

4.3 Topography

4.3.1 Existing Conditions

Similar to much of the topography in Putnam County, the local topography reflects the underlying geology, with north-south trending hills separated by low areas, typically containing wetlands, streams or lakes. Lake Carmel is located approximately 2,500 feet west of the site.

The project site occupies the northeastern slope of a broad hillside. Topography on the site is varied and is shown in Figure 4.3-1, Local Site Topography. The topography on the property generally slopes towards the northeast. The site, bounded on the north and east by Route 311 and Interstate 84 respectively, slopes steeply in these directions.

The high point of the site is in the southern section in the area where there is an existing wireless communications tower. The elevation is approximately 895 feet at the highest point. The lowest elevations on the site are found in the northern end near Route 311, with an elevation of approximately 630 feet. There are no prominent or unique features on the project site. On-site topography is shown in Figure 4.3-2, Existing Slopes Map. The table below, Table 4.3-1, shows the break down of the site into different slope categories.

Table 4.3-1 Existing Slopes	
Slope Category	Approximate Acres Existing
0% to 8%	39.2
8% to 15%	28.8
15% to 25%	16.4
>25%	6.1
Total Site Area	90.5
Source: Insite Engineering, Surveying & Landscape Architecture, P.C.	

4.3.2 Future “No Build” Conditions

The “No Build” alternative is the scenario that would occur if no development were to take place at the site. Under the “No Build” condition, the site would remain in its current undeveloped state and no improvements would occur. Therefore, the proposed project would not result in any impacts to the topography on or in the areas surrounding the site.

4.3.3 Future Conditions

Slopes Impacts

Impacts from disturbance to steep slopes are directly related to the potential for soil erosion during construction. A Slope Disturbance Map is shown in Figure 4.3-3 and a Steep Slopes Disturbance Map is shown in Figure 4.3-4 indicating where steep slopes, as defined by the town, are to be disturbed by the proposed development. The table below indicates that 32.2 acres of the 0-8% slope range is proposed to be disturbed, 23.9 acres of the 8-15% slope

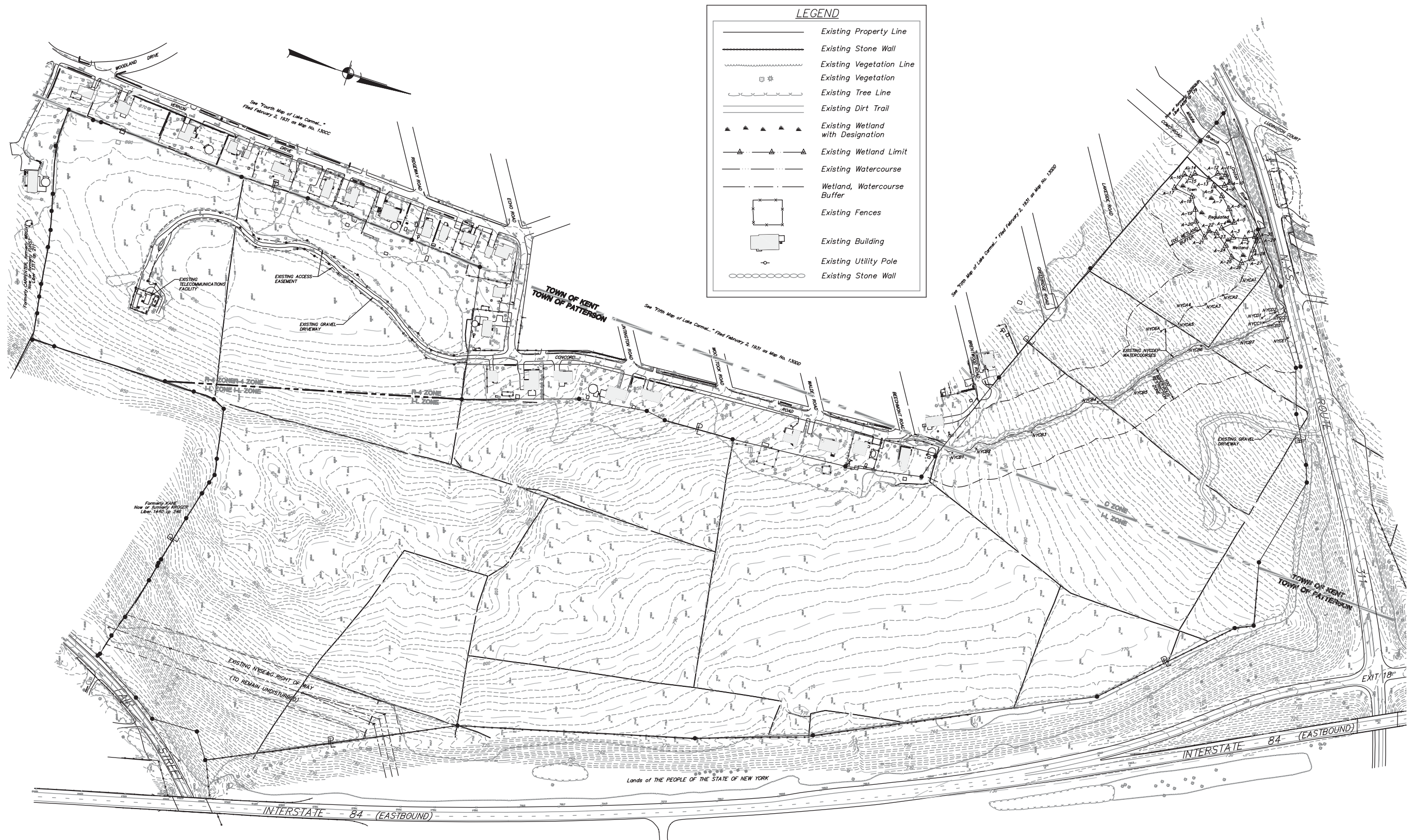
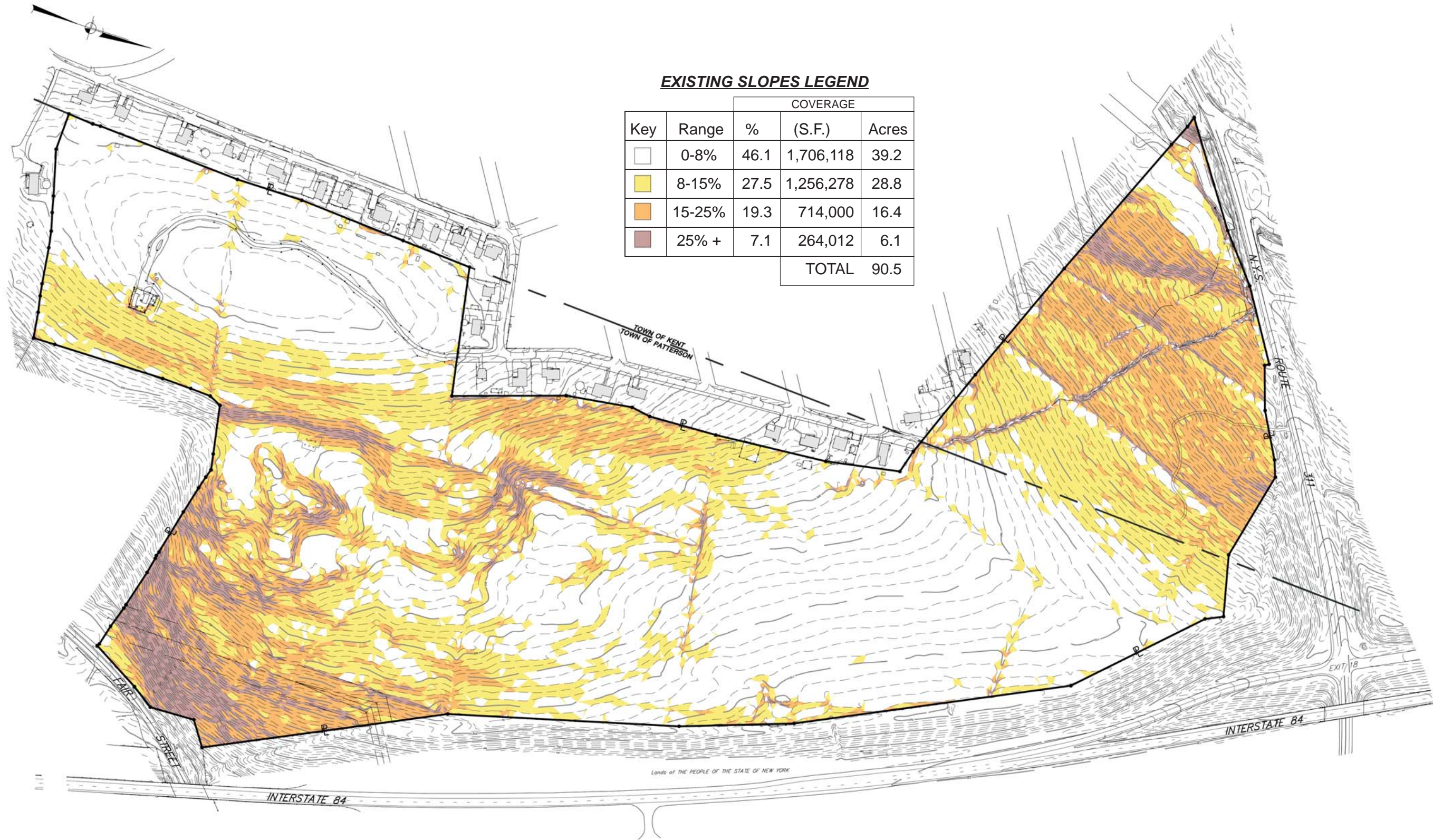


Figure 4.3-1: Local Site Topography
 Patterson Crossing Retail Center
 Town of Patterson and Town of Kent,
 Putnam County, New York
 Source: Insite Engineering, Surveying & Landscape Architecture, P.C
 Scale: 1 inch = 300 feet



EXISTING SLOPES LEGEND

Key	Range	%	COVERAGE	
			(S.F.)	Acres
□	0-8%	46.1	1,706,118	39.2
■	8-15%	27.5	1,256,278	28.8
■	15-25%	19.3	714,000	16.4
■	25% +	7.1	264,012	6.1
			TOTAL	90.5

Figure 4.3-2: Existing Slopes Map
 Patterson Crossing Retail Center
 Town of Patterson and Town of Kent,
 Putnam County, New York

Source: Insite Engineering, Surveying & Landscape Architecture, P.C.
 Scale: 1 inch = 300 feet

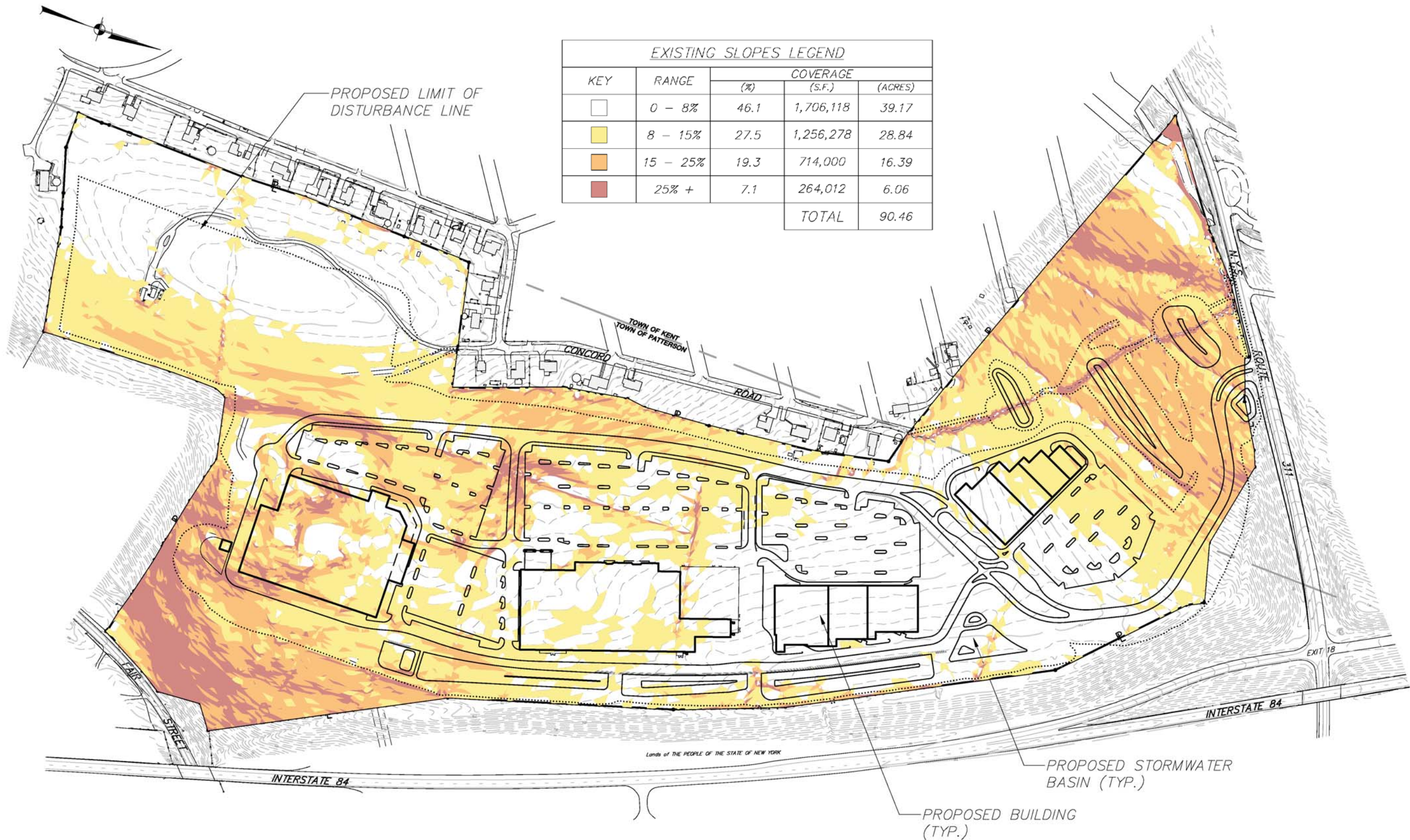
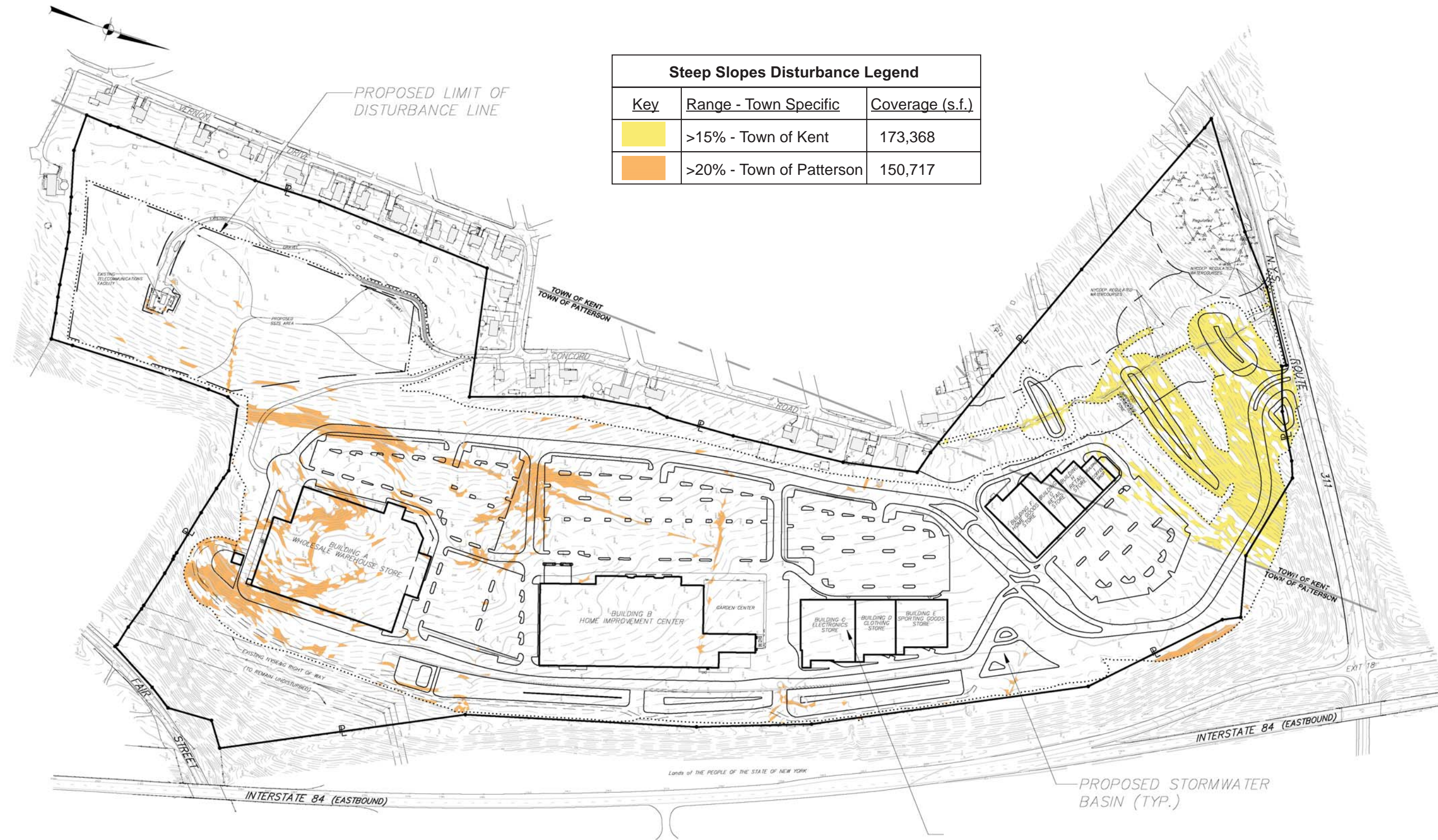


Figure 4.3-3: Slope Disturbance Map
 Patterson Crossing Retail Center
 Town of Patterson and Town of Kent,
 Putnam County, New York
 Source: Insite Engineering, Surveying & Landscape Architecture, P.C.
 Date: 05/21/06
 Scale: 1 inch = 300 feet



Steep Slopes Disturbance Legend		
Key	Range - Town Specific	Coverage (s.f.)
	>15% - Town of Kent	173,368
	>20% - Town of Patterson	150,717

Figure 4.3-4: Steep Slopes Disturbance Map
 Patterson Crossing Retail Center
 Town of Patterson and Town of Kent,
 Putnam County, New York
 Source: Insite Engineering, Surveying & Landscape Architecture, P.C.
 Date: 04/19/06
 Scale: 1 inch = 300 feet

range is proposed to be disturbed, 9.9 acres of the 15-25% slope range is proposed to be disturbed, and 2.4 acres of slopes greater than 25% is proposed to be disturbed. The proposed disturbance of each slope classification is summarized in Table 4.3-2, Disturbance to Slopes.

Table 4.3-2 Disturbance to Slopes	
Slope Category	Approximate Acres Disturbed
0% to 8%	32.2
8% to 15%	23.9
15% to 25%	9.9
>25%	2.4
Total Site Disturbance	68.4

Note: Total Site Acreage = 90.5
Source: Insite Engineering, Surveying, & Landscape Architecture, P.C.

The majority of the project disturbance will occur in areas with slopes of less than 15%. Building locations and parking lots, as well as storm water basins, have been carefully located on the site to minimize disturbance to steep slopes. It is anticipated that 12.3 acres of slopes greater than 15% will be disturbed as a result of the proposed project. Approximately 3.98 acres of slopes categorized as steep in the Town of Kent are proposed to be disturbed for the construction of the entrance road and the stormwater management basins. The Town Kent defines steep slopes as those of 15 % or greater. In addition, grading and slope stabilization will be completed to mitigate an existing naturally eroded drainage channel in the northern portion of the property, in the Town of Kent. Construction of the wholesale warehouse store building pad will require steep slope disturbance in the southeastern corner of the site in the Town of Patterson. The Town of Patterson defines steep slopes as slopes of 20 percent or greater; approximately 3.46 acres of the slopes categorized as steep are proposed to be disturbed. Approximately 90 percent of the proposed grading of all slopes on the project site will take place on the Patterson portion of the site.

Exposing soils on steep slopes during construction increases the potential for erosion and instability in the short term. These potential impacts will be mitigated by adherence to soil erosion and sedimentation control practices and the Construction Phasing Plan described in section 4.2. During construction, the areas where rock removal will be required (Figure 4.1-1) will contribute only minimally to erosion as exposed rock will not erode. Following construction, soil erosion from the property is expected to be minimal since developed areas will be stabilized with pavements, buildings, and storm water management features will be fully functional.

It is anticipated that proposed slope cuts and slopes of 2H:1V (horizontal to vertical) will be stable if they are well drained given the known geology of the property and the available test borings that were conducted. It is possible to make this determination without the need for formal stability analysis (e.g. by inspection) based on the engineers experience and the density and strength of anticipated foundation soils present on the site. If ground water is encountered during slope cutting, the slopes will need to be stabilized by one of three of the

following methods: slope drainage, slope armoring (such as rip-rap or stone), or slope flattening.

As slope stability analyses are dependent upon detailed slope geometry, slope locations and the degree of down-gradient development, additional analyses will be performed during the site plan review process to confirm that the final proposed cut and fill slopes will remain stable after construction.

4.3.4 Mitigation Measures

Steep Slopes

Exposing soils on steep slopes during construction increases the potential for erosion in the short term. This potential impact will be mitigated by adherence to soil erosion and sedimentation control practices described in section 4.2 and on the erosion control drawings SP-4.1, SP-4.2, and SP-4.3 provided with this DEIS. Following construction, soil erosion from the property is expected to be minimal since storm water management features will be fully functional and developed areas will be stabilized with pavements, buildings, lawn and landscaping.

To avoid disturbance to steep slopes the majority, 56.1 of 68.4 acres of disturbance will occur within the portion of the site that contains 0-15% slopes. The disturbance to slopes greater than 25% has been minimized.

Steep slopes are defined in the Town of Kent Code 66 - Steep Slopes Protection, as "All ground areas having a topographical gradient equal to or greater than fifteen percent (15%) measured by utilizing two (2) good contours, which contain a rectangle on a horizontal plain having a length of seventy-five (75) feet and a width of twenty-five (25) feet, and exclusive or areas which cannot contain such a rectangle". The code also indicates that it is unlawful to create any disturbance within an area of steep slopes unless exempt or a steep slopes permit is granted by the Planning Board pursuant to the requirements in this code. The applicant will apply for a Town of Kent Steep Slopes permit and will comply with all requirements and provisions of the permit. The applicant will also follow all requirements provided in the Town of Kent Code 66 - Steep Slopes Protection.

The Town of Patterson regulates work in areas of steep slope under the Town Code, Chapter 133 - Stormwater, Soil Erosion and Sediment Control. Chapter 133-4 indicates that certain activities cannot commence until a land development permit has been issued under provisions of the chapter, including "site preparation or clearing on slopes which exceed one foot of vertical rise to five feet of horizontal distance (20 %)." The applicant will apply for a land development permit from the Town of Patterson in connection with the site plan application for the Patterson Crossing Retail Center, and will comply with all requirements and provisions of the permit.

