APPENDIX F

WRITTEN PUBLIC COMMENTS

Appendix F-1
Comments on DEIS of the Hills PDD

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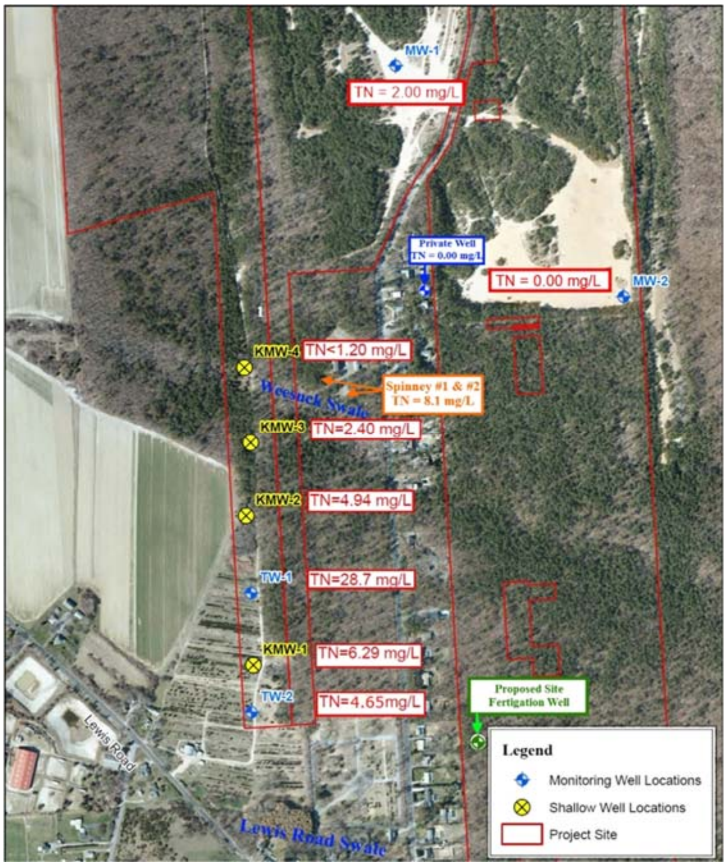
NELSON POPE & VOORHIS, LLC
ENVIRONMENTAL • PLANNING • CONSULTING

COMMENTS ON DEIS OF THE HILLS PDD: EFFECTS OF SURFACE AND GROUNDWATER QUALITY



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Executive Summary:

F-1.1
Sec. 2.2.2

The Hills is a Planned Development District (PDD) proposed by Discovery Land Corporation (DLC) to be built in East Quogue. The Hills property is currently comprised of 591 acres of Pine Barrens, open space, and farm land that has been proposed by DLC via the PDD to be made into a seasonal resort with a golf course. The Hills property lies within the watershed of western Shinnecock Bay which has experienced significant losses of seagrass and bivalves in recent years due to increasing nitrogen loads, harmful algal blooms, and low oxygen events. Increases in nitrogen loading to this region is expected to worsen these conditions. For this evaluation, a dynamic nitrogen loading model was constructed using information generated by the NYS Department of Environmental Conservation's Long Island Nitrogen Action Plan (LINAP) as well as standard practices used to determine nitrogen loading rates across Long Island this decade. Using this model, the nitrogen loading rates currently delivered to this property and expected from multiple development scenarios were quantified using information provided by the PDD Draft Environmental Impact Statement (DEIS) for The Hills, information from LINAP, and the most up-to-date science available. Calculations demonstrated that the lowest nitrogen loading rates are associated with current conditions whereas the PDD yielded the highest nitrogen loading rates and as of right development provided rates between these extremes. It is estimated that current conditions yield 1,200 lbs of nitrogen per year, lower than the 1,700 lbs per year estimated by the DEIS. As of right development is estimated to yield 1,600 to 3,500 lbs of nitrogen per year, depending on the level of occupancy, fertilization rates, and the extent of clearing and lawns on properties with the upper bound of this calculation being nearly equal with the level quantified in the DEIS for As of Right development. The lower bound of this estimate primarily uses the details of the PDD without a golf course. The PDD gross nitrogen load was found to be ~3,600 lbs of nitrogen per year if the planned fertigation approach as stated in the DEIS were to be fully successful and continuingly delivering groundwater with 15 mg N per liter. Given the consultants for the DEIS have recently stated this level of nitrogen delivery as well as 10 mg N per liter are overestimates/optimistic as well as the many unknowns surrounding fertigation, a conservative approach from an environmental impact perspective would be to not consider fertigation as a nitrogen off-set but rather consider it a potential future environmental benefit of the project. Were such an approach adopted, this would add 2,500 lbs of nitrogen from fertilizer which, at a 20% leaching rate, would result in ~4,100 lbs of nitrogen per year from the PDD. It is noted that since the DEIS has been completed, the consultants for DLC have reconsidered their nitrogen loading calculations and have stated plans to construct a sewage treatment plant to treat wastewater on site, an approach that would reduce the nitrogen footprint of the PDD. Since the entire load of wastewater nitrogen from the PDD is ~500 lbs nitrogen per year, mitigation of other nitrogen sources would also be needed to bring the total nitrogen load in-line with the levels delivered by most other uses.

