INSITE
ENGINEERING, SURVEYING &
LANDSCAPE ARCHITECTURE, P.C.

PRELIMINARY STORMWATER POLLUTION PREVENTION PLAN

For

1 Croton Point

Croton Point Ave.
Croton-On-Hudson, New York

March 26, 2025

Applicant Information:

WBP Development, LLC
480 Bedford Road
Chappaqua, NY 10514

Note: This report in conjunction with the project plans make up the complete Stormwater Pollution Prevention Plan.

STATE OF NEW YORK
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CONTENTS

1.0 INTRODUCTION

1.1 Project Description

The project consists of a proposed 100-unit, for sale affordable condominium development consisting of 46 one-bedroom and 54 two-bedroom homes in a to be constructed 5-story building with requisite parking and amenities (the “Development”) to be located on lands fronting on Croton Point Avenue consisting of (i) Tax Map Parcels 79.17-1-5 & 3 owned by the Village (“Lot A”); and (ii) Tax Map Parcel 79.17-1-3 owned by Croton Point Realty Inc (the “CPR Parcel”). Lot A is currently in use as a Village commuter parking lot. The CPR Parcel is improved with an office building which is proposed to be demolished for the Development.

The proposed brick and metal panel building will be served by 100 parking spaces to be located in a below grade parking level and two outdoor parking areas, including five (5) Level 2 EV charging stations. Amenities within the building will include a community room, a fitness center, a co-working lounge, a bike storage room and a roof-top deck providing expansive scenic views overlooking Croton Point Bay and the Hudson River.

Sustainable building design features will likely include full electrification, solar readiness, high efficiency HVAC equipment (cold climate air source heat pumps) and appliances (Energy Star Multifamily New Construction Program) and low-flow water fixtures.

In total the property consist of 1.8 ± acres and is located in the LI (Light Industrial with a Transoriented Development Overlay) zoning district, the Village of Corton-on-Hudson Water District and the Ossining Sanitary Sewer District.

1.2 Existing Site Conditions

The subject project is located on Croton Point Avenue across from Veterans Plaza in the Village of Croton-On-Hudson. As previously stated, the site currently exists as a commercial development with several buildings, parking areas, walkways, and other appurtenances. The stormwater runoff from the existing property generally drains from a high point in the center of the property north and south towards the existing drain inlets and their collection system, which discharge to the west and east respectively. The northern drain inlet flows west onto MTA property and the southern drain inlet flows east onto NYSDOT property.

The two drain inlets discussed above have been designed as Design Points for the purpose of stormwater quantity analysis contained herein, and are shown on Figures 2 and 3. Design Point 1 represents the existing drainage structure at the corner of Croton Point Avenue and NYS Route 9 that flows east. Design Point 2 represents the drainage structure that is part of the existing collection system that discharges west towards the Metro North Railroad property.

Onsite soils belong to the Hydrologic Group B. Pursuant to the National Resource Conservation Service Web Soil Survey, the soil designations of the onsite soils consist of Urban land (Uf) and Udorthents (Ub). The soil boundaries are shown on the enclosed pre- and post-development drainage figures, Figures 2 and 3 of this report.

1.3 Proposed Site Conditions

It is proposed to construct a 21,500 sf ± (footprint area) affordable condominium with associated parking and various site appurtenances. The new five-story building will contain one hundred apartments. There will be 46 one-bedroom apartments and 54 two-bedroom apartments. Amenity spaces will also be constructed which will be used by the residents of the building only.

This project is a redevelopment project with an overall decrease in impervious area. The project results in a net decrease of 0.2 acres +/-.

It is proposed to maintain the overall drainage boundaries to the maximum extent practicable and tie into the existing onsite collection system in the proposed condition. New drainage structures will capture the runoff from the redeveloped site and will discharge into the hydrodynamic separators for treatment of the new impervious areas. The intent is to capture and treat the stormwater runoff from the redeveloped area of the site and treat it in accordance with the NYSDEC standards for quality and quantity prior to discharging to the existing stormwater collection systems, such there is no impact to the surrounding stormwater design. Two hydrodynamic separators are proposed in total, one tributary to each design point.

As shown in the following sections of this report, the stormwater quality and quantity for the proposed development have been treated in accordance with the requirements of the General Permit, GP-0-25-001. Additionally, an erosion and sediment control plan has been prepared in accordance with the *New York State Standards and Specifications for Erosion and Sediment Control* (Blue Book) to protect the existing waterbodies and drainage features during construction activities.

2.0 STORMWATER MANAGEMENT

The proposed stormwater management system for the project has been designed to meet the requirements of the state stormwater ordinances and guidelines, including but not limited to those of the NYSDEC.

As noted in Part III.A.2 of the General Permit GP-0-25-001, consideration of future physical risks due to climate change pursuant to Community Risk and Resiliency Act (CRRA), 6 NYCRR Part 490 shall be considered. First, the CRRA primarily focuses on areas subject to flooding and areas at risk of sea level rise. The proposed project is not in an area for flood risk due to sea level rise and there are no FEMA regulated Floodways or Floodplains on the subject property or within the surrounding vicinity. Additionally, there is no immediate downstream infrastructure such as dams or major road culvert crossings that are potentially impacted by the proposed project. There are no known flood issues that have occurred in or around the project site. See below the current rainfall data obtained from the Northeast Regional Climate Center (NRCC) and the Natural Resources Conservation Service (NRCS) utilized in this report. This rainfall data which is updated annually allows designers to account for the most recent climate data recorded and allows for site specific distribution curves to be utilized. Based on the foregoing, it is believed the requirements of Part III.A.2 of General Permit GP-0-25-001 are addressed through this project SWPPP.

In accordance with the GP-0-25-001, Part III.B.2.b.iii., as the subject project SWPPP was submitted for review as part of the Site Plan application to the Village of Croton-on-Hudson Planning Board prior to the issuance of the GP-0-25-001 and was developed using the 2015 NYSDEC *New York State Stormwater Management Design Manual* (Design Manual), the subject project may continue to design the post-construction stormwater management practices in conformance with the performance criteria in the 2015 Design Manual.

Since the subject project proposes the disturbance of more than one (1) acre, coverage under the New York State Department of Environmental Conservation (NYSDEC) SPDES General Permit No. GP-0-25-001 (General Permit) is required. Chapter 4 of the NYSSMDM specifies five design criteria that are Water Quality Volume (WQ_v), Runoff Reduction Volume (RR_v), Stream Channel Protection Volume (CP_v), Overbank Flood Control (Q_p), and Extreme Storm Control (Q_f). The first two of these requirements relates to treating water quality, while the later pertain to stormwater quantity (peak flow) attenuation. As noted in previous sections of this report, this project is a redevelopment project with an increase in impervious area. As such the RRv requirements and CPv requirements are not required. Per Chapter 9, the proposed hydrodynamic separators have been designed as a flow through practice. As such, the flow through practices have been sized for the peak rate of runoff from 100% of the WQv design storm, as defined Chapter 4 to treat the WQv in accordance with the NYSSMDM.

To meet the above referenced requirements, the following post construction stormwater management practices are proposed for the project:

Table 2.0.1 – Proposed SMP Design Criteria Summary Table

Proposed SMP ID	NYSSMDM Ch. 9 Design Designation	NYSDEC Uniform Stormwater Sizing Criteria Satisfied
HDS 1.1	Hydrodynamic Separator (Alt. Practice)	WQ_v
HDS 2.1	Hydrodynamic Separator (Alt. Practice)	WQ_v

Sizing calculations for the hydrodynamic separators have been provided in Appendix A. Information regarding the sizing and maintenance of the proposed hydrodynamic separators can be in Appendix F. As noted above the hydrodynamic separators result in treatment of the entire site and will be sized to treat the WQv peak flow as required by Chapter 9.

To address stormwater quantity requirements of the NYSDEC, the "HydroCAD" Stormwater Modeling System," by HydroCAD Software Solutions LLC in Tamworth, New Hampshire, was used to model and assess the peak stormwater flows for the subject project. HydroCAD is a computer aided design program for modeling the hydrology and hydraulics of stormwater runoff. It is based primarily on hydrology techniques developed by the United States Department of Agriculture, Soil Conservation Service (USDA, SCS) TR-20 method combined with standard hydraulic calculations. For details on the input data for the subcatchments and design storms, please refer to Appendices B and C.

The input requirements for the HydroCAD computer program are as follows:

Subcatchments (contributing watershed/sub-watersheds)

- Design storm rainfall in inches
- CN (runoff curve number) values which are based on soil type and land use/ground cover
- T_c (time of concentration) flow path information
- Watershed Area in Acres

Stormwater Basins

- Surface area at appropriate elevations
- Flood elevation
- Outlet structure information

The following is a general description of the input data used to calculate the pre- and post-development stormwater runoff values. For detailed information for each subcatchment and stormwater management practice, see Appendices B & C. The 1-year, 10-year, and 100-year 24-hour design storm were obtained from the New York State Stormwater Management Design Manual. The values provided are for 24-hour design storms.

Table 2.0.1 – Precipitation Values for Corresponding Design Storms

Design Storm	24-Hour Rainfall
1-Year	2.34"
10-Year	4.66"
100-Year	8.82"

The CN (runoff curve number) values utilized in this report were referenced from the USDA, SCS publication *Urban Hydrology for Small Watersheds*. The following is a summary of the various land uses/ground covers and their associated CN values utilized in this report.

Table 2.0.2 – Project Ground Cover and Associated Curve Numbers (CN)

Land Use/Ground Cover	CN Value
Paved Parking and Roofs, All Soils	98
>75% Grass Cover, D Soils	80
Woods, Good, HSG D	77
>75% Grass Cover, B Soils	61
Woods, Good, HSG B	55

2.1 NYSDEC Runoff Reduction Volume, RR_v

The Runoff Reduction Volume (RR_v) criterion is intended to replicate pre-development hydrology by maintaining preconstruction infiltration, peak flow runoff, discharge volume, as well as minimizing concentrated stormwater flow. As noted above, meeting the Runoff Reduction Volume (RRv) sizing criteria is not required for redevelopment projects with a reduction in overall impervious cover.

2.2 NYSDEC Water Quality Volume, WQ_v

The stormwater management practice has been designed in accordance with the *Water Quality Volume (*WQ_v*)* Section (Chapter 4.2) of the NYSSMDM. As outlined in Chapter 4.2, the WQ_v is the runoff volume generated from the entire 90th percentile rain event. As previously stated, partitions of the proposed impervious surfaces will overlap existing impervious surfaces within the site area. As stated in Chapter 9 of the NYSSMDM only 25% of existing impervious (redevelopment) and 100% of new impervious surfaces within the proposed subcatchment require treatment. However, the proposed hydrodynamic separators (HDS 1.1 & HDS 2.1) have been designed as a flow through practice. As such, the flow through alternative practices have been sized for the peak rate of runoff from 100% of the WQv design storm, as defined Chapter 4 to treat the WQv in accordance with the NYSSMDM. In Appendix A of this report the calculation for the WQ_v to be treated.

Table 2.2.1 and 2.2.2 below summarizes the WQv treatment and Required Elements for the proposed Hydrodyanmic Separators (HDS 1.1 & HDS 2.1). The hydrodynamic separators have been designed in accordance with the Chapter 9 of the Design Manual for an alternative practice. As shown on the project plans, a StormSettler Hydrodynamic Separator by StormTrap are proposed. The StormTrap StormSettler is an NJCAT verified proprietary practice. The table below summarizes the required and provided WQv treatment rates. See Appendix A and F for more sizing information.

Table 2.2.1 Alternative Practice Sizing Summary

Subcatchment ID	HDS ID	100% WQ_v Peak Flow (C.F.)	100%WQ_v Peak Flow (C.F.S)	Hydrodynamic Separator Model	Maximum Treatment Flow Rate (C.F.S.)
1.1S	HDS 1.1	4,165	1.4	StormSettler-4	1.41 CFS
1.2S	HDS 2.1	1,810	0.6	StormSettler-3	0.79 CFS

It should be noted that the above tables illustrate the water quality volume requirements set forth in the NYSSWDM have been met for the Hydrodynamic Separators (HDS 1.1 & HDS 2.1). By meeting the Water Quality Volume requirements through employment of an alternative practice, the water quality objectives of the NYSDEC to treat the water quality volume will be met.

2.3 NYSDEC Stream Channel Protection Volume, CP_v

The Stream Channel Protection (CP_v) criterion is intended to protect stream channels from erosion and is accomplished by the 24-hour extended detention of the center-of-mass of the one-year, 24-hour storm event. As per the NYSSWDM Chapter 9, if the post-construction 1-year 24 hour discharge rate and velocities are less than or equal to the pre-construction design rate, providing 24 hours detention of the 1 year storm to meet CPv criteria is not required. Table 2.3.1 below summarizes the peak flows discharging for the 1-Year 24-Hour design storm and demonstrates that the 1-Year 24-Hour post development rate is less than the predevelopment rate.

Table 2.4.1– Pre and Post-Development Peak Flows at the Design Point

	1-YEAR **(Channel Protection Volume)**	
	Pre	**Post**
Design Point 1	3.0	2.6
Design Point 2	2.2	2.1

The data for the table above was taken from Appendix B & C of this SWPPP. As shown in the table above the peak flows discharging to the design point have beem mitigated for the 1-Year 24-Hour Storm. By providing a reduction in peak flows during the 1-Year, 24-hour storm, the NYSDEC requirements for Stream Channel Protection (Cpv) have been met.

2.4 NYSDEC Overbank Flood Control, Q_p, and Extreme Flood Control, Q_f

The Overbank Flood Control (Q_p) requirement is intended to prevent an increase in the frequency and magnitude of out-of-bank flooding events generated by urban development. Overbank control requires storage to attenuate the post-development 10-year, 24-hour peak discharge to pre-development rates. The Extreme Flood Control (Q_f) requirement is intended to prevent the increased risk of flood damage from large storm events, maintain the boundaries of the pre-development 100-year flood plain, and protect the physical integrity of stormwater management practices. Extreme flood control requires storage to attenuate the post-development 100-year, 24-hour peak discharge to pre-development rates. As shown in Table 2.4.1 attenuation for both the 10-year and 100-year 24-hour storms has been provided thus satisfying the Q_p and Q_f requirements.

Table 2.4.1– Pre and Post-Development Peak Flows at the Design Point

24-HOUR DESIGN STORM PEAK FLOWS (c.f.s.)				
	10-YEAR **(Overbank Flood Control)**		**100-YEAR** **(Extreme Flood Control)**	
	Pre	**Post**	**Pre**	**Post**
Design Point 1	5.2	5.0	8.6	8.4
Design Point 2	4.8	4.7	8.9	8.8

As shown in the above table the peak flows discharging to the design point in the proposed condition have been mitigated to below the existing condition levels, therefore the receiving downstream drainage systems will see a reduction in peak flows during the storm events shown above and as such satisfy the Overbank and Extreme Overbank Flood Control requirements.

3.0 STORMWATER CONVEYANCE SYSTEM

The stormwater collection and conveyance systems for the project will consist of catch basins, drain inlets, yard drains, and HDPE pipe. The pipe conveyance system will be sized to collect and convey at minimum the 25-year, 1-hour design storm using the Rational Method. The Rational Method is a standard method used by engineers to develop flow rates for sizing collection systems. The Rational Method calculates flows based on a one-hour design storm. See Appendix G for Pipe Sizing Calculations

4.0 EROSION AND SEDIMENT CONTROL

Erosion and sediment control should be accomplished by four basic principles: diversion of clean water, containment of sediment, treatment of dirty water, and stabilization of disturbed areas. Diversion of clean water should be accomplished with swales. This diverted water should be safely conveyed around the construction area as necessary and discharged downstream of the disturbed areas. Sediment should be contained with the use of silt fence at the toe of disturbed slopes and excavation of the temporary sediment basin. Disturbed areas should be permanently stabilized within 14 days of final grading to limit the required length of time that the temporary facilities must be utilized. The owner will be responsible for the maintenance of the temporary erosion control facilities.

4.1 Temporary Erosion and Sediment Control Facilities

Temporary erosion and sediment control facilities should be installed and maintained as required to reduce the impacts to off-site properties. The owner will be required to provide maintenance for the temporary erosion and sediment control facilities. In general, the following temporary methods and materials should be used to control erosion and sedimentation from the project site:

- Stabilized Construction Entrance
- Silt Fence Barriers
- Storm Drain Inlet Protection

A stabilized construction entrance should be installed at the entrance to the site. The design drawings will include details to guide the contractor in the construction of this entrance. The intent of the stabilized construction entrance is to prevent the "tracking" of soil from the site. Dust control should be accomplished with water sprinkling trucks if required. During dry periods, sprinkler trucks should wet all exposed earth surfaces as required to prevent the transport of air-borne particles to adjoining areas.

Siltation barriers constructed of geosynthetic filter cloth should be installed at the toe of all disturbed slopes. The intent of these barriers is to contain silt and sediment at the source and inhibit its transport by stormwater runoff. The siltation barriers will also help reduce the rate of runoff by creating filters through which the stormwater must pass.

Storm drain inlet protection in the form of stone drop inlet protection will be installed around all proposed inlets. The stone drop inlet protection will serve to filter stormwater runoff before it enters the collection system. Throughout construction the concrete drainage structures, associated piping and inlet protections shall be inspected weekly and after a rainfall event. These items shall be cleaned, repaired and/or replaced when needed.

4.2 Permanent Erosion and Sediment Control Facilities

Permanent erosion and sediment control will be accomplished by diverting stormwater runoff from steep slopes, controlling/reducing stormwater runoff velocities and volumes, and vegetative and structural surface stabilization. All of the permanent facilities are relatively maintenance free and only require periodic inspections. The owner will provide maintenance for all the permanent erosion and sediment control facilities.

Other than the buildings and paved surfaces, disturbed surfaces will be stabilized with vegetation. The vegetation will control stormwater runoff by preventing soil erosion, reducing runoff volume and velocities, and providing a filter medium. Permanent seeding should optimally be undertaken in the spring from March 21st through May 20th and in late summer from August 15th to October 15th.

5.0 IMPLEMENTATION, MAINTENANCE & GENERAL HOUSEKEEPING

5.1 Construction Phase

Details associated with the implementation and maintenance of the proposed stormwater facilities and erosion control measures during construction are shown on the project drawings. A construction sequence has been provided to guide the contractor in the installation of the erosion control measures as well as the site plan features. The erosion control plan, includes associated details and notes to aid the contractor in implementing the plan.

During construction, a Site Log Book, Appendix E, is required to be kept per NYSDEC SPDES General Permit GP-0-25-001. Erosion and sediment control inspections are required to be conducted as necessary under coverage of the permit (minimum once a week, two times a week should the overall disturbance exceed five acres) and an updated logbook and a copy of the SWPPP is required to be kept on site for the duration of the construction activities. The Construction Site Log Book is an appendix taken from the *New York Standards and Specifications for Erosion and Sediment Control* (Blue Book).

In addition to the proposed erosion and sediment control facilities, the following good housekeeping best management practices shall be implemented to mitigate potential pollution during the construction phase of the project. The general contractor overseeing the day-to-day site operation shall be responsible for the good housekeeping best management practices included in the following general categories:

- Material Handling and Waste Management
- Establishment of Building Material Staging Areas
- Establishment of Washout Areas
- Proper Equipment Fueling and Maintenance Practices
- Spill Prevention and Control Plan

All construction waste materials shall be collected and removed from the site regularly by the general contractor. The general contractor shall supply waste barrels for proper disposal of waste materials. All personnel working on the site shall be instructed of the proper procedures for construction waste disposal.

Although it is not anticipated any hazardous waste materials will be utilized during construction, any hazardous waste materials shall be disposed of in accordance with federal, state, and local regulations. No hazardous waste shall be disposed of on-site. Hazardous waste materials shall be stored in appropriate and clearly marked containers and segregated from the other non-waste materials. All hazardous waste shall be stored in structurally sound and sealed shipping containers located in the staging areas. Material safety data sheets, material inventory, and emergency contact numbers will be maintained in the office trailer. All personnel working on the site shall be instructed of the proper procedures for hazardous waste disposal.

Temporary sanitary facilities (portable toilets) shall be provided on site during the entire length of construction. The sanitary facilities shall be located in an alternate area away from the construction activities on the site. The portable toilets shall be inspected weekly for evidence of leaking holding tanks.

All recyclables, including wood pallets, cardboard boxes, and all other recyclable construction scraps shall be disposed of in a designated recycling barrel provided by the contractor and removed from the site regularly. All personnel working on the site shall be instructed of the proper procedures for construction waste recycling.

All construction equipment and maintenance materials shall be stored in a designated staging area. Silt fence shall be installed down gradient of the construction staging area. Shipping containers shall be utilized to store hand tools, small parts, and other construction materials, not taken off site daily. Construction waste barrels, recycling barrels and if necessary hazardous waste containers shall be located within the limits of the construction staging area.

Throughout the construction of the project, several types of vehicles and equipment will be used on-site. Fueling of the equipment shall occur within the limits of the construction staging area. Fuel will be delivered to the site as needed, by the general contractor, or a party chosen by the general contractor. Only minor vehicle equipment maintenance shall occur on-site, all major maintenance shall be performed off-site. All equipment fluids generated from minor maintenance activities shall be disposed of into designated drums and stored in accordance with the hazardous waste storage as previously discussed.

Vehicles and equipment shall be inspected on each day of use. Any leak discovered shall be repaired immediately. All leaking equipment unable to be repaired shall be removed from the site. Ample supplies of absorbent, spill-cleanup materials, and spill kits shall be located in the construction staging area. All spills shall be cleaned up immediately upon discovery. Spent absorbent materials and rags shall be hauled off-site immediately after the spill is cleaned for disposal at a local landfill. All personnel working on the site shall be instructed of the proper procedures for spill prevention and control.

During the construction phase of the project the subsurface infiltration system shall be cordoned off with construction fence to prevent undue compaction of the surrounding soils. The infiltration areas shall not be allowed to receive runoff until the contributing area to the system is completely stabilized in accordance with the erosion and sediment control notes on the project drawings. Installation of the system after the contributing area is stable will help to prevent any sediment from entering the SMP.

5.2 Long Term Maintenance Plan

Each spring the paved areas should be cleaned to remove the winter's accumulation of traction sand. After this is completed, all drain inlets sumps and the stormwater basins should be cleaned. All pipes should be checked for debris and blockages and cleaned as required. During the cleaning process, the drain inlets, catch basins, and pipes should be inspected for structural integrity and overall condition; repairs and/or replacement will be made as required.

The stormwater facilities for the subject project have been designed to minimize the required maintenance. This section discusses the minimum maintenance requirements to insure long-term performance of the stormwater facilities. Initially the stormwater facilities will require an increased maintenance and inspection schedule until all portions of the site are stable. Generally, the stormwater facilities consist of either collection and conveyance components or treatment components.

The stormwater collection and conveyance system is composed of HDPE, drainage pipe and precast concrete drainage structures. The owner will assume the maintenance responsibilities for the drainage system. Minimal maintenance is typically required for these facilities. All pipes should be checked for debris and blockages and cleaned as required. All drain inlet sumps shall be cleaned to removed deposited sediment. During the cleaning process, the pipes should be inspected for structural integrity and overall condition; repairs and/or replacement should be made as required.

Additionally, the hydrodynamic separators shall be checked for deposited sediment. Visual inspection of the bioretention filter shall take place after major storm events. Visual inspection of the hydrodynamic separator shall take place yearly.

APPENDIX A

NYSDEC Water Quality Volume WQv Calculation Worksheet

WQv Flow Calculation Worksheet

Project: 1 Croton Point
Project #: 24154.100
Date: 3/25/2025

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The following calculation determines the water quality flow rate for the 90% Water Quality Event using the Small Storm Hydrology Method specified in Appendix B of the New York State Stormwater Management Design Manual.

HDS ID: 1.1S

1.Water Quality Volume $= WQ_v = \frac{P * R_v * A}{12}$

P = WQv 24-hour Rainfall Amount	=	1.5	in.
A = Subcatchment Area	=	39204	SF
Ai= Impervious Area within Subcatchment Area	=	34848	
I = Ai/A	=	88.9	%
Rv = 0.05 + 0.009 (I%)	=	0.85	
WQv = Water Quality Volume	=	4,165	CF

WQv Flow Calculation Worksheet

Project: 1 Croton Point
Project #: 24154.100
Date: 8/1/2024

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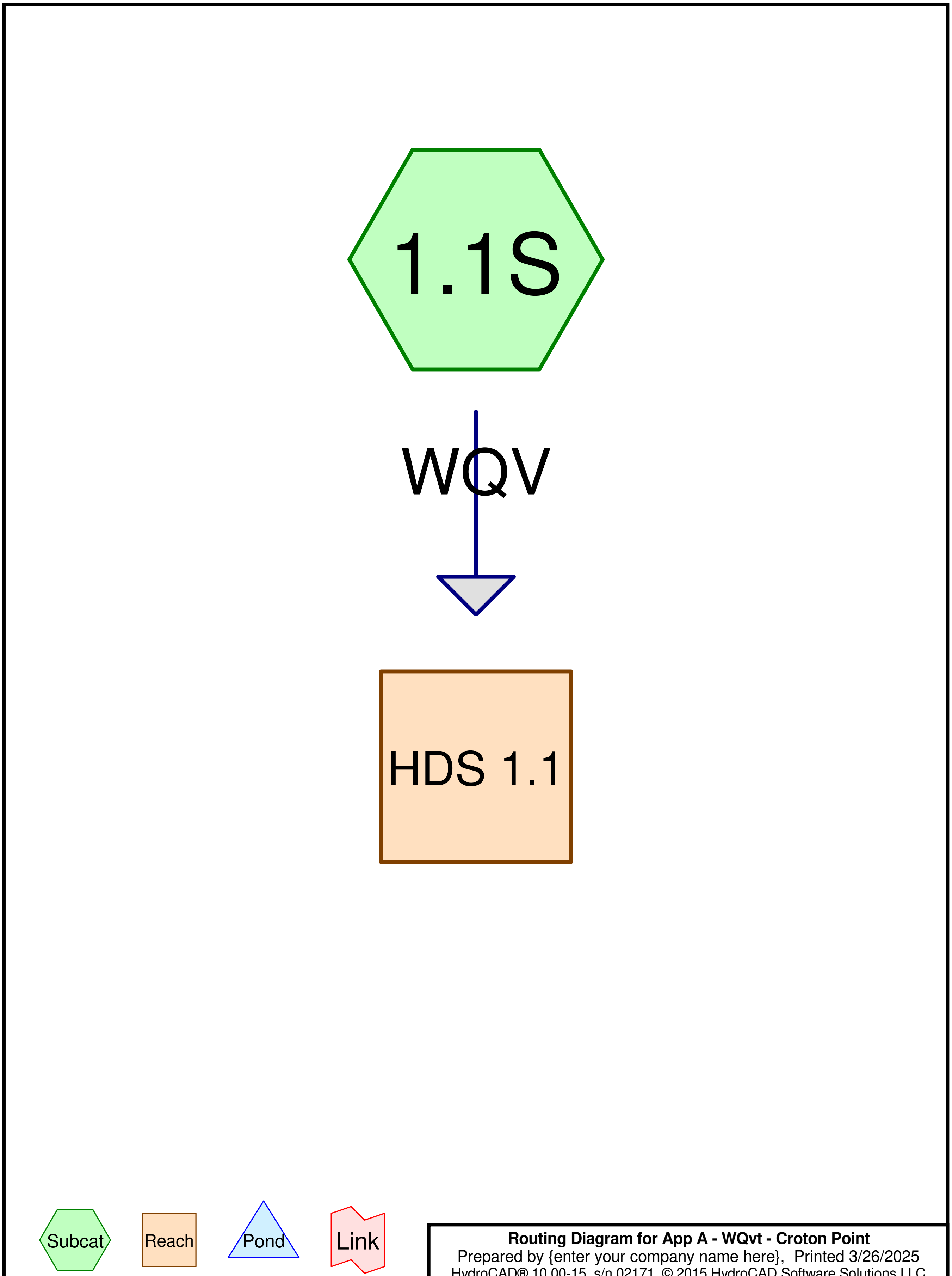
The following calculation determines the water quality flow rate for the 90% Water Quality Event using the Small Storm Hydrology Method specified in Appendix B of the New York State Stormwater Management Design Manual.

