

STORMWATER MANAGEMENT PLAN

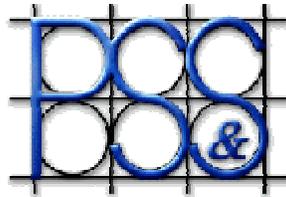
LIBERTY RIDGE HOMES

**VILLAGE OF SLOATSBURG
ROCKLAND COUNTY, NEW YORK**

Prepared for:

BAKER COMPANIES, LLC

Prepared by:



PAULUS, SOKOLOWSKI & SARTOR, PC
Consulting Engineers and Environmental Planners
67-A Mountain Boulevard Extension, Warren, New Jersey 07059

PS&S Job No.

Joseph J. Fleming, P.E.
Professional Engineer
New York License No. 066591

DECEMBER, 2005

TABLE OF CONTENTS

1.0	Introduction.....	1
2.0	Existing Site Conditions	1
3.0	Proposed Site Conditions.....	2
3.1	Methodology	2
3.2	Stormwater Management Approach	3
3.3	Stormwater Runoff Control	4
3.4	Water Quality	7
4.0	Soil Erosion and Sediment Control.....	8
5.0	Pollutant removal	12
5.1	Introduction	12

APPENDICES

APPENDIX A	SITE LOCATION MAP
APPENDIX B	HYDROLOGIC PARAMETERS
APPENDIX C	STORMWATER HYDROGRAPHS
APPENDIX D	STORM SEWER PIPE CALCULATIONS EMERGENCY SPILLWAY CALCULATIONS
APPENDIX E	SOIL EROSION AND SEDIMENT CONTROL CONDUIT OUTLET PROTECTION
APPENDIX F	POLLUTANT LOADING ANALYSIS
APPENDIX G	DRAINAGE AREA MAPS

LIBERTY RIDGE HOMES

STORMWATER MANAGEMENT PLAN

1.0 INTRODUCTION

This report has been prepared to present design objectives, methodology and calculations for the management of stormwater runoff under post-development conditions for Liberty Ridge Homes, a proposed residential development located in the Village of Sloatsburg, Rockland County, New York. The project is bordered to the West and North by Post Road, to the East by Orange Turnpike (Rt. 17), to the Southeast by Liberty Rock Road and to the South by Eagle Valley Road. The project proposed the construction of 90 single family homes, four roads, two retention ponds, utility infrastructure and retaining walls. There are two access points to the development, the main access shall be from the East through Orange Turnpike and a secondary access is proposed through Post Road at the West corner of the property.

2.0 EXISTING SITE CONDITIONS

The project site is located adjacent to the Route 17 southbound lane, (a.k.a. Orange Turnpike) with Post Road located along northern property limits. The 56.617 acre site is identified as Tax Parcel No. 38.35-1-7 7 38.35-1-9 on the tax maps of the Village of Sloatsburg.

The property is steep to moderately sloping from a high elevation of approximately 588 feet NAVD 1998 at the top of the rock outcrop in the center of the property, to a lower elevation of approximately 398 feet NAVD 1988 within the freshwater wetland located in the northeasterly corner of the property. The site is essentially undeveloped, mainly covered with good condition woodlands with some rock outcrops within the high points, characteristic for the type of soil present in the area. Located at the center of the site on

an outparcel identified as 38.35-1-10 is an existing water tank owned and operated by United Water of New York.

The existing site has been divided into four major watersheds draining into separate and distinct points off-site. The Existing Conditions Drainage Area Map identifies each subwatershed limit and discharge point and is included in Appendix G.

Time of concentration (T_c) for watersheds has been computed using Technical Release No. 55 (TR-55), "Urban Hydrology for Small Watersheds". Because of the existing steep conditions throughout the site, the T_c for all four watersheds did not exceed 2-3 minutes. A minimum of 10 minutes was used for the pre-development time of concentration.

3.0 PROPOSED SITE CONDITIONS

The proposed Liberty Ridge development will be located on 28.93 acres of the site (approximately 50% of the site) and will include construction of 90 single-family units, infrastructure, stormwater management facilities and other improvements related to residential use as well as recreational amenities typical for community living.