Preface:

Christopher J. Gobler is a professor within the School of Marine and Atmospheric Sciences (SoMAS) at Stony Brook University. He received his M.S. and Ph.D. from Stony Brook University in the 1990s. He began his academic career at Long Island University (LIU) in 1999. In 2005, he joined Stony Brook University as the Director of Academic Programs for SoMAS on the Stony Brook – Southampton campus. In 2014, he was appointed as the Associate Dean of Research at SoMAS and in 2015, he was named co-Director of the New York State Center for Clean Water Technology. In 2016, he was named the 40th most influential person on Long Island by the Long Island Press and was given the Environmental Champion Award by the US Environmental Protection Agency for his research efforts. The major research focus within his group is investigating how anthropogenic activities such as climate change, eutrophication, and the over-harvesting of fisheries alters the ecological functioning of coastal ecosystems. He has been researching these topics on eastern Long Island for 25 years and has published more than 150 peer-reviewed manuscripts in international journals on these subjects.

Background on regional groundwater and surface waters:

Current conditions

'The Hills in Southampton' is comprised of nearly 500 acres of undisturbed Pine Barrens in the town of East Quogue. Beyond the intrinsic value of open space and the ecosystem services and benefits of the Long Island Pine Barrens, this property has numerous benefits to water quality in the region. The natural vegetation on this property acts as a natural filter for nitrogen and other contaminants deposited from the atmosphere. This is clear from the levels of nitrogen and general contaminant currently present in the Suffolk County Water Authority's groundwater wells on Malloy Drive which show exceedingly low levels of nitrogen (< 0.5 mg per liter) and undetectable levels of pesticides and other organic compounds[1]. In contrast, other groundwater in the region has been contaminated by various land use processes. For example, the upper glacial aquifer in regions away from the Hills such as the SCWA Spinney Road well field is already contaminated with high levels of nitrate and perchlorate to the point Suffolk County Water Authority has stopped using these wells to deliver drinking water.[1]. Unfortunately, more than 100 families in East Quogue with private wells rely on upper glacial aquifer for drinking water.[1]

The proposed development in The Hills is located 1,500 feet from Weesuck Creek and western Shinnecock Bay and groundwater travels times from land to bay in this region are less than five years[2] meaning that land use changes on the Hills such as adding homes or a golf course will quickly impact the nearby coastal ecosystems. This being the case, it is important to clearly understand and document the current and recent conditions of these ecosystems. During Hurricane Sandy, the waters of Shinnecock Bay crossed Montauk Highway in East Quogue, flooded the three major communities on the East Quogue peninsula (Shinnecock Shores, Pinesfield, Pine Neck Landing) and approached Main Street[3]. East Quogue has been fortunate to still have lush stands of salt marsh along the east and west sides of Weesuck Creek. During Sandy, those salt marshes protected East Quogue from a significantly worse flooding scenario than it would have experienced without these marshes[4].

In 2010, NYSDEC declared Shinnecock Bay impaired waterbody due to excessive wastewater nitrogen loads[5]; total nitrogen levels in the Bay exceed guidance levels set by USEPA[6]. Impairments brought about by high nitrogen loading to western Shinnecock Bay include: Annual toxic brown tides[6], dissolved oxygen levels in summer dangerously low for marine life[6,7], the near complete loss of seagrass beds[8], a critical habitat for fisheries[8], and low densities of hard clams and conditions under which baby shellfish cannot survive[9] . Brown tides in Shinnecock Bay continue to worsen. The brown tide in 2016 was the most intense on record and excessive nitrogen loading will make such events worse in the future. Brown tides have a cascading effect on the marine ecosystem, killing off remaining seagrass and shellfish, which in turn makes the ecosystem more vulnerable to additional brown tides[6]. Western Shinnecock Bay is one of five places in NYS that experiences paralytic shellfish poisoning (PSP) caused by saxitoxin and was closed by NYSDEC to due to this toxin in 2011, 2012, and 2015.[10] In fact, every year the epicenter of PSP during these events has been in Weesuck Creek in East Quogue. And the PSP event in 2015 was three-fold more toxic than any measurement made to date[10] suggesting that conditions are worsening.

