A. INTRODUCTION AND SUMMARY OF FINDINGS

This chapter describes the current drainage patterns on the Project Site and analyzes potential impacts related to stormwater flow and infrastructure as a result of the Proposed Project.

As discussed in section D.2 below, with the implementation of the proposed preliminary stormwater management practices, peak runoff rates for all storms would decrease at one post-development "design point" (Design Point 1) and increase for all storms at the other design point (Design Point 2) (see **Table 10-4**), and certain post-development drainage areas would not meet stormwater quality goals (see **Table 10-5**). The Applicant has determined that the scale of the Proposed Project would need to be reduced to accommodate the additional infrastructure that would be needed to achieve applicable stormwater quantity and quality goals, and that the cost to the Applicant of the reduction in unit count coupled with the cost of the additional infrastructure would make the Proposed Project economically infeasible.

B. EXISTING CONDITIONS

B.1. WATERSHED AND DRAINAGE PATTERNS

The Project Site occupies 35.5 acres within the Peekskill and Haverstraw Watershed Basin. The Project Site generally slopes north to south. The elevation of the developed portion of the Project Site, in the vicinity of the existing office buildings, is approximately 70 feet higher than the elevation of the Project Site's entrance at Old Route 6. Approximately 30 percent of the Project Site (10.74 acres) is currently developed, with the northern 70 percent of the Project Site (approximately 24.79 acres) undeveloped and in a forested state.

The predominant soil types on the Project Site are Charlton fine sandy loam and Charlton-Chatfield Complex. These soils are well drained, typically found on hilltops and hillsides. The Hydrologic classifications range from "B to D" as classified by the United States Department of Agriculture (USDA). The erosion hazard level for these soils is slight to moderate with greater hazards on steep slopes.

The surface runoff pattern on the Project Site is generally from the east to the southwest. The surface runoff pattern is a combination of sheet flow and concentrated flow. Surface runoff from most of the existing impervious areas, including the buildings, parking, and roadways as well as adjoining areas, is collected and transported to the existing

stormwater management basins where the runoff receives water quality treatment and attenuation.[1]

B.2. EXISTING DRAINAGE AREAS

To analyze stormwater conditions on the Project Site, the Project Site was divided into two Existing Drainage Areas (EDAs) each draining to a Design Point (see **Appendix I**, Sheet WS-1.)

EDA-1 is the northern, undeveloped area of the Project Site tributary to the west towards the Taconic State Parkway, and exits the Project Site at Design Point 1. This drainage area, covering 9.43 acres, collects the upgradient lightly treed woodland. The area is segmented by stonewalls and is mostly moderately sloped. There is an existing infiltration basin (Infiltration Basin 1) in this watershed.

EDA-2 encompasses the currently developed area of the Project Site. For purposes of analysis, EDA-2 has been divided into two smaller sub-areas (EDA-2A and EDA-2B). Each area is tributary to one of the two existing stormwater basins. EDA-2A consists of an undeveloped area to the north of the current office campus, from which runoff flows to the outer ring road, and some of the north building, parking, hardscape and adjoining areas. The runoff from this area is collected by surface catch basins and piped to an existing stormwater basin (Pocket Wetland 3) located in the southernmost portion of the Project Site. This is the smaller of the two existing stormwater basins. EDA-2B, which covers 5.22 acres, comprises a majority of the developed portion of the Project Site, including part of the northern building, the entire southern building, and the remainder of the parking, roadway, hardscape, and adjoining areas. Stormwater from this area is collected by the surface catch basins and is transported to the main stormwater basin (Pocket Wetland 2) located below the southern parking lot. This stormwater basin was constructed as a conventional detention pond, and was subsequently converted to a stormwater wetland basin. Both of the existing stormwater basins receive runoff and provide water quality treatment as well as attenuation up to the 100-year storm. The driveway, from its starting point at the southern boundary of the Project Site to the intersection with the ring road, is downgradient from the stormwater basins and continues offsite through the drainage collection system. The point reference for analysis of EDA-2 is the existing drainage structure within the driveway (Design Point 2).

