

STORMWATER MANAGEMENT REPORT

**Block 14301 – Lots 4 & 7-10
Monroe Township, Gloucester County, New Jersey**

Prepared for:

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December 7, 2020

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TABLE OF CONTENTS

Section	Page
PROJECT SUMMARY.....	1
PRE-DEVELOPMENT CONDITIONS	1
POST-DEVELOPMENT CONDITIONS.....	2
DESIGN METHODOLOGY	2
GROUNDWATER RECHARGE.....	5
NONSTRUCTURAL STORMWATER MANAGEMENT STRATEGIES.....	5
SOIL EROSION AND SEDIMENT CONTROL.....	6
CONCLUSION	6
FIGURES	
1 – PRE-DEVELOPMENT DRAINAGE AREA MAP	
2 – POST-DEVELOPMENT DRAINAGE AREA MAP	
3 – INLET DRAINAGE AREA MAP	
APPENDICES	
APPENDIX A: Pre-Developed Calculations	
APPENDIX B: Post-Developed Calculations	
APPENDIX C: Water Quality Calculations (N.J.A.C. 7:8)	
APPENDIX D: Groundwater Recharge	
APPENDIX E: Soil Erosion and Sediment Control Design Calculations	
APPENDIX F: Soil Erosion Routing Calculations	
APPENDIX G: Stormwater Management Collection System	
APPENDIX H: Soil Test Pit Data	

PROJECT SUMMARY

The applicant, Wood Management, LLC currently owns Block 14301, Lots 4 and 7-10, which includes approximately 58± acres of land within Monroe Township, Gloucester County, New Jersey, which is located within the Business Park (BP) District. Lots 7-9 currently contain a single-family residence as well as wooded areas and some cleared areas with stockpiles of mulch, sand, topsoil, firewood, etc. Existing Lot 4 is currently used for farming and composting. Existing Lot 10 is located is currently a retail building with storage, stormwater management and an area used for mulch manufacturing. North of the site is an existing airport, which include Airport Drive and east of the project is Tuckahoe Road, which fronting on Tuckahoe Road opposite the site is an existing church and single-family residences.

Site improvements for the project consist of 8 proposed self-storage buildings to be located on existing lots 8 and 9 as well as vehicle storage, which will be located on the rear portion of Lot 7. The applicant is proposing to construct an access drive that extends from the existing retail center on Lot 10 through the site to Airport Drive to the north, which will provide access to the vehicle and self-storage areas. A stormwater management basin is also proposed for the improvements and will be located at the rear of lots 7 and 8. The existing residence, which is located on Lot 7, will be subdivided and remain on its own lot along Tuckahoe Road.

This Stormwater Management Report was developed to demonstrate compliance with the requirements of the Monroe Township Land Use Regulations, Gloucester County Land Development Regulations, New Jersey Department of Environmental Protection (NJDEP) at N.J.A.C. 7:8 and the Standards for Soil Erosion and Sediment Control in New Jersey.

PRE-DEVELOPMENT CONDITIONS

SURFACE COVER/DEVELOPMENT:

The existing project area is mostly wooded areas with some gravel/stone areas with stockpiles. The project drainage area that will be analyzed will be the area that includes the main development, which will be surrounded with a proposed berm. The total area that will be analyzed is approximately 14.2 acres.

TOPOGRAPHY:

There is a high point located at the northeast area of the proposed area to be developed. The elevation at this location is approximately 164 feet above mean sea level (AMSL). Topography gently slopes away from this area towards the southwest. The lowest elevation is at approximately 146 feet AMSL.

SOIL CONDITIONS:

Based on information provided in the *United States Department of Agriculture, Soil Conservation Service, Soil Survey of Gloucester County, New Jersey*, soils within the project area are identified as Aura sandy loam (AugB), Downer loamy sand (DocB) and Woodstown-Glassboro complex (WokA). The Soil Survey classifies these soils as hydrologic group 'B'. Subsurface soil investigations were performed within the project limits on September 7, 2018 and November 2, 2020 for evaluation of general subsurface conditions. Please see the soil test pit data and soil testing information found in Appendix H.

HYDROLOGIC CONDITIONS:

Under pre-developed conditions, stormwater runoff from the project area flows in two drainage areas in the proposed development area, the first one from the northeast to the southwest, which is identified as Pre DA-1. Pre DA-2 is located at the north end of the site and discharges to the north of the site at Airport Drive. The overall drainage areas total 14.2 acres for the proposed development area. There is also a third (Pre DA-3) area of 1.28 acres that is outside the proposed development.

A summary of the pre-developed peak run-off rates for this watershed is included in Appendix A. Pre-developed drainage area calculations and hydrographs are included in Appendix A. A brief summary of the results is as follows:

Watershed	2 yr. Storm	10 yr. Storm	100 yr. Storm
Pre DA-1	2.22 cfs	8.61 cfs	26.87 cfs
Pre DA-2	0.06 cfs	0.29 cfs	1.04 cfs
Pre DA-3	0.26 cfs	1.26 cfs	4.06 cfs

POST-DEVELOPMENT CONDITIONS

SURFACE COVER/DEVELOPMENT:

The project proposes construction of 8 storage units totaling 76,800 SF, with a vehicle storage area, drive aisles and access areas, stormwater management facilities and other pertinent site improvements. Construction of the new development will result in a reduction in the existing on-site wooded area. Portions of the property not included in the drainage area map will not be disturbed as part of the project and shall remain in their current state. Stormwater management facilities shall be provided within the project limits for the provision of water quantity, quality and recharge control.

TOPOGRAPHY:

Topography in the project area will be altered as a result of the proposed development, but will be designed to keep the run-off directed in the same general direction. Grading for the developed on-site areas shall be designed so that surface drainage flows to a proposed stormwater management basin. Topography for areas outside the project area shall remain the same as exists in the pre-development condition.

HYDROLOGIC CONDITIONS:

Stormwater from the developed site will all be directed into a proposed stormwater management basin located in the southwest corner of the proposed development area. Pre-DA areas 1 and 2 (Post DA-1) will be combined into one post developed drainage area and will be directed to the basin via grading and a system of stormwater management swales and a pipe network. Post DA-2, which is the same as Pre DA-3, will also be routed to the proposed basin. Additionally, the outfall from the Basin will discharge to an existing area to the south of the proposed basin area. This stormwater management facility is proposed as an infiltration basin for collection, treatment and attenuation of surface run-off prior to discharge.

Post-developed drainage area calculations and hydrographs are included in Appendix B. A summary of the peak run-off rates to the proposed stormwater management basins are included in Appendix B. A brief summary is as follows:

Watershed	2 yr. Storm	10 yr. Storm	100 yr. Storm
Post DA-1	15.60 cfs	27.39 cfs	50.85 cfs
Post DA-2	0.26 cfs	1.26 cfs	4.06 cfs

DESIGN METHODOLOGY

HYDROLOGIC AND HYDRAULIC CALCULATIONS:

The design, construction, and maintenance of stormwater management facilities proposed for the project

will be in accordance with the Monroe Township Land Use Regulations, Gloucester County Land Development Regulations and the Standards for Soil Erosion and Sediment Control in New Jersey. Calculations for pre-development and post-development discharge comparative analysis were prepared using the SCS TR-55 methodology for the 2, 10 and 100 year frequency, 24 hour storm. In accordance with the recommendations of the NJDEP Stormwater Best Management Practices Manual, hydrographs for the impervious and pervious areas within each on-site watershed have been computed separately. The impervious areas consist of all gravel (access drive, parking areas) and concrete surfaces (storage buildings) which are connected to the proposed stormwater collection systems. The pervious areas are comprised of open space and wooded areas. Analysis and design of the stormwater pipe collection systems were prepared using the Rational Method for the 100 year storm.

CALCULATION SOFTWARE:

The calculations included within this report include hydrologic analysis by HydroCad 10.0. The HydroCad software was used to develop pre-developed and post-developed runoff hydrographs for comparison based on the U.S. Department of Agriculture Soil Conservation Service Technical Release 55 (SCS TR-55) methodology, considering the DelMarVa unit hydrograph for all watersheds. Hydraflow™ Storm Sewers software by Intelisolve, Inc. was utilized to analyze and design the pipe collection systems using the Rational Method.

RUNOFF COEFFICIENT AND CURVE NUMBER VALUES:

As described above, soil classifications for use in establishing runoff curve numbers (CN) for each drainage area were taken from the *United States Department of Agriculture, Soil Conservation Service, Soil Survey of Gloucester County, New Jersey*. Evaluation of these maps indicated that the soils within the project area should be analyzed as hydrologic soil group 'B', as defined within the U.S. Department of Agriculture Soil Conservation Service Manual "Urban Hydrology for Small Watersheds", v. 1986. Calculations assume woods and open space in good condition for the pre-developed and post-developed conditions.

Runoff CN values for developing SCS TR-55 hydrographs for the various cover conditions within each watershed were assigned to various surfaces as follows:

<u>Ground Cover</u>	<u>CN Value</u>
Impervious Areas (All Soils)	98
Woods – Good Condition ('B' Soils)	55
<50% Grass Cover – Poor Condition ('B' Soils)	79
Gravel Surface (Milled Areas) ('B' Soils)	96

Runoff coefficients for collection system calculations via the Rational Method were obtained from Table 7.1 of the Residential Site Improvement Standards as follows:

<u>Ground Cover</u>	<u>C Value</u>
Paved Areas/Streets & Roads (All Soils)	0.99
Open Space – Fair Condition ('B' Soils)	0.45
Woods – Fair Condition ('B' Soils)	0.34

PIPE FLOW CALCULATIONS:

Pipe flow calculations have been performed utilizing the Rational Method for estimating run-off to each inlet within the project area. The Manning equation was utilized to study proposed pipe capacities and velocities. Associated calculations determining peak run-off for each drainage area and substantiating capacity to convey peak runoff are provided within the post developed calculations. Determination of the hydraulic grade line (water surface) within the stormwater collection systems are also provided within the pipe flow calculations to demonstrate the anticipated water surface will not extend above the grate/rim elevation of storm structures. The system is designed to convey the 100 year storm so that all run-off is conveyed to the basin.

STORMWATER MANAGEMENT BASIN DESIGN:

The proposed stormwater management system for the project area will include the installation of one (1) stormwater basin. Stormwater will be redirected per the proposed grading, but will basically follow the existing flow path. The stormwater management facility is proposed as an infiltration basin with extended detention.

Basin

The proposed Basin will be an infiltration basin with extended detention located to the west of the proposed improvements. This basin is designed in accordance with Chapter 9.5 of the BMP Manual with the basin bottom elevation more than 2.5 feet above the seasonal high groundwater elevation to avoid impacts from fluctuations in the static groundwater table. The TSS removal rate is 80% in accordance with the BMP. The peak storage capacity of Basin #1 is approximately 5.206 ac-ft during the 100 -year storm event. Emergency discharge will be provided via a grassed spillway and directed toward the rear of the property, which is owned by the applicant.

Rainfall Event	Basin Inflow	Basin Outflow	Water Surface	Peak Storage
2 year Storm	15.84 cfs	0.28 cfs	147.03 ft.	2.360 ac-ft
10 year Storm	28.33 cfs	4.91 cfs	147.71 ft.	3.198 ac-ft
100 year Storm	53.66 cfs	10.23 cfs	149.39 ft.	5.428 ac-ft

RUNOFF RATE REDUCTION:

The stormwater management regulations of the NJDEP require that the post-development peak runoff from the disturbed areas of the project be reduced below pre-development rates based on the SCS TR-55 method of stormwater runoff estimation for a 24 hour storm distribution under the 2, 10, and 100 year design storm frequencies. Required reductions are 50%, 75%, and 80% respectively of pre-development peak rates. For the project, three discharge points from the developed portions of the site were analyzed which must comply with the NJDEP rate reduction requirements. A summary of the peak run-off rates comparing the pre-developed rates and total discharge from the project area is as follows:

Storm Event	Pre-Developed Peak Rate (Pre DA-1)	Required Reduction	Reduced Rate (Pre DA-1)	Pre-Developed Peak Rate (DA-3)	Total Allowed (Reduced Rate for DA-1 & 2)	Post-Developed Peak Rate
2 year	2.22 cfs	50%	1.11 cfs	0.26 cfs	1.37 cfs	0.28 cfs
10 year	8.61 cfs	75%	6.46 cfs	1.26 cfs	7.72 cfs	4.91 cfs
100 year	26.87 cfs	80%	21.50 cfs	4.06 cfs	25.56 cfs	10.23 cfs

WATER QUALITY:

In order to comply with NJDEP requirements for water quality, measures for addressing and improving water quality of stormwater discharge from the project area have been incorporated into the stormwater management design. Surface run-off from the new impervious areas of the site will be conveyed to the proposed stormwater management basin. Run-off from the water quality design storm shall be treated through infiltration. This treatment process provides the requisite TSS removal rate for the water quality design storm, as specified in the NJDEP Stormwater Best Management Practices Manual. Calculations demonstrating compliance with the applicable water quality requirements of the NJDEP are provided in Appendix C.

The adopted removal rate for infiltration basins per Table 4-1 of the New Jersey Stormwater Best

Management Practices Manual (NJSBMP Manual) is 80% removal of TSS. All rates are evaluated for the Water Quality Design Storm (1.25"/2-hour duration storm event).

The basin is designed with an infiltration area and 6-inch thick sand bottom to provide infiltration and recharge of the water quality design storm. The adopted TSS Removal Ratio for an infiltration structure from Table 4.1 of the NJSBMP Manual = **80%**. Since the entire water quality design storm volume (0.531 ac-ft) is retained and infiltrated within Basin #1, **80% TSS** removal is achieved.

GROUNDWATER RECHARGE

NJDEP groundwater recharge requirements have been accommodated in the proposed stormwater management design. Groundwater recharge requirements, in the form of the NJGRS spreadsheet, are included in Appendix D. The proposed infiltration basins will provide sufficient capacity to store and recharge the deficit in the average annual recharge volume calculated in the NJGRS spreadsheet based on the area of proposed impervious coverage for the new site improvements directed to the basin. The NJGRS spreadsheet was given the bottom area, depth, and contributory impervious area for the combined infiltration facilities and the spreadsheet calculated the effective depth necessary to accommodate the total Post Development Annual Recharge Deficit of 127,412 cubic feet. The effective depth was then compared to the design depth to confirm sufficient infiltration capacity was provided.

Per the NJ Stormwater Management Regulations (N.J.A.C. 7:8), 100% of the site's average annual pre-developed groundwater recharge volume must be maintained after development. For groundwater recharge, the infiltration area at the bottom of proposed Basin #1 has been selected with the following dimensions:

Basin #1

Infiltration Capacity = 1.103 ac.ft. – volume of Basin #1 below elevation 148.29
Depth = 2.0 ft. or 24 inches
Bottom Area = 47,757± square feet
Sand Bed Depth = 6 inches
Depth to SHWT = ≥ 2.5 ft.

Utilizing the New Jersey Groundwater Recharge Spreadsheet (NJGRS), infiltration structures with a combined bottom area of 47,757 square feet located approximately 72 inches below existing grade must have a minimum depth of 3 inches to meet the annual BMP recharge requirements for the site. Since the proposed infiltration area of Basin #1 has a proposed depth of 3± inches, recharge requirements for the project have been satisfied. In addition, the volumes of the infiltration area in the basin is sufficient to store the entire water quality design storm volume directed to the basin (1.103 ac.-ft.).

An infiltration rate of 4.4 inches/hour has been utilized for Basin #1 which is equivalent to the ½ of the average rate obtained from laboratory testing of the in-situ subsurface soils. The routing results indicate Basin #1 will drain within 4.9 hours after the time of peak storage for the water quality design storm and 13.97 hours for the 100-year (largest) design storm event, which are both less than the required 72 hours.

NONSTRUCTURAL STORMWATER MANAGEMENT STRATEGIES

The stormwater management design incorporates nonstructural stormwater strategies to the maximum extent practicable in accordance with the requirements of NJAC 7:8-5.3. The strategies are as follows:

1. The proposed improvements are located on site and are as remote as possible from the existing

state open waters. In addition, the improvements are located so that the surface run-off is contained and will have little chance of causing erosion into the nearby water bodies.

2. The proposed driveway and parking lot will be constructed of gravel. In addition, the surface run-off is directed through swales and a sediment forebay prior to flowing into the basin. The forebay, in particular, will help to keep trash and spills from contaminating the main infiltration basins.
3. A note has been added to the plans requiring that only low ground pressure vehicles be utilized in the construction of the basins and proposed vegetated areas in order to maintain ground water recharge in those areas.
4. Fertilizer application rates are specified in accordance with the Soil Erosion and Sediment Control Standards of New Jersey and those recommended by the local Soil Conservation District.

SOIL EROSION AND SEDIMENT CONTROL

A comprehensive and coordinated sediment control program will be implemented throughout the construction of the project in accordance with the New Jersey Soil Erosion and Sediment Control Act (Chapter 251, P.L. 1975), which will minimize the disturbance from the stormwater runoff, retard non-point pollution from sediment, and conserve and protect the environmental resources of the State. The Soil Erosion and Sediment Control Plan, as proposed, will be reviewed by the Gloucester County Soil Conservation District for plan certification approval in accordance with New Jersey State requirements.

In accordance with the Standards for Soil Erosion and Sediment Control in New Jersey, conduit outlet protection for all new stormwater outfalls and stable discharge through basin emergency spillways shall be provided. Off-site stability shall be provided by limiting the overall post-developed peak flow at or below pre-developed conditions and demonstrating compliance with the reductions in post-developed discharges for the 2 yr. and 10 yr. storm events. For determination of off-site stability, infiltration within stormwater management basin cannot be considered. The following table summarizes the post-developed discharges from the basin without infiltration and the resulting peak flow rate at the corresponding analysis points when compared to the pre-developed peak flow rate.

Condition	2 yr.	10 yr.
(Pre-Developed)	2.54 cfs	10.16 cfs
Basin 1 (Post-Developed)	0.32 cfs	8.18 cfs

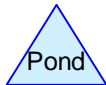
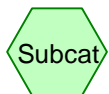
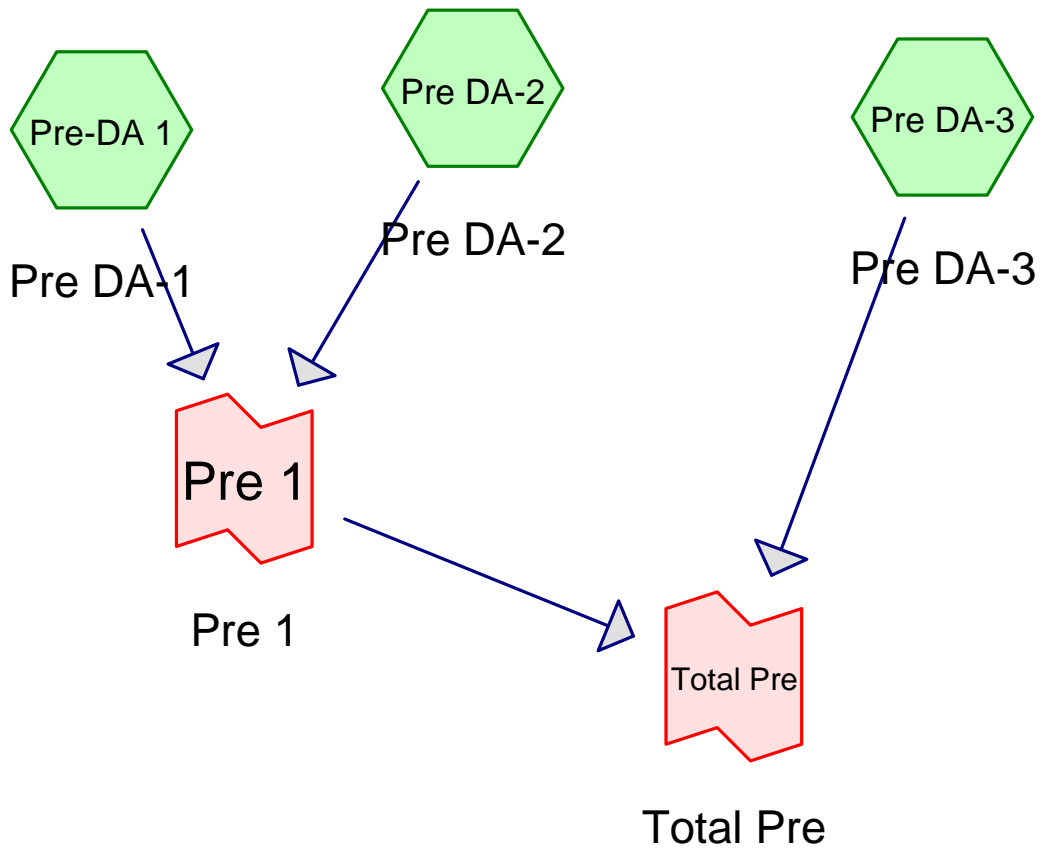
Calculations for the design of conduit outlet protection, emergency spillway stability and the discharges from the basins without infiltration are included in Appendix F.

CONCLUSION

The proposed stormwater management facilities have been designed to minimize the impact to the natural drainage features of the surrounding land uses. Based on the analysis, the project as proposed will have no significant detrimental impact on existing downstream drainage systems. The proposed reduction of run-off rates below pre-developed rates at the overall points of analysis will comply with the NJDEP stormwater requirements. Provisions for groundwater recharge will mitigate loss of pervious land surface areas by allowing groundwater to recharge within stormwater management facilities. Providing groundwater recharge will maintain the health of the nearby water courses and aquifers. Water quality improvements implemented through the proposed basin will preserve the overall water quality of stormwater discharges from the project area.

FIGURES

APPENDIX A
PRE-DEVELOPED CALCULATIONS
2 YR. STORM
10 YR. STORM
100 YR. STORM



Routing Diagram for Pre-Dev
 Prepared by DEWBERRY, Printed 12/7/2020
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.540	96	Gravel surface, HSG B (Pre DA-3, Pre-DA 1)
0.070	98	Unconnected roofs, HSG B (Pre DA-3, Pre-DA 1)
5.880	55	Woods, Good, HSG B (Pre DA-2, Pre DA-3, Pre-DA 1)
7.990	58	Woods/grass comb., Good, HSG B (Pre DA-2, Pre DA-3, Pre-DA 1)
15.480	61	TOTAL AREA

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
15.480	HSG B	Pre DA-2, Pre DA-3, Pre-DA 1
0.000	HSG C	
0.000	HSG D	
0.000	Other	
15.480		TOTAL AREA

Pre-Dev

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	1.540	0.000	0.000	0.000	1.540	Gravel surface	Pre DA-3, Pre-DA 1
0.000	0.070	0.000	0.000	0.000	0.070	Unconnected roofs	Pre DA-3, Pre-DA 1
0.000	5.880	0.000	0.000	0.000	5.880	Woods, Good	Pre DA-2, Pre DA-3, Pre-DA 1
0.000	7.990	0.000	0.000	0.000	7.990	Woods/grass comb., Good	Pre DA-2, Pre DA-3, Pre-DA 1
0.000	15.480	0.000	0.000	0.000	15.480	TOTAL AREA	

Pre-Dev

NOAA 24-hr C 2 Yr Rainfall=3.31"

Prepared by DEWBERRY

Printed 12/7/2020

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Page 5

Time span=0.00-80.00 hrs, dt=0.05 hrs, 1601 points
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Pre DA-2: Pre DA-2

Runoff Area=0.570 ac 0.00% Impervious Runoff Depth=0.35"
Flow Length=385' Tc=22.8 min CN=57 Runoff=0.06 cfs 0.016 af

Subcatchment Pre DA-3: Pre DA-3

Runoff Area=1.280 ac 3.91% Impervious Runoff Depth=0.42"
Flow Length=155' Tc=9.2 min UI Adjusted CN=59 Runoff=0.26 cfs 0.044 af

Subcatchment Pre-DA 1: Pre DA-1

Runoff Area=13.630 ac 0.15% Impervious Runoff Depth=0.49"
Flow Length=740' Tc=25.8 min CN=61 Runoff=2.22 cfs 0.556 af

Link Pre 1: Pre 1

Inflow=2.27 cfs 0.573 af
Primary=2.27 cfs 0.573 af

Link Total Pre: Total Pre

Inflow=2.47 cfs 0.617 af
Primary=2.47 cfs 0.617 af

Total Runoff Area = 15.480 ac Runoff Volume = 0.617 af Average Runoff Depth = 0.48"
99.55% Pervious = 15.410 ac 0.45% Impervious = 0.070 ac

Summary for Subcatchment Pre DA-2: Pre DA-2

Runoff = 0.06 cfs @ 12.68 hrs, Volume= 0.016 af, Depth= 0.35"

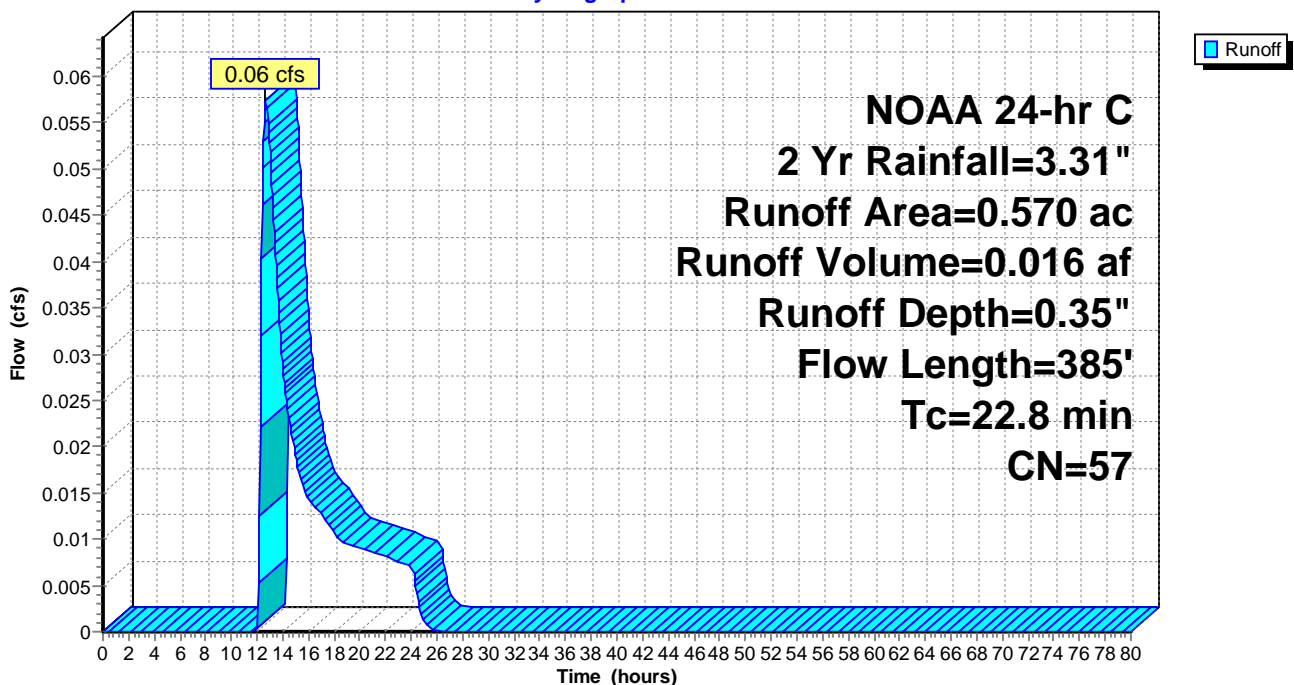
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 2 Yr Rainfall=3.31"

Area (ac)	CN	Description
0.210	55	Woods, Good, HSG B
0.360	58	Woods/grass comb., Good, HSG B
0.570	57	Weighted Average
0.570		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	70	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
10.6	30	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
2.4	100	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.6	185	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
22.8	385	Total			

Subcatchment Pre DA-2: Pre DA-2

Hydrograph



Summary for Subcatchment Pre DA-3: Pre DA-3

Runoff = 0.26 cfs @ 12.28 hrs, Volume= 0.044 af, Depth= 0.42"

