Atmos. N Load-3 (ag; imperv; other)	30.96	lbs/year
11	N(at) = N Load 1 + 2 +3	56.48	lbs
12	N = loss/removed	147.73	lbs

B	***Cat Waste Nitrogen***	***Value***	***Units***
1	Number of Cats per Dwelling	0.07	cats/dwelling
2	Number of Cats (Cats/dwelling x dwellings)	113	cats
3	Cat Waste Nitrogen Load	3.22	lbs/cat/year
4	N(p) = AR x cats x Adjustment (if applicable)	364.33	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	91.08	lbs
7	N = (loss/removed)	273.25	lbs

B'	***Dog Waste Nitrogen***	***Value***	***Units***
1	Number of Dogs per Dwelling	0.14	dogs/dwelling
2	Number of Dogs (Dogs/dwelling x dwellings)	214	dogs
3	Dog Waste Nitrogen Load	4.29	lbs/dog/year
4	N(p) = AR x dogs x Adjustment (if applicable)	918.32	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	229.58	lbs
7	N = (loss/removed)	688.74	lbs

D	***Water Supply Nitrogen*** ***(other than wastewater, if applicable)***		
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	8.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

F	***Fertilized Land (Unfertilized Landscaping)***		
1	A = Area of Land Fertilized 2	0	sq ft
2	AR = Application Rate	0.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	0.00	lbs
4	LR = Leaching Rate	0%	percent
5	N(F2) = A x AR x LR	0.00	lbs
6	N = loss/removed	0.00	lbs

H	***Irrigation Nitrogen***		
1	R = Irrigation Recharge (inches)	1.57	inches
2	R = Irrigation Rate (feet)	0.1312	feet
3	A = Area of Land Irrigated	1,045,440	sq ft
4	R(I) = R(irr) x A	137,128	cu ft
5	R(I) = Site Irrigation (liters)	3,883,451	liters
6	N = Nitrogen in Water Supply	2.00	mg/l
7	N(T) = Nitrogen (total applied)	17.13	lbs
8	LR = Leaching Rate	10%	percent
9	N(irr) = R(I) x N x LR	776,690	milligrams
10	N(irr) = Irrigation Nitrogen	1.71	lbs
11	N = loss/removed	15.41	lbs

Total Site Nitrogen		
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)	
N=	**9,568.10**	lbs

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 4

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

Alternative 5 - Multi-Generational Residential
Sayville, NY

FINAL COMPUTATIONS

A	*Nitrogen in Recharge (concentr.)*	*Value*	*Units*
1	N = Total Nitrogen (lbs)	9,568.10	lbs
2	N = Total Nitrogen (milligrams)	4,343,918,309	milligrams
3	R(T) = Total Recharge (inches)	69.11	inches
4	R(T) = Total Recharge (feet)	5.76	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	28,684,295	cu ft
7	R = Site Recharge Volume	812,339,222	liters
9	NR = N/R	5.35	mg/l

CONCENTRATION OF
NITROGEN IN RECHARGE

5.35

A	*Nitrogen in Recharge*	*Value*	*Units*
1	N = Total Nitrogen (lbs)	9,568.10	lbs
2	N = Total Nitrogen (milligrams)	4,343,918,309	milligrams
3	R(T) = Total Recharge (inches)	69.11	inches
4	R(T) = Total Recharge (feet)	5.76	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	28,684,295	cu ft
7	R = Site Recharge Volume	812,339,222	liters
9	NR = N/R	5.35	mg/l

Conversions used in SONIR	
Acres x 43,560 = Square Feet	Gallons x 0.1337 = Cubic Feet
Cubic Feet x 7.48052 = Gallons	Gallons x 3.785 = Liters
Cubic Feet x 28.32 = Liters	Grams / 1,000 = Milligrams
Days x 365 = Years	Grams x 0.002205 = Pounds
Feet x 12 = Inches	Milligrams / 1,000 = Grams

B	*Site Recharge Summary*	*Value*	*Units*
1	R(T) = Total Site Recharge	69.11	inches/yr
2	R = Site Recharge Volume	28,684,295	cu ft/yr
3	R = Site Recharge Volume	214,573,439	gal/yr
4	R = Site Recharge Volume	214.57	MG/yr