HDS ID: **2.1S**

1.Water Quality Volume $= WQ_v = \dfrac{P * R_v * A}{12}$

P = WQv 24-hour Rainfall Amount	=	1.5	in.
A = Subcatchment Area	=	15246	SF
Ai= Impervious Area within Subcatchment Area	=	15246	
I = Ai/A	=	100.0	%
Rv = 0.05 + 0.009 (I%)	=	0.95	
WQv = Water Quality Volume	=	1,810	CF



Routing Diagram for App A - WQvt - Croton Point
Prepared by {enter your company name here}, Printed 3/26/2025

Summary for Subcatchment 1.1S: WQV

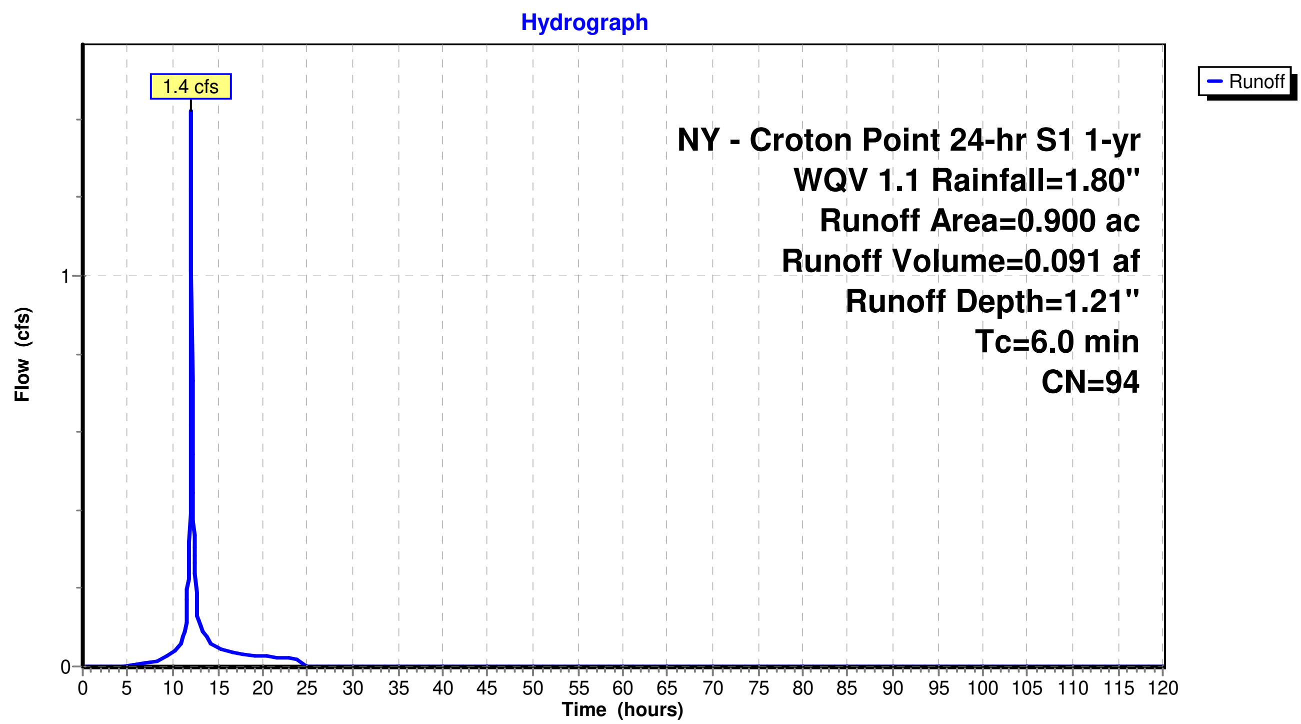
Runoff = 1.4 cfs @ 12.04 hrs, Volume= 0.091 af, Depth= 1.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NY - Croton Point 24-hr S1 1-yr WQV 1.1 Rainfall=1.80"

	Area (ac)	CN	Description
*	0.800	98	Impervious
	0.100	61	>75% Grass cover, Good, HSG B
	0.900	94	Weighted Average
	0.100		11.11% Pervious Area
	0.800		88.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1.1S: WQV

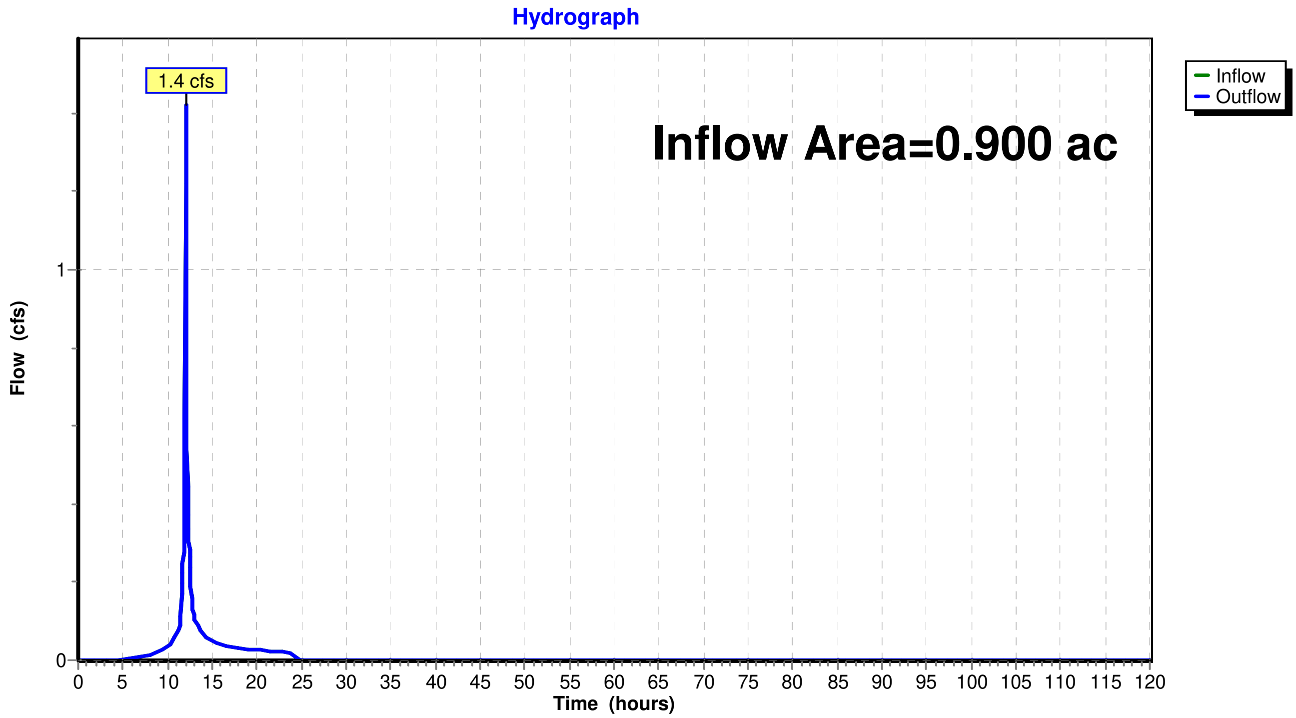


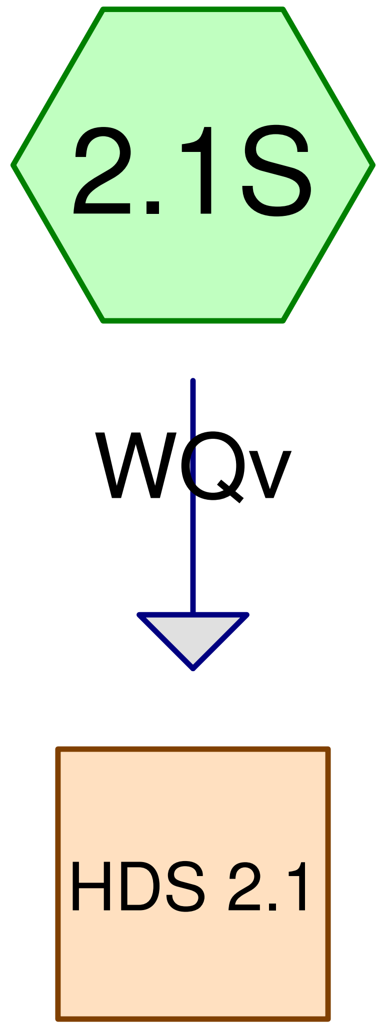
Summary for Reach HDS 1.1:

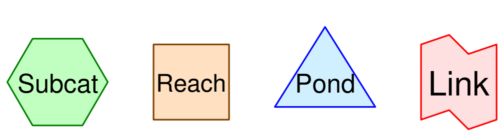
Inflow Area =	0.900 ac,	88.89% Impervious,	Inflow Depth = 1.21"	for WQV 1.1 event
Inflow =	1.4 cfs @	12.04 hrs,	Volume=	0.091 af
Outflow =	1.4 cfs @	12.04 hrs,	Volume=	0.091 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Reach HDS 1.1:







Routing Diagram for App A - WQvt - Croton Point
Prepared by {enter your company name here}, Printed 3/26/2025
HydroCAD® 10.00-15 s/n 02171 © 2015 HydroCAD Software Solutions LLC

Summary for Subcatchment 2.1S: WQv

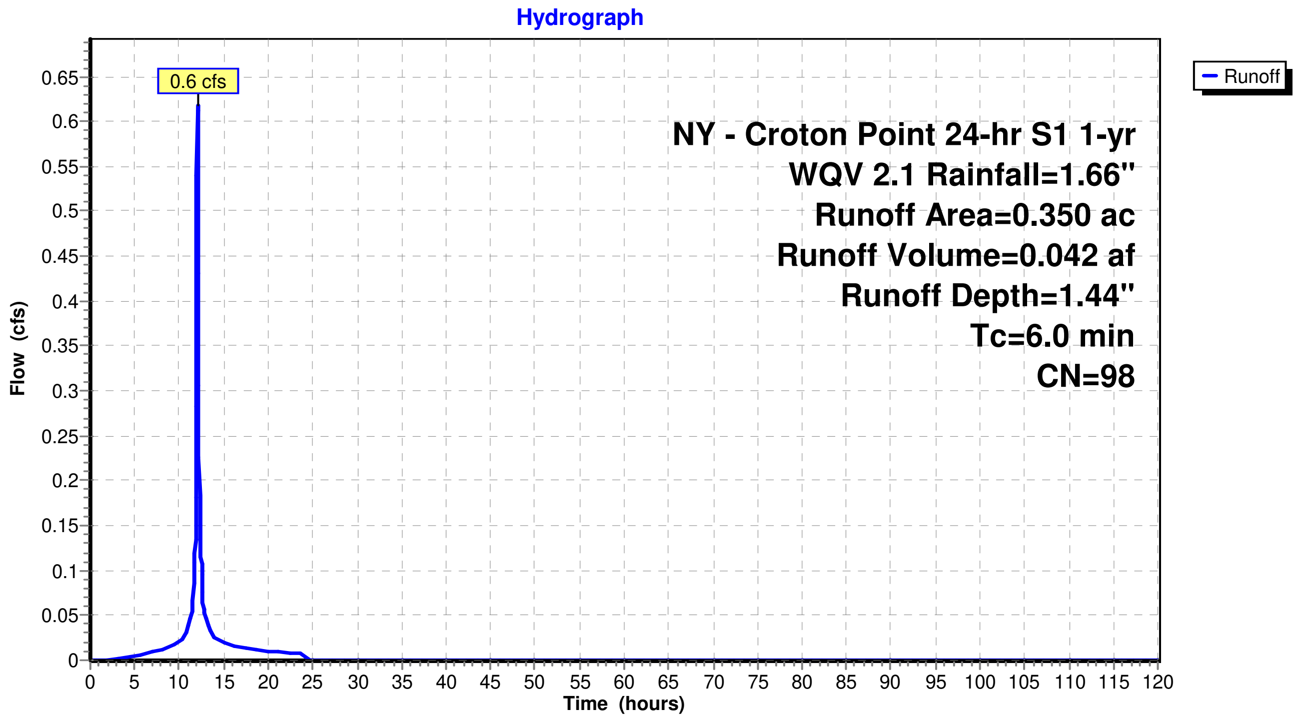
Runoff = 0.6 cfs @ 12.04 hrs, Volume= 0.042 af, Depth= 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NY - Croton Point 24-hr S1 1-yr WQV 2.1 Rainfall=1.66"

	Area (ac)	CN	Description
*	0.350	98	Impervious
	0.350		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2.1S: WQv

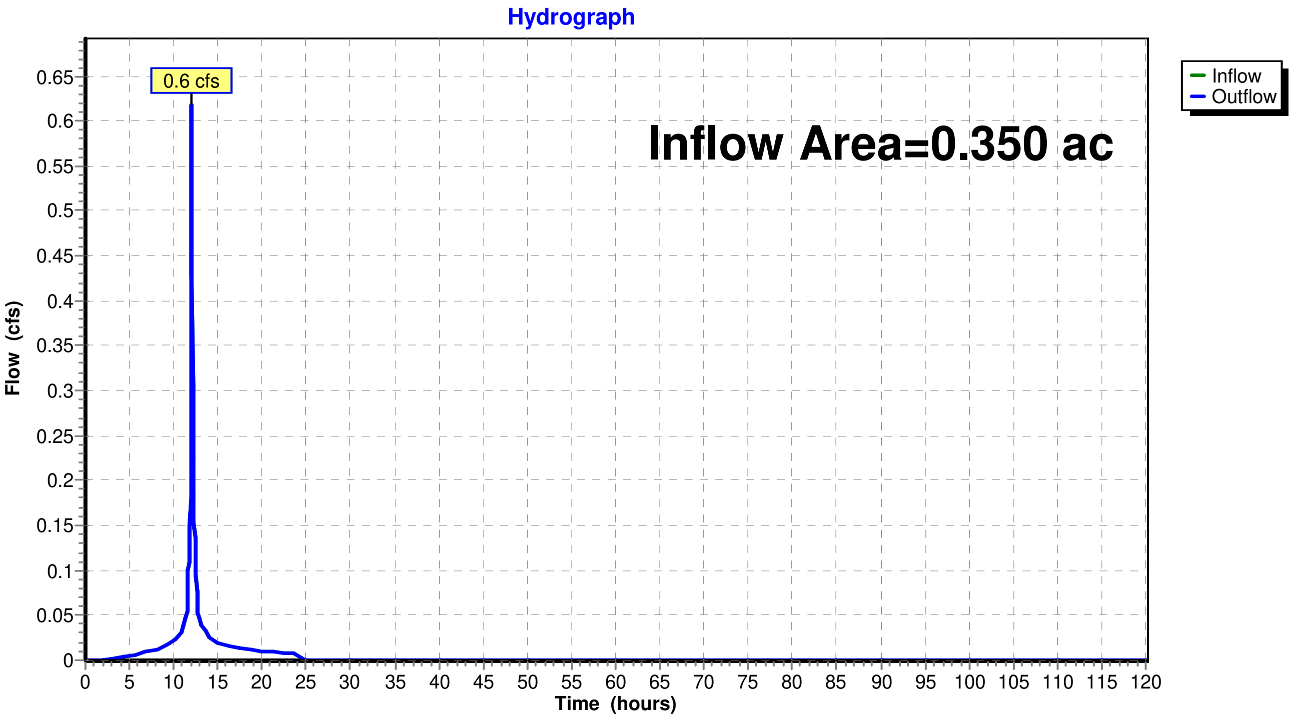


Summary for Reach HDS 2.1:

Inflow Area = 0.350 ac,100.00% Impervious, Inflow Depth = 1.44" for WQV 2.1 event
Inflow = 0.6 cfs @ 12.04 hrs, Volume= 0.042 af
Outflow = 0.6 cfs @ 12.04 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

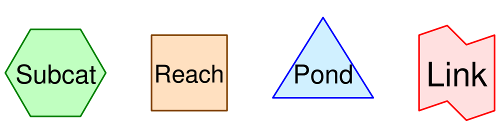
Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Reach HDS 2.1:



APPENDIX B

Pre-Development Computer Data



Routing Diagram for App B - Pre Development - Croton Point

Prepared by Insite Engineering, Surveying and Landscape Architecture, P.C., Printed 7/31/2024

Summary for Subcatchment PRE 1:

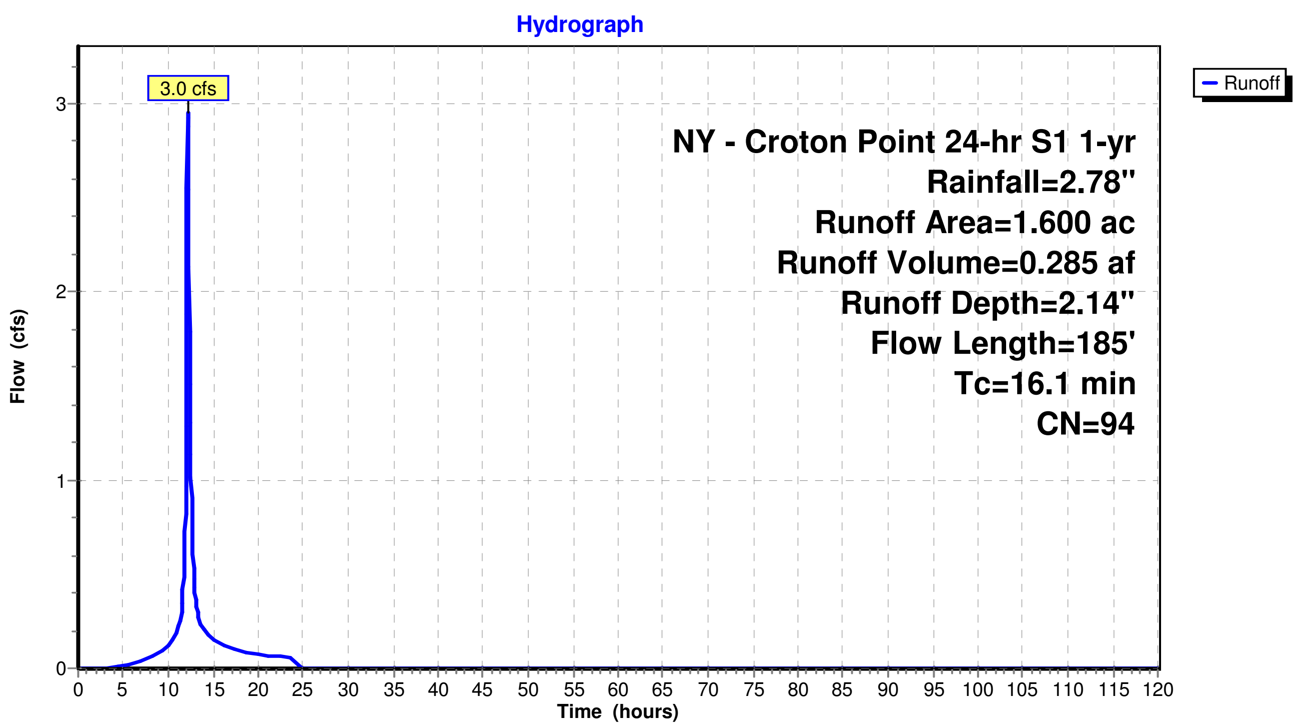
Runoff = 3.0 cfs @ 12.17 hrs, Volume= 0.285 af, Depth= 2.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NY - Croton Point 24-hr S1 1-yr Rainfall=2.78"

Area (ac)	CN	Description
0.100	61	>75% Grass cover, Good, HSG B
1.450	98	Paved parking, HSG D
0.050	55	Woods, Good, HSG B
1.600	94	Weighted Average
0.150		9.38% Pervious Area
1.450		90.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.37"
1.6	85	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.1	185	Total			

Subcatchment PRE 1:



Summary for Subcatchment PRE 2:

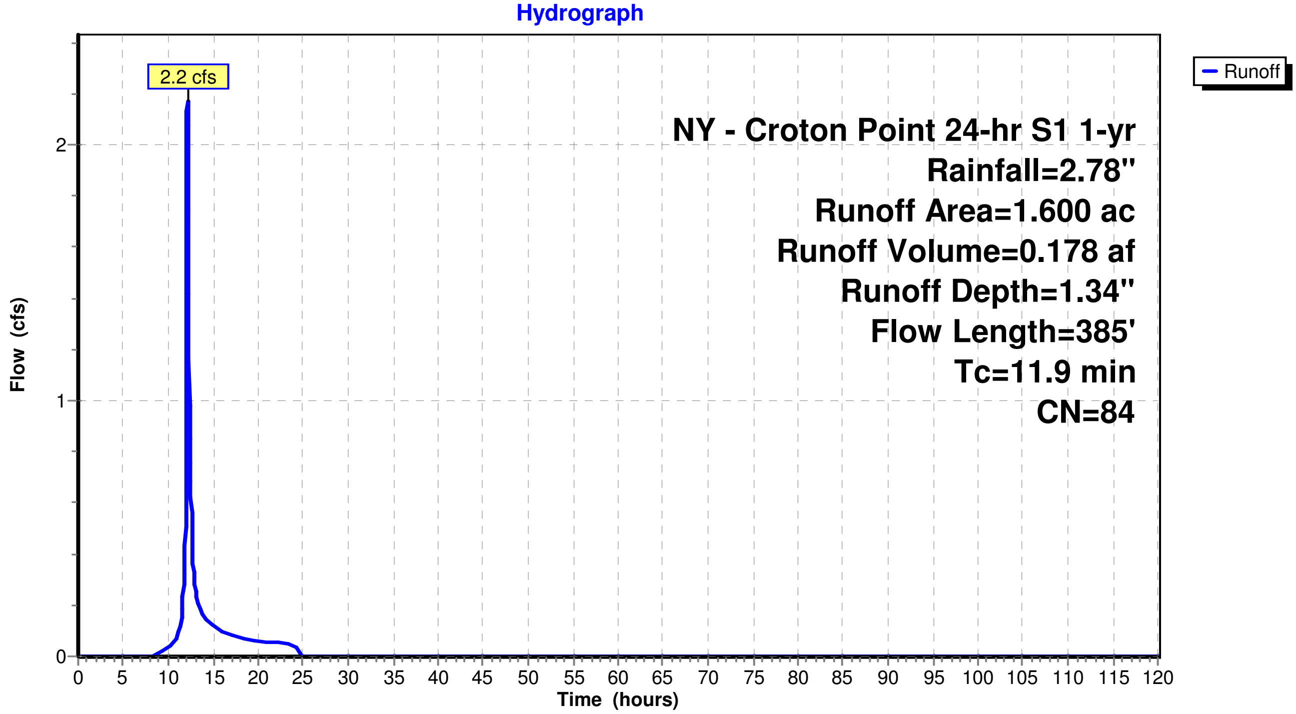
Runoff = 2.2 cfs @ 12.12 hrs, Volume= 0.178 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NY - Croton Point 24-hr S1 1-yr Rainfall=2.78"

Area (ac)	CN	Description
0.100	80	>75% Grass cover, Good, HSG D
0.150	77	Woods, Good, HSG D
0.250	61	>75% Grass cover, Good, HSG B
0.200	55	Woods, Good, HSG B
0.900	98	Paved parking, HSG D
1.600	84	Weighted Average
0.700		43.75% Pervious Area
0.900		56.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	40	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.37"
3.8	60	0.0700	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
0.4	38	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	90	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	73	0.2100	3.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	56	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	28	0.2000	25.50	31.30	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
11.9	385	Total			

Subcatchment PRE 2:



Summary for Subcatchment PRE 1:

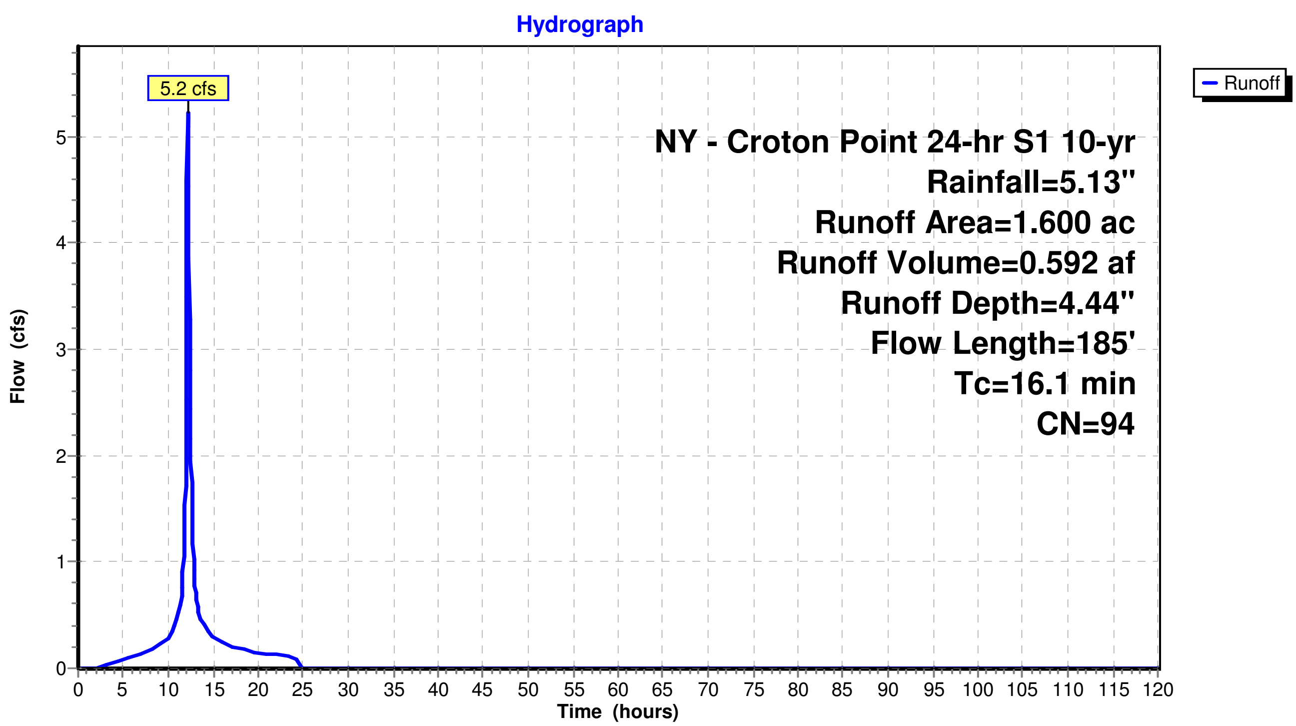
Runoff = 5.2 cfs @ 12.17 hrs, Volume= 0.592 af, Depth= 4.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NY - Croton Point 24-hr S1 10-yr Rainfall=5.13"

Area (ac)	CN	Description
0.100	61	>75% Grass cover, Good, HSG B
1.450	98	Paved parking, HSG D
0.050	55	Woods, Good, HSG B
1.600	94	Weighted Average
0.150		9.38% Pervious Area
1.450		90.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.37"
1.6	85	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.1	185	Total			

Subcatchment PRE 1:



Summary for Subcatchment PRE 2:

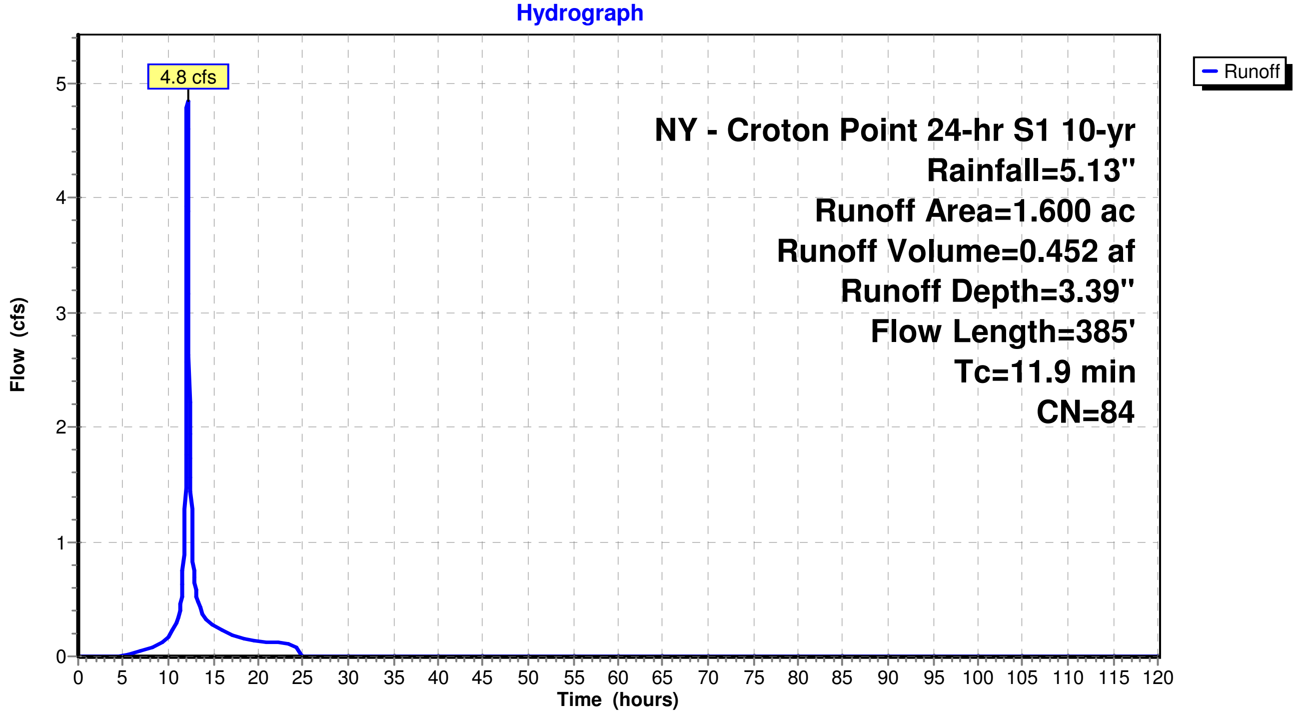
Runoff = 4.8 cfs @ 12.12 hrs, Volume= 0.452 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NY - Croton Point 24-hr S1 10-yr Rainfall=5.13"

Area (ac)	CN	Description
0.100	80	>75% Grass cover, Good, HSG D
0.150	77	Woods, Good, HSG D
0.250	61	>75% Grass cover, Good, HSG B
0.200	55	Woods, Good, HSG B
0.900	98	Paved parking, HSG D
1.600	84	Weighted Average
0.700		43.75% Pervious Area
0.900		56.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	40	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.37"
3.8	60	0.0700	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
0.4	38	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	90	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	73	0.2100	3.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	56	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	28	0.2000	25.50	31.30	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
11.9	385	Total			

Subcatchment PRE 2:



Summary for Subcatchment PRE 1:

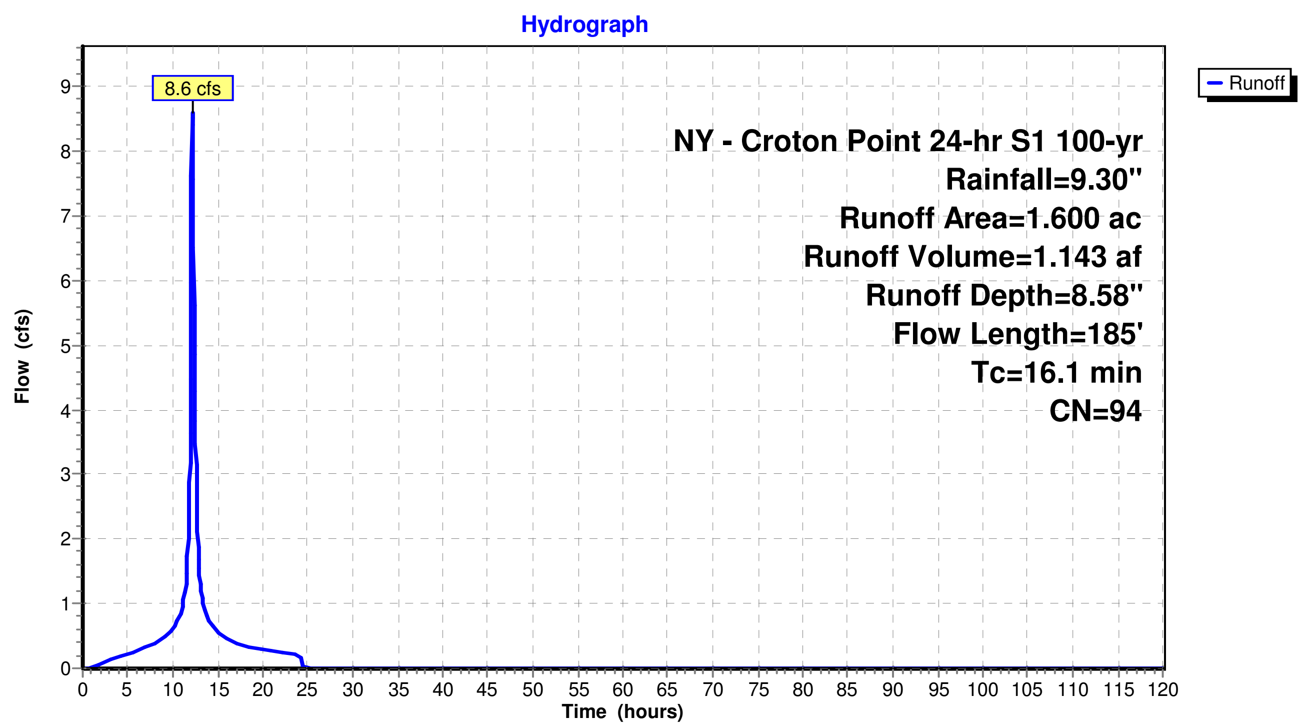
Runoff = 8.6 cfs @ 12.17 hrs, Volume= 1.143 af, Depth= 8.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NY - Croton Point 24-hr S1 100-yr Rainfall=9.30"

Area (ac)	CN	Description
0.100	61	>75% Grass cover, Good, HSG B
1.450	98	Paved parking, HSG D
0.050	55	Woods, Good, HSG B
1.600	94	Weighted Average
0.150		9.38% Pervious Area
1.450		90.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.37"
1.6	85	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.1	185	Total			

Subcatchment PRE 1:



Summary for Subcatchment PRE 2:

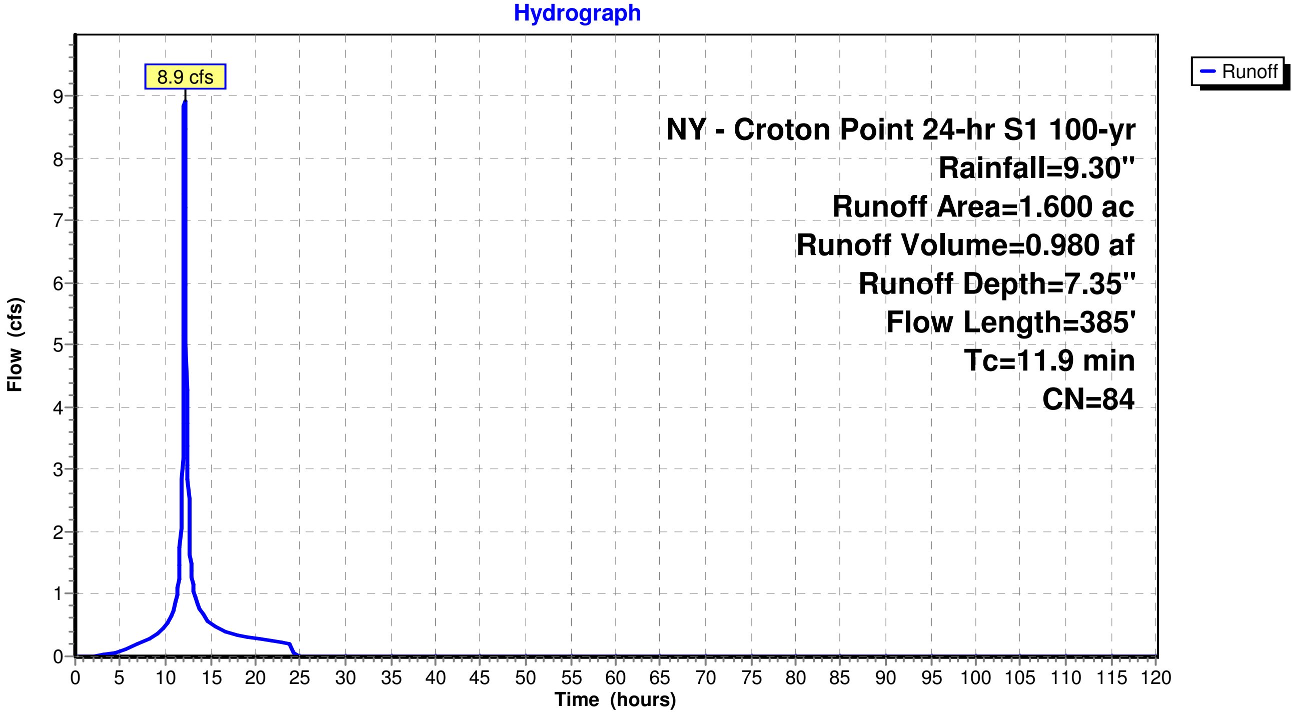
Runoff = 8.9 cfs @ 12.11 hrs, Volume= 0.980 af, Depth= 7.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NY - Croton Point 24-hr S1 100-yr Rainfall=9.30"