Future threats

Any additional nitrogen loading from land in East Quogue will worsen existing conditions in the bay. Enhanced nitrogen loading will push already high nitrate levels in public and private water supply wells for East Quogue closer to the USEPA federal limit for drinking water[1]. In conducting a state-wide assessment of coastal flooding, NYSDEC released a report in April 2014 that concluded that salt marsh habitats provide critical flood protection to New York coastal communities and that increases in land-to-sea delivery of nitrogen degrades, erodes, and eventually destroys salt marshes[4]. Given the progression of sea level rise, there could be an intensification of flooding risk in East Quogue coastal communities associated with storms, hurricanes, and/or extreme tides with more nitrogen loading. Furthermore, the numerous impairments in Shinnecock Bay including toxic brown tides, low oxygen levels, the loss of eelgrass, and the loss of shellfish will all worsen in Shinnecock Bay with additional nitrogen loads[8,13,14]. Increasing nitrogen loading has been shown increase the intensity and toxicity of PSP on Long Island[15] more nitrogen loading in East Quogue could intensify PSP in and around Weesuck Creek leading to larger and/or longer shellfish bed closures. This also creates the risk that citizens of Southampton could become seriously sickened or worse from eating contaminated shellfish. Due to diffusive groundwater flow and tidal exchange, the impacts of enhanced nitrogen loads on surface water will be experienced in regions to the east and west including Hampton Bays, Quogue, and Westhampton Beach. Finally, all of these worsened conditions have serious economic repercussions on tourism, fisheries, restaurants, and even home values[16].

References

1: Suffolk County Water Authority, Spinney Road Well Head tests, 2010-2104; **2.** Suffolk County Comprehensive Water Resources Management Plan. 2010. Draft report; **3:** USGS Hurricane Sandy Storm Tide mapper. **4:** NYSDEC 2014. Nitrogen Pollution and Adverse Impacts on Resilient Tidal Marshlands Technical Briefing Summary. **5:** NYSDEC 2010. 303-d List. **6:** Suffolk County Department of Health Services 1976-2013. Annual reports of surface water quality. **7:** News 12 Water Quality Index Reports, 2014. **8:** New York State Department of Environmental Conservation 2009. Seagrass Task Force Final Report. **9:** Shinnecock Bay Restoration Project Final report 2013. Stony Brook University. **10:** NYSDEC 2011 – 2014. Marine Division annual monitoring of PSP on Long Island. **12:** Bowen, J. L., et al. 2007. NLOAD: an interactive, web-based modeling tool for nitrogen management in estuaries. Ecological Applications, 17(sp5), S17-S30. **13:** Valiela, I. 2006. Global Coastal Change, Blackwell Publishing. **14:** Gobler CJ, Sunda WG. 2012. Ecosystem disruptive algal blooms of the brown tide species, Aureococcus anophagefferens and Aureoumbra lagunensis. Harmful Algae. 14: 36–45; **15:** Hattenrath TK, Anderson DA, Gobler CJ. 2010. The influence of nutrients and climate on the dynamics and toxicity of *Alexandrium fundyense* blooms in a New York (USA) estuary. *Harmful Algae* 9: 402–412. **16:** Johnston RJ et al. 2002. Valuing Estuarine Resource Services Using Economic and Ecological Models:The Peconic Estuary System Study. Coastal Management, 30:47–65.

Scope of DEIS analysis

This document has been prepared to solely consider the potential impacts of the Hills PDD on groundwater and surface water in the region. Within this realm, the overwhelming majority of this document will consider the loading rates of nitrogen that will be a consequence of differing potential land uses of the property given the sensitivity of surface water and habitats to nitrogen loading rates. The author has created a dynamic nitrogen loading model that uses the loading rate constants and assumptions that have been developed as part of the NYSDEC's Long Island Nitrogen Action Plan (LINAP). This plan has been collaboratively developed by CDM Smith, NYSDEC, Suffolk County, Cornell University, USGS, US EPA, and Stony Brook University and represents a scientific consensus among these teams and contains the most up-to-date and best science available on the subject of nitrogen loading within coastal watersheds. The tables and constants used in my calculations appear in Table 1. This document comments on the actual contents of the DEIS only. The author acknowledges that the consultants representing Discovery Land Corporation are in the process of updating several aspects of the DEIS (*see Epilogue).* The author further acknowledges there are many other very important aspects of the project beyond nitrogen loading that are not considered here.

Current use of properties

Presently, the 591 acres of land that comprise the Hills PDD are comprised of open space, pine barrens forest, and farm land. The Burbs model analyses determined that the current use of the property results in 1,712 lbs of nitrogen being loaded per year. My analyses indicate the nitrogen loading rate is closer to 1,200 lbs per year if the farm fields within the property are actively being fertilizer (Table 2). If they are not actively being fertilizer, the loading drops to ~660 lbs per year (Table 2). Local observations have indicated that the singular farm field on the Parlato property is not used every year and thus not always fertilized. Similarly, it is not clear if the Kracke property under consideration is actively managed and fertilized. Further, the area contains shrubs and ornamentals which are typically fertilizer at a lower rate than row crops and thus at a lower rate than used in the DEIS. Differences between my calculated nitrogen loads and those of the DEIS also arise from the use of a leaching rates for nitrogen different than those that have been accepted by LINAP and a fertilization rate higher than has been accepted by LINAP.

In the FEIS, it is recommended that the Town require use of the accepted LINAP rates and constants. Further, proof of consistent year-after-year fertilizer use on the plots of land should be provided and the specific types of crops being grown should be indicated such that the appropriate fertilizer applications rates can be used in calculations.

