UPDATED GROUNDWATER MONITORING PLAN

THE BAYBERRY PROJECT
Southampton, New York

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Lead Agency:
Town of Southampton
Town Board
116 Hampton Road
Southampton, New York 11968

Project Sponsor:
Sebonack Neck Holdings, LLC.
270 South Service Rd, Suite 45
Melville, New York 11747

Prepared by:
P.W. Grosser Consulting
Engineer and Hydrogeologist, P.C.
630 Johnson Avenue
Suite 7
Bohemia, New York 11716-2618

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PURPOSE

The purpose of this document is to present an updated ground water monitoring plan for the five year period 2013 through 2017 for the Sebonack Golf Club. This updated plan has been revised based upon the findings and recommendations of the 2012 Technical Review of the first five years of sampling by the Town of Southampton and their consultants: A. Martin Petrovic, Ph.D. and Thomas Cambareri CGWP, LSP and discussions with representatives of the Sebonack Golf Club. Changes in this monitoring plan reflects the desire of Sebonack Golf Club and the Town to refine the data obtained from the monitoring program so that it is more representative in identifying groundwater impacts and better documents the excellent operation and maintenance of the golf course. In the case where a protocol change from 2007 to 2012 is not clear, the intent of the 2012 Technical Review recommendations will take precedence, as attached to this Protocol.

INTRODUCTION

The Sebonack Golf Club is the development of a privately owned organic golf course utilizing turf management practices which do not rely on traditional application practices using pesticides and fertilizers. The intent is to meet or exceed the organic golf course management standards adopted by Suffolk County. The owner's goal is to set the standard for combining challenging golf within the most environmentally sensitive framework possible. The project employs two compatible guidelines in working toward this goal. The overall project has been enrolled in the Audubon Signature Program whose requirements provide a guide for environmentally responsible development and management of the golf course and overall site. In addition, an Integrated Turf Health Management (ITHM) protocol has been adopted for the construction and maintenance of the golf course. The ITHM is based on the research of Dr. Michael Boehm and his colleagues at Ohio State University. Integrated Turf Health Management represents an advancement beyond earlier Integrated Pest Management (IPM) programs.

Following is a list of elements which have been key to reaching the project goal of establishing and maintaining an organic-based golf course that minimizes adverse environmental impacts.

- Implementing environmentally sensitive design and construction procedures.

- Building a healthy soil profile, primarily through the use of compost.
- Properly irrigating and draining the course.
- Using the most appropriate disease-and pest-resistant turf grass varieties on the in-play areas.
- Using native and compatible grass, shrub, and tree species in secondary rough and out-of-play restoration areas.
- Following a vigilant and proactive Integrated Turf Health Management Program.

Some of the procedures and techniques that are employed include:

- Soil ecology monitoring and management.
- Daily scouting of the course for determination of maintenance needs and early detection of disease with regular condition reports (weekly, monthly, annual). The scouting consists of observation by course personnel as a standard operating procedure and reporting to the Superintendent who maintains internal records of the observations and areas that are distressed.
- Collecting and managing the data using geographic information system technology to map where problem areas are and a facility management application specifically tailored for this project and site. These data enhance the decision making process required of the Superintendent in maintaining soil and turf health. In addition, the data are available to the research/educational project members.
- Regular testing to assess soil conditions in terms of biological activity, organic content, macro-and micronutrient levels, compaction, and drainage characteristics.
- Establishment of acceptable thresholds for regionally common pests and disease.
- Pre-planned response actions to early warning detections and threshold exceedance.
- Use of organic, non-toxic primary treatment options such as physical removal of pest ridden or diseased section, adjustment of watering rates, cutting

heights, nutritional levels, etc., and the use of biological/organic products to treat pests or disease organisms**.**

GREEN LINERS

In order to control nitrate and pesticide leaching from the most actively managed part of the course, the greens are lined with impermeable materials and the drainage collected and conveyed to a lined greens irrigation pond, from where it is recycled to the turf surface. Having the greens lined allows for sample collection and analysis that enhances the study of the use of natural and organic materials. Over the next two years a protocol will be developed to improve confidence in the effectiveness of the liners and the sampling results.

While use of a green liner system is not a common practice, it is consistent with the environmental sensitivity applied throughout the project. The liner prevents leaching of nitrogen and other turf care products that may be used on the greens. As the greens are typically the most intensively managed areas of the course, this approach enhances the water quality protection efforts for the overall project. The use of the liners is not just for water quality protection, but also allows for periodic monitoring of the quantity and quality of water moving through the system. The lined greens, swales, and drainpipe system also improves water conservation by providing a means to recycle the irrigation water from these areas of the course.

Although the use of liners in golf course greens is a relatively new and rare approach, the technology employed has been proven in other industries. Lined greens have been used successfully on other golf course projects such as the Santa Lucia Preserve golf course in Carmel, California and the Vineyard Club on Martha's Vineyard in Massachusetts. This project has taken the liner concept further by incorporating irrigation and drainage systems to maintain a closed system. The liner material installed is made of HDPE (high density polyethylene, a much tougher material than PVC) and is 40 mils thick (four times thicker than originally proposed in 2004). The life span of this material is typically well in excess of twenty (20) years. Failures are exceedingly rare, and when reported, are usually related to the liner being punctured, not deterioration of the material.

The 2012 Technical Review found that the water balance component of the 2004 Groundwater Monitoring Protocol was not adequately implemented. This 2012 Protocol includes the 2012 Technical Review recommendations to begin a two year evaluation period of methods to obtain appropriate information about the performance of the green drainage system and identify potential failures.

2004 MONITORING PROGRAM

For the maintenance of environmental quality and to facilitate monitoring for research and management adjustments, lysimeters and monitoring wells were installed in 2004 in key locations as shown on **Figure 1**. Lysimeters are devices installed within the unsaturated zone to collect samples of water percolating down through the soil column. They were installed at different depths in clusters of three, to provide an early indication of nutrients and other inputs migrating vertically through the soil to the water table below. Since tee box areas typically require greater maintenance than fairways, lysimeters were installed near selected tee boxes, with remote access points for sampling, located outside of the area of play. A total of fifteen lysimeters have been installed in groups of three each, at five different locations.

Monitoring Well Installation

To monitor groundwater quality, five monitoring wells were installed in 2004 adjacent to and down gradient of, each of the five lysimeter clusters (using regional available information). The hydrological analysis performed, as part of the 2012 Technical Review, indicates that groundwater flows radially out from the center of Sebonack Neck toward the major surface water bodies in the area. The effective result is that, depending on location on the course, groundwater flow is either toward Peconic Bay, Bull Head Bay or Cold Spring Pond. Therefore, the monitoring well locations were selected to ascertain groundwater quality adjacent to and locally down gradient of relatively high maintenance areas such as tee boxes, and, in a regional sense, down gradient of the full course at positions along Peconic Bay and Cold Spring Pond (see **Figure 1**).