Area (ac)	CN	Description
0.100	80	>75% Grass cover, Good, HSG D
0.150	77	Woods, Good, HSG D
0.250	61	>75% Grass cover, Good, HSG B
0.200	55	Woods, Good, HSG B
0.900	98	Paved parking, HSG D
1.600	84	Weighted Average
0.700		43.75% Pervious Area
0.900		56.25% Impervious Area

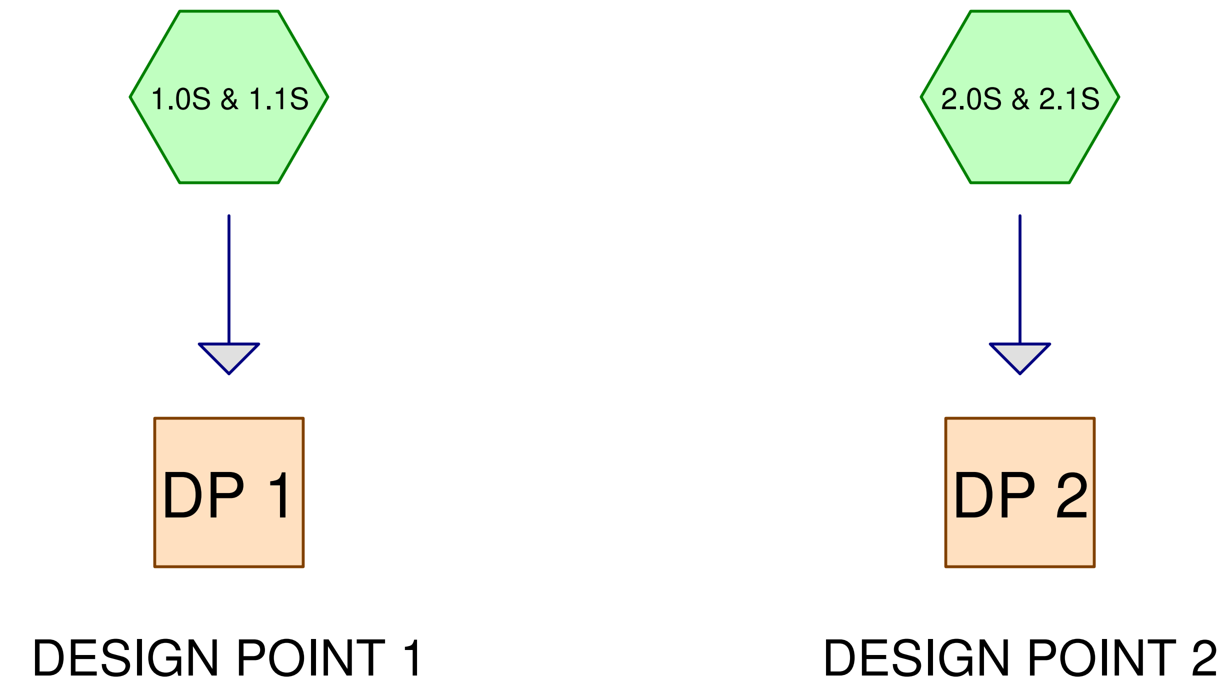
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	40	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.37"
3.8	60	0.0700	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
0.4	38	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	90	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	73	0.2100	3.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	56	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	28	0.2000	25.50	31.30	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
11.9	385	Total			

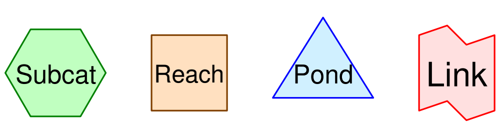
Subcatchment PRE 2:



APPENDIX C

Post-Development Computer Data





Routing Diagram for App C - Post Development - Croton Point
Prepared by {enter your company name here}, Printed 3/26/2025
HydroCAD® 10.00-15 s/n 02171 © 2015 HydroCAD Software Solutions LLC

Summary for Subcatchment 1.0S & 1.1S:

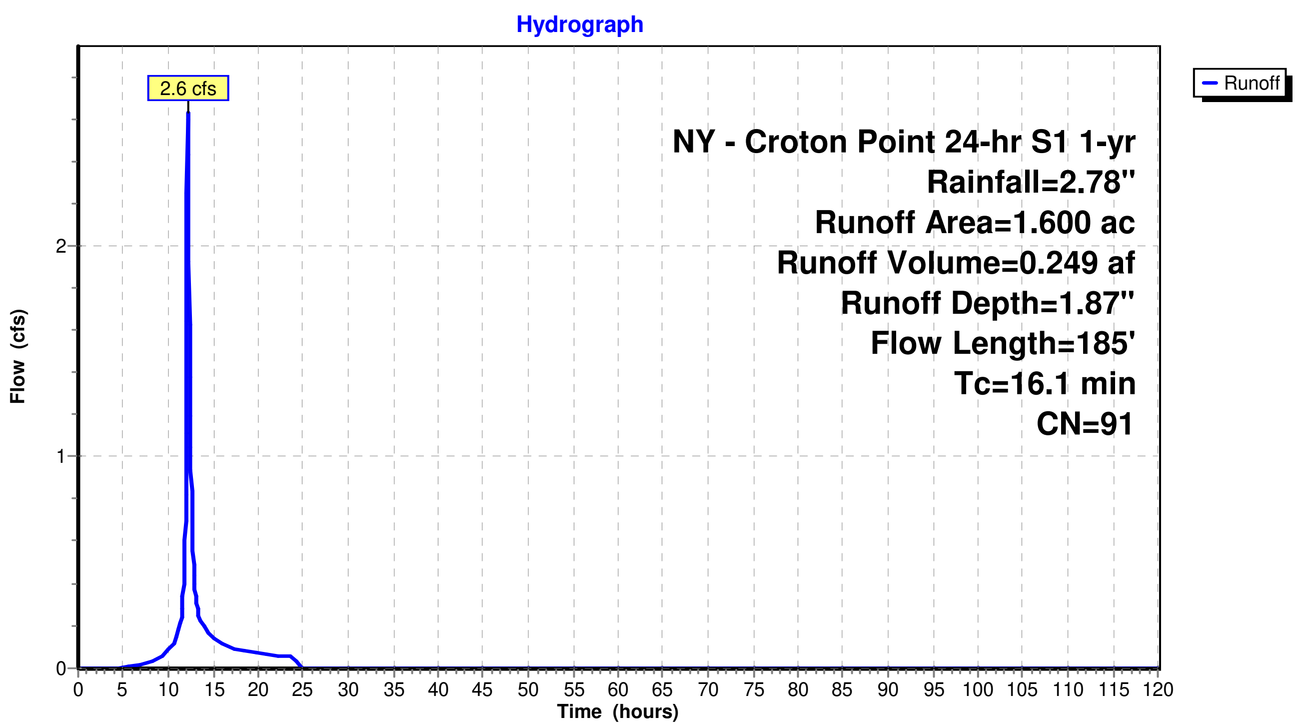
Runoff = 2.6 cfs @ 12.17 hrs, Volume= 0.249 af, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NY - Croton Point 24-hr S1 1-yr Rainfall=2.78"

Area (ac)	CN	Description
0.250	61	>75% Grass cover, Good, HSG B
0.050	55	Woods, Good, HSG B
1.300	98	Paved parking, HSG D
1.600	91	Weighted Average
0.300		18.75% Pervious Area
1.300		81.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.37"
1.6	85	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.1	185	Total			

Subcatchment 1.0S & 1.1S:



Summary for Subcatchment 2.0S & 2.1S:

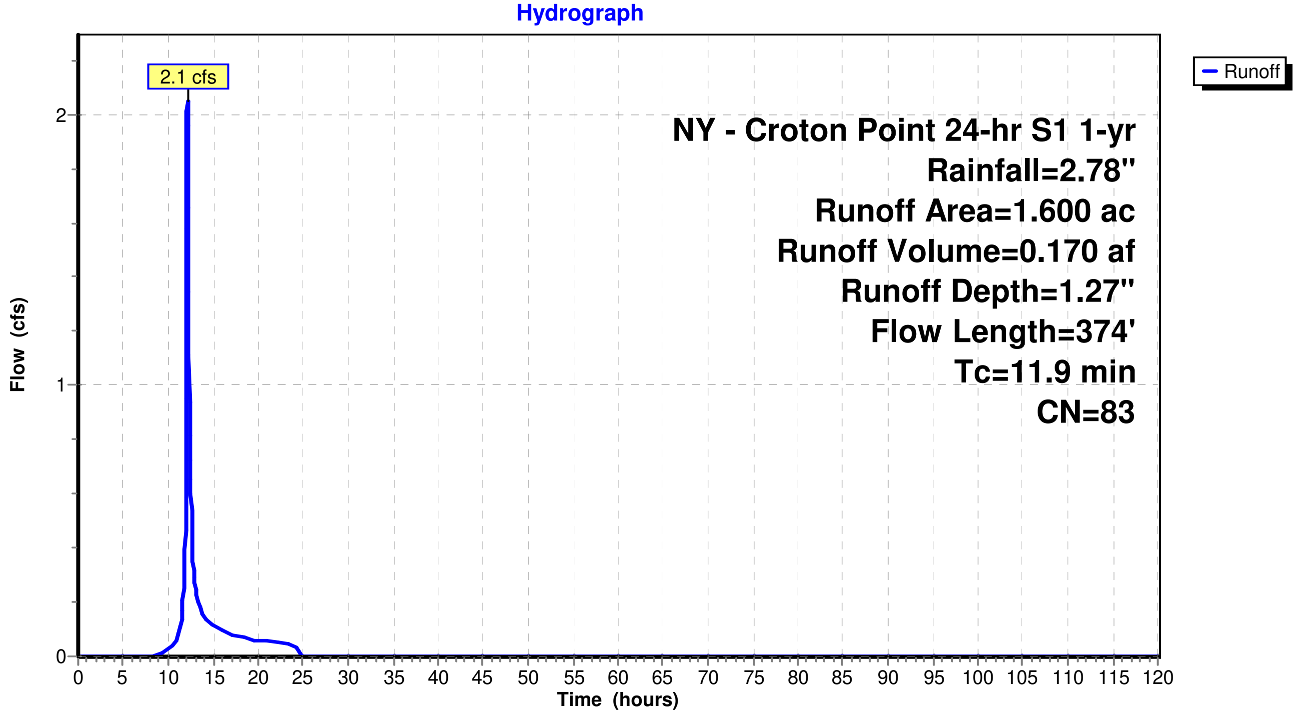
Runoff = 2.1 cfs @ 12.12 hrs, Volume= 0.170 af, Depth= 1.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NY - Croton Point 24-hr S1 1-yr Rainfall=2.78"

Area (ac)	CN	Description
0.150	80	>75% Grass cover, Good, HSG D
0.100	77	Woods, Good, HSG D
0.300	61	>75% Grass cover, Good, HSG B
0.200	55	Woods, Good, HSG B
0.850	98	Paved parking, HSG D
1.600	83	Weighted Average
0.750		46.88% Pervious Area
0.850		53.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	40	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.37"
3.8	60	0.0700	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
0.4	38	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	90	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	73	0.2100	3.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	22	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	36	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	15	0.0010	1.80	2.21	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
11.9	374	Total			

Subcatchment 2.0S & 2.1S:

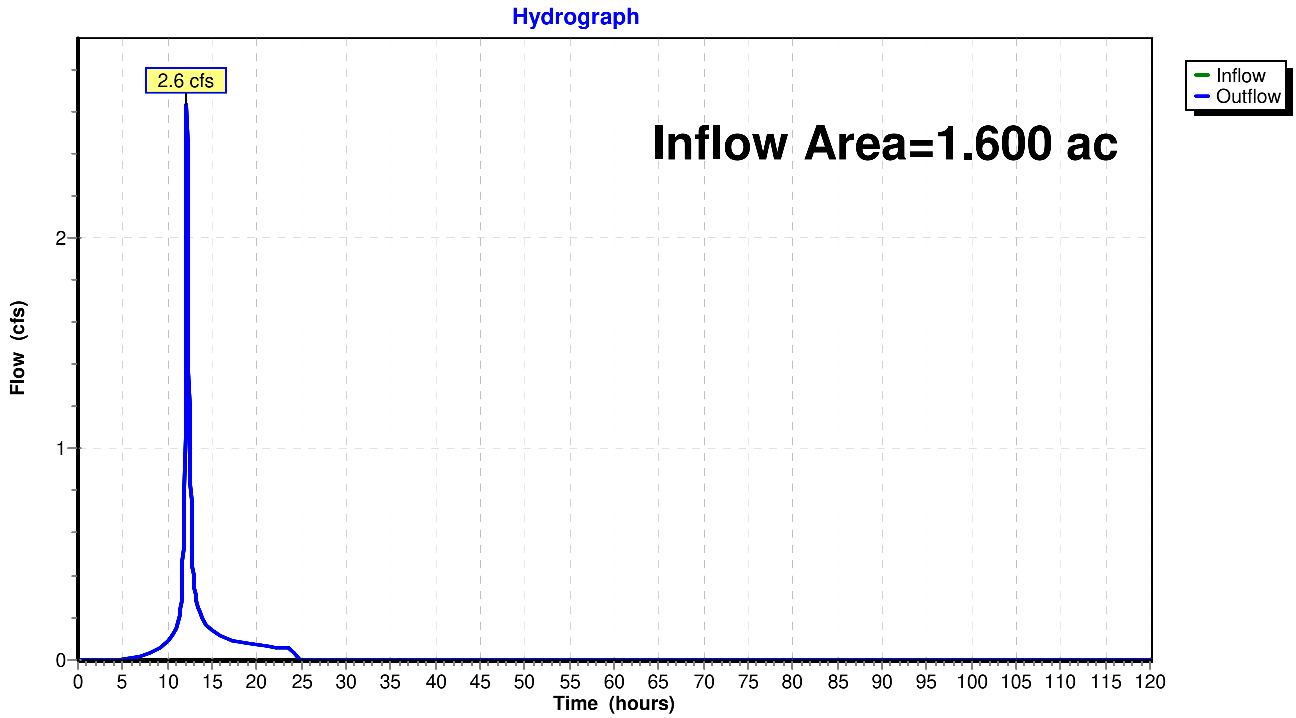


Summary for Reach DP 1: DESIGN POINT 1

Inflow Area = 1.600 ac, 81.25% Impervious, Inflow Depth = 1.87" for 1-yr event
Inflow = 2.6 cfs @ 12.17 hrs, Volume= 0.249 af
Outflow = 2.6 cfs @ 12.17 hrs, Volume= 0.249 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Reach DP 1: DESIGN POINT 1

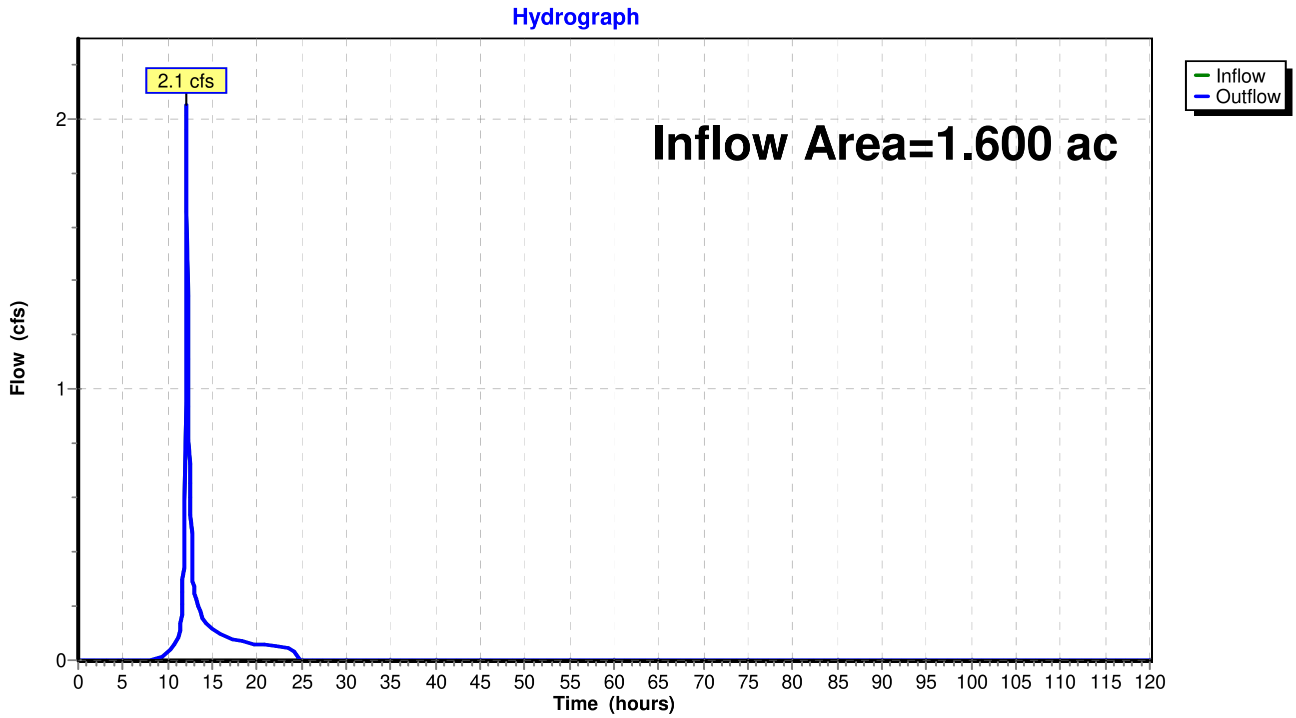


Summary for Reach DP 2: DESIGN POINT 2

Inflow Area = 1.600 ac, 53.13% Impervious, Inflow Depth = 1.27" for 1-yr event
Inflow = 2.1 cfs @ 12.12 hrs, Volume= 0.170 af
Outflow = 2.1 cfs @ 12.12 hrs, Volume= 0.170 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Reach DP 2: DESIGN POINT 2



Summary for Subcatchment 1.0S & 1.1S:

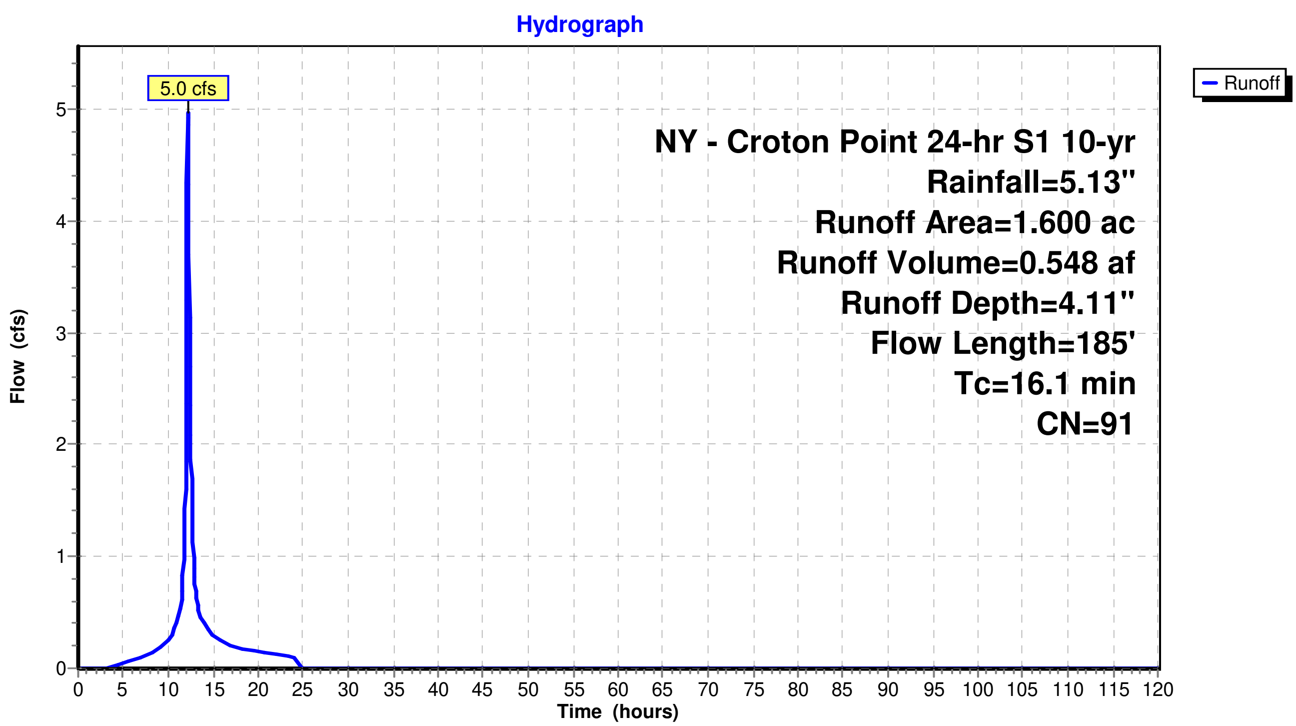
Runoff = 5.0 cfs @ 12.17 hrs, Volume= 0.548 af, Depth= 4.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NY - Croton Point 24-hr S1 10-yr Rainfall=5.13"

Area (ac)	CN	Description
0.250	61	>75% Grass cover, Good, HSG B
0.050	55	Woods, Good, HSG B
1.300	98	Paved parking, HSG D
1.600	91	Weighted Average
0.300		18.75% Pervious Area
1.300		81.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.37"
1.6	85	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.1	185	Total			

Subcatchment 1.0S & 1.1S:



Summary for Subcatchment 2.0S & 2.1S:

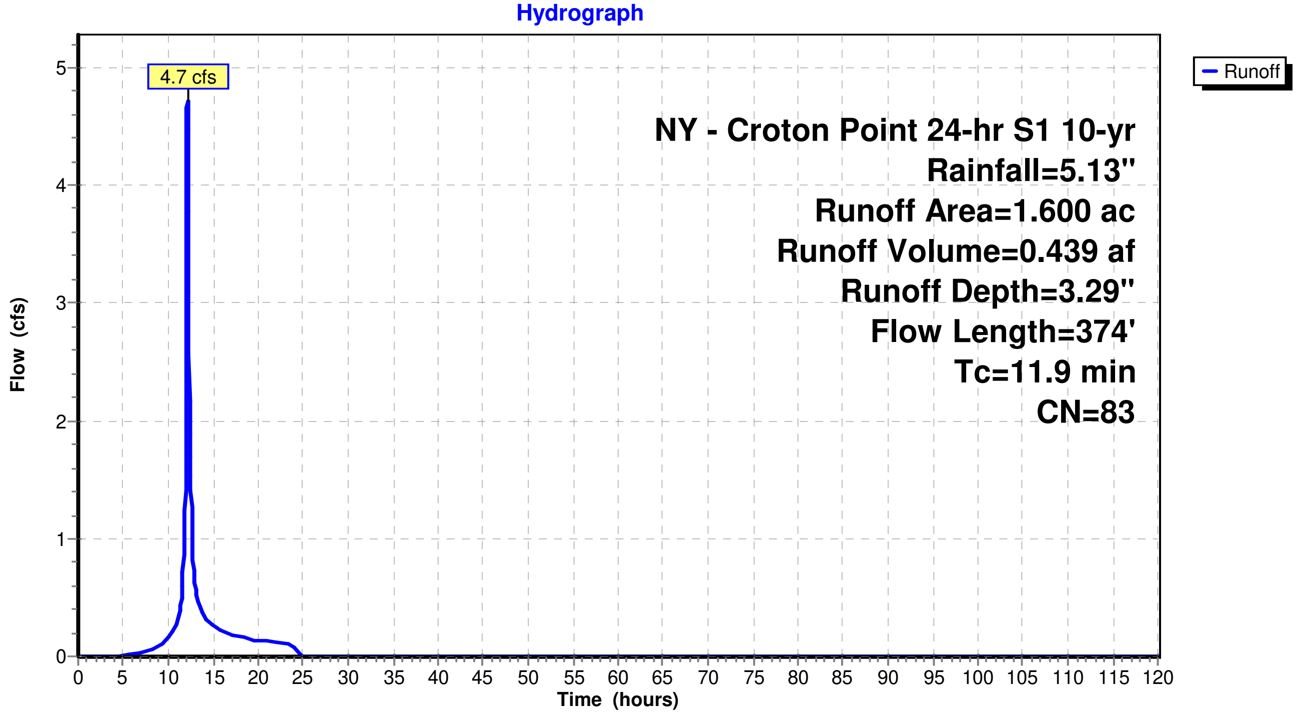
Runoff = 4.7 cfs @ 12.12 hrs, Volume= 0.439 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NY - Croton Point 24-hr S1 10-yr Rainfall=5.13"

Area (ac)	CN	Description
0.150	80	>75% Grass cover, Good, HSG D
0.100	77	Woods, Good, HSG D
0.300	61	>75% Grass cover, Good, HSG B
0.200	55	Woods, Good, HSG B
0.850	98	Paved parking, HSG D
1.600	83	Weighted Average
0.750		46.88% Pervious Area
0.850		53.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	40	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.37"
3.8	60	0.0700	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
0.4	38	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	90	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	73	0.2100	3.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	22	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	36	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	15	0.0010	1.80	2.21	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
11.9	374	Total			

Subcatchment 2.0S & 2.1S:

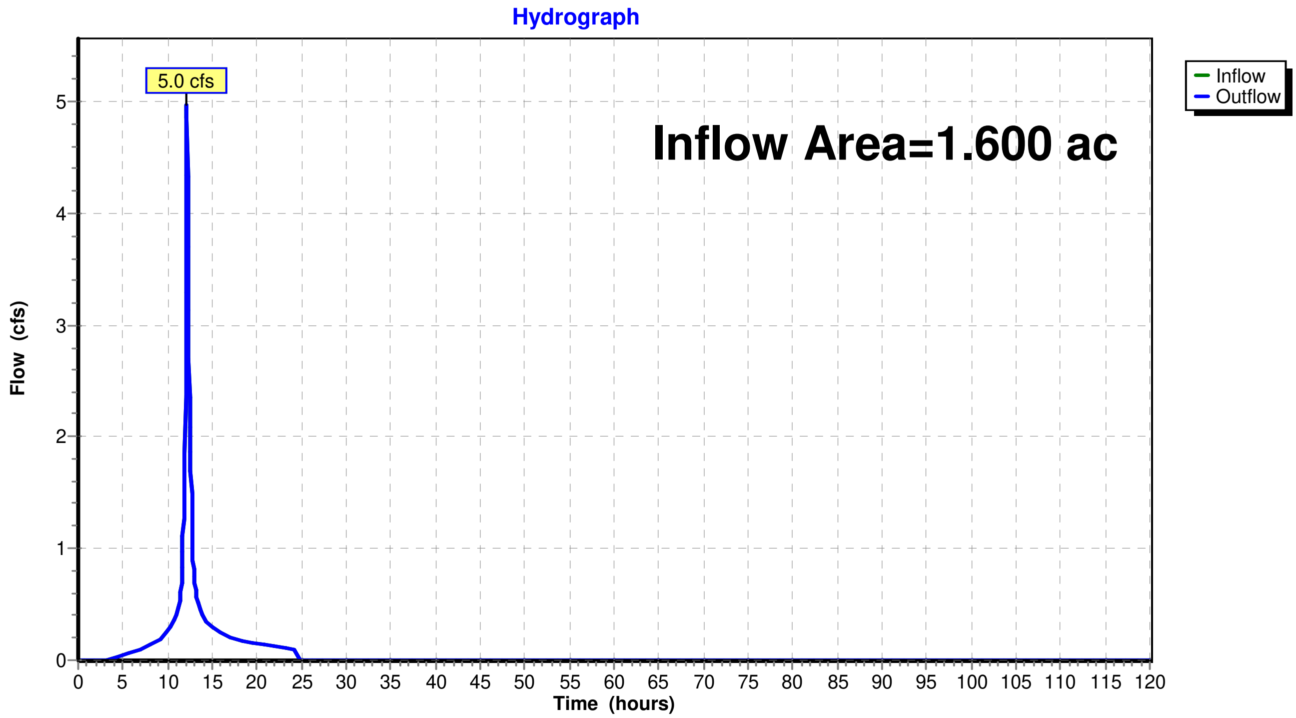


Summary for Reach DP 1: DESIGN POINT 1

Inflow Area =	1.600 ac, 81.25% Impervious,	Inflow Depth = 4.11"	for 10-yr event	
Inflow =	5.0 cfs @ 12.17 hrs,	Volume=	0.548 af	
Outflow =	5.0 cfs @ 12.17 hrs,	Volume=	0.548 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Reach DP 1: DESIGN POINT 1

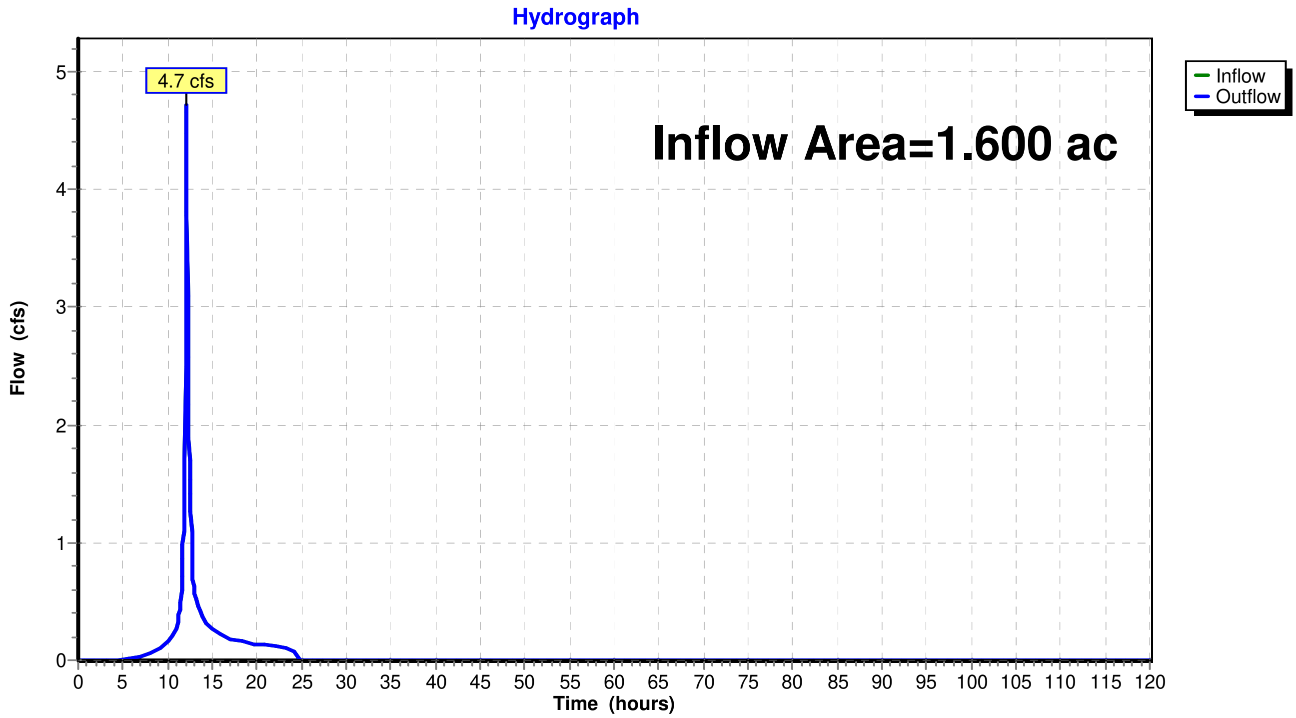


Summary for Reach DP 2: DESIGN POINT 2

Inflow Area = 1.600 ac, 53.13% Impervious, Inflow Depth = 3.29" for 10-yr event
Inflow = 4.7 cfs @ 12.12 hrs, Volume= 0.439 af
Outflow = 4.7 cfs @ 12.12 hrs, Volume= 0.439 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Reach DP 2: DESIGN POINT 2