Comprehensive soil boring investigations were conducted to determine the soil type, characteristics and depth to bedrock on the site. Boring logs can be found in Appendix D and are described in further detail in Sections 4.1 and 4.2 herein. Based on this information, material suitable for the proposed uses is present on the project site. The enclosed plans call for appropriate engineering methods to compensate for soil and topographic limitations, such as erosion controls, or other improvements will be required.

4.4 Groundwater

4.4.1 Existing Groundwater Conditions

The majority of properties in the Town of Patterson and the Town of Kent are served by individual wells, since there are limited community water supply systems in both Towns. Business and residential properties in the vicinity of the Patterson Crossing Retail Center site are served by individual wells. The adjoining residential community of Lake Carmel, located on the western edge of the Patterson Crossing Retail Center site also utilizes individual wells.

Groundwater in the vicinity of the project area is primarily found in the bedrock. Shallow groundwater is found in the glacial till material locally, but is not a reliable source of groundwater due to the relatively thin cover of glacial till in the area, and the potential for impacts from near surface contamination. Bedrock wells are installed into the metamorphic gneiss and schist rocks found locally. Bedrock wells are generally dependent upon fractures in the rock to provide sufficient water for a reliable water supply. Therefore, depths of wells and well yields can vary considerably, depending upon the size and quantity of fractures that are intercepted by any specific well.

Depth to water table (surficial groundwater elevations) varies on the site. Typically, shallow groundwater is found at the interface of the bedrock and overlying soils or in layers of sand, gravel or silt, in the surficial glacial till material. This shallow groundwater generally follows the surface topography. Since the surface water drainage flows toward the east and the northwest, shallow groundwater movement can be assumed to be consistent with surface water, towards the property's lower elevations.

Two separate geotechnical investigations provided site specific information on the shallow groundwater elevations. A Supplemental Hydrogeological Evaluation was completed by GeoDesign, Inc., in August 2005 (Appendix E). A total of six shallow wells were installed to characterize the unconsolidated deposits for potential on-site sanitary sewage disposal. In the southern portion of the site, the depth to stabilized groundwater ranged from 23 to 25 feet below surface grade. In the northern portion of the site, groundwater was found at nine to 35 feet below surface grades. A series of geotechnical borings were completed by Connecticut Test Borings, LLC, in March, 2004 (Appendix D). Twenty-five borings were completed and nine (9) of these borings contained no groundwater upon completion of the drilling. Groundwater levels in the remaining 16 borings varied from six to 26 feet in depth. Groundwater levels averaged 13 feet in depth, across the site.

As described below, two six-inch diameter bedrock production wells were drilled on the Patterson Crossing Retail Center site to provide water supply for the development. Static water levels in the two bedrock wells were 50 feet and 61 feet, respectively.

Groundwater flow direction in the bedrock aquifer is somewhat influenced by surface topography, but is also influenced by major fracture systems in the rock, faults, and surface water bodies such as Lake Carmel, located west of the site, and areas of wetlands, located east and southeast of the site. Groundwater flow direction on the site is not known but, based upon local topography, groundwater is expected to generally flow towards lower elevations west of the site, towards Lake Carmel, and towards the northeast, southeast and east, towards off-site wetland areas at lower elevations in the vicinity of Interstate 84.

Putnam County recently completed a Groundwater Protection and Utilization Plan, prepared by the Chazen Companies (September, 2004). The purpose of the plan was to provide an inventory of groundwater resources in the County, determine levels of groundwater usage, and to develop management approaches for future use and protection of groundwater. According to the Plan, the Patterson Crossing Retail Center site is located at the western edge of a higher yielding bedrock aquifer. The higher yielding aquifer corresponds with the Walloomsac Formation, which is composed of pyllite, schist and metagraywacke rocks. These are generally fine grained metamorphic rocks. The majority of the project site is underlain by older biotite-quartz paragneiss bedrock, which is categorized by the Chazen study as having generally lower groundwater yields.

Locally, groundwater quality is generally good, with no reported concerns, according to the Putnam County Department of Health (PCDOH). Water hardness, as well as elevated iron and manganese is a problem in certain wells, locally. Such results are typically a problem for well and water equipment maintenance and are not a health concern.

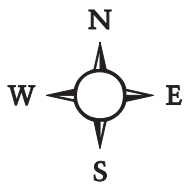
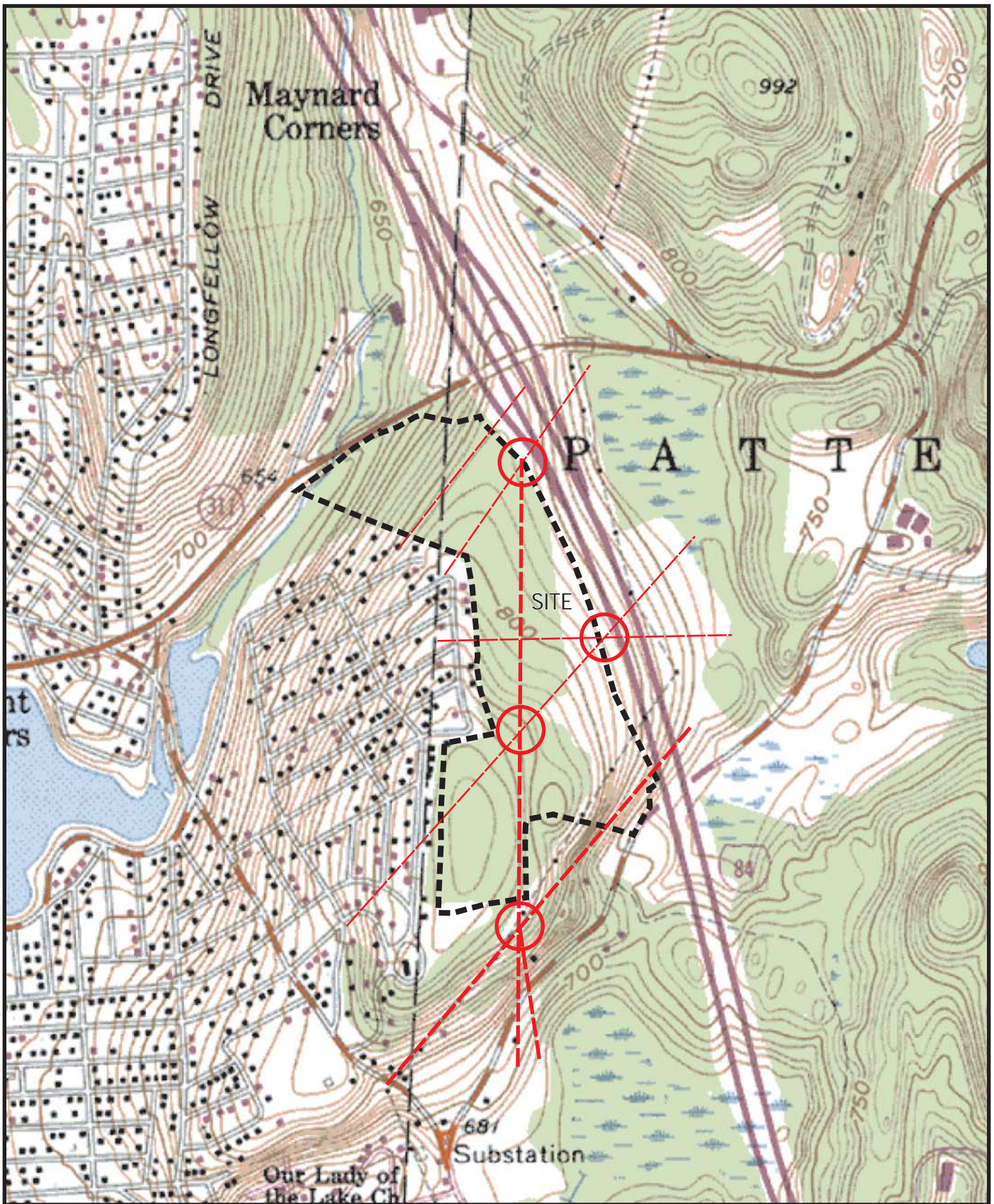
Fracture Trace Analysis

A fracture trace analysis was completed for the Patterson Crossing Retail Center site in order to assist in the location and development of water supply wells for the project. Fracture trace analysis utilizes high altitude infrared photography and geologic maps to identify surface features which reflect underlying geologic structures such as faults and bedrock fractures. The number and location of bedrock fractures is dependent on the degree of deformation that the bedrock has undergone through its formation. Typically, the larger, more productive fractures tend to produce visible topographic traces. These traces can be found using aerial photography and digital terrain modeling.

Review of the high altitude infrared photography shows that the project area has one major fracture trending from south to north through the approximate center of the site and a second major trace trending from southwest to northeast at the southern edge of the site. Fracture traces are shown in Figure 4.4-1, Fracture Trace Map. Several smaller traces were observed on the site, most trending southwest to northeast. The intersection of the major fracture traces occurs slightly south of the property boundary. Three locations appeared suitable for ground water development at the edges or within the property limits. These locations are at the intersection of the fractures shown on the fracture trace map (Figure 4.4-1).

Recharge Analysis

A recharge analysis was completed for the Patterson Crossing Retail Center site and is described below. A recharge analysis provides a general estimate of the amount of water that is contributed to a groundwater system or aquifer by precipitation over a given period of time. Typically, annual rainfall is used for the development of a recharge analysis. A portion of the annual precipitation that falls in a given area leaves the system through surface run-off. The water that enters the soil is defined as infiltration. A portion of the water that enters the soil is returned to the atmosphere by evapotranspiration. Evapotranspiration is the process of water that is taken up by plant and tree roots and transpired through the plants leaves or needles. Infiltrated water that is not taken up by plants travels vertically through soil and rock to the saturated zone and becomes groundwater. Depending upon the physical characteristics of







-  Major Fracture Trace
-  Minor Fracture trace
-  Potential Well Location
-  Site Property Boundary

Figure 4.4-1: Fracture Trace Map
 Patterson Crossing Retail Center
 Town of Patterson and Town of Kent,
 Putnam County, New York

Source: TMA

Base Map: USGS 7.5-minute Topographic Map, Lake Carmel Quad
 Scale: 1 inch = 1,000 feet

the recharge area, between 15 and 40 percent of the annual precipitation typically recharges the local aquifer.

Evaluation of groundwater recharge with respect to a specific project or land use is usually done by comparing the projected water demand and the ability of the local watershed to recharge the aquifer. Generally, in a shallow unconfined aquifer (unconsolidated material) the groundwater table will loosely follow the surface topography of the land. Groundwater would be expected to flow from drainage boundaries, such as ridges, toward points topographically lower in the watershed. In bedrock aquifers, such as the aquifer utilized by the Patterson Crossing Retail Center wells, groundwater flow is controlled by available fractures in the bedrock and therefore, only a portion of total basin recharge could transmit water to any given pumping area. For example, heavily faulted and fractured bedrock zones are capable of transmitting larger quantities of water to recharge the bedrock aquifer than are less fractured zones.

The project site is likely underlain by a system of subsurface fractures and minor faults. The fractures, if tapped successfully, will potentially pick up recharge from a large area, including the area beneath Lake Carmel, Wonder Lake and local streams and drainage ways. The faults and fractures that form the valleys surrounding the project site may extend for miles and intercept additional fractures well beyond the property. Precipitation falling anywhere within this area naturally drains towards the valleys from the higher elevations. As described in the Section 4.5 Surface Water, the Patterson Crossing Retail Center site is located on the divide between two different surface water drainage basins; the Middle Branch Reservoir Watershed and the East Branch Reservoir Watershed. The fractures tapped by the Patterson Crossing Retail Center wells may extend a considerable distance beyond the property boundaries and have a potentially large area for recharge contribution.

GeoDesign completed a hydrogeology investigation which included groundwater modeling for the purpose of evaluating hydrogeologic conditions as they relate to subsurface sewage disposal. GeoDesign based their site groundwater recharge model on a specific area the boundaries of which are depicted in Figure No. 1 of the report (see Appendix E). In general, the groundwater recharge area boundaries are identified as Lake Carmel to the west, wetlands bordering Interstate 84 to the east and topography exceeding 800 feet to the north and south.

A recharge analysis was completed to estimate the amount of water available for recharge from the Patterson Crossing Retail Center property, only. This analysis provides a conservative estimate of available groundwater within the site boundaries. As indicated above, the actual area contributing groundwater to the on-site wells would be larger, due to bedrock fractures extending beyond the property boundaries.

The recharge analysis is based upon a model created by Keith Eggleston, a former senior climatologist at the Northeast Regional Climate Center at Cornell University. The model estimates the amount of evapotranspiration, on a monthly basis, for forested land in the lower Hudson Valley. Forested land has a higher degree of evapotranspiration than does turf covered surfaces (lawns, golf course) and represents a more conservative estimate for this project. Runoff was limited to 40% due to the topography of the project site. Northern and southern portions of the site have steep slopes. The rainfall figures are an average of readings for Middletown, Harriman and Poughkeepsie for the ten year period of 1990 to 2000.

Table 4.4-1 Recharge Calculations	
Acres	94.4
Square Feet	4,112,064
Average rainfall per year (inches)	48.8
Average rainfall per year (feet)	3.67
Cubic feet of precipitation per year	16,722,323
Gallons of precipitation per year	125,082,976
Amount lost to evapotranspiration and runoff (66% based upon model)	83,103,858
Amount, in gallons, available for recharge per year	41,979,118
Amount, in gallons, available for recharge per day	115,011
Amount, in gallons, available for recharge per minute	79.9
Source: Tim Miller Associates, Inc., Note: Rainfall figures are an average of annual rainfall amounts for Middletown, Harriman and Poughkeepsie for the period 1990 to 2000.	

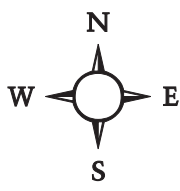
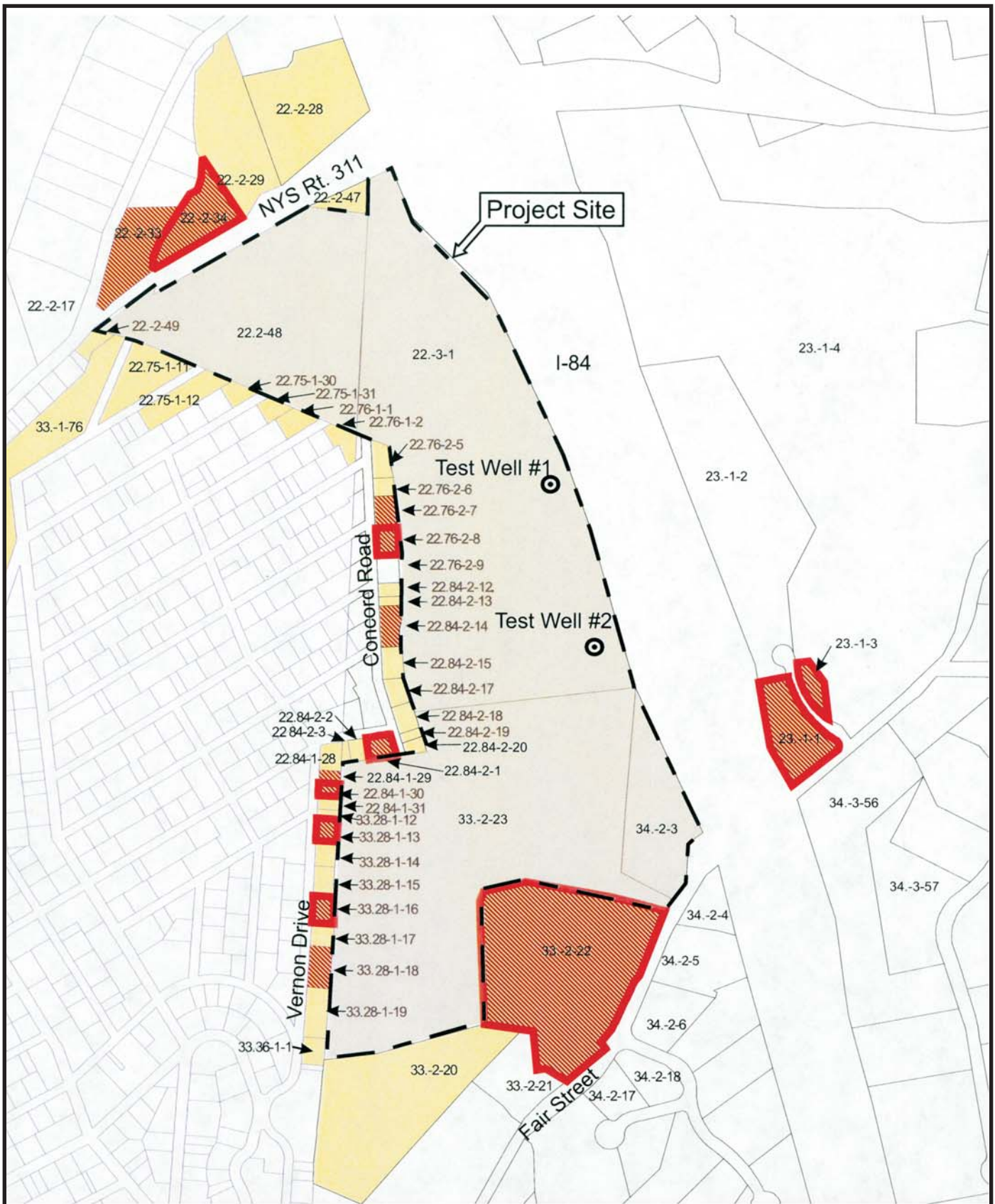
As provided above, an estimated 115,011 gallons per day or 79.9 gallons per minute is available for groundwater recharge on the Patterson Crossing Retail Center property. This amount far exceeds the project estimated water demand of 10,740 gallons per day (gpd) or 7.5 gallons per minute (gpm). Project impacts to groundwater are further discussed in Section 4.4.3 Future Conditions With the Project.

Current Use of Groundwater

As described above, properties in the vicinity of the Patterson Crossing Retail Center site utilize private wells since no public water supply systems are available. Individual wells are used by nearby residential and commercial properties in the Town of Patterson and the Town of Kent. Residents of the adjacent Lake Carmel residential community also use individual wells.

The specific area contributing recharge to the site and the extent of underground bedrock fracture systems surrounding the site is not known. Two recently installed production wells will be used to supply water for the Patterson Crossing Retail Center development. Approximately 217 tax lots are located within a 2,000 foot radius around the two Patterson Crossing Retail Center production wells. These tax lots comprise approximately 294 acres. Since each of the surrounding lots has the potential to have an individual supply well, it is assumed that there may be up to 217 private wells within the 2000 foot radius from the Patterson Crossing Retail Center wells.

Local water usage within 2000 feet of the Patterson Crossing Retail Center wells can only be estimated since surrounding lots contain a mix of residential and commercial uses and some undeveloped lots. As a conservative estimate, it can be assumed that all of the lots contain residences, since residences typically use more water than small commercial and office uses. No major industrial facilities with substantial water uses are located in the vicinity of the Patterson Crossing Retail Center site. Local residences are a mixture of small homes in the Lake Carmel development and larger newer homes. If all surrounding residential lots are assumed to have three bedrooms, then each household size is estimated to be an average of 3.3 persons (Development Impact Assessment Handbook, ULI, 1994). Using a conservative household size of 4 persons per residence, each resident will use 75 gallons



Legend

	Properties monitored during pump test
	Properties consenting to monitoring
	Properties sent letter request for monitoring
	Properties in Town of Kent
	Properties in Town of Patterson

Figure 4.4-2: Well Monitoring Locations
 Patterson Crossing Retail Center
 Town of Patterson and Town of Kent
 Putnam County, New York
 Base Map: Putnam County GIS Dept.
 Approx. Scale: 1 inch = 600 feet

per day or 300 gallons per day per household. The estimated 217 tax lots would conservatively use 65,100 gallons per day. The amount of recharge available to this off-site area (294 acres) is estimated to be 358,191 gallons per day. Septic systems will also return a majority of this water to the local aquifer.

Production Well Testing

Two proposed water supply wells were drilled on the property in October and November, 2004. Well No. 1 was drilled to a depth of 805 feet and Well No. 2 to a depth of 705 feet. Well locations are shown in Figure 4.4-2, Well Monitoring Locations. The wells have 80 feet and 50 feet of 6-inch steel casing, respectively. Well logs for the wells are provided in the Patterson Crossing Retail Center Water Supply Report (see Appendix H). Wells No. 1 and No. 2 are located 170 and 180 feet respectively from the eastern property line.

According to subpart 5-D.2, "Water Well Location and Protection" of Chapter 1 of the State's Sanitary Code, "Wells serving public water systems shall be located such that the owner of the water system possess legal title to lands with 100' of the well and the owner controls by ownership, lease, easement, or other legally enforceable arrangement the land use activities within 200' of the well.

According to subpart 5-D.1, "Application and Definitions" of Chapter 1 of the State's Sanitary Code "the Department or local Health Department may allow deviations from a standard on a case by case basis in accordance with procedures and criteria established by the Department. Such deviations may only be allowed upon approval in writing by the Department or local Health Department". The applicant owns the property within 100' of both wells. The 200' radius from the two wells extends approximately 20 and 30' from well number 2 and 1 respectfully beyond the eastern property line. Referencing subpart 5-1 "Public Water Systems" of Chapter 1 of the State's Sanitary Code, the water system for the project is classified as a "non-transient, non-community water system". Based on discussions with the Putnam County Department of Health (PCDOH), as well as the past policies of the PCDOH, only community public water system are required to have ownership of Property with 100' and control within 200' of their supply wells in Putnam County. Accordingly, since the water system for this project is classified as a "non-transient, non-community water system", it should not have to comply with these distances. As part of the permitting process the applicant will seek written approval from the PCDOH for the water system including the supply wells. The Town will receive a copy of this written approval, or variance, regarding control of land within 200-feet of a non-community, non-transient water supply source, following approval by the PCDOH.

A well testing protocol was prepared by Tim Miller Associates, Inc. and reviewed by the PCDOH as well as the Town of Patterson. The purpose of the pumping test was to determine if sufficient groundwater was available to support the project and to determine if future operation of the project wells would have any adverse impact on existing private wells near the site.

In order to monitor the effects of pumping, the on-site wells and selected off-site private wells were monitored during the 72 hour pump test. Requests for permission to monitor were sent to forty (40) residences and businesses surrounding the Patterson Crossing Retail Center property. Thirteen positive responses were received providing permission to monitor private wells. A copy of the well monitoring request, the well survey and a list of residents involved in the well monitoring, are included in Appendix B of the Patterson Crossing Retail Center Water Supply Report (Appendix H of this DEIS). At two locations, positive responses were received

from adjoining residences and therefore only one of the two adjoining properties was monitored. At three of the thirteen off-site locations, the wells were inaccessible and therefore not monitored. In total, wells on eight (8) off-site properties were monitored, as shown in Figure 4.4-2. Electronic data loggers were installed in the off-site wells and programmed to monitor water levels over the period of the pumping test. The well monitoring started a minimum of 48 hours before the pumping test, continued through the test, and continued for eight days after the pumping of the on-site wells was completed.