In conclusion, the DEIS nitrogen loading rates under the current use / existing conditions scenario were overestimated. Further information is required regarding fertilization use on the property to accurately assess the current nitrogen loading rates.

Proposed PDD

The BURBS model analyses within the DEIS determined that the proposed use of the property results in 1,319 lbs of nitrogen being loaded per year. My analyses indicate the nitrogen loading rate is closer to 4,128 lbs per year (Table 2). Differences between these two numbers arise from a series of differences among constants and assumptions used in the respective models. The DEIS assumed a 60-day occupancy whereas the stated intent is for occupants to be capable of living within the facility for 180 days per year. This difference adds 250 lbs of nitrogen to the DEIS budget. The DEIS used a leaching rate of 10% for the proposed golf course whereas the LINAP consensus value is 20%. The staff at Suffolk County Department of Health Services has used data from The Bridge golf course to empirically determine their leaching rate was 24%. The leach rate at the Sebonack course might be higher in some cases as some pristine groundwater wells on the course increased in nitrate concentrations from 0.1 to 2 mg nitrate per liter from before (2005) to after (2012) the golf course was constructed (e.g. monitoring wells #2 and #5). Regardless, a comprehensive meta-analysis of new, highly managed golf courses by LINAP determined they leached, on average, 20%, which is what was applied to the present analyses. This adds about 700 lbs of nitrogen to the DEIS budget. As described below in the fertigation section, the amount of nitrogen loaded as fertilizer will also now need to increase since the well on the property to be used as fertigation has been determined with agreement from the applicant to contain less than 15 mg N per liter. This would increase the nitrogen applied as fertilizer by as much as 2,500 lbs per year.

There is also wastewater nitrogen that was never accounted for within the DEIS. For example, the DEIS indicates there will be 102 seasonal workers as well as 12 year-round workers at the Hills, but their nitrogen loading to the property was not considered. The DEIS mentions up to 132 daily golf guests, but their nitrogen loading to the property was not considered. The DEIS mentions a club house and catering facility that is more than 130,000 sq ft and further mentions use of the facility for events for outside groups (e.g. as a community benefit), but nitrogen loading from events within this facility to the property was not considered. The inclusion of these individuals into the nitrogen budget adds more than 100 lbs of nitrogen per year. Other differences between the DEIS model and the author's calculated nitrogen loading rates likely arise from differences in other constants and rates used in the DEIS compared to the model. It should be noted that every effort was made to use every value within the DEIS in the modeled values presented here. This includes the precise acreage ascribed to every land use as well as the fertilization rates stated to be used on the golf course, the per home occupancy, and more. On this front, the occupancy rate for the homes within the DEIS is set at 2.5 people per home, but the homes contain four bedrooms. It is unclear if such an occupancy rate for the facility is appropriate.

Fertigation:

The DEIS describes the use of fertigation as a nitrogen off-set. Via this process, groundwater with high levels of nitrogen will be pumped from under the property and used to irrigate the golf course. The consumption and volatilization of the nitrogen by the turf is proposed to remove nitrogen from the groundwater. This is a novel and innovative approach for mitigating nitrogen on the property. While this process may successfully remove some quantity of nitrogen from groundwater, it is certain that the value represented in the DEIS as being removed by this process (2,500 lbs N per year) is a significant overestimate of the potential removal. For example, the accepted LINAP nitrogen leaching rates of turf is 20% whereas the DEIS uses a value of 10% which dropped the estimated removal in half and requires 1,250 additional lbs of fertilizer must be applied.

The use of fertigation from nitrate-contaminated groundwater for the purposes of removing nitrogen on a golf course is experimental. While fertigation is used as a practice in some locations across the country, it is typically used for wastewater nitrogen and has yet to be used in this precise configuration. The first ever fertigation practice on Long Island was implemented in late 2016 in Riverhead and its efficacy has yet to be quantified. None of the individuals involved with the

PDD has ever been involved in a golf course fertigation project. While the concept of fertigation, shows promise, there are a series of unknowns and questions surrounding its application and use at the Hills that suggest it should not be relied on as a quantitative nitrogen removal mechanism, but rather should / could be implemented as an experimental practice that may show promise for future remediation efforts.