Summary for Subcatchment 1.0S & 1.1S:

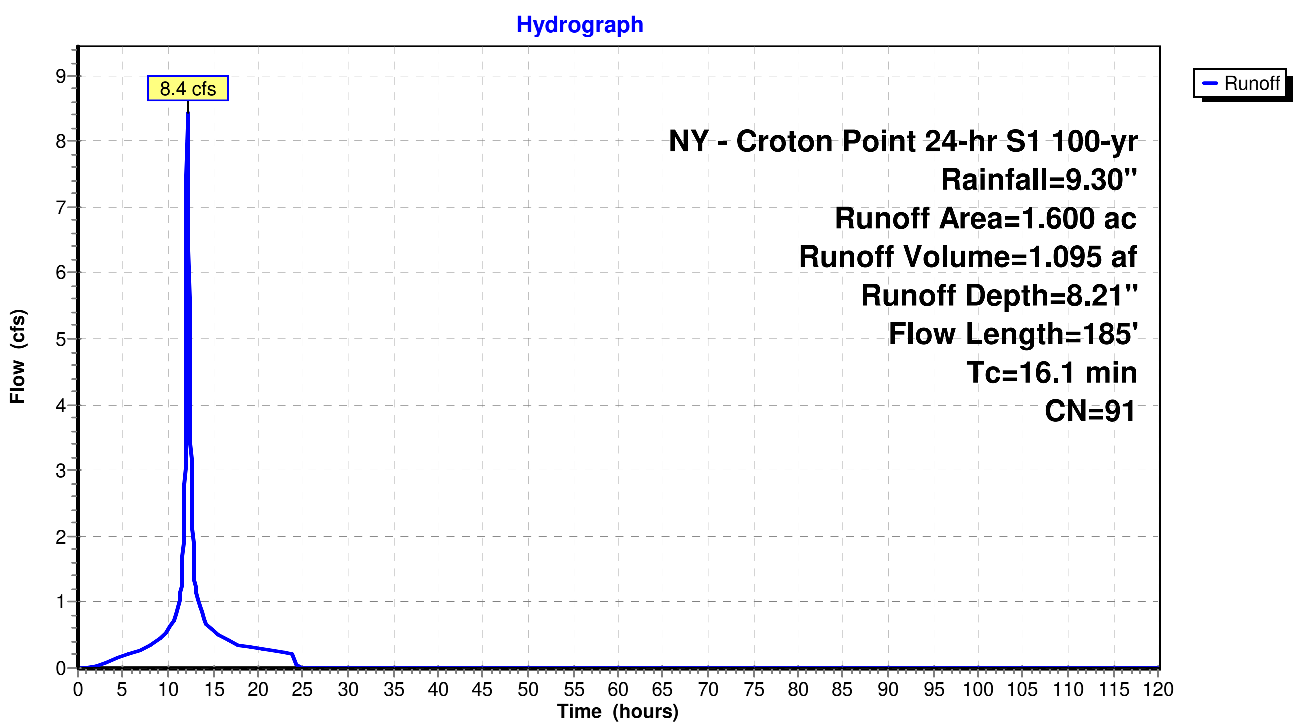
Runoff = 8.4 cfs @ 12.17 hrs, Volume= 1.095 af, Depth= 8.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NY - Croton Point 24-hr S1 100-yr Rainfall=9.30"

Area (ac)	CN	Description
0.250	61	>75% Grass cover, Good, HSG B
0.050	55	Woods, Good, HSG B
1.300	98	Paved parking, HSG D
1.600	91	Weighted Average
0.300		18.75% Pervious Area
1.300		81.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.37"
1.6	85	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.1	185	Total			

Subcatchment 1.0S & 1.1S:



Summary for Subcatchment 2.0S & 2.1S:

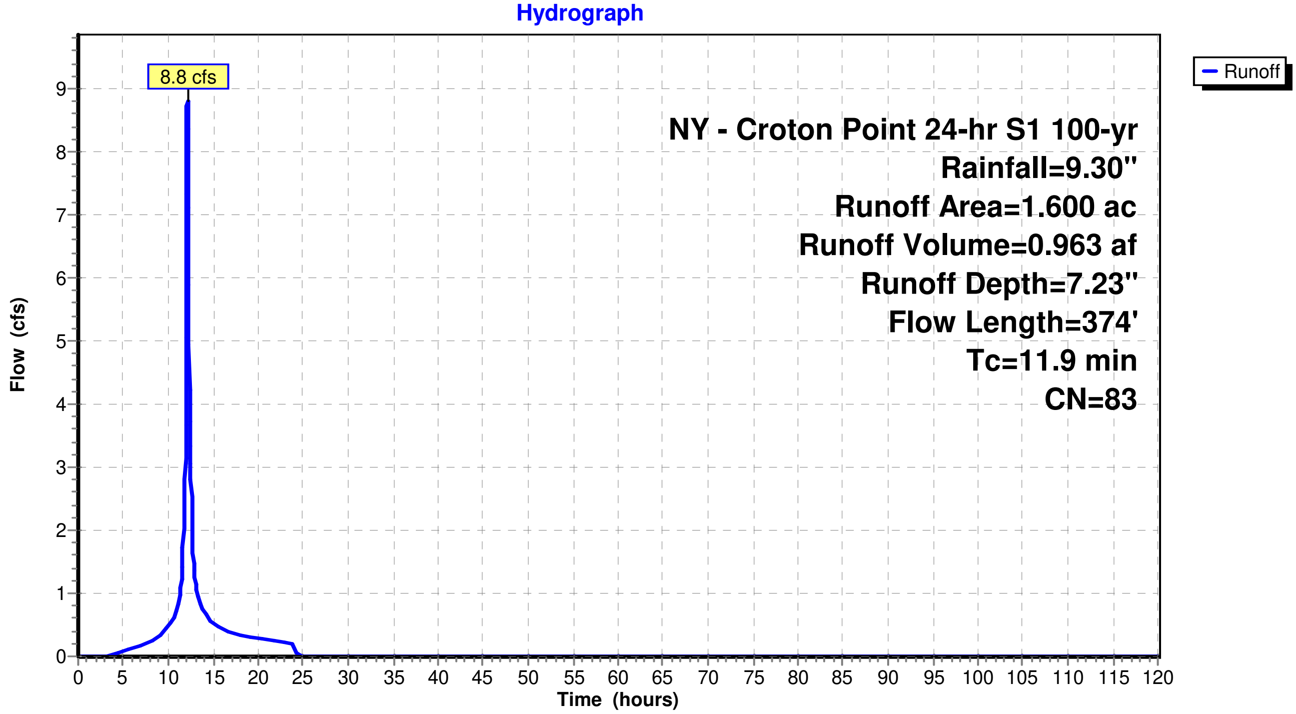
Runoff = 8.8 cfs @ 12.11 hrs, Volume= 0.963 af, Depth= 7.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NY - Croton Point 24-hr S1 100-yr Rainfall=9.30"

Area (ac)	CN	Description
0.150	80	>75% Grass cover, Good, HSG D
0.100	77	Woods, Good, HSG D
0.300	61	>75% Grass cover, Good, HSG B
0.200	55	Woods, Good, HSG B
0.850	98	Paved parking, HSG D
1.600	83	Weighted Average
0.750		46.88% Pervious Area
0.850		53.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	40	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.37"
3.8	60	0.0700	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
0.4	38	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	90	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	73	0.2100	3.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	22	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	36	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	15	0.0010	1.80	2.21	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
11.9	374	Total			

Subcatchment 2.0S & 2.1S:

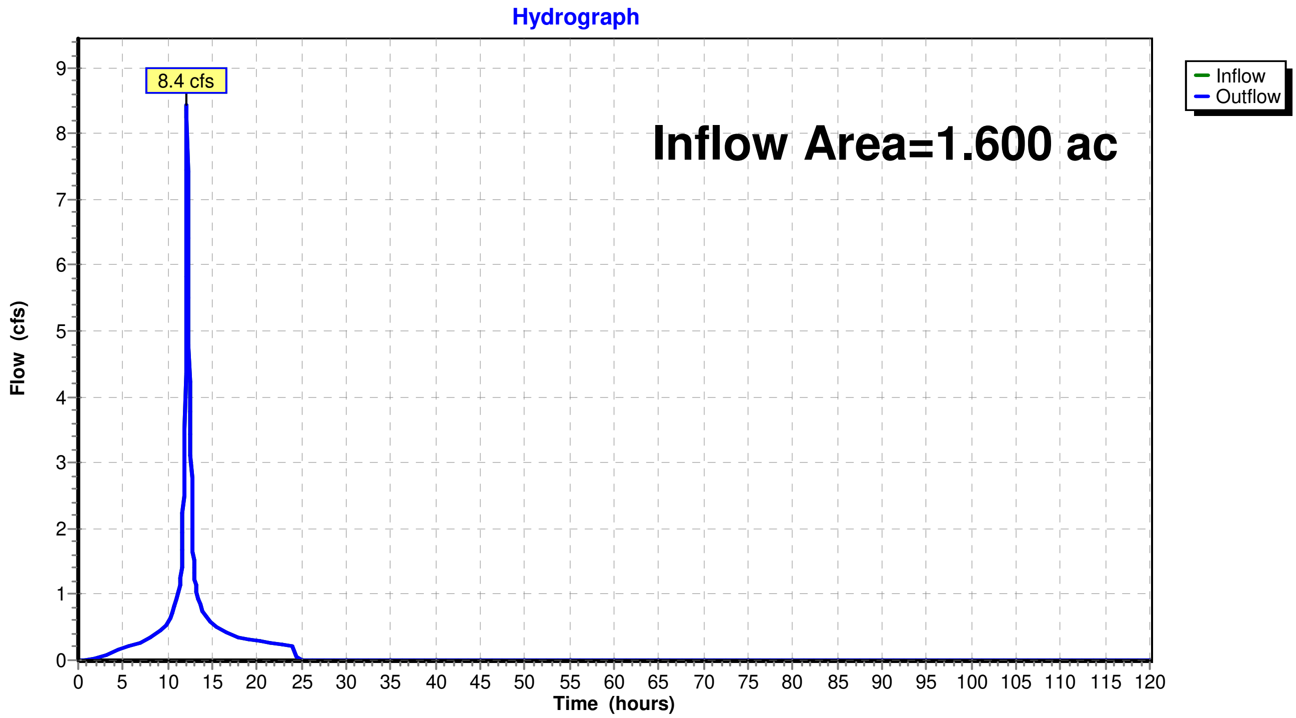


Summary for Reach DP 1: DESIGN POINT 1

Inflow Area = 1.600 ac, 81.25% Impervious, Inflow Depth = 8.21" for 100-yr event
Inflow = 8.4 cfs @ 12.17 hrs, Volume= 1.095 af
Outflow = 8.4 cfs @ 12.17 hrs, Volume= 1.095 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Reach DP 1: DESIGN POINT 1

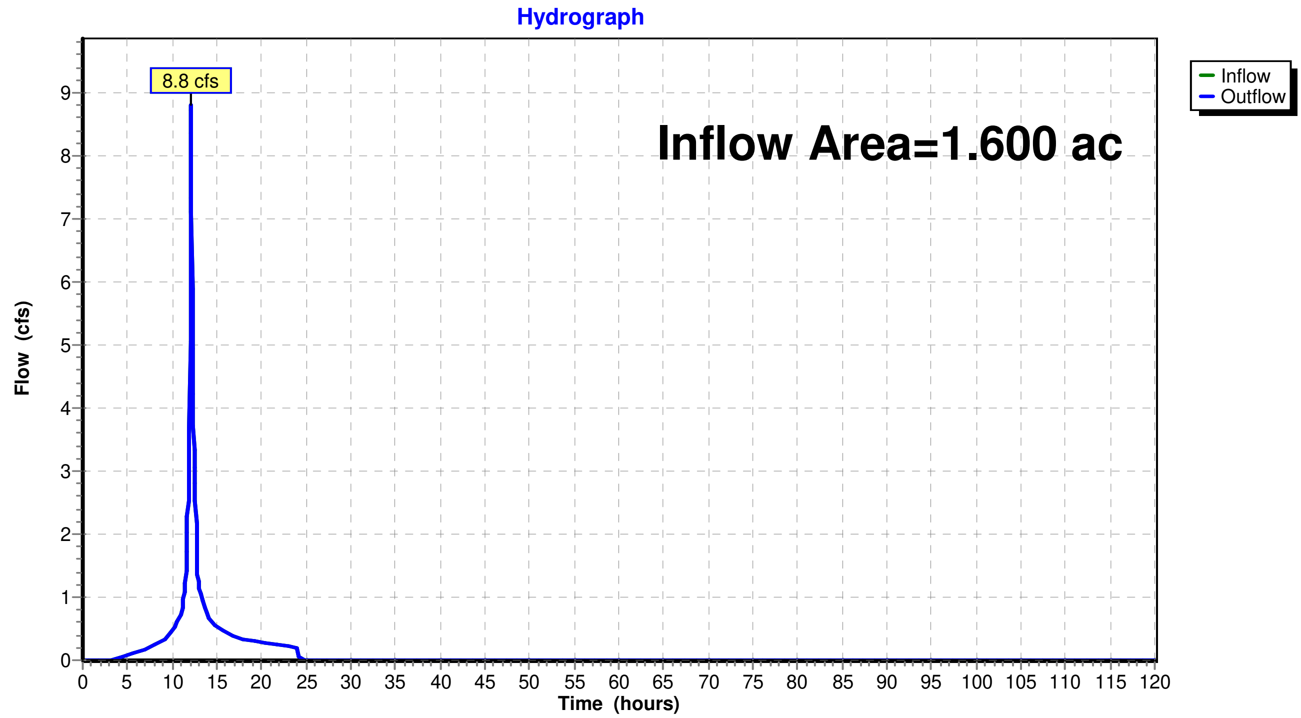


Summary for Reach DP 2: DESIGN POINT 2

Inflow Area = 1.600 ac, 53.13% Impervious, Inflow Depth = 7.23" for 100-yr event
Inflow = 8.8 cfs @ 12.11 hrs, Volume= 0.963 af
Outflow = 8.8 cfs @ 12.11 hrs, Volume= 0.963 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Reach DP 2: DESIGN POINT 2



APPENDIX D

Project and Owner Information

Site Data:

Croton Point Ave. & Veterans Plaza
Croton-On-Hudson, New York 10520

Applicant Information:

WBP Development LLC
480 Bedford Road
Chappaqua, NY 10514

Party Responsible for Implementation of the Stormwater Pollution Prevention Plan:

To be determined prior to construction

Qualified Professional Responsible for Inspection of the Stormwater Pollution Prevention Plan:

Inspector to be determined at time of construction

APPENDIX E

NYSDEC SPDES General Permit for Construction Activities Construction Site Log Book

APPENDIX F
CONSTRUCTION SITE INSPECTION AND MAINTENANCE LOG BOOK

STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM FOR CONSTRUCTION ACTIVITIES

SAMPLE CONSTRUCTION SITE LOG BOOK

Table of Contents

I. PRE-CONSTRUCTION MEETING DOCUMENTS

Project Name ____

Permit No. ______________________________ **Date of Authorization** ____________

Name of Operator ____

Prime Contractor ____

a. Preamble to Site Assessment and Inspections

The Following Information To Be Read By All Person's Involved in The Construction of Stormwater Related Activities:

The Operator agrees to have a qualified inspector[1] conduct an assessment of the site prior to the commencement of construction[2] and certify in this inspection report that the appropriate erosion and sediment controls described in the SWPPP have been adequately installed or implemented to ensure overall preparedness of the site for the commencement of construction.

Prior to the commencement of construction, the Operator shall certify in this site logbook that the SWPPP has been prepared in accordance with the State's standards and meets all Federal, State and local erosion and sediment control requirements. A preconstruction meeting should be held to review all of the SWPPP requirements with construction personnel.

When construction starts, site inspections shall be conducted by the qualified inspector at least every 7 calendar days. The Operator shall maintain a record of all inspection reports in this site logbook. The site logbook shall be maintained on site and be made available to the permitting authorities upon request.

Prior to filing the Notice of Termination or the end of permit term, the Operator shall have a qualified inspector perform a final site inspection. The qualified inspector shall certify that the site has undergone final stabilization[3] using either vegetative or structural stabilization methods and that all temporary erosion and sediment controls (such as silt fencing) not needed for long-term erosion control have been removed. In addition, the Operator must identify and certify that all permanent structures described in the SWPPP have been constructed and provide the owner(s) with an operation and maintenance plan that ensures the structure(s) continuously functions as designed.

1 Refer to "Qualified Inspector" inspection requirements in the current SPDES General Permit for Stormwater Discharges from Construction Activity for complete list of inspection requirements.
2 "Commencement of construction" means the initial removal of vegetation and disturbance of soils associated with clearing, grading or excavating activities or other construction activities.
3 "Final stabilization" means that all soil-disturbing activities at the site have been completed and a uniform, perennial vegetative cover with a density of eighty (80) percent has been established or equivalent stabilization measures (such as the use of mulches or geotextiles) have been employed on all unpaved areas and areas not covered by permanent structures.

b. Pre-construction Site Assessment Checklist
(NOTE: Provide comments below as necessary)

1. Notice of Intent, SWPPP, and Contractors Certification:

Yes No NA
[ ] [ ] [ ] Has a Notice of Intent been filed with the NYS Department of Conservation?
[ ] [ ] [ ] Is the SWPPP on-site? Where?_______________________________
[ ] [ ] [ ] Is the Plan current? What is the latest revision date?______________
[ ] [ ] [ ] Is a copy of the NOI (with brief description) onsite? Where?______________
[ ] [ ] [ ] Have all contractors involved with stormwater related activities signed a contractor's certification?

2. Resource Protection

Yes No NA
[ ] [ ] [ ] Are construction limits clearly flagged or fenced?
[ ] [ ] [ ] Important trees and associated rooting zones, on-site septic system absorption fields, existing vegetated areas suitable for filter strips, especially in perimeter areas, have been flagged for protection.
[ ] [ ] [ ] Creek crossings installed prior to land-disturbing activity, including clearing and blasting.

3. Surface Water Protection

Yes No NA
[ ] [ ] [ ] Clean stormwater runoff has been diverted from areas to be disturbed.
[ ] [ ] [ ] Bodies of water located either on site or in the vicinity of the site have been identified and protected.
[ ] [ ] [ ] Appropriate practices to protect on-site or downstream surface water are installed.
[ ] [ ] [ ] Are clearing and grading operations divided into areas <5 acres?

4. Stabilized Construction Access

Yes No NA
[ ] [ ] [ ] A temporary construction entrance to capture mud and debris from construction vehicles before they enter the public highway has been installed.
[ ] [ ] [ ] Other access areas (entrances, construction routes, equipment parking areas) are stabilized immediately as work takes place with gravel or other cover.
[ ] [ ] [ ] Sediment tracked onto public streets is removed or cleaned on a regular basis.

5. Sediment Controls

Yes No NA
[ ] [ ] [ ] Silt fence material and installation comply with the standard drawing and specifications.
[ ] [ ] [ ] Silt fences are installed at appropriate spacing intervals
[ ] [ ] [ ] Sediment/detention basin was installed as first land disturbing activity.
[ ] [ ] [ ] Sediment traps and barriers are installed.

6. Pollution Prevention for Waste and Hazardous Materials

Yes No NA
[ ] [ ] [ ] The Operator or designated representative has been assigned to implement the spill prevention avoidance and response plan.
[ ] [ ] [ ] The plan is contained in the SWPPP on page ______
[ ] [ ] [ ] Appropriate materials to control spills are onsite. Where? ___________________

II. CONSTRUCTION DURATION INSPECTIONS

a. Directions:

Inspection Forms will be filled out during the entire construction phase of the project.

Required Elements:

1) On a site map, indicate the extent of all disturbed site areas and drainage pathways. Indicate site areas that are expected to undergo initial disturbance or significant site work within the next 14-day period;

2) Indicate on a site map all areas of the site that have undergone temporary or permanent stabilization;

3) Indicate all disturbed site areas that have not undergone active site work during the previous 14-day period;

4) Inspect all sediment control practices and record the approximate degree of sediment accumulation as a percentage of sediment storage volume (for example, 10 percent, 20 percent, 50 percent);

5) Inspect all erosion and sediment control practices and record all maintenance requirements such as verifying the integrity of barrier or diversion systems (earthen berms or silt fencing) and containment systems (sediment basins and sediment traps). Identify any evidence of rill or gully erosion occurring on slopes and any loss of stabilizing vegetation or seeding/mulching. Document any excessive deposition of sediment or ponding water along barrier or diversion systems. Record the depth of sediment within containment structures, any erosion near outlet and overflow structures, and verify the ability of rock filters around perforated riser pipes to pass water; and

6) Immediately report to the Operator any deficiencies that are identified with the implementation of the SWPPP.

SITE PLAN/SKETCH

______________________________ ______________________________
Inspector (print name) **Date of Inspection**

______________________________ ______________________________
Qualified Inspector (print name) **Qualified Inspector Signature**

The above signed acknowledges that, to the best of his/her knowledge, all information provided on the forms is accurate and complete.

Maintaining Water Quality

Yes No NA
[ ] [ ] [ ] Is there an increase in turbidity causing a substantial visible contrast to natural conditions at the outfalls?
[ ] [ ] [ ] Is there residue from oil and floating substances, visible oil film, or globules or grease at the outfalls?
[ ] [ ] [ ] All disturbance is within the limits of the approved plans.
[ ] [ ] [ ] Have receiving lake/bay, stream, and/or wetland been impacted by silt from project?

Housekeeping

1. General Site Conditions

Yes No NA
[ ] [ ] [ ] Is construction site litter, debris and spoils appropriately managed?
[ ] [ ] [ ] Are facilities and equipment necessary for implementation of erosion and sediment control in working order and/or properly maintained?
[ ] [ ] [ ] Is construction impacting the adjacent property?
[ ] [ ] [ ] Is dust adequately controlled?

2. Temporary Stream Crossing

Yes No NA
[ ] [ ] [ ] Maximum diameter pipes necessary to span creek without dredging are installed.
[ ] [ ] [ ] Installed non-woven geotextile fabric beneath approaches.
[ ] [ ] [ ] Is fill composed of aggregate (no earth or soil)?
[ ] [ ] [ ] Rock on approaches is clean enough to remove mud from vehicles & prevent sediment from entering stream during high flow.

3. Stabilized Construction Access

Yes No NA
[ ] [ ] [ ] Stone is clean enough to effectively remove mud from vehicles.
[ ] [ ] [ ] Installed per standards and specifications?
[ ] [ ] [ ] Does all traffic use the stabilized entrance to enter and leave site?
[ ] [ ] [ ] Is adequate drainage provided to prevent ponding at entrance?

Runoff Control Practices

1. Excavation Dewatering

Yes No NA
[ ] [ ] [ ] Upstream and downstream berms (sandbags, inflatable dams, etc.) are installed per plan.
[ ] [ ] [ ] Clean water from upstream pool is being pumped to the downstream pool.
[ ] [ ] [ ] Sediment laden water from work area is being discharged to a silt-trapping device.
[ ] [ ] [ ] Constructed upstream berm with one-foot minimum freeboard.

Runoff Control Practices (continued)

2. Flow Spreader

Yes No NA
[ ] [ ] [ ] Installed per plan.
[ ] [ ] [ ] Constructed on undisturbed soil, not on fill, receiving only clear, non-sediment laden flow.
[ ] [ ] [ ] Flow sheets out of level spreader without erosion on downstream edge.

3. Interceptor Dikes and Swales

Yes No NA
[ ] [ ] [ ] Installed per plan with minimum side slopes 2H:1V or flatter.
[ ] [ ] [ ] Stabilized by geotextile fabric, seed, or mulch with no erosion occurring.
[ ] [ ] [ ] Sediment-laden runoff directed to sediment trapping structure

4. Stone Check Dam

Yes No NA
[ ] [ ] [ ] Is channel stable? (flow is not eroding soil underneath or around the structure).
[ ] [ ] [ ] Check is in good condition (rocks in place and no permanent pools behind the structure).
[ ] [ ] [ ] Has accumulated sediment been removed?.

5. Rock Outlet Protection

Yes No NA
[ ] [ ] [ ] Installed per plan.
[ ] [ ] [ ] Installed concurrently with pipe installation.

Soil Stabilization

1. Topsoil and Spoil Stockpiles

Yes No NA
[ ] [ ] [ ] Stockpiles are stabilized with vegetation and/or mulch.
[ ] [ ] [ ] Sediment control is installed at the toe of the slope.

2. Revegetation

Yes No NA
[ ] [ ] [ ] Temporary seedings and mulch have been applied to idle areas.
[ ] [ ] [ ] 4 inches minimum of topsoil has been applied under permanent seedings

Sediment Control Practices

1. Silt Fence and Linear Barriers

Yes No NA
[ ] [ ] [ ] Installed on Contour, 10 feet from toe of slope (not across conveyance channels).
[ ] [ ] [ ] Joints constructed by wrapping the two ends together for continuous support.
[ ] [ ] [ ] Fabric buried 6 inches minimum.
[ ] [ ] [ ] Posts are stable, fabric is tight and without rips or frayed areas.
Sediment accumulation is ___% of design capacity.

Sediment Control Practices (continued)

2. Storm Drain Inlet Protection (Use for Stone & Block; Filter Fabric; Curb; or, Excavated; Filter Sock or Manufactured practices)

Yes No NA
[ ] [ ] [ ] Installed concrete blocks lengthwise so open ends face outward, not upward.
[ ] [ ] [ ] Placed wire screen between No. 3 crushed stone and concrete blocks.
[ ] [ ] [ ] Drainage area is 1acre or less.
[ ] [ ] [ ] Excavated area is 900 cubic feet.
[ ] [ ] [ ] Excavated side slopes should be 2:1.
[ ] [ ] [ ] 2” x 4” frame is constructed and structurally sound.
[ ] [ ] [ ] Posts 3-foot maximum spacing between posts.
[ ] [ ] [ ] Fabric is embedded 1 to 1.5 feet below ground and secured to frame/posts with staples at max 8-inch spacing.
[ ] [ ] [ ] Posts are stable, fabric is tight and without rips or frayed areas.
[ ] [ ] [ ] Manufactured insert fabric is free of tears and punctures.
[ ] [ ] [ ] Filter Sock is not torn or flattened and fill material is contained within the mesh sock.
Sediment accumulation ___% of design capacity.

3. Temporary Sediment Trap

Yes No NA
[ ] [ ] [ ] Outlet structure is constructed per the approved plan or drawing.
[ ] [ ] [ ] Geotextile fabric has been placed beneath rock fill.
[ ] [ ] [ ] Sediment trap slopes and disturbed areas are stabilized.
Sediment accumulation is ___% of design capacity.

4. Temporary Sediment Basin

Yes No NA
[ ] [ ] [ ] Basin and outlet structure constructed per the approved plan.
[ ] [ ] [ ] Basin side slopes are stabilized with seed/mulch.
[ ] [ ] [ ] Drainage structure flushed and basin surface restored upon removal of sediment basin facility.
[ ] [ ] [ ] Sediment basin dewatering pool is dewatering at appropriate rate.
Sediment accumulation is ___% of design capacity.

Note: Not all erosion and sediment control practices are included in this listing. Add additional pages to this list as required by site specific design. All practices shall be maintained in accordance with their respective standards.

Construction inspection checklists for post-development stormwater management practices can be found in Appendix F of the New York Stormwater Management Design Manual.

CONSTRUCTION DURATION INSPECTIONS

b. Modifications to the SWPPP (To be completed as described below)

The Operator shall amend the SWPPP whenever:

1. There is a significant change in design, construction, operation, or maintenance which may have a significant effect on the potential for the discharge of pollutants to the waters of the United States and which has not otherwise been addressed in the SWPPP; or
2. The SWPPP proves to be ineffective in:
   a. Eliminating or significantly minimizing pollutants from sources identified in the SWPPP and as required by this permit; or
   b. Achieving the general objectives of controlling pollutants in stormwater discharges from permitted construction activity; and
3. Additionally, the SWPPP shall be amended to identify any new contractor or subcontractor that will implement any measure of the SWPPP.

Modification & Reason:

b. Operators Certification

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. Further, I hereby certify that the SWPPP meets all Federal, State, and local erosion and sediment control requirements. I am aware that false statements made herein are punishable as a class A misdemeanor pursuant to Section 210.45 of the Penal Law. "

Name (please print):____

Title ____**Date:**_______________

Address: ____

Phone: ____________ **Email:**____

Signature:____

c. Qualified Professional's Credentials & Certification

" I hereby certify that I meet the criteria set forth in the General Permit to conduct site inspections for this project and that the appropriate erosion and sediment controls described in the SWPPP and as described in the following Pre-construction Site Assessment Checklist have been adequately installed or implemented, ensuring the overall preparedness of this site for the commencement of construction."

Name (please print):____

Title ____**Date:**_______________

Address: ____

Phone: ___________ **Email:**____

Signature:____

d. Contractors Certification Statement

"I hereby certify that I understand and agree to comply with the terms and conditions of the SWPPP and agree to implement any corrective actions identified by the qualified inspector during a site inspection. I also understand that the owner or operator must comply with the terms and conditions of the most current version of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for stormwater discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings."

____

Signature of Contractor Date

____

Print Name Title

____

Signature of Trained Contractor Date

____

Print Name of Trained Contractor Title

Name of Contracting Firm ____

Street Address ____

City, State, Zip ____

Telephone No. ____

A copy of this statement shall be retained as part of the Stormwater Pollution Prevention Plan (SWPPP) for a period off at least five (5) years after the subject property is stabilized.

APPENDIX F

Hydrodynamic Separator Sizing and Maintenance Information

NJCAT TECHNOLOGY VERIFICATION

StormTrap StormSettler® Hydrodynamic Separator

StormTrap LLC

December 2022

Table of Contents

List of Tables

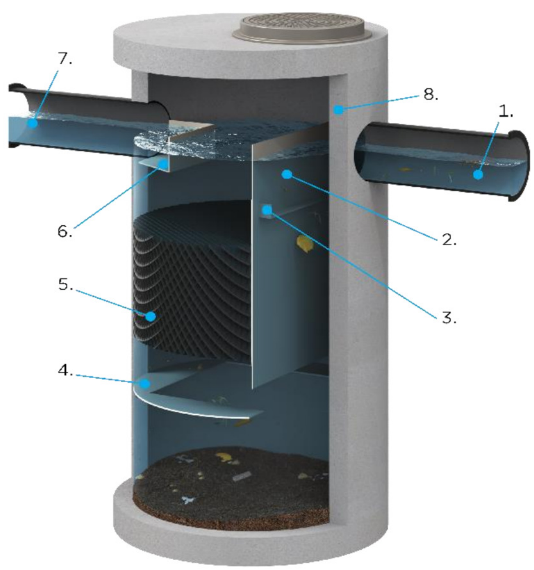
List of Figures

1. Description of Technology

The StormSettler® is a patent pending manufactured treatment device, specifically a hydrodynamic separator (HDS), developed by StormTrap. The StormSettler is designed to remove sediment from runoff using inclined tube settling technology. An inclined tube settler enhances settling by providing many small channels that reduce the settling distance, and therefore the settling time required for a particle to be captured. The settling pack in each StormSettler model occupies 75% of the cross-sectional area of the separator, while the dimensions of the settling tubes remain constant. The number of settling tubes and the settling area of the settling pack scales linearly with pack area, ensuring identical settling times in all models. If floatables capture is required, the system can be fitted with a net or basket in consultation with StormTrap. This configuration was not tested; hence, no performance claim is made.

In addition to the inclined tube settler, also called an enhanced settling pack, the StormSettler employs several flow modifiers to control the flow and optimize performance. The flow modifiers were designed using computational fluid dynamics (CFD) to create an optimal flow distribution that increases removal while decreasing scour potential. The internal components are typically fabricated using plastic parts however in some applications the components may be metal. StormSettler is typically housed within a concrete structure.

Figure 1 shows the StormSettler in a low flow condition and **Figure 2** shows the StormSettler in a high flow condition (See also **Figure 3**). The view is reversed from **Figure 1** to **Figure 2** to show the internal components more clearly.



