STORMWATER MANAGEMENT REPORT

FOR

THE GREENS

PLATE 148, BLOCK 14801, LOT 12

MONROE TOWNSHIP, GLOUCESTER COUNTY, NEW JERSEY

CES – 2264-02

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Introduction

Consulting Engineer Services (CES) has prepared this Stormwater Management Report for the Greens; a proposed residential development consisting of 117 age-restricted multi-family units (39 triplex buildings) located on Block 14801, Lot 12 on the official Tax Map of the Monroe Township, Gloucester County, New Jersey (hereinafter the "Site"). The approximate 38.98± acre Site has frontage along Franklinville-Turnersville Road, A.K.A. Fries Mill-Blackwoodtown Road, (County Route 655) and Glassboro-Cross Keys Road (County Route 689).

This report describes the existing stormwater conditions of the site and the potential effects of the proposed development. This report is intended to be used as part of the Monroe Township Planning Board, the Gloucester County Planning Board, and the Gloucester County Soil Conservation District's application review process, in conjunction with the project drawings.

Description of Existing Conditions

The subject property is comprised of seven (7) onsite drainage areas as well as two (2) offsite drainage areas. For the purposes of this stormwater management investigation, three (3) different discharge locations have been analyzed and are listed below:

1. Analysis Point-West: A majority of the existing Site, as well as a small offsite area which passes through the Site, flows overland in the westerly directly to "Analysis Point-West", the existing farm field. Additionally, there is an existing depression on the Site; when the stormwater in the depression reaches elevation 57.09, it discharges runoff in the westerly direction to "Analysis Point-West".

2. Analysis Point-East: A portion of the existing Site, as well as a small offsite area, flows overland in the easterly direction towards Franklinville-Turnersville Road (County Route 655) to "Analysis Point-East". In proposed conditions, there is no stormwater runoff that discharges to "Analysis Point-East".

3. Analysis Point-CVS: A small portion of the existing Site flows overland in the northeasterly direction towards the existing CVS located on Block 14801, Lot 12.02.

A map showing the location of the existing drainage watersheds is included in this report and is entitled "Pre-Development Drainage Area Map." A general description of the existing watersheds and their approximate routes of flow are described below.

- Watershed X1 consists of approximately 19.42± acres which flows overland to the analysis point "AP-West". The majority of the area was previously farmed, however, has now gone fallow. The area is also comprised of a dirt road and a small portion of gravel area.

- Watershed X1a consists of approximately 4.61± acres which flows overland to the analysis point "AP-West". The majority of the area was previously farmed, however, has now gone fallow. The area is also comprised of a small portion of gravel.

- Watershed X2 consists of approximately 6.71± acres which flows overland to the analysis point "AP-East". The majority of the area was previously farmed, however, has now gone fallow. The area is also comprised of a small portion of dirt road.

- Watershed X3 consists of approximately 0.51± acres which flows overland to the analysis point "AP-CVS". The majority of the area was previously farmed, however, has now gone fallow. The area is also comprised of a small portion of gravel.

- Watershed OFS1 consists of approximately 0.78± acres which flows overland into watershed X1 and ultimately to analysis point "AP-West". In the proposed condition, this area will be disturbed. A portion of the disturbed area will be routed to Basin A, which ultimately discharges to analysis point "AP-West". The remaining portion will flow overland to the analysis point "AP-West". The area is comprised of impervious and grassed areas.

- Watershed OFS2 consists of approximately 0.96± acres which flows overland into watershed X2 and ultimately to analysis point "AP-East". In the proposed condition, this area will be disturbed and will be routed to Basin B, which ultimately discharges to analysis point "AP-West". The area is comprised of impervious and grassed areas.

- Watershed UNDIST1 consists of approximately 2.48± acres which flows overland to analysis point "AP-West". In the proposed condition, this area will remain undisturbed; therefore, peak flow rate reductions in accordance with N.J.A.C 7:8 will not be applied to the stormwater runoff from this watershed. The stormwater runoff from this watershed will continue to flow overland to the analysis point. The entire area was previously farmed but has now gone fallow.

- Watershed UNDIST2 consists of approximately 1.82± acres which flows overland to analysis point "AP-East". In the proposed condition, this area will remain undisturbed; therefore, peak flow rate reductions in accordance with N.J.A.C 7:8 will not be applied to the stormwater runoff from this watershed. The stormwater runoff from this watershed will be directed to Basin B and ultimately discharge to analysis point "AP-West". The entire area was previously farmed but has now gone fallow.

As described above, the majority of the existing Site was previously farmed and has now gone fallow. Review of historic aerial photographs confirm that this condition has been present for a least the previous five (5) years and, in accordance with NJDEP regulations, is the appropriate ground cover to use for these calculations.

The stormwater drainage conditions for the subject property were analyzed using the Technical Release No. 20 (TR-20) Method, published by the National Resources Conservation Service (NRCS) (formerly USDA Soil Conservation Service). Additionally, calculations have been performed utilizing the methodology of separately calculating then combining the runoff volumes from pervious and directly connected impervious surfaces within each drainage area. Soils information utilized in the calculations was based upon the Gloucester County Soil Survey. Peak rates of runoff were determined for the 2-year, 10-year, and 100-year storm events so as to facilitate assessment of impacts on downstream properties pursuant to applicable regulations.

Description of Proposed Conditions

Stormwater runoff under developed conditions will be collected by a drainage system consisting of a series of inlets and pipes that will convey the water to the proposed stormwater management Basins A, A1, A2, A3, B, and C located on site. The proposed drainage inlets and pipes have been designed to collect and convey the water from a 25-year storm event utilizing the Rational Method, as appropriate pursuant to N.J.A.C. 5:21-7.2(c)4.

The stormwater discharge points for the Site under post-development conditions will remain similar to those under existing conditions. A map showing the proposed drainage conditions are included in this report entitled "Post-Development Basin Drainage Area Map". The results are summarized within the Appendices of the report.

Summary of Methodology

The Site is designed to comply with N.J.A.C. 7:8 (Stormwater Management regulations promulgated by the NJDEP). A detailed description of the methodologies provided for the design of the stormwater management system follows.

In accordance with the NJDEP Stormwater Best Management Practices Manual, to accurately compute the rates and volume of stormwater runoff from the site, the runoff volume associated with the pervious and directly connected impervious portion of the drainage area were computed separately to produce the runoff volume. Calculations have been based on this requirement. Note that HydroCAD reports show that pervious and impervious coverages were spilt. This can be seen on the node summary sheet for each analyzed storm event, on the background data line as "Split Pervious/Imperv.".

Existing Watersheds & Allowable Discharge

A summary of the existing drainage conditions of the Site is tabulated below.

Peak Runoff Rates for Existing Watersheds

Watershed	Q_2 (cfs)	Q_{10} (cfs)	Q_{100} (cfs)
X1	11.85	22.52	45.38
X1a	3.56	6.74	13.53
X2	4.40	8.35	16.79
X3	0.79	1.47	2.89
OFS1	1.31	2.22	4.27
OFS2	1.59	2.70	5.22
UNDIST1	2.14	4.06	8.13
UNDIST2	1.33	2.52	5.07

The stormwater runoff from watersheds X1a and UNDIST1 pass through the existing on-site depression before discharging to analysis point "AP-West". The depression is modeled as a basin and detailed calculations are included in the appendices of this report.

The peak runoff rates for the watersheds may be verified by review of the detailed calculations included in the appendices of this report. A summary of the maximum allowable discharge from the site to each analysis point, reduced per BMP standards, is tabulated in the following table.

Summary of Allowable Discharges from the Site to Analysis Point – West

Design Storm	X1, X1a, OFS1, UNDIST1 Discharge (cfs)	Required Reduction* (%)	Total Allowable Discharge (cfs)
2-Year Storm	12.12	50	6.06
10-Year Storm	26.32	75	17.90
100-Year Storm	65.11	80	52.90

*Watershed UNDIST1 remains undisturbed in proposed conditions, therefore peak flow rate reductions are not applied to the stormwater runoff from this watershed. The peak flow rate reduction in accordance with N.J.A.C. 7:8 are applied to the stormwater runoff from watersheds X1, X1a, and OFS1 .

Summary of Allowable Discharges from the Site to Analysis Point – East

Design Storm	X2, OFS2, UNDIST2 Discharge (cfs)	Required Reduction* (%)	Total Allowable Discharge (cfs)
2-Year Storm	6.19	50	3.79
10-Year Storm	11.70	75	9.41
100-Year Storm	23.53	80	19.84

*Watershed UNDIST2 remains undisturbed in proposed conditions, therefore peak flow rate reductions are not applied to the stormwater runoff from this watershed. The peak flow rate reduction in accordance with N.J.A.C. 7:8 are applied to the stormwater runoff from watersheds X2 and OFS2 .

Summary of Allowable Discharges from the Site to Analysis Point – CVS

Design Storm	X3 Discharge (cfs)	Required Reduction (%)	Total Allowable Discharge (cfs)
2-Year Storm	0.79	50	0.39
10-Year Storm	1.47	75	1.10
100-Year Storm	2.89	80	2.32

Proposed Watersheds

In accordance with N.J.A.C. 7:8, in order to control stormwater runoff quantity impacts, the design engineer shall, using assumptions and factors necessary for stormwater runoff calculations, complete one of the following:

1. Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the 2, 10, and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events;

2. Demonstrate through hydrologic and hydraulic analysis that there is no increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the 2, 10, and 100-year storm events and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site. This analysis shall include

the analysis of impacts of existing land uses and projected land uses assuming full development under existing zoning and land use ordinances in the drainage area;

3. Design stormwater management measures so that the post-construction peak runoff rates for the 2, 10 and 100 year storm events are 50, 75 and 80 percent, respectively, of the preconstruction peak runoff rates. The percentages apply only to the post-construction stormwater runoff that is attributable to the portion of the site on which the proposed development or project is to be constructed. The percentages shall not be applied to post-construction stormwater runoff into tidal flood hazard areas if the increased volume of stormwater runoff will not increase flood damages below the point of discharge. For this stormwater analysis, this method was used.

The following tables summarize the flow rates and water surface elevations as well as physical basin parameters for Basin A.

Basin A Characteristics

Design Storm	Peak Inflow (cfs)	Peak Outflow (cfs)	Water Surface Elevation
WQ Storm	9.06	0.00	147.43±
2-Year Storm	13.59	2.04	149.11±
10-Year Storm	30.27	6.08	150.46±
100-Year Storm	63.08	15.82	153.99±

Basin A Physical Parameters

Inflow Drainage Area	30.77 Ac.
Top of Berm Elevation	156.00
Bottom of Basin Elevation	146.25
Emergency Spillway Elevation	154.00
Depth of 100-yr Flow over Emergency Spillway	0.21 ft
Height of Freeboard	1.79 ft
SHWT Elevation*	141.99

*Test Pits #J

The following tables summarize the flow rates and water surface elevations as well as physical basin parameters for Basin A1.

Basin A1 Characteristics

Design Storm	Peak Inflow (cfs)	Peak Outflow (cfs)	Water Surface Elevation
WQ Storm	0.40	0.00	147.75±
2-Year Storm	2.07	1.52	149.86±
10-Year Storm	6.23	4.40	150.93±
100-Year Storm	11.84	7.98	153.88±

Basin A1 Physical Parameters

Inflow Drainage Area	32.00 Ac.
Top of Berm Elevation	155.50
Bottom of Basin Elevation	147.75
Emergency Spillway Elevation	154.00
Depth of 100-yr Flow over Emergency Spillway	0.17 ft
Height of Freeboard	1.33 ft
SHWT Elevation *	143.63

*Test Pits #E

The following tables summarize the flow rates and water surface elevations as well as physical basin parameters for Basin A2.

Basin A2 Characteristics

Design Storm	Peak Inflow (cfs)	Peak Outflow (cfs)	Water Surface Elevation
WQ Storm	0.00	0.00	146.50±
2-Year Storm	1.51	0.00	151.32±
10-Year Storm	4.41	1.55	154.09±
100-Year Storm	8.04	8.03	154.28±

Basin A2 Physical Parameters

Inflow Drainage Area	33.07 Ac.
Top of Berm Elevation	155.50
Bottom of Basin Elevation	146.50
Emergency Spillway Elevation	154.00
Depth of 100-yr Flow over Emergency Spillway	0.28 ft
Height of Freeboard	1.22 ft
SHWT Elevation *	143.51

*Test Pits #G

The following tables summarize the flow rates and water surface elevations as well as physical basin parameters for Basin A3.

Basin A3 Characteristics

Design Storm	Peak Inflow (cfs)	Peak Outflow (cfs)	Water Surface Elevation
WQ Storm	1.20	0.00	152.26±
2-Year Storm	1.88	0.00	152.99±
10-Year Storm	4.35	0.80	155.01±
100-Year Storm	10.71	8.26	155.06±

Basin A3 Physical Parameters

Inflow Drainage Area	36.06 Ac.
Top of Berm Elevation	155.50
Bottom of Basin Elevation	152.00
Emergency Spillway Elevation	155.00
Depth of 100-yr Flow over Emergency Spillway	0.07 ft
Height of Freeboard	0.43 ft
SHWT Elevation *	144.57

*Test Pits #I

The following tables summarize the flow rates and water surface elevations as well as physical basin parameters for Basin B.

Basin B Characteristics

Design Storm	Peak Inflow (cfs)	Peak Outflow (cfs)	Water Surface Elevation
WQ Storm	9.90	0.45	150.17±
2-Year Storm	16.13	4.60	151.80±
10-Year Storm	31.11	13.14	153.11±
100-Year Storm	66.19	24.32	155.82±

Basin B Physical Parameters

Inflow Drainage Area	18.82 Ac.
Top of Berm Elevation	157.30
Bottom of Basin Elevation	148.50
Emergency Grate Elevation	155.85
Depth of 100-yr Flow over Emergency Spillway	1.10 ft
SHWT Elevation *	144.85

*Test Pits #Q

The following tables summarize the flow rates and water surface elevations as well as physical basin parameters for Basin C.

Basin C Characteristics

Design Storm	Peak Inflow (cfs)	Peak Outflow (cfs)	Water Surface Elevation
WQ Storm	3.60	0.22	154.42±
2-Year Storm	4.42	0.36	154.93±
10-Year Storm	7.92	0.49	155.60±
100-Year Storm	16.13	2.57	156.57±

Basin C Physical Parameters

Inflow Drainage Area	3.52 Ac.
Top of Berm Elevation	159.00
Norma Water Surface Elevation	154.00
Bottom of Basin Elevation	149.00
SHWT Elevation *	145.42

*Test Pits #S

A summary of the proposed discharge from the areas flowing to each point of analysis is tabulated in the following tables.

Calculation of Proposed Peak Runoff to Analysis Point–West

Design Storm	Allowable (cfs)	Proposed Runoff (cfs)
2-Year Storm	6.06	0.28
10-Year Storm	17.90	1.13
100-Year Storm	52.90	8.34

Calculation of Proposed Peak Runoff to Analysis Point–East

Design Storm	Allowable (cfs)	Proposed Runoff (cfs)
2-Year Storm	3.79	0.00
10-Year Storm	9.41	0.00
100-Year Storm	19.84	0.00

Calculation of Proposed Peak Runoff to Analysis Point–CVS

Design Storm	Allowable (cfs)	Proposed Runoff (cfs)
2-Year Storm	0.39	0.34
10-Year Storm	1.10	0.59
100-Year Storm	2.32	1.19

The peak runoff rates in the proposed condition are less than the existing to the same location.

Basin Design Criteria

Each infiltration basin (Basins A, A1, A2, A3, and B) was designed to the criteria, listed below, as outlined in Chapter 9.5 of the Best Management Practices Manual.

1. Storage Volume, Depth and Duration– As will be shown; the basin will infiltrate the water quality storm. The basin must fully drain within 72 hours– #2 below states how this criterion was met. The bottom of the infiltration basin must be 2 feet above the seasonal high water table, as measured from the bottom of the sand layer. The following table lists the distance between the bottom of the basin and seasonal high water table for each basin.

Basin	Bottom of Basin	Bottom of Sand Layer	SHWT Elevation	Distance between Bottom of Sand Layer and SHWT (ft)
Basin A	146.25	145.75	141.99	3.76
Basin A1	147.75	147.25	143.63	3.62
Basin A2	146.50	146.00	143.51	2.49
Basin A3	152.00	151.50	144.57	6.93
Basin B	148.50	148.00	144.85	3.15
Basin C	149.00	N/A	145.42	3.58

As shown in the table above, there is adequate distance between the bottom of the sand layer and the seasonal high water table.

2. Drain Time– The design permeability rate of the soil must be sufficient to fully drain the basins' maximum design storm runoff volume within 72 hours. The maximum design storm drain times for each basin have been calculated to be less than 72 hours, and therefore meets this criterion. Calculations are included in the Appendix of this report. The permeability rates for each basin is listed below.

   - Basin A: 3.0 in/hr., 23.3 in/hr., 27.5 in/hr., 41.4 in/hr.
   - Basin A1: 22.95 in/hr., 13.2 in/hr., 25.5 in/hr.
   - Basin A2: 20.3 in/hr., 22.3 in/hr., 8.9 in/hr.
   - Basin A3: 6.33 in/hr.,22.3 in/hr.
   - Basin B: 2.1 in/hr., 0.5 in/hr.
   - Basin C: 48.0 in/hr., 8.5 in/hr.

   The elevation at which the permeability test was performed for Basin B was elevation 153.45 and 154.35. The testing elevations are above the basin bottom, and since the basins are fully excavated, the restrictive layer is removed. The soil strata beneath the permeability test elevation is similar to the test pits for Basin A; therefore, it is assumed that the permeability rates are similar. However, to be conservative, an infiltration rate of 6 in/hr. with a factor of safety of 2 is used.

3. Bottom Sand Layer– Basin A, A1, A2, A3, and B shall have a 6-inch layer of sand placed in the bottom of the basin, which will meet the specifications of a K5 soil.

4. Overflows– Each basin shall convey overflows to downstream drainage systems in a safe and stable manner.

5. On-Line and Off-Line Systems – All basins are on-line systems.

Conduit Outlet Protection

Conduit outlet protection is provided at each point of discharge into the basin in accordance with the Standard for Soil Erosion and Sediment Control in New Jersey. Calculations for the conduit outlet protection are included in the Appendix of this report.

Spillway Design

Spillways are proposed for Basins A, A1, A2, and A3 in the form of broad crested weirs and have been designed to convey the entire 100-year storm event runoff assuming the basin is full. The velocity over each spillway is listed below:

- Basin A (220 LF Spillway) – 1.25 ft/sec
- Basin A1 (68 LF Spillway) – 1.06 ft/sec
- Basin A2 (20 LF Spillway) – 1.33 ft/sec
- Basin 3 (233 LF Spillway) – 0.68 ft/sec

The approximate downstream slope for each spillway is 0.33 ft/ft. The soil at the spillway location is assumed to be sandy loam (See Appendix). The Standards for Soil Erosion and Sediment Control list the maximum stable velocity for point discharges for sandy loam as 2.5 ft/sec. Due to the velocity being less than 2.5 ft/sec, the spillway will not be reinforced.

The spillway calculations can be found in the Appendix of this report.

Groundwater Recharge Analysis

The Stormwater Management Rules require that a proposed major land development comply with one of the following two groundwater recharge requirements:

Requirement 1: That 100 percent of the site's average annual pre-developed groundwater recharge volume be maintained after development; or

Requirement 2: That 100 percent of the difference between the site's pre- and post-development 2- Year runoff volumes be infiltrated.

Requirement 2 was followed to comply with the recharge requirements. The runoff volumes for are listed in the following table.

2- Year Runoff Volumes for the Site

Existing 2-Year Runoff Volume *(all watersheds)*	5.31 acre-feet
Proposed 2-Year Runoff Volume *(all watersheds)*	4.61 acre-feet
Net Difference between Existing and Proposed 2-Year Runoff Volume	0.70 acre-feet

This yields a net volume of 0.70 acre-feet that is required to be stored in the basins. The volume stored below the lowest invert elevation of Basin A is 1.24 ac-ft; therefore, the Annual Groundwater Recharge Requirement as provided by NJDEP is met.

Water Quality

Basins A, A1, A2, A3, and B are designed as an infiltration/detention basin. Therefore, in order to provide the TSS removal rate as required by the NJDEP BMP Manual chapter 9.5, the entire Water Quality storm must be retained, filtered by the sand basin bottom and infiltrated into the groundwater.

The peak flow rate for the Water Quality storm to "AP-West" is 0.00 cfs. The entire Water Quality storm is infiltrated into the groundwater between Basins A, A1, A2, A3, and B and the BMP groundwater quality requirements are met for the infiltration basins.

Basin C is designed as a wet pond, therefore the TSS removal rate as required by the NJDEP BMP Manual 9.5 is not applied. Water Quality storm hydrographs can be found in the Appendix of this report.

Off-Site Stability Summary

In accordance with the New Jersey Standards for Soil Erosion and Sediment Control, section 21, stability is demonstrated when the discharge is less than 10 cfs for the 10-year storm. For this stormwater analysis, Basin A and A3 discharge to "AP-West". Both Basin A and Basin A3 discharge 0.00 cfs to "AP-West" when infiltration in Basins A and B fails.

For Basins A, A1, B, and C, the flow from the 10-year storm event discharges to a discharge pipe. The outfall of the discharge pipe was designed in accordance with the New Jersey Standards for Soil Erosion and Sediment Control, section 12-1, Conduit Outlet Protection. Therefore, this criterion is met. Calculations are provided in Appendix of this report.

Groundwater Mounding Analysis

A groundwater mounding analysis has been performed for Basins D, F, G, H, and I. A spreadsheet was developed by NRCS to solve the Hantush analytical equation, which can be used to calculate groundwater mounding. The Hantush equation incorporates simplifying assumptions, including that all flow is horizontal. The spreadsheet accepts user-supplied values for horizontal soil permeability, initial saturated aquifer thickness, specific yield, basin length, basin width, and duration and magnitude of recharge rate. This spreadsheet was utilized for these calculations.

The following table provides the basin bottom, seasonal high water table elevation, mounding thickness, and mounded elevation for Basins D, F, G, H, and I.

Basin	Basin Bottom Elevation	Seasonal High Water Table Elevation	Groundwater Mounding Thickness (ft)	Mounded Elevation
Basin A	146.25	141.99	0.76	142.75
Basin A1	147.75	143.63	3.81	147.44
Basin A2	146.50	143.51	2.94	146.45
Basin A3	152.00	144.57	2.38	146.95
Basin B	148.50	144.85	3.48	148.33

As shown in the table above, the mounded elevation for each basin is below the basin bottom; therefore, the groundwater mound will not cause hydraulic breakout at the surface or side slopes of the basin, within the immediate area around the basin, downstream of the basin or create insufficient treatment of stormwater runoff.

The anticipated groundwater mounding thickness for Basin A is 0.76 ft at the center of the basin and reduces to 0.00 feet approximately 80 feet from the center of the basin. The closest dwelling to Basin A is approximately 245 feet from the center of the basin. Therefore, the resulting groundwater mounding from Basin A will be insignificant at the nearest dwelling.

The anticipated groundwater mounding thickness for Basin A1 is 3.81 ft at the center of the basin and reduces to 0.00 feet approximately 140 feet from the center of the basin. The closest dwelling to Basin A1 is approximately 145 feet from the center of the basin. Therefore, the resulting groundwater mounding from Basin A1 will be insignificant at the nearest dwelling.

The anticipated groundwater mounding thickness for Basin A2 is 2.94 ft at the center of the basin and reduces to 0.00 feet approximately 120 feet from the center of the basin. The closest dwelling to Basin A2 is approximately 140 feet from the center of the basin. Therefore, the resulting groundwater mounding from Basin A2 will be insignificant at the nearest dwelling.

The anticipated groundwater mounding thickness for Basin A3 is 2.38 ft at the center of the basin and reduces to 0.00 feet approximately 140 feet from the center of the basin. The closest dwelling to Basin H is approximately 50 feet from the center of the basin. The groundwater mounding thickness at 50 feet from the basin bottom is approximately 0.87 feet, resulting in a mounded groundwater elevation of approximately 145.44. the top of slab of the nearest dwelling is 157.60, 12.16 feet higher than the approximated mounded groundwater elevation. The proposed dwellings do not have a basement, therefore, the resulting groundwater mounding from Basin A3 will be insignificant at the nearest dwelling.

The anticipated groundwater mounding thickness for Basin B is 3.48 ft at the center of the basin and reduces to 0.00 feet approximately 120 feet from the center of the basin. The closest dwelling to Basin I is approximately 130 feet from the center of the basin. Therefore, the resulting groundwater mounding from Basin B will be insignificant at the nearest dwelling.

Detailed calculations can be found in the Appendix of this report.

Nonstructural Strategies

Several nonstructural strategies have been implemented into the design of the project. The purpose of these strategies is to reduce the impact of development in terms of water quality, water quantity, and groundwater recharge.

The following nine (9) nonstructural strategies are recommended to be implemented into the design of a project. For those strategies not implemented, a description of why it was not implemented is also included.

1. *Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss*: Any areas that may be susceptible to erosion or sediment loss will be appropriately stabilized in accordance with NJ Soil Erosion Control Standards.

2. *Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces:* The construction of the proposed single-family homes are the predominant improvements on this site. Given the disturbance area is limited to the smallest area necessary, impervious areas have been minimized to the smallest extent practical.

3. *Maximize the protection of natural drainage features and vegetation:* As the site was previously farmed and has now gone fallow, protecting the natural drainage features and vegetation will be maximized.

4. *Minimize the decrease in the "Time of Concentration" from pre-developed to post-developed conditions:* Although a decrease in the Time of Concentration is unavoidable, a sizeable portion of the rear yards in the lots are remaining unpaved, which assists to minimize the decrease in the Time of Concentration.

5. *Minimize land disturbance including clearing and grading:* The construction of the proposed multi-unit dwellings are the predominant improvements on this site. The limits of the land disturbances, clearing and grading are minimized.

6. *Minimize soil compaction:* A substantial portion of the improvements is the construction of the proposed multi-unit dwellings which require appropriate compaction to ensure structural integrity. However, soil compaction will be minimized within the stormwater management facilities.

7. *Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides:* Low maintenance landscaping is proposed.

8. *Provide vegetated open channel conveyance systems discharging into and through stable vegetated areas:* With a substantial portion of the site improvements being the construction of the proposed multi-unit dwellings, there are no areas where an open channel conveyance system is feasible. However, grass swales are proposed to the maximum extent practicable.

9. *Provide other source controls to prevent or minimize the use or exposure of pollutants at the site, in order to prevent or minimize the release of those pollutants into stormwater runoff. Such source controls include, but are not limited to:*
   (1) Site design features that help to prevent accumulation of trash and debris in drainage systems: Stormwater inlets are designed with ECO-curb pieces and ECO-grates, compliant with NJPDES Municipal Stormwater Management requirements, which help reduce the accumulation of trash and debris in the stormwater drainage system.
   (2) Site design features that help to prevent discharge of trash and debris from drainage systems: A trash rack will be provided on the stormwater Outflow Structure to prevent discharge of trash and debris from the proposed basin.
   (3) Site design features that help to prevent and/or contain spills or other harmful accumulations of pollutants at industrial or commercial development: The site is a residential development.
   (4) Applying fertilizer in accordance with the requirements established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq., and implementing rules, when establishing vegetation after land disturbance: Fertilizer will be applied in accordance with the Soil Erosion and Sediment Control Act as indicated on the Soil Erosion and Sediment Control Notes and Detail plan sheet.

Sections

The Greens will be constructed in three (3) sections. Section 1 will consist of the following:

- 48 age restricted units (triplex buildings)
- Storm pipes and structures in roadways (Queensferry – Prestwick – Panmure Loop)
- Storm utilities along Fries Mill Road
- Basins A, B, C and the associated pipes and structures
- Portion of Basin A3 located to the south of Section 1 buildings
- Stormwater pipe run STMB1 on the north side
- Stormwater pipe run STMA2 and STMA7 along Glassboro-Cross Keys Road
- Stormwater pipe run STMA10 to E inlet A26 and connect a temporary 24" pipe (280 LF HP, to be reused in later sections)from A26 to B17
- Other non-stormwater improvements

Section 2 will consist of the following:

- 30 age restricted units (triplex buildings)
- Basins A1 and A2 and associated pipes and structures
- Remove temporary stormwater pipe run from E inlet A26 to B17
- Install remainder of stormwater pipe run STMA10 E inlet A26 to Basin A
- Other non-stormwater improvements

Section 3 will consist of the following:

- 30 age restricted units (triplex buildings)
- Remaining portion of Basin A3
- Other non-stormwater improvements

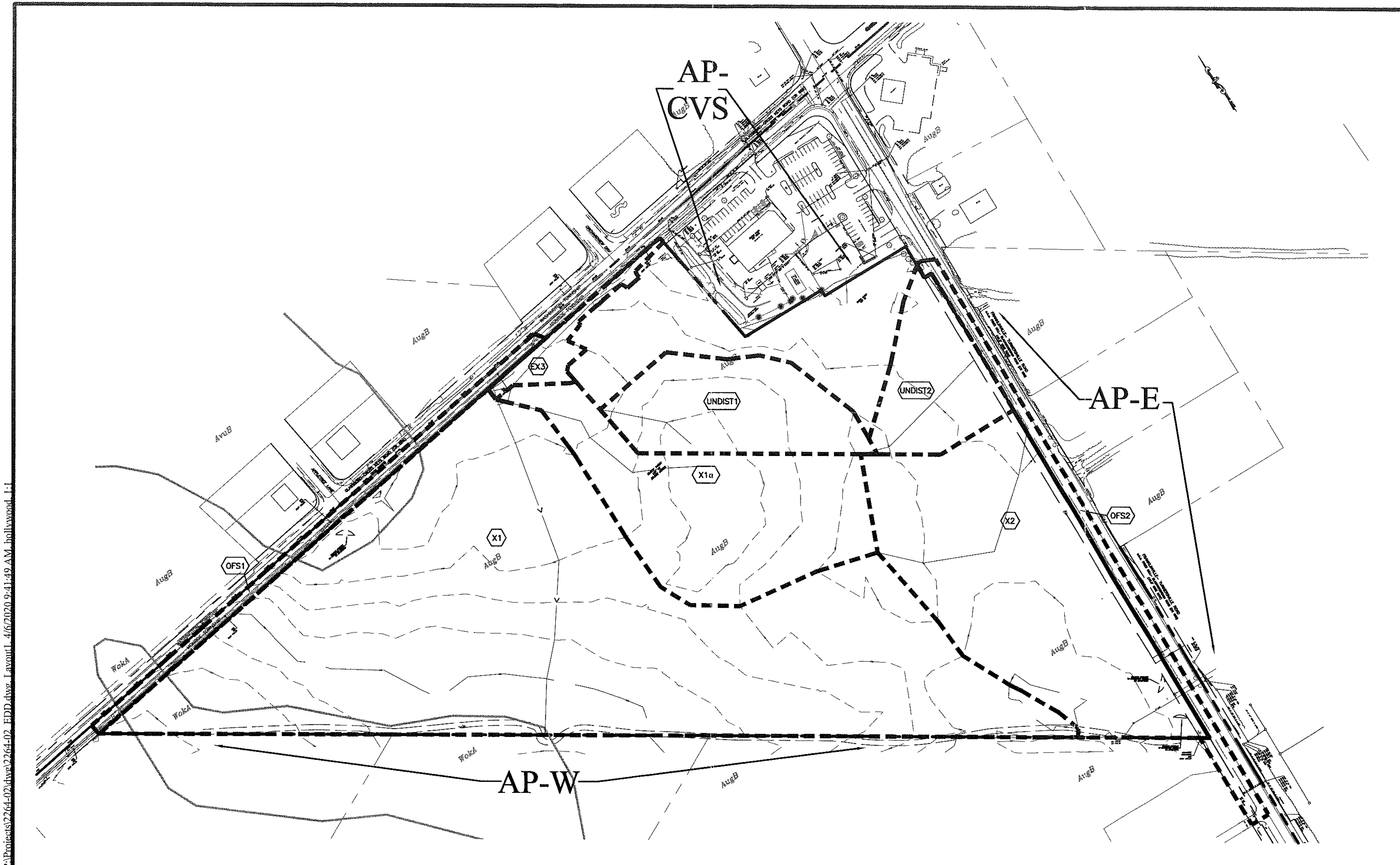
Please refer to the Overall Development Sectioning/Traffic Circulation Plan in the Preliminary/Final Major Subdivision Plan Set for phasing.

Conclusions

As detailed above, the post-developed flow for both analysis points is reduced below the required reductions in flow for the 2, 10 and 100 year storms. The site exceeds the appropriate groundwater recharge requirements. Finally, the site meets the requirements for water quality. Therefore, the stormwater management system, as designed, is in compliance with the appropriate regulations.

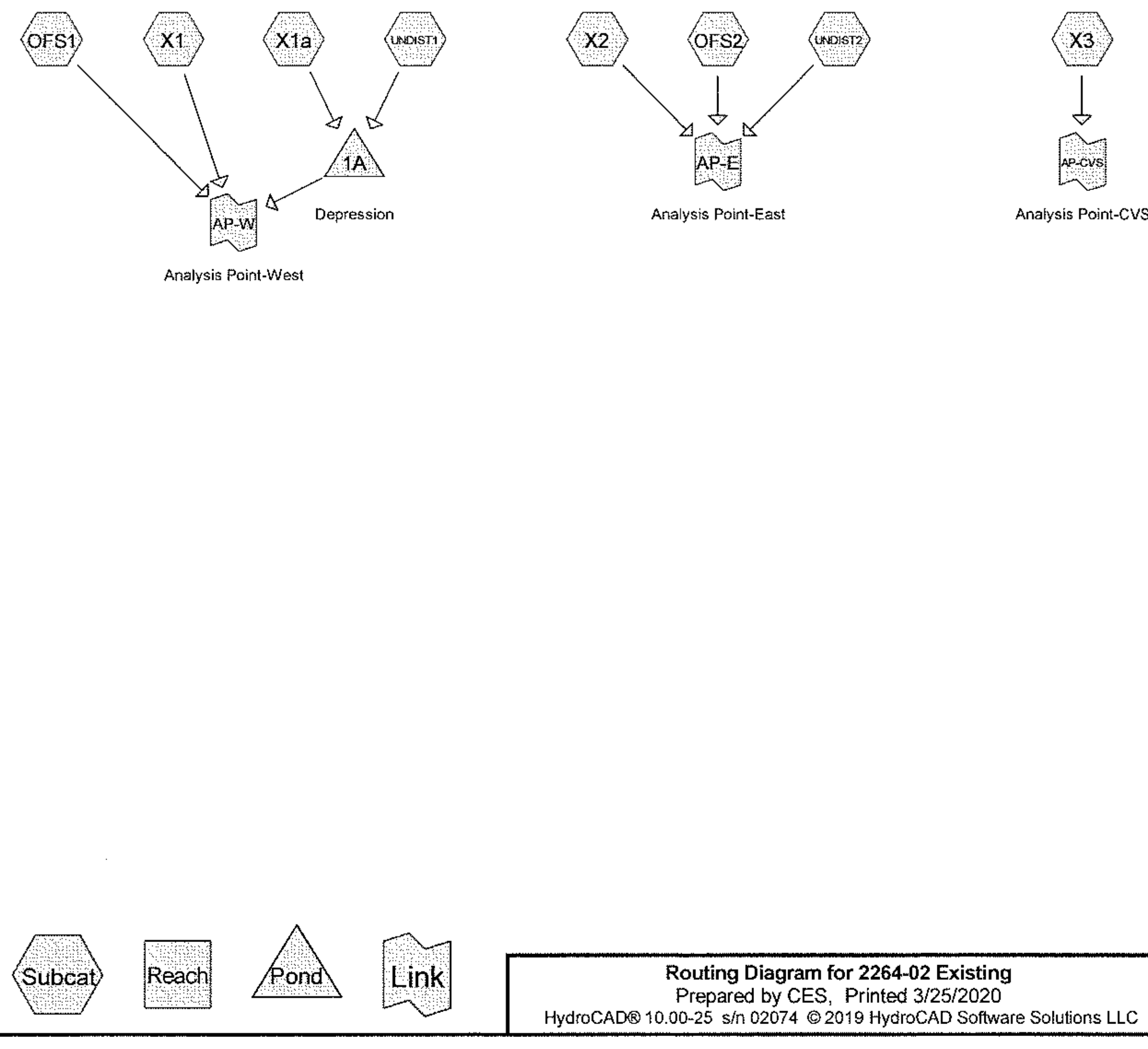
APPENDIX A

PRE-DEVELOPED DRAINAGE AREA MAP & PRE-DEVELOPED DRAINAGE CONDITIONS STORM HYDROGRAPHS



Consulting Engineer Services
Engineers, Planners, and Land Surveyors

PRE-DEVELOPMENT DRAINAGE AGE MAP
SCALE: 1"=200'



Routing Diagram for 2264-02 Existing
Prepared by CES, Printed 3/25/2020
HydroCAD® 10.00-25 s/n 02074 © 2019 HydroCAD Software Solutions LLC

Summary for Subcatchment OFS1:

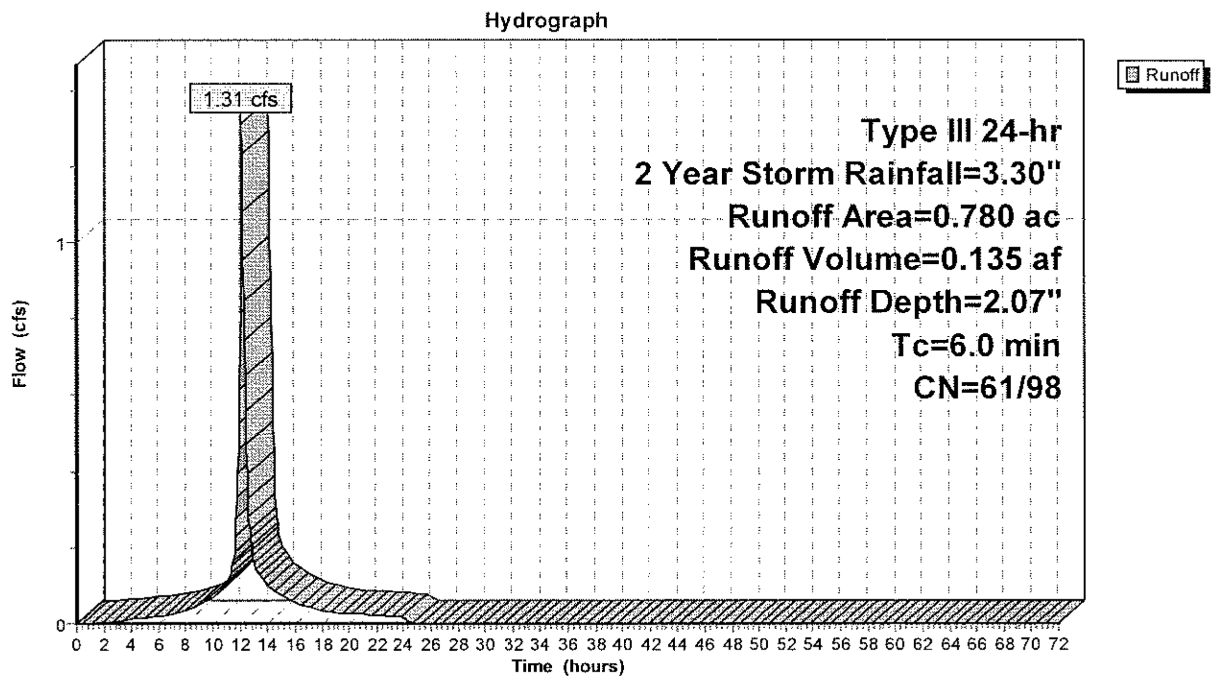
Runoff = 1.31 cfs @ 12.11 hrs, Volume= 0.135 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
0.480	98	Unconnected pavement, HSG B
0.300	61	>75% Grass cover, Good, HSG B
0.780	84	Weighted Average
0.300	61	38.46% Pervious Area
0.480	98	61.54% Impervious Area

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

Subcatchment OFS1:



Summary for Subcatchment OFS2:

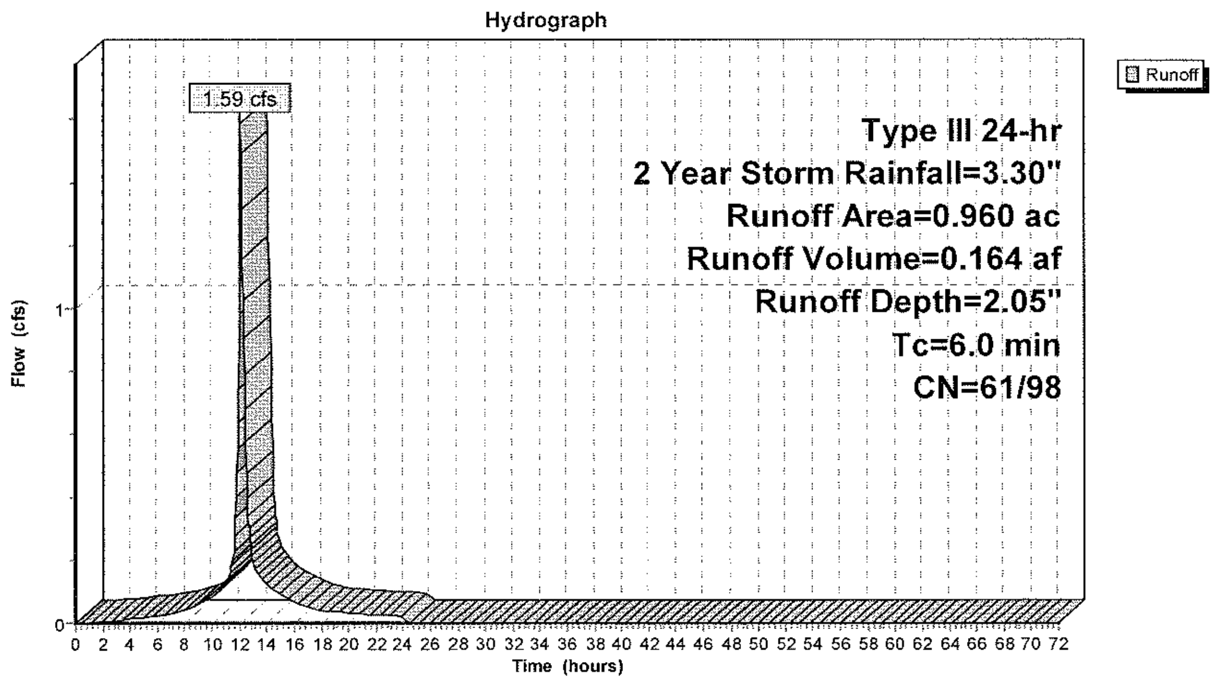
Runoff = 1.59 cfs @ 12.11 hrs, Volume= 0.164 af, Depth= 2.05"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
0.580	98	Unconnected pavement, HSG B
0.380	61	>75% Grass cover, Good, HSG B
0.960	83	Weighted Average
0.380	61	39.58% Pervious Area
0.580	98	60.42% Impervious Area

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

Subcatchment OFS2:



Summary for Subcatchment UNDIST1:

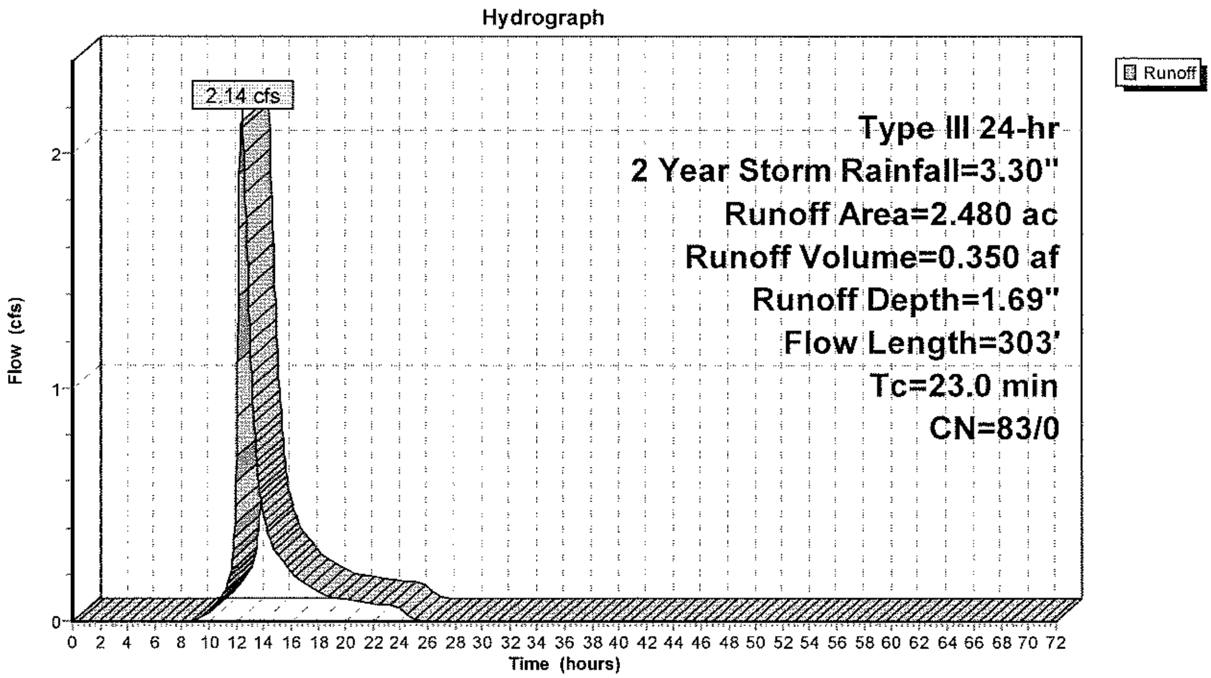
Runoff = 2.14 cfs @ 12.39 hrs, Volume= 0.350 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
2.480	83	Fallow, crop residue, Good, HSG B
2.480	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	150	0.0087	0.12		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
2.4	153	0.0111	1.05		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
23.0	303	Total			

Subcatchment UNDIST1:



Summary for Subcatchment UNDIST2:

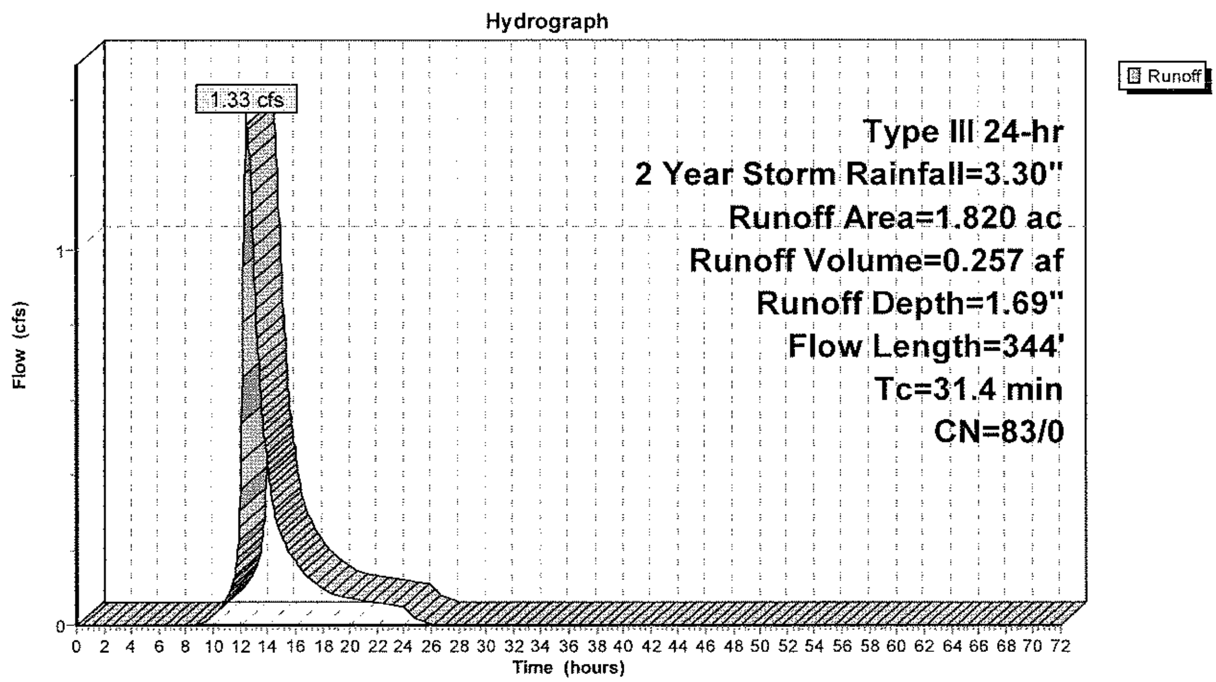
Runoff = 1.33 cfs @ 12.52 hrs, Volume= 0.257 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
1.820	83	Fallow, crop residue, Good, HSG B
1.820	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	150	0.0043	0.09		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
4.1	194	0.0062	0.79		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
31.4	344	Total			

Subcatchment UNDIST2:



Summary for Subcatchment X1:

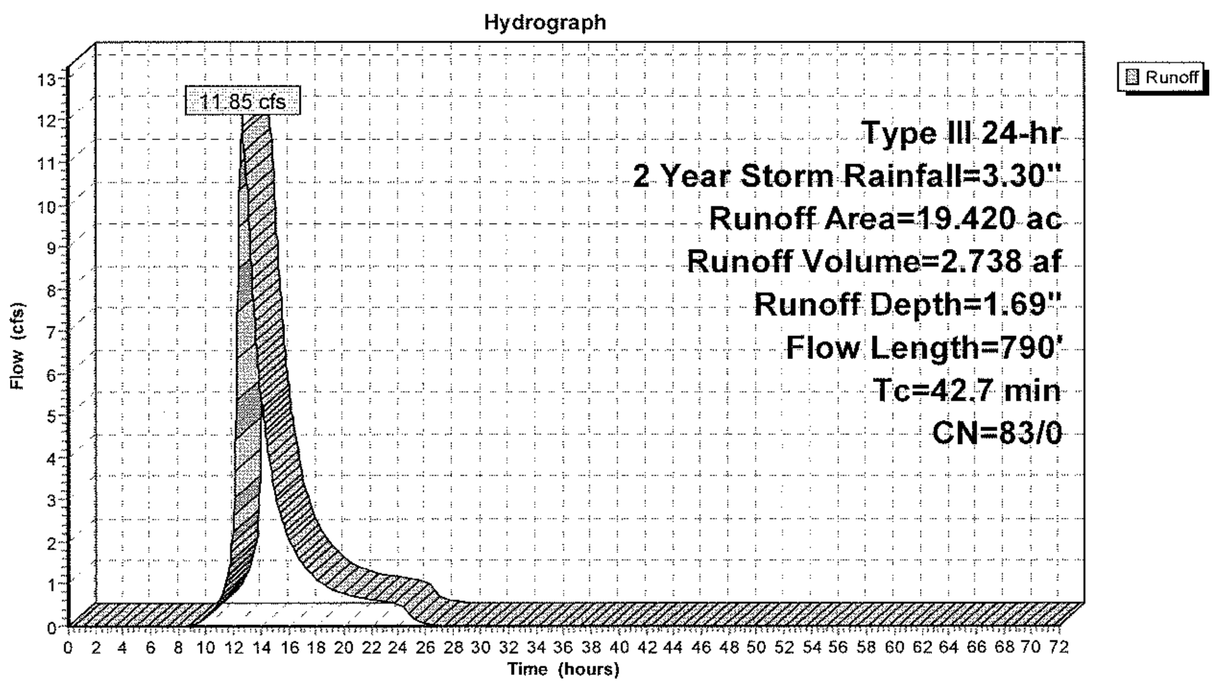
Runoff = 11.85 cfs @ 12.67 hrs, Volume= 2.738 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
18.890	83	Fallow, crop residue, Good, HSG B
0.520	82	Dirt roads, HSG B
0.010	96	Gravel surface, HSG B
19.420	83	Weighted Average
19.420	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	150	0.0030	0.08		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
11.2	640	0.0090	0.95		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
42.7	790	Total			

Subcatchment X1:



Summary for Subcatchment X1a:

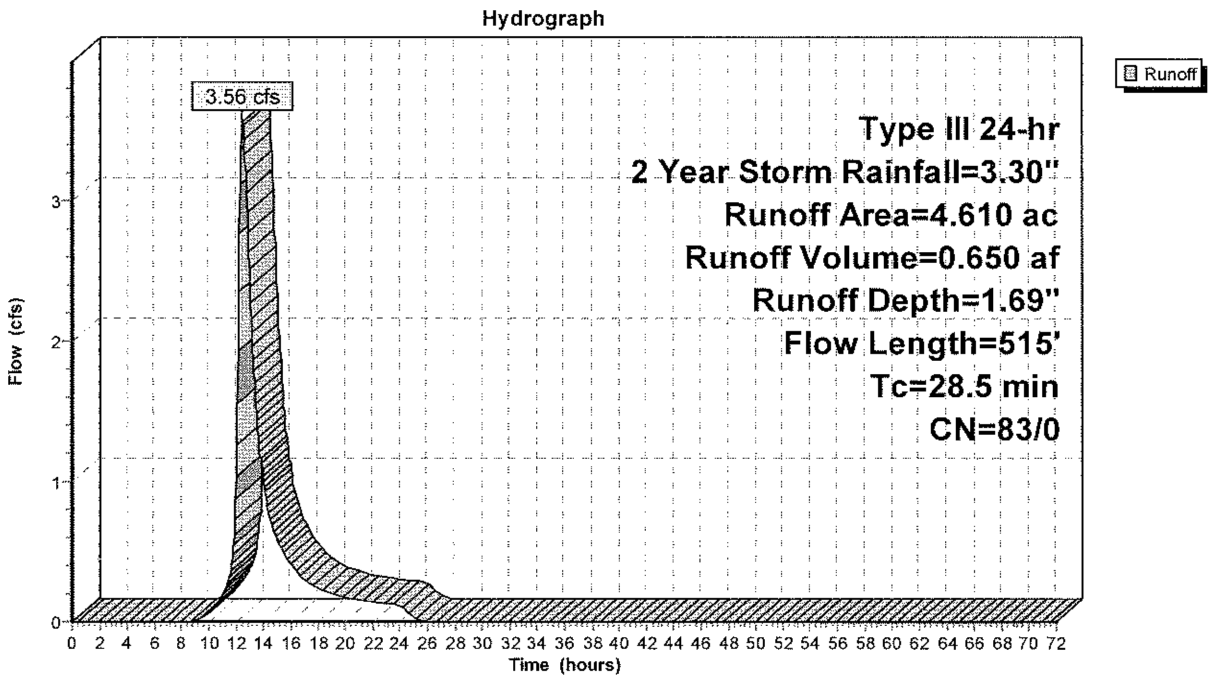
Runoff = 3.56 cfs @ 12.48 hrs, Volume= 0.650 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
4.580	83	Fallow, crop residue, Good, HSG B
0.030	96	Gravel surface, HSG B
4.610	83	Weighted Average
4.610	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4	150	0.0070	0.11		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
6.1	365	0.0100	1.00		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
28.5	515	Total			

Subcatchment X1a:



Summary for Subcatchment X2:

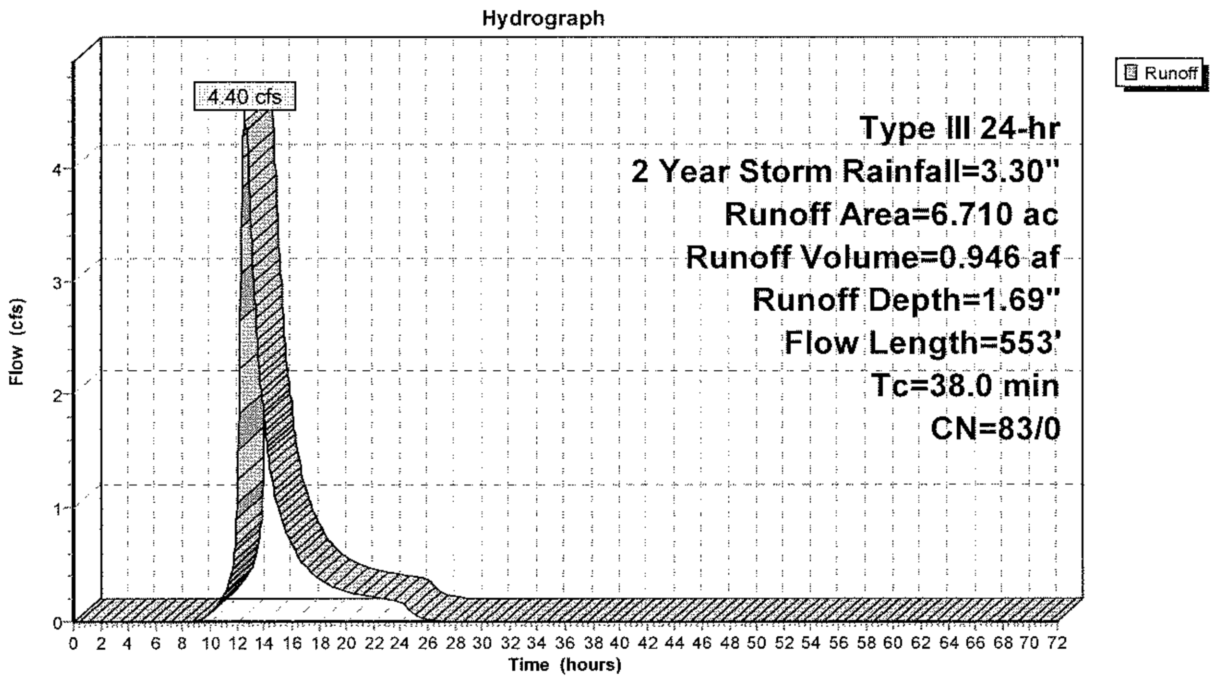
Runoff = 4.40 cfs @ 12.61 hrs, Volume= 0.946 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
0.120	82	Dirt roads, HSG B
6.590	83	Fallow, crop residue, Good, HSG B
6.710	83	Weighted Average
6.710	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.7	150	0.0050	0.10		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
12.3	403	0.0030	0.55		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
38.0	553	Total			

Subcatchment X2:



Summary for Subcatchment X3:

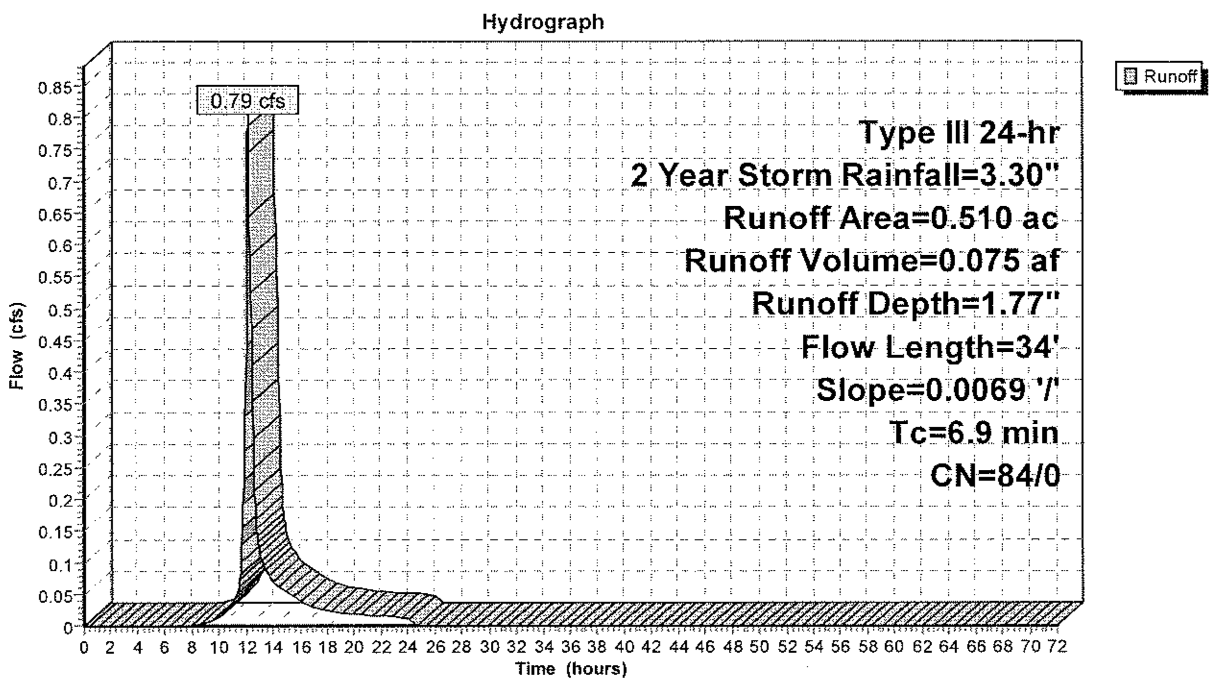
Runoff = 0.79 cfs @ 12.13 hrs, Volume= 0.075 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
0.040	96	Gravel surface, HSG B
0.470	83	Fallow, crop residue, Good, HSG B
0.510	84	Weighted Average
0.510	84	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	34	0.0069	0.08		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"

Subcatchment X3:



Summary for Pond 1A: Depression

Inflow Area = 7.090 ac, 0.00% Impervious, Inflow Depth = 1.69" for 2 Year Storm event
Inflow = 5.67 cfs @ 12.45 hrs, Volume= 0.999 af
Outflow = 0.87 cfs @ 15.01 hrs, Volume= 0.370 af, Atten= 85%, Lag= 153.7 min
Primary = 0.87 cfs @ 15.01 hrs, Volume= 0.370 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 157.12' @ 15.01 hrs Surf.Area= 1.738 ac Storage= 0.673 af

Plug-Flow detention time= 365.1 min calculated for 0.370 af (37% of inflow)
Center-of-Mass det. time= 229.8 min (1,096.6 - 866.8)

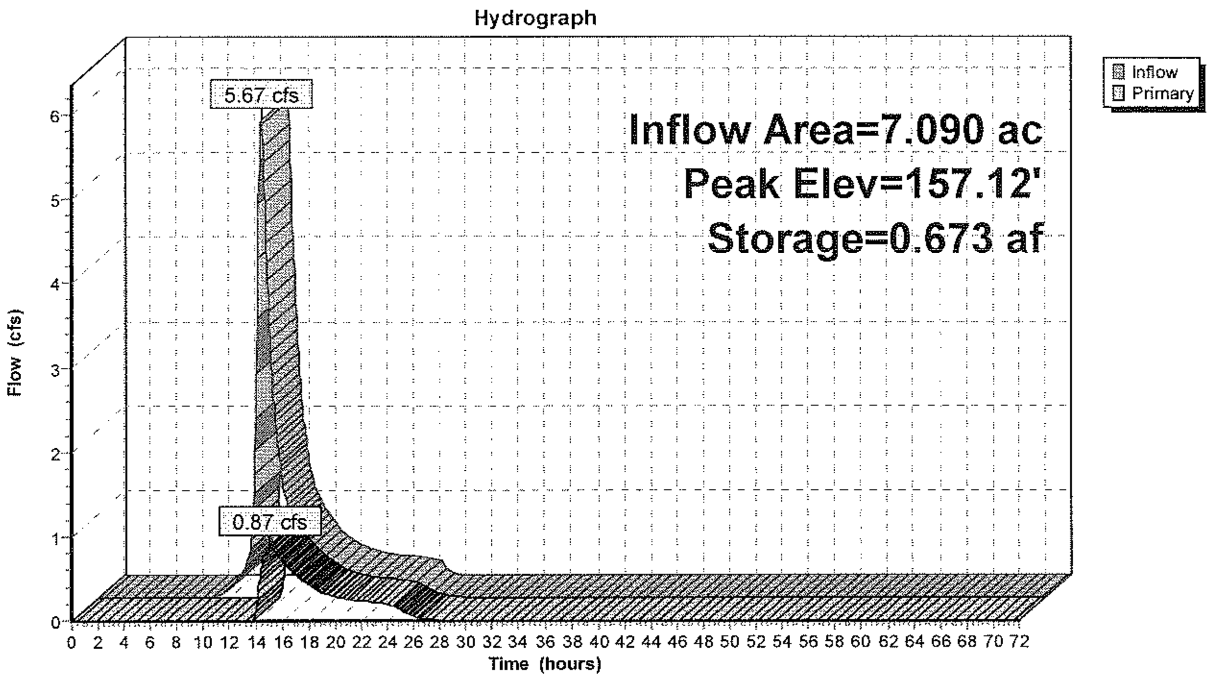
Volume	Invert	Avail.Storage	Storage Description
#1	156.25'	1.515 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
156.25	0.004	0.000	0.000
156.50	0.321	0.041	0.041
157.00	1.467	0.447	0.488
157.50	2.641	1.027	1.515

Device	Routing	Invert	Outlet Devices
#1	Primary	157.09'	**86.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.86 cfs @ 15.01 hrs HW=157.12' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.86 cfs @ 0.39 fps)

Pond 1A: Depression

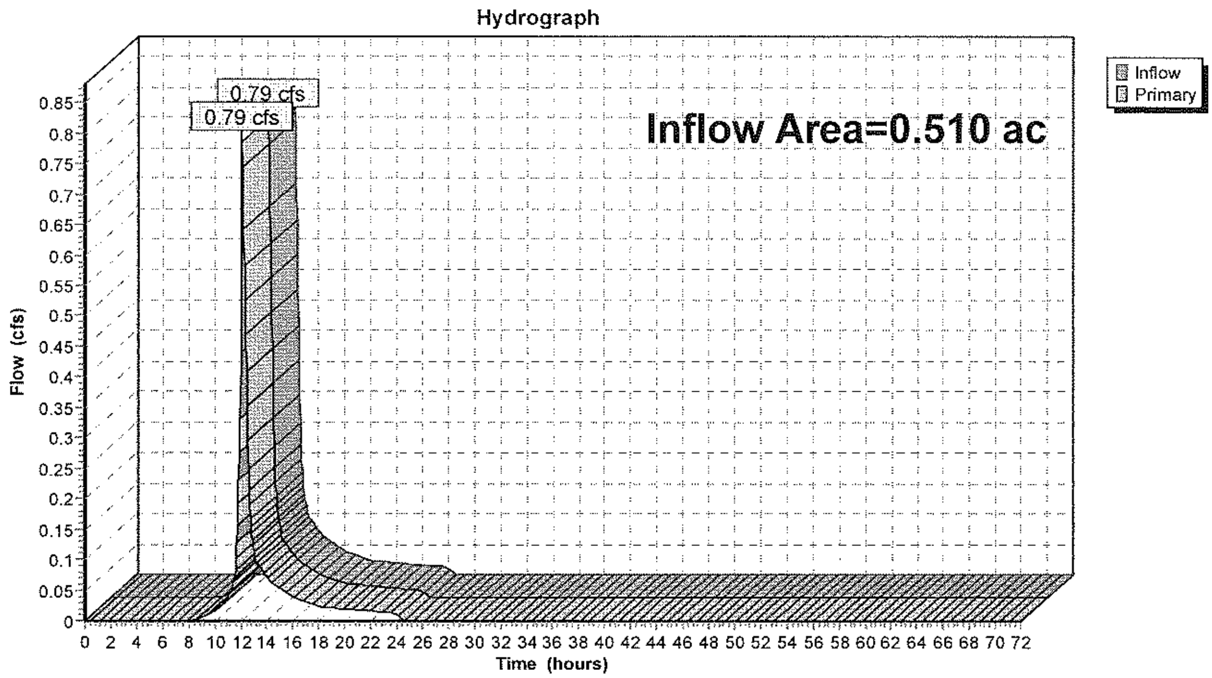


Summary for Link AP-CVS: Analysis Point-CVS

Inflow Area =	0.510 ac,	0.00% Impervious, Inflow Depth = 1.77"	for 2 Year Storm event
Inflow =	0.79 cfs @	12.13 hrs, Volume=	0.075 af
Primary =	0.79 cfs @	12.13 hrs, Volume=	0.075 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-CVS: Analysis Point-CVS

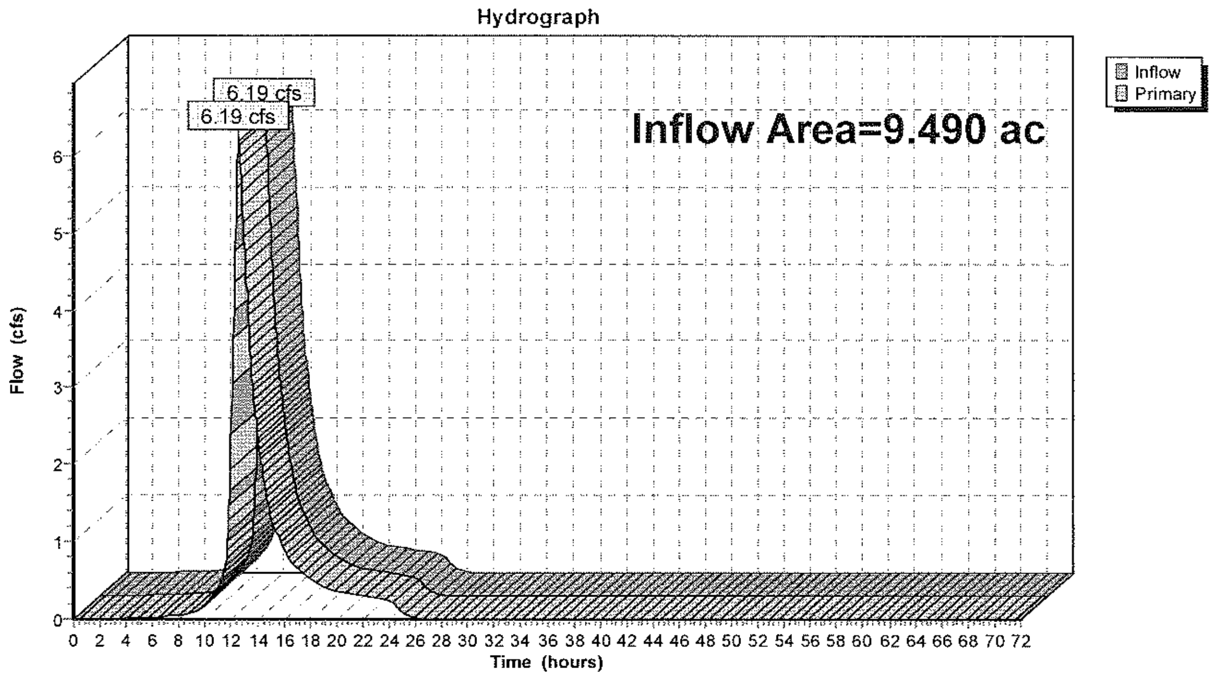


Summary for Link AP-E: Analysis Point-East

Inflow Area =	9.490 ac, 6.11% Impervious, Inflow Depth = 1.73"	for 2 Year Storm event
Inflow =	6.19 cfs @ 12.52 hrs, Volume=	1.366 af
Primary =	6.19 cfs @ 12.52 hrs, Volume=	1.366 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-E: Analysis Point-East

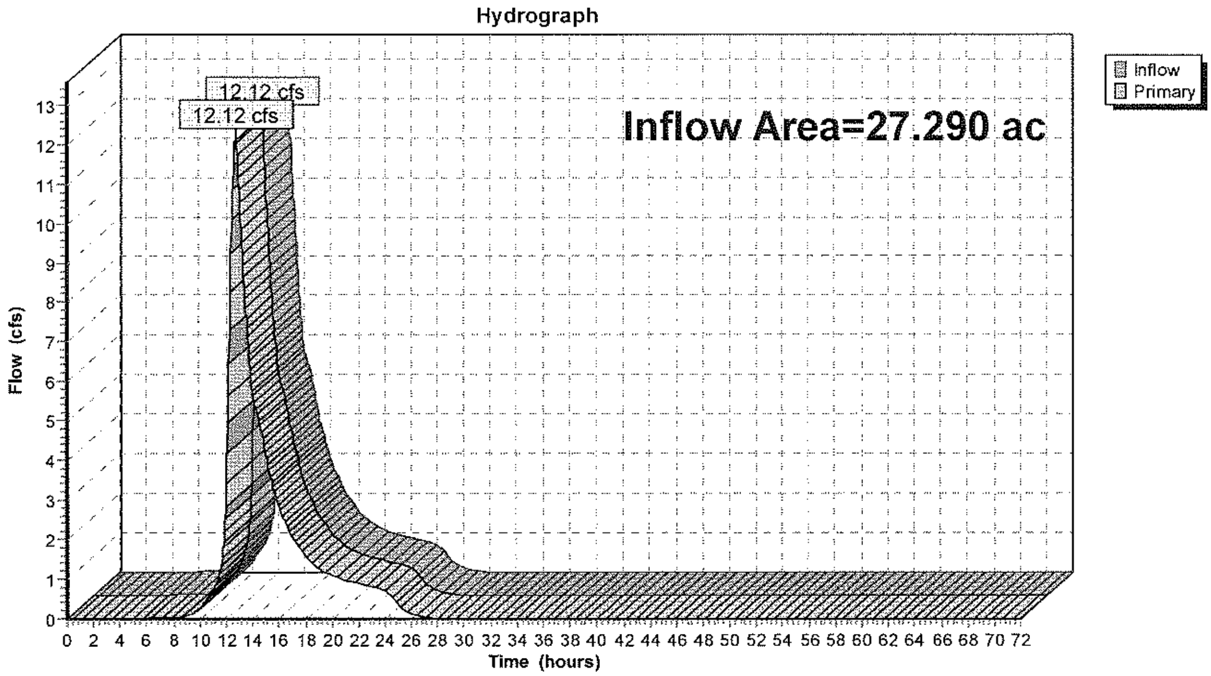


Summary for Link AP-W: Analysis Point-West

Inflow Area =	27.290 ac,	1.76% Impervious, Inflow Depth = 1.43"	for 2 Year Storm event
Inflow =	12.12 cfs @	12.65 hrs, Volume=	3.243 af
Primary =	12.12 cfs @	12.65 hrs, Volume=	3.243 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-W: Analysis Point-West



