E. Surface Water Resources and Stormwater Management

1. Existing Conditions

Stormwater runoff within the Project Site is generally in a north to south direction towards an existing pond at Washburn Road. The developed area of the site is situated in a watershed of approximately 36 acres. Within the overall watershed, 20 acres drain towards the existing pond located just outside of the southeast corner of the property. On-site, a portion of the runoff is collected in a series of inlets located along the western driveway off Washburn Road (proposed project entrance). These inlets are connected to a catchbasin situated on the northwest corner of the driveway's intersection with Washburn Road. In addition to the inlet flow from the property, this basin has an 18" pipe connection to a drainage structure to its west and collects road runoff that flows overland in a ditch along the edge of Washburn Road. The outlet from this catchbasin, an 18" RCP pipe, flows to a headwall situated on the north side of the small pond on the lot at the southeast end of Washburn Road. This pond has a pipe outlet to the NYSDEC wetland adjacent to the Taconic State Parkway. Below (east) the proposed project entrance, runoff flows in a ditch on the north side of Washburn Road, then across the pavement at the dead end and into the NYSDEC wetland.,

None of the Site is within the New York City reservoir watershed. In addition, there are no wetlands, waterbodies, surface watercourses, or floodplains on or in the vicinity of the site except the NYSDEC Freshwater Wetland located to the south of the property as described in Section III.C.1.1 of the Scoping document.

The properties surrounding the Project Site are all served by Village of Briarcliff Manor water supply system and there are no wells that are used for drinking water use in the vicinity of the site. In general, in unconfined aquifers such as those present at the project site, groundwater recharge areas are usually in elevated topographical areas; discharge areas are located in topographic lows. Discharge areas typically feature vegetation common to wet soils and surface water. Due to the physical characteristics of this site (i.e. direction of land slope, bedrock outcroppings, wetland soils, watercourses, etc.), it is probable that most precipitation, which falls on this site, is discharged to the watercourse adjacent to the southbound Taconic State Parkway and south of Washburn Road --- both through surface water runoff and groundwater discharge.

According to the "Soil Survey of Westchester County" by the U.S. Department of Agriculture, Soil Conservation Service, on-site soils predominantly include Charlton-Chatfield complex, rolling (CrC), Chatfield-Charlton complex, hilly (CsD) and Paxton (PnD).

Most of the project site is wooded. There are also areas of grass along the existing paved roads. The central western section of the site is nicely forested and has an orchard aspect. There are no wetlands or watercourses on the site. The highest part of the parcel is found in the northwestern section of the property approximately 200 feet west of the existing tennis court, where the elevation is 415.0 feet. The lowest area of the property is at an elevation of 250.0 feet and is located at the southeastern section of the property.

In order to determine the pre-development conditions for the site, two analysis points (A and B) with the corresponding watersheds were chosen in relationship with the possible impact downstream of the developed areas (*see Section D: Plan Figures - Figure 2, Pre-Development Drainage Areas* in Appendix B). The pre-development conditions will ultimately be used in determining the stormwater detention needs for the proposed development. An analysis of the drainage basins was done to compute the peak runoff rates during each of the design storms. A printout of the complete results is contained in *Section C: Calculations – PRE-DEVELOPMENT DRAINAGE ANALYSIS* in Appendix B. The input parameters for drainage area, time of concentration (T_C) and composite curve number (CN), as well as the analysis results for pre-development are summarized in Table III.E-1.

Table III.E- 1
Existing (Pre-Development) Drainage Conditions

Drainage Basin	Drainage Area (Acres)	Curve No. (CN)	Travel Time (T_C) (hr)	Peak Runoff Rate (cfs)					
				1-Year (C_{Pv})	2-Year	10-Year (Q_P)	25-Year	50-Year	100-Year (Q_F)
A	20.1	65	0.34	4.5	9.7	24.1	35.3	47.3	53.6
B	16.0	65	0.23	4.1	8.9	22.0	32.1	42.9	48.5

Source: Stormwater Management Plan, Chas. H. Sells, October 2007, Revised September 2009.