1. Inlet
2. Vertical baffle
3. Vortex disruptor
4. Flow modifiers
5. Enhanced Settling pack
6. Outlet control diverter
7. Outlet
8. Tank wall

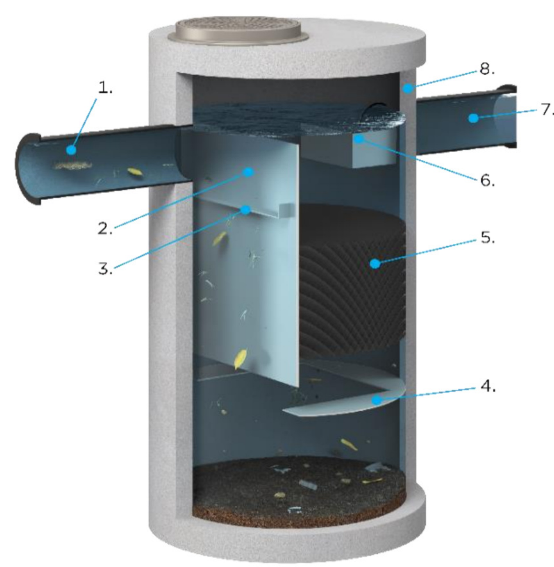


Figure 1 StormSettler Low Flow Operation

Figure 2 StormSettler High Flow Operation

During normal operations, where the vertical baffle forces all the flow under it, stormwater enters the inlet side of the StormSettler HDS through an inlet pipe (1), where it is immediately directed downward by the vertical baffle (2). A vortex disruptor (3) on the baffle helps prevent high velocity vortices on the inlet side. Water then flows under the vertical baffle where additional flow modifiers (4) help distribute the flow more evenly in the outlet chamber prior to the flow entering the enhanced settling pack (5).

The enhanced settling pack (5) consists of a large number of narrow channels which provide an effective settling area much greater than the system footprint. Upon exiting the enhanced settling device, the water is directed through an outlet diverter (6) to prevent any short circuiting and then to the outlet pipe (7).

During high flow events the vertical baffle acts as an internal bypass. All excess flow is directed over the baffle and the top of the outlet diverter. The remaining flow follows the low flow path and is fully treated. The internals are affixed to the tank wall (8). Maintenance is performed by accessing the tank floor from the inlet side.

Figure 3 shows the elevations of the various components in a 4' unit, which was the size tested.

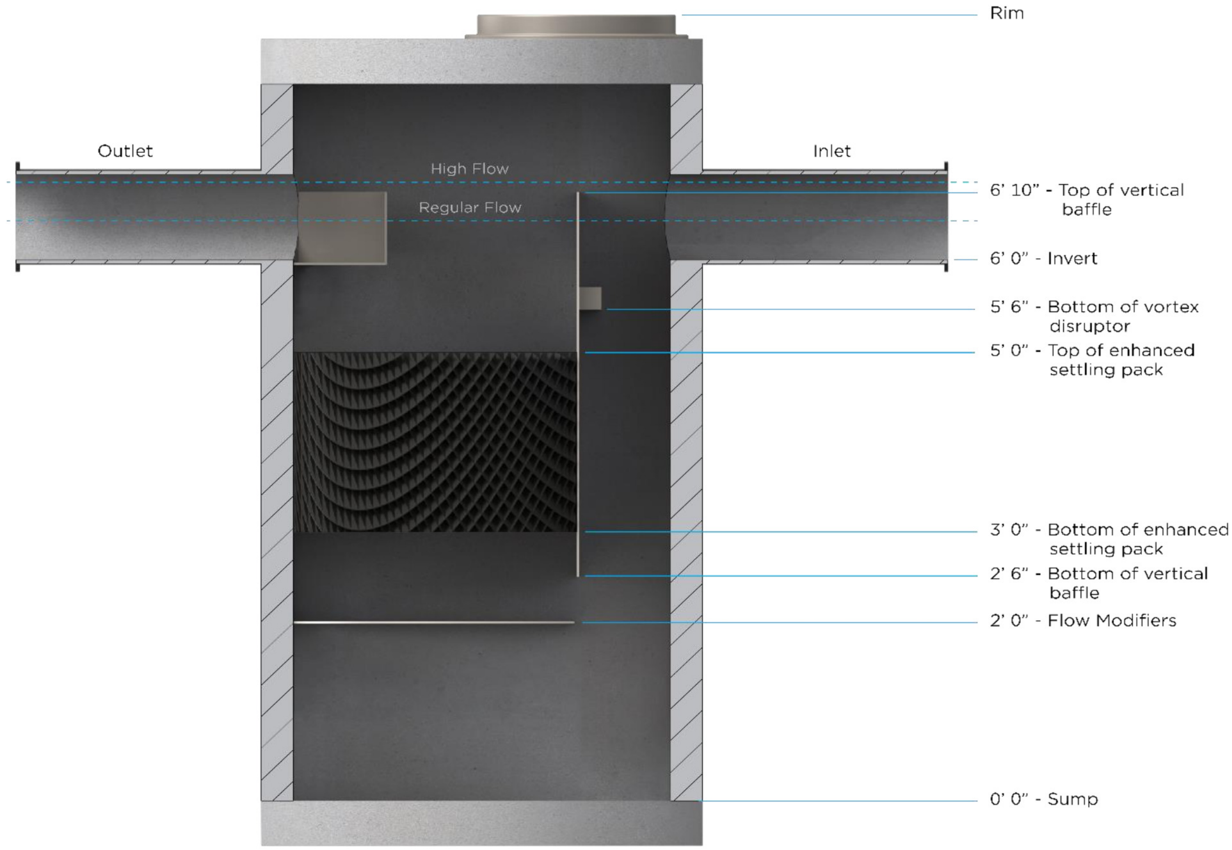


Figure 3 4-Foot System with Component Elevations

2. Laboratory Testing

The test program was conducted by Good Harbour Laboratories, an independent water technology testing lab, at their site in Mississauga, Ontario, Canada. The StormSettler was evaluated for sediment removal efficiency and scour in accordance with *the New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device (January 1, 2021).* Prior to starting the performance testing program, a quality assurance project plan (QAPP) was submitted to and approved by the New Jersey Corporation for Advanced Technology (NJCAT).

The device tested was a prototype of a commercially available 4-foot diameter StormSettler unit consisting of internal components housed in a metal manhole prototype. In commercial systems, the internal components are typically housed in a concrete manhole. The metal prototype of the test unit was equivalent to commercial concrete manholes in all key dimensions. The use of a metal prototype was proposed due to the difficulties associated with transporting and physically supporting the weight of a concrete unit. Using metal in lieu of concrete did not have any impact on system performance. The test unit was equipped with a 24-inch diameter access port with an invert 12 inches above the floor to access the sump to allow for easy recovery of captured sediment. The port contained a plug to maintain a smooth inner wall. The prototype utilized in testing is in conformance with the test protocol.

The laboratory test set-up was a water flow loop, capable of moving water at a rate of up to 3 cfs. The test loop, illustrated in **Figure 4**, is comprised of a series of water reservoirs, pumps, sediment filter, receiving tank and flow meters.

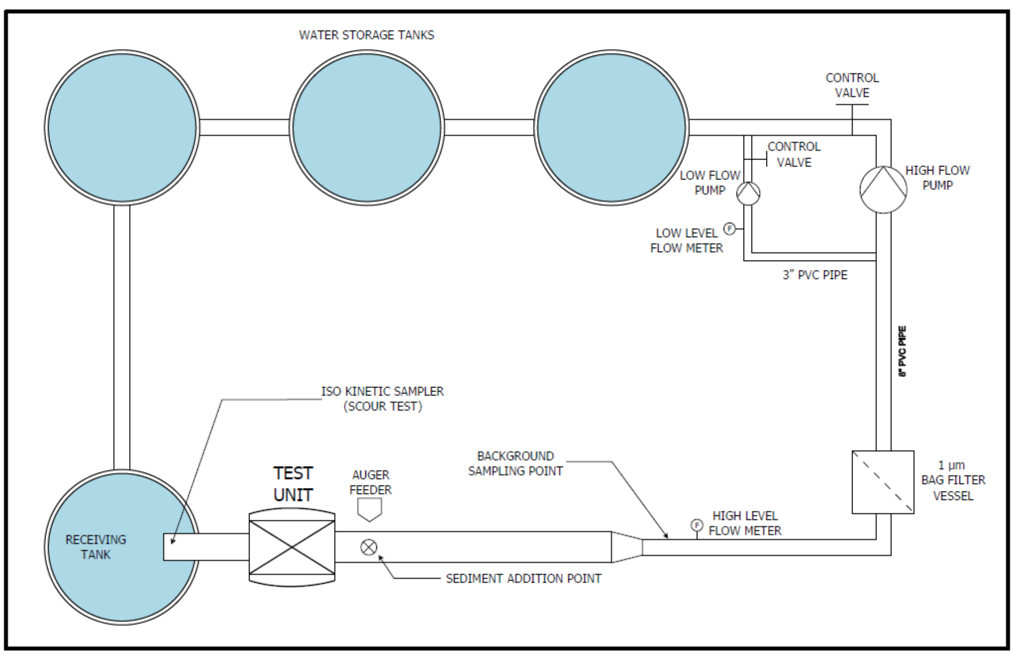


Figure 4 Laboratory Test Setup

2.1 Test Setup

The treatment device tested was a full-scale StormSettler unit (StormSettler-4); dimensional details are provided in **Table 1**. Both the inlet and outlet pipes were 12" in diameter. This unit had a total sump area of 12.6 ft^2 and a ***target*** maximum treatment flow rate (MTFR) of 1.15 cfs (516 gpm). For the sake of consistency with other reports the Effective Treatment Area is the cross-sectional area of the system.

Table 1 StormSettler-4 Dimensions

MTFR (target)		Diameter (ft)	Sump Area (ft^2)	Sediment Storage (ft^3)	Maximum Sediment Storage Depth (in)	Effective Treatment Area (ft^2)	Target Loading Rate (gpm/ft^2)
(cfs)	(gpm)						
1.15	516	4	12.6	14.7	14	12.6	40.9

Water Flow and Measurement

From the water supply tanks, water was pumped using either a WEG Model FC00312 (1 - 200 gpm) or an Armstrong Model 8X8X10 4380 (100 – 1300 gpm) centrifugal pump. Flow measurement was done using either a 3" Toshiba Model GF630 electromagnetic type flow meter with an accuracy of ± 0.2% of reading (1 - 200 gpm) or a MJK Magflux Type 7200 flow meter Model 297237 with an accuracy of ± 0.25% of reading (100 - 1300 gpm). All flow meters were installed away from flow disturbances in accordance with the manufacturer's recommendation. The data logger used was a MadgeTech Process 101A data logger, configured to record a flow measurement once every 30 seconds.

The water in the flow loop was circulated through a filter housing containing high-efficiency pleated bag filters with 0.5 µm or 1.0 µm absolute rating for removal efficiency testing and 1 µm nominal rating for scour testing. The influent pipe was 12 inches in diameter, 84 inches long and installed with a 1% slope. Sediment addition was done through a port on the crown of the influent pipe, 24 inches upstream of the StormSettler. The sediment feeder was an Auger Feeders Model VF-1 volumetric screw feeder with vibratory hopper. The feeder had a 10-gallon hopper above the auger screw to provide a constant supply of sediment.

Water flow exited the StormSettler through a 47-inch length of effluent pipe, 12-inch diameter, also installed with a 1% slope, and terminated with a free-fall into the receiving tank to complete the flow loop.

Sample Collection

Background water samples were taken by grab sampling. A 1L, wide-mouth, sample jar was filled using a ¾-inch, full-port (**Figure 5**), sampling ball valve located downstream of the sediment bag filter and upstream of the sediment addition point.

Removal efficiency was determined by mass recovery; no effluent samples were collected for removal efficiency analysis. Both the sediment mass recovered in the manufactured treatment device (MTD) and the inlet pipe were quantified and reported separately.

For the scour test, effluent samples were taken by hand. The effluent pipe drained freely into the receiving tank. The end of the effluent pipe was fitted with a 3-tube isokinetic sampler **(Figure 6**) and the effluent sample was taken at that point. The sampling technique was to hold a 1 L wide-mouth jar underneath the stream of effluent flow from the isokinetic sampler such that all three tubes drained completely into the jar.

Duplicate samples were collected for background and scour effluent samples. The primary set was analyzed and reported while the second set was held under refrigerated conditions in case there was a need for investigation of any aberrant results. The duplicate samples were not used.

Figure 5 Background Sampling Point

Figure 6 Scour Effluent Sampling Point

Sediment calibration samples were taken at the end of the auger feeder's spout attachment (**Figure 7**) by holding a 500 mL jar just under the opening. The test sediment was sampled six times per run to confirm the sediment feed rate. Each sediment feed rate sample was collected over an interval timed to the nearest second. Samples were weighed to the nearest 0.01 g.

Figure 7 Sediment Auger Feeder

Other Instrumentation and Measurement

Water temperature was measured and recorded using a MadgeTech MicroTemp data logger that was suspended inside the StormSettler next to the inlet pipe. The MicroTemp was configured to take a temperature reading once every minute.

Run and sampling times were measured using a NIST traceable stopwatch, Control Company Model 62379-460.

The sediment feed samples that were taken during the run were collected in 500 mL jars and weighed on a top loading balance (Mettler Toledo, PB 4002-S/FACT) with a precision of 0.01 g.

The sediment that was added to the auger feeder, and the sediment recovered following each run, was weighed on an industrial balance (Mettler Toledo, BBA 231-3BB35A/S) with a precision of 5 grams.

2.2 Test Sediment

Removal Efficiency Test Sediment

The test sediment used for the removal efficiency study (1-1000 µm) was a custom blend of commercially available silica sediments blended by GHL. This particular batch was GHL lot # A031-119. The blend ratio was determined such that the particle size distribution (PSD) of the resulting blended sediment would meet the specification for the test protocol. The sediment was sampled in multiple locations throughout the blending process; three composite samples were created for PSD analysis. The final blended sediment was stored in 12 sealed buckets until needed.

Each of the three composite samples was reduced in size using a riffle splitter. The three samples were analyzed for PSD by a qualified 3rd party analytical laboratory (Bureau Veritas in Mississauga) in accordance with ASTM D6913-17, "Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis" and ASTM D7928-17 "Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis". The moisture content of the test sediment was determined using the test method in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act, as required by Ontario Regulation 153/04. It differs from ASTM Method D2216-19, "Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass", only in that the drying temperature is 105 ^{o}C instead of 110 ±5^{o}C. The test results are summarized in **Table 2** and shown graphically in **Figure 8.**

Table 2 Particle Size Distribution of 1- 1000 µm Test Sediment

Particle Size (µm)	Test Sediment Particle size (%passing)◊				NJDEP Specification (minimum % passing)*
	Sample 1	Sample 2	Sample 3	Average	
1000	100	100	100	100	100
500	96	96	96	96	95
250	89	89	90	89	90
150	79	79	81	80	75
100	58	58	63	60	60
75	51	53	59	54	50
50	45	45	47	46	45
20	39	39	39	39	35
8	28	25	27	27	20
5	22	20	22	21	10
2	11	12	11	11	5

◊Where required, particle size data has been interpolated to allow for comparison to the required particle size specification.

*A measured value may be lower than a target minimum % less than value by up to two percentage points, (e.g., at least 3% of the particles must be less than 2 microns in size [target is 5%]), provided the measured d50 value does not exceed 75 microns for TSS test removal efficiency PSD.

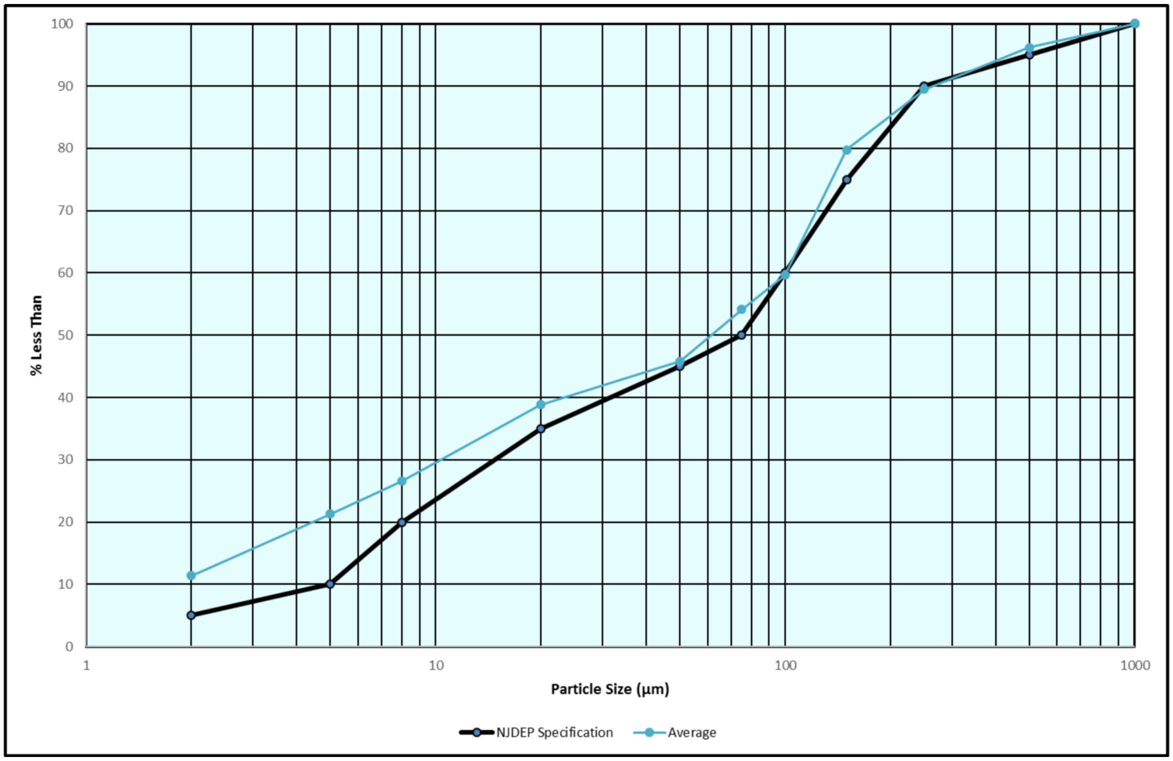


Figure 8 Average Particle Size Distribution of 1-1000 µm Test Sediment

In addition to particle size distribution, Bureau Veritas also performed a moisture analysis of the test sediment and determined the water content to be < 0.30%, the method detection limit. This amount of moisture is not considered significant and therefore no correction for the amount of moisture in the sediment mass was made.

The blended test sediment was found to meet the NJDEP particle size specification and was acceptable for use. With a median (d_{50}) of 65µm, the test sediment was finer than the sediment required by the NJDEP test protocol.

Scour Test Sediment

The test sediment used for the scour study was also a custom blend of commercially available silica sediments blended by GHL. This particular batch was GHL lot # A034-081. The blend ratio was determined such that the particle size distribution of the resulting blended sediment would meet the specification for the test protocol. The blended scour test sediment was stored in 9 five-gallon buckets. Three separate composite samples were created by sampling all of the five-gallon buckets used to load the StormSettler for the scour test. Each bucket was sampled in three locations: top third, middle third and bottom third. The composite samples were well blended and reduced in size using a sediment riffle splitter.

The three samples were analyzed for PSD by a qualified 3rd party analytical laboratory (GeoTesting Express in Massachusetts) in accordance with ASTM D6913-17, "Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis" and ASTM

D7928-17 “Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis”. The moisture content of the test sediment was also determined in accordance with ASTM Method D2216-19, “Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.” The test results are summarized in

Table 3 and shown graphically in **Figure 9**. The scour test sediment was finer than the sediment required by the NJDEP test protocol and therefore was acceptable for use. The moisture content was reported as 0.0%.

Table 3 Particle Size Distribution of Scour Test Sediment

Particle Size (µm)	**Test Sediment Particle size (%passing) ◊**				**NJDEP Specification (minimum % Passing)***
	Sample 1	**Sample 2**	**Sample 3**	**Average**	
1000	100	100	100	100	100
500	93	94	94	94	90
250	57	61	58	59	55
150	44	48	45	46	40
100	25	29	23	26	25
75	8	11	5	8	10

◊Where required, particle size data has been interpolated to allow for comparison to the required particle size specification.

*A measured value may be lower than a target minimum % less than value by up to two percentage points, (e.g., at least 8% of the particles must be less than 75 microns in size [target is 10%]).

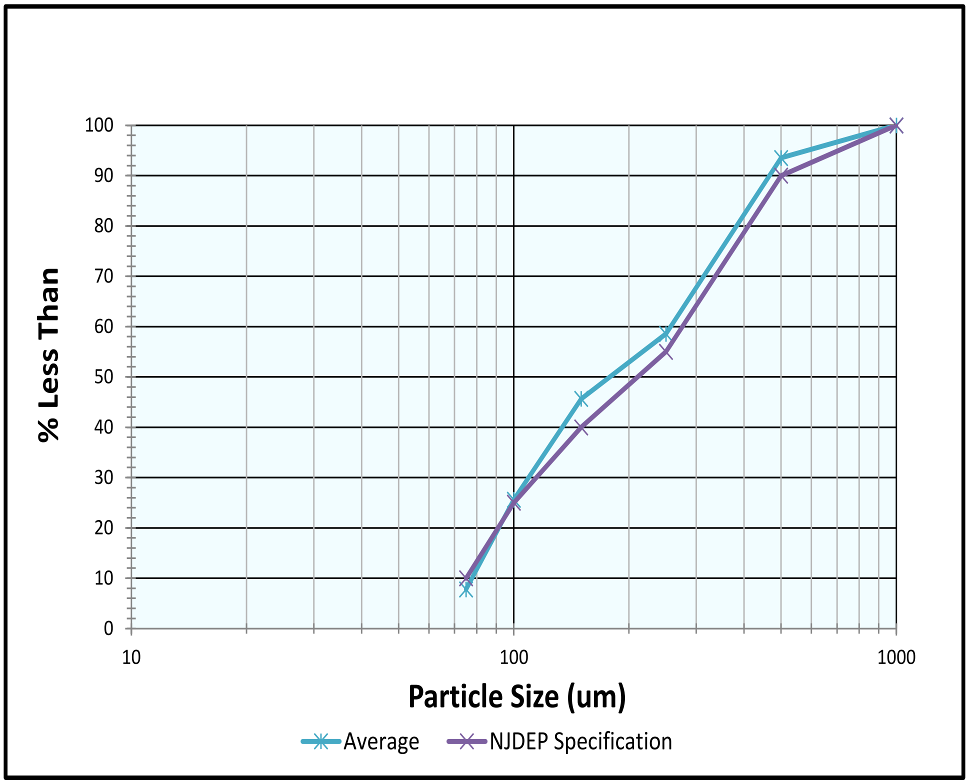


Figure 9 Average Particle Size Distribution of Scour Test Sediment

2.3 Hydraulic Testing

Prior to the start of testing with sediment, water flow and the corresponding water levels in the inlet and outlet pipes were measured and recorded to establish the head loss across the device, in accordance with Section 4.B.6 of the NJDEP Laboratory Protocol for Hydrodynamic Sedimentation MTDs. The head loss measurements were taken approximately one pipe-diameter upstream and downstream of the test unit. The measurements covered the span of 10% to 200% of the target MTFR and included the point when bypass occurred. The false floor was installed at the 50% level for the hydraulic test. Testing results are given in section 4.3.

2.4 Removal Efficiency Testing

Removal efficiency testing was conducted in accordance with Section 4 of the NJDEP Laboratory Protocol for Hydrodynamic Sedimentation MTDs. Testing was completed at flow rates of 10%, 25%, 50%, 75%, 100%, 125% and 150% of the target MTFR (0.12 cfs - 1.73 cfs) and at a target influent sediment concentration of 200 mg/L. A false floor was installed at an elevation of 7 inches in the sump, equivalent to 50% of the maximum sediment storage depth.

The test sediment was sampled 6 times per run, using 500 mL jars, to confirm the sediment feed rate. Each sediment feed rate sample was a minimum of 100 mL, or the amount collected over a 1-minute period, whichever came first.

Each run continued until at least 25 lbs of sediment had been added to the MTD. Eight background water samples were taken at evenly-spaced intervals during each test run.

At the end of each run, water flow continued for one detention time after sediment feed was stopped to allow for sediment that would not normally be captured to pass through the MTD. The sediment added during a run was determined by weighing the hopper feed sediment before and after each run and correcting for the six feed sediment calibration samples that were taken.

At the end of the test program the results were fit to a curve, in accordance with the NJDEP HDS protocol, and the result determined that the MTFR is 1.41 cfs. With an MTFR at 1.41 cfs, then the 125% flow rate, which is the highest flow used in the net annual removal calculation, would be 1.76 cfs. The implications of this were discussed with Dr. Richard Magee and the following decision was reached: Since the original test program only went to 1.73 cfs, it was necessary to do an additional run at or greater than 1.76 cfs in order that none of the data in the net annual removal calculations was extrapolated. This 8^{th} run was completed at 1.76 cfs and included with the previous data.

2.5 Scour Testing

Prior to the start of testing, sediment was loaded into the sump of the StormSettler and leveled at a depth of 4 inches above the false floor, for a total depth of 7 inches. The final height of the sediment was at an elevation equivalent to 50% of the maximum sediment storage capacity of the MTD. After loading of the sediment, the unit was gradually filled with clear water, so as not to disturb the sediment, to the invert of the inlet pipe. The filled unit was allowed to sit for approximately 95 hours before starting the scour test.

When the removal efficiency testing indicated that an MTFR of 1.41 cfs could be claimed, the scour test was repeated with a target flow rate of 2.83 cfs (1270 gpm), a little more than 200% of the selected MTFR. During the scour test, the water flow rate was recorded once every 30 seconds and the temperature was recorded once every minute. Testing commenced by gradually increasing the water flow into the system until the target flow rate was achieved (within 3 minutes of commencing the test). Background and effluent sampling began 1 minute after starting the flow. An effluent grab sample was taken once every two minutes, until a total of 15 effluent samples were taken. The first effluent sample, at t = 1 min, was taken by sweeping a jar through the effluent flow because the isokinetic sampler tubes were not yet flowing full. All subsequent samples were taken from the isokinetic sampling tubes. A total of eight background water samples were collected (taken with every odd-numbered effluent sample).

It should be noted that the initial scour test was conducted at a target flow rate of 2.3 cfs (1030 gpm). A second scour test was conducted at a target flow rate of 2.80 cfs (1257 gpm). The system passed both the scour tests, but the results are not reported since they were superseded by the higher flow test reported here.

2.6 Laboratory Proficiency Testing

Prior to the start of testing, six spiked blind Total Suspended Solids (SSC) samples, three at a concentration of around 20 mg/L and the other three at a concentration of around 50 mg/L were prepared by GHL using the same test sediment as for the removal performance testing. These samples were submitted to OSHTECH Inc, an ISO 17025 accredited laboratory in Etobicoke, Ontario. Samples were analyzed by OSHTECH for sediment concentration (SSC) in accordance with ASTM Method D 3977-97 "Standard Test Methods for Determining Sediment

Concentrations in Water Samples". The results of the proficiency testing are summarized in **Table 4** below.

Table 4 Laboratory Proficiency Testing Results

Sample ID	Sample Concentration (mg/L)	Reported SSC (mg/L)	% Recovery
Control #1	20.6	18.6	90.3
Control #4	22.7	21.5	94.7
Control #5	21.3	20.2	94.8
		Average	**93.3**
Control #2	52.4	47.9	91.4
Control #3	50.0	49.3	98.6
Control #6	49.4	46.3	93.7
		Average	**94.6**

The average recovery percentage of the spiked SSC samples was 93.3% at 20 mg/L and 94.6% at 50 mg/L, meeting the requirement of 85 – 115%. The lab, OSHTECH Laboratory, passed the Laboratory Proficiency Testing for SSC analysis.

3. Performance Claims

Per the NJDEP verification procedure, the following are the performance claims made by StormTrap LLC and/or established via the laboratory testing conducted for the StormSettler Hydrodynamic Separator.

Total Suspended Solids (TSS) Removal Rate

The TSS removal rate of the StormSettler was calculated using the annualized weighted method required by the NJDEP mass capture HDS MTD protocol. Based on a MTFR of 1.41 cfs (633 gpm), the StormSettler achieved an annualized weighted TSS removal rate of 50.4%.

Maximum Treatment Flow Rate (MTFR)

The tested StormSettler unit had a surface area of 12.6 ft^2 and a maximum treatment flow rate (MTFR) of 1.41 cfs (633 gpm). This equates to a hydraulic loading rate of 50.2 gpm/ft^2.

Maximum Sediment Storage Depth and Volume

The maximum sediment storage depth is 14 inches which equates to 14.7 ft^3 of sediment storage volume.

Effective Treatment/Sedimentation Area

The effective treatment area and effective sedimentation area are 12.6 ft^2.

Detention Time and Wet Volume

The detention time at 100% MTFR of the test unit is 61 seconds. The wet volume of the test unit was 86 ft^3, calculated based on the water level at 100% MTFR.

Online Installation

Based on the laboratory scour testing, the StormSettler qualifies for online installation.

4. Supporting Documentation

The NJDEP Procedure (NJDEP, 2021) for obtaining verification of a stormwater manufactured treatment device (MTD) from the New Jersey Corporation for Advanced Technology (NJCAT) requires that "copies of the laboratory test reports, including all collected and measured data; all data from performance evaluation test runs; spreadsheets containing original data from all performance test runs; all pertinent calculations; etc." be included in this section. This was discussed with NJDEP, and it was agreed that as long as such documentation could be made available by NJCAT upon request that it would not be prudent or necessary to include all this information in this verification report. All supporting documentation will be retained securely by GHL to be provided to NJCAT or NJDEP upon request.

4.1 Removal Efficiency Testing

A total of 7 removal efficiency test runs were completed in accordance with the NJDEP HDS protocol. The target flow rate ranged from 10 - 150% of the target MTFR and the target influent sediment concentration was 200 mg/L. A false floor was set at 7”, which is 50% of the storage depth. The results from all 7 runs were used to calculate the overall removal efficiency of the StormSettler. Sediment removal efficiencies were plotted vs. flow rate to generate a removal efficiency curve from which the MTFR was selected, and an annual weighted removal efficiency was calculated.

The total water volume and average flow rate per run were calculated from the data collected by the flow data logger, one reading every 30 seconds. The average influent sediment concentration for each test flow was determined by mass balance. The amount of sediment fed into the auger feeder during dosing, and the amount remaining at the end of a run, was used to determine the amount of sediment fed during a run. The sediment mass was corrected for the mass of the six feed rate samples taken during the run. The mass of the sediment fed was divided by the volume of water that flowed through the MTD during dosing to determine the average influent sediment concentration for each run.

Six feed rate samples were collected at evenly spaced intervals during the run to ensure the rate was stable. The COV of the samples had to be ≤ 0.10 per the NJDEP protocol.

Following each run, the captured sediment in the StormSettler was allowed to settle overnight before draining. Once drained, all of the captured sediment was removed from the unit’s sump. The sediment that was retained in the inlet pipe was collected separately from the sediment collected in the sump. Any trace amount of sediment that was left behind was flushed with water and suctioned with a wet/dry vacuum. The contents of the vacuum were transferred to a 100 L container and allowed to settle for at least 2 hours before decanting the water. The settled sediment in the container was collected and added to the sediment collected from the sump. All collected sediment was placed in glass trays and dried in a convection oven, that was set to 110 ^{0}C, until a constant weight was obtained when cooled to room temperature, as determined by two successive measurements taken no less than two hours apart which show no more than a 0.1% difference in measured mass weighed to a precision of 10 grams. Any sediment that was recovered from the inlet pipe was dried and weighed separately from the sediment that was recovered from the unit’s sump. There was no sediment accumulation in the effluent pipe for any of the seven runs.

