3.2 Surface Water Resources

3.2.1 Existing Conditions

Surface Water Resources

Existing surface water features and drainage areas are shown on Figure 3.2-1. The terrain on-site gently slopes toward Route 202 where it feeds the three existing stream crossings and four drainage swales (Local Highway drainage system). The site falls within the Mahwah River Watershed and includes five watercourses and an existing pond. Two streams are classified by NYSDEC as Class B streams, DEC Unit 806-15, Brian Brook and an Unnamed tributary (Tributary 2 on LJA Maps in the Appendix of the Stormwater Pollution Prevention Plan (SWPPP; Appendix D) exiting from the existing on-site pond. According to the NYS DEC, the best usages for B class streams are primary and secondary contact recreation and fishing, and these waters shall be suitable for fish propagation and survival. The three other on-site streams are unclassified and intermittent. The intermittent watercourse that exits the DEC wetland TH30 is not a mapped watercourse, and therefore carries a 'D" classification. There is no DEC regulation of a Class D stream or its bed and banks. No disturbance is proposed to this watercourse or any other regulated water feature on site. Six NYSDEC and USCOE wetlands areas are located at different locations on the site. No disturbance to any wetland or wetland regulated adjacent area is proposed with this project.

Existing Stormwater Runoff Conditions

Runoff from the site does not discharge into any New York State Section 303(d) Listed Impaired/ TMDL Waters. Runoff from Patrick Farm contributes to seven crossings on Route 202 located on the North-West Side of the property. The seven discharge points include three stream crossings and four highway drainage swales. The discharge points are identified as Points A through G on the Existing Conditions Pre-Development drainage map Figure 3.2-2.

Hydrologic analyses were prepared for existing and proposed conditions and utilized SCS unit hydrographs. SCS soil curve numbers for existing and proposed conditions were based on the soil types and coverage present at the site utilizing USDA TR-55 as a guide. The Times of Concentration were calculated for existing and proposed conditions using guidelines in TR-55. Curve numbers and times of concentration were then incorporated into the Army Corps of Engineers Hydrological Computer Program, HEC-1 to derive the peak discharges of the 1, 2, 5, 10, 25 and 100-year storm frequencies. To establish these flows, the 1, 2, 5, 10, 25 and 100 year, 24-hour storm precipitation values were derived from available TP-40 information and incorporated in the HEC-1 models. Refer to the SWPPP's Appendix D and the HEC-1 output data for the calculations and summary output in support of the analysis.

Existing runoff rates from the project site have been calculated for the 1-year, 2-year, 5-year, 10-year, 25-year, 50-year and 100-year storm events. All assumptions for land cover types, soil groups, slopes and curve number calculations are provided in the project engineer's stormwater management report (Appendix D). Table 3.2-1 summarizes the peak pre-development stormflows.

Table 3.2-1
Peak Pre-development Flow Summary for 24-Hour Design Storms
(Cubic Feet per Second)

Design Point	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
A	90.80	154.80	232.30	303.80	358.40	506.00
B	53.04	92.83	142.99	189.89	225.96	324.32
C	1.73	3.92	6.80	9.61	11.83	18.03
D	3.40	7.21	12.19	17.01	20.79	31.30
E	19.33	40.84	72.09	104.25	130.12	279.65
F	5.20	10.03	16.15	21.96	26.96	38.87
G	4.48	8.60	13.82	18.78	22.62	33.19

Source: Stormwater Management Report, LJA, 2008

Detailed information pertaining to the existing watersheds and site drainage features is provided in the stormwater management report prepared for this project (Appendix D).

3.2.2 Potential Impacts

Direct Impacts to Wetlands and Surface or Ground Waters

No roads, buildings or other direct impacts to existing surface water features are proposed. No direct impacts to wetlands, surface water or groundwater are anticipated.