2. Anticipated Impacts

For the post-development condition similar watersheds were used, however both drainage areas were subdivided and modified to reflect the changes of the site to analyze the hydrology under proposed conditions (*see Section D: Plan Figures - Figure 3, Post-Development Drainage Areas, Conventional Layout* in Appendix B). Input parameters were modified to reflect changes in the drainage basin boundaries, plus changes to the times of concentration and curve numbers that resulted because of the development of the site. The complete analysis for the post-development condition is contained in *Section C: Calculations – POST-DEVELOPMENT DRAINAGE ANALYSIS – CONVENTIONAL LAYOUT* in Appendix B. The input parameters for drainage area, T_C and CN, as well as the analysis results for post-development are summarized in Table III.E-2 for the Conventional Layout. These values reflect the peak runoff rate prior to the design of any stormwater peak discharge mitigation measures.

Table III.E- 2
Post-Development Drainage Conditions
Conventional Layout
(without Mitigation)

Drainage Basin	Drainage Area (Acres)	Curve No, CN	Travel Time, T_C	Peak Runoff Rate (cfs)					
				1-	2-	10-	25-	50-	100-

			(hr)	Year (C_{Pv})	Year	Year (Q_P)	Year	Year	Year (Q_F)
A1	17.1	63	0.34	2.9	6.9	18.4	27.5	37.4	42.5
A2	4.3	76	0.20	3.3	5.2	9.9	13.2	16.6	18.3
A1+A2	21.4			5.3	11.1	26.8	38.7	51.5	58.2
B1	5.4	68	0.16	2.2	4.3	9.5	13.5	17.6	19.8
B2	9.3	69	0.22	3.8	7.2	15.7	22.1	28.8	32.3
B1+B2	14.7			6.0	11.3	25.0	35.3	46.0	51.6

Source: Stormwater Management Plan, Chas. H. Sells, October 2007, Revised September 2009.

To evaluate the change from pre- and post-development conditions, the peak flows for several of the subwatersheds were hydrologically added to compute peak runoff rates at common downstream points. Using the common discharge points a comparison was made for pre- and post-development peak runoff rates for the site and is shown in Table III.E-3.

Table III.E- 3
Pre- Versus Post-Development Peak Discharges
Conventional Layout(without Mitigation)

Drainage Basin	Pre-Development Peak Runoff Rate (cfs)						Post-Development Peak Runoff Rate (cfs)					
	1-Year (C_{Pv})	2-Year	10-Year (Q_P)	25-Year	50-Year	100-Year (Q_F)	1-Year (C_{Pv})	2-Year	10-Year (Q_P)	25-Year	50-Year	100-Year (Q_F)
A (A1+A2)	4.5	9.7	24.1	35.3	47.3	53.6	(5.3)	(11.1)	(26.8)	(38.7)	(51.5)	(58.2)
B (B1+B2)	4.1	8.9	22.0	32.1	42.9	48.5	(6.0)	(11.3)	(25.0)	(35.3)	(46.0)	(51.6)

Source: Stormwater Management Plan, Chas. H. Sells, October 2007, Revised September 2009.

As can be seen in Table III.E-3, without detention there would be small increases in the peak runoff rates. To mitigate any increases, a detention basin has been proposed as shown in Table III.E-5. The detention basin will collect the runoff from Drainage Areas A2 and B1. The peak flows will be conveyed through a closed storm sewer system. The basin shall have approximately 1.3 acre-feet (56,650 cubic feet) of storage and will mitigate any increase in peak runoff for the 1-, 2-, 10-, 25-, 50- and 100-year design storms at the common discharge point A. In general, this includes runoff collected by the proposed access roads and diverted towards the detention basin. The proposed drainage system will be capable of conveying a 100-year frequency storm to the detention basin.