The data collected for each sediment removal efficiency run is presented below:

10% MTFR

Table 5 Sampling Schedule - 10% MTFR

Runtime (min)	Sampling Schedule	
	Sediment Feed	Background
0.0	1	1
44.3		2
62.0	2	
88.6		3
124.0	3	
132.9		4
177.1		5
186.0	4	
221.4		6
248.0	5	
265.7		7
310.0	6	8
320.0	End of Testing	
MTD Detention Time = 9.9 minutes Sediment Sampling Time = 1 minute		

Table 6 Water Flow and Temperature - 10% MTFR

Run Parameters	Water Flow Rate (gpm)				Maximum Water Temperature (°F)
	Target	Actual	Difference	COV	
	51.5	51.5	0.1%	0.005	68.5
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

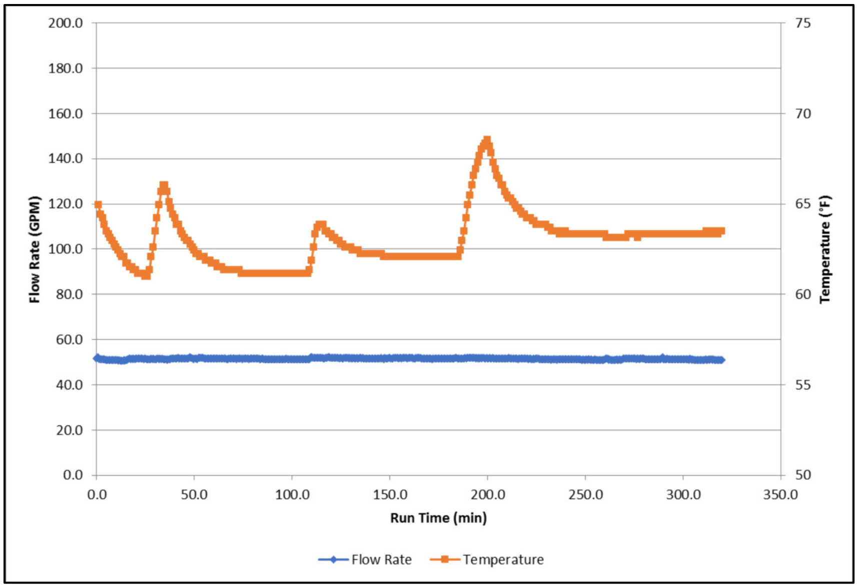


Figure 10 Water Flow and Temperature - 10% MTFR

*Temperature fluctuations are due to GHL filling the reservoir tanks.

Table 7 Sediment Feed Rate Summary – 10% MTFR

Sediment Feed Rate (g/min)		Sediment Mass Balance	
1	40.03	Starting Weight of Sediment (lbs.)	72.54
2	38.99		
3	37.28	Recovered Weight of Sediment (lbs.)	45.45
4	39.02		
5	39.28	Mass of Sediment Used (lbs.)	27.09
6	38.39	Volume of Water Through MTD During Dosing (gal)	15,716
Average	38.83		
COV	0.024	Average Influent Sediment Concentration (mg/L)	202.7*
QA/QC Limit	0.10 PASS	QA/QC Limit	180 – 220 mg/L PASS

*Corrected for sediment feed rate samples

Table 8 Background SSC - 10% MTFR

	Suspended Sediment Concentration (mg/L)								
Sample #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**QA/QC Limit**
Background	3.1	1.4	1.1	2.2	3.1	2.8	3.7	3.3	≤ 20 mg/L PASS

25% MTFR

Table 9 Sampling Schedule - 25% MTFR

Runtime (min)	Sampling Schedule	
	Sediment Feed	Background
0.0	1	1
17.9		2
25.1	2	
35.9		3
50.2	3	
53.8		4
71.7		5
75.3	4	
89.6		6
100.4	5	
107.6		7
125.5	6	8
129.5	End of Testing	
MTD Detention Time = 4.0 minutes Sediment Sampling Time = 1 minute		

Table 10 Water Flow and Temperature - 25% MTFR

Run Parameters	Water Flow Rate (gpm)				Maximum Water Temperature (°F)
	Target	Actual	Difference	COV	
	128.8	130.4	1.2%	0.012	66.7
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

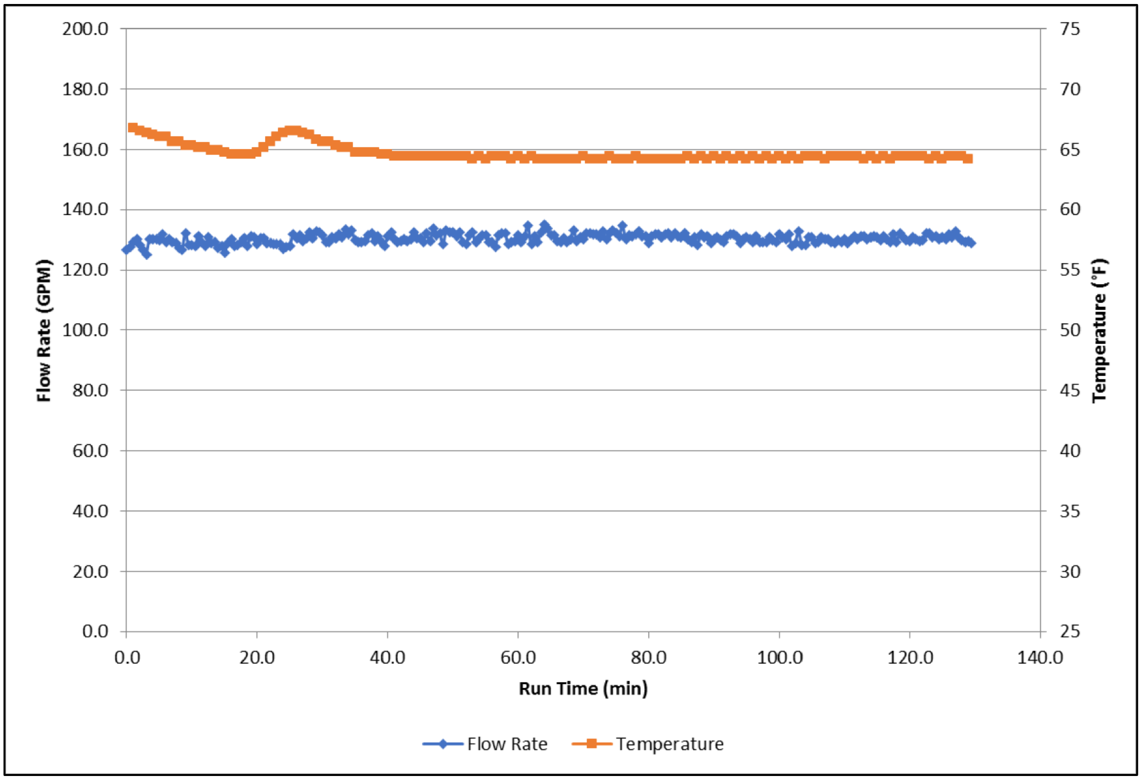


Figure 11 Water Flow and Temperature - 25% MTFR

Table 11 Sediment Feed Rate Summary – 25% MTFR

Sediment Feed Rate (g/min)		**Sediment Mass Balance**	
1	103.73	Starting Weight of Sediment (lbs.)	73.03
2	103.78		
3	103.89	Recovered Weight of Sediment (lbs.)	43.24
4	109.84		
5	108.67	Mass of Sediment Used (lbs.)	29.78
6	102.14	Volume of Water Through MTD During Dosing (gal)	15,715
Average	105.34		
COV	0.030	Average Influent Sediment Concentration (mg/L)	216.5*
QA/QC Limit	0.10 PASS	QA/QC Limit	180 – 220 mg/L PASS

*Corrected for sediment feed rate samples

Table 12 Background SSC - 25% MTFR

	Suspended Sediment Concentration (mg/L)								
Sample #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**QA/QC Limit**
Background	1.3	1.2	1.1	ND	2.5	1.7	2.4	1.9	≤ 20 mg/L PASS

ND = below method detection limit of 1.0 mg/L

50% MTFR

Table 13 Sampling Schedule - 50% MTFR

Runtime (min)	Sampling Schedule	
	Sediment Feed	**Background**
0.0	1	1
9.4		2
13.1	2	
18.7		3
26.2	3	
28.1		4
37.4		5
39.3	4	
46.8		6
52.4	5	
56.1		7
65.5	6	8
67.5	End of Testing	
MTD Detention Time = 2.0 minutes Sediment Sampling Time = 1 minute		

Table 14 Water Flow and Temperature - 50% MTFR

Run Parameters	Water Flow Rate (gpm)				Maximum Water Temperature (°F)
	Target	**Actual**	**Difference**	**COV**	
	257.5	256.9	-0.2%	0.008	65.7
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

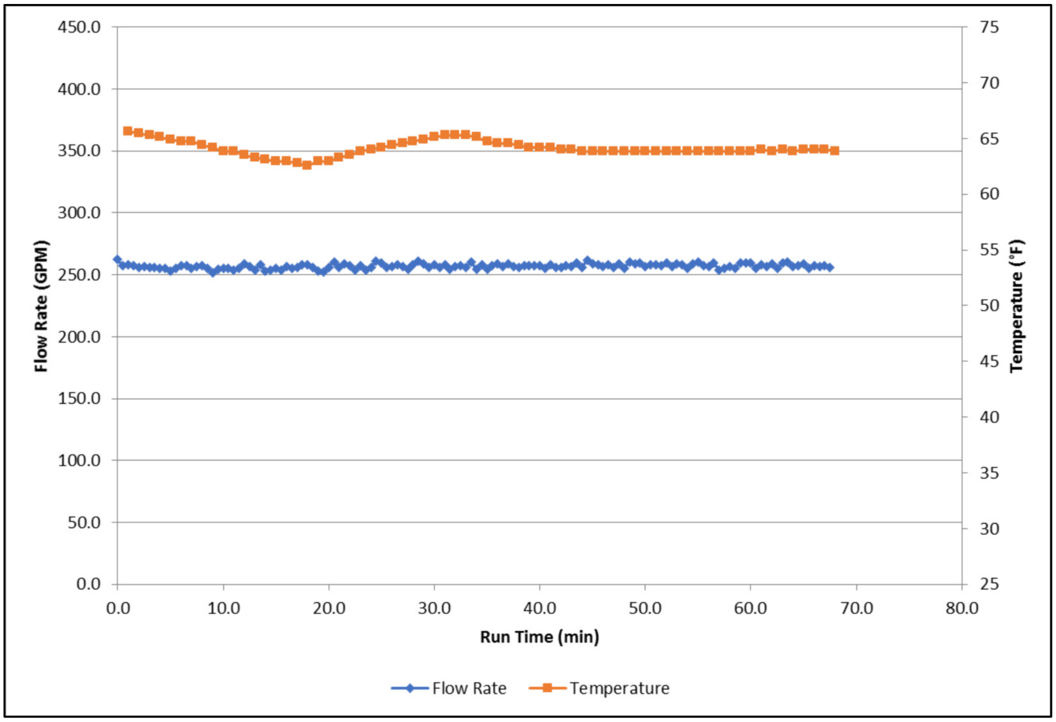


Figure 12 Water Flow and Temperature - 50% MTFR

Table 15 Sediment Feed Rate Summary – 50% MTFR

Sediment Feed Rate (g/min)		**Sediment Mass Balance**	
1	194.12	Starting Weight of Sediment (lbs.)	71.78
2	192.23		
3	197.60	Recovered Weight of Sediment (lbs.)	43.17
4	189.96		
5	191.17	Mass of Sediment Used (lbs.)	28.62
6	199.81	Volume of Water Through MTD During Dosing (gal)	15,612
Average	194.15		
COV	0.020	Average Influent Sediment Concentration (mg/L)	200.0*
QA/QC Limit	0.10 PASS	QA/QC Limit	180 – 220 mg/L PASS

*Corrected for sediment feed rate samples

Table 16 Background SSC - 50% MTFR

	Suspended Sediment Concentration (mg/L)								
Sample #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**QA/QC Limit**
Background	ND	ND	1.0	1.2	1.4	1.0	1.7	1.0	≤ 20 mg/L PASS

ND = below method detection limit of 1.0 mg/L

75% MTFR

Table 17 Sampling Schedule - 75% MTFR

Runtime (min)	Sampling Schedule	
	Sediment Feed	Background
0.0	1	1
6.2		2
8.7	2	
12.4		3
17.4	3	
18.6		4
24.9		5
26.1	4	
31.1		6
34.8	5	
37.3		7
43.5	6	8
45.0	End of Testing	
MTD Detention Time = 1.3 minutes Sediment Sampling Time = 30 seconds		

Table 18 Water Flow and Temperature - 75% MTFR

Run Parameters	Water Flow Rate (gpm)				Maximum Water Temperature (°F)
	Target	Actual	Difference	COV	
	386.3	385.9	-0.1%	0.006	65.1
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

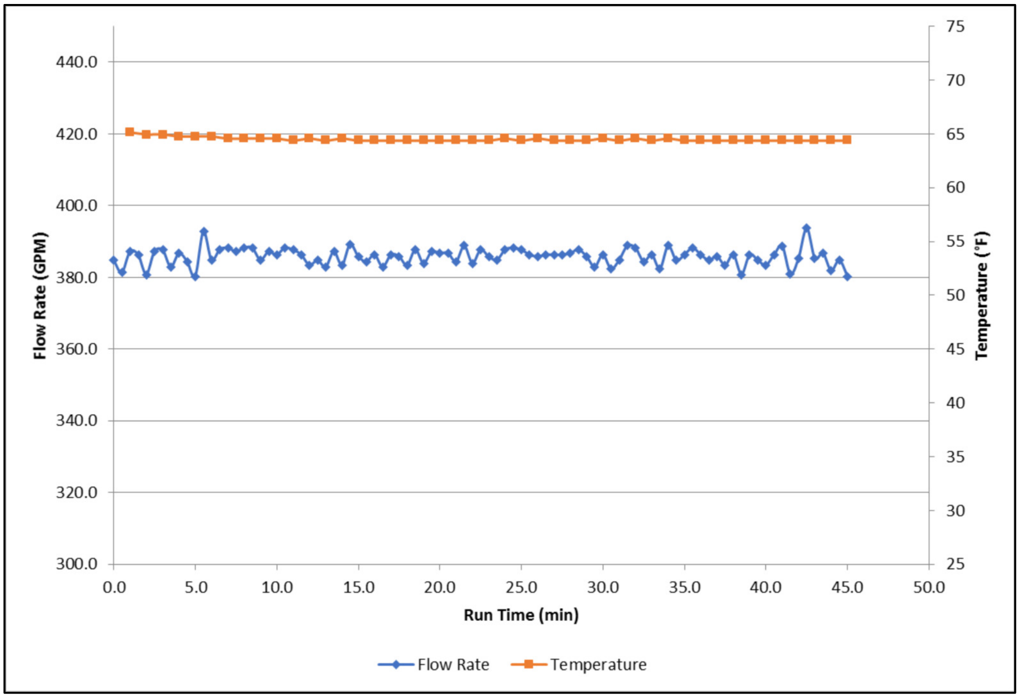


Figure 13 Water Flow and Temperature - 75% MTFR

Table 19 Sediment Feed Rate Summary – 75% MTFR

Sediment Feed Rate (g/min)		**Sediment Mass Balance**	
1	288.22	Starting Weight of Sediment (lbs.)	70.82
2	312.73		
3	296.09	Recovered Weight of Sediment (lbs.)	41.77
4	298.87		
5	294.95	Mass of Sediment Used (lbs.)	29.06
6	303.19	Volume of Water Through MTD During Dosing (gal)	15,823
Average	299.01		
COV	0.028	Average Influent Sediment Concentration (mg/L)	205.1*
QA/QC Limit	0.10 PASS	QA/QC Limit	180 – 220 mg/L PASS

*Corrected for sediment feed rate samples

Table 20 Background SSC - 75% MTFR

	Suspended Sediment Concentration (mg/L)								
Sample #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**QA/QC Limit**
Background	1.2	1.7	2.7	4.6	6.4	6.9	6.2	2.4	≤ 20 mg/L PASS

100% MTFR

Table 21 Sampling Schedule - 100% MTFR

Runtime (min)	Sampling Schedule	
	Sediment Feed	Background
0.0	1	1
4.7		2
6.6	2	
9.4		3
13.2	3	
14.1		4
18.9		5
19.8	4	
23.6		6
26.4	5	
28.3		7
33.0	6	8
34.0	End of Testing	
MTD Detention Time = 1.0 minutes Sediment Sampling Time = 30 seconds		

Table 22 Water Flow and Temperature - 100% MTFR

Run Parameters	Water Flow Rate (gpm)				Maximum Water Temperature (°F)
	Target	Actual	Difference	COV	
	515.0	514.6	-0.1	0.006	57.6
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

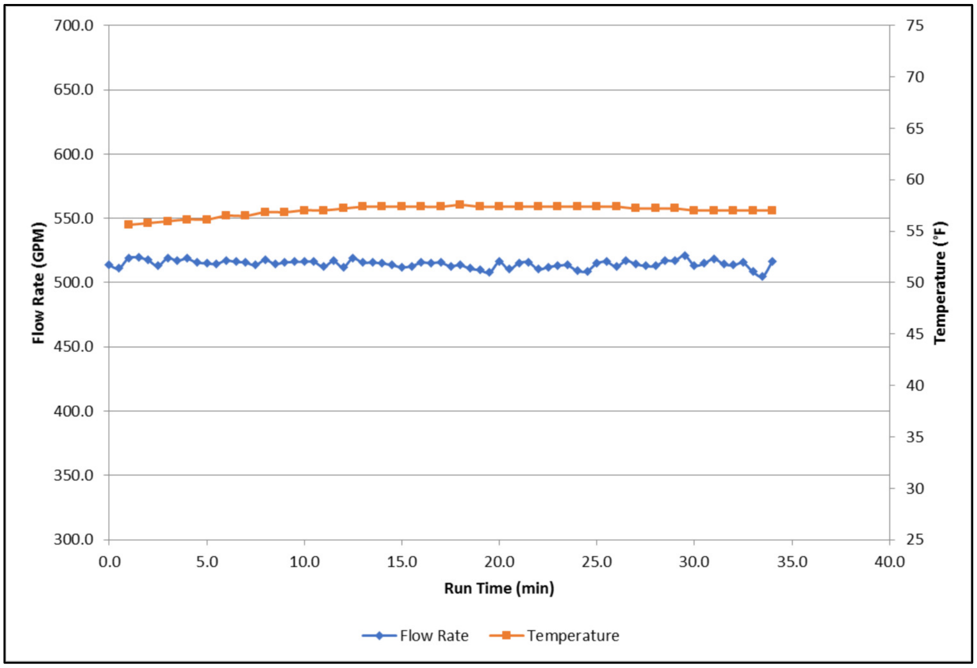


Figure 14 Water Flow and Temperature - 100% MTFR

Table 23 Sediment Feed Rate Summary – 100% MTFR

Sediment Feed Rate (g/min)		**Sediment Mass Balance**	
1	385.32	Starting Weight of Sediment (lbs.)	75.50
2	390.97		
3	380.19	Recovered Weight of Sediment (lbs.)	47.13
4	390.20		
5	386.73	Mass of Sediment Used (lbs.)	28.36
6	405.29	Volume of Water Through MTD During Dosing (gal)	15,702
Average	389.78		
COV	0.022	Average Influent Sediment Concentration (mg/L)	196.9*
QA/QC Limit	0.10 PASS	QA/QC Limit	180 – 220 mg/L PASS

*Corrected for sediment feed rate samples

Table 24 Background SSC - 100% MTFR

	Suspended Sediment Concentration (mg/L)								
Sample #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**QA/QC Limit**
Background	ND	ND	ND	ND	ND	1.3	3.2	2.2	≤ 20 mg/L PASS

ND = below method detection limit of 1.0 mg/L

125% MTFR

Table 25 Sampling Schedule - 125% MTFR

Runtime (min)	Sampling Schedule	
	Sediment Feed	Background
0.0	1	1
3.7		2
5.2	2	
7.4		3
10.3	3	
11.0		4
14.7		5
15.4	4	
18.4		6
20.6	5	
22.1		7
25.7	6	8
26.5	End of Testing	
MTD Detention Time = 0.8 minutes Sediment Sampling Time = 20 seconds		

Table 26 Water Flow and Temperature - 125% MTFR

Run Parameters	Water Flow Rate (gpm)				Maximum Water Temperature (°F)
	Target	Actual	Difference	COV	
	643.8	645.1	0.2%	0.008	59.4
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

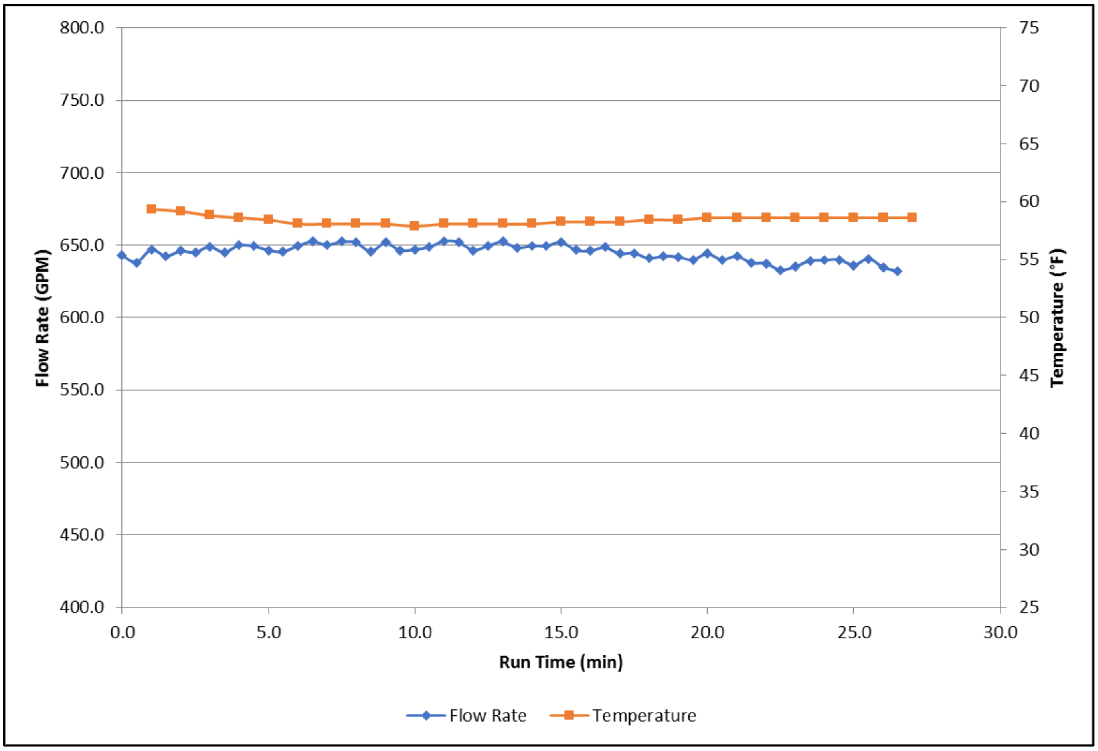


Figure 15 Water Flow and Temperature - 125% MTFR

Table 27 Sediment Feed Rate Summary – 125% MTFR

Sediment Feed Rate (g/min)		**Sediment Mass Balance**	
1	477.28	Starting Weight of Sediment (lbs.)	73.67
2	534.32		
3	495.16	Recovered Weight of Sediment (lbs.)	45.18
4	488.29		
5	514.02	Mass of Sediment Used (lbs.)	28.48
6	516.01	Volume of Water Through MTD During Dosing (gal)	15,528
Average	504.18		
COV	0.042	Average Influent Sediment Concentration (mg/L)	202.7*
QA/QC Limit	0.10 PASS	QA/QC Limit	180 – 220 mg/L PASS

*Corrected for sediment feed rate samples

Table 28 Background SSC - 125% MTFR

	Suspended Sediment Concentration (mg/L)								
Sample #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**QA/QC Limit**
Background	ND	ND	ND	ND	1.5	3.0	4.1	5.6	≤ 20 mg/L PASS

ND = below method detection limit of 1.0 mg/L

150% MTFR

Table 29 Sampling Schedule - 150% MTFR

Runtime (min)	Sampling Schedule	
	Sediment Feed	**Background**
0.0	1	1
3.2		2
4.5	2	
6.4		3
8.9	3	
9.6		4
12.8		5
13.4	4	
16.0		6
17.9	5	
19.1		7
22.3	6	8
23.0	End of Testing	
MTD Detention Time = 0.7 minutes Sediment Sampling Time = 18 seconds		

Table 30 Water Flow and Temperature - 150% MTFR

Run Parameters	Water Flow Rate (gpm)				Maximum Water Temperature (°F)
	Target	**Actual**	**Difference**	**COV**	
	772.5	755.4	-2.2%	0.007	60.4
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

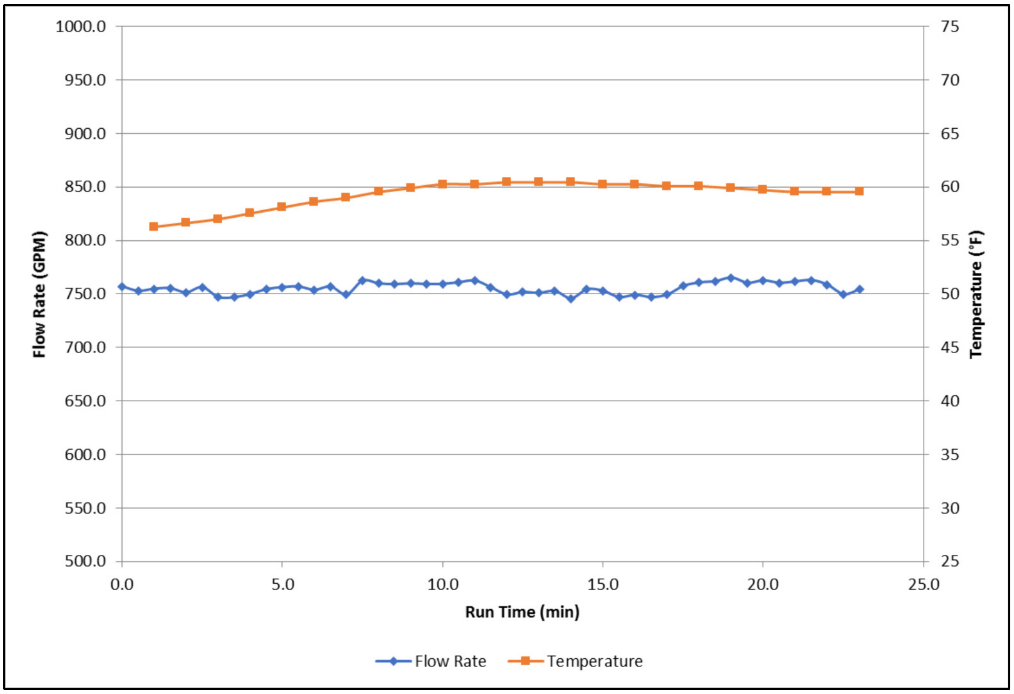


Figure 16 Water Flow and Temperature - 150% MTFR

Table 31 Sediment Feed Rate Summary – 150% MTFR

Sediment Feed Rate (g/min)		**Sediment Mass Balance**	
1	572.90	Starting Weight of Sediment (lbs.)	72.17
2	594.64		
3	569.95	Recovered Weight of Sediment (lbs.)	44.28
4	581.73		
5	581.14	Mass of Sediment Used (lbs.)	27.89
6	574.95	Volume of Water Through MTD During Dosing (gal)	15,739
Average	579.22		
COV	0.015	Average Influent Sediment Concentration (mg/L)	194.8*
QA/QC Limit	0.10 PASS	QA/QC Limit	180 – 220 mg/L PASS

*Corrected for sediment feed rate samples

Table 32 Background SSC - 150% MTFR

	Suspended Sediment Concentration (mg/L)								
Sample #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**QA/QC Limit**
Background	ND	ND	ND	ND	1.0	1.9	3.3	4.1	≤ 20 mg/L PASS

ND = below method detection limit of 1.0 mg/L

All the recovered sediment was dried in glass trays using a convection oven. The sediment was dried until a constant weight was achieved. The recovered sediment mass and removal efficiency for each run are summarized below:

Table 33 Sediment Removal Efficiency Based on Captured Sediment

% MTFR	10	25	50	75	100	125	150
Total Mass Added (lb)	26.58	28.39	26.06	27.08	25.80	26.26	25.59
Total Mass Retained in Inlet Pipe + MTD (lb)	18.24	18.89	16.19	14.91	10.77	8.63	6.31
Sediment Retained in Inlet Pipe (lb)	0.14	1.05	0.00	0.00	0.00	0.00	0.00
Sediment Captured in MTD (lb)	18.10	17.85	16.19	14.91	10.77	8.63	6.31
Removal Efficiency* (%)	68.1	62.9	62.1	55.1	41.7	32.9	24.6
% of Retained Sediment in Inlet Pipe	0.8	5.5	0.0	0.0	0.0	0.0	0.0

* Sediment retained in the inlet pipe is excluded from the removal efficiency calculation.

Analysis of the initial 7 runs showed that the fitted MTFR for the tested StormSettler could be as high as 1.41 cfs (633 gpm). Claiming a higher MTFR would mean that 125% MTFR is 1.76 cfs (791 gpm). This exceeds any of the previous seven runs so an 8th run was completed at 1.76 cfs and removal was recalculated with this 8th point. To be consistent with the first seven runs the 8th run is labeled as 154% of the ***target*** MTFR.

The rationale for this is that none of the 5 points used in the Annual Removal calculation can be extrapolated. Using a new MTFR also required a new, higher flow scour test, so that was done in addition to the 8th performance run. Details of the scour test are in section 4.2.

154% MTFR

Table 34 Sampling Schedule - 154% MTFR

Runtime (min)	Sampling Schedule	
	Sediment Feed	Background
0.0	1	1
3.0		2
4.3	2	
6.1		3
8.5	3	
9.1		4
12.1		5
12.8	4	
15.2		6
17.0	5	
18.2		7
21.3	6	8
22.0	End of Testing	
MTD Detention Time = 0.6 minutes Sediment Sampling Time = 15 seconds		

Table 35 Water Flow and Temperature - 154% MTFR

Run Parameters	Water Flow Rate (gpm)				Maximum Water Temperature (°F)
	Target	Actual	Difference	COV	
	791.0	791.9	0.1%	0.006	70.7
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

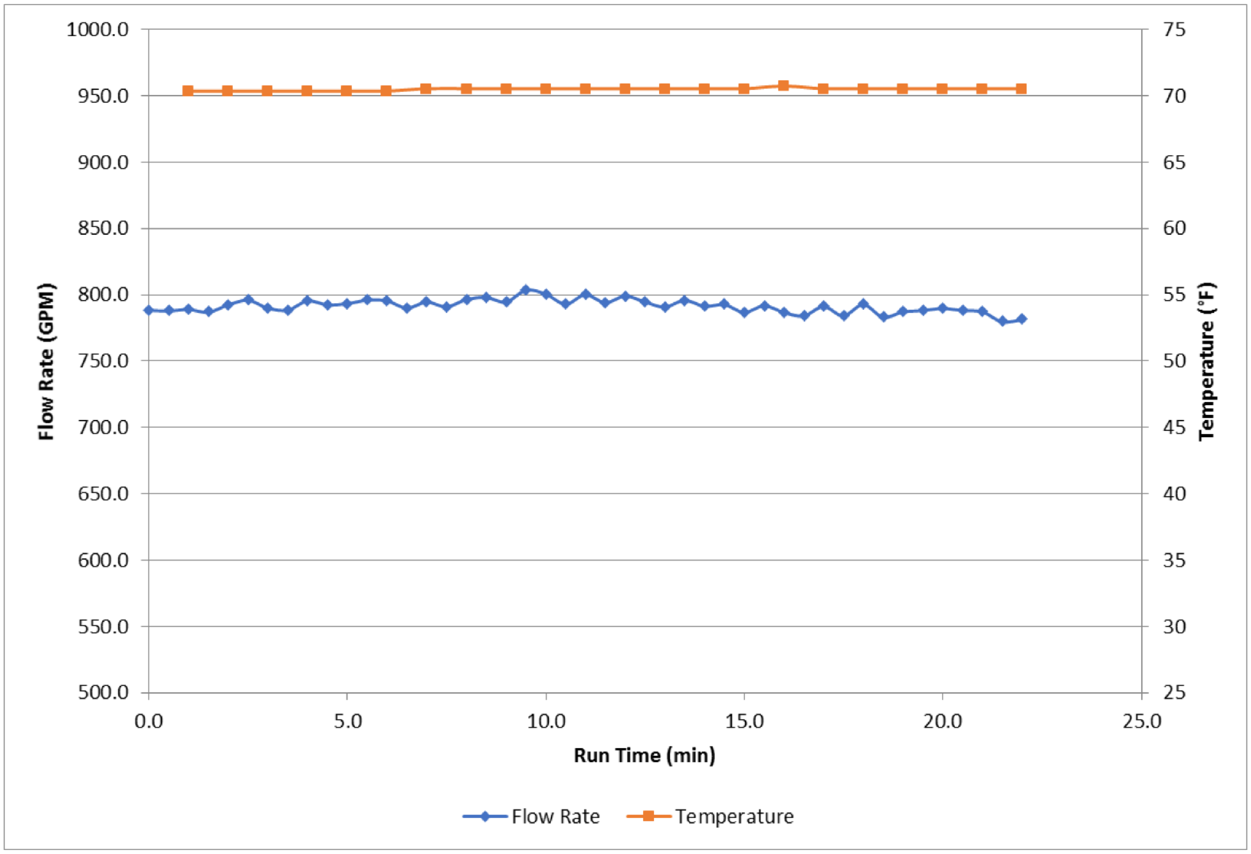


Figure 17 Water Flow and Temperature - 154% MTFR

Table 36 Sediment Feed Rate Summary – 154% MTFR

Sediment Feed Rate (g/min)		**Sediment Mass Balance**	
1	589.49	Starting Weight of Sediment (lbs.)	72.50
2	640.01		
3	605.45	Recovered Weight of Sediment (lbs.)	43.40
4	627.30		
5	611.14	Mass of Sediment Used (lbs.)	29.10
6	615.65	Volume of Water Through MTD During Dosing (gal)	15827
Average	614.84		
COV	0.028	Average Influent Sediment Concentration (mg/L)	204.8*
QA/QC Limit	0.10 PASS	QA/QC Limit	180 – 220 mg/L PASS

*Corrected for sediment feed rate samples

Table 37 Background SSC - 154% MTFR

	Suspended Sediment Concentration (mg/L)								
Sample #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**QA/QC Limit**
Background	ND	1.1	1.0	1.2	ND	1.4	3.1	3.7	≤ 20 mg/L PASS

ND = below method detection limit of 1.0 mg/L

Table 38 Sediment Removal Efficiency at 154% MTFR (791 gpm)

% MTFR	154
Total Mass Added (lb)	27.05
Total Mass Retained in Inlet Pipe + MTD (lb)	6.71
Sediment Retained in Inlet Pipe (lb)	0.00
Sediment Captured in MTD (lb)	6.71
Removal Efficiency (%)	24.8

Annualized Weighted Removal Efficiency

A plot was made of the removal efficiency vs. flow rate data (**Figure 18**) for all eight runs and a curve of best fit was obtained using a 3rd order polynomial ($r^2 = 0.990$). The curve was used to determine the StormSettler MTFR and the annualized weighted removal efficiency for sediment in stormwater has been calculated using the rainfall weighting factors provided in the NJDEP laboratory test protocol. For a MTFR of 1.41 cfs (633 gpm), the annual weighted removal is 50.4%, as shown in **Table 39**.