The on-site test wells were pumped at a rate of 22 gallons per minute each for the duration of the 72-hour pump test, this being three times the proposed project need. The test was run from January 17, 2005 to January 20, 2005. Pumping at on-site test well "PW-1" began first with pumping at well "PW-2" commencing two hours later. A minimum of 48 hours of background data was collected from the off-site monitoring wells prior to the start of the pumping test. The test continued for 72 hours and achieved the minimum required stabilization of six hours as per the New York State Department of Health and the PCDOH requirements. A full description of the pumping test is provided in the Patterson Crossing Retail Center Water Supply Report (see Appendix H).

Stabilization is defined as an unchanged water level within the on-site test wells accompanied by a constant pumping rate. If the on-site test wells had not stabilized for the minimum six hour period, the test would have continued until the wells stabilized for the required duration. The pumps were removed at the conclusion of the test and the on-site test wells resealed.

Water Quality

Water was collected from each test well just before the test was shut down. The samples were transported (same day) in iced coolers to a New York State certified laboratory for analysis using the parameters specified by the PCDOH. The quality of the water sampled on the property meets the New York State Drinking Water Standards. The analytical report supplied by the laboratory is available in Appendix C of the Patterson Crossing Retail Center Water Supply Report contained in Appendix H herein.

4.4.2 Future Conditions Without the Project

It is anticipated that groundwater future usage, without the Patterson Crossing Retail Center project would be similar to current conditions, with minor increases in water usage expected due to continued local growth and development. Limited future development may occur along Fair Street, south of the site and along Route 52, north of the site. Physical constraints such as steep slopes and wetlands will also limit future growth and development in the vicinity of the site. Therefore, without the project, the future use of groundwater will increase proportionately with local residential and commercial growth on the limited parcels available for development.

4.4.3 Future Conditions With the Project

Water Demand

The Patterson Crossing Retail Center development will require approximately 10,740 gallons per day (gpd) or 7.5 gallons per minute (gpm), according to estimates completed by the project engineer (see Appendix G, Water System Report). This water demand is

substantially less than the sustained well yields of the two project supply wells, which were pumped at a rate of 22 gpm each for 72 hours. The pumping test was originally designed by the project hydrogeologist with a greater projected water demand and therefore the wells were pumped at rates much higher than the current project water demand, as estimated by the project engineer. The pumping test demonstrated an adequate on-site water supply for the project, which meets the regulatory requirements of the New York State Department of Health and the PCDOH.

The project is proposed to be comprised of dry retail with the exception of the wholesale warehouse store and the coffee shop. Water use and wastewater discharge will therefore be primarily associated with restroom usage. The use of water saving plumbing fixtures, as required by the building code, would further limit water usage at the site. Please note that irrigation water will be supplied by a separate system that will collect and store roof runoff for that purpose.

The reference design standards for water and wastewater flows provide general design flows covering a broad range of usage categories. The New York State Department of Conservation (NYSDEC) publication "Design Standards for Wastewater Treatment Works, 1988" provides two alternatives for establishing design flows: hydraulic loading rates tables or water usage data. In either case a daily design flow rate must be calculated. The daily design flow rate is a conservatively high estimate of daily flow used by the engineer in the design of the water and sewer infrastructure.

In order to establish design flows, it is acceptable to use actual flows multiplied by a factor of safety of 1.5, or design flows based on published hydraulic loading rates. The design flows for the subject project have been calculated based on a combination of typical corporate user flow data (multiplied by the factor of safety) and the applicable hydraulic loading rate. It is commonly accepted by both the PCDOH and the New York City Department of Environmental Protection (NYCDEP) to apply a factor of safety of 1.5 to actual flows for use as design flows. Note that the NYSDEC publication "Design Standards for Wastewater Treatment Works, 1988" does not require a factor of safety. The following tables provide a summary of the proposed users and their estimated daily design flows (potable water and waste water design flows).

Table 4.4-2	
Hydraulic Loading Rates Based on Typical Corporate Usage Data	
(The following actual water flow data is based on information provided by probable tenants for each of the following stores.)	
Wholesale Warehouse	3,500 GPD
Home Improvement Center	750 GPD
Electronics Store	800 GPD
Home Goods Store	360 GPD
Coffee Shop	500 GPD
Subtotal based on typical usage data	5,910 GPD
Factor of safety (1.5 x 5,910)	
Total design flow based on usage data	8,865 GPD
Source: Insite Engineering, Surveying & Landscape Architecture, P.C.	

Table 4.4-3 Hydraulic Loading Rates Based on Hydraulic Loading Rate Table (The following design flow rates are based on unit flow rates as published in the NYSDEC Publications "Design Standards for Wastewater Treatment Works" since no actual water usage data is available for these users)			
User	Employee Restroom Usage	Customer Restroom Usage	Total
Clothing Store	15 GPD/employee x 15 employees = 225 GPD	5 GPD/use x 50 = 250 GPD	475 GPD
Sporting Goods Store	15 GPD/employee x 28 employees = 420 GPD	5 GPD/use x 100 = 500 GPD	920 GPD
Retail Store	15 GPD/employee x 15 employees = 225	5 GPD/use x 50 = 250 GPD	475 GPD
Retail Store	15 GPD/employee x 15 employees = 225 GPD	5 GPD/use x 50 = 250 GPD	475 GPD
Subtotal based on hydraulic loading rate table			2,345 GPD
Less 20% Reduction for water saving plumbing fixtures			470 GPD
Total design flow based on hydraulic loading rate table			1,875 GPD
Source: Insite Engineering, Surveying, & Landscape Architecture, P.C.			

Table 4.4-4 Total Project Design Flow	
Design flow based on usage data	8,865 GPD
Design flow based on hydraulic loading rate table	1,875 GPD
Total Design Flow	10,740

The number of employees is based on retailer statistics provided in the DEIS. The employee flow data is based on the NYSDEC reference standard. The customer usage is based on projected customer restroom visits and a per visit flow of 5 gpd/use. The 5 gpd/use is a conservative estimate for a customer restroom visit which will utilize the water closet and lavatory.

As discussed above, an estimated 115,011 gallons per day or 79.8 gallons per minute is available for groundwater recharge on the Patterson Crossing Retail Center property. This amount far exceeds the project estimated water demand of 10,740 gallons per day (gpd) or 7.5 gallons per minute (gpm). The recharge estimate does not include the likely recharge contribution from off-site sources.

The project will result in the conversion of 32.26 acres of the site to impervious surface. Therefore, the amount of area in which rainfall can directly fall on pervious (unpaved) surfaces and potentially recharge the aquifer will be reduced by approximately 36 percent. It should be noted that all stormwater from impervious surfaces will be directed to stormwater treatment facilities, such as vegetated swales and detention basins, thereby allowing much of the precipitation falling on impervious surface to potentially contribute to aquifer recharge. Also, most of the water utilized at the Patterson Crossing Retail Center will be returned to the ground via proposed septic systems. Estimates of groundwater recharge demonstrate that sufficient groundwater recharge area and volume will remain on the subject property, following construction, to balance the volume of groundwater utilized by the project. If the potential recharge area on the property was reduced by 36 percent as the result of paving and buildings, and none of this water was returned to the aquifer as a result of stormwater

facility infiltration, then 73,607 gallons per day or 51.1 gallons per minute would be available to recharge the aquifer within the project boundaries. This conservative estimate is substantially greater than the project water demands of 10,740 gallons per day (gpd) or 7.5 gallons per minute (gpm). Therefore, based upon conservative analysis, the project is not anticipated to have an adverse affect upon local groundwater recharge or groundwater availability to on-site or off-site wells.

Well Drawdown Impacts

No influence or drawdown attributable to the on-site pumping wells was observed in any of the private off-site monitoring wells. Well monitoring data and further discussion of the pump test results is provided in the Patterson Crossing Retail Center Water Supply Report (see Appendix H). A full 72-hour pump test of the proposed wells was carried out in accordance with PCDOH standards.

Construction Impacts

Construction of the project is not expected to have an affect on local groundwater resources. The Patterson Crossing Retail Center wells are drilled to 705 and 805 feet in depth. The nearby residential wells are drilled to depths ranging from 150 feet to 500 feet. Surface grading is not expected to have any impact on nearby private wells.

As described in Section 4.1 Geology, blasting will be required for the development of the project site. While the likelihood for impacts to nearby private wells is extremely low, any documented impact to private or local wells will be remedied by the blasting contractor. While damage to nearby wells is rare when blasting is performed by a qualified and experienced contractor, the applicant has developed a Blasting Mitigation Plan (Copy included in Appendix Q) which includes provisions to identify impacts to existing wells resulting from blasting on the Patterson Crossing Retail Center site should they occur.

Septic System Impacts

A hydrogeological investigation/mounding analysis (Appendix E) was performed by GeoDesign on the project site to assess the soils and groundwater in relation to the proposed SSTS. The analysis was based on field investigations, review of existing data and preparation of a three-dimensional computer model using an 11,000 gallon per day sewage flow rate applied to the area of the proposed SSTS. The simulation run for the site predicts there will be no leachate breakout at the ground surface, no leaching trench flooding and a minimum three year travel time for the leachate to reach the nearest property line. Refer to the Mitigation Section (4.4.4) below for a discussion of the recommendations made to mitigate for potential issues related to the proposed SSTS.

4.4.4 Mitigation

Present water supply systems in this part of Patterson rely on groundwater for water supply, and proposed Patterson Crossing Retail Center development is also expected to rely on groundwater for water supply. As described above, future development is not expected to result in significant adverse impacts on groundwater resources.

Potential Well Pumping Impacts

Monitoring of private off-site test wells carried out by Tim Miller Associates, Inc. demonstrates no on-site or off-site draw down interference effects. A full 72-hour pump test of the proposed wells was carried out in accordance with PCDOH standards. The recharge analysis completed for the project demonstrates that more water is recharged to the aquifer, on the subject property, than is proposed to be used by the project and that reducing the recharge area by 32.26 acres will not cause an imbalance in water taking versus recharge.

While no adverse impacts to groundwater resources are expected, several mitigation measures are proposed by the applicant. Undeveloped and landscaped portions of the site will remain undeveloped and will allow continued recharge of the aquifer. As described above, the majority of stormwater collected from parking lots and driveways will be treated in stormwater management facilities. Water will infiltrate into the ground in these facilities thereby contributing to the recharge of the groundwater on-site.

As described above, the monitoring of off-site wells during the pumping test showed no indication of off-site drawdown or potential impacts to off-site wells. The applicant would consider a limited program of off-site private well monitoring, in order to document that the use of on-site wells will have no off-site drawdown impacts. Typically, a number of off-site private wells closest to the production wells would be monitored. A potential monitoring program would involve up to five private wells of residences located on Concord Road and Vernon Drive. Selected wells would be monitored with dedicated pressure transducer/data logger units of the type used during the pumping test. Permission for the long-term monitoring would need to be obtained from each of the respective home-owners. Monitoring of the wells would be done for a period of at least two years following the completion and full occupancy of the proposed Patterson Crossing Retail Center development. If such a monitoring program is implemented, monitoring should begin at the start of construction so that there is a baseline of pre-pumping water level data before the on-site wells go into service.

The need for and utility of a such a long term water level monitoring program should be determined by the Lead Agency in consultation with a professional hydrogeologist. If such a monitoring program is implemented, the potential affects of the project upon individual off-site wells should be evaluated and determined by a professional hydrogeologist, retained by the Town of Patterson and paid for by the Applicant.

A well monitoring program, as described above, would provide the Town and a limited number of homeowners, with data to document whether the project could potentially affect existing off-site wells. Without such monitoring data, it would be difficult to document or substantiate whether the project wells were affecting off-site wells or whether other factors, not related to the project were affecting the capacity of off-site wells.

If a local resident experiences a reduction or loss of well function as a result of Patterson Crossing Retail Center well usage, complaints would be filed with the Town of Patterson or Town of Kent Building Inspector as appropriate. Complaints regarding potential well impacts should be limited to a reasonable distance, such as within 1500 feet of the production wells, and to a period of two years following the complete build-out of the Patterson Crossing Retail Center development.

The hydrogeologic consultant retained by the Town, will determine if the well impact is the result of project pumping or other factors, not related to the project. Appropriate mitigation, such as well deepening or well replacement will be provided by the applicant should it be determined that the project well pumping resulted in loss of function of an off-site well.

Potential Construction Impacts

As described above, any documented impact to private local wells caused by the project construction, will be remedied. Such mitigation may include monitoring of wells for potential impacts, hydrofracing wells, the deepening of wells through drilling or drilling replacement wells. Typically, if blasting is done by qualified and experienced contractors, damage to nearby wells is rare. In the event that damage to wells does occur, the damage will be remedied by the blasting contractor.

In order to document or substantiate claims of well damage due to blasting the applicant has developed a Blasting Mitigation Plan (Copy included in Appendix Q) to obtain water level data on wells within 500 feet of blasting sites, before, during and after blasting. Foundation surveys of structures within 500 feet of the blasting sites have been included in this plan. Copies of all documentation concerning off-site structures, including photographic and/or video documentation, will be provided to the Towns of Patterson and Kent. The well monitoring will provide data regarding well conditions prior to and following blasting. If a local resident experiences a reduction or loss of well function as a result of blasting, a complaint will be filed with the Town of Patterson or Town of Kent Building Inspector as appropriate. A Town representative, either the respective Town Building Inspector, or the retained hydrogeologic consultant, will determine if the well damage is the result of project construction activity. Appropriate mitigation, such as well deepening or well replacement will be provided by the blasting contractor should it be determined that the blasting related to the proposed project resulted in damage or loss of function of a monitored well.

Potential SSTS Impacts

In their hydrogeological investigation/mounding analysis report, GeoDesign recommends that a minimum of two feet of sand-gravel fill be placed over the proposed disposal area to increase separation between the bottom of the leach fields and the groundwater.

Recognizing the fact that the project will be serviced by a subsurface sewage treatment system (SSTS) with an engineered available capacity, project wastewater flows will be limited to the 10,740 gpd design flow. Future retail users must have wastewater flows which fit into the flow projections for the project. In order to assure the project wastewater design flow is not exceeded the applicant would agree to appropriate controls to assure each user's wastewater flows fit the project's design flows. One such control would require each specific user present the Town Building Department with a wastewater design flow at the time they apply for their building permit, or with any change in occupancy. This will allow for the monitoring of design flow to assure that all users wastewater generation falls within the system design capacity. It should be noted that actual water and wastewater flow metering/monitoring will be required as part of the water and sewer permitting with the PCDOH, NYCDEP and NYSDEC. This metering/monitoring will provide an assurance that the actual project flows do not exceed the system design capacity.

Potential Spill Impacts

The project will not result in the introduction of a gasoline service station or petroleum storage tanks to the site. Therefore, based upon the proposed retail uses, a formal spill contingency plan is not necessary for the site. Development of the project site introduces the potential for minor spills of petroleum resulting from vehicle accidents. Spills would first reach internal roadways and parking lots and then travel to stormdrains if drains are in close proximity to the spill location. Spills from vehicles at the Patterson Crossing Retail Center site will be responded to by emergency service providers and depending upon the size and extent of a spill, by a NYSDEC contracted spill response firm.

4.5 Surface Water

4.5.1 Existing Conditions

Drainage Areas

The project site is located on the divide between two different drainage basins (Middle Branch Reservoir watershed and East Branch Reservoir watershed) within the watershed of New York City's Croton Reservoir System. The New York City Department of Environmental Protection (NYCDEP) regulates certain activities within this watershed for purposes of protecting the drinking water resources within their control. The Croton system provides approximately 10% of the City's total drinking water. It supplies some 900,000 people with potable water on an average daily basis, and is the source of drinking water for upwards of 2.5 million people during drought or emergency conditions. Information is provided in this section related to the two drainages of this watershed which extend into the proposed project development area.

Middle Branch Reservoir Watershed

Approximately 21 acres (23 percent) of the northwestern portion of the project site are situated within the Lake Carmel subbasin of the Middle Branch Reservoir watershed. A reach of approximately 250 feet of the Middle Branch of the Croton River crosses the northwest corner of the site adjacent to Route 311 in the Town of Kent. There is a local wetland associated with this reach of the river, which is regulated by the Town of Kent and the United States Army Corps of Engineers (USACE). In addition to this on-site wetland there are five identified watercourses (Watercourses NYC-A, NYC-B, NYC-C, NYC-D and NYC-E) on the property in the Town of Kent that have been delineated by the NYCDEP (See Drawing SP-1). These watercourses drain off of the property in the northwest corner towards NYS Route 311 before merging and entering the Middle Branch of the Croton River. One of these watercourses (NYC-B) carries stormwater runoff from the Concord Road neighborhood to the south, conveying flows from south to north across the northwest portion of the site. Channel characteristics of this watercourse are described in greater detail below.

Watercourse NYC-B is the largest of the intermittent watercourses and flows northwesterly across the Kent portion of the project site. When the flows reach the northerly property boundary, they combine with roadside runoff from NYS Route 311 and Interstate 84 (NYC-E) prior to discharging into the Middle Branch of the Croton River. Much of this watercourse flows through a highly eroded channel on the hillside between Concord Road and the Middle Branch of the Croton River. The channel is formed in sandy loam subsoils with occasional cobbles and few meanders. Deepening of the channel due to high water flow velocities in this straight stream segment continues to be a source of downstream sedimentation problems. Erosion of this channel has resulted in the uncontrolled deposition of substantial volumes of untreated runoff and associated nutrients into the Middle Branch of the Croton River just upstream of Lake Carmel.

At the northern end of NYC-B, two groundwater discharge points were also observed which create shallow channels (NYC-C and NYC-D) on the western side of NYC-B. These short, shallow segments which have formed in existing surface cobbles merge into NYC-B approximately 250 feet east of the culvert that carries the Middle Branch of the Croton River under Route 311.

NYC-A is a shallow channeled stream segment that extends approximately 350 feet up grade of where it meets Wetland A. The channel for NYC-A is generally well-defined as a surface feature within the stony surface of the slope. NYC--A collects surface runoff from the portion of the slope west of NYC-B and without the point source of collected runoff from Concord Road has not developed the deeper cut channel or high water flow velocities of NYC-A. Water flow is generally from surface runoff and snow melt, but some seasonal groundwater discharge has been observed. The conveyed water flows in NYC-A provide a significant amount of the hydrology to the eastern end of Wetland A.

The Middle Branch Reservoir watershed encompasses approximately 13,640 acres and extends northwards from the Middle Branch Reservoir in the Town of Southeast (Putnam County) to Ludington Lake in the Town of Beekman (Dutchess County). The boundaries of the Middle Branch watershed are shown in Figure 4.5-1, Middle Branch Watershed.

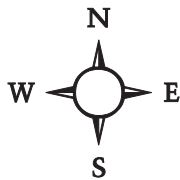
The Middle Branch Reservoir watershed consists of two subbasins: the Lake Carmel subbasin to the north and the Middle Branch subbasin to the south. The Lake Carmel subbasin, including a portion of the project site, drains into the Middle Branch subbasin. The existing land cover of the two subbasins is provided in Table 4.5-1.

Table 4.5-1 Middle Branch Reservoir Watershed Land Cover		
Land Use Category	Acres	Percent
<i>Middle Branch subbasin</i>		
Forest Land Use	10,467	48.5
Urban Land Use	1,285	6.0
Agriculture/Open Space Land Use	724	3.3
Water	872	4.0
<i>Lake Carmel subbasin</i>		
Forest Land Use	6,832	31.6
Urban Land Use	707	3.3
Agriculture/Open Space Land Use	314	1.4
Water	398	1.8
Source: New York City Department of Environmental Protection website		

As indicated in Table 4.5-1, more than 80 percent of the Middle Branch Reservoir watershed is currently forested land and less than ten percent is in urban land use.

The New York State Department of Environmental Conservation (NYSDEC) has classified the Middle Branch Reservoir as a Class “A” water body. This classification requires that very high water quality standards be established to protect its status as a source of drinking water. The Middle Branch Reservoir was formed in 1878 by the damming of the Middle Branch of the Croton River which flows from Lake Carmel. The Middle Branch Reservoir is rated mesotrophic by NYCDEP based on algae populations and levels of bacteria, phosphorus and color.¹

¹ New York City Department of Environmental Protection. 2002. 2001 Watershed Water Quality Annual Report .



- - - - Middle Branch Watershed Boundary
- Site Property
- NYCDEP Water Quality Monitoring Site

**Figure 4.5-1: Middle Branch Watershed
Patterson Crossing Retail Center
Town of Patterson and Town of Kent,
Putnam County, New York**

Base: USGS 7.5-minute Topographic Map
Approx. Scale: 1 inch = 9,300 feet

East Branch Reservoir Watershed

Approximately 69 acres (77 percent) of the project site are situated within the East Branch Reservoir watershed. The East Branch Reservoir watershed encompasses approximately 49,025 acres and extends northwards from Peach Lake in the Town of North Salem (Westchester County) to the southern portion of the Village of Pawling (Dutchess County). The boundaries of the East Branch watershed are shown in Figure 4.5-2, East Branch Watershed.

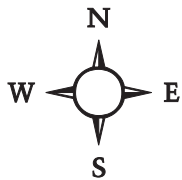
The East Branch Reservoir watershed consists of ten subbasins, representing the larger tributary streams or receiving bodies. The project site is within the Muddy Brook subbasin, which encompasses approximately 847 acres. The NYCDEP, for purposes of land cover calculations, divides East Branch Reservoir watershed into three major subbasins, named for the receiving waterbodies; the East Branch subbasin, the Peach Lake subbasin, and the Putnam Lake subbasin. A major portion of the project site is within the East Branch subbasin. The existing land cover of these subbasins is provided in Table 4.5-2.

Table 4.5-2 East Branch Reservoir Watershed Land Cover		
Land Use Category	Acres	Percent
<i>East Branch subbasin</i>		
Forest Land Use	36,660	72.1
Urban Land Use	3,714	7.3
Agriculture/Open Space Land Use	5,691	11.2
Water	1,732	3.4
<i>Peach Lake subbasin</i>		
Forest Land Use	467	0.9
Urban Land Use	215	0.4
Agriculture/Open Space Land Use	180	0.4
Water	232	0.5
<i>Putnam Lake Subbasin</i>		
Forest Land Use	1,285	2.5
Urban Land Use	366	0.7
Agriculture/Open Space Land Use	25	0
Water	264	0.5
Source: New York City Department of Environmental Protection website		

As indicated in Table 4.5-2, more than 75 percent of the East Branch Watershed is currently forested land and less than nine percent supports urban land use.

The NYSDEC has classified the East Branch Reservoir as a Class "AA" water body. This classification requires that very high water quality standards be established to protect its status as a source of drinking water. The East Branch Reservoir is classified as eutrophic by the NYCDEP based on algae populations and levels of bacteria, phosphorus and color².

² New York City Department of Environmental Protection. 2002. 2001 Watershed Water Quality Annual Report .



- - - - East Branch Watershed Boundary
- Site boundary
- NYCDEP Water Quality Monitoring Site

**Figure 4.5-2: East Branch Watershed
Patterson Crossing Retail Center
Town of Patterson and Town of Kent,
Putnam County, New York**

Base: USGS 7.5-minute Topographic Map
Approx. Scale: 1 inch = 9,300 feet

Discharge Points for Existing Drainage Areas

Stormwater entering the project area is currently routed by natural topography, soils and vegetation. The project site presently drains to upper reaches of both the Middle and the East Branch of the Croton River drainage systems, with the majority of the surface drainage flowing eastward into the drainage line of a collection system alongside Interstate 84 within the East Branch Reservoir Basin.