Nitrogen Load Summary - On-Site	**Load**	**Percent**
Sanitary Nitrogen (On-Site Wastewater)	7,343.93	76.75%
Fertilized Landscaping	1845.32	19.29%
Dog Waste Nitrogen	229.58	2.40%
Cat Waste Nitrogen	91.08	0.95%
Atmospheric Nitrogen	56.48	0.59%
Irrigation Nitrogen	1.71	0.02%
Total Pounds Nitrogen	9,568.10	100.00%

Appendix E-8
SONIR Model Results-Alternative 7

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 1

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT — **Alternative 7 - Multifamily Residential (golf)**
Sayville, NY

DATA INPUT FIELD

A	Site Recharge Parameters	Value	Units
1	Area of Site	114.34	acres
2	Precipitation Rate	49.90	inches
3	Acreage of Fertilized Landscaping	69.87	acres
4	Fraction of Land in above	0.611	fraction
5	Evapotranspiration from above	25.50	inches
6	Runoff from above	0.50	inches
7	Acreage of Unfertilized Landscaping	0.00	acres
8	Fraction of above	0.000	fraction
9	Evapotranspiration from above	25.50	inches
10	Runoff from above	0.50	inches
11	Acreage of Unvegetated/Dirt Roads	0.00	acres
12	Fraction of above	0.000	fraction
13	Evapotranspiration from above	0.00	inches
14	Runoff from above	0.00	inches
15	Acreage of Water/Ponds	0.00	acres
16	Fraction of Site in above	0.000	fraction
17	Evaporation from above	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreage of Natural	0.00	acres
20	Fraction of above	0.000	fraction
21	Evapotranspiration from above	25.50	inches
22	Runoff from above	0.50	inches
23	Acreage of Impervious/Paved/Bldgs	44.47	acres
24	Fraction of Land in above	0.389	fraction
25	Evapotrans. from above	4.99	inches
26	Runoff from Impervious	0.00	inches
23	Acreage of Other	0.00	acres
24	Fraction of Land in above	0.000	fraction
25	Evapotrans. from above	25.50	inches
26	Runoff from above	0.00	inches
27	Acreage of Land Irrigated	69.87	acres
28	Fraction of Land Irrigated	0.611	fraction
29	Irrigation Rate	24.00	inches
30	Number of Dwellings	1365	units
31	Water Use per Dwelling	225	gal/day
32	Wastewater Design Flow (units)	307,125	gal/day

B	Nitrogen Budget Parameters	Value	Units
1	Persons per Dwelling	1.98	persons
2	Nitrogen per Person per Year	10.0	lbs
3	a. Sanitary Nitrogen Leaching Rate	84%	percent
3	b. Treated Sanitary Nitrogen Leaching Rate	100%	percent
4	Fertilized Landscaping	69.87	acres
5	Fertilizer Application Rate (for above)	1.00	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent
7	Fertilized Land (other, if applicable)	0.00	acres
8	Fertilizer Application Rate (for above)	0.00	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate (for above)	0%	percent
10	Outdoor Cat Population	0.19	pets/dwelling
11	Cat Waste Nitrogen Load	3.22	lbs/pet/year
12	Outdoor Dog Population	0.35	pets/dwelling
13	Dog Waste Nitrogen Load	4.29	lbs/pet/year
14	Pet Waste Nitrogen Leaching Rate	25%	percent
15	Area of Land Irrigated	69.87	acres
16	Irrigation Rate	24.00	inches
17	Irrigation Nitrogen Leaching Rate	10%	percent
18	Atmospheric Nitrogen Application/Load	0.04	lbs/1000 sq ft
19	Atmos. N Leaching Rate (Natural/Wetlands)	25%	percent
20	Atmos. N Leaching Rate (Turf/Landscaped)	20%	percent
21	Atmos. N. Leaching Rate (Ag; Imperv; Other)	40%	percent
22	Nitrogen in Water Supply	2.00	mg/l
23	Nitrogen in Treated Sanitary Flow	8.00	mg/l

C	Comments		
1)	Please refer to user manual for data input instructions; updated per LINAP.		
	Developed Area	114.34	100%
	Natural/Unvegetated/Revegetated Area	0.00	0%
	Total Acreage Check	114.34	100%

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 2

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 7 - Multifamily Residential (golf)

SITE RECHARGE COMPUTATIONS

A	*Fertilized Landscaping*	*Value*	*Units*
1	A = Fraction of Land in Cover Type	0.611	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(a) = P - (E + Q)	23.90	inches
6	R(A) = R(a) x A	14.60	inches