Stormwater runoff from the development area will be collected and conveyed via underground storm sewer networks and discharged into one of the two retention ponds, each serving its own developed watershed. The Proposed Conditions Drainage Area Map is included in Appendix G.

3.1 Methodology

The assessment of stormwater runoff has been based upon the Soil Conservation Service Method as described in Technical Release No. 55 (TR-55), "Urban Hydrology for Small Watersheds". Theoretical storms are modeled with the 24 Hour SCS Unit Dimensionless

Hydrograph utilizing a Type III rainfall distribution and recurrence intervals of 1, 2, 10 and 100 years. Hydrograph generations and routings were accomplished via Intelisolve's Hydraflow 2005 Program. The program is tailored to model the SCS Method for hydrograph generations and to perform iterative solutions of the continuity equation (outflow=inflow +/- storage) with the intermediate values of the routing curve obtained through linear interpolation. The program has a default shape factor of 484.

Storm sewers hydraulics have been based upon surface runoff generated by the 25 year storm event and the Manning's Equation as defined in the "Handbook of Hydraulics" by Brater and King, sixth edition. The corresponding Manning's "n" value for HDPE pipe utilized in the design is 0.011. Storm sewer capacity is based upon full depth gravity flow.

Hydrological soil classifications with the watersheds are based on the Soil Conservation Service Soil Survey of Rockland County, New York which has adopted the NYDEC state standards. Soils within the project site are predominantly PsC and PsE, Paxton, very stony with soil group designation of "C".

Design for conduit outlet protection, for the proposed headwalls, has been furnished in accordance with New York Standards & Specifications for Erosion and Sediment Control. Computations are provided in Appendix E.

3.2 Stormwater Management Approach

The primary objective of the Stormwater Management Plan is to reduce the post-developed rate of runoff below the pre-developed rate of runoff under the influence of a 2, 10, and 100-year frequency storm. This project falls under the jurisdiction of the Village of Sloatsburg, Rockland County, which regulate the discharge of stormwater. The project is further under the jurisdiction of the NYDEC and the Stormwater Management Design Guidelines adopted in August 2003. The post-development peak

runoff rate for 2, 10 & 100-yr storm event must be equal to or less than the pre-development peak runoff rate.

In order to evaluate the existing and proposed runoff rates, the following procedure was utilized:

- Identify major watersheds. Four major watersheds have been identified.
- Calculate the existing (pre-developed) runoff rate from the watershed using the SCS method.
- Determine post-development site sub-watershed boundaries.
- Assess proposed runoff rates and design stormwater management facilities.

3.3 Stormwater Runoff Control

Implementation of the Stormwater Management Plan will result in peak runoff attenuation, reducing the proposed rates of runoff. As mentioned above, there are four watersheds that discharge to four distinct discharge points. Following is a description of each watershed;

- Drainage Area A (DA-A): Existing DA-A consists of 7.22 acres and discharges north of the site at discharge point A. In the proposed condition, a portion of DA-A shall be tributary to Drainage Area B, reducing the drainage area to control point A to 3.26 acres which results in a decrease in flow to discharge point A for all storm events.
- Drainage Area B (DA-B): Existing DA-B consists of 18.32 acres and discharges East of the site at discharge point B. In the proposed condition, portions of DA-A, DA-C and DA-D are tributary to Basin 1, therefore increasing the net drainage area of postdevelopment DA-B to 34.13 acres. Post development DA-B is divided into two drainage areas. DA-B2 consists of 15.09 acres, will remain undisturbed

and is direct to discharge point B. The remaining 19.05 acres, proposed for development, is designated as DA-B1, shall be treated in Basin 1. Flow from Basin 1 is tributary to discharge point B. The net flow to discharge point B does not exceed the predevelopment rate for all storm events.