A total of six monitoring wells were installed at the following locations: Monitoring well (MW-1) was installed south-west of the 2nd tee area, west of the clubhouse and parking lot area. MW-2 is located south of the 14th tee area on the southern portion of the

property. MW-3 was also installed on the southern portion of the property near the 8th and 9th tees, close to the maintenance area where there is storage, loading and mixing of materials. MW-4 is located on the southwestern portion of the property to the east of the 13th tee boxes. MW-5 is located in between the 3rd and 17th tee boxes. A sixth well, MW-6 is located along the northeast property line, to monitor groundwater flowing from the adjacent property. Subsequent data from the 2012 Technical Review indicates that MW-6 monitors groundwater flowing from the extreme northwest portion of the site, primarily the driving range. The rationale for selecting lysimeter/monitoring well locations is provided in **Table 1**.

TABLE 1
Monitoring Well / Lysimeter Cluster
2004 Location Selection

Well	PURPOSE
MW1/LC1	To monitor leaching from the tee areas at the 2nd and 3rd holes, and general groundwater quality in the northwestern area of the course migrating toward Peconic Bay. This well has been shown to be impacted by previous land uses at the site.
MW2/LC2	To monitor leaching from the tee area at the 14th hole, and general groundwater quality in the southern area of the course migrating toward Cold Spring Pond.
MW3/LC3	To monitor leaching from the tee areas at the 8th and 9th holes, and general groundwater quality in the eastern area of the course migrating toward Cold Spring Pond. This well has been shown to be impacted by previous land uses at the site.
MW4/LC4	To monitor leaching from the tee area at the 13th hole, and general groundwater quality in the southwestern area of the course migrating toward Cold Spring Pond.
MW5/LC5	To monitor leaching from the tee area at the 3rd, 11th and 17th holes, and general groundwater quality in this area of the course migrating toward Peconic Bay.
MW6	To monitor flow onto the property from the National Golf Links of America. Subsequent data have shown that this monitors flow from the northwest portion of the site and the driving range, which is not fertilized. This flow is towards Bull Head Bay.

Lysimeter Installation

As an early warning of any nitrogen and/or pesticides leaching through the root zone, fifteen suction lysimeters have been installed in five clusters (three lysimeters each), near each of five monitoring wells (MW-1 through MW-5). The samplers were installed at depths of 3 feet, 9 feet and 15 feet below ground surface, allowing samples to be taken from the unsaturated zone above the groundwater. Unlike the monitoring wells, which were installed down gradient of the intended sample area, the lysimeters were installed directly within the managed turf area. Samples are collected from the lysimeter via a remote access point located outside of the area of play.

Local Groundwater Flow

A water table map of Sebonack Neck was prepared from depth to water table measurements from the 2009 Annual report by Petrovic and Cambareri (see **Figure 1**). Those measurements are converted to elevations of the water table relative to mean sea level from an elevation survey of the top of the wells. The depth to the water table ranges from zero at the coast to more than 75 feet. Additional information to prepare the water table map included detailed topographic information provided by the Town GIS Department to approximate surface water elevations and review of USGS reports and maps. The groundwater system of Sebonack Neck appears to be an independent mound or lens of the upper glacial aquifer. It has a high water table contour elevation of approximately 10 feet above mean sea level at MW-6. The 2-foot contours are concentric with decreasing elevations towards the coast and wetland drainage areas. The irrigation system is supplied by an irrigation well that taps this lens. The location and depth of the well were selected to minimize the chances of the well being impacted by saltwater under the expected pumpage needs. Although not required by the NYSDEC well permit, Sebonack will attempt to minimize the amount of water pumped and will monitor the specific conductance in a monitoring well adjacent to the irrigation supply well. This will be done using a down well specific conductance data logger for the start of the 2013 pumping season. The data logger will periodically be removed from the well and the data down loaded for review.

Groundwater flow is perpendicular to the water table contours. Major groundwater flow paths were delineated. The Sebonack Neck groundwater mound discharges to Peconic

Bay to the Northwest, Cold Spring Pond to the South and Bull Head Bay to the Northeast. The water table map and flow-net shows that portion of the groundwater flow system beneath the Sebonack Golf Course that flows/discharges to Peconic Bay (59%) and Cold Spring Pond (34%), with a small portion flowing northeast to Bull Head Bay (7%). These amounts include the 5.7 acre driving range as an active managed turf area, the majority of which is, located in the Bull Head Bay sub-watershed.

The time of travel for a particle of water introduced to the top of the Sebonack Neck mound to migrate to the coast is up to 15 years, thus it may take 5-15 years for pre-existing water quality impacts to flush out of the surficial aquifer.