Summary for Subcatchment OFS1:

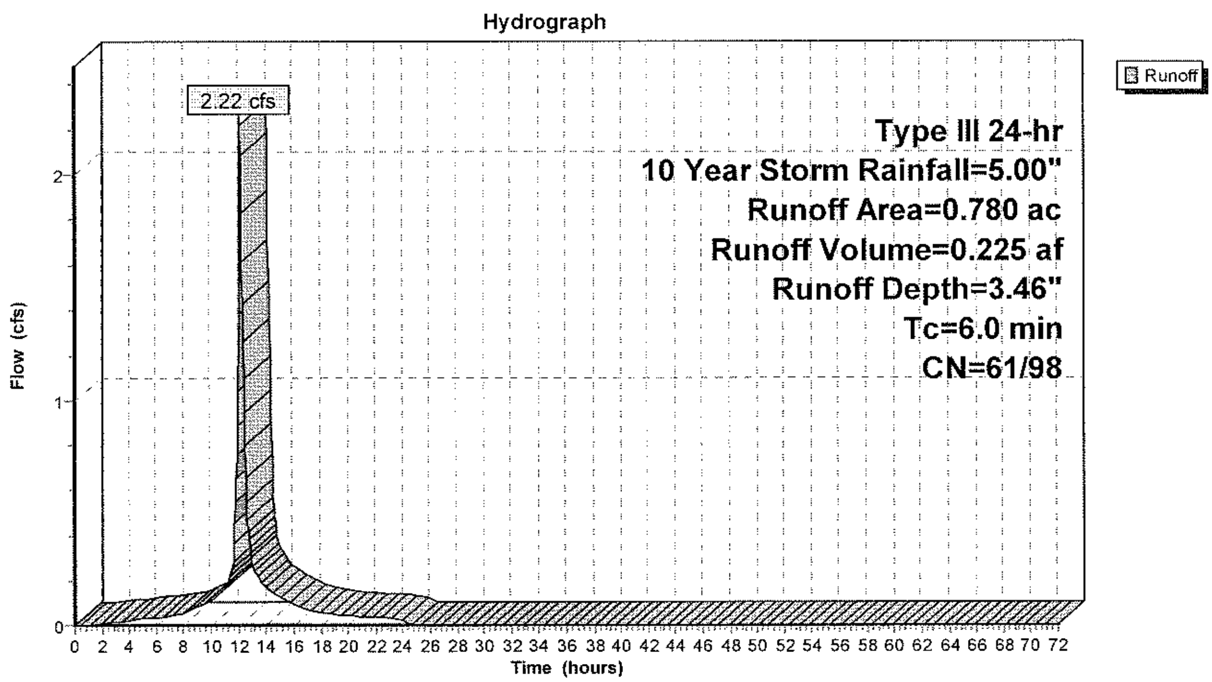
Runoff = 2.22 cfs @ 12.11 hrs, Volume= 0.225 af, Depth= 3.46"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
0.480	98	Unconnected pavement, HSG B
0.300	61	>75% Grass cover, Good, HSG B
0.780	84	Weighted Average
0.300	61	38.46% Pervious Area
0.480	98	61.54% Impervious Area

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

Subcatchment OFS1:



Summary for Subcatchment OFS2:

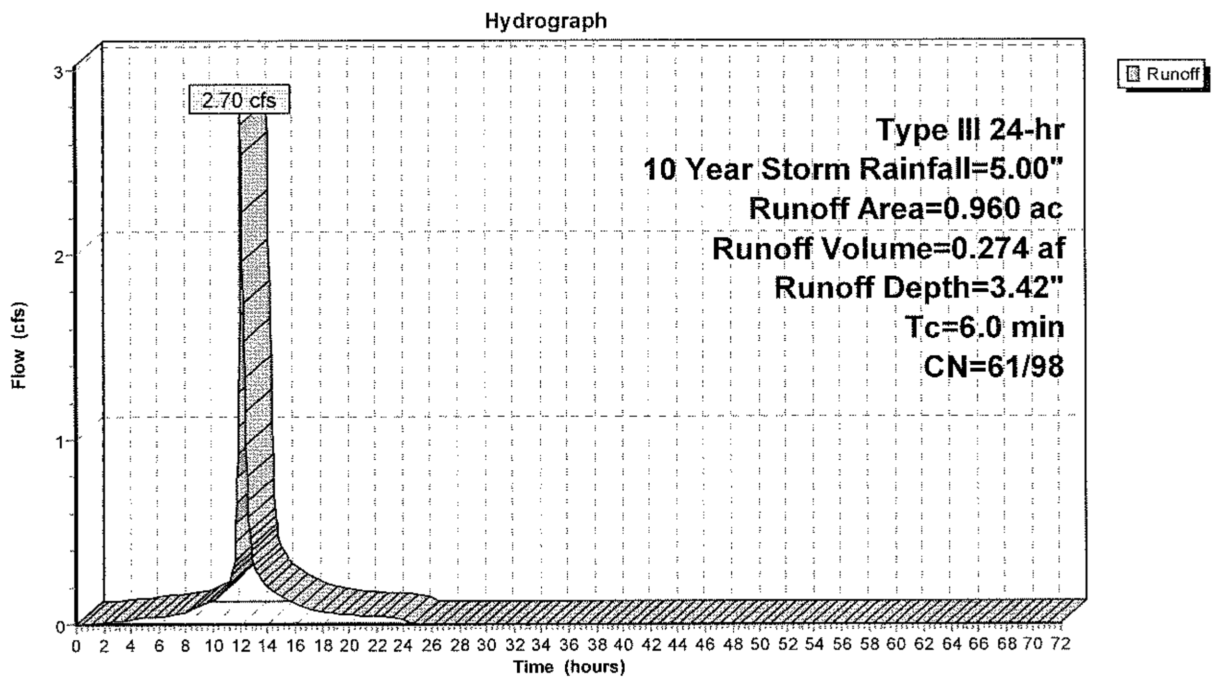
Runoff = 2.70 cfs @ 12.11 hrs, Volume= 0.274 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
0.580	98	Unconnected pavement, HSG B
0.380	61	>75% Grass cover, Good, HSG B
0.960	83	Weighted Average
0.380	61	39.58% Pervious Area
0.580	98	60.42% Impervious Area

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

Subcatchment OFS2:



Summary for Subcatchment UNDIST1:

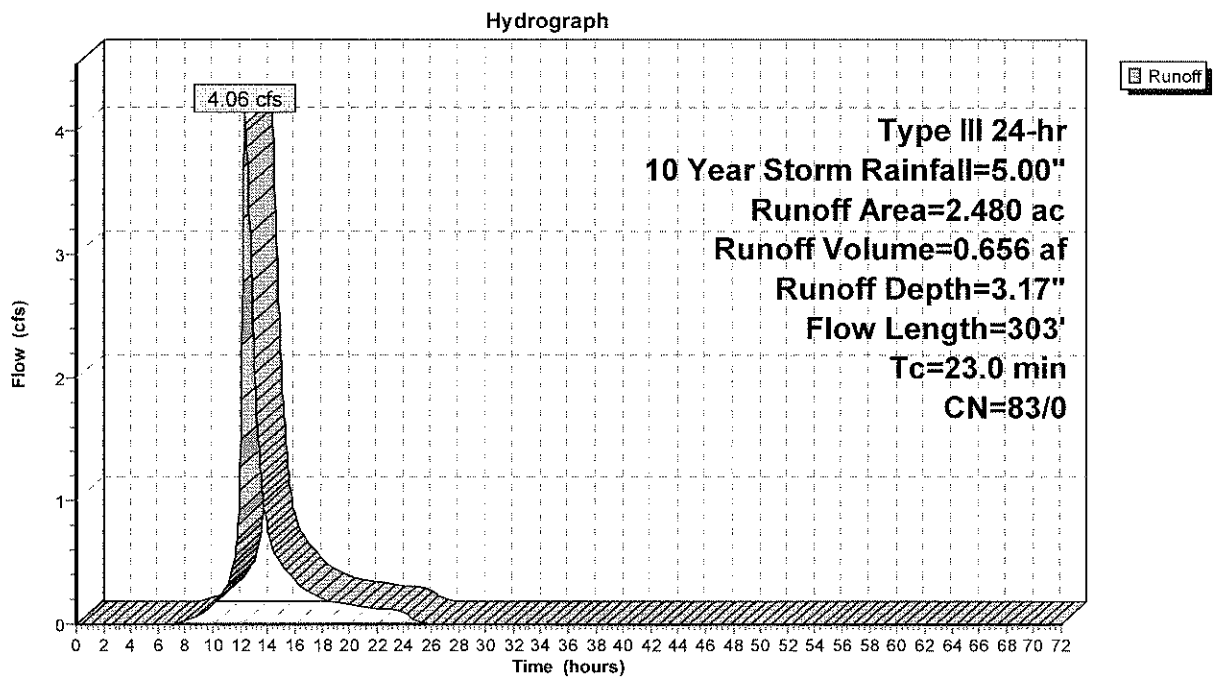
Runoff = 4.06 cfs @ 12.37 hrs, Volume= 0.656 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
2.480	83	Fallow, crop residue, Good, HSG B
2.480	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	150	0.0087	0.12		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
2.4	153	0.0111	1.05		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
23.0	303	Total			

Subcatchment UNDIST1:



Summary for Subcatchment UNDIST2:

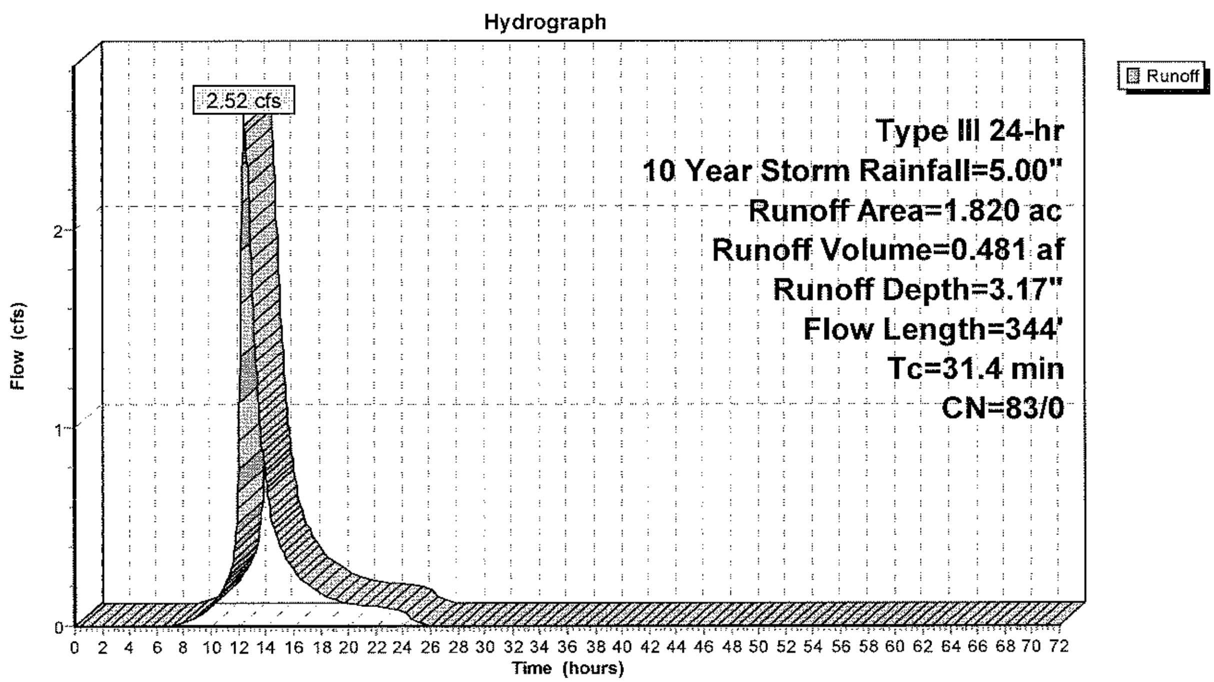
Runoff = 2.52 cfs @ 12.50 hrs, Volume= 0.481 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
1.820	83	Fallow, crop residue, Good, HSG B
1.820	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	150	0.0043	0.09		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
4.1	194	0.0062	0.79		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
31.4	344	Total			

Subcatchment UNDIST2:



Summary for Subcatchment X1:

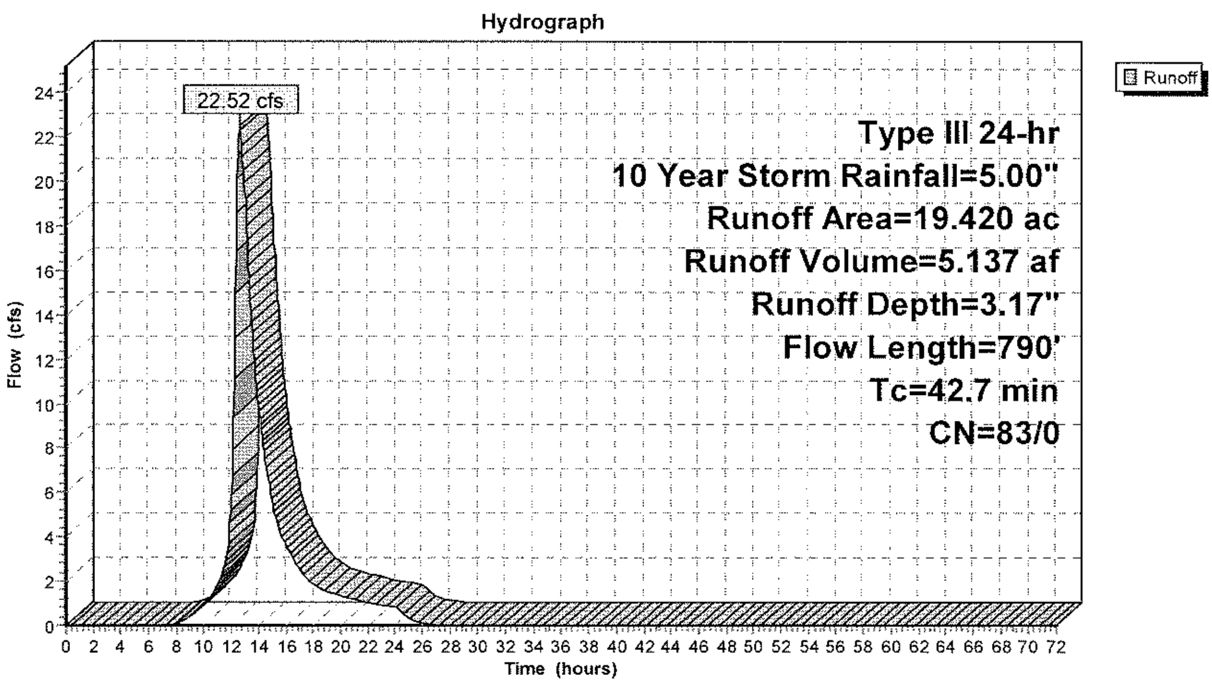
Runoff = 22.52 cfs @ 12.65 hrs, Volume= 5.137 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
18.890	83	Fallow, crop residue, Good, HSG B
0.520	82	Dirt roads, HSG B
0.010	96	Gravel surface, HSG B
19.420	83	Weighted Average
19.420	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	150	0.0030	0.08		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
11.2	640	0.0090	0.95		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
42.7	790	Total			

Subcatchment X1:



Summary for Subcatchment X1a:

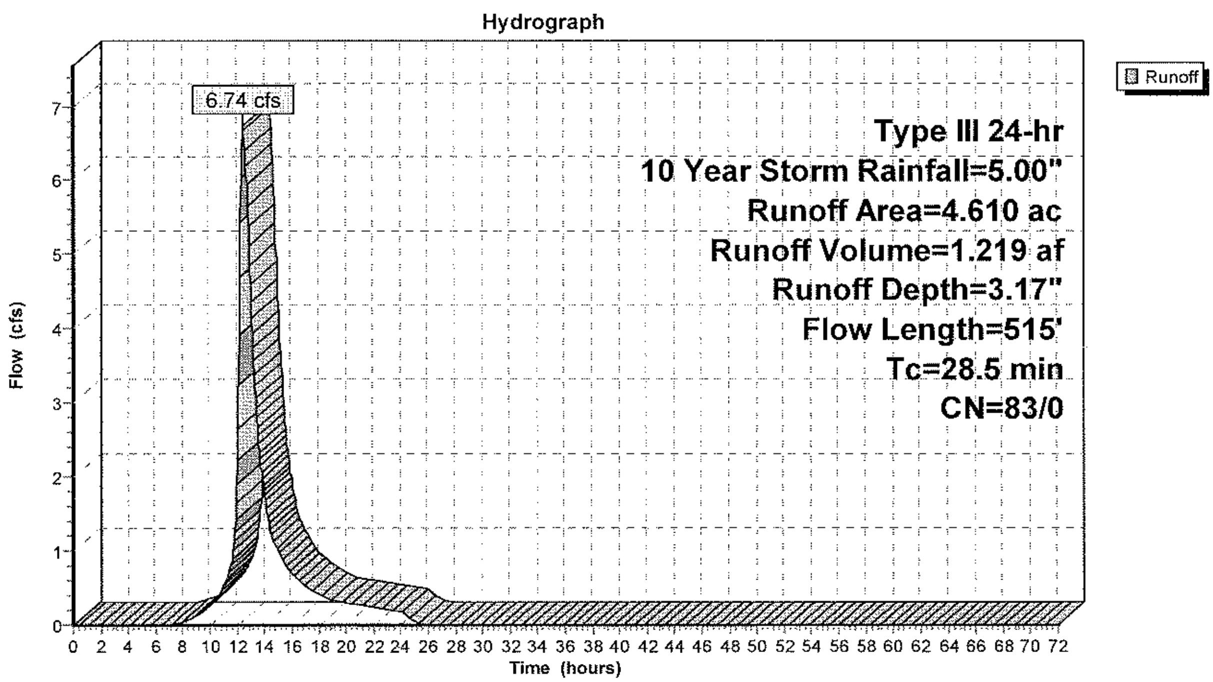
Runoff = 6.74 cfs @ 12.46 hrs, Volume= 1.219 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
4.580	83	Fallow, crop residue, Good, HSG B
0.030	96	Gravel surface, HSG B
4.610	83	Weighted Average
4.610	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4	150	0.0070	0.11		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
6.1	365	0.0100	1.00		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
28.5	515	Total			

Subcatchment X1a:



Summary for Subcatchment X2:

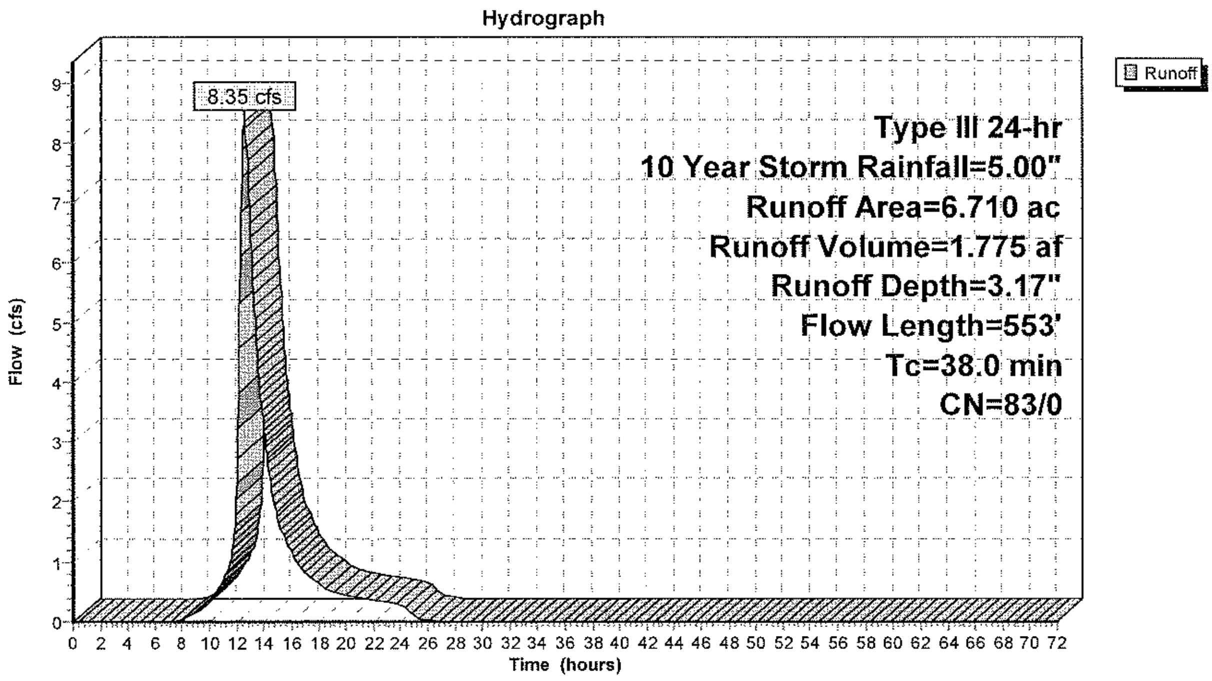
Runoff = 8.35 cfs @ 12.59 hrs, Volume= 1.775 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
0.120	82	Dirt roads, HSG B
6.590	83	Fallow, crop residue, Good, HSG B
6.710	83	Weighted Average
6.710	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.7	150	0.0050	0.10		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
12.3	403	0.0030	0.55		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
38.0	553	Total			

Subcatchment X2:



Summary for Subcatchment X3:

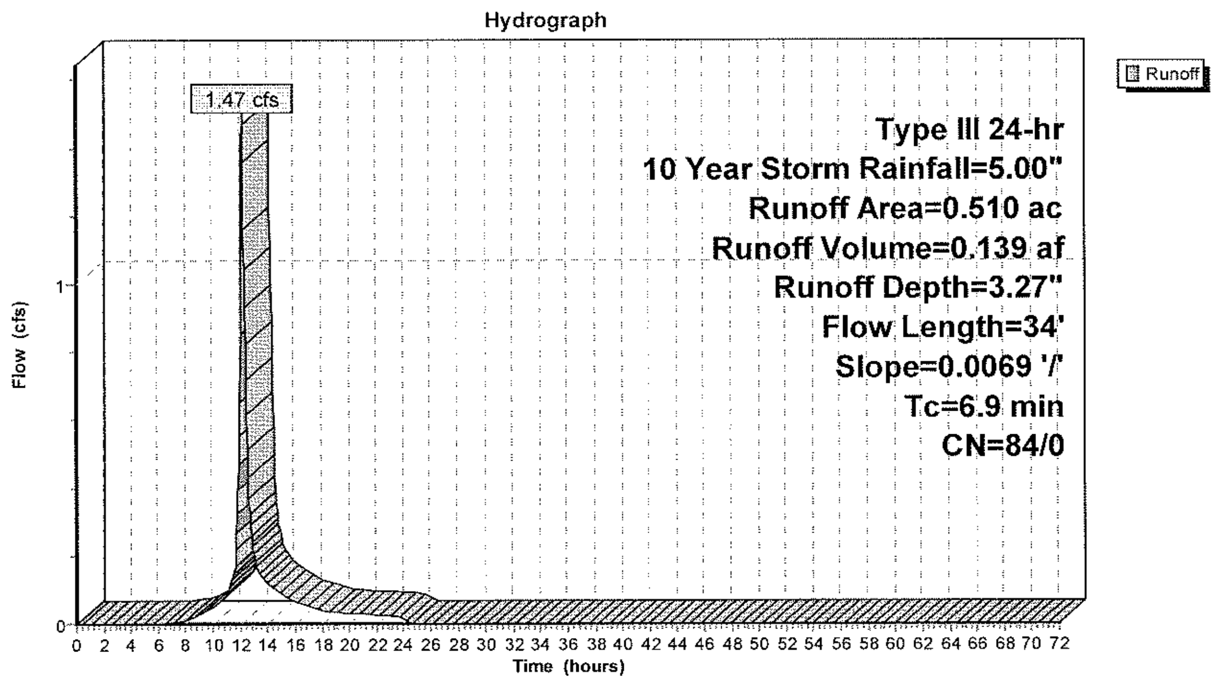
Runoff = 1.47 cfs @ 12.12 hrs, Volume= 0.139 af, Depth= 3.27"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
0.040	96	Gravel surface, HSG B
0.470	83	Fallow, crop residue, Good, HSG B
0.510	84	Weighted Average
0.510	84	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	34	0.0069	0.08		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"

Subcatchment X3:



Summary for Pond 1A: Depression

Inflow Area = 7.090 ac, 0.00% Impervious, Inflow Depth = 3.17" for 10 Year Storm event
Inflow = 10.74 cfs @ 12.42 hrs, Volume= 1.875 af
Outflow = 5.97 cfs @ 13.08 hrs, Volume= 1.246 af, Atten= 44%, Lag= 39.6 min
Primary = 5.97 cfs @ 13.08 hrs, Volume= 1.246 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 157.18' @ 13.08 hrs Surf.Area= 1.897 ac Storage= 0.796 af

Plug-Flow detention time= 199.4 min calculated for 1.245 af (66% of inflow)
Center-of-Mass det. time= 99.7 min (948.4 - 848.7)

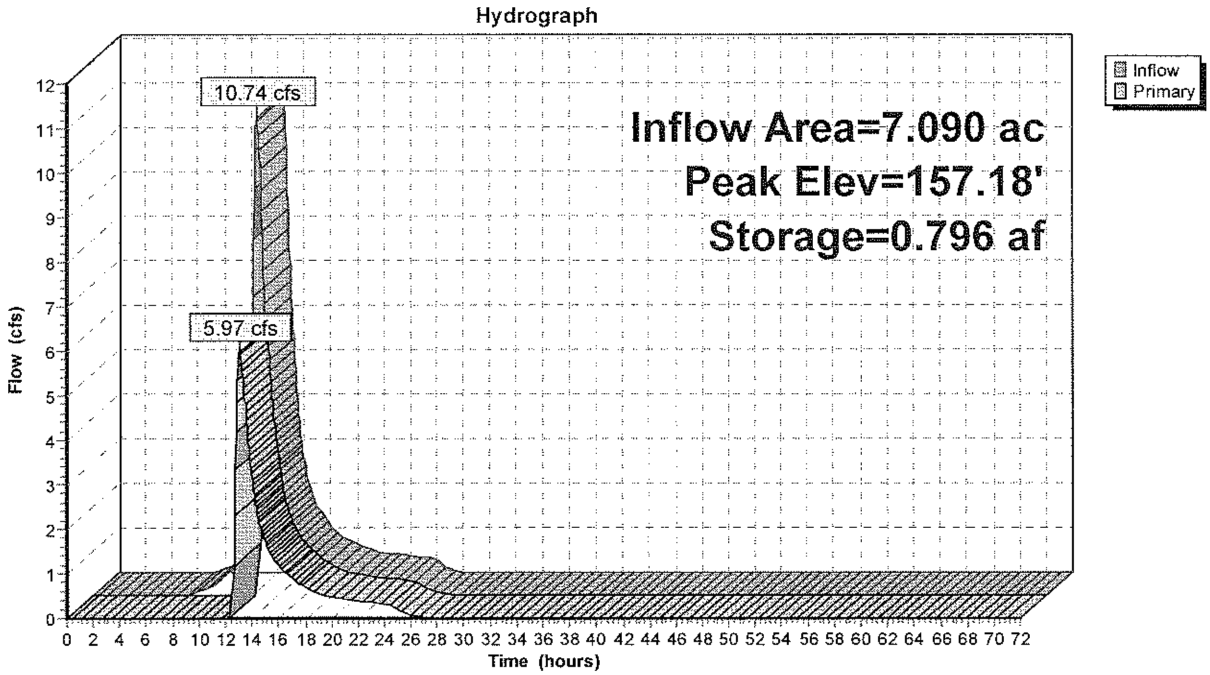
Volume	Invert	Avail.Storage	Storage Description
#1	156.25'	1.515 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
156.25	0.004	0.000	0.000
156.50	0.321	0.041	0.041
157.00	1.467	0.447	0.488
157.50	2.641	1.027	1.515

Device	Routing	Invert	Outlet Devices
#1	Primary	157.09'	**86.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=5.96 cfs @ 13.08 hrs HW=157.18' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 5.96 cfs @ 0.74 fps)

Pond 1A: Depression

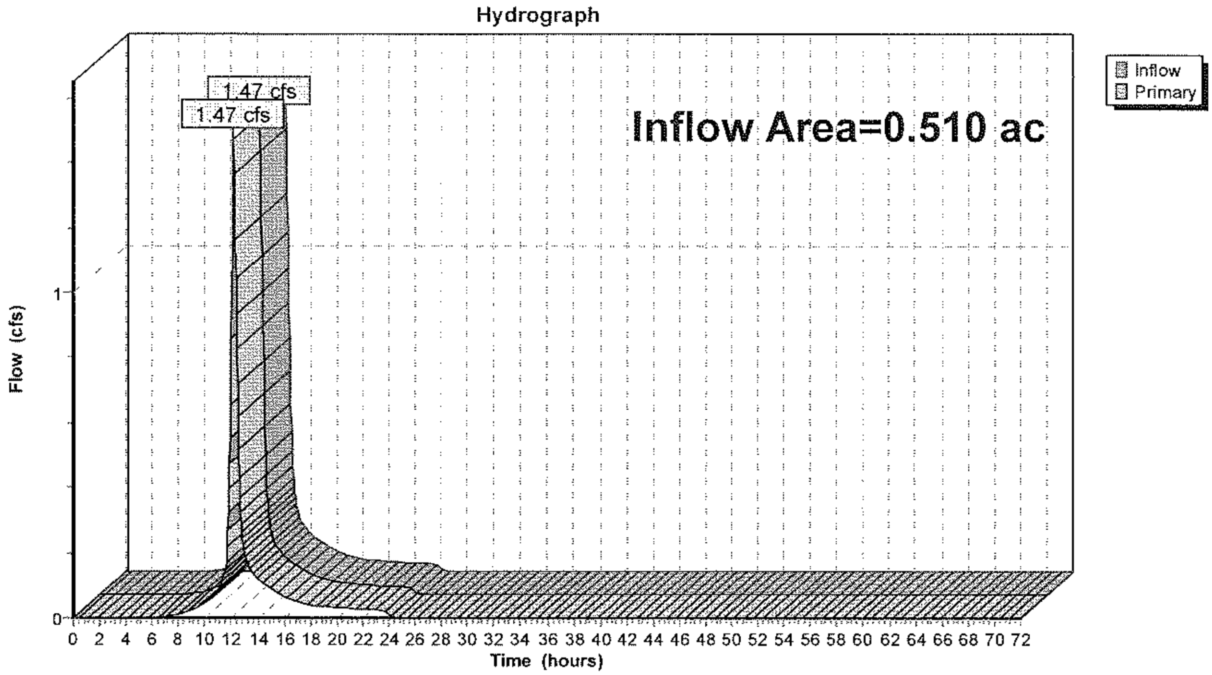


Summary for Link AP-CVS: Analysis Point-CVS

Inflow Area =	0.510 ac,	0.00% Impervious, Inflow Depth = 3.27"	for 10 Year Storm event	
Inflow =	1.47 cfs @	12.12 hrs, Volume=	0.139 af	
Primary =	1.47 cfs @	12.12 hrs, Volume=	0.139 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-CVS: Analysis Point-CVS

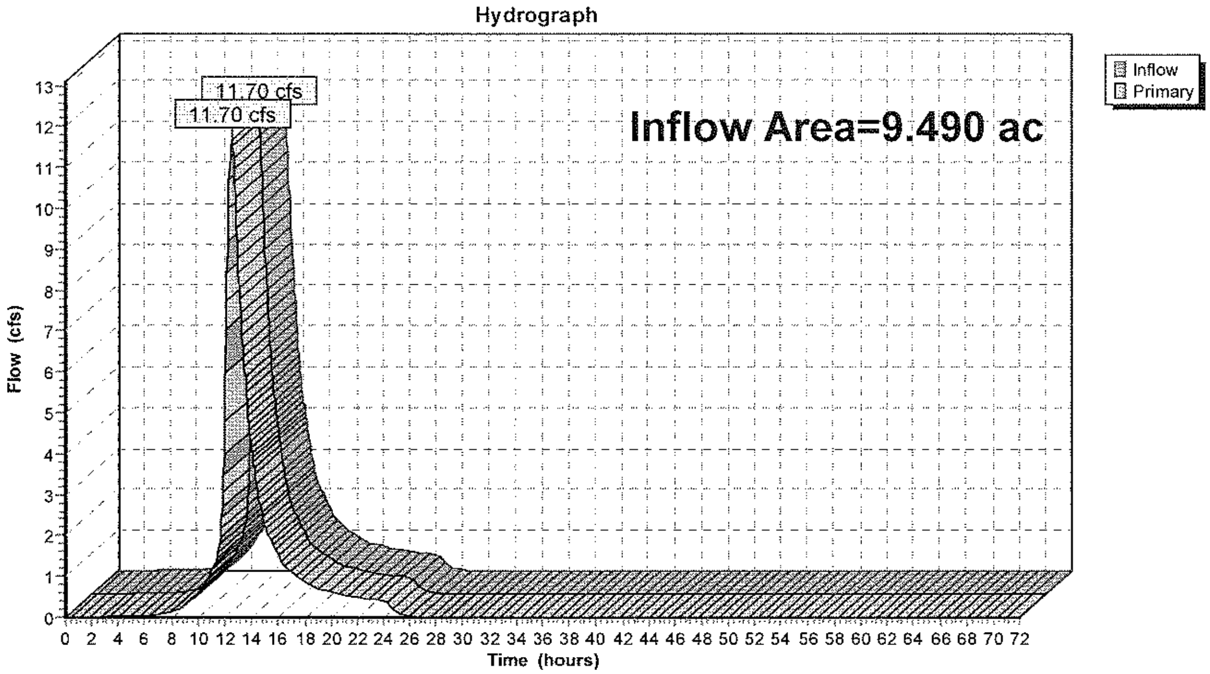


Summary for Link AP-E: Analysis Point-East

Inflow Area =	9.490 ac,	6.11% Impervious,	Inflow Depth = 3.20"	for 10 Year Storm event
Inflow =	11.70 cfs @	12.51 hrs, Volume=	2.530 af	
Primary =	11.70 cfs @	12.51 hrs, Volume=	2.530 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-E: Analysis Point-East

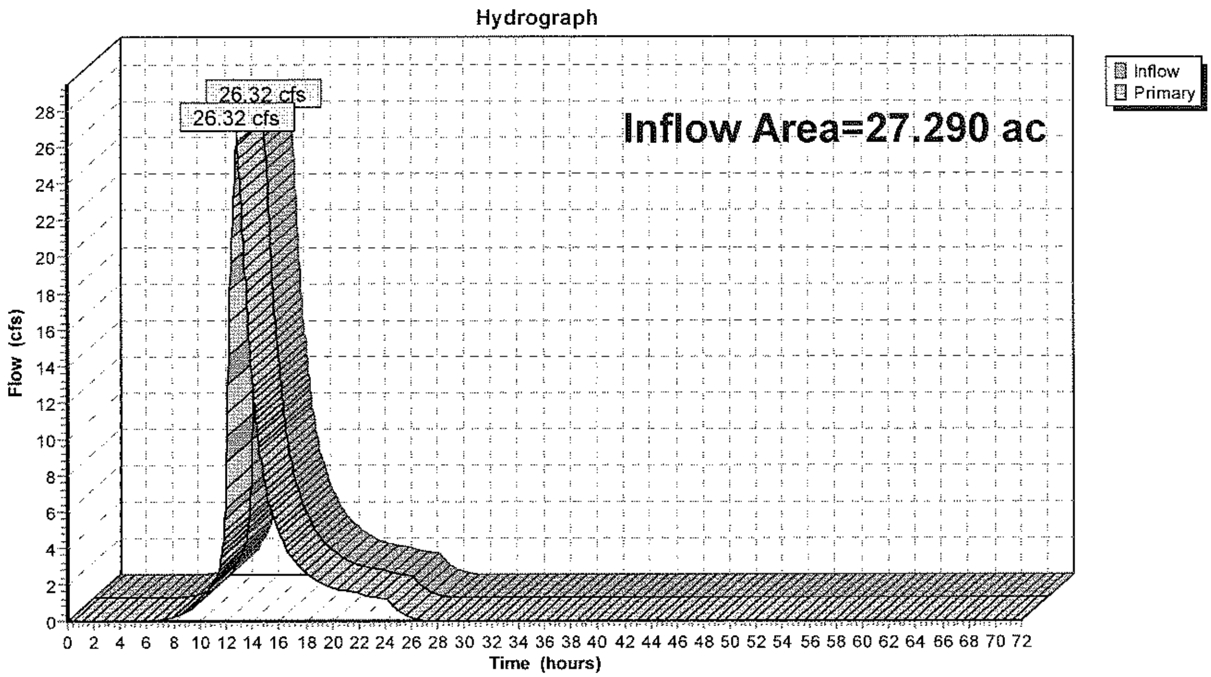


Summary for Link AP-W: Analysis Point-West

Inflow Area =	27.290 ac,	1.76% Impervious, Inflow Depth = 2.91"	for 10 Year Storm event
Inflow =	26.32 cfs @	12.85 hrs, Volume=	6.608 af
Primary =	26.32 cfs @	12.85 hrs, Volume=	6.608 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-W: Analysis Point-West



Summary for Subcatchment OFS1:

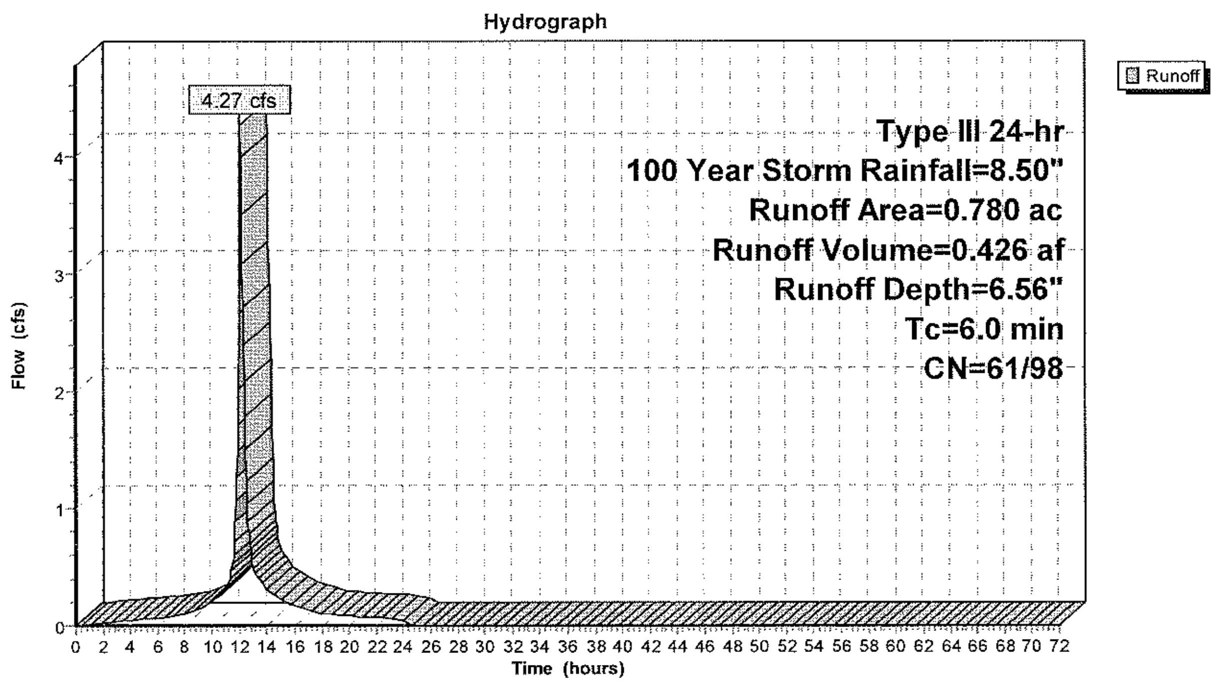
Runoff = 4.27 cfs @ 12.11 hrs, Volume= 0.426 af, Depth= 6.56"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
0.480	98	Unconnected pavement, HSG B
0.300	61	>75% Grass cover, Good, HSG B
0.780	84	Weighted Average
0.300	61	38.46% Pervious Area
0.480	98	61.54% Impervious Area

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

Subcatchment OFS1:



Summary for Subcatchment OFS2:

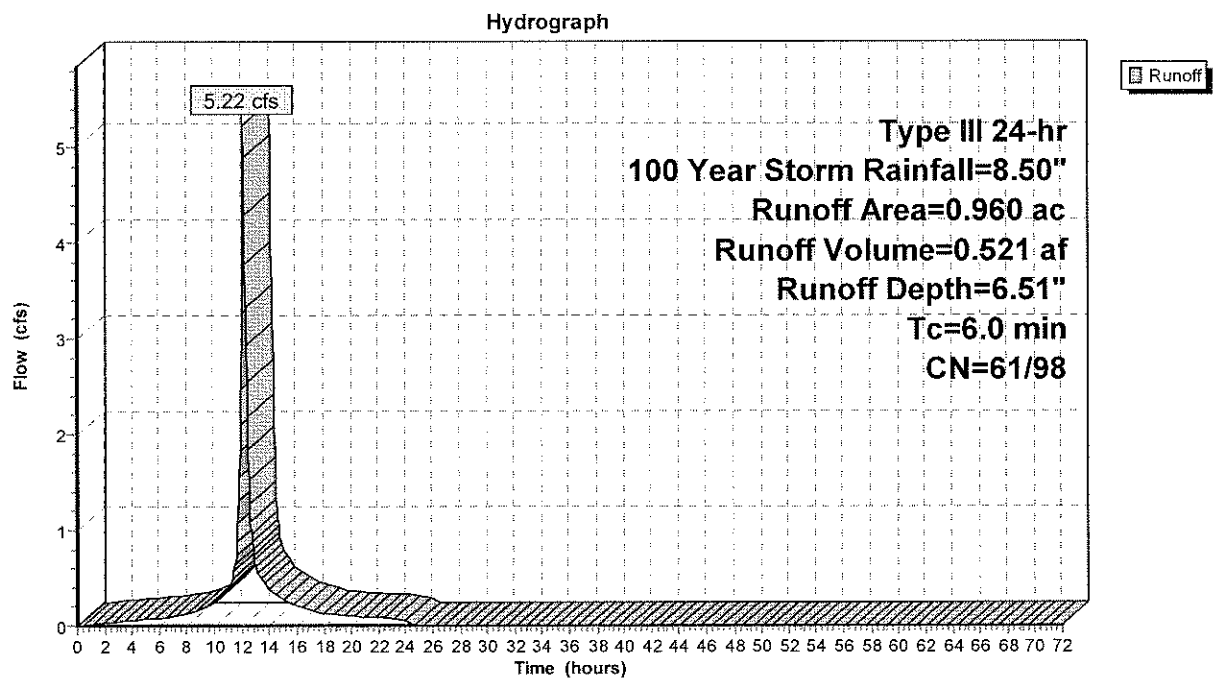
Runoff = 5.22 cfs @ 12.11 hrs, Volume= 0.521 af, Depth= 6.51"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
0.580	98	Unconnected pavement, HSG B
0.380	61	>75% Grass cover, Good, HSG B
0.960	83	Weighted Average
0.380	61	39.58% Pervious Area
0.580	98	60.42% Impervious Area

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

Subcatchment OFS2:



Summary for Subcatchment UNDIST1:

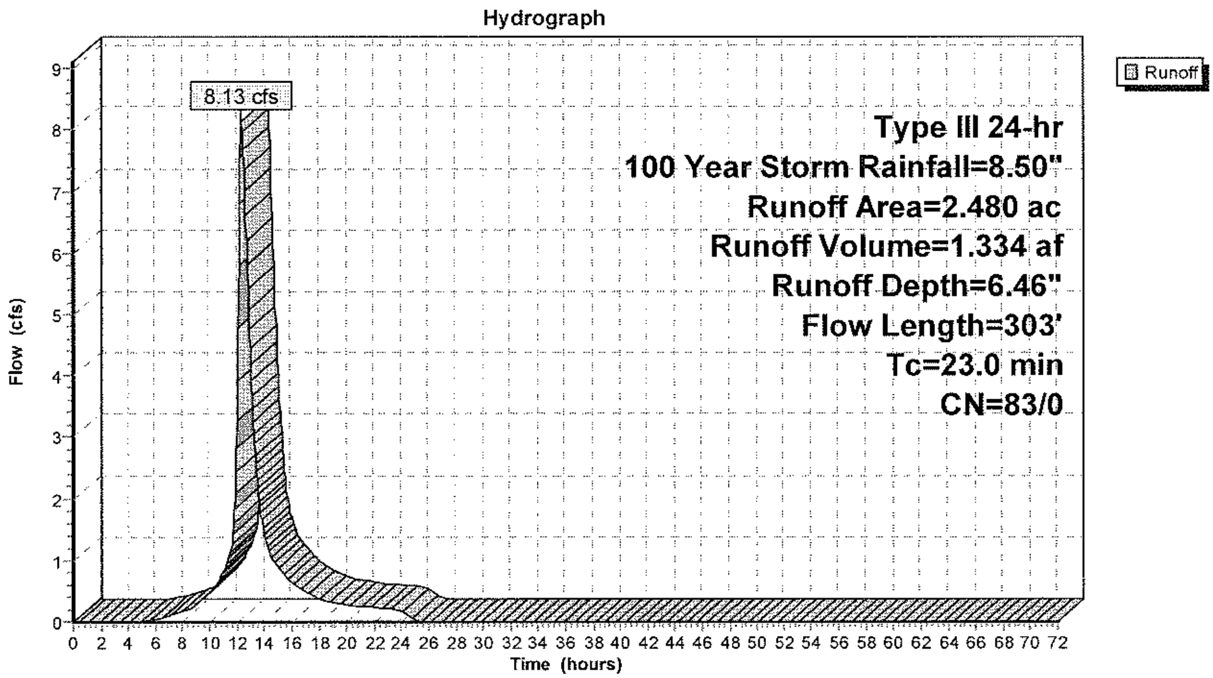
Runoff = 8.13 cfs @ 12.36 hrs, Volume= 1.334 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
2.480	83	Fallow, crop residue, Good, HSG B
2.480	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	150	0.0087	0.12		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
2.4	153	0.0111	1.05		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
23.0	303	Total			

Subcatchment UNDIST1:



Summary for Subcatchment UNDIST2:

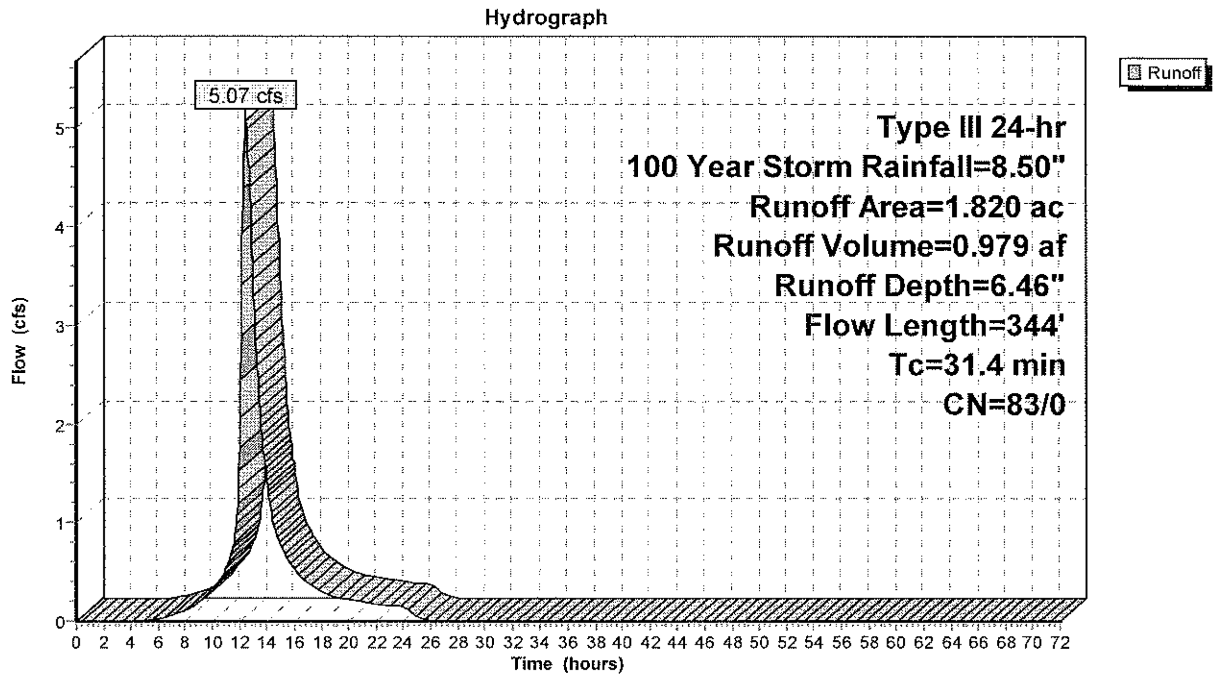
Runoff = 5.07 cfs @ 12.48 hrs, Volume= 0.979 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
1.820	83	Fallow, crop residue, Good, HSG B
1.820	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	150	0.0043	0.09		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
4.1	194	0.0062	0.79		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
31.4	344	Total			

Subcatchment UNDIST2:



Summary for Subcatchment X1:

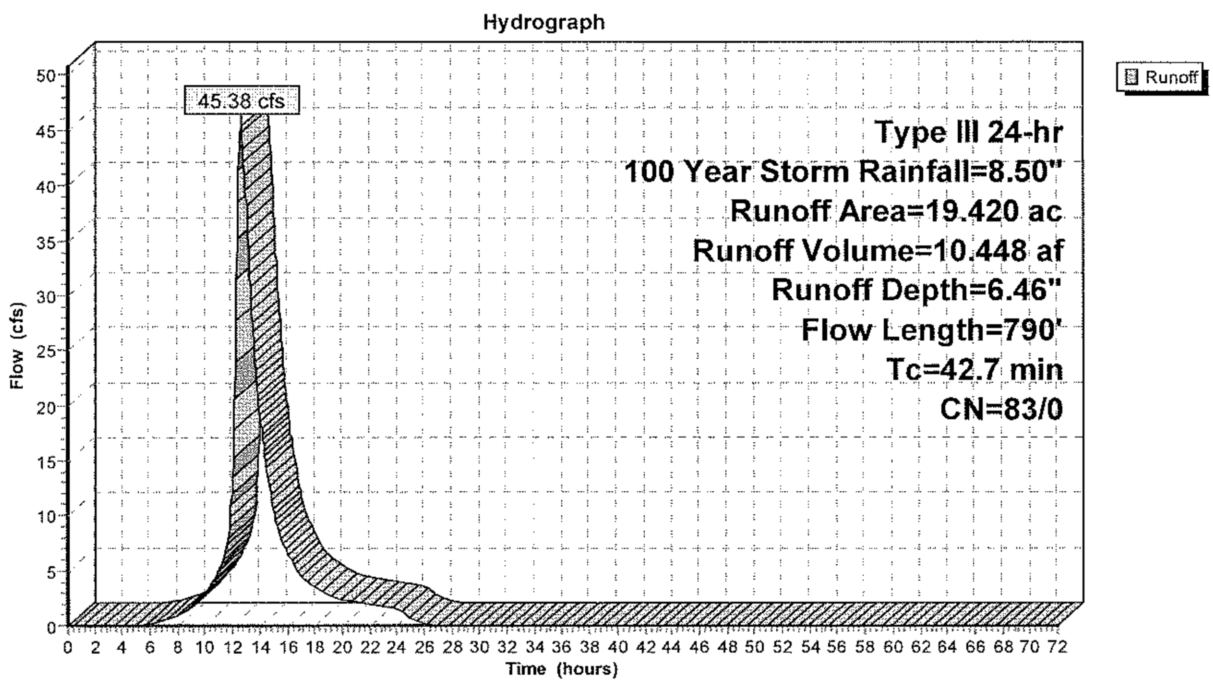
Runoff = 45.38 cfs @ 12.63 hrs, Volume= 10.448 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
18.890	83	Fallow, crop residue, Good, HSG B
0.520	82	Dirt roads, HSG B
0.010	96	Gravel surface, HSG B
19.420	83	Weighted Average
19.420	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	150	0.0030	0.08		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
11.2	640	0.0090	0.95		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
42.7	790	Total			

Subcatchment X1:



Summary for Subcatchment X1a:

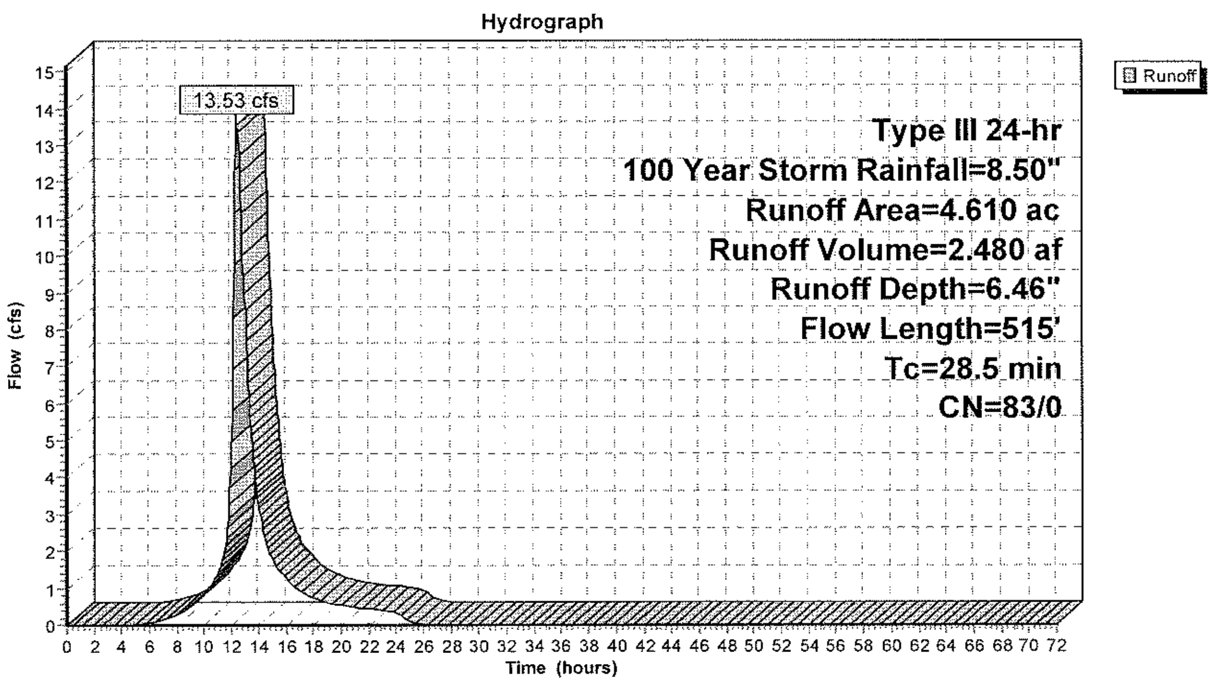
Runoff = 13.53 cfs @ 12.44 hrs, Volume= 2.480 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
4.580	83	Fallow, crop residue, Good, HSG B
0.030	96	Gravel surface, HSG B
4.610	83	Weighted Average
4.610	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4	150	0.0070	0.11		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
6.1	365	0.0100	1.00		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
28.5	515	Total			

Subcatchment X1a:



Summary for Subcatchment X2:

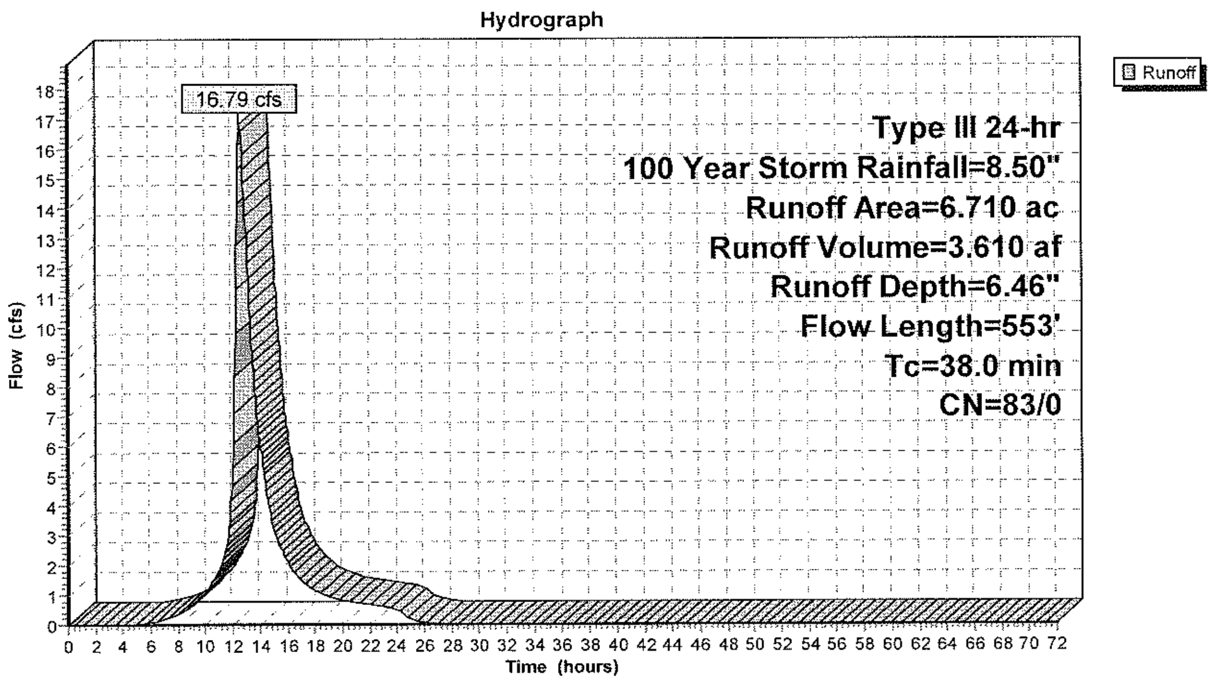
Runoff = 16.79 cfs @ 12.57 hrs, Volume= 3.610 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
0.120	82	Dirt roads, HSG B
6.590	83	Fallow, crop residue, Good, HSG B
6.710	83	Weighted Average
6.710	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.7	150	0.0050	0.10		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
12.3	403	0.0030	0.55		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
38.0	553	Total			

Subcatchment X2:



Summary for Subcatchment X3:

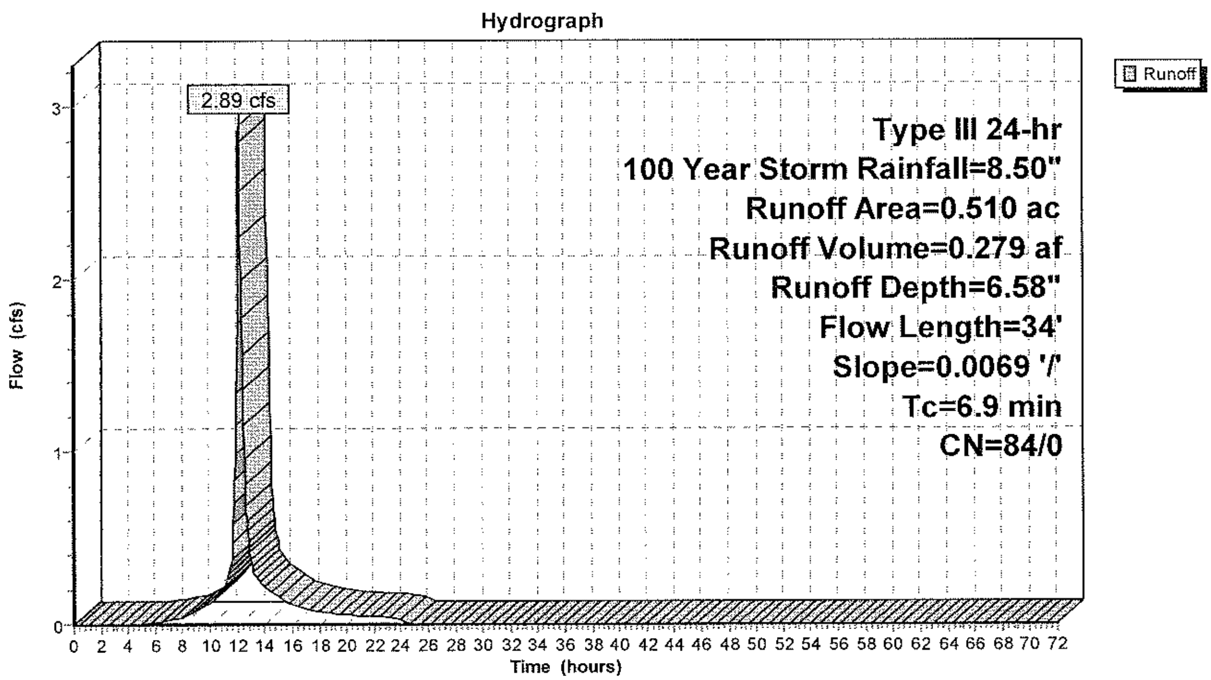
Runoff = 2.89 cfs @ 12.12 hrs, Volume= 0.279 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
0.040	96	Gravel surface, HSG B
0.470	83	Fallow, crop residue, Good, HSG B
0.510	84	Weighted Average
0.510	84	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	34	0.0069	0.08		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"

Subcatchment X3:



Summary for Pond 1A: Depression

Inflow Area =	7.090 ac,	0.00% Impervious, Inflow Depth =	6.46"	for 100 Year Storm event
Inflow =	21.55 cfs @	12.41 hrs, Volume=	3.814 af	
Outflow =	18.82 cfs @	12.66 hrs, Volume=	3.185 af,	Atten= 13%, Lag= 14.7 min
Primary =	18.82 cfs @	12.66 hrs, Volume=	3.185 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 157.29' @ 12.66 hrs Surf.Area= 2.149 ac Storage= 1.012 af

Plug-Flow detention time= 128.5 min calculated for 3.183 af (83% of inflow)
Center-of-Mass det. time= 61.1 min (889.9 - 828.8)

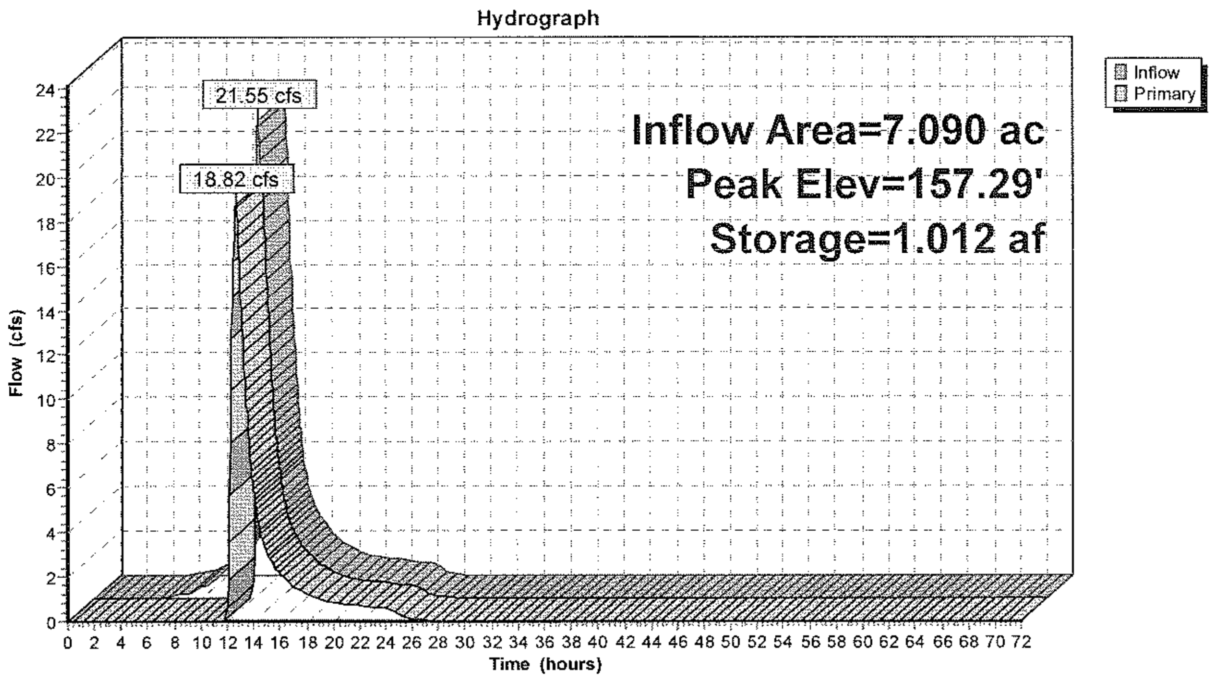
Volume	Invert	Avail.Storage	Storage Description
#1	156.25'	1.515 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
156.25	0.004	0.000	0.000
156.50	0.321	0.041	0.041
157.00	1.467	0.447	0.488
157.50	2.641	1.027	1.515

Device	Routing	Invert	Outlet Devices
#1	Primary	157.09'	**86.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=18.79 cfs @ 12.66 hrs HW=157.29' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 18.79 cfs @ 1.09 fps)

Pond 1A: Depression

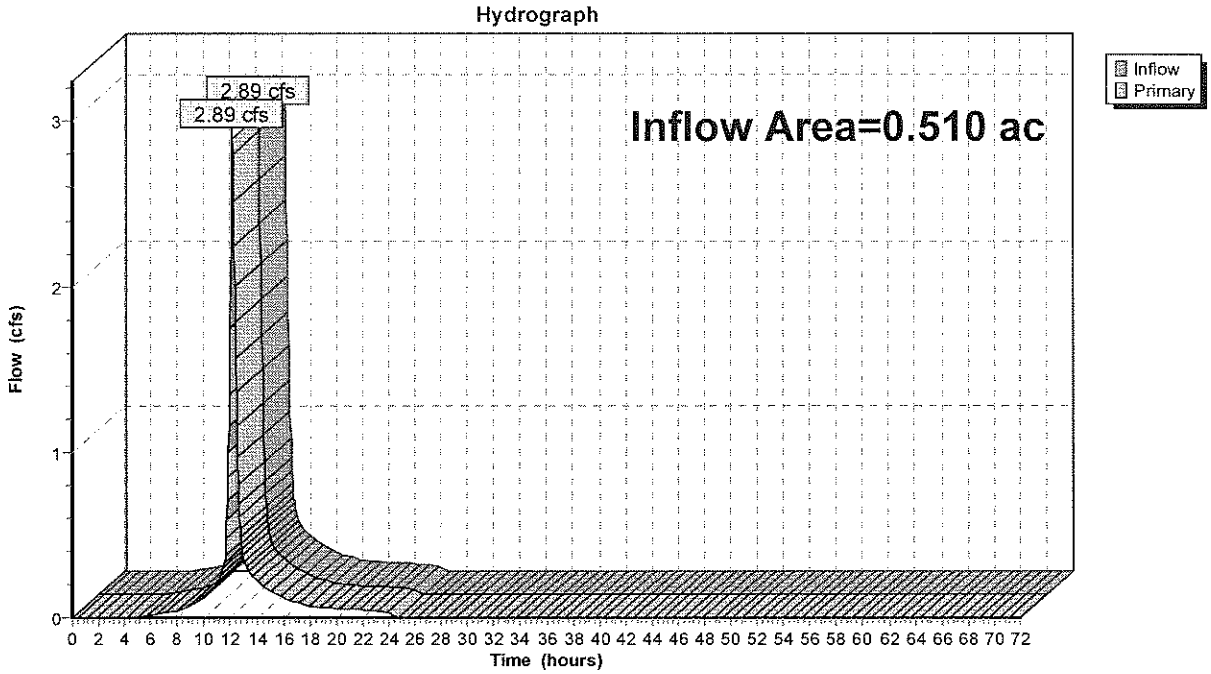


Summary for Link AP-CVS: Analysis Point-CVS

Inflow Area =	0.510 ac,	0.00% Impervious, Inflow Depth = 6.58"	for 100 Year Storm event	
Inflow =	2.89 cfs @	12.12 hrs, Volume=	0.279 af	
Primary =	2.89 cfs @	12.12 hrs, Volume=	0.279 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-CVS: Analysis Point-CVS

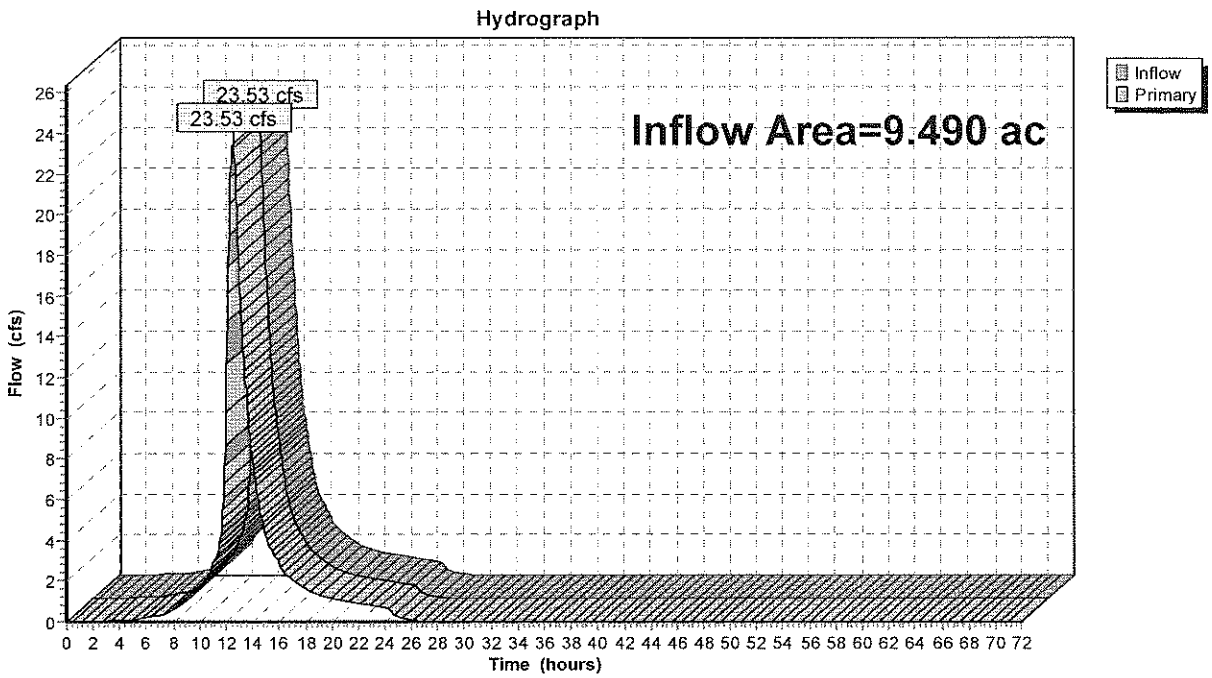


Summary for Link AP-E: Analysis Point-East

Inflow Area =	9.490 ac,	6.11% Impervious,	Inflow Depth = 6.46"	for 100 Year Storm event	
Inflow =	23.53 cfs @	12.50 hrs,	Volume=	5.110 af	
Primary =	23.53 cfs @	12.50 hrs,	Volume=	5.110 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-E: Analysis Point-East