Future Runoff Conditions

The proposed increase in impervious coverage (46.1 acres) on the project site would result in increases in the rate of stormwater runoff in the absence of appropriate stormwater controls. Minor changes to the existing drainage patterns of the site will also occur as the land is regraded to construct buildings, parking areas, and roads. If not properly mitigated, these activities could cause stream erosion and flooding due to uncontrolled stormwater increases, and change the hydrology of associated wetlands and floodplains. In order to offset these changes, the design of the development incorporates eight stormwater management basins (ponds) four recharge areas and multiple dry wells to control and convey stormwater runoff to the seven design points. Figure 3.2-3 illustrates the Post-Development drainage conditions.

Each of the stormwater basins will eventually contribute discharges to the seven design points via outlet control structures that will reduce all post-development peak outflows from the basins and lower the overall site peak runoff to less than the pre-development peak runoff of the unconstrained watersheds (Table 3.2-2), thus satisfying the “zero net increase of peak flow” provisions of state stormwater regulations.

The 9 stormwater management ponds and recharge areas located within the multifamily areas shall be maintained by the Homeowners Association. The remaining 5 stormwater management ponds located in the single family area shall be maintained by the Town. A letter included in Appendix B, Correspondence, has been submitted to the Town for their concurrence on this matter.

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Table 3.2-2
Peak Post-development Flow Summary for 24-Hour Design Storms
(Cubic Feet per Second)

Design Point	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
A	89.30	142.50	225.10	293.70	346.20	487.60
B	51.43	83.48	134.32	177.30	210.30	299.83
C	1.50	2.86	4.57	6.27	7.46	10.92
D	0.00	0.00	0.00	0.00	0.00	0.00
E	17.33	39.47	60.85	95.07	120.94	271.11
F	2.27	4.48	7.31	10.15	12.38	18.56
G	3.91	7.69	12.50	17.08	20.65	30.47

Source: Stormwater Management Report, LJA, 2008
Note :Design Point D runoff is diverted to Design Point E in the developed condition.

Design Point	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
A pre	90.80	154.80	232.30	303.80	358.40	506.00
A post	89.30	142.50	225.10	293.70	346.20	487.60
change	-1.50	-12.30	-7.20	-10.10	-12.20	-18.40
B pre	53.04	92.83	142.99	189.89	225.96	324.32
B post	51.43	83.48	134.32	177.30	210.30	299.83
change	-1.61	-9.35	-8.67	-12.59	-15.66	-24.40
C pre	1.73	3.92	6.80	9.61	11.83	18.03
C post	1.50	2.86	4.57	6.27	7.46	10.92
change	-0.23	-1.06	-2.23	-3.34	-4.37	-7.11
D pre	3.40	7.21	12.19	17.01	20.79	31.30
D post	0.00	0.00	0.00	0.00	0.00	0.00
change	-3.40	-7.21	-12.19	-17.01	-20.79	-31.30
E pre	19.33	40.84	72.09	104.25	130.12	279.65
E post	17.33	39.47	60.85	95.07	120.94	271.11
change	-2.00	-1.37	-11.24	-9.18	-9.18	-8.54
F pre	5.20	10.03	16.15	21.96	26.96	38.87
F post	2.27	4.48	7.31	10.15	12.38	18.56
change	-2.93	-5.10	-8.84	-11.81	-14.09	-20.31
G pre	4.48	8.60	13.82	18.78	22.62	33.19
G post	3.91	7.69	12.50	17.08	20.65	30.47
change	-0.57	-0.91	-1.32	-1.70	-1.97	-2.72

Source: Stormwater Management Report, LJA, 2008

The hydrology report provides details on the post-development drainage basins resulting from the proposed development of the project site. Drawings included with the report depict drainage areas associated with the development and provide information on basin sizing and flow control structures.

All proposed stormwater facilities will result in peak flow rates offsite that will be maintained at or below pre-development levels. As indicated by the calculations provided in the stormwater management report, the results of which are summarized in the tables above, the proposed stormwater facilities will meet those standards.