- **Drainage Area C (DA-C):** Existing DA-C consists of 26.10 acres and discharges south of the site at discharge point C. In the proposed condition, a portion of DA-C shall be tributary to Drainage Area B, reducing the drainage area to control point C to 16.94 acres. Post development DA-C is divided into two drainage areas. DA-C1 consists of 3.86, is proposed for development and shall be tributary to Basin 2. Flow from Basin 2 is tributary to discharge point C. DA-C2 consists of 13.09 acres. A small portion of DA-C2 shall be disturbed. Disturbance is limited to fill activities, no impervious coverage is proposed. Flow from DA-C2 shall be direct to control point C. The net flow to discharge point C shall not exceed the predevelopment rate for all storm events.
- **Drainage Area D (DA-D):** Existing DA-D consists of 6.04 acres and discharges west of the site at discharge point D. In the proposed condition, a portion of DA-D shall be tributary to Drainage Area B, reducing the drainage area to discharge point D to 3.43 acres which results in a decrease in flow to discharge point D for all storm events.

The results of the 2, 10 and 100-year routed hydrographs for existing and proposed conditions can be found in Appendix C, and are summarized below.

Table 1 - Existing Hydrologic Parameters & Flow						
Watershed	Total Drainage Area (Ac)	SCS Curve Number	Tc, Time of Concentration (Min.)	2-Year (CFS)	10-Year (CFS)	100-Year (CFS)
D.A. - A	7.20	61.1	10 minimum	2.46	9.13	18.33

D.A. - B	18.32	64.1	10 minimum	8.46	27.14	51.73
D.A. - C	26.10	70.0	10 minimum	19.49	49.89	87.60
D.A. - D	6.00	70.0	10 minimum	4.48	11.47	20.14

Table 2 - Proposed Hydrologic Parameters & Flow						
Watershed	Total Drainage Area (Ac)	SCS Curve Number	Tc, Time of Concentration (Min.)	2-Year (CFS)	10-Year (CFS)	100-Year (CFS)
D.A. - A	3.60	53	10 minimum	0.33	2.33	5.83
D.A. - B1	15.01	77.7	10 minimum	0.38	1.49	2.44
D.A. - B2	14.77	65.3	10 minimum	7.46	23.12	43.58
D.A. - C1	8.96	80.5	10 minimum	0.43	1.07	1.48
D.A. - C2	12.32	70.0	10 minimum	9.78	25.02	43.93
D.A. - D	3.43	70.0	10 minimum	2.56	6.56	11.51

Table 3 - Summary of Pre and Post Development Hydrologic Model Flows						
Watershed	EXIST 2-yr. (cfs)	EXIST. 10-yr. (cfs)	EXIST. 100-yr. (cfs)	POST. 2-yr. (cfs)	POST. 10-yr. (cfs)	POST. 100-yr. (cfs)
D.A. - A	2.46	9.13	18.33	0.33	2.33	5.83
D.A. - B	8.46	27.14	51.73	7.68	23.46	44.27
D.A. - C	19.49	49.89	87.60	9.92	25.58	45.01
D.A. - D	4.48	11.47	20.14	2.56	6.56	11.51

3.4 Water Quality

In accordance with NYSTOGS and NYS Stormwater Management Guidelines, consideration has been given to providing water quality enhancement of stormwater runoff from proposed stormwater management facilities. The extended detention time within the proposed retention ponds, integration of forebays and water quality storage volume shall provide water quality enhancement, sufficient retention for settling of the urbanized stormwater runoff for this development. The stormwater systems are designed to maintain water treatment at the site. This will be accomplished through the installation of an underground stormwater collection system leading to retention ponds 1 & 2 which are designed to provide extended detention of surface runoff. “First-flush” runoff resulting from the 1-year, 24-hour storm will be captured and treated in the ponds through the use of a Forebays and a 3 inch diameter orifice as the low level outlet. The proposed retention ponds also provide extended detention time.

As per the New York State Stormwater Management Design Manual dated August 2003, the proposed forebay for each of the basins shall provide a minimum volume of 10% of the water quality volume while the wet pond shall provide a minimum volume of 50%. Following is a summary of the results.