Table III.E-5
Pre- Versus Post-Development Peak Discharges
Conventional Layout (with Mitigation)

Drainage Basin	Pre-Development Peak Runoff Rate (cfs)						Post-Development Peak Runoff Rate (cfs)					
	1-Year (C_{Pv})	2-Year	10-Year (Q_P)	25-Year	50-Year	100-Year (Q_F)	1-Year (C_{Pv})	2-Year	10-Year (Q_P)	25-Year	50-Year	100-Year (Q_F)
A (A1+A2)	4.5	9.7	24.1	35.3	47.3	53.6	4.5	9.7	24.1	35.3	47.3	53.6
B (B1+B2)	4.1	8.9	22.0	32.1	42.9	48.5	4.1	8.9	22.0	32.1	42.9	48.5

Source: Stormwater Management Plan, Chas. H. Sells, October 2007, Revised September 2009.

3. Proposed Mitigation

Several Stormwater Management Practices (SMPs) are incorporated into the stormwater management system design to maintain water quality. The methodology used for the design of the SMPs will follow the guidelines contained in *New York State Stormwater Design Manual* to meet the Phase II Stormwater Regulations.

Several SMPs have been identified to mitigate water quality. These include dry swales, plunge pools and dry wells/infiltrator chambers (*see Section D: Plan Figures – Figures 3 & 4: Post-Development Drainage Areas* in Appendix B).

- Grassed, dry swales will be constructed in several locations near the proposed detention basin on the site. These swales will be used to provide water quality treatment before peak discharges enter the detention pond. At the upstream end of the dry swales, plunge pools will be constructed to pre-treat 25% of the water quality volume. In order to treat the water quality flow up to the channel protection discharge (CPv), a diversion structure will be constructed upstream of each plunge pool. The diversion structure will allow smaller flows toward the plunge pool and larger flows to enter directly into the detention basin. A water quality swale is also directed to the plunge pool. The swale reduces the velocity, temporarily stores stormwater runoff and promotes infiltration. Pollutant removal mechanisms in water quality swales include sedimentation, adsorption, biological treatment and microbial breakdown. The swales will be trapezoidal with a 3:1 side slope, 3.0-foot bottom and 0.008 slope. The swales are designed to carry the water quality discharge at a minimum of 10 minutes detention time and allowed to pass the overbank flood (Qp). Table III.E-6 and Table III.E-7 show the quality swale design data.

Table III.E-6
Water Quality Swales
Required Volumes and Dimensions
Conventional Layout

Water Quality Swale	Drainage Area (Acres)	Water Quality Volume, WQV (cfs)	Required Length (ft)
Drainage Area A2	4.3	7,041	210
Drainage Area B1	5.4	5,173	192

Source: Stormwater Management Plan, Chas. H. Sells, October 2007, Revised September 2009.

Table III.E-7
Water Quality Swales
Discharges and Depths
Conventional Layout

Water Quality Swale	Proposed Condition Discharges (cfs)				Proposed Condition Water Depth (ft)			
	C_{Pv}	Q_P	Q_F	Q_{WQ}	C_{Pv}	Q_P	Q_F	Q_{WQ}
Drainage Area A2	3.3	9.9	18.3	1.5	N/A	N/A	N/A	0.8
Drainage Area B1	2.2	9.5	19.8	1.1	N/A	N/A	N/A	0.7

Source: Stormwater Management Plan, Chas. H. Sells, October 2007, Revised September 2009.

- Dry Wells/Infiltration Trenches. First flush runoff volumes from roof and drive areas will be collected in infiltration trenches as required, to provide the volume of water quality treatment prescribed by NYSDEC guidelines. Dwellings which do not drain directly to the detention basin watershed will be provided with infiltration trenches (Exhibit III.E-1). The required roof runoff quality volumes are shown in Table III.E-8.

Table III.E-8
Roof Buildings
Water Quality Requirements

Source	Area (Ac)	I	Rv	WQV (ft3)	WQV (gal)
House & Drive	0.13	100	0.95	583	4,360

Source: Stormwater Management Plan, Chas. H. Sells, October 2007, Revised September 2009.

- The use of infiltrator chambers (12- Cultec 150HD surrounded in stone, with a volume of 36.7 ft^3/unit) was recommended.