The first and largest concern with regard to fertigation is the concentration of nitrogen in the groundwater that will be used for this practice. The DEIS states that the well being used for fertigation (TW-1) will reliably and consistently provide 15 mg N per liter for fertigation. There are a series of facts that do not support this hypothesis and in meetings since the DEIS, the consultants representing the Hills PDD has admitted that 15 mg N per liter is unrealistically high. The reasons the levels are not this high and, instead, are uncertain are as follows. First, the well TW-1 is an anomaly with regard to groundwater nitrogen concentrations in the region. This well has 29 mg N per L as a surface groundwater concentration while the two wells directly to its north and south have concentrations of 5 and 6 mg N per liter. While nearby SCWA wells on Spinney Road have higher levels, they are surrounded by wells with zero to 2 mg N per L. This demonstrates that there is significant spatial heterogeneity of groundwater nitrogen concentrations in the region. A vertical profile of nitrogen at well TW-1 shows that the levels of nitrogen within this well decrease sharply with depth. According to DEIS Appendix A-12, "Groundwater Monitoring Analysis of Nitrogen Capture", page 8, the proposed Hills irrigation well will be screened at depth at a level across the bottom 30 feet of the Upper Glacial aquifer, approximately -80 ft. to -110 ft. AMSL, where vertical profile concentrations were measured as 10 – 15 mg N per liter. There are, however, a series of facts and unknowns that makes the future groundwater nitrogen concentrations to be pulled from this well uncertain. First, the TW-1 well is under a compost pile created by the Kracke Farm. Given the very highly anomalous nitrogen concentrations within this well compared to every other well in this region, this composting activity is almost certainly the source of the high nitrogen within this well. A figure from the NYSBMP for golf courses, shown in Appendix J ITHMP.pdf - virtual page 187, 5.3.1 Infiltration Rate Figure 5-2 indicates that groundwater travels vertically six feet per day through the unsaturated zone meaning that the surface groundwater concentrations of nitrogen are strongly influenced by the composting activity, and these concentrations are then diluted with the low nitrogen groundwater found at depth and to the west. The nitrogen concentrations at this well will obviously begin to decrease once the composting activity ceases. A critical question is what is the three-dimensional distribution of groundwater nitrogen concentrations in the regions to the northwest of the well where the groundwater that will feed this well is presently located. That is to say, the vertical profile of nitrogen previously documented is no longer representative of what is within the well, as that groundwater has moved to the south and east of the well at a rate likely close to 0.5 feet per day. What do the nitrogen concentrations looks like vertically today? What will they look like once the groundwater pumping and fertigation begins? How will the pumping effect the flow of groundwater in the region in three-dimensions? There is the sense that region flow will not change along the surface of the groundwater pumping depth, but large volumes wells are known to draw water from depth and the concentrations of nitrogen at depth are significantly lower than surface concentrations in this region. It is the author's professional opinion that that the level of nitrogen that will be in the groundwater pumped from well TW-1 is impossible to accurately predict with the information available, but that it is certainly lower than the 15 mg N per liter used in the DEIS and lower than the 10 mg per liter more recently estimated by the consultants (3/1/7/17; Town Hall meeting).

There are questions with regard to how the turf will respond to the constant dosing of high nitrogen groundwater. Under normal scenarios, fertilizers are applied to lawns seasonally during the times when the fertilizer is needed by the turf. The use of high nitrogen groundwater to irrigate turf could result in the turf being over fertilized during some times of the year with turf leaching rates of nitrogen going above 20%. Similarly, following intense rainfall events when upper soils are saturated, it is likely that surface applied groundwater will be rapidly transferred back to the aquifer at a leaching rate exceeding 20%. The DEIS states that water applied to surface soils within the unsaturated zone of the region move 6 feet per day (figure from the NYSBMP for golf courses, shown in Appendix J of the MUPDD), suggesting that water applied as irrigation one day will be rapidly moving back to the aquifer the next. Finally, it seems likely leaching rates will change with temperature, light levels, spatially, and as a function of the types of nitrogen applied, although these issues were not directly discussed in the DEIS.

There exists questions regarding the manner in which nitrogen will be delivered to the golf course. The consultants for DLC have described (3/1/7/17; Town Hall meeting) a complex system of three distinct ponds being constructed that will be filled with high nitrogen groundwater from well TW-1, pristine low nitrogen groundwater from another, known source, and a third pond within which a high nitrogen fertilizer solution will be mixed and kept. All three ponds will be connected to the golf course irrigation system and mixed in order to deliver the proper amount of nitrogen to the golf course on a regular basis. This will require a highly competent individual capable of measuring the nitrogen concentrations and speciation in each pond as well as a complex delivery system that can be set to deliver the precisely correct proportion of source water to obtain the desired level of nitrogen within the irrigation system. Again, it is important to emphasize that this kind of system has never been constructed on Long Island and perhaps anywhere, has never been operated by the people presently involved in the project, and is prone to error. While groundwater nitrogen levels can be steady once pumping rates come to equilibrium with the surrounding groundwater flow regime, they can also be highly dynamic. Measurements of groundwater nitrate levels within the SCWA Spinney Road facility can fluctuate by as much as 100% within the same day (e.g. 1/31/12, well #2 among multiple examples). As such, it is certain that the proposed three-pond system will result in days when the system is over-fertilized. The duration of such occurrences will depend on the frequency of measurements and frequency of corrections. If the system is under-fertilized, it is assumed that additional fertilizer will be used to make up the deficit in order to maintain turf health.