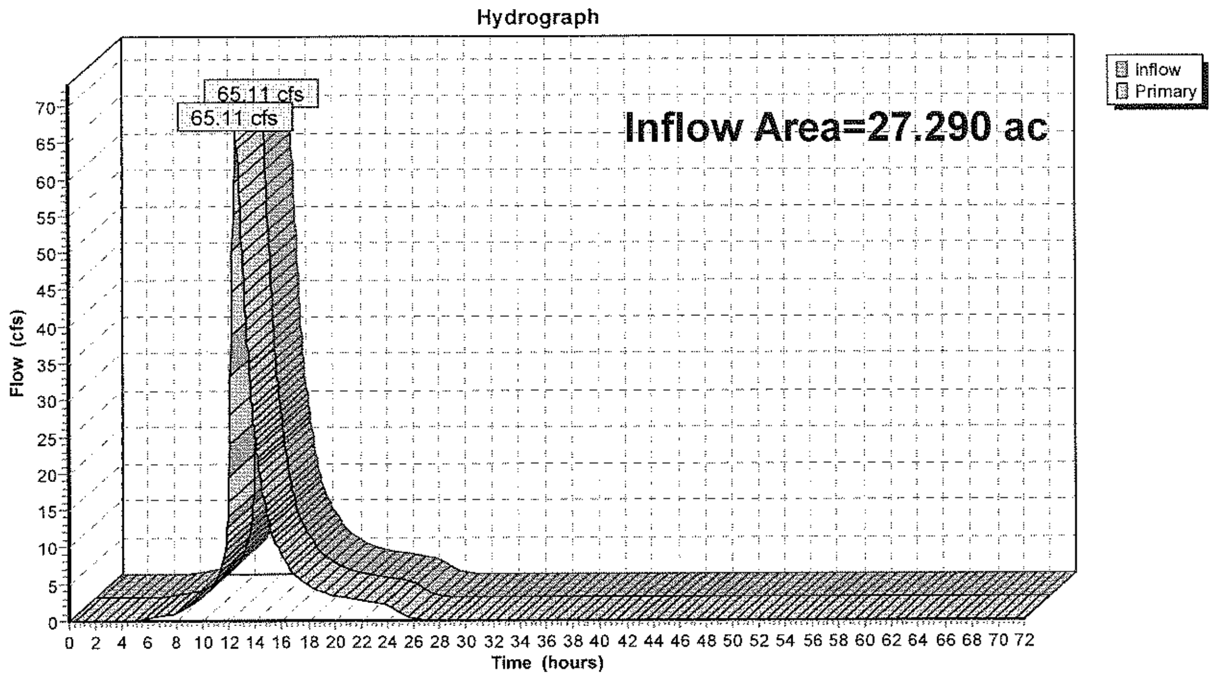


Summary for Link AP-W: Analysis Point-West

Inflow Area =	27.290 ac,	1.76% Impervious, Inflow Depth = 6.18"	for 100 Year Storm event	
Inflow =	65.11 cfs @	12.63 hrs, Volume=	14.059 af	
Primary =	65.11 cfs @	12.63 hrs, Volume=	14.059 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-W: Analysis Point-West



Summary for Subcatchment OFS1:

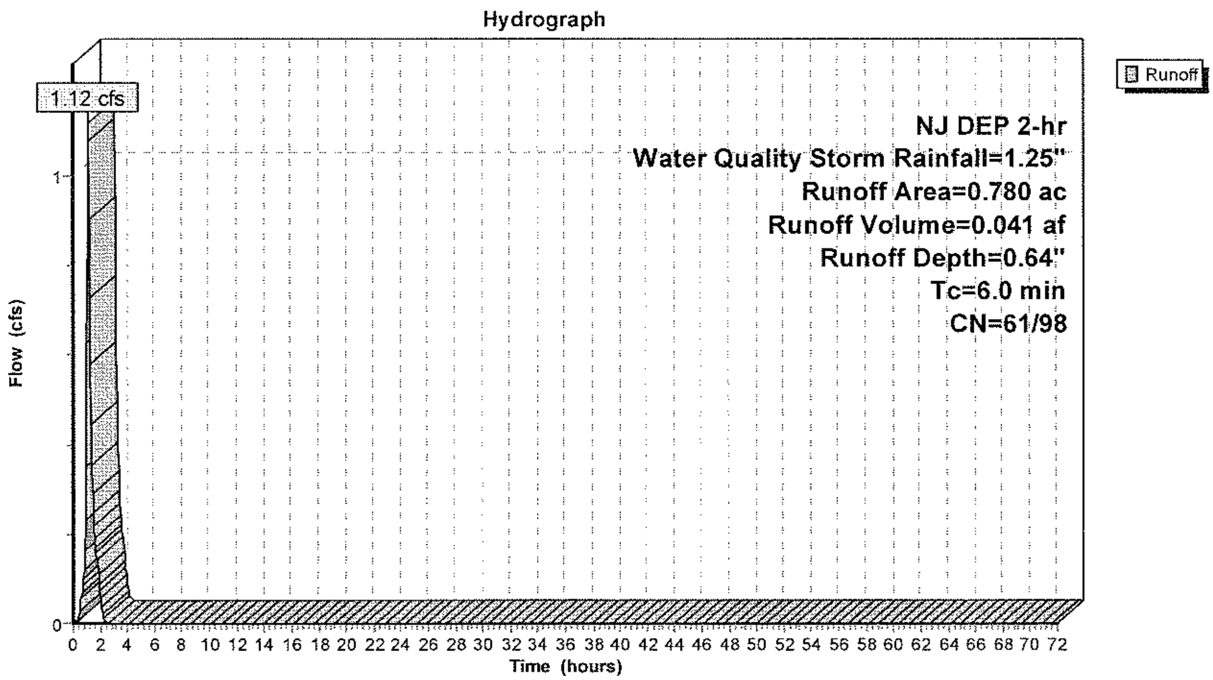
Runoff = 1.12 cfs @ 1.12 hrs, Volume= 0.041 af, Depth= 0.64"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
0.480	98	Unconnected pavement, HSG B
0.300	61	>75% Grass cover, Good, HSG B
0.780	84	Weighted Average
0.300	61	38.46% Pervious Area
0.480	98	61.54% Impervious Area

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

Subcatchment OFS1:



Summary for Subcatchment OFS2:

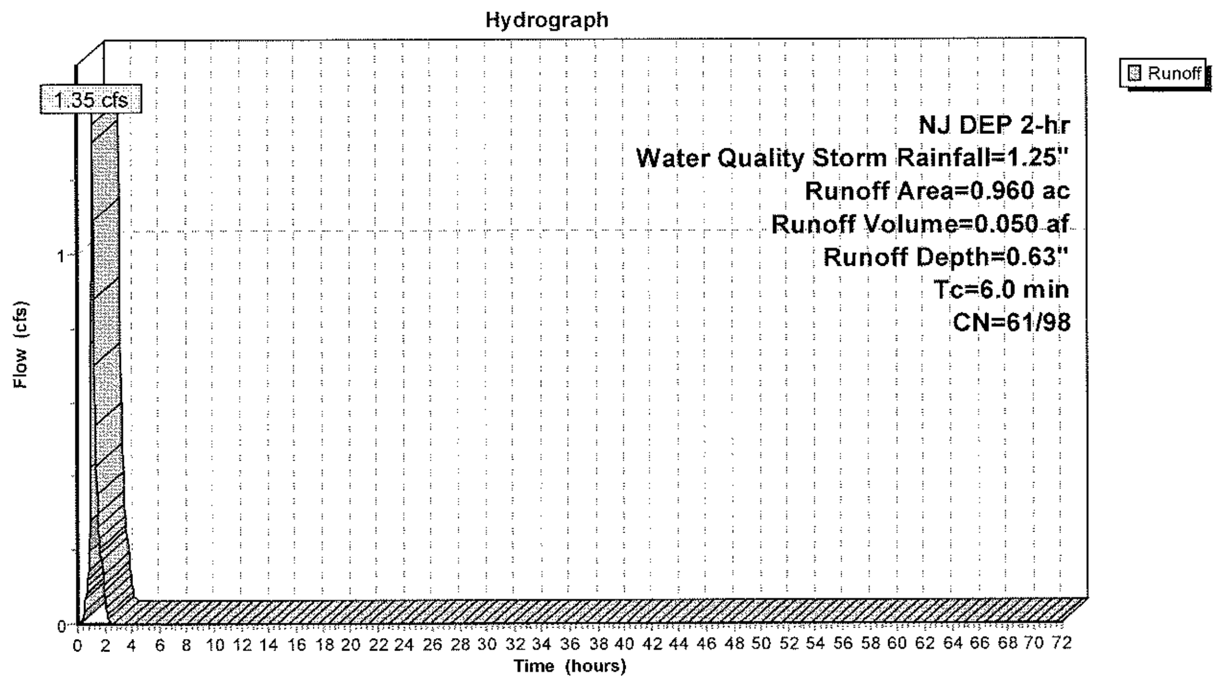
Runoff = 1.35 cfs @ 1.12 hrs, Volume= 0.050 af, Depth= 0.63"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
0.580	98	Unconnected pavement, HSG B
0.380	61	>75% Grass cover, Good, HSG B
0.960	83	Weighted Average
0.380	61	39.58% Pervious Area
0.580	98	60.42% Impervious Area

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

Subcatchment OFS2:



Summary for Subcatchment UNDIST1:

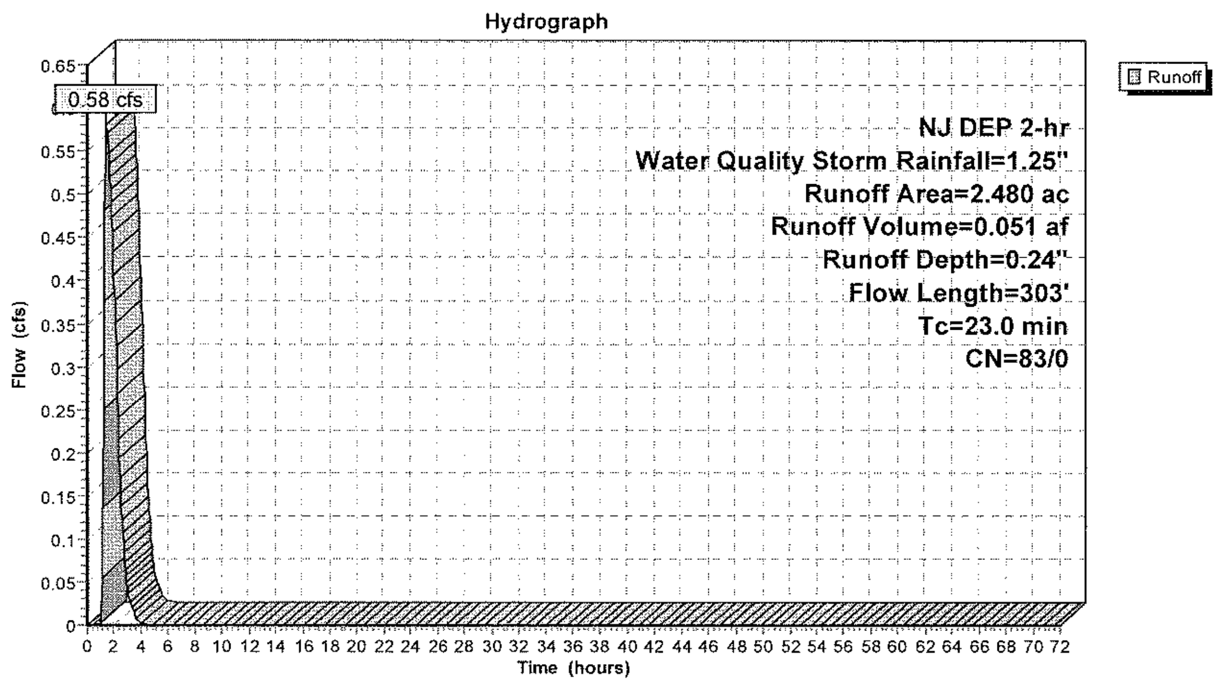
Runoff = 0.58 cfs @ 1.44 hrs, Volume= 0.051 af, Depth= 0.24"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
2.480	83	Fallow, crop residue, Good, HSG B
2.480	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	150	0.0087	0.12		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
2.4	153	0.0111	1.05		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
23.0	303	Total			

Subcatchment UNDIST1:



Summary for Subcatchment UNDIST2:

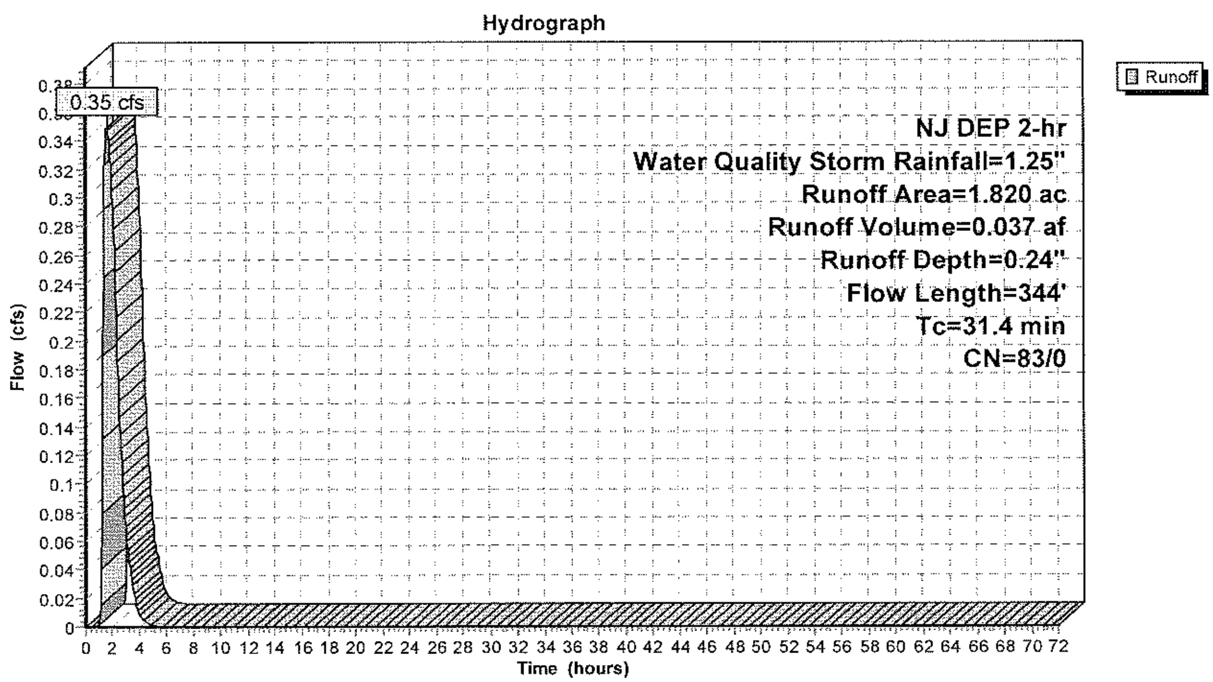
Runoff = 0.35 cfs @ 1.59 hrs, Volume= 0.037 af, Depth= 0.24"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
1.820	83	Fallow, crop residue, Good, HSG B
1.820	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	150	0.0043	0.09		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
4.1	194	0.0062	0.79		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
31.4	344	Total			

Subcatchment UNDIST2:



Summary for Subcatchment X1:

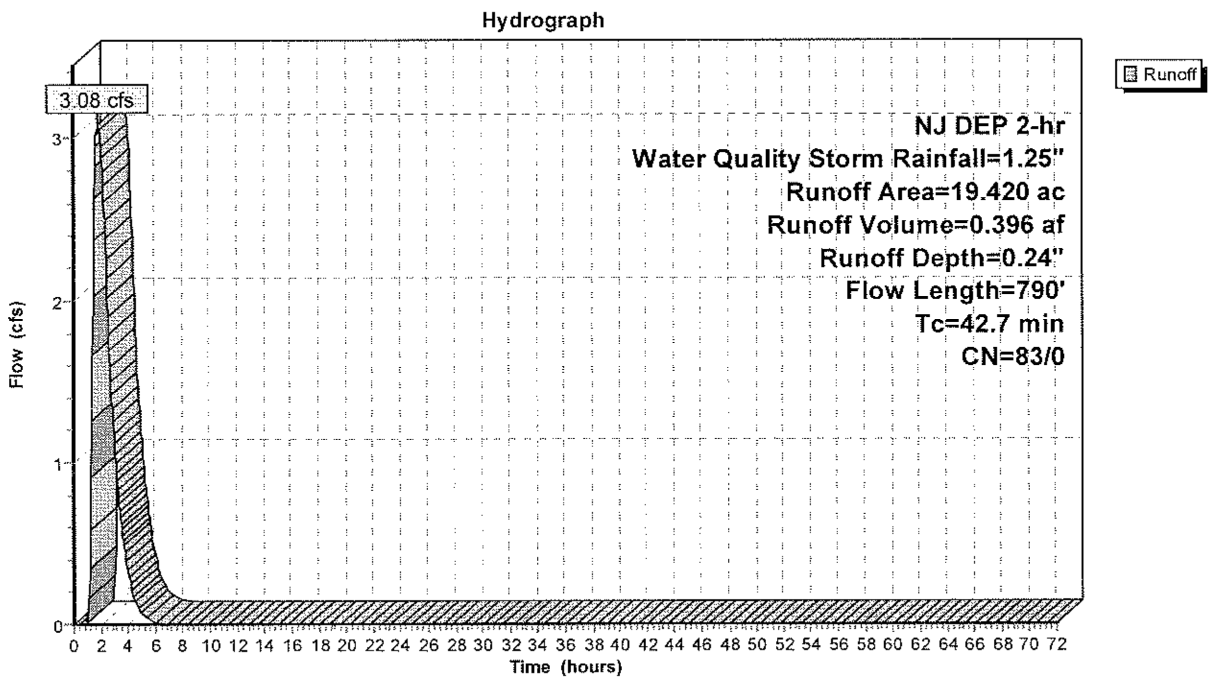
Runoff = 3.08 cfs @ 1.82 hrs, Volume= 0.396 af, Depth= 0.24"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
18.890	83	Fallow, crop residue, Good, HSG B
0.520	82	Dirt roads, HSG B
0.010	96	Gravel surface, HSG B
19.420	83	Weighted Average
19.420	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	150	0.0030	0.08		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
11.2	640	0.0090	0.95		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
42.7	790	Total			

Subcatchment X1:



Summary for Subcatchment X1a:

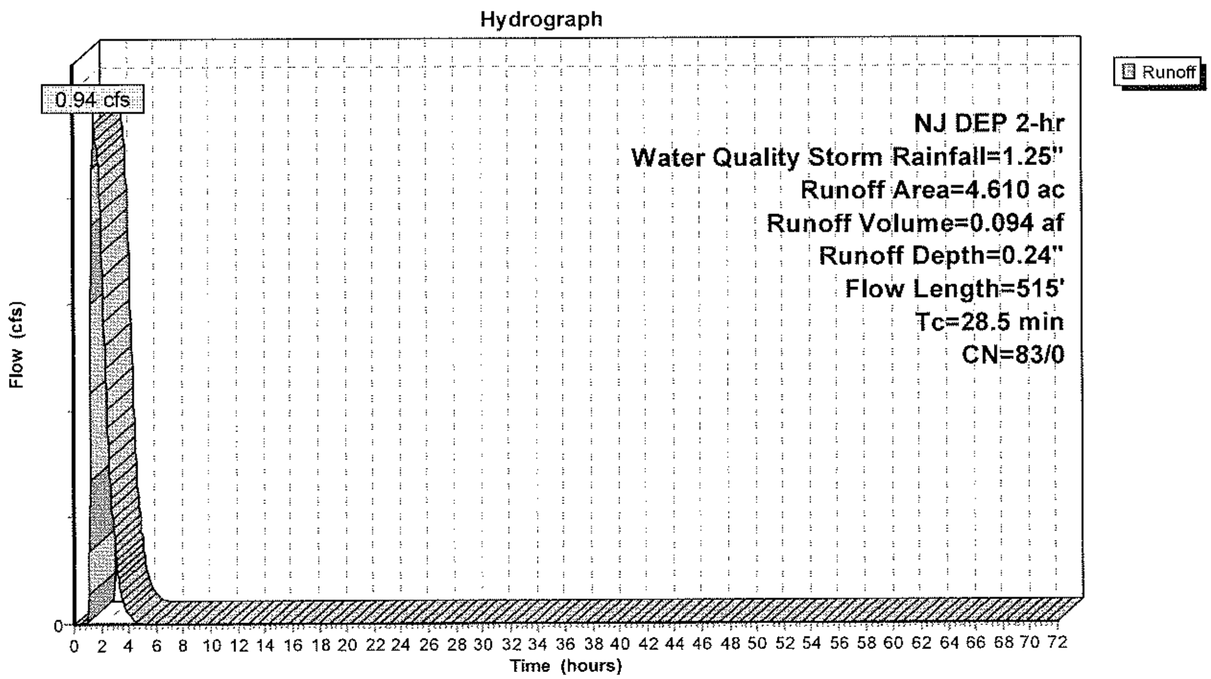
Runoff = 0.94 cfs @ 1.55 hrs, Volume= 0.094 af, Depth= 0.24"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
4.580	83	Fallow, crop residue, Good, HSG B
0.030	96	Gravel surface, HSG B
4.610	83	Weighted Average
4.610	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4	150	0.0070	0.11		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
6.1	365	0.0100	1.00		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
28.5	515	Total			

Subcatchment X1a:



Summary for Subcatchment X2:

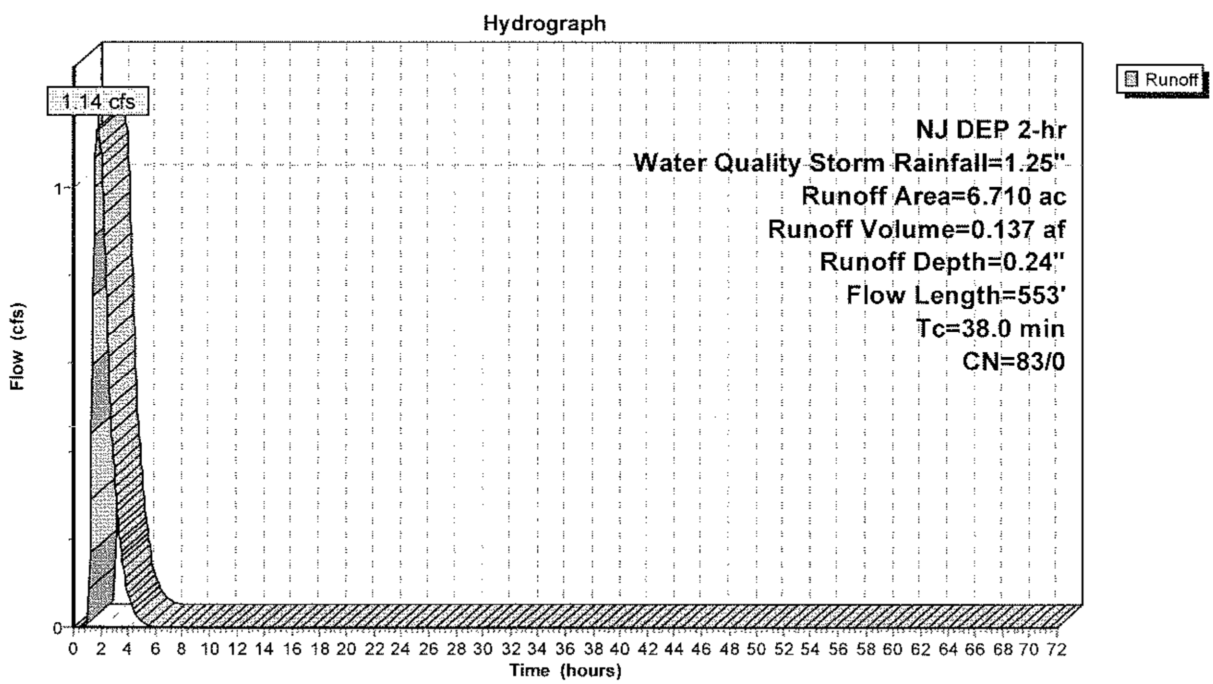
Runoff = 1.14 cfs @ 1.73 hrs, Volume= 0.137 af, Depth= 0.24"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
0.120	82	Dirt roads, HSG B
6.590	83	Fallow, crop residue, Good, HSG B
6.710	83	Weighted Average
6.710	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.7	150	0.0050	0.10		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
12.3	403	0.0030	0.55		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
38.0	553	Total			

Subcatchment X2:



Summary for Subcatchment X3:

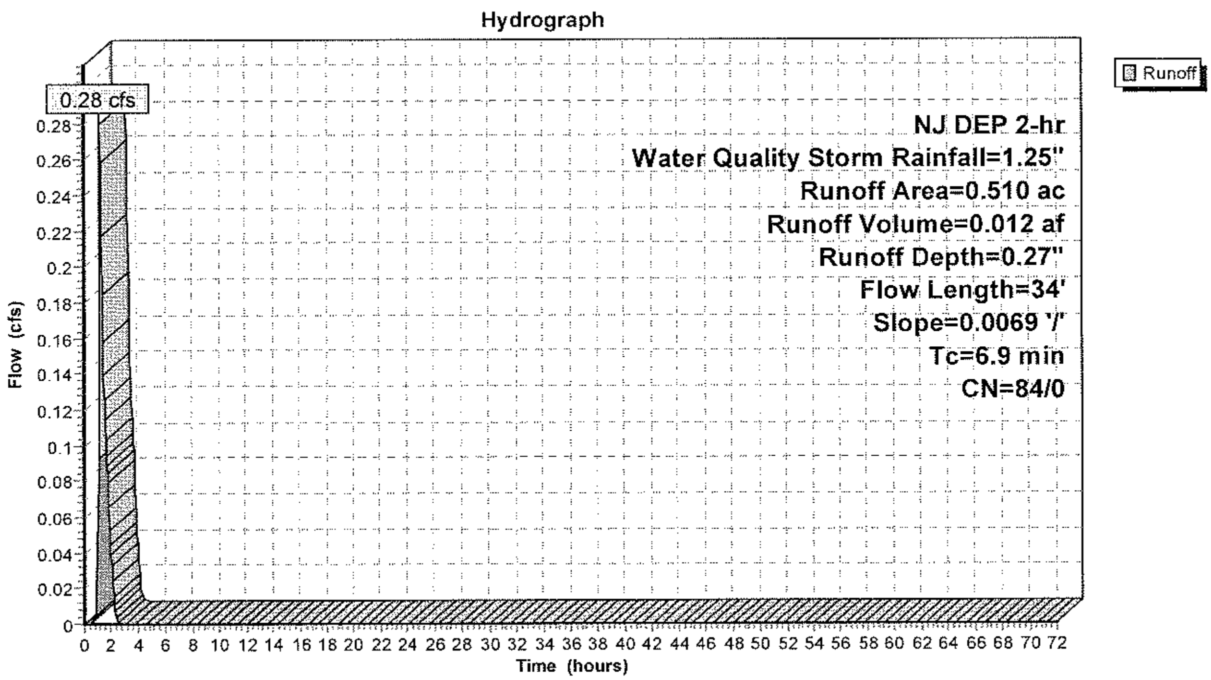
Runoff = 0.28 cfs @ 1.17 hrs, Volume= 0.012 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
0.040	96	Gravel surface, HSG B
0.470	83	Fallow, crop residue, Good, HSG B
0.510	84	Weighted Average
0.510	84	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	34	0.0069	0.08		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"

Subcatchment X3:



Summary for Pond 1A: Depression

Inflow Area = 7.090 ac, 0.00% Impervious, Inflow Depth = 0.24" for Water Quality Storm event
Inflow = 1.51 cfs @ 1.51 hrs, Volume= 0.144 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

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 156.69' @ 5.20 hrs Surf.Area= 0.761 ac Storage= 0.144 af

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

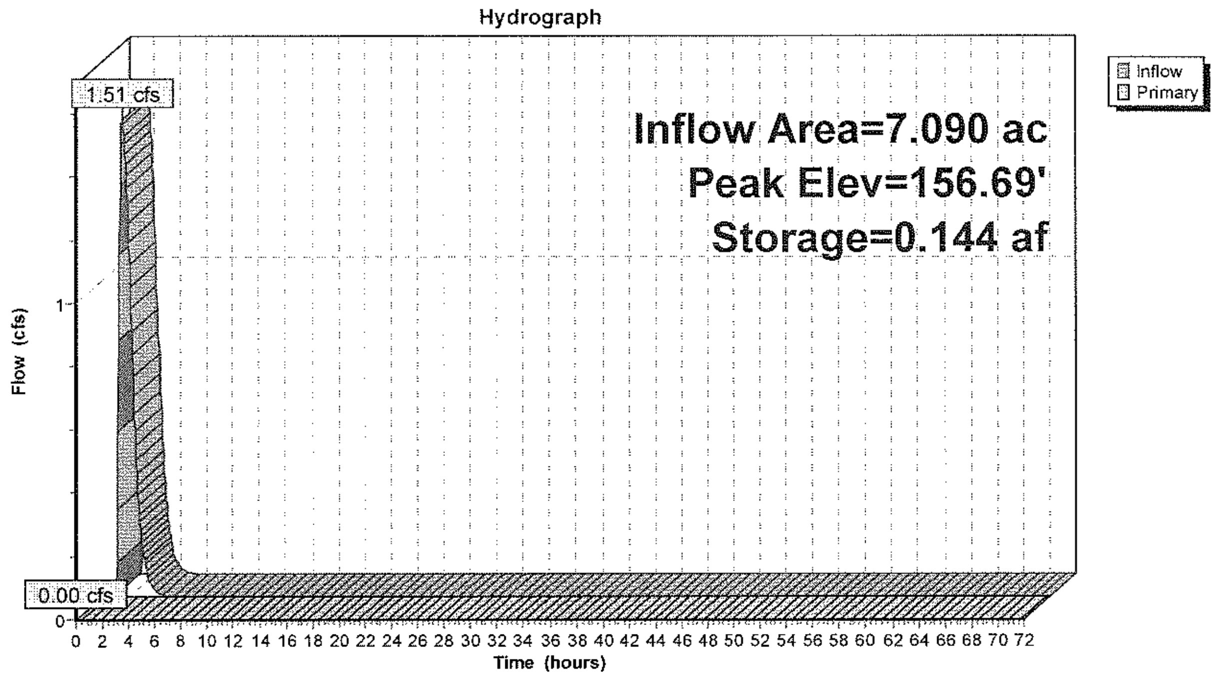
Volume	Invert	Avail.Storage	Storage Description
#1	156.25'	1.515 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
156.25	0.004	0.000	0.000
156.50	0.321	0.041	0.041
157.00	1.467	0.447	0.488
157.50	2.641	1.027	1.515

Device	Routing	Invert	Outlet Devices
#1	Primary	157.09'	**86.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=156.25' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1A: Depression

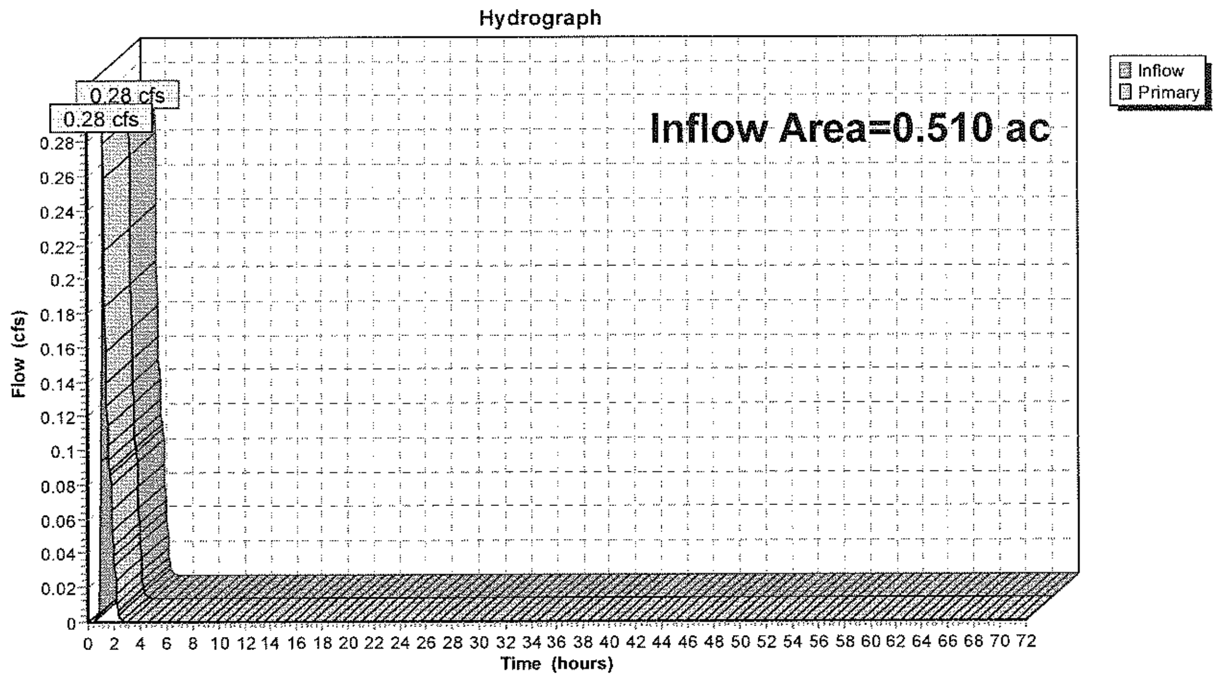


Summary for Link AP-CVS: Analysis Point-CVS

Inflow Area =	0.510 ac,	0.00% Impervious, Inflow Depth = 0.27"	for Water Quality Storm event	
Inflow =	0.28 cfs @	1.17 hrs, Volume=	0.012 af	
Primary =	0.28 cfs @	1.17 hrs, Volume=	0.012 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-CVS: Analysis Point-CVS

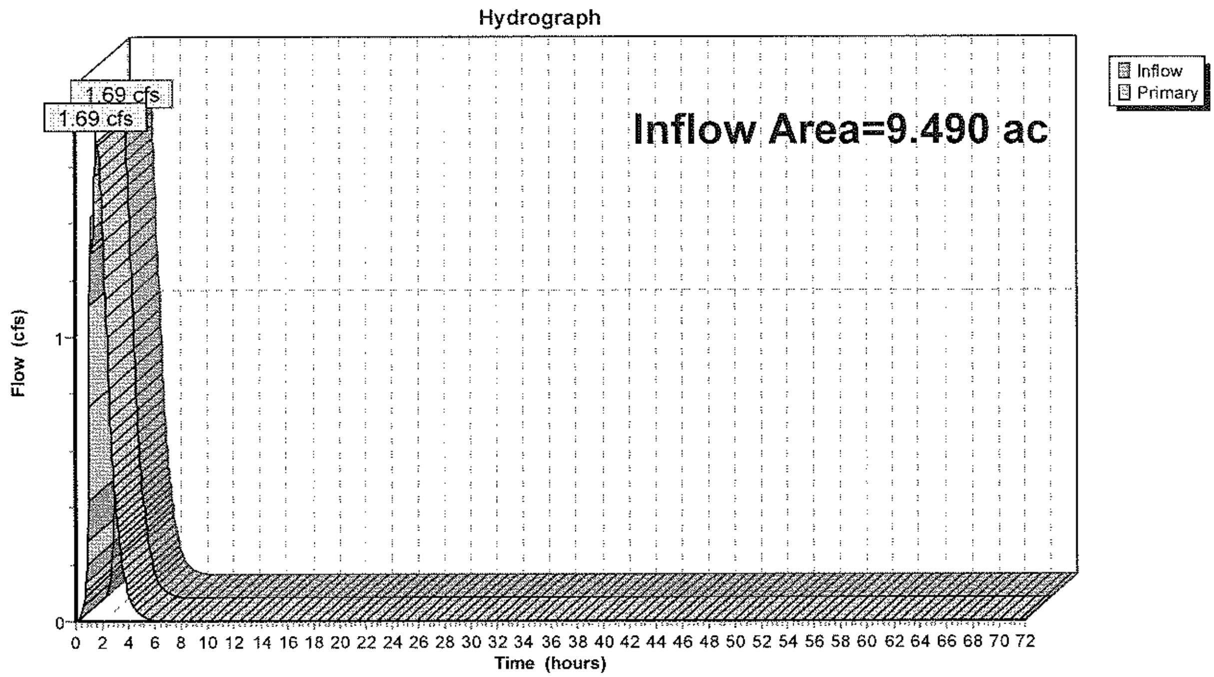


Summary for Link AP-E: Analysis Point-East

Inflow Area =	9.490 ac,	6.11% Impervious, Inflow Depth = 0.28"		for Water Quality Storm event
Inflow =	1.69 cfs @	1.60 hrs, Volume=	0.224 af	
Primary =	1.69 cfs @	1.60 hrs, Volume=	0.224 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-E: Analysis Point-East

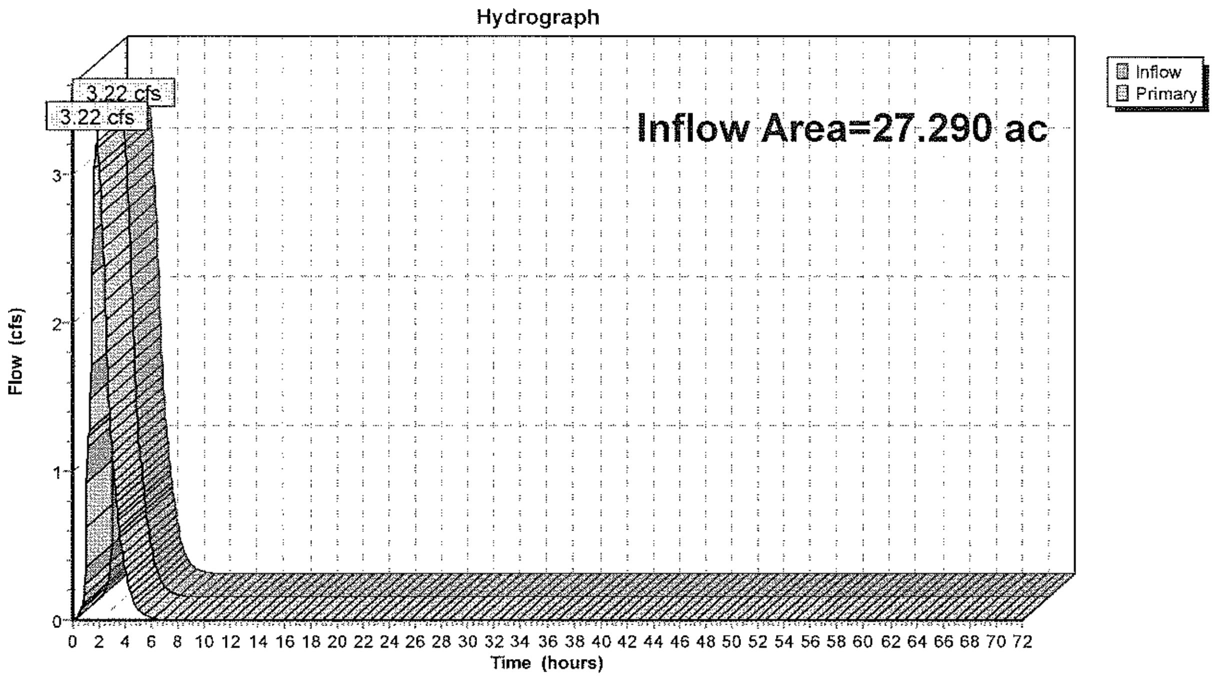


Summary for Link AP-W: Analysis Point-West

Inflow Area = 27.290 ac, 1.76% Impervious, Inflow Depth = 0.19" for Water Quality Storm event
Inflow = 3.22 cfs @ 1.78 hrs, Volume= 0.437 af
Primary = 3.22 cfs @ 1.78 hrs, Volume= 0.437 af, Atten= 0%, Lag= 0.0 min

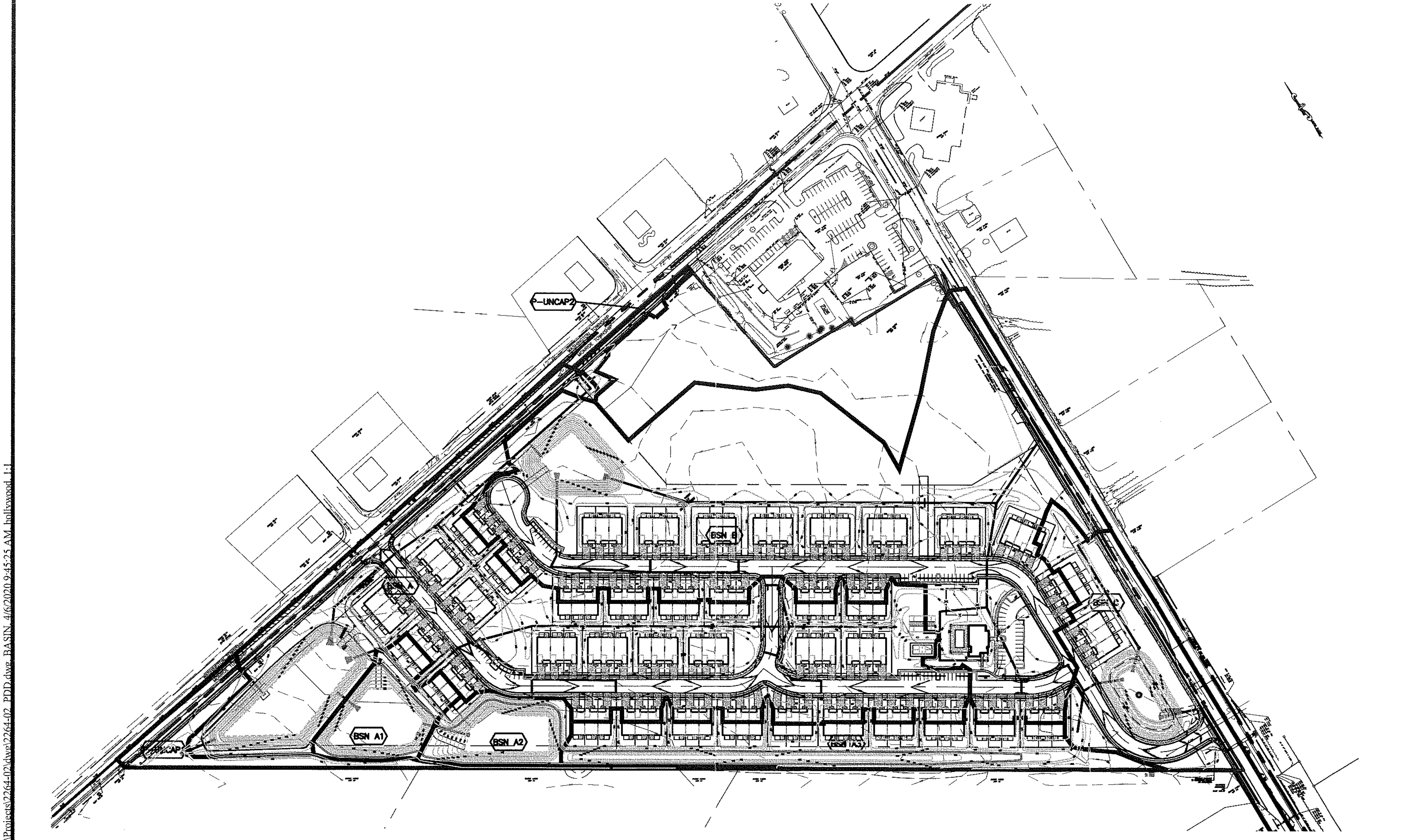
Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-W: Analysis Point-West



APPENDIX B

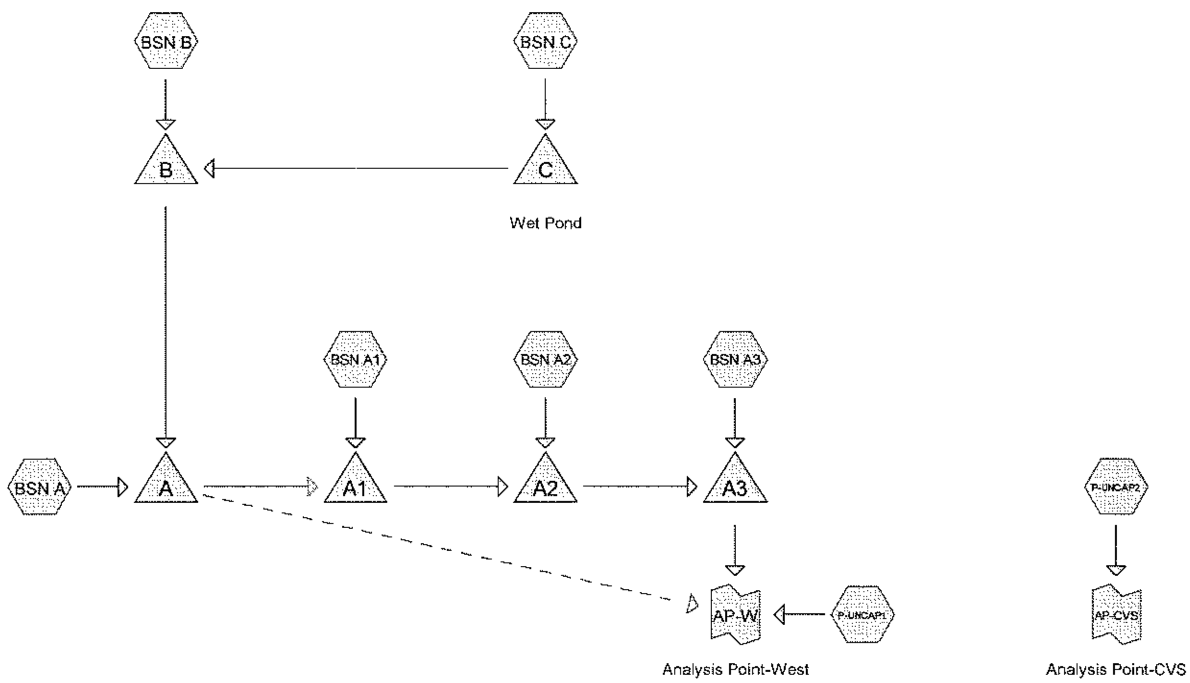
POST-DEVELOPMENT DRAINAGE AREA MAPS & POST-DEVELOPMENT CONDITIONS STORM HYDROGRAPHS

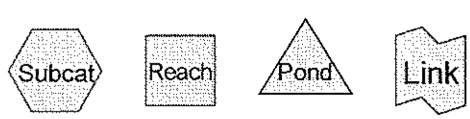


Consulting Engineer Services
Engineers, Planners, and Land Surveyors

POST-DEVELOPED BASIN DRAINAGE AREA MAP

SCALE: 1"=200'





Routing Diagram for 2264-02 Proposed
Prepared by CES, Printed 3/25/2020
HydroCAD® 10.00-25 s/n 02074 © 2019 HydroCAD Software Solutions LLC

Summary for Subcatchment BSN A:

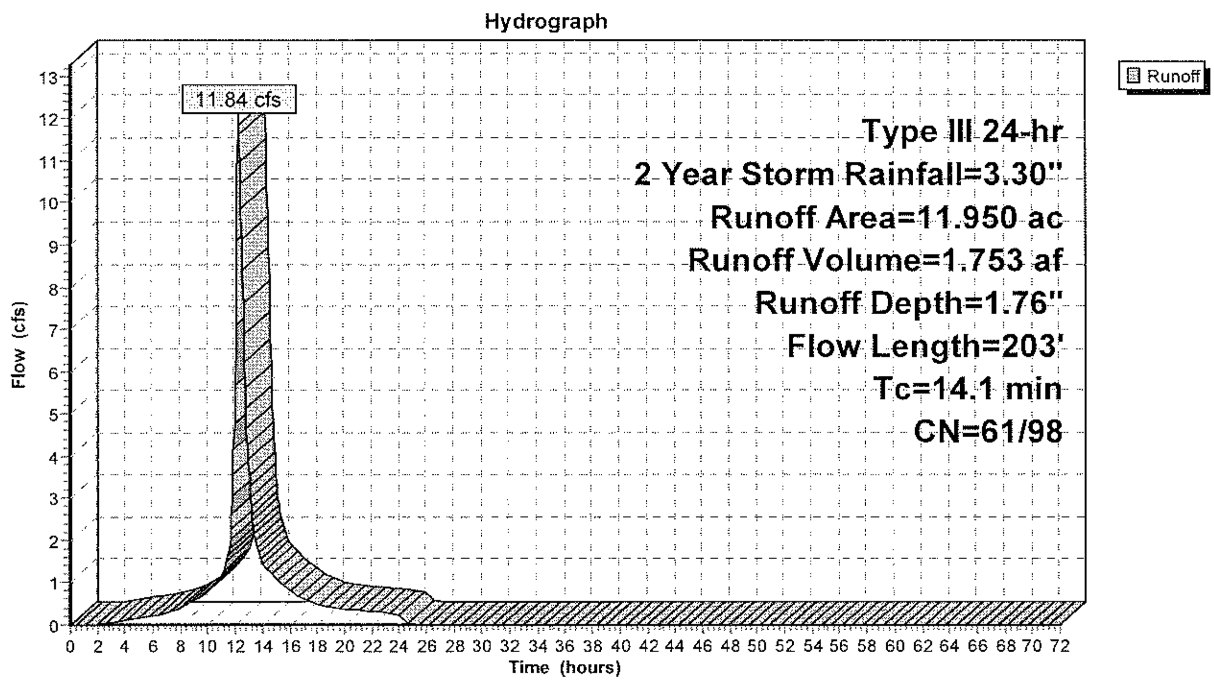
Runoff = 11.84 cfs @ 12.23 hrs, Volume= 1.753 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
6.050	61	>75% Grass cover, Good, HSG B
5.900	98	Paved roads w/curbs & sewers
11.950	79	Weighted Average
6.050		50.63% Pervious Area
5.900		49.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	18	0.0089	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.3	132	0.0069	0.96		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.5	53	0.0069	1.69		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.9					**Direct Entry, from pipe calcs**
14.1	203	Total			

Subcatchment BSN A:



Summary for Subcatchment BSN A1:

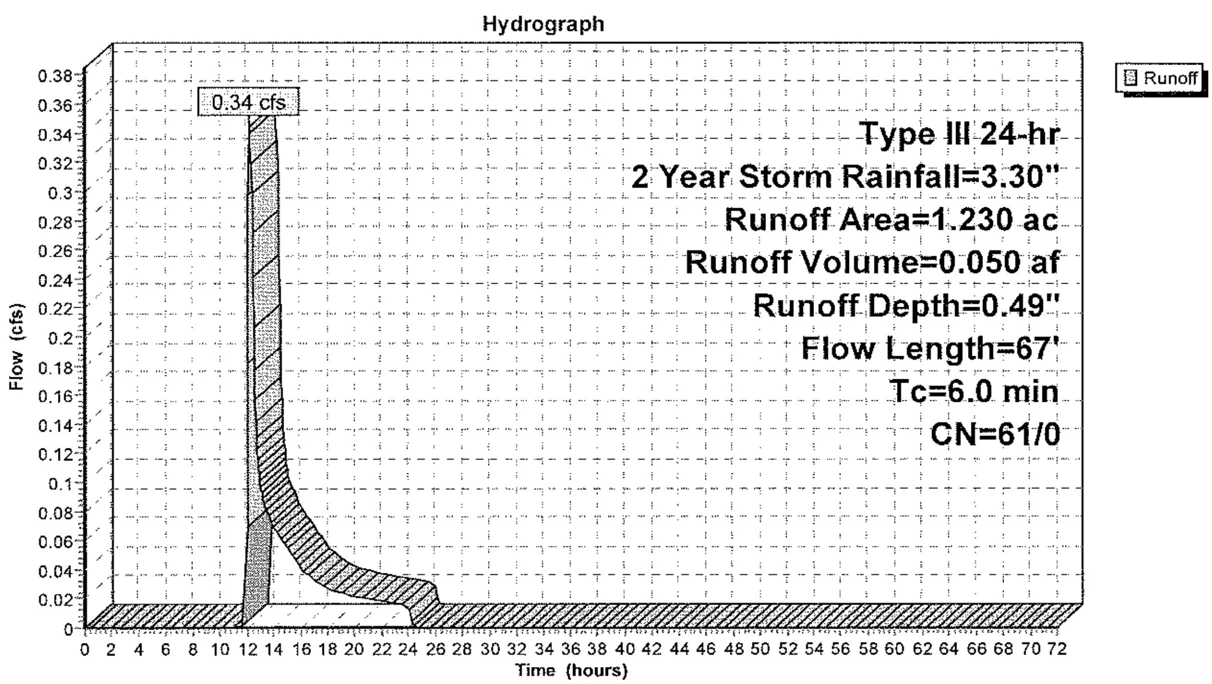
Runoff = 0.34 cfs @ 12.20 hrs, Volume= 0.050 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
1.230	61	>75% Grass cover, Good, HSG B
1.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	18	0.0560	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.6	12	0.3333	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
1.1	13	0.0784	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
1.0	24	0.3333	0.40		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
4.3	67	Total, Increased to minimum Tc = 6.0 min			

Subcatchment BSN A1:



Summary for Subcatchment BSN A2:

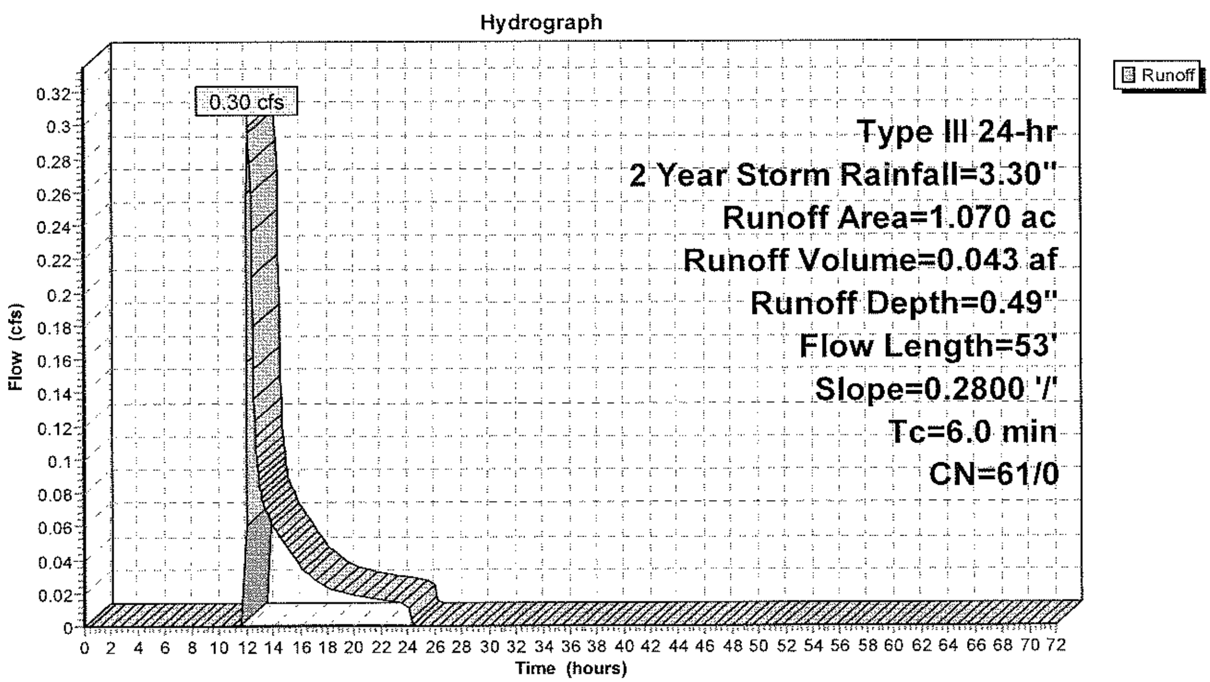
Runoff = 0.30 cfs @ 12.20 hrs, Volume= 0.043 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
1.070	61	>75% Grass cover, Good, HSG B
1.070		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	53	0.2800	0.44		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.0	53	Total, Increased to minimum Tc = 6.0 min			

Subcatchment BSN A2:



Summary for Subcatchment BSN A3:

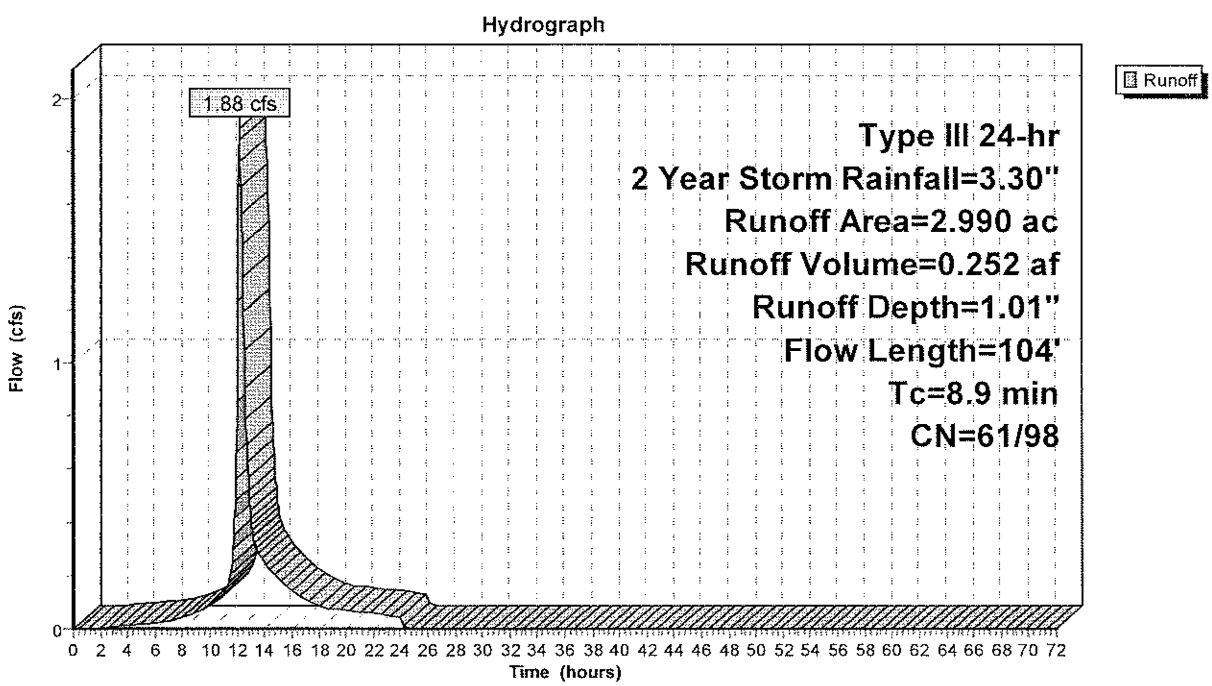
Runoff = 1.88 cfs @ 12.17 hrs, Volume= 0.252 af, Depth= 1.01"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
2.380	61	>75% Grass cover, Good, HSG B
0.610	98	Paved parking, HSG B
2.990	69	Weighted Average
2.380		79.60% Pervious Area
0.610		20.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	92	0.0249	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.6	12	0.3333	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
8.9	104	Total			

Subcatchment BSN A3:



Summary for Subcatchment BSN B:

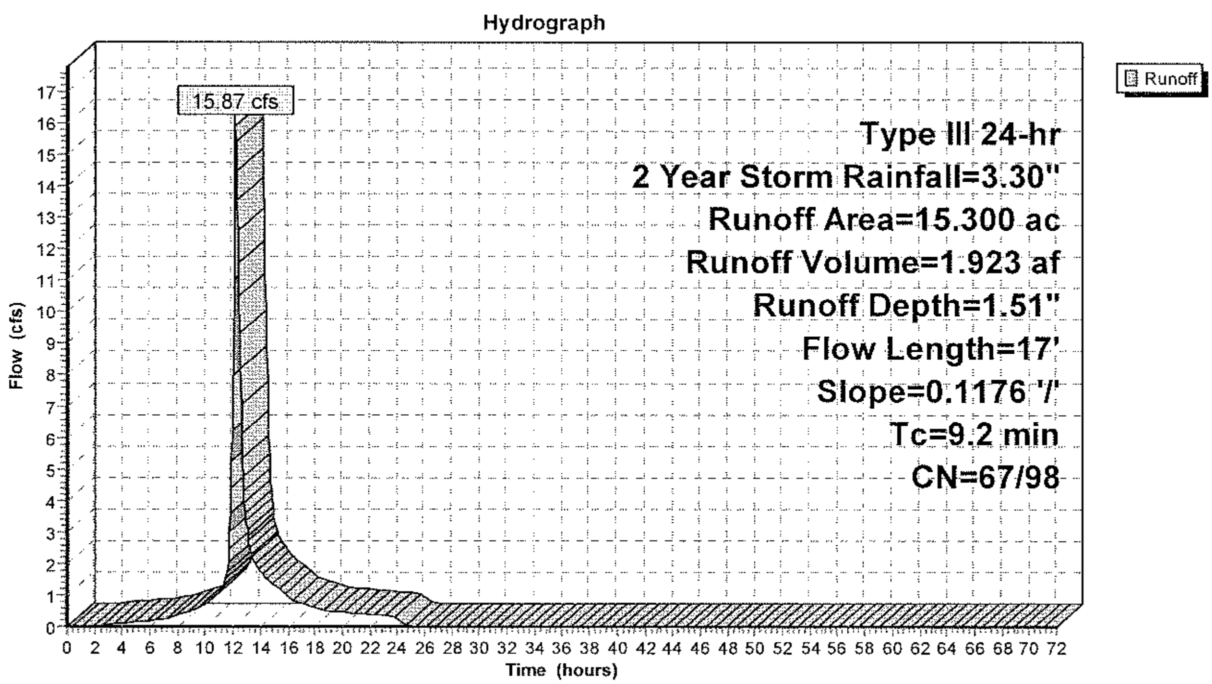
Runoff = 15.87 cfs @ 12.16 hrs, Volume= 1.923 af, Depth= 1.51"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
5.050	98	Paved parking & roofs
7.610	61	>75% Grass cover, Good, HSG B
2.640	83	Fallow, crop residue, Good, HSG B
15.300	77	Weighted Average
10.250		66.99% Pervious Area
5.050		33.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	17	0.1176	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
8.0					**Direct Entry, from pipe calcs**
9.2	17	Total			

Subcatchment BSN B:



Summary for Subcatchment BSN C:

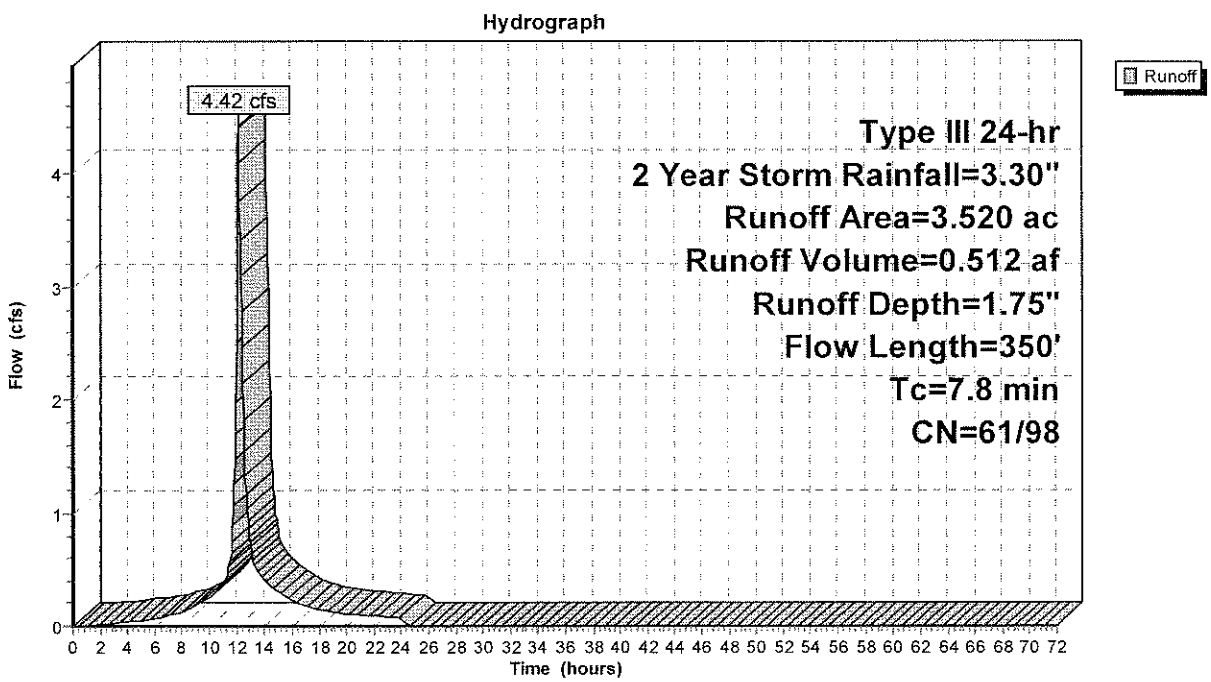
Runoff = 4.42 cfs @ 12.14 hrs, Volume= 0.512 af, Depth= 1.75"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
1.720	98	Paved parking & roofs
1.800	61	>75% Grass cover, Good, HSG B
3.520	79	Weighted Average
1.800		51.14% Pervious Area
1.720		48.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	25	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.4	125	0.0056	0.88		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
2.2	200	0.0056	1.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.8	350	Total			

Subcatchment BSN C:



Summary for Subcatchment P-UNCAP1:

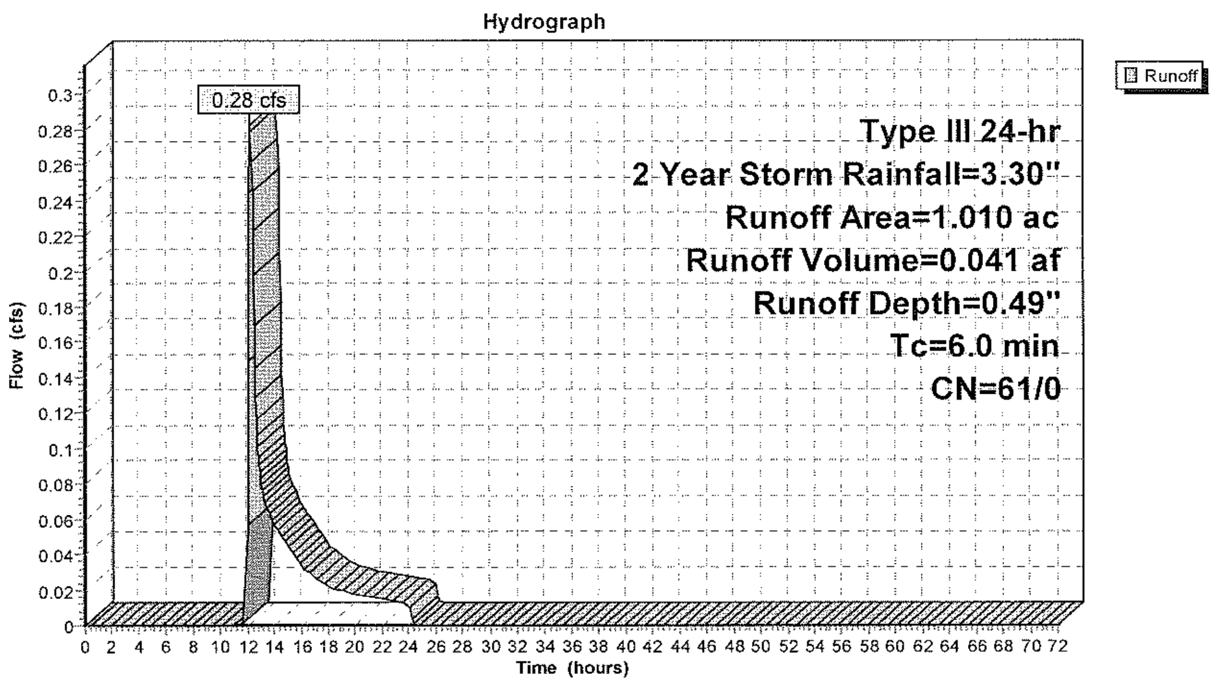
Runoff = 0.28 cfs @ 12.20 hrs, Volume= 0.041 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
1.010	61	>75% Grass cover, Good, HSG B
1.010		100.00% Pervious Area

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

Subcatchment P-UNCAP1:



Summary for Subcatchment P-UNCAP2:

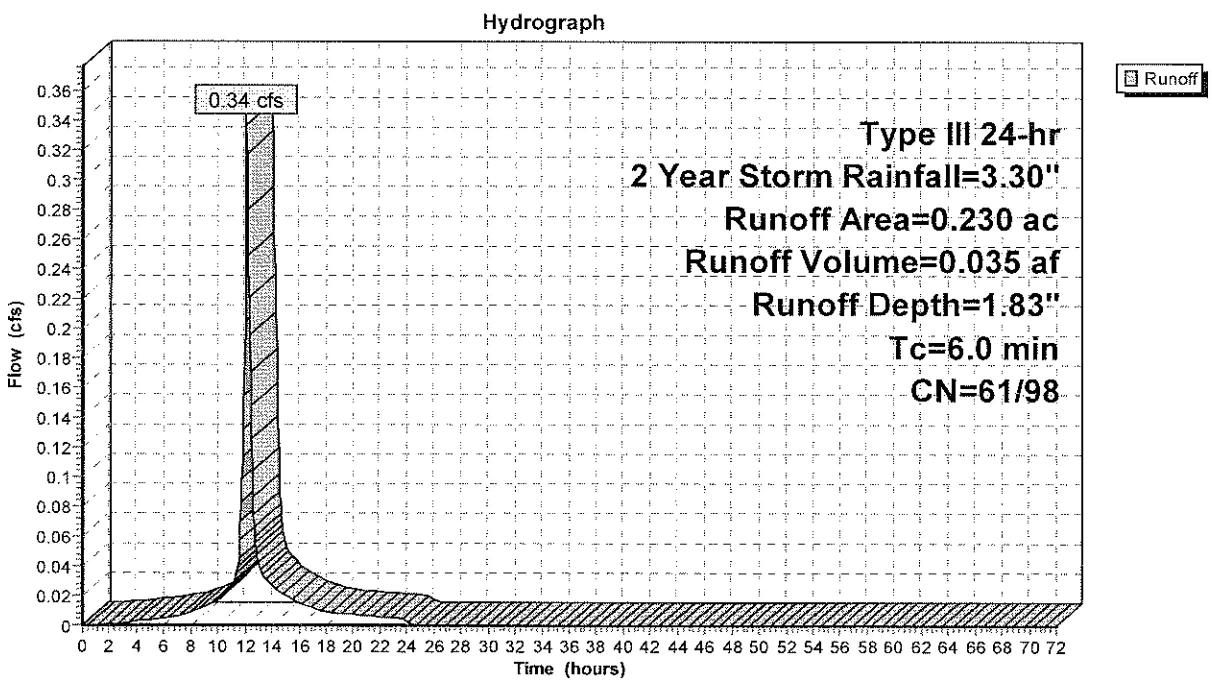
Runoff = 0.34 cfs @ 12.11 hrs, Volume= 0.035 af, Depth= 1.83"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
0.120	98	Unconnected pavement, HSG B
0.110	61	>75% Grass cover, Good, HSG B
0.230	80	Weighted Average
0.110		47.83% Pervious Area
0.120		52.17% Impervious Area

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

Subcatchment P-UNCAP2:



Summary for Pond A:

Inflow Area =	30.770 ac, 41.18% Impervious, Inflow Depth > 1.53"	for 2 Year Storm event	
Inflow =	13.59 cfs @ 12.33 hrs, Volume=	3.928 af	
Outflow =	2.04 cfs @ 17.38 hrs, Volume=	2.635 af,	Atten= 85%, Lag= 303.3 min
Primary =	2.04 cfs @ 17.38 hrs, Volume=	2.635 af	
Secondary =	0.00 cfs @ 0.00 hrs, Volume=	0.000 af	
Tertiary =	0.00 cfs @ 0.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 149.11' @ 17.38 hrs Surf.Area= 0.841 ac Storage= 2.176 af

Plug-Flow detention time= 742.5 min calculated for 2.635 af (67% of inflow)
Center-of-Mass det. time= 521.1 min (1,523.1 - 1,002.0)

Volume	Invert	Avail.Storage	Storage Description
#1	146.25'	9.525 af	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
146.25	0.690	0.000	0.000
147.00	0.721	0.529	0.529
148.00	0.777	0.749	1.278
149.00	0.835	0.806	2.084
150.00	0.894	0.864	2.949
151.00	0.957	0.925	3.874
152.00	1.019	0.988	4.862
153.00	1.083	1.051	5.913
154.00	1.147	1.115	7.028
155.00	1.213	1.180	8.208
156.00	1.421	1.317	9.525