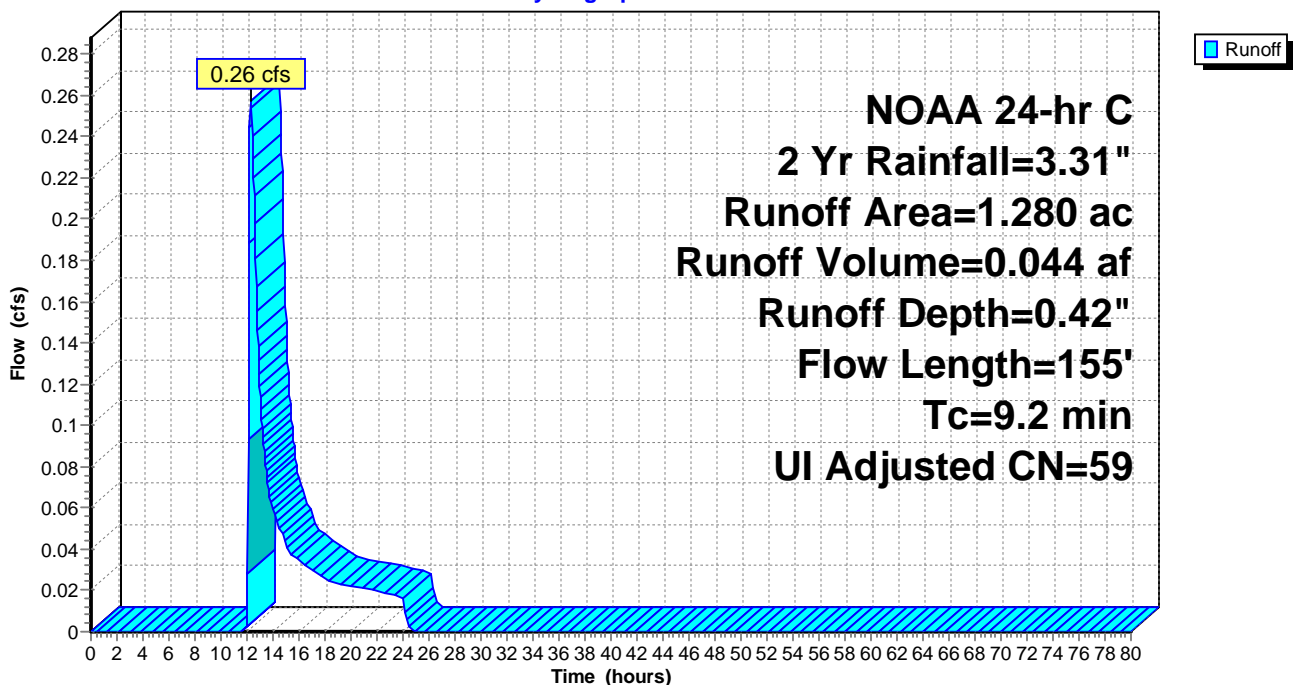
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 2 Yr Rainfall=3.31"

Area (ac)	CN	Adj	Description
0.750	55		Woods, Good, HSG B
0.420	58		Woods/grass comb., Good, HSG B
0.050	98		Unconnected roofs, HSG B
0.060	96		Gravel surface, HSG B
1.280	60	59	Weighted Average, UI Adjusted
1.230			96.09% Pervious Area
0.050			3.91% Impervious Area
0.050			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
1.0	55	0.0350	0.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.2	155	Total			

Subcatchment Pre DA-3: Pre DA-3

Hydrograph



Summary for Subcatchment Pre-DA 1: Pre DA-1

Runoff = 2.22 cfs @ 12.63 hrs, Volume= 0.556 af, Depth= 0.49"

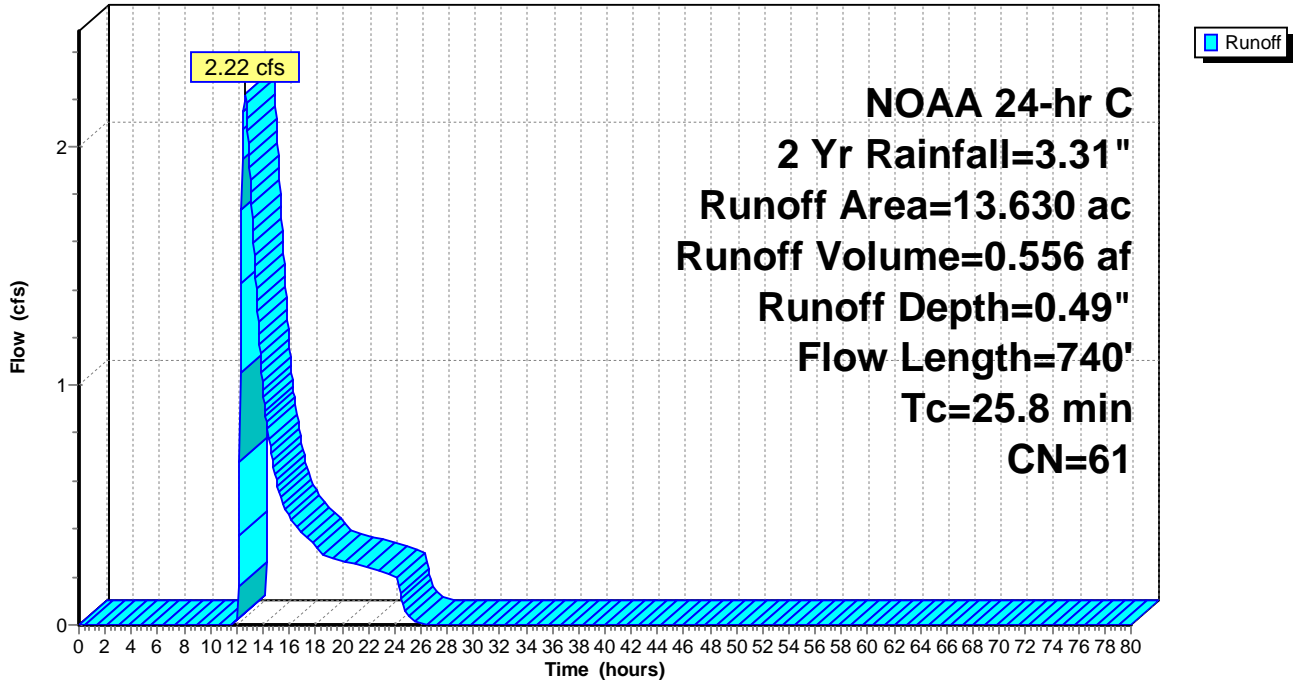
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 2 Yr Rainfall=3.31"

Area (ac)	CN	Description
4.920	55	Woods, Good, HSG B
0.020	98	Unconnected roofs, HSG B
1.480	96	Gravel surface, HSG B
7.210	58	Woods/grass comb., Good, HSG B
13.630	61	Weighted Average
13.610		99.85% Pervious Area
0.020		0.15% Impervious Area
0.020		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	100	0.0130	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
1.2	57	0.0130	0.80		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
4.5	253	0.0350	0.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
2.2	120	0.0170	0.91		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
6.4	210	0.0120	0.55		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
25.8	740	Total			

Subcatchment Pre-DA 1: Pre DA-1

Hydrograph



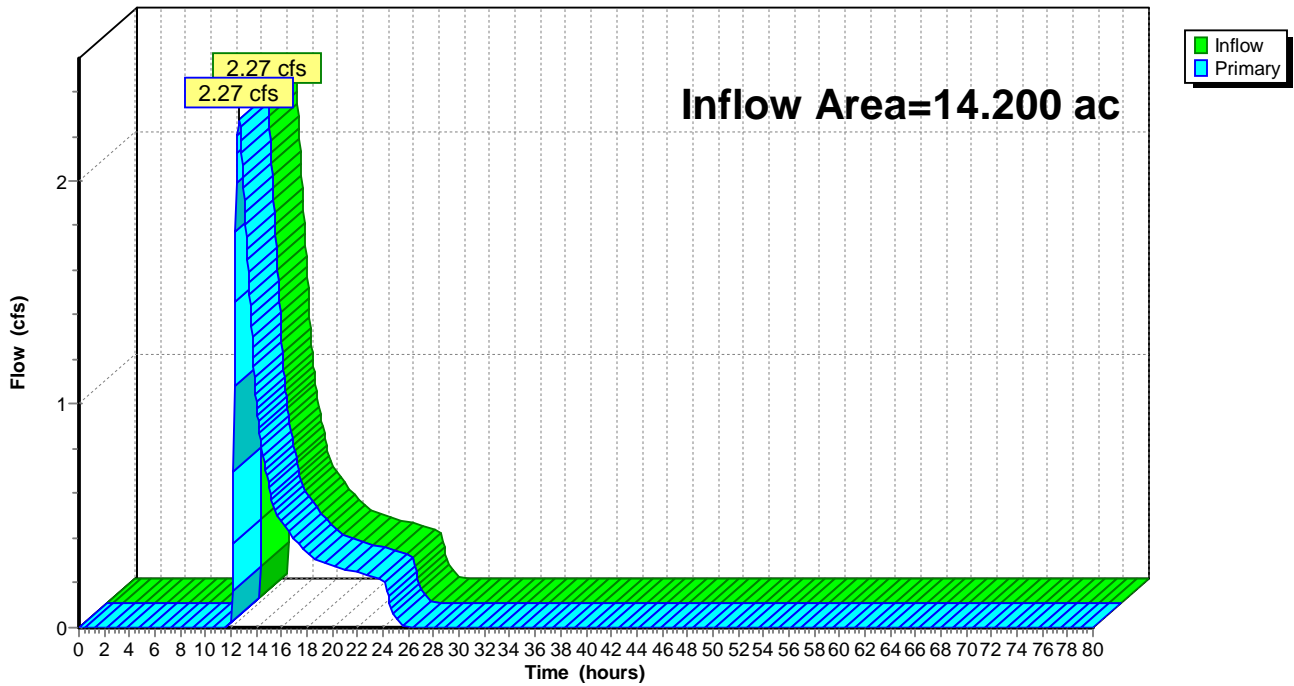
Summary for Link Pre 1: Pre 1

Inflow Area = 14.200 ac, 0.14% Impervious, Inflow Depth = 0.48" for 2 Yr event
Inflow = 2.27 cfs @ 12.63 hrs, Volume= 0.573 af
Primary = 2.27 cfs @ 12.63 hrs, Volume= 0.573 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link Pre 1: Pre 1

Hydrograph



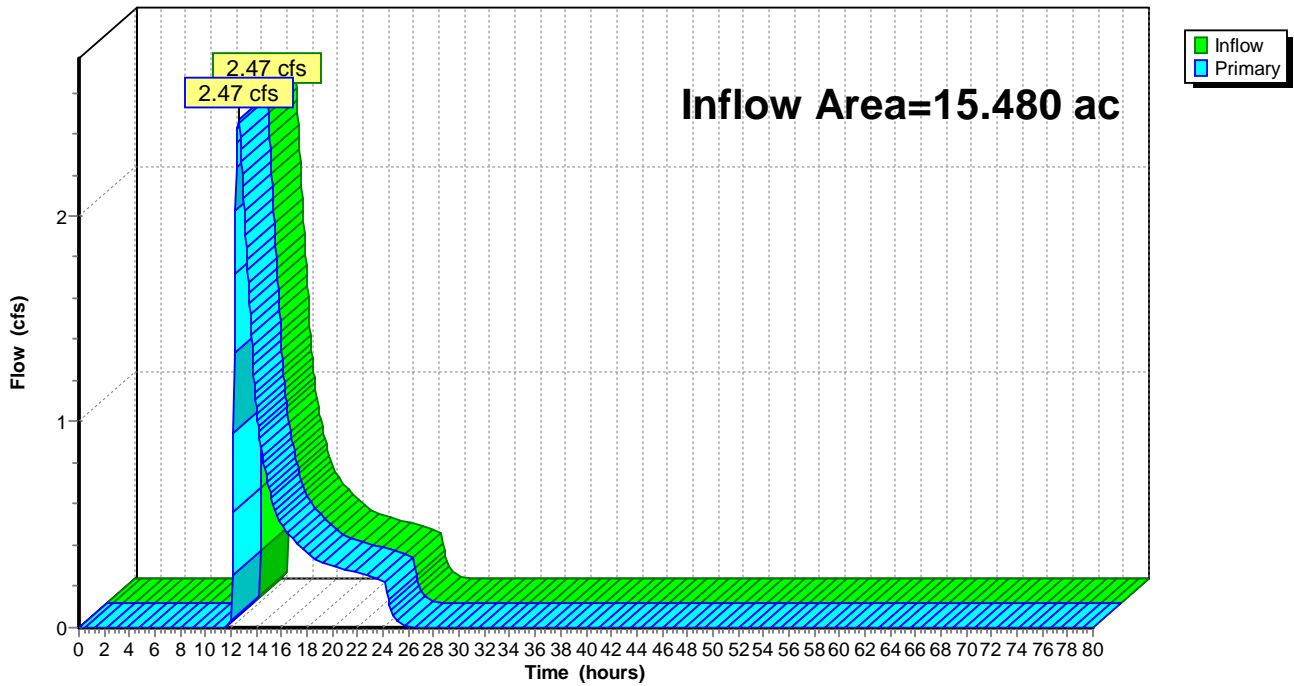
Summary for Link Total Pre: Total Pre

Inflow Area = 15.480 ac, 0.45% Impervious, Inflow Depth = 0.48" for 2 Yr event
Inflow = 2.47 cfs @ 12.59 hrs, Volume= 0.617 af
Primary = 2.47 cfs @ 12.59 hrs, Volume= 0.617 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link Total Pre: Total Pre

Hydrograph



Pre-Dev

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NOAA 24-hr C 10 Yr Rainfall=5.11"

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Page 12

Time span=0.00-80.00 hrs, dt=0.05 hrs, 1601 points
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Pre DA-2: Pre DA-2

Runoff Area=0.570 ac 0.00% Impervious Runoff Depth=1.16"
Flow Length=385' Tc=22.8 min CN=57 Runoff=0.29 cfs 0.055 af

Subcatchment Pre DA-3: Pre DA-3

Runoff Area=1.280 ac 3.91% Impervious Runoff Depth=1.30"
Flow Length=155' Tc=9.2 min UI Adjusted CN=59 Runoff=1.26 cfs 0.138 af

Subcatchment Pre-DA 1: Pre DA-1

Runoff Area=13.630 ac 0.15% Impervious Runoff Depth=1.44"
Flow Length=740' Tc=25.8 min CN=61 Runoff=8.61 cfs 1.631 af

Link Pre 1: Pre 1

Inflow=8.90 cfs 1.686 af
Primary=8.90 cfs 1.686 af

Link Total Pre: Total Pre

Inflow=9.74 cfs 1.824 af
Primary=9.74 cfs 1.824 af

Total Runoff Area = 15.480 ac Runoff Volume = 1.824 af Average Runoff Depth = 1.41"
99.55% Pervious = 15.410 ac 0.45% Impervious = 0.070 ac

Summary for Subcatchment Pre DA-2: Pre DA-2

Runoff = 0.29 cfs @ 12.45 hrs, Volume= 0.055 af, Depth= 1.16"

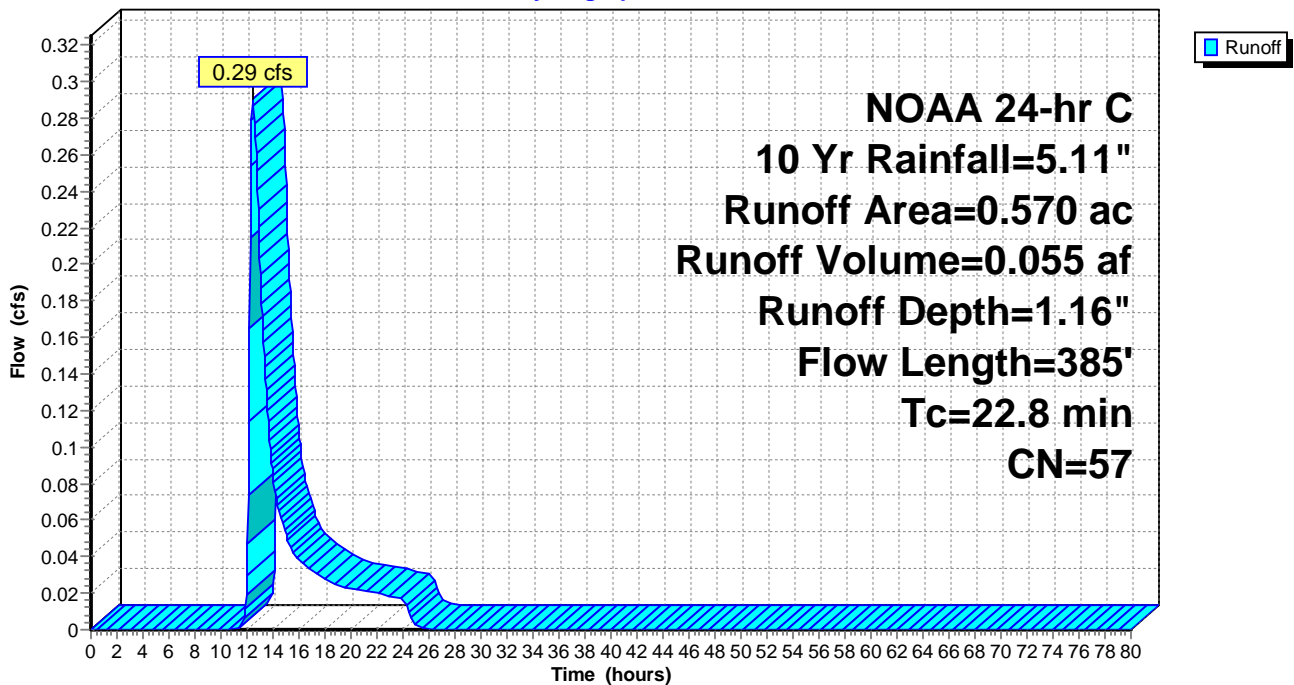
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 10 Yr Rainfall=5.11"

Area (ac)	CN	Description
0.210	55	Woods, Good, HSG B
0.360	58	Woods/grass comb., Good, HSG B
0.570	57	Weighted Average
0.570		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	70	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
10.6	30	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
2.4	100	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.6	185	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
22.8	385	Total			

Subcatchment Pre DA-2: Pre DA-2

Hydrograph



Summary for Subcatchment Pre DA-3: Pre DA-3

Runoff = 1.26 cfs @ 12.21 hrs, Volume= 0.138 af, Depth= 1.30"

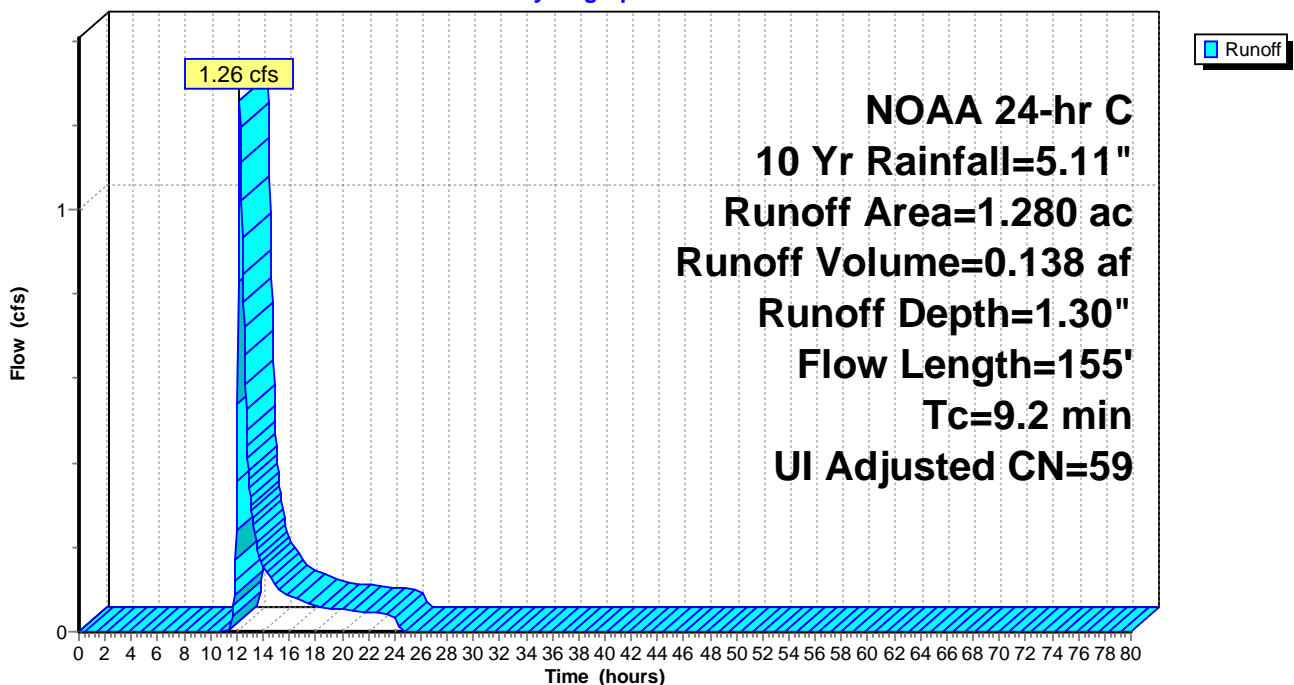
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 10 Yr Rainfall=5.11"

Area (ac)	CN	Adj	Description
0.750	55		Woods, Good, HSG B
0.420	58		Woods/grass comb., Good, HSG B
0.050	98		Unconnected roofs, HSG B
0.060	96		Gravel surface, HSG B
1.280	60	59	Weighted Average, UI Adjusted
1.230			96.09% Pervious Area
0.050			3.91% Impervious Area
0.050			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
1.0	55	0.0350	0.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.2	155	Total			

Subcatchment Pre DA-3: Pre DA-3

Hydrograph



Summary for Subcatchment Pre-DA 1: Pre DA-1

Runoff = 8.61 cfs @ 12.47 hrs, Volume= 1.631 af, Depth= 1.44"

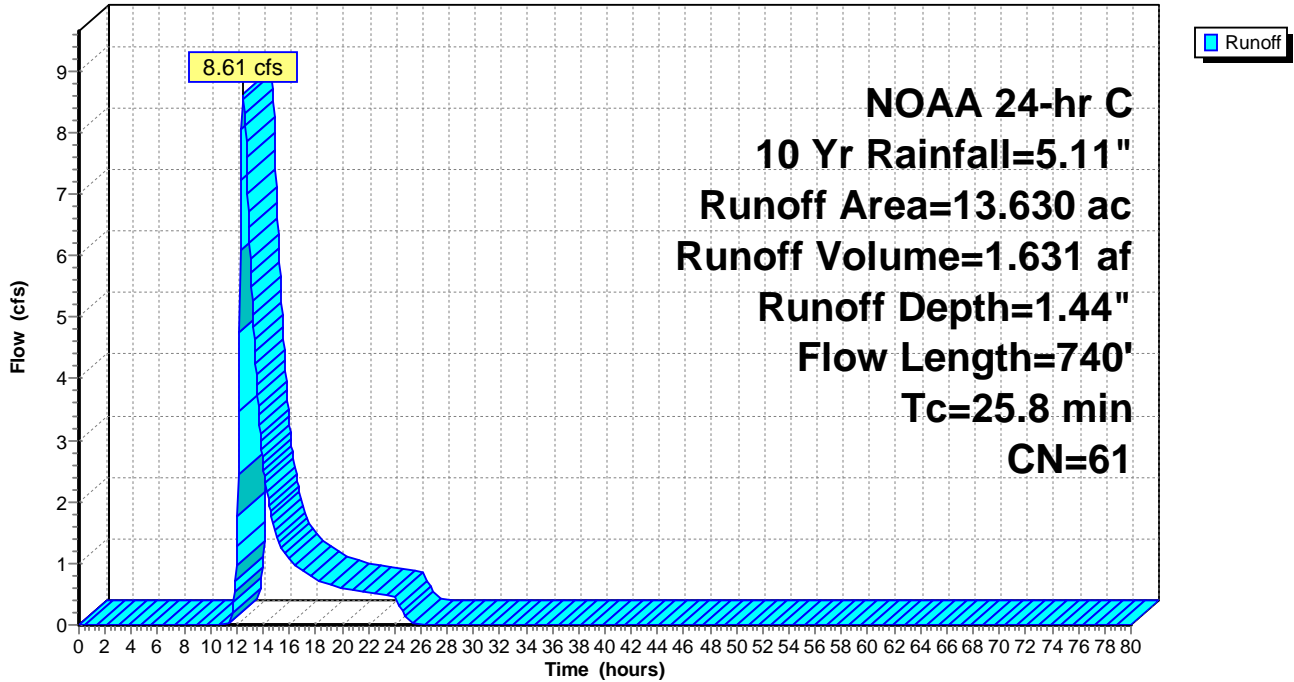
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 10 Yr Rainfall=5.11"

Area (ac)	CN	Description
4.920	55	Woods, Good, HSG B
0.020	98	Unconnected roofs, HSG B
1.480	96	Gravel surface, HSG B
7.210	58	Woods/grass comb., Good, HSG B
13.630	61	Weighted Average
13.610		99.85% Pervious Area
0.020		0.15% Impervious Area
0.020		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	100	0.0130	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
1.2	57	0.0130	0.80		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
4.5	253	0.0350	0.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
2.2	120	0.0170	0.91		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
6.4	210	0.0120	0.55		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
25.8	740	Total			

Subcatchment Pre-DA 1: Pre DA-1

Hydrograph



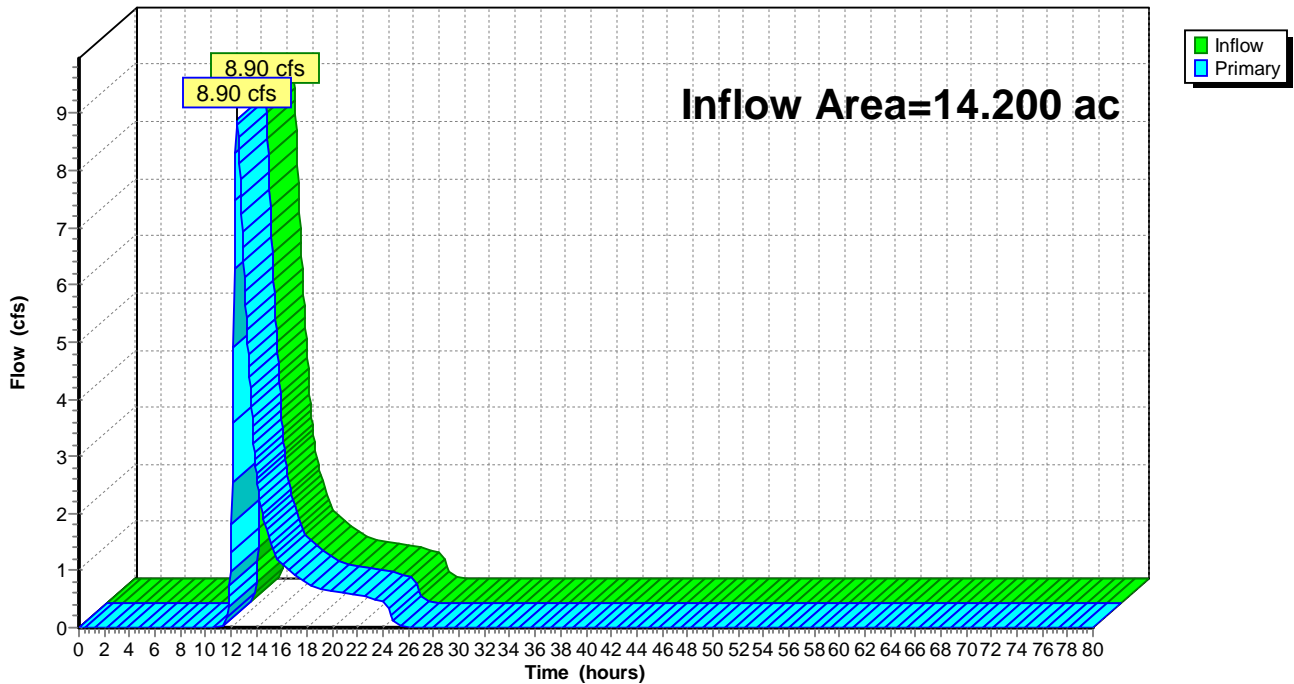
Summary for Link Pre 1: Pre 1

Inflow Area = 14.200 ac, 0.14% Impervious, Inflow Depth = 1.42" for 10 Yr event
Inflow = 8.90 cfs @ 12.47 hrs, Volume= 1.686 af
Primary = 8.90 cfs @ 12.47 hrs, Volume= 1.686 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link Pre 1: Pre 1