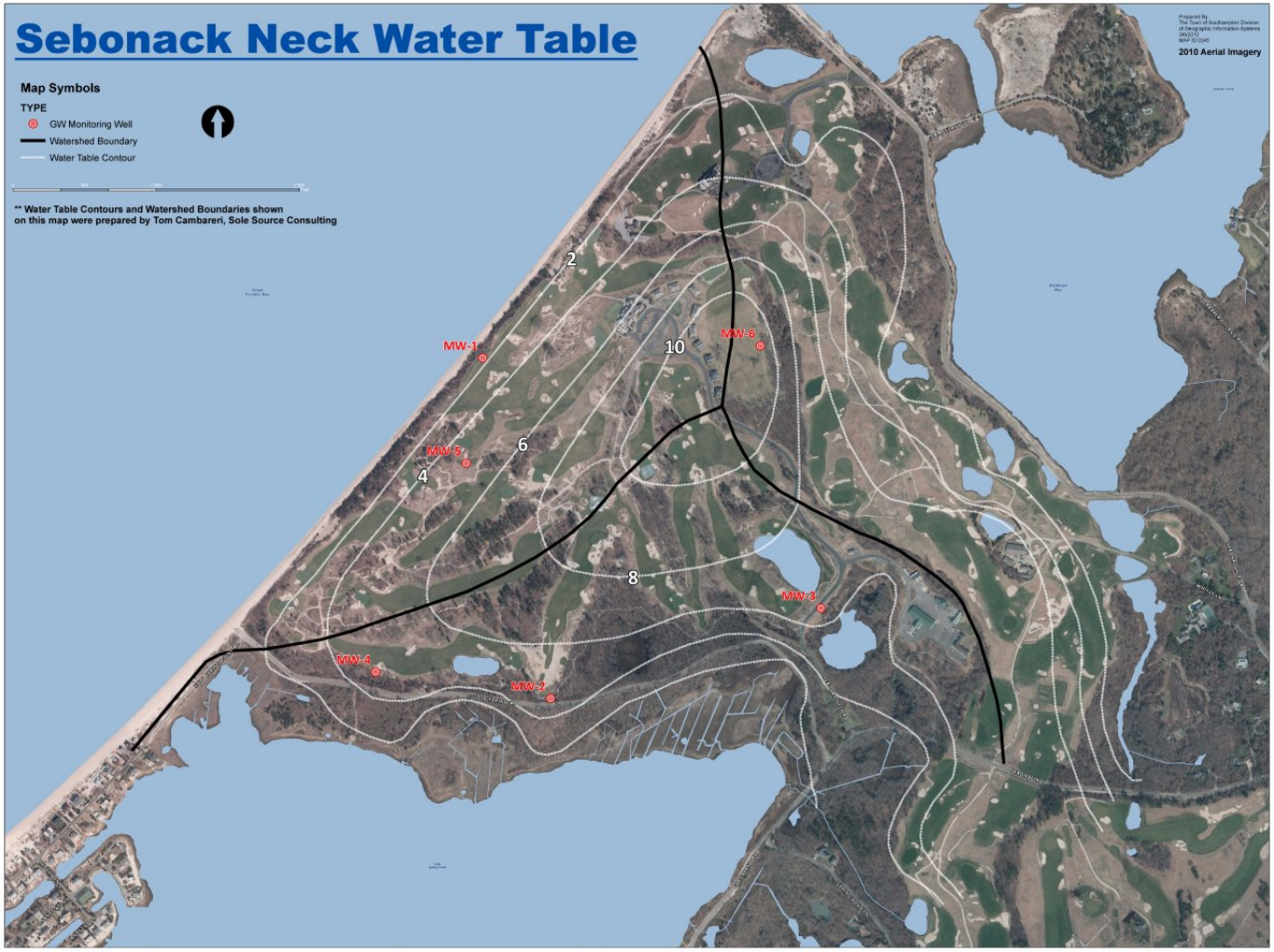

Figure 1 - Sebonack Neck Water Table Map and Sub-Watersheds to Coastal Waters

SAMPLING AND ANALYSIS PROGRAM (SAP)

An analysis of the Nitrogen trends in groundwater at Sebonack was performed by Petrovic and Cambareri for the 2012 Technical Review with the following findings:

> "Nitrogen primarily in the form of nitrate has been detected over a range of concentrations (0 to 16 ppm) in groundwater at the Sebonack Golf Course. One set of wells have relatively low levels of nitrate and another set of wells has much higher levels of nitrate (**Figure 2**). The wells with the highest background nitrate concentration are decreasing and a number of the wells with low background nitrate concentrations show a slight increasing trend."

As a result of the slightly increasing nitrogen trend Sebonack will establish a tentative goal to reduce the amount of fertilizer applied by 20 percent of the present average of 4,500 pounds per year. Attainment of the goal will be dependent upon special needs and circumstances encountered each year depending on weather and course use.

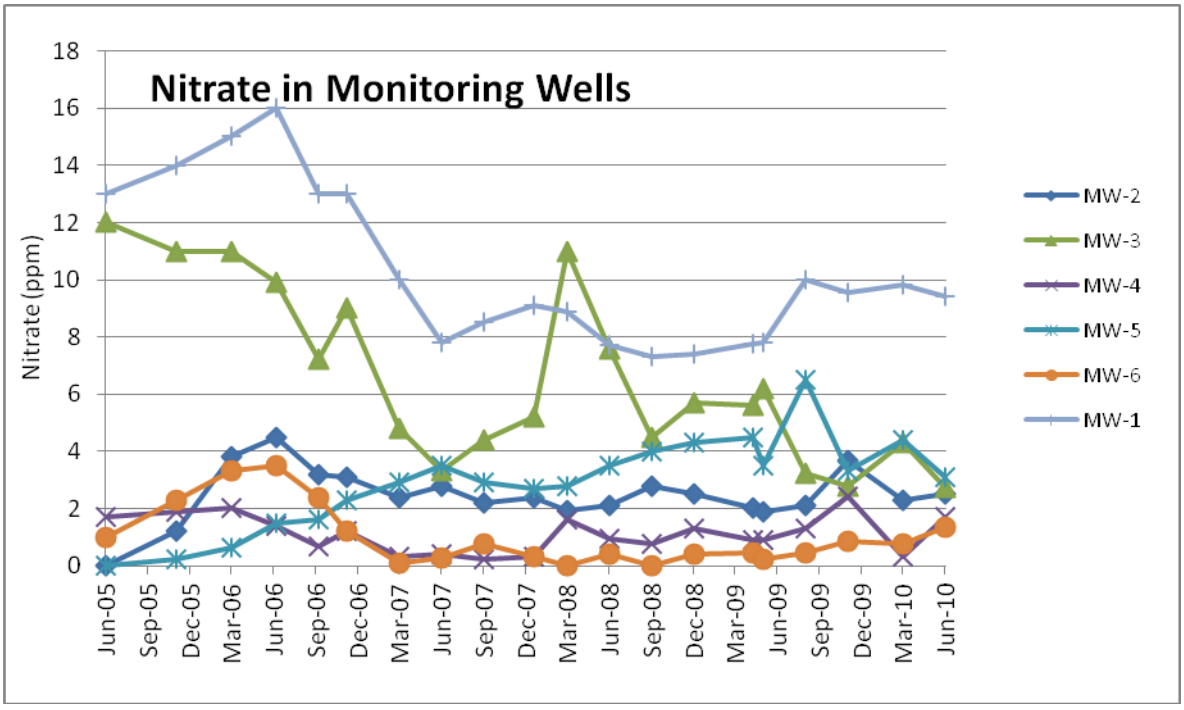

Figure 2 - Nitrogen in Groundwater at Monitoring Wells

"To make better sense of the nitrogen concentrations and trends it is useful to look at other general water quality parameters. Fortunately, the protocol for sampling at Sebonack includes field measurements of Specific Conductance (conductance). Specific conductance is a measurement of the ability of water to pass an electrical current. A high specific conductance value indicates a high number of dissolved ionic substances in water. Fresh ambient groundwater has a low conductance of less than 100 uS/cm (micro-Siemens per centimeter) since there are no contaminants from land uses. Altered groundwater by suburban land use is typically 100 to 300 uS/cm, and groundwater impacted from point sources of contamination like high volume wastewater disposal or landfills, have an abundance of dissolved ionic compounds with a conductance above 300 uS/cm. The graph of specific conductance for the monitoring wells shows that groundwater at MW-1 has a significantly higher specific conductance in the 600 to 900 uS/cm range (**Figure 3)**. A level that high can only result from a pre-existing land use, as discussed in earlier reports. The conductance at MW-3 was also initially high at nearly 200 uS/cm. The other monitoring wells MW-2, MW-4, MW-5 and MW-6 were all nearly at 50 uS/cm at the beginning but show a slight increase to approximately 150 to 200 uS/cm over the course of the monitoring program."