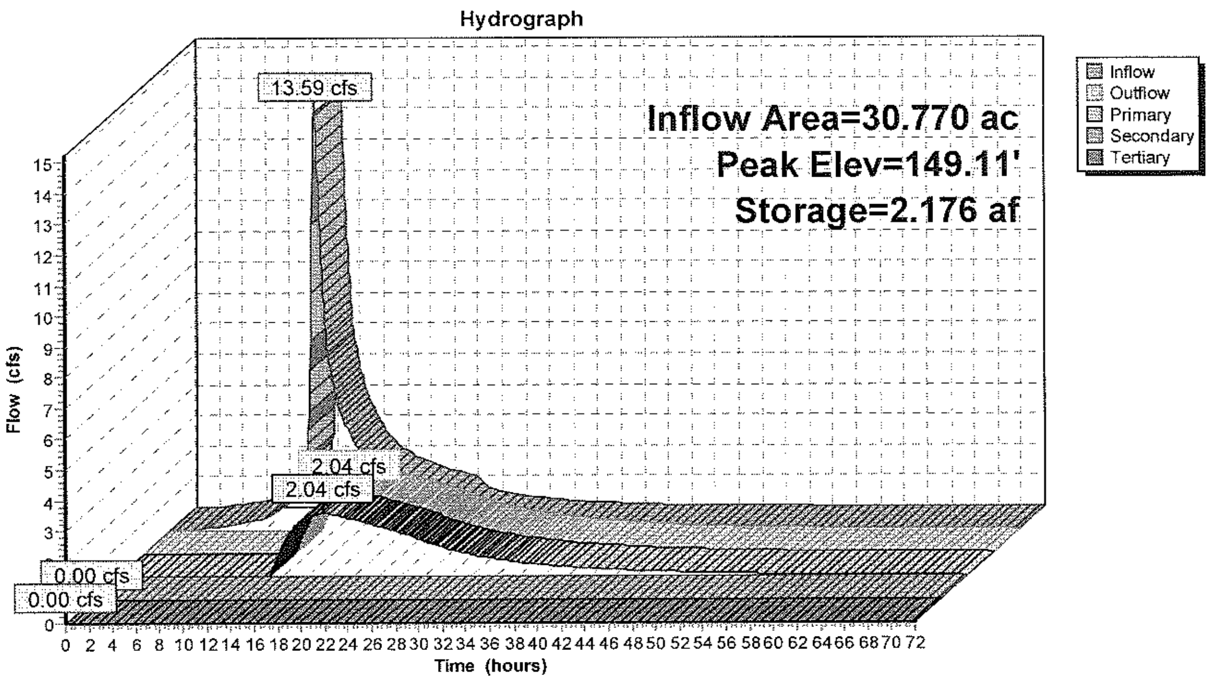
Device	Routing	Invert	Outlet Devices
#1	Primary	147.94'	**24.0" Round Culvert** L= 47.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 147.94' / 147.75' S= 0.0040 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	147.95'	**Weir, Cv= 2.62 (C= 3.28)** Elev. (feet) 147.95 150.05 Width (feet) 0.50 0.50
#3	Device 1	154.00'	**42.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	152.50'	**15.0" Round Culvert** L= 77.4' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 152.50' / 152.00' S= 0.0065 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#5	Tertiary	154.00'	**220.0' long x 9.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 Coef. (English) 2.48 2.55 2.70 2.69 2.68 2.69 2.67 2.64 2.64 2.64 2.64 2.64 2.64 2.65 2.65 2.66

Primary OutFlow Max=2.04 cfs @ 17.38 hrs HW=149.11' (Free Discharge)
1=Culvert (Passes 2.04 cfs of 5.12 cfs potential flow)
2=Weir (Weir Controls 2.04 cfs @ 3.52 fps)
3=Grate (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=146.25' (Free Discharge)
4=Culvert (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=146.25' (Free Discharge)
5=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond A:



Summary for Pond A1:

Inflow Area = 32.000 ac, 39.59% Impervious, Inflow Depth > 1.01" for 2 Year Storm event
Inflow = 2.07 cfs @ 17.29 hrs, Volume= 2.685 af
Outflow = 1.50 cfs @ 23.56 hrs, Volume= 2.129 af, Atten= 28%, Lag= 376.1 min
Primary = 1.50 cfs @ 23.56 hrs, Volume= 2.129 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 149.86' @ 23.56 hrs Surf.Area= 0.540 ac Storage= 1.040 af

Plug-Flow detention time= 721.3 min calculated for 2.129 af (79% of inflow)
Center-of-Mass det. time= 462.6 min (1,974.4 - 1,511.8)

Volume	Invert	Avail.Storage	Storage Description
#1	147.75'	5.278 af	**Custom Stage Data (Prismatic)** Listed below

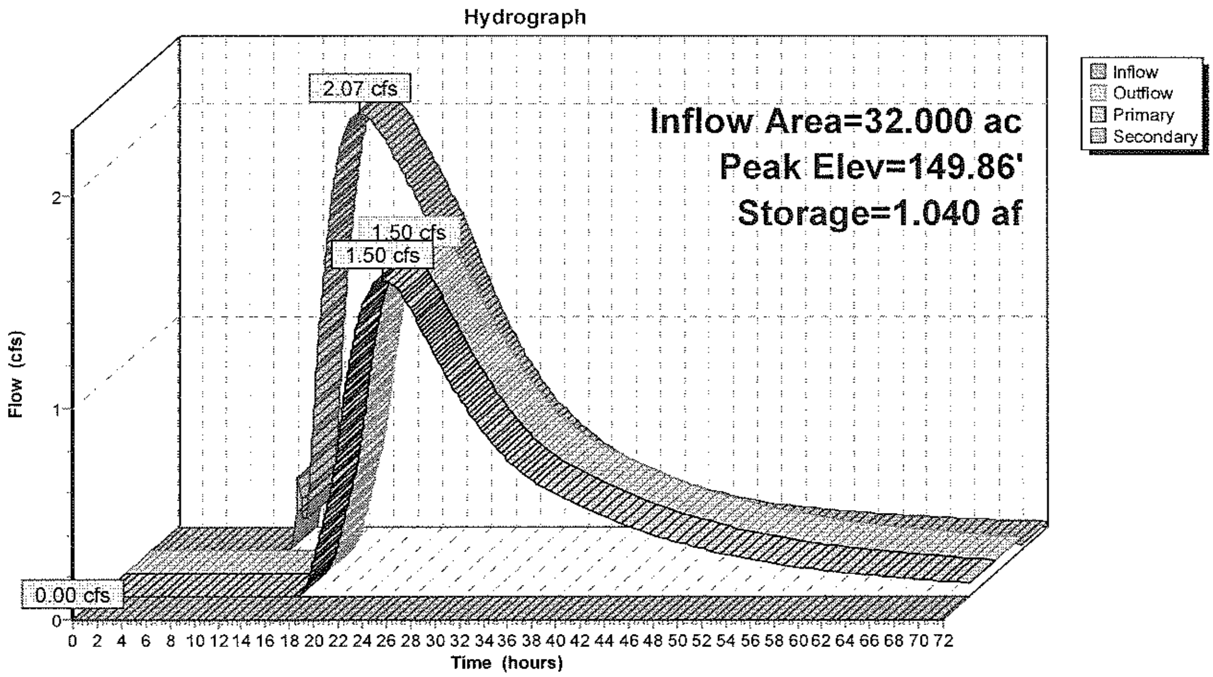
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
147.75	0.443	0.000	0.000
148.00	0.454	0.112	0.112
149.00	0.500	0.477	0.589
150.00	0.546	0.523	1.112
151.00	0.594	0.570	1.682
152.00	0.643	0.618	2.301
153.00	0.693	0.668	2.969
154.00	0.744	0.718	3.687
155.00	0.794	0.769	4.456
156.00	0.849	0.821	5.278

Device	Routing	Invert	Outlet Devices
#1	Primary	147.75'	**24.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 147.75' / 146.50' S= 0.0125 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	148.75'	**Weir, Cv= 2.62 (C= 3.28)** Elev. (feet) 148.75 149.50 149.50 150.10 Width (feet) 0.25 0.25 1.00 1.00
#3	Secondary	154.00'	**68.0' 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=1.49 cfs @ 23.56 hrs HW=149.86' (Free Discharge)
↑—**1=Culvert** (Passes 1.49 cfs of 15.95 cfs potential flow)
  ↑—**2=Weir** (Weir Controls 1.49 cfs @ 2.72 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=147.75' (Free Discharge)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A1:


Hydrograph
2.07 cfs
1.50 cfs
1.50 cfs
0.00 cfs
Inflow Area=32.000 ac
Peak Elev=149.86'
Storage=1.040 af
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)
0
1
2
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Pond A2:

Inflow Area = 33.070 ac, 38.31% Impervious, Inflow Depth > 0.79" for 2 Year Storm event
Inflow = 1.51 cfs @ 23.54 hrs, Volume= 2.172 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

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 151.32' @ 72.00 hrs Surf.Area= 0.572 ac Storage= 2.172 af

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

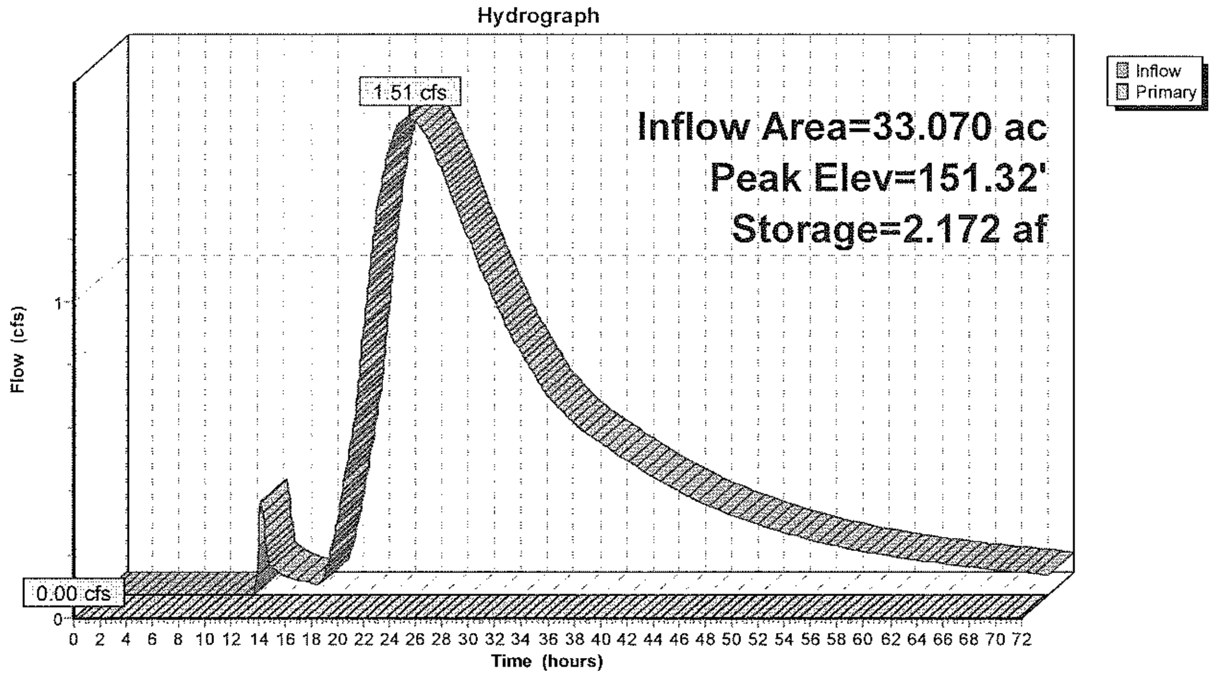
Volume	Invert	Avail.Storage	Storage Description
#1	146.50'	5.502 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
146.50	0.340	0.000	0.000
147.00	0.361	0.175	0.175
148.00	0.405	0.383	0.558
149.00	0.453	0.429	0.987
150.00	0.502	0.478	1.465
151.00	0.554	0.528	1.993
152.00	0.610	0.582	2.575
153.00	0.668	0.639	3.214
154.00	0.738	0.703	3.917
155.00	0.792	0.765	4.682
156.00	0.848	0.820	5.502

Device	Routing	Invert	Outlet Devices
#1	Primary	154.00'	**20.0' long x 17.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=146.50' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A2:


Hydrograph
1.51 cfs
0.00 cfs
Inflow
Primary
Inflow Area=33.070 ac
Peak Elev=151.32'
Storage=2.172 af
Flow (cfs)
1
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
Time (hours)

Summary for Pond A3:

Inflow Area = 36.060 ac, 36.83% Impervious, Inflow Depth = 0.08" for 2 Year Storm event
Inflow = 1.88 cfs @ 12.17 hrs, Volume= 0.252 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 152.99' @ 25.05 hrs Surf.Area= 0.324 ac Storage= 0.252 af

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	152.00'	1.980 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

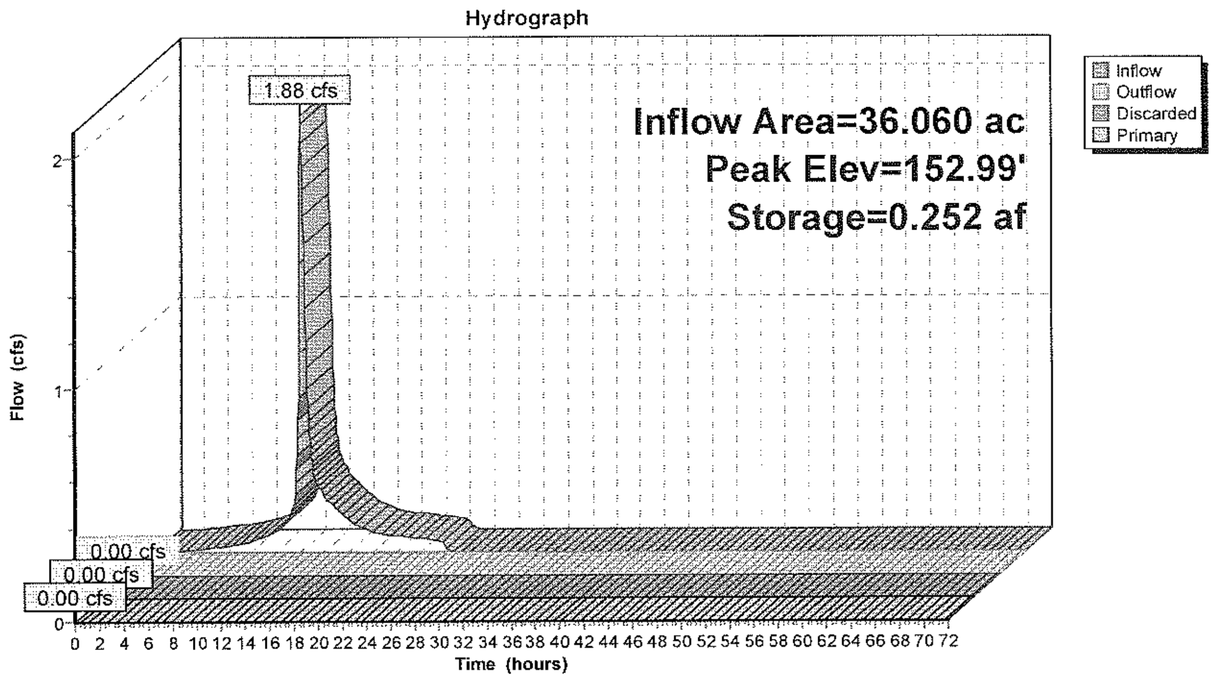
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
152.00	0.188	0.000	0.000
153.00	0.326	0.257	0.257
154.00	0.485	0.405	0.662
155.00	0.648	0.566	1.229
156.00	0.854	0.751	1.980

Device	Routing	Invert	Outlet Devices
#1	Primary	155.00'	**233.0' long x 8.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.45 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.65 2.66 2.67 2.69 2.71
#2	Discarded	152.00'	**3.000 in/hr Exfiltration X 0.00 over Horizontal area** Conductivity to Groundwater Elevation = 141.01'

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=152.00' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=152.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A3:


Hydrograph
1.88 cfs
Inflow Area=36.060 ac
Peak Elev=152.99'
Storage=0.252 af
0.00 cfs
0.00 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
2
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
Time (hours)

Summary for Pond B:

Inflow Area = 18.820 ac, 35.97% Impervious, Inflow Depth > 1.55" for 2 Year Storm event
Inflow = 16.13 cfs @ 12.16 hrs, Volume= 2.434 af
Outflow = 4.60 cfs @ 12.81 hrs, Volume= 2.175 af, Atten= 71%, Lag= 38.7 min
Primary = 4.60 cfs @ 12.81 hrs, Volume= 2.175 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 151.80' @ 12.81 hrs Surf.Area= 0.368 ac Storage= 0.977 af

Plug-Flow detention time= 352.1 min calculated for 2.173 af (89% of inflow)
Center-of-Mass det. time= 257.2 min (1,170.0 - 912.8)

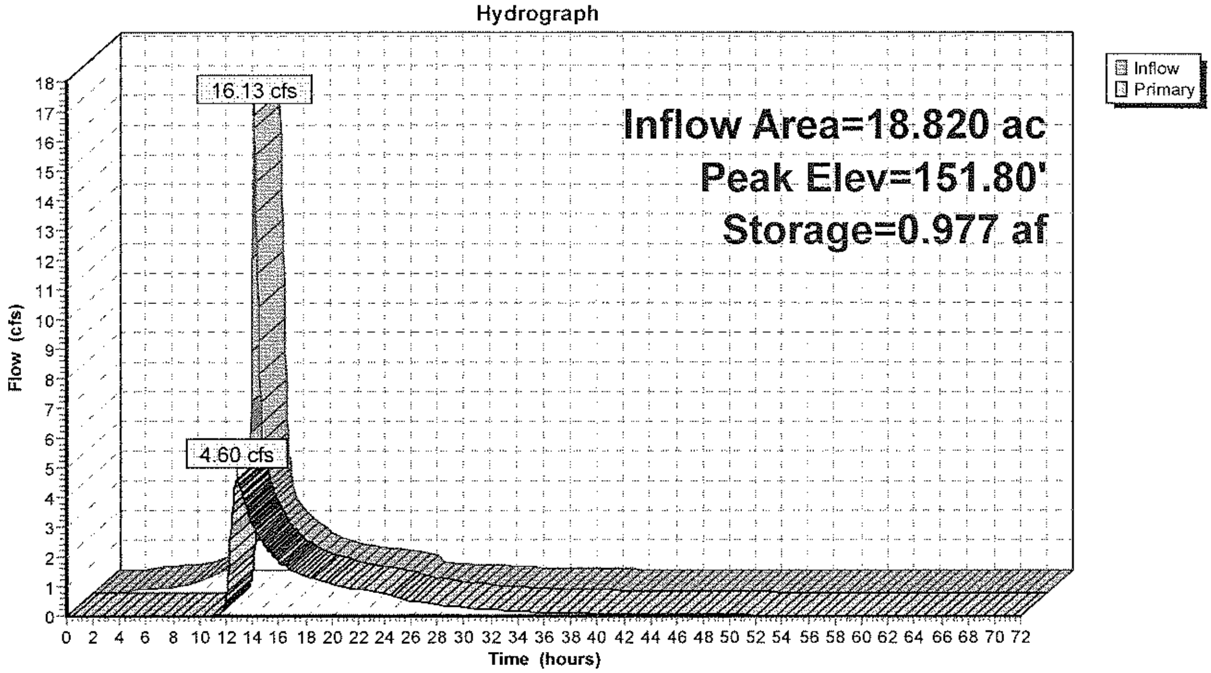
Volume	Invert	Avail.Storage	Storage Description
#1	148.50'	4.441 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
148.50	0.229	0.000	0.000
149.00	0.248	0.119	0.119
150.00	0.289	0.269	0.388
151.00	0.332	0.311	0.698
152.00	0.377	0.354	1.053
153.00	0.424	0.400	1.453
154.00	0.474	0.449	1.902
155.00	0.527	0.500	2.403
156.00	0.581	0.554	2.957
157.00	0.728	0.654	3.611
158.00	0.932	0.830	4.441

Device	Routing	Invert	Outlet Devices
#1	Primary	148.00'	**36.0" Round Culvert** L= 690.8' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 148.00' / 146.25' S= 0.0025 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf
#2	Device 1	149.50'	**Weir, Cv= 2.62 (C= 3.28)** Elev. (feet) 149.50 151.00 151.00 153.10 Width (feet) 0.25 0.25 1.00 1.00
#3	Device 1	155.85'	**48.0" x 42.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.59 cfs @ 12.81 hrs HW=151.80' (Free Discharge)
└─**1=Culvert** (Passes 4.59 cfs of 39.12 cfs potential flow)
  ├─**2=Weir** (Weir Controls 4.59 cfs @ 3.92 fps)
  └─**3=Grate** (Controls 0.00 cfs)

Pond B:


Hydrograph
Inflow
Primary
16.13 cfs
4.60 cfs
Inflow Area=18.820 ac
Peak Elev=151.80'
Storage=0.977 af
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Pond C: Wet Pond

Inflow Area = 3.520 ac, 48.86% Impervious, Inflow Depth = 1.75" for 2 Year Storm event
Inflow = 4.42 cfs @ 12.14 hrs, Volume= 0.512 af
Outflow = 0.36 cfs @ 14.41 hrs, Volume= 0.511 af, Atten= 92%, Lag= 136.0 min
Primary = 0.36 cfs @ 14.41 hrs, Volume= 0.511 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Starting Elev= 154.00' Surf.Area= 0.306 ac Storage= 1.067 af
Peak Elev= 154.93' @ 14.41 hrs Surf.Area= 0.337 ac Storage= 1.366 af (0.298 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 528.5 min (1,312.7 - 784.2)

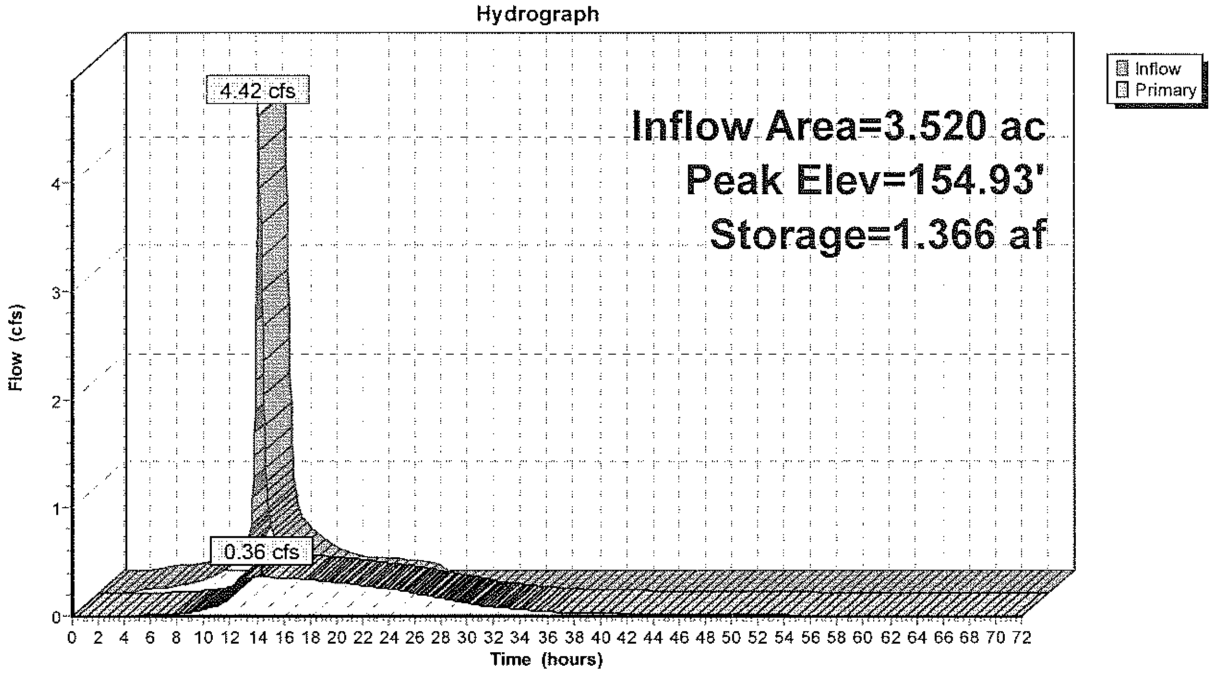
Volume	Invert	Avail.Storage	Storage Description
#1	149.00'	3.136 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
149.00	0.127	0.000	0.000
150.00	0.151	0.139	0.139
151.00	0.176	0.164	0.303
151.40	0.186	0.072	0.375
151.50	0.232	0.021	0.396
152.00	0.246	0.119	0.515
153.00	0.276	0.261	0.776
154.00	0.306	0.291	1.067
155.00	0.339	0.322	1.390
155.10	0.369	0.035	1.425
156.00	0.400	0.346	1.771
157.00	0.436	0.418	2.189
158.00	0.473	0.454	2.644
159.00	0.511	0.492	3.136

Device	Routing	Invert	Outlet Devices
#1	Primary	154.00'	**15.0" Round Culvert** L= 1,486.3' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 154.00' / 148.00' S= 0.0040 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Device 1	154.00'	**4.0" W x 3.0" H Vert. Orifice** C= 0.600
#3	Device 1	155.58'	**Weir, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 Width (feet) 0.33 1.00

Primary OutFlow Max=0.36 cfs @ 14.41 hrs HW=154.93' (Free Discharge)
↑—**1=Culvert** (Passes 0.36 cfs of 2.53 cfs potential flow)
  ↑—**2=Orifice** (Orifice Controls 0.36 cfs @ 4.31 fps)
  └—**3=Weir** (Controls 0.00 cfs)

Pond C: Wet Pond

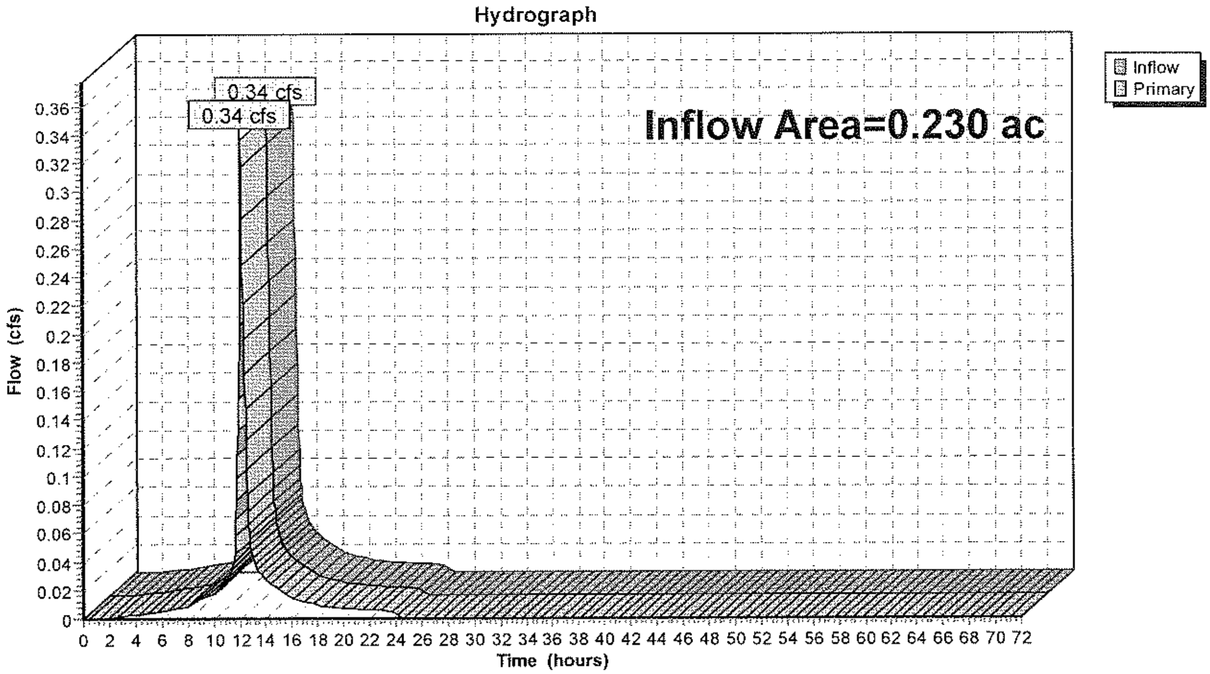


Summary for Link AP-CVS: Analysis Point-CVS

Inflow Area =	0.230 ac, 52.17% Impervious, Inflow Depth = 1.83"	for 2 Year Storm event
Inflow =	0.34 cfs @ 12.11 hrs, Volume=	0.035 af
Primary =	0.34 cfs @ 12.11 hrs, Volume=	0.035 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-CVS: Analysis Point-CVS

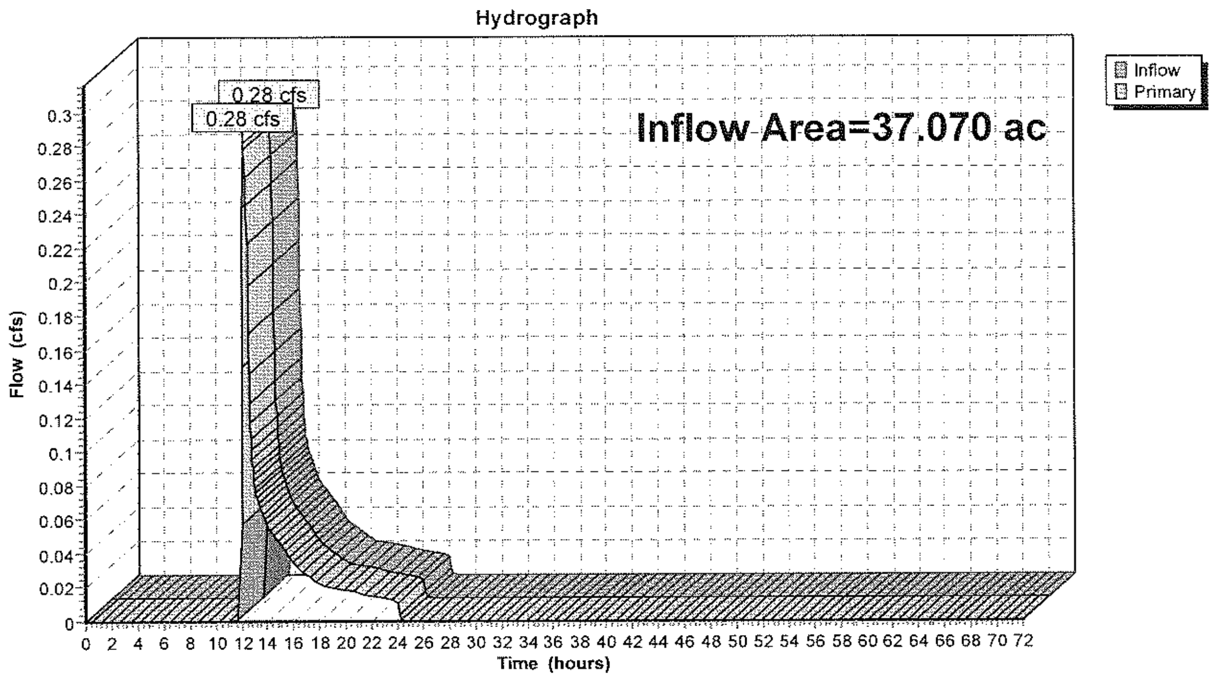


Summary for Link AP-W: Analysis Point-West

Inflow Area =	37.070 ac, 35.82% Impervious, Inflow Depth = 0.01"	for 2 Year Storm event
Inflow =	0.28 cfs @ 12.20 hrs, Volume=	0.041 af
Primary =	0.28 cfs @ 12.20 hrs, Volume=	0.041 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-W: Analysis Point-West



Summary for Subcatchment BSN A:

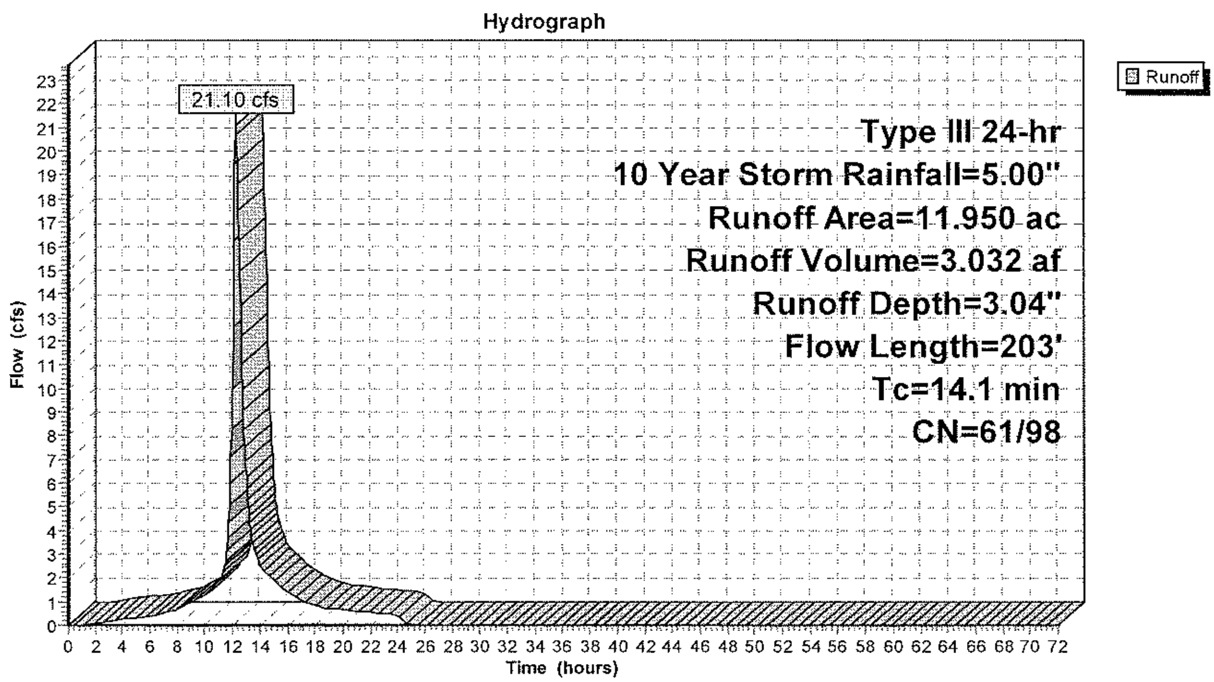
Runoff = 21.10 cfs @ 12.23 hrs, Volume= 3.032 af, Depth= 3.04"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
6.050	61	>75% Grass cover, Good, HSG B
5.900	98	Paved roads w/curbs & sewers
11.950	79	Weighted Average
6.050		50.63% Pervious Area
5.900		49.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	18	0.0089	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.3	132	0.0069	0.96		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.5	53	0.0069	1.69		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.9					**Direct Entry, from pipe calcs**
14.1	203	Total			

Subcatchment BSN A:



Summary for Subcatchment BSN A1:

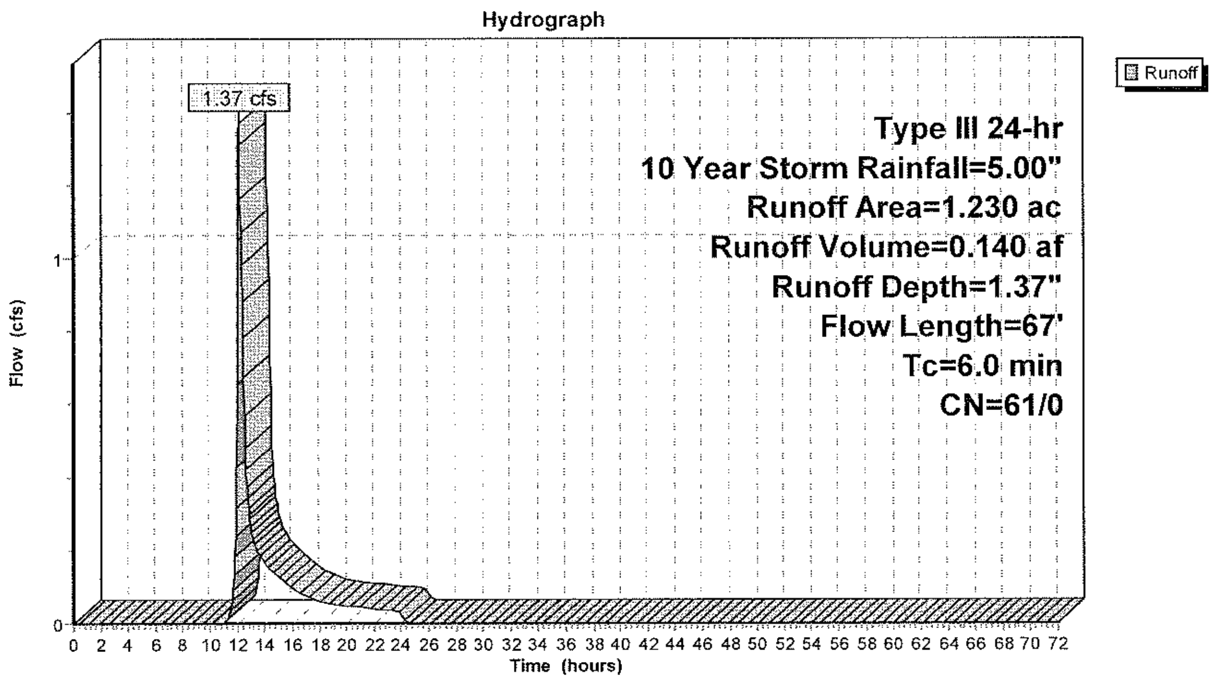
Runoff = 1.37 cfs @ 12.13 hrs, Volume= 0.140 af, Depth= 1.37"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
1.230	61	>75% Grass cover, Good, HSG B
1.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	18	0.0560	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.6	12	0.3333	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
1.1	13	0.0784	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
1.0	24	0.3333	0.40		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
4.3	67	Total, Increased to minimum Tc = 6.0 min			

Subcatchment BSN A1:



Summary for Subcatchment BSN A2:

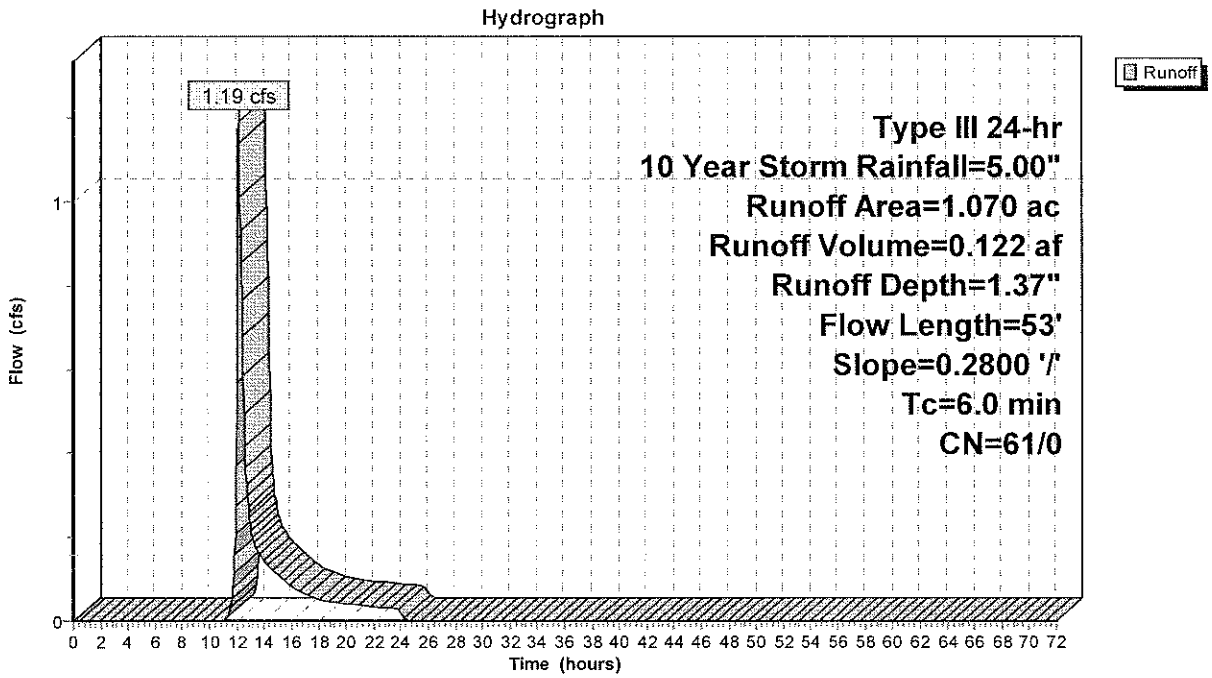
Runoff = 1.19 cfs @ 12.13 hrs, Volume= 0.122 af, Depth= 1.37"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
1.070	61	>75% Grass cover, Good, HSG B
1.070		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	53	0.2800	0.44		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.0	53	Total, Increased to minimum Tc = 6.0 min			

Subcatchment BSN A2:



Summary for Subcatchment BSN A3:

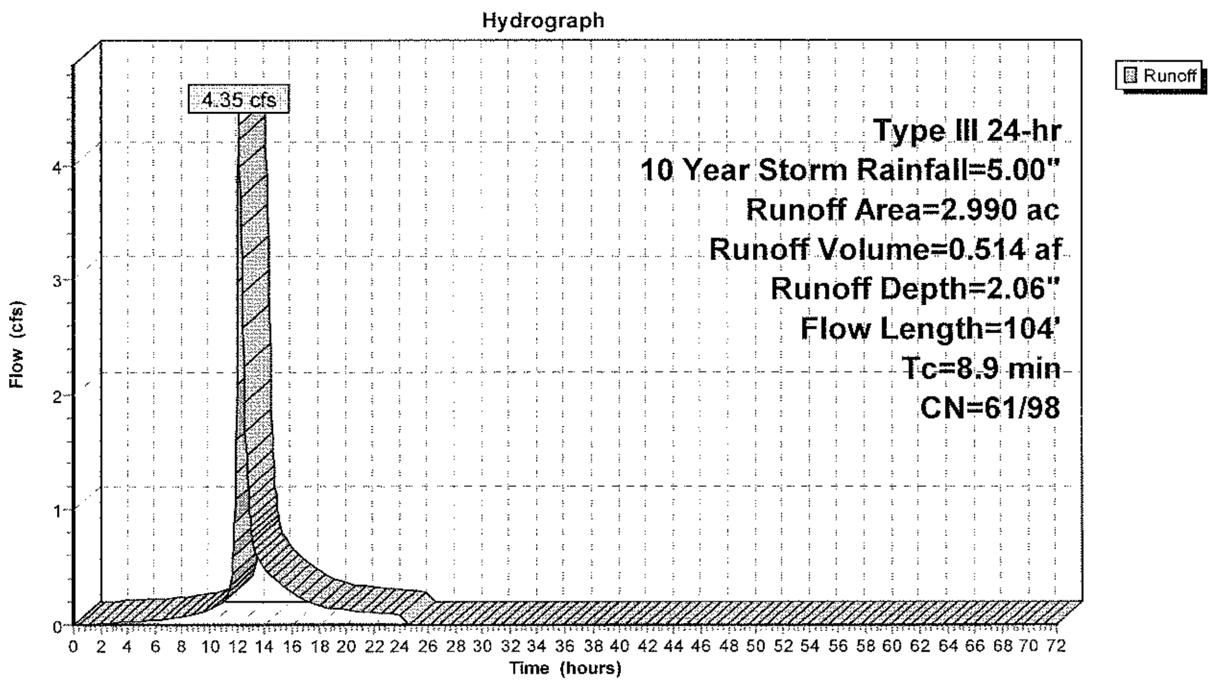
Runoff = 4.35 cfs @ 12.16 hrs, Volume= 0.514 af, Depth= 2.06"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
2.380	61	>75% Grass cover, Good, HSG B
0.610	98	Paved parking, HSG B
2.990	69	Weighted Average
2.380		79.60% Pervious Area
0.610		20.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	92	0.0249	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.6	12	0.3333	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
8.9	104	Total			

Subcatchment BSN A3:



Summary for Subcatchment BSN B:

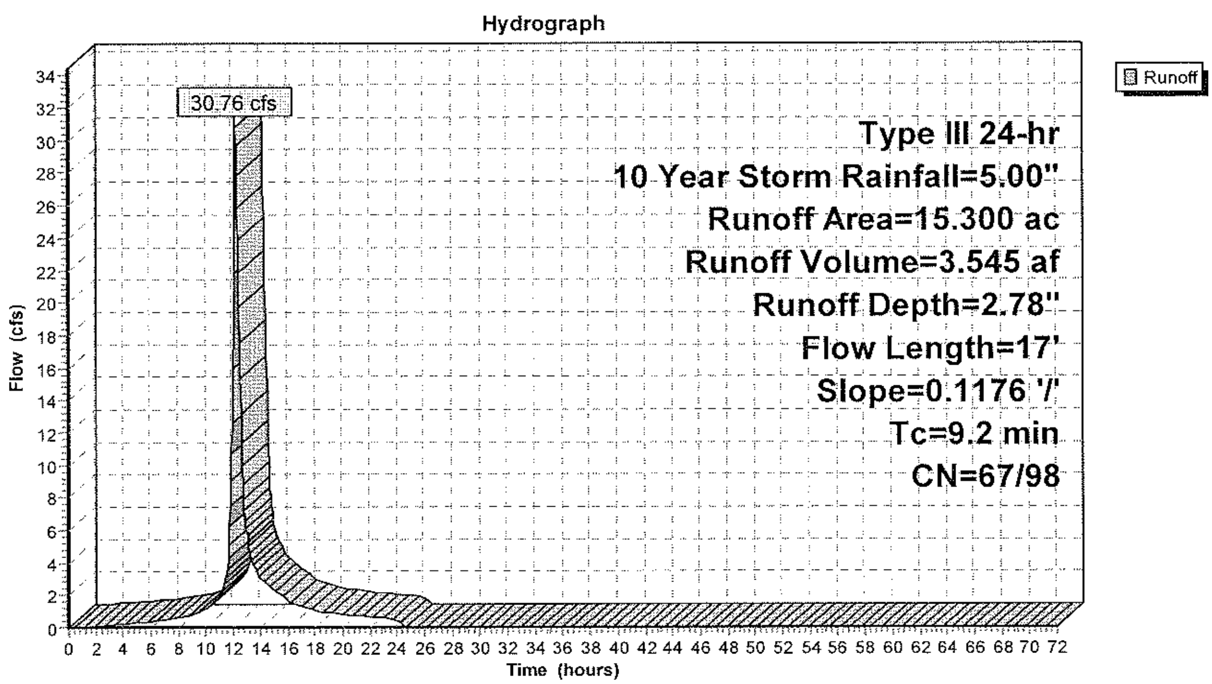
Runoff = 30.76 cfs @ 12.16 hrs, Volume= 3.545 af, Depth= 2.78"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
5.050	98	Paved parking & roofs
7.610	61	>75% Grass cover, Good, HSG B
2.640	83	Fallow, crop residue, Good, HSG B
15.300	77	Weighted Average
10.250		66.99% Pervious Area
5.050		33.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	17	0.1176	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
8.0					**Direct Entry, from pipe calcs**
9.2	17	Total			

Subcatchment BSN B:



Summary for Subcatchment BSN C:

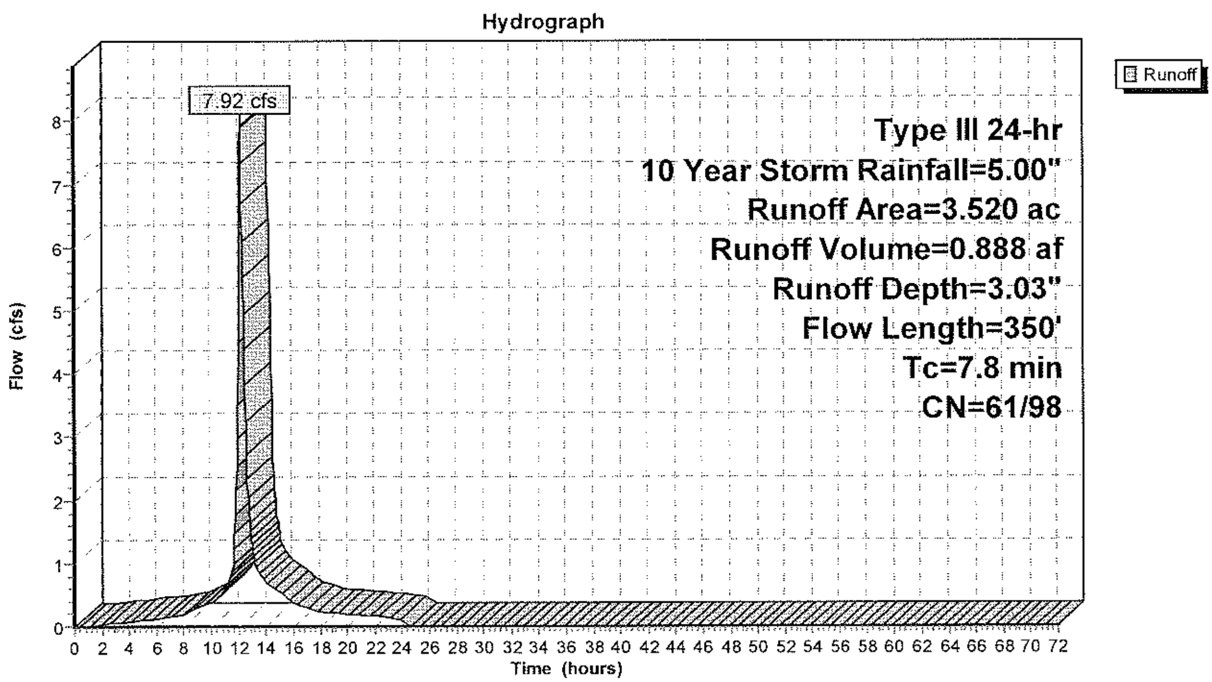
Runoff = 7.92 cfs @ 12.14 hrs, Volume= 0.888 af, Depth= 3.03"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
1.720	98	Paved parking & roofs
1.800	61	>75% Grass cover, Good, HSG B
3.520	79	Weighted Average
1.800		51.14% Pervious Area
1.720		48.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	25	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.4	125	0.0056	0.88		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
2.2	200	0.0056	1.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.8	350	Total			

Subcatchment BSN C:



Summary for Subcatchment P-UNCAP1:

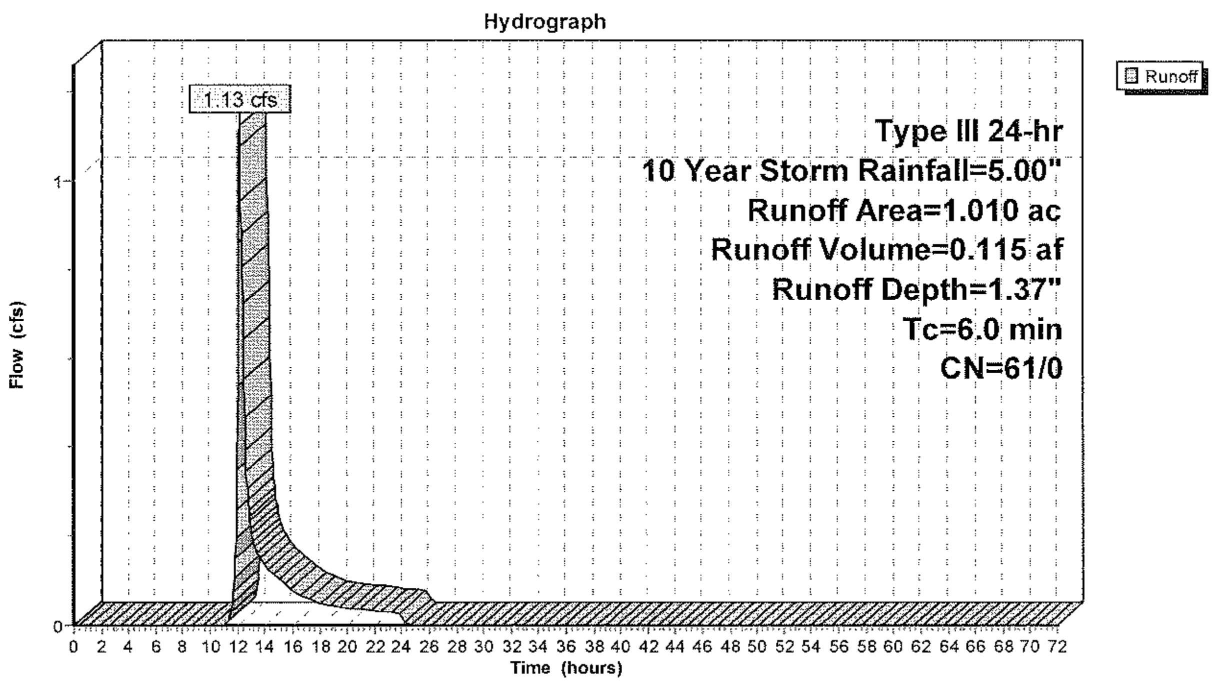
Runoff = 1.13 cfs @ 12.13 hrs, Volume= 0.115 af, Depth= 1.37"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
1.010	61	>75% Grass cover, Good, HSG B
1.010		100.00% Pervious Area

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

Subcatchment P-UNCAP1:



Summary for Subcatchment P-UNCAP2:

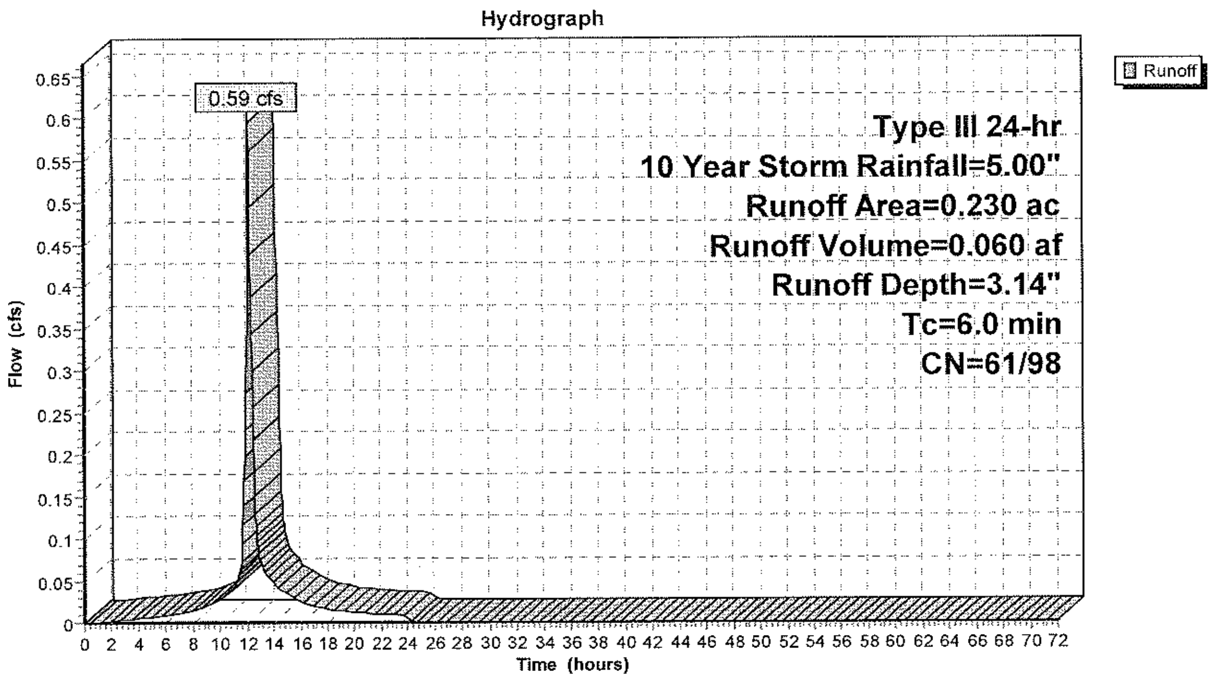
Runoff = 0.59 cfs @ 12.11 hrs, Volume= 0.060 af, Depth= 3.14"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
0.120	98	Unconnected pavement, HSG B
0.110	61	>75% Grass cover, Good, HSG B
0.230	80	Weighted Average
0.110		47.83% Pervious Area
0.120		52.17% Impervious Area

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

Subcatchment P-UNCAP2:



Summary for Pond A:

Inflow Area = 30.770 ac, 41.18% Impervious, Inflow Depth > 2.81" for 10 Year Storm event
Inflow = 30.27 cfs @ 12.36 hrs, Volume= 7.199 af
Outflow = 6.08 cfs @ 14.92 hrs, Volume= 5.893 af, Atten= 80%, Lag= 153.4 min
Primary = 6.08 cfs @ 14.92 hrs, Volume= 5.893 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 150.46' @ 14.92 hrs Surf.Area= 0.923 ac Storage= 3.372 af

Plug-Flow detention time= 526.6 min calculated for 5.889 af (82% of inflow)
Center-of-Mass det. time= 366.9 min (1,347.3 - 980.4)

Volume	Invert	Avail.Storage	Storage Description
#1	146.25'	9.525 af	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
146.25	0.690	0.000	0.000
147.00	0.721	0.529	0.529
148.00	0.777	0.749	1.278
149.00	0.835	0.806	2.084
150.00	0.894	0.864	2.949
151.00	0.957	0.925	3.874
152.00	1.019	0.988	4.862
153.00	1.083	1.051	5.913
154.00	1.147	1.115	7.028
155.00	1.213	1.180	8.208
156.00	1.421	1.317	9.525

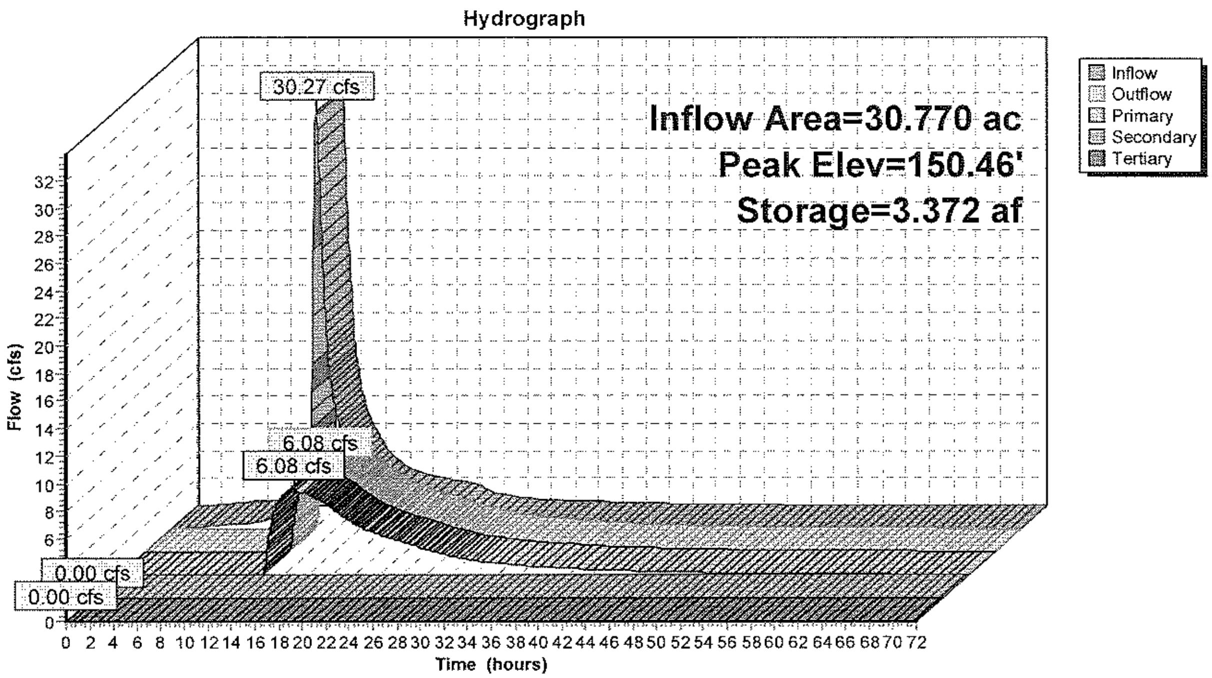
Device	Routing	Invert	Outlet Devices
#1	Primary	147.94'	**24.0" Round Culvert** L= 47.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 147.94' / 147.75' S= 0.0040 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	147.95'	**Weir, Cv= 2.62 (C= 3.28)** Elev. (feet) 147.95 150.05 Width (feet) 0.50 0.50
#3	Device 1	154.00'	**42.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	152.50'	**15.0" Round Culvert** L= 77.4' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 152.50' / 152.00' S= 0.0065 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#5	Tertiary	154.00'	**220.0' long x 9.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 Coef. (English) 2.48 2.55 2.70 2.69 2.68 2.69 2.67 2.64 2.64 2.64 2.64 2.64 2.64 2.65 2.65 2.66

Primary OutFlow Max=6.08 cfs @ 14.92 hrs HW=150.46' (Free Discharge)
↑—**1=Culvert** (Passes 6.08 cfs of 16.14 cfs potential flow)
  ↑—**2=Weir** (Orifice Controls 6.08 cfs @ 5.79 fps)
  └—**3=Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=146.25' (Free Discharge)
↑—**4=Culvert** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=146.25' (Free Discharge)
↑—**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A:



Summary for Pond A1:

Inflow Area =	32.000 ac,	39.59% Impervious,	Inflow Depth > 2.26"	for 10 Year Storm event
Inflow =	6.21 cfs @	14.83 hrs, Volume=	6.034 af	
Outflow =	4.36 cfs @	18.90 hrs, Volume=	5.456 af, Atten= 30%, Lag= 243.8 min	
Primary =	4.36 cfs @	18.90 hrs, Volume=	5.456 af	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 150.93' @ 18.90 hrs Surf.Area= 0.591 ac Storage= 1.644 af

Plug-Flow detention time= 418.2 min calculated for 5.456 af (90% of inflow)
Center-of-Mass det. time= 268.4 min (1,604.7 - 1,336.3)

Volume	Invert	Avail.Storage	Storage Description
#1	147.75'	5.278 af	**Custom Stage Data (Prismatic)** Listed below

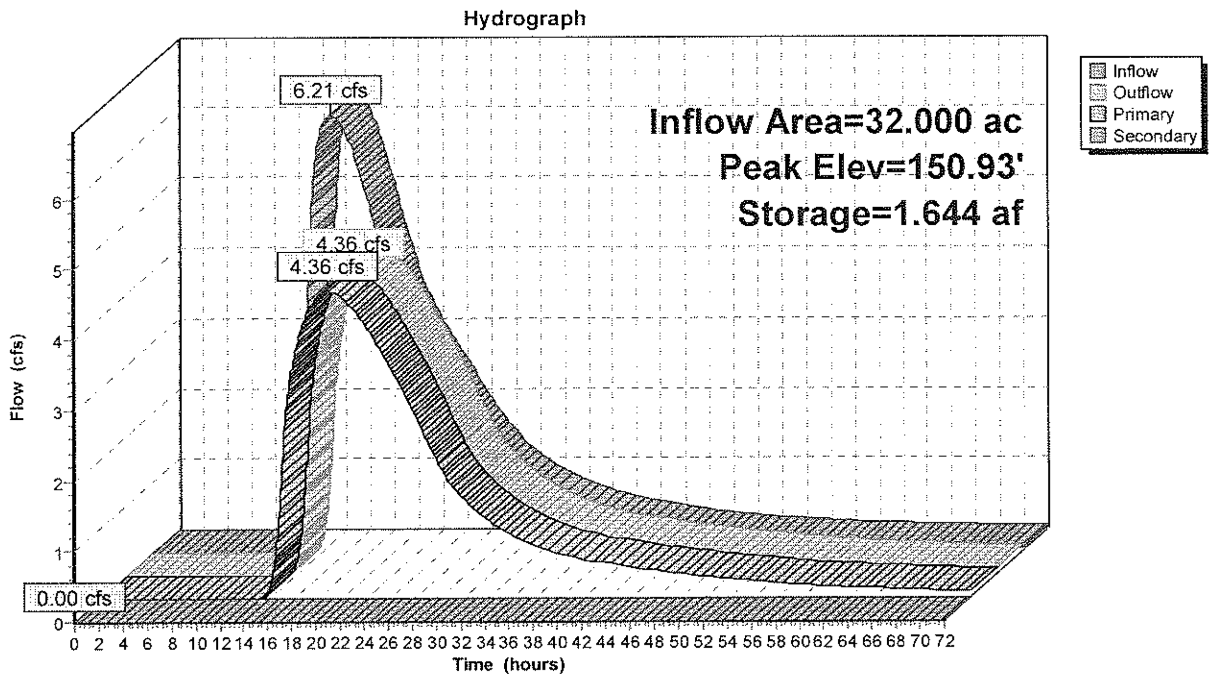
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
147.75	0.443	0.000	0.000
148.00	0.454	0.112	0.112
149.00	0.500	0.477	0.589
150.00	0.546	0.523	1.112
151.00	0.594	0.570	1.682
152.00	0.643	0.618	2.301
153.00	0.693	0.668	2.969
154.00	0.744	0.718	3.687
155.00	0.794	0.769	4.456
156.00	0.849	0.821	5.278

Device	Routing	Invert	Outlet Devices
#1	Primary	147.75'	**24.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 147.75' / 146.50' S= 0.0125 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	148.75'	**Weir, Cv= 2.62 (C= 3.28)** Elev. (feet) 148.75 149.50 149.50 150.10 Width (feet) 0.25 0.25 1.00 1.00
#3	Secondary	154.00'	**68.0' 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=4.36 cfs @ 18.90 hrs HW=150.93' (Free Discharge)
↑—**1=Culvert** (Passes 4.36 cfs of 22.35 cfs potential flow)
  ↑—**2=Weir** (Orifice Controls 4.36 cfs @ 5.54 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=147.75' (Free Discharge)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A1:


Hydrograph
6.21 cfs
4.36 cfs
4.36 cfs
0.00 cfs
Inflow Area=32.000 ac
Peak Elev=150.93'
Storage=1.644 af
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
0 1 2 3 4 5 6

Summary for Pond A2:

Inflow Area = 33.070 ac, 38.31% Impervious, Inflow Depth > 2.02" for 10 Year Storm event
Inflow = 4.41 cfs @ 18.87 hrs, Volume= 5.578 af
Outflow = 1.55 cfs @ 29.40 hrs, Volume= 1.655 af, Atten= 65%, Lag= 631.9 min
Primary = 1.55 cfs @ 29.40 hrs, Volume= 1.655 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 154.09' @ 29.40 hrs Surf.Area= 0.743 ac Storage= 3.985 af

Plug-Flow detention time= 1,400.9 min calculated for 1.655 af (30% of inflow)
Center-of-Mass det. time= 843.4 min (2,432.2 - 1,588.8)

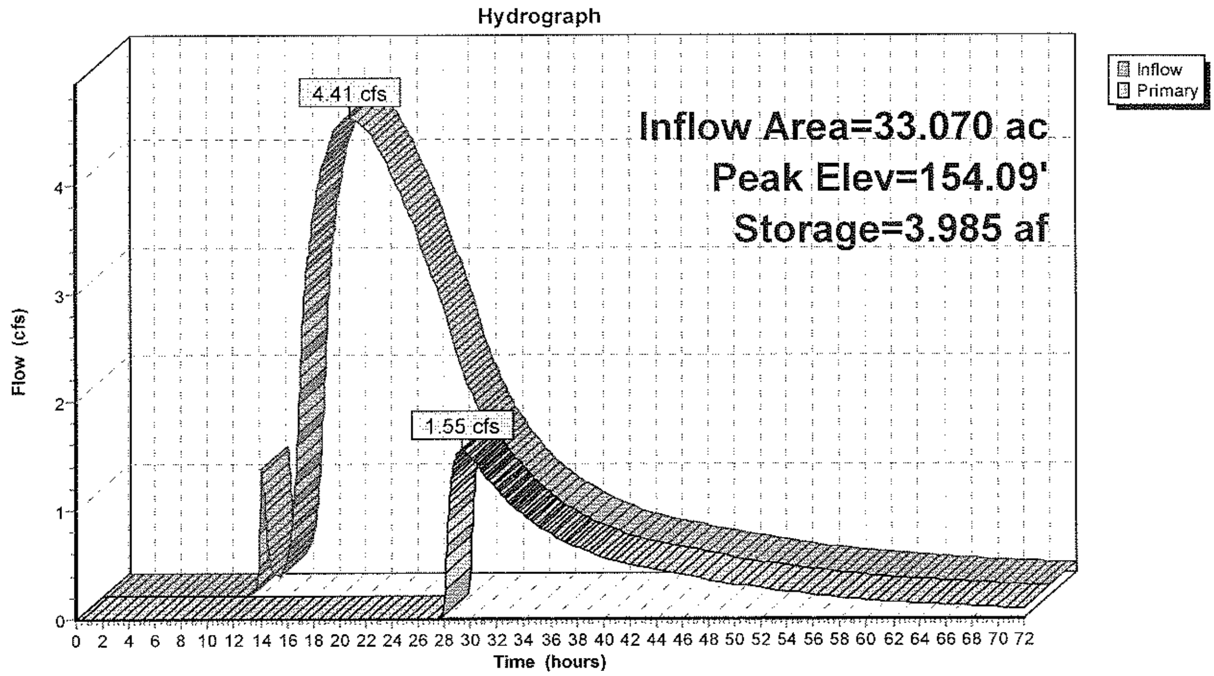
Volume	Invert	Avail.Storage	Storage Description
#1	146.50'	5.502 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
146.50	0.340	0.000	0.000
147.00	0.361	0.175	0.175
148.00	0.405	0.383	0.558
149.00	0.453	0.429	0.987
150.00	0.502	0.478	1.465
151.00	0.554	0.528	1.993
152.00	0.610	0.582	2.575
153.00	0.668	0.639	3.214
154.00	0.738	0.703	3.917
155.00	0.792	0.765	4.682
156.00	0.848	0.820	5.502

Device	Routing	Invert	Outlet Devices
#1	Primary	154.00'	**20.0' long x 17.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.49 cfs @ 29.40 hrs HW=154.09' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.49 cfs @ 0.81 fps)

Pond A2:


Hydrograph
4.41 cfs
1.55 cfs
Inflow Area=33.070 ac
Peak Elev=154.09'
Storage=3.985 af
Inflow
Primary
Flow (cfs)
0
1
2
3
4
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Pond A3:

Inflow Area =	36.060 ac, 36.83% Impervious, Inflow Depth > 0.72"	for 10 Year Storm event		
Inflow =	4.35 cfs @	12.16 hrs, Volume=	2.169 af	
Outflow =	0.80 cfs @	35.74 hrs, Volume=	0.939 af,	Atten= 82%, Lag= 1,414.7 min
Discarded =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	
Primary =	0.80 cfs @	35.74 hrs, Volume=	0.939 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 155.01' @ 35.74 hrs Surf.Area= 0.649 ac Storage= 1.234 af

Plug-Flow detention time= 1,585.3 min calculated for 0.939 af (43% of inflow)
Center-of-Mass det. time= 800.5 min (2,851.3 - 2,050.8)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	1.980 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

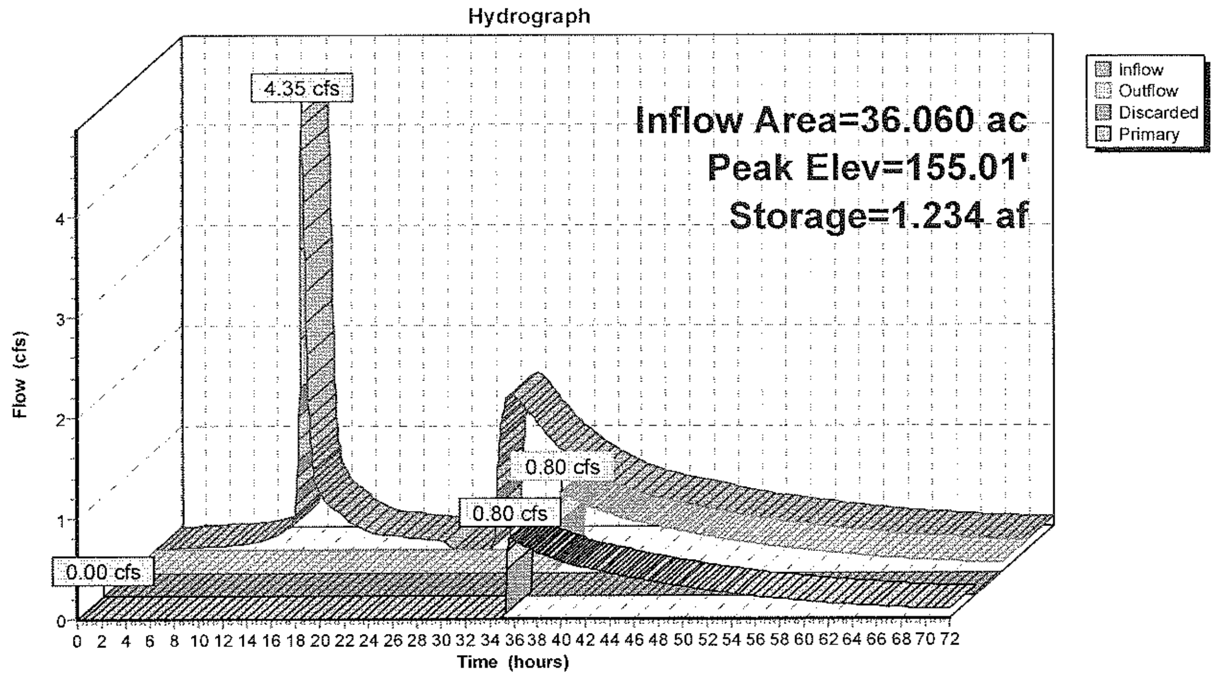
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
152.00	0.188	0.000	0.000
153.00	0.326	0.257	0.257
154.00	0.485	0.405	0.662
155.00	0.648	0.566	1.229
156.00	0.854	0.751	1.980