Runoff collected alongside Interstate 84 is directed through diversionary structures associated with the highway towards Fair Street where the flow crosses beneath the interstate. This flow enters an unnamed wetland east of the interstate, and ultimately enters the Muddy Brook, a tributary to the upper reach of the East Branch Reservoir Basin.

Runoff from the site to the Middle Branch Reservoir Basin presently occurs as sheet runoff directly to the Middle Branch of the Croton River, or as channeled runoff through an intermittent watercourse. This watercourse runs northwesterly across the smaller portion of the project site and combines with roadside runoff from NYS Route 311 and Interstate 84 prior to discharging into the river. Much of this watercourse flows through a highly eroded channel on the hillside between Concord Road and the Middle Branch of the Croton River. The existing pipe/swale developed structures which contain a portion of this runoff end abruptly approximately 200 ft from the riverbank. Erosion of this channel has resulted in the uncontrolled deposition of substantial quantities of untreated runoff and associated nutrients into the river just upstream of Lake Carmel. The Applicant's plan to remedy this source of sediment and nutrients to Lake Carmel is addressed in section 4.5.3 (Future Conditions with Project) below and in the preliminary Stormwater Pollution Prevention Plan (Appendix F).

Existing Stormwater Quantity

Model estimates of the existing runoff conditions for storm events up to and including 100-year events were made during the development of the preliminary Storm Water Pollution Prevention Plan (SWPPP). Appendix F presents the model design parameters and the preliminary SWPPP developed for this project. Appendix B of the SWPPP also includes descriptions of the 1, 2, 10, 25 and 100 year, 24 hour storm events pursuant to the Final Scoping Document. The computer-aided program used is based primarily on hydrological modeling techniques developed for use by the Soil Conservation Service of the United States Department of Agriculture. Peak pre-development flows from the project site into the two major watersheds were calculated at three design points. These flows were calculated utilizing regional precipitation values obtained from the Putnam County Soil and Water Conservation District office, and are shown in Table 4.5-3.

Design Point 1 is a point along the west side of Interstate 84, at an existing culvert. Design Point 2 is also along Interstate 84, where drainage is conveyed via an existing swale to an existing catch basin at Fair Street. Design Point 3 collects flows draining from the northeast portion of the site to the Middle Branch of the Croton River. This design point includes flows from the watercourse draining Concord Road. The location of these design points is shown on Figure 4.5-3, Existing Drainage Areas.

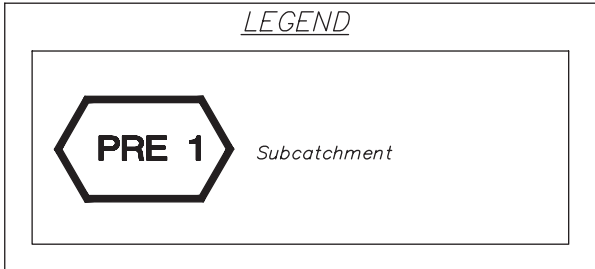
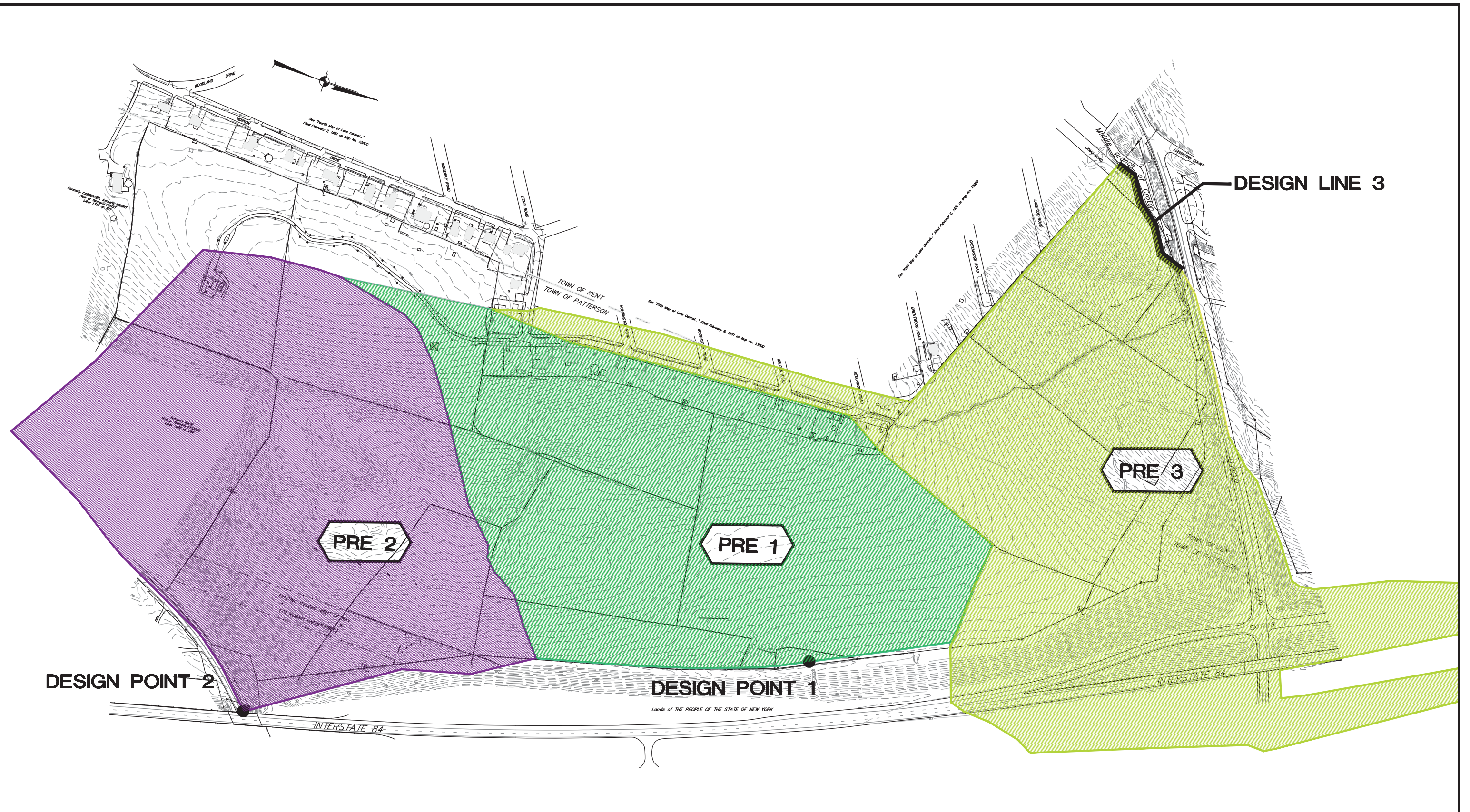


Figure 4.5-3: Existing Drainage Areas
 Patterson Crossing Retail Center
 Town of Patterson and Town of Kent,
 Putnam County, New York
 Source: Insite Engineering, Surveying & Landscape Architecture, P.C.
 Scale: 1 inch = 300 feet

Table 4.5-3 Peak Pre-development Flow Summary, in CFS, for 24-Hour Design Storms				
Design Point	2-Year	10-Year	25-Year	100-Year
DP-1	20.88	43.81	60.68	87.3
DP-2	22.86	49.08	68.51	99.33
DP-3	35.38	68.46	92.14	128.87

The United States Geological Service (USGS) maintains a gauging station on the Middle Branch of the Croton River at a location downstream of the Lake Carmel dam. An overview of flow data collected at this station is presented in Section 4.6-1. Representative annual mean stream flow at this Middle Branch USGS station over the period 1996-2002 has ranged from 15.6 to 44.9 cubic feet per second (cfs) with a peak flow of 758 cfs measured in September of 1999 (after passage of Hurricane Floyd). Comparable USGS gaging station information is not available for the East Branch of the Croton River due to the absence of any monitoring station similarly near to the project site. Refer to Section 4.6 for details on USGS gaging stations.

Existing Stormwater Quality

Stormwater quality leaving the site at each of the proposed design points is discussed below with the pollutant loading analysis, which examines pre- and post-development estimates for site loading of nutrients, suspended sediments and BOD. However, as described below, some information was available to describe existing conditions in the adjacent receiving waters.

The NYCDEP has two proximate monitoring points for the mainstream Middle and East branches of the Croton River which were selected to represent the pre-development condition within the two drainage basins. The mainstream of the Middle Branch of the Croton River crosses the site, and project discharge would be direct into the river after treatment. The mainstem of the East Branch of the Croton River is located approximately five (5) miles downstream of the project, and after treatment project discharge would flow through a series of wetland, stream and swamp waterbodies before merging with the river. Sampling routinely conducted at these stations includes measurements for total phosphorus, turbidity, dissolved oxygen, total nitrogen, and conductivity.

The monitoring site on the East Branch of the Croton River (EBCR4, shown on Figure 4.5-2) is located approximately one mile upstream from the discharge of Muddy Brook into the East Branch of the Croton River, thus representing conditions upstream of the project site. The monitoring site on the Middle Branch of the Croton River (MIDBR8, shown on Figure 4.5-1) is located approximately 2000 feet downstream from the northwest corner of the site, thus representing the pre-development condition. This sampling point includes runoff from the Lake Carmel community. Average values for the most recently reported sampling years (1998-2001) are shown in Table 4.5-4.

Table 4.5-4 NYCDEP Croton River Water Quality Monitoring 1998-2001						
Watershed		Total Phosphorus (ug/l)	Turbidity (NTU)	Dissolved Oxygen (mg/l)	Total Nitrogen (mg/l)	Conductivity (mS/cm ²)
East Branch	MIN	5	0.9	2.3	0.3	79
	MAX	282	98.4	13	1.1	656
	AVG:	44.8	6.1	8.5	0.6	378.8
Middle Branch	MIN	8	0.9	5.9	0.3	297
	MAX	129	100	16.4	1.1	1,395
	AVG:	24.1	6.2	10.8	0.5	569.8

Conductivity of the Middle Branch is higher than typical for surface waters in this area, possibly as a result of town and state storage of road salt in the watershed. Recent conductivities of 600 mS/cm² have been observed by the NYSDEC, within an area where streams typically have conductivities of 100-200 mS/cm².³

Total Phosphorus

Phosphorus is typically identified as the limiting nutrient in freshwater ecosystems. Elevated levels of phosphorus may lead to mesotrophic or eutrophic conditions which encourage growth of aquatic vegetation both rooted plants and suspended or attached algae species.

The Middle Branch and East Branch Reservoir Basins are classified as "phosphorus restricted" by the NYCDEP. A phosphorus-restricted basin is defined by New York City's Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its Sources (City Administrative Procedure Act 1997) as a "drainage basin of a reservoir or controlled lake in which the total phosphorus (TP) load [the amount of phosphorous entering a reservoir from point and nonpoint sources in the reservoir's watershed] results in phosphorus concentrations above those provided in the DEC Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality and Guidance Values (October 22, 1993)."

Under the provisions of the Clean Water Act, the NYSDEC has established specific Phase II Total Maximum Daily Load (TMDL) limitations for phosphorus inputs into the Middle and East Branch Reservoirs. A phosphorous TMDL is a reservoir's loading capacity for total phosphorous and is considered to be a watershed budget for the pollutant, representing the amount of total phosphorous [from point and nonpoint sources] that can be assimilated by a reservoir without causing impairment, or exceeding water quality standards, including the TOGS guidance values. TMDLs represent the sum of the point source wasteload allocations (WLAs), or the amount of phosphorous being discharged to the reservoir from point sources such as wastewater treatment plants, the nonpoint source load allocations (LA), or the amount of phosphorous entering the reservoir from nonpoint sources such as urban stormwater runoff, and an added "margin of safety" to account for uncertainty in the loading calculations.

NYSDEC's Phase II Phosphorus Total Maximum Daily Loads for the Reservoirs in the New York City Water Supply Watershed, June 2000 (the Phase II Report)⁴, provides the following

³ Mr. Ron Pierce, NYSDEC Region 3, telephone interview. May 9, 2005.

⁴ NYSDEC, Division of Water, Bureau of Watershed Management. June 2000. Phase II Phosphorous Total

information concerning the Phase II TMDLs, and phosphorus, in the Middle Branch and East Branch Reservoirs.

Middle Branch Reservoir

The Phase II Report indicates that the existing 949 kg/yr phosphorus TMDL set for the Middle Branch Reservoir (the amount of daily phosphorous input that the reservoir can assimilate) is based upon a 20 ug/l guidance value (the target concentration of phosphorous in the reservoir). This load limit includes a margin of safety of 14% or 133 kg/yr. Removing the margin of safety from the TMDL leaves 816 kg/yr of total phosphorus available for allocation between the contributing point sources (such as wastewater treatment plant discharges) and nonpoint sources. At a point source Waste Load Allocation (WLA) of 184 kg/yr (the volume set for the identified point source in the watershed), the nonpoint source Load Allocation (LA) is then 632 kg/yr. The Phase II Report further indicates that the Middle Branch TMDL is being exceeded and that water quality in the reservoir is impaired as a consequence of existing phosphorous inputs to the reservoir from its watershed. The current load (phosphorous input to the reservoir from point and nonpoint sources in the reservoir's watershed) to the reservoir from its watershed of 1,020 kg/yr is greater than the load that can be assimilated (949 kg/yr). Even after reductions in the point source loading in the Middle Branch watershed due to the application of the City's Watershed Regulations, the available load (additional input of phosphorous that can be assimilated) will be exceeded by 204 kg/yr. The most significant contributor of phosphorus to the Middle Branch Reservoir, at 528 kg/yr, is the upstream load from the Lake Carmel subbasin. Therefore, reductions in this load coupled with reductions of the urban runoff load of 211 kg/yr would be necessary in order to meet the TMDL.

The Phase II Report indicates that the State anticipates that the necessary phosphorus reductions will be achieved by implementing the nonpoint source programs listed in Section VI of the Phase II Report. These New York City funded programs include: Sewer Extension design and construction, Septic System Rehabilitation and Replacements, Stormwater Retrofits, Watershed Planning in the Croton System, East of Hudson Water Quality Investment Funds, and Future Stormwater Controls for Single Family Houses, Small Businesses, and Low Income Housing.

The Phase II Report also states that a five year average of 1992-1996 annual geometric means of reservoir data indicates a phosphorus concentration of 22.1 ug/l (02.21 ug/l greater than the guidance value) can be expected as a growing season average.

East Branch Reservoir

The Phase II Report indicates that the existing 2,822 kg/yr phosphorus TMDL set for the East Branch Reservoir (the amount of daily phosphorous input that the reservoir can assimilate) is based upon the 20 ug/l guidance value (the recommended concentration of phosphorus in the reservoir). This load limit includes a margin of safety of 12.5% or 353 kg/yr. Removing the margin of safety from the TMDL leave 2,469 kg/yr of total phosphorus available for allocation between the contributing point sources (wastewater treatment plant discharges) and nonpoint sources. At a point source WLA of 449 kg/yr the volume set for the identified point source in the watershed), the nonpoint source LA is then 2,020 kg/yr.

Maximum Daily Loads for Reservoirs in the New York City Water Supply Watershed (Delaware, Dutchess, Greene, Putnam, Schoharie, Sullivan, Ulster, and Westchester Counties).

The Phase II Report further indicates that the East Branch Reservoir TMDL is being exceeded and that water quality in the reservoir is impaired as a consequence of existing phosphorous inputs into the reservoir from its watershed. The current load (phosphorous input from point and nonpoint sources) of 3,462 kg/yr to the reservoir from its watershed is also greater than the load that can be assimilated (2,822 kg/yr). Even after reductions in point source loading in the East Branch watershed due to the application of New York City's Watershed Regulations, the available load (additional input of phosphorous that can be assimilated) will be exceeded by 993 kg/yr. Significant reductions in the urban runoff load of 1,141 kg/yr and the 189 kg/yr upstream loads from Peach and Putnam Lake subbasins would have to be achieved to meet the target load.

The Phase II Report indicates that the nonpoint source programs included in its Section IV will be implemented to meet the East Branch Reservoir LA. These City funded nonpoint control programs include: Sewer Extension design and construction, Septic System Rehabilitation and Replacements, Stormwater Retrofits, Watershed Planning in the Croton System, East of Hudson Water Quality Investment Funds, and Future Stormwater Controls for Single Family Houses, Small Businesses, and Low Income Housing.

The Phase II Report also indicates that a five year average of 1992-1996 annual geometric means of reservoir data indicates a phosphorus concentration of 22.8 ug/l (02.8 ug/l greater than the guidance value) can be expected as a growing season average.

The Middle Branch Reservoir and other impoundments discharging to the watershed above it, such as Lake Carmel, utilize an existing State guidance value of 20 ug/l for Phase II TMDL for phosphorus. A single sample taken September 18, 1996 at the gauging station below the outfall of Lake Carmel on the Middle Branch is reported by the USGS. This sample had a conductivity of 438 ms/cm and a total unfiltered phosphorus of 80 ug/l.

A 2002 survey of Lake Carmel reported a total phosphorus level of 70 ug/l (0.07 mg/l) in surface waters.⁵ Conditions that may be contributing to these elevated levels, such as failing or undersized septic systems around Lake Carmel, combined with surface runoff and re-suspended sediments, persist.

Existing water quality conditions in Lake Carmel, including the elevated phosphorus levels, presently allow for seasonal phytoplankton blooms which are being treated as a nuisance problem by the Town of Kent. Reducing the total phosphorus loading into the lake is a goal of the town to minimize the nuisance level of phytoplankton which presently affects public perception and recreational use of this municipal resource.

Non-point phosphorus exports from the Middle Branch of the Croton River to the Middle Branch Reservoir were estimated by the NYCDEP to be greater than 2700 lbs/yr TP.⁶ While the Phase II Report indicates that the non-point source phosphorus load to the East Branch Reservoir is 3,462 kg/yr, or some 7630 lbs /yr. Patterson and Kent are together required to institute a phosphorus load reduction to the Middle Branch Reservoir of 238 lb/year TP. This constitutes over half the phosphorus load reduction that is required for the Middle Branch.

⁵ Princeton Hydro, LLC. 2003. The 2002 Lake Carmel Water Quality Monitoring Report, Town of Kent, Putnam County, New York. Town of Kent, Carmel, NY. 18 pp. plus appendix.

⁶ New York City Department of Environmental Protection website.

The Croton Falls Reservoir, to which the Middle Branch Reservoir is tributary, currently exceeds its Phase II TMDL limits⁷. It has been determined that up to 28 percent of the phosphorus loading to the Croton Falls Reservoir comes from the three upstream reservoirs (West Branch, Middle Branch and Diverting).

Total Nitrogen

Nitrogen is often cited as the second limiting nutrient for plant growth in aquatic systems. Dissolved forms of nitrogen may be expressed as Total Nitrogen (TN). Dissolved nitrogen primarily occurs as ammonia (NH₃), nitrite (NO₂), or nitrate (NO₃) compounds, and both bacterial and plant metabolic processes act to bioconvert these three classes of nitrogen compounds into biomass or atmospheric releases of nitrogen.

A survey of Lake Carmel waters in September of 2002 found levels of ammonia and nitrate which were considered to be acceptable for surface waters. Ammonia (as mg/l NH₃-N) was measured at 0.05 mg/l and nitrate (as mg/l NO₃-N) was measured at 0.07 mg/l.

Biological Oxygen Demand

In aquatic systems, most organic constituents may be degraded over time by bacterial metabolism. The amount of oxygen used in the metabolism of biodegradable organics is termed Biological Oxygen Demand (BOD). Therefore, the BOD loads measured for water samples are commonly used as an indirect indicator of the total organic load carried in natural water.

Suspended Solids

Suspended solids measurements, or Total Suspended Solids (TSS), for surface waters provide an indication of the amount of particulate matter carried in the water column, and also provide an indirect indication of levels of coloring and turbidity. Increased levels of TSS may result in brown or green colored waters, leading to reduced light penetration and increased fouling of sediments and rooted plant growth within a water body. Additionally, the public may perceive that water bodies with higher levels of TSS have impaired water quality. A survey of Lake Carmel waters in September of 2002, found a level of TSS which was considered to be acceptable for surface waters. A TSS level of 17 mg/l was recorded for mid-lake waters.

There are no stormwater management facilities currently on the project site. The quality of runoff during storm events is presently determined by existing land usage and specific soils, vegetation, and erosional patterns of the site. The preliminary project SWPPP used this information to develop estimates of the existing load of runoff constituents which enters into the two drainages from the project site. These estimates are presented in the following sections which discuss specific aspects of runoff water quality. Because the majority of the site is vegetated, there is limited soil erosion from most of the site, with the exception of the eroded drainage channel in the northern part of the site. Refer to section 4.5.3 (Future Conditions with Project) below and the preliminary SWPPP (Appendix F) for the Applicant's plan to remedy this source of sediment and nutrients to Lake Carmel.

⁷ Kimberlee Kane, NYCDEP, July 2005

Runoff from Adjacent Single Family Residential Area

There is an existing watercourse that currently drains the single family residential area located along a ridgeline at the western property line. The stormwater runoff from much of this area is conveyed along Concord Road from south to north before discharging (by pipe) to a watercourse on the property that flows down the slopes in the northern portion of the project site. This untreated and erosive runoff discharges into the watercourse, and has caused erosion along the length of the channel, ultimately resulting in an eroded 6- to 8-foot-deep drainage ditch. The gully remains active, in that erosive water is still being discharged to it during storm events. This deeply incised watercourse is a direct source of sediment being discharged into the Middle Branch of the Croton River and ultimately into the north end of Lake Carmel. Over the years, thousands of tons of soil have been eroded out of this watercourse channel to form the substantial gorge on the hillside adjacent to NYS Route 311. It is likely that untreated runoff from the residential areas around Concord Road are also contributing to nutrient loading of Lake Carmel. Phosphorus, which is known to adhere to suspended particulate matter, is a particular concern.

4.5.2 Future “No Build” Conditions

Without the project developments, there would be no related modification to on-site watercourses and the preexisting drainage patterns shown in Figure 4.5-3 would generally be maintained. Existing loading of nutritive pollutants from runoff water into nearby water bodies would persist.

In the portion of the property which discharges to the Middle Branch, a Lake Carmel stormwater improvement project is under consideration which is unrelated to the proposed retail development. The goal of this project is to reduce the erosion currently caused by the existing runoff from the housing development along Concord Road. This runoff is currently untreated by any improvements, and runs in an open, eroded channel to a discharge point bankside at the river. Without the proposed development, this project might be initiated utilizing public monies. Under the “No Build” condition, the stabilization of this eroded gully and the incorporation of this runoff into any series of surface sand filters, stormwater detention basins, or riverbank discharge improvements would not be funded as part of the proposed project developments and may not be implemented.

4.5.3 Future Conditions with Project

The proposed development must comply with a New York State Pollution Discharge Elimination System (SPDES) General Permit for stormwater discharges. In the New York City watersheds, the NYCDEP is also an involved agency, and must ultimately approve a SWPPP prior to commencement of construction. The objective of a SWPPP is to control erosion and sedimentation during construction and to reduce post-development stormwater pollutant loadings to that of pre-development levels to the greatest extent practicable. This applies to all land areas for which the perviousness has been changed over pre-development conditions due to land clearing, land grading or construction. Project plans were thus developed in accordance with the requirements of the NYCDEP.