Hydrograph



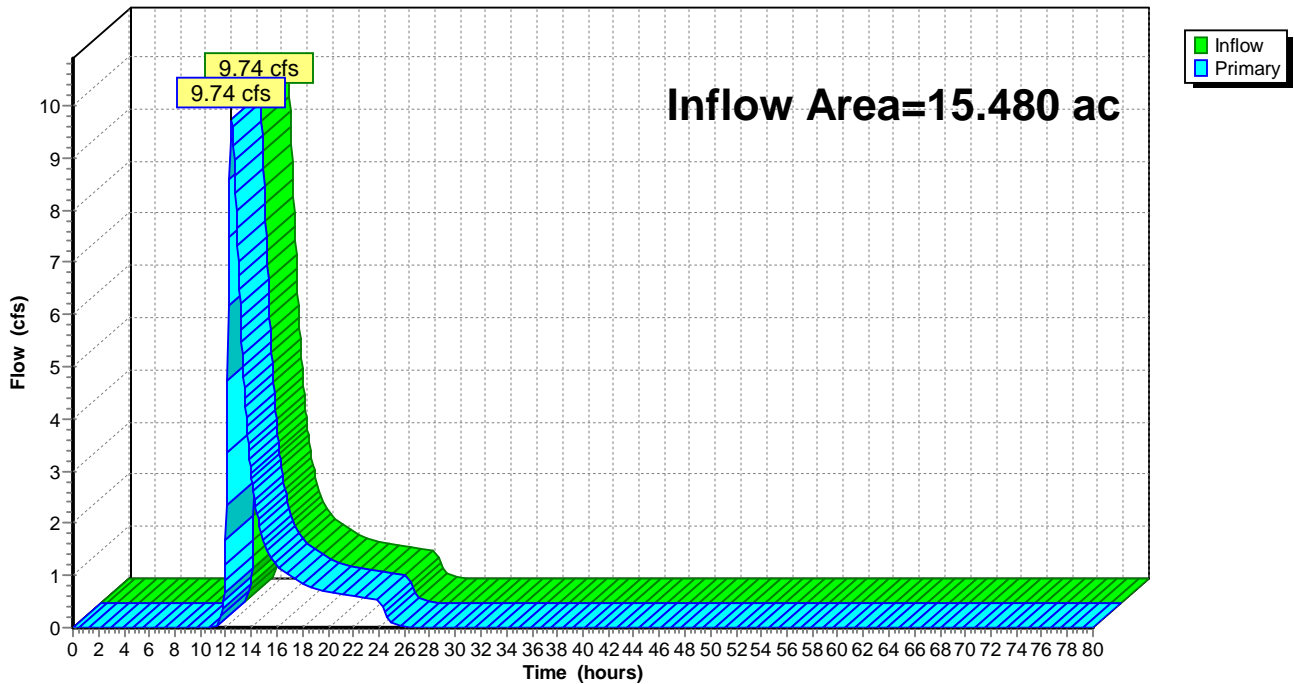
Summary for Link Total Pre: Total Pre

Inflow Area = 15.480 ac, 0.45% Impervious, Inflow Depth = 1.41" for 10 Yr event
Inflow = 9.74 cfs @ 12.44 hrs, Volume= 1.824 af
Primary = 9.74 cfs @ 12.44 hrs, Volume= 1.824 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link Total Pre: Total Pre

Hydrograph



Pre-Dev

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NOAA 24-hr C 100 Yr Rainfall=8.71"

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Page 19

Time span=0.00-80.00 hrs, dt=0.05 hrs, 1601 points
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Pre DA-2: Pre DA-2

Runoff Area=0.570 ac 0.00% Impervious Runoff Depth=3.52"
Flow Length=385' Tc=22.8 min CN=57 Runoff=1.04 cfs 0.167 af

Subcatchment Pre DA-3: Pre DA-3

Runoff Area=1.280 ac 3.91% Impervious Runoff Depth=3.76"
Flow Length=155' Tc=9.2 min UI Adjusted CN=59 Runoff=4.06 cfs 0.401 af

Subcatchment Pre-DA 1: Pre DA-1

Runoff Area=13.630 ac 0.15% Impervious Runoff Depth=3.99"
Flow Length=740' Tc=25.8 min CN=61 Runoff=26.87 cfs 4.537 af

Link Pre 1: Pre 1

Inflow=27.90 cfs 4.704 af
Primary=27.90 cfs 4.704 af

Link Total Pre: Total Pre

Inflow=30.59 cfs 5.105 af
Primary=30.59 cfs 5.105 af

Total Runoff Area = 15.480 ac Runoff Volume = 5.105 af Average Runoff Depth = 3.96"
99.55% Pervious = 15.410 ac 0.45% Impervious = 0.070 ac

Summary for Subcatchment Pre DA-2: Pre DA-2

Runoff = 1.04 cfs @ 12.39 hrs, Volume= 0.167 af, Depth= 3.52"

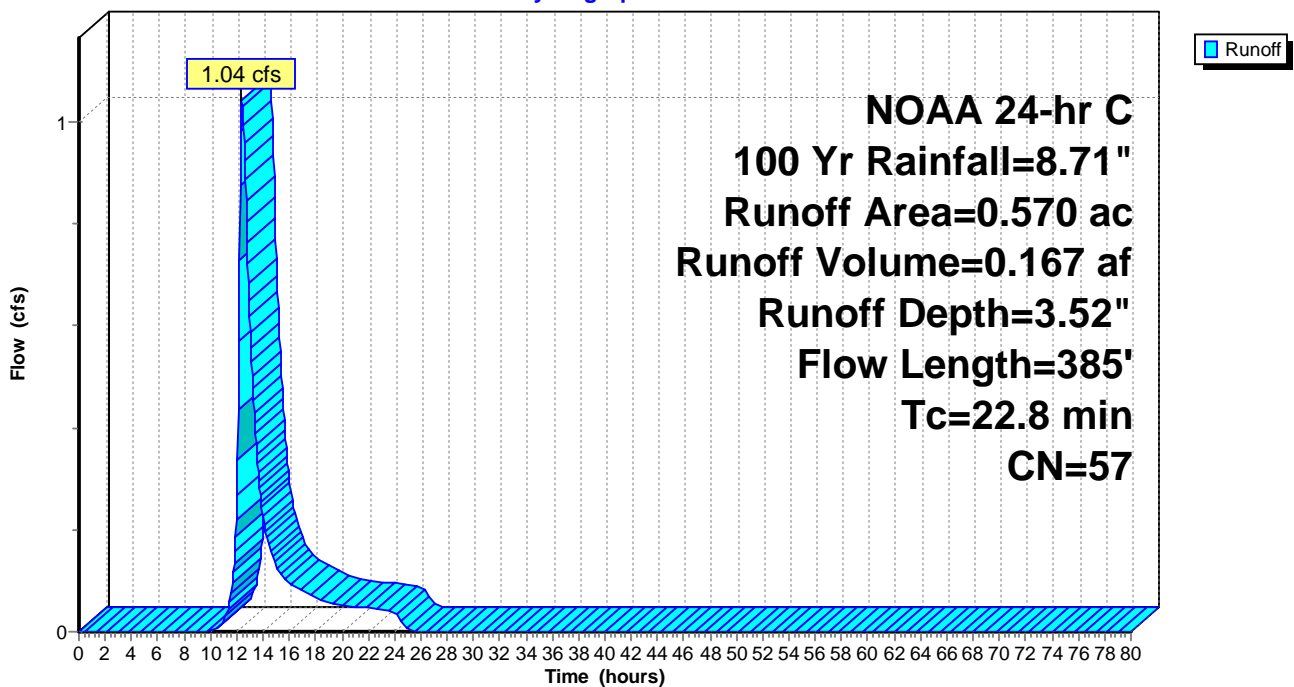
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 100 Yr Rainfall=8.71"

Area (ac)	CN	Description
0.210	55	Woods, Good, HSG B
0.360	58	Woods/grass comb., Good, HSG B
0.570	57	Weighted Average
0.570		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	70	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
10.6	30	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
2.4	100	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.6	185	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
22.8	385	Total			

Subcatchment Pre DA-2: Pre DA-2

Hydrograph



Summary for Subcatchment Pre DA-3: Pre DA-3

Runoff = 4.06 cfs @ 12.19 hrs, Volume= 0.401 af, Depth= 3.76"

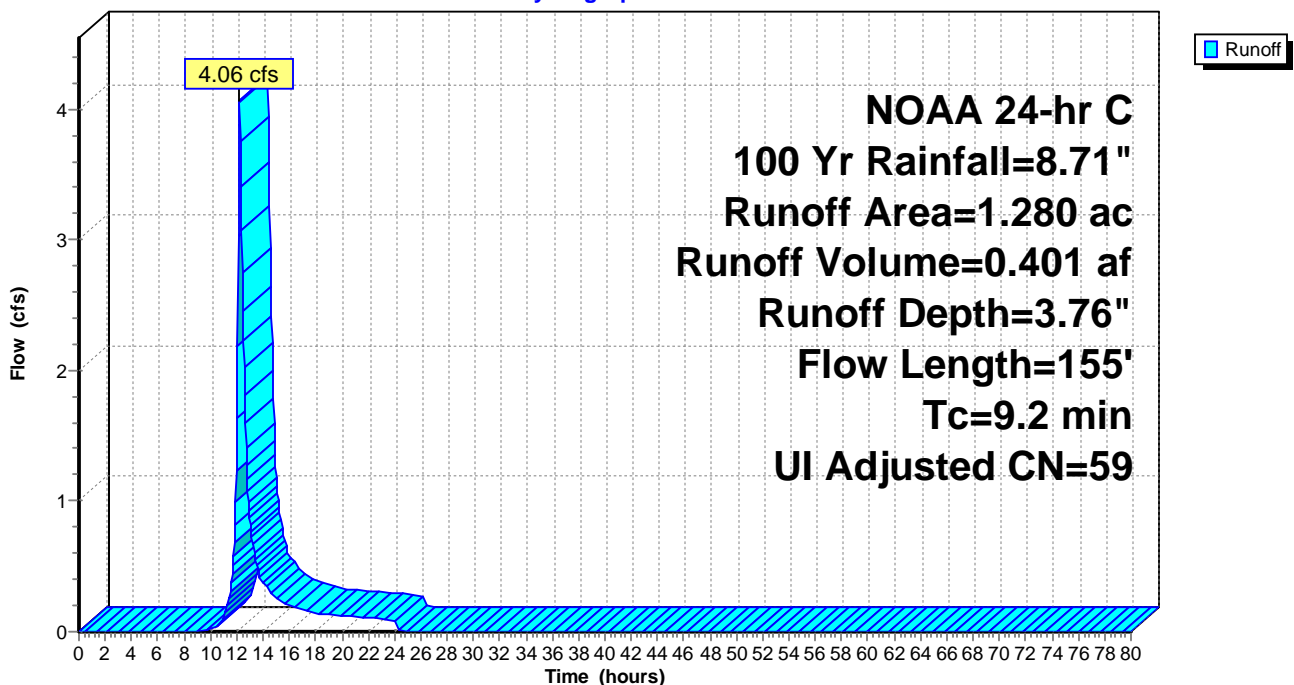
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 100 Yr Rainfall=8.71"

Area (ac)	CN	Adj	Description
0.750	55		Woods, Good, HSG B
0.420	58		Woods/grass comb., Good, HSG B
0.050	98		Unconnected roofs, HSG B
0.060	96		Gravel surface, HSG B
1.280	60	59	Weighted Average, UI Adjusted
1.230			96.09% Pervious Area
0.050			3.91% Impervious Area
0.050			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
1.0	55	0.0350	0.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.2	155	Total			

Subcatchment Pre DA-3: Pre DA-3

Hydrograph



Summary for Subcatchment Pre-DA 1: Pre DA-1

Runoff = 26.87 cfs @ 12.42 hrs, Volume= 4.537 af, Depth= 3.99"

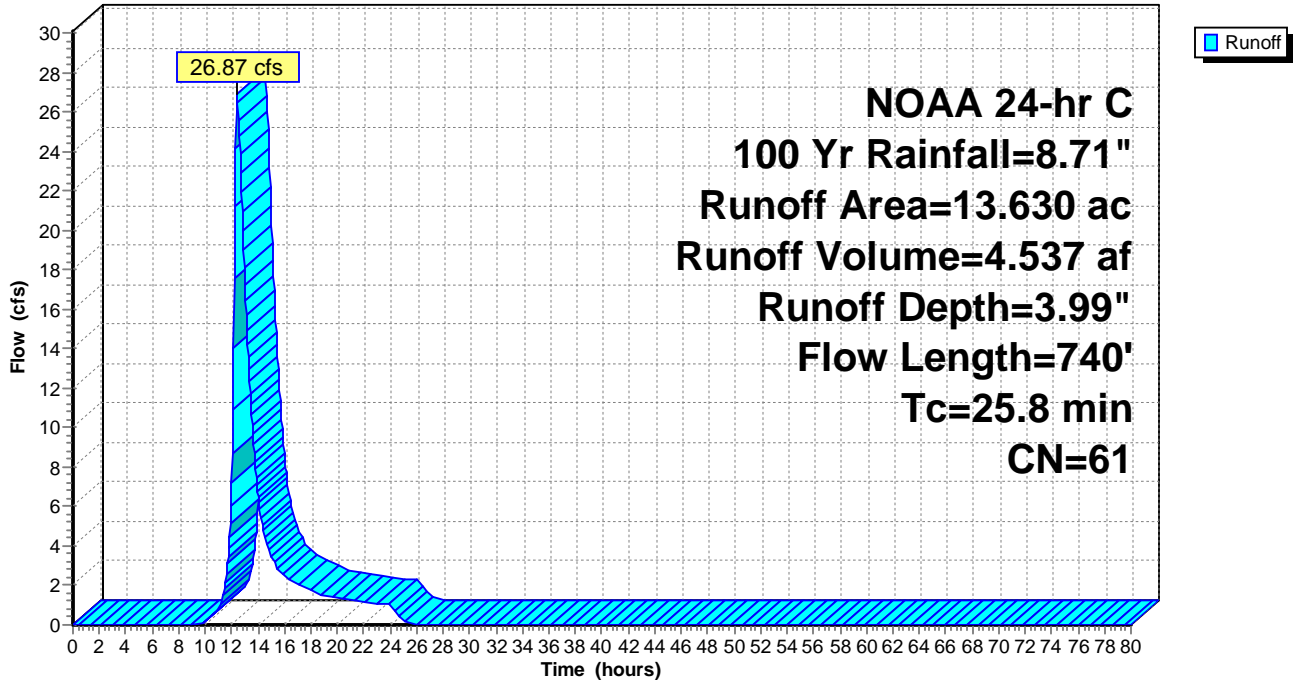
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 100 Yr Rainfall=8.71"

Area (ac)	CN	Description
4.920	55	Woods, Good, HSG B
0.020	98	Unconnected roofs, HSG B
1.480	96	Gravel surface, HSG B
7.210	58	Woods/grass comb., Good, HSG B
13.630	61	Weighted Average
13.610		99.85% Pervious Area
0.020		0.15% Impervious Area
0.020		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	100	0.0130	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
1.2	57	0.0130	0.80		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
4.5	253	0.0350	0.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
2.2	120	0.0170	0.91		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
6.4	210	0.0120	0.55		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
25.8	740	Total			

Subcatchment Pre-DA 1: Pre DA-1

Hydrograph



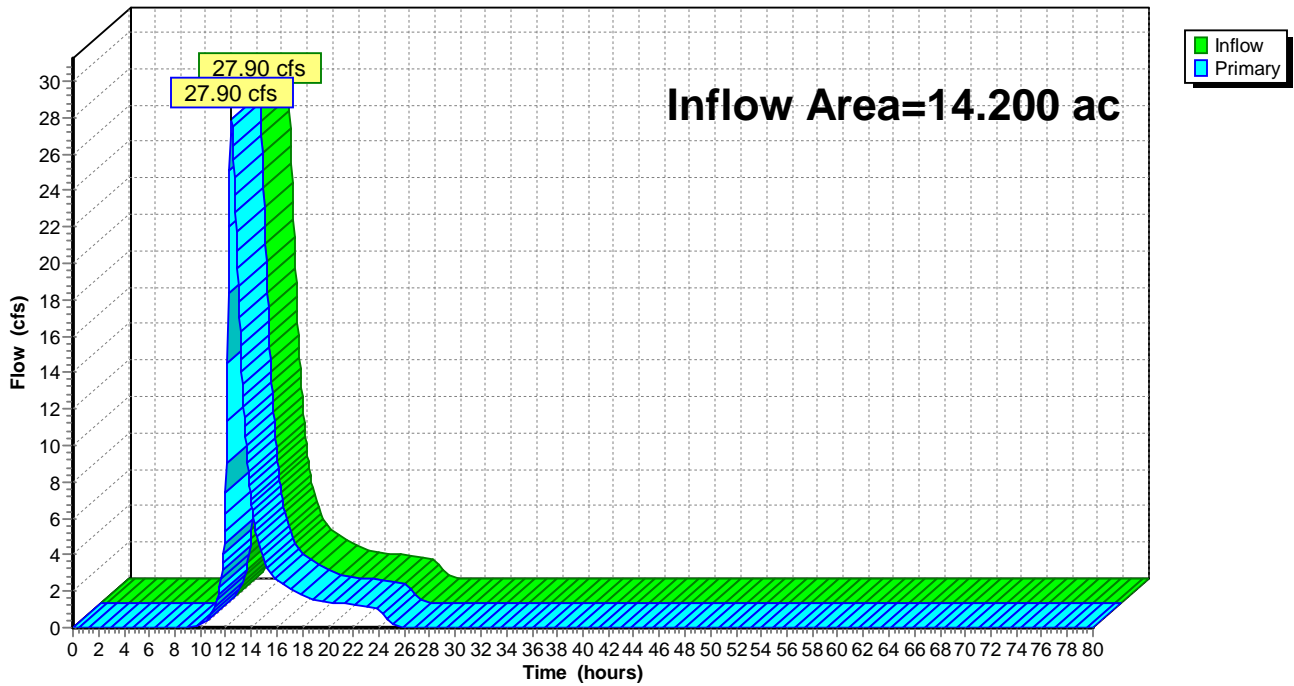
Summary for Link Pre 1: Pre 1

Inflow Area = 14.200 ac, 0.14% Impervious, Inflow Depth = 3.98" for 100 Yr event
Inflow = 27.90 cfs @ 12.42 hrs, Volume= 4.704 af
Primary = 27.90 cfs @ 12.42 hrs, Volume= 4.704 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link Pre 1: Pre 1

Hydrograph



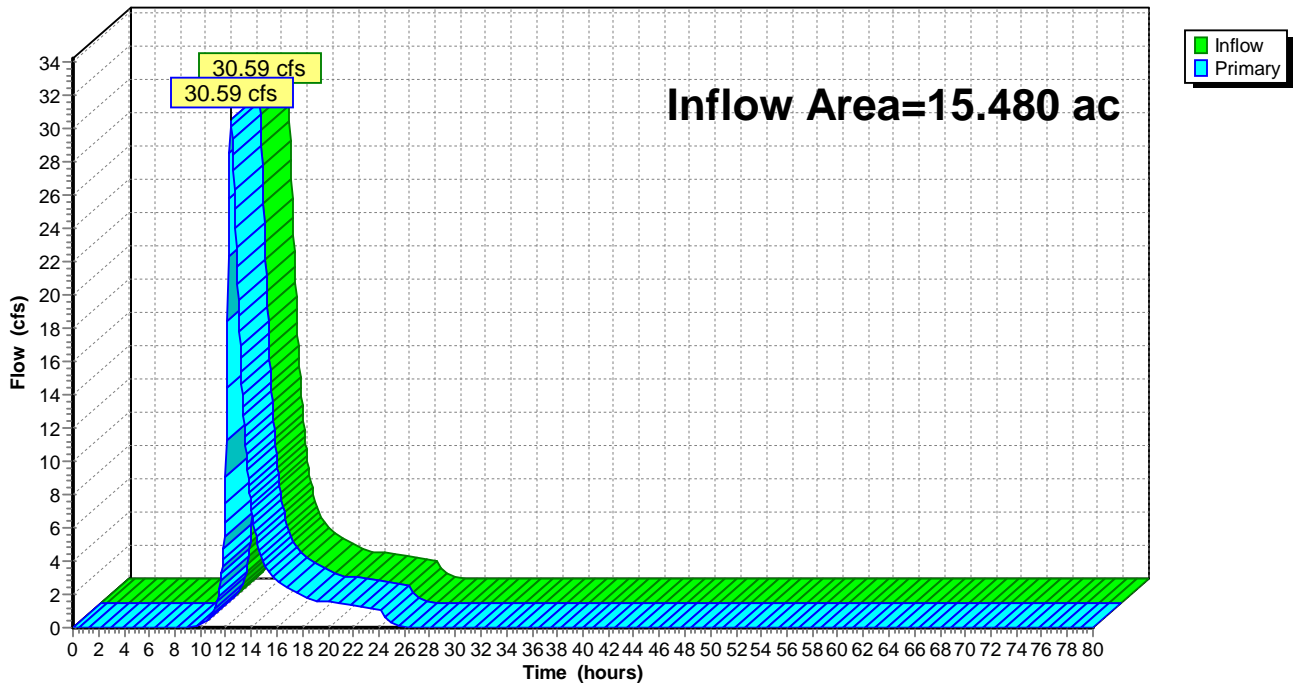
Summary for Link Total Pre: Total Pre

Inflow Area = 15.480 ac, 0.45% Impervious, Inflow Depth = 3.96" for 100 Yr event
Inflow = 30.59 cfs @ 12.40 hrs, Volume= 5.105 af
Primary = 30.59 cfs @ 12.40 hrs, Volume= 5.105 af, Atten= 0%, Lag= 0.0 min

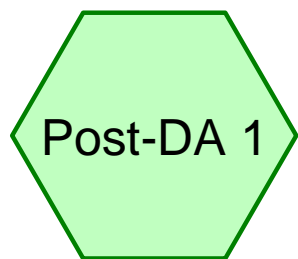
Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link Total Pre: Total Pre

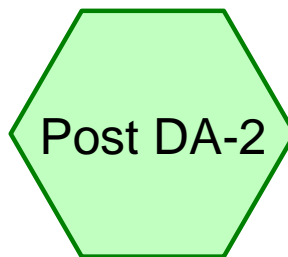
Hydrograph



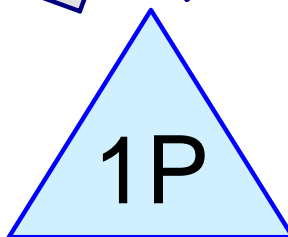
APPENDIX B
POST-DEVELOPED CALCULATIONS
2 YR. STORM
10 YR. STORM
100 YR. STORM



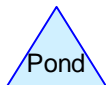
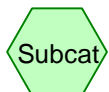
Post DA-1



Post DA-2



Basin



Routing Diagram for Post-Dev
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Post-Dev

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.920	79	<50% Grass cover, Poor, HSG B (Post-DA 1)
0.060	96	Gravel surface, HSG B (Post DA-2)
6.080	98	Paved parking, HSG B (Post-DA 1)
1.810	98	Unconnected roofs, HSG B (Post DA-2, Post-DA 1)
1.190	55	Woods, Good, HSG B (Post DA-2, Post-DA 1)
0.420	58	Woods/grass comb., Good, HSG B (Post DA-2)
15.480	86	TOTAL AREA

Post-Dev

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
15.480	HSG B	Post DA-2, Post-DA 1
0.000	HSG C	
0.000	HSG D	
0.000	Other	
15.480		TOTAL AREA

Post-Dev

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Page 4

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	5.920	0.000	0.000	0.000	5.920	<50% Grass cover, Poor	Post-DA 1
0.000	0.060	0.000	0.000	0.000	0.060	Gravel surface	Post DA-2
0.000	6.080	0.000	0.000	0.000	6.080	Paved parking	Post-DA 1
0.000	1.810	0.000	0.000	0.000	1.810	Unconnected roofs	Post DA-2, Post-DA 1
0.000	1.190	0.000	0.000	0.000	1.190	Woods, Good	Post DA-2, Post-DA 1
0.000	0.420	0.000	0.000	0.000	0.420	Woods/grass comb., Good	Post DA-2
0.000	15.480	0.000	0.000	0.000	15.480	TOTAL AREA	

Post-Dev

NOAA 24-hr C 2 Yr Rainfall=3.31"

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Page 5

Time span=0.00-75.00 hrs, dt=0.05 hrs, 1501 points x 3
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Post DA-2: Post DA-2

Runoff Area=1.280 ac 3.91% Impervious Runoff Depth=0.42"
Flow Length=155' Tc=9.2 min UI Adjusted CN=59 Runoff=0.26 cfs 0.044 af

Subcatchment Post-DA 1: Post DA-1

Runoff Area=14.200 ac 55.21% Impervious Runoff Depth=2.18"
Flow Length=945' Tc=25.9 min CN=89 Runoff=15.60 cfs 2.582 af

Pond 1P: Basin

Peak Elev=147.03' Storage=102,820 cf Inflow=15.84 cfs 2.627 af
Primary=0.28 cfs 1.238 af Secondary=0.00 cfs 0.000 af Outflow=0.28 cfs 1.238 af

Total Runoff Area = 15.480 ac Runoff Volume = 2.627 af Average Runoff Depth = 2.04"
49.03% Pervious = 7.590 ac 50.97% Impervious = 7.890 ac

Post-Dev

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NOAA 24-hr C 2 Yr Rainfall=3.31"

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Page 6

Summary for Subcatchment Post DA-2: Post DA-2

Runoff = 0.26 cfs @ 12.28 hrs, Volume= 0.044 af, Depth= 0.42"

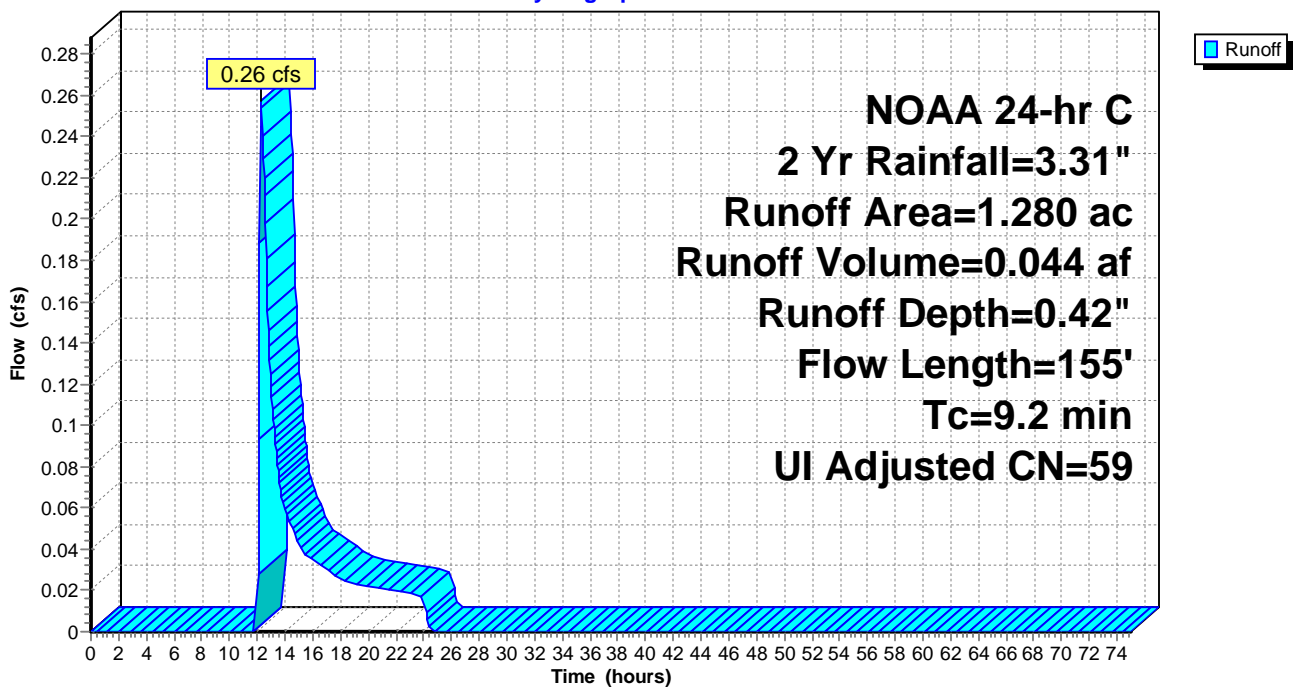
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 2 Yr Rainfall=3.31"

Area (ac)	CN	Adj	Description
0.750	55		Woods, Good, HSG B
0.420	58		Woods/grass comb., Good, HSG B
0.050	98		Unconnected roofs, HSG B
0.060	96		Gravel surface, HSG B
1.280	60	59	Weighted Average, UI Adjusted
1.230			96.09% Pervious Area
0.050			3.91% Impervious Area
0.050			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
1.0	55	0.0350	0.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.2	155	Total			

Subcatchment Post DA-2: Post DA-2

Hydrograph



Post-Dev

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NOAA 24-hr C 2 Yr Rainfall=3.31"

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Page 7

Summary for Subcatchment Post-DA 1: Post DA-1

Runoff = 15.60 cfs @ 12.41 hrs, Volume= 2.582 af, Depth= 2.18"