Device	Routing	Invert	Outlet Devices
#1	Primary	155.00'	**233.0' long x 8.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.45 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.65 2.66 2.67 2.69 2.71
#2	Discarded	152.00'	**3.000 in/hr Exfiltration X 0.00 over Horizontal area** Conductivity to Groundwater Elevation = 141.01'

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=152.00' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.34 cfs @ 35.74 hrs HW=155.01' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.34 cfs @ 0.21 fps)

Pond A3:


Hydrograph
4.35 cfs
Inflow Area=36.060 ac
Peak Elev=155.01'
Storage=1.234 af
0.80 cfs
0.80 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
2
3
4
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
Time (hours)

Summary for Pond B:

Inflow Area = 18.820 ac, 35.97% Impervious, Inflow Depth > 2.82" for 10 Year Storm event
Inflow = 31.11 cfs @ 12.16 hrs, Volume= 4.429 af
Outflow = 13.14 cfs @ 12.62 hrs, Volume= 4.167 af, Atten= 58%, Lag= 27.2 min
Primary = 13.14 cfs @ 12.62 hrs, Volume= 4.167 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 153.11' @ 12.62 hrs Surf.Area= 0.430 ac Storage= 1.500 af

Plug-Flow detention time= 264.8 min calculated for 4.164 af (94% of inflow)
Center-of-Mass det. time= 189.8 min (1,117.2 - 927.4)

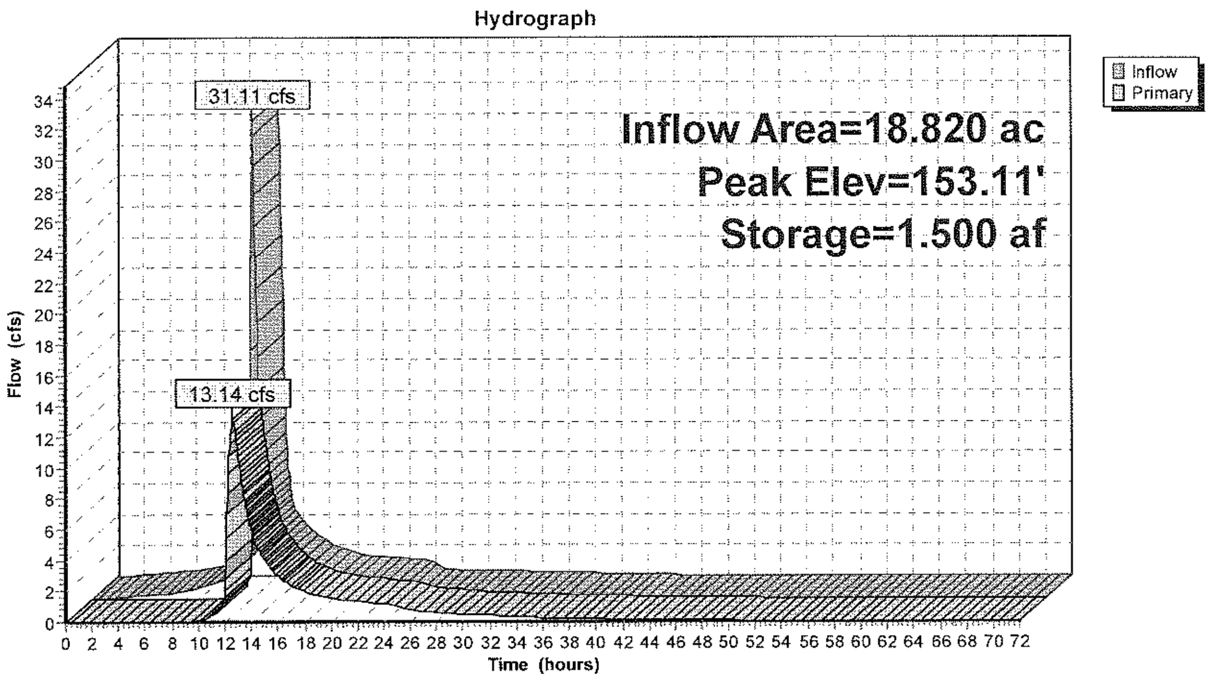
Volume	Invert	Avail.Storage	Storage Description
#1	148.50'	4.441 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
148.50	0.229	0.000	0.000
149.00	0.248	0.119	0.119
150.00	0.289	0.269	0.388
151.00	0.332	0.311	0.698
152.00	0.377	0.354	1.053
153.00	0.424	0.400	1.453
154.00	0.474	0.449	1.902
155.00	0.527	0.500	2.403
156.00	0.581	0.554	2.957
157.00	0.728	0.654	3.611
158.00	0.932	0.830	4.441

Device	Routing	Invert	Outlet Devices
#1	Primary	148.00'	**36.0" Round Culvert** L= 690.8' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 148.00' / 146.25' S= 0.0025 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf
#2	Device 1	149.50'	**Weir, Cv= 2.62 (C= 3.28)** Elev. (feet) 149.50 151.00 151.00 153.10 Width (feet) 0.25 0.25 1.00 1.00
#3	Device 1	155.85'	**48.0" x 42.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=13.13 cfs @ 12.62 hrs HW=153.11' (Free Discharge)
↑—**1=Culvert** (Passes 13.13 cfs of 44.85 cfs potential flow)
  ↑—**2=Weir** (Orifice Controls 13.13 cfs @ 5.30 fps)
  └—**3=Grate** (Controls 0.00 cfs)

Pond B:


Hydrograph
31.11 cfs
13.14 cfs
Inflow Area=18.820 ac
Peak Elev=153.11'
Storage=1.500 af
Inflow
Primary
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
Time (hours)

Summary for Pond C: Wet Pond

Inflow Area = 3.520 ac, 48.86% Impervious, Inflow Depth = 3.03" for 10 Year Storm event
Inflow = 7.92 cfs @ 12.14 hrs, Volume= 0.888 af
Outflow = 0.49 cfs @ 15.31 hrs, Volume= 0.885 af, Atten= 94%, Lag= 190.5 min
Primary = 0.49 cfs @ 15.31 hrs, Volume= 0.885 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Starting Elev= 154.00' Surf.Area= 0.306 ac Storage= 1.067 af
Peak Elev= 155.60' @ 15.31 hrs Surf.Area= 0.386 ac Storage= 1.613 af (0.546 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 641.4 min (1,424.6 - 783.2)

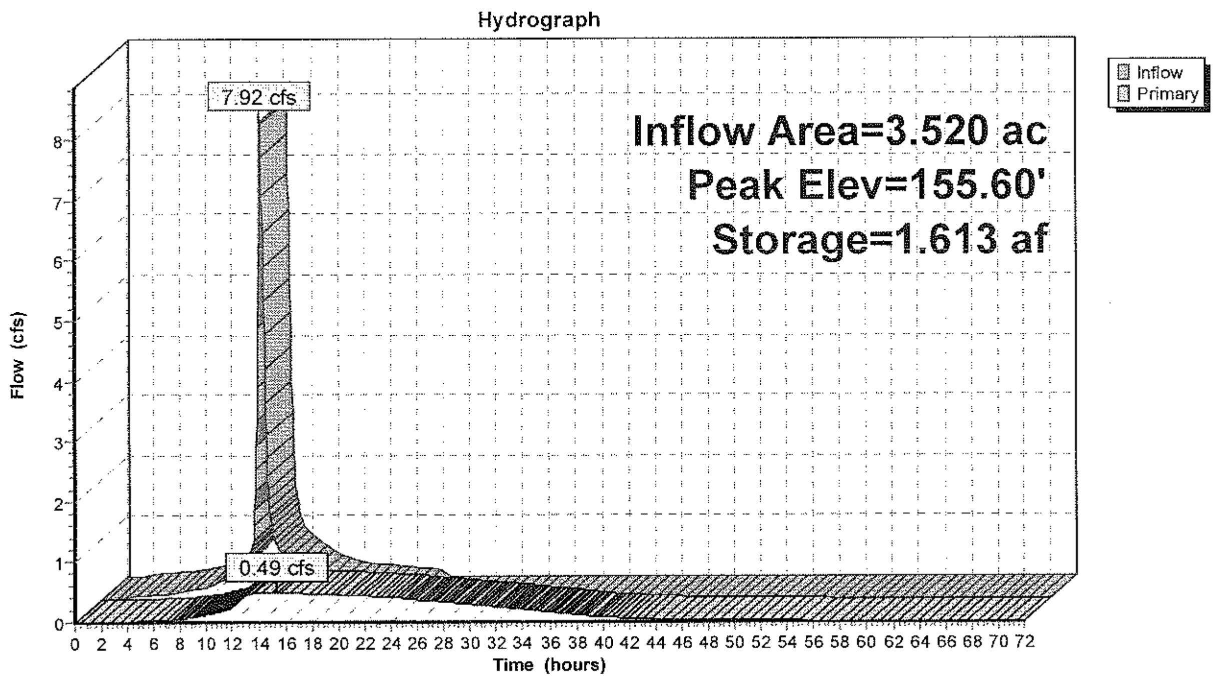
Volume	Invert	Avail.Storage	Storage Description
#1	149.00'	3.136 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
149.00	0.127	0.000	0.000
150.00	0.151	0.139	0.139
151.00	0.176	0.164	0.303
151.40	0.186	0.072	0.375
151.50	0.232	0.021	0.396
152.00	0.246	0.119	0.515
153.00	0.276	0.261	0.776
154.00	0.306	0.291	1.067
155.00	0.339	0.322	1.390
155.10	0.369	0.035	1.425
156.00	0.400	0.346	1.771
157.00	0.436	0.418	2.189
158.00	0.473	0.454	2.644
159.00	0.511	0.492	3.136

Device	Routing	Invert	Outlet Devices
#1	Primary	154.00'	**15.0" Round Culvert** L= 1,486.3' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 154.00' / 148.00' S= 0.0040 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Device 1	154.00'	**4.0" W x 3.0" H Vert. Orifice** C= 0.600
#3	Device 1	155.58'	**Weir, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 Width (feet) 0.33 1.00

Primary OutFlow Max=0.49 cfs @ 15.31 hrs HW=155.60' (Free Discharge)
└─**1=Culvert** (Passes 0.49 cfs of 4.60 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 0.49 cfs @ 5.84 fps)
  └─**3=Weir** (Weir Controls 0.00 cfs @ 0.44 fps)

Pond C: Wet Pond

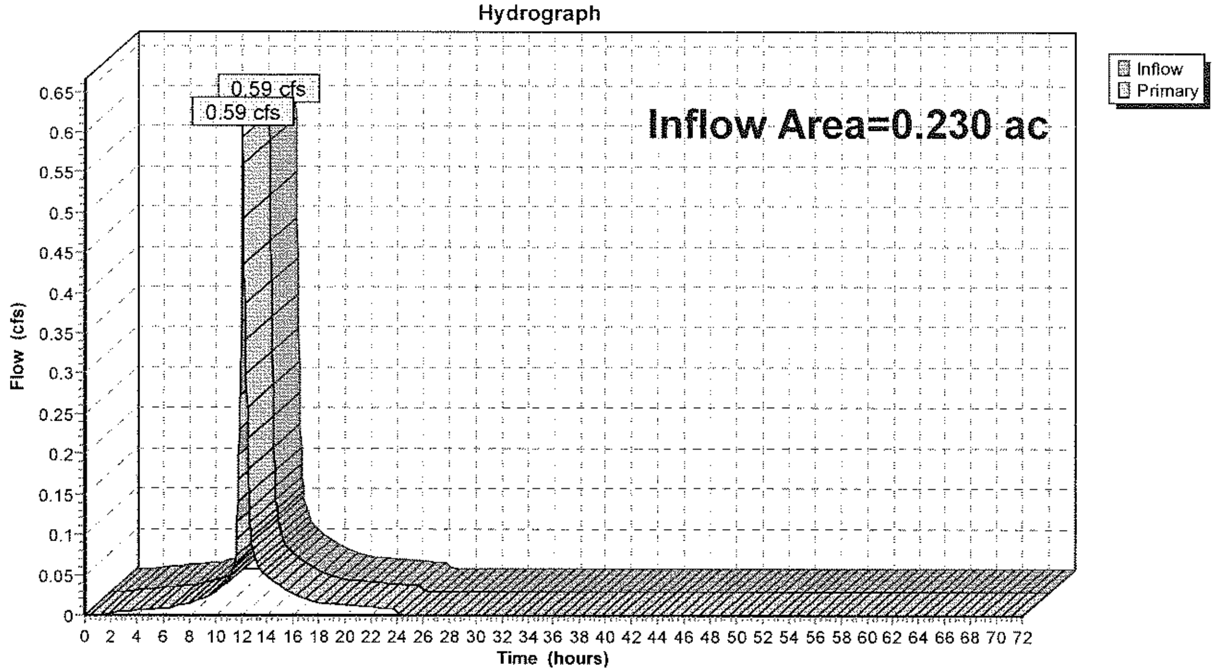


Summary for Link AP-CVS: Analysis Point-CVS

Inflow Area =	0.230 ac, 52.17% Impervious, Inflow Depth = 3.14"	for 10 Year Storm event	
Inflow =	0.59 cfs @ 12.11 hrs, Volume=	0.060 af	
Primary =	0.59 cfs @ 12.11 hrs, Volume=	0.060 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-CVS: Analysis Point-CVS

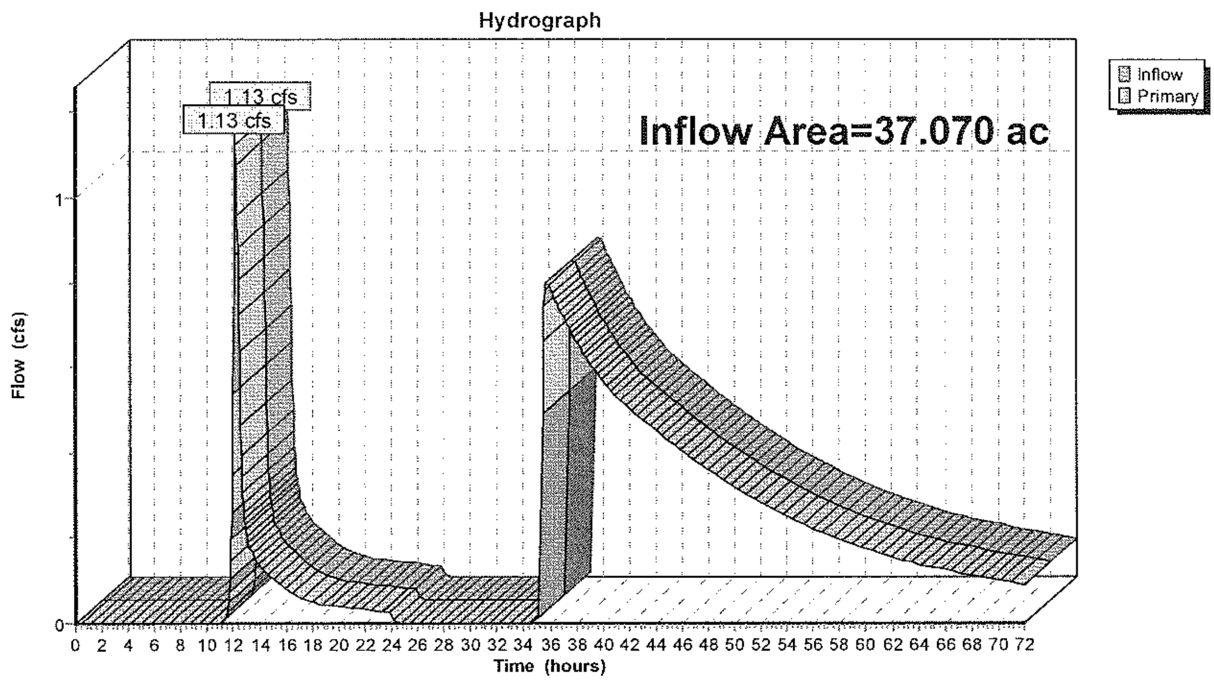


Summary for Link AP-W: Analysis Point-West

Inflow Area =	37.070 ac, 35.82% Impervious, Inflow Depth > 0.34"	for 10 Year Storm event
Inflow =	1.13 cfs @ 12.13 hrs, Volume=	1.054 af
Primary =	1.13 cfs @ 12.13 hrs, Volume=	1.054 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-W: Analysis Point-West



Summary for Subcatchment BSN A:

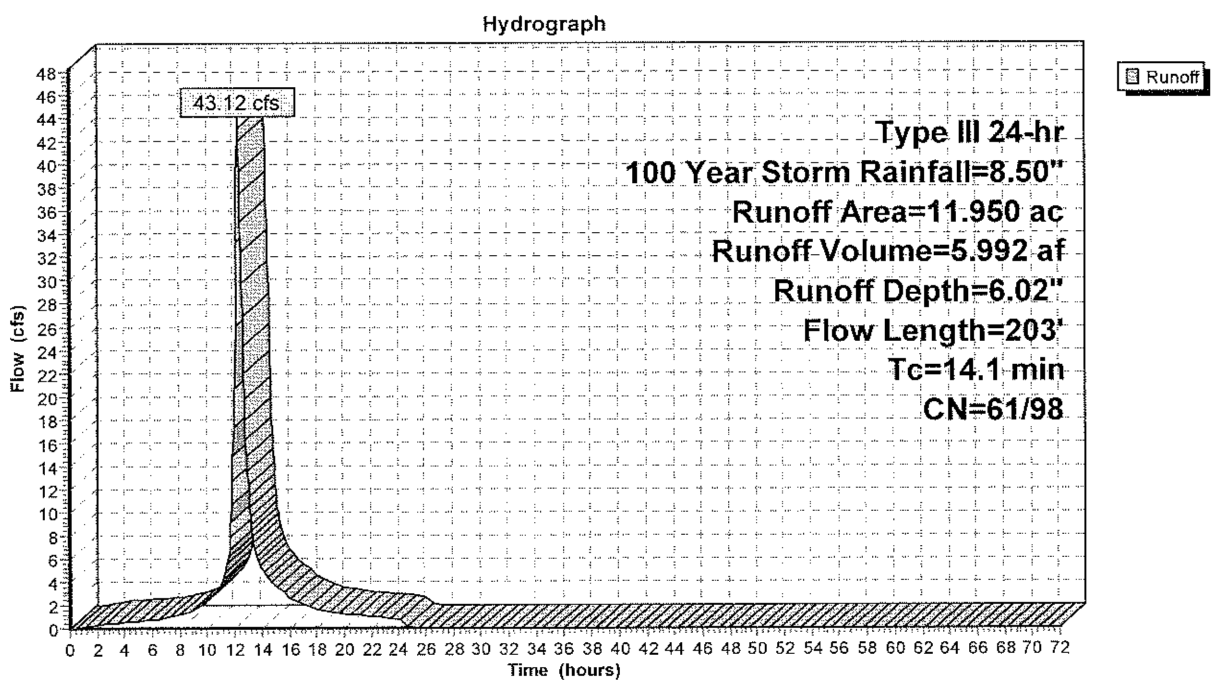
Runoff = 43.12 cfs @ 12.22 hrs, Volume= 5.992 af, Depth= 6.02"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
6.050	61	>75% Grass cover, Good, HSG B
5.900	98	Paved roads w/curbs & sewers
11.950	79	Weighted Average
6.050		50.63% Pervious Area
5.900		49.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	18	0.0089	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.3	132	0.0069	0.96		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.5	53	0.0069	1.69		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.9					**Direct Entry, from pipe calcs**
14.1	203	Total			

Subcatchment BSN A:



Summary for Subcatchment BSN A1:

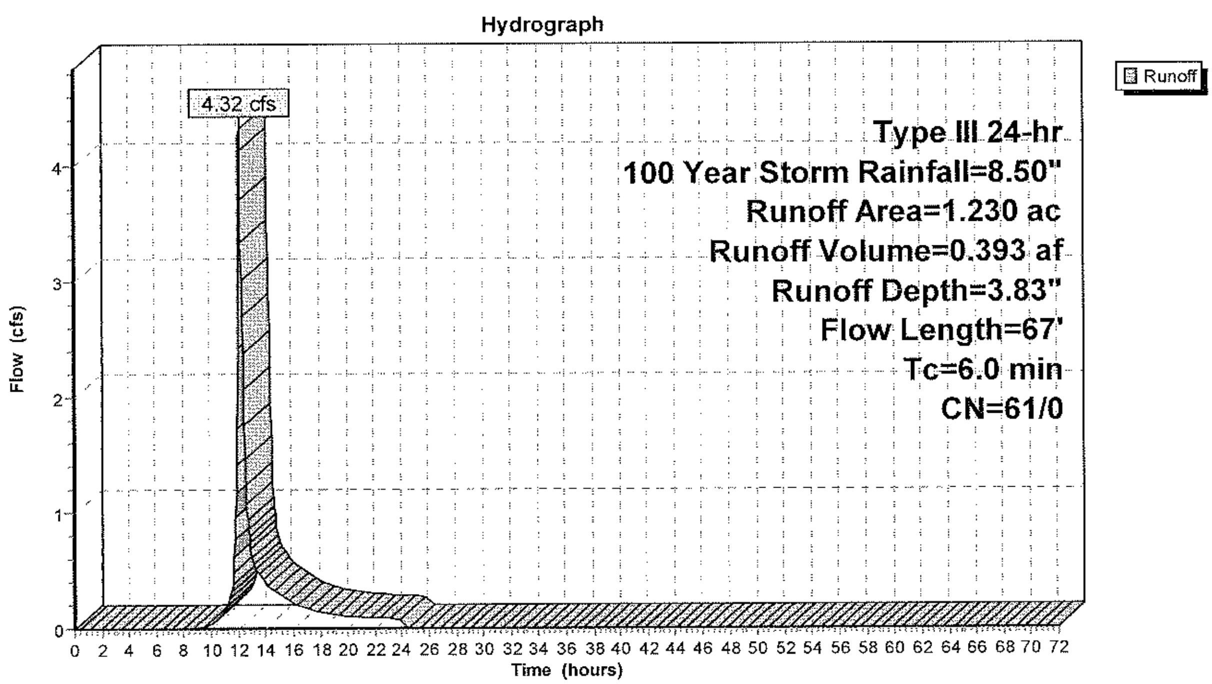
Runoff = 4.32 cfs @ 12.12 hrs, Volume= 0.393 af, Depth= 3.83"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
1.230	61	>75% Grass cover, Good, HSG B
1.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	18	0.0560	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.6	12	0.3333	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
1.1	13	0.0784	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
1.0	24	0.3333	0.40		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
4.3	67	Total, Increased to minimum Tc = 6.0 min			

Subcatchment BSN A1:



Summary for Subcatchment BSN A2:

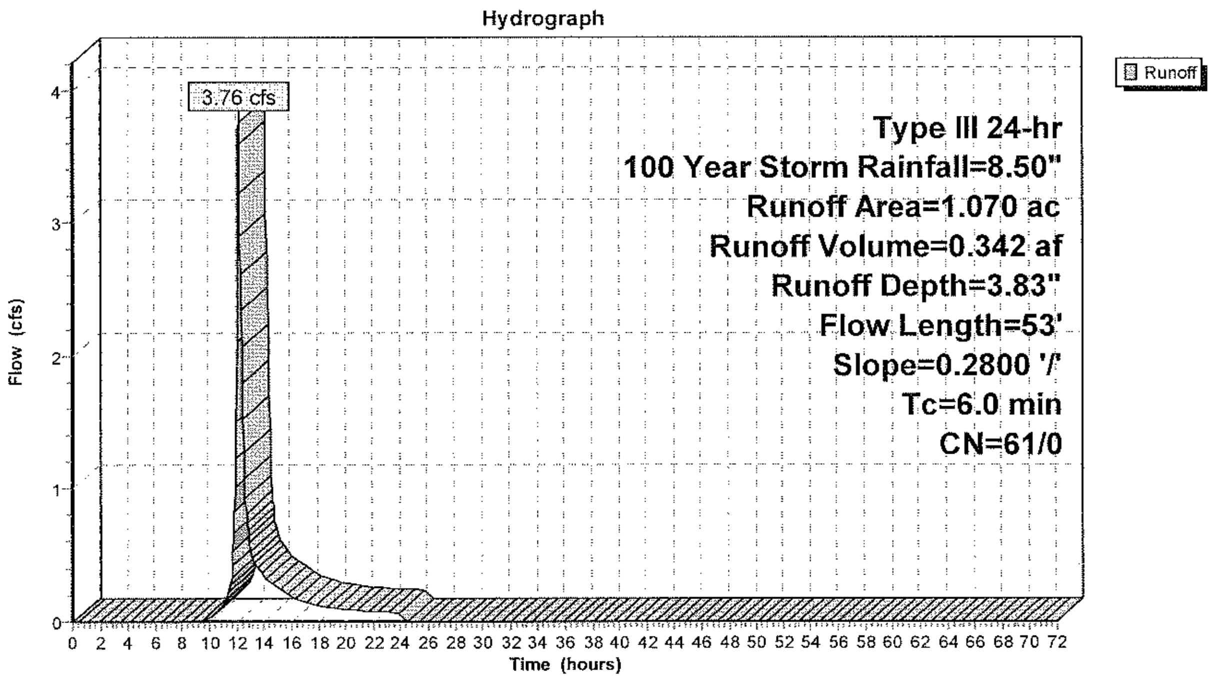
Runoff = 3.76 cfs @ 12.12 hrs, Volume= 0.342 af, Depth= 3.83"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
1.070	61	>75% Grass cover, Good, HSG B
1.070		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	53	0.2800	0.44		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.0	53	Total, Increased to minimum Tc = 6.0 min			

Subcatchment BSN A2:



Summary for Subcatchment BSN A3:

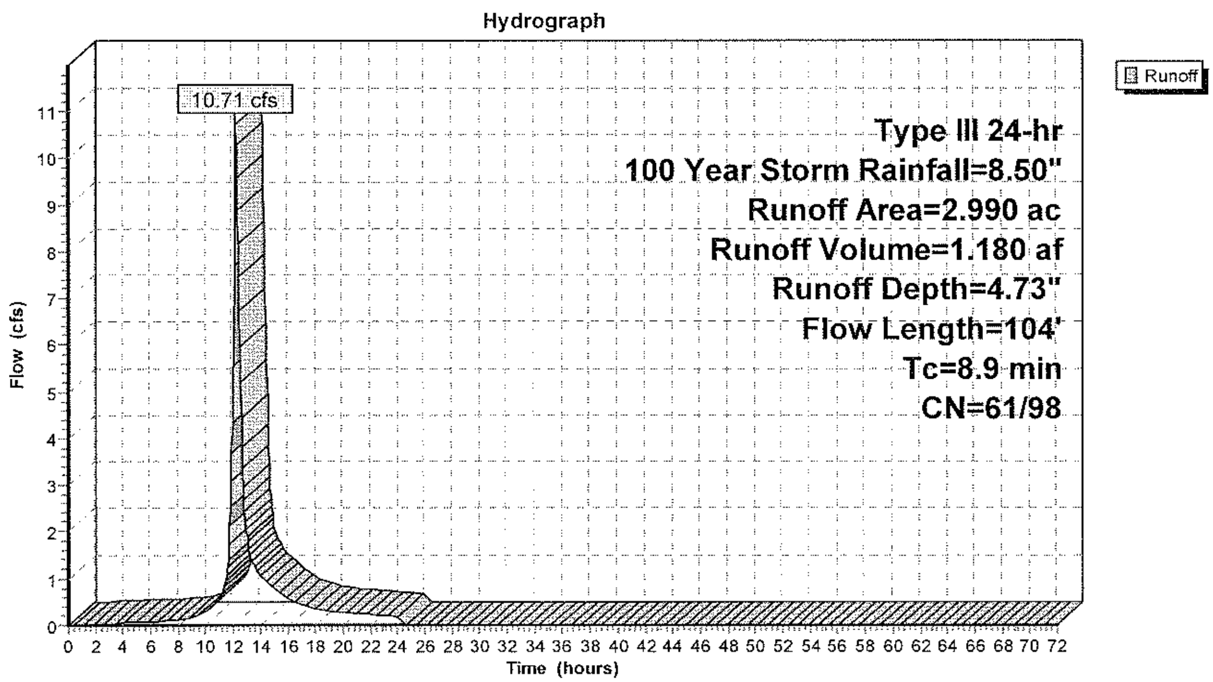
Runoff = 10.71 cfs @ 12.16 hrs, Volume= 1.180 af, Depth= 4.73"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
2.380	61	>75% Grass cover, Good, HSG B
0.610	98	Paved parking, HSG B
2.990	69	Weighted Average
2.380		79.60% Pervious Area
0.610		20.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	92	0.0249	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.6	12	0.3333	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
8.9	104	Total			

Subcatchment BSN A3:



Summary for Subcatchment BSN B:

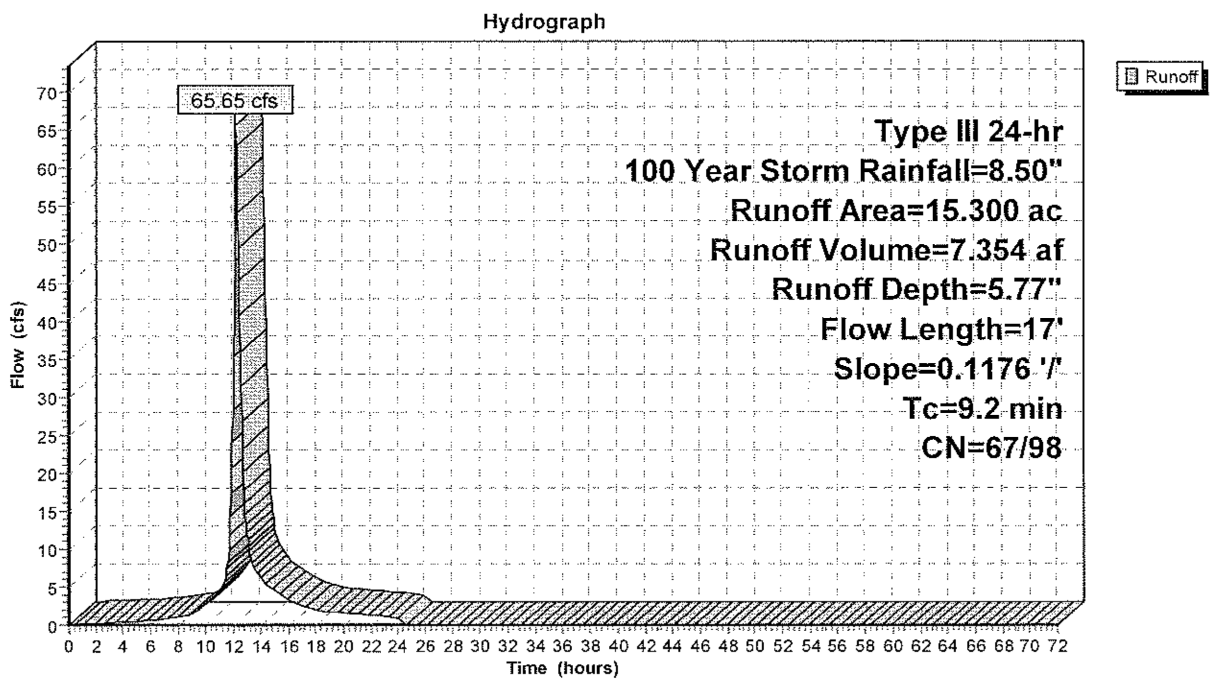
Runoff = 65.65 cfs @ 12.16 hrs, Volume= 7.354 af, Depth= 5.77"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
5.050	98	Paved parking & roofs
7.610	61	>75% Grass cover, Good, HSG B
2.640	83	Fallow, crop residue, Good, HSG B
15.300	77	Weighted Average
10.250		66.99% Pervious Area
5.050		33.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	17	0.1176	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
8.0					**Direct Entry, from pipe calcs**
9.2	17	Total			

Subcatchment BSN B:



Summary for Subcatchment BSN C:

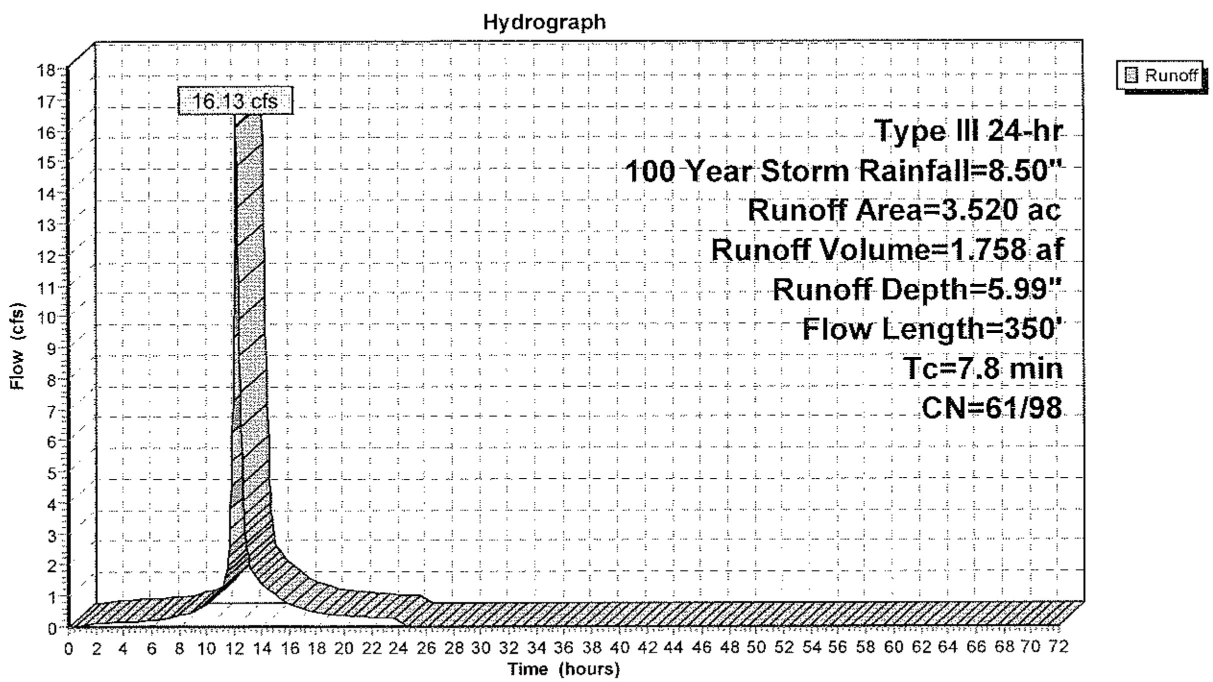
Runoff = 16.13 cfs @ 12.14 hrs, Volume= 1.758 af, Depth= 5.99"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
1.720	98	Paved parking & roofs
1.800	61	>75% Grass cover, Good, HSG B
3.520	79	Weighted Average
1.800		51.14% Pervious Area
1.720		48.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	25	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.4	125	0.0056	0.88		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
2.2	200	0.0056	1.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.8	350	Total			

Subcatchment BSN C:



Summary for Subcatchment P-UNCAP1:

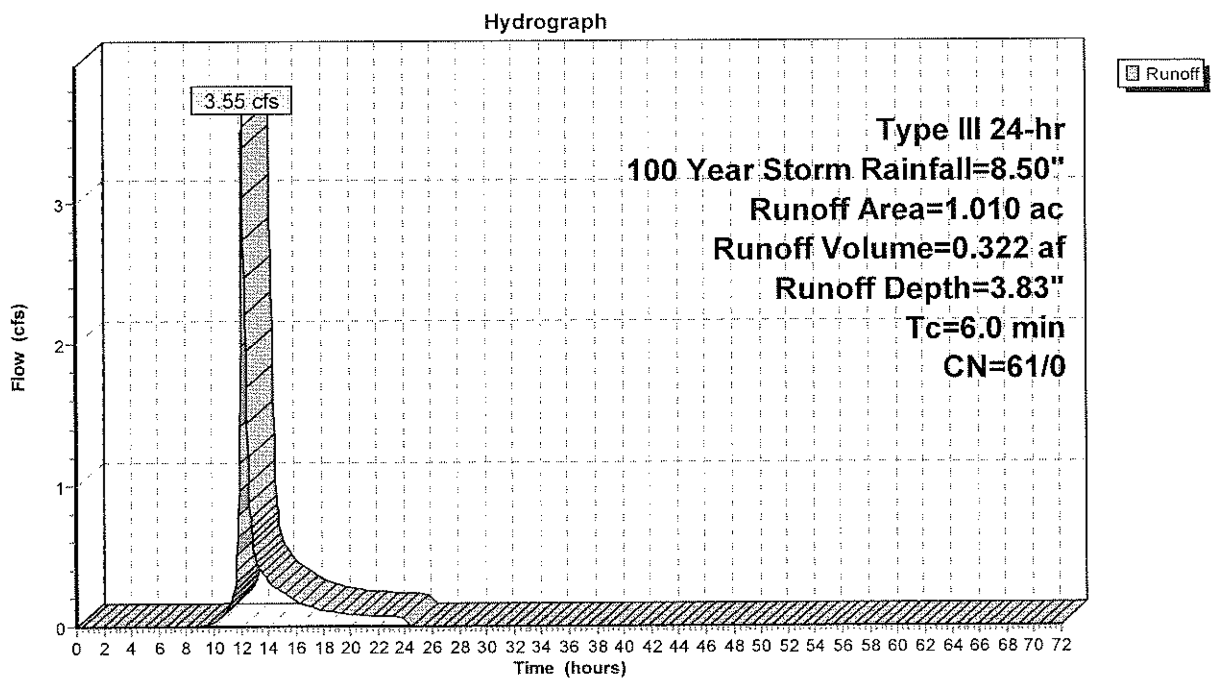
Runoff = 3.55 cfs @ 12.12 hrs, Volume= 0.322 af, Depth= 3.83"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
1.010	61	>75% Grass cover, Good, HSG B
1.010		100.00% Pervious Area

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

Subcatchment P-UNCAP1:



Summary for Subcatchment P-UNCAP2:

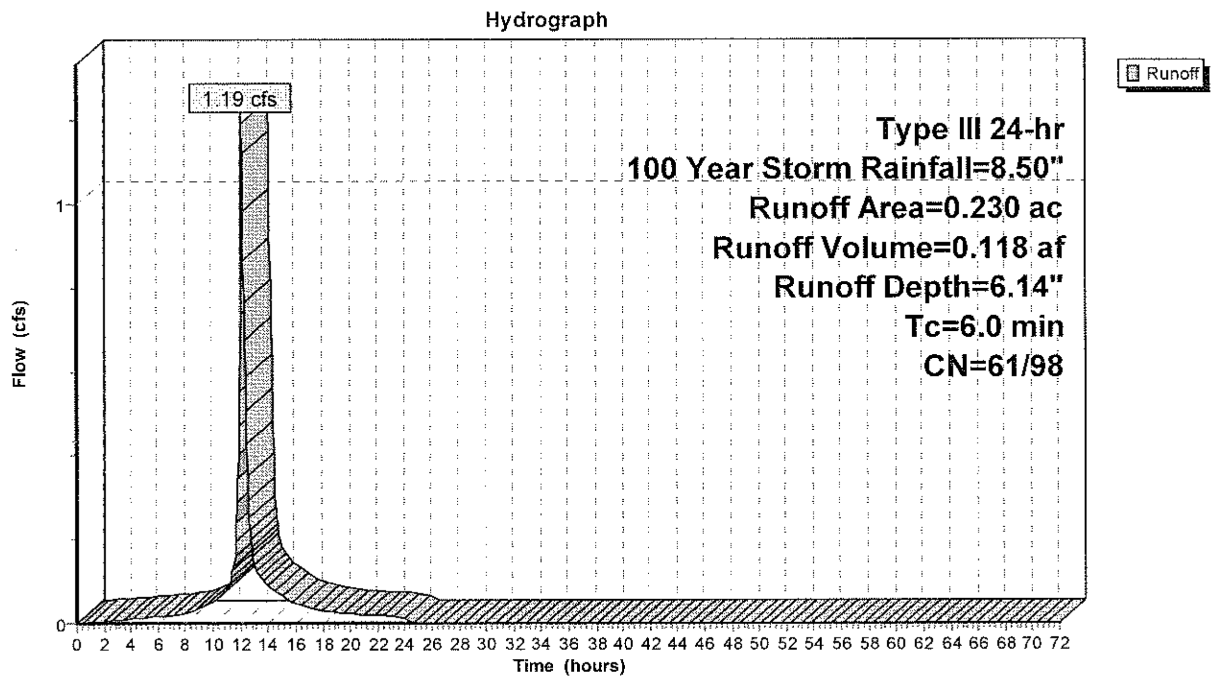
Runoff = 1.19 cfs @ 12.11 hrs, Volume= 0.118 af, Depth= 6.14"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.50"

Area (ac)	CN	Description
0.120	98	Unconnected pavement, HSG B
0.110	61	>75% Grass cover, Good, HSG B
0.230	80	Weighted Average
0.110		47.83% Pervious Area
0.120		52.17% Impervious Area

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

Subcatchment P-UNCAP2:



Summary for Pond A:

Inflow Area = 30.770 ac, 41.18% Impervious, Inflow Depth > 5.78" for 100 Year Storm event
Inflow = 63.08 cfs @ 12.26 hrs, Volume= 14.834 af
Outflow = 15.82 cfs @ 14.70 hrs, Volume= 13.516 af, Atten= 75%, Lag= 146.2 min
Primary = 11.50 cfs @ 14.70 hrs, Volume= 12.341 af
Secondary = 4.33 cfs @ 14.70 hrs, Volume= 1.176 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 153.99' @ 14.70 hrs Surf.Area= 1.146 ac Storage= 7.012 af

Plug-Flow detention time= 413.3 min calculated for 13.507 af (91% of inflow)
Center-of-Mass det. time= 322.5 min (1,250.1 - 927.6)

Volume	Invert	Avail.Storage	Storage Description
#1	146.25'	9.525 af	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
146.25	0.690	0.000	0.000
147.00	0.721	0.529	0.529
148.00	0.777	0.749	1.278
149.00	0.835	0.806	2.084
150.00	0.894	0.864	2.949
151.00	0.957	0.925	3.874
152.00	1.019	0.988	4.862
153.00	1.083	1.051	5.913
154.00	1.147	1.115	7.028
155.00	1.213	1.180	8.208
156.00	1.421	1.317	9.525

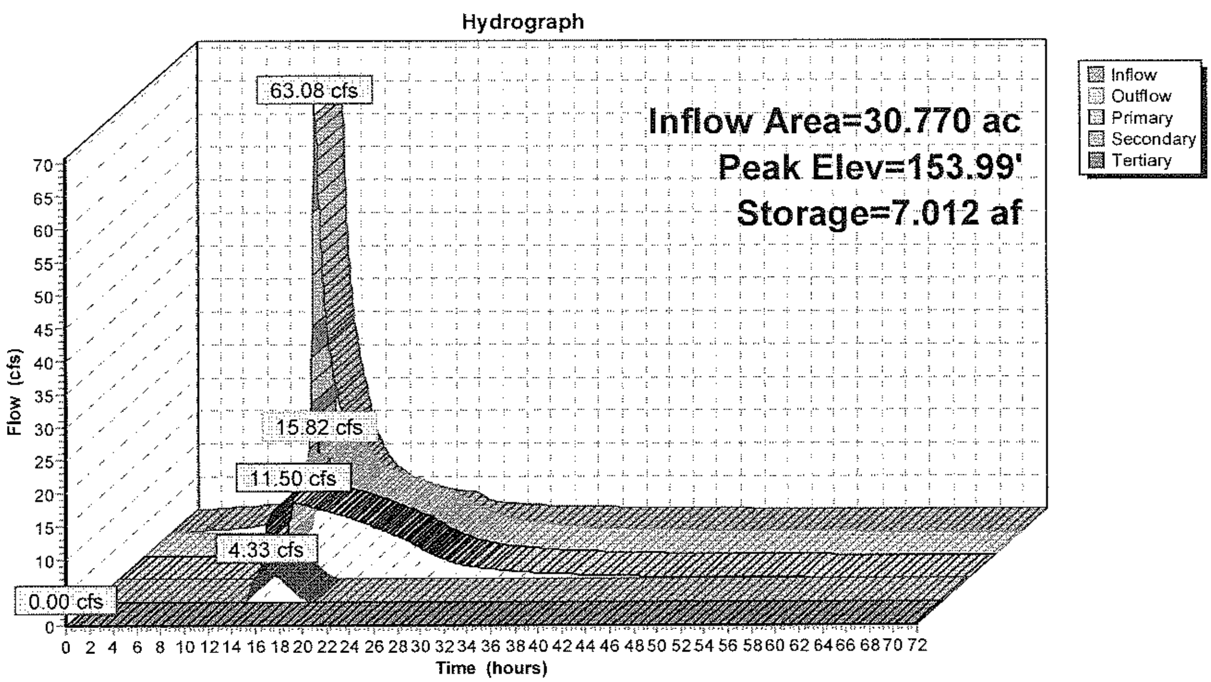
Device	Routing	Invert	Outlet Devices
#1	Primary	147.94'	**24.0" Round Culvert** L= 47.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 147.94' / 147.75' S= 0.0040 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	147.95'	**Weir, Cv= 2.62 (C= 3.28)** Elev. (feet) 147.95 150.05 Width (feet) 0.50 0.50
#3	Device 1	154.00'	**42.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	152.50'	**15.0" Round Culvert** L= 77.4' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 152.50' / 152.00' S= 0.0065 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#5	Tertiary	154.00'	**220.0' long x 9.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 Coef. (English) 2.48 2.55 2.70 2.69 2.68 2.69 2.67 2.64 2.64 2.64 2.64 2.64 2.64 2.65 2.65 2.66

Primary OutFlow Max=11.50 cfs @ 14.70 hrs HW=153.99' (Free Discharge)
└─**1=Culvert** (Passes 11.50 cfs of 33.98 cfs potential flow)
  ├─**2=Weir** (Orifice Controls 11.50 cfs @ 10.95 fps)
  └─**3=Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=4.33 cfs @ 14.70 hrs HW=153.99' (Free Discharge)
└─**4=Culvert** (Inlet Controls 4.33 cfs @ 3.53 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=146.25' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A:



Summary for Pond A1:

Inflow Area = 32.000 ac, 39.59% Impervious, Inflow Depth > 4.77" for 100 Year Storm event
Inflow = 11.83 cfs @ 14.60 hrs, Volume= 12.733 af
Outflow = 7.96 cfs @ 21.62 hrs, Volume= 12.139 af, Atten= 33%, Lag= 421.0 min
Primary = 7.96 cfs @ 21.62 hrs, Volume= 12.139 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 153.88' @ 21.62 hrs Surf.Area= 0.738 ac Storage= 3.599 af

Plug-Flow detention time= 348.0 min calculated for 12.139 af (95% of inflow)
Center-of-Mass det. time= 267.3 min (1,535.9 - 1,268.7)

Volume	Invert	Avail.Storage	Storage Description
#1	147.75'	5.278 af	**Custom Stage Data (Prismatic)** Listed below

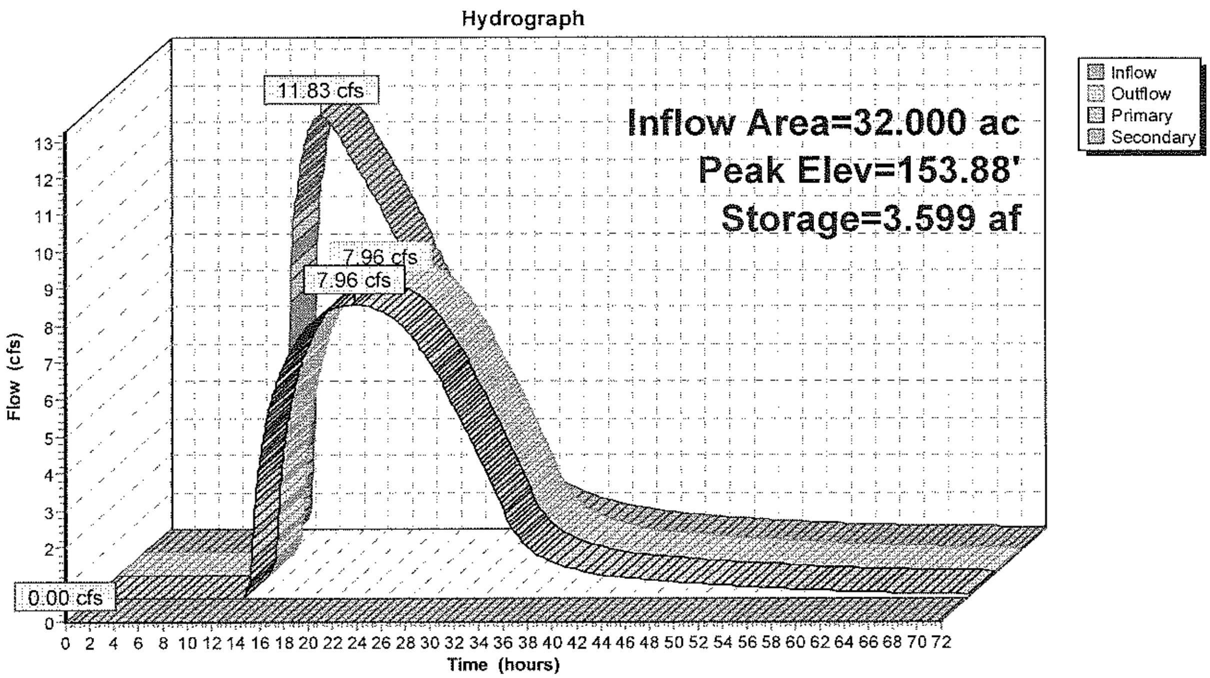
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
147.75	0.443	0.000	0.000
148.00	0.454	0.112	0.112
149.00	0.500	0.477	0.589
150.00	0.546	0.523	1.112
151.00	0.594	0.570	1.682
152.00	0.643	0.618	2.301
153.00	0.693	0.668	2.969
154.00	0.744	0.718	3.687
155.00	0.794	0.769	4.456
156.00	0.849	0.821	5.278

Device	Routing	Invert	Outlet Devices
#1	Primary	147.75'	**24.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 147.75' / 146.50' S= 0.0125 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	148.75'	**Weir, Cv= 2.62 (C= 3.28)** Elev. (feet) 148.75 149.50 149.50 150.10 Width (feet) 0.25 0.25 1.00 1.00
#3	Secondary	154.00'	**68.0' 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=7.96 cfs @ 21.62 hrs HW=153.88' (Free Discharge)
↑—**1=Culvert** (Passes 7.96 cfs of 34.25 cfs potential flow)
↑—**2=Weir** (Orifice Controls 7.96 cfs @ 10.10 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=147.75' (Free Discharge)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A1:


Hydrograph
11.83 cfs
Inflow Area=32.000 ac
Peak Elev=153.88'
Storage=3.599 af
7.96 cfs
7.96 cfs
0.00 cfs
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)
0
2
3
4
5
6
7
8
9
10
11
12
13
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Pond A2:

Inflow Area = 33.070 ac, 38.31% Impervious, Inflow Depth > 4.53" for 100 Year Storm event
Inflow = 8.04 cfs @ 21.51 hrs, Volume= 12.480 af
Outflow = 8.03 cfs @ 21.97 hrs, Volume= 8.556 af, Atten= 0%, Lag= 27.6 min
Primary = 8.03 cfs @ 21.97 hrs, Volume= 8.556 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 154.28' @ 21.97 hrs Surf.Area= 0.753 ac Storage= 4.126 af

Plug-Flow detention time= 537.9 min calculated for 8.556 af (69% of inflow)
Center-of-Mass det. time= 253.1 min (1,770.1 - 1,517.0)

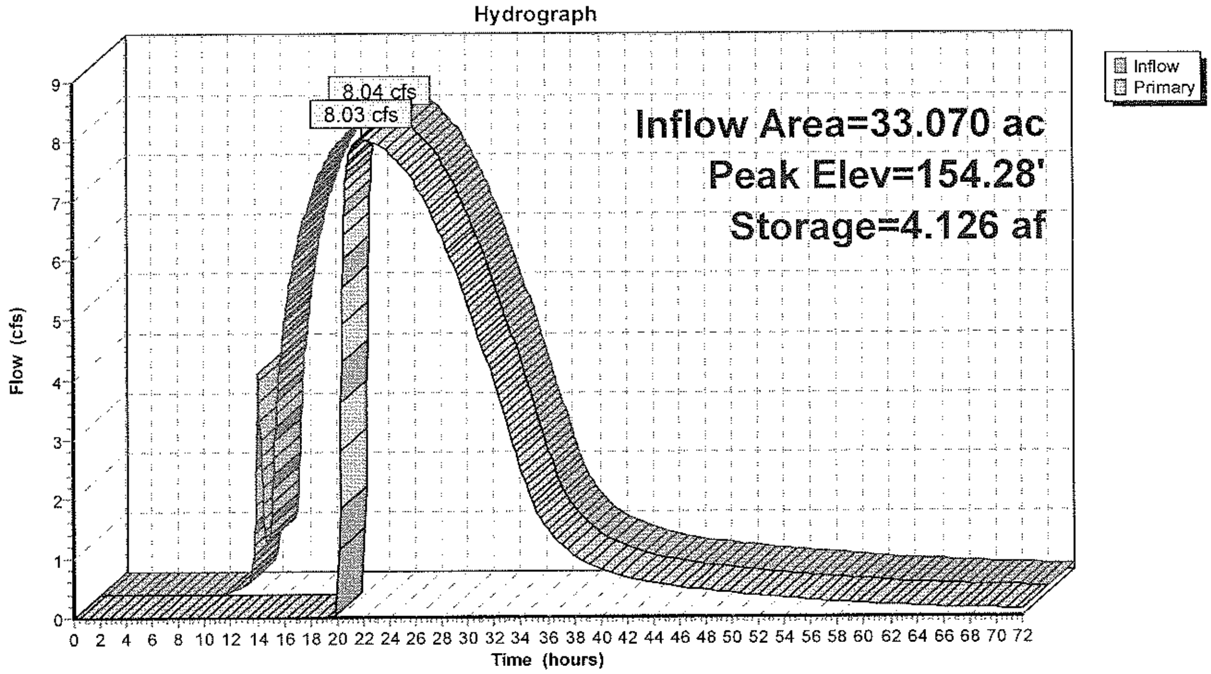
Volume	Invert	Avail.Storage	Storage Description
#1	146.50'	5.502 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
146.50	0.340	0.000	0.000
147.00	0.361	0.175	0.175
148.00	0.405	0.383	0.558
149.00	0.453	0.429	0.987
150.00	0.502	0.478	1.465
151.00	0.554	0.528	1.993
152.00	0.610	0.582	2.575
153.00	0.668	0.639	3.214
154.00	0.738	0.703	3.917
155.00	0.792	0.765	4.682
156.00	0.848	0.820	5.502

Device	Routing	Invert	Outlet Devices
#1	Primary	154.00'	**20.0' long x 17.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=8.00 cfs @ 21.97 hrs HW=154.28' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 8.00 cfs @ 1.42 fps)

Pond A2:


Hydrograph
8.04 cfs
8.03 cfs
Inflow Area=33.070 ac
Peak Elev=154.28'
Storage=4.126 af
Inflow
Primary
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Pond A3:

Inflow Area =	36.060 ac, 36.83% Impervious, Inflow Depth > 3.24" for 100 Year Storm event			
Inflow =	10.71 cfs @	12.16 hrs,	Volume=	9.736 af
Outflow =	8.26 cfs @	21.88 hrs,	Volume=	8.505 af, Atten= 23%, Lag= 583.4 min
Discarded =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Primary =	8.26 cfs @	21.88 hrs,	Volume=	8.505 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 155.06' @ 21.88 hrs Surf.Area= 0.660 ac Storage= 1.267 af

Plug-Flow detention time= 292.8 min calculated for 8.505 af (87% of inflow)
Center-of-Mass det. time= 123.5 min (1,777.7 - 1,654.2)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	1.980 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

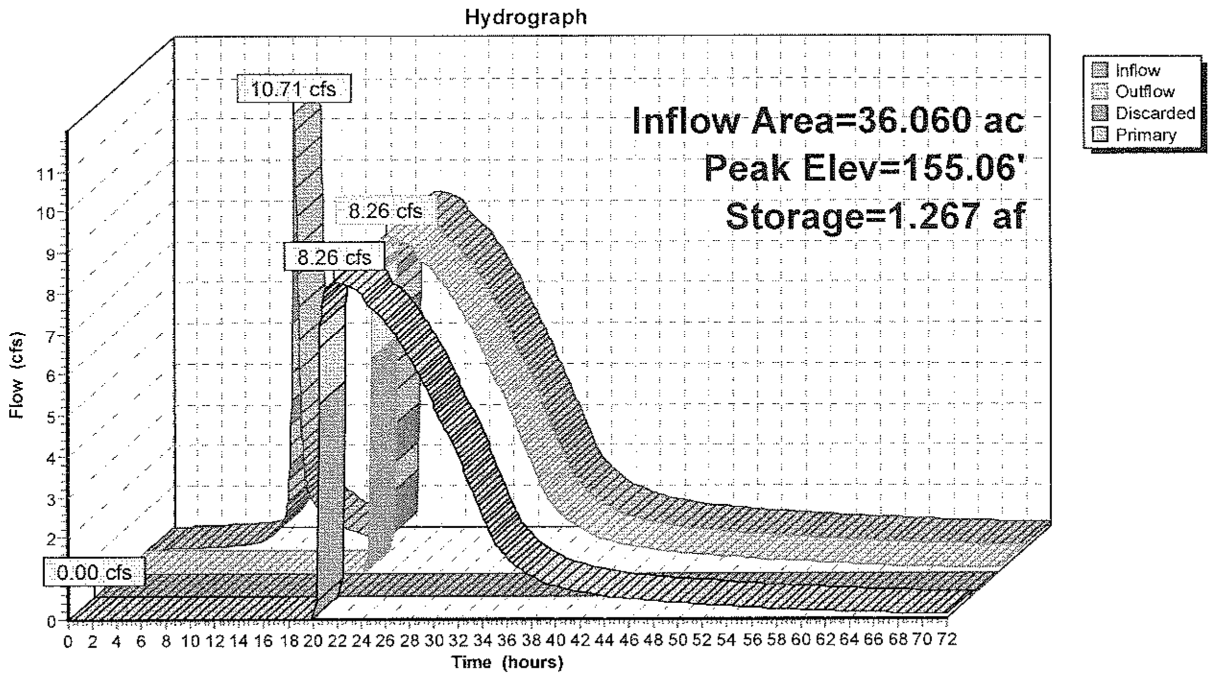
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
152.00	0.188	0.000	0.000
153.00	0.326	0.257	0.257
154.00	0.485	0.405	0.662
155.00	0.648	0.566	1.229
156.00	0.854	0.751	1.980

Device	Routing	Invert	Outlet Devices
#1	Primary	155.00'	**233.0' long x 8.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.45 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.65 2.66 2.67 2.69 2.71
#2	Discarded	152.00'	**3.000 in/hr Exfiltration X 0.00 over Horizontal area** Conductivity to Groundwater Elevation = 141.01'

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=152.00' (Free Discharge)
↑**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=7.91 cfs @ 21.88 hrs HW=155.06' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 7.91 cfs @ 0.59 fps)

Pond A3:


Hydrograph
10.71 cfs
8.26 cfs
8.26 cfs
0.00 cfs
Inflow Area=36.060 ac
Peak Elev=155.06'
Storage=1.267 af
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)

Summary for Pond B:

Inflow Area = 18.820 ac, 35.97% Impervious, Inflow Depth = 5.81" for 100 Year Storm event
Inflow = 66.19 cfs @ 12.16 hrs, Volume= 9.107 af
Outflow = 24.32 cfs @ 12.67 hrs, Volume= 8.842 af, Atten= 63%, Lag= 30.8 min
Primary = 24.32 cfs @ 12.67 hrs, Volume= 8.842 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 155.82' @ 12.67 hrs Surf.Area= 0.571 ac Storage= 2.855 af

Plug-Flow detention time= 178.5 min calculated for 8.842 af (97% of inflow)
Center-of-Mass det. time= 133.4 min (1,021.6 - 888.2)

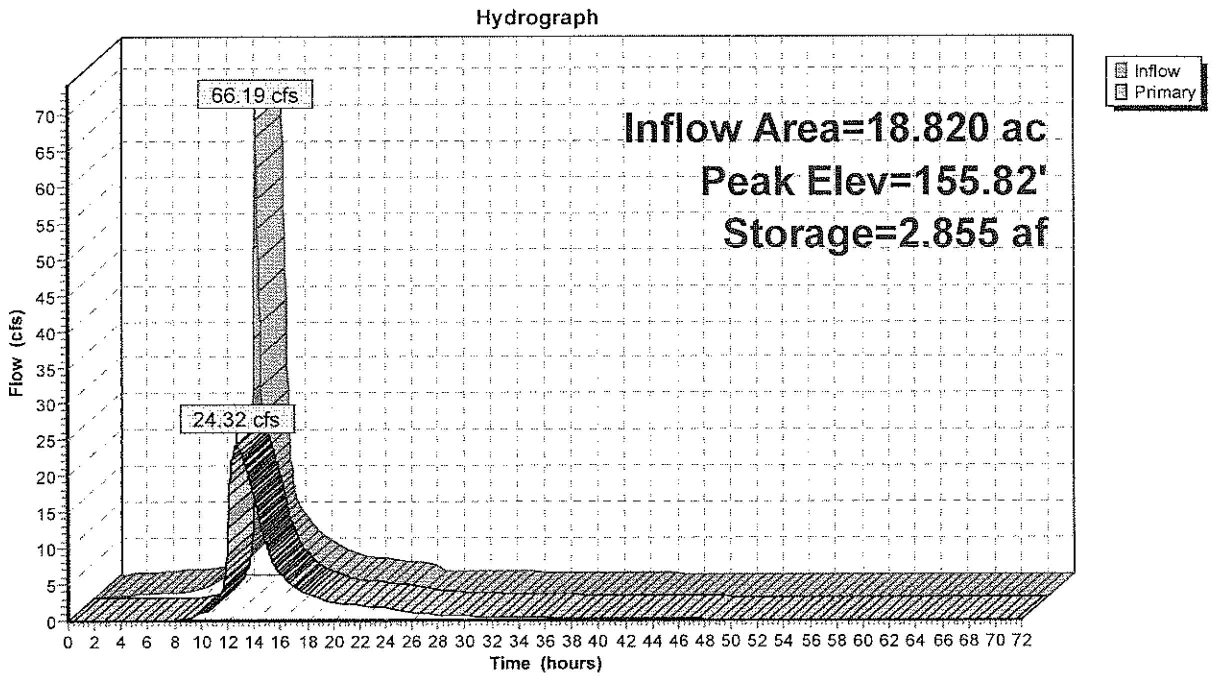
Volume	Invert	Avail.Storage	Storage Description
#1	148.50'	4.441 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
148.50	0.229	0.000	0.000
149.00	0.248	0.119	0.119
150.00	0.289	0.269	0.388
151.00	0.332	0.311	0.698
152.00	0.377	0.354	1.053
153.00	0.424	0.400	1.453
154.00	0.474	0.449	1.902
155.00	0.527	0.500	2.403
156.00	0.581	0.554	2.957
157.00	0.728	0.654	3.611
158.00	0.932	0.830	4.441

Device	Routing	Invert	Outlet Devices
#1	Primary	148.00'	**36.0" Round Culvert** L= 690.8' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 148.00' / 146.25' S= 0.0025 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf
#2	Device 1	149.50'	**Weir, Cv= 2.62 (C= 3.28)** Elev. (feet) 149.50 151.00 151.00 153.10 Width (feet) 0.25 0.25 1.00 1.00
#3	Device 1	155.85'	**48.0" x 42.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=24.31 cfs @ 12.67 hrs HW=155.82' (Free Discharge)
└─**1=Culvert** (Passes 24.31 cfs of 58.52 cfs potential flow)
  ├─**2=Weir** (Orifice Controls 24.31 cfs @ 9.82 fps)
  └─**3=Grate** (Controls 0.00 cfs)

Pond B:


Hydrograph
66.19 cfs
24.32 cfs
Inflow Area=18.820 ac
Peak Elev=155.82'
Storage=2.855 af
Inflow
Primary
Flow (cfs)
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70

Summary for Pond C: Wet Pond

Inflow Area = 3.520 ac, 48.86% Impervious, Inflow Depth = 5.99" for 100 Year Storm event
Inflow = 16.13 cfs @ 12.14 hrs, Volume= 1.758 af
Outflow = 2.57 cfs @ 12.95 hrs, Volume= 1.754 af, Atten= 84%, Lag= 48.5 min
Primary = 2.57 cfs @ 12.95 hrs, Volume= 1.754 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Starting Elev= 154.00' Surf.Area= 0.306 ac Storage= 1.067 af
Peak Elev= 156.57' @ 12.95 hrs Surf.Area= 0.421 ac Storage= 2.007 af (0.940 af above start)

Plug-Flow detention time= 1,254.5 min calculated for 0.686 af (39% of inflow)
Center-of-Mass det. time= 497.8 min (1,277.5 - 779.7)

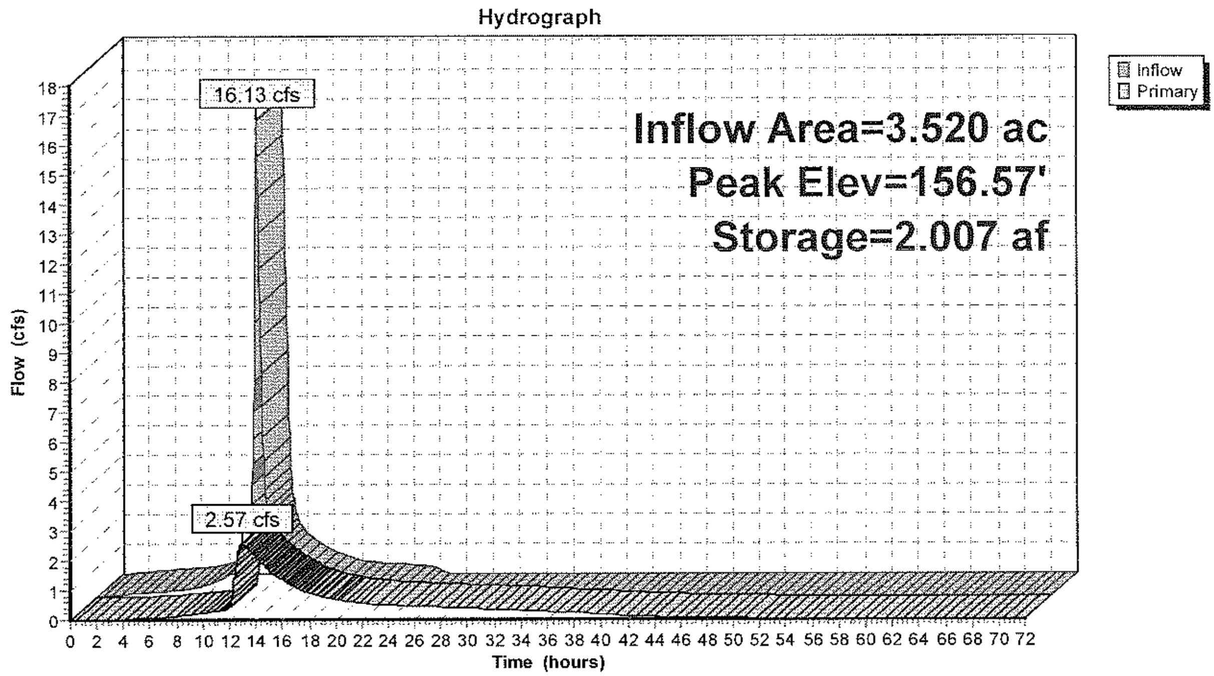
Volume	Invert	Avail.Storage	Storage Description
#1	149.00'	3.136 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
149.00	0.127	0.000	0.000
150.00	0.151	0.139	0.139
151.00	0.176	0.164	0.303
151.40	0.186	0.072	0.375
151.50	0.232	0.021	0.396
152.00	0.246	0.119	0.515
153.00	0.276	0.261	0.776
154.00	0.306	0.291	1.067
155.00	0.339	0.322	1.390
155.10	0.369	0.035	1.425
156.00	0.400	0.346	1.771
157.00	0.436	0.418	2.189
158.00	0.473	0.454	2.644
159.00	0.511	0.492	3.136

Device	Routing	Invert	Outlet Devices
#1	Primary	154.00'	**15.0" Round Culvert** L= 1,486.3' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 154.00' / 148.00' S= 0.0040 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Device 1	154.00'	**4.0" W x 3.0" H Vert. Orifice** C= 0.600
#3	Device 1	155.58'	**Weir, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 Width (feet) 0.33 1.00

Primary OutFlow Max=2.57 cfs @ 12.95 hrs HW=156.57' (Free Discharge)
└─**1=Culvert** (Passes 2.57 cfs of 4.75 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 0.63 cfs @ 7.54 fps)
  └─**3=Weir** (Weir Controls 1.94 cfs @ 2.94 fps)

Pond C: Wet Pond

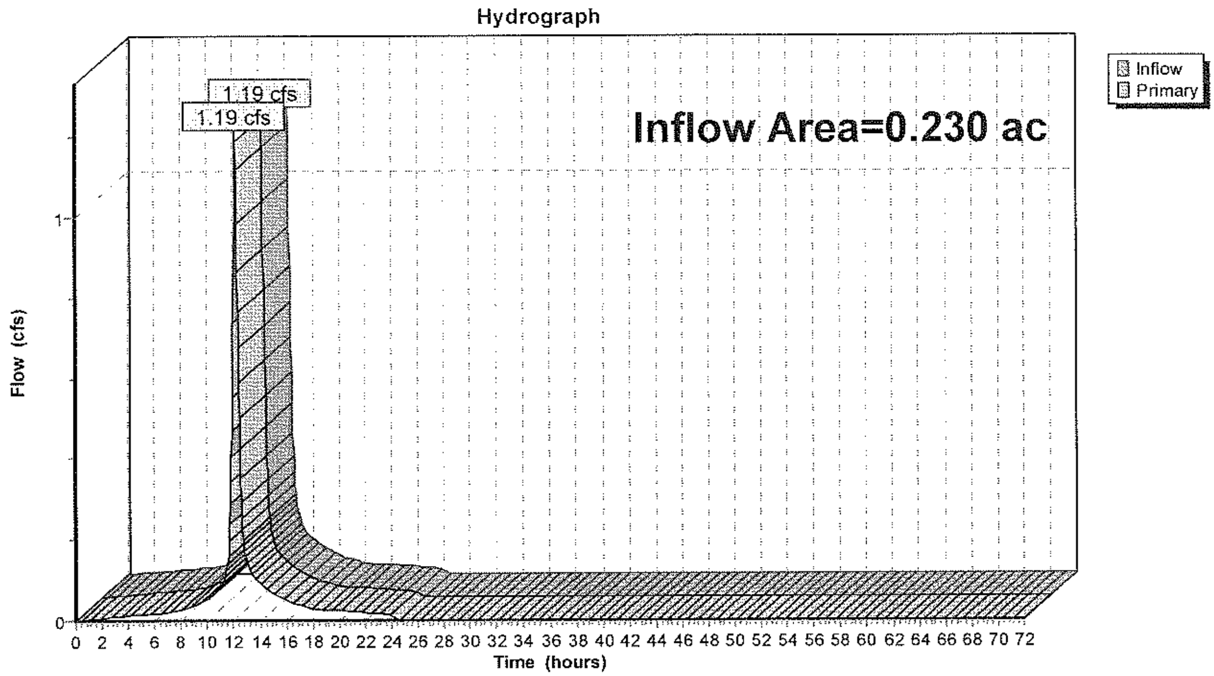


Summary for Link AP-CVS: Analysis Point-CVS

Inflow Area =	0.230 ac, 52.17% Impervious, Inflow Depth = 6.14"	for 100 Year Storm event
Inflow =	1.19 cfs @ 12.11 hrs, Volume=	0.118 af
Primary =	1.19 cfs @ 12.11 hrs, Volume=	0.118 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-CVS: Analysis Point-CVS