The SWPPP for the project has been prepared in accordance with the NYCDEP requirement to capture and treat the runoff (from disturbed areas) generated by the 2 year storm event. It therefore also meets the New York State requirement to capture and treat the runoff from

the 90th percentile rainfall event. Note that to comply with the City watershed regulations, SWPPPs required for projects in phosphorous restricted basins, such as the East Branch and Middle Branch, must include an analysis of pre- and post-construction phosphorus concentrations in stormwater runoff, and include measures to capture and treat runoff from a 2-year, 24-hour storm event. .

The proposed Patterson Crossing Retail Center would result in disturbance of 68.4 acres of land. Given the change from woodland to commercial and landscaped developments, water quality management will be important in light of the site's location within the upper basins of the Croton Reservoir watershed.

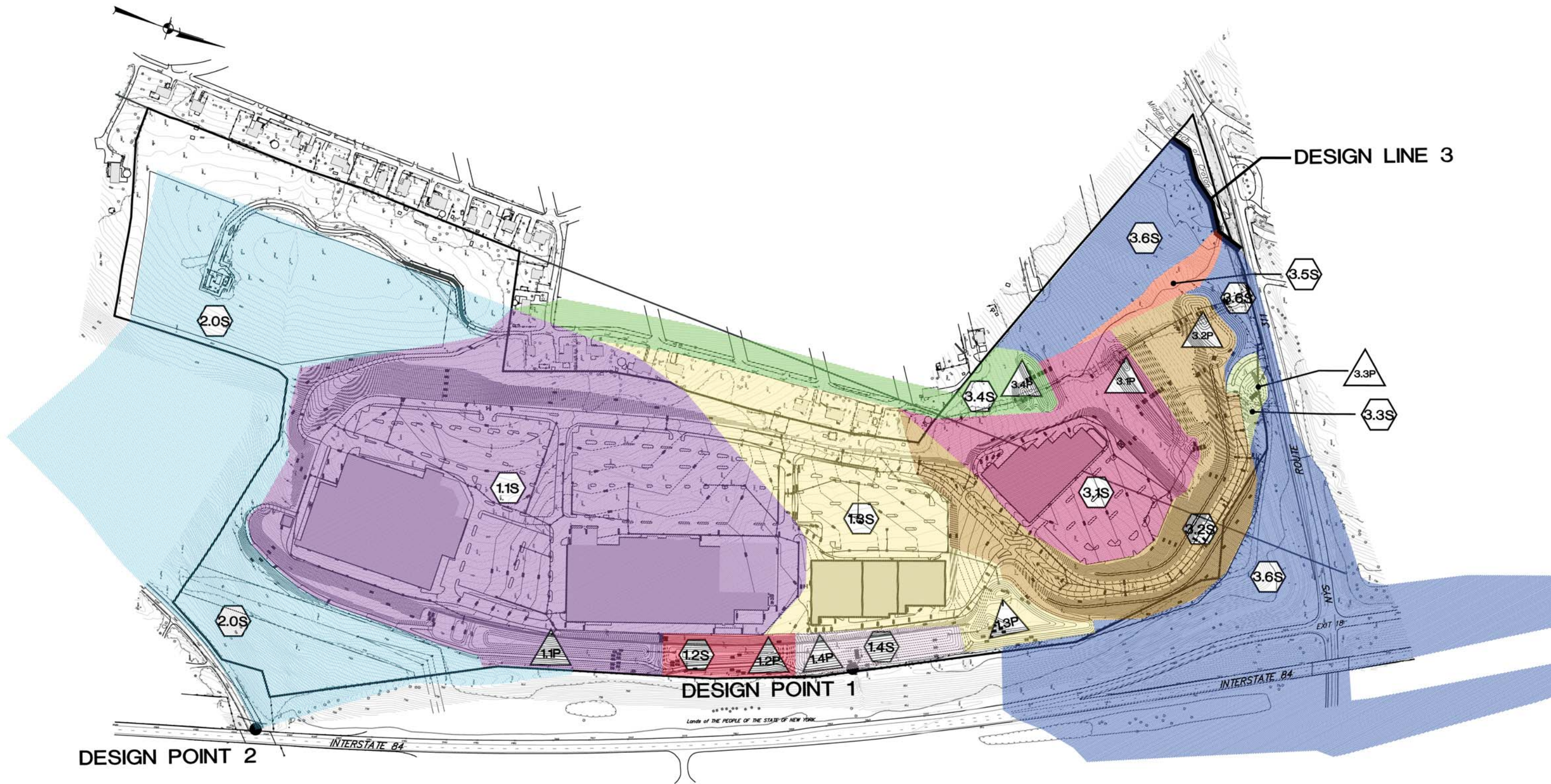
Under the Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its Sources (the "Watershed Regulations"), the NYCDEP must review and approve certain activities that may potentially impact the water quality of the reservoir system. A preliminary SWPPP has been prepared by the project engineer to comply with all applicable SPDES conditions. Specific measures proposed for the maintenance of water quality for this site, and the pollutant loading analysis for the developed condition are presented in detail in the SWPPP (Appendix F). An overview of the SWPPP is presented in this section.

Post-Development Runoff Quantity and Quality

The project SWPPP (Appendix F) was developed to be in compliance with all applicable town (Towns of Patterson and Kent), NYCDEP Watershed Regulations, and NYSDEC guidelines, including the New York State Stormwater Management Design Manual and the New York Guidelines for Urban Erosion and Sediment Control. Specific attention has been given to generally maintain existing reservoir basin drainage divides, to create TMDL benefits, to attenuate post development increases in peak discharges and to meet NYSDEC stormwater treatment criteria. Treatment methods include only natural processes; no chemical treatment of the runoff is allowed. All treatment methods will comply with NYSDEC stormwater treatment criteria.

The stormwater management system for the proposed Patterson Crossing Retail Center has been designed to meet applicable standards through the incorporation of a treatment train that will utilize a series of pipes, grass swales, and a variety of stormwater management basins including wet, dry and micropool extended detention ponds. The incorporation of Low Impact Design techniques and Best Management Practices (BMPs) into the project plan, as documented in section 4.5.4 Proposed Mitigation Measures below, will reduce the volume of stormwater post development runoff and advance the control of erosion and sedimentation from the project site.

The primary means of treatment for runoff discharging from the project will be with the various stormwater management basins. Passively controlled outlets to the basins will extend the discharge duration from the basins to 24 hours or more. Stormwater runoff will be collected in constructed drainage systems and transported to stormwater basins for ultimate discharge from the site at three design points as shown in Figure 4.5-4, Proposed Drainage Areas. The treatment train for the bulk of the runoff will be constructed in multiple series of three sequential stormwater basins. A smaller portion of the development will receive two levels of treatments through paired basins. The last pond in either series of basins is designated as a "wet extended detention pond" (P-3) per the NYSDEC Design Manual.



LEGEND



	Subcatchment
	Pond

Figure 4.5-4: Proposed Drainage Areas
 Patterson Crossing Retail Center
 Town of Patterson and Town of Kent,
 Putnam County, New York
 Source: Insite Engineering, Surveying & Landscape Architecture, P.C.
 Scale: 1 inch = 300 feet

Ponds were sized to meet the 90% treatment requirement of the NYSDEC for average runoff events. Based on the proposed best management practices, combined with phasing of the construction and regular maintenance and monitoring of erosion control measures, it is expected that there will be no adverse environmental impacts to Lake Carmel.

The project sponsor also proposes to undertake the Lake Carmel stormwater improvement project noted above and repair the channel receiving runoff from Concord Road. Repair to this highly eroded channel will minimize future transport of eroded sediments to the Middle Branch of the Croton River and ultimately to Lake Carmel. It is proposed to pipe the discharge from Concord Road to a proposed "pocket pond" (P-5) for treatment. From this pocket pond, flows will be diverted back to a surface watercourse at non-erosive rates, which will provide further aeration and opportunity for biological activity prior to discharge into the Middle Branch. In order to better focus the repair project, the Applicant will voluntarily sample and test water conveyed by the eroded channel. Water quality test results will be provided to the Town of Patterson. This proposal will allow the Applicant to significantly reduce the volume of sediment entering the Middle Branch of the Croton River and ultimately Lake Carmel, and decrease nutrient loading from this portion of the watershed. Because phosphorus is known to adhere to sediment particles and fine particulates, any reduction in the volume of sediment conveyed to the lake will have a positive impact on Lake Carmel water quality.

Peak post-development (i.e. developed) flows from the project site to the three design points are presented in Table 4.5-5 and compared to the pre-development (i.e. existing) flows as presented in Table 4.5-3. The stormwater flow to the East Branch Reservoir basin consists of the majority of the runoff, as it did in pre-development conditions. Additionally, pursuant to New York State standards, 24-hour detention of the post development 1- and 2-year, 24-hour storm events has been provided for stream channel protection. Finally, it is recommended that 12-hours of detention time be provided when discharging to a protected trout stream.

Calculated future peak flow rates for each of the 24-hour events considered in the model are expected to be reduced in comparison to the calculated existing flows (Table 4.5-5), as required by the NYCDEP and NYSDEC. The stormwater basin volumes have been scaled to allow for the capture and treatment of 90% of the average stormwater runoff, as required by the NYSDEC.

Table 4.5-5 Peak Flow Summary, in CFS, for 24-Hour Design Storms								
Design Point	2-Year		10-Year		25-Year		100-Year	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
DP-1	20.88	1.54	43.81	24.36	60.68	49.03	87.3	78.74
DP-2	22.86	21.00	49.08	44.20	68.51	61.25	99.33	88.15
DP-3	35.38	24.62	68.46	45.78	92.14	72.08	128.87	127.69

The preliminary SWPPP projects future water quality parameters in surface runoff. Values are presented for BOD, phosphorus, nitrogen, and total suspended solids. Total annual loads (as lbs/yr) for each of these pollutants were calculated for post-development discharges into each of the three design points, and comparisons are provided with estimates of pre-development loads from the project site. Conservative loading coefficients

were used for these calculations, in keeping with NYCDEP policy. However, based on the numerous and redundant stormwater management practices proposed as part of the project, and the use of low impact development (LID) techniques, it is expected that pollutant removal efficiencies will be on the higher end of the scale for each constituent. Proposed LID measures include depressed landscape islands within the parking fields, captured roof runoff for irrigation, and pervious pavement areas within the perimeter parking. Post-development loads are approximately equal to or less than the pre-development loads, as required by NYCDEP regulations. These patterns are maintained for the discharge into the Middle Branch of the Croton River even with discounting the specific improvements proposed for treating the existing unmanaged runoff from the Concord Road housing development.

The stormwater runoff discharging to Design Point 1 is proposed to enter the Interstate 84 collection system. The collection system is located on the southern side of the eastbound travel lanes. From there it runs (is piped) into the median where it flows in an easterly direction towards Fair Street. The collection system continues across Fair Street and discharges in the wetland located northeast of the Interstate 84/Fair Street intersection. The stormwater runoff discharging from Design Point 2 sheets off of the subject property in a southerly direction before entering the collection system along the western side of Fair Street. The collection system in Fair Street flows in a northerly direction along Fair Street before discharging into the same wetland as the Interstate 84 collection system. The drainage areas discharging to Design Points 1 and 2 make up a small portion of the overall drainage area to the receiving wetland. Based on the above, in combination with the fact that the contributing area to each of the design points (DP-1, DP-2 and DP-3) is less than the 50 acre minimum threshold stated in the NYSDEC Stormwater Management Design Manual, the Applicant has determined that a geomorphic assessment is not required.

Table 4.5-6 Annual Pollutant Load Summary, in lbs/yr								
Design Point	BOD		TP		TN		TSS	
	Pre	Post*	Pre	Post*	Pre	Post*	Pre	Post*
DP-1	327.5	1467/514	5.4	7.18/2.57	73.8	112.2/53.6	3,265	515.0/0.0
DP-2	260.4	189	3.7	2.9	67	66.7	2,864	4,275.3
DP-3	1,399.7	1684/1456	12.3	12.34/10.81	116.1	117.8/99.7	9,048	7892/7291.5

Source: Insite Engineering, Surveying and Landscape Architecture, P.C., 2005
 * Range of expected loadings based on pollutant removal efficiencies per NYSDEC publications.

As shown in Table 4.5-6, post construction levels of phosphorus, nitrogen and total suspended solids to both the Middle Branch and East Branch Reservoir basins are significantly reduced. These calculations include water quality improvements derived from the diversion and treatment of the flows entering the site from Concord Road. As shown in the detailed calculations in the preliminary SWPPP, these constituents are still reduced if the proposed Concord Road improvements are not made. Appendix B of the SWPPP includes storm data for the 90th percentile 1, 2, 10, 25 and 100 year, 24 hour, storm events pursuant to the Final Scoping document.

Stormwater Runoff During Construction

Throughout the construction phase, five basic principles of runoff management established under the SWPPP will be applied at the site to control stormwater runoff: 1) construction sequencing, 2) rapid stabilization of disturbed areas; (3) containment of sediments; (4)

treatment of dirty water; and (5) reduction of runoff velocities and diversion of clean water around disturbed soils.

Implemented, monitored, and enforceable Best Management Practices (BMPs), as specified in the SWPPP, will be utilized during the construction phase as the primary means of instituting controls for erosion and sediment control. The greatest potential impacts associated with this project relative to soils disturbance would be from erosion and sedimentation during construction. A construction phasing and sequencing plan (13 phases in all) is included as part of the engineer's drawing package included at the back of this DEIS. A Sediment and Erosion Control Plan is also provided in the set of site plans accompanying this document which incorporates both structural and nonstructural (i.e. operational) provisions. The primary aim of this plan is to minimize the potential for soil erosion from areas exposed during construction and prevent sediment from reaching the downgradient rivers, lakes and wetlands. All soil erosion and sedimentation control practices will be installed in accordance with the NYSDEC SPDES General Permit for Stormwater Discharges from Construction Activities (Permit No. GP-02-01), BMPs of Putnam County Soil Conservation Service, and the town municipal codes. Prior to the commencement of any phase of this project that will result in the disturbance of soils, erosion and sediment control measures will be placed in accordance with the specifications on the construction drawings and in the SWPPP. These measures will be maintained in good condition and left in place until permanent vegetative cover is established.

During construction, areas of active disturbance will be minimized at all times, and runoff from areas outside of disturbances will be diverted from erodable surfaces.

Potential for Erosion and Sedimentation

During construction, a comprehensive soil erosion and sediment control plan will be implemented to mitigate potential impacts on receiving wetlands and streams. This plan is discussed in more detail in the preliminary SWPPP (Appendix F).

That portion of the stormwater which is collected from impervious surfaces will be managed so as to control any sedimentation or erosional effects both on- and off-the site. Accumulated silt, as well as other sediments collected at runoff control structures will be removed and properly disposed of in order to maintain the effectiveness of these structures.

Bankside discharge points and velocity dissipaters will be structured so as to protect stream side banks and vegetation. Some of the post-development stormwater will continue to occur as sheet runoff from undisturbed and protected areas of the site, in a manner similar to existing conditions on the property.

Following construction, the potential for erosion and sedimentation from the site will be minimal as runoff rates and discharge points from impervious surfaces, and landscaped areas, will be controlled by the project SWPPP and the remainder of the site land cover will be remain stabilized by preexisting forested or vegetated areas.

Potential for Thermal Impacts to Downstream Fish Habitat in the Middle Branch of the Croton River

Thermal impacts to receiving waters, through the elimination of shade trees along stream banks and addition of impervious surfaces in upstream drainage areas, are an important concern in areas where there is a known natural or annual stocking of cold water fish species (i.e., trout). Increases to average annual water temperature may constrain a cold water fishery.

NYSDEC performs maintenance stockings of trout into some rivers of Putnam County, including the three branches of the Croton River. In the Town of Kent, these stockings occur only in the West Branch drainage, where brown trout are typically stocked annually. No state stockings are made into the Middle Branch Reservoir Basin in waters above the Lake Carmel dam. The upper East Branch Reservoir Basin is more widely stocked, with plantings of brown trout and rainbow trout occurring in the Towns of Patterson and Southeast.

Although not stocked, the upper portions of the Middle Branch of the Croton River provides potential trout habitat, and temperature changes to it as a result of storm water runoff from paved surfaces, particularly first flush storm water runoff, could potentially affect the quality of this habitat. This segment of the Middle Branch is classified as C(T) by the DEC, as described in Section 4.6, and consideration must be given to maintaining dissolved oxygen content and moderating stream temperature.

Stormwater management techniques which may be used to limit the temperature rise of runoff water include decreasing retention time and the exposure of the sun to the runoff. Runoff leaving the Patterson Crossing Retail Center site will be conveyed through long sections of underground corrugated pipe prior to discharge to receiving waters. This will allow time for dissipation of collected heat in the water. The drainage into the Middle Branch of the Croton River will come from management structures to be built on the existing north sloping and wooded portion of the property. Stormwater management basins within this drainage will be located so as to minimize the potential for solar heating of retained water and are designed to limit detention times so that standing water has less of a chance to absorb surface heat. By conserving existing forest canopy when possible, stormwater basins in this area will be provided the benefit of shading to reduce the effect of detention period on the warming of runoff water. Additionally, the north slope locations of these basins will serve to reduce the insolation of runoff during detention periods.

As described in the Princeton Hydro report, Lake Carmel currently supports a healthy and diverse warm water fishery, which is not sensitive to small fluctuations in surface temperatures.⁸

Potential for Failure of Detention Pond

Stormwater pond or basin failure is not likely to occur for properly constructed and maintained structures. These structures are typically constructed to have relatively shallow water depths held in below grade basins or in broad, stabilized berms, and engineered, through-bank discharge structures. Embankments of any size must be constructed according to the NYSDEC Guidelines for Designs of Dams. For practically all storm events,

⁸ Princeton Hydro, LLC. 2003. The 2002 Lake Carmel Water Quality Monitoring Report, Town of Kent, Putnam County, New York. Town of Kent, Carmel, NY. 18 pp. plus appendix.

the ponds are oversized, as their total capacity is derived from estimates of extreme flood control needs based on regional 100-year storm data. Additional freeboard height of the berms above the 100-year flood depth is also incorporated into basin sizing. The intent of applying extreme flood control criteria is to prevent the increased risk of flood damage from large storm events and thereby protect the physical integrity of the stormwater management facilities. To control a rainfall event in excess of the greatest design volume of any basin, stabilized spillway structures are incorporated into the berm of each basin. These spillways channel over capacity flows out of a basin and thus act to prevent uncontrolled erosion over the top of a basin berm. Other potential causes of leakage through an earthen berm, such as erosional channeling as a result of animal or plant invasion of the structure, will be monitored for and remediated as part of the long-term maintenance program proposed for the property.

Potential Water Quality Impacts from De-icing Materials

De-icing compounds, particularly salt, can have a negative impact on receiving water quality if used in excess. In most cases, only sand will be used for traction following plowing of the parking areas and access road. In some situations de-icing materials will be used if weather conditions require it, but application will follow strict guidelines.

Because the Middle Branch and East Branch Reservoirs, which receive stormwater runoff from the project site, have been designated as phosphorus restricted by the NYCDEP, the Applicant proposes the use of traction sand, which has a low phosphorus concentration, as the primary winter road safety agent. Due to varying and unpredictable snow and ice accumulations on the traveled surfaces, no specific abrasive sand application rates are proposed. Instead, sand application rates will be dictated by the need to provide safe traveling conditions for the public and emergency vehicles, and by road and parking lot conditions. Traction sand will be applied in accordance with the following specific guidelines excerpted from *Recommendations for Winter Traction Materials Management on Roadways Adjacent to Bodies of Water*, Western Transportation Institute, December 2004.

- The application of sand will be minimized to the extent necessary to ensure that public safety is not compromised;
- Abrasive sands applied to roadways and parking areas will be recovered by street sweeping and snow storage;
- Structural components of the site specific stormwater management plan for the project will be employed to capture abrasive sands before they migrate off-site and into wetlands, watercourses and water bodies.

Increase in Nutrients and other Pollutants Associated with Parking Lot

The inclusion of runoff from impervious surfaces related to roadways and parking lots poses a potential increase in road and vehicle-related contaminants in the stormwater diverted to treatment basins. These include hydrocarbons derived primarily from crankcase oil drippings and uncombusted exhaust hydrocarbons. Roadway runoff may also typically contain detectable levels of heavy and trace metal contaminants such as lead, zinc, copper, chromium and nickel, which usually result from automobile and truck traffic. The preliminary SWPPP, which incorporates many of the recommendations and guidelines established by the NYSDEC, incorporates a combination of vegetative filtering, infiltration, and stormwater detention to filter, adsorb and dilute these potential pollutants.

Future Monitoring of Basins and Stormwater Discharged From Site

Each swale and basin, when stabilized, is designed to allow for sediments to accumulate for a period of 10 to 20 years before the functional capacity of the structure will be impacted. Sediment removal at this time will restore the structure to its original over-design capacity. Entry to the basins for performing scheduled maintenance activities will be through stabilized basin accesses. The basin accesses, grass swales, and the side slopes and berms of the basins will be mown annually to prevent the establishment of woody plants within these areas.

During construction, all basins and sedimentation and erosion controls must be inspected on a weekly basis, in compliance with GP-02-01. Monitoring reports will be left at the site construction trailer for inspection and will be forwarded to the local jurisdictions if requested. Inspections will also occur on a random basis following any storm event that produces more than 1/2 inch of precipitation. These inspections include observation of storm water leaving the site.

Geomorphic Assessment

As described in Appendix J of the New York State Stormwater Design Manual, channel stability can be determined using a rapid geomorphic assessment (RGA) of the channel downstream of the outlet of a proposed stormwater management pond. The RGA protocol involves the identification of the presence of in-stream features resulting from a variety of geomorphic processes to provide a semi-quantitative assessment of a streams stability and mode-of-adjustment. As noted in section 4.5.3 herein, the criteria for conducting a geomorphic assessment are not met. As such, that analysis is not required for this project. . Further, pursuant to New York State standards, 24 hour detention of the post development discharge from the 1 year, twenty four hour storm event has been provided as channel protection. Finally, it is recommended that 12-hours of detention time be provided when discharging to a protected trout stream.

Mosquito Control in Stormwater Basins

Swales and detention basins will not retain standing water for intervals much more than 24 hours, thus preventing their use by mosquitos or other aquatic species which utilize standing bodies of water for completing their life cycles. Wet ponds will retain pools of standing water, which may persist long enough to be populated by a variety of local aquatic species, including mosquitoes. This condition is typical of many stormwater management structures throughout southeastern New York. Natural mosquito control can be built into the final design of the wet basins on the site. Patterson Crossing Retail Center basins will be landscaped to encourage use by a variety of wildlife. Generally, such larger sized intermittent ponds are colonized by balanced communities of species, including both predator and prey organisms, and this balance results in natural control of nuisance insects to the extent possible.

Off-site Road Improvement and Stormwater Practices

Off-site road improvements will be made to widen NYS Route 311 to provide the traffic safety measures necessary for the development of the proposed primary access road onto the site. As detailed in Section 4.5.1, the existing drainage pattern for this roadside area

flows through a collection system of swales and drainage pipes which drain west along the southern side of NYS Route 311. This pipe/swale system ends abruptly approximately 200 feet from the Middle Branch of the Croton River to form an open watercourse running parallel to Route 311 prior to discharging at bankside into the river.