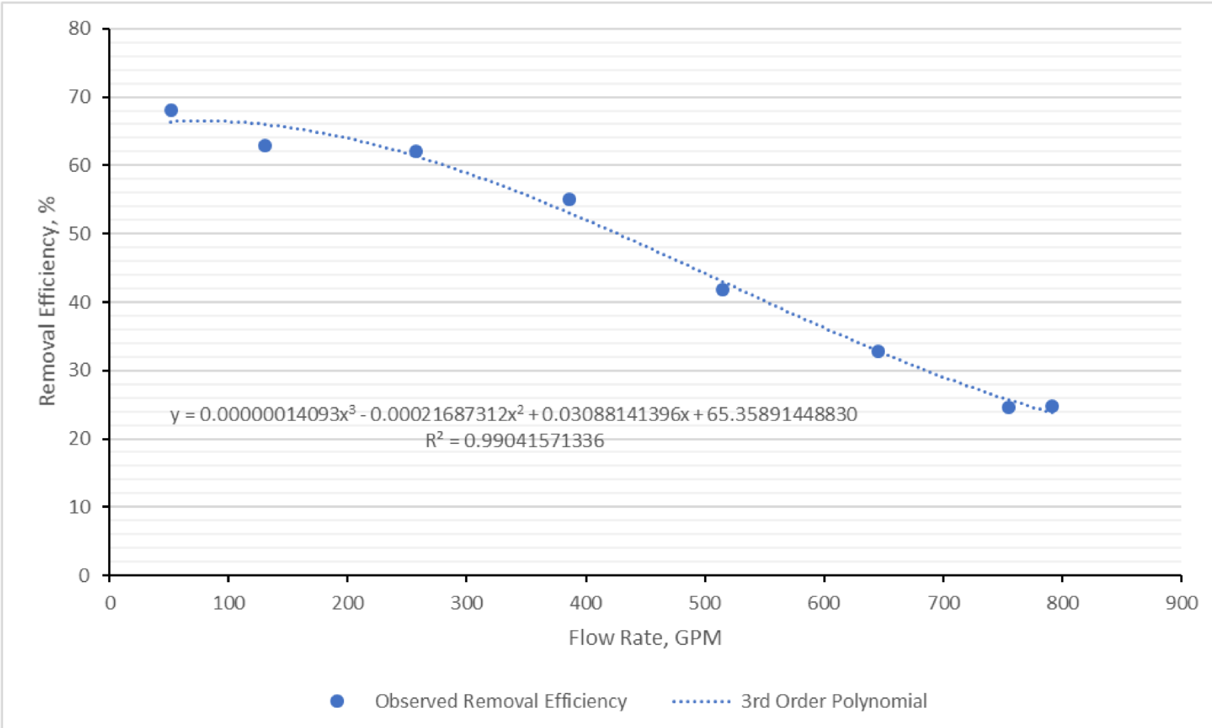


Figure 18 StormSettler® Removal Efficiency Curve

Table 39: Annualized Weighted Removal Efficiency for StormSettler®

%MTFR	Flow Rate (gpm)	Removal Efficiency (%)	Annual Weighting Factor	Weighted Removal Efficiency (%)
25	158	65.4	0.25	16.3
50	316	57.9	0.30	17.4
75	475	46.2	0.20	9.2
100	633	33.8	0.15	5.1
125	791	23.8	0.10	2.4
Annualized Weighted Removal Efficiency				**50.4%**

4.2 Scour Testing

Scour testing was conducted in accordance with Section 5 of the NJDEP Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation MTD. Testing was initially conducted at a target flow rate of 2.3 cfs (1030 gpm), 200% of the target MTFR. Due to the change in MTFR based on the sediment removal performance results, it was repeated at 2.80 cfs (1257 gpm), which was slightly below 200% of the desired MTFR due to a miscalculation. A last test was conducted at 2.83 cfs (1270 gpm) slightly more than 200% of the maximum treatment flow rate (MTFR). All three scour tests passed the scour criteria for online installation but only the last scour test results at 2.83 cfs are reported.

In preparation for the scour test, the false floor inside the unit sump was lowered to 4 inches below the 50% maximum sediment storage volume. The sump was then loaded with scour test sediment. When levelled, the sediment formed a layer 4 inches thick, so the top of the sediment was 7 inches above the sump floor. After sediment loading, the sump was filled with water. The water was added in such a way as to avoid disturbing the sediment bed. The StormSettler was allowed to sit for 95 hours before commencing the scour test.

Scour testing began by gradually increasing the flow rate to the target flow within a 3-minute period. The sampling frequency for background and effluent samples is summarized in **Table 40**. Run time 0 min. is when the pump was started.

Table 40 Scour Test Sampling Frequency

Sample/ Measurement Taken	Run Time (min.)														
	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29
Effluent	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Background	X		X		X		X		X		X		X		X

Table 41 Water Flow and Temperature - Scour Test

Run Parameters	Water Flow Rate (gpm)				Maximum Water Temperature (°F)
	Target	Actual	Difference	COV	
	1270	1270	-0.001%	0.004	64.6
QA/QC Limit	-	-	±10% PASS	0.03 PASS	80 PASS

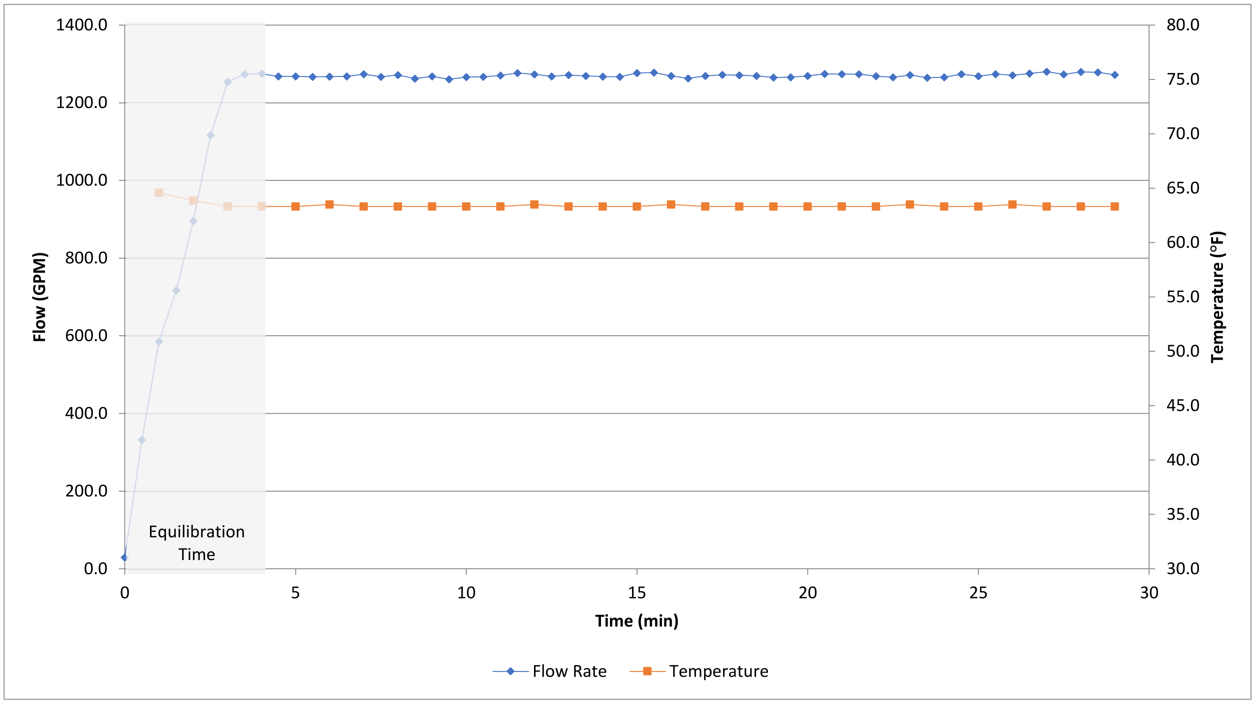


Figure 19 Water Flow and Temperature - Scour Test

The effluent and background SSC results are reported in **Table 42**. For instances where the reported SSC concentration was below 1.0 mg/L, the method detection limit, a value of 0.5 mg/L was used for calculation purposes. The adjusted effluent concentration was calculated as:

$$Adjusted\ Effluent\ Concentration\ \left(\frac{mg}{L}\right) = Initial\ Concentration - Background\ Concentration$$

For effluent samples that did not have a corresponding background sample, the background value was interpolated from the previous and subsequent samples. The average adjusted effluent concentration was 6.8 mg/L at >200% of the MTFR, therefore, the StormSettler meets the criteria for online use.

Table 42 Suspended Sediment Concentrations for Scour Test

	Scour Suspended Sediment Concentration (mg/L)														
Sample #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Effluent	0.5	1.3	6.8	8.9	10.2	11.6	8.4	11	11	6.5	8.2	7.9	8.7	6.8	3.7
Background	1.1		0.5		0.5		0.5		1.1		0.5		0.5		0.5
Adjusted Effluent	0	0.5	6.3	8.4	9.7	11.1	7.9	10.2	9.9	5.7	7.7	7.4	8.2	6.3	3.2
Average Adjusted Effluent Concentration							6.8 mg/L								

4.3 Hydraulic Testing

Prior to performance testing, the head loss across the StormSettler was determined by measuring and comparing the difference between the water level at the influent side of the MTD and the effluent side, defined as the difference in water elevation, or Δh. Measurements were made on a clean unit, without sediment, using a manometer equipped with a meter stick graduated in 1 mm increments.

For the head loss measurements, the false floor was set in the sump at 7”, which is 50% of the maximum rated sediment storage depth. Measured flows spanned the range of 10% - 200% MTFR. The head loss data are presented in **Table 43.**

Bypass occurred at ~450 gpm, as indicated by the plateau in the headloss curve at that point. Using the results in **Table 43** the headloss coefficient, k, was calculated to be 1.25.

Table 43 StormSettler Head Loss

Flow Rate		Water Elevation (cm)		Δh	
cfs	**gpm**	**Influent**	**Effluent**	**cm**	**inches**
0.03	12.3	2.7	1.4	1.3	0.5
0.06	24.7	3.7	2.0	1.7	0.7
0.11	51.5	6.0	3.1	2.9	1.1
0.14	61.7	6.9	3.5	3.4	1.3
0.27	121	10.4	5.0	5.4	2.1
0.29	129	10.9	5.3	5.6	2.2
0.41	184	13.9	6.9	7.0	2.8
0.55	249	17.6	8.7	8.9	3.5

0.57	258	18.0	9.0	9.0	3.5
0.68	307	20.4	9.8	10.6	4.2
0.86	384	23.9	10.8	13.1	5.2
0.96	431	25.6	11.3	14.3	5.6
1.03	462	27.0	12.9	14.1	5.6
1.15	515	27.7	13.2	14.5	5.7
1.37	617	28.9	13.6	15.3	6.0
1.43	643	29.3	13.9	15.4	6.1
1.72	774	31.5	14.5	17.0	6.7
1.79	803	32.0	14.7	17.3	6.8
2.30	1033	36.2	16.5	19.7	7.8
2.67	1200	40.0	16.7	23.3	9.2
2.85	1278	42.1	16.8	25.3	10.0

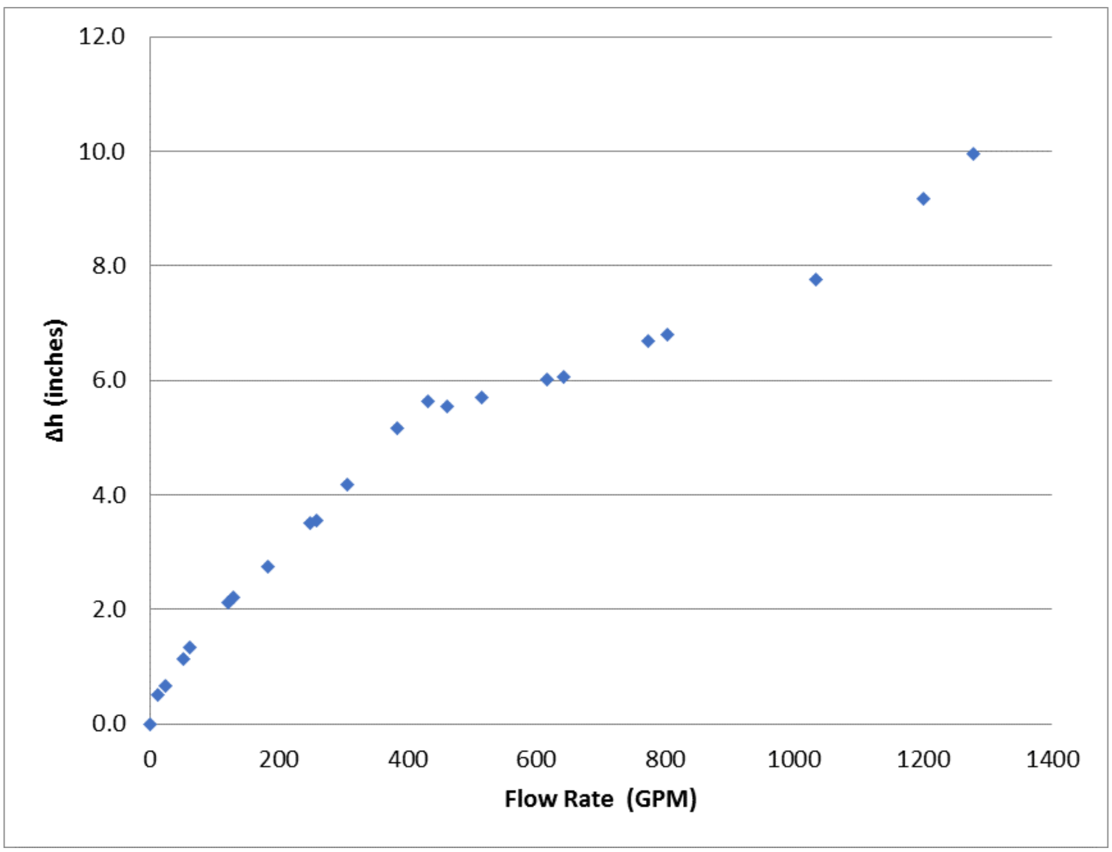


Figure 20 StormSettler Head Loss

4.4 Excluded Results

The NJDEP Verification Procedure requires disclosure and a discussion of any data excluded from analysis. Shortly after the start of testing at 125 % MTFR on February 7, 2022, it was discovered that there was a communication error between the flow meter data logger and the data acquisition laptop. This meant that none of the flow rate data was recorded so the run was halted with no results. The test unit was emptied and cleaned thoroughly and testing at 125% MTFR was restarted and completed successfully.

Data for a scour test at 1030 gpm was omitted since it was replaced by a higher flow scour test. Data for a scour test at 1257 gpm was also omitted since it too was replaced by a higher flow test. The unit passed both these earlier conducted scour tests.

5. Design Limitations

The StormTrap StormSettler is an engineered system designed to meet site-specific requirements. Design parameters and limitations are listed below.

Soil Characteristics

StormSettler is an enclosed, flow-through system that can be installed and function as intended in all soil types. StormSettler units are installed in accordance with ASTM C-891 "Standard Practice for Installation of Underground Precast Concrete Utility Structures".

Slope of Drainage Pipe

The system was verified with an inlet pipe slope of 1%, in accordance with the protocol, but there are no specific drainage pipe slope limitations provided that both the inlet and outlet pipe elevations are identical.

Maximum Treatment Flow Rate

The maximum treatment flow rate (MTFR) for StormTrap StormSettler models is based upon the diameter of the system as shown in **Table A-1**. Systems are sized to a hydraulic loading rate of 50.4 gpm/ft^2 of effective treatment area.

Maintenance Requirements

StormSettler systems should be inspected and maintained following the recommendations and guidelines included in the StormSettler Manufacturer's Instruction Manual available at:

https://stormtrap.com/products/stormsettler/stormsettler-maintenance-manual/

Section 6 of this report includes a detailed description of inspection and maintenance requirements.

Driving Head

StormSettler driving head requirements can be found in **Table 43** and **Figure 20**. The system headloss coefficient, k=1.25.

Installation Limitations

StormTrap provides contractors with detailed installation and assembly instructions as well as specific pick weights prior to delivery.

Configurations

StormSettler has an internal bypass and can be installed online or offline. The NJCAT/NJDEP verified/certified configuration is a single inlet and outlet at 180 degrees, but other configurations are possible.

Structural Load Limitations

StormSettler modules are typically designed for HS-20 loading. Contact StormTrap if alternate design loadings are anticipated or required for site specific conditions.

Pre-treatment Requirements

The StormSettler has no pre-treatment requirements.

Depth to Seasonal High-Water Table

StormSettler performance is independent of high groundwater conditions. Contact StormTrap if groundwater is above the system invert for site specific structural/floatation calculations.

6. Maintenance Plans

The StormSettler treatment device by StormTrap is designed to capture and store pollutants from stormwater. The unit must be inspected and maintained routinely to ensure peak removal efficiency. StormSettler maintenance frequency is site dependent and routine inspections, particularly during the first year after installation, are needed to determine the needed maintenance frequency of the unit.

Inspection

Inspections of the StormSettler are important to ensure peak performance and assess the condition of the system internals. Inspection is simple and can be performed in a short amount of time. Inspections should be performed during dry weather conditions, after the unit has had time to dewater to the usual water level.

Inspection Equipment

- StormSettler Maintenance Manual and Inspection Checklist
- Flashlight
- Manhole cover removal tools
- Proper protective equipment
- Proper traffic control signage
- Sediment probe

Inspection should begin by removing the manhole cover(s) on the unit and visually inspecting the integrity of the internal components. On larger units where two manhole covers are present, both are recommended to be removed to inspect both the inlet and outlet side of the device as effectively as possible. Visually ensure that the baffle is intact and seated properly, that the vortex disruptor is in place and undamaged, that the tube pack is free from obstructions, and the outlet diverter is seated properly and in good condition.

Sediment depth should then be determined. NJDEP requires sediment removal when sediment has reached 50% of the unit's storage depth. The 50% sediment storage depth for StormSettler NJDEP models is 7-in. Sediment depth can be determined either by using a sediment probe or by taking a measurement to the top of the sediment in relation to a fixed object in the system.

Maintenance

StormTrap recommends that a Vactor truck or similar type of vacuum equipment be used to remove sediment from the StormSettler unit. Access to the bottom of the unit is on the inlet side of the baffle.

If a pressure washer is used to assist with dislodging any debris within the system, special care must be taken when spraying the enhanced settling pack. Use a wide spray nozzle on or around the pack to avoid altering the tubes within the enhanced settling pack.

Maintenance Procedure

1. Remove manhole cover(s) to expose the inlet side of the StormSettler.
2. A Vactor truck or similar type of equipment should be used to remove all water and sediment from the system. The rodding hose of the Vactor truck should be used to remove any sediment that is stuck. Maintenance crews should be careful not to damage the internal components.
3. Refill the StormSettler unit to the normal water level.
4. Replace the manhole cover(s).
5. Dispose of any waste according to local regulations.

Dispose of all waste during maintenance per local, state, and federal guidelines and regulations.

If, during maintenance or inspection, any parts of the StormSettler are determined to be damaged, contact StormTrap to order replacements.

7. Statements

The following attached pages are signed statements from the manufacturer (StormTrap LLC), the independent test lab (Good Harbour Labs), and NJCAT. These statements are a requirement of the verification process.

In addition, it should be noted that this report has been subjected to public review (e.g., stormwater industry) and all comments and concerns have been satisfactorily addressed.

StormTrap

December 14, 2022

To: Dr. Richard Magee, Sc.D., P.E. BCEE
Executive Director
New Jersey Corporation for Advanced Technology
c/o Center for Environmental Systems
Stevens Institute of Technology
One Castle Point on Hudson
Hoboken, NJ 07030

Subject: StormSettler Laboratory Verification Report – Manufacturer's Statement of Compliance

Dr. Magee,

StormTrap has completed verification testing for the StormSettler Hydrodynamic Separator in accordance with the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device", dated January 1, 2021.

As required by the "NJDEP Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology (NJCAT)", dated August 4, 2021, this letter serves as StormTrap's statement that all procedures and requirements identified in the aforementioned protocol and process document were met or exceeded.

If you have any questions or comments regarding this verification, please do not hesitate to contact me.

Sincerely,

Greg Williams

Greg Williams, PhD., P. Eng.
Director of Water Quality Technology

PHONE 815 941 4663 | WEB www.stormtrap.com | 1287 Windham Parkway
FAX 331 318 5347 | EMAIL info@stormtrap.com | Romeoville, Illinois 60446

December 13, 2022

Dr. Richard Magee, ScD., P.E., BCEE
Executive Director
New Jersey Corporation for Advanced Technology (NJCAT)

Re: Performance Verification of the StormTrap StormSettler® System

Dear Dr. Magee,

Good Harbour Laboratories was contracted by StormTrap LLC to conduct performance testing of their StormSettler® hydrodynamic separator in accordance with the New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device (January 1, 2021).

Good Harbour Laboratories is an independent hydraulic test facility located in Mississauga, Ontario Canada. I certify that we evaluated the StormSettler from January - October 2022, according to the aforementioned test protocol. The results presented in the NJCAT Verification Report dated December 2022 are accurate and all procedures and requirements stated in the test protocol were met or exceeded. I confirm that all test data that was collected is included or referenced in the report.

GHL provides testing and verification services for numerous water treatment technologies including stormwater treatment devices. GHL has had several different stormwater equipment manufacturers as clients and we have accumulated considerable experience in testing these devices. In order to be able to make this experience available to as many potential clients as possible, GHL is careful to maintain its position as an independent service provider.

With the above in mind I, the undersigned, on behalf of GHL, confirm:

- that I do not have any conflict of interest in connection to the contracted testing;

- that I will inform NJCAT, without delay, of any situation constituting a conflict of interest or potentially giving rise to a conflict of interest;

Good Harbour Laboratories
T: 905.696.7276 | F: 905.696.7279
A: 2596 Dunwin Drive, Mississauga, ON L5L 1J5
www.goodharbourlabs.com

- that I have not granted, sought, attempted to obtain or accepted and will not grant, seek, attempt to obtain, or accept any advantage, financial or in kind, to or from any party whatsoever, constituting an illegal or corrupt practice, either directly or indirectly, as an incentive or reward relating to the outcome of the testing.

Sincerely,

Date

December 13, 2022

Roland DuBois, P.Eng.
Managing Director
Good Harbour Laboratories

CC: Dan Fajman, StormTrap LLC
Greg Williams, StormTrap LLC

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Center for Environmental Systems
Stevens Institute of Technology
One Castle Point
Hoboken, NJ 07030-0000

December 15, 2022

Gabriel Mahon, Chief
NJDEP
Bureau of Non-Point Pollution Control
Bureau of Water Quality
401 E. State Street
Mail Code 401-02B, PO Box 420
Trenton, NJ 08625-0420

Dear Mr. Mahon,

Based on my review, evaluation and assessment of the testing conducted on a full-scale, commercially available StormTrap StormSettler® Hydrodynamic Separator (StormSettler-4) by Good Harbour Laboratories (GHL), an independent water technology testing lab, at their site in Mississauga, Ontario, Canada, the test protocol requirements contained in the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" (NJDEP HDS Protocol, January 1, 2021) were met or exceeded consistent with the NJDEP Approval Process. Specifically:

Removal Efficiency Test Sediment

The test sediment used for the removal efficiency study (1-1000 µm) was a custom blend of commercially available silica sediments blended by GHL. This particular batch was GHL lot # A031-119. The blend ratio was determined such that the particle size distribution of the resulting blended sediment would meet the specification for the test protocol. The sediment was sampled in multiple locations throughout the blending process; three composite samples were created for PSD analysis. The final blended sediment was stored in 12 sealed buckets until needed.

Each of the three composite samples was reduced in size using a riffle splitter. The three samples were analyzed for PSD by a qualified 3rd party analytical laboratory (Bureau Veritas in Mississauga) in a manner consistent with ASTM D6913-17, "Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis" and ASTM D7928-17 "Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis". The sediment exceeded the protocol specifications (d_{50} 65 microns). The moisture content of the test sediment was also determined in accordance with ASTM Method D2216-19, “Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.” Moisture content was < 0.30%.

Scour Test Sediment

The test sediment used for the scour study was also a custom blend of commercially available silica sediments; this particular batch was GHL lot # A034-081. The blend ratio was determined such that the particle size distribution of the resulting blended sediment would meet the specification for the test protocol. The blended scour test sediment was stored in 9 five-gallon buckets. Three separate composite samples were created by sampling all of the five-gallon buckets used to load the StormSettler for the scour test. Each bucket was sampled in three locations: top third, middle third and bottom third. The composite samples were well blended and reduced in size using a sediment riffle splitter.

The three samples were analyzed for PSD by a qualified 3rd party analytical laboratory (GeoTesting Express in Massachusetts) in accordance with ASTM D6913-17, “Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis” and ASTM D7928-17 “Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis”. The moisture content of the test sediment was also determined in accordance with ASTM Method D2216-19, “Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.” The scour test sediment was finer than the sediment required by the test protocol and therefore was acceptable for use.

Removal Efficiency Testing

Removal efficiency testing followed the mass capture test method outlined in Section 4.C of the NJDEP HDS Protocol. The sediment removal efficiency of the StormSettler-4 at an MTFR of 1.41 cfs was 50.4%.

Scour Testing

Scour testing of the StormSettler-4 was conducted in accordance with Section 5 of the NJDEP HDS Protocol at a target flow rate slightly greater than 200% of the MTFR to qualify the MTD for online conveyance installation. The average adjusted effluent concentration was 6.8 mg/L at 200% of the MTFR, therefore, the StormSettler meets the criteria for online use.

Sincerely,

Richard S Magee

Richard S. Magee, Sc.D., P.E., BCEE

8. References

1. Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology. August 4, 2021, 2013.
2. New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device. January 1, 2021.

VERIFICATION APPENDIX

Introduction

- Manufacturer – StormTrap LLC, 1287 Windham Parkway, Romeoville, IL 60446
  Website: www.stormtrap.com General Phone: (815) 941-4663

- MTD: StormTrap StormSettler Hydrodynamic Separator. Verified StormSettler models are shown in **Table A-1**.

- TSS Removal Rate: 50%

- Offline or Online Installation

Detailed Specification

- NJDEP sizing and dimensional table is attached as **Table A-1**.

- New Jersey requires that the peak flow rate of the New Jersey Water Quality Design Storm (NJWQDS), 1.25 inches of rainfall in a 2-hour duration, shall be used to determine the appropriate size for the MTD. The StormSettler-4 has a maximum treated flow (MTFR) of 1.41 cfs (633 gpm), which corresponds to a hydraulic loading rate of 50.2 gpm/ft^2 of effective treatment area.

- Pick weights and installation procedures vary with model size. StormTrap provides contractors with project-specific unit pick weights and installation instructions prior to delivery.

- Maximum sediment depth for all units is 14 inches. StormTrap recommends that the units be cleaned when sediment depth reaches 7 inches, representing 50% sediment storage capacity.

- An Inspection and Maintenance Manual is provided for each project installation and available at:
  https://stormtrap.com/products/stormsettler/stormsettler-maintenance-manual/

- According to N.J.A.C. 7:8-5.5, NJDEP stormwater design requirements do not allow a hydrodynamic separator such as the StormTrap StormSettler to be used in series with another hydrodynamic separator to achieve an enhanced TSS removal rate.

Table A-1 StormSettler MTFRs, Sediment Removal Intervals, and Standard Dimensions

Model	Manhole Diameter (ft)	NJDEP 50% TSS Maximum Treatment Flow Rate (MTFR) (cfs)	Effective Treatment Area (ft^2)	Hydraulic Loading Rate[1] (gpm/ft^2)	Effective Sedimentation Area (ft^2)	50% Maximum Sediment Storage (ft^3)	Sediment Removal Interval[2] (years/months)	Chamber Depth[3] (ft)	Effective Treatment Depth[4] (ft)	Aspect Ratio Treatment Depth:Diameter[5]
StormSettler-3	3	0.79	7.1	50.2	7.1	4.1	3.1 / 37	5	4.42	1.47
StormSettler-4	4	1.41	12.6	50.2	12.6	7.3	3.1 / 37	6	5.42	1.35
StormSettler-5	5	2.19	19.6	50.2	19.6	11.5	3.1 / 37	6	5.42	1.08
StormSettler-6	6	3.17	28.3	50.2	28.3	16.5	3.1 / 37	6	5.42	0.90
StormSettler-7	7	4.30	38.5	50.2	38.5	22.4	3.1 / 37	9	8.42	1.20
StormSettler-8	8	5.63	50.3	50.2	50.3	29.3	3.1 / 37	10	9.42	1.18
StormSettler-10	10	8.78	78.5	50.2	78.5	45.8	3.1 / 37	12.5	11.92	1.19
StormSettler-12	12	12.7	113.1	50.2	113.1	66.0	3.1 / 37	14.5	13.92	1.16

[1] Hydraulic loading rate is defined as the ratio of MTFR to effective treatment area.

[2] Sediment removal interval is calculated using the equation presented in Appendix A, Section B of the NJDEP Protocol.