Given the complexity of the system and the mixing of groundwater nitrogen with fertilizer nitrogen, there will not be a method for accurately tracking how much of the nitrogen that is leached by the system and returned to the aquifer will be from groundwater or from fertilizer. Hence, there will not be a method for quantitatively tracking the nitrogen removed from groundwater by the project. A further consideration is the monitoring system that will be in place to evaluate the nitrogen leaching to groundwater by the PDD. The Sabonac Golf course had six monitoring wells installed to evaluate nitrogen leaching by this course. Two of the wells were placed in regions with already-contaminated groundwater, prohibiting the quantification of nitrogen leaching from the course to the aquifer. Another well was placed, presumably as a control, within the influence of the National Golf course. This left three monitoring wells to evaluate the impact of the course on regional groundwater. Two of these wells rose from 0.1 to > 2 mg N per liter between 2005 and 2012, while a third well also showed increasing nitrogen levels. The ‘control’ well showed decreasing nitrogen concentrations suggesting that the actual nitrogen contamination in others wells was worse that depicted. Decreasing nitrogen within the previously contaminated wells was consistent with the idea that the previous high occupancy rates and wastewater nitrogen source was eliminated when the property became a golf course. However, the potential increase in groundwater nitrogen coming from fertilizer within these wells could not be quantified. A parallel situation exists for the Hills. Most of the nitrogen within the groundwater in the region has levels between 2 and 10 mg N per liter. Given this, and the fact that the project seeks to not increase groundwater nitrogen levels by more than 2 mg N per liter, how will the nitrogen leaching rates be precisely and accurately quantified? How will temporal and spatial variability be accounted for. How many monitoring wells will be installed per hole of the golf course? How will lysimeters be used? How will lysimeter data be interpreted? How will the nitrogen impact of the project be quantified? How will precise nitrogen leaching rates of the PDD be quantified? What corrective action will be taken by whom to rectify a problem if and when it is documented? What are the levels of agricultural pesticides in the groundwater being brought to turf surfaces and what might their impacts be?

A final and significant concern with regard to fertigation is the double importance the PDD has placed on the fertigation approach. Specifically, the quantity of fertilizer applied to the golf course is wholly and directly dependent on the nitrogen yielded via the fertigation well. If fetigation provides less nitrogen, then more nitrogen must be applied via fertilizer application. According to the Integrated Turf Health Management Plan for the Hills at Southampton, East Quogue, NY Page 96, "The Hills golf course will receive nitrogen from its irrigation water, which is calculated to contain 15 ppm of N. Based on an estimated use of 20 MG per year of irrigation applied to the playing areas of the golf course, the annual quantity of N derived from irrigation applied to the 78 acres of golf course managed turf area is 2,502 pounds, equivalent to 0.74 pounds of nitrogen per 1000 square feet of turf area (expressed as 0.74 # N/1000 SF)." Given that the leaching rates for the golf course are presumed to be 20% not 10%, this means the fertization rates will need to double. Furthermore, given that a steady source of 15 mg N per liter groundwater in not available, this deficit will also need to be made up via increased fertilization rates. This increase was not quantified by this document or in the DEIS.

Fertigation is a novel and innovative approach for groundwater remediation and holds promise to be one of many potential mitigation strategies used on Long Island to reduce the loading of nitrogen from land to sea. Given this approach has never been used on Long Island and given the immense uncertainty surrounding the fertigation as outlined in the pages above, using it as an approach to quantitatively remove nitrogen is not inappropriate. If this experimental approach goes well, it would a project benefit. Given the extreme number of variables outlined above in this document, it is certain that the nitrogen removed by this approach would be significantly less than the amount indicated within the DEIS. As stated above, this means some amount of the additional 2,500 bs of fertilizer nitrogen will need to be applied. A suggested approach is to not include the fertigation approach within the net nitrogen budget, given the uncertainty surrounding the approach. The experimental approach should / could be treated as experimental at the outset of the project. Once actual amounts of nitrogen in the groundwater pumped and fertilizer nitrogen applied and nitrogen leaching rates are known, then these values could be applied to updated nitrogen budgets for this property. In the meanwhile, efforts to assign definitive, quantitative numbers for this approach seem is premature and potentially dangerous given the environmental stakes described in the introduction to this document.

As of right development

For consideration of the 'As of Right' development, two scenarios were considered: One that included nearly all of the default assumptions made by the DLC consultants and a second considering considered a 'reduced impact' alternative, using some information proposed by the PDD. It should be noted that many of these assumptions and conditions are quite similar to the ‘reduced impact’ alternative proposed by The Group for the East End for the property. The analyses performed here estimate that the As of Right development using the DLC default assumptions would yield 3,454 lbs of nitrogen per year a level similar to the level determined by the DLC consultants (3,288 lbs). The remarkable similarity for this analysis and the assessment of the current conditions indicates that the methods used here are consistent with the consultants and that the largest differences arise from assumptions with regard to the use of fertigation and wastewater generation associated with the golf course operations and clubhouse.