It is proposed to replace the existing pipe system extending west from the area of the project access road to the bank of the Middle Branch of the Croton River. The bankside discharge point will be improved by the installation of a stable discharge structure and apron. This proposed pipe system will be sized to safely convey the discharge from both the proposed stormwater detention basins on the project site and the roadside runoff from NYS Route 311.

4.5.4 Proposed Mitigation Measures

Stormwater Pollution Prevention Plan

New York State and NYCDEP standards require an analysis of pre- and post-construction water quality to determine if mitigation measures are required to deal with the 90th percentile and 2 year twenty-four hour storm events, respectively. Further, State standards require water quality analyses to determine if mitigation measures are required for the 1, 10, and 100 year, twenty-four hour, storm events. An “analysis” of the twenty-five year, twenty-four hour storm event is also required by NYCDEP. Mathematical analyses of these storm events substantiating that water quality impacts would be satisfactorily mitigated are provided in the preliminary SWPPP developed for the proposed action (Appendix F). As noted, the City Watershed Regulations, require that a SWPPP developed for a project in a phosphorous restricted basin must include an analysis of pre- and post-construction phosphorus concentrations in stormwater runoff, and include measures to capture and treat runoff from a 2-year, 24-hour storm event.

The preliminary SWPPP has been developed to assure that the characteristics of pre- and post-construction stormwater runoff are not significantly altered. The plan manages post-development runoff to provide a zero percent increase in the peak rates of discharge in each affected sub-basin of the Croton Reservoir Basin. Significantly, the plan provides stormwater improvements which are designed to create an overall reduction of any increase in the total phosphorus and suspended solids loads in the runoff discharging to the receiving reservoir basins, thereby contributing to mandated TMDL reductions in these pollutants from the towns. Section 2.2 of the SWPPP includes calculations demonstrating that the detention pond components of the proposed stormwater management system meet the treatment requirements of the NYSDEC design manual.

The state (NYSDEC) and city (NYCDEP) standards require stormwater mitigation measures for stormwater runoff quality and quantity. The state standards for stormwater runoff quality mitigation require the treatment of the water quality volume (WQv) as calculated per the NYSDEC design manual. The stormwater practices on the site have been designed in accordance with the sizing criteria for treatment of the WQv per the design manual. In addition to the state stormwater quality mitigation, 24-hour plug flow detention has been provided in all of the proposed stormwater basins to meet the NYCDEP stormwater quality requirements. The state standards for stormwater runoff quantity include the 24-hour center of mass detention for the 1-year 24-hour design storm, in addition to the attenuation of the peak flows in the post development condition to pre development levels for the 10-, and

100-year 24-hour design storms. The NYCDEP standards for quantity mitigation require mitigation of the peak flows for the 2-, 10-, 25-, and 100-year 24-hour design storms. Mathematical analyses substantiating that the water quality and quantity would be satisfactorily mitigated are provided in the preliminary SWPPP developed for the proposed action (Appendix F)

The preliminary SWPPP includes a site specific erosion and sediment control plan which identifies the program developed to minimize erosion and sedimentation during all phases of construction. The erosion and sediment control plan also provides details and notes associated with the implementation and maintenance of short and long term erosion control measures. Regular, routine attention will be given to monitoring, assessing, and, if needed, reestablishing seeded vegetation in the extended detention basins over the initial year to ensure that the most adaptable species within each basin will become established.

The stormwater management facilities and BMPs documented in the preliminary SWPPP and the sediment and erosion control plan, which require review and approval by state and city agencies, have been designed and selected to ensure that the project has no impact on Lake Carmel, the Middle Branch Reservoir, or the East Branch Reservoir.

Use of Low Impact Development Techniques (LID)

Low Impact Development (LID) materials and methods are incorporated as part of a comprehensive approach to stormwater management. LID techniques can be used to address a wide range of wet weather flow issues, including those associated with SPDES stormwater permits, TMDL limits, non-point source program goals, and other specific water quality standards. General LID management practices are typically addressed by consideration of a spectrum of build-out alternatives, including the use of bioretention (e.g. grassed swales and vegetated basins), permeable pavements, water harvesting, soil amendments, structural soils, and adaptive road design. Aspects of LID inspired techniques considered for this project are discussed below. These LID measures were not considered in the stormwater management calculations, resulting in projections that are conservative when these other factors are considered.

Use of Runoff Collected from Building Roofs

Rainwater runoff from the two most expansive roofs adjacent to the proposed garden center would be collected in bulk storage tanks for use as irrigation or plant nursery watering. The combined surface areas of these two roofs is approximately 6.43 acres, and the roofline runoff system proposed will supply an estimated volume of 10,000 gallons of usable irrigation water per inch of rainfall. Utilization of this runoff source will serve to reduce overall site runoff volume. Runoff will be collected in a 10,000 gallon subsurface tank, and used for irrigation at the proposed garden center. Excess stormwater will be conveyed via an overflow pipe to the stormwater management basins. In drought conditions, water from the proposed water supply system will be used to keep this irrigation tank full.

The use of multiple, decentralized swales, detention basins, and recessed parking area islands will increase the flow path and retention time for stormwater deposited on the site. This process will decrease site runoff by maximizing the infiltration, evaporation, and transpiration of stormwater.

Runoff Reduction from Parking and Roadway Areas

Runoff controls throughout the site will be directed to reducing the magnitude of runoff wherever practicable. Controls to be instituted include porous pavement surfaces and below grade traffic islands and runoff strips to increase local infiltration rates.

Permeable pavement structures such as sand-set paving blocks will be incorporated for a portion of the parking areas. Location of these surfaces and determination of areal coverage for each location will be dependent on final grading plans for each parking area.

Certain roadway islands constructed to control traffic flow patterns will be designed to be below local grades, which will allow them to capture a portion of the immediate runoff. Larger roadway islands will have additional flow input from catch basins situated at more distant areas of the roadway. These islands will be grassed, to provide for immediate infiltration of a portion of the inflow. Overflow inlets situated at low points within each island will collect excess inflow for conveyance to the larger project stormwater management basins.

Stormwater Treatment from Adjoining Residential Areas

As discussed in Section 4.5-3, the stormwater from Concord Road that flows onto the site will be collected and treated with detention pond structures prior to discharge into the Middle Branch of the Croton River. This improvement will eliminate an existing sediment and pollutant loading problem, and is expected to contribute to a reduction in sediment loading to Lake Carmel.

Stabilize Existing Stream Bank Erosion Problems

As discussed in Section 4.5-3, the preexisting stream bank erosion which extends from alongside Concord Road down slope to the point of flow into the Middle Branch of the Croton River will be repaired and stabilized. Additionally, a stable discharge structure will be installed at the Middle Branch of the Croton River for controlled release of this flow into the river.

Soil Erosion Control Measures and Construction Phasing Plan

Both temporary and permanent erosion control facilities and activities will be applied over the duration of project related activities on the site. Implementation of the soil erosion control plan will be based on the latest New York State Guidelines for Urban Erosion and Sediment Control (Empire State Chapter of the Soil and Water Conservation Society).

A draft plan for phasing and sequencing of site construction has been prepared and is submitted with the DEIS plan set. Overall, a total of thirteen phases are proposed in sequence, from initial construction of temporary sediment basins and upgrading the existing gravel road to the completion of the proposed subsurface wastewater treatment system. Each phase will stand alone with regards to erosion controls, use of best management practices and site stabilization. This plan, as prepared, is intended to meet the requirements of the NYS General Permit and NYCDEP permitting.

In general, the following temporary methods and materials will be used to control erosion from the project site:

- Stabilized construction entrances
- Diversion swales and Water bars
- Silt fence barriers
- Stone check dams
- Storm drain inlet protection
- Sediment basins

In accordance with the Town of Patterson requirements, temporary or permanent stabilization must be accomplished no more than seven days after construction activities have temporarily or permanently ceased. The use of a planned sequence of phased construction activities across the site will limit the maintenance requirements for temporary facilities during the construction phase.

Permanent methods of erosion control will be accomplished by diverting stormwater runoff from steep slopes, controlling or reducing stormwater runoff velocities and volumes, and installing vegetative and structural features which will act to stabilize soil surfaces. All of the permanent facilities will be selected from options which feature low-maintenance requirements and long-term exposure stability. Basin and swale BMP features are manmade and the result of years of engineering research and design as well as actual in-situ case histories. They function as “natural” removal systems which are featured to blend into the other proposed landscaped and natural features of the property.

The Applicant will be responsible for ensuring all stormwater management practices are adhered to and stormwater controls are properly maintained. Responsible parties for the implementation and maintenance of each of the erosion control measures and stormwater facilities will be specifically identified and documented prior to construction activity. The NYCDEP also requires, as part of the SWPPP, a maintenance program to ensure long term operation of the SWPPP.

4.6 Wetlands, Streams and Water Bodies

4.6.1 Existing Conditions

Wetlands

Following the review of available state, federal and county mapping, the Patterson Crossing Retail Center property was surveyed by wetland specialists from Tim Miller Associates, Inc. in the Spring of 2005. New York State Department of Environmental Conservation (NYSDEC) Freshwater Wetlands and US Fish and Wildlife Service (USFWS) National Wetland Inventory maps are shown on Figures 4.6-1 and 4.6-2 respectively. One wetland was identified that would be regulated by the Town of Kent and the US Army Corps of Engineers (USACE) and is labeled as Wetland A. This wetland, which measures 0.52 acres in size, is located adjacent to the Middle Branch of the Croton River, in the northwest corner of the project site. No NYSDEC regulated wetlands are mapped by the state or were observed during the survey.

The applicant has not contacted the USACE for a jurisdictional determination (JD) for this site. Due to a heavy work load, the USACE does not currently require JD's for projects where no impact to wetlands are expected. At some point, based on USACE feedback to the DEIS process, the applicant may need to provide data sheets and other documentation to the agency to support these conclusions. This information is provided with this DEIS in Appendix P.

Wetland A (0.52 acres) is located at the toe of the slope along NYS Route 311, upgrade from the Middle Branch of the Croton River in the Town of Kent (Figure 4.6-3, On-site Wetlands). This wetland collects stormwater runoff from the adjacent slope to the south in a broad flat area, resulting in a well developed wooded swamp with hydrology that is drawn down over the growing season. There is some overbank flooding from the Middle Branch of the Croton River so that in large storms this wetland area is likely inundated. Additional hydrology is provided by an intermittent watercourse which surfaces in the middle of the slope upgradient of the wetland. This watercourse, flagged by the New York City Department of Environmental Protection as "NYC-A", flows in a northwesterly direction into the wetland. The Town of Kent regulates activities within and adjacent to Wetland A under Chapter 39A of the Town Code.

Vegetation in the wetland is dominated by red maple, American elm and occasional green ash in the canopy. Spicebush, witch hazel and winterberry holly are common shrubs species. Common herbaceous species include Virginia creeper, skunk cabbage, poison ivy, tussock sedge, cinnamon and sensitive fern and jack in the pulpit. Soils are rocky Ridgebury soils as indicated in the Soil Survey of Putnam and Westchester Counties (USDA, 1994).

The small size of Wetland A and its proximity to NYS Route 311 limits its value as habitat for wetland dependent species. The presence of fresh water in the Middle Branch does attract small mammal species, including raccoon, opossum, woodchuck and a variety of rodent species. Green and pickerel frogs are likely to utilize the banks of the river for habitat as well. Northern water snake (*Nerodia sipedon*) is a likely reptile species in and near the water.

Based on site reconnaissance and site walks by the Town Environmental Conservation Inspector, there are no wetlands on the Patterson portion of the property that meet the

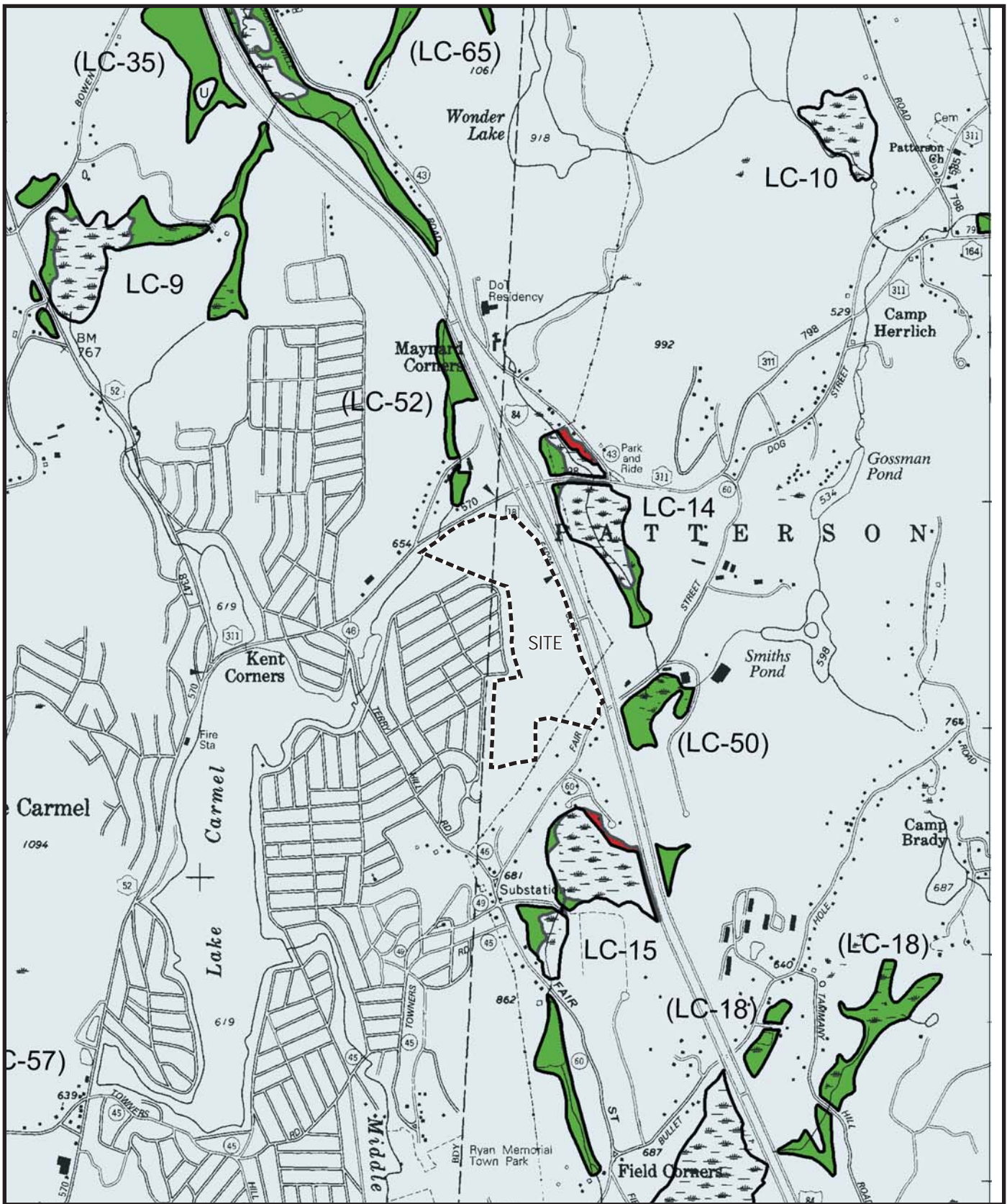
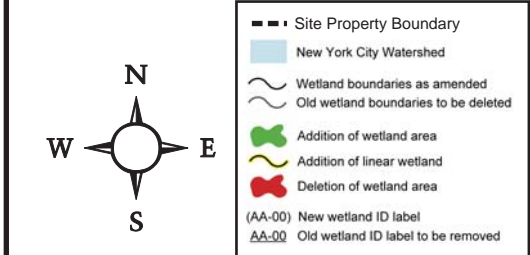
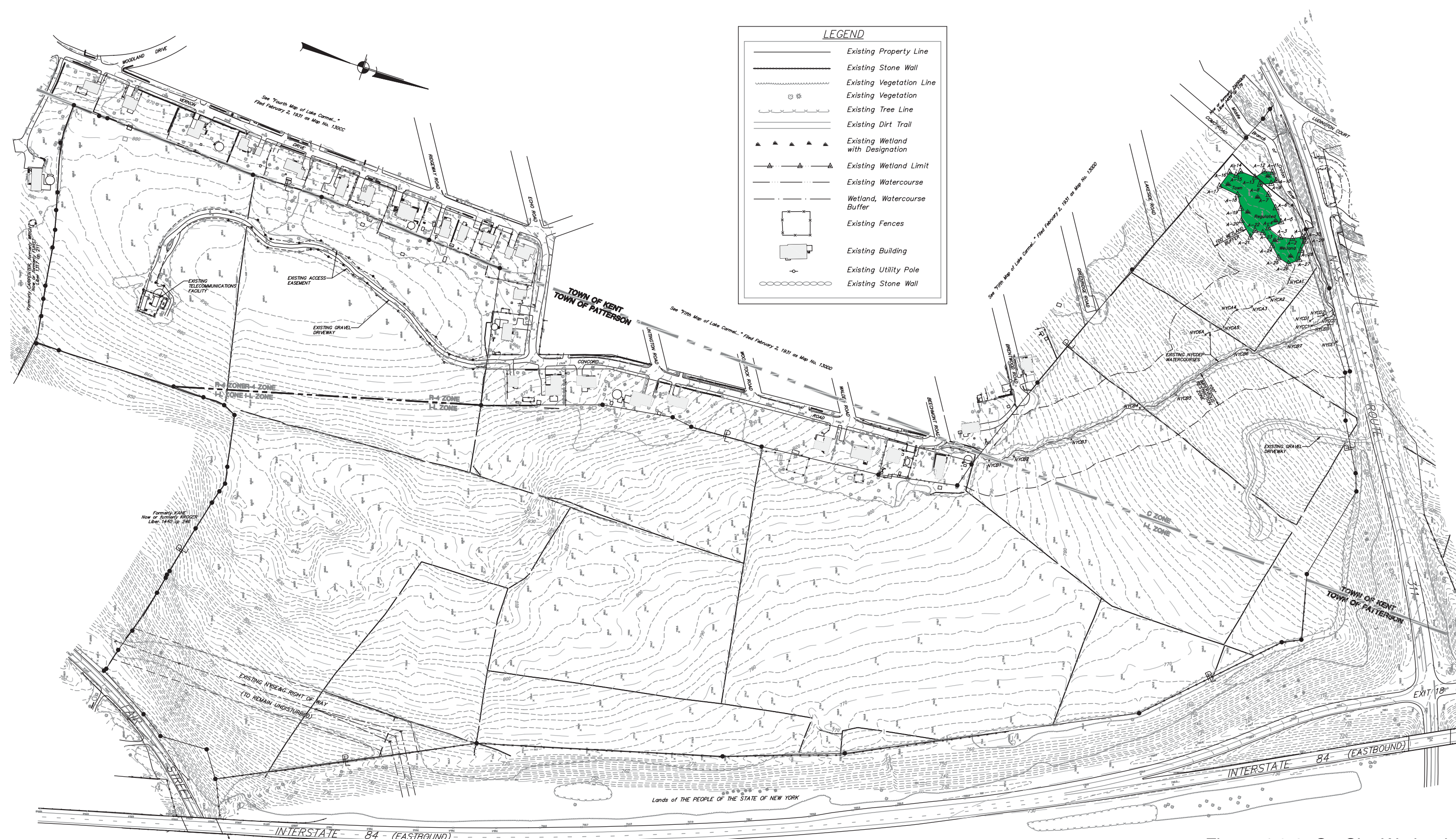


Figure 4.6-1: NYSDEC Freshwater Wetlands Map (Proposed 2005)
 Patterson Crossing Retail Center
 Town of Patterson and Town of Kent
 Putnam County, New York
 Source: New York State Dept. of Environmental Conservation
 Scale: 1 inch = 2,000 feet





LEGEND

	Existing Property Line
	Existing Stone Wall
	Existing Vegetation Line
	Existing Vegetation
	Existing Tree Line
	Existing Dirt Trail
	Existing Wetland with Designation
	Existing Wetland Limit
	Existing Watercourse
	Wetland, Watercourse Buffer
	Existing Fences
	Existing Building
	Existing Utility Pole
	Existing Stone Wall

Figure 4.6-3: On-Site Wetlands
 Patterson Crossing Retail Center
 Town of Patterson and Town of Kent,
 Putnam County, New York
 Source: Insite Engineering, Surveying & Landscape Architecture, P.C
 Scale: 1 inch = 275 feet

criteria of Chapter 154 of the Patterson Town Code. There is an off-site NYSDEC wetland (LC-14) located approximately 800 feet to the east of the project site. The slope of the land runs generally from the project site down toward this wetland, however the Interstate 84 corridor intervenes between the site and the wetland, and presently all runoff from this slope is redirected southward along the highway to an unnamed wetland southeast of the interstate. This unnamed wetland also receives drainage from NYSDEC Wetland LC-14. The unnamed off-site wetland drains into an unnamed secondary tributary of the East Branch of the Croton River.

Streams

The Middle Branch of the Croton River flows along the northwest edge of the site, parallel to NYS Route 311. The river enters the site via a culvert under NYS Route 311. The width of the channel at the road crossing is constricted to approximately 12.5 feet. Above and below this crossing, a wider stream channel is maintained by the river flows. Presently, a section of highly eroded stream bank exists where an unregulated surface discharge of stormwater runoff from Concord Road, above the proposed project site, enters the river.

Seasonal flow variations

The United States Geological Service (USGS) maintains a gauging station on the Middle Branch Croton River at a location downstream of the Lake Carmel dam. Comparable USGS gaging station information is not available for the East Branch Croton River due to the absence of any monitoring station similarly near to the project site.

The initial downstream USGS gaging station (Station No. 0137449480) on the East Branch Croton River is located at County Road 65 (Putnam Lake Road), at a distance of approximately nine miles downstream of the project site, represents the combined flow from the upper 62.1 square miles of the watershed drainage, including the flows through the contributory areas (approximately 70 acres) of this site. The intervening watershed consists primarily of The Great Swamp (NYSDEC Wetland DP-22), an extensive area of wetlands that significantly moderates flows in the East Branch drainage. As a result of the location of the Great Swamp, between the project site and the USGS gaging station, any variation of flow of water from the site would be negligible at the station.

The initial downstream gauging station on the Middle Branch of the Croton River is more proximate to the site, located below Lake Carmel 1.8 miles downstream of the Lake Carmel dam. This station, designated as 01374654, represents the combined flow from the upper 13.7 square miles of the watershed drainage, including the flows through the contributory areas (approximately 20 acres) of this site and would be more influenced by both pre- and post-development runoff patterns from the site than the distant station on the East Branch.

Representative annual mean stream flow at the Middle Branch station, over the period 1996-2002, has ranged from 15.6 to 44.9 cubic feet per second (cfs). Average annual mean stream flow was approximately 24 cfs. Monthly mean stream flows over the same period have ranged from a low of 5.4 cfs in the month of August to a high of 43.4 cfs in the month of March. Annual (water year) peak stream flows at this gauging station are highly variable and have been observed in all seasons over the representative eight data years. This data is presented in Table 4.6-1.