In addition to these measures, a micropool and extended detention area has been identified as a suitable stormwater management practice that could be incorporated into the detention basin discussed in Section III.E.1.b above (see also Tables III.E-3 and III.E-5) to enhance stormwater quality and reduce peak discharge. During construction, the detention basin could function as a temporary sediment basin to capture sediment from construction.

Temporary Erosion and Sediment Control Facilities

Land disturbance at the Project Site will be carefully sequenced so that grading operations can begin and end as quickly as possible, thus minimizing the exposed areas subject to erosion. Site clearing, access roads, rough land grading, and installation of underground utilities (storm, water, electric, telephone, etc.), will commence initially. All material from excavation will be stockpiled in-situ to concentrate the area of loose soil exposed to runoff. At the stockpile, silt fences will be installed and temporary dikes/swales will be placed if necessary during construction.

During this stage, soil in areas previously covered will be exposed to runoff. Erosion of these areas will be controlled by establishing temporary seeding and mulch, and by placing straw bale dikes and silt fences. The purpose of the temporary seeding and mulch is to reduce sediment carried by the runoff from the exposed areas and to control dust. Temporary seeding and mulch will be placed as soon as the removal activity is completed. During development, areas where construction has temporarily or permanently ceased will be stabilized within 14 days unless construction will resume within 21 days.

Construction of the buildings and their associated site improvements will commence once site work has been substantially completed and stabilized. Prior to starting these activities, silt fences will be placed along the perimeter of the cleared areas. Any areas disturbed as a result of this activity will receive temporary seeding.

Structural Measures

Straw Bale Dike -

Straw bale barriers will be provided down gradient of all construction activities. The purpose of a bale barrier is to trap sediment from sheet erosion before it travels overland to down-gradient properties. The straw bale dikes will be placed as construction progresses on the site.

Silt Fence -
Silt fence sediment barriers will be installed down-slope of disturbed areas with minimal slope to filter sediment runoff from sheet flow. Silt fences will also be provided around stockpile areas and between construction areas and property lines to reduce sediment-laden runoff from traveling off-site. Additional silt fences will be installed as required during construction activities.

Anti-tracking Apron at Site Entrance -
A temporary stabilized construction entrance of gravel will be installed where the access area intersects with Washburn Road and Carleton Avenue. During muddy conditions, drivers of construction vehicles will be required to wash their wheels before exiting the site.

Storm Drain Inlet Protection -
All storm catch basin inlets will be protected to prevent sediment-laden runoff from clogging the drain pipes during construction. Filter fabric inlet protection and/or inlet sediment devices should be used on each inlet until upland areas are stabilized.

Diversion Dike/Swale -
Diversion dikes/swales will be included in the erosion and sedimentation plan to control and reduce the amount of sediments leaving the site. These diversion dikes/swales will be placed downgrade of disturbed areas, whenever these areas become larger than the areas allowed to be controlled by only a straw bale or silt fence. The diversion dikes/swales will be placed following the existing topography and will be temporarily seeded with a fast-germinating grass, and riprap protected at any discharge points.

Check Dams -
Check dams will be added to diversion swales/channels, as well as any temporary drainage swales to reduce the flow velocity in the channels. This will help to reduce erosion of those temporary drainage facilities.

Water Bars -
Water bars will be provided across the proposed roads, particularly in areas where the grades are in excess of 5%. The water bars will limit the accumulation of erosive velocities of stormwater runoff by diverting the surface water to diversion or temporary drainage swales/channels.

Temporary Sediment Basins -
Temporary sediment basins will be constructed at the permanent detention basin locations to intercept sediment-ladened runoff and to trap and retain the sediment. The size of the basin will be in accordance with the *New York State Standards and Specifications for Erosion and Sediment Control* for the area contributing to the basin during a particular construction phase.

Vegetative Measures
Temporary Seeding -

All cleared areas which will not reach final grading for a period of more than 30 days will be seeded temporarily with fast germinating temporary grasses to reduce erosion potential, immediately following grading. Selection of the seed mixture will depend on the time of year it is applied, as recommended in Section 3 of the *New York State Standards and Specifications for Erosion and Sediment Control*.