Some differences from the consultants include the septic systems used at the site. In August of 2016, Article 19 of the Suffolk County Department of Health Services was passed which legalized the use of innovative and alternative on-site wastewater treatment systems (I/A OWTS). According the Suffolk County Deputy Supervisor and Wastewater Czar, Peter Scully, legislation is pending that will require these systems for all new construction in Critical Resource Areas as well as within high priority sub-watersheds which western Shinnecock Bay will be designated as in 2017 as per the NYSDEC LINAP Sub-watersheds study. Beyond Suffolk County regulations. The Town of Southampton is similarly moving towards such requirements. Given the pace of these regulations and this development, it seems more likely than not that such systems will be required for this property if built ‘As of Right’. Other important considerations for the property include the duration of occupancy of the residents. The DEIS assumed that for the As of Right development, homes will be occupied for 365 days per year. A tour of similar neighborhoods in the East Quogue region (e.g. The Pines, Fox Hollow Road) demonstrates that a majority of homeowners are seasonal. For this analyses, it was assumed that half of the residents would live on the premise for half of the year and that half of the residents would be full-time residents, matching the analyses of the PDD which was half-year occupancy. While many of the seasonal residents may be present for a lesser period, matching the PDD analysis used in this study seems most appropriate.

Using the reduced impact alternative, the size of lawns, roads, driveways and roofs were made to largely match what the DEIS indicated will be used for the PDD. In some cases, the information used for this model seemed more realistic as, for example, it seems unlikely that lawns and structures will comprise the entire buildable land within the developable parts of the properties as had been presumed for the As of Right scenario in the DEIS. Furthermore, the DEIS As of Right calculation shows that fertilizer represents 56% of the total nitrogen load which is a percentage larger than any region in Southampton Town. This further supports the concept that the size of lawns and/or rate of fertilization was overestimated in the DEIS. Regarding occupancy for the reduced impact alternative, it was assumed that the homes were fully occupied for half of the year, as observation consistent with the PDD and observations of equivalent communities in

East Quogue (Fox Hollow, Southampton Pines). This occupancy can be achieved via equivalent numbers of people being present year-round, six months, and three months.

The reduced impact alternative provides a nitrogen loading rate (~1,700 lbs nitrogen per year) that is roughly half of the As of Right conditions but highly similar to the PDD without the golf course. This value would be made even lower if, as has been proposed by Group for the East End, fertilization was greatly restricted or eliminated. The lower loading rates for this alternative is associated with there being no seasonal workers, no full time workers, no golfing guests, no catering hall guests, and no gold course.

Epilogue:

The comments within this document focus almost exclusively on the DEIS for The Hills. It is noted that since the publication of this document, I have provided the consultants representing The Hills with two oral critiques of their nitrogen loading budgets within the DEIS and at the behest of Southampton Town Council woman, Christine Scalera, met with the author of this document to discuss differing points of view with regard to nitrogen loading. Through this process, the consultants have made multiple changes to the manner in which they are considering nitrogen load from this project to groundwater and surface waters including the implementation of LINAP assumptions and constants into their calculations and the consideration of more advanced wastewater treatment for the project, specifically a sewage treatment plant. The adaptation of LINAP assumptions and constants seems likely to collectively bring the estimated nitrogen loads from the project to be quantitatively more similar to those determined by the author. The implementation of more advanced sewage treatment will reduce nitrogen loads from this project to groundwater and surface waters. Since the entire load of wastewater nitrogen from the PDD is 550 lbs nitrogen per year, mitigation of fertilizer nitrogen would also be needed to bring the total nitrogen load below the levels delivered by most other uses. An official document that details all of the proposed change will be required as part of the FEIS, however, to quantify the changes to nitrogen loads based on these changes.

Table 1. Constants used to determine nitrogen loads for this report. Note units of kg, ha, etc..

Constants and Calculations	**Hills**	**As of right**	**As of right**	**Golf-tees**	**Golf-rough**	**Existing**	
N inputs from wet and dry deposition	5.37	5.37	5.37	5.37	5.37	5.37	*kg per ha per yr*
Forest N uptake	0.75	0.75	0.75	0.75	0.75	0.75	*percent of deposition retained*
Forest N release	0.25	0.25	0.25	0.25	0.25	0.25	*percent od deposition released*
Vadose N uptake	0	0	0	0	0	0	*percent of deposition retained*
Vadose N release	1	1	1	1	1	1	*percent of deposition released*
Turf N uptake	0.7	0.7	0.7	0.7	0.7	0.7	*percent of deposition retained*
Turf N release	0.3	0.3	0.3	0.3	0.3	0.3	*percent of deposition released*
Agriculture N release	0.4	0.4	0.4	0.4	0.4	0.4	*percent of deposition released*
N throughput from freshwater ponds to aquifer	0.45	0.45	0.45	0.45	0.45	0.45	*percent of inputs*
N throughput from wetlands to aquifer	0.25	0.25	0.25	0.25	0.25	0.25	*percent of inputs*
N released per person per year	4.536	4.536	4.536	4.536	4.536	4.536	*kg per cap per yr*
Percent of N inputs released from septic tanks	0.94	0.94	0.94	0.94	0.94	0.94	*percent of added N released*
Leaching field effluent	0.9	0.9	0.9	0.9	0.9	0.9	*percent of added N released*
N released from the plume of the septic system (I/A OSWT)	0.4	0.4	0.4	0.4	0.4	0.4	*percent of added N released*
Percent of buildings with fertilized lawns	1	0.9	0.9	0.9	0.9	0.9	*percent*
Fertilizer applied to lawns	99	99	99	99	99	99	*kg per ha per yr*
Fertilizer applied to golf courses	189.9	189.9	189.9	189.9	49	123	*kg per ha per yr*
Fertilizer applied to Parks & Athletic Fields	45	45	45	45	45	45	*kg per ha per yr*
Fertilizer applied to agriculture	90.81	90.81	90.81	90.81	90.81	90.81	*kg per ha per yr*
Gaseous loss of fertilizer - residential lawns	0.3	0.3	0.3	0.3	0.3	0.3	*Percent fertilizer transported*
Gaseous loss of fertilizer - golf courses	0.2	0.2	0.2	0.2	0.2	0.2	*Percent fertilizer transported*
Gaseous loss of fertilizer - parks & athletic fields	0.4	0.4	0.4	0.4	0.4	0.4	*Percent fertilizer transported*
Gaseous loss of fertilizer - Agriculture	0.4	0.4	0.4	0.4	0.4	0.4	*Percent fertilizer transported*
Moraine attenuation	0.075	0.075	0.075	0.075	0.075	0.075	*percent of N entering the aquifer that is lost*
Moraine attenuation	0.925	0.925	0.925	0.925	0.925	0.925	*percent of N entering the aquifer that is released*