Groundwater Recharge

The proposed Patrick Farm project includes an extensive groundwater recharge program which has been designed to insure that the groundwater recharge capability of the site post development is equal to or greater than the pre development groundwater recharge capability. Based upon extensive study and soil permeability testing, the potential loss in the pre development ground water recharge capability is estimated to be 14.7 million gallons per year. The potential loss is based upon the proposed impervious surfaces that would tend to inhibit recharge. Based upon the proposed recharge system proposed at Patrick Farm, the projected groundwater recharge from the new impervious surfaces is estimated to be 18.7 million gallons per year, an increase of 4 million gallons per year. This does not take into account the water that could be drawn down from the three existing wells on site, nor does it account for the stormwater that will fall on the pervious site areas after construction. Based upon these two factors the estimated increase of 4 million gallons per year will in actuality be even higher.

The Applicant has designed a Stormwater Management System that exceeds typical mitigation for the treatment of stormwater runoff quantity and quality. The project design has incorporated a cutting-edge proposal for an overall groundwater recharge system over the Patrick Farm site. Groundwater Recharge is a sustainable practice that is receiving increasing attention and is recognized by the EPA as a Low Impact Development (LID) practice. LID is a stormwater management approach and set of practices that can be used to reduce runoff and pollutant loadings by managing runoff as close to its sources as possible. LID is typically used to achieve or pursue the goal of maintaining or closely replicating the pre-development hydrology of the site. Groundwater Recharge is not required by code, however it is likely that the groundwater recharge design approach utilized at the Patrick Farm site will become a model and a local standard for all site development in the future.

The Patrick Farm Groundwater Recharge system was designed to provide zero loss in groundwater recharge that occurs under existing conditions today. It is a form of Rainwater harvesting (RWH) in that it serves to replenish the Ramapo Aquifer, similar to pre development conditions. Groundwater hydrogeologists performed on-site permeability tests to define the rate at which the soils could transmit runoff back into the ground. The recharge system is designed capture rooftop runoff via rooftop water runoff leaders in order to infiltrate that runoff into the ground in a manner and quantity that mimics the natural water cycle. Groundwater recharge and is considered a critical component of sustainability by the applicant, based upon the site's relation to the Ramapo Aquifer.

Water Quality

The introduction of impervious surfaces and residential uses may influence the quality of stormwater runoff compared to a site's undeveloped condition. Concentrations and types of pollutants introduced from automobiles, pet waste, herbicide and pesticide application and atmospheric deposition could increase.

The stormwater management plan is required to incorporate structures and methods designed to satisfy provisions specified in the most recent (April 2008) version of the NYS DEC Stormwater Management Design Manual that incorporates Phase II stormwater regulations.

The NYS DEC Stormwater Management Design Manual presents sizing and performance criteria for developing site-specific stormwater management practices (SMP) that can provide acceptable water quality treatment for stormwater runoff. An acceptable SMP will capture and treat 90 percent of the average annual runoff volume from stormwaters and be capable of removing 80 percent of the Total Suspended Solids and 40 percent of the Total Phosphorous in the runoff water.

As the NYS DEC manual requires that 90% of the average annual runoff volume be treated, this requirement was used to determine the water quality storage volumes for the project site. The sizing and design of the water quality ponds were based on these calculated volumes.

The use of an approved erosion and sediment control plan will incorporate Best Management Practices to comply with NYS regulations for suspended sediment control in runoff water from construction sites. With proper stormwater management and the use of erosion control BMPs, site development can occur while minimizing or avoiding impacts to downstream receiving waters. The proposed plans are designed to comply with the requirements of the SPDES General Permit for Stormwater Discharges so that such potential impacts are mitigated prior to stormwater discharge into the receiving stream.

As described under “Mitigation” below, the proposal as submitted will mitigate against potential soil erosion and sedimentation by the phasing of site construction, use of rapid site stabilization after grading, provision of lawn and landscaping in disturbed areas, and the use of extended detention basins and other BMPs. These basins are designed to remove up to 80 percent of the remaining suspended sediment load after site stabilization. Sediment loading post construction is not expected to represent an adverse environmental impact to the receiving waters.