B	*Unfertilized Landscaping*	*Value*	*Units*
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(b) = P - (E + Q)	23.90	inches
6	R(B) = R(b) x A	0.00	inches

C	*Unvegetated/Dirt Roads*	*Value*	*Units*
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	0.00	inches
4	Q = Runoff Rate	0.00	inches
5	R(c) = P - (E + Q)	49.90	inches
6	R(C) = R(c) x A	0.00	inches

D	*Water/Ponds*		
1	A = Fraction of Site in Water	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evaporation Rate	30.00	inches
4	Q = Runoff Rate	0.00	inches
5	M = Makeup Water	0.00	inches
6	R(d) = {P - (E+Q)} - M	19.90	inches
7	R(D) = R(d) x A	0.00	inches

E	*Natural*		
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.50	inches
5	R(e) = P - (E + Q)	23.90	inches
6	R(E) = R(e) x A	0.00	inches

F	*Impervous/Paved/Roads*	*Value*	*Units*
1	A = Fraction of Land in Cover Type	0.389	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	4.99	inches
4	Q = Runoff Rate	0.00	inches
5	R(f) = P - (E + Q)	44.91	inches
6	R(F) = R(f) x A	17.47	inches

G	*Other*		
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	25.50	inches
4	Q = Runoff Rate	0.00	inches
5	R(g) = P - (E + Q)	24.40	inches
6	R(G) = R(g) x A	0.00	inches

H	*Irrigation Recharge*		
1	A = Fraction of Land Irrigated	0.611	fraction
2	I = Irrigation Rate	24.00	inches
3	E = Evaptranspiration Rate	21.40	inches
4	Q = Runoff Rate	0.00	inches
5	R(h) = I - (E + Q)	2.60	inches
6	R(H) = R(H) x A	1.59	inches

I	*Wastewater Recharge*		
1	WDF = Wastewater Design Flow	307,125	gal/day
2	WDF = Wastewater Design Flow	14,987,854	cu ft/yr
3	A = Area of Site	4,980,650	sq ft
4	R(j) = WDF/A	3.01	feet
5	R(I) = Wastewater Recharge	36.11	inches

J	*Runoff Recharge*		
1	Q(A) = Runoff from Landscaped	0.306	inches
2	Q(B) = Runoff from Unfertilized Landscaping	0.000	inches
3	Q(C) = Runoff from Unvegetated	0.000	inches
4	Q(E) = Runoff from Natural	0.000	inches
5	Q(H) = Runoff from Other	0.000	inches
6	Q(I) = Runoff from Irrigation	0.00	inches
7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.31	inches

Total Site Recharge		
R(T) =	R(A)+R(B)+R(C)+R(D)+R(E)+R(F)+R(G)+R(H)+R(I)+R(J)+Q(tot)	
R(T) =	**70.08**	**inches**

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 3

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 7 - Multifamily Residential (golf)

SITE NITROGEN BUDGET

A	*Sanitary Nitrogen-Residential*	*Value*	*Units*
1	Number of Dwellings	0	units
2	Persons per Dwelling	1.98	capita
3	P = Population	0.00	capita
4	N = Nitrogen per person	10	lbs
6	N = (total; pre loss/removal)	0	lbs
7	LR = Leaching Rate	84%	percent
8	N(S) = P x N x LR	0.00	lbs
9	N = loss/removed	0.00	lbs

B	*Cat Waste Nitrogen*	*Value*	*Units*
1	Number of Cats per Dwelling	0.19	cats/dwelling
2	Number of Cats (Cats/dwelling x dwellings)	253	cats
3	Cat Waste Nitrogen Load	3.22	lbs/cat/year
4	N(p) = AR x cats x Adjustment (if applicable)	813.13	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	203.28	lbs
7	N = (loss/removed)	609.85	lbs

B'	*Dog Waste Nitrogen*	*Value*	*Units*
1	Number of Dogs per Dwelling	0.35	dogs/dwelling
2	Number of Dogs (Dogs/dwelling x dwellings)	478	dogs
3	Dog Waste Nitrogen Load	4.29	lbs/dog/year
4	N(p) = AR x dogs x Adjustment (if applicable)	2049.55	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	512.39	lbs
7	N = (loss/removed)	1537.16	lbs