Table 4.6-1 Annual Peak Streamflow Below Lake Carmel Dam		
Water Year	Month	Streamflow (cfs)
1996	January	428
1997	November	220
1998	May	159
1999	September	758
2000	October	125
2001	October	164
2002	June	178
2003	March	243

The reach of the Middle Branch in the vicinity of the project site is not stocked with trout by the state stocking program. The existing uncontrolled runoff of silt and other sediments into this section of the river from the highly eroded stream channel described above is likely limiting trout use in this section of the river.

NYSDEC Classification

The NYSDEC (NYSCRR Part 701.9) classifies waterbodies, including streams, statewide for best usage and water quality standards. The highest value streams are assigned "Class AA" water bodies and the lowest "Class D". Additionally, water bodies which may support trout, or trout spawning, are further noted with a "T" or "TS" designation, respectively. A demonstrated ability to support trout is also an indicator of good water body health and water quality conditions.

The headwater stream of the Middle Branch of the Croton River drains from Stump Pond (Drew Lake) and transects the northwestern most corner of the property prior to entering Lake Carmel. This portion of the Croton River drainage (H-31-P44-23-P59-6) is classified by the NYSDEC as Class C(T). Waters classified as C(T) or higher are regulated under Article 15 Protection of Waters section of the State's Environmental Conservation Law. Activities within the bed and banks of a C(T) stream would require review and approval of the NYSDEC. Below Lake Carmel, the river's designation remains C(T).

The best usage identified by the NYSDEC for a Class C(T) stream is fishing. The water quality for Class C(T) streams shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes. Special consideration is taken for projects along C(T) streams to maintain cool stream temperatures and high dissolved oxygen content (to support trout populations).

Lake Carmel receives stream input from several small drainages, including the headwater stream described above. Lake Carmel is classified by the NYSDEC as a Class B water. NYSCRR Part 701.9 defines the best usage of Class B waters to be primary and secondary

contact recreation and fishing. It further states that these waters shall be suitable for fish propagation and survival.

As mentioned above, drainage off-site to the East Branch of the Croton River is initially into an unnamed wetland east of the Interstate 84 corridor. This wetland broadens out downstream of a Class D headwater drainage of the Muddy Brook and NYSDEC Wetland LC-14. The brook retains a Class D designation until several miles downstream where it enters into a Class C(T) section of the East Branch of the Croton River.

The best usage assigned to Class D streams is fishing. These streams are considered suitable for fish survival, but not fish propagation. The NYSDEC regulations require the water quality of Class D streams be suitable for primary and secondary contact recreation, but allowance is made for other factors which might limit the use of these streams for such recreation purposes.

There are no other NYSDEC classified streams on the project site.

In addition to the on-site wetland described above there are five watercourses on the property in the Town of Kent that have been delineated by the NYCDEP (Watercourses NYC-A, NYC-B, NYC-C, NYC-D and NYC-E). These watercourses drain off of the property in the northwest corner towards NYS Route 311 before entering the Middle Branch of the Croton River. One of these watercourses (NYC-B) carries stormwater runoff from the Concord Road neighborhood to the south, conveying flows from south to north across the northwest portion of the site. Channel characteristics of this watercourse are described in greater detail below.

Watercourse NYC-B is the largest of the intermittent channels, and flows northwesterly across the Kent portion of the project site. When the flows reach the northerly property boundary, they combine with roadside runoff from NYS Route 311 and Interstate 84 (NYC-E) prior to discharging into the river. Much of this watercourse flows through a highly eroded channel on the hillside between Concord Road and the Middle Branch of the Croton River. The channel is formed in sandy loam subsoils with occasional cobbles and few meanders. Deepening of the channel due to high water flow velocities in this straight stream segment continues to be a problem. Erosion of this channel has resulted in the uncontrolled deposition of substantial quantities of untreated runoff and associated nutrients into the river just upstream of Lake Carmel. Scouring of the channel by high velocity water flows results in the removal of any accumulated organic matter thereby eliminating the potential for this channel to support much biologically.

At the northern end of NYC-B, two groundwater discharge points were also observed which create shallow channels (NYC-C and NYC-D) on the western side of NYC-B. These short, shallow segments which have formed in existing surface cobbles, merge into NYC-B approximately 250 feet east of the Middle Branch culvert under Route 311.

NYC-A is a shallow channeled stream segment that extends approximately 350 feet up grade of where it meets Wetland A. The channel for NYC-A is generally well-defined as a surface feature within the stony surface of the slope. NYC-A collects surface runoff from the portion of the slope west of NYC-B, and without the point source of collected runoff from Concord Road has not developed the deeper cut channel or high water flow velocities of NYC-B. Flows in this channel are generally from surface runoff and snow melt, but some seasonal

groundwater discharge has been observed. The conveyed water flows in NYC-A provide a significant amount of the hydrology to the eastern end of Wetland A.

Due to the lower velocity water flows and existence of accumulated organic matter, including live plants, watercourses NYC-A, NYC-C and NYC-D support a limited macroinvertebrate community that form part of the food web within this segment of the Middle Branch Reservoir watershed

Floodplains

The Federal Emergency Management Agency's Flood Insurance Rate Maps (FIRM, Community Panel 3606710004B) show that the only portion of the project site located within the 100 year flood zone is the short stretch of the Middle Branch of the Croton River that crosses the northwest portion of the property. A narrow band of mapped flood zone occurs along this water course, with a mapped base flood elevation varying from 631 to 635 feet (Figure 4.6-4, FEMA Floodplain Map). This floodplain area is tightly confined within the existing stream channel. No other mapped floodplain areas are identified on any other portion of the project site.

Water Bodies

Lake Carmel receives inflow from the reach of the Middle Branch of the Croton River immediately downstream of the project. The lake supports a warmwater fishery of local recreational interest. Lake waters are typically shallow and unstratified, with a maximum depth of approximately 15 feet¹ and a surface of about 218 acres. Due to this shallow and broad topography, seasonal increases in water temperatures can be expected to occur between the inlet at the Middle Branch of the Croton River and the discharge at the lake dam. Representatives of 18 fish species have been collected from the lake. The NYSDEC last sampled this lake during 1962, when survey by gillnet and trap net yielded 13 species: largemouth bass, yellow perch, white perch, black crappie, brown bullhead, yellow bullhead, bluegill, pumpkinseed, rock bass, chain pickerel, white sucker, golden shiner, and killifish. An electrofishing survey conducted during 2002 collected many of these warm water species, but also added several newly observed species, including smallmouth bass, longear sunfish, alewife, American eel and the exotic grass carp (*Ctenopharyngodon idella*). The fish population within Lake Carmel can be considered to be typical for a small warm water lake.

The grass carp resident in the lake had been stocked by the Town of Kent in 1999 as part of a program to control the excessive growth of submerged aquatic plants. The use of genetically sterile grass carp for controlling aquatic weeds is a state permitted activity, under the control of the NYSDEC.

A lake ecological assessment survey was conducted for the Town of Kent in 2002 as part of its ongoing monitoring of its NYSDEC regulated grass carp stocking permit.² The study assessed town efforts to control aquatic weeds as well as phytoplankton and blue-green algae blooms which occur within the lake. At that time, lake conditions persisted which favored the development of large blooms of nuisance blue-green algae species in late summer and early fall. Results of the study indicated that the introduced carp had an

¹ Mr. Ron Pierce, NYSDEC Region 3, telephone interview. May 9, 2005.

² Princeton Hydro, LLC. 2003. The 2002 Lake Carmel Water Quality Monitoring Report, Town of Kent, Putnam County, New York. Town of Kent, Carmel, NY. 18 pp. plus appendix.

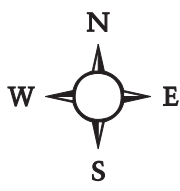
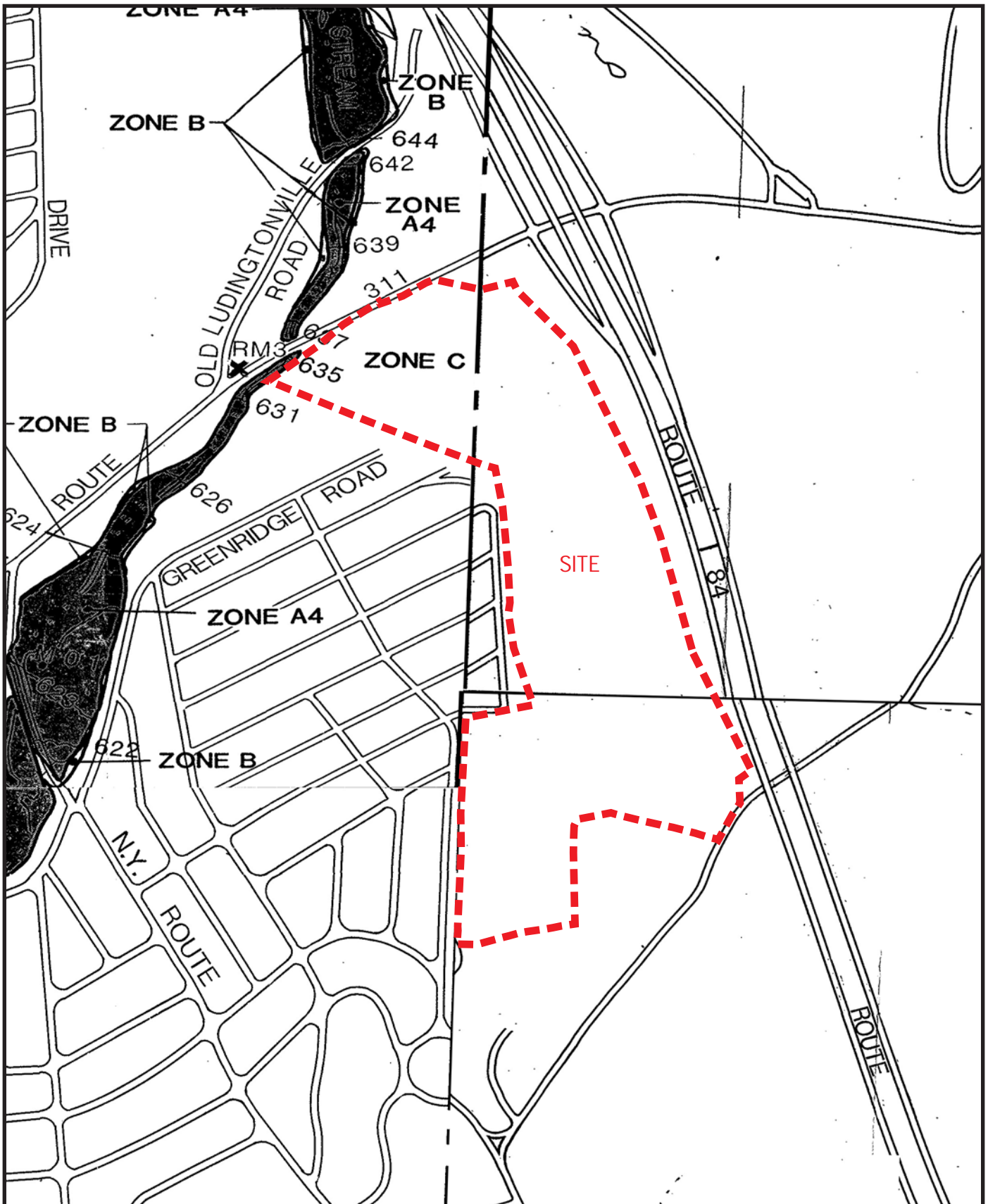


Figure 4.6-4: FEMA Floodplain Map
 Patterson Crossing Retail Center
 Town of Patterson and Town of Kent,
 Putnam County, New York
 Source: Federal Emergency Management Agency
 Scale: 1 inch = 800 feet

observable effect towards reducing the number of rooted plant beds but not altering species dominance patterns within the lake.

Coontail (*Ceratophyllum demersum*) and elodea (*Elodea canadensis*) were the two dominant submerged aquatic plants observed within the lake in 1999 and 2002 surveys. Minor constituents of this plant community were: naiad (*Najas* sp.), sago pondweed (*Potamogeton pectinatus*), Eurasian water milfoil (*Myriophyllum spicatum*), and northern water milfoil (*M. sibiricum*).

The Putnam County Department of Health (PCDOH) tests the water quality at five public beaches at Lake Carmel approximately six to eight times during the summer months. The County testing program documents fecal coliform and total coliform levels. According to the PCDOH, there have been no beach closures in the past eight to ten years due to elevated levels of fecal coliform or total coliform.

The NYCDEP has a water quality sampling location on the Middle Branch of the Croton River between Lake Carmel and the project site (Figure 4.5-1). An overview of data collected at this station is presented in Section 4.5.1.

A water quality improvement project was conducted in 2004-2005 to replace the storm drains and pipes on Barrett Hill and Clarkson Roads and install a water quality unit prior to discharge at the western shoreline of Lake Carmel. Existing discharges had deposited sediment loads into the lake at these two points which had caused substantial shoaling in and around the areas of town bathing beaches. The stormwater quality units installed can separate the silt and sediment load from design capacities of 16,000 gallons of water for each unit. These units also function as hydrodynamic separators that separate oils and floatables from the stormwater. The money to fund this project came from the NYCDEP watershed agreement with Putnam County.

4.6.2 Future “No build” Conditions

Under the “No Build” condition, the wetland, streams and water bodies would not be subject to stormwater runoff generated by the project, but would continue to be subject to unmanaged flows from the Concord Road runoff. This runoff will continue to carry eroded sediments into the on-site wetland and the Middle Branch of the Croton River.

4.6.3 Future Conditions with Project

Disturbance to Town and Federally Regulated Wetlands in Connection with Stormwater Discharge

The wetland area that is regulated by the Town of Kent and the US Army Corps of Engineers (USACE) is isolated from most site activities, and would not be impacted directly by construction. No activities are proposed within the 100-foot Town wetland buffer; therefore no wetland permit will be required from the Town of Kent or from the USACE. Nearby earth movement could potentially cause siltation of the wetland if uncontrolled, but this is considered in the proposed sediment and erosion control plan. Only treated stormwater discharges would be directed toward the wetland.

Potential Alteration of Natural Hydrology of Wetlands on the Site

Implementation of the project's preliminary SWPPP would act to prevent high volume runoffs through the existing wetland on the site by diverting surface flows from them by capturing and detaining these flows during high rainfall events. However, as shown on the plan, set flow paths will not be altered and the discharged stormwater will be conveyed through an existing watercourse to the wetland.

Additionally, by providing controlled flow discharge points into the Middle Branch of the Croton River, project improvements would act to eliminate future erosion of bankside wetlands by such uncontrolled flows. This area of the site has already been impacted by sedimentation caused by the erosion of the existing watercourse from Concord Road. The proposed capture and treatment of those flows will represent a positive impact to the wetland system and adjacent buffer by eliminating the source of sedimentation. No activities are proposed within the bed and banks of the Middle Branch, thus no Article 15 permit would be required from the NYSDEC.

Potential Impacts to Wildlife

Section 4.7 discusses potential project impacts to wildlife.

Potential Changes to Existing Streams on the site

With the exception of stream channel improvements proposed for the intermittent stream which drains from Concord Road, no changes are proposed to existing streams on the site.

Effect on Water Quality of Lake Carmel

The Applicant is sensitive to the need to maintain the water quality of Lake Carmel. An analysis of drainage of stormwater runoff reveals that 19 percent of all impervious surfaces on the site will drain toward Lake Carmel. This runoff will be intercepted and treated by the stormwater management systems which will be installed on site.

A report prepared by the NYSDEC in 1999 included an inventory of waterbodies and considered existing impairments. Lake Carmel (DEC Index no. H-31-P44-23-P59-6-P62a) was listed as being impaired for public bathing due to high nutrients (particularly phosphorus), with the suspected source being the "failing and/or inadequate on-site septic systems serving many homes along the lake shore and from other runoff from urban/suburban development in the watershed" (DEC, 1999, Putnam County WQCC, 1996).

Lake Carmel supports a warmwater fishery which is unlikely to be adversely affected by the measures instituted to protect the existing coolwater thermal regime of the Middle Branch of the Croton River from stormwater runoff impacts of the project. The stormwater quality features that are incorporated into the preliminary Stormwater Pollution Prevention Plan (Appendix F) will prevent nutrient loading and other water quality impacts to Lake Carmel.

While the Applicant is not in a position to address the issue of failing septic systems, the project sponsor proposes to repair the channel receiving runoff from Concord Road. Repair to this highly eroded channel will minimize future transport of eroded sediments to the Middle Branch of the Croton River and ultimately to Lake Carmel. It is proposed to pipe the

discharge from Concord Road to a proposed "pocket pond" (P-5) for treatment. From this pocket pond, flows will be diverted back to a surface watercourse at non-erosive rates, which will provide further aeration and opportunity for biological activity prior to discharge into the Middle Branch of the Croton River.

This proposal will contribute to a significant reduction in the sediment load entering the Middle Branch of the Croton River and ultimately Lake Carmel, and a decrease in the nutrient load from this portion of the watershed. Because phosphorus is known to adhere to sediment particles and fine particulates, any decrease in the load of sediments to the lake will have some positive impact on Lake Carmel water quality. Conditions that may be contributing to elevated phosphorus levels, such as failing or undersized septic systems around Lake Carmel, combined with surface runoff and re-suspended sediments, persist.

4.6.4 Mitigation Measures

Stormwater mitigation measures which would act to protect and preserve the wetland, streams and water bodies down gradient of the project site are presented in the Surface Water Chapter (4.5) of this document. Potential stormwater impacts which are addressed by the proposed mitigation techniques discussed in Section 4.5.4, Proposed Mitigation Measures, herein include thermal impacts, water quality, nutrient runoff, stormwater erosion and wetland plant community alteration. Because no direct impacts to the wetland will result from the project, physical expansion or replacement of wetland areas is not proposed.

4.7 Vegetation and Wildlife

4.7.1 Existing Conditions

Existing Vegetative Cover

The project site consists almost entirely of successional deciduous woodland with limited brushlands as shown on the aerial photograph provided in Figure 4.7-1, Aerial Photograph of Project Site. There is one small wetland regulated by the town of Kent that is located on the northern portion of the property near the site boundary with NYS Route 311.

The presence of stone walls on the project site indicates that the site supported farming activity, presumably grazing, in the past. The vegetative community supports a three strata system dominated by a canopy layer of medium size trees (<15" to 20" diameter at breast height (dbh)), an understory of shrubs, and a ground level layer of herbs. It is estimated that the older observed trees in this community type range from 40 to 50 years of age. Overall, the site vegetation appears to be healthy and productive. The dominant vegetative species are identified below. Species abundance appears to be typical for a second growth upland community. The understory is generally more open in the interior of the site and denser near the site boundaries. The majority of the site has a well developed tree canopy.

A mix of predominantly deciduous tree species occurs on the project site, and includes: black cherry (*Prunus serotina*), eastern cottonwood (*Populus deltoides*), red oak (*Quercus rubra*), white oak (*Quercus alba*), bur oak (*Quercus macrocarpa*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), sycamore (*Platanus occidentalis*), shagbark hickory (*Carya ovata*), black birch (*Betula lenta*), tulip tree (*Lireodendron tulipifera*), American elm (*Ulmus americana*) and American beech (*Fagus grandifolia*). Evergreen trees observed on the project site include white pine (*Pinus strobus*) and hemlock (*Tsuga canadensis*).

The shrub layer on the majority of this site is sparse due to dense tree canopy, and consists primarily of younger saplings of the tree species identified in the preceding paragraph, as well as shrub species and vining and cane species. Besides tree saplings, this understory layer includes the following species: spice bush (*Lindera benzoin*), multiflora rose (*Rosa multiflora*), barberry (*Berberis sp.*), brambles (*Rubus sp.*), poison ivy (*Toxicodendron radicans*), fox grape (*Vitis labrusca*), honeysuckle (*Lonicera sp.*), and bittersweet (*Celastrus scandens*).

Herbaceous plants observed at the project site include the following species: Christmas fern (*Polystichum acrostichoides*), garlic mustard (*Alliaria petiolata*), goldenrod (*Solidago sp.*), pokeweed (*Phytolacca americana*), wild lettuce (*Lactuca sp.*), barren strawberry (*Waldsteinia fragarioides*), common mullein (*Verbascum thapsus*), soft rush (*Juncus effusus*), fringed sedge (*Carex crinita*), and tussock sedge (*Carex stricta*).

Natural habitat in the surrounding properties is limited. Medium density residential development exists to the west, and the Interstate 84 corridor is to the east. The adjacent land to the north and south is not densely developed and appears to consist of habitat similar to the project site, with the exception of existing development along road frontage. The largest nearby natural area is Wonder Lake State Park, a 575+ acre park approximately one mile to the northeast of the project site and on the opposite side of Interstate 84.

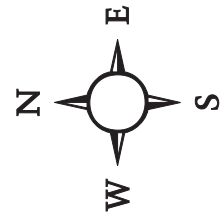


Figure 4.7-1: Aerial Photograph of Project Site
Patterson Crossing Retail Center
Town of Patterson and Town of Kent,
Putnam County, New York
Source: NYS GIS Clearinghouse, 2004 Aerial
Scale: 1 inch = 560 feet

Existing Wildlife

The woodlands provide wildlife habitat for a number of common species, including deer, raccoon, opossum, chipmunk, gray squirrel and others. Bird species that selectively reside within tree canopies are also likely to be present (some have been observed), including wood thrush, owls, warblers and vireos. The woodlands on this site offer a number of cavity opportunities for owls, cavity nesting songbirds and small mammals.

Table 4.7-1 provides a list of wildlife species common to the area which are known to or could reasonably be expected to utilize the site. This list identifies common species that are likely to utilize the habitat available at the project site. The list is not limited to direct site observations, but is a more thorough compilation of observations that have been documented throughout Putnam County in similar habitat conditions. It indicates, by asterisks, those species that were identified during project related field activities. Identification was either by direct sighting, audible observation, identification of scat or tracks, or other signs noted during recent field activities. The site was investigated for the potential presence of rare and endangered species on a number of days in the spring and summer of 2005, and none were found. Primary wildlife survey dates were 3/22/05, 3/29/05, 4/13/05, 5/10/05, 6/1/05 and 6/2/05. Additional observations were made on 1/18/05, 5/3/05, 5/17/05, 7/21/05 and 8/9/05.

The list of birds included in Table 4.7-1 was derived in part from the New York State Breeding Bird Atlas (BBA) as well as from the experience of the consulting biologists in similar areas over a number of years. The BBA is a comprehensive, statewide bird survey that documents the breeding birds identified by trained volunteers in three-mile square blocks. The most recent surveys (2000 through 2004) have been completed and data is being compiled for inclusion in the final report to be released in 2005. The listings include data on the breeding behavior observed, the year the bird(s) was observed and the state protection status.

The Patterson Crossing Retail Center project site falls within the Breeding Bird Atlas Blocks 6059D (NYSDEC 2005). The breeding bird list for this block is available from both the 1980 to 1985 and the recent 2000 to 2004 surveys. The latter data is considered "interim data" until released officially as part of the final report. It is important to note that birds will choose to breed in the habitat most suitable to their species. Therefore, the listing of a particular bird in a breeding block does not mean that the species will breed everywhere in that block. Therefore, the list for each block will include a greater number of breeding birds than will utilize any given site within that block.

Field observation methods used on the site included the walking of transects through the site for wildlife observations, discrete observations of biological indices (e.g. bird song, scat, tracks, markings, carcasses) and prolonged stationary observations taken at several locations across the site.