3.2.3 Mitigation Measures

Stormwater Runoff Quality Treatment Measures

The applicant has submitted plans that conform to the criteria established by the NYS DEC. These plans include the use of erosion controls, phased site development and stormwater management practices (SMPs) that are acceptable to the NYS DEC and described in their Stormwater Management Design Manual (April 2008). Setbacks from wetlands and waterbodies are shown on Figure 3.2-4.

The proposed stormwater management design utilizes SMPs to best provide acceptable water quality treatment prior to the stormwater runoff being discharged from the project site. The project proposes to utilize multiple separate wet extended detention ponds and groundwater recharge facilities. As detailed in Appendix D, each of these stormwater ponds would employ forebays, permanent pools and flow control structures at each pond outlet. All of these wet extended detention ponds were designed in accordance with NYS DEC sizing criteria to treat a portion of the water quality volume (WQv) by detaining storm flows above a permanent pool for a specified minimum detention time. Also, the proposed wet extended detention ponds are capable of achieving the desired goals for pollutant removal (80 percent for suspended solids and 40 percent for phosphorous), have exhibited acceptable longevity in the field, and possess pretreatment mechanisms. The proposed stormwater management design will also provide channel protection as well as overbank and extreme flood attenuation by moderating runoff flow rates. The proposed pond discharge outlet points, where the collected stormwater runoff will be discharged from the ponds ultimately flows to the seven design points along Route 202.

Erosion and Sediment Control Measures

A comprehensive erosion control plan will be employed to minimize the potential adverse impacts resulting from the proposed clearing, excavation and grading necessary to undertake the proposed project. Erosion control plans for this project are included as part of the site plan and presented in Appendix E. The plan shall incorporate various measures to reduce erosion during construction and trap sediment to prevent it from being carried from areas being actively graded. The measures will be installed in accordance with the New York "Standards and Specifications for Erosion and Sediment Control", dated April 2005. Several key measures that are proposed to improve the quality of stormwater discharged from the site and reduce the impact on downstream waters or other offsite areas incorporate methods to improve soil stabilization, runoff control, sediment control, and fugitive dust control including:

1. Soil covers/temporary seeding
2. Silt fences
3. Curb inlet protections
4. A stabilized construction entrance
5. Dust control measures

- **Soil Covers/Temporary Seeding.** Any exposed soils that are exposed and left bare and are not being graded for a period of 7 days will be temporarily stabilized. Mulching or hydroseeding will be applied to ground with low slopes that have been stripped of natural vegetation. Riprapping, matting or sodding will be applied to soils for permanent stabilization if conditions warrant.

- **Silt Fences.** Silt fence will be installed at the toe of slopes below areas to be graded. Silt fence allows water to pass through the fabric while trapping most of the sediment in the runoff. A double row of silt fence will be installed in locations where the topography is sloped toward surface water resources.

- **Curb Inlet Protections.** All proposed drain inlets will be provided with drain inlet protection during construction. Stone, hay bales, fabric or excavated depressions will be established around inlets to filter sediments from the runoff.

- **Stabilized Construction Entrance.** The construction entrance will be provided with a lined stone pad of appropriate dimensions to reduce the transport of soil to adjacent roadways.

- **Dust Control Measures.** Dust during construction activities will be controlled through a combination of temporary stabilization measures, including the use of vegetative covers or spray-on tackifiers for disturbed areas not subject to traffic, mulching (including gravel mulch) and seeding, compaction of disturbed soil, water sprinkling, wind screens erected at right angles to prevailing wind currents and the use of stone covers (crushed stone or coarse gravel) on construction roads. Dust generation will also be limited through phasing of the project that will limit the overall area of exposed soils in each phase. All on-site vehicle speeds will be limited to 15 MPH on unpaved construction roads through the use of traffic controls. When wind gusts exceed 25 MPH all hauling operations would be stopped until high wind conditions subside.