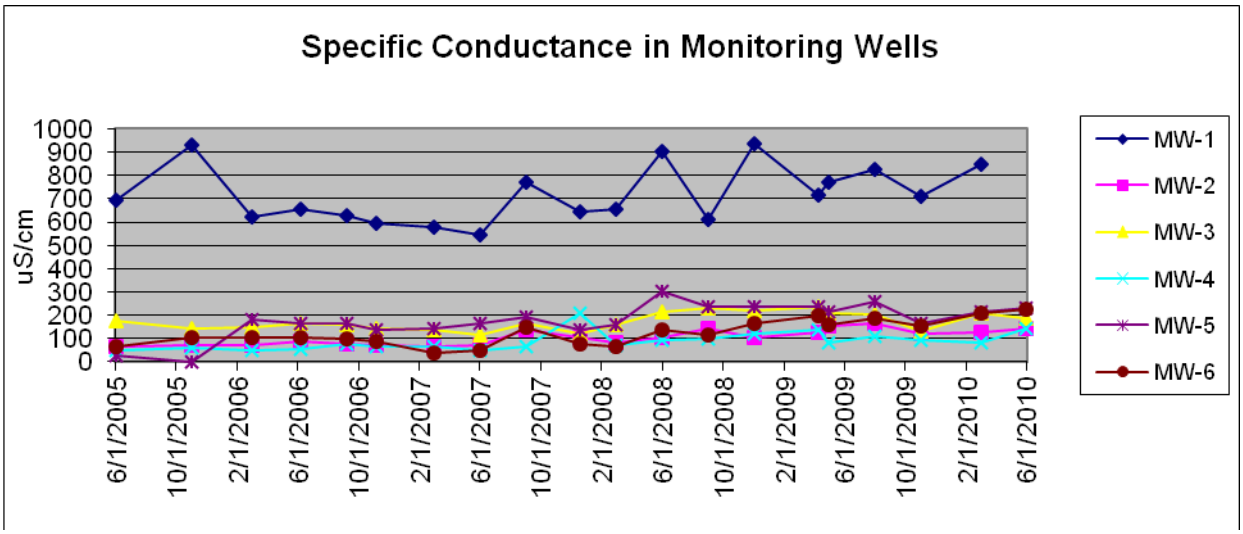

Figure 3 - Specific Conductance in Monitoring Wells

Since MW-1 is clearly impacted by prior land uses at the site, the 2012 Technical Report recommended to install a replacement well (MW-1R) that is not in an area that is impacted by prior land use and can provide a representative sample of groundwater that reflects groundwater quality influenced only by the golf course. MW-1 will no longer be considered part of the turf monitoring system. When nitrate concentrations are less than

5 ppm for two years, the role of MW-1 in the monitoring program will be reconsidered including permanent abandonment from the program. This well will not be monitored for pesticides.

MW-3 has a mixed response to pre-existing and existing non-turf conditions. It is doubtful that the sampling results of MW-3 could offer a credible indication of a response to turf management since it is located down gradient of a roadway catch basin. As the catch basin continues as a source of flushing and dilution we would expect pre-existing nitrogen concentrations to continue to decrease in coming years. When nitrate concentrations are less than 5 ppm for two years, the role of MW-3 will be considered for abandonment. The Non-Turf Wells have an average nitrate concentration of 6.96 ppm over the last 2.5 years. The nitrate concentrations at MW-1 and MW-3 have decreased significantly over the course of the 5 year sampling program indicating that the pre-existing sources are moderating. The concentrations are now below the 10 ppm state and federal drinking water standard and there are no water supplies being used on Sebonack Neck. These Non-Turf Monitoring Wells will continue to be monitored for continued improvement annually for field measurements and testing for nitrate and TKN. The goal for these wells is 5 ppm nitrate and a management threshold is 10 ppm (**Table 3**). The results of the tests for MW-1 and MW-3 will not be used to interpret the effects of turf management.

Petrovic and Cambareri found, “The shallow lysimeters show the greatest fluctuations of concentrations and together with the well results can inform turf management decisions. However, the value of continuing to monitor both of the mid and deep lysimeters is debatable since they track fairly consistently with the concentrations in their associated monitoring well and have been near or below 5 ppm. The 2012 Technical Review recommended that shallow and intermediate depth lysimeters at LC1R, LC2, LC4 and LC5 continue to be sampled. Deep lysimeters at LC1 and LC3 shall continue to be sampled on a semi-annual basis until field verifications as recommended by the 2012 Technical Review are undertaken after which they will no longer need to be sampled.”

The SAP employs a monitoring network of eight lysimeters and four monitoring wells installed around the course to detect and track nutrients and other inputs migrating

through the soil and the groundwater. The basic network of lysimeters and monitoring wells is supplemented by collecting water samples from the two on-site ponds. One pond reflects the drainage from the green liners, while the other is the raw irrigation water. The lysimeters and monitoring wells were sampled initially, prior to any use of chemicals on the golf course, to establish a site-specific baseline. The sampling collection program is performed by a qualified environmental consulting company (presently, Legette, Breshears and Graham), selected by the Town Planning and Development Administrator, in accordance with NYSDEC and USEPA protocols to assure sample integrity.

Sample analysis is based on a semi-annual sampling plan, which includes a chemical list of pesticides used on the golf course in the last year. Lysimeters will no longer be sampled for pesticides. Nitrogen series compounds have been analyzed on a quarterly basis to assess impacts from the application of fertilizers at the golf course. In the future they will be collected on a semi-annual basis. Samples from the lined greens and ponds are collected on a yearly basis and are analyzed for the nitrogen series and site-specific pesticides only. Analytical work for the monitoring program is performed by a NYSDOH Certified Environmental Laboratory. The sampling frequency is subject to review by the Town Planning and Development Administrator, and may be adjusted in response to trends in sample results. The sampling parameters and frequency are summarized in **Table 3**.

During 2011-2012 the results of the five year sampling plan were reviewed by the Town Planning and Development Administrator and the Town's consultants, A. Martin Petrovic, Ph.D. and Thomas C. Cambareri for the sampling period 2005 through 2010. Their findings and recommendations are presented in "Technical Review of Five Years of Test Results Based on the Groundwater Monitoring Plan for the Sebonack Golf Course Southampton, NY" dated August 8, 2012. The protocols have been modified to reflect their recommendations and are attached as Appendix A.

It should be noted that NYSDOH and/or USEPA approved methods may not be currently available or may not currently exist for several of the listed compounds. Only compounds that have been approved by USEPA for use on Long Island will be applied at the course and at or below the dosages recommended by USEPA or the manufacturer.

These compounds would have gone through rigorous screening from USEPA regarding toxicity and potential for transport and would have proven effective for the use at the course. In addition, it may not be feasible to analyze for certain compounds using approved methods for every constituent on the site-specific list. However, alternative analysis methods, if available, will be considered in order to analyze for the presence of as many compounds on the list as possible. As approved test methods become available in the future, compounds that previously could not be tested will be included in the next scheduled sampling event to establish a baseline.

Five Year Sampling Plan

The list of pesticides considered for emergency use on-site is presented in **Table 2.**

Table 2
Pesticides Considered for Use

Chlorothalonil	Fludioxonil	Vinclozolin
Propamocarb	Trinexapac-Ethyl	
Metaconazole	Boscalid	Paclobutrizol
Sethoxydim	Carefentrazone-Ethyl	Prodiamine
Bensulide	Spinosyn A	Fluazifop-P-Butyl
Etridiazole	Flutolanil	Ethephon
Bacillus subtilis	Fenarimol	Mefanoxam
Mesotrione	Bispyibac-Sodium	Civitas
Polyoxin D	Propoconazole	Myclobutanil
Azoxystrobin	Dimethylamine salt of propionic acid	
Pyraclostrobin	Siduron	Triadimefon
Dimethylamine salt of dicamba		Aluminum tris O-ethyl
Dimethylamine salt of 2,4-Dichlorophenoxyacetic acid		

The results of the risk analysis performed on each of these compounds indicated that the potential leaching impact from the selected list was extremely low. Several of the products showed no leaching at all in the 10 year model and none on the list showed leaching concentrations that are considered detectable by current practical laboratory methods. Merit 75 (Imadacloprid) was the only product modeled which even approached detectable limits (in the last month of the tenth year). As this product modeled

significantly higher than the alternate insecticide, it has been removed from the list of products considered for use, pending further analysis.