Erosion Control Blankets or Mulch -
North American Green biodegradable erosion control blankets will be installed to provide immediate erosion protection and vegetation establishment on excavated or fill slopes or low flow channels which have been brought to final grade and have been seeded to protect the slopes from rill and gully erosion and to allow the seeds to germinate properly. The erosion control blankets will be double netting with degradable thread. This practice shall be applied especially at areas where slopes exceed 5 percent. Mulch (straw or fiber) will be used to control dust resulting from construction activity.

Maintenance and Inspection of Temporary Control Measures
The Applicant will have a qualified inspector as defined by NYSDEC check all erosion and sediment control measures once every 14 days and within 24 hours of the end of a rainfall event of 0.5 inches or greater, unless otherwise specified by NYSDEC. The following items will be checked in particular:

1. Existing riprap protection outlets will be inspected to determine if high flows have caused scouring beneath the riprap or filter fabric. If repairs are needed, they should be done immediately.
2. Temporary dikes/swales shall be inspected for proper functioning or signs of erosion and shall be repaired as necessary. Sediment accumulated to an elevation one foot below the crest of the earth barrier shall be removed and placed in the stockpile.
3. Silt fence barriers shall be inspected for damage resulting from deterioration or undercutting and shall be repaired or replaced as necessary. Sediment shall be removed when the level of sediment deposition reaches halfway to the top of the barrier.
4. Catchbasins and drainage outlets will be checked for accumulation of sediment.
5. Straw bale dikes shall be inspected immediately after each rainfall event of 0.5 inches or greater. All damaged bales, end runs and undercutting beneath bales shall be replaced or repaired. Sediment deposits shall be removed after each rainfall or when the level of deposition reaches half the height of the barrier.
6. Sediment shall be removed from temporary sediment basins whenever their capacity has been reduced by fifty percent from the design capacity.
7. Construction entrance shall be inspected for evidence of off-site sediment tracking. The paved street adjacent to the site entrance will be swept every construction day to remove any excess mud, dirt or rock tracked from the site. Repair road and/or add stone as necessary. Dump trucks hauling material from the construction site will be covered with a tarp.
8. The paved street adjacent to the site entrance will be swept every construction day to remove any excess mud, dirt or rock tracked from the site.

9. Areas that have received final stabilization shall be inspected at least once per month until the entire site has been stabilized.
10. Disturbed areas and exposed areas used for storage/stockpiling that have not received final stabilization shall be inspected for their potential sediment contribution to stormwater.
11. The seeded areas shall be inspected regularly to ensure that a good stand is maintained. Areas where vegetation is missing or damaged shall be fertilized and reseeded as needed as soon as practical and no later than the next growing season.
12. Inspection schedule will be completed and maintained on-site and will contain the following information: date, name of person conducting inspection, areas inspected, problems/conditions encountered, actions taken to correct problem.
13. Employees will be trained to recognize any pollution source and report such immediately. Training will be provided before the construction activity begins.
14. A maintenance schedule will be kept on-site to record and describe any discharge incidents occurring during construction activity, including actions taken to correct the problem, date and name of person conducting the maintenance.

Permanent Erosion and Sediment Control Facilities

Grading of the existing surface will be required in and around the proposed buildings and roadway areas. Runoff from rooftops and drives will be directed to drywells/infiltration galleries to reduce the quantity of runoff requiring treatment for stormwater quality. Surface runoff from access roads, paths, and landscaped areas will be directed to drainage swales and channels, and where appropriate catch basins for ultimate connection to the grass dry swales and detention basin. Drainage swales and channels will be permanently stabilized with vegetative material or rip-rap to prevent erosion and control runoff velocities.

In order to disperse or “spread” the concentrated flow from the detention basin outlet thinly over the existing undisturbed vegetated ground, a level spreader will be provided. Its purpose is to spread the concentrated outflow over a wide area so that the erosion does not occur. The level spreader will also remove other pollutants from runoff by filtration, infiltration, adsorption and decomposition.

G:\D\D-429 Taconic Tract-Mt. Pleasant\DEIS\III.E Surface Water and Stormwater Management.doc