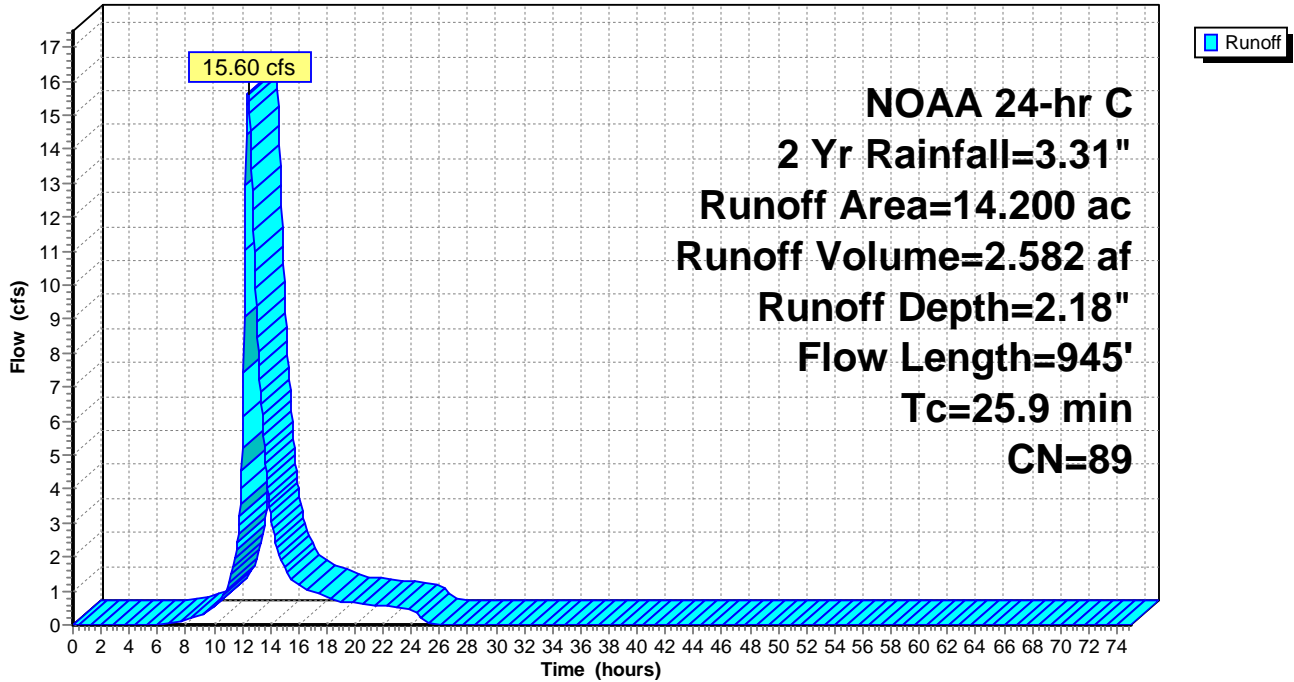
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2 Yr Rainfall=3.31"

Area (ac)	CN	Description
0.440	55	Woods, Good, HSG B
1.760	98	Unconnected roofs, HSG B
6.080	98	Paved parking, HSG B
5.920	79	<50% Grass cover, Poor, HSG B
14.200	89	Weighted Average
6.360		44.79% Pervious Area
7.840		55.21% Impervious Area
1.760		22.45% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	70	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
10.6	30	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
4.7	100	0.0200	0.35		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
1.7	85	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.8	100	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.9	560	0.0050	4.97	8.78	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
25.9	945	Total			

Subcatchment Post-DA 1: Post DA-1

Hydrograph



Summary for Pond 1P: Basin

Inflow Area = 15.480 ac, 50.97% Impervious, Inflow Depth = 2.04" for 2 Yr event
 Inflow = 15.84 cfs @ 12.41 hrs, Volume= 2.627 af
 Outflow = 0.28 cfs @ 24.46 hrs, Volume= 1.238 af, Atten= 98%, Lag= 723.5 min
 Primary = 0.28 cfs @ 24.46 hrs, Volume= 1.238 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 147.03' @ 24.46 hrs Surf.Area= 53,373 sf Storage= 102,820 cf

Plug-Flow detention time= 1,794.0 min calculated for 1.238 af (47% of inflow)
 Center-of-Mass det. time= 1,669.8 min (2,518.3 - 848.5)

Volume	Invert	Avail.Storage	Storage Description
#1	145.00'	321,757 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
145.00	47,757	0	0
146.00	50,484	49,121	49,121
147.00	53,276	51,880	101,001
148.00	56,130	54,703	155,704
149.00	59,048	57,589	213,293
150.00	62,030	60,539	273,832
150.50	63,545	31,394	305,225
150.75	68,708	16,532	321,757

Device	Routing	Invert	Outlet Devices
#1	Primary	145.00'	18.0" Round RCP_Round 18" L= 560.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 145.00' / 143.50' S= 0.0027 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf
#2	Device 1	147.50'	42.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	145.48'	3.0" Vert. Orifice/Grate C= 0.600
#4	Secondary	149.75'	40.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.28 cfs @ 24.46 hrs HW=147.03' (Free Discharge)

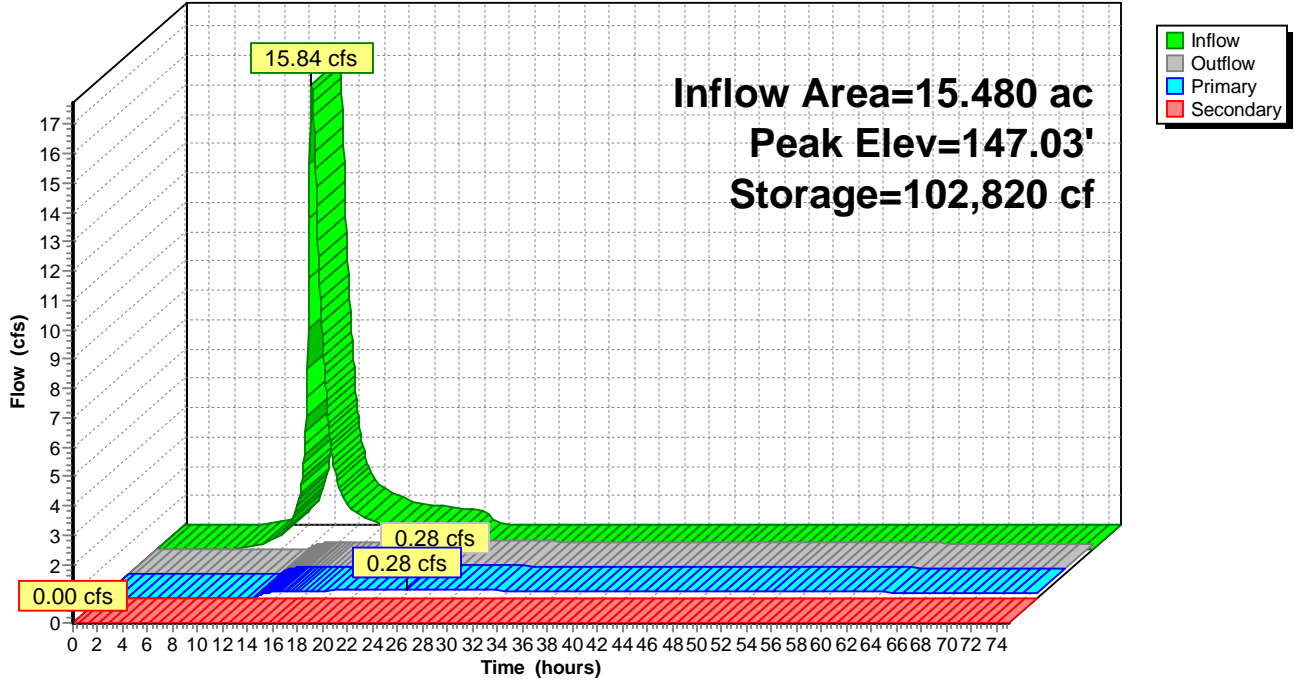
- ↑ **1=RCP_Round 18"** (Passes 0.28 cfs of 6.97 cfs potential flow)
- ↑ **2=Orifice/Grate** (Controls 0.00 cfs)
- ↑ **3=Orifice/Grate** (Orifice Controls 0.28 cfs @ 5.76 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=145.00' (Free Discharge)

- ↑ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Basin

Hydrograph



Post-Dev

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NOAA 24-hr C 10 Yr Rainfall=5.11"

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Page 11

Time span=0.00-75.00 hrs, dt=0.05 hrs, 1501 points x 3
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Post DA-2: Post DA-2

Runoff Area=1.280 ac 3.91% Impervious Runoff Depth=1.30"
Flow Length=155' Tc=9.2 min UI Adjusted CN=59 Runoff=1.26 cfs 0.138 af

Subcatchment Post-DA 1: Post DA-1

Runoff Area=14.200 ac 55.21% Impervious Runoff Depth=3.88"
Flow Length=945' Tc=25.9 min CN=89 Runoff=27.39 cfs 4.588 af

Pond 1P: Basin

Peak Elev=147.71' Storage=139,295 cf Inflow=28.33 cfs 4.727 af
Primary=4.91 cfs 2.916 af Secondary=0.00 cfs 0.000 af Outflow=4.91 cfs 2.916 af

Total Runoff Area = 15.480 ac Runoff Volume = 4.727 af Average Runoff Depth = 3.66"
49.03% Pervious = 7.590 ac 50.97% Impervious = 7.890 ac

Post-Dev

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NOAA 24-hr C 10 Yr Rainfall=5.11"

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Page 12

Summary for Subcatchment Post DA-2: Post DA-2

Runoff = 1.26 cfs @ 12.21 hrs, Volume= 0.138 af, Depth= 1.30"

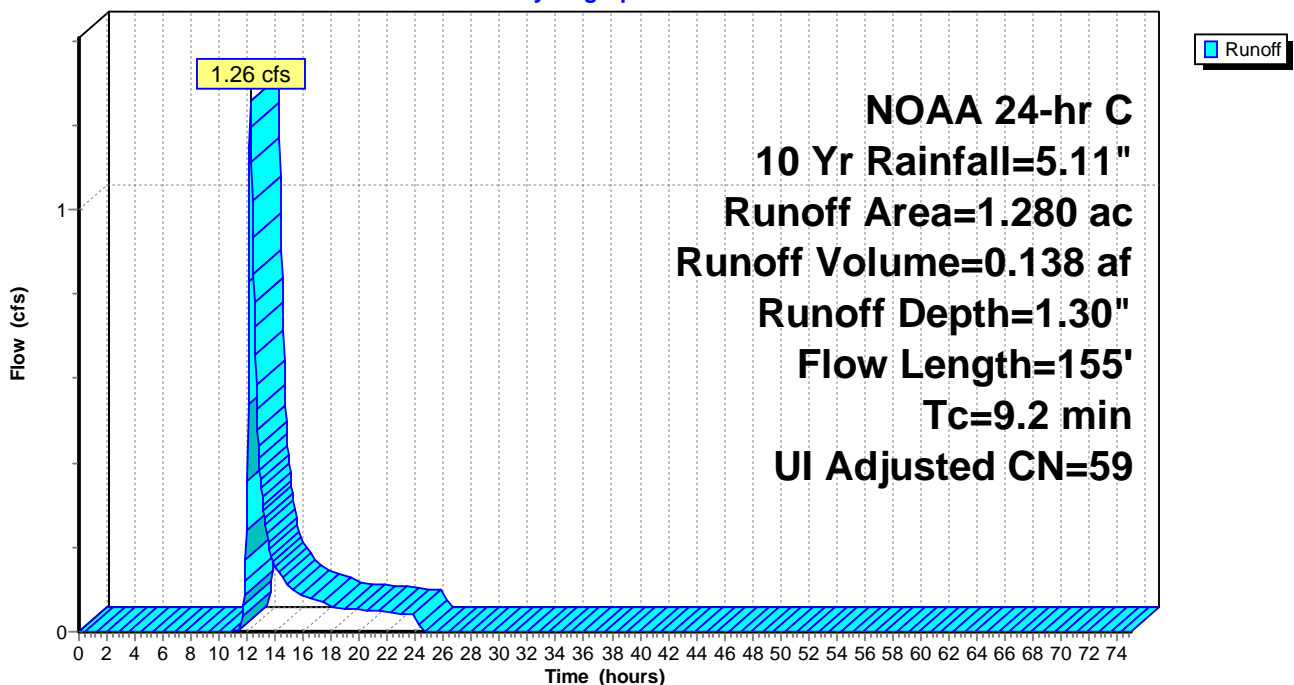
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 10 Yr Rainfall=5.11"

Area (ac)	CN	Adj	Description
0.750	55		Woods, Good, HSG B
0.420	58		Woods/grass comb., Good, HSG B
0.050	98		Unconnected roofs, HSG B
0.060	96		Gravel surface, HSG B
1.280	60	59	Weighted Average, UI Adjusted
1.230			96.09% Pervious Area
0.050			3.91% Impervious Area
0.050			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
1.0	55	0.0350	0.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.2	155	Total			

Subcatchment Post DA-2: Post DA-2

Hydrograph



Post-Dev

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NOAA 24-hr C 10 Yr Rainfall=5.11"

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Page 13

Summary for Subcatchment Post-DA 1: Post DA-1

Runoff = 27.39 cfs @ 12.40 hrs, Volume= 4.588 af, Depth= 3.88"

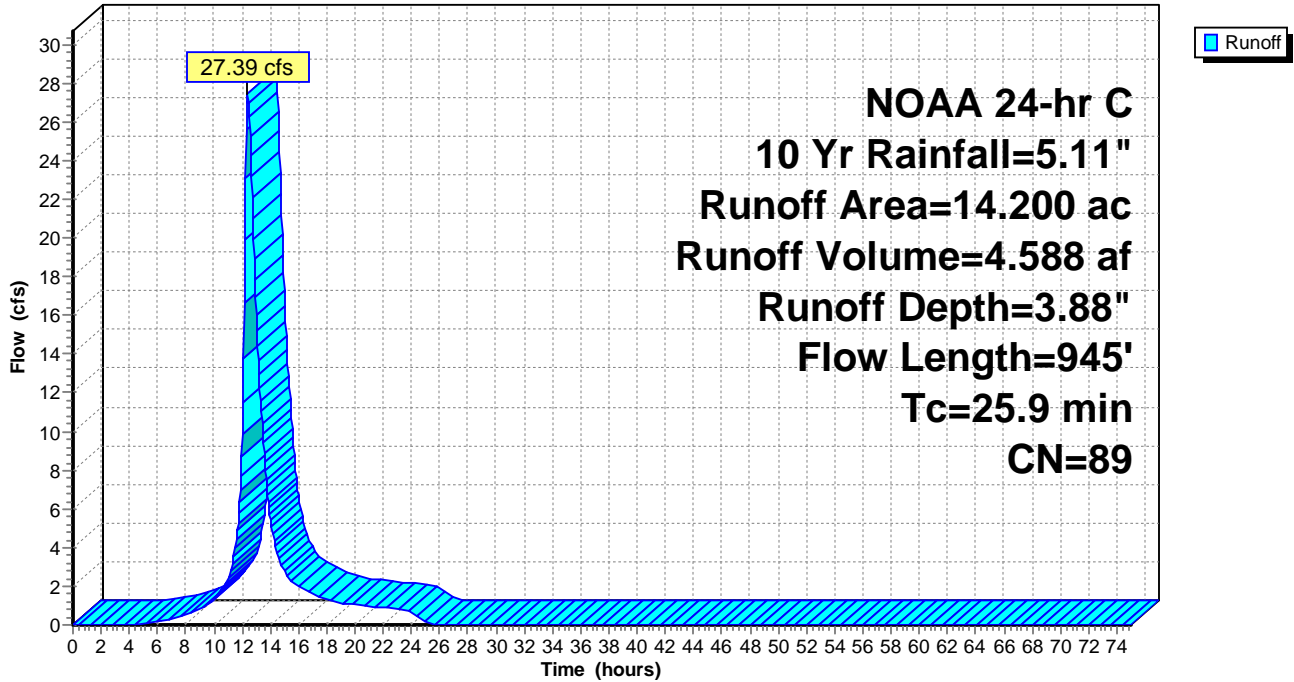
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10 Yr Rainfall=5.11"

Area (ac)	CN	Description
0.440	55	Woods, Good, HSG B
1.760	98	Unconnected roofs, HSG B
6.080	98	Paved parking, HSG B
5.920	79	<50% Grass cover, Poor, HSG B
14.200	89	Weighted Average
6.360		44.79% Pervious Area
7.840		55.21% Impervious Area
1.760		22.45% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	70	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
10.6	30	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
4.7	100	0.0200	0.35		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
1.7	85	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.8	100	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.9	560	0.0050	4.97	8.78	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
25.9	945	Total			

Subcatchment Post-DA 1: Post DA-1

Hydrograph



Summary for Pond 1P: Basin

Inflow Area = 15.480 ac, 50.97% Impervious, Inflow Depth = 3.66" for 10 Yr event
 Inflow = 28.33 cfs @ 12.39 hrs, Volume= 4.727 af
 Outflow = 4.91 cfs @ 14.15 hrs, Volume= 2.916 af, Atten= 83%, Lag= 105.5 min
 Primary = 4.91 cfs @ 14.15 hrs, Volume= 2.916 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 147.71' @ 14.15 hrs Surf.Area= 55,289 sf Storage= 139,295 cf

Plug-Flow detention time= 1,062.3 min calculated for 2.914 af (62% of inflow)
 Center-of-Mass det. time= 956.9 min (1,789.1 - 832.2)

Volume	Invert	Avail.Storage	Storage Description
#1	145.00'	321,757 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
145.00	47,757	0	0
146.00	50,484	49,121	49,121
147.00	53,276	51,880	101,001
148.00	56,130	54,703	155,704
149.00	59,048	57,589	213,293
150.00	62,030	60,539	273,832
150.50	63,545	31,394	305,225
150.75	68,708	16,532	321,757

Device	Routing	Invert	Outlet Devices
#1	Primary	145.00'	18.0" Round RCP_Round 18" L= 560.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 145.00' / 143.50' S= 0.0027 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf
#2	Device 1	147.50'	42.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	145.48'	3.0" Vert. Orifice/Grate C= 0.600
#4	Secondary	149.75'	40.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=4.91 cfs @ 14.15 hrs HW=147.71' (Free Discharge)

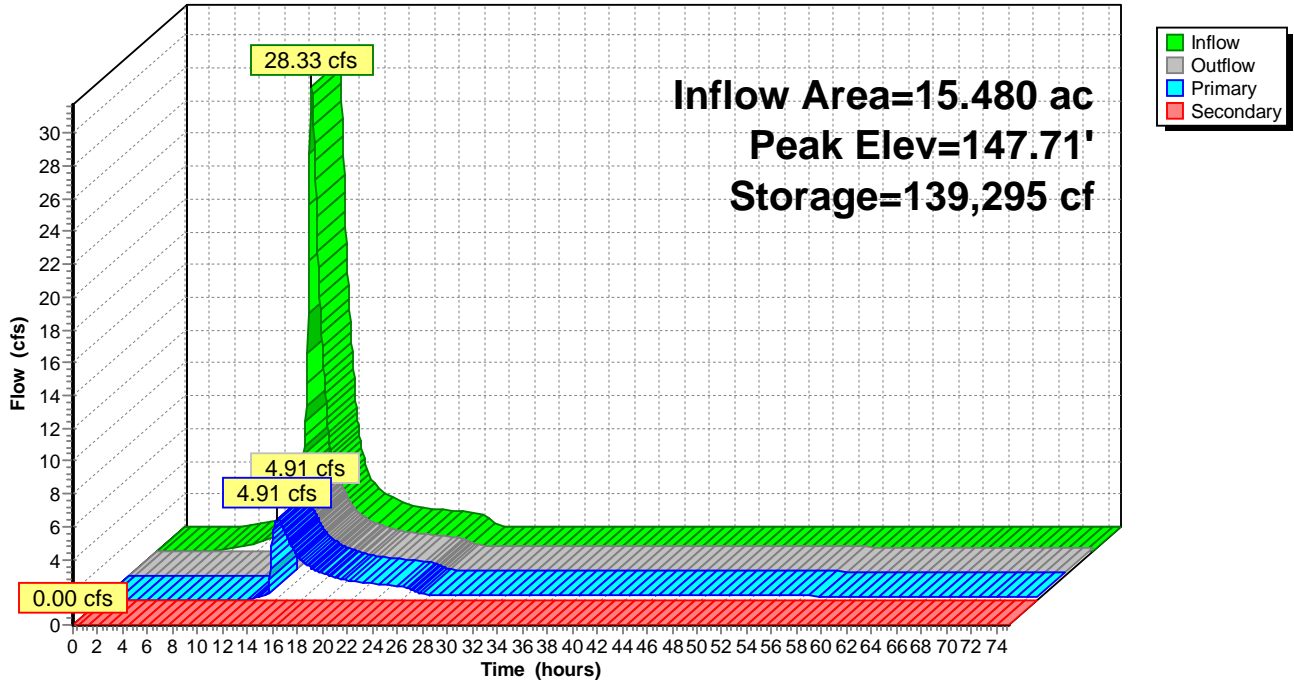
- ↑ **1=RCP_Round 18"** (Passes 4.91 cfs of 8.03 cfs potential flow)
- ↑ **2=Orifice/Grate** (Weir Controls 4.57 cfs @ 1.48 fps)
- ↑ **3=Orifice/Grate** (Orifice Controls 0.34 cfs @ 6.98 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=145.00' (Free Discharge)

- ↑ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Basin

Hydrograph



Post-Dev

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NOAA 24-hr C 100 Yr Rainfall=8.71"

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Page 17

Time span=0.00-75.00 hrs, dt=0.05 hrs, 1501 points x 3
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Post DA-2: Post DA-2

Runoff Area=1.280 ac 3.91% Impervious Runoff Depth=3.76"
Flow Length=155' Tc=9.2 min UI Adjusted CN=59 Runoff=4.06 cfs 0.401 af

Subcatchment Post-DA 1: Post DA-1

Runoff Area=14.200 ac 55.21% Impervious Runoff Depth=7.38"
Flow Length=945' Tc=25.9 min CN=89 Runoff=50.85 cfs 8.738 af

Pond 1P: Basin

Peak Elev=149.39' Storage=236,442 cf Inflow=53.66 cfs 9.139 af
Primary=10.23 cfs 7.319 af Secondary=0.00 cfs 0.000 af Outflow=10.23 cfs 7.319 af

Total Runoff Area = 15.480 ac Runoff Volume = 9.139 af Average Runoff Depth = 7.08"
49.03% Pervious = 7.590 ac 50.97% Impervious = 7.890 ac

Post-Dev

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NOAA 24-hr C 100 Yr Rainfall=8.71"

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Page 18

Summary for Subcatchment Post DA-2: Post DA-2

Runoff = 4.06 cfs @ 12.19 hrs, Volume= 0.401 af, Depth= 3.76"

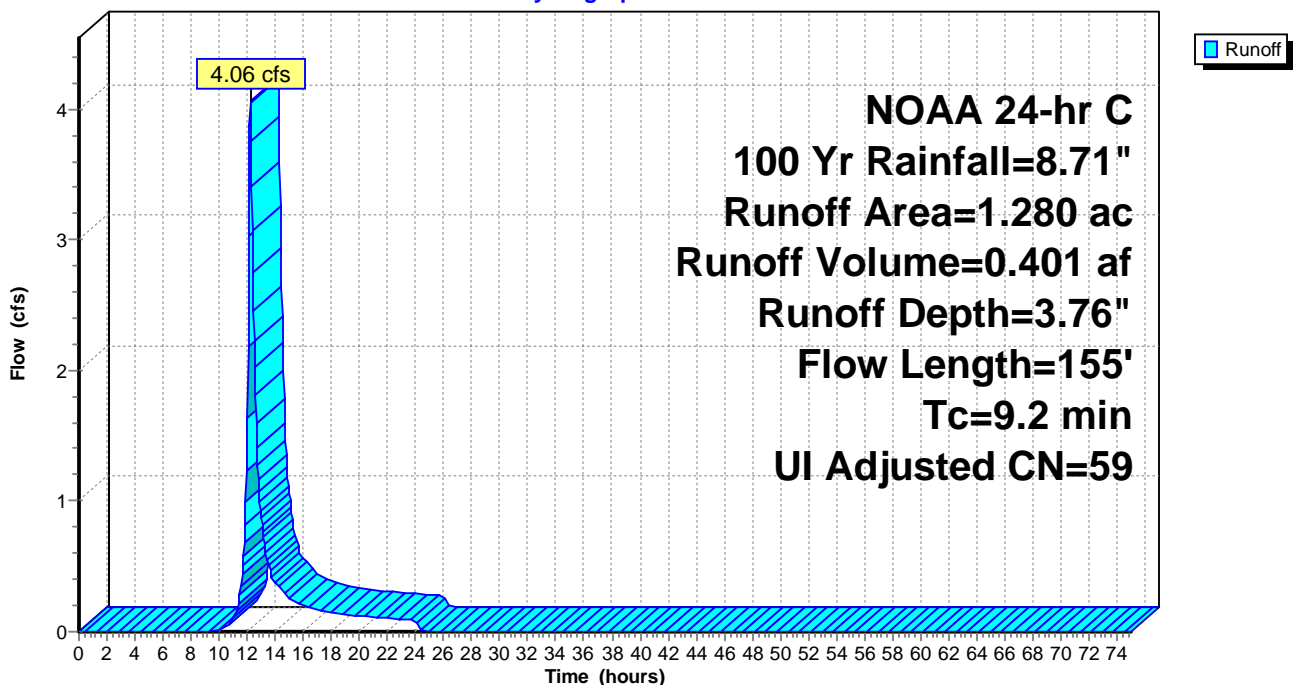
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 100 Yr Rainfall=8.71"

Area (ac)	CN	Adj	Description
0.750	55		Woods, Good, HSG B
0.420	58		Woods/grass comb., Good, HSG B
0.050	98		Unconnected roofs, HSG B
0.060	96		Gravel surface, HSG B
1.280	60	59	Weighted Average, UI Adjusted
1.230			96.09% Pervious Area
0.050			3.91% Impervious Area
0.050			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
1.0	55	0.0350	0.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.2	155	Total			

Subcatchment Post DA-2: Post DA-2

Hydrograph



Post-Dev

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NOAA 24-hr C 100 Yr Rainfall=8.71"

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Page 19

Summary for Subcatchment Post-DA 1: Post DA-1

Runoff = 50.85 cfs @ 12.39 hrs, Volume= 8.738 af, Depth= 7.38"

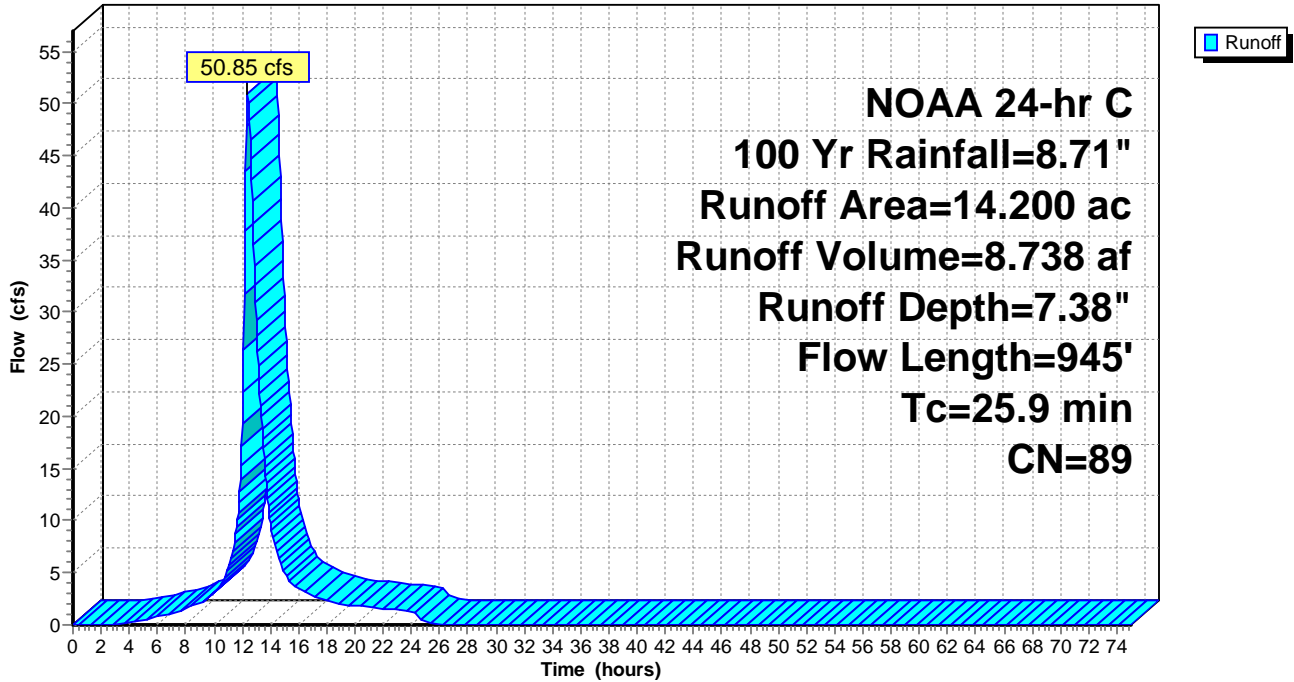
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 100 Yr Rainfall=8.71"