New, more environmentally friendly, products are constantly coming on line. The applicant may file a request with the Town Planning and Development Administrator to add these products as they become available. The Town will respond to such requests within 45 days.

REVISED 2012 Sampling Program

The Sebonack Groundwater Monitoring Plan will be reviewed every five years and the sampling will be reduced to a semi-annual basis by sampling the on-site monitoring network of eight lysimeters and four Turf-Response monitoring wells. Testing should be done in May-June and again in November-December. Analysis of the semi-annual samples will include the nitrogen series (now only TKN and nitrate) and those pesticides that have been used on-site during the previous twelve month period. Monitoring wells MW-2, 4, 5 and 6 are to be considered "Turf Response Wells" and will be used to evaluate the impacts from the golf course and to trigger response actions in pesticide/fertilizer use. The response action trigger for nitrogen has been modified to be a single sample above 4 mg/l in the "Turf Response Wells". MW-1 and MW-3 are to be designated Non-Turf wells and will not be used to trigger response actions, except notice to the Town if results exceed 10 ppm. A new well will be installed, MW-1R, which may be used as a "Turf Response Well" in the future, should the sampling results for the first two years justify it. The Non Turf wells will be purged and sampled annually for specific conductance, physical parameters and nitrate. Should nitrate concentrations be less than 5 ppm for 2 years the role of the Non-Turf wells within the monitoring program can be reconsidered and potentially dropped from the program.

MW-1R will be constructed within the first year of the new protocol. Its location will be confirmed by evaluating aerials and in the field. The well will have 15 feet of screen 13 feet into groundwater. Soil profiling will be performed during drilling to confirm that the well is placed in a non-disturbed location. Field screening for nitrate will be performed with a Hach kit, or equivalent to confirm that water quality is not compromised by pre-existing uses. A proposed field concentration of <2.5 ppm will be used for that determination. If either previously disturbed soil or the field detection is >2.5 ppm is

encountered another location will be identified and a well attempted there with the same protocol. Along with MW-1R, lysimeters will be placed at 3 and 6 foot depths in proximity to the well.

The shallow and intermediate depth lysimeters at LC1R, LC2, LC4 and LC5 will be monitored semi-annually for TKN and nitrate. The deep lysimeters at LC1 and LC3 will also be monitored semi-annually until field verifications as recommended are undertaken, after which they no longer will be sampled. The remaining lysimeters will no longer be sampled. An overview of the 2012 Sampling Program is presented in **Table 3**.

Table 3 - Sebonack Golf Course Monitoring Program 2012

	NITROGEN SAMPLING						PESTICIDE SAMPLING[1]		
Well	Monitoring Frequency	Field[2] Measurements	Sampling Parameters	Goal Concentration (ppm)	Management Response Level (ppm)	Resampling Threshold (ppm)	Monitoring Frequency	Resampling Threshold [4]	Suspended Use Level [4]
Turf Response Wells									
MW-1R	Semi-Annual	Yes	Nitrate TKN	2	4	4	Semi-Annual	>25 % HAL	>25% NYS AWQ
MW-2	Semi-Annual	Yes	Nitrate TKN	2	4	4	Semi-Annual	>25 % HAL	>25% NYS AWQ
MW-4	Semi-Annual	Yes	Nitrate TKN	2	4	4	Semi-Annual	>25 % HAL	>25% NYS AWQ
MW-5	Semi-Annual	Yes	Nitrate TKN	2	4	4	Semi-Annual	>25 % HAL	>25% NYS AWQ
MW-6	Semi-Annual	Yes	Nitrate TKN	2	4	4	Semi-Annual	>25 % HAL	>25% NYS AWQ
Non-Turf Response Wells									
MW-1	Annual	Yes	Nitrate Only	5 [3]	10	NA	-	-	-
MW-3	Annual	Yes	Nitrate Only	5 [3]	10	NA	-	-	-
Lysimeters and Ponds									
Shallow and Int. Lysimeters: LC1R, LC2, LC4, LC5	Semi-Annual	Yes	Nitrate TKN	5	10	NA	-	-	-
Deep Lysimeters: LC1 and LC3	Semi-Annual	Yes	Nitrate TKN	5[3]	10	NA	-	-	-
Greens Pond	Annual	NA	Nitrate TKN	2	4	NA	Annual	>25 % HAL	100% NYS AWQ
Irrigation Pond	Annual	NA	Nitrate TKN	2	4	NA	Annual	>25 % HAL	100% NYS AWQ

*Semi-Annual Sampling will take place in May-June and November-December.

(1) Pesticide Sampling will include all Pesticides used on-site during the previous 12 month period.

(2) Field Measurements include conductivity (µS/cm), Temperature (°F), and pH.

(3)When analyitical results show nitrate is less than 5ppm for 2 years, wells and deep lysimeters may be removed from monitoring program.

(4) Resampling and suspension levels are a detection of > 25% of the HAL, 25% of the USDA-NCRS human toxicity level or 5 times the laboratory quantitation limit (detection limit), which ever is less.

Response Actions (Pesticide Detections)

The use of organic formulations to control pests and provide nutrients to the turf is the first choice to minimize the likelihood of contamination. Detection of pesticides will be thoroughly investigated to determine the approximate time range when compounds were applied by correlating compounds, rate of flow, and application procedures. If necessary, precipitation events over the prior period will be reviewed to correlate findings. The following action procedures have been established and will be implemented in the event that a pesticide used on the course is detected in groundwater, greens drainage or irrigation pond sample.

Tees and Fairways

- The well will be tested again as soon as practicable, if the detection is > 25% of the HAL or 5 times the laboratory method quantitation limit (detection limit), which ever is less, to confirm the presence of the pesticide and to see if the concentration is increasing. Consider applying mitigation measures if pesticide is confirmed. See **Table 4** for the appropriate standards.
- Document the environmental (rainfall after application) and management (amount of irrigation after application, amount of pesticide application, etc.) conditions at the time of the pesticide application and immediately after.
- Use of a particular product on tees and fairways will be suspended if it is: Detected within the monitoring well above 25% of the NYS AWQS/USEPA Guidance, 25% of the USDA-NCRS human toxicity level or 50ug/l, whichever is lower.

Greens Drainage Pond

- The use of the product will be temporarily suspended on the greens, if it is:
    a) Detected in the greens drainage pond above 100% of the NYS AWQS/USEPA Guidance, 50% of the aquatic LC50, 100% of the

USDA-NCRS human toxicity level or 50ug/l, whichever is lower, or;

b) Any pesticide detected twice in one year in a monitoring well above 25% of the NYS AWQS/USEPA Guidance, 10% of the aquatic LC50, 25 % of the USDA-NCRS human toxicity level or 50 ug/l would be removed from use on the course pending review by the Town. Refer to **Table 4** for NYS AWQS/USEPA guidance values and aquatic LC50 values by active ingredient, for the proposed products.