Topsoil will be spread following final grading operations and the ground surface will be promptly revegetated using trees, shrubs, ground covers and grasses as set forth in the landscape plan.

The sediment and erosion control plan will be part of the site plan approval and construction bid documents. Therefore, the contractor will be obligated to provide weekly and rain-event inspections by a qualified professional to assure the maintenance of each sediment and erosion control measure throughout all construction phases of the project as specified in the New York SPEDES Stormwater General Permit. The inspections will continue until the site has undergone final stabilization and the designated project operator has filed a “Notice of Termination” with the NYS DEC.

Stormwater Pollution Prevention Plan

As noted, the Applicant will submit a Stormwater Pollution Prevention Plan (SWPPP) to the NYS DEC for review and approval. The objective of the SWPPP is to control runoff of pollutants from the project site during and after construction activities by complying with the NY State Pollutant Discharge Elimination System (SPDES) Stormwater Permit for construction activities. The SWPPP will implement the following practices:

- Reduction or elimination of erosion and sediment loading to waterbodies during construction;
- Control of the impact of stormwater runoff on the water quality of the receiving waters;
- Control of the increased volume and peak rate of runoff during and after construction, and;
- Maintenance of stormwater controls during and after completion of construction.

The SWPPP will specify the selection, sizing and siting of the SMPs to protect water resources from stormwater impacts. The designs of the proposed SMPs were determined using current engineering methodologies that apply appropriate sizing criteria to avoid the overburdening of stormwater conveyance structures. The applicant shall retain the services of an engineer for scheduled inspections and report preparation as to the implementation of the measures identified in the SWPPP for the proposed project.

Long Term Operation, Maintenance, and Inspection

SMP Stormwater Ponds must be properly operated and maintained if they are to function as intended over a long period of time. The Homeowners Association, will maintain six of the ten stormwater management ponds and all four of the recharge basins. The volunteer housing entity will maintain the seventh stormwater management pond and it id proposed that the Town of Ramapo maintain the eight stormwater management pond located in proximity to the single family lots. Each entity, who will be responsible for the long-term operation and maintenance of the stormwater ponds for this project, should use the Stormwater Pond Operation, Maintenance and Management Inspection Checklist forms in the Appendix of the SWPPP developed for this project to monitor and document operational conditions. Typical SMP maintenance tasks include routine inspections for structural conditions, debris removal, mowing, structural repairs as well as control of nuisance plant and animal species. Plans can be based on and developed by reference to recent standard regulatory documents, including the NYS DEC Stormwater Management Design Manual (April 2008) and the US EPA National Management Measures to Control Nonpoint Source Pollution from Urban Areas (November 2005).

Each of the wet extended detention ponds should be inspected monthly for the first six months of operation after construction and on an annual basis thereafter. The structures should also be inspected following any major storm rainfall event. Inspection priorities should include checking the embankments for subsidence, erosion, cracking, tree growth, and the presence of burrowing animals. Also to be inspected should be the condition of the emergency spillways and drains, sediment accumulations, clogging of outlets, erosion control measures in the contributory drainages and channel erosion control measures at the outlet.

Establishment of trees and woody shrubs would be prevented on embankments, emergency spillways and buffer areas through periodic mowing. Debris and litter should be removed from the surface of the pond, surrounding buffer areas, and riser and outlet areas in conjunction with the mowing operations. Accumulated debris and litter should also be removed following any major storm event.

Eroding soils in the drainage area that are contributing to the wet ponds should be stabilized immediately with vegetation or other erosion control practices. Soils may slump in buffer areas outside the edges of the wet ponds, from the wet pond embankments or emergency spillways. When soils are exposed by erosion or slumping, corrective measures such as regrading and revegetation may be necessary. Similarly, the riprap protecting the channel downstream of the outlet channel may have to be repositioned and stabilized as necessary.

All wet ponds shall have a mosquito breeding suppression plan which has been approved by the Rockland County Health Department.

Concrete inlet and outlet control devices and riser structures will deteriorate slowly over time and may need to be repaired or replaced in the long term. Concrete barrels and risers have a useful design life of approximately 50 to 75 years or longer.

Significant quantities of sediment can accumulate in an extended detention facility. Sediment buildup should be properly removed from the forebay areas prior to accumulations reaching fifty percent of the design depth in order to preserve the available stormwater management capacity of the pond. While more frequent clean-out may be needed in the forebays and around outlet control structures, a typical clean-out cycle for the lower stages of an extended detention facility should range from 5 to 10 years.

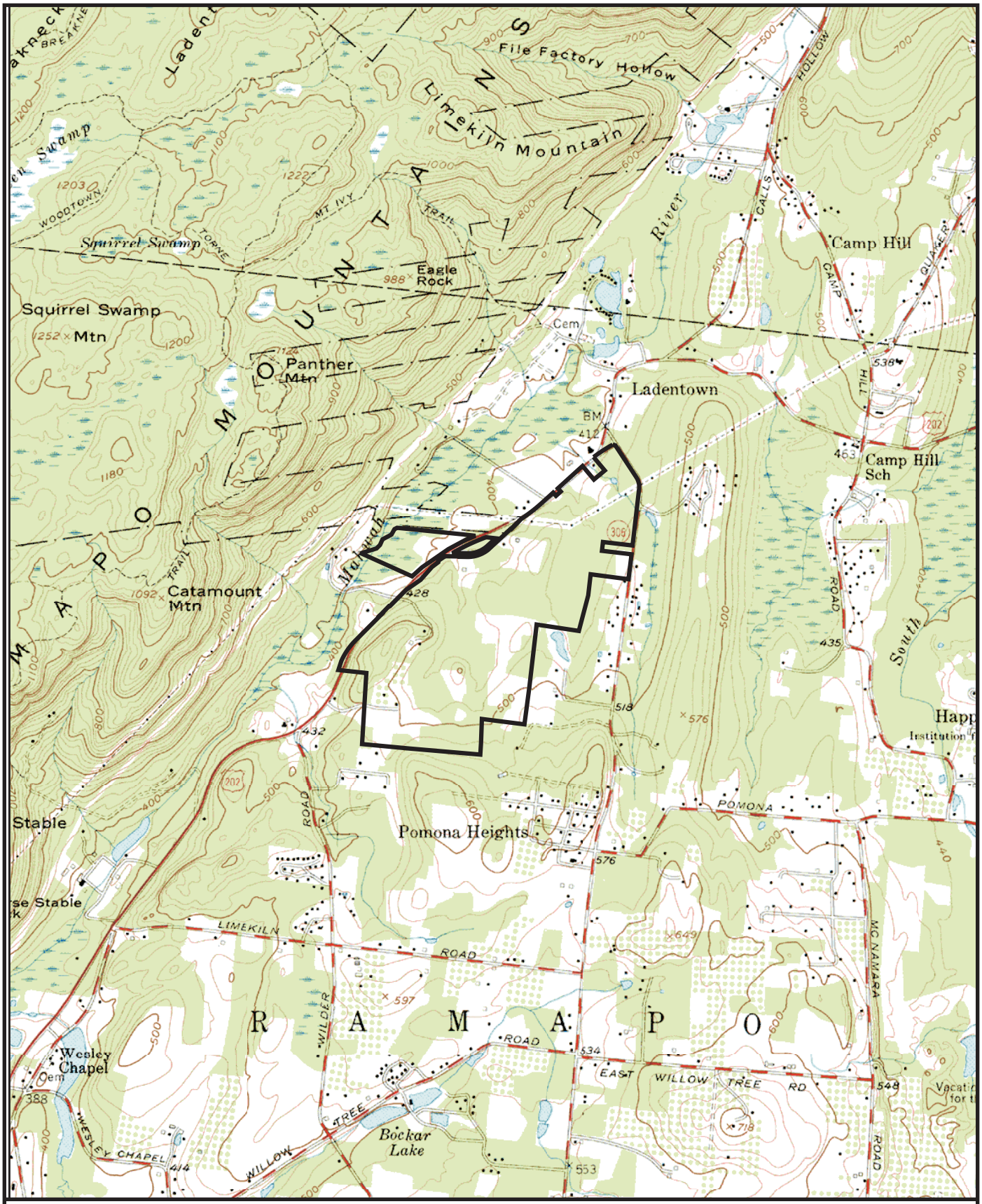

Figure 3.2-1: Existing Surface Water Resources

Patrick Farm

Town of Ramapo, Rockland County, New York

Base: USGS 7.5-Minute Topographic Map, Theills Quad

Scale: 1" = 2,000'

File 07119 12/21/07
JS:\07119

Tim Miller Associates, Inc.,10 North Street, Cold Spring, New York 10516 (845) 265-4400 Fax (845) 265-4418

LEGEND

– PROPERTY LINE

– EASEMENT LINE

– DRAINAGE AREA DELINEATION

– TIME OF CONCENTRATION LINE

Pt. A – POINT OF INTEREST

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)

OFF # 6
AREA = 1.2 AC
IMP = 0.46 AC

SITE # 5
AREA = 9.8 AC
IMP = 0.00 AC

OFF # 5
AREA = 191.0 AC
IMP = 76.41 AC

SITE # 14
AREA = 6.7 AC
IMP = 0.20 AC

SITE # 13
AREA = 6.2 AC
IMP = 0.40 AC

SITE # 4
AREA = 44.0 AC
IMP = 0.00 AC

SITE # 11
AREA = 6.8 AC
IMP = 0.14 AC

SITE # 12
AREA = 13.3 AC
IMP = 0.70 AC

SITE # 9
AREA = 12.2 AC
IMP = 0.43 AC

SITE # 10
AREA = 16.0 AC
IMP = 0.11 AC

SITE # 6
AREA = 5.6 AC
IMP = 0.1 AC

SITE # 7
AREA = 6.0 AC
IMP = 0.1 AC

OFF # 7
AREA = 5.5 AC

SITE # 8
AREA = 19.0 AC
IMP = 0.10 AC

SITE # 15
AREA = 2.30 AC
IMP = 0.0 AC

OFF # 4
AREA = 85.0 AC
IMP = 33.94 AC

SITE # 1
AREA = 17.2 AC
IMP = 0.19 AC

SITE # 2
AREA = 11.6 AC
IMP = 0.0 AC

SITE # 3
AREA = 22.5 AC
IMP = 0.08 AC

OFF # 1
AREA = 20.2 AC
IMP = 8.08 AC

OFF # 2
AREA = 12.6 AC
IMP = 5.04 AC

OFF # 3
AREA = 60.7 AC
IMP = 24.27 AC

Pt. A
Pt. B
Pt. C
Pt. D
Pt. E
Pt. F
Pt. G
Pt. H
Pt. I
Pt. J
Pt. K
Pt. L
Pt. M
Pt. N
Pt. O

Tributary # 1
Tributary # 2
Tributary # 3
Tributary # 4

MAPPED WETLANDS 8.46 ACRES
MAPPED WETLANDS 12.28 ACRES
MAPPED WETLANDS 3.75 ACRES

Old Route 306
Route 306
Seeley Drive

Figure 3.2-2: Existing Condition Pre-development Drainage
Patrick Farm
Town of Ramapo, Rockland County, NY
Source: Leonard Jackson Associates, 7/18/08
Scale: 1" = 450'

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Figure 3.2-3: Post-development Drainage
Patrick Farm
Town of Ramapo, Rockland County, NY
Source: Leonard Jackson Associates, 7/18/08
Scale: 1" = 450'

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