Area (ac)	CN	Description
0.440	55	Woods, Good, HSG B
1.760	98	Unconnected roofs, HSG B
6.080	98	Paved parking, HSG B
5.920	79	<50% Grass cover, Poor, HSG B
14.200	89	Weighted Average
6.360		44.79% Pervious Area
7.840		55.21% Impervious Area
1.760		22.45% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	70	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
10.6	30	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
4.7	100	0.0200	0.35		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
1.7	85	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.8	100	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.9	560	0.0050	4.97	8.78	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
25.9	945	Total			

Subcatchment Post-DA 1: Post DA-1

Hydrograph



Summary for Pond 1P: Basin

Inflow Area = 15.480 ac, 50.97% Impervious, Inflow Depth = 7.08" for 100 Yr event
 Inflow = 53.66 cfs @ 12.38 hrs, Volume= 9.139 af
 Outflow = 10.23 cfs @ 13.99 hrs, Volume= 7.319 af, Atten= 81%, Lag= 96.3 min
 Primary = 10.23 cfs @ 13.99 hrs, Volume= 7.319 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 149.39' @ 13.99 hrs Surf.Area= 60,206 sf Storage= 236,442 cf

Plug-Flow detention time= 563.2 min calculated for 7.314 af (80% of inflow)
 Center-of-Mass det. time= 486.2 min (1,300.8 - 814.6)

Volume	Invert	Avail.Storage	Storage Description
#1	145.00'	321,757 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
145.00	47,757	0	0
146.00	50,484	49,121	49,121
147.00	53,276	51,880	101,001
148.00	56,130	54,703	155,704
149.00	59,048	57,589	213,293
150.00	62,030	60,539	273,832
150.50	63,545	31,394	305,225
150.75	68,708	16,532	321,757

Device	Routing	Invert	Outlet Devices
#1	Primary	145.00'	18.0" Round RCP_Round 18" L= 560.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 145.00' / 143.50' S= 0.0027 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf
#2	Device 1	147.50'	42.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	145.48'	3.0" Vert. Orifice/Grate C= 0.600
#4	Secondary	149.75'	40.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=10.23 cfs @ 13.99 hrs HW=149.39' (Free Discharge)

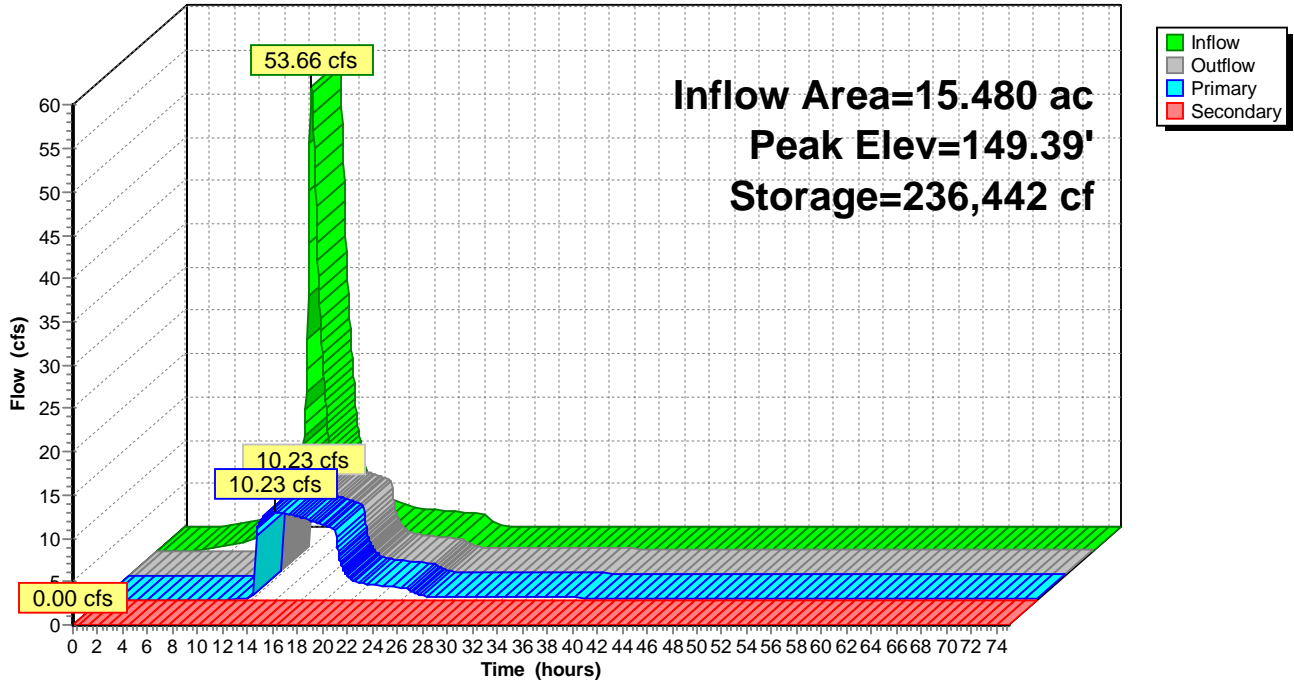
- ↑ 1=RCP_Round 18" (Barrel Controls 10.23 cfs @ 5.79 fps)
- ↑ 2=Orifice/Grate (Passes < 92.63 cfs potential flow)
- ↑ 3=Orifice/Grate (Passes < 0.46 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=145.00' (Free Discharge)

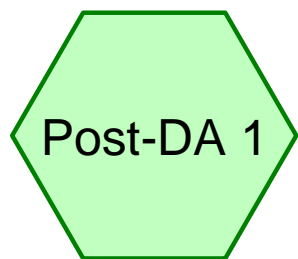
- ↑ 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 1P: Basin

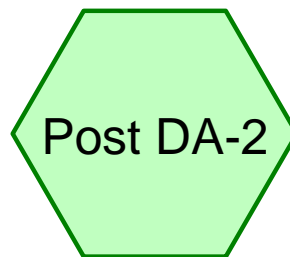
Hydrograph



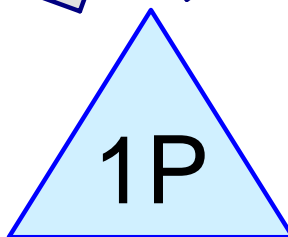
APPENDIX C
WATER QUALITY
CALCULATIONS
(N.J.A.C. 7:8)



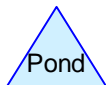
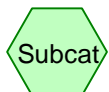
Post DA-1



Post DA-2



Basin



Routing Diagram for Post-Dev
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Post-Dev

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.920	79	<50% Grass cover, Poor, HSG B (Post-DA 1)
0.060	96	Gravel surface, HSG B (Post DA-2)
6.080	98	Paved parking, HSG B (Post-DA 1)
1.810	98	Unconnected roofs, HSG B (Post DA-2, Post-DA 1)
1.190	55	Woods, Good, HSG B (Post DA-2, Post-DA 1)
0.420	58	Woods/grass comb., Good, HSG B (Post DA-2)
15.480	86	TOTAL AREA

Post-Dev

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
15.480	HSG B	Post DA-2, Post-DA 1
0.000	HSG C	
0.000	HSG D	
0.000	Other	
15.480		TOTAL AREA

Post-Dev

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Page 4

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	5.920	0.000	0.000	0.000	5.920	<50% Grass cover, Poor	Post-DA 1
0.000	0.060	0.000	0.000	0.000	0.060	Gravel surface	Post DA-2
0.000	6.080	0.000	0.000	0.000	6.080	Paved parking	Post-DA 1
0.000	1.810	0.000	0.000	0.000	1.810	Unconnected roofs	Post DA-2, Post-DA 1
0.000	1.190	0.000	0.000	0.000	1.190	Woods, Good	Post DA-2, Post-DA 1
0.000	0.420	0.000	0.000	0.000	0.420	Woods/grass comb., Good	Post DA-2
0.000	15.480	0.000	0.000	0.000	15.480	TOTAL AREA	

Post-Dev

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NJ DEP 2-hr WQ Rainfall=1.25"

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Page 5

Time span=0.00-75.00 hrs, dt=0.05 hrs, 1501 points x 3
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Post DA-2: Post DA-2

Runoff Area=1.280 ac 3.91% Impervious Runoff Depth=0.00"
Flow Length=155' Tc=9.2 min UI Adjusted CN=59 Runoff=0.00 cfs 0.000 af

Subcatchment Post-DA 1: Post DA-1

Runoff Area=14.200 ac 55.21% Impervious Runoff Depth=0.45"
Flow Length=945' Tc=25.9 min CN=89 Runoff=6.05 cfs 0.532 af

Pond 1P: Basin

Peak Elev=145.48' Storage=23,154 cf Inflow=6.05 cfs 0.532 af
Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 15.480 ac Runoff Volume = 0.532 af Average Runoff Depth = 0.41"
49.03% Pervious = 7.590 ac 50.97% Impervious = 7.890 ac

Post-Dev

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NJ DEP 2-hr WQ Rainfall=1.25"

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Page 6

Summary for Subcatchment Post DA-2: Post DA-2

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

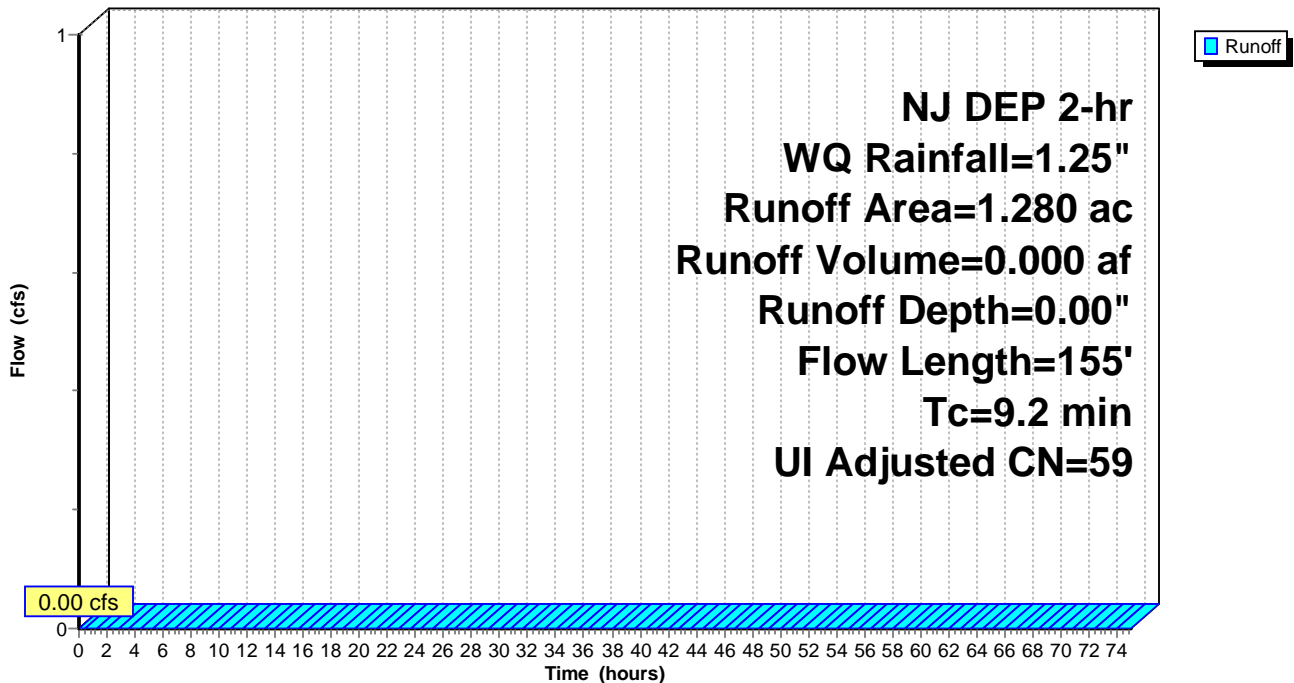
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs
 NJ DEP 2-hr WQ Rainfall=1.25"

Area (ac)	CN	Adj	Description
0.750	55		Woods, Good, HSG B
0.420	58		Woods/grass comb., Good, HSG B
0.050	98		Unconnected roofs, HSG B
0.060	96		Gravel surface, HSG B
1.280	60	59	Weighted Average, UI Adjusted
1.230			96.09% Pervious Area
0.050			3.91% Impervious Area
0.050			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
1.0	55	0.0350	0.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.2	155	Total			

Subcatchment Post DA-2: Post DA-2

Hydrograph



Post-Dev

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NJ DEP 2-hr WQ Rainfall=1.25"

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Page 7

Summary for Subcatchment Post-DA 1: Post DA-1

Runoff = 6.05 cfs @ 1.43 hrs, Volume= 0.532 af, Depth= 0.45"

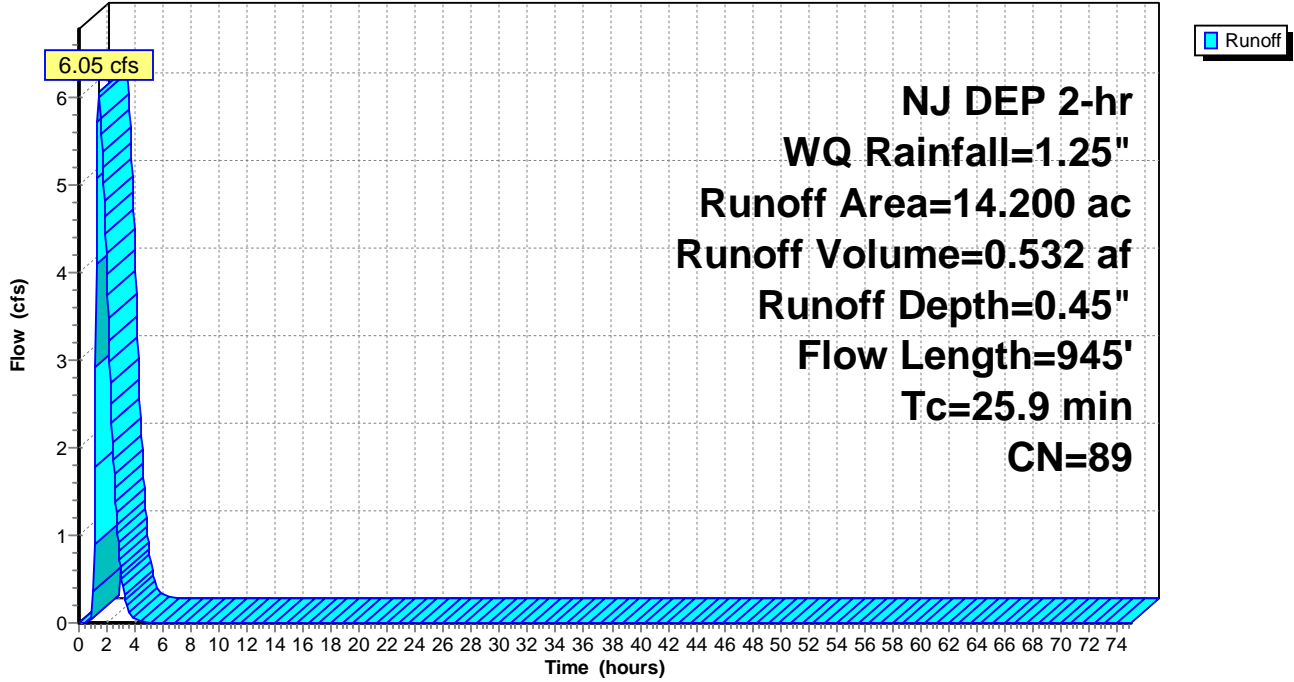
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr WQ Rainfall=1.25"

Area (ac)	CN	Description
0.440	55	Woods, Good, HSG B
1.760	98	Unconnected roofs, HSG B
6.080	98	Paved parking, HSG B
5.920	79	<50% Grass cover, Poor, HSG B
14.200	89	Weighted Average
6.360		44.79% Pervious Area
7.840		55.21% Impervious Area
1.760		22.45% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	70	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
10.6	30	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
4.7	100	0.0200	0.35		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
1.7	85	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.8	100	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.9	560	0.0050	4.97	8.78	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
25.9	945	Total			

Subcatchment Post-DA 1: Post DA-1

Hydrograph



Post-Dev

Prepared by DEWBERRY

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NJ DEP 2-hr WQ Rainfall=1.25"

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Page 9

Summary for Pond 1P: Basin

Inflow Area = 15.480 ac, 50.97% Impervious, Inflow Depth = 0.41" for WQ event
 Inflow = 6.05 cfs @ 1.43 hrs, Volume= 0.532 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 145.48' @ 4.90 hrs Surf.Area= 49,061 sf Storage= 23,154 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	145.00'	321,757 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
145.00	47,757	0	0
146.00	50,484	49,121	49,121
147.00	53,276	51,880	101,001
148.00	56,130	54,703	155,704
149.00	59,048	57,589	213,293
150.00	62,030	60,539	273,832
150.50	63,545	31,394	305,225
150.75	68,708	16,532	321,757

Device	Routing	Invert	Outlet Devices
#1	Primary	145.00'	18.0" Round RCP_Round 18" L= 560.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 145.00' / 143.50' S= 0.0027 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf
#2	Device 1	147.50'	42.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	145.48'	3.0" Vert. Orifice/Grate C= 0.600
#4	Secondary	149.75'	40.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=145.00' (Free Discharge)

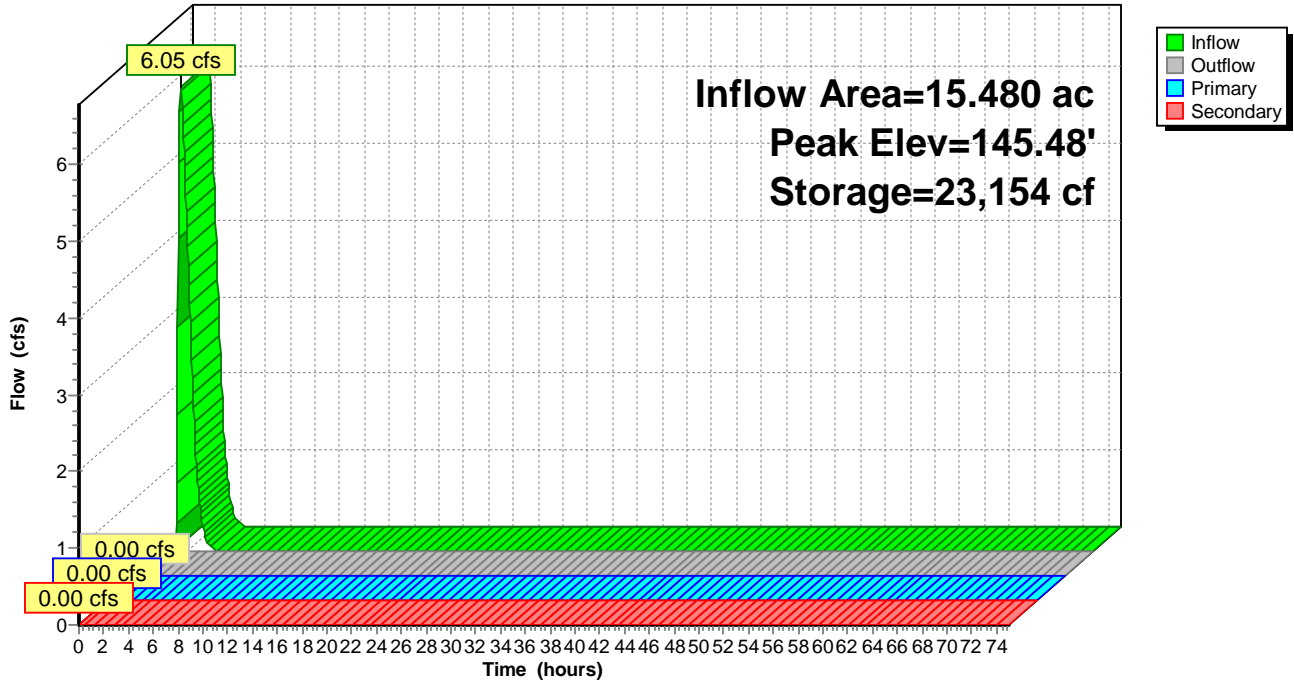
- ↑ 1=RCP_Round 18" (Controls 0.00 cfs)
- ↑ 2=Orifice/Grate (Controls 0.00 cfs)
- ↑ 3=Orifice/Grate (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=145.00' (Free Discharge)

- ↑ 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 1P: Basin

Hydrograph



APPENDIX D
GROUNDWATER RECHARGE

Annual Groundwater Recharge Analysis (based on GSR-32)

Select Township ↓ GLoucester Co., Monroe TWP	Average Annual P (in) 44.0	Climatic Factor 1.36
--------------------------------------------------------	--------------------------------------	--------------------------------

Project Name:	Peach Country
Description:	Basin 1
Analysis Date:	11/23/20

Pre-Developed Conditions					
Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	5.13	Woods	Aura	11.8	220,193
2	1.5	Impervious areas	Aura	0.0	-
3	7.57	Open space	Aura	12.1	331,662
4	0				
5	0				
6	0				
7	0				
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =				14.2	
				Total Annual Recharge (in)	10.7
				Total Annual Recharge (cu-ft)	551,855

Post-Developed Conditions					
Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	0.44	Woods	Aura	11.8	18,886
2	7.84	Impervious areas	Aura	0.0	-
3	5.92	Open space	Aura	12.1	259,371
4	0				
5	0				
6	0				
7	0				
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =				14.2	
				Total Annual Recharge (in)	5.4
				Total Annual Recharge (cu-ft)	278,257

Procedure to fill the Pre-Development and Post-Development Conditions Tables

For each land segment, first enter the area, then select TR-55 Land Cover, then select Soil. Start from the top of the table and proceed downward. Don't leave blank rows (with A=0) in between your segment entries. Rows with A=0 will not be displayed or used in calculations. For impervious areas outside of standard lots select "Impervious Areas" as the Land Cover. Soil type for impervious areas are only required if an infiltration facility will be built within these areas.

Annual Recharge Requirements Calculation			
% of Pre-Developed Annual Recharge to Preserve =	100%	Total Impervious Area (sq.ft)	341,510
Post-Development Annual Recharge Deficit= 273,598 (cubic feet)			
Recharge Efficiency Parameters Calculations (area averages)			
RWC= 3.56 (in)	DRWC= 3.56 (in)		
ERWC= 1.14 (in)	EDRWC= 1.14 (in)		

Project Name		Description	Basin 1	Analysis Date	11/23/20	BMP or LID Type	Infiltration Basins
---------------------	--	--------------------	---------	----------------------	----------	------------------------	---------------------

Recharge BMP Input Parameters				Root Zone Water Capacity Calculated Parameters				Recharge Design Parameters			
Parameter	Symbol	Value	Unit	Parameter	Symbol	Value	Unit	Parameter	Symbol	Value	Unit
BMP Area	ABMP	48051.1	sq.ft	Empty Portion of R/WC under Post-D Natural Recharge	ERWC	1.47	in	Inches of Runoff to capture	Qdesign	0.43	in
BMP Effective Depth, this is the design variable Upper level of the BMP surface (negative if above ground)	dBMP	3.0	in	ERWC Modified to consider dEXC	EDRWC	1.47	in	Inches of Rainfall to capture	Pdesign	0.54	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	-3.0	in	Empty Portion of R/WC under Infiltr. BMP	RERWC	1.21	in	Recharge Provided Avg. over Imp. Area		9.6	in
Post-development Land Segment Location of BMP, Input Zero if Location is distributed or undetermined	SegBMP	3	unitless					Runoff Captured Avg. over imp. Area		21.0	in

Parameters from Annual Recharge Worksheet				BMP Calculated Size Parameters				CALCULATION CHECK MESSAGES			
Parameter	Symbol	Value	Unit	Parameter	Symbol	Value	Unit	Parameter	Symbol	Value	Unit
Post-D Deficit Recharge (or desired recharge volume)	Vdef	273,598	cu.ft	ABMP/Aimp	Aratio	0.14	unitless	Volume Balance-->		OK	
Post-D Impervious Area (or target Impervious Area)	Aimp	341,510	sq.ft	BMP Volume	VBMP	12,013	cu.ft	BMP Check-->		OK	
Root Zone Water Capacity	RWC	4.59	in	Annual BMP Recharge Volume		273,598	cu.ft	dEXC Check-->		OK	
RWC Modified to consider dEXC	DRWC	4.59	in	Avg BMP Recharge		45.8%	%	BMP Location-->		OK	
Climatic Factor	C-factor	1.36	no units	%Rainfall became Runoff		77.6%	%	OTHER NOTES			
Average Annual P	Pavg	44.0	in	%Runoff Infiltrated		61.6%	%	Design is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensitive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses			
Recharge Requirement over Imp. Area	dr	9.6	in	%Runoff Recharged		28.2%	%				
				%Rainfall Recharged		21.8%	%				

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP. To solve for a smaller BMP or a LID-IIMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration click the "Default Vdef & Aimp" button.

APPENDIX E
SOIL EROSION AND SEDIMENT CONTROL
DESIGN CALCULATIONS
CONDUIT OUTLET PROTECTION
EMERGENCY SPILLWAY STABILITY

Conduit Outlet Protection:

Design in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey

1 Headwall #A-1

USE RIP RAP APRON

Discharge Flow, $Q_{25} = 8.28$ cfs

Maximum Inside Culvert Depth, $D_o = 30$ inches or **2.50** feet

Maximum Inside Culvert Width, $W_o = 30$ inches or **2.50** feet

Tailwater Depth, TW (Assume TW = $0.2D_o = 0.2 \times 2.50$ ft.) = **0.50** feet

Unit Discharge, $q = Q/W_o = 3.31$ cfs

Since $T_w < \frac{1}{2}D_o$: Length of Apron, $L_a = \frac{1.8q}{D_o^{1/2}} + 7D_o$

Width of Apron, $W = 3W_o + L_a$

Median Stone Diameter, $d_{50} = 0.016T_w \times (Q/D_o)^{4/3}$

Results: $L_a = 21.27$ ft. $W = 28.77$ ft. $d_{50} = 0.16$ ft.

Use a 21.50 ft. x 29.00 ft. rip-rap apron with $d_{50} = 6"$ at a thickness of 12" w/underlying filter fabric

Conduit Outlet Protection

Design in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey

1 Headwall #B-1

USE RIP RAP APRON

Discharge Flow, $Q_{25} = 10.71$ cfs

Maximum Inside Culvert Depth, $D_o = 36$ inches or **3.00** feet

Maximum Inside Culvert Width, $W_o = 36$ inches or **3.00** feet

Tailwater Depth, TW (Assume TW = $0.2D_o = 0.2 \times 3.0$ ft.) = **0.60** feet

Unit Discharge, $q = Q/W_o = 3.57$ cfs

Since $T_w < \frac{1}{2}D_o$: Length of Apron, $L_a = \frac{1.8q}{D_o^{1/2}} + 7D_o$

Width of Apron, $W = 3W_o + L_a$

Median Stone Diameter, $d_{50} = 0.016T_w \times (Q/D_o)^{4/3}$

Results: $L_a = 24.71$ ft. $W = 33.71$ ft. $d_{50} = 0.15$ ft.

Use a 25.00 ft. x 34.00 ft. rip-rap apron with $d_{50} = 6"$ at a thickness of 12" w/underlying filter fabric

Conduit Outlet Protection

Design in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey

1 Headwall #C-1

USE RIP RAP APRON

Discharge Flow, $Q_{25} = 9.70$ cfs

Maximum Inside Culvert Depth, $D_o = 24$ inches or **2.00** feet

Maximum Inside Culvert Width, $W_o = 24$ inches or **2.00** feet

Tailwater Depth, TW (Assume $TW = 0.2D_o = 0.2 \times 2.0$ ft.) = **0.40** feet

Unit Discharge, $q = Q/W_o = 4.85$ cfs

Since $T_w < \frac{1}{2}D_o$: Length of Apron, $L_a = \frac{1.8q}{D_o^{1/2}} + 7D_o$

Width of Apron, $W = 3W_o + L_a$

Median Stone Diameter, $d_{50} = 0.016T_w \times (Q/D_o)^{4/3}$

Results: $L_a = 20.17$ ft. $W = 26.17$ ft. $d_{50} = 0.33$ ft.