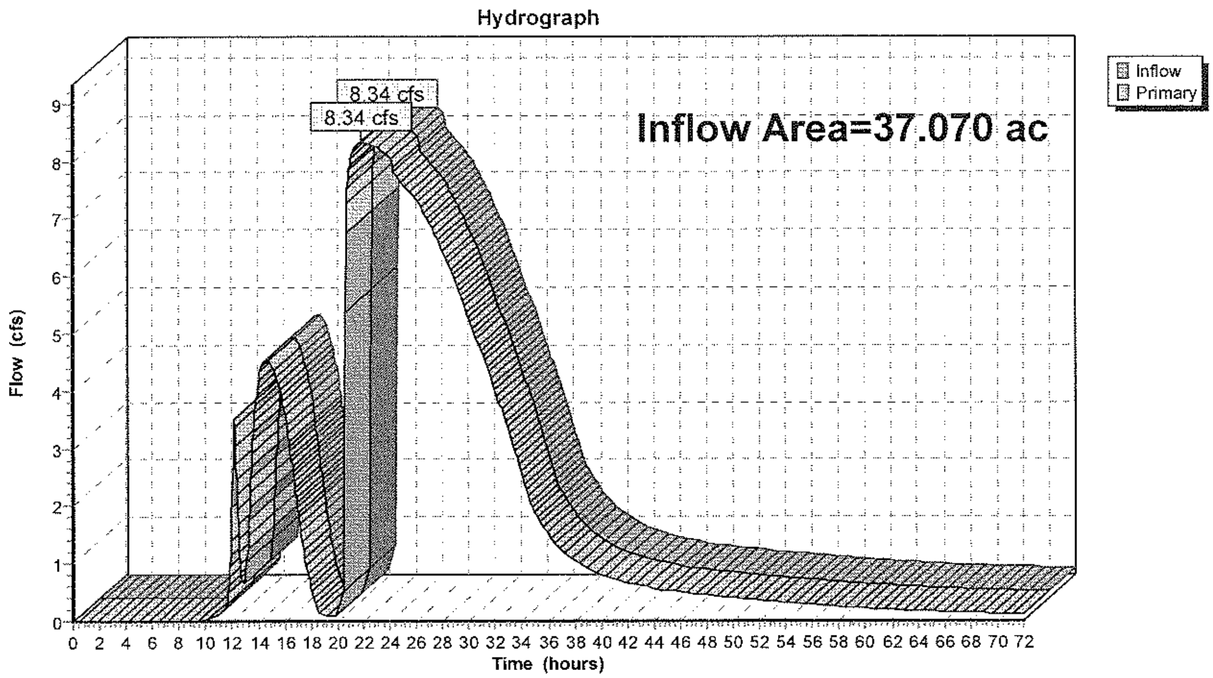


Summary for Link AP-W: Analysis Point-West

Inflow Area =	37.070 ac, 35.82% Impervious, Inflow Depth > 3.24"	for 100 Year Storm event
Inflow =	8.34 cfs @ 21.85 hrs, Volume=	10.004 af
Primary =	8.34 cfs @ 21.85 hrs, Volume=	10.004 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-W: Analysis Point-West



Summary for Subcatchment BSN A:

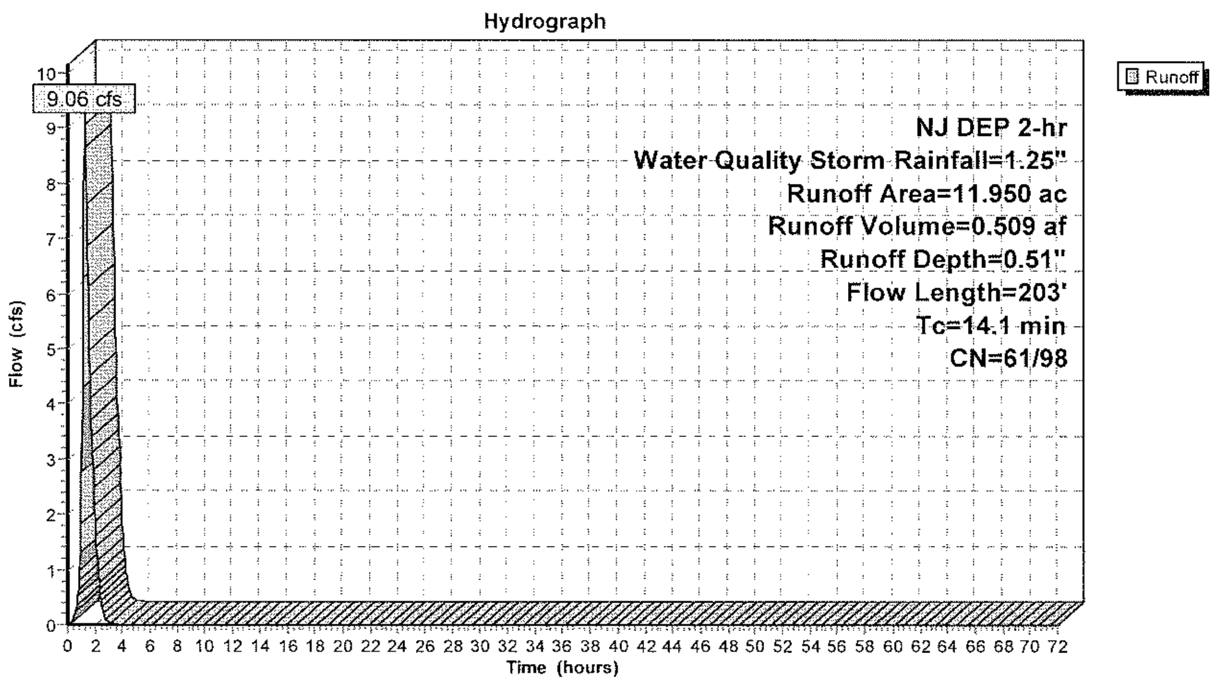
Runoff = 9.06 cfs @ 1.22 hrs, Volume= 0.509 af, Depth= 0.51"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
6.050	61	>75% Grass cover, Good, HSG B
5.900	98	Paved roads w/curbs & sewers
11.950	79	Weighted Average
6.050		50.63% Pervious Area
5.900		49.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	18	0.0089	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.3	132	0.0069	0.96		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.5	53	0.0069	1.69		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.9					**Direct Entry, from pipe calcs**
14.1	203	Total			

Subcatchment BSN A:



Summary for Subcatchment BSN A1:

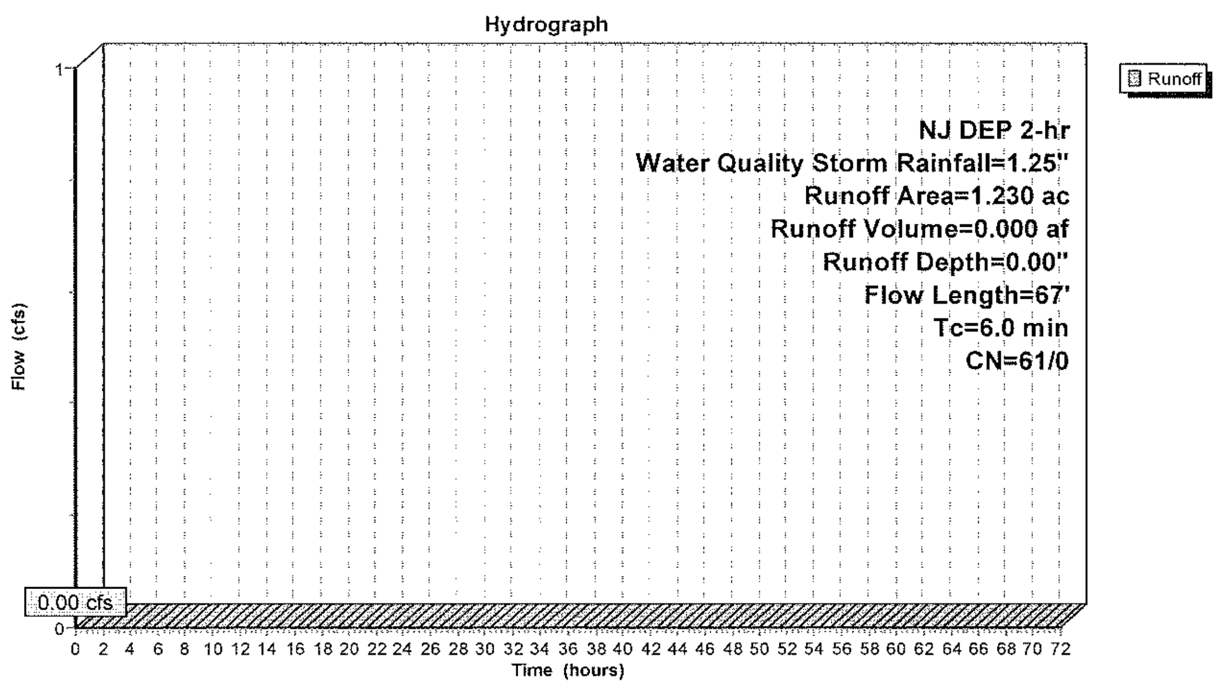
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
1.230	61	>75% Grass cover, Good, HSG B
1.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	18	0.0560	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.6	12	0.3333	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
1.1	13	0.0784	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
1.0	24	0.3333	0.40		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
4.3	67	Total, Increased to minimum Tc = 6.0 min			

Subcatchment BSN A1:



Summary for Subcatchment BSN A2:

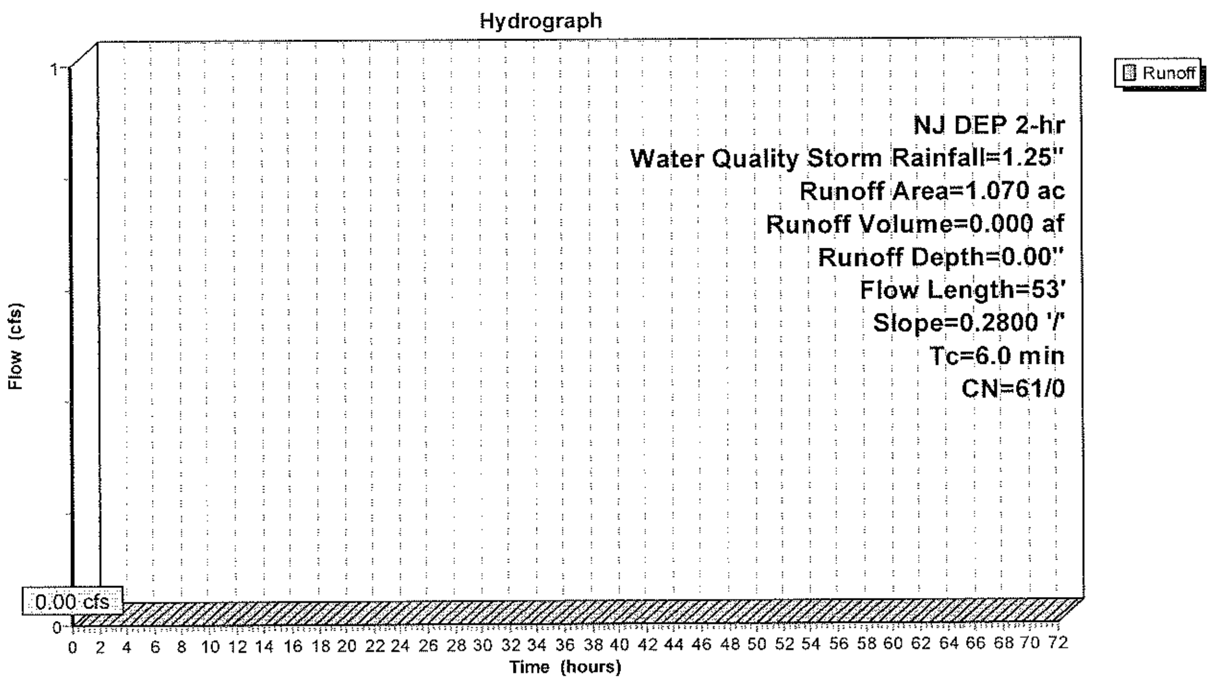
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
1.070	61	>75% Grass cover, Good, HSG B
1.070		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	53	0.2800	0.44		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.0	53	Total, Increased to minimum Tc = 6.0 min			

Subcatchment BSN A2:



Summary for Subcatchment BSN A3:

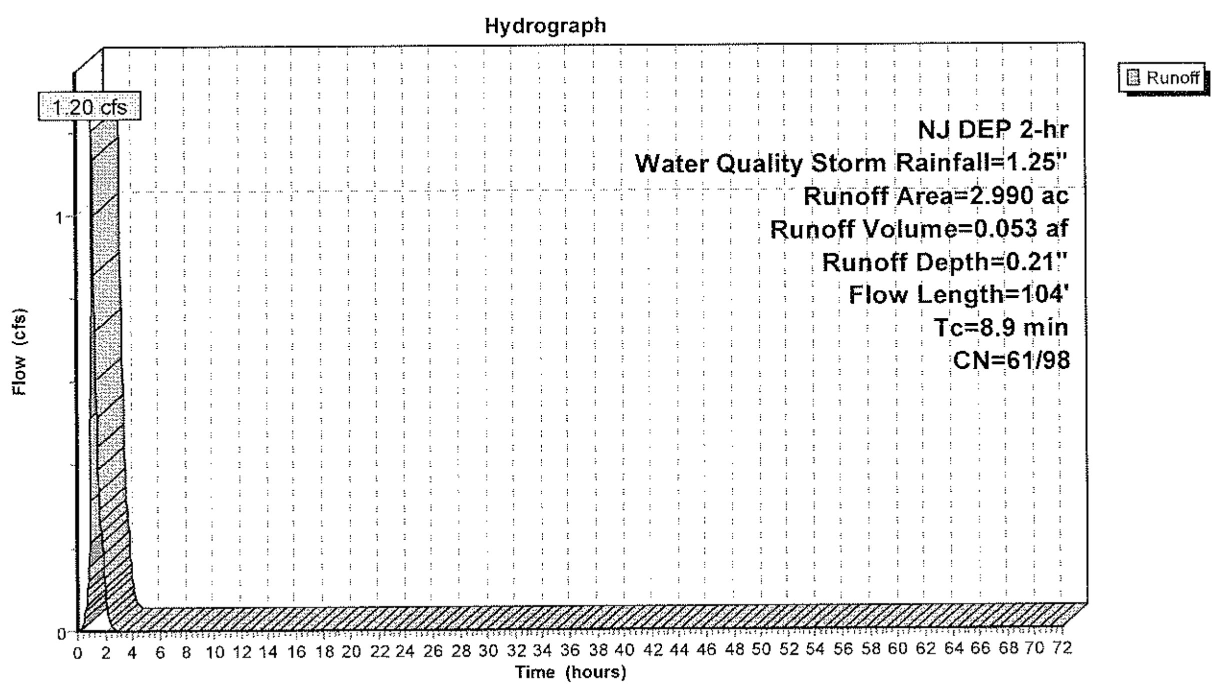
Runoff = 1.20 cfs @ 1.16 hrs, Volume= 0.053 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
2.380	61	>75% Grass cover, Good, HSG B
0.610	98	Paved parking, HSG B
2.990	69	Weighted Average
2.380		79.60% Pervious Area
0.610		20.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	92	0.0249	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.6	12	0.3333	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
8.9	104	Total			

Subcatchment BSN A3:



Summary for Subcatchment BSN B:

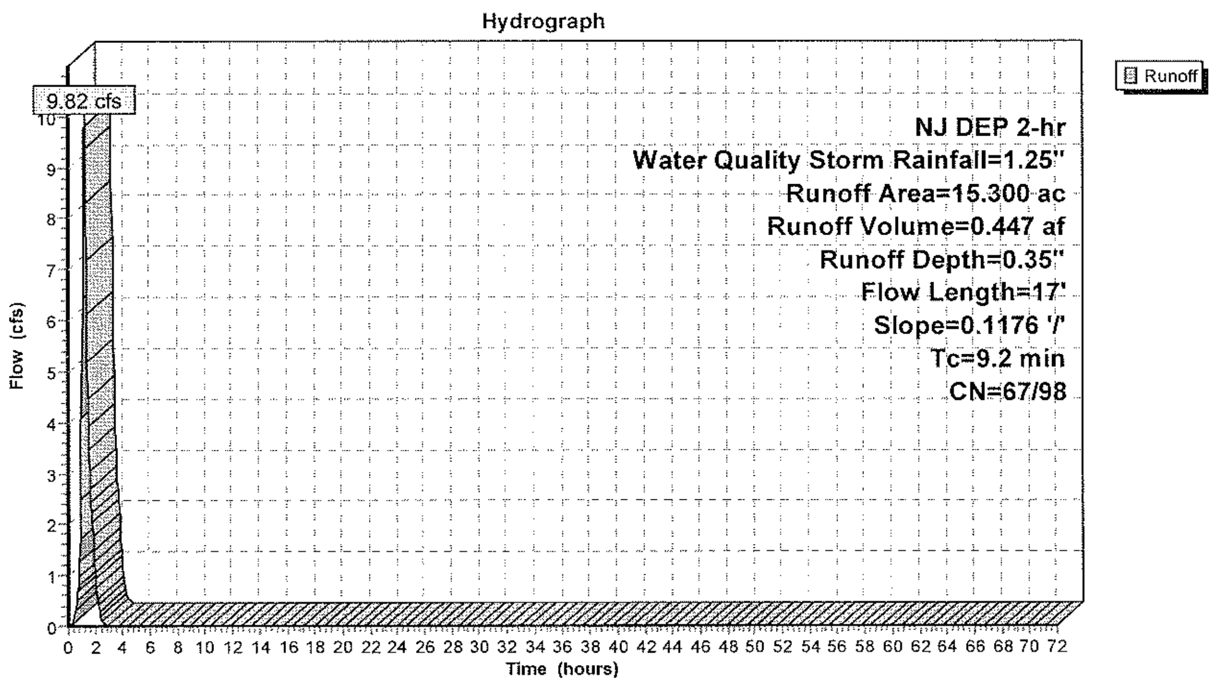
Runoff = 9.82 cfs @ 1.16 hrs, Volume= 0.447 af, Depth= 0.35"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
5.050	98	Paved parking & roofs
7.610	61	>75% Grass cover, Good, HSG B
2.640	83	Fallow, crop residue, Good, HSG B
15.300	77	Weighted Average
10.250		66.99% Pervious Area
5.050		33.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	17	0.1176	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
8.0					**Direct Entry, from pipe calcs**
9.2	17	Total			

Subcatchment BSN B:



Summary for Subcatchment BSN C:

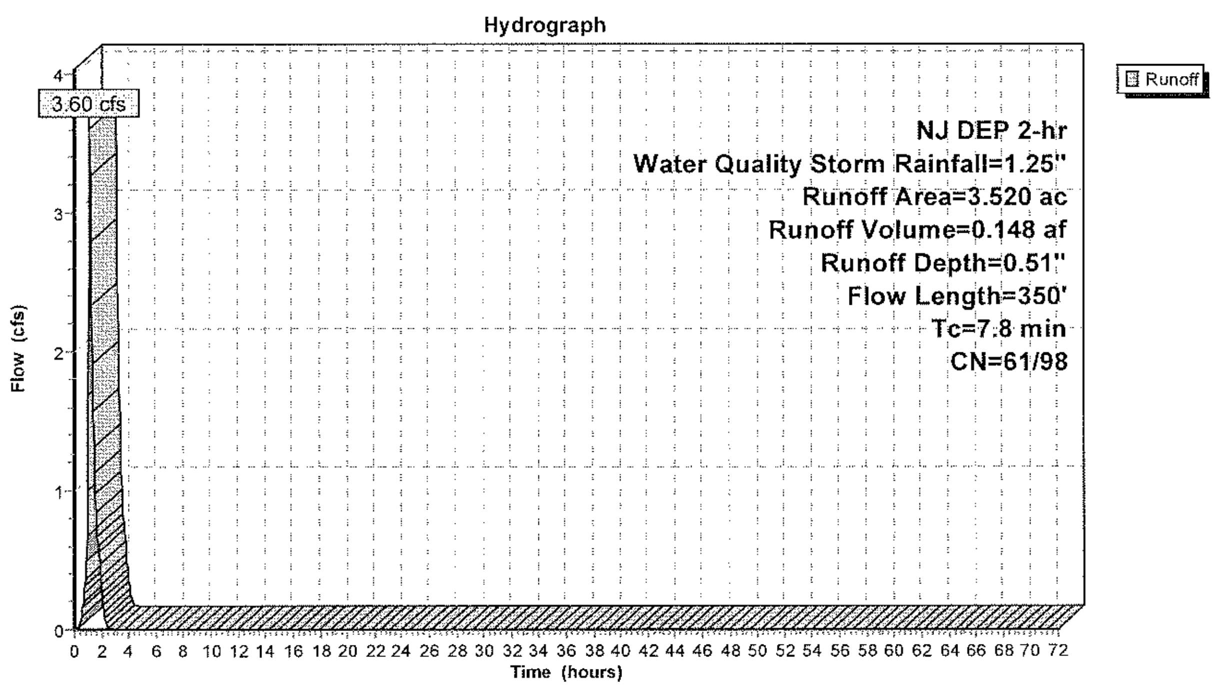
Runoff = 3.60 cfs @ 1.15 hrs, Volume= 0.148 af, Depth= 0.51"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
1.720	98	Paved parking & roofs
1.800	61	>75% Grass cover, Good, HSG B
3.520	79	Weighted Average
1.800		51.14% Pervious Area
1.720		48.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	25	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.4	125	0.0056	0.88		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
2.2	200	0.0056	1.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.8	350	Total			

Subcatchment BSN C:



Summary for Subcatchment P-UNCAP1:

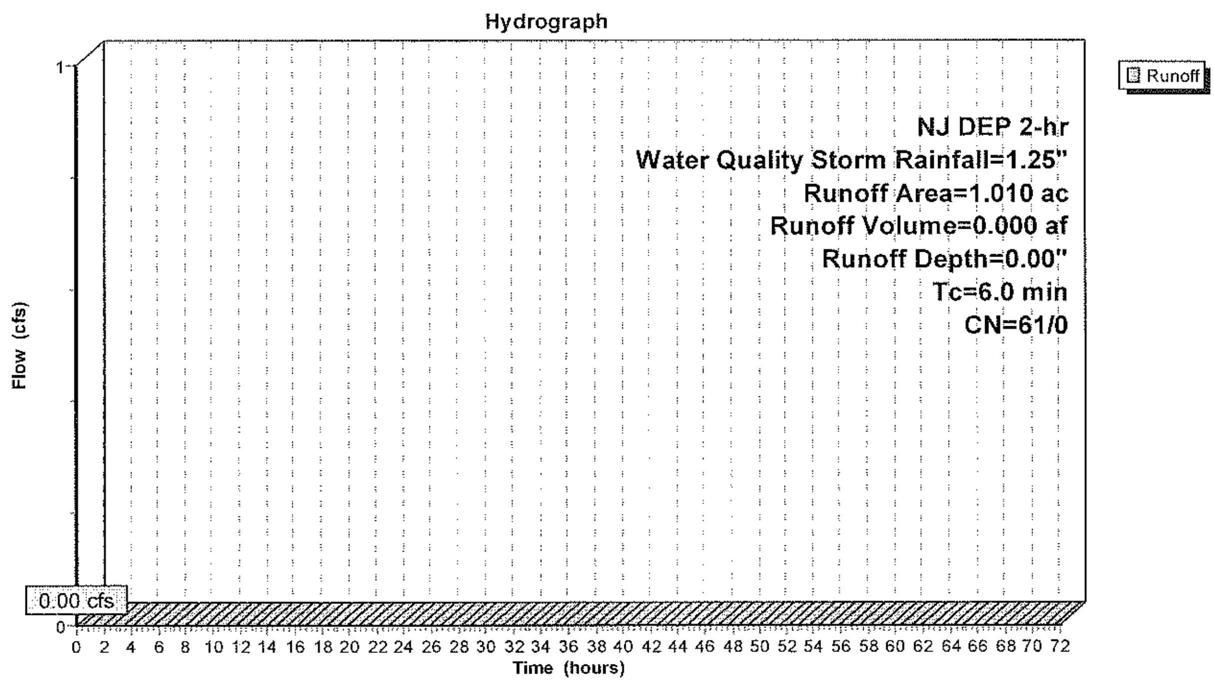
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
1.010	61	>75% Grass cover, Good, HSG B
1.010		100.00% Pervious Area

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

Subcatchment P-UNCAP1:



Summary for Subcatchment P-UNCAP2:

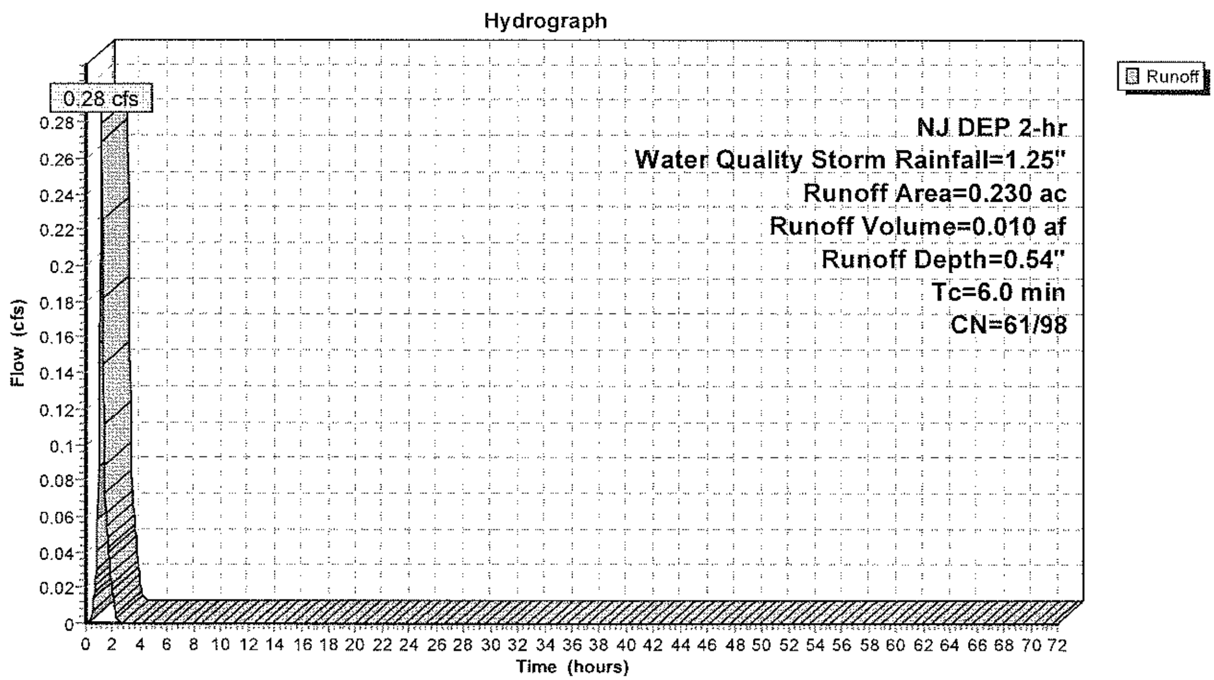
Runoff = 0.28 cfs @ 1.12 hrs, Volume= 0.010 af, Depth= 0.54"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr Water Quality Storm Rainfall=1.25"

Area (ac)	CN	Description
0.120	98	Unconnected pavement, HSG B
0.110	61	>75% Grass cover, Good, HSG B
0.230	80	Weighted Average
0.110		47.83% Pervious Area
0.120		52.17% Impervious Area

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

Subcatchment P-UNCAP2:



Summary for Pond A:

Inflow Area = 30.770 ac, 41.18% Impervious, Inflow Depth > 0.33" for Water Quality Storm event
Inflow = 9.06 cfs @ 1.22 hrs, Volume= 0.852 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
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 147.43' @ 72.00 hrs Surf.Area= 0.745 ac Storage= 0.852 af

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	146.25'	9.525 af	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
146.25	0.690	0.000	0.000
147.00	0.721	0.529	0.529
148.00	0.777	0.749	1.278
149.00	0.835	0.806	2.084
150.00	0.894	0.864	2.949
151.00	0.957	0.925	3.874
152.00	1.019	0.988	4.862
153.00	1.083	1.051	5.913
154.00	1.147	1.115	7.028
155.00	1.213	1.180	8.208
156.00	1.421	1.317	9.525

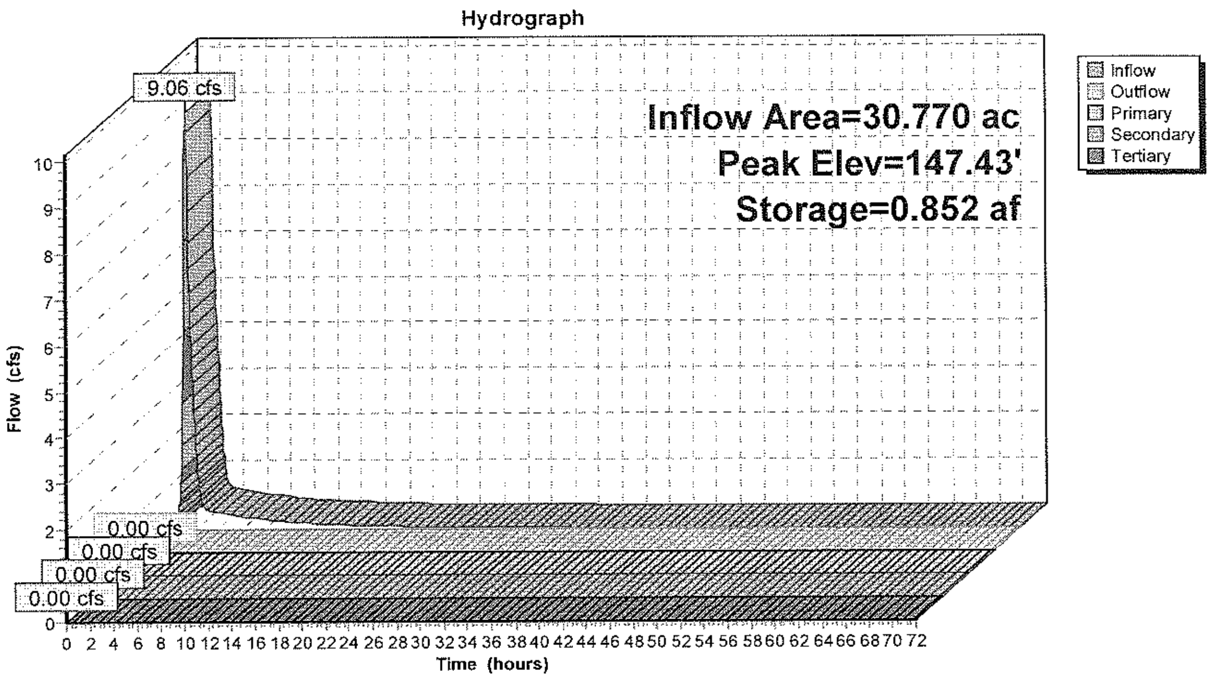
Device	Routing	Invert	Outlet Devices
#1	Primary	147.94'	**24.0" Round Culvert** L= 47.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 147.94' / 147.75' S= 0.0040 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	147.95'	**Weir, Cv= 2.62 (C= 3.28)** Elev. (feet) 147.95 150.05 Width (feet) 0.50 0.50
#3	Device 1	154.00'	**42.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	152.50'	**15.0" Round Culvert** L= 77.4' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 152.50' / 152.00' S= 0.0065 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#5	Tertiary	154.00'	**220.0' long x 9.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 Coef. (English) 2.48 2.55 2.70 2.69 2.68 2.69 2.67 2.64 2.64 2.64 2.64 2.64 2.64 2.65 2.65 2.66

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=146.25' (Free Discharge)
↑—**1=Culvert** (Controls 0.00 cfs)
↑—**2=Weir** (Controls 0.00 cfs)
└—**3=Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=146.25' (Free Discharge)
↑—**4=Culvert** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=146.25' (Free Discharge)
↑—**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A:



Summary for Pond A1:

Inflow Area = 32.000 ac, 39.59% Impervious, Inflow Depth = 0.00" for Water Quality Storm event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, 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 Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 147.75' @ 0.00 hrs Surf.Area= 0.443 ac Storage= 0.000 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	147.75'	5.278 af	**Custom Stage Data (Prismatic)** Listed below

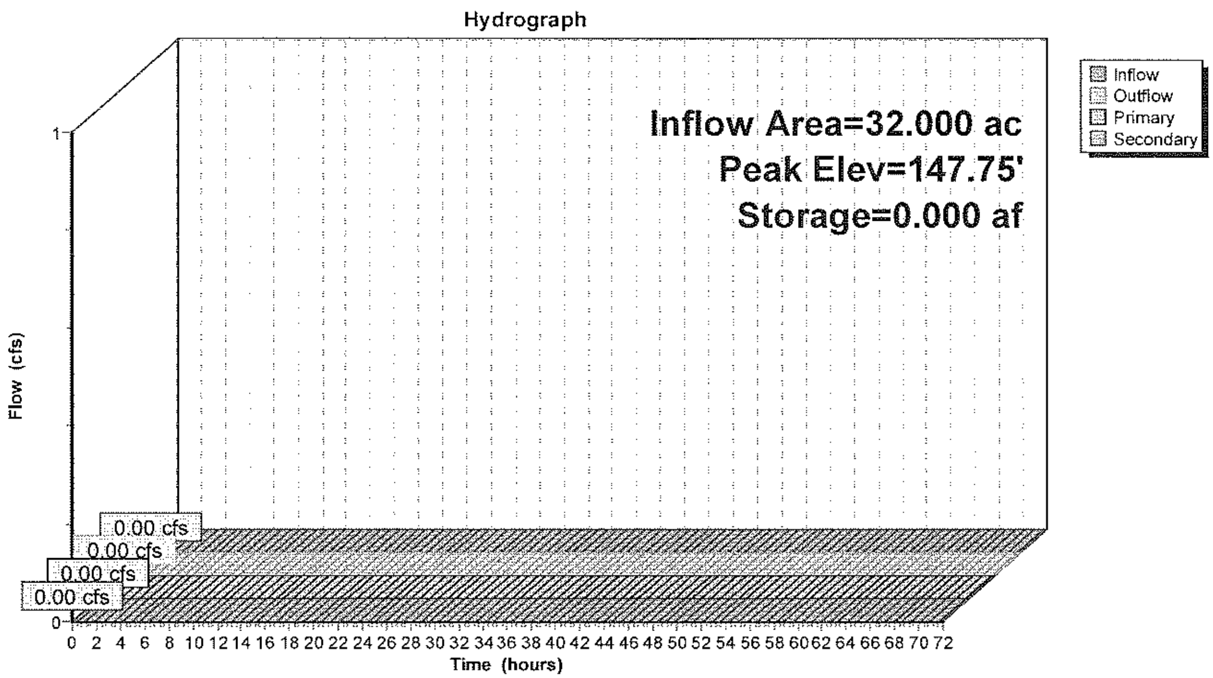
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
147.75	0.443	0.000	0.000
148.00	0.454	0.112	0.112
149.00	0.500	0.477	0.589
150.00	0.546	0.523	1.112
151.00	0.594	0.570	1.682
152.00	0.643	0.618	2.301
153.00	0.693	0.668	2.969
154.00	0.744	0.718	3.687
155.00	0.794	0.769	4.456
156.00	0.849	0.821	5.278

Device	Routing	Invert	Outlet Devices
#1	Primary	147.75'	**24.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 147.75' / 146.50' S= 0.0125 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	148.75'	**Weir, Cv= 2.62 (C= 3.28)** Elev. (feet) 148.75 149.50 149.50 150.10 Width (feet) 0.25 0.25 1.00 1.00
#3	Secondary	154.00'	**68.0' 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=147.75' (Free Discharge)
↑—**1=Culvert** (Controls 0.00 cfs)
↑—**2=Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=147.75' (Free Discharge)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A1:


Hydrograph
Inflow
Outflow
Primary
Secondary
Inflow Area=32.000 ac
Peak Elev=147.75'
Storage=0.000 af
0.00 cfs
0.00 cfs
0.00 cfs
0.00 cfs
Flow (cfs)
1
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
Time (hours)

Summary for Pond A2:

Inflow Area = 33.070 ac, 38.31% Impervious, Inflow Depth = 0.00" for Water Quality Storm event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 146.50' @ 0.00 hrs Surf.Area= 0.340 ac Storage= 0.000 af

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

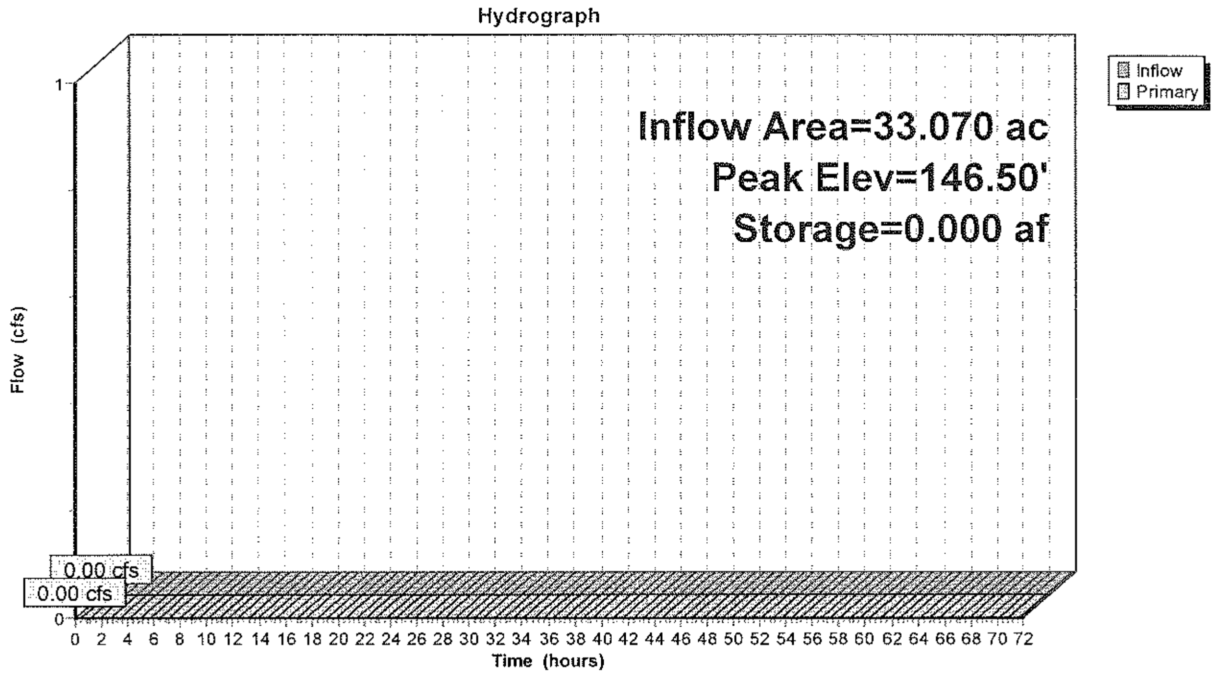
Volume	Invert	Avail.Storage	Storage Description
#1	146.50'	5.502 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
146.50	0.340	0.000	0.000
147.00	0.361	0.175	0.175
148.00	0.405	0.383	0.558
149.00	0.453	0.429	0.987
150.00	0.502	0.478	1.465
151.00	0.554	0.528	1.993
152.00	0.610	0.582	2.575
153.00	0.668	0.639	3.214
154.00	0.738	0.703	3.917
155.00	0.792	0.765	4.682
156.00	0.848	0.820	5.502

Device	Routing	Invert	Outlet Devices
#1	Primary	154.00'	**20.0' long x 17.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=146.50' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A2:


Hydrograph
Inflow
Primary
Inflow Area=33.070 ac
Peak Elev=146.50'
Storage=0.000 af
0.00 cfs
0.00 cfs
Flow (cfs)
1
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
Time (hours)

Summary for Pond A3:

Inflow Area =	36.060 ac,	36.83% Impervious,	Inflow Depth = 0.02"	for Water Quality Storm event
Inflow =	1.20 cfs @	1.16 hrs, Volume=	0.053 af	
Outflow =	0.00 cfs @	0.00 hrs, Volume=	0.000 af,	Atten= 100%, Lag= 0.0 min
Discarded =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	
Primary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 152.26' @ 3.05 hrs Surf.Area= 0.223 ac Storage= 0.053 af

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	152.00'	1.980 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

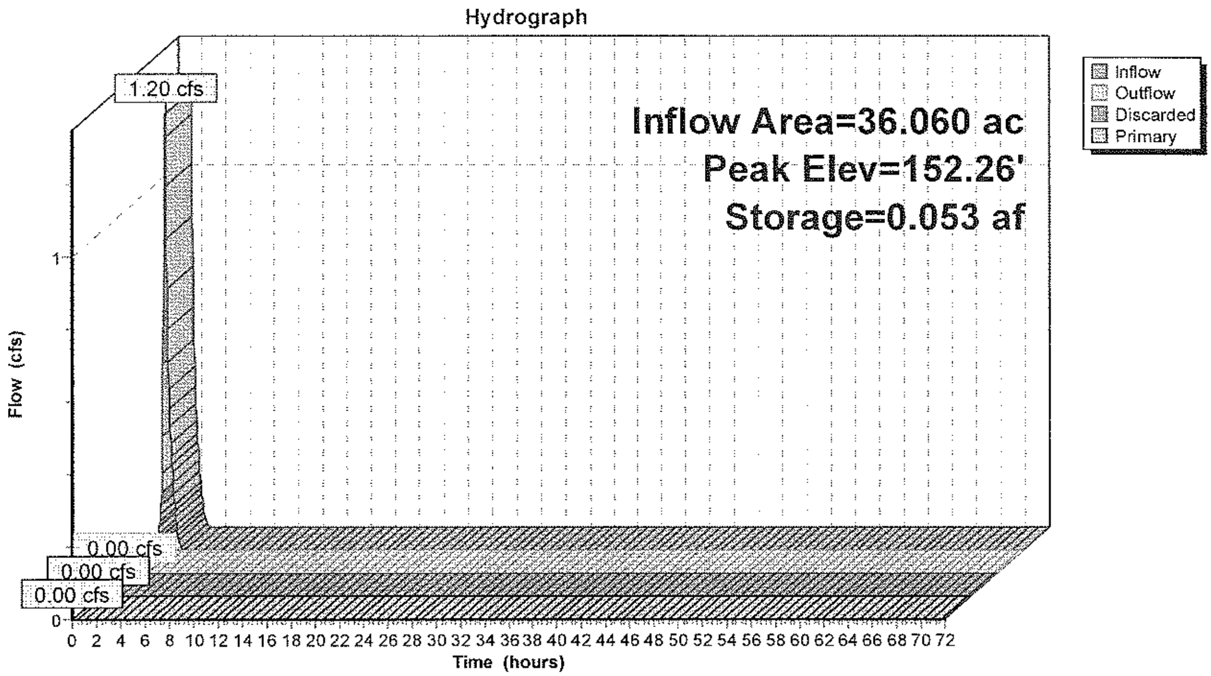
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
152.00	0.188	0.000	0.000
153.00	0.326	0.257	0.257
154.00	0.485	0.405	0.662
155.00	0.648	0.566	1.229
156.00	0.854	0.751	1.980

Device	Routing	Invert	Outlet Devices
#1	Primary	155.00'	**233.0' long x 8.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.45 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.65 2.66 2.67 2.69 2.71
#2	Discarded	152.00'	**3.000 in/hr Exfiltration X 0.00 over Horizontal area** Conductivity to Groundwater Elevation = 141.01'

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=152.00' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=152.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A3:


Hydrograph
1.20 cfs
Inflow Area=36.060 ac
Peak Elev=152.26'
Storage=0.053 af
Inflow
Outflow
Discarded
Primary
0.00 cfs
0.00 cfs
0.00 cfs
Flow (cfs)
1
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
Time (hours)

Summary for Pond B:

Inflow Area = 18.820 ac, 35.97% Impervious, Inflow Depth = 0.38" for Water Quality Storm event
Inflow = 9.90 cfs @ 1.16 hrs, Volume= 0.595 af
Outflow = 0.45 cfs @ 2.29 hrs, Volume= 0.343 af, Atten= 95%, Lag= 67.8 min
Primary = 0.45 cfs @ 2.29 hrs, Volume= 0.343 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 150.17' @ 2.29 hrs Surf.Area= 0.296 ac Storage= 0.438 af

Plug-Flow detention time= 644.4 min calculated for 0.343 af (58% of inflow)
Center-of-Mass det. time= 512.5 min (717.8 - 205.3)

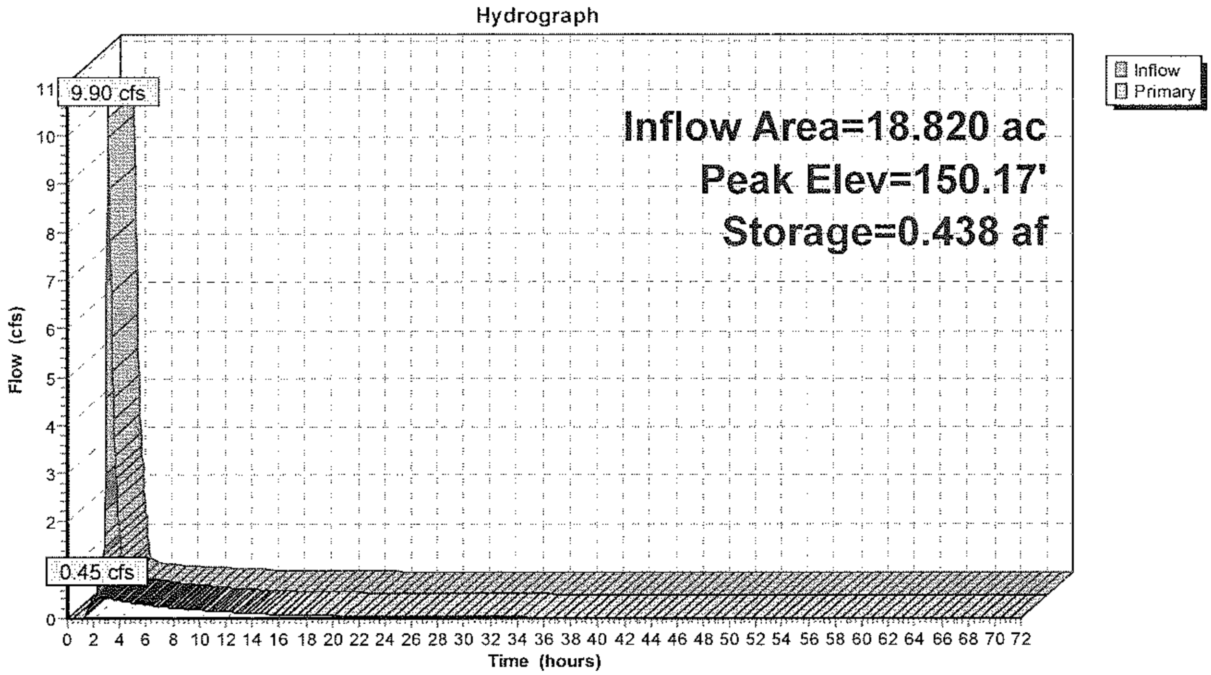
Volume	Invert	Avail.Storage	Storage Description
#1	148.50'	4.441 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
148.50	0.229	0.000	0.000
149.00	0.248	0.119	0.119
150.00	0.289	0.269	0.388
151.00	0.332	0.311	0.698
152.00	0.377	0.354	1.053
153.00	0.424	0.400	1.453
154.00	0.474	0.449	1.902
155.00	0.527	0.500	2.403
156.00	0.581	0.554	2.957
157.00	0.728	0.654	3.611
158.00	0.932	0.830	4.441

Device	Routing	Invert	Outlet Devices
#1	Primary	148.00'	**36.0" Round Culvert** L= 690.8' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 148.00' / 146.25' S= 0.0025 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf
#2	Device 1	149.50'	**Weir, Cv= 2.62 (C= 3.28)** Elev. (feet) 149.50 151.00 151.00 153.10 Width (feet) 0.25 0.25 1.00 1.00
#3	Device 1	155.85'	**48.0" x 42.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.45 cfs @ 2.29 hrs HW=150.17' (Free Discharge)
└─**1=Culvert** (Passes 0.45 cfs of 19.63 cfs potential flow)
  ├─**2=Weir** (Weir Controls 0.45 cfs @ 2.69 fps)
  └─**3=Grate** (Controls 0.00 cfs)

Pond B:


Hydrograph
9.90 cfs
0.45 cfs
Inflow Area=18.820 ac
Peak Elev=150.17'
Storage=0.438 af
Inflow
Primary
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Pond C: Wet Pond

Inflow Area = 3.520 ac, 48.86% Impervious, Inflow Depth = 0.51" for Water Quality Storm event
Inflow = 3.60 cfs @ 1.15 hrs, Volume= 0.148 af
Outflow = 0.22 cfs @ 2.06 hrs, Volume= 0.148 af, Atten= 94%, Lag= 55.0 min
Primary = 0.22 cfs @ 2.06 hrs, Volume= 0.148 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Starting Elev= 154.00' Surf.Area= 0.306 ac Storage= 1.067 af
Peak Elev= 154.42' @ 2.06 hrs Surf.Area= 0.320 ac Storage= 1.198 af (0.131 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 508.0 min (584.8 - 76.7)

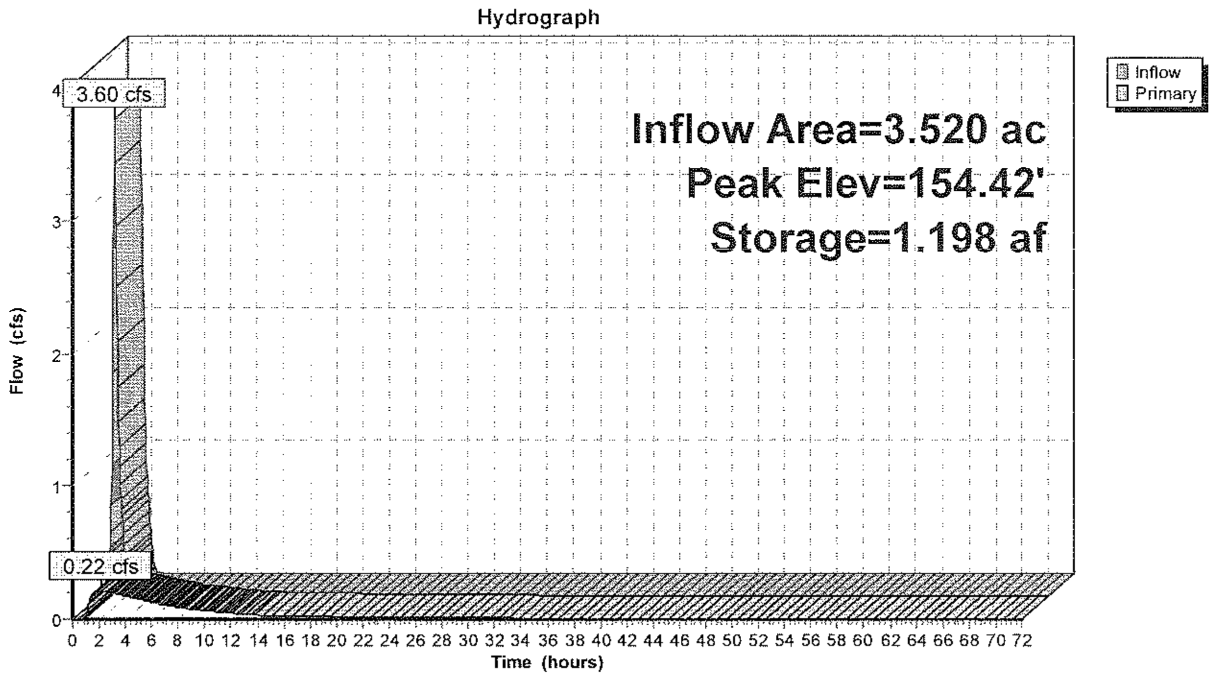
Volume	Invert	Avail.Storage	Storage Description
#1	149.00'	3.136 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
149.00	0.127	0.000	0.000
150.00	0.151	0.139	0.139
151.00	0.176	0.164	0.303
151.40	0.186	0.072	0.375
151.50	0.232	0.021	0.396
152.00	0.246	0.119	0.515
153.00	0.276	0.261	0.776
154.00	0.306	0.291	1.067
155.00	0.339	0.322	1.390
155.10	0.369	0.035	1.425
156.00	0.400	0.346	1.771
157.00	0.436	0.418	2.189
158.00	0.473	0.454	2.644
159.00	0.511	0.492	3.136

Device	Routing	Invert	Outlet Devices
#1	Primary	154.00'	**15.0" Round Culvert** L= 1,486.3' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 154.00' / 148.00' S= 0.0040 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Device 1	154.00'	**4.0" W x 3.0" H Vert. Orifice** C= 0.600
#3	Device 1	155.58'	**Weir, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 Width (feet) 0.33 1.00

Primary OutFlow Max=0.22 cfs @ 2.06 hrs HW=154.42' (Free Discharge)
└─**1=Culvert** (Passes 0.22 cfs of 0.61 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 0.22 cfs @ 2.59 fps)
  └─**3=Weir** (Controls 0.00 cfs)

Pond C: Wet Pond

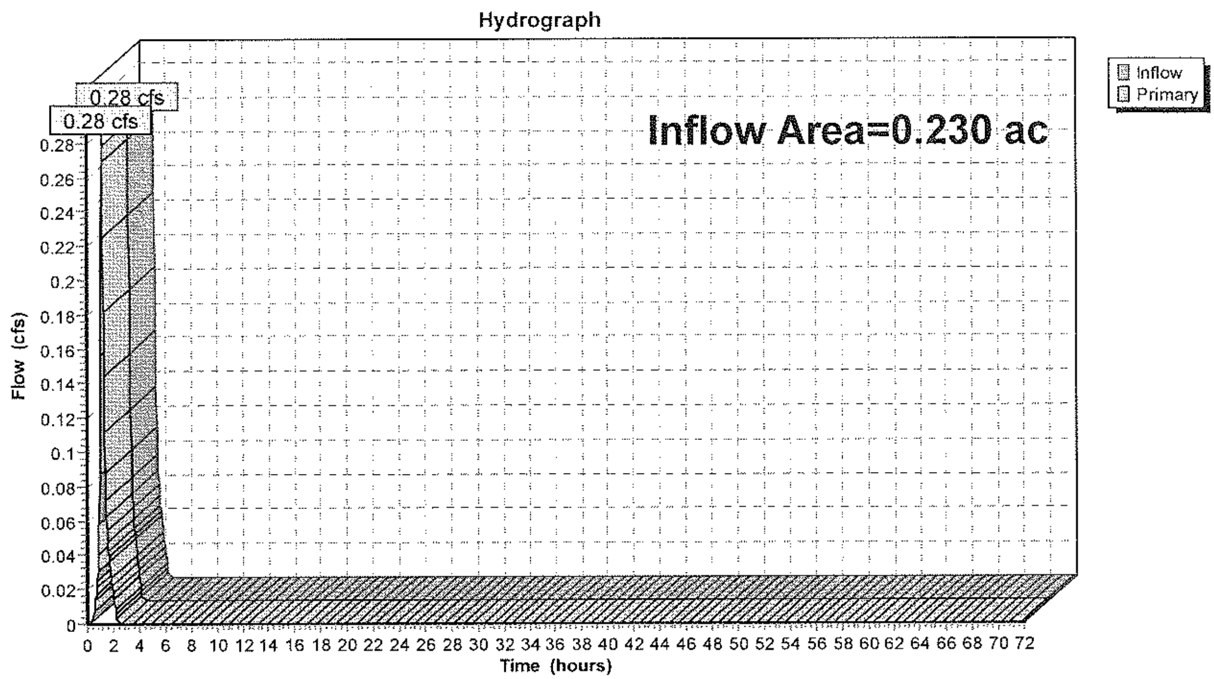


Summary for Link AP-CVS: Analysis Point-CVS

Inflow Area =	0.230 ac,	52.17% Impervious,	Inflow Depth = 0.54"	for Water Quality Storm event
Inflow =	0.28 cfs @	1.12 hrs, Volume=	0.010 af	
Primary =	0.28 cfs @	1.12 hrs, Volume=	0.010 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-CVS: Analysis Point-CVS

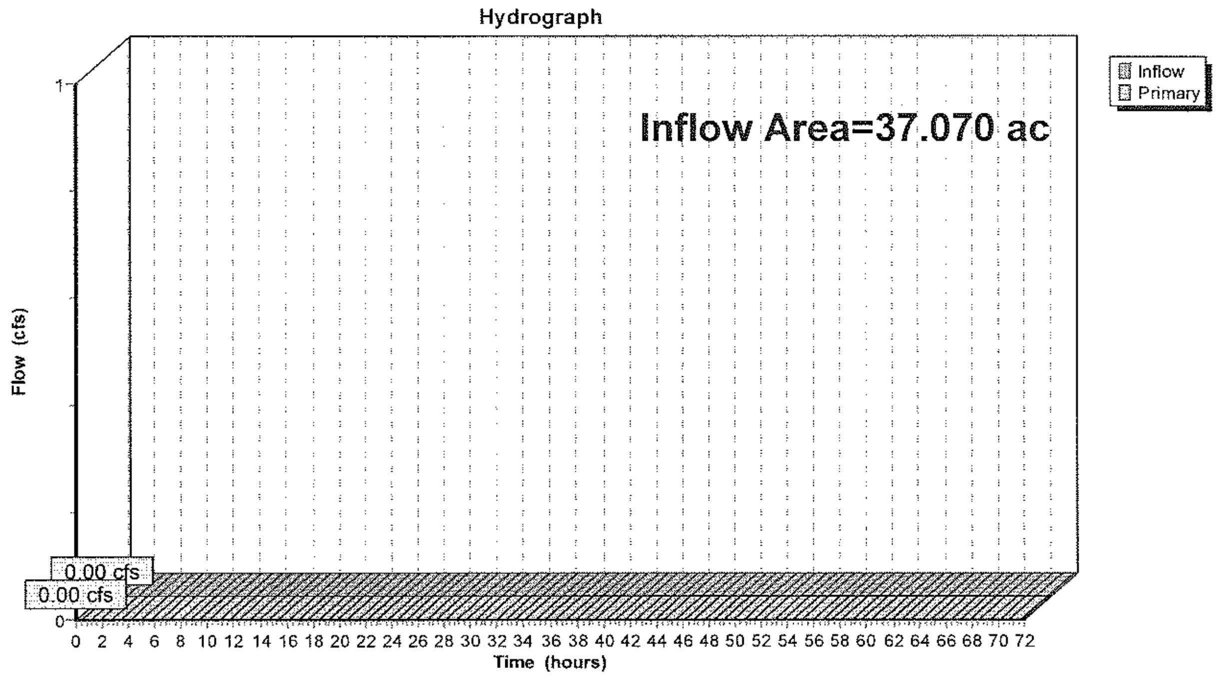


Summary for Link AP-W: Analysis Point-West

Inflow Area =	37.070 ac, 35.82% Impervious,	Inflow Depth = 0.00"	for Water Quality Storm event
Inflow =	0.00 cfs @ 0.00 hrs,	Volume=	0.000 af
Primary =	0.00 cfs @ 0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link AP-W: Analysis Point-West



APPENDIX C

SOILS INVESTIGATION

TEST PIT LOG

PROJECT NAME: Proposed Stirling Glenn II Stormwater | TEST PIT #: **TP-D** 2/24/2014

PROJECT NUMBER: 1400161 CLIENT: J.S. Hovnanian

LOCATION: Fries Mill Road, Monroe Twp., Gloucester Co., NJ

X FIELD SURVEYED ☐ TOPO ESTIMATE

Elevation

TOP OF GROUND: 153.75'

GROUNDWATER DATA: Wet

DEPTH: 13.3' TIME: Completion

DEPTH (ft.)	SOIL DESCRIPTION		REMARKS
	0.0' - 1.0'	TOPSOIL (12")	**Topsoil**
	1.0' - 3.0'	Strong brown (7.5 YR 5/8) sandy loam, 10% gravel; weak, med., granular; v. friable; clear, irregular boundary	
	3.0' - 3.5'	Brownish yellow (10 YR 6/8) sandy clay loam; weak, fine, massive; friable; clear, broken boundary	
5	3.5' - 6.0'	Strong brown (7.5 YR 5/8) sandy loam, 15% gravel; weak, med., single grained; loose; diffuse, irregular boundary	
	6.0' - 10.5'	Very pale brown (10YR 8/4) sand; 20% gravel; weak, med., single grained; loose; diffuse, irregular boundary Permeability Tests (2) Conducted at 6.5' (±147.25')	Average Rate= 22.95 in/hr (K5)
10			
	10.5' - 14.0'	Very pale brown (10YR 8/4) sand with few, coarse, faint mottles (7.5YR 7/1), 15% gravel; weak, med., single grained; loose; diffuse, irregular boundary	*Seasonal High @ 10.5'* **Groundwater @ 13.3'** **Stratum I**
15		**End of Test Pit Excavation@ 14.0'**	
20			
25			

advantage engineers

520 Fellowship Road Suite A-106, Mt Laurel, NJ 08054

Office: (856) 231-0800 Fax: (856) 231-9949

www.advantageengineers.com

EXCAVATION METHOD: Rubber-tire Backhoe

ADVANTAGE REPRESENTATIVE: Richard Jackson

DRAWN/COMPILED BY: Richard Jackson

DATE COMPILED: February 24, 2014

TEST PIT LOG

PROJECT NAME: Proposed Stirling Glenn II Stormwater — TEST PIT #: **TP-E** — 2/24/2014

PROJECT NUMBER: 1400161 CLIENT: J.S. Hovnanian

LOCATION: Fries Mill Road, Monroe Twp., Gloucester Co., NJ

[X] FIELD SURVEYED [ ] TOPO ESTIMATE

Elevation: TOP OF GROUND: 154.63'
GROUNDWATER DATA: Wet
DEPTH: 13.5' TIME: Completion

DEPTH (ft.)	SOIL DESCRIPTION		REMARKS
	0.0' - 0.5'	TOPSOIL (6")	**Topsoil**
	0.5' - 5.0'	Strong brown (7.5 YR 5/8) sandy loam; 5% gravel; weak, medium, granular; friable; clear, wavy boundary	
5		Permeability Test Conducted at 4.75' (±149.88')	6.8 in/hr (K4)
	5.0' - 11.0'	Strong brown (7.5 YR 5/8) sandy loam; 15% gravel; weak, medium, granular; friable; gradual, irregular boundary	
10		Permeability Test Conducted at 10.0' (±144.63')	13.2 in/hr (K4)
	11.0' - 14.0'	Reddish brown (7.5YR 6/8) loamy sand with common, coarse, prominent mottles (7.5YR 8/2), 10% gravel; weak, fine, single grained; friable; gradual, irregular boundary	*Seasonal High @ 11.0'* **Groundwater @ 13.5'**
15		**End of Test Pit Excavation @ 14.0'**	**Stratum I**
20			
25			

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EXCAVATION METHOD: Rubber-tire Backhoe

ADVANTAGE REPRESENTATIVE: Richard Jackson

DRAWN/COMPILED BY: Richard Jackson

DATE COMPILED: February 24, 2014

TEST PIT LOG

PROJECT NAME: Proposed Stirling Glenn II Stormwater   TEST PIT #: **TP-F**   2/24/2014

PROJECT NUMBER: 1400161 CLIENT: J.S. Hovnanian

LOCATION: Fries Mill Road, Monroe Twp., Gloucester Co., NJ

X FIELD SURVEYED   ☐ TOPO ESTIMATE

Elevation: TOP OF GROUND: 154.86'

GROUNDWATER DATA: Wet

DEPTH: 14.0'   TIME: Completion

DEPTH (ft.)		SOIL DESCRIPTION	REMARKS
	0.0' - 0.5'	TOPSOIL (6")	**Topsoil**
	0.5' - 5.0'	Strong brown (7.5YR 5/8) loam, 10% gravel; weak, fine, granular; firable; gradual, irregular boundry	
		Permeability Test Conducted at 4.5' (±150.36')	7.2 in/hr (K4)
5	5.0' - 6.0'	Brownish yellow (10YR 6/8) loamy sand, 20% gravel; weak, fine, granular; loose; diffuse, irregular boundary	
		Permeability Test Conducted at 5.0' (±149.86')	25.4 in/hr (K5)
	6.0' - 8.0'	Brownish yellow (10YR 6/8) sandy loam; weak, fine granular; loose; diffuse, irregular boundary	
10	8.0' - 11.5'	Brownish yellow (10YR 6/8) sand, 10% gravel; weak, fine, single grained; loose; gradual, wavy boundary	
		Permeability Test Conducted at 8.5' (±146.36')	20.3 in/hr (K5)
	11.5' - 14.5'	Yellow (10YR 7/8) sand with few, coarse, faint mottles (7.5YR 6/1), 5% gravel; weak, fine, single grained; loose; diffuse, irregular boundary	*Seasonal High @ 11.5'* **Groundwater @ 14.0'** **Stratum I**
15		**End of Test Pit Excavation @ 14.5'**	
20			
25			

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EXCAVATION METHOD: Rubber-tire Backhoe

ADVANTAGE REPRESENTATIVE: Richard Jackson

DRAWN/COMPILED BY: Richard Jackson

DATE COMPILED: February 24, 2014

TEST PIT LOG

PROJECT NAME: Proposed Stirling Glenn II Stormwater

TEST PIT #: **TP-G** 2/24/2014

PROJECT NUMBER: 1400161 CLIENT: J.S. Hovnanian

LOCATION: Fries Mill Road, Monroe Twp., Gloucester Co., NJ

[X] FIELD SURVEYED [ ] TOPO ESTIMATE

Elevation

TOP OF GROUND: 154.51'

GROUNDWATER DATA: Wet

DEPTH: 13.0' TIME: Completion

DEPTH (ft.)		SOIL DESCRIPTION	REMARKS
	0.0' - 1.0'	TOPSOIL (12")	**Topsoil**
	1.0' - 3.0'	Strong brown (7.5 YR 5/8) sandy loam, 10% gravel; weak, very fine, granular; very friable; clear, wavy boundary	
5	3.0' - 6.0'	Brownish yellow (10 YR 6/8) sandy clay loam, 10% gravel; weak, fine, single grained; loose; gradual, irregular boundary	
		Permeability Tests (2) Conducted at 4.25' (±150.26')	Average Rate= 1.05 in/hr (K2)
	6.0' - 11.0'	Very pale brown (10YR 8/3) sand; weak, fine, single grained; loose; diffuse, irregular boundary	
		Permeability Test Conducted at 7.5' (±147.01')	22.3 in/hr (K5)
10	11.0' - 13.0'	Very pale brown (10YR 8/3) sand with few, medium, faint mottles (7.5YR 7/1); weak, fine, single grained; loose; diffuse, irregular boundary	*Seasonal High @ 11.0'* **Groundwater @ 13.0'**
		End of Test Pit Excavation (Cave-in) @ 13.0'	**Stratum I**
15			
20			
25			

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EXCAVATION METHOD: Rubber-tire Backhoe

ADVANTAGE REPRESENTATIVE: Richard Jackson

DRAWN/COMPILED BY: Richard Jackson

DATE COMPILED: February 24, 2014

TEST PIT LOG

PROJECT NAME: Proposed Stirling Glenn II Stormwater TEST PIT #: TP-H 2/24/2014

PROJECT NUMBER: 1400161 CLIENT: J.S. Hovnanian

LOCATION: Fries Mill Road, Monroe Twp., Gloucester Co., NJ

[X] FIELD SURVEYED [ ] TOPO ESTIMATE

Elevation — TOP OF GROUND: 155.81'

GROUNDWATER DATA: Wet

DEPTH: 14.8' TIME: Completion

DEPTH (ft.)		SOIL DESCRIPTION	REMARKS
	0.0' - 0.25'	TOPSOIL (3")	**Topsoil**
	0.25' - 3.0'	Dark yellowish brown (10 YR 4/6) sandy loam, 20% gravel; moderate, med., subangular blocky; v. friable; clear, wavy boundary	
	3.0' - 8.0'	Strong brown (7.5YR 5/8) loamy sand, 15% gravel; weak, fine, single grained; loose; gradual, irregular boundary	
5		Permeability Tests (2) Conducted at 4.5' (±151.31')	Average Rate= 6.33 in/hr (K4)
	8.0' - 12.0'	Brownish yellow (10YR 6/8) sand, 5% gravel; weak, fine, single grained; loose; gradual, irregular boundary	
10			
	12.0' - 15.0'	Brownish yellow (10YR 6/8) sand with few, medium, faint mottles (7.5YR 7/2), 5% gravel; weak, fine, single grained; loose; gradual, irregular boundary	*Seasonal High @ 12.0'*
15			**Groundwater @ 14.8'**
		End of Test Pit Excavation @ 15.0'	**Stratum I**
20			
25			

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EXCAVATION METHOD: Rubber-tire Backhoe

ADVANTAGE REPRESENTATIVE: Richard Jackson

DRAWN/COMPILED BY: Richard Jackson

DATE COMPILED: February 24, 2014

TEST PIT LOG

PROJECT NAME: Proposed Stirling Glenn II Stormwater TEST PIT #: **TP-I** 2/24/2014

PROJECT NUMBER: 1400161 CLIENT: J.S. Hovnanian

LOCATION: Fries Mill Road, Monroe Twp., Gloucester Co., NJ

[X] FIELD SURVEYED [ ] TOPO ESTIMATE

Elevation: TOP OF GROUND: 157.07'

GROUNDWATER DATA: Wet

DEPTH: 15.0' TIME: Completion

DEPTH (ft.)	SOIL DESCRIPTION		REMARKS
	0.0' - 0.08'	TOPSOIL (1")	**Topsoil**
	0.08' - 0.67'	Yellowish brown (10YR5/8) sand; weak, v. fine, single grained, loose, abrupt, smooth boundary	
	0.67' - 8.0'	Strong Brown (7.5YR 5/8) loamy sand, 5% gravel; moderate, granular; firm; clear, wavy boundary	
5		Permeability Test Conducted at 5.75' (±151.32')	12.9 in/hr (K4)
	8.0' - 12.5'	Reddish yellow (10YR 6/8) loamy sand, 10% gravel; weak, very fine, single grained; loose; gradual, irregular boundary	
10		Permeability Test Conducted at 8.0' (±149.07')	22.3 in/hr (K5)
	12.5' - 15.5'	Reddish yellow (10YR 6/8) sand with few, coarse, faint mottles (7.5YR 6/2); weak, very fine, single grained; loose; gradual, irregular boundary	Seasonal High @ 12.5'
15			**Groundwater @ 15.0'** **Stratum I**
		End of Test Pit Excavation @ 15.5'	
20			
25			

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EXCAVATION METHOD: Rubber-tire Backhoe

ADVANTAGE REPRESENTATIVE: Richard Jackson

DRAWN/COMPILED BY: Richard Jackson

DATE COMPILED: February 24, 2014

DRAFT TEST PIT LOG

Project: The Clusters Residential Stormwater Investigation
Client: Cohen Schatz Associates Inc.
Date Completed: 2/3/2020
Location: See Test Pit Location Plan

Test Pit Number: TP- J
Groundwater Depth: 15.0'
Top of Ground Elevation: 152.99'
Topo Est.: _ **Field Survey:** X

Depth (ft)	Soil Description		Remarks
	0.0' - 0.5'	Topsoil (6")	**Topsoil**
1–2	0.5' - 2.0'	Dark Yellowish Brown (10YR 3/6) SANDY CLAY LOAM; 30% Gravel; Moist, Friable	**Stratum I**
3–4	2.0' - 4.0'	Strong Brown (7.5YR 4/6) SANDY LOAM; 20% Gravel; Moist, Loose	
5–7	4.0' - 7.0'	Strong Brown (7.5YR 5/8) SANDY LOAM; 5-20% Gravel; Moist, Loose	
8	7.0' - 14.5	Brownish Yellow (10YR 6/8) LOAMY SAND, with few, fine, faint, Yellow Mottles (10YR 7/6) 5% Gravel, Moist, Loose	
9		In-Lab Tube Permeameter Testing at 7.5 feet	27.5 in/hr (K5)
10–14			*Seasonal High Growndwater at 11.0'*
15	14.5' - 15.0'	Olive Yellow (2.5YR 6/6) SANDY LOAM, 15% Gravel, Moist, Loose	H20 at 15.0'
		End of Test Pit at 15 Feet	**Stratum II**

RPM ENGINEERING With Integrity
297 Westwood Drive, West Deptford, NJ 08096

Excavator: Scheideler Excavation
Excavation Method: Trackhoe
RPM Representative: B. Bedilion
Log Completed By: F. DeFeo
Sheet: 1 of 1

DRAFT TEST PIT LOG

Project: The Clusters Residential Stormwater Investigation
Client: Cohen Schatz Associates Inc.
Date Completed: 2/3/2020
Location: See Test Pit Location Plan

Test Pit Number: TP- K
Groundwater Depth: NE
Top of Ground Elevation: 153.45'
Topo Est.: __ **Field Survey:** X