Wildlife surveys did not include trapping, mist netting or other means of animal collection that would potentially result in injury or mortality of some species. Such measures were not considered appropriate for the level of investigation being conducted for this site.

The project site does not currently function as a significant wildlife corridor to off-site habitat areas, due to the surrounding roadways and development. Therefore, the project would not fragment an existing wildlife corridor between off-site habitat areas.

**Table 4.7-1
Wildlife List**

Common Name	Scientific Name	Common Name	Scientific Name
Mammals		Birds	
white tailed deer *	<i>Odocoileus virginianus</i>	wild turkey*	<i>Meleagris gallopavo</i>
Eastern chipmunk *	<i>Eutamias sp.</i>	ruffed grouse	<i>Bonasa umbellus</i>
raccoon *	<i>Procyon lotor</i>	wood thrush	<i>Hylocichla mustelina</i>
gray squirrel *	<i>Sciurus carolinensis</i>	pileated woodpecker	<i>Dryocopus pileatus</i>
red fox	<i>Vulpes vulpes</i>	hairy woodpecker*	<i>Picoides villosus</i>
gray fox	<i>Urocyon cinereoargenteus</i>	Yellow-shafted (northern) flicker	<i>Colaptes auratus</i>
Eastern coyote	<i>Canis latrans</i>	downy woodpecker *	<i>Picoides pubescens</i>
opossum*	<i>Didelphis virginiana</i>	Red-bellied woodpecker	<i>Melanerpes carolinus</i>
striped skunk*	<i>Mephitis mephitis</i>	black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>
white-footed mouse	<i>Peromyscus leucopus</i>	red-tailed hawk *	<i>Buteo jamaicensis</i>
deer mouse	<i>Peromyscus maniculatus</i>	American robin *	<i>Turdus migratorius</i>
house mouse	<i>Mus musculus</i>	gray catbird*	<i>Dumetella carolinensis</i>
meadow vole	<i>Microtus pennsylvanicus</i>	northern mockingbird*	<i>Mimus polyglottos</i>
woodchuck*	<i>Marmota monax</i>	flycatchers	<i>Empidonax sp.</i>
short-tailed shrew	<i>Blarina brevicauda</i>	eastern phoebe	<i>Sayornis phoebe</i>
common shrew	<i>Sorex cinereus</i>	American redstart	<i>Setophaga ruticella</i>
star-nosed mole	<i>Codylura cristata</i>	red-eyed vireo*	<i>Vireo olivaceus</i>
Eastern mole	<i>Scalopus aquaticus</i>	American crow *	<i>Corvus brachyrhynchos</i>
little brown bat	<i>Myotis lucifugus</i>	blue jay*	<i>Cyanocitta cristata</i>
red bat	<i>Lasiurus borealis</i>	scarlet tanager	<i>Piranga olivacea</i>
porcupine	<i>Erithizon dorsatum</i>	American goldfinch	<i>Carduelis tristis</i>
cottontail rabbit*	<i>Sylvilagus floridanus</i>	northern cardinal *	<i>Cardinalis cardinalis</i>
		chipping sparrow*	<i>Spizella passerina</i>
		eastern towhee	<i>Pipilo erythrophthalmus</i>
Reptiles		slate-colored junco*	<i>Junco hyemalis</i>
box turtle	<i>Terrapene carolina</i>	mourning dove*	<i>Zenaida macroura</i>
garter snake	<i>Thamnophis sirtalis</i>	black-capped chickadee *	<i>Poecile atricapilla</i>
Eastern racer	<i>Coluber constrictor</i>	White-breasted nuthatch *	<i>Sitta carolinensis</i>
ringneck snake	<i>Diadophis punctatus</i>	turkey vulture *	<i>Cathartes aura</i>
milk snake	<i>Lampropeltis triangulum</i>	eastern screech owl	<i>Otus asio</i>
hognose snake	<i>Heterodon pletyrhinus</i>	great horned owl	<i>Bubo virginianus</i>
brown snake	<i>Storeria dekayi</i>	Carolina wren	<i>Thryothorus ludovicianus</i>
		house wren	<i>Troglodytes aedon</i>
Amphibians		house finch	<i>Carpodacus mexicanus</i>
spring peepers *	<i>Hyla crucifer</i>	Purple finch	<i>Carpodacus purpureus</i>
gray treefrog	<i>Hyla versicolor</i>	Northern (Baltimore) oriole	<i>Icterus galbula</i>
newt	<i>Notophthalmus viridescens</i>	tufted titmouse *	<i>Parus bicolor</i>
spotted salamander	<i>Ambystoma maculatum</i>	warbler*	<i>Dendroica spp.</i>
slimy salamander	<i>Plethodon glutinosus</i>	eastern wood-pewee	<i>Contopus virens</i>
red-backed salamander	<i>Plethodon cinereus</i>	common yellowthroat	<i>Geothlypis trichas</i>
wood frog	<i>Rana sylvatica</i>	ovenbird	<i>Seiurus aurocapillus</i>
American toad	<i>Bufo americanus</i>	rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>
pickerel frog	<i>Rana palustris</i>	brown thrasher	<i>Toxostoma rufum</i>
green frog	<i>Rana clamitans</i>	Brown-headed cowbird	<i>Molothrus ater</i>
		Blue-gray gnatcatcher	<i>Poliophtila caerulea</i>

* observed individuals or indicators

Note: this list represents many species that could potentially inhabit this site. It is not, however, an exhaustive list.

Field survey dates: December 22, 2004; April 8, 2005; March 30, 2005; April 13, 2005; May 3,10,17 2005.

Prepared by: Tim Miller Associates, Inc., 2005

Potential for Use by Rare or Endangered Species

According to the New York State Department of Environmental Conservation (NYSDEC), there are no records of rare or endangered wildlife species known to inhabit the site or nearby areas. (See letter in Appendix B, Correspondence). On-site investigations were conducted by Steve Marino of Tim Miller Associates, Inc. who is a certified Professional Wetland Scientist, with a degree in Biology and over 18 years of experience in the assessment of wetlands and terrestrial ecology, along with other biologists from Tim Miller Associates. No species that are listed as endangered or threatened were observed or are expected to utilize the site based on a habitat assessment.

The investigation employed a series of random, zig-zag transects with observation, listening, and/or ground searches being conducted as site specific features changed along the walking transect route (i.e. upland hardwood forest slopes to stream corridor to wetland, etc.). The route of the transects generally followed the existing dirt roads on the site.

The random nature of these transects allowed the investigator to observe and actively investigate features of interest along the way. This tactic also allowed data to be collected from a greater variety of micro-habitats.

The site was examined for potential use by a number of rare, endangered or protected species, as listed by the NYSDEC (2001). Based strictly on the wooded nature of the property and the existence of an identified wetland area, habitat potential for the following species listed by the State as endangered or threatened was analyzed:

- Bog Turtle - Endangered
- Mud Turtle - Endangered
- Tiger Salamander - Endangered
- Northern Cricket Frog - Endangered
- Indiana Bat - Endangered
- Fence Lizard - Threatened
- Timber Rattlesnake - Threatened

Habitat potential for the following species of special concern was also evaluated:

- Spotted Turtle
- Wood Turtle
- Eastern Box Turtle
- Eastern Hognose Snake
- Worm Snake
- Marbled Salamander
- Jefferson Salamander
- Blue spotted salamander

Several of these species were eliminated from consideration due to the lack of known populations in Patterson specifically or Putnam County generally:

- Mud turtle - north of its known range, lack of open field areas, lack of suitable open water
- Tiger salamander - north of its known range, confined to eastern Long Island

- Northern cricket frog - requires a sunny pond, known only in the Hudson Highlands and Shawangunk area (Catskills)
- Timber rattlesnake - known in higher altitudes, rugged terrain with open areas of rocky ledges for basking

Habitat conditions available on the site (successional forested upland, stream corridors, stone walls) were then considered, and several species eliminated from consideration.

- Spotted turtle - lack of suitable open water and basking areas
- Wood turtle - lack of suitable stream corridors with sandy banks and overhangs, open meadows for nesting and foraging. Wood turtles are known to occur in the Peekskill Hollow Brook corridor.
- Fence lizard - similar to Timber rattlesnake for terrain and basking, does not prefer closed canopy woodlands
- Mole salamanders - lack of vernal pool or significant wetland areas on site

Regarding Indiana bats, the U.S. Fish and Wildlife Service reports that the proposed project area is approximately 12 miles from known roost sites and approximately 32 miles from known hibernacula. The NYSDEC has documented that female bats have traveled up to 40 miles from their wintering hibernacula to roosting sites in the area and that they are capable of flying much greater distances. The site does contain limited potential roosting/maternity trees (trees with exfoliating bark and/or split branches or trunks) and limited potential foraging habitat (upland forest canopy). Potential roosting/maternity trees, however, are few and far between on the subject site, and the observed trees have little direct exposure to solar radiation (roosts warmed by sunlight are preferred to those in the shade). This species generally roosts in several trees in relatively close proximity over the summer months. Although not preferred habitat, Indiana bats do forage in upland forest canopies, with which the site is over 75% covered.

During a habitat assessment in March of 2006, observations were made regarding the numbers of potential maternity/roosting trees on the Patterson Crossing Retail Center property, and their location relative to solar exposure and other habitat requirements. Special care was taken to search for black locust (*Robinia pseudoacacia*), shagbark hickory (*Carya ovata*) and standing dead trees (snags), which are the preferred roosting/maternity trees used by this bat species due to the overhanging or peeling bark and the presence of cracks and splits in the snags.

Only a very small number of shagbark hickories were observed, with many of these trees being less than 6 inches dbh. Small black locusts were observed, and standing dead trees are uncommon. The conclusion of this site evaluation is that, while some potential roosting trees do exist, the site has a very low probability of supporting Indiana bats.

Regarding the potential presence of bog turtles, this well-studied and surveyed species was not identified by the NYSDEC Natural Heritage Program as being known to occur in the area of this proposal project. It appears that the closed canopy of the wooded wetland on site and the lack of open fen habitat would not provide the necessary basking and nesting opportunities for bog turtles. There are no suitable corridor connections to other sites that may support bog turtles.

Evaluations of site specific requirements were then conducted for the remaining State listed species (Eastern Box Turtle, Eastern Hognose Snake, Worm Snake).

Snakes

There is the possibility that habitat on-site could support the eastern hognose snake (Heterodon platyrhinos). This species is listed by New York State as being a species of special concern (NYSDEC, 2001), although it is identified as being locally common in Putnam County. It is a highly secretive species that may utilize the stone walls and wooded areas of the site for cover and feeding. Since this species also is adaptable to new fields, pastures and suburban areas, the proposed development, which will leave large undeveloped areas to the north and south of the proposed building pads, should continue to survive on this parcel if in fact it is present on this site.

A similar situation exists for the eastern worm snake (Carphophis amoenus). The worm snake inhabits moist wooded areas with sandy or rocky substrate, often burrowing underground for long periods to avoid dry surface conditions. Its main food sources are earthworms and salamanders, which are plentiful on this site along the stream corridors and within the existing stone walls. If there is a population of worm snakes on this site, they are likely to avoid the areas of new development but should otherwise be unaffected by site development in the long term. In the short term, site excavation and rock removal may cause some individuals close to areas of disturbance to relocate temporarily. Large open space areas will remain around the perimeter of the site and adjacent to the stream corridor, providing space for temporary movement if required. No worm snakes were observed during on-site field investigations.

Turtles

The eastern box turtle is another species that may occupy this site. Recently listed as a State species of special concern, the box turtle may wander the woods of this site, although none were observed during numerous site visits. It is primarily a terrestrial turtle, although it may use stream beds or shallow ponds during the hot summer months. The major threat to box turtles appears to be pesticide poisoning and collection as pets.

4.7.2 Future “No build” Conditions

Under “no-build” conditions, the site would continue to be private land, with limited public access, and no disturbance or removal of existing vegetation would occur. The site would continue to provide habitat for wildlife, with changing community structure as the wetland and forest areas mature.

4.7.3 Future Conditions with Project

Loss of Wildlife Habitat

The project engineer estimates that approximately 68.4 acres of existing wooded habitat on the site would be disturbed by grading activities. Of this amount, 36.0 acres would be revegetated and 32.26 acres would become impervious surfaces. Table 4.7-2 provides the existing and proposed land cover acreages.

Table 4.7-2 Existing and Proposed Approximate Land Coverage		
	Existing Acreage	Proposed Acreage
Existing upland vegetation	89.95	21.92
Impervious areas (includes roads, parking, buildings, sidewalks and porous paving)	0.03	32.26
Landscaped/re-vegetated areas (includes septic area)	0.00	31.50
Proposed stormwater basins	0.00	4.30
Wetlands	0.52	0.52
TOTAL	90.50	90.50
Source: In-site Engineering, Surveying & Landscape Architecture, P.C., 2005 Totals may not sum, due to rounding.		

Approximately 76 percent of the site acreage (68.4 acres) would be disturbed as a result of the project development; much of this will be lost as future wildlife habitat. The existing vegetative cover and habitat on the remaining 22.1 acres of the site would not be disturbed by the project. These areas would continue to provide habitat for many typical woodland species.

In general, as a site is developed, many wildlife species move out of the areas of disturbance and upon project completion, the developed areas no longer function as habitat for many species of wildlife. Most species would relocate to similar habitats off-site, with bird species able to fly in search of new habitat and terrestrial species restricted to overland movements. Most wildlife movement from this site would be expected toward the north, south and east (beyond Interstate 84) of the property. These areas offer similar habitat and are less densely developed than the areas to the west.

Many of the interior woodland bird species are migratory, and therefore have always left the subject property in previous years. Upon return, most migratory species will adaptively seek other nearby or regionally available environments in response to alterations to this property. The proximity of this site to other woodlands is expected to provide alternative habitat for most of these species.

After the project development is completed, the composition of the wildlife population on the project site will adjust to final site conditions. Species better able to adapt to generally open and landscaped environments (such as raccoons, opossum, woodchucks, mice and songbirds) will have a greater ability to populate the site in comparison to species that are less tolerant of human activity.

While not as valuable as the existing forested habitat, many species of trees and shrubs chosen for the proposed landscaping will provide both forage and nesting sites for birds, and or denning sites for small mammals and the preserved habitat areas and re-vegetated open space areas would still be used by deer and other wildlife. The septic area in the southern part of the site will be re-vegetated as open meadow, and will provide a contrast to the surrounding tree line and new habitat opportunities for bird, reptile and small mammal species.

Protected Plant or Wildlife Species

No protected wildlife species have been identified or observed on the project site. Thus, no impacts are projected to occur.

4.7.4 Mitigation Measures

Dedication of Restricted Open Space

All open space areas on the project site would remain in private ownership, and no dedication to the Town or other conservation-related organization is proposed. As such, the open space and undeveloped areas will remain on the tax rolls at their full assessed value. The Applicant will designate such areas as "open space", "reservation" or "undeveloped" on the site plans.

Under the proposed action, the open space and undeveloped areas will comprise 58 acres of the project site. The areas currently identified as "TO REMAIN UNDISTURBED" and "PROPOSED RESERVATION AREA" on the site plan (Drawing No. SP-1) would be dedicated as open space through the incorporation of legal mechanisms (e.g. deed restrictions) and may be a condition of the Planning Board's final approval resolution. As part of the site plan approval process additional areas may be identified as viable open space areas and dedicated as such through the appropriate legal mechanisms. No public access is proposed for these areas. Areas of the site that will remain undisturbed are shown on Figure 4.7-2 (Post Development Vegetated Area) as well as areas where vegetation will be re-established after construction.

Preservation of Forest Cover

All trees within the central developed portion of the site will be removed, equal to the limits of disturbance as shown on the site plans. Due to the topographic complexities of connecting the proposed buildings, parking areas and access roads, no existing trees can be preserved within this area. The limits of disturbance will be established in the field. No trees beyond these limits will be disturbed. These limits will be delineated by fencing or similar methods prior to commencing clearing or grading activities.

A 200 foot wide strip along the western property line will remain undisturbed and forested, and will be adjacent to the open meadow area created by the construction of the septic system. Similarly the wooded areas between Concord Road and NYS Route 311 will remain.

The proposed site plan minimizes the amount of vegetation to be removed to the extent possible while allowing for the scheduled program of temporary and permanent uses and the needs for associated parking and infrastructure.

As planned, the development would result in the clearing of vegetation from approximately 68.4 acres. Existing vegetation would be retained on the remaining 22.1 acres. All areas that are not proposed to be impervious surfaces will be re-vegetated, including the large area on the southern portion of the site that will serve as the septic area. Upon completion of the



Figure 4.7-2: Post Development Vegetated Areas
 Patterson Crossing Retail Center
 Town of Patterson and Town of Kent,
 Putnam County, New York
 Source: NYS GIS Clearinghouse, 2004 Aerial
 Scale: 1 inch = 560 feet

proposed development, the site would be approximately 64 percent vegetated (existing vegetative communities and landscaped areas).

Regarding Indiana bats, it is unlikely that Indiana bats are utilizing this site. The USFWS's standard recommendation to avoid any potential for directly killing Indiana bats..." is to clear all potential roost trees between October 1 and March 30 (for sites greater than 5 miles from an hibernaculum). When the SEQRA process is completed, and definitive lines for the limits of disturbance are drawn, each construction phase will be evaluated for removal of potential roosting trees and, if necessary, these trees will be removed within the USFWS guidelines.

Preservation of Vegetative Stream Bank Buffer

There are no streams located within the proposed areas of disturbance. The existing streams, water courses and drainage channels on the site will be retained in their existing condition with no disturbance to the stream bank vegetation, except for the water quality improvement measures proposed at the drainage channel that conveys off-site runoff from Concord Avenue northwards through the project site towards the Middle Branch Croton River. Treatment for this off-site source of runoff is proposed in a stormwater basin in order to improve an existing condition. Discharges from this basin will be directed back into an existing watercourse and conveyed to the Middle Branch of the Croton River.

Landscape With High Quality Native Vegetation for Wildlife Habitat

Native species will be used for landscaping purposes where possible. This preference is based on the fitness they have for being adapted to local climatic variables such as temperature, precipitation and growing season lengths. Native landscape species may also be selected which would be beneficial to native wildlife, especially birds. According to the Cornell Lab of Ornithology, establishing a diversity of plant groups in the landscaped areas is preferred, as a variety of plantings will better provide habitat to a larger diversity of bird species. Functional plant groupings of most utility include: conifers, grasses and legumes, nectar-producing plants, summer-fruiting plants, fall-fruiting plants, and winter-persistent plants. Proposed water quality and detention basins will also be planted with native species and will provide additional habitat potential for a number of avian and other wildlife species.

Coniferous trees and shrubs such as pines, spruces, firs, arborvitae, and junipers provide shelter and nest sites. Unmown grasses and legumes provide cover for ground-nesting birds. Nectar-producing plants may attract hummingbird and orioles. Summer-fruiting plants provide food during nesting season. Many native fruit-bearing plants which are adaptable to landscaping use are available, including various species of cherry, chokeberry, raspberry, serviceberry, blackberry, blueberry, mulberry, and elderberry.

Fall-fruiting plants are important for building up or maintaining fat reserves during bird migrations. Examples of these include dogwoods, cotoneasters, and buffalo-berries.

Lastly, winter-persistent plants provide season long fruit sources for winter resident species. Adaptable members of this group include varieties of crabapple, snowberry, bittersweet, sumac, viburnum, as well as American highbush cranberry, eastern wahoo, and winterberry (holly).

Nuts and acorn trees, including oaks, hickories, buckeyes, chestnuts, butternuts, walnuts, and hazels, provide nutrient rich foods for birds and mammals as well as providing good nesting habitat for many birds.

Many native landscaping species can be selected to provide nesting and cover and food for birds. A partial list of specific plant species recommended by the Cornell Lab of Ornithology includes:

Deciduous Trees:

- Mulberry (summer fruiting)
- Serviceberry (summer fruiting)
- Flowering dogwood (fall fruiting)
- Crabapple (fall fruiting, winter persistent fruits)
- White oak (fall fruiting, winter-persistent fruits)
- Red maple (spring fruiting)
- Sugar maple (Summer fruiting)

Coniferous Trees:

- Eastern red cedar (fall fruiting, winter persistent fruit, excellent nest sites).
- Spruces (fall fruiting, winter persistent fruit)

Native Vines:

- Virginia creeper (fall fruiting, winter persistent fruit)

Shrubs:

- Northern bayberry (fall fruiting, winter persistent fruit)
- Red-osier dogwood, gray dogwood (fall fruiting)
- Viburnums such as nannyberry and arrowwood viburnum (fall fruiting, some fruits are winter persistent)
- Winterberry (fall fruiting, winter persistent fruits)

Typical landscape plantings are likely to include those species listed in Table 4.7-3 or similar selections.

Table 4.7-3 "Typical" Upland Condition Landscaping Plantings	
Trees	Shrubs
Deciduous Trees - Major	Deciduous Shrubs
horse chestnut (<i>Aesculus hippocastanum</i>)	bottlebrush buckeye (<i>Aesculus parviflora</i>)
red maple (<i>Acer rubrum</i>)	oak leaf hydrangea (<i>Hydrangea quercifolia</i>)
sugar maple (<i>Acer saccharinum</i>)	witchhazel (<i>Hamamelis virginiana</i>)
American beech (<i>Fagus grandifolia</i>)	staghorn sumac (<i>Rhus typhina</i>)
white oak (<i>Quercus alba</i>)	beautybush (<i>Kolkwitzia amabilis</i>)
ash (<i>Fraxinus sp.</i>)	bayberry (<i>Myrica pennsylvanica</i>)
red oak (<i>Quercus rubra</i>)	viburnum (<i>Viburnum sp.</i>)
little leaf linden (<i>Tilia cordata</i>)	
American elm (<i>Ulmus americana</i>)	
Deciduous Trees - Minor	Evergreen shrubs
shadblow (<i>Amelanchier canadensis</i>)	inkberry (<i>Ilex glabra</i>)
paperbark birch (<i>Betula papyrifera</i>)	Virginia red cedar (<i>Juniperus virginiana</i>)
flowering dogwood (<i>Cornus florida</i>)	mountain laurel (<i>Kalmia latifolia</i>)
crabapple (<i>Malus sp.</i>)	rosebay rhododendron (<i>Rhododendron maximum</i>)
cherry (<i>Prunus sp.</i>)	white rhododendron (<i>Rhododendron album</i>)
plum (<i>Prunus sp.</i>)	leatherleaf viburnum (<i>Viburnum rhytidophyllum</i>)
Coniferous Trees	
white fir (<i>Abies concolor</i>)	
Colorado spruce (<i>Picea pungens</i>)	
Norway spruce (<i>Picea abies</i>)	
douglas fir (<i>Pseudotsuga mensiesii</i>)	
white pine (<i>Pinus strobus</i>)	
red pine (<i>Pinus resinosa</i>)	
Source: Tim Miller Associates, Inc., 2005	

Proper siting of landscape plants is important as most plants will not thrive in all soils or exposures. Established research regarding planting preferences, e.g., moist or dry soils, shady or sun-tolerant species, will be used in determining site plantings.

In addition, certain invasive species such as multi-flora rose, barberry, tree-of-heaven and Phragmites will be eliminated where encountered on the project site. The replacement of these invasive plants with native plants should be beneficial to most wildlife species which repopulate the site.