Use a 20.50 ft. x 26.50 ft. rip-rap apron with $d_{50} = 6"$ at a thickness of 12" w/underlying filter fabric

Conduit Outlet Protection:

Design in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey

1 Headwall #D-2

USE RIP RAP APRON

Discharge Flow, $Q_{25} = 8.62$ cfs

Maximum Inside Culvert Depth, $D_o = 18$ inches or **1.50** feet

Maximum Inside Culvert Width, $W_o = 18$ inches or **1.50** feet

Tailwater Depth, TW (Assume $TW = 0.2D_o = 0.2 \times 2.0$ ft.) = **0.30** feet

Unit Discharge, $q = Q/W_o = 5.75$ cfs

Since $T_w < \frac{1}{2}D_o$: Length of Apron, $L_a = \frac{1.8q}{D_o^{1/2}} + 7D_o$

Width of Apron, $W = 3W_o + L_a$

Median Stone Diameter, $d_{50} = 0.016T_w \times (Q/D_o)^{4/3}$

Results: $L_a = 18.95$ ft. $W = 23.45$ ft. $d_{50} = 0.55$ ft.

Use a 19.00 ft. x 23.50 ft. rip-rap apron with $d_{50} = 9"$ at a thickness of 12" w/underlying filter fabric

Job: Peach Country Tractor
Project #: 50132475

Notes By: BDJ
Checked By:

DATE: 11/23/20
DATE:

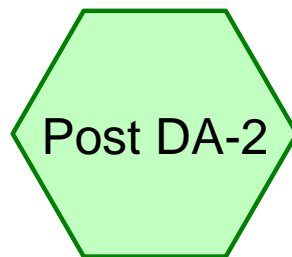
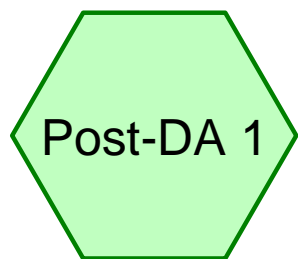
Emergency Spillway Stability

Basin #1

Surface of Spillway (Ground Cover):	Lawn Grass Mixture
Type of Soils:	Sandy Loam
Permissible Velocity per Table 12-1 of NJ SESC:	2.50 fps
100 yr. Storm Peak Inflow Rate, Q_{100} :	53.66 cfs
Length of Spillway:	40 ft.
Weir Coefficient:	3.2
Flow Height over Spillway from Weir Equation =	0.56 ft. $H = (Q_{100}/CL)^{2/3}$
Assuming Wide Rectangular Channel for Flow, Velocity =	2.39 fps $V = (Q_{100}/HL)$

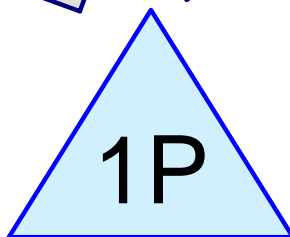
Since **2.39** fps is \leq **2.50** fps, stability requirements have been satisfied.

APPENDIX F
SOIL EROSION ROUTING CALCULATIONS

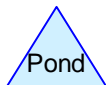
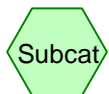


Post DA-1

Post DA-2



Basin



Routing Diagram for Post-Dev
Prepared by DEWBERRY, Printed 12/7/2020
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Post-Dev

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.920	79	<50% Grass cover, Poor, HSG B (Post-DA 1)
0.060	96	Gravel surface, HSG B (Post DA-2)
6.080	98	Paved parking, HSG B (Post-DA 1)
1.810	98	Unconnected roofs, HSG B (Post DA-2, Post-DA 1)
1.190	55	Woods, Good, HSG B (Post DA-2, Post-DA 1)
0.420	58	Woods/grass comb., Good, HSG B (Post DA-2)
15.480	86	TOTAL AREA

Post-Dev

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
15.480	HSG B	Post DA-2, Post-DA 1
0.000	HSG C	
0.000	HSG D	
0.000	Other	
15.480		TOTAL AREA

Post-Dev

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Page 4

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	5.920	0.000	0.000	0.000	5.920	<50% Grass cover, Poor	Post-DA 1
0.000	0.060	0.000	0.000	0.000	0.060	Gravel surface	Post DA-2
0.000	6.080	0.000	0.000	0.000	6.080	Paved parking	Post-DA 1
0.000	1.810	0.000	0.000	0.000	1.810	Unconnected roofs	Post DA-2, Post-DA 1
0.000	1.190	0.000	0.000	0.000	1.190	Woods, Good	Post DA-2, Post-DA 1
0.000	0.420	0.000	0.000	0.000	0.420	Woods/grass comb., Good	Post DA-2
0.000	15.480	0.000	0.000	0.000	15.480	TOTAL AREA	

Post-Dev

NOAA 24-hr C 2 Yr Rainfall=3.31"

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Page 5

Time span=0.00-75.00 hrs, dt=0.05 hrs, 1501 points x 3
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Post DA-2: Post DA-2

Runoff Area=1.280 ac 3.91% Impervious Runoff Depth=0.42"
Flow Length=155' Tc=9.2 min UI Adjusted CN=59 Runoff=0.26 cfs 0.044 af

Subcatchment Post-DA 1: Post DA-1

Runoff Area=14.200 ac 55.21% Impervious Runoff Depth=2.18"
Flow Length=945' Tc=25.9 min CN=89 Runoff=15.60 cfs 2.582 af

Pond 1P: Basin

Peak Elev=147.42' Storage=123,807 cf Inflow=15.84 cfs 2.627 af
Primary=0.32 cfs 1.444 af Secondary=0.00 cfs 0.000 af Outflow=0.32 cfs 1.444 af

Total Runoff Area = 15.480 ac Runoff Volume = 2.627 af Average Runoff Depth = 2.04"
49.03% Pervious = 7.590 ac 50.97% Impervious = 7.890 ac

Post-Dev

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NOAA 24-hr C 2 Yr Rainfall=3.31"

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Page 6

Summary for Subcatchment Post DA-2: Post DA-2

Runoff = 0.26 cfs @ 12.28 hrs, Volume= 0.044 af, Depth= 0.42"

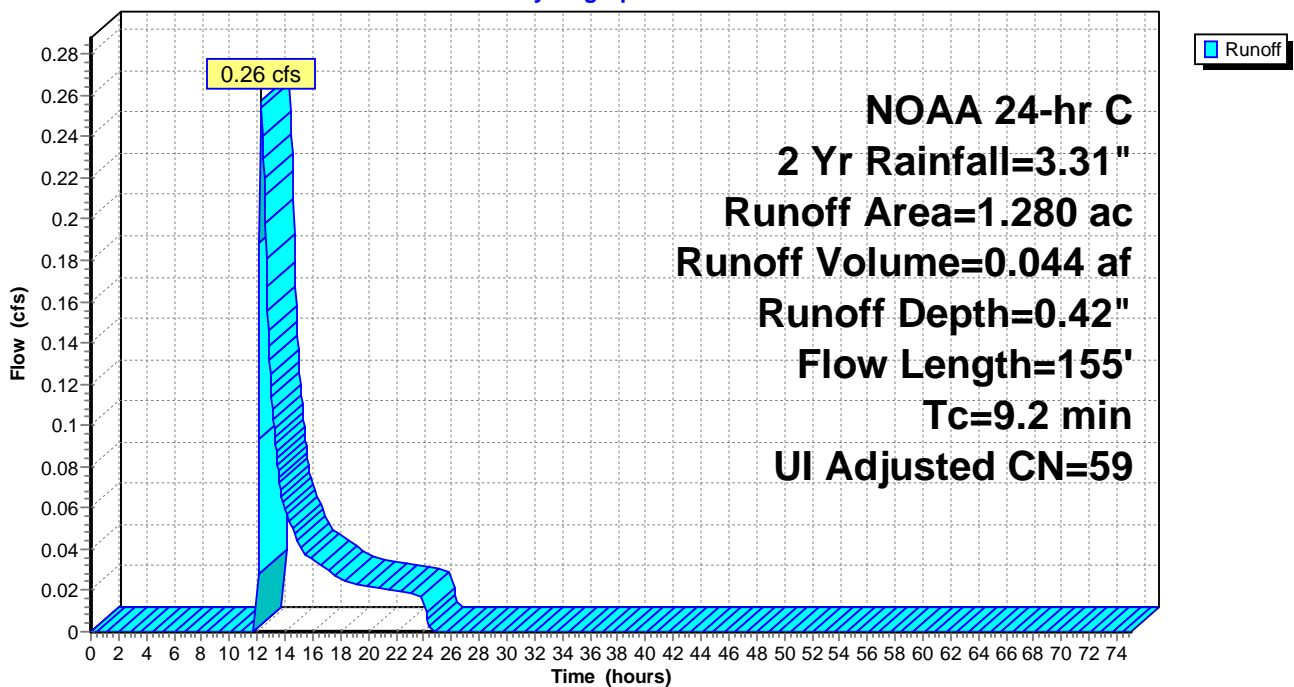
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 2 Yr Rainfall=3.31"

Area (ac)	CN	Adj	Description
0.750	55		Woods, Good, HSG B
0.420	58		Woods/grass comb., Good, HSG B
0.050	98		Unconnected roofs, HSG B
0.060	96		Gravel surface, HSG B
1.280	60	59	Weighted Average, UI Adjusted
1.230			96.09% Pervious Area
0.050			3.91% Impervious Area
0.050			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
1.0	55	0.0350	0.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.2	155	Total			

Subcatchment Post DA-2: Post DA-2

Hydrograph



Post-Dev

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NOAA 24-hr C 2 Yr Rainfall=3.31"

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Page 7

Summary for Subcatchment Post-DA 1: Post DA-1

Runoff = 15.60 cfs @ 12.41 hrs, Volume= 2.582 af, Depth= 2.18"

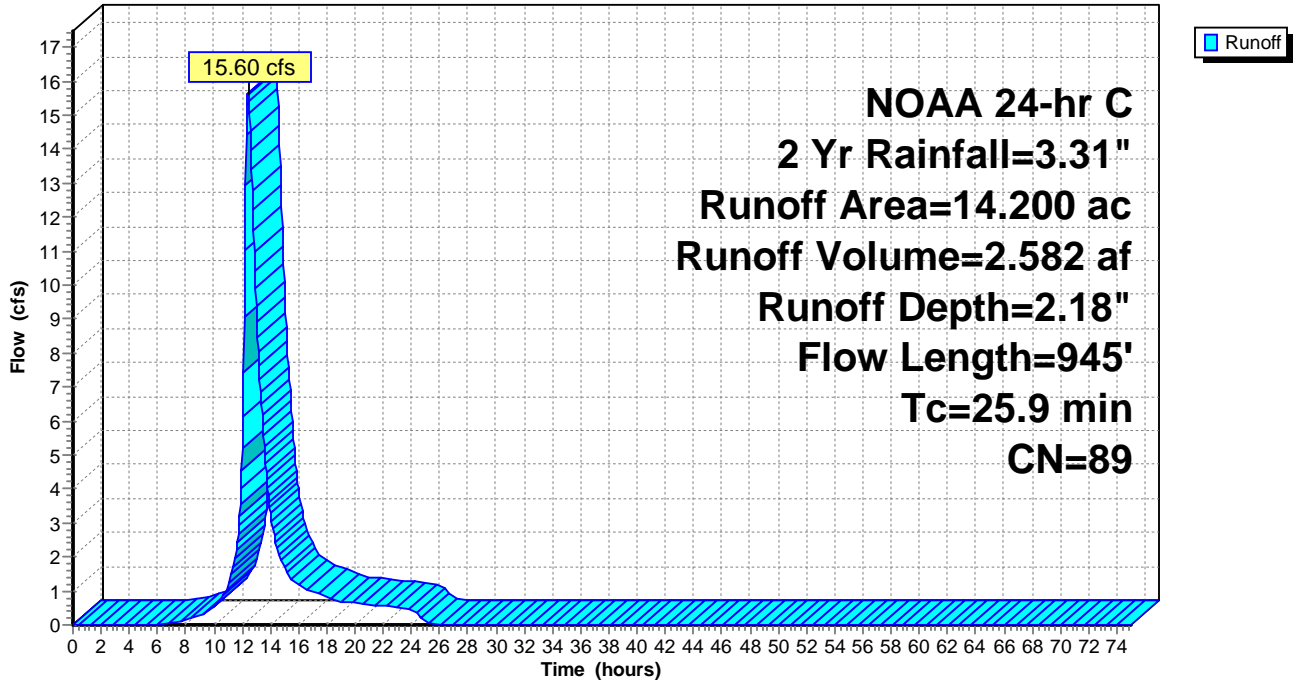
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2 Yr Rainfall=3.31"

Area (ac)	CN	Description
0.440	55	Woods, Good, HSG B
1.760	98	Unconnected roofs, HSG B
6.080	98	Paved parking, HSG B
5.920	79	<50% Grass cover, Poor, HSG B
14.200	89	Weighted Average
6.360		44.79% Pervious Area
7.840		55.21% Impervious Area
1.760		22.45% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	70	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
10.6	30	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
4.7	100	0.0200	0.35		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
1.7	85	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.8	100	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.9	560	0.0050	4.97	8.78	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
25.9	945	Total			

Subcatchment Post-DA 1: Post DA-1

Hydrograph



Post-Dev

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NOAA 24-hr C 2 Yr Rainfall=3.31"

Printed 12/7/2020

Page 9

Summary for Pond 1P: Basin

Inflow Area = 15.480 ac, 50.97% Impervious, Inflow Depth = 2.04" for 2 Yr event
 Inflow = 15.84 cfs @ 12.41 hrs, Volume= 2.627 af
 Outflow = 0.32 cfs @ 24.41 hrs, Volume= 1.444 af, Atten= 98%, Lag= 720.0 min
 Primary = 0.32 cfs @ 24.41 hrs, Volume= 1.444 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs / 3
 Starting Elev= 145.48' Surf.Area= 49,066 sf Storage= 23,238 cf
 Peak Elev= 147.42' @ 24.41 hrs Surf.Area= 54,484 sf Storage= 123,807 cf (100,569 cf above start)

Plug-Flow detention time= 2,474.9 min calculated for 0.910 af (35% of inflow)
 Center-of-Mass det. time= 1,666.7 min (2,515.1 - 848.5)

Volume	Invert	Avail.Storage	Storage Description
#1	145.00'	321,757 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
145.00	47,757	0	0
146.00	50,484	49,121	49,121
147.00	53,276	51,880	101,001
148.00	56,130	54,703	155,704
149.00	59,048	57,589	213,293
150.00	62,030	60,539	273,832
150.50	63,545	31,394	305,225
150.75	68,708	16,532	321,757

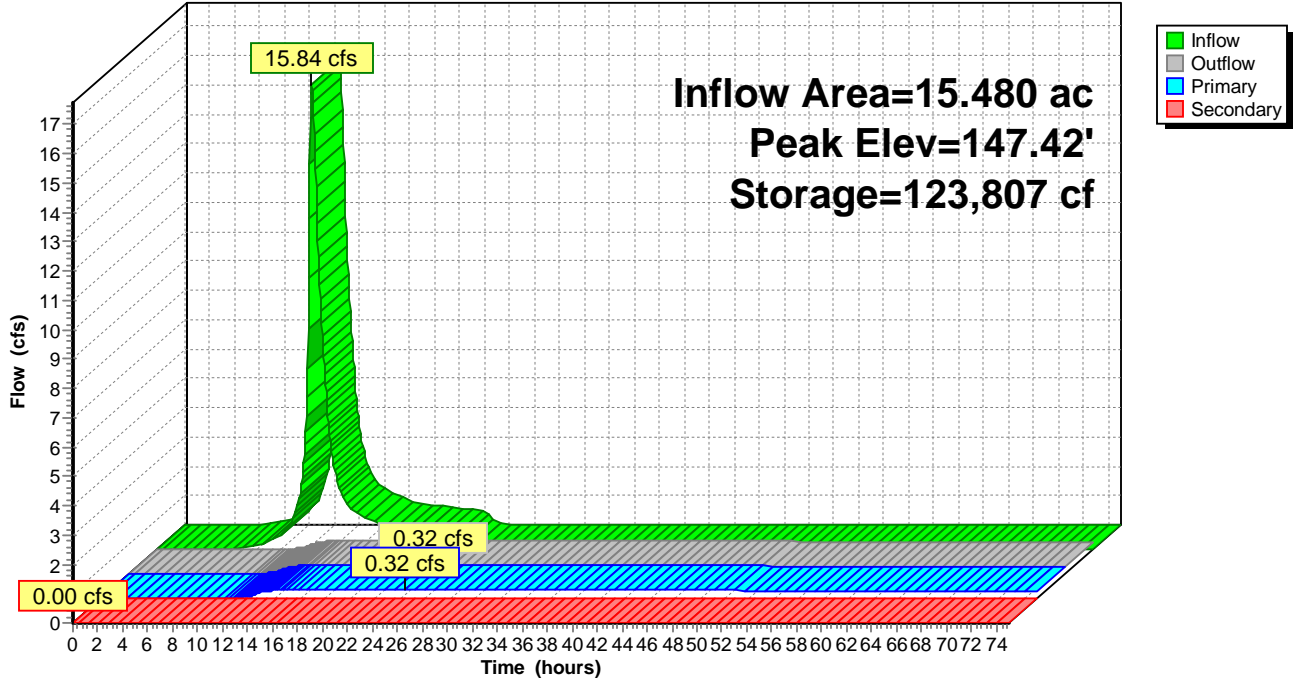
Device	Routing	Invert	Outlet Devices
#1	Primary	145.00'	18.0" Round RCP_Round 18" L= 560.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 145.00' / 143.50' S= 0.0027 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf
#2	Device 1	147.50'	42.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	145.48'	3.0" Vert. Orifice/Grate C= 0.600
#4	Secondary	149.75'	40.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.32 cfs @ 24.41 hrs HW=147.42' (Free Discharge)
 ↑ **1=RCP_Round 18"** (Passes 0.32 cfs of 7.60 cfs potential flow)
 ↑ **2=Orifice/Grate** (Controls 0.00 cfs)
 ↑ **3=Orifice/Grate** (Orifice Controls 0.32 cfs @ 6.49 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=145.48' (Free Discharge)
 ↑ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Basin

Hydrograph



Post-Dev

Prepared by DEWBERRY

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NOAA 24-hr C 10 Yr Rainfall=5.11"

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Page 11

Time span=0.00-75.00 hrs, dt=0.05 hrs, 1501 points x 3
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Post DA-2: Post DA-2

Runoff Area=1.280 ac 3.91% Impervious Runoff Depth=1.30"
Flow Length=155' Tc=9.2 min UI Adjusted CN=59 Runoff=1.26 cfs 0.138 af

Subcatchment Post-DA 1: Post DA-1

Runoff Area=14.200 ac 55.21% Impervious Runoff Depth=3.88"
Flow Length=945' Tc=25.9 min CN=89 Runoff=27.39 cfs 4.588 af

Pond 1P: Basin

Peak Elev=147.81' Storage=144,900 cf Inflow=28.33 cfs 4.727 af
Primary=8.18 cfs 3.450 af Secondary=0.00 cfs 0.000 af Outflow=8.18 cfs 3.450 af

Total Runoff Area = 15.480 ac Runoff Volume = 4.727 af Average Runoff Depth = 3.66"
49.03% Pervious = 7.590 ac 50.97% Impervious = 7.890 ac

Post-Dev

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NOAA 24-hr C 10 Yr Rainfall=5.11"

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Page 12

Summary for Subcatchment Post DA-2: Post DA-2

Runoff = 1.26 cfs @ 12.21 hrs, Volume= 0.138 af, Depth= 1.30"

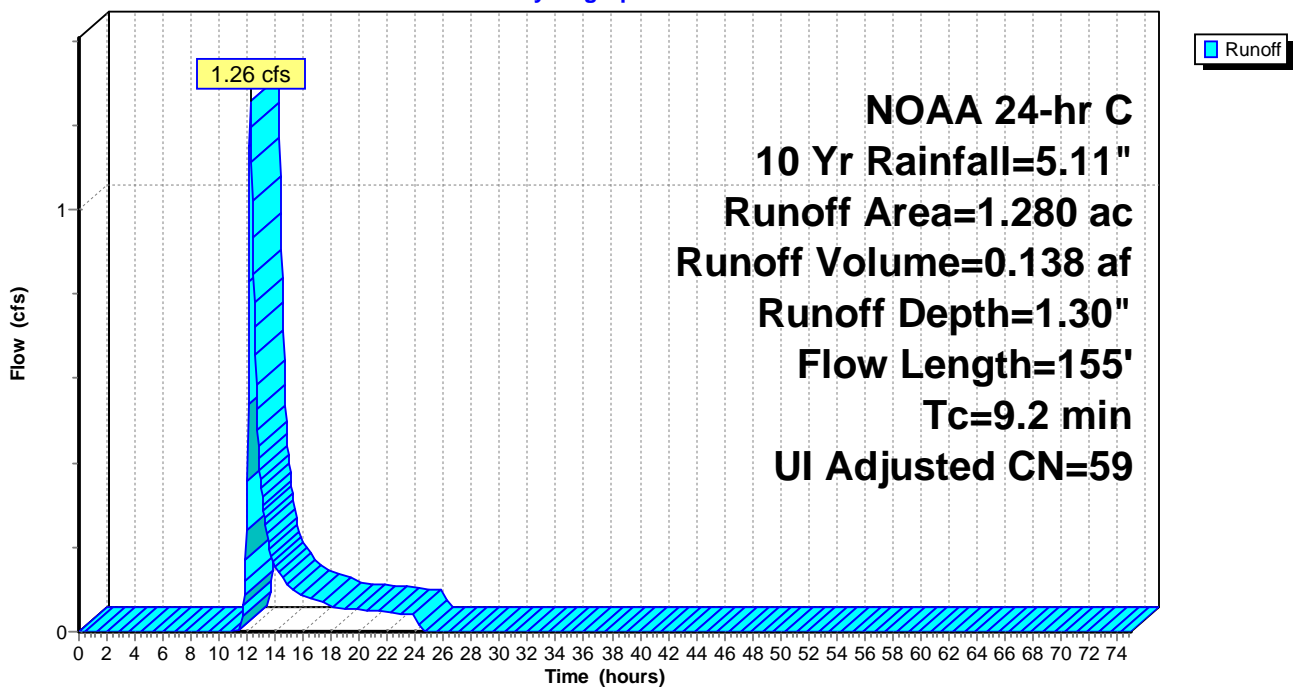
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs
 NOAA 24-hr C 10 Yr Rainfall=5.11"

Area (ac)	CN	Adj	Description
0.750	55		Woods, Good, HSG B
0.420	58		Woods/grass comb., Good, HSG B
0.050	98		Unconnected roofs, HSG B
0.060	96		Gravel surface, HSG B
1.280	60	59	Weighted Average, UI Adjusted
1.230			96.09% Pervious Area
0.050			3.91% Impervious Area
0.050			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
1.0	55	0.0350	0.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.2	155	Total			

Subcatchment Post DA-2: Post DA-2

Hydrograph



Post-Dev

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NOAA 24-hr C 10 Yr Rainfall=5.11"

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Page 13

Summary for Subcatchment Post-DA 1: Post DA-1

Runoff = 27.39 cfs @ 12.40 hrs, Volume= 4.588 af, Depth= 3.88"

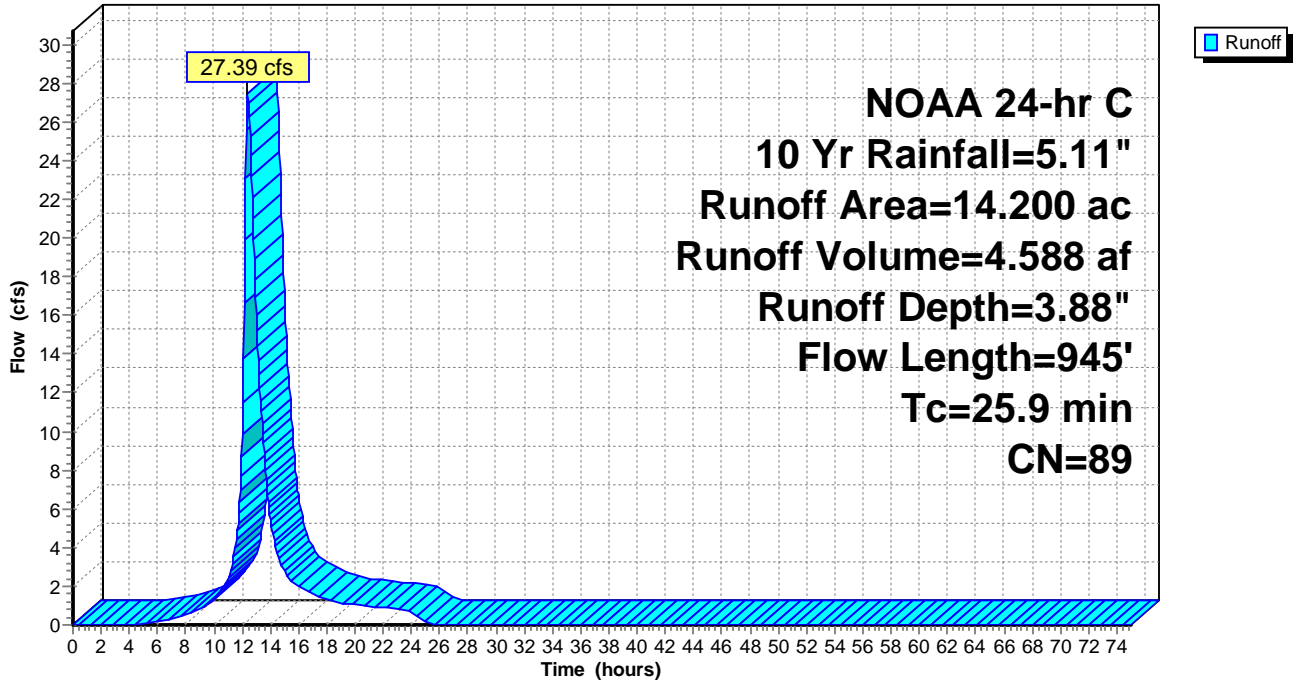
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10 Yr Rainfall=5.11"

Area (ac)	CN	Description
0.440	55	Woods, Good, HSG B
1.760	98	Unconnected roofs, HSG B
6.080	98	Paved parking, HSG B
5.920	79	<50% Grass cover, Poor, HSG B
14.200	89	Weighted Average
6.360		44.79% Pervious Area
7.840		55.21% Impervious Area
1.760		22.45% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	70	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.30"
10.6	30	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.30"
4.7	100	0.0200	0.35		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
1.7	85	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.8	100	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.9	560	0.0050	4.97	8.78	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
25.9	945	Total			

Subcatchment Post-DA 1: Post DA-1

Hydrograph



Post-Dev

Prepared by DEWBERRY

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NOAA 24-hr C 10 Yr Rainfall=5.11"

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Page 15

Summary for Pond 1P: Basin

Inflow Area = 15.480 ac, 50.97% Impervious, Inflow Depth = 3.66" for 10 Yr event
 Inflow = 28.33 cfs @ 12.39 hrs, Volume= 4.727 af
 Outflow = 8.18 cfs @ 13.65 hrs, Volume= 3.450 af, Atten= 71%, Lag= 75.2 min
 Primary = 8.18 cfs @ 13.65 hrs, Volume= 3.450 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-75.00 hrs, dt= 0.05 hrs / 3
 Starting Elev= 145.48' Surf.Area= 49,066 sf Storage= 23,238 cf
 Peak Elev= 147.81' @ 13.65 hrs Surf.Area= 55,578 sf Storage= 144,900 cf (121,662 cf above start)

Plug-Flow detention time= 1,066.5 min calculated for 2.916 af (62% of inflow)
 Center-of-Mass det. time= 806.0 min (1,638.1 - 832.2)

Volume	Invert	Avail.Storage	Storage Description
#1	145.00'	321,757 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
145.00	47,757	0	0
146.00	50,484	49,121	49,121
147.00	53,276	51,880	101,001
148.00	56,130	54,703	155,704
149.00	59,048	57,589	213,293
150.00	62,030	60,539	273,832
150.50	63,545	31,394	305,225
150.75	68,708	16,532	321,757

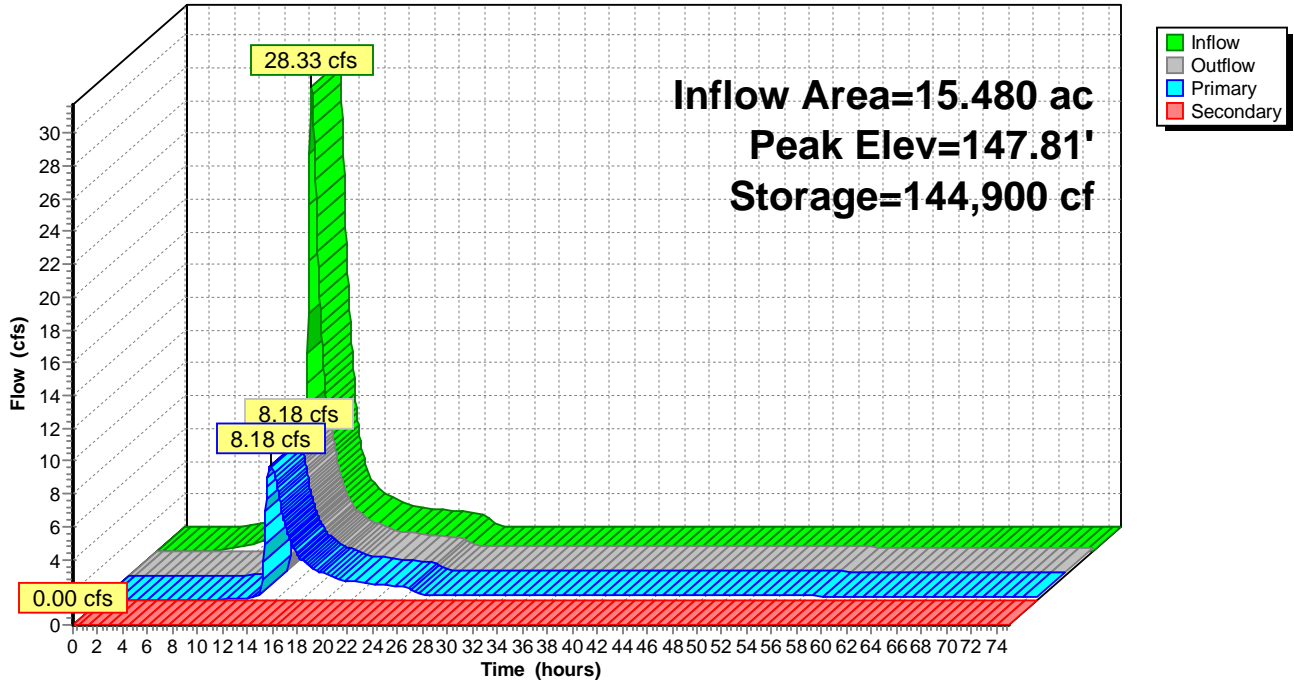
Device	Routing	Invert	Outlet Devices
#1	Primary	145.00'	18.0" Round RCP_Round 18" L= 560.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 145.00' / 143.50' S= 0.0027 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf
#2	Device 1	147.50'	42.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	145.48'	3.0" Vert. Orifice/Grate C= 0.600
#4	Secondary	149.75'	40.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=8.18 cfs @ 13.65 hrs HW=147.81' (Free Discharge)
 ↑1=RCP_Round 18" (Barrel Controls 8.18 cfs @ 4.63 fps)
 ↑2=Orifice/Grate (Passes < 8.32 cfs potential flow)
 ↑3=Orifice/Grate (Passes < 0.35 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=145.48' (Free Discharge)
 ↑4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 1P: Basin

Hydrograph



APPENDIX G
STORMWATER MANAGEMENT COLLECTION SYSTEM

Rational C_w Calculations for System: 100

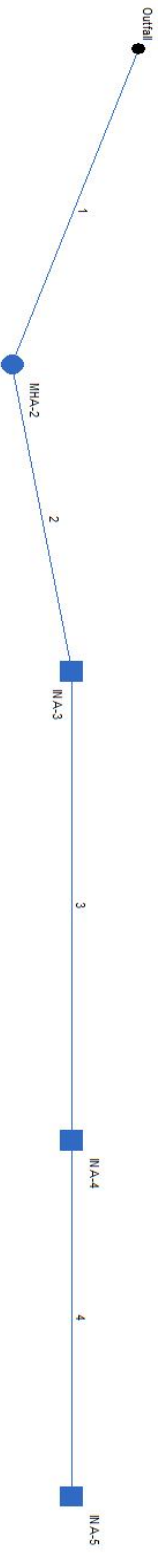
Runoff Coefficient = Type A Soils 0.10 Woods (good) Type B Soils 0.15 Woods (good) Type C Soils 0.45 Woods (good)
 Runoff Coefficient = 0.15 Open Space (good) 0.25 Open Space (good) 0.51 Open Space (good)

Runoff Coefficient = Type A, B or C Soils 0.99 Impervious (Buildings, pavement, sidewalks, etc.)