Mitigation measures to reduce the amount of pesticides applied may include raising the ITHM application threshold, spot treating instead of broadcasting, or selection of different fertilizer or pesticide formulas that includes less of the target compound. If the use of a product is suspended or banned as specified above, compounds with lower mobility and persistence properties will be substituted. Should a detection be confirmed by subsequent sampling and analyses of circumstances a remediation plan will be prepared and submitted to the Town for review and concurrence.

Response Actions (Nitrogen Detections)

To minimize the likelihood of contamination from fertilizers, the first choice will be the use of organic formulations to provide nutrients to the turf. In addition, nitrogen testing will be performed to monitor the effects of fertilizers which may be used, as needed, on the course. This testing will be performed semi-annually and the compounds that are being used will be adjusted, as necessary, based on the results of these tests. Other adjustments to fertilizer application will be made if it is recognized that certain compounds are leaching more than others.

If at any point measurements show nitrogen (TKN or nitrates individually) to be above 10 parts per million (PPM) in the lysimeters associated with the “Turf Response Wells” or above 4 PPM in groundwater, several different actions will take place:

- The well(s) in question will be resampled as soon as feasible after receipt of the results. If the concentration is confirmed in the offending well (s), all fertilization

will stop in the surface watershed and groundwater area up gradient of the offending well(s).

- An evaluation will then be conducted in consultation with the Town to determine the conditions and issues that caused the large increase (fertilizer, rainfall, irrigation runoff) and plans to remediate the condition.
- Fertilization will resume when the concentration of the offending well is less than 2 ppm of nitrate-nitrogen or as outlined in the remediation plan.
- The remediation plan may include additional sampling frequency and allow that fertilization can resume prior to achieving 2 ppm if turf integrity is at risk.

An overview of the response levels for nitrogen and all pesticides allowed on-site is presented in **Table 4**.

Table 4 - Sebonack Golf Course Monitoring Program 2012 - Compound Action Levels

Compound	NYSDEC AWQS (ppm)	USDA-NCRS Human Toxicity (ppm)	Aquatic LC50 Freshwater (ppm)	USEPA HAL (ppm)	Response Threshold MW and Lysimeter (ppm) [4]	Response Threshold Greens & Irrigation Pond (ppm) [4]
Nitrogen Series						
Nitrate	10	NA	NA	100[1]	4/10*	4
TKN (Total Kjehldal Nitrogen)	10	NA	NA	NA	4/10*	4
Pesticides - Target Compounds List						
Dacthal (DCPA)	NS	NA	>100	0.07[2]	>0.0175	0.05
Metalaxyl	NS	NA	28	NA	0.05	0.05
Bromacil	0.0044	NA	71	0.07[2]	0.0011	0.0044
DEHP (Di(2-ethylhexyl)phthalate)	0.005	NA	0.16	0.3 [3]	0.00125	0.005
Pesticides - Emergency Use List						
Aluminum tris O-ethyl	NS	NA	>150	NA	0.05	0.05
Azoxystrobin	NS	1.26	NH	NA	0.05	0.05
Bacillus subtilis	NS	50	NH	NA	0.05	0.05
Bensulide	NS	0.046	0.7	0.15[1]	0.012	0.046
Bispyribac-Sodium	NS	0.7	>100	NA	0.05	0.05
Boscalid	NS	0.153	NA	NA	0.05	0.05
Carefentrazone-Ethyl	NS	3.5	NH	NA	0.05	0.05
Chlorothalanil	0.005	0.015	0.047	0.15[3]	0.00125	0.005
Civitas	NS	NA	NA	NA	0.05	0.05
Dimethylamine salt of dicamba	0.00044	0.035	>100	4[2]	0.00011	0.00044
Dimethylamine salt of propionic acid	NS	0.035	NH	NA	0.009	0.035
Ethephon	NS	0.126	170	NA	0.03	0.05
Etridiazole	NS	0.011	NA	NA	0.003	0.011

Compound	NYSDEC AWQS (ppm)	USDA-NCRS Human Toxicity (ppm)	Aquatic LC50 Freshwater (ppm)	USEPA HAL (ppm)	Response Threshold MW and Lysimeter (ppm) [4]	Response Threshold Greens & Irrigation Pond (ppm) [4]
Fluazifop-P-Butyl	NS	0.07	NA	NA	0.018	0.05
Fludioxonil	NS	0.21	0.47	NA	0.05	0.05
Flutolanil	NS	4.2	2.5	NA	0.05	0.05
Imadacloprid	NS	0.399	211	NA	0.05	0.05
Mefenoxam	NS	0.518	>113	NA	0.05	0.05
Mesotrione	NS	0.049	840	NA	0.012	0.049
Metacanazole	NS	NA	NA	NA	0.05	0.05
Myclobutanil	NS	0.175	2.4	NA	0.04	0.05
Paclobitrazol	NS	0.175	23.6	NA	0.04	0.05
Prodiamine	NS	0.035	0.55	NA	0.009	0.035
Propamocarb	NS	0.7	235	NA	0.05	0.05
Pyraclostrobin	NS	0.21	0.033	NA	0.0033	0.0033
Sethoxydim	NS	NA	78.1	NA	0.05	0.05
Siduran	NS	52.5	NA	NA	0.05	0.05
Spinosyn A	NS	0.188	>90.9	NA	0.05	0.05
Triadimefon	NS	0.028	1.6	NA	0.007	0.028
Trinexapac-Ethyl	NS	0.221	68	NA	0.05	0.05
Vinlozen	NS	0.0084	NA	NA	0.002	0.0084

NA - Not Available

NH - Non-Hazardous to marine animal populations

NS - No Standard

(1) Based on an exposure duration of one day, for a 10 kg child

(2) Based on a lifetime exposure, for a 70 kg adult

(3) Based on the Drinking Water Specific Risk Level Concentration for Cancer (10^{-4} Cancer Risk)

(4) Response threshold as per 2012 Groundwater Monitoring Plan

*Analytical results are above 4ppm in MW's or above 10ppm in Lysimeters

SAMPLING METHODOLOGY AND QA/QC PROCEDURES

Lysimeters

The lysimeters are equipped with a two line system designed to be sampled with a vacuum/pressure pump. A vacuum is first applied to the vacuum line to draw vadose water into the ceramic cup. Pressure is then applied to the pressure line to push the sample up the vacuum line and to the surface. Samples are collected directly from the polyethylene line to the appropriate laboratory-supplied container.

The rate of influx and quantity of soil pore water obtained from lysimeters during the sampling is dependent on the soil moisture content, hydraulic potentials that exist in the soil and the lysimeter device. Due to the limited sample volume only a nitrogen series analysis is to be performed on samples from the lysimeters.

Monitoring Wells

Prior to each sampling event, measurements will be obtained to calculate groundwater elevations and the volume of water contained in the well casing. A minimum of three casing volumes will be purged from each well using a submersible pump or other suitable purging equipment. Field parameters including pH (units), conductivity (uS/cm), and temperature (degrees F) will be obtained after purging. Upon completion of the purging, a water sample will be obtained using a disposable dedicated polyethylene bailer and string or other appropriate method.