Table 7 - Summary of Outflow from Ponds - Water Quality Storm		
Drainage Area to Pond	Inflow (CFS)	Routed Outflow (CFS)
DA - B1	8.75	0.22
DA - C1	6.37	0.22

4.0 SOIL EROSION AND SEDIMENT CONTROL

The construction of the proposed development will require the excavation/grading of soils on site. The total area of disturbance is approximately 30.00 acres, or 53% of the existing

site. Approximately 47% of the site will remain undisturbed, which exceeds the requirement of the governing agencies to preserve 40% of the site as open space.

During construction of the proposed development, temporary and permanent soil erosion and sediment control measures shall be implemented, to minimize impacts to the surrounding land areas and water bodies.

Soil erosion would be controlled by:

- keeping disturbed areas to a minimum and providing temporary seeding and mulching if construction operations cease for more than 20 days;
- keeping topsoil stockpiles less than 35 feet high, and keeping the side slopes of these stockpiles at or less than 2:1;
- constructing a crushed stone tracking pad at the points of egress and ingress for construction vehicles of each phase; and
- placing stone rip-rap at the outlets of storm sewer pipe networks.

Sedimentation would be controlled by:

- installing silt fence barriers along the base of slopes and around the perimeter of topsoil stockpiles;
- placing an inlet filter over the grate of each stormwater inlet or catch basin as it is constructed to prevent sedimentation within the storm sewer system; and
- cleaning inlet filters and the upstream sides of all silt fencing after each erosion producing storm.

Soil erosion and sediment control shall be ensured during the construction period through a program of daily observation and maintenance with particular emphasis on inspection and repair following rain storms. All graded areas shall be permanently seeded and landscaped to minimize erosion. All control measures shall be carried out in accordance with NYSDEC Technical Operational Guidelines Series (TOGS) requirements.

The project has been designed to minimize any potential adverse impacts to surface waters. Any impacts related to project construction would be short-term in nature, and no greater than impacts expected for the type of development which the project site is zoned.

5.0 POLLUTANT REMOVAL

5.1 Introduction

This section presents methodology and calculations for pollutant loading under existing and proposed conditions, and subsequent pollutant removal by stormwater management systems.

Pollutant loading rates were estimated using the Simple Method described on page 36 of “Reducing the Impacts of Stormwater Runoff from New Development”, (RISR), second edition by the New York State Department of Environmental Conservation, April, 1993. The pollutants analyzed are total suspended solids, total phosphorus, total nitrogen, and biological oxygen demand as described on page 61 of the RISR.

The analyzed watershed currently consists of 56.617 acres of primarily wooded area. Proposed improvements will decrease the pervious coverage by 9.6 acres. Runoff from the proposed development will be collected in underground systems and will discharge into proposed retention ponds.

5.2 Pollutant Loading

5.2.1 Existing Conditions

Annual pollutant loading rates were calculated using the Simple Method with an annual rainfall depth of 40 inches and a correction factor of 0.9 for annual calculations. Storm runoff coefficients were taken from Figure 9 of RISR and pollutant loading coefficients were taken from Table 8 of RISR. The pollutant

loading factor for total suspended solids was taken from “Stormwater and Nonpoint Source Pollution Control Best Management Practices Manual”, by the New Jersey Department of Environmental Protection, dated December 1994.

The present condition of the watershed required the use of “Hardwood Forest” land use form Table 8 in the calculations.

5.2.2 Proposed Conditions

Under proposed conditions the overall watershed will consist of approximately 36% impervious coverage. The loading coefficients used can be found in the “New Suburban Sites” land use category of Table 8.

5.3 Pollutant Removal

The development runoff generated by the impervious surfaces shall be collected and conveyed into the proposed retention ponds which have been designed for water quality treatment. Design 2, described in Figure 15 of the RISR, entitled Comparative Pollutant Removal of Urban BMP Designs, requires 24 hour detention of the runoff volume produced by 1.0 inch of rainfall. The resulting pollutant loading rates after the retention ponds as well as the existing conditions are shown in the summary table, in appendix F, with the increased rates - a direct result of the additional impervious area.