Depth (ft)	Soil Description	Remarks
	0.0' - 0.5' Topsoil (6")	Topsoil
1		
	0.5' - 3.0' Dark Yellowish Brown (10YR 3/4) SANDY CLAY LOAM; 20% Gravel; Moist, Friable	
2		
3	3.0' - 5.0' Strong Brown (7.5YR 4/6) SANDY CLAY LOAM; 15% Gravel; Moist, Loose	
4		Stratum I
5		
	5.0' - 8.0' Strong Brown (10YR 5/8) SANDY CLAY LOAM; 5-20% Gravel; Moist, Loose	
6		
7		
	In-Lab Tube Permeameter Testing at 7.0 feet	3.0 in/hr (K3)
8		
	8.0' - 12.0' Reddish Yellow (7.5YR 6/8) LOAMY SAND; 15% Gravel; Moist, Loose	
9		
10		
11		
12		
	12.0' - 13.0' Brownish Yellow (10YR 6/8) SANDY LOAM; 10% Gravel; Moist, Loose	Stratum II
13		
14		*Seasonal High Groundwater at 14.0'*
	13.0' - 15.0' Pale Brown (2.5YR 7/4) SANDY LOAM; with few, fine, faint, Brownish Yellow Mottles (10YR 6/8), Moist, Loose	
15	End of Test Pit at 15 Feet	

RPM ENGINEERING
With Integrity
297 Westwood Drive, West Deptford, NJ 08096

Excavator: Scheideler Excavation
Excavation Method: Trackhoe
RPM Representative: B. Bedilion
Log Completed By: F. DeFeo
Sheet: 1 of 1

DRAFT TEST PIT LOG

Project: The Clusters Residential Stormwater Investigation
Client: Cohen Schatz Associates Inc.
Date Completed: 2/3/2020
Location: See Test Pit Location Plan

Test Pit Number: TP- L
Groundwater Depth: NE
Top of Ground Elevation: 156.30'
Topo Est.: _ **Field Survey:** X

Depth (ft)	Soil Description	Remarks
	0.0' - 0.5' Topsoil (6")	**Topsoil**
1	0.5' - 4.5' Dark Yellowish Brown (10YR 3/6) to Yellowish Red (10YR 4/6) SANDY LOAM; 5% Gravel; Moist, Friable	**Stratum I**
2		
3		
4		
5	4.5' - 8.0' Strong Brown (7.5YR 5/8) SANDY CLAY LOAM; 10% Gravel; Moist, Friable	
6		
7		
8		
9	8.0' - 9.25' Strong Brown (7.5YR 4/6) SANDY LOAM; 10% Gravel; Moist, Loose	**Stratum II**
10	9.25' - 12.0' Brownish Yellow (10YR 6/8) LOAMY SAND; 5% Gravel; Moist, Loose	
11	In-Lab Tube Permeameter Testing at 10.5 feet	41.4 in/hr (K5)
12		
13	12.0' - 13.0' Strong Brown (10YR 5/8) LOAMY SAND; 15% Gravel; Moist, Loose	
14		
15	13.0' - 15.0' Brownish Yellow (10YR 6/6) LOAMY SAND; Moist, Loose	
	End of Test Pit at 15 Feet	

RPM ENGINEERING
With Integrity
297 Westwood Drive, West Deptford, NJ 08096

Excavator: Scheideler Excavation
Excavation Method: Trackhoe
RPM Representative: B. Bedilion
Log Completed By: F. DeFeo
Sheet: 1 of 1

DRAFT TEST PIT LOG

Project: The Clusters Residential Stormwater Investigation
Client: Cohen Schatz Associates Inc.
Date Completed: 2/3/2020
Location: See Test Pit Location Plan

Test Pit Number: TP- M
Groundwater Depth: NE
Top of Ground Elevation: 156.14'
Topo Est.: _ **Field Survey:** X

Depth (ft)	Soil Description	Remarks
1	0.0' - 1.0' Topsoil (12")	**Topsoil**
2	1.0' - 2.25' Dark Brown (7.5YR 3/3) SANDY LOAM; 10% Gravel; Moist, Friable	**Stratum I**
3	2.25' - 3.75' Yellowish Brown (5YR 4/6) SANDY CLAY LOAM; Moist, Friable	
4	3.75' - 8.0' Strong Brown (7.5YR 5/8) SANDY LOAM; 25% Gravel; Moist, Friable	
5		
6		
7		
8		
9	8.0' - 10.0' Strong Brown (7.5YR 5/6) SANDY LOAM; 15% Gravel; Moist, Loose	**Stratum II**
10	10.0' - 14.0' Brownish Yellow (10YR 6/6) SANDY LOAM; 15% Gravel; Moist, Loose	
11	In-Lab Tube Permeameter Testing at 10.5 feet	23.3 in/hr (K5)
12		
13		
14		
15	14.0' - 15.0' Brownish Yellow (10YR 6/8) SANDY LOAM; Moist, Loose	
	End of Test Pit at 15 Feet	

RPM ENGINEERING
With Integrity
297 Westwood Drive, West Deptford, NJ 08096

Excavator: Scheideler Excavation
Excavation Method: Trackhoe
RPM Representative: B. Bedillion
Log Completed By: F. DeFeo
Sheet: 1 of 1

DRAFT TEST PIT LOG

Project: The Clusters Residential Stormwater Investigation
Client: Cohen Schatz Associates Inc.
Date Completed: 2/3/2020
Location: See Test Pit Location Plan

Test Pit Number: TP- N
Groundwater Depth: NE
Top of Ground Elevation: 155.00'
Topo Est.: _ **Field Survey:** X

Depth (ft)	Soil Description	Remarks
1	0.0' - 1.5' Topsoil (18")	**Topsoil**
2	1.5' - 3.0' Strong Brown (7.5YR 4/6) SANDY CLAY LOAM; 5% Gravel; Moist, Friable	**Stratum I**
3		
4	3.0' - 6.75' Yellowish Red (5R 4/6) SANDY CLAY LOAM; 30% Gravel; Moist, Friable	
5		
6		
7	6.75' - 8.0' Yellow (7.5YR 7/8) SANDY LOAM; 10% Gravel; Moist, Loose	
8	In-Lab Tube Permeameter Testing at 7.5 feet	25.5 in/hr (K5)
9	8.0' - 11.0' Brownish Yellow (10YR 6/8) SANDY LOAM; 25% Gravel; Moist, Loose	
10		
11		**Stratum II**
12	11.0' - 15.0' Strong Brown (10YR 6/8) SANDY LOAM; with few, fine, faint Light Gray (7.5 YR 7/1) Mottles, Moist, Loose	
13		*Seasonal High Groundwater at 14.0'*
14		
15	**End of Test Pit at 15 Feet**	

RPM ENGINEERING With Integrity
297 Westwood Drive, West Deptford, NJ 08096

Excavator: Scheideler Excavation
Excavation Method: Trackhoe
RPM Representative: B. Bedilion
Log Completed By: F. DeFeo
Sheet: 1 of 1

DRAFT TEST PIT LOG

Project: The Clusters Residential Stormwater Investigation
Client: Cohen Schatz Associates Inc.
Date Completed: 2/3/2020
Location: See Test Pit Location Plan

Test Pit Number: TP- O
Groundwater Depth: NE
Top of Ground Elevation: 154.16'
Topo Est.: _ **Field Survey:** X

Depth (ft)	Soil Description		Remarks
	0.0' - 0.5'	Topsoil (6")	**Topsoil**
1	0.5' - 1.5'	Brown (10YR 4/3) SANDY LOAM; 5% Gravel; Moist, Friable	
2	1.5' - 5.0'	Strong Brown (7.5YR 4/6) SANDY CLAY LOAM; 5-15% Gravel; Moist, Friable	
3			**Stratum I**
4			
5			
6	5.0' - 7.0'	Yelowish Brown (7.5YR 5/6) SANDY LOAM; 0-5% Gravel; Moist, Loose	
7			
8	7.0' - 9.5'	Yellow (10YR 6/8) to Very Pale Brown (10YR 7/4) LOAMY SAND; 35-50% Gravel; Moist, Loose	
9			
	9.5' - 10.5'	Very Pale Brown (10YR 8/2) SANDY LOAM; 5% Gravel; Moist, Loose	
10		In-Lab Tube Permeameter Testing at 9.5 feet	8.9 in/hr (K4)
11	10.5' - 15.0'	Brownish Yellow (10YR 6/8) LOAMY SAND; with few, fine, faint, Strong Brown Mottles (7.5YR 5/8), Moist, Loose	
12			
13			*Seasonal High Growndwater at 13.0'*
14			**Stratum II**
15		**End of Test Pit at 15 Feet**	

RPM ENGINEERING
With Integrity
297 Westwood Drive, West Deptford, NJ 08096

Excavator: Scheideler Excavation
Excavation Method: Trackhoe
RPM Representative: B. Bedilion
Log Completed By: F. DeFeo
Sheet: 1 of 1

DRAFT TEST PIT LOG

Project: The Clusters Residential Stormwater Investigation
Client: Cohen Schatz Associates Inc.
Date Completed: 2/3/2020
Location: See Test Pit Location Plan

Test Pit Number: TP- P
Groundwater Depth: NE
Top of Ground Elevation: 159.20'
Topo Est.: _ **Field Survey:** X

Depth (ft)	Soil Description	Remarks
1	0.0' - 1.0' Topsoil (12")	**Topsoil**
2	1.0' - 4.0' Strong Brown (7.5YR 4/6) SANDY CLAY LOAM; 5-20% Gravel; Moist, Friable	**Stratum I**
3		
4	4.0' - 5.75' Yellowish Red (5YR 4/6) SANDY LOAM; 35% Gravel; Moist, Friable	
5		
6	5.75' - 7.0' Yellowish Brown (10YR 5/8) LOAM; Moist, Friable	
7	Double Ring Infiltrometer Test at 5.75 feet	2.1 in/hr (K3)
8	7.0' - 8.0' Yellowish Brown (10YR 5/6) LOAMY SAND; Moist, Loose	**Stratum II**
9	8.0' - 10.0' Brownish Yellow (10YR 6/8) LOAMY SAND; 15% Gravel; Moist, Loose	
10	10.0' - 15.0' Light Yellowish Brown (10YR 6/4) LOAMY SAND, with few, fine, faint, Strong Brown Mottles (7.5YR 5/8) 5% Gravel, Moist, Loose	
11		
12		
13		
14		*Seasonal High Groundwater at 15.0'*
15	**End of Test Pit at 15 Feet**	

RPM ENGINEERING
With Integrity
297 Westwood Drive, West Deptford, NJ 08096

Excavator: Scheideler Excavation
Excavation Method: Trackhoe
RPM Representative: B. Bedilion
Log Completed By: F. DeFeo
Sheet: 1 of 1

DRAFT TEST PIT LOG

Project: The Clusters Residential Stormwater Investigation
Client: Cohen Schatz Associates Inc.
Date Completed: 2/3/2020
Location: See Test Pit Location Plan

Test Pit Number: TP - Q
Groundwater Depth: NE
Top of Ground Elevation: 159.85'
Topo Est.: __ **Field Survey:** X

Depth (ft)	Soil Description	Remarks
1	0.0' - 0.50' Topsoil (6")	**Topsoil**
2	0.50' - 2.0' Brown (7.5YR 4/4) SANDY LOAM; 40% Gravel; Moist, Loose	**Stratum I**
3	2.0' - 5.5' Dark Yellowish Brown (10YR 4/6) SANDY LOAM; 30-45% Gravel; Moist, Loose	
4		
5		
6	5.5' - 6.5' Strong Brown (7.5YR 5/6) LOAM; 15% Gravel; Moist, Friable	
	Double Ring Infiltrometer Test at 5.5 feet	0.5 in/hr (K1)
7	6.5' - 10.0' Yellowish Brown (10YR 5/6) SANDY LOAM; 10-20% Gravel; Moist, Friable	**Stratum II**
8		
9		
10	10.0' - 12.0' Yellowish Brown (10YR 5/6) LOAMY SAND; 40% Gravel; Moist, Loose	
11		
12		
13	12.0' - 15.0' Light Yellowish Brown (10YR 6/4) LOAMY SAND, with few, fine, faint, Strong Brown Mottles (7.5YR 5/8) 5% Gravel, Moist, Loose	
14		*Seasonal High Groundwater at 15.0'*
15	**End of Test Pit at 15 Feet**	

RPM ENGINEERING
With integrity
297 Westwood Drive, West Deptford, NJ 08096

Excavator: Scheideler Excavation
Excavation Method: Trackhoe
RPM Representative: B. Bedilion
Log Completed By: F. DeFeo
Sheet: 1 of 1

DRAFT TEST PIT LOG

Project: The Clusters Residential Stormwater Investigation
Client: Cohen Schatz Associates Inc.
Date Completed: 2/4/2020
Location: See Test Pit Location Plan

Test Pit Number: TP - R
Groundwater Depth: NE
Top of Ground Elevation: 158.84'
Topo Est.: __ **Field Survey:** X

Depth (ft)	Soil Description	Remarks
1	0.0' - 1.0' Topsoil (12")	**Topsoil**
2	1.0' - 2.0' Dark Yellowish Brown (10YR 4/4) SANDY CLAY LOAM; 15% Gravel; Moist, Loose	**Stratum I**
3	2.0' - 5.5' Strong Brown (10YR 4/6) SANDY LOAM; 40% Gravel; Moist, Friable	
4		
5		
6	Double Ring Infiltrometer Test at 5.5 feet	48.0 in/hr (K5)
7	5.5' - 9.5' Strong Brown (7.5YR 5/6) SANDY LOAM; 5% Gravel; Moist, Friable	
8		
9		
10	9.5' - 11.0' Yellowish Brown (10YR 5/6) SANDY LOAM; 35% Gravel; Moist, Loose	**Stratum II**
11		
12	11.0' - 13.5' Strong Brown (7.5YR 5/8) SANDY LOAM; Moist, Loose	
13		
14	13.5' - 15.0' Brownish Yellow (10YR 6/6) SANDY LOAM, with few, fine, faint, Light Gray Mottles (7.5YR 7/1), Moist, Loose	***Seasonal High Groundwater at 15.0'***
15	**End of Test Pit at 15 Feet**	

RPM ENGINEERING
With Integrity
297 Westwood Drive, West Deptford, NJ 08096

Excavator: Scheideler Excavation
Excavation Method: Trackhoe
RPM Representative: B. Bedilion
Log Completed By: F. DeFeo
Sheet: 1 of 1

DRAFT TEST PIT LOG

Project: The Clusters Residential Stormwater Investigation
Client: Cohen Schatz Associates Inc.
Date Completed: 2/4/2020
Location: See Test Pit Location Plan

Test Pit Number: TP - S
Groundwater Depth: NE
Top of Ground Elevation: 159.42'
Topo Est.: __ **Field Survey:** X

Depth (ft)	Soil Description	Remarks
1	0.0' - 1.0' Topsoil (12")	**Topsoil**
2	1.0' - 2.0' Dark Yellowish Brown (10YR 3/6) SANDY CLAY LOAM; Moist, Loose	**Stratum I**
3	2.0' - 3.0' Strong Brown (7.5YR 4/6) SANDY LOAM; 20% Gravel; Moist, Friable	
4	3.0' - 7.0' Strong Brown (7.5YR 5/6) SANDY LOAM; 40% Gravel; Moist, Friable	
5	Double Ring Infiltrometer Test at 4.0 feet	8.5 in/hr (K4)
6		
7		
8	7.0' - 11.5' Strong Brown (7.5YR 5/6) to Yellowish Brown (7.5YR 5/8) SANDY LOAM; 5% Gravel; Moist, Friable	
9		
10		**Stratum II**
11		
12	11.5' - 12.5' Yellowish Brown (10 YR 5/8) SANDY LOAM; 40% Gravel; Moist, Loose	
13	12.5' - 14.0' Yellowish Brown (10YR 5/6) SANDY LOAM; 5% Gravel; Moist, Loose	
14		
15	**End of Test Pit at 14 Feet (Cave In)**	

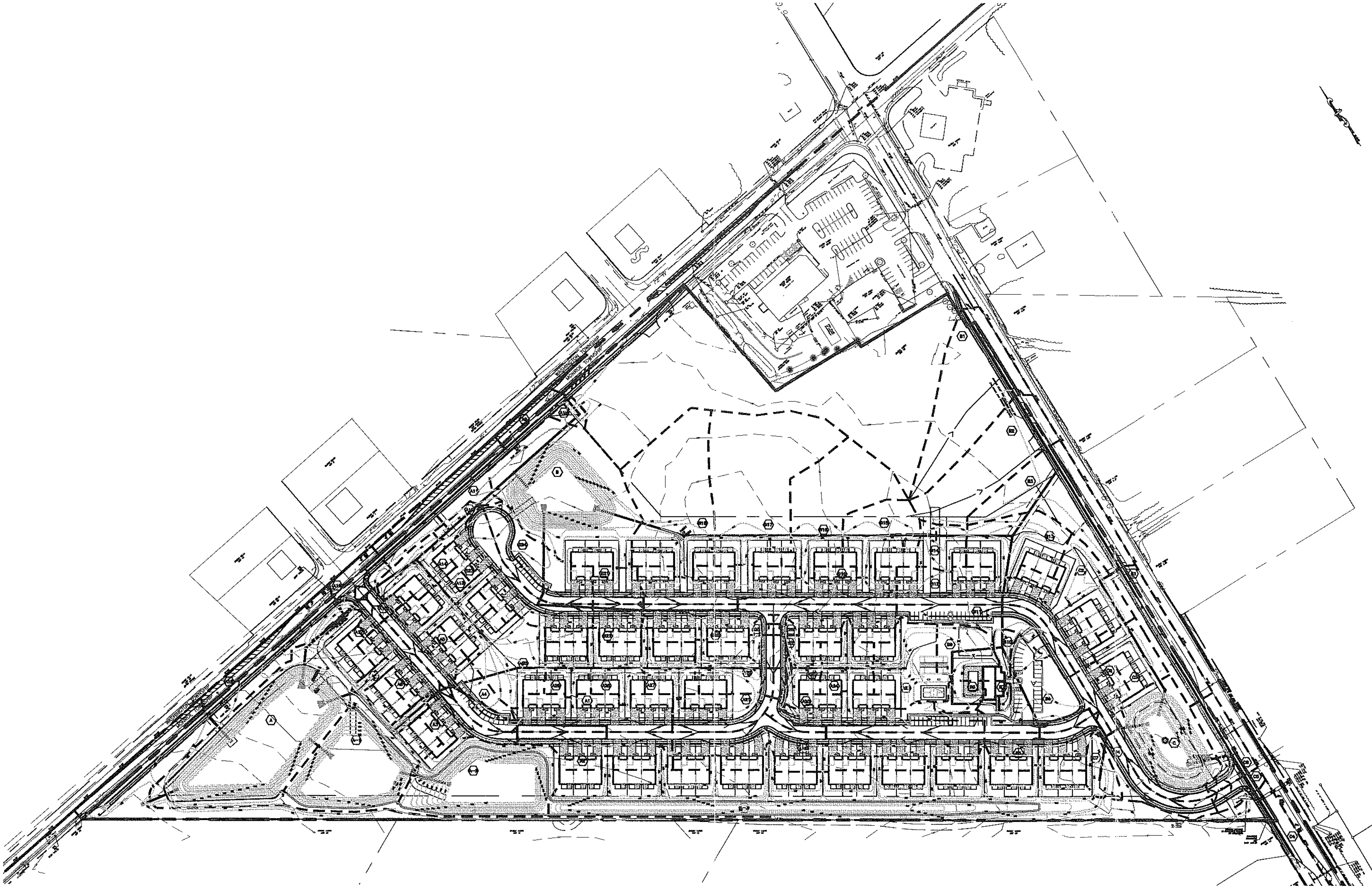
RPM ENGINEERING *With Integrity*
297 Westwood Drive, West Deptford, NJ 08096

Excavator: Scheideler Excavation
Excavation Method: Trackhoe
RPM Representative: B. Bedilion
Log Completed By: F. DeFeo
Sheet: 1 of 1

APPENDIX D

INLET & PIPE DESIGN

CONDUIT OUTLET PROTECTION DESIGN



P:\Projects\2264-02\dwg\2264-02_PDD.dwg, INLET, 4/6/2020 9:48:30 AM, hollywood, 1:1

Consulting Engineer Services
Engineers, Planners, and Land Surveyors

POST-DEVELOPED INLET DRAINAGE AREA MAP

SCALE: 1"=200'

CONSULTING ENGINEER SERVICES
PROFESSIONAL ENGINEERS

The Greens

BY: LAM DATE: 3/16/2020 JOB NO.: 2264-02

REV. BY: DATE: Time of Concentration Minimum 10.0 NOTE: Min Tc = 10.0 min. perN.J.A.C 5:21-7.(c)3.

Note: Design based on 25-year storm event

	AVERAGE "C" COEFFICIENT						TIME OF CONCENTRATION										
WATER SHED ID NO.	TOTAL AREA AC.	PERMEABLE AREA AC.	"C"	IMPERVIOUS AREA AC.	"C"	AVG. "C"	GRASS SLOPE %	LENGTH	TC	IMPERVIOUS SLOPE %	LENGTH	TC	TOTAL TC	Rainfall	RUNOFF	STRU TYPE	COMMENTS
A	1.96	1.9	0.25	0.06	0.99	0.24											
A1	0.59	0.14	0.25	0.45	0.99	0.81	2.00	44	8.1	0.70	178	3.0	11.05	6.00	2.87	E	traffic bearing grate
A2	0.47	0.1	0.25	0.37	0.99	0.83	2.00	18	5.2	0.70	188	3.1	10.00	6.20	2.42	E	traffic bearing grate
A3	0.26	0.06	0.25	0.2	0.99	0.81	2.14	43	7.8	0.70	200	3.1	10.96	6.02	1.27	B	
A4	0.27	0.13	0.25	0.14	0.99	0.62	2.90	78	9.5	0.88	143	2.5	11.98	5.82	0.97	B	
A5	0.32	0.07	0.25	0.25	0.99	0.82	2.00	36	7.3	1.71	198	2.3	10.00	6.20	1.63	B	
A6	0.32	0.06	0.25	0.26	0.99	0.85	2.88	36	6.5	1.73	186	2.3	10.00	6.20	1.69	E	traffic bearing grate
A7	0.05	0.05	0.25	0	0.99	0.22	2.00	113	12.9				12.94	5.62	0.06	E	
A8	0.06	0.06	0.25	0	0.99	0.22	2.00	95	11.9				11.86	5.84	0.08	E	
A9	0.17	0.02	0.25	0.15	0.99	0.9	2.00	10	3.8	0.74	167	2.8	10.00	6.20	0.95	B	
A10	0.07	0.07	0.25	0	0.99	0.22	6.09	64	6.7				10.00	6.20	0.10	E	
A11	0.49	0.18	0.25	0.31	0.99	0.71	2.00	10	3.8	0.35	192	3.9	10.00	6.20	2.16	B	
A12	0.08	0.08	0.25	0	0.99	0.22	2.00	76	10.6				10.61	6.08	0.11	E	
A13	0.32	0.17	0.25	0.15	0.99	0.58	2.00	110	12.8				12.77	5.66	1.05	A	
A14	0.28	0.2	0.25	0.08	0.99	0.44	2.96	115	11.5				11.47	5.92	0.73	E	
A15	0.08	0.02	0.25	0.06	0.99	0.8	2.10	36	7.2	0.79	66	1.7	10.00	6.20	0.40	B	
A16	0.21	0.06	0.25	0.15	0.99	0.77	3.00	30	5.8	0.80	132	2.4	10.00	6.20	1.00	B	
A17	0.08	0.02	0.25	0.06	0.99	0.8	2.10	35	7.1	0.79	64	1.7	10.00	6.20	0.40	B	
A18	0.54	0.16	0.25	0.38	0.99	0.76	8.60	33	4.3	1.63	356	3.2	10.00	6.20	2.54	B	
A19	1.2	0.27	0.25	0.93	0.99	0.82	2.00	36	7.3	0.70	329	4.0	11.34	5.94	5.84	E	traffic bearing grate
A20	0.65	0.17	0.25	0.48	0.99	0.79	2.00	15	4.7	0.75	337	4.0	10.00	6.20	3.18	E	traffic bearing grate
A21	0.44	0.17	0.25	0.27	0.99	0.69	3.26	35	6.1	0.83	224	3.2	10.00	6.20	1.88	B	
A22	0.14	0.06	0.25	0.08	0.99	0.66	4.03	40	6.1	0.90	133	2.4	10.00	6.20	0.57	B	
A23	0.50	0.40	0.25	0.1	0.99	0.37	3.15	130	11.9				11.95	5.82	1.08	E	
A24	0.31	0.15	0.25	0.16	0.99	0.62	2.94	109	11.2				11.19	5.98	1.15	E	
A25	0.19	0.11	0.25	0.08	0.99	0.54	2.33	91	11.0				11.04	6.00	0.62	E	
A26	0.33	0.20	0.25	0.13	0.99	0.52	2.52	151	13.9				13.86	5.44	0.93	E	
A27	0.32	0.17	0.25	0.15	0.99	0.58	2.06	160	15.2				15.25	5.18	0.96	E	

NOTE: Average "C" based upon Standards for Soil Erosion and Sediment Control, Appendix A-9, pg A9-1 and as noted in NJBMP Manual page 5-5.

CONSULTING ENGINEER SERVICES
PROFESSIONAL ENGINEERS

The Greens

BY: LAM DATE: 3/16/2020 JOB NO.: 2264-02

REV. BY: DATE: Time of Concentration Minimum 10.0 NOTE: Min Tc = 10.0 min. perN.J.A.C 5:21-7.(c)3.

Note: Design based on 25-year storm event

	AVERAGE "C" COEFFICIENT						TIME OF CONCENTRATION										
WATER SHED I.D. NO.	TOTAL AREA AC.	PERMEABLE AREA AC.	"C"	IMPERVIOUS AREA AC.	"C"	AVG. "C"	GRASS SLOPE %	LENGTH	TC	IMPERVIOUS SLOPE %	LENGTH	TC	TOTAL TC	Rainfall	RUNOFF	STRU TYPE	COMMENTS
A28	0.32	0.17	0.25	0.15	0.99	0.58	2.22	162	15.0				14.97	5.22	0.97	E	
A29	0.25	0.11	0.25	0.14	0.99	0.65	2.65	68	9.1				10.00	6.20	1.01	E	
A30	0.60	0.48	0.25	0.12	0.99	0.37	2.24	156	14.6				14.64	5.28	1.17	E	
A25a	0.04	0.02	0.25	0.021	0.99	0.61							10.00	6.20	0.16	B	
A25b	0.04	0.02	0.25	0.02	0.99	0.6							10.00	6.20	0.15	B	

NOTE: Average "C" based upon Standards for Soil Erosion and Sediment Control, Appendix A-9, pg A9-1 and as noted in NJBMP Manual page 5-5.

CONSULTING ENGINEER SERVICES
PROFESSIONAL ENGINEERS

The Greens

BY: LAM DATE: 3/16/2020 JOB NO.: 2264-02

REV. BY: DATE: Time of Concentration Minimum 10.0 NOTE: Min Tc = 10.0 min. perN.J.A.C 5:21-7.(c)3.

Note: Design based on 25-year storm event

	AVERAGE "C" COEFFICIENT						TIME OF CONCENTRATION										
WATER SHED I.D. NO.	TOTAL AREA AC.	PERMEABLE AREA AC.	"C"	IMPERVIOUS AREA AC.	"C"	AVG. "C"	GRASS SLOPE %	LENGTH	TC	IMPERVIOUS SLOPE %	LENGTH	TC	TOTAL TC	Rainfall	RUNOFF	STRU TYPE	COMMENTS
B	1.548	1.468	0.25	0.08	0.99	0.26											
B1	1.03	0.84	0.25	0.19	0.99	0.36	2.00	15	4.7	0.50	159	3.1	10.00	6.20	2.30	B	
B2	0.82	0.69	0.25	0.13	0.99	0.34	2.00	15	4.7	0.26	116	3.3	10.00	6.20	1.74	B	
B3	0.80	0.53	0.25	0.27	0.99	0.48	2.00	23	5.8	0.31	248	4.6	10.43	6.12	2.34	B	
B5	0.42	0.10	0.25	0.32	0.99	0.81	2.00	14	4.6	1.42	114	1.9	10.00	6.20	2.10	E	traffic bearing grate
B6	0.67	0.27	0.25	0.4	0.99	0.68	2.00	8	3.4	1.56	209	2.5	10.00	6.20	2.81	B	
B7	0.04	0.02	0.25	0.02	0.99	0.64	2.45	49	8.0				10.00	6.20	0.15	YD	
B8	0.14	0.09	0.25	0.05	0.99	0.49	2.00	70	10.2				10.18	6.18	0.44	E	
B9	0.31	0.27	0.25	0.04	0.99	0.32	2.00	120	13.3				13.33	5.54	0.55	E	
B10	0.09	0.08	0.25	0.01	0.99	0.31	2.00	68	10.0				10.04	6.20	0.17	E	
B11	0.43	0.12	0.25	0.31	0.99	0.78	2.00	10	3.8	0.72	208	3.2	10.00	6.20	2.06	B	
B12	0.85	0.26	0.25	0.59	0.99	0.76	3.35	23	4.9	0.70	236	3.4	10.00	6.20	3.98	E	traffic bearing grate
B13	0.54	0.39	0.25	0.15	0.99	0.43	2.20	155	14.7				14.68	5.28	1.23	E	
B14	0.22	0.12	0.25	0.1	0.99	0.57	2.64	125	12.4				12.42	5.72	0.72	E	
B15	0.50	0.40	0.25	0.1	0.99	0.37	2.78	115	11.7				11.71	5.86	1.09	E	
B16	0.91	0.83	0.25	0.08	0.99	0.29	2.72	125	12.3				12.30	5.74	1.51	E	
B17	1.48	1.39	0.25	0.09	0.99	0.27	2.42	91	10.9				10.90	6.02	2.41	E	
B18	1.17	1.05	0.25	0.12	0.99	0.3	2.30	104	11.9				11.85	5.84	2.04	E	
B19	0.95	0.44	0.25	0.51	0.99	0.64	5.49	35	5.2	0.73	322	3.9	10.00	6.20	3.75	E	traffic bearing grate
B20	0.83	0.17	0.25	0.66	0.99	0.83	2.49	35	6.7	0.71	337	4.1	10.77	6.06	4.16	E	traffic bearing grate
B21	0.18	0.10	0.25	0.08	0.99	0.56	2.57	35	6.6	0.70	105	2.3	10.00	6.20	0.63	E	traffic bearing grate
B22	0.19	0.08	0.25	0.11	0.99	0.68	2.00	35	7.2	0.70	105	2.3	10.00	6.20	0.78	E	traffic bearing grate
B23	0.67	0.29	0.25	0.38	0.99	0.66	2.00	55	9.0	0.86	222	3.1	12.13	5.78	2.54	E	traffic bearing grate
B24	0.53	0.27	0.25	0.26	0.99	0.6	2.00	28	6.4	0.95	206	2.9	10.00	6.20	1.98	E	traffic bearing grate

NOTE: Average "C" based upon Standards for Soil Erosion and Sediment Control, Appendix A-9, pg A9-1 and as noted in NJBMP Manual page 5-5.

CONSULTING ENGINEER SERVICES
PROFESSIONAL ENGINEERS

The Greens

BY: LAM DATE: 3/16/2020 JOB NO.: 2264-02

REV. BY: DATE: Time of Concentration Minimum 10.0 NOTE: Min Tc = 10.0 min. perN.J.A.C 5:21-7.(c)3.

Note: Design based on 25-year storm event

	AVERAGE "C" COEFFICIENT						TIME OF CONCENTRATION										
WATER SHED ID. NO.	TOTAL AREA AC.	PERMEABLE AREA AC.	"C"	IMPERVIOUS AREA AC.	"C"	AVG. "C"	GRASS SLOPE %	LENGTH	TC	IMPERVIOUS SLOPE %	LENGTH	TC	TOTAL TC	Rainfall	RUNOFF	STRU TYPE	COMMENTS
C	0.69	0.38	0.25	0.31	0.99	0.57											
C1	0.44	0.15	0.25	0.29	0.99	0.73	2.00	25	6.1	0.26	325	5.6	11.65	5.88	1.88	B	
C2	0.43	0.35	0.25	0.08	0.99	0.36	3.12	141	12.5				12.48	5.72	0.88	E	
C3	0.32	0.23	0.25	0.09	0.99	0.43	2.16	134	13.7				13.74	5.46	0.76	E	
C4	0.38	0.15	0.25	0.23	0.99	0.68	2.00	117	13.2	0.20	123	3.7	16.90	4.97	1.30	B	
C5	0.11	0.04	0.25	0.07	0.99	0.69	2.00	24	6.0	1.11	102	1.9	10.00	6.20	0.49	B	
C6	0.30	0.10	0.25	0.2	0.99	0.73	2.50	27	5.9	0.60	130	2.7	10.00	6.20	1.36	B	
C7	0.15	0.15	0.25	0	0.99	0.22	4.84	97	9.0				10.00	6.20	0.21	E	
C8	0.41	0.12	0.25	0.29	0.99	0.76	2.00	12.5	4.3	0.81	259	3.4	10.00	6.20	1.94	B	
B4	0.28	0.12	0.25	0.16	0.99	0.66	2.00	24	6.0	0.70	300	3.9	10.00	6.20	1.15	B	

NOTE: Average "C" based upon Standards for Soil Erosion and Sediment Control, Appendix A-9, pg A9-1 and as noted in NJBMP Manual page 5-5.

CONSULTING ENGINEER SERVICES
PROFESSIONAL ENGINEERS

The Greens

BY: LAM DATE: 3/16/2020

REV. BY: OAS DATE: 12/23/2020 JOB NO.: 2264-02

Note: Design based on 25-year storm event
N = 0.010 FOR HDPE 0.013 FOR RCP

PIPE SECTION			AREA				RUNOFF			PIPE DESIGN DATA								RIM / GRATE		INVERT		PIPE CLASS		COMMENTS
WATER SHED ID NO.	FROM	TO	INCRE. ACRES	AVG "C"	EQUIV. AREA C*A	TOTAL AREA C*A	TC MIN.	I IN./HR.	TOTAL RUNOFF CFS	SLOPE OF PIPE %	DIA. OF PIPE IN.	LENGTH FT.	N	FLOW TIME MIN.	FULL CAPACITY CFS	FULL VELOCITY FPS	DESIGN VELOCITY FPS	UPPER END	LOWER END	UPPER END	LOWER END	UPPER END	LOWER END	
A3	A3	A4	0.26	0.81	0.21	0.21	11.0	6.0	1.27	0.35	15	30	0.013	0.16	3.82	3.11	2.80	158.33	158.33	154.70	154.60	III	III	
A2	A2	A1	0.47	0.83	0.39	0.39	10.0	6.2	2.42	0.35	15	26	0.013	0.14	3.82	3.11	3.29	157.16	157.16	155.00	154.91	V	V	
A1	A1	A4	0.59	0.81	0.48	0.87	11.0	6.0	5.21	0.40	18	191	0.013	0.85	6.64	3.76	4.16	157.16	158.33	154.33	153.57	IV	III	
A4	A4	A5	0.27	0.62	0.17	1.25	11.9	5.8	7.28	0.50	18	162	0.013	0.64	7.43	4.20	4.79	158.33	159.72	153.57	152.76	III	III	
A5	A5	A6	0.32	0.82	0.26	4.86	16.9	5.0	24.22	0.20	36	30	0.013	0.12	29.83	4.22	4.70	159.72	159.89	146.92	146.86	III	III	
A6	A6	A7	0.32	0.85	0.27	5.13	17.0	5.0	25.51	0.20	36	132	0.012	0.48	32.31	4.57	5.06	159.89	158.00	146.86	146.59	ok	ok	
A7	A7	A8	0.05	0.22	0.01	5.14	17.5	4.9	25.26	0.18	36	115	0.012	0.44	30.66	4.34	4.84	158.00	159.00	146.59	146.39	ok	ok	
A8	A8	FES1a	0.06	0.22	0.01	5.16	17.9	4.9	25.08	0.20	36	71	0.012	0.26	32.31	4.57	5.05	159.00		146.39	146.25	ok	FES	FES BSN A 146.25
A19	A19	A20	1.20	0.82	0.98	0.98	11.3	5.9	5.84	0.85	15	26	0.013	0.09	5.96	4.85	5.53	155.33	155.33	152.55	152.33	III	III	
A20	A20	MH3a	0.65	0.79	0.51	1.50	11.4	5.9	8.87	0.80	18	67	0.013	0.21	9.40	5.32	6.05	155.33	155.86	152.08	151.55	III	III	
MH3a	MH3a	A22				1.50	11.6	5.9	8.81	0.75	18	65	0.013	0.21	9.10	5.15	5.86	155.86	156.19	151.55	151.06	III	III	
A21	A21	A22	0.44	0.69	0.30	0.30	10.0	6.2	1.88	0.50	15	30	0.013	0.13	4.57	3.72	3.54	156.19	156.19	152.40	152.25	III	III	
A22	A22	A25	0.14	0.66	0.09	1.89	11.8	5.8	11.06	0.24	24	71	0.013	0.34	11.08	3.53	4.02	156.19	155.70	150.56	150.39	III	III	
A23	A23	A24	0.50	0.37	0.19	0.19	11.9	5.8	1.08	0.55	15	125	0.012	0.49	5.19	4.23	3.33	155.50	155.90	152.50	151.81	ok	ok	
A24	A24	A25	0.31	0.62	0.19	0.38	12.4	5.7	2.16	0.57	15	117	0.012	0.45	5.28	4.31	4.08	155.90	155.70	151.81	151.14	ok	ok	
A25	A25	A26	0.19	0.54	0.10	2.42	12.9	5.6	13.67	0.37	24	115	0.013	0.44	13.76	4.38	4.99	155.70	156.00	150.39	149.97	III	III	
A26	A26	A27	0.33	0.52	0.17	2.60	13.9	5.4	14.12	0.35	24	127	0.012	0.46	14.50	4.62	5.26	156.00	156.30	149.97	149.52	ok	ok	

CONSULTING ENGINEER SERVICES
PROFESSIONAL ENGINEERS

The Greens

BY: LAM　　DATE: 3/16/2020

REV. BY: OAS　　DATE: 12/23/2020　　JOB NO.: 2264-02

Note: Design based on 25-year storm event
N = 0.010 FOR HDPE　　0.013 FOR RCP

PIPE SECTION			AREA				RUNOFF			PIPE DESIGN DATA								RIM / GRATE		INVERT		PIPE CLASS		COMMENTS
WATER SHED ID NO.	FROM	TO	INCRE. ACRES	AVG "C"	EQUIV. AREA C*A	TOTAL AREA C*A	TC MIN.	I IN./HR.	TOTAL RUNOFF CFS	SLOPE OF PIPE %	DIA. OF PIPE IN.	LENGTH FT.	N	FLOW TIME MIN.	FULL CAPACITY CFS	FULL VELOCITY FPS	DESIGN VELOCITY FPS	UPPER END	LOWER END	UPPER END	LOWER END	UPPER END	LOWER END	
A27	A27	A28	0.32	0.58	0.19	2.78	15.2	5.2	14.39	0.35	24	115	0.012	0.42	14.50	4.62	5.26	156.30	157.00	149.52	149.12	ok	ok	
A28	A28	A29	0.32	0.58	0.19	2.97	15.7	5.1	15.21	0.40	24	115	0.012	0.39	15.50	4.93	5.62	157.00	157.80	149.12	148.66	ok	ok	
A29	A29	A30	0.25	0.65	0.16	3.13	16.1	5.1	15.89	0.45	24	115	0.012	0.37	16.44	5.23	5.96	157.80	157.30	148.66	148.14	ok	ok	
A30	A30	A5	0.60	0.37	0.22	3.35	16.4	5.0	16.86	0.50	24	145	0.012	0.44	17.33	5.52	6.29	157.30	159.72	148.14	147.42	ok	ok	
A9	A9	A10	0.17	0.90	0.15	0.15	10.0	6.2	0.95	2.80	18	50	0.013	0.08	17.58	9.95	5.29	159.06	157.15	154.50	153.10	III	III	
A10	A10	MH1a	0.07	0.22	0.02	0.17	10.1	6.2	1.04	0.35	15	186	0.012	0.92	4.14	3.37	2.81	157.15	159.20	153.10	152.45	ok	ok	
	OFSB	MH1a	100 YR Storm HydroCAD Outflow						24.32	0.28	36	42	0.012	0.13	38.23	5.41	5.73	155.85	159.20	148.00	147.88	ok	ok	100 YR WSE from B
	MH1a	A12				0.17	10.1	6.2	25.36	0.28	36	185	0.012	0.57	38.23	5.41	5.78	159.20	160.00	147.88	147.36	ok	ok	100 YR WSE from B
A11	A11	A12	0.49	0.71	0.35	0.35	10.0	6.2	2.16	1.60	18	50	0.013	0.11	13.29	7.52	5.52	159.57	160.00	155.73	154.93	III	III	
A12	A12	A14	0.08	0.22	0.02	0.53	10.7	6.1	27.57	0.28	36	94	0.012	0.29	38.23	5.41	5.88	160.00	159.40	147.36	147.10	ok	ok	100 YR WSE from B
A13	A13	A14	0.32	0.58	0.19	0.19	12.8	5.7	1.05	0.35	15	125	0.012	0.62	4.14	3.37	2.82	158.70	159.40	155.50	155.06	ok	ok	
A14	A14	A15	0.28	0.44	0.12	0.84	13.4	5.5	28.99	0.23	36	121	0.012	0.41	34.65	4.90	5.49	159.40	160.21	147.10	146.82	ok	ok	100 YR WSE from B
A15	A15	A17	0.08	0.8	0.06	0.91	13.8	5.5	29.27	0.23	36	30	0.013	0.11	31.99	4.53	5.13	160.21	160.06	146.82	146.75	III	III	100 YR WSE from B
A16	A16	A17	0.21	0.77	0.16	0.16	10.0	6.2	1.00	0.28	18	51	0.013	0.27	5.56	3.15	2.38	159.35	160.06	156.30	156.16	III	III	
A17	A17	MH2a	0.08	0.8	0.06	1.13	13.9	5.4	30.46	0.23	36	151	0.013	0.56	31.99	4.53	5.15	160.06	158.00	146.75	146.41	III	III	100 YR WSE from B

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CONSULTING ENGINEER SERVICES
PROFESSIONAL ENGINEERS

The Greens

BY: LAM DATE: 3/16/2020

REV. BY: OAS DATE: 12/23/2020 JOB NO.: 2264-02

Note: Design based on 25-year storm event
N = 0.010 FOR HDPE 0.013 FOR RCP

PIPE SECTION			AREA				RUNOFF			PIPE DESIGN DATA								RIM / GRATE		INVERT		PIPE CLASS		COMMENTS
WATER SHED ID NO.	FROM	TO	INCRE. ACRES	AVG "C"	EQUIV. AREA C*A	TOTAL AREA C*A	TC MIN.	I IN./HR.	TOTAL RUNOFF CFS	SLOPE OF PIPE %	DIA. OF PIPE IN.	LENGTH FT.	N	FLOW TIME MIN.	FULL CAPACITY CFS	FULL VELOCITY FPS	DESIGN VELOCITY FPS	UPPER END	LOWER END	UPPER END	LOWER END	UPPER END	LOWER END	
	MH2a	FES2a				1.13	14.5	5.3	30.34	0.23	36	67	0.012	0.23	34.65	4.90	5.53	158.00		146.41	146.25	ok	FES	100 YR WSE from B
A18	A18	FES3a	0.54	0.76	0.41	0.41	10.0	6.2	2.54	2.32	18	75	0.013	0.14	16.00	9.05	6.62	154.21		148.00	146.25	III	FES	FES BSN A 146.25
A25a	A25a	A25b	0.04	0.61	0.03	0.03	10.0	6.2	0.16	1	15	30	0.013	0.09	6.46	5.26	2.21	157.10	157.10	154.00	153.70	III	III	
A25b	A25b	A25	0.04	0.6	0.02	0.05	10.1	6.2	0.31	1	15	96	0.012	0.28	7.00	5.70	2.87	157.10	155.70	153.70	152.74	ok	ok	

CONSULTING ENGINEER SERVICES
PROFESSIONAL ENGINEERS

The Greens

BY: LAM   DATE: 3/16/2020

REV. BY: OAS   DATE: 12/23/2020   JOB NO.: 2264-02

Note: Design based on 25-year storm event
N = 0.010 FOR HDPE   0.013 FOR RCP

PIPE SECTION			AREA				RUNOFF			PIPE DESIGN DATA								RIM / GRATE		INVERT		PIPE CLASS		COMMENTS
WATER SHED ID NO.	FROM	TO	INCRE. ACRES	AVG "C"	EQUIV. AREA C*A	TOTAL AREA C*A	TC MIN.	I IN./HR.	TOTAL RUNOFF CFS	SLOPE OF PIPE %	DIA. OF PIPE IN.	LENGTH FT.	N	FLOW TIME MIN.	FULL CAPACITY CFS	FULL VELOCITY FPS	DESIGN VELOCITY FPS	UPPER END	LOWER END	UPPER END	LOWER END	UPPER END	LOWER END	
B1	B1	B2	1.03	0.36	0.37	0.37	10.0	6.2	2.30	0.28	18	213	0.013	1.13	5.56	3.15	2.99	156.69	157.55	153.28	152.68	III	III	
B2	B2	B3	0.82	0.34	0.28	0.65	11.1	6.0	3.90	0.28	18	176	0.013	0.93	5.56	3.15	3.40	157.55	157.68	152.68	152.19	III	III	
B3	B3	B13	0.80	0.48	0.38	1.03	12.1	5.8	6.00	0.35	18	183	0.013	0.87	6.21	3.52	4.01	157.68	157.00	152.19	151.55	III	III	
		B4	100 YR Storm HydroCad Outflow BsnC						2.57	0.35	15	88	0.012	0.43	4.14	3.37	3.55							B4 weir OFS from BsnC
B4	B4	MH1b	0.28	0.66	0.18	0.18	10.0	6.2	3.72	0.50	15	67	0.013	0.30	4.57	3.72	4.15	158.18	158.76	154.00	153.66	III	III	
MH1b	MH1b	B6				0.18	10.3	6.1	3.70	0.99	15	112	0.013	0.35	6.43	5.24	5.42	158.76	156.76	153.66	152.56	III	III	
B5	B5	B6	0.42	0.81	0.34	0.34	10.0	6.2	2.10	0.60	15	28	0.013	0.11	5.00	4.08	3.90	156.93	156.76	152.73	152.56	III	III	
B6	B6	B10	0.67	0.68	0.45	0.79	10.7	6.1	7.39	0.20	24	183	0.013	0.94	10.22	3.25	3.54	156.76	158.00	151.81	151.44	III	III	
B7	B7	B8	0.04	0.64	0.02	0.02	10.0	6.2	0.15	0.70	15	108	0.012	0.38	5.86	4.77	2.02	158.10	157.20	154.00	153.24	ok	ok	
B8	B8	B9	0.14	0.49	0.07	0.09	10.4	6.1	0.58	0.35	15	110	0.012	0.54	4.14	3.37	2.37	157.20	157.00	153.24	152.86	ok	ok	
B9	B9	B10	0.31	0.32	0.10	0.19	13.3	5.5	1.08	0.35	15	106	0.012	0.53	4.14	3.37	2.83	157.00	158.00	152.86	152.48	ok	ok	
B10	B10	B11	0.09	0.31	0.03	1.01	13.9	5.4	8.09	0.20	24	75	0.012	0.35	11.07	3.52	3.84	158.00	157.62	151.44	151.29	ok	ok	
B11	B11	B12	0.43	0.78	0.33	1.35	14.2	5.4	9.79	0.20	24	28	0.013	0.14	10.12	3.22	3.67	157.62	157.79	151.29	151.23	III	III	
B12	B12	B13	0.85	0.76	0.64	1.99	14.4	5.3	13.19	0.30	24	132	0.012	0.51	13.42	4.27	4.87	157.79	157.00	151.23	150.83	ok	ok	
B13	B13	B14	0.54	0.43	0.23	3.26	14.9	5.2	19.63	0.20	30	140	0.012	0.58	19.87	4.05	4.62	157.00	158.20	150.33	150.05	ok	ok	
B14	B14	B15	0.22	0.57	0.13	3.38	15.5	5.2	20.00	0.21	30	172	0.012	0.69	20.36	4.15	4.73	158.20	157.00	150.05	149.69	ok	ok	
B15	B15	B16	0.5	0.37	0.19	3.57	16.1	5.1	20.66	0.12	36	130	0.012	0.61	25.03	3.54	3.95	157.00	156.40	149.19	149.04	ok	ok	
B16	B16	B17	0.91	0.29	0.26	3.83	16.8	5.0	21.71	0.12	36	130	0.012	0.62	24.82	3.51	3.96	156.40	155.00	149.04	148.88	ok	ok	

CONSULTING ENGINEER SERVICES
PROFESSIONAL ENGINEERS

The Greens

BY: LAM DATE: 3/16/2020

REV. BY: OAS DATE: 12/23/2020 JOB NO.: 2264-02

Note: Design based on 25-year storm event
N = 0.010 FOR HDPE 0.013 FOR RCP

PIPE SECTION			AREA				RUNOFF			PIPE DESIGN DATA								RIM / GRATE		INVERT		PIPE CLASS		COMMENTS
WATER SHED ID NO.	FROM	TO	INCRE. ACRES	AVG "C"	EQUIV. AREA C*A	TOTAL AREA C*A	TC MIN.	I IN./HR.	TOTAL RUNOFF CFS	SLOPE OF PIPE %	DIA. OF PIPE IN.	LENGTH FT.	N	FLOW TIME MIN.	FULL CAPACITY CFS	FULL VELOCITY FPS	DESIGN VELOCITY FPS	UPPER END	LOWER END	UPPER END	LOWER END	UPPER END	LOWER END	
B17	B17	B18	1.48	0.27	0.40	4.23	17.4	4.9	23.41	0.12	36	130	0.012	0.61	25.03	3.54	4.02	155.00	155.00	148.88	148.73	ok	ok	
B18	B18	FES1b	1.17	0.3	0.35	4.58	18.0	4.9	24.80	0.12	36	186	0.012	0.87	25.03	3.54	4.04	155.00		148.73	148.50	ok		FES to Basin B
B19	B19	B20	0.95	0.64	0.61	0.61	10.0	6.2	3.75	0.28	18	26	0.013	0.14	5.56	3.15	3.38	156.90	156.90	153.85	153.78	III	III	
B20	B20	B22	0.83	0.83	0.69	1.29	10.8	6.1	7.83	0.35	21	201	0.013	0.86	9.37	3.90	4.36	156.90	158.33	153.53	152.82	III	III	
B21	B21	B22	0.18	0.56	0.10	0.10	10.0	6.2	0.63	0.35	15	26	0.013	0.14	3.82	3.11	2.30	158.33	158.33	154.52	154.43	III	III	
B22	B22	B23	0.19	0.68	0.13	1.52	11.6	5.9	8.94	0.45	21	226	0.013	0.85	10.63	4.42	4.95	158.33	158.31	152.82	151.80	III	III	
B23	B23	B24	0.67	0.66	0.44	1.96	12.5	5.7	11.21	0.35	24	28	0.013	0.11	13.38	4.26	4.77	158.31	158.31	149.37	149.27	III	III	
B24	B24	FES2b	0.53	0.6	0.32	2.28	12.6	5.7	12.99	0.45	24	172	0.013	0.59	15.18	4.83	5.43	158.31		149.27	148.50	III		FES to Basin B

CONSULTING ENGINEER SERVICES
PROFESSIONAL ENGINEERS

The Greens

BY: LAM DATE: 3/16/2020

REV. BY: OAS DATE: 12/23/2020 JOB NO.: 2264-02

Note: Design based on 25-year storm event
N = 0.010 FOR HDPE 0.013 FOR RCP

PIPE SECTION			AREA				RUNOFF			PIPE DESIGN DATA								RIM / GRATE		INVERT		PIPE CLASS		COMMENTS
WATER SHED ID NO.	FROM	TO	INCRE. ACRES	AVG "C"	EQUIV. AREA C*A	TOTAL AREA C*A	TC MIN.	I IN./HR.	TOTAL RUNOFF CFS	SLOPE OF PIPE %	DIA. OF PIPE IN.	LENGTH FT.	N	FLOW TIME MIN.	FULL CAPACITY CFS	FULL VELOCITY FPS	DESIGN VELOCITY FPS	UPPER END	LOWER END	UPPER END	LOWER END	UPPER END	LOWER END	
C1	C1	C2	0.44	0.73	0.32	0.32	11.7	5.9	1.88	0.35	18	50	0.013	0.24	6.21	3.52	3.08	158.28	157.00	153.00	152.83	III	III	18" rqd in cnty rd
C2	C2	C3	0.43	0.36	0.15	0.47	12.5	5.7	2.71	0.35	15	160	0.012	0.79	4.14	3.37	3.60	157.00	158.00	152.83	152.27	ok	ok	
C3	C3	MH1c	0.32	0.43	0.14	0.61	13.7	5.5	3.34	0.35	15	110	0.012	0.54	4.16	3.39	3.77	158.00	159.00	152.27	151.88	ok	ok	
MH1c	MH1c	FES1c				0.61	14.3	5.4	3.28	0.35	15	47	0.012	0.23	4.14	3.37	3.74	159.00		149.16	149.00	ok		FES to Basin C
C4	C4	C5	0.38	0.68	0.26	0.26	16.9	5.0	1.30	0.35	18	146	0.013	0.70	6.17	3.49	2.76	157.70	158.16	154.36	153.86	III	III	
C5	C5	C6	0.11	0.69	0.08	0.34	17.6	4.9	1.66	0.28	18	94	0.013	0.50	5.56	3.15	2.74	158.16	158.51	149.80	149.54	III	III	
C6	C6	FES2c	0.30	0.73	0.22	0.56	18.1	4.8	2.70	0.63	18	85	0.013	0.30	8.34	4.72	4.20	158.51		149.54	149.00	III		FES to Basin C
C7	C7	B4	0.15	0.22	0.03	0.03	10.0	6.2	0.40	0.35	15	93	0.013	0.50	3.82	3.11	2.01	157.30	158.18	154.00	153.67	III	III	
B4	B4	C8	0.28	0.66	0.18	0.22	10.5	6.1	1.33	0.35	15	30	0.013	0.16	3.84	3.13	2.84	158.18	158.18	153.67	153.57	III	III	
C8	C8	FES3c	0.41	0.76	0.31	0.53	10.7	6.1	3.23	0.50	15	58	0.012	0.24	4.95	4.03	4.29	158.18		149.29	149.00	ok		FES to Basin C

NEW JERSEY SOIL EROSION & SEDIMENT CONTROL STANDARDS
FOR
CONDUIT OUTLET PROTECTION

Structure: **FES 1a**

Date:
Page:

DESIGN CRITERIA:		APRON DIMENSIONS:	
Design Storm	25 yr	Length (La)	14.5 Ft
Flow Rate, Q=	25.08 CFS	Width @ Culvert (3D)	9.0 Ft
Pipe Horiz Dim.=	36 In	Width @ End (W)	14.8 Ft
Pipe Vert Dim.=	36 In	D(50) calc.	1 in
Tailwater Depth=	2.86 Ft	D(50) to be used	4 in
Filter Fabric Used?	Y (Y/N)	Thickness (F)	8 in
D(50) min.	4 in	Volume	4.29 cy.

SCOUR HOLE DIMENSIONS:		SCOUR HOLE DIMENSIONS:	
Depth of Hole (E)	1.5 Ft	Depth of Hole (E)	3.0 Ft
Length of Bottom (A)	9.0 Ft	Length of Bottom (A)	9.0 Ft
Width of Bottom (C)	6.0 Ft	Width of Bottom (C)	6.0 Ft
Length of Scour Hole (B)	18.0 Ft	Length of Scour Hole (B)	27.0 Ft
Width of Scour Hole (D)	15.0 Ft	Width of Scour Hole (D)	24.0 Ft
D(50) calc.	1 in	D(50) calc.	1 in
D(50) to be used	4 in	D(50) to be used	4 in
Thickness (F)	8 in	Thickness (F)	8 in
Volume	6.67 cy.	Volume	16.00 cy.

Structure: **FES 2a**

DESIGN CRITERIA:		APRON DIMENSIONS:	
Design Storm	25 yr	Length (La)	17.5 Ft
Flow Rate, Q=	30.34 CFS	Width @ Culvert (3D)	9.0 Ft
Pipe Horiz Dim.=	36 In	Width @ End (W)	16.0 Ft
Pipe Vert Dim.=	36 In	D(50) calc.	1 in
Tailwater Depth=	2.86 Ft	D(50) to be used	4 in
Filter Fabric Used?	Y (Y/N)	Thickness (t)	8 in
D(50) min.	4 in	Volume	5.24 cy.

SCOUR HOLE DIMENSIONS:		SCOUR HOLE DIMENSIONS:	
Depth of Hole (E)	1.5 Ft	Depth of Hole (E)	3.0 Ft
Length of Bottom (A)	9.0 Ft	Length of Bottom (A)	9.0 Ft
Width of Bottom (C)	6.0 Ft	Width of Bottom (C)	6.0 Ft
Length of Scour Hole (B)	18.0 Ft	Length of Scour Hole (B)	27.0 Ft
Width of Scour Hole (D)	15.0 Ft	Width of Scour Hole (D)	24.0 Ft
D(50) calc.	1 in	D(50) calc.	1 in
D(50) to be used	4 in	D(50) to be used	4 in
Thickness (F)	8 in	Thickness (F)	8 in
Volume	6.67 cy.	Volume	16.00 cy.

NOTE: Use Boxed Dimensions

NEW JERSEY SOIL EROSION & SEDIMENT CONTROL STANDARDS
FOR
CONDUIT OUTLET PROTECTION

Structure: **FES 3a** | Date: | Page:

DESIGN CRITERIA:		APRON DIMENSIONS:	
Design Storm	25 yr	Length (La)	4.2 Ft
Flow Rate, Q=	2.54 CFS	Width @ Culvert (3D)	4.5 Ft
Pipe Horiz Dim.=	18 In	Width @ End (W)	6.2 Ft
Pipe Vert Dim.=	18 In	D(50) calc.	0 in
Tailwater Depth=	2.86 Ft	D(50) to be used	4 in
Filter Fabric Used?	Y (Y/N)	Thickness (F)	8 in
D(50) min.	4 in	Volume	0.66 cy.

SCOUR HOLE DIMENSIONS:		SCOUR HOLE DIMENSIONS:	
Depth of Hole (E)	0.8 Ft	Depth of Hole (E)	1.5 Ft
Length of Bottom (A)	4.5 Ft	Length of Bottom (A)	4.5 Ft
Width of Bottom (C)	3.0 Ft	Width of Bottom (C)	3.0 Ft
Length of Scour Hole (B)	9.0 Ft	Length of Scour Hole (B)	13.5 Ft
Width of Scour Hole (D)	7.5 Ft	Width of Scour Hole (D)	12.0 Ft
D(50) calc.	0 in	D(50) calc.	0 in
D(50) to be used	4 in	D(50) to be used	4 in
Thickness (F)	8 in	Thickness (F)	8 in
Volume	1.67 cy.	Volume	4.00 cy.

Structure: **FES 5a**

DESIGN CRITERIA:		APRON DIMENSIONS:	
Design Storm	100 yr	Length (La)	14.3 Ft
Flow Rate, Q=	4.33 CFS	Width @ Culvert (3D)	3.8 Ft
Pipe Horiz Dim.=	15 In	Width @ End (W)	18.1 Ft
Pipe Vert Dim.=	15 In	D(50) calc.	4 in
Tailwater Depth=	0.25 Ft	D(50) to be used	4 in
Filter Fabric Used?	Y (Y/N)	Thickness (t)	8 in
D(50) min.	4 in	Volume	4.06 cy.

SCOUR HOLE DIMENSIONS:		SCOUR HOLE DIMENSIONS:	
Depth of Hole (E)	0.6 Ft	Depth of Hole (E)	1.3 Ft
Length of Bottom (A)	3.8 Ft	Length of Bottom (A)	3.8 Ft
Width of Bottom (C)	2.5 Ft	Width of Bottom (C)	2.5 Ft
Length of Scour Hole (B)	7.5 Ft	Length of Scour Hole (B)	11.3 Ft
Width of Scour Hole (D)	6.3 Ft	Width of Scour Hole (D)	10.0 Ft
D(50) calc.	3 in	D(50) calc.	2 in
D(50) to be used	4 in	D(50) to be used	4 in
Thickness (F)	8 in	Thickness (F)	8 in
Volume	1.16 cy.	Volume	2.78 cy.

NOTE: Use Boxed Dimensions

NEW JERSEY SOIL EROSION & SEDIMENT CONTROL STANDARDS
FOR
CONDUIT OUTLET PROTECTION

Structure: **FES 1-A1**

Date:
Page:

DESIGN CRITERIA:		APRON DIMENSIONS:	
Design Storm	25 yr	Length (La)	12.2 Ft
Flow Rate, Q=	11.50 CFS	Width @ Culvert (3D)	6.0 Ft
Pipe Horiz Dim.=	24 In	Width @ End (W)	10.9 Ft
Pipe Vert Dim.=	24 In	D(50) calc.	1 in
Tailwater Depth=	2.11 Ft	D(50) to be used	4 in
Filter Fabric Used?	Y (Y/N)	Thickness (F)	8 in
D(50) min.	4 in	Volume	2.44 cy.

SCOUR HOLE DIMENSIONS:		SCOUR HOLE DIMENSIONS:	
Depth of Hole (E)	1.0 Ft	Depth of Hole (E)	2.0 Ft
Length of Bottom (A)	6.0 Ft	Length of Bottom (A)	6.0 Ft
Width of Bottom (C)	4.0 Ft	Width of Bottom (C)	4.0 Ft
Length of Scour Hole (B)	12.0 Ft	Length of Scour Hole (B)	18.0 Ft
Width of Scour Hole (D)	10.0 Ft	Width of Scour Hole (D)	16.0 Ft
D(50) calc.	1 in	D(50) calc.	0 in
D(50) to be used	4 in	D(50) to be used	4 in
Thickness (F)	8 in	Thickness (F)	8 in
Volume	2.96 cy.	Volume	7.11 cy.

Structure: **FES 1-A2**

DESIGN CRITERIA:		APRON DIMENSIONS:	
Design Storm	25 yr	Length (La)	8.4 Ft
Flow Rate, Q=	7.96 CFS	Width @ Culvert (3D)	6.0 Ft
Pipe Horiz Dim.=	24 In	Width @ End (W)	9.4 Ft
Pipe Vert Dim.=	24 In	D(50) calc.	0 in
Tailwater Depth=	4.82 Ft	D(50) to be used	4 in
Filter Fabric Used?	Y (Y/N)	Thickness (t)	8 in
D(50) min.	4 in	Volume	1.67 cy.

SCOUR HOLE DIMENSIONS:		SCOUR HOLE DIMENSIONS:	
Depth of Hole (E)	1.0 Ft	Depth of Hole (E)	2.0 Ft
Length of Bottom (A)	6.0 Ft	Length of Bottom (A)	6.0 Ft
Width of Bottom (C)	4.0 Ft	Width of Bottom (C)	4.0 Ft
Length of Scour Hole (B)	12.0 Ft	Length of Scour Hole (B)	18.0 Ft
Width of Scour Hole (D)	10.0 Ft	Width of Scour Hole (D)	16.0 Ft
D(50) calc.	0 in	D(50) calc.	0 in
D(50) to be used	4 in	D(50) to be used	4 in
Thickness (F)	8 in	Thickness (F)	8 in
Volume	2.96 cy.	Volume	7.11 cy.

NOTE: Use Boxed Dimensions

NEW JERSEY SOIL EROSION & SEDIMENT CONTROL STANDARDS
FOR
CONDUIT OUTLET PROTECTION

Structure: **FES 1b**

Date:
Page:

DESIGN CRITERIA:		APRON DIMENSIONS:	
Design Storm	25 yr	Length (La)	14.3 Ft
Flow Rate, Q=	24.80 CFS	Width @ Culvert (3D)	9.0 Ft
Pipe Horiz Dim.=	36 In	Width @ End (W)	14.7 Ft
Pipe Vert Dim.=	36 In	D(50) calc.	1 in
Tailwater Depth=	3.30 Ft	D(50) to be used	4 in
Filter Fabric Used?	Y (Y/N)	Thickness (F)	8 in
D(50) min.	4 in	Volume	4.24 cy.

SCOUR HOLE DIMENSIONS:		SCOUR HOLE DIMENSIONS:	
Depth of Hole (E)	1.5 Ft	Depth of Hole (E)	3.0 Ft
Length of Bottom (A)	9.0 Ft	Length of Bottom (A)	9.0 Ft
Width of Bottom (C)	6.0 Ft	Width of Bottom (C)	6.0 Ft
Length of Scour Hole (B)	18.0 Ft	Length of Scour Hole (B)	27.0 Ft
Width of Scour Hole (D)	15.0 Ft	Width of Scour Hole (D)	24.0 Ft
D(50) calc.	1 in	D(50) calc.	0 in
D(50) to be used	4 in	D(50) to be used	4 in
Thickness (F)	8 in	Thickness (F)	8 in
Volume	6.67 cy.	Volume	16.00 cy.

Structure: **FES 2b**

DESIGN CRITERIA:		APRON DIMENSIONS:	
Design Storm	25 yr	Length (La)	13.8 Ft
Flow Rate, Q=	12.99 CFS	Width @ Culvert (3D)	6.0 Ft
Pipe Horiz Dim.=	24 In	Width @ End (W)	11.5 Ft
Pipe Vert Dim.=	24 In	D(50) calc.	1 in
Tailwater Depth=	3.30 Ft	D(50) to be used	4 in
Filter Fabric Used?	Y (Y/N)	Thickness (t)	8 in
D(50) min.	4 in	Volume	2.81 cy.

SCOUR HOLE DIMENSIONS:		SCOUR HOLE DIMENSIONS:	
Depth of Hole (E)	1.0 Ft	Depth of Hole (E)	2.0 Ft
Length of Bottom (A)	6.0 Ft	Length of Bottom (A)	6.0 Ft
Width of Bottom (C)	4.0 Ft	Width of Bottom (C)	4.0 Ft
Length of Scour Hole (B)	12.0 Ft	Length of Scour Hole (B)	18.0 Ft
Width of Scour Hole (D)	10.0 Ft	Width of Scour Hole (D)	16.0 Ft
D(50) calc.	1 in	D(50) calc.	0 in
D(50) to be used	4 in	D(50) to be used	4 in
Thickness (F)	8 in	Thickness (F)	8 in
Volume	2.96 cy.	Volume	7.11 cy.

NOTE: Use Boxed Dimensions

NEW JERSEY SOIL EROSION & SEDIMENT CONTROL STANDARDS
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Structure: **FES 1c** Date:
Page:

DESIGN CRITERIA:			APRON DIMENSIONS:		
Design Storm	25	yr	Length (La)	8.9	Ft
Flow Rate, Q=	4.14	CFS	Width @ Culvert (3D)	3.8	Ft
Pipe Horiz Dim.=	15	In	Width @ End (W)	7.3	Ft
Pipe Vert Dim.=	15	In	D(50) calc.	0	in
Tailwater Depth=	5.93	Ft	D(50) to be used	4	in
Filter Fabric Used?	Y	(Y/N)	Thickness (F)	8	in
D(50) min.	4	in	Volume	1.14	cy.

SCOUR HOLE DIMENSIONS:			SCOUR HOLE DIMENSIONS:		
Depth of Hole (E)	0.6	Ft	Depth of Hole (E)	1.3	Ft
Length of Bottom (A)	3.8	Ft	Length of Bottom (A)	3.8	Ft
Width of Bottom (C)	2.5	Ft	Width of Bottom (C)	2.5	Ft
Length of Scour Hole (B)	7.5	Ft	Length of Scour Hole (B)	11.3	Ft
Width of Scour Hole (D)	6.3	Ft	Width of Scour Hole (D)	10.0	Ft
D(50) calc.	0	in	D(50) calc.	0	in
D(50) to be used	4	in	D(50) to be used	4	in
Thickness (F)	8	in	Thickness (F)	8	in
Volume	1.16	cy.	Volume	2.78	cy.

Structure: **FES 2c**

DESIGN CRITERIA:			APRON DIMENSIONS:		
Design Storm	25	yr	Length (La)	13.6	Ft
Flow Rate, Q=	8.34	CFS	Width @ Culvert (3D)	4.5	Ft
Pipe Horiz Dim.=	18	In	Width @ End (W)	9.9	Ft
Pipe Vert Dim.=	18	In	D(50) calc.	0	in
Tailwater Depth=	5.93	Ft	D(50) to be used	4	in
Filter Fabric Used?	Y	(Y/N)	Thickness (t)	8	in
D(50) min.	4	in	Volume	2.22	cy.

SCOUR HOLE DIMENSIONS:			SCOUR HOLE DIMENSIONS:		
Depth of Hole (E)	0.8	Ft	Depth of Hole (E)	1.5	Ft
Length of Bottom (A)	4.5	Ft	Length of Bottom (A)	4.5	Ft
Width of Bottom (C)	3.0	Ft	Width of Bottom (C)	3.0	Ft
Length of Scour Hole (B)	9.0	Ft	Length of Scour Hole (B)	13.5	Ft
Width of Scour Hole (D)	7.5	Ft	Width of Scour Hole (D)	12.0	Ft
D(50) calc.	0	in	D(50) calc.	0	in
D(50) to be used	4	in	D(50) to be used	4	in
Thickness (F)	8	in	Thickness (F)	8	in
Volume	1.67	cy.	Volume	4.00	cy.

NOTE: Use Boxed Dimensions

NEW JERSEY SOIL EROSION & SEDIMENT CONTROL STANDARDS
FOR
CONDUIT OUTLET PROTECTION

Structure: **FES 3a**

Date:
Page:

DESIGN CRITERIA:			APRON DIMENSIONS:		
Design Storm	25	yr	Length (La)	4.2	Ft
Flow Rate, Q=	2.54	CFS	Width @ Culvert (3D)	4.5	Ft
Pipe Horiz Dim.=	18	In	Width @ End (W)	6.2	Ft
Pipe Vert Dim.=	18	In	D(50) calc.	0	in
Tailwater Depth=	2.86	Ft	D(50) to be used	4	in
Filter Fabric Used?	Y	(Y/N)	Thickness (F)	8	in
D(50) min.	4	in	Volume	0.66	cy.

SCOUR HOLE DIMENSIONS:			SCOUR HOLE DIMENSIONS:		
Depth of Hole (E)	0.8	Ft	Depth of Hole (E)	1.5	Ft
Length of Bottom (A)	4.5	Ft	Length of Bottom (A)	4.5	Ft
Width of Bottom (C)	3.0	Ft	Width of Bottom (C)	3.0	Ft
Length of Scour Hole (B)	9.0	Ft	Length of Scour Hole (B)	13.5	Ft
Width of Scour Hole (D)	7.5	Ft	Width of Scour Hole (D)	12.0	Ft
D(50) calc.	0	in	D(50) calc.	0	in
D(50) to be used	4	in	D(50) to be used	4	in
Thickness (F)	8	in	Thickness (F)	8	in
Volume	1.67	cy.	Volume	4.00	cy.

Structure: **FES 5a**

DESIGN CRITERIA:			APRON DIMENSIONS:		
Design Storm	25	yr	Length (La)	14.3	Ft
Flow Rate, Q=	4.33	CFS	Width @ Culvert (3D)	3.8	Ft
Pipe Horiz Dim.=	15	In	Width @ End (W)	18.1	Ft
Pipe Vert Dim.=	15	In	D(50) calc.	4	in
Tailwater Depth=	0.25	Ft	D(50) to be used	4	in
Filter Fabric Used?	Y	(Y/N)	Thickness (t)	8	in
D(50) min.	4	in	Volume	4.06	cy.

SCOUR HOLE DIMENSIONS:			SCOUR HOLE DIMENSIONS:		
Depth of Hole (E)	0.6	Ft	Depth of Hole (E)	1.3	Ft
Length of Bottom (A)	3.8	Ft	Length of Bottom (A)	3.8	Ft
Width of Bottom (C)	2.5	Ft	Width of Bottom (C)	2.5	Ft
Length of Scour Hole (B)	7.5	Ft	Length of Scour Hole (B)	11.3	Ft
Width of Scour Hole (D)	6.3	Ft	Width of Scour Hole (D)	10.0	Ft
D(50) calc.	3	in	D(50) calc.	2	in
D(50) to be used	4	in	D(50) to be used	4	in
Thickness (F)	8	in	Thickness (F)	8	in
Volume	1.16	cy.	Volume	2.78	cy.

NOTE: Use Boxed Dimensions

NEW JERSEY SOIL EROSION & SEDIMENT CONTROL STANDARDS
FOR
CONDUIT OUTLET PROTECTION

Structure: **FES 3c**

Date:
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DESIGN CRITERIA:		APRON DIMENSIONS:	
Design Storm	25 yr	Length (La)	10.6 Ft
Flow Rate, Q=	4.95 CFS	Width @ Culvert (3D)	3.8 Ft
Pipe Horiz Dim.=	15 In	Width @ End (W)	8.0 Ft
Pipe Vert Dim.=	15 In	D(50) calc.	0 in
Tailwater Depth=	5.93 Ft	D(50) to be used	4 in
Filter Fabric Used?	Y (Y/N)	Thickness (F)	8 in
D(50) min.	4 in	Volume	1.42 cy.