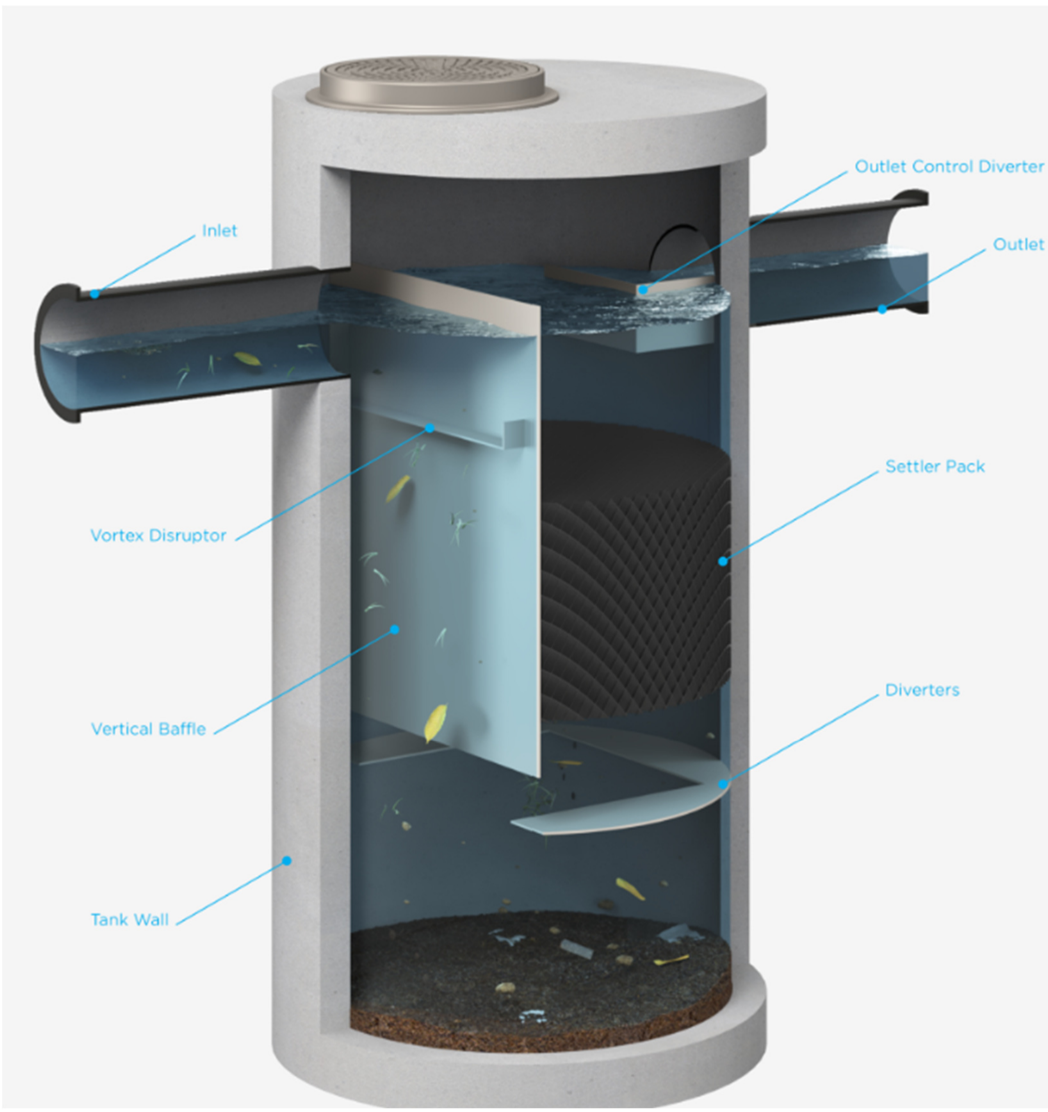
[3] Chamber depth is defined as depth from effluent invert to sump floor.

[4] Effective treatment depth is defined as depth from effluent invert to 50% of the sediment storage depth.

[5] Aspect ratio is defined as the ratio of effective treatment depth to manhole diameter. The aspect ratio for the tested unit is 1.35. Larger models (>250% MTFR of the unit tested, >3.5 cfs) must be geometrically proportional to the tested unit within the allowable ±15% tolerance.

StormSettler®

StormSettler® Inspection and Maintenance Manual



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Romeoville, Illinois 60446

StormSettler® Manufacturer's Inspection and Maintenance Manual

The StormSettler treatment device, manufactured by StormTrap, is a hydrodynamic separating device designed to capture and store pollutants from stormwater. StormSettler's maintenance frequency is site dependent and routine inspections are recommended to ensure that the system is functioning as designed. Please contact your authorized StormTrap representative if you have questions regarding the inspection and maintenance of the StormSettler system.

Inspection Scheduling

StormSettler inspections are important to assess the condition of the system internals to ensure peak performance. The frequency of inspections and maintenance is dependent on site specific loading conditions and rainfall frequency. Within the first year of operation, it is recommended that the unit be inspected quarterly to determine the rate of pollutant accumulation in order to develop a more accurate maintenance schedule. Inspections should be performed during dry weather conditions when no flow is entering the system. StormSettler systems are recommended to be inspected whenever the upstream and downstream catch basins and stormwater pipes of the stormwater collection system are inspected or maintained. If checked on an annual basis, the inspection should be conducted before the stormwater season begins to ensure that the system is functioning properly for the upcoming storm season.

Inspection and Maintenance Equipment

The following equipment is recommended to have during inspections:

- StormSettler Inspection and Maintenance Manual and Inspection Checklist
- Flashlight

- Manhole hook/lifter or pry bar to lift the manhole cover
- Measuring device(s) of sufficient length to reach the bottom of the device's sump
- Proper personal protective equipment
- Adequate traffic control signage
- Pole with skimmer or net (optional for maintenance procedure)
- Vacuum truck or similar trailer mounted equipment (for maintenance procedure)

Inspection Procedure

Inspections should be done such that a sufficient time has lapsed since the most recent rain event to allow for a static water condition and rainfall is not anticipated to occur during the duration of the inspection procedure. StormSettler does not require entry into the system for inspection or maintenance; however, if entering the system is deemed necessary, it is prudent to note that prior to entry into any underground storm sewer or underground structure, appropriate OSHA and local safety regulations and guidelines should be followed.

To begin the inspection process, set up the necessary traffic control signage per local ordinances. Open all manhole covers using appropriate equipment and ensure the manhole covers are in a location that would not prohibit the inspection process. Visually inspect the system at all manhole access opening locations. During the visual inspection, ensure that all components are in working order. An inspection checklist is provided within this guide for ease and reference.

If any components are not in working order, contact your authorized StormTrap representative.

After the components are inspected, visually quantify the accumulation of trash, debris, and hydrocarbons within the system by using a measuring device such as a tape measure, grade stick, dipstick, etc. Measure and record the depth of trash, debris, and hydrocarbon accumulation from the static water elevation (pipe elevation) to the average elevation of the trash and debris.

If sorbent materials are used for retention of hydrocarbons, the level of discoloration of the sorbent material should also be noted during the inspection process.

For sediment accumulation, utilize either a sludge sampler or a sediment pole to measure and document the amount of sediment accumulation. To determine the amount of sediment in the system with a sludge sampler, follow the manufacturer's instructions. If utilizing a sediment pole or similar device, first insert the pole to the top of the sediment layer and record the depth. Then, insert the pole to the bottom of the system and record the depth. The difference in the two measurements corresponds to the amount of sediment in the system. Alternatively, sediment depth can also be determined by taking a measurement from a known and consistent elevation (manhole frame, pipe invert, vertical baffle top, etc.) to the top of the sediment layer. That distance can then be compared to the measurement between the known elevation to the sump floor. The difference between these two measurements will correspond to the sediment layer depth.

After completion of the inspection process, ensure that manhole covers are replaced and securely seated in the manhole frame and remove traffic control signage.

StormSettler units can also be installed with remote monitoring technology that measures the current capacities within the system and reports the data to any internet capable device. If a remote monitoring device is used, proper maintenance of the device, such as replacement of batteries, cleaning sensor, etc. needs to be completed to ensure functionality of the remote monitoring technology.

If it is determined during the inspection process that the accumulation of trash and debris or sediment is at or near the capacities of the StormSettler device, maintenance should be performed to ensure performance is not impacted for subsequent storm events.

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FAX 331 318 5347 EMAIL info@stormtrap.com Romeoville, Illinois 60446

Maintenance Procedure

Maintenance should be done such that a sufficient time has lapsed since the most recent rain event to allow for a static water condition and rainfall is not anticipated to occur during the duration of the maintenance procedure.

To begin the maintenance process, set up the necessary traffic control signage per local ordinances. Open all manhole covers using appropriate equipment and ensure the manhole covers are in a location that would not prohibit the maintenance process.

Visually inspect the system at all manhole access opening locations. During the visual inspection, ensure that all components are undamaged. If any components are not in working order, contact your authorized StormTrap representative.

After the components are inspected, remove all accumulated trash, debris, and hydrocarbons stored on the surface of the water using the vacuum hose or pole with attached skimmer or net.

If sorbent materials are used, the materials may have to be moved to not impact pollutant removal. If significant discoloration of the sorbent material has occurred, simply remove the sorbent materials and replace upon completion of maintenance activities.

To remove sediment, insert the vacuum truck's hose on the inlet side of the vertical baffle into the sump. The system should be completely drained, and all sediment should be removed from the sump. For smaller diameter devices (3' or 4' units), a 6" or smaller vacuum hose diameter may be required for effective cleaning due to maneuverability constraints. If the vacuum truck that is being utilized has a hose diameter greater than 6", a smaller tube can be affixed to the boom hose with duct tape to improve maneuverability within the device.

If excessive sediment or debris buildup occurs within the device, components can be washed with sewer jetting equipment or a spray lance to remove stubborn materials. Particular attention must be taken when spraying the settler pack. A wide spray nozzle is recommended around the settler pack to ensure there is no damage to the material.

After completion of the maintenance procedure, complete a post maintenance inspection to ensure that all components are in good condition. Ensure that manhole covers are replaced and securely seated in the manhole frame and remove traffic control signage. Dispose of all pollutants removed during maintenance per local, state, and federal guidelines and regulations.

Inspection and Maintenance Documentation

Proof of inspections and maintenance activities is the responsibility of the owner. All inspection and maintenance reports and any relevant data should be kept on site or at a location where they will be accessible in accordance with local requirements. It is a good practice to take time stamped photographs after every inspection and maintenance event to include within logs. It is also good practice to keep records of rainfall events between maintenance events and the weight of material removed, even if no report is required. Some municipalities may require inspection and maintenance reports be forwarded to the proper governmental permitting agency on an annual basis. Refer to your local regulations and ordinances for any additional maintenance requirements and schedules not contained herein. Inspections and maintenance activities should be performed to ensure performance is not impacted and the device performs as designed.

Inspection Items

- StormSettler Maintenance Manual and Inspection Checklist
- Flashlight
- Manhole hook/lifter or pry bar to lift the manhole cover
- Measuring device(s) of sufficient length to reach the bottom of the device's sump
- Proper personal protective equipment
- Adequate traffic control signage

Maintenance Items

- StormSettler Maintenance Manual and Inspection Checklist
- Flashlight
- Manhole hook/lifter or pry bar to lift the manhole cover
- Measuring device(s) of sufficient length to reach the bottom of the device's sump
- Proper personal protective equipment
- Adequate traffic control signage
- Pole with skimmer or net (optional for maintenance procedure)
- Vacuum truck or similar trailer mounted equipment (for maintenance procedure)

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StormSettler™	StormSettler Inspection Checklist			
Structure ID:				
Location/Address:				
Inspector Name:		Inspector Contact Information:		
Date:	Time:	Weather Conditions:		
Rain in the Last 48hrs:		If yes, list amount and timing:		

*Do not enter underground chambers to inspect system unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.
*Follow inspection and maintenance instructions provided by system manufacturer.
*Please circle the condition of each inspection item below. 1 being the worst and 5 being the best condition.

Inspection Item	Condition	Comment	Action Needed	
1.) Frames and Covers				
Accumulation of debris and/or sediment	1 2 3 4 5		Yes	No
Component(s) structural condition	1 2 3 4 5		Yes	No
2.) Inlet Pipe(s)				
Accumulation of debris and/or sediment	1 2 3 4 5		Yes	No
Component(s) structural condition	1 2 3 4 5		Yes	No
3.) Vortex Disruptor				
Accumulation of debris and/or sediment	1 2 3 4 5		Yes	No
Component(s) structural condition	1 2 3 4 5		Yes	No
4.) Verticle Baffle				
Accumulation of debris and/or sediment	1 2 3 4 5		Yes	No
Component(s) structural condition	1 2 3 4 5		Yes	No
5.) Enhanced Settling Pack				
Accumulation of debris and/or sediment	1 2 3 4 5		Yes	No
Component(s) structural condition	1 2 3 4 5		Yes	No
6.) Flow Modifiers				
Accumulation of debris and/or sediment	1 2 3 4 5		Yes	No
Component(s) structural condition	1 2 3 4 5		Yes	No

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7.) Outlet Control Diverter								
Excessive accumulation of debris and/or sediment present	1	2	3	4	5		Yes	No
Component(s) structurally sound	1	2	3	4	5		Yes	No
8.) Outlet Pipe								
Accumulation of debris and/or sediment	1	2	3	4	5		Yes	No
Component(s) structurally sound	1	2	3	4	5		Yes	No
9.) Concrete Chamber								
Component(s) structural condition	1	2	3	4	5		Yes	No
10.) Sediment Storage Capacity								
Sediment storage capacity	1	2	3	4	5		Yes	No

Additional Notes:

Wet Weather Inspection Needed:	Yes	No	
Maintenance Activities Needed:	Yes	No	

APPENDIX G

Pipe Sizing Calculations

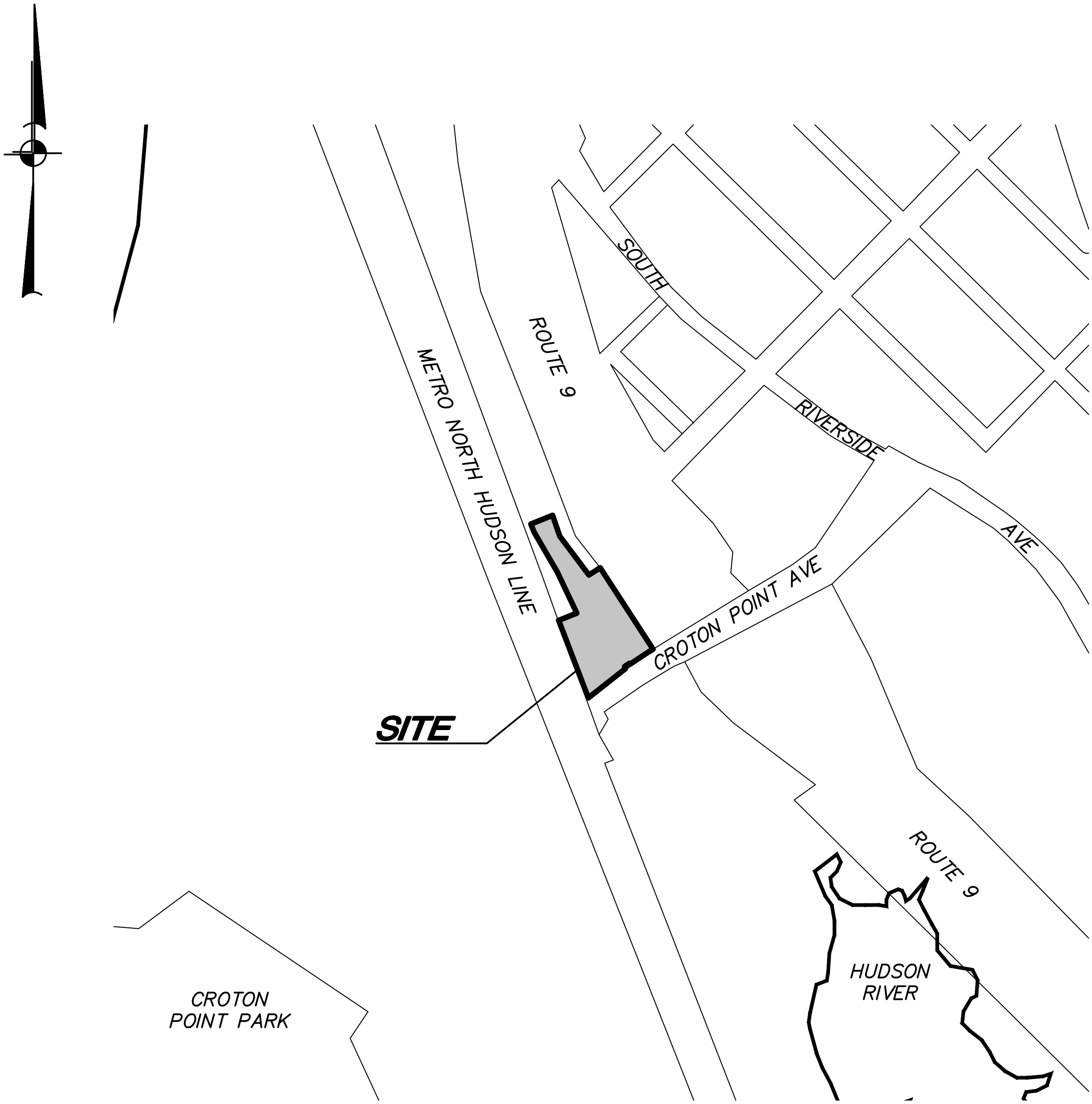
INSITE
ENGINEERING, SURVEYING & LANDSCAPE ARCHITECTURE, P.C.

DRAINAGE SYSTEM CALCULATIONS
Design Storm: 25-Year

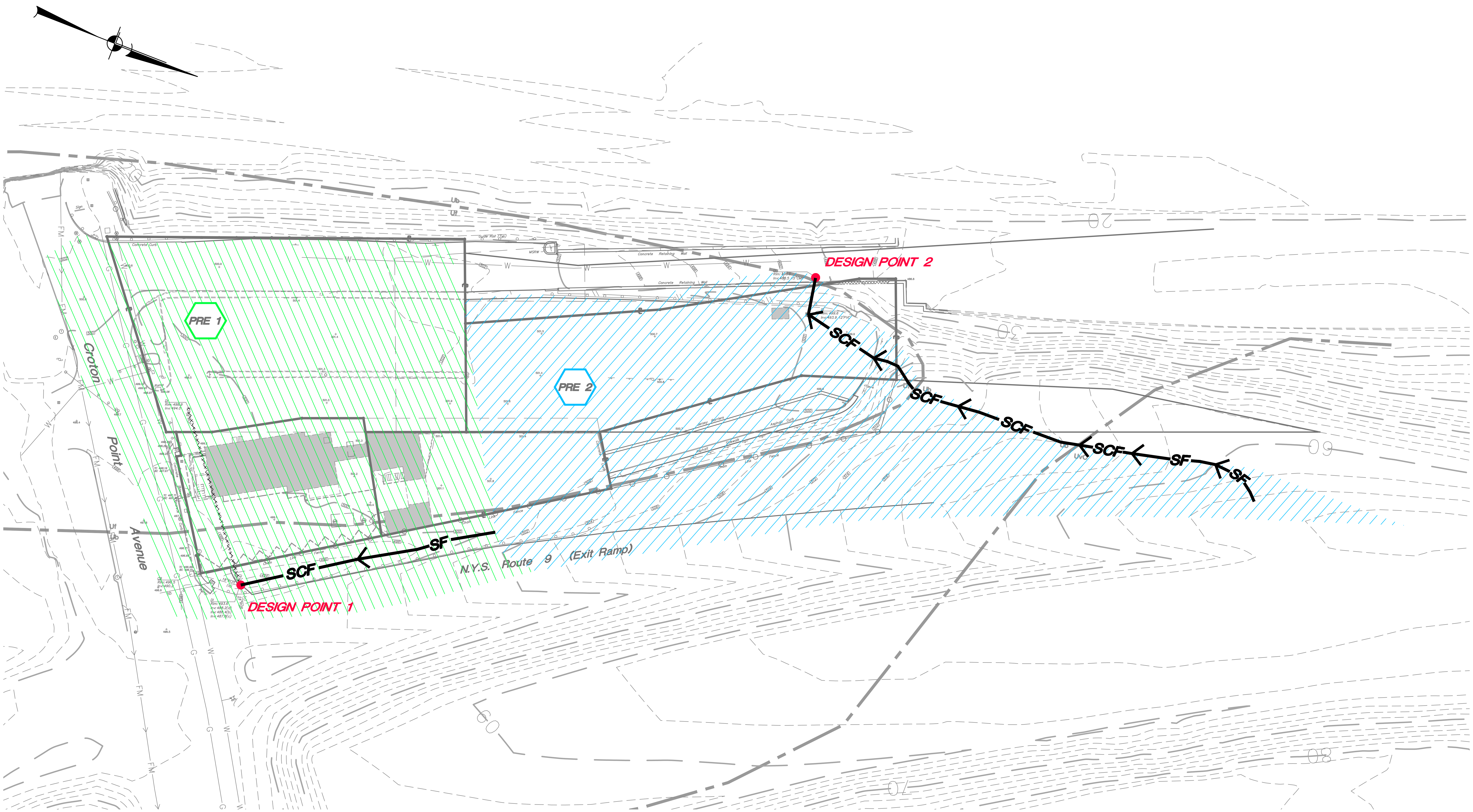
PROJECT: **Croton Point**
JOB NUMBER: **24154.100**
BY: CMS DATE: 3-26-2025
CHK: JWM DATE: 3-26-2025

STRUCTURE		IMPERVIOUS AREA			PERVIOUS AREA			CA	TIME OF CONC. (min.)			I	Q (cfs)		PIPE DESIGN					STRUCTURE	
FROM	TO	A (ac.)	C	CA	A (ac.)	C	CA		INLET	PIPE	TOTAL		DESIGN	CAP.	V(ft/s)	n	s (%)	L (ft)	DIA (in)	FROM	TO
CB 3C	CB 3B	0.15	0.9	0.14	0.00	0.3	0.00	0.14	6	-	6	7.2	1.0	3.7	4.0	0.012	0.9	66	12	CB 3C	CB 3B
CB 3B	CB 3A	0.05	0.9	0.05	0.00	0.3	0.00	0.19	6	-	6	7.2	1.4	5.9	6.1	0.012	2.3	48	12	CB 3B	CB 3A
CB 3A	CB 3	0.09	0.9	0.08	0.02	0.3	0.01	0.28	6	-	6	7.2	2.0	4.9	5.9	0.012	1.6	62	12	CB 3A	CB 3
CB 3	CB 2	0.05	0.9	0.05	0.02	0.3	0.01	0.34	6	-	6	7.2	2.4	4.7	6.1	0.012	1.5	68	12	CB 3	CB 2
CB 2	HDS 1.1	0.47	0.9	0.42	0.06	0.3	0.02	0.78	6	-	6	7.2	5.6	10.6	8.8	0.012	2.3	22	15	CB 2	HDS 1.1
HDS 1.1	EX DI	0.00	0.9	0.00	0.00	0.3	0.00	0.78	6	-	6	7.2	5.6	25.7	16.8	0.012	13.5	22	15	HDS 1.1	EX DI
CB 8	CB 7	0.10	0.9	0.09	0.00	0.3	0.00	0.09	6	-	6	7.2	0.6	3.7	3.5	0.012	0.9	55	12	CB 8	CB 7
CB 7	DMH 6	0.10	0.9	0.09	0.00	0.3	0.00	0.18	6	-	6	7.2	1.3	3.0	3.7	0.012	0.6	72	12	CB 7	DMH 6
DMH 6	HDS 2.1	0.00	0.9	0.00	0.00	0.3	0.00	0.33	6	-	6	7.2	2.4	4.9	4.0	0.012	0.5	114	15	DMH 6	HDS 2.1
HDS 2.1	DI 5	0.00	0.9	0.00	0.00	0.3	0.00	0.33	6	-	6	7.2	2.4	4.4	3.7	0.012	0.4	102	15	HDS 2.1	DI 5
DI 5	DI 4	0.15	0.9	0.14	0.00	0.3	0.00	0.69	6	-	6	7.2	5.0	7.7	6.7	0.012	1.2	8	15	DI 5	DI 4
CB 6B	CB 6A	0.05	0.9	0.05	0.00	0.3	0.00	0.05	6	-	6	7.2	0.4	4.2	3.3	0.012	1.2	17	12	CB 6B	CB 6A
CB 6A	DMH 6	0.05	0.9	0.05	0.00	0.3	0.00	0.10	6	-	6	7.2	0.7	3.7	3.6	0.012	0.9	11	12	CB 6A	DMH 6
CB 6C	DMH 6	0.05	0.9	0.05	0.00	0.3	0.00	0.05	6	-	6	7.2	0.4	3.7	3.0	0.012	0.9	11	12	CB 6C	DMH 6
CB 5A	DI 5	0.05	0.9	0.05	0.57	0.3	0.17	0.22	6	-	6	7.2	1.6	3.7	4.5	0.012	0.9	11	12	CB 5A	DI 5

FIGURES



PROJECT: 1 CROTON POINT CROTON POINT AVE. & VETERANS PLAZA, VILLAGE OF CROTON-ON-HUDSON, WESTCHESTER CO., NY	PREPARED BY:	DATE: 6-28-24
	INSITE ENGINEERING, SURVEYING & LANDSCAPE ARCHITECTURE, P.C.	SCALE: 1"=500'
	3 Garrett Place • Carmel, New York 10512	PROJECT NO.: 24154.100
DRAWING: LOCATION MAP	Phone (845) 225-9690 • Fax (845) 225-9717 www.insite-eng.com	FIGURE: FIGURE-1



SOILS LEGEND

SOILS	DESCRIPTION	HYDROLOGICAL GROUP
Uf	Urban land	D
Ub	Udorthents, smoothed	B
UvC	Urban land–Riverhead complex	D
	NRCS Soil Boundary Line	

LEGEND

PRE 1	SUBCATCHMENT
SF →	TIME OF CONCENTRATION SHEET FLOW
SCF →	TIME OF CONCENTRATION SHALLOW CONCENTRATED FLOW
DESIGN POINT	DESIGN POINT
	SUBCATCHMENT CONTRIBUTING AREA

GRAPHIC SCALE

0 25 50 100

(IN FEET)
1 inch = 50 ft.

NO.	DATE	REVISION	BY

INSITE
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3 Garrett Place
Carmel, NY 10512
(845) 225-9690
(845) 225-9717 fax
www.insite-eng.com

PROJECT:

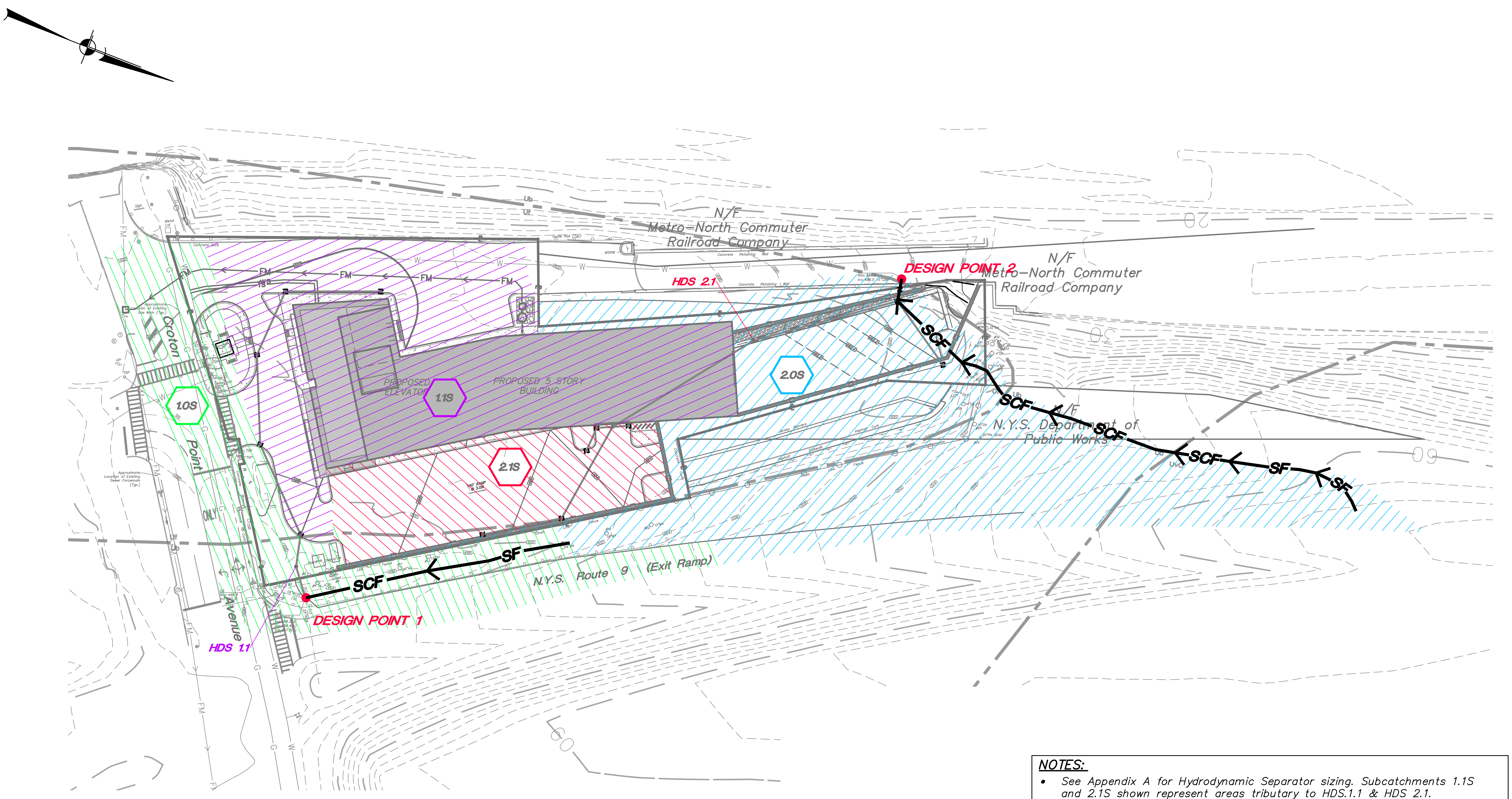
1 CROTON POINT

CROTON POINT AVE. & VETERANS PLAZA, VILLAGE OF CROTON-ON-HUDSON, WSTCHESTER CO., NY

DRAWING:

PRE-DEVELOPMENT MAP

PROJECT NUMBER	24154.100	PROJECT MANAGER	R.D.W.	DRAWING NO. FIG-2
DATE	6-28-24	DRAWN BY	C.M.S.	SHEET 2/3
SCALE	1" = 50'	CHECKED BY	J.W.M.	



NOTES:

- See Appendix A for Hydrodynamic Separator sizing. Subcatchments 1.1S and 2.1S shown represent areas tributary to HDS.1.1 & HDS 2.1.
- See Appendix B & C for Pre vs Post Development Peak Flow analysis for the project. Because of reduction in impervious surfaces at the site, onsite detention is not necessary and the entire tributary area to each design point was modeled as a single Subcatchment (ie. 1.0S and 1.1S were combined as a single Subcatchment tributary to Design Point 1.)

SOILS LEGEND

SOILS	DESCRIPTION	HYDROLOGICAL GROUP
Uf	Urban land	D
Ub	Udorthents, smoothed	B
UvC	Urban land–Riverhead complex	D
	NRCS Soil Boundary Line	

LEGEND

1.0S	SUBCATCHMENT
—SF→	TIME OF CONCENTRATION SHEET FLOW
—SCF→	TIME OF CONCENTRATION SHALLOW CONCENTRATED FLOW
—PF→	TIME OF CONCENTRATION PIPE FLOW
DESIGN POINT	DESIGN POINT
	SUBCATCHMENT CONTRIBUTING AREA

GRAPHIC SCALE

0 10 20 40

(IN FEET)
1 inch = 40 ft.

ALTERATION OF THIS DOCUMENT, UNLESS UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, IS A VIOLATION OF SECTION 7209 OF ARTICLE 145 OF THE EDUCATION LAW.

NO.	DATE	REVISION	BY

INSITE
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PROJECT:

1 CROTON POINT

CROTON POINT AVE. & VETERANS PLAZA, VILLAGE OF CROTON–ON–HUDSON, WSTCHESTER CO., NY

DRAWING:

POST–DEVELOPMENT MAP

PROJECT NUMBER	24154.100	PROJECT MANAGER	R.D.W.
DATE	6–28–24	DRAWN BY	C.M.S.
SCALE	1" = 40'	CHECKED BY	J.W.M.

DRAWING NO. FIG–3

SHEET 3 / 3

Z:\E\24154100 WBP Croton Point Ave\Stormwater\Figures\Figure 3 - Post Development Map.dwg, 3/26/2025 10:50:47 AM, jmcmanus, 1:1