Quality Assurance/ Quality Control Procedures (QA/QC)

Collected samples will be placed in laboratory-supplied containers and delivered to a New York State Department of Health approved laboratory for analysis of some or all of the following compounds, as indicated by sample type, location and event:

- Site-specific list of insecticides, herbicides, and fungicides provided by the golf course management
- Nitrogen series (TKN, NO_3).
- SCDOH 2002 Golf Course Pesticide Study - detected compound list: Dacthal, metalaxyl, bromicil, DEHP

QA/QC implemented during sampling activities will include the use of trip blanks and field blanks. A laboratory prepared trip blank will accompany samples while in transit on each day of sampling to ensure contamination of the samples does not occur during handling and transport. A field blank will be prepared to document whether decontamination procedures are effectively preventing cross contamination between sampling locations. It shall be prepared by pouring laboratory supplied water over the decontaminated sampling device into laboratory supplied containers. Field blanks will only be prepared when non-dedicated, non-disposable materials are used to collect samples. One field blank will be prepared for each different combination of sampling

method/decontamination procedure employed. Trip blanks and field blanks will be analyzed for the same suite of analysis as that of the collected samples.

2012 REPORTING REQUIREMENTS

An annual report will be sent to the Town by Sebonack that will contain:

- sampling results and their interpretation
- program modifications
- any response action taken to address pesticide detections or nitrogen threshold exceedances that occurred during the year

Additionally, whenever a result is above the threshold value for nitrogen or pesticides or use of a new pesticide when lab tests are received, the Town will be notified promptly and informed of the steps taken to reduce the risk of any further contamination of groundwater. Annual reports will include:

- copies of the insecticide/herbicide/fungicide usage log
- records of the field efforts conducted for the monitoring program
- irrigation well pumping records (monthly pumpage, precipitation, evapotranspiration)
- specific conductance records of the irrigation well water
- well and lysimeter sampling forms
- laboratory reports
- fertilizer amounts in pounds of nitrogen applied to greens, fairways, tees and driving range
- other pertinent records generated by the maintenance of the course including but not limited to reporting on the site specific actions items below.

The Superintendent will notify the sampling contractor when new pesticides are used to insure that the appropriate analyses are being performed.

SITE SPECIFIC ITEMS FOR FURTHER EVALUATION AND INVESTIGATION

1. A soil profiling test will be performed at LC-1 in the first year of the new protocol. This involves using a small hand bucket auger to retrieve continuous soil samples to a depth of 3 to 6 feet adjacent to LC1. The soils will be observed and soil samples taken for potential analysis. Photos will be taken of each soil sample.
2. The sampling tube lengths at LC3 will be measured with a small diameter wire and reported.
3. A nitrate reduction plan will be developed for MW-5 in up gradient areas to ensure reduction of nitrate concentrations by abandoning dry wells. A program to target a reduction of fertilizer application for a limited time (one year period) in the up gradient area will be implemented to evaluate the nitrogen response in MW-5.
4. Within the next two years, a strategy to test the performance of the greens drainage system will be developed and implemented. This strategy will incorporate measuring the response of pond water levels to irrigation and precipitation as well as pumpage from the pond and that the feasibility of using the electrical demand of the force main pumps and/or retrofitting some aspect of the system with flow meters to record flow volumes from the greens drainage system be evaluated. An Operation and Maintenance Plan shall be prepared that outlines the present normal operation and maintenance protocols that are followed to assure the Greens Drainage system is operating and presented within two years.
5. Another round of dry well sampling will be performed within the first year of the revised GWMP.

OPERATIONAL GOALS

1. The Sebonack Golf Course has voluntarily adopted a five year program to reduce the amount of fertilizer applied by 20% of the present annual average

of 4,500 pounds. The amounts of fertilizer applied will be documented in the annual report.

2. Regularly monitoring for specific conductance in the monitoring well adjacent to irrigation supply well will be performed with a data logger. No changes are contemplated in the typical pumpage of 23 million gallons per year from the irrigation well.

APPENDIX A

2012 Technical Review Recommended Changes to the Protocol

The 2005-2010 five-year review evaluated the Sebonack monitoring program for compliance with the Groundwater Monitoring Plan and its results and identified the flowing items to optimize and focus the Groundwater Monitoring Program on turf management and maintaining its environmental quality.

1. Recommend a reduction of sampling frequency from quarterly to semi-annual since the trends of nitrogen in wells appear to be consistent as shown on Table ES-1 and ES-2.

2. Eliminate the testing results from the Non-Turf wells MW-1and MW-3 for evaluating the impacts from the Golf Course. Continue to purge and take field measurements for Specific Conductance and other physical measurements and sample for nitrate annually to gage natural restoration that may occur over time. When tests results show nitrate is less than 5 ppm for 2 years reconsider their role in the monitoring program.

3. Recommend the adoption of monitoring wells MW-2, 4, 5 and 6 as Turf Response Wells. It is recommended to install a new well, MW-1R to monitor turf management activities, to replace the Non-Turf MW-1. Sampling data from this well will need to be evaluated for two years to confirm its suitability as a Turf Response well.

4. Recommend that the Sebonack Golf Course adopt a collective average goal of 2 ppm for the 4 existing and the MW-1R replacement turf response wells with an action threshold of 4 ppm in any one Turf Response Well to trigger a turf management response and better reflect the conditions on the course and to better guide turf management decisions as shown in Table ES-1.

5. Based upon the recommendation of the reduction of sampling from quarterly to semi-annually we recommend reducing the action threshold to resample in any turf well from 5 ppm of nitrate-nitrogen to 4 ppm. The well(s) in question will be resampled as soon as feasible after receipt of the results. If the concentration is confirmed in the offending well(s), all fertilization will stop in the surface watershed and groundwater area up gradient of the offending well(s). An evaluation will then be conducted in consultation with the Town to determine the conditions and issues that caused the large increase (fertilizer, rainfall, irrigation, runoff) and plans to remediate the condition. Fertilization will resume when the concentration of the offending well is less than 2 ppm of nitrate-nitrogen or as outlined in the remediation plan. The remediation plan may include additional sampling frequency and allow that fertilization can resume prior to achieving 2 ppm if turf integrity is at risk.

6. The shallow lysimeters show the greatest fluctuations of concentrations and together with the well results can inform turf management decisions. However, the value of continuing to monitor the deep lysimeters is debatable since they track fairly consistently with the concentrations in their associated monitoring well and have been near or below 5 ppm. We recommend that shallow and intermediate depth lysimeters at LC1R, LC2, LC4 and LC5 continue to be sampled. The nitrate goal is for these lysimeters to be below 5 ppm, with a management response for detection above 10 ppm (as indicated on the Table ES-2). Deep lysimeters at LC1 and LC3 shall continue to be sampled on a semi-annual basis until field verifications as recommended are undertaken, after which they no longer need to be sampled. The lysimeters do not produce enough water for pesticide analysis so it is recommended that they only be tested for nitrogen.

7. Recommend that nitrogen sampling will consist of nitrate and Kjeldahl-nitrogen. Ammonia and nitrite will no longer be analyzed because the monitoring program has not seen appreciable detections of these compounds over the five year sampling program.