Structure	TYPE A SOILS		TYPE B SOILS		TYPE C SOILS		A _{imp}	A _{total}	C _w	C _w x A _{tot}	T _c to Inlet
	A _{woods}	A _{open}	A _{woods}	A _{open}	A _{woods}	A _{open}					
A-3	0.00	0.00	0.00	0.26	0.00	0.00	0.43	0.69	0.71	0.49	13.3
A-4	0.00	0.00	0.00	0.28	0.00	0.00	0.45	0.73	0.71	0.52	12.7
A-5	0.00	0.00	0.00	0.53	0.00	0.00	0.90	1.43	0.72	1.02	13
B-3	0.00	0.00	0.00	0.40	0.00	0.00	1.09	1.49	0.79	1.18	6.1
B-4	0.00	0.00	0.00	0.42	0.00	0.00	1.06	1.48	0.78	1.15	6.1
B-5	0.00	0.00	0.00	0.55	0.00	0.00	1.36	1.91	0.78	1.48	6.8
B-7	0.00	0.00	0.00	0.01	0.00	0.00	0.13	0.14	0.94	0.13	6
B-8	0.00	0.00	0.17	0.44	0.00	0.00	0.14	0.75	0.37	0.27	25.9
B-9	0.00	0.00	0.75	0.42	0.00	0.00	0.11	1.28	0.26	0.33	9.2
C-2	0.00	0.00	0.00	0.28	0.00	0.00	0.42	0.70	0.69	0.49	13.4
C-3	0.00	0.00	0.00	0.27	0.00	0.00	1.29	1.56	0.86	1.34	11.5
	0.00	0.00	0.92	3.60	0.00	0.00	6.95	11.47	0.69	7.92	

See attached TR-55 T_c Calculations Sheets for Times of Concentration

Hydraflow Plan View



Project File: PIPECALCS-A.stm

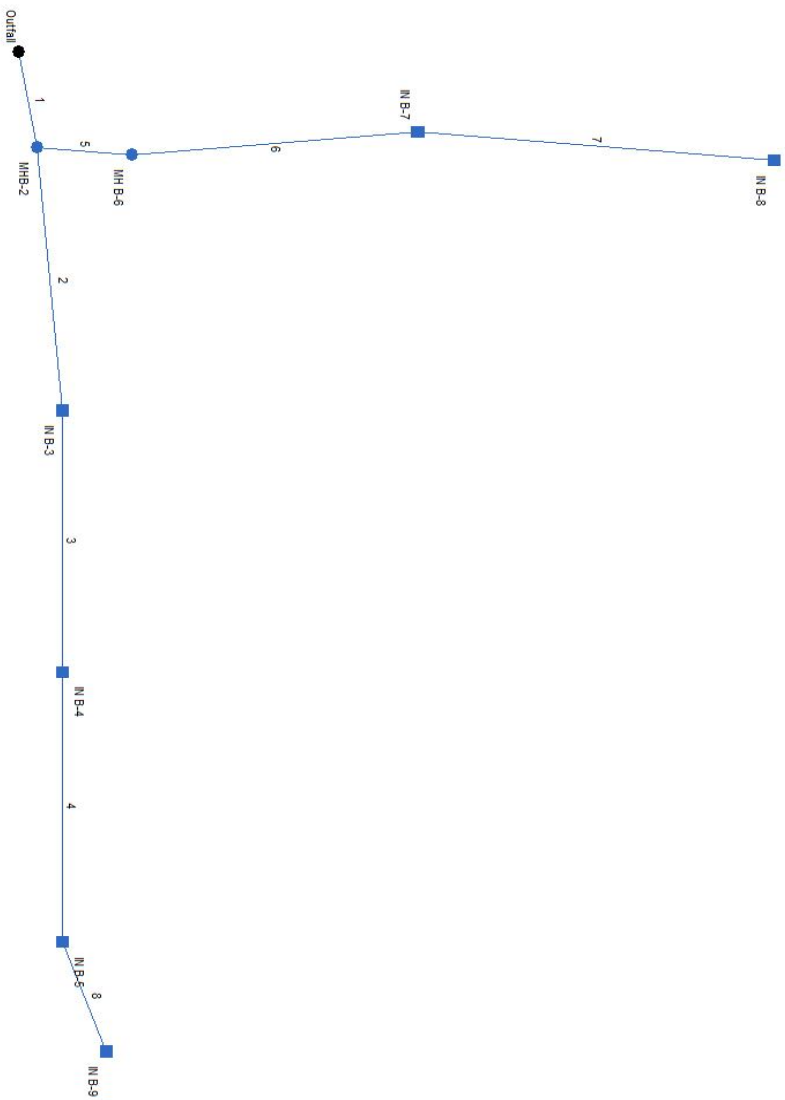
No. Lines: 4

12-07-2020

Storm Sewer Tabulation

Station	To Line	Len (ft)	Drng Area		Rhooff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
			Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	136.0	0.00	2.32	0.00	0.00	1.66	0.0	15.6	5.0	8.28	15.99	5.15	24	0.50	145.68	145.00	146.70	146.01	151.50	146.50	HW-A1-MHA2
2	1	126.0	0.69	2.32	0.71	0.49	1.66	13.3	14.8	5.1	8.47	15.99	4.07	24	0.50	146.31	145.68	147.39	147.23	154.40	151.50	MHA2-INLA3
3	2	190.0	0.73	1.63	0.71	0.52	1.17	12.7	13.8	5.2	6.12	7.43	4.70	18	0.50	147.76	146.81	148.80	147.85	154.00	154.40	INLA3-INLA4
4	3	144.0	0.90	0.90	0.72	0.65	0.65	13.0	13.0	5.4	3.49	4.57	3.41	15	0.50	148.73	148.01	149.58	149.19	154.00	154.00	INLA4-INLA5
Project File: PIPECALCS-A.stm																Number of lines: 4				Run Date: 12-07-2020		
NOTES: Intensity = 50.77 / (Inlet time + 10.50) ^ 0.71; Return period = 25 Yrs.																						

Hydraflow Plan View



Project File: PIPECALCS-B.stm

No. Lines: 8

12-07-2020

Storm Sewer Tabulation

Station	To Line	Len (ft)	Drng Area		Rhooff coeff (C)	Area x C		Tc		Rain (I) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
			Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	70.0	0.00	7.05	0.00	0.00	4.56	0.0	65.1	2.3	10.71	29.00	5.17	30	0.50	145.35	145.00	146.45	146.09	152.25	146.50	HW-B1-MHB2
2	1	190.0	1.49	6.16	0.79	1.18	4.15	6.1	11.9	5.6	23.14	29.00	6.57	30	0.50	146.30	145.35	147.98	147.04	154.80	152.25	MHB2-INLB3
3	2	188.0	1.48	4.67	0.78	1.15	2.98	6.1	11.0	5.7	17.08	29.00	3.98	30	0.50	147.24	146.30	149.06	148.80	154.80	154.80	INLB3-INLB4
4	3	194.0	1.91	3.19	0.78	1.49	1.82	6.8	10.0	5.9	10.79	15.99	4.84	24	0.50	148.71	147.74	149.88	149.34	154.70	154.80	INLB4-INLB5
5	1	62.0	0.00	0.89	0.00	0.00	0.41	0.0	63.8	2.4	0.97	4.57	0.79	15	0.50	145.99	145.68	147.27	147.25	154.00	152.25	MHB6-MHB2
6	5	188.0	0.14	0.89	0.94	0.13	0.41	60.0	60.0	2.5	1.01	4.57	1.52	15	0.50	146.93	145.99	147.43	147.27	157.00	154.00	INB7-MHB6
7	6	234.0	0.75	0.75	0.37	0.28	0.28	25.9	25.9	3.9	1.09	4.57	2.46	15	0.50	148.10	146.93	148.52	147.53	150.85	157.00	INB8-INB7
8	4	84.0	1.28	1.28	0.26	0.33	0.33	9.2	9.2	6.1	2.03	4.57	2.50	15	0.50	149.88	149.46	150.54	150.45	160.25	154.70	INB5-INB9
Project File: PIPECALCS-B.stm														Number of lines: 8				Run Date: 12-07-2020				
NOTES: Intensity = 50.77 / (inlet time + 10.50) ^ 0.71; Return period = 25 Yrs.																						

Hydraflow Plan View



Project File: PIPECALCS-C.stm

No. Lines: 2

12-07-2020

Storm Sewer Tabulation

Station	To Line	Len (ft)	Drng Area		Rho/fi coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
			Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	74.0	0.70	2.26	0.69	0.48	1.82	13.4	13.4	5.3	9.70	12.33	4.85	24	0.30	145.22	145.00	146.59	146.10	149.50	146.50	HW-C1-INLC2
2	1	104.0	1.56	1.56	0.86	1.34	1.34	11.5	11.5	5.6	7.57	12.35	3.07	24	0.30	145.53	145.22	146.91	146.80	148.70	149.50	INLC2-INLC3
Project File: PIPECALCS-C.stm																						
Number of lines: 2																						
Run Date: 12-07-2020																						
NOTES: Intensity = 50.77 / (Inlet time + 10.50) ^ 0.71; Return period = 25 Yrs.																						

APPENDIX H
SOIL TEST PIT DATA

LOG OF TEST PIT NUMBER: TP-1

GROUND SURFACE ELEVATION (ft.): 147.0 (Approx.)

PROJECT DESCRIPTION: PEACH COUNTRY TRACTOR

PROJECT LOCATION: BLOCK 14301; LOTS 8 & 9

PROJECT CLIENT: WOOD MANAGEMENT, INC.



Dewberry®

Dewberry Engineers Inc.
1015 Briggs Road, Suite 210
Mount Laurel, New Jersey 08054
Tel: 856.802.0843 Fax: 856.802.0846

DEPTH BELOW SURFACE (FT)	WATER LEVEL *	SAMPLE DATA			SAMPLE DESCRIPTION		
		SAMPLE NUMBER	INDEX PROPERTIES	USCS SYMBOL	LITHOLOGIC DESCRIPTION	ELEVATION/ DEPTH (FT)	
1		BS-50"	k = 17.4 in/hr	FILL	Fill - Mulch/Topsoil (Wet)	146.2 0.8	
2				SM		Grey Fine SAND and Silt (Moist, Loose)	145.0 2.0
3						Orange/Brown Fine SAND and Silt (Moist, Loose)	
4							143.0 4.0
5						Orange/Brown Fine SAND, Some Silt (Moist, Loose)	
6							139.9 7.1
7							
8					Orange/Brown Fine SAND, Little Silt (Moist, Loose)		
9							
10					End of Log	137.0 10.0	
11							
12							
13							
14							
15							

COMPLETION DEPTH (ft.): 10'
 DEPTH TO GROUNDWATER (ft.): N.E.
 DEPTH TO ESHWT (ft.): N.E.
 DATE TEST PIT STARTED: SEPTEMBER 7, 2018
 DATE TEST PIT COMPLETED: SEPTEMBER 7, 2018
 EXCAVATOR: WOOD MANAGEMENT, INC.
 FIELD REP.: E. HILL
 PROJECT NUMBER: 50105867

COMMENTS:

* Groundwater depths refer to stabilized readings observed within the test pit during the period of this investigation.
 N.E. = Not Encountered

LOG OF TEST PIT NUMBER: TP-2

GROUND SURFACE ELEVATION (ft.): 151.0 (Approx.)

PROJECT DESCRIPTION: PEACH COUNTRY TRACTOR

PROJECT LOCATION: BLOCK 14301; LOTS 8 & 9

PROJECT CLIENT: WOOD MANAGEMENT, INC.



Dewberry®

Dewberry Engineers Inc.
 1015 Briggs Road, Suite 210
 Mount Laurel, New Jersey 08054
 Tel: 856.802.0843 Fax: 856.802.0846

DEPTH BELOW SURFACE (FT)	WATER LEVEL *	SAMPLE DATA			SAMPLE DESCRIPTION	
		SAMPLE NUMBER	INDEX PROPERTIES	USCS SYMBOL	LITHOLOGIC DESCRIPTION	ELEVATION/ DEPTH (FT)
1		BS-48"	k = 13.5 in/hr	FILL	Fill - Mulch/Topsoil (Wet)	150.2 0.8
2				SM	Grey Fine SAND, Little Silt (Moist, Loose)	148.3 2.7
3					Orange/Brown Fine SAND, Some Silt (Moist, Loose)	
4						
5						
6						
7						
8						
9						
10						140.8 10.2
11					End of Log	
12						
13						
14						
15						

COMPLETION DEPTH (ft.): 10.2
 DEPTH TO GROUNDWATER (ft.): N.E.
 DEPTH TO ESHWT (ft.): N.E.
 DATE TEST PIT STARTED: SEPTEMBER 7, 2018
 DATE TEST PIT COMPLETED: SEPTEMBER 7, 2018
 EXCAVATOR: WOOD MANAGEMENT, INC.
 FIELD REP.: E. HILL
 PROJECT NUMBER: 50105867

COMMENTS:

* Groundwater depths refer to stabilized readings observed within the test pit during the period of this investigation.
 N.E. = Not Encountered

LOG OF TEST PIT NUMBER: TP-3

GROUND SURFACE ELEVATION (ft.): 149.0 (Approx.)

PROJECT DESCRIPTION: PEACH COUNTRY TRACTOR

PROJECT LOCATION: BLOCK 14301; LOTS 8 & 9

PROJECT CLIENT: WOOD MANAGEMENT, INC.



Dewberry®

Dewberry Engineers Inc.
 1015 Briggs Road, Suite 210
 Mount Laurel, New Jersey 08054
 Tel: 856.802.0843 Fax: 856.802.0846

DEPTH BELOW SURFACE (FT)	WATER LEVEL *	SAMPLE DATA			SAMPLE DESCRIPTION	
		SAMPLE NUMBER	INDEX PROPERTIES	USCS SYMBOL	LITHOLOGIC DESCRIPTION	ELEVATION/ DEPTH (FT)
1				FILL	Fill - Mulch/Topsoil (Wet)	147.3
2		BS-24"	k = 18.8 in/hr	SM	Grey Fine SAND, Some Silt (Moist, Loose)	145.2
3						
4		BS-50"	k = 13.2 in/hr		Orange/Brown Fine SAND, Little Silt (Moist, Loose)	145.2
5						3.8
6						
7						
8						
9					End of Log	140.0
10						9.0
11						
12						
13						
14						
15						

COMPLETION DEPTH (ft.): 9
 DEPTH TO GROUNDWATER (ft.): N.E.
 DEPTH TO ESHWT (ft.): N.E.
 DATE TEST PIT STARTED: SEPTEMBER 7, 2018
 DATE TEST PIT COMPLETED: SEPTEMBER 7, 2018
 EXCAVATOR: WOOD MANAGEMENT, INC.
 FIELD REP.: E. HILL
 PROJECT NUMBER: 50105867

COMMENTS:

* Groundwater depths refer to stabilized readings observed within the test pit during the period of this investigation.
 N.E. = Not Encountered

LOG OF TEST PIT NUMBER: TP-4

GROUND SURFACE ELEVATION (ft.): 148.0 (Approx.)

PROJECT DESCRIPTION: PEACH COUNTRY TRACTOR

PROJECT LOCATION: BLOCK 14301; LOTS 8 & 9

PROJECT CLIENT: WOOD MANAGEMENT, INC.



Dewberry Engineers Inc.
 1015 Briggs Road, Suite 210
 Mount Laurel, New Jersey 08054
 Tel: 856.802.0843 Fax: 856.802.0846

DEPTH BELOW SURFACE (FT)	WATER LEVEL *	SAMPLE DATA			SAMPLE DESCRIPTION	
		SAMPLE NUMBER	INDEX PROPERTIES	USCS SYMBOL	LITHOLOGIC DESCRIPTION	ELEVATION/ DEPTH (FT)
1				FILL	Fill - Mulch/Topsoil (Wet)	
2						145.5
3						2.5
4					Grey Fine SAND, Some Silt, Trace Small Roots (Moist, Loose)	
5						143.0
6		BS-80"	k = 15.4 in/hr	SM	Orange/Brown Fine SAND, Some Silt (Moist, Medium Dense)	5.0
7						
8						140.0
9					Orange/Brown Fine SAND, Little Silt (Moist, Loose)	8.0
10					End of Log	138.0
11						10.0
12						
13						
14						
15						

COMPLETION DEPTH (ft.): 10
 DEPTH TO GROUNDWATER (ft.): N.E.
 DEPTH TO ESHWT (ft.): N.E.
 DATE TEST PIT STARTED: SEPTEMBER 7, 2018
 DATE TEST PIT COMPLETED: SEPTEMBER 7, 2018
 EXCAVATOR: WOOD MANAGEMENT, INC.
 FIELD REP.: E. HILL
 PROJECT NUMBER: 50105867

COMMENTS:
 * Groundwater depths refer to stabilized readings observed within the test pit during the period of this investigation.
 N.E. = Not Encountered

LOG OF TEST PIT NUMBER: TP-5

GROUND SURFACE ELEVATION (ft.): 150.5 (Approx.)

PROJECT DESCRIPTION: PEACH COUNTRY TRACTOR

PROJECT LOCATION: BLOCK 14301; LOTS 8 & 9

PROJECT CLIENT: WOOD MANAGEMENT, INC.



Dewberry Engineers Inc.
 1015 Briggs Road, Suite 210
 Mount Laurel, New Jersey 08054
 Tel: 856.802.0843 Fax: 856.802.0846

DEPTH BELOW SURFACE (FT)	WATER LEVEL *	SAMPLE DATA			SAMPLE DESCRIPTION	
		SAMPLE NUMBER	INDEX PROPERTIES	USCS SYMBOL	LITHOLOGIC DESCRIPTION	ELEVATION/ DEPTH (FT)
1		BS-40"	k = 8.8 in/hr	FILL	Fill - Mulch/Topsoil (Wet)	
2						
3					Grey Fine SAND, Little Silt (Moist, Loose)	147.8 2.7
4						
5						
6				SM	Orange/Brown Fine SAND, Some Silt (Moist, Loose)	
7						
8						
9						
10					End of Log	140.7 9.8
11						
12						
13						
14						
15						

COMPLETION DEPTH (ft.): 9.8
 DEPTH TO GROUNDWATER (ft.): N.E.
 DEPTH TO ESHWT (ft.): N.E.
 DATE TEST PIT STARTED: SEPTEMBER 7, 2018
 DATE TEST PIT COMPLETED: SEPTEMBER 7, 2018
 EXCAVATOR: WOOD MANAGEMENT, INC.
 FIELD REP.: E. HILL
 PROJECT NUMBER: 50105867

COMMENTS:
 * Groundwater depths refer to stabilized readings observed within the test pit during the period of this investigation.
 N.E. = Not Encountered

Dewberry Perm

Tube Permeameter Test Data

PROJECT #: **50105867**

1 TEST# TP-1

DATE COLLECTED: 9/18/2018

2 MATERIAL TESTED: Fill Native Soil XX
DEPTH: 50" Retrieved sample

3 TYPE OF SAMPLE: UNDISTURBED DISTURBED XX

4 BULK DENSITY DETERMINATION (disturbed Samples Only)
Sample Density Used No Yes Section density

5 HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
At the beginning of each test interval, H1 20.35 STAND PIPE r = 0.33cm
At the end of each test interval, H2 12.07 SAMPLE TUBE R = 1.78cm

6 RATE OF WATER LEVEL DROP: (interval in minutes)
TIME T₁ TIME T₂ TIME T₃ LENGTH OF SAMPLE = 3.0"
0 0.186 0.186
0 0.186 0.186
0 0.186 0.186 AVERAGE TIME = 0.186 min

7 CALCULATION OF PERMEABILITY:
 $K, (\text{in/hr.}) = 60 \text{ min. / hr.} \times r^2/R^2 \times L (\text{in}) / T (\text{min.}) \times \ln (H_1/H_2)$
K= 17.4 in/hr.

8 DEFECTS IN THE SAMPLE (Check the appropriate items)
None Cracks Worn Channels Dry Soil Root Channels Large gravel Large Roots
Soil / Tube Contacts Smearing Compaction Others (Specify) _____

9 I HEARBY CERTIFY THAT THE INFORMATION FURNISHED ON FORM 3-B OF THIS APPLICATION (AND ATTACHMENTS THERETO) IS TRUE AND ACCURATE. I AM AWARE THAT FALSIFICATION OF DATA IS IN VIOLATION OF THE WATER POLLUTION CONTROL ACT N.J.S.A.58:10A-1 (et. Seq) AND IS SUBJECTED TO PENALTIES AS PRESCRIBED IN N.J.A.C. 7:14.8

SIGNATURE OF SOIL EVALUATOR: Thomas Quinlan

Dewberry Perm

Tube Permeameter Test Data

PROJECT #: **50105867**

1 TEST# TP-2

DATE COLLECTED: 9/18/2018

2 MATERIAL TESTED: Fill Native Soil XX
DEPTH: 48" Retrieved sample

3 TYPE OF SAMPLE: UNDISTURBED DISTURBED XX

4 BULK DENSITY DETERMINATION (disturbed Samples Only)
Sample Density Used No Yes Section density

5 HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
At the beginning of each test interval, H1 20.35 STAND PIPE r = 0.33cm
At the end of each test interval, H2 12.07 SAMPLE TUBE R = 1.78cm

6 RATE OF WATER LEVEL DROP: (interval in minutes)
TIME T₁ TIME T₂ TIME T₃ LENGTH OF SAMPLE = 3.0"
0 0.240 0.240
0 0.240 0.240
0 0.240 0.240 AVERAGE TIME = 0.240 min

7 CALCULATION OF PERMEABILITY:
 $K, (\text{in/hr.}) = 60 \text{ min. / hr.} \times r^2/R^2 \times L (\text{in}) / T (\text{min.}) \times \ln (H_1/H_2)$
K= 13.5 in/hr.

8 DEFECTS IN THE SAMPLE (Check the appropriate items)
None Cracks Worn Channels Dry Soil Root Channels Large gravel Large Roots
Soil / Tube Contacts Smearing Compaction Others (Specify) _____

9 I HEARBY CERTIFY THAT THE INFORMATION FURNISHED ON FORM 3-B OF THIS APPLICATION (AND ATTACHMENTS THERETO) IS TRUE AND ACCURATE. I AM AWARE THAT FALSIFICATION OF DATA IS IN VIOLATION OF THE WATER POLLUTION CONTROL ACT N.J.S.A.58:10A-1 (et. Seq) AND IS SUBJECTED TO PENALTIES AS PRESCRIBED IN N.J.A.C. 7:14.8

SIGNATURE OF SOIL EVALUATOR: Thomas Quinlan

Dewberry Perm

Tube Permeameter Test Data

PROJECT #: **50105867**

1 TEST# TP-3

DATE COLLECTED: 9/18/2018

2 MATERIAL TESTED: Fill Native Soil XX
DEPTH: 24" Retrieved sample

3 TYPE OF SAMPLE: UNDISTURBED DISTURBED XX

4 BULK DENSITY DETERMINATION (disturbed Samples Only)
Sample Density Used No Yes Section density

5 HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
At the beginning of each test interval, H1 20.35 STAND PIPE r = 0.33cm
At the end of each test interval, H2 12.07 SAMPLE TUBE R = 1.78cm

6 RATE OF WATER LEVEL DROP: (interval in minutes)
TIME T₁ TIME T₂ TIME T₃ LENGTH OF SAMPLE = 3.0"
0 0.172 0.172
0 0.172 0.172
0 0.172 0.172 AVERAGE TIME = 0.172 min

7 CALCULATION OF PERMEABILITY:
 $K, (\text{in/hr.}) = 60 \text{ min. / hr.} \times r^2/R^2 \times L (\text{in}) / T (\text{min.}) \times \ln (H_1/H_2)$
K= 18.8 in/hr.

8 DEFECTS IN THE SAMPLE (Check the appropriate items)
None Cracks Worn Channels Dry Soil Root Channels Large gravel Large Roots
Soil / Tube Contacts Smearing Compaction Others (Specify) _____

9 I HEARBY CERTIFY THAT THE INFORMATION FURNISHED ON FORM 3-B OF THIS APPLICATION (AND ATTACHMENTS THERETO) IS TRUE AND ACCURATE. I AM AWARE THAT FALSIFICATION OF DATA IS IN VIOLATION OF THE WATER POLLUTION CONTROL ACT N.J.S.A.58:10A-1 (et. Seq) AND IS SUBJECTED TO PENALTIES AS PRESCRIBED IN N.J.A.C. 7:14.8

SIGNATURE OF SOIL EVALUATOR: Thomas Quinlan

Dewberry Perm

Tube Permeameter Test Data

PROJECT #: **50105867**

1 TEST# TP-3

DATE COLLECTED: 9/18/2018

2 MATERIAL TESTED: Fill Native Soil XX
DEPTH: 50" Retrieved sample

3 TYPE OF SAMPLE: UNDISTURBED DISTURBED XX

4 BULK DENSITY DETERMINATION (disturbed Samples Only)
Sample Density Used No Yes Section density

5 HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
At the beginning of each test interval, H1 20.35 STAND PIPE r = 0.33cm
At the end of each test interval, H2 12.07 SAMPLE TUBE R = 1.78cm

6 RATE OF WATER LEVEL DROP: (interval in minutes)
TIME T₁ TIME T₂ TIME T₃ LENGTH OF SAMPLE = 3.0"
0 0.244 0.244
0 0.244 0.244
0 0.244 0.244 AVERAGE TIME = 0.244 min

7 CALCULATION OF PERMEABILITY:
 $K, (\text{in/hr.}) = 60 \text{ min. / hr.} \times r^2/R^2 \times L (\text{in}) / T (\text{min.}) \times \ln (H_1/H_2)$
K= 13.2 in/hr.