C	*Sanitary Nitrogen (Wastewater Design Flow)*		
1	CF = Commercial/STP Flow	307,125	gal/day
2	CF = Commercial/STP Flow	424,300,866	liters/yr
5	N =Nitrogen	8.00	mg/l
6	N = Nitrogen	7484.67	lbs
7	LR = Leaching Rate	100%	percent
8	N(S) = CF x N x LR	3,394,406,925	milligrams
9	N(S) = Sanitary Nitrogen	7484.67	lbs
10	N = loss/removed	0.00	lbs

D	*Water Supply Nitrogen (other than wastewater, if applicable)*		
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	8.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

E	*Fertilized Land (Fertilized Landscaping)*		
1	A = Area of Land Fertilized	3,043,537	sq ft
2	AR = Application Rate	1.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	3043.54	lbs
4	LR = Leaching Rate	30%	percent
5	N(F1) = A x AR x LR	913.06	lbs
6	N = loss/removed	2130.48	lbs

F	*Fertilized Land (Unfertilized Landscaping)*		
1	A = Area of Land Fertilized 2	0	sq ft
2	AR = Application Rate	0.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	0.00	lbs
4	LR = Leaching Rate	0%	percent
5	N(F2) = A x AR x LR	0.00	lbs
6	N = loss/removed	0.00	lbs

G	*Atmospheric Nitrogen (existing condition)*		
1	Application Load	0.041	lbs/1000 sf
2	Area of Natural/Wetlands/1000 sf	0	1000 sf
3	Leaching Rate	25%	percent
4	Atmos. N Load-1 (natural/wetlands)	0.00	lbs/year
5	Area of turf/landscaped/1000 sf	3,044	1000 sf
6	Leaching Rate	20%	percent
7	Atmos. N Load-2 (golf/turf)	24.96	lbs/year
8	Area of Impervious/Agricult/1000 sf	1,937	1000 sf
9	Leaching Rate	40%	percent
10	Atmos. N Load-3 (ag; imperv; other)	31.77	lbs/year
11	N(at) = N Load 1 + 2 +3	56.73	lbs
12	N = loss/removed	147.48	lbs

H	*Irrigation Nitrogen*		
1	R = Irrigation Recharge (inches)	1.59	inches
2	R = Irrigation Rate (feet)	0.1324	feet
3	A = Area of Land Irrigated	1,045,440	sq ft
4	R(I) = R(irr) x A	138,415	cu ft
5	R(I) = Site Irrigation (liters)	3,919,918	liters
6	N = Nitrogen in Water Supply	2.00	mg/l
7	N(T) = Nitrogen (total applied)	17.29	lbs
8	LR = Leaching Rate	10%	percent
9	N(irr) = R(I) x N x LR	783,984	milligrams
10	N(irr) = Irrigation Nitrogen	1.73	lbs
11	N = loss/removed	15.56	lbs

Total Site Nitrogen		
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)	
N=	**9,171.85**	lbs

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

SHEET 4

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT — **Alternative 7 - Multifamily Residential (golf)**
Sayville, NY

FINAL COMPUTATIONS

A	*Nitrogen in Recharge (concentr.)*	*Value*	*Units*
1	N = Total Nitrogen (lbs)	9,171.85	lbs
2	N = Total Nitrogen (milligrams)	4,164,020,933	milligrams
3	R(T) = Total Recharge (inches)	70.08	inches
4	R(T) = Total Recharge (feet)	5.84	feet
5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	29,085,458	cu ft
7	R = Site Recharge Volume	823,700,182	liters
9	NR = N/R	5.06	mg/l

CONCENTRATION OF
NITROGEN IN RECHARGE

5.06

A	*Nitrogen in Recharge*	*Value*	*Units*
1	N = Total Nitrogen (lbs)	9,171.85	lbs
2	N = Total Nitrogen (milligrams)	4,164,020,933	milligrams
3	R(T) = Total Recharge (inches)	70.08	inches
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5	A = Area of Site	4,980,650	sq ft
6	R = R(T) x A	29,085,458	cu ft
7	R = Site Recharge Volume	823,700,182	liters
9	NR = N/R	5.06	mg/l

Conversions used in SONIR	
Acres x 43,560 = Square Feet	Gallons x 0.1337 = Cubic Feet
Cubic Feet x 7.48052 = Gallons	Gallons x 3.785 = Liters
Cubic Feet x 28.32 = Liters	Grams / 1,000 = Milligrams
Days x 365 = Years	Grams x 0.002205 = Pounds
Feet x 12 = Inches	Milligrams / 1,000 = Grams