In order to analyze the pre- and post-development conditions, TR-55 methodology was utilized; specifically, the Type III, 24-hour storm for the 1-, 2-, 10-, 25-, and 100-year storm events. Rainfall depths for the respective storm events are presented in **Table 10-1**. Existing peak discharge rates at Design Point 1 and Design Point 2 are presented in **Table 10-2**.

[1] The Project Site was originally developed prior to water quality requirements, and was therefore only subject to attenuation requirements. Later phases of the development (i.e., the north building) were subject to water quality requirements.

Table 10-1
24-Hour Rainfall Amounts

Storm Recurrence Interval	Inches of Rainfall (in)
1 Year	2.78 in
2 Year	3.41 in
10 Year	5.13 in
25 Year	6.49 in
100 Year	9.28 in

Note: in = inches
Source: SDC

Table 10-2
Summary of Existing Peak Rates of Runoff

Storm Recurrence Interval	Design Point 1 (cfs)	Design Point 2 (cfs)
1 Year	5.81	3.09
2 Year	7.94	4.27
10 Year	15.86	8.15
25 Year	22.78	11.98
100 Year	36.52	18.58

Note: cfs = cubic feet per second
Source: SDC

C. THE FUTURE WITHOUT THE PROPOSED PROJECT

In the future without the Proposed Project, there would not be any changes to the existing Project Site drainage patterns or stormwater management systems.

D. THE FUTURE WITH THE PROPOSED PROJECT

D.1. PROPOSED DRAINAGE AREAS

Preliminary stormwater management practices were located and designed to maximize the treatment and retention of stormwater from the new impervious surfaces introduced by the Proposed Project. These practices, illustrated in **Appendix I**, Sheet WS-3, result in the creation of eight post-development drainage areas (DAs), described in detail below, that ultimately drain to Design Point 1 and Design Point 2.

DA-1A - This is the tributary area to the townhome component of the Proposed Project. This drainage area collects the upgradient woodland and the east portion of the townhomes. Runoff from this area would be collected and transported to a stormwater infiltration basin to the north side of the townhomes. The infiltration basin is designed to provide the full RRv, pre-treatment prior to the infiltration of the full WQv, and the attenuation of the higher intensity storm events. the point of reference for the analysis of this Drainage Arae is Design Point 1.

DA-1B - This drainage area collects the west portion of the townhome component and woodlands to the north of the townhomes. Runoff from this area would be collected and conveyed to a stormwater infiltration basin southwest of the townhomes. The infiltration basin is designed to provide 38 percent of the WQv and RRv and pre-treatment prior to

the infiltration of the full water quality volume. the point of reference for the analysis for this Drainage Area is Design Point 1.

DA-2 - This drainage area collects the upgradient woodland, portions of the townhome component, and the northern half of the clubhouse building and amenities area. Runoff from this area would be collected and conveyed to a stormwater infiltration basin to the west side of the Project Site. The infiltration basin is designed to provide 63 percent of the WQv and RRv and pre-treatment prior to the infiltration of the full WQv. The point of reference for the analysis of this Drainage Area is Design Point 1.

DA-3A - This drainage area collects the amenities area and a portion of the clubhouse building. Runoff from this area would be collected and conveyed to a stormwater infiltration basin between the clubhouse building and amenities area. The infiltration basin is designed to provide 71 percent of the WQv and RRv and pre-treatment prior to the infiltration of the full WQv. the point of reference for the analysis of this Drainage Area is Design Point 1.

DA-3B - This drainage area collects the villa buildings in the center of the Project Site and the roads and walkways. Runoff from this area would be collected and conveyed to a stormwater infiltration basin on the west side of the Project Site. The infiltration basin is designed to provide 63 percent of the WQv and RRv and pre-treatment prior to the infiltration of the full WQv. the point of reference for the analysis of this Drainage Area is Design Point 2.

DA-4 - This drainage area collects the villa buildings in the southeast portion of the Project Site and a portion of the amenities area. Runoff from this area would be collected and conveyed to underground infiltration chambers between the decorative ponds and apartment building. The infiltration basin is designed to provide 57 percent of the WQv and RRv and pre-treatment prior to the infiltration of the full WQv. the point of reference for the analysis of this Drainage Area is Design Point 2.

DA-5 - This drainage area collects the apartment building, roads, and walkways at the southernmost area of the Project Site. Runoff from this area would be collected and conveyed to underground infiltration chambers between the roads and apartment building. The infiltration basin is designed to provide the full RRv and pre-treatment prior to the infiltration of the full WQv and the attenuation of the higher intensity storm events. the point of reference for the analysis of this Drainage Area is Design Point 2.

DA-6 - This drainage area collects from the flats. Runoff from this area would be collected and transported to a stormwater infiltration basin on the west side of the Project site. The infiltration basin is designed to provide 52 percent of the WQv and RRv and pre-treatment prior to the infiltration of the full water quality volume. the point of reference for the analysis of this Drainage Area is Design Point 2.

D.2. POST-DEVELOPMENT CONDITIONS

As described above, preliminary stormwater management practices have been designed for the Proposed Project. With the implementation of these practices, the Proposed Project would reduce the peak runoff rate for all storms at Design Point 1 (see **Table 10-3**), but would increase the peak runoff rate for all storms at Design Point 2 (see **Table 10-4**). For multiple drainage areas, the Proposed Project, with the preliminary stormwater practices described, would not meet stormwater quality goals (see **Table 10-5**).

Table 10-3
Design Point 1 – Proposed Peak Runoff Rates

Storm Recurrence Interval	Pre-Development Peak Flow (cfs)	Post-Development Peak Flow (cfs)	Net Change of Peak Flow (cfs)	Percent Reduction
1	5.81	0.53	-5.28	91%
2	7.94	1.41	-6.53	82%
10	15.86	4.03	-11.83	75%
25	22.78	5.11	-17.67	78%
100	36.52	5.11	-31.41	86%

Note: cfs = cubic feet per second
Source: SDC

Table 10-4
Design Point 2 – Proposed Peak Runoff Rates

Storm Recurrence Interval	Pre-Development Peak Flow (cfs)	Post-Development Peak Flow (cfs)	Net Change of Peak Flow (cfs)	Percent Increase
1	3.09	5.00	+1.91	62%
2	4.27	6.15	+1.88	44%
10	8.15	18.14	+9.99	123%
25	11.98	20.58	+8.60	72%
100	18.58	24.00	+5.42	29%

Note: cfs = cubic feet per second
Source: SDC

Table 10-5
Water Quality Analysis

Drainage Area	WQv Based on 90% Rainfall Event (cf)	WQv Provided (cf)	Percent Provided of WQv	RRv Provided (cf)
DA-1A	3,359 cf	3,450 cf	100.0%	3,450 cf
DA-1B	7,466 cf	2,866 cf	38.4%	2,866 cf
DA-2	7,051 cf	4,462 cf	63.3%	4,462 cf
DA-3A	9,857 cf	7,035 cf	71.4%	7,035 cf
DA-3B	4,792 cf	3,022 cf	63.1%	3,022 cf
DA-4	12,606 cf	7,185 cf	57.0%	6,190 cf
DA-5	7,648 cf	7,607 cf	99.5%	4,583 cf
DA-6	4,269 cf	2,217 cf	51.9%	2,217 cf

Note: cf = cubic feet
Source: SDC

E. MITIGATION MEASURES

With the increase in impervious surfaces on the Project Site resulting from the Proposed Project, runoff rates in the future with the Proposed Project would decrease at Design Point 1 and increase at Design Point 2. Impacts would be partially mitigated by the proposed stormwater management practices, and could be further mitigated by measures to decrease runoff rate to Design Point 2 and increase WQv and RRv, potentially including additional underground detention and treatment practices, potentially including a conservation easement over undeveloped land, porous pavement, green roofs, rainwater harvesting, soil restoration, planters, and strategic reduction of impervious surfaces. ✷