Table 2. Nitrogen loading rates for differing scenarios. Note units of kg, ha, etc.

	Hills	As of right, max	As of right, min	Golf-tees	Golf-rough	Existing	
Inputs	0	15% cleared, SH, WHB	six months				
Total Occupancy >200m of shore	180	220	150	0	0	0	people
Total Occupancy <200m of shore	0	0	0	0	0	0	people
Watershed area	204	239	239	17	19	236	ha
Area of wetlands (freshwater)	0	0	0	0	0	0	ha
Area of agriculture	0	0	0	0	0	7.48	ha
Area of golf courses	0	0	0	17	19	0	ha
Area of parks and athletic field lawns	0	0	0	0	0	0	ha
Impervious surfaces total	26	67.35701382	24	0	0	0	ha
Area of freshwater ponds	2	0	0	0	0	0	ha
Area of road	7.00	7	7.00	0	0	0.00	ha
Area of driveway	7.00	35	7.00	0	0	0.00	ha
Area of roof	10.00	15	10.00	0	0	0.00	ha
Area of residential lawn	10	35.4	10	0	0	0	ha
Other Impervious Surfaces total	2.00	10.36	1.00	0.00	0.00	0.00	ha
Local Constants							
Percent of parcels with cesspools	0	0	0	0	0	0	
Percent of parcels with septic systems	1	1	1	1	1	1	
Calculations							
Atmospheric Deposition							
Natural Vegetation	223	183	275	0	0	307	kg/yr
Turf	16	57	16	27	31	0	kg/yr
Agriculture	0	0	0	0	0	16	kg/yr
Other Impervious Surfaces	11	56	0	0	0	0	kg/yr
Ponds	5	0	0	0	0	0	kg/yr
Wetlands	0	0	0	0	0	0	kg/yr
Roads	38	38	38	0	0	0	kg/yr
Driveways	11	56	11	0	0	0	kg/yr
Roof	16	24	16	0	0	0	kg/yr
Subtotal	320	414	356	27	31	323	kg/yr
Total with transport loss	**296**	**383**	**330**	**25**	**28**	**299**	kg/yr
	651						
Fertilizer							
Agriculture	0	0	0	0	0	272	kg/yr
Residential Lawns	297	946	267	0	0	0	kg/yr
Golf	0	0	0	646	186	0	kg/yr
Parks +Athletic fields	0	0	0	0	0	0	kg/yr
Subtototal	297	946	267	646	186	272	kg/yr
Total with transport loss	**275**	**875**	**247**	**597**	**172**	**251**	kg/yr
Wastewater							
Cesspools - outside 200m of shore	0	0	0	0	0	0	kg/yr
Septic - outside 200m of shore	256	312	213	0	0	0	kg/yr
Cesspools - within 200m of shore	0	0	0	0	0	0	kg/yr
Septic - within 200m of shore	0	0	0	0	0	0	kg/yr
Total	**256**	**312**	**213**	**0**	**0**	**0**	kg/yr
Total Nload (kg/yr)	**826**	**1,570**	**790**	**623**	**201**	**550**	kg/yr
Total Nload (kg/ha/yr)	**4.048288944**	**6.570328802**	**3.304637429**	**36.621675**	**10.555175**	**2.330367629**	
Hills plus golf calc	**1,649**						kg/yr
Hills plus golf, and not N from fertigation	**1,876**						kg/yr

Table 3. Summary of nitrogen loads for each use of property in pounds per year.

	Existing	As of right, max	As of right, min	Hills, sans golf	Golf-tees	Golf-rough	Hills & golf	Hills& golf & fertilization not received from fertigation
Total Nload (lbs/yr)	1,210	3,455	1,738	1,817	1,370	441	3,628	4,128