Nitrogen Load Summary - On-Site	**Load**	**Percent**
Sanitary Nitrogen (On-Site Wastewater)	7,484.67	81.60%
Fertilized Landscaping	913.06	9.96%
Dog Waste Nitrogen	512.39	5.59%
Cat Waste Nitrogen	203.28	2.22%
Atmospheric Nitrogen	56.73	0.62%
Irrigation Nitrogen	1.73	0.02%
Total Pounds Nitrogen	9,171.85	100.00%

B	*Site Recharge Summary*	*Value*	*Units*
1	R(T) = Total Site Recharge	70.08	inches/yr
2	R = Site Recharge Volume	29,085,458	cu ft/yr
3	R = Site Recharge Volume	217,574,353	gal/yr
4	R = Site Recharge Volume	217.57	MG/yr

Appendix E-9
Groundwater Mounding Analysis

PWGC

undated

Groundwater Mounding Analysis

The proposed sewage treatment plant (STP) would be capable of treating and discharging a peak daily flow rate of 377,000 gpd of wastewater. The plant effluent is proposed to be discharged to groundwater via a series of shallow 10 ft diameter leaching pools. Depth to groundwater in the area of where the STP effluent leaching pools are being considered is on the order of 8 feet. The shallow depth to groundwater, the large number of leaching structures proposed and the estimated peak daily design flow rate will create an artificial groundwater mound in the vicinity of the discharge field. The following groundwater mounding analysis has been performed to investigate the maximum height of a mound that will form directly below the leaching pools and to determine what, if any, local effects the mound will have on site and with regards to the surrounding area.

A total of 600 leaching pools are being proposed for the project. At any given time only 150 pools will be receiving STP effluent. A simplified conservative approach was taken with regards to establishing an equivalent discharge bed area. The bottom area of 150 leaching pools was combined into a single composite area (A) totaling 11,781 ft^2. In reality 150 pools will occupy more than this area as the pools will be arrayed in a linear fashion with 8 feet between rows of pools. The smaller composite area is being used in the analysis as it will reduce the total area that the peak daily discharge will be spread out over and thus produce a conservative estimate of a mound height. A square shaped area was further used to additionally concentrate the STP effluent and produce a higher mounding effect. Thus, a square area with equal length (L) and width (W) dimensions of 108.5 ft each is being conservatively used in the analysis.

The percolation rate of STP effluent into groundwater was then calculated using the peak daily design flow rate of 377,00 gpd and a leaching area of 11,781 ft^2. This produced a maximum percolation rate (i) of 4.28 ft/day (2.14 in/hr). With the required infiltration rate established specific hydrogeological parameters used in mounding analyses were then researched for the site based on soil borings conducted by PWGC as part of the Phase II Environmental Site Assessment investigation. Generally, the shallow soils at the site were characterized as medium to course sands with gravel. Specific yields (S_y) for materials of this nature are cited as having average values of 0.26 to 0.27 (Fetter, 2001). Published USGS information was reviewed for local hydraulic conductivity (K_H) values as well as the initial saturated aquifer thickness (h_i). USGS maps for the Upper Glacial aquifer in the area of the site indicate fairly conductivity material with an estimated horizontal hydraulic conductivity of 2,000 gpd/ft^2 (267.4 ft/day) and a saturated aquifer thickness on the order of 100 ft.

The Hantush Derivation (1967) for calculating groundwater mounds under rectangular recharge areas was employed to solve for the maximum expected mound height beneath the proposed leaching area. The solution involves a complex integral function with multiple variables. Due to the complexity of the equation it is approximated using numerical methods and thus an estimate as opposed to an exact solution is found. The equation and variables are presented below:

$h_m^2 - h_i^2 = (2i/K_H)\ Vt\ S^*(((0.5L)/\mathrm{sqrt}(4Vt)), ((0.5W)/\mathrm{sqrt}(4Vt)))$

h_m = mounded height thickness of aquifer (ft) – equation is solved for this variable

h_i = initial saturate aquifer thickness (ft) = 100 ft

i = percolation rate (ft/day) = 4.28 ft/day

K_H = horizontal hydraulic conductivity (ft/day) = 267.4 ft/day

t = time (days) = 3,650 days

$V = (K_H \underline{b})/S_y$

S_y = specific yield (unitless) = 0.26

$\underline{b} = [h_i(0) + h(t)]/2$

$S^*(\alpha,\beta) = \int_0^1 \mathrm{erf}(\alpha/\mathrm{sqrt}(T) \cdot \mathrm{erf}(\beta/\mathrm{sqrt}(T)\ dT$

An online calculator was used to solve the equation

(www.groundwatersoftware.com/calculator_9_hantush_mounding.htm)

with the inputs described above. The calculator output predicts a maximum 1.2 ft rise in the water table directly beneath the leaching area. A time period of 10 years was selected to provide a sufficiently long duration in order for the leaching system to reach steady state conditions (i.e., conditions are no longer changing with increasing time).

As per SCDPW requirements the leaching pools need to be installed a minimum of 3 ft above the high historical groundwater elevation for the area. Based on the predicted maximum groundwater mound height the bottoms of the leaching pools should not become submerged due to saturated conditions. During periods of recharge as STP effluent leaches out of the bottoms of the pools the unsaturated zone between the pool bottoms and the water table will become wetted. As the area in and around the leaching pool fields is prohibited to be anything other than a grassed area per SCDPW requirements no utilities or building foundations should be impacted other than those associated with the STP.

The horizontal extents of the mounding effects were also evaluated as part of this analysis. Equations developed by Herman Bouwer (1999) using the Thiem equation (radial well flow hydraulics) as a basis were employed to estimate the radius of influence of the leaching field under steady state conditions. This again is a conservative estimate as steady state conditions occur after very long durations of time and the radius of influence is where zero change in the water table would occur under continuous percolation conditions. The Bouwer equation based on the Thiem equation and its associated variables are presented below:

$h_m - h_i = [(iR^2)/(4T)] \times [1 + 2\ln(R_n/R)]$

h_m = mounded height thickness of aquifer (ft) = 101.2 ft (from online calculator analysis)

h_i = initial saturated aquifer thickness (ft) = 100 ft

i = percolation rate (ft/day) = 4.28 ft/day

T = aquifer transmissivity (ft^2/day) = $K_h b$ = 267.4 ft x 100 ft/day = 26,740 ft^2/day

K_H = horizontal hydraulic conductivity (ft/day) = 267.4 ft/day

b = aquifer thickness(ft) = 100 ft

R = ½ the width of length of leaching area = 108.5 ft / 2 = 54.25 ft

R_n = distance to the original aquifer thickness from center of leaching area (ft)

Solving the equation for R_n produces a result of 5,369 ft. This means that at this distance from the center of the leaching area after a significantly long period of time and at a constant recharge rate of 4.28 ft/day there will be no detectable increase in the water table. Again, this a very conservative analysis. The peak mounding conditions will occur directly under the center of the proposed leaching field on site at the Greybarn-Sayville development. The mound created will theoretically have a parabolic type of shape to it where it starts to drop off rapidly right after the extents of the leaching field and start to take on an asymptotic trajectory where it gradually returns to the natural water table at 5,369 ft from the center of the field.

The STP is proposed to have 600 shallow leaching pools with only 150 in service at a time. Thus, a rotational usage pattern could be established to reduce over usage of any particular grouping of leaching pools. The analysis assumes a constant recharge rate of 377,000 gpd, which is the proposed peak STP capacity. In reality the plant will not operate at capacity very often and flows will likely constantly vary and be considerably lower than 377,000 gpd. The leaching pools will also be arrayed in a larger and more linear type of configuration than evaluated under this analysis, this will create an overall lower mounding height and with a lower mounding height it will also have less reach or effect in the horizontal direction as well.

References

1. Bouwer, Herman, Jennifer Beck, James M. Oliver, "*Predicting Infiltration and Ground-Water Mounds for Artificial Recharge*", Journal of Hydrologic Engineering, pp 350-357, October 1999.
2. Fetter, Charles Willard, *"Applied Hydrogeology – Fourth Edition"*, Prentice Hall, Upper Saddle River, New Jersey, 2001.
3. www.groundwatersoftware.com/calculator_9_hantush_mounding.htm
4. United States Geological Survey, *"Hydrologic Maps of the Upper Glacial Aquifer, Long Island, New York – Professional Paper 627-E, Plate 1"*, Washington D.C., 1972.