8 DEFECTS IN THE SAMPLE (Check the appropriate items)
None Cracks Worn Channels Dry Soil Root Channels Large gravel Large Roots
Soil / Tube Contacts Smearing Compaction Others (Specify) _____

9 I HEARBY CERTIFY THAT THE INFORMATION FURNISHED ON FORM 3-B OF THIS APPLICATION (AND ATTACHMENTS THERETO) IS TRUE AND ACCURATE. I AM AWARE THAT FALSIFICATION OF DATA IS IN VIOLATION OF THE WATER POLLUTION CONTROL ACT N.J.S.A.58:10A-1 (et. Seq) AND IS SUBJECTED TO PENALTIES AS PRESCRIBED IN N.J.A.C. 7:14.8

SIGNATURE OF SOIL EVALUATOR: Thomas Quinlan

Dewberry Perm

Tube Permeameter Test Data

PROJECT #: **50105867**

1 TEST# TP-4

DATE COLLECTED: 9/18/2018

2 MATERIAL TESTED: Fill Native Soil XX
DEPTH: 80" Retrieved sample

3 TYPE OF SAMPLE: UNDISTURBED DISTURBED XX

4 BULK DENSITY DETERMINATION (disturbed Samples Only)
Sample Density Used No Yes Section density

5 HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
At the beginning of each test interval, H1 20.35 STAND PIPE r = 0.33cm
At the end of each test interval, H2 12.07 SAMPLE TUBE R = 1.78cm

6 RATE OF WATER LEVEL DROP: (interval in minutes)

TIME T ₁	TIME T ₂	TIME T ₃	
0	0.210	0.210	LENGTH OF SAMPLE = 3.0"
0	0.210	0.210	
0	0.210	0.210	AVERAGE TIME = 0.210 min

7 CALCULATION OF PERMEABILITY:

$$K, (\text{in/hr.}) = 60 \text{ min. / hr.} \times r^2/R^2 \times L (\text{in}) / T (\text{min.}) \times \ln (H_1/H_2)$$

K= 15.4 in/hr.

8 DEFECTS IN THE SAMPLE (Check the appropriate items)

None Cracks Worn Channels Dry Soil Root Channels Large gravel Large Roots
Soil / Tube Contacts Smearing Compaction Others (Specify) _____

9 I HEARBY CERTIFY THAT THE INFORMATION FURNISHED ON FORM 3-B OF THIS APPLICATION (AND ATTACHMENTS THERETO) IS TRUE AND ACCURATE. I AM AWARE THAT FALSIFICATION OF DATA IS IN VIOLATION OF THE WATER POLLUTION CONTROL ACT N.J.S.A.58:10A-1 (et. Seq) AND IS SUBJECTED TO PENALTIES AS PRESCRIBED IN N.J.A.C. 7:14.8

SIGNATURE OF SOIL EVALUATOR: Thomas Quinlan

Dewberry Perm

Tube Permeameter Test Data

PROJECT #: **50105867**

1 TEST# TP-5

DATE COLLECTED: 9/18/2018

2 MATERIAL TESTED: Fill Native Soil XX
DEPTH: 40" Retrieved sample

3 TYPE OF SAMPLE: UNDISTURBED DISTURBED XX

4 BULK DENSITY DETERMINATION (disturbed Samples Only)
Sample Density Used No Yes Section density

5 HEIGHT OF WATER LEVEL ABOVE RIM OF BASIN IN INCHES:
At the beginning of each test interval, H1 20.35 STAND PIPE r = 0.33cm
At the end of each test interval, H2 12.07 SAMPLE TUBE R = 1.78cm

6 RATE OF WATER LEVEL DROP: (interval in minutes)
TIME T₁ TIME T₂ TIME T₃ LENGTH OF SAMPLE = 3.0"
0 0.365 0.365
0 0.365 0.365
0 0.365 0.365 AVERAGE TIME = 0.365 min

7 CALCULATION OF PERMEABILITY:

$$K, (\text{in/hr.}) = 60 \text{ min. / hr.} \times r^2/R^2 \times L (\text{in}) / T (\text{min.}) \times \ln (H_1/H_2)$$

K= 8.8 in/hr.

8 DEFECTS IN THE SAMPLE (Check the appropriate items)

None Cracks Worn Channels Dry Soil Root Channels Large gravel Large Roots
Soil / Tube Contacts Smearing Compaction Others (Specify) _____

9 I HEARBY CERTIFY THAT THE INFORMATION FURNISHED ON FORM 3-B OF THIS APPLICATION (AND ATTACHMENTS THERETO) IS TRUE AND ACCURATE. I AM AWARE THAT FALSIFICATION OF DATA IS IN VIOLATION OF THE WATER POLLUTION CONTROL ACT N.J.S.A.58:10A-1 (et. Seq) AND IS SUBJECTED TO PENALTIES AS PRESCRIBED IN N.J.A.C. 7:14.8

SIGNATURE OF SOIL EVALUATOR: Thomas Quinlan

November 5, 2020

Brian Jillson, Civil Designer
Dewberry Engineers Inc.
1015 Briggs Road, Suite 210
Mount Laurel, New Jersey 08054

Sent via email to: bjillson@dewberry.com

Re: Geotechnical Investigation - Proposed Stormwater Management Basin
Block 14301; Lots 4 & 7-10 – 1463 North Tuckerton Road
Williamstown, New Jersey 08094

Dear Brian:

EDH Engineering Services, LLC. (EDH) is pleased to provide this letter report summarizing the results of a geotechnical investigation performed at the above referenced property for the proposed stormwater management basin.

PROJECT BACKGROUND

The property is currently occupied by a landscape supply company. Based on our discussions with you, it is our understanding that the property owner is proposing to re-develop the property with contractor storage units, resulting in the need for stormwater management improvements. Five (5) test pits and permeability tests were previously performed within the basin location; however, the basin location has been modified and additional test pits were required to comply with New Jersey BMP standards for stormwater management. The location of the proposed stormwater basin, as well as suggested locations for test pits were provided by Dewberry.

SUBSURFACE SOILS EVALUATION

EDH's geotechnical engineer visited the site on November 5, 2020 and guided/observed three (3) test pits excavated by a representative of Peach Country Tractor. Test pits, designated TP-7 through TP-8, were performed using a New Holland B95C backhoe and extended to depths ranging from 9.5 to 10 feet below the existing ground surface. Test pits were excavated at locations identified by Dewberry and measured in the field from existing features. EDH's geotechnical engineer observed the excavation of test pits, visually classified the subsurface soils, noted the presence/absence of groundwater and/or seasonal high water table depths and prepared soil logs.

Four (4) soil samples were collected from the test pits for permeability testing purposes.

CONCLUSIONS

Based on the results of our geotechnical investigation, the planned development is feasible. The onsite soils primarily consist of silty sands. Groundwater and seasonal high water table elevations were not observed within the test pits performed during this study.

For the three (3) test pits performed for this study (TP-6 through TP-8), permeability rates for the subsurface soils located beneath the proposed basin bottom elevation (EL 148) were observed to range from 12.2 inches/hour to 16.4 inches/hour. EDH reviewed prior test pit (TP-1 through TP-5) and permeability data provided by Dewberry and notes that permeability rates ranged from 13.2 inches per hour to 18.8 inches per hour for the test pits located within the proposed basin (TP-1, TP-3 and TP-4).

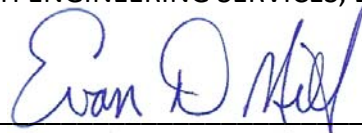
Based on our evaluation of the subsurface soils data collected to date, the proposed basin bottom elevation of 148 is not within 2-feet of the seasonal high water table. It is also our opinion that the proposed infiltration basin could be designed utilizing the measured permeability rate of 12.2 inches per hour and appropriate safety factor of 2 as per the NJDEP BMP requirements, resulting in a design permeability rate of 6.1 inches per hour. The infiltration basin should be designed to meet all other applicable NJDEP BMP requirements. Design documents should include a basin construction and maintenance plan to ensure that the construction and maintenance of the basin is performed in accordance with Best Management Practices.

CLOSING

We thank you for providing us the opportunity to prepare this report and aid you with this project. If you have any questions or require additional information, please do not hesitate to us.

Very truly yours,

EDH ENGINEERING SERVICES, LLC.



Evan D. Hill, P.E., C.M.E.
President

Attachments:

Test Pit Logs (3 pages)

Test Pit Location Sketch (1 page)

Permeability Testing Results (4 pages)

C:\Users\Evan Hill\Documents\EDH Engineering Services LLC\Projects\Dewberry\Peach Country\PeachCountry_Stormwater_GeotechReport_1152020.doc

LOG OF TEST PIT NUMBER: TP-6

GROUND SURFACE ELEVATION (FT): 149.5

PROJECT DESCRIPTION: PEACH COUNTRY TRACTOR

PROJECT LOCATION: BLOCK 14301; LOTS 4 & 7-10

PROJECT CLIENT: DEWBERRY



EDH Engineering Services, LLC.

446 Burke Road
Jackson, New Jersey 08527
(732) 904-9085 edhengineering@gmail.com

DEPTH BELOW SURFACE (FT)	WATER LEVEL	SAMPLE DATA			SAMPLE DESCRIPTION				
		SAMPLE NUMBER	INDEX PROPERTIES	USCS SYMBOL	LITHOLOGIC DESCRIPTION				
1		BS=60"	k = 13.1 in/hr	FILL	Fill - mulch/topsoil (wet)				
2				SM		Grey fine SAND, some silt (moist, loose)			
3									
4									
5						Orange/brown fine SAND, and silt (moist, loose)			
6									
7									
8									Orange/brown fine SAND, some silt (moist, loose)
9									
10									End of Log
11									
12									
13									
14									
15									

COMPLETION DEPTH (ft): 9.5

DEPTH TO GROUNDWATER (ft): N.E.

DEPTH TO ESHWT (ft): N.E.

DATE TEST PIT STARTED: 11/2/2020

DATE TEST PIT COMPLETED: 11/2/2020

EXCAVATOR: Wood Mgmt

FIELD REP: E. HILL

PROJECT NUMBER: DEI00120

COMMENTS:

(1) Groundwater depth refers to stabilized readings observed within the test pit during the period of this investigation.

N.E. = Not Encountered

LOG OF TEST PIT NUMBER: TP-7

GROUND SURFACE ELEVATION (FT): 150

PROJECT DESCRIPTION: PEACH COUNTRY TRACTOR

PROJECT LOCATION: BLOCK 14301; LOTS 4 & 7-10

PROJECT CLIENT: DEWBERRY



EDH Engineering Services, LLC.

446 Burke Road
Jackson, New Jersey 08527
(732) 904-9085 edhengineering@gmail.com

DEPTH BELOW SURFACE (FT)	WATER LEVEL	SAMPLE DATA			SAMPLE DESCRIPTION
		SAMPLE NUMBER	INDEX PROPERTIES	USCS SYMBOL	LITHOLOGIC DESCRIPTION
1		BS=48"	k= 13.4 in/hr	SM	Brown fine to medium SAND, and silt (TOPSOIL)
2					Grey fine SAND, and silt (moist, medium-dense)
3					Orange/brown fine SAND, and silt (moist, loose)
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

COMPLETION DEPTH (ft): 9.5

DEPTH TO GROUNDWATER (ft): N.E.

DEPTH TO ESHWT (ft): N.E.

DATE TEST PIT STARTED: 11/2/2020

DATE TEST PIT COMPLETED: 11/2/2020

EXCAVATOR: Wood Mgmt

FIELD REP: E. HILL

PROJECT NUMBER: DEI00120

COMMENTS:

(1) Groundwater depth refers to stabilized readings observed within the test pit during the period of this investigation.

N.E. = Not Encountered

LOG OF TEST PIT NUMBER: TP-8

GROUND SURFACE ELEVATION (FT): 149

PROJECT DESCRIPTION: PEACH COUNTRY TRACTOR

PROJECT LOCATION: BLOCK 14301; LOTS 4 & 7-10

PROJECT CLIENT: DEWBERRY



EDH Engineering Services, LLC.

446 Burke Road
Jackson, New Jersey 08527
(732) 904-9085 edhengineering@gmail.com

DEPTH BELOW SURFACE (FT)	WATER LEVEL	SAMPLE DATA			SAMPLE DESCRIPTION
		SAMPLE NUMBER	INDEX PROPERTIES	USCS SYMBOL	LITHOLOGIC DESCRIPTION
1		BS=36"	k = 12.2 in/hr	SM	Brown fine to medium SAND, and silt (TOPSOIL)
2					Light brown fine SAND, some silt (loose, moist)
3		BS=72"	k = 16.4 in/hr	SM	Orange/brown fine sand, and silt (moist, medium-dense)
4					Orange/brown fine SAND, little silt (moist, loose)
5					stratified with grey fine sand, little silt at 7'
6					
7					
8					
9					
10					
11					End of Log
12					
13					
14					
15					

COMPLETION DEPTH (ft): 10

DEPTH TO GROUNDWATER (ft): N.E.

DEPTH TO ESHWT (ft): N.E.

DATE TEST PIT STARTED: 11/2/2020

DATE TEST PIT COMPLETED: 11/2/2020

EXCAVATOR: Wood Mgmt

FIELD REP: E. HILL

PROJECT NUMBER: DEI00120

COMMENTS:

(1) Groundwater depth refers to stabilized readings observed within the test pit during the period of this investigation.

N.E. = Not Encountered

TEST PIT LOCATION SKETCH

PROJECT DESCRIPTION: PEACH COUNTRY TRACTOR

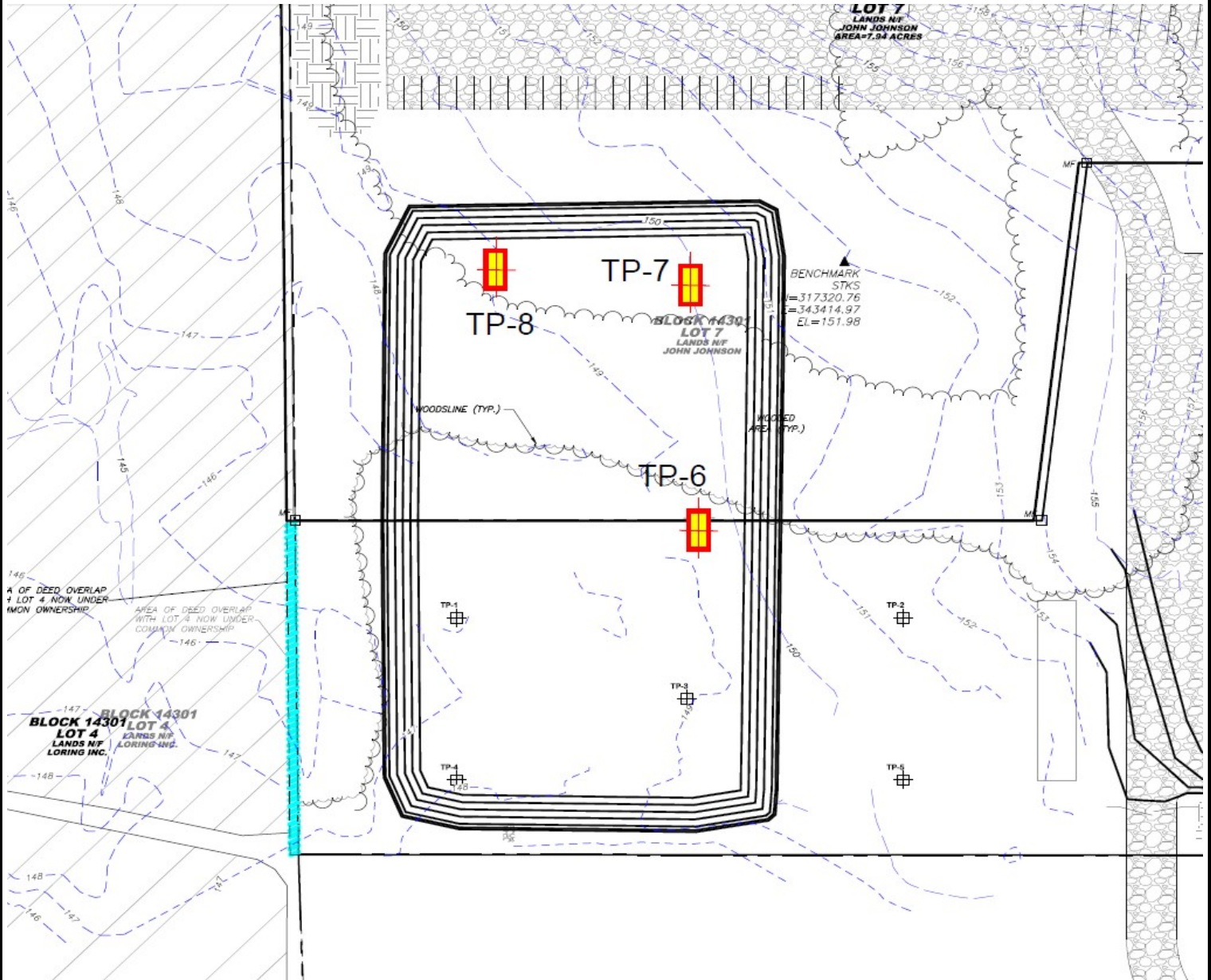
PROJECT LOCATION: BLOCK 14301; LOTS 4 & 7-10

PROJECT CLIENT: DEWBERRY



EDH Engineering Services, LLC.

446 Burke Road
Jackson, New Jersey 08527
(732) 904-9085 edhengineering@gmail.com



APPROXIMATE LOCATION OF TEST PITS BASED ON FIELD MEASUREMENTS AND EXISTING FEATURES

PROJECT NUMBER: DEI00120

NOT TO SCALE

CIVIL & GEOTECHNICAL CONSULTING ENGINEERS

FORM 3B TUBE PERMEAMETER TEST

Project: Peach Country Tractor - Stormwater Basin **Address:** Tuckahoe Road
Monroe Township **Block:** 14301
Sample Source: Onsite Bulk Sample from Test Pit **Date Collected:** 11/2/2020 **By:** E. Hill
Date Tested: 11/3/2020 **By:** E. Hill
Lot: 4 & 7-10

- 1 Test No. TP-6; 60"
- 2 Material Tested _____ Fill X Native Soil (depth)
- 3 Type of Sample _____ Undisturbed X Disturbed
- 4 Sample Dimensions Inside radius of sample tube, R _____ **0.75** inches
Length of sample, L _____ **3.1** inches
- 5 Bulk Density determination (disturbed samples only):
Sample Weight, Sw _____ **114** grams
Sample Volume (L x 3.14 x R²)(16.39), Sv _____ **89.74** cc
Bulk Density (Sw/Sv) _____ **1.27** grams/cc
- 6 Standpipe Used X Yes _____ No 0.25 radius, inches
- 7 Height of water above rim of test basin, inches
At beginning of each test interval, H1
At end of each test interval, H2

Rate of water level drop:

	H1 (inches)	H2 (inches)	Time, Start of Test Interval, T1 (minutes)	Time, End of Test Interval, T2 (minutes)	Length of Test Interval, T, minutes
Test 1	23	8.9	0.00	1.50	1.50
Test 2					
Test 3					
Test 4					
Test 5					
Test 6					
Test 7					

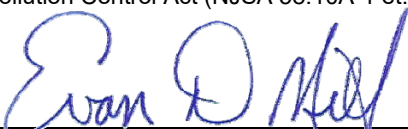
8 Calculation of Permeability:

$K \text{ (in/hr)} = 60 \text{min/hr} \times r^2/R^2 \times L(\text{in})/T(\text{min}) \times \ln(H1/H2)$

K₁ (in/hr)= 13.1 _____ Soil Permeability Class
K₂ (in/hr)= _____ _____ Soil Permeability Class
K₃ (in/hr)= _____ _____ Soil Permeability Class
K₄ (in/hr)= _____ _____ Soil Permeability Class
K₅ (in/hr)= _____ _____ Soil Permeability Class
K₆ (in/hr)= _____ _____ Soil Permeability Class
K₇ (in/hr)= _____ _____ Soil Permeability Class

9 I hereby certify that the information furnished on Form 3B of this application is true and accurate. I am aware that falsification of the data is a violation of the Water Pollution Control Act (NJSA 58:10A-1 et.seq) and is subject to penalties as prescribed in NJAC 7:14-8.

Signature of Professional Engineer



New Jersey Licensed Professional Engineer
24GE4305800

Date 11/4/2020

CIVIL & GEOTECHNICAL CONSULTING ENGINEERS

FORM 3B TUBE PERMEAMETER TEST

Project: Peach Country Tractor - Stormwater Basin **Address:** Tuckahoe Road
Monroe Township **Block:** 14301
Lot: 4 & 7-10

Sample Source: Onsite Bulk Sample from Test Pit **Date Collected:** 11/2/2020 **By:** E. Hill
Date Tested: 11/3/2020 **By:** E. Hill

- 1 Test No. TP-7; 48"
- 2 Material Tested Fill Native Soil (depth)
- 3 Type of Sample Undisturbed Disturbed
- 4 Sample Dimensions *Inside radius of sample tube, R* **0.75** inches
 Length of sample, L **3.1** inches
- 5 Bulk Density determination (disturbed samples only):
Sample Weight, Sw **118** grams
Sample Volume (L x 3.14 x R²)(16.39), Sv **89.74** cc
Bulk Density (Sw/Sv) **1.3** grams/cc
- 6 Standpipe Used Yes No **0.25** radius, inches
- 7 Height of water above rim of test basin, inches
At beginning of each test interval, H1
At end of each test interval, H2

Rate of water level drop:

	H1 (inches)	H2 (inches)	Time, Start of Test Interval, T1 (minutes)	Time, End of Test Interval, T2 (minutes)	Length of Test Interval, T, minutes
Test 1	22	11.5	0.00	1.00	1.00
Test 2					
Test 3					
Test 4					
Test 5					
Test 6					
Test 7					

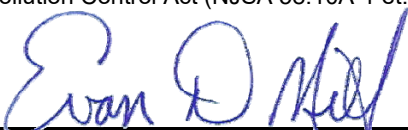
8 Calculation of Permeability:

$$K \text{ (in/hr)} = 60 \text{min/hr} \times r^2/R^2 \times L(\text{in})/T(\text{min}) \times \ln(H1/H2)$$

- K₁ (in/hr)= 13.4 Soil Permeability Class
- K₂ (in/hr)= Soil Permeability Class
- K₃ (in/hr)= Soil Permeability Class
- K₄ (in/hr)= Soil Permeability Class
- K₅ (in/hr)= Soil Permeability Class
- K₆ (in/hr)= Soil Permeability Class
- K₇ (in/hr)= Soil Permeability Class

9 I hereby certify that the information furnished on Form 3B of this application is true and accurate. I am aware that falsification of the data is a violation of the Water Pollution Control Act (NJSA 58:10A-1 et.seq) and is subject to penalties as prescribed in NJAC 7:14-8.

Signature of Professional Engineer



New Jersey Licensed Professional Engineer
24GE4305800

Date 11/4/2020

CIVIL & GEOTECHNICAL CONSULTING ENGINEERS

FORM 3B TUBE PERMEAMETER TEST

Project: Peach Country Tractor - Stormwater Basin **Address:** Tuckahoe Road
Monroe Township **Block:** 14301
Lot: 4 & 7-10

Sample Source: Onsite Bulk Sample from Test Pit **Date Collected:** 11/2/2020 **By:** E. Hill
Date Tested: 11/3/2020 **By:** E. Hill

- 1 Test No. TP-8; 36"
- 2 Material Tested _____ Fill Native Soil (depth)
- 3 Type of Sample _____ Undisturbed Disturbed
- 4 Sample Dimensions *Inside radius of sample tube, R* _____ **0.75** inches
Length of sample, L _____ **3.1** inches
- 5 Bulk Density determination (disturbed samples only):
Sample Weight, Sw _____ **122** grams
Sample Volume (L x 3.14 x R²)(16.39), Sv _____ **89.74** cc
Bulk Density (Sw/Sv) _____ **1.4** grams/cc
- 6 Standpipe Used Yes _____ No _____ **0.25** radius, inches
- 7 Height of water above rim of test basin, inches
At beginning of each test interval, H1
At end of each test interval, H2

Rate of water level drop:

	H1 (inches)	H2 (inches)	Time, Start of Test Interval, T1 (minutes)	Time, End of Test Interval, T2 (minutes)	Length of Test Interval, T, minutes
Test 1	22	12.2	0.00	1.00	1.00
Test 2					
Test 3					
Test 4					
Test 5					
Test 6					
Test 7					

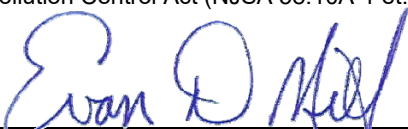
8 **Calculation of Permeability:**

$K \text{ (in/hr)} = 60 \text{min/hr} \times r^2/R^2 \times L(\text{in})/T(\text{min}) \times \ln(H1/H2)$

- K₁ (in/hr)= 12.2 _____ Soil Permeability Class
- K₂ (in/hr)= _____ _____ Soil Permeability Class
- K₃ (in/hr)= _____ _____ Soil Permeability Class
- K₄ (in/hr)= _____ _____ Soil Permeability Class
- K₅ (in/hr)= _____ _____ Soil Permeability Class
- K₆ (in/hr)= _____ _____ Soil Permeability Class
- K₇ (in/hr)= _____ _____ Soil Permeability Class

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Signature of Professional Engineer


New Jersey Licensed Professional Engineer
24GE4305800

Date 11/4/2020

CIVIL & GEOTECHNICAL CONSULTING ENGINEERS

FORM 3B TUBE PERMEAMETER TEST

Project: Peach Country Tractor - Stormwater Basin **Address:** Tuckahoe Road
Monroe Township **Block:** 14301
Lot: 4 & 7-10

Sample Source: Onsite Bulk Sample from Test Pit **Date Collected:** 11/2/2020 **By:** E. Hill
Date Tested: 11/3/2020 **By:** E. Hill

- | | | | |
|---|-------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------|
| 1 | Test No. | <u>TP-8; 72"</u> | |
| 2 | Material Tested | _____ Fill | <input checked="" type="checkbox"/> Native Soil (depth) |
| 3 | Type of Sample | _____ Undisturbed | <input checked="" type="checkbox"/> Disturbed |
| 4 | Sample Dimensions | <i>Inside radius of sample tube, R</i> | <u>0.75</u> inches |
| | | <i>Length of sample, L</i> | <u>3.1</u> inches |
| 5 | Bulk Density determination (disturbed samples only): | | |
| | Sample Weight, Sw | | <u>115</u> grams |
| | Sample Volume (L x 3.14 x R ²)(16.39), Sv | | <u>89.74</u> cc |
| | Bulk Density (Sw/Sv) | | <u>1.3</u> grams/cc |
| 6 | Standpipe Used | <input checked="" type="checkbox"/> Yes _____ No | <u>0.25</u> radius, inches |
| 7 | Height of water above rim of test basin, inches | | |
| | At beginning of each test interval, H1 | | |
| | At end of each test interval, H2 | | |

Rate of water level drop:

	H1 (inches)	H2 (inches)	Time, Start of Test Interval, T1 (minutes)	Time, End of Test Interval, T2 (minutes)	Length of Test Interval, T, minutes
Test 1	23	10.4	0.00	1.00	1.00
Test 2					
Test 3					
Test 4					
Test 5					
Test 6					
Test 7					


8 Calculation of Permeability:

$$K \text{ (in/hr)} = 60 \text{min/hr} \times r^2/R^2 \times L(\text{in})/T(\text{min}) \times \ln(H1/H2)$$

- | | | | |
|-------------------------|-------------|-------|-------------------------|
| K ₁ (in/hr)= | <u>16.4</u> | _____ | Soil Permeability Class |
| K ₂ (in/hr)= | _____ | _____ | Soil Permeability Class |
| K ₃ (in/hr)= | _____ | _____ | Soil Permeability Class |
| K ₄ (in/hr)= | _____ | _____ | Soil Permeability Class |
| K ₅ (in/hr)= | _____ | _____ | Soil Permeability Class |
| K ₆ (in/hr)= | _____ | _____ | Soil Permeability Class |
| K ₇ (in/hr)= | _____ | _____ | Soil Permeability Class |

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Signature of Professional Engineer



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Date 11/4/2020