SCOUR HOLE DIMENSIONS:		SCOUR HOLE DIMENSIONS:	
Depth of Hole (E)	0.6 Ft	Depth of Hole (E)	1.3 Ft
Length of Bottom (A)	3.8 Ft	Length of Bottom (A)	3.8 Ft
Width of Bottom (C)	2.5 Ft	Width of Bottom (C)	2.5 Ft
Length of Scour Hole (B)	7.5 Ft	Length of Scour Hole (B)	11.3 Ft
Width of Scour Hole (D)	6.3 Ft	Width of Scour Hole (D)	10.0 Ft
D(50) calc.	0 in	D(50) calc.	0 in
D(50) to be used	4 in	D(50) to be used	4 in
Thickness (F)	8 in	Thickness (F)	8 in
Volume	1.16 cy.	Volume	2.78 cy.

APPENDIX E

NORMAL DRAIN TIME CALCULATIONS

CONSULTING ENGINEER SERVICES
PROFESSIONAL ENGINEERS

Normal Drain Time Per NJ Stormwater BMP Manual - Basin A

BY:	KMD	DATE:	3/24/2020	CES #:	2264-02
REV BY:		DATE:			

INPUTS

WSE at weir (ft)	147.95		
Basin Bottom (ft)	146.25		
GWSE (ft)	141.99		
A = Basin Area (Ac)	0.690	30,056	sf
V = Volume up to weir (Ac-Ft)	1.241	54,058	cf
K = Hydraulic Conductivity (in/hr)	23.3	From: Geotech Investigation and Analysis	
Factor of Safety =	2.0	Per NJ Stormwater BMP Manual	

CALCULATED VALUES (PER NJ Stormwater BMP Manual, Ch 9.5)

d (ft) =	4.26	
D1 (ft) =	4.26	
D2 (ft) =	5.96	
Davg (ft) =	5.11	
K (ft/sec) =	2.697E-04	
I = Davg / d =	1.200	
Q (cfs) = KIA =	9.723	
T (sec) = V / Q =	5,560	
T (hr) =	1.5	<= 72 hours

The design of an infiltration basin is based upon Darcy's Law:

$$Q = KIA$$

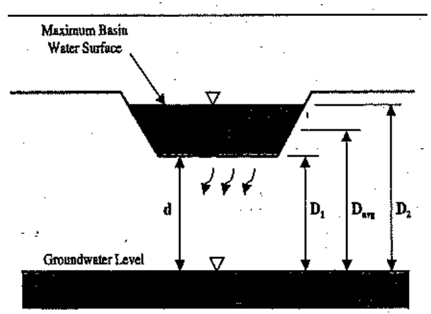
where:

Q = the rate of infiltration in cubic feet per second (cfs)
K = the hydraulic conductivity of the soil in feet per second (fps)
I = the hydraulic gradient
A = the area of infiltration in square feet (sf)

From the variables shown in Figure 9.5-2 below:

Average Hydraulic Gradient = D_{avg}/d
Minimum Hydraulic Gradient = D_1/d
Maximum Hydraulic Gradient = D_2/d

Figure 9.5-2: Schematic of Darcy's Law



CONSULTING ENGINEER SERVICES
PROFESSIONAL ENGINEERS

Normal Drain Time Per NJ Stormwater BMP Manual - Basin A1

BY:	KMD	DATE:	3/24/2020	CES #:	2264-02
REV BY:		DATE:			

INPUTS

WSE at weir (ft)	148.75		
Basin Bottom (ft)	147.75		
GWSE (ft)	143.63		
A = Basin Area (Ac)	0.443	19,297	sf
V = Volume up to weir (Ac-Ft)	0.470	20,473	cf
K = Hydraulic Conductivity (in/hr)	13.2	From: Geotech Investigation and Analysis	
Factor of Safety =	2.0	Per NJ Stormwater BMP Manual	

CALCULATED VALUES (PER NJ Stormwater BMP Manual, Ch 9.5)

d (ft) =	4.12	
D1 (ft) =	4.12	
D2 (ft) =	5.12	
Davg (ft) =	4.62	
K (ft/sec) =	1.528E-04	
I = Davg / d =	1.121	
Q (cfs) = KIA =	3.306	
T (sec) = V / Q =	6,193	
T (hr) =	1.7	<= 72 hours

The design of an infiltration basin is based upon Darcy's Law:

$$Q = KIA$$

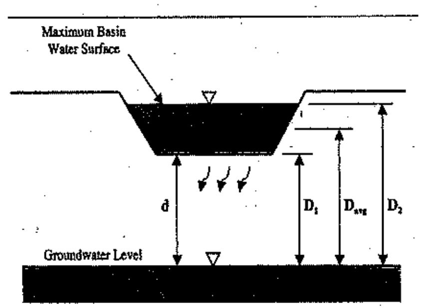
where:

Q = the rate of infiltration in cubic feet per second (cfs)
K = the hydraulic conductivity of the soil in feet per second (fps)
I = the hydraulic gradient
A = the area of infiltration in square feet (sf)

From the variables shown in Figure 9.5-2 below:

Average Hydraulic Gradient = D_{avg}/d
Minimum Hydraulic Gradient = D_1/d
Maximum Hydraulic Gradient = D_2/d

Figure 9.5-2: Schematic of Darcy's Law



CONSULTING ENGINEER SERVICES
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Normal Drain Time Per NJ Stormwater BMP Manual - Basin A2

BY:	KMD	DATE:	3/24/2020	CES #:	2264-02
REV BY:		DATE:			

INPUTS

WSE at weir (ft)	154.15		
Basin Bottom (ft)	146.50		
GWSE (ft)	143.51		
A = Basin Area (Ac)	0.340	14,810	sf
V = Volume up to weir (Ac-Ft)	3.917	170,625	cf
K = Hydraulic Conductivity (in/hr)	8.9	From: Geotech Investigation and Analysis	
Factor of Safety =	2.0	Per NJ Stormwater BMP Manual	

CALCULATED VALUES (PER NJ Stormwater BMP Manual, Ch 9.5)

d (ft) =	2.99	
D1 (ft) =	2.99	
D2 (ft) =	10.64	
Davg (ft) =	6.82	
K (ft/sec) =	1.030E-04	
I = Davg / d =	2.279	
Q (cfs) = KIA =	3.477	
T (sec) = V / Q =	49,069	
T (hr) =	13.6	<= 72 hours

The design of an infiltration basin is based upon Darcy's Law:

$$Q = KIA$$

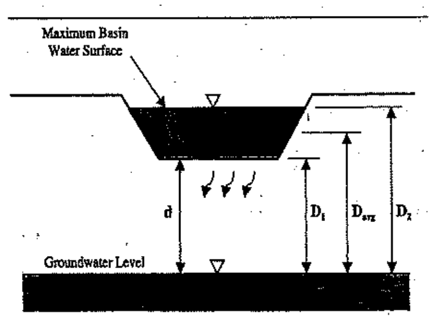
where:

Q = the rate of infiltration in cubic feet per second (cfs)
K = the hydraulic conductivity of the soil in feet per second (fps)
I = the hydraulic gradient
A = the area of infiltration in square feet (sf)

From the variables shown in Figure 9.5-2 below:

Average Hydraulic Gradient = D_{avg}/d
Minimum Hydraulic Gradient = D_1/d
Maximum Hydraulic Gradient = D_2/d

Figure 9.5-2: Schematic of Darcy's Law



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Normal Drain Time Per NJ Stormwater BMP Manual - Basin A3

BY:	KMD	DATE:	3/24/2020	CES #:	2264-02
REV BY:		DATE:			

INPUTS

WSE at weir (ft)	155		
Basin Bottom (ft)	152.00		
GWSE (ft)	144.57		
A = Basin Area (Ac)	0.188	8,189	sf
V = Volume up to weir (Ac-Ft)	1.229	53,535	cf
K = Hydraulic Conductivity (in/hr)	6.33	From: Geotech Investigation and Analysis	
Factor of Safety =	2.0	Per NJ Stormwater BMP Manual	

CALCULATED VALUES (PER NJ Stormwater BMP Manual, Ch 9.5)

d (ft) =	7.43	
D1 (ft) =	7.43	
D2 (ft) =	10.43	
Davg (ft) =	8.93	
K (ft/sec) =	7.326E-05	
I = Davg / d =	1.202	
Q (cfs) = KIA =	0.721	
T (sec) = V / Q =	74,241	
T (hr) =	20.6	<= 72 hours

The design of an infiltration basin is based upon Darcy's Law:

$$Q = KIA$$

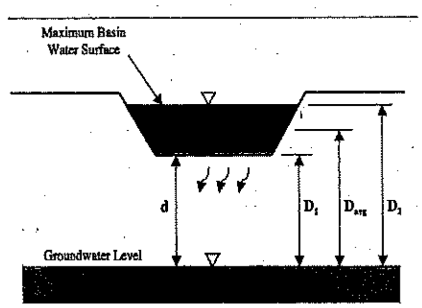
where:

Q = the rate of infiltration in cubic feet per second (cfs)
K = the hydraulic conductivity of the soil in feet per second (fps)
I = the hydraulic gradient
A = the area of infiltration in square feet (sf)

From the variables shown in Figure 9.5-2 below:

Average Hydraulic Gradient = D_{avg}/d
Minimum Hydraulic Gradient = D_1/d
Maximum Hydraulic Gradient = D_2/d

Figure 9.5-2: Schematic of Darcy's Law



CONSULTING ENGINEER SERVICES
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Normal Drain Time Per NJ Stormwater BMP Manual - Basin B

BY:	KMD	DATE:	3/24/2020	CES #:	2264-02
REV BY:		DATE:			

INPUTS

WSE at weir (ft)	149.5		
Basin Bottom (ft)	148.50		
GWSE (ft)	144.85		
A = Basin Area (Ac)	0.229	9,975	sf
V = Volume up to weir (Ac-Ft)	0.248	10,803	cf
K = Hydraulic Conductivity (in/hr)	3	From: Geotech Investigation and Analysis	
Factor of Safety =	2.0	Per NJ Stormwater BMP Manual	

CALCULATED VALUES (PER NJ Stormwater BMP Manual, Ch 9.5)

d (ft) =	3.65	
D1 (ft) =	3.65	
D2 (ft) =	4.65	
Davg (ft) =	4.15	
K (ft/sec) =	3.472E-05	
I = Davg / d =	1.137	
Q (cfs) = KIA =	0.394	
T (sec) = V / Q =	27,432	
T (hr) =	7.6	<= 72 hours

The design of an infiltration basin is based upon Darcy's Law:

$$Q = KIA$$

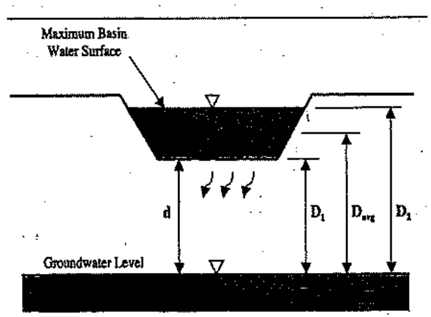
where:

Q = the rate of infiltration in cubic feet per second (cfs)
K = the hydraulic conductivity of the soil in feet per second (fps)
I = the hydraulic gradient
A = the area of infiltration in square feet (sf)

From the variables shown in Figure 9.5-2 below:

Average Hydraulic Gradient = D_{avg}/d
Minimum Hydraulic Gradient = D_1/d
Maximum Hydraulic Gradient = D_2/d

Figure 9.5-2: Schematic of Darcy's Law



Hydrograph for Pond C: Wet Pond

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	1.067	154.00	0.00
2.50	0.10	1.076	154.03	0.01
5.00	0.19	1.102	154.11	0.04
7.50	0.32	1.136	154.22	0.11
10.00	**0.73**	1.202	154.43	0.22
12.50	**7.58**	**1.939**	**156.41**	**1.98**
15.00	1.03	**1.898**	**156.31**	**1.67**
17.50	0.51	1.780	156.02	0.99
20.00	0.35	1.698	155.82	0.67
22.50	0.28	1.641	155.67	0.53
25.00	0.00	1.574	155.50	0.47
27.50	0.00	1.481	155.25	0.43
30.00	0.00	1.398	155.02	0.38
32.50	0.00	1.325	154.81	0.33
35.00	0.00	1.262	154.61	0.28
37.50	0.00	1.209	154.45	0.23
40.00	0.00	1.168	154.32	0.17
42.50	0.00	1.138	154.23	0.11
45.00	0.00	1.119	154.17	0.07
47.50	0.00	1.106	154.13	0.05
50.00	0.00	1.098	154.10	0.03
52.50	0.00	1.092	154.08	0.03
55.00	0.00	1.088	154.07	0.02
57.50	0.00	1.084	154.05	0.02
60.00	0.00	1.081	154.04	0.01
62.50	0.00	1.078	154.03	0.01
65.00	0.00	1.076	154.03	0.01
67.50	0.00	1.074	154.02	0.01
70.00	0.00	1.073	154.02	0.01
72.50	0.00	1.072	154.01	0.00
75.00	0.00	1.071	154.01	0.00
77.50	0.00	1.070	154.01	0.00
80.00	0.00	1.070	154.01	0.00
82.50	0.00	1.069	154.01	0.00
85.00	0.00	1.069	154.01	0.00
87.50	0.00	1.069	154.00	0.00
90.00	0.00	1.068	154.00	0.00
92.50	0.00	1.068	154.00	0.00
95.00	0.00	1.068	154.00	0.00

APPENDIX F

OFF-SITE STABILITY CALCULATIONS

Summary for Pond A:

Inflow Area = 30.770 ac, 41.18% Impervious, Inflow Depth > 1.63" for 2 Year Storm event
Inflow = 14.95 cfs @ 12.34 hrs, Volume= 4.176 af
Outflow = 4.12 cfs @ 14.45 hrs, Volume= 4.124 af, Atten= 72%, Lag= 126.2 min
Primary = 4.12 cfs @ 14.45 hrs, Volume= 4.124 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Starting Elev= 147.95' Surf.Area= 0.774 ac Storage= 1.241 af
Peak Elev= 149.80' @ 14.45 hrs Surf.Area= 0.882 ac Storage= 2.777 af (1.536 af above start)

Plug-Flow detention time= 751.7 min calculated for 2.882 af (69% of inflow)
Center-of-Mass det. time= 334.8 min (1,319.0 - 984.1)

Volume	Invert	Avail.Storage	Storage Description
#1	146.25'	9.525 af	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
146.25	0.690	0.000	0.000
147.00	0.721	0.529	0.529
148.00	0.777	0.749	1.278
149.00	0.835	0.806	2.084
150.00	0.894	0.864	2.949
151.00	0.957	0.925	3.874
152.00	1.019	0.988	4.862
153.00	1.083	1.051	5.913
154.00	1.147	1.115	7.028
155.00	1.213	1.180	8.208
156.00	1.421	1.317	9.525

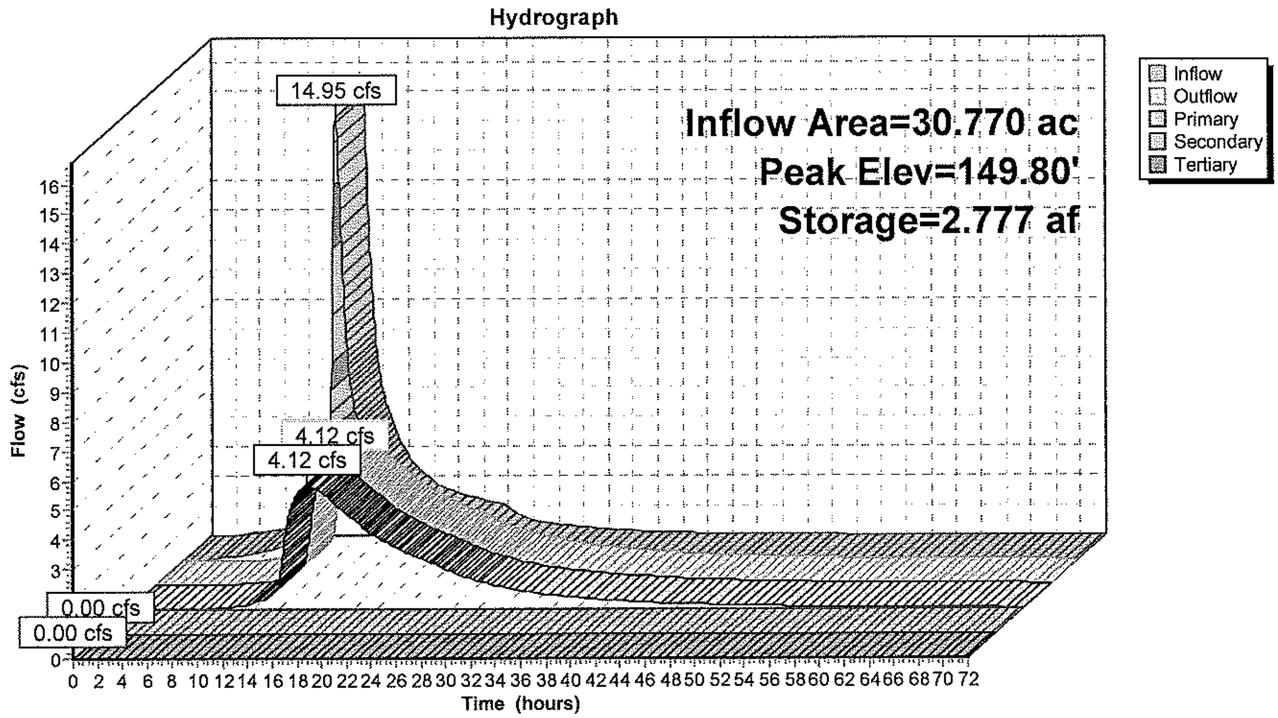
Device	Routing	Invert	Outlet Devices
#1	Primary	147.94'	**24.0" Round Culvert** L= 47.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 147.94' / 147.75' S= 0.0040 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	147.95'	**Weir, Cv= 2.62 (C= 3.28)** Elev. (feet) 147.95 150.05 Width (feet) 0.50 0.50
#3	Device 1	154.00'	**42.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	152.50'	**15.0" Round Culvert** L= 77.4' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 152.50' / 152.00' S= 0.0065 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#5	Tertiary	154.00'	**220.0' long x 9.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 Coef. (English) 2.48 2.55 2.70 2.69 2.68 2.69 2.67 2.64 2.64 2.64 2.64 2.64 2.64 2.65 2.65 2.66

Primary OutFlow Max=4.12 cfs @ 14.45 hrs HW=149.80' (Free Discharge)
└─**1=Culvert** (Passes 4.12 cfs of 11.04 cfs potential flow)
  ├─**2=Weir** (Weir Controls 4.12 cfs @ 4.46 fps)
  └─**3=Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=147.95' (Free Discharge)
└─**4=Culvert** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=147.95' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A:



Summary for Pond A3:

Inflow Area = 36.060 ac, 36.83% Impervious, Inflow Depth = 0.08" for 2 Year Storm event
Inflow = 1.88 cfs @ 12.17 hrs, Volume= 0.252 af
Outflow = 0.68 cfs @ 12.71 hrs, Volume= 0.252 af, Atten= 64%, Lag= 32.7 min
Discarded = 0.68 cfs @ 12.71 hrs, Volume= 0.252 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 152.24' @ 12.71 hrs Surf.Area= 0.221 ac Storage= 0.049 af

Plug-Flow detention time= 22.3 min calculated for 0.252 af (100% of inflow)
Center-of-Mass det. time= 22.1 min (845.2 - 823.1)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	1.980 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

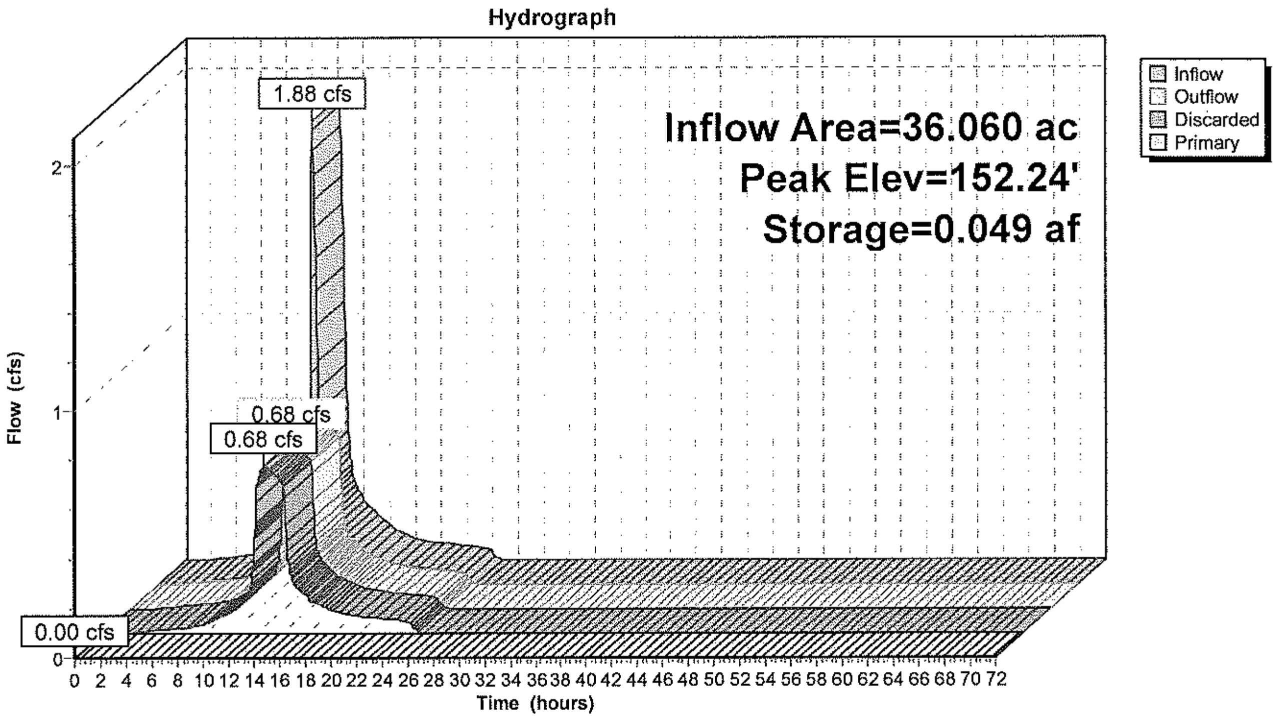
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
152.00	0.188	0.000	0.000
153.00	0.326	0.257	0.257
154.00	0.485	0.405	0.662
155.00	0.648	0.566	1.229
156.00	0.854	0.751	1.980

Device	Routing	Invert	Outlet Devices
#1	Primary	155.00'	**233.0' long x 8.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.45 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.65 2.66 2.67 2.69 2.71
#2	Discarded	152.00'	**3.000 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 141.01'

Discarded OutFlow Max=0.68 cfs @ 12.71 hrs HW=152.24' (Free Discharge)
↑**2=Exfiltration** (Controls 0.68 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=152.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A3:


Hydrograph
1.88 cfs
0.68 cfs
0.68 cfs
0.00 cfs
Inflow Area=36.060 ac
Peak Elev=152.24'
Storage=0.049 af
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
2
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
Time (hours)

Summary for Pond A:

```
Inflow Area =      30.770 ac, 41.18% Impervious, Inflow Depth >  2.90"   for 10 Year Storm event
Inflow      =     31.16 cfs @  12.35 hrs, Volume=         7.447 af
Outflow     =      7.67 cfs @  14.28 hrs, Volume=         7.382 af, Atten= 75%, Lag= 115.6 min
Primary     =      7.67 cfs @  14.28 hrs, Volume=         7.382 af
Secondary   =      0.00 cfs @   0.00 hrs, Volume=         0.000 af
Tertiary    =      0.00 cfs @   0.00 hrs, Volume=         0.000 af
```

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Starting Elev= 147.95' Surf.Area= 0.774 ac Storage= 1.241 af
Peak Elev= 151.25' @ 14.28 hrs Surf.Area= 0.973 ac Storage= 4.125 af (2.884 af above start)

Plug-Flow detention time= 554.0 min calculated for 6.137 af (82% of inflow)
Center-of-Mass det. time= 296.2 min (1,264.7 - 968.5)

Volume	Invert	Avail.Storage	Storage Description
#1	146.25'	9.525 af	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
146.25	0.690	0.000	0.000
147.00	0.721	0.529	0.529
148.00	0.777	0.749	1.278
149.00	0.835	0.806	2.084
150.00	0.894	0.864	2.949
151.00	0.957	0.925	3.874
152.00	1.019	0.988	4.862
153.00	1.083	1.051	5.913
154.00	1.147	1.115	7.028
155.00	1.213	1.180	8.208
156.00	1.421	1.317	9.525

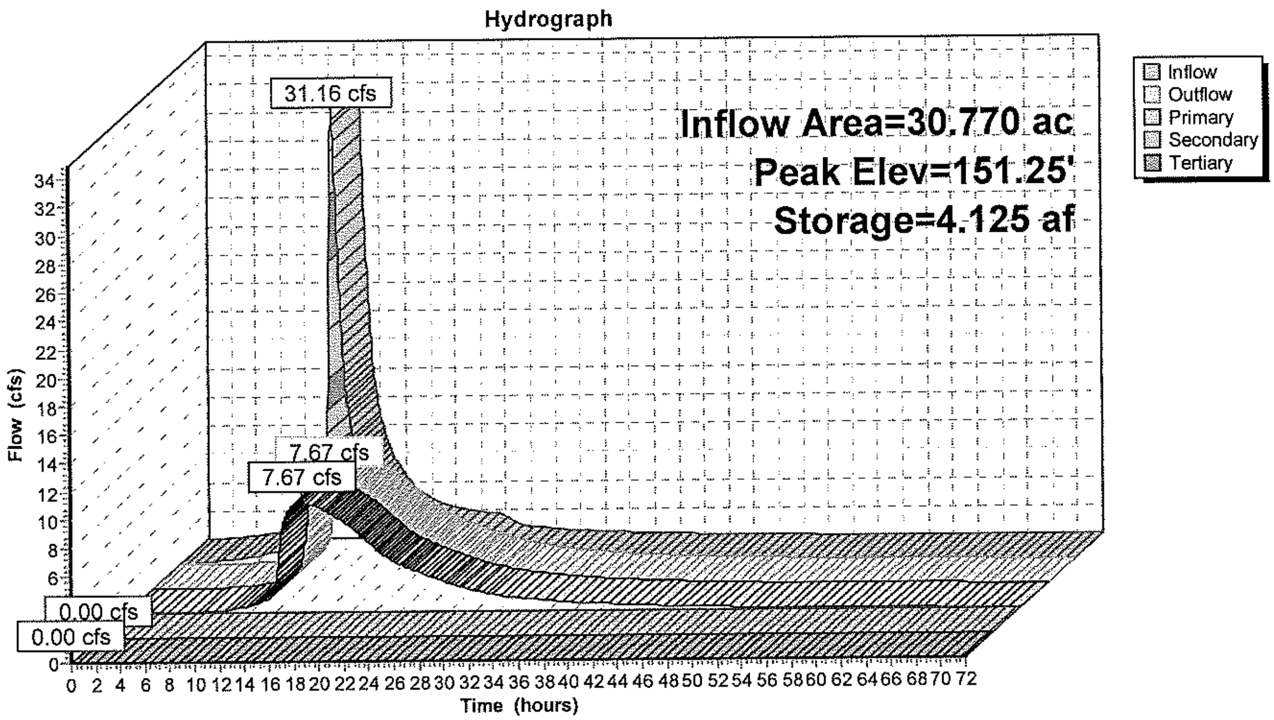
Device	Routing	Invert	Outlet Devices
#1	Primary	147.94'	**24.0" Round Culvert** L= 47.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 147.94' / 147.75' S= 0.0040 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	147.95'	**Weir, Cv= 2.62 (C= 3.28)** Elev. (feet) 147.95 150.05 Width (feet) 0.50 0.50
#3	Device 1	154.00'	**42.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	152.50'	**15.0" Round Culvert** L= 77.4' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 152.50' / 152.00' S= 0.0065 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#5	Tertiary	154.00'	**220.0' long x 9.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 Coef. (English) 2.48 2.55 2.70 2.69 2.68 2.69 2.67 2.64 2.64 2.64 2.64 2.64 2.64 2.65 2.65 2.66

Primary OutFlow Max=7.67 cfs @ 14.28 hrs HW=151.25' (Free Discharge)
↑—**1=Culvert** (Passes 7.67 cfs of 21.87 cfs potential flow)
  ↑—**2=Weir** (Orifice Controls 7.67 cfs @ 7.31 fps)
  └—**3=Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=147.95' (Free Discharge)
↑—**4=Culvert** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=147.95' (Free Discharge)
↑—**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A:



Summary for Pond A3:

Inflow Area = 36.060 ac, 36.83% Impervious, Inflow Depth > 1.22" for 10 Year Storm event
Inflow = 4.35 cfs @ 12.16 hrs, Volume= 3.658 af
Outflow = 1.85 cfs @ 29.46 hrs, Volume= 3.656 af, Atten= 57%, Lag= 1,037.8 min
Discarded = 1.85 cfs @ 29.46 hrs, Volume= 3.656 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 154.33' @ 29.46 hrs Surf.Area= 0.540 ac Storage= 0.834 af

Plug-Flow detention time= 196.8 min calculated for 3.654 af (100% of inflow)
Center-of-Mass det. time= 195.9 min (2,048.1 - 1,852.2)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	1.980 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

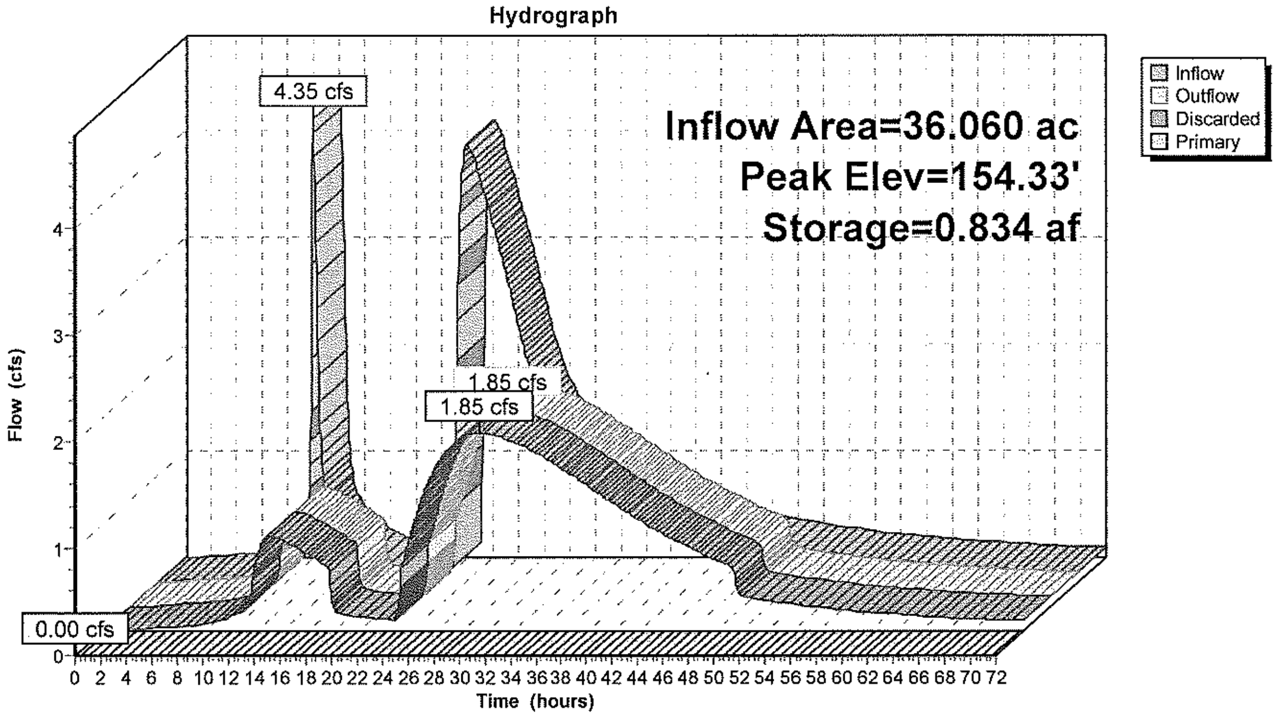
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
152.00	0.188	0.000	0.000
153.00	0.326	0.257	0.257
154.00	0.485	0.405	0.662
155.00	0.648	0.566	1.229
156.00	0.854	0.751	1.980

Device	Routing	Invert	Outlet Devices
#1	Primary	155.00'	**233.0' long x 8.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.45 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.65 2.66 2.67 2.69 2.71
#2	Discarded	152.00'	**3.000 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 141.01'

Discarded OutFlow Max=1.85 cfs @ 29.46 hrs HW=154.33' (Free Discharge)
↑—**2=Exfiltration** (Controls 1.85 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=152.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond A3:


Hydrograph
4.35 cfs
1.85 cfs
1.85 cfs
0.00 cfs
Inflow Area=36.060 ac
Peak Elev=154.33'
Storage=0.834 af
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
2
3
4
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
Time (hours)

APPENDIX G

EMERGENCY OVERFLOW DESIGN

Summary for Pond A:

[95] Warning: Outlet Device #2 rise exceeded
[81] Warning: Exceeded Pond B by 5.50' @ 0.00 hrs

Inflow Area =	30.770 ac, 41.18% Impervious, Inflow Depth = 5.79" for 100 Year Storm event			
Inflow =	63.08 cfs @	12.26 hrs, Volume=	14.849 af	
Outflow =	62.67 cfs @	12.31 hrs, Volume=	16.430 af,	Atten= 1%, Lag= 2.9 min
Primary =	4.75 cfs @	12.31 hrs, Volume=	0.642 af	
Secondary =	4.85 cfs @	12.31 hrs, Volume=	8.635 af	
Tertiary =	53.07 cfs @	12.31 hrs, Volume=	7.153 af	

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Starting Elev= 154.00' Surf.Area= 1.147 ac Storage= 7.028 af
Peak Elev= 154.21' @ 12.31 hrs Surf.Area= 1.161 ac Storage= 7.274 af (0.246 af above start)

Plug-Flow detention time= 529.8 min calculated for 9.397 af (63% of inflow)
Center-of-Mass det. time= 67.2 min (998.9 - 931.7)

Volume	Invert	Avail.Storage	Storage Description
#1	146.25'	9.525 af	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
146.25	0.690	0.000	0.000
147.00	0.721	0.529	0.529
148.00	0.777	0.749	1.278
149.00	0.835	0.806	2.084
150.00	0.894	0.864	2.949
151.00	0.957	0.925	3.874
152.00	1.019	0.988	4.862
153.00	1.083	1.051	5.913
154.00	1.147	1.115	7.028
155.00	1.213	1.180	8.208
156.00	1.421	1.317	9.525

Device	Routing	Invert	Outlet Devices
#1	Primary	147.94'	**24.0" Round Culvert** L= 47.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 147.94' / 147.75' S= 0.0040 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	147.95'	**Weir X 0.00, Cv= 2.62 (C= 3.28)** Elev. (feet) 147.95 150.05 Width (feet) 0.50 0.50
#3	Device 1	154.00'	**42.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	152.50'	**15.0" Round Culvert** L= 77.4' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 152.50' / 152.00' S= 0.0065 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#5	Tertiary	154.00'	**220.0' long x 9.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00

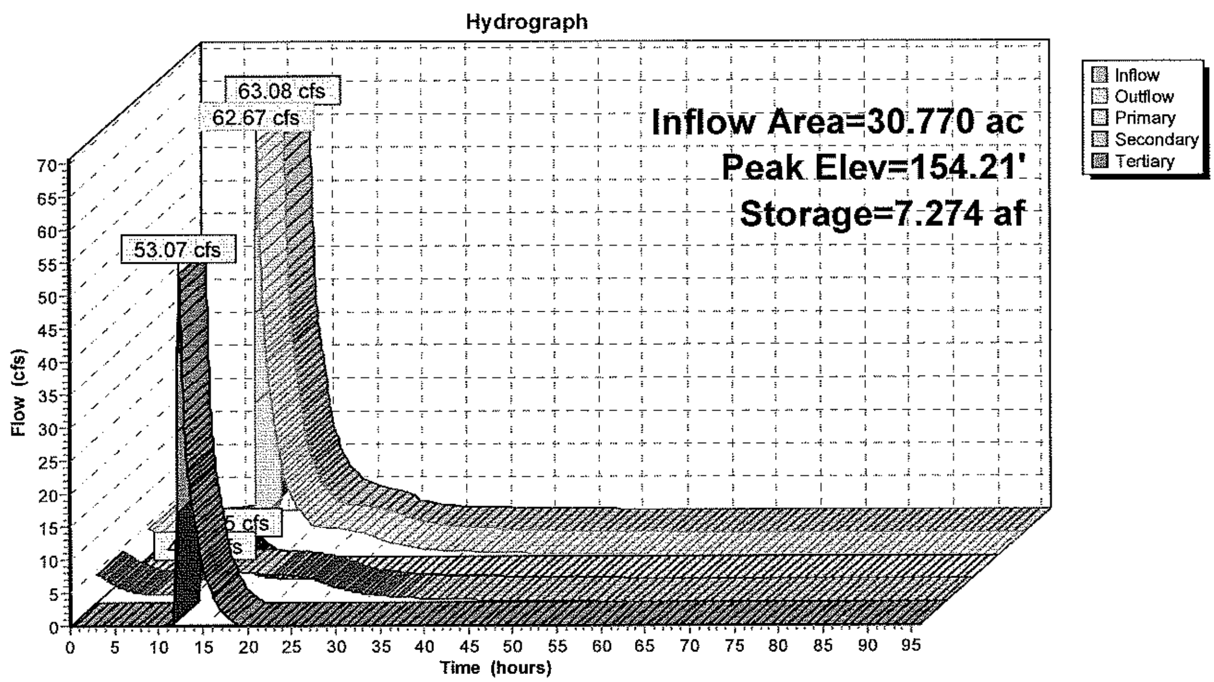
2.50 3.00 3.50 4.00 4.50 5.00
Coef. (English) 2.48 2.55 2.70 2.69 2.68 2.69 2.67 2.64 2.64 2.64
2.64 2.64 2.64 2.65 2.65 2.66

Primary OutFlow Max=4.64 cfs @ 12.31 hrs HW=154.21' (Free Discharge)
↑—**1=Culvert** (Passes 4.64 cfs of 34.72 cfs potential flow)
↑—**2=Weir** (Controls 0.00 cfs)
└—**3=Grate** (Weir Controls 4.64 cfs @ 1.49 fps)

Secondary OutFlow Max=4.85 cfs @ 12.31 hrs HW=154.21' (Free Discharge)
↑—**4=Culvert** (Inlet Controls 4.85 cfs @ 3.96 fps)

Tertiary OutFlow Max=51.71 cfs @ 12.31 hrs HW=154.21' (Free Discharge)
↑—**5=Broad-Crested Rectangular Weir** (Weir Controls 51.71 cfs @ 1.13 fps)

Pond A:



Summary for Pond A1:

[95] Warning: Outlet Device #2 rise exceeded
[81] Warning: Exceeded Pond A by 7.75' @ 0.00 hrs
[81] Warning: Exceeded Pond A by 7.04' @ 9.15 hrs

Inflow Area = 32.000 ac, 39.59% Impervious, Inflow Depth > 4.80" for 100 Year Storm event
Inflow = 11.83 cfs @ 14.60 hrs, Volume= 12.788 af
Outflow = 11.82 cfs @ 14.70 hrs, Volume= 12.787 af, Atten= 0%, Lag= 5.9 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 11.82 cfs @ 14.70 hrs, Volume= 12.787 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Starting Elev= 154.00' Surf.Area= 0.744 ac Storage= 3.687 af
Peak Elev= 154.17' @ 14.70 hrs Surf.Area= 0.752 ac Storage= 3.816 af (0.129 af above start)

Plug-Flow detention time= 441.0 min calculated for 9.095 af (71% of inflow)
Center-of-Mass det. time= 9.8 min (1,293.8 - 1,284.0)

Volume	Invert	Avail.Storage	Storage Description
#1	147.75'	5.278 af	**Custom Stage Data (Prismatic)** Listed below

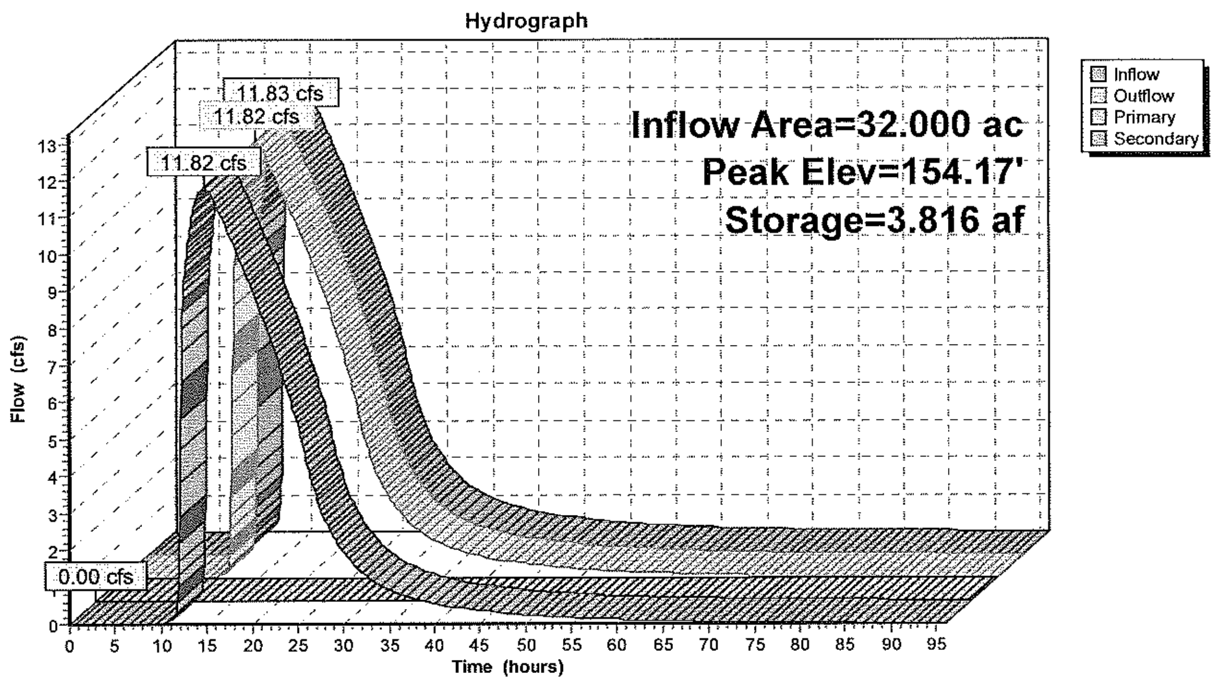
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
147.75	0.443	0.000	0.000
148.00	0.454	0.112	0.112
149.00	0.500	0.477	0.589
150.00	0.546	0.523	1.112
151.00	0.594	0.570	1.682
152.00	0.643	0.618	2.301
153.00	0.693	0.668	2.969
154.00	0.744	0.718	3.687
155.00	0.794	0.769	4.456
156.00	0.849	0.821	5.278

Device	Routing	Invert	Outlet Devices
#1	Primary	147.75'	**24.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 147.75' / 146.50' S= 0.0125 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	148.75'	**Weir X 0.00, Cv= 2.62 (C= 3.28)** Elev. (feet) 148.75 149.50 149.50 150.10 Width (feet) 0.25 0.25 1.00 1.00
#3	Secondary	154.00'	**68.0' 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=154.00' (Free Discharge)
↑—**1=Culvert** (Passes 0.00 cfs of 34.66 cfs potential flow)
↑—**2=Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=11.64 cfs @ 14.70 hrs HW=154.17' (Free Discharge)
↑—**3=Broad-Crested Rectangular Weir** (Weir Controls 11.64 cfs @ 1.02 fps)

Pond A1:



Summary for Pond A2:

[81] Warning: Exceeded Pond A1 by 6.25' @ 0.00 hrs
[81] Warning: Exceeded Pond A1 by 6.25' @ 9.15 hrs

Inflow Area =	33.070 ac, 38.31% Impervious, Inflow Depth > 4.57"		for 100 Year Storm event
Inflow =	8.04 cfs @ 21.51 hrs, Volume=	12.604 af	
Outflow =	8.04 cfs @ 21.74 hrs, Volume=	12.600 af, Atten= 0%, Lag= 13.8 min	
Primary =	8.04 cfs @ 21.74 hrs, Volume=	12.600 af	

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs / 2
Starting Elev= 154.00' Surf.Area= 0.738 ac Storage= 3.917 af
Peak Elev= 154.28' @ 21.74 hrs Surf.Area= 0.753 ac Storage= 4.126 af (0.209 af above start)

Plug-Flow detention time= 578.1 min calculated for 8.683 af (69% of inflow)
Center-of-Mass det. time= 21.1 min (1,571.4 - 1,550.3)

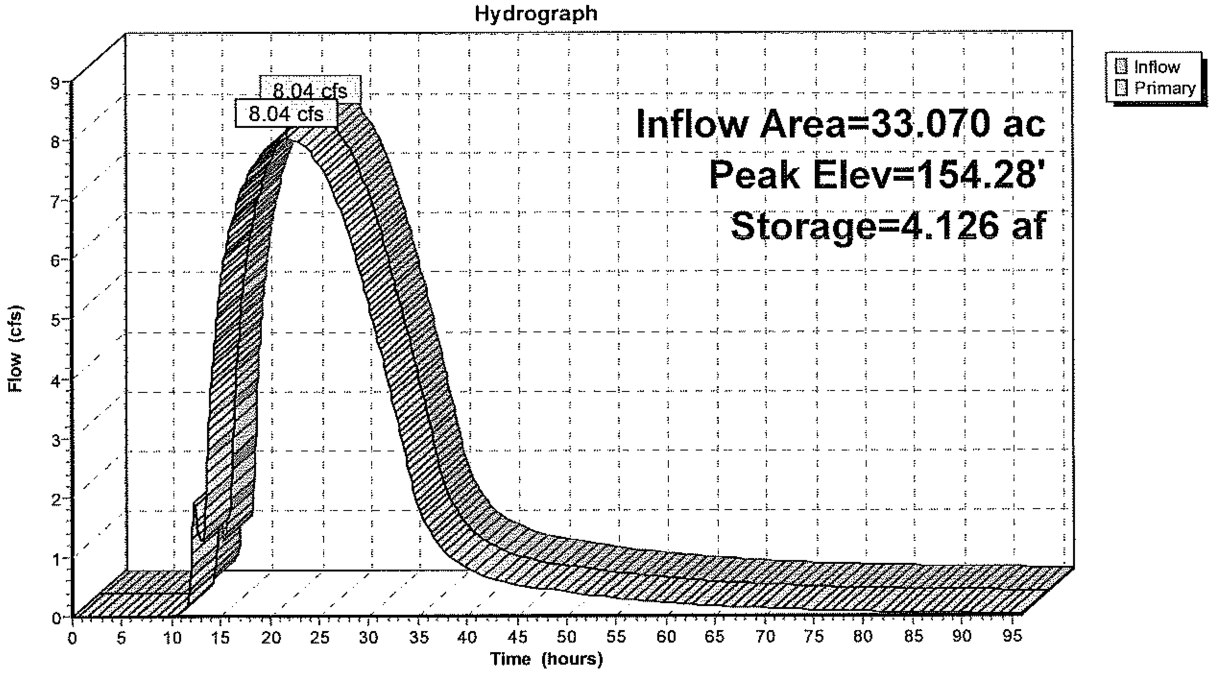
Volume	Invert	Avail.Storage	Storage Description
#1	146.50'	5.502 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
146.50	0.340	0.000	0.000
147.00	0.361	0.175	0.175
148.00	0.405	0.383	0.558
149.00	0.453	0.429	0.987
150.00	0.502	0.478	1.465
151.00	0.554	0.528	1.993
152.00	0.610	0.582	2.575
153.00	0.668	0.639	3.214
154.00	0.738	0.703	3.917
155.00	0.792	0.765	4.682
156.00	0.848	0.820	5.502

Device	Routing	Invert	Outlet Devices
#1	Primary	154.00'	**20.0' long x 17.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=8.00 cfs @ 21.74 hrs HW=154.28' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 8.00 cfs @ 1.42 fps)

Pond A2:


Hydrograph
Inflow
Primary
8.04 cfs
8.04 cfs
Inflow Area=33.070 ac
Peak Elev=154.28'
Storage=4.126 af
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
Time (hours)

Summary for Pond A3:

[81] Warning: Exceeded Pond A2 by 8.50' @ 9.35 hrs

Inflow Area =	36.060 ac,	36.83% Impervious,	Inflow Depth >	3.28"	for 100 Year Storm event
Inflow =	10.71 cfs @	12.16 hrs,	Volume=	9.863 af	
Outflow =	10.29 cfs @	12.21 hrs,	Volume=	9.863 af,	Atten= 4%, Lag= 2.9 min
Discarded =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	
Primary =	10.29 cfs @	12.21 hrs,	Volume=	9.863 af	

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs / 2
Starting Elev= 155.00' Surf.Area= 0.648 ac Storage= 1.229 af
Peak Elev= 155.07' @ 12.21 hrs Surf.Area= 0.662 ac Storage= 1.273 af (0.044 af above start)

Plug-Flow detention time= 329.0 min calculated for 8.634 af (88% of inflow)
Center-of-Mass det. time= 3.6 min (1,699.7 - 1,696.1)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	1.980 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

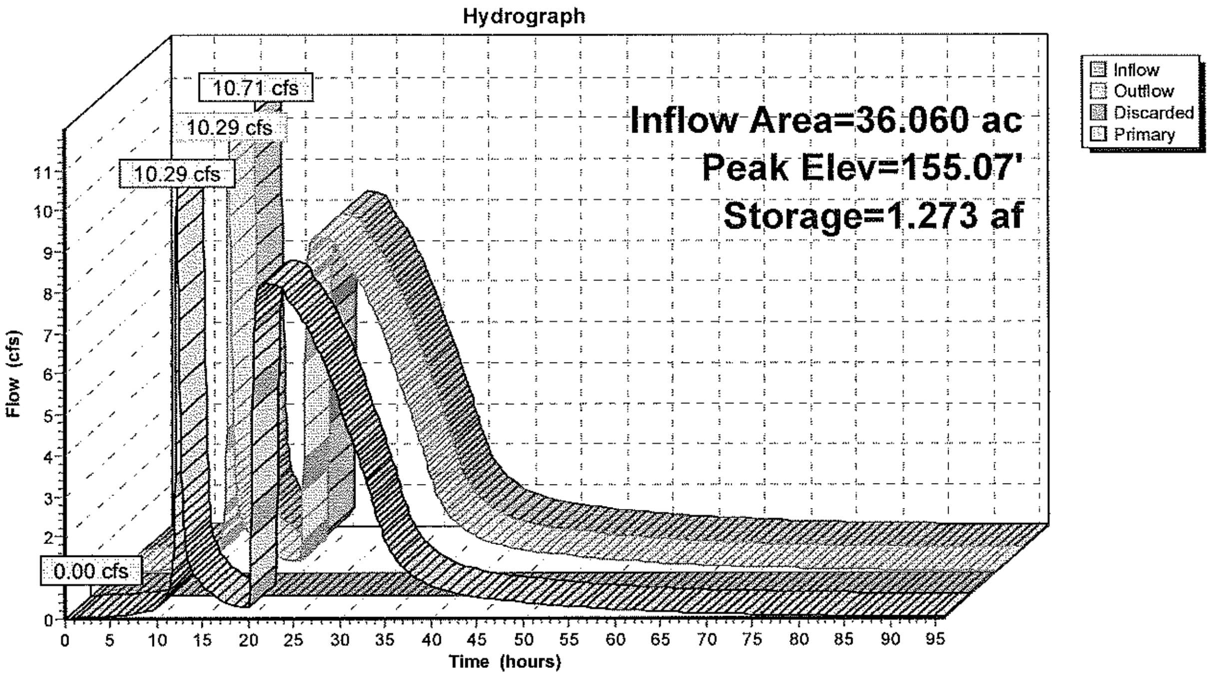
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
152.00	0.188	0.000	0.000
153.00	0.326	0.257	0.257
154.00	0.485	0.405	0.662
155.00	0.648	0.566	1.229
156.00	0.854	0.751	1.980

Device	Routing	Invert	Outlet Devices
#1	Primary	155.00'	**233.0' long x 8.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.45 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.65 2.66 2.67 2.69 2.71
#2	Discarded	152.00'	**3.000 in/hr Exfiltration X 0.00 over Horizontal area** Conductivity to Groundwater Elevation = 141.01'

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=155.00' (Free Discharge)
└**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=9.95 cfs @ 12.21 hrs HW=155.07' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 9.95 cfs @ 0.64 fps)

Pond A3:


Hydrograph
10.71 cfs
10.29 cfs
10.29 cfs
0.00 cfs
Inflow Area=36.060 ac
Peak Elev=155.07'
Storage=1.273 af
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0
1
2
3
4
5
6
7
8
9
10
11
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond B:

[95] Warning: Outlet Device #2 rise exceeded
[81] Warning: Exceeded Pond C by 1.85' @ 1.15 hrs

Inflow Area =	18.820 ac, 35.97% Impervious, Inflow Depth =	5.81"	for 100 Year Storm event
Inflow =	66.19 cfs @ 12.16 hrs, Volume=	9.111 af	
Outflow =	56.66 cfs @ 12.29 hrs, Volume=	9.111 af,	Atten= 14%, Lag= 7.8 min
Primary =	56.66 cfs @ 12.29 hrs, Volume=	9.111 af	

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Starting Elev= 155.85' Surf.Area= 0.573 ac Storage= 2.870 af
Peak Elev= 156.95' @ 12.29 hrs Surf.Area= 0.721 ac Storage= 3.576 af (0.705 af above start)

Plug-Flow detention time= 307.2 min calculated for 6.241 af (68% of inflow)
Center-of-Mass det. time= 17.0 min (907.0 - 890.0)

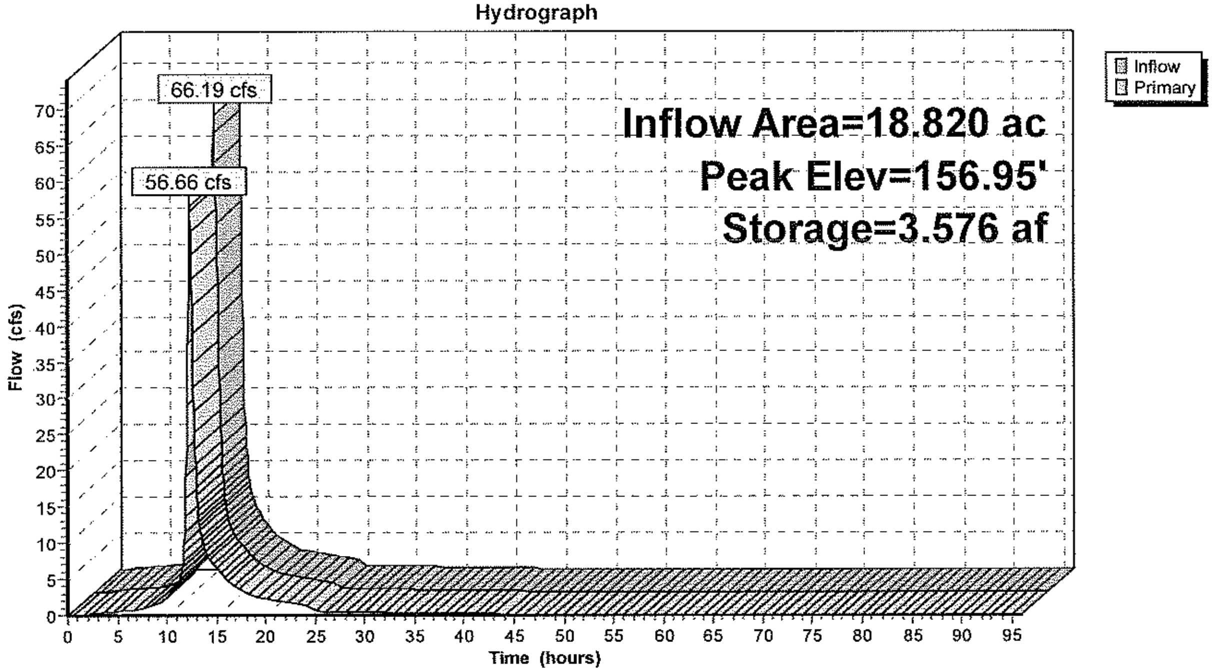
Volume	Invert	Avail.Storage	Storage Description
#1	148.50'	4.441 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
148.50	0.229	0.000	0.000
149.00	0.248	0.119	0.119
150.00	0.289	0.269	0.388
151.00	0.332	0.311	0.698
152.00	0.377	0.354	1.053
153.00	0.424	0.400	1.453
154.00	0.474	0.449	1.902
155.00	0.527	0.500	2.403
156.00	0.581	0.554	2.957
157.00	0.728	0.654	3.611
158.00	0.932	0.830	4.441

Device	Routing	Invert	Outlet Devices
#1	Primary	148.00'	**36.0" Round Culvert** L= 690.8' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 148.00' / 146.25' S= 0.0025 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf
#2	Device 1	149.50'	**Weir X 0.00, Cv= 2.62 (C= 3.28)** Elev. (feet) 149.50 151.00 151.00 153.10 Width (feet) 0.25 0.25 1.00 1.00
#3	Device 1	155.85'	**48.0" x 42.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=56.50 cfs @ 12.29 hrs HW=156.95' (Free Discharge)
└─**1=Culvert** (Passes 56.50 cfs of 63.35 cfs potential flow)
  ├─**2=Weir** (Controls 0.00 cfs)
  └─**3=Grate** (Weir Controls 56.50 cfs @ 3.43 fps)

Pond B:


Hydrograph
66.19 cfs
56.66 cfs
Inflow
Primary
Inflow Area=18.820 ac
Peak Elev=156.95'
Storage=3.576 af
Flow (cfs)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
Time (hours)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95

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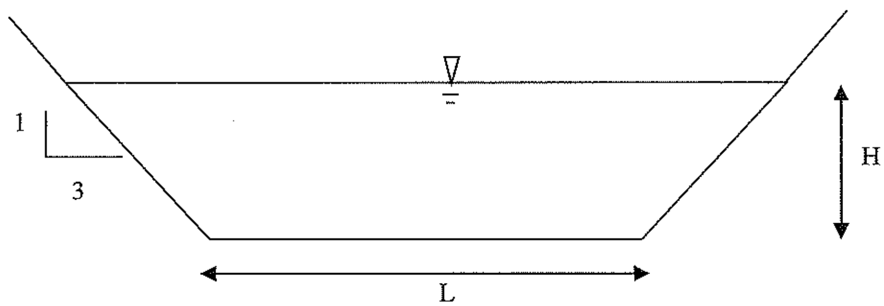
Emergency Spillway Design - Basin A

BY:	KMD	DATE:	3/23/2020	CES #:	2264-02
REV BY:		DATE:			



DETERMINE DEPTH OF WATER OVER SPILLWAY:

USE WEIR EQUATION: $Q=CLH^{3/2}$

Q=	63.08	CFS
C=	2.64	
L=	220	FT
S_o=	0.33	FT/FT
V=	1.25	FT/SEC
H=	0.23	FT

DETERMINE SIZE OF RIP RAP REQUIRED FOR 100-YEAR STORM:

1.) CALCULATE b/d RATIO AND OBTAIN P/R RATIO

b/d= 966

R/P = A/P^2 = 0.0010

2.) $d_{50}=12(118\ Q_{100}S_o^{13/6}R/P)^{2/5}$

d_{50}= 10.38 in

3.) SPILLWAY WILL BE REINFORCED WITH
The spillway will not be reinforced since the velocity is less than the allowable velocity of 2.5 ft/s.

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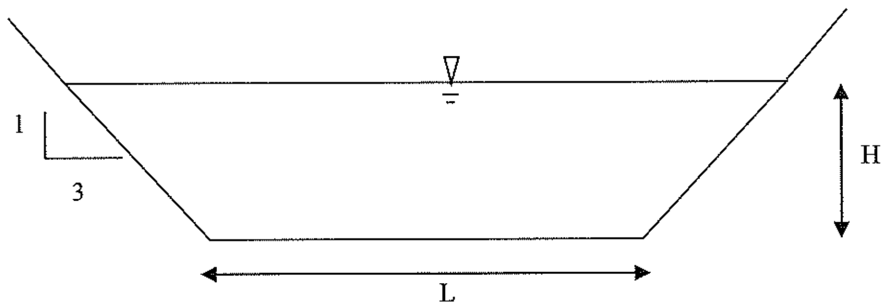
Emergency Spillway Design - Basin A1

BY: KMD DATE: 3/23/2020 CES #: 2264-02
REV BY: ________ DATE: ________



DETERMINE DEPTH OF WATER OVER SPILLWAY:

USE WEIR EQUATION: $Q=CLH^{3/2}$

Q=	11.83	CFS
C=	2.64	
L=	68	FT
S_o=	0.33	FT/FT
V=	1.06	FT/SEC
H=	0.16	FT

DETERMINE SIZE OF RIP RAP REQUIRED FOR 100-YEAR STORM:

1.) CALCULATE b/d RATIO AND OBTAIN P/R RATIO

b/d= 417

$R/P = A/P^2 =$ 0.0024

2.) $d_{50}=12(118\ Q_{100}S_o^{13/6}R/P)^{2/5}$

d_{50}= 7.43 in

3.) SPILLWAY WILL BE REINFORCED WITH
The spillway will not be reinforced since the velocity is less than the allowable velocity of 2.5 ft/s.

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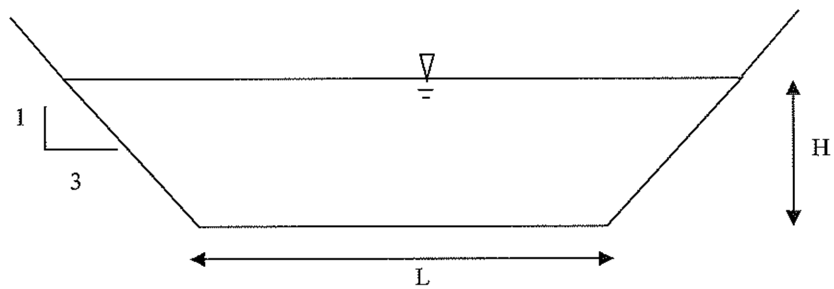
Emergency Spillway Design - Basin A2

BY:	KMD	DATE:	3/23/2020	CES #:	2264-02
REV BY:		DATE:			



DETERMINE DEPTH OF WATER OVER SPILLWAY:

USE WEIR EQUATION: $Q=CLH^{3/2}$

Q=	8.04 CFS
C=	2.64
L=	20 FT
S_o=	0.33 FT/FT
V=	1.33 FT/SEC
H=	0.29 FT

DETERMINE SIZE OF RIP RAP REQUIRED FOR 100-YEAR STORM:

1.) CALCULATE b/d RATIO AND OBTAIN P/R RATIO

b/d= 70

R/P = A/P^2 = 0.0138

2.) $d_{50}=12(118\ Q_{100}S_o^{13/6}R/P)^{2/5}$

d_{50}= 12.84 in

3.) SPILLWAY WILL BE REINFORCED WITH
The spillway will not be reinforced since the velocity is less than the allowable velocity of 2.5 ft/s.

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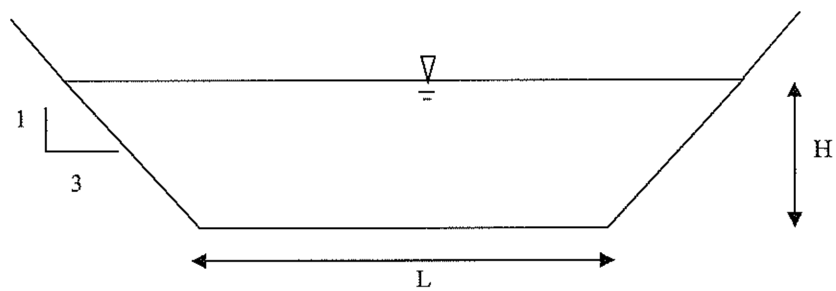
Emergency Spillway Design - Basin A3

BY: KMD DATE: 3/23/2020 CES #: 2264-02
REV BY: ______ DATE: ______



DETERMINE DEPTH OF WATER OVER SPILLWAY:

USE WEIR EQUATION: $Q=CLH^{3/2}$

Q=	10.71 CFS
C=	2.64
L=	233 FT
S_o=	0.33 FT/FT
V=	0.68 FT/SEC
H=	0.07 FT

DETERMINE SIZE OF RIP RAP REQUIRED FOR 100-YEAR STORM:

1.) CALCULATE b/d RATIO AND OBTAIN P/R RATIO

b/d= 3468

$R/P = A/P^2 =$ 0.0003

2.) $d_{50}=12(118\ Q_{100}S_o^{13/6}R/P)^{2/5}$

d_{50}= 3.06 in

3.) SPILLWAY WILL BE REINFORCED WITH
The spillway will not be reinforced since the velocity is less than the allowable velocity of 2.5 ft/s.

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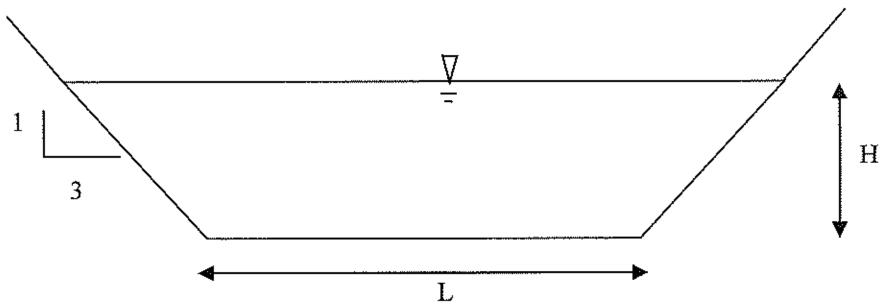
Emergency Spillway Design - Basin B

BY:	KMD	DATE:	3/23/2020	CES #:	2264-02
REV BY:		DATE:			



DETERMINE DEPTH OF WATER OVER SPILLWAY:

USE WEIR EQUATION: $Q=CLH^{3/2}$

Q=	66.19	CFS
C=	2.64	
L=	39	FT
S_o=	0.33	FT/FT
V=	2.12	FT/SEC
H=	0.74	FT

DETERMINE SIZE OF RIP RAP REQUIRED FOR 100-YEAR STORM:

1.) CALCULATE b/d RATIO AND OBTAIN P/R RATIO

b/d= 52

$R/P = A/P^2 =$ 0.0183

2.) $d_{50}=12(118\ Q_{100}S_o^{13/6}R/P)^{2/5}$

d_{50}= 33.40 in

3.) SPILLWAY WILL BE REINFORCED WITH
The spillway will not be reinforced since the velocity is less than the allowable velocity of 2.5 ft/s.

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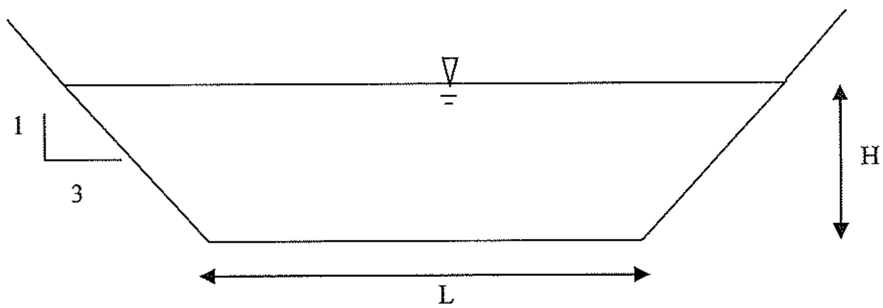
Emergency Spillway Design - Basin C

BY:	KMD	DATE:	3/23/2020	CES #:	2264-02
REV BY:		DATE:			



DETERMINE DEPTH OF WATER OVER SPILLWAY:

USE WEIR EQUATION: $Q=CLH^{3/2}$

Q=	16.13	CFS
C=	2.64	
L=	125	FT
S_o=	0.33	FT/FT
V=	0.96	FT/SEC
H=	0.13	FT

DETERMINE SIZE OF RIP RAP REQUIRED FOR 100-YEAR STORM:

1.) CALCULATE b/d RATIO AND OBTAIN P/R RATIO

b/d= 935

$R/P = A/P^2 =$ 0.0011

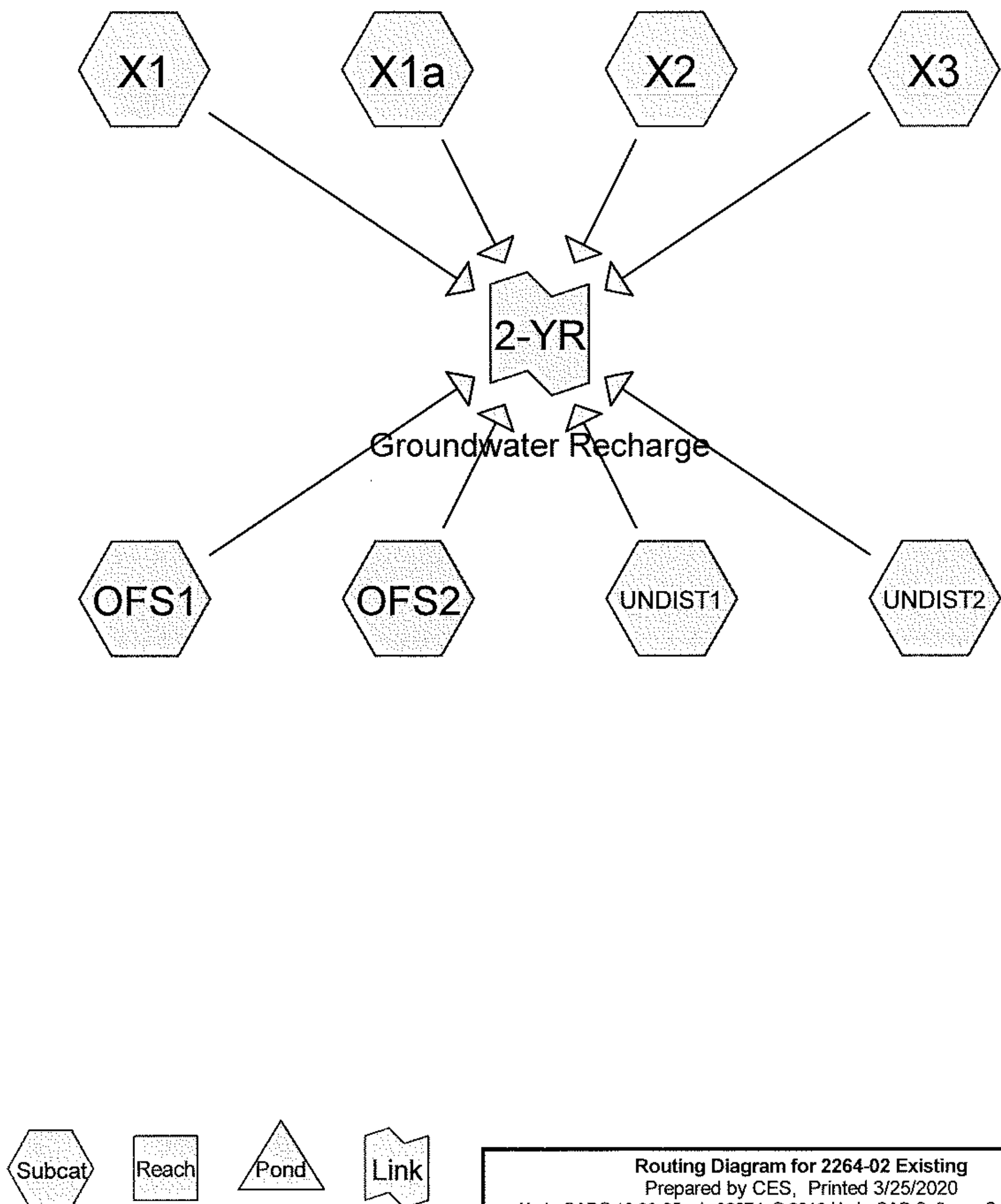
2.) $d_{50}=12(118\ Q_{100}S_o^{13/6}R/P)^{2/5}$

d_{50}= 6.09 in

3.) SPILLWAY WILL BE REINFORCED WITH
The spillway will not be reinforced since the velocity is less than the allowable velocity of 2.5 ft/s.

APPENDIX H

GROUNDWATER RECHARGE ANALYSIS



Routing Diagