APPENDIX D

Stormwater Pollution Prevention Plan
& Drainage System Design

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TOWN OF RAMAPO, ROCKLAND COUNTY, NEW YORK

STORMWATER POLLUTION PREVENTION PLAN

DATE: 08/21/08
JOB # 02033

LEONARD JACKSON ASSOCIATES

LJA #02033
August 21, 2008

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SWPPP - Report

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A. NARRATIVE REPORT

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I. Introduction:

Patrick Farm Development is proposed on 200 +/- AC property located on easterly side of Route 202 at the northwest corner of Town of Ramapo. A total of 497 residential dwellings are proposed as a part of the Patrick Farm development; including a mix of Single Family Homes, Multi-Family Townhomes, Multi-Family affordable homes and Homes for Emergency Services members. The proposed development will have new a road network, parking facilities, driveways and sidewalks and recreational areas which will cover existing undeveloped areas on site with impervious area. The onsite storm water management system was designed in accordance with NYSDEC guidelines in the Storm Water Manual to meet the required Storm Water Pollution Prevention guidelines developed by NYSDEC and the Town of Ramapo's requirement of a zero net increase in peak discharges from any newly developed site in post development condition. The total disturbed area on site is 145 +/- acres and the total impervious area consisting of buildings and pavement is 45.7 acres. The construction activity is anticipated to commence in Fall 2009 and to be complete by approximately the Fall, 2014.

II. Site Geography:

The terrain onsite gently slopes toward Route 202 where it feeds the three existing stream crossings and 4 drainage swales (Local Highway drainage system). The site falls within 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 Unnamed tributary (Tributary 2 on LJA Maps) exiting from the existing on site Pond. The three other streams are unclassified and intermittent. Five 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).The type of soil on the site ranges from sandy loam to silt loam. The hydrologic soil groups which exists at the site are consists of the A/D, B, C and C/D soil groups and are graphically represented on Soil Maps in the report under Maps section for existing and proposed conditions. Runoff from the site does not discharge into the New York State Section 303(d) List of Impaired/ TMDL Waters.

III. Methodology:

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 Drainage Maps attached in Map Section of the report.

Two additional Off-site locations where site drainage area contributes runoff to offsite locations are labeled Point M and Point N on Drainage Maps.

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 TR-55 as a guide. The Times of Concentration were calculated for existing and proposed conditions using guidelines in TR-55 and the California Method.

Curve numbers and times of concentration were then incorporated into the 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 Appendix D and the HEC-1 output data for the calculations and summary output in support of our analysis.

IV. Conclusion

Refer to Summary Tables # 1 to # 9 for a comparison of peak discharges under existing and developed conditions.

Summary Table #1 – Peak Discharges at the Point of Interest (Pt. "A") for Existing and Developed Conditions

	Storm Frequency (in years)					
Conditions	**1**	**2**	**5**	**10**	**25**	**100**
Pre-Development Discharges (cfs)	90.8	154.8	232.3	303.8	358.4	506.0
Post-Development Discharges (cfs)	89.3	142.5	225.1	293.7	346.2	487.6
Net Change: (cfs)	-1.5	-12.3	-7.2	-10.1	-12.2	-18.4

<u>Summary Table #2</u> – Peak Discharges at the Point of Interest (Pt. "B") for Existing and Developed Conditions.

Storm Frequency (in years)

Conditions	**1**	**2**	**5**	**10**	**25**	**100**
Pre-Development Discharges (cfs)	53.04	92.83	142.99	189.89	225.96	324.23
Post-Development Discharges (cfs)	51.43	83.48	134.32	177.30	210.30	299.83
Net Change: (cfs)	-1.61	-9.35	-8.67	-12.59	-15.66	-24.4

<u>Summary Table #3</u> – Peak Discharges at the Point of Interest (Pt. "C") for Existing and Developed Conditions.

Storm Frequency (in years)

Conditions	**1**	**2**	**5**	**10**	**25**	**100**
Pre-Development Discharges (cfs)	1.73	3.92	6.80	9.61	11.83	18.03
Post-Development Discharges (cfs)	1.50	2.86	4.57	6.27	7.46	10.92
Net Change: (cfs)	-0.23	-1.06	-2.23	-3.34	-4.37	-7.11

<u>Summary Table #4</u> – Peak Discharges at the Point of Interest (Pt. "D") for Existing and Developed Conditions.

Storm Frequency (in years)

Conditions	**1**	**2**	**5**	**10**	**25**	**100**
Pre-Development Discharges (cfs)	3.4	7.21	12.19	17.01	20.79	31.3
Post-Development Discharges (cfs)	0	0	0	0	0	0
Net Change: (cfs)	-3.4	-7.21	-12.19	-17.01	-20.79	-31.3

Note: Onsite Drainage Area contributing to runoff at Point "D" is diverted to Point "E" in proposed condition hence Point "D" will be fed by a small area consisting of Route 202 drainage.

<u>Summary Table #5</u> – Peak Discharges at the Point of Interest (Pt. "E") for Existing and Developed Conditions.

Storm Frequency (in years)

Conditions	**1**	**2**	**5**	**10**	**25**	**100**
Pre-Development Discharges (cfs)	19.33	40.84	72.09	104.25	130.12	279.65
Post-Development Discharges (cfs)	17.33	39.47	60.85	95.07	120.94	271.11
Net Change: (cfs)	-2.00	-1.37	-11.24	-9.18	-9.18	-8.54

<u>Summary Table # 6</u> – Peak Discharges at the Point of Interest (Pt. "F") for Existing and Developed Conditions.

Storm Frequency (in years)

Conditions	**1**	**2**	**5**	**10**	**25**	**100**
Pre-Development Discharges (cfs)	5.20	10.03	16.15	21.96	26.47	38.87
Post-Development Discharges (cfs)	2.27	4.48	7.31	10.15	12.38	18.56
Net Change: (cfs)	-2.93	-5.10	-8.84	-11.81	-14.09	-20.31

<u>Summary Table #7</u> – Peak Discharges at the Point of Interest (Pt. "G") for Existing and Developed Conditions.

Storm Frequency (in years)

Conditions	**1**	**2**	**5**	**10**	**25**	**100**
Pre-Development Discharges (cfs)	4.48	8.60	13.82	18.78	22.62	33.19
Post-Development Discharges (cfs)	3.91	7.69	12.50	17.08	20.65	30.47
Net Change: (cfs)	-0.57	-0.91	-1.32	-1.70	-1.97	-2.72

<u>Summary Table #8</u> – Peak Discharges at the Point of Interest (Pt. "M") for Existing and Developed Conditions.

Storm Frequency (in years)

Conditions	**1**	**2**	**5**	**10**	**25**	**100**
Pre-Development Discharges (cfs)	47.89	80.96	120.89	157.70	186.06	263.62
Post-Development Discharges (cfs)	47.18	75.11	117.89	153.77	181.51	256.47
Net Change: (cfs)	-0.71	-5.85	-3.00	-3.93	-4.55	-7.15

<u>Summary Table #9</u> – Peak Discharges at the Point of Interest (Pt. "N") for Existing and Developed Conditions.

Storm Frequency (in years)

Conditions	**1**	**2**	**5**	**10**	**25**	**100**
Pre-Development Discharges (cfs)	90.79	154.63	231.98	303.43	357.96	505.33
Post-Development Discharges (cfs)	88.85	142.52	225.06	293.78	346.18	487.62
Net Change: (cfs)	-1.94	-12.11	-6.92	-9.65	-11.78	-17.71

Attached are drainage area maps, drainage calculations and backup HEC-1 output data in support of our analysis.

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B. PLAN COMPONENTS

1. **Erosion and Sediment Control**
2. **Water Quality Mitigation**
3. **Water Quantity Attenuation**
4. **Ground Water Recharge**

B. PLAN COMPONENTS

1. Erosion and Sediment Control

An Erosion and Sediment Control Plan has been developed for the proposed development in compliance with the New York State Pollutant Discharge Elimination System (SPDES) Stormwater General Permit. The design specifications and maintenance requirements of the erosion and sediment control practices utilized are based upon the guidelines of the New York State Standards and Specifications for Erosion and Sediment Control. The sequence of actions in the Erosion and Sediment Control plan is runoff control, stabilization, and then sediment control.

The maximum disturbance for construction at any one time is 5 acres. Prior to any clearing and grubbing activities, silt fences shall be placed along the perimeter of the clearing limit and construct stabilized construction entrances shall be constructed. Erosion control measures shall be installed immediately to reduce the impact of construction. As construction proceeds, all disturbed areas shall be paved, seeded, sodded, or planted as specified on the plans in a timely manner to prevent unnecessary erosion. Once disturbed areas have been properly stabilized, temporary control measures shall be removed. The Erosion Control Plans are attached as Appendix F. Refer to the erosion and sediment control practices to be utilized during each phase of the construction. The Phasing Plan of the site plans provides the specific construction schedules for each phase.

The following are inspection and maintenance practices that will be used to maintain erosion and sediment controls:

1. All control measures will be inspected at least once a week and immediately after periods of rainfalls greater than 0.5 inch.
2. All measures will be maintained in good working order. If a repair is necessary, it will be initiated within 24 hours of report.
3. Built-up sediment will be removed from silt fence when it has reached one-third the height of the fence.
4. Silt fence will be inspected for depth of sediment, tears, to see if the fabric is securely attached to the fence posts, and to see that the fence posts are firmly in the ground.
5. Temporary and permanent seeding and planting will be inspected for bare spots, washouts, and healthy growth.
6. A maintenance inspection report will be made after each inspection.

The on-site water quality structures will be owned and maintained by the Home Owners Association and the storm drainage pipes will be maintained by the Town of Ramapo, NY. The owner will select and be responsible for individuals who will be performing inspections, maintenance and repairs and to keep a log of all inspections and work performed. Personnel selected for inspection and maintenance responsibilities will receive training from the owner. They will be trained in all the inspection and maintenance practices necessary for keeping the erosion and sediment controls used on site in good working order.

2. Water Quality Control

Based on the New York State Stormwater Management Design Manual, we have provided water quality treatment will be provided for the proposed Patrick Farm Development. All runoff from the new non rooftop impervious areas are treated on site for water quality by means of stormwater ponds, and all rooftop areas are treated by a method of infiltration (Recharge Basins & Drywells) in accordance to the New York State Department of Environmental Conservation (NYSDEC) Stormwater Design Manual guidelines. The runoff from the proposed development is intercepted by catch basins and conveyed via storm drainage pipes to the stormwater management practices.

The objective of stormwater management practices is to trap coarse sediments and is to remove pollutants prior discharging into water bodies. Runoff from the new impervious areas is conveyed via storm drainage pipes to these stormwater management practices.

The site has been graded to complement the natural topography. The site has also been developed to avoid the disturbance of potentially environmentally sensitive areas.
Proposed roadway, parking lot and sidewalks on site have been graded so that the impervious surfaces drain to the water quality basin via storm drainage pipes. The basins have been sized to provide water quality and channel protection volumes as required by the NYSDEC Phase II Stormwater Quality Manual. Each basin includes a forebay, permanent pool, pond drain and trash rack, which are connected to an outlet structure where runoff is routed through a series of orifii and then discharged to outlet points nearest to the watercourses via on site storm drain system. Pond maintenance may require a pond to be drained which can be accomplished via a 6-inch pond drain line.

Rooftop runoff on site that does not contribute to the water quality basins is treated by methods of infiltration. Recharge basins and drywell systems are provided for water quality treatment and pretreatment. Each recharge basin includes a stilling basin, recharge pool and trash racks which are connected to an outlet structure where runoff is routed through a series of orifii and then discharged to outlet points nearest to the watercourses via on site storm drain system. The drywells will have an open grate that will function as a flow distributor to convey larger storms.

Refer to Appendix A for water quality and channel protection volumes calculation provided for the project. Proposed mitigation for the entire site includes: 10 water quality ponds (Non-roof areas) and 4 recharge basins (multi-family roof area). Independent drywells systems were designed for single family houses and ambulance corp. residences rooftop areas to meet water quality mitigation requirements. The proposed water quality basin, recharge basins and drywells; and storm drainage structures related to the Stormwater Management Practices will be owned and maintained by the Home Owner Associates (HOA) and Town of Ramapo.

3. Water Quantity Control

Onsite water quantity mitigation is provided as per the for NYSDEC water quantity control (Overbank flood protection (10 Year) & Extreme Flood Protection (100 Year)

mitigation requirements and Town of Ramapo requirements of zero net increase in peak rate of runoff from any proposed development.
Onsite detention in the existing pond is achieved by improving the existing spillway configuration is provided for the proposed drainage system contributing runoff to the study point of interest "E" as depicted on the attached drainage maps. Onsite detention was also provided in the water-quality and channel protection detention basins - 3, 9, and 10 to meet the required water quantity mitigation. Refer to the Summary Tables # 1 to 9 for the comparison of the peak discharges for both existing and developed conditions at all points of interest considered for the project.

4. Ground Water Recharge.

Onsite ground water recharge mitigation is proposed as part of the Storm Water Pollution Prevention Plan for maintaining the existing ground water recharge volume from the undeveloped site in the proposed conditions. The Consulting Firm Leggette, Brashears & Graham, Inc (LBG) provided expertise for guidance in the designing the ground water recharge systems. The runoff volume generated by one inch of rainfall over the proposed 45 acres of impervious area was recommended bye LBG, as the targeted monthly groundwater recharge volume from the proposed Groundwater Recharge systems. The ground water recharge basins and drywells system have been designed in accordance with NYSDEC stormwater manual guidelines.

The proposed Patrick Farm Development will have total 45 acres of impervious area which will reduce the rate of ground water recharge from the site. Only the rooftop impervious area of 17± acres was considered for the ground water recharge systems as stormwater runoff from parking lots and pavement area is not recommended for ground water recharge purposes.

In the existing conditions, it was determined by LBG based on the climatic conditions in the region that an average of 0.75 inch of rainfall per month can be recharged into the ground. Usually most of the groundwater recharge is achieved in the months of September to April when evaporation losses from the trees and plants are minimal. The onsite soils were evaluated for suitability of infiltration and onsite field soil permeability tests were performed by LBG to obtain percolation rate at proposed recharge basins locations.

The proposed recharge system was designed to recharge an average of 1 inch of rainfall per month over new impervious surfaces of 45 acres by meeting the NYSDEC requirements for Water Quality and Channel Protection runoff volume detention in the recharge Basins & Drywell systems (infiltration systems) for the proposed rooftop impervious area of 17± acres. It was assumed for the conservative design approach that the proposed system will effectively infiltrate 75% of the total average monthly runoff generated by the rooftop only impervious area into the ground under normal circumstances. The remaining 25% of the rooftop runoff assumed to be lost in evaporation and other miscellaneous conveyance losses for the demonstration purposes

only. All the recharge systems were designed to handle 100% of the rooftop runoff generated for up to 2.5 inches of rainfall event.

The Following summarizes the key design consideration for the Ground Water Recharge systems:

- The average rainfall for Rockland County, NY of 3.8 inches/month was obtained from NOAA data for the Suffern rain gauge.
- Runoff generated by one inch of rainfall over 45 Ac of impervious area = 45 Ac-Ft.
- 75% of average monthly rainfall = 3.8 in/Month * 0.75 = 2.85 Inch/Month.
- 75% of average monthly rainfall (2.85 in/Month)* 17 Ac Rooftop Area = 48.4 Ac-Ft.

Thus the designed groundwater Recharge System can effectively achieve the required goal of offsetting the potential loss in infiltration of 1 inch of rainfall over new 45 acres of new impervious area by infiltrating only about 75% of monthly rooftop only impervious area of 17 acres. The recharge systems were designed in consideration of infiltration of the normal water quality volume design rainfall event (1.3 inches) in less than 48 hours to utilize the maximum infiltration during relatively small but consecutive rainfall events.