8. Reconcile the types of pesticides applied with the types of analytical methods so that lab tests are performed for the pesticides that are applied in each sampling round.

9. Additional scrutiny of sod farm products and securing guarantees that pesticides of concern have not been used to grow the sod is recommended. In the future, any time sod or any other material that could contain pesticides (soil or other plant material) is brought on site; any pesticide that was applied to sod in the past 12 months needs to be given to LBG to be included in the list of pesticides for testing.

10. Specific Conductance shall continue to be reported as micro Siemens per centimeter for consistency (uS/cm) and tracked for all wells.

11. Monitor and report the salinity of the pumped irrigation water in the annual report.

Reconfiguration of Monitoring Wells and Lysimeters

The 2005-2010 five year review found that two of the monitor wells were measuring water quality not associated with Turf Management. Therefore one of those wells and its associated lysimeters will be replaced. Both of the Non-Turf wells will continue to be sampled for reduced general parameters.

1. Recommend to install a new Turf Response well at MW-1R within the first year of the new protocol. Location will be confirmed by evaluating aerials and in the field. Well will have 15 foot screen 13 ft into the groundwater. To reduce the

cost of two mobilizations, soil profiling during drilling will confirm non-disturbed location. Field screening for nitrate with a Hach kit or equivalent can be used to confirm that water quality is not compromised by pre-existing uses. A proposed field nitrate concentration of <2.5 ppm will be used for that determination. If either previously disturbed soil or the field detection is > 2.5 ppm, then move to another appropriate location further from the area of disturbance.

2. Recommend to replace the LC1 lysimeter set with LC1R at 3 and 6 feet deep in the vicinity of the new MW-1R well.

Site Specific Items for Further Evaluation and Investigation

The 2005-2010 five-year review identified several items that need further evaluation and investigation. These items are recommended to be incorporated as conditions to be implemented within the amended protocol as described in the attached Action Plan.

1. Recommend a soil profiling test at LC1 in the first year of the new protocol. This would involve a small hand bucket auger to retrieve continuous soil samples to a depth of 3 to 6 feet adjacent to the LC1. This investigation will provide information on soils (sand, organics, and clay) and provide soil samples for potential analysis. Photos of soil samples arranged by depth will be taken.

2. Recommend measurement of sampling tube lengths at LC3 with small diameter wire or line to confirm lysimeter lengths.

3. Recommend the development of a nitrate reduction plan for MW-5 in upgradient area to ensure reduction of nitrate concentrations by abandoning dry wells in upgradient area. A program to target a reduction of fertilizer application for a limited time (one year) in the upgradient area was also discussed to evaluate nitrogen response in MW-5.

4. Recommend the development of a strategy to test the performance of the green drainage system. It is recommended that a data logger be installed to measure the greens pond water level response to irrigation and/or precipitation events. It is also recommended that an Operation and Maintenance Plan be prepared that outlines the normal operation and maintenance protocols that are followed to assure the Greens Drainage system is operating. It is also recommended that the feasibility of using the electrical demand of the force main pumps and/or retrofitting some aspect of the system with flow meters to record flow volumes from the greens drainage system be evaluated within the next two years.

5. Recommend another round of dry well sampling to confirm 2011 results.

6. It is recommended that the Town submit the reconnaissance assessment of Cold Spring Pond to the Peconic Estuary Program to review this information and evaluate the need for further study. Aspects of additional work can include, interpretation of other water quality data, bathymetric survey of Cold Spring Pond and its tidal flushing characteristics, determination of residence times, refinement of the land use nitrogen loading, evaluation of the other long term water quality parameters being monitored in Cold Spring Pond, characterization of previous levels of activities at former Union Resort, and review of water use records.

Golf Course Operations

The 2005-2010 five-year review identified the following changes in turf management to maintain its low level of impact on water quality.

1. It is recommended that the Sebonack Golf Course adopt a five year goal of reducing the amount of nitrogen fertilizer applied by 20% of the present annual average of 4,500 pounds.
2. Maintain the current average annual groundwater pumping for irrigation by regular monitoring of salinity.

Reporting

1. Compiling certain sets of information over the five year program was difficult, so we recommend that the semi-annual reporting of the items below also be included in the annual reports so that these parameters can be more easily tracked:

    a. Fertilizer amounts in lbs. of nitrogen applied to greens, fairways, tees and driving range.
    b. Monthly compilations of irrigation pumped, precipitation and evapotranspiration and salinity.
    c. Pesticides applied.

2. Recommend the adoption of reporting tasks that include a written notification to the town of:
    a. An exceedence of a nitrogen management response.
    b. Detection of pesticide or,
    c. Use of a new pesticide when lab tests are received.

3. The Superintendent will notify the sampling contractor when new pesticides are used to insure that the appropriate analyses are being used.

4. Adopt the water table configuration for Sebonack Neck as shown in in Figure 3 of the Technical Review Report.

5. Report progress and result of the specific items recommended for further evaluation and reporting.

6. The Town and Sebonack Golf Course shall discuss the Monitoring Program for compliance with the performance standards and conditions and its potential modification in five years increments. The need and extent for a formal review study will be determined at those five year meetings.

Table ES-1and 2 Sebonack Golf Course Sampling and Response Protocol

SEBONACK GOLF COURSE MONITORING PROGRAM 2012									
		NITRATE (ppm)				PESTICIDES			
Well	Category	NITRATE	Field Measurements	GOAL*	Management Response	Pesticides	2-YEAR	Resampling Trigger	Management Trigger
MW-1**	Non-Turf	Annual	yes	5	10	na	VOC	na	na
MW-1R	Turf Respons	Semi	yes	<2	4	Semi		25% HAL	10% HAL
MW-2	Turf Respons	Semi	yes	<2	4	Semi		25% HAL	10% HAL
MW-3**	Non-Turf	Annual	yes	5	10	na	VOC	na	na
MW-4	Turf Respons	Semi	yes	<2	4	Semi		25% HAL	10% HAL
MW-5	Turf Respons	Semi	yes	<2	4 ***	Semi		25% HAL	10% HAL
MW-6	Turf Respons	Semi	yes	<2	4	Semi		25% HAL	10% HAL
Green Pond	Pond	Semi	na	<2	4	na		25% HAL	10% HAL
Irrigation Pond	Pond	Annual	na	<2	4	Annual		25% HAL	10% HAL
* The nitrate Goal for Turf Response Wells is a collective average of 2 ppm									
**sampling of these well can cease after 2 years of nitrate < 5ppm									

*** The threshold response for MW-5 can take its past performance to the local nitrogen source from lysimeter area into consideration

SEBONACK GOLF COURSE SAMPLING PROGRAM 2012			
	NITRATE		
Lysimeters	NITRATE	GOAL	Mgmt Response
LC1R-3	Semi	5	10
LC1R-6	Semi	5	10
LC2-3	Semi	5	10
LC2-6	Semi	5	10
LC4-3	Semi	5	10
LC4-6	Semi	5	10
LC5-3	Semi	5	10
LC5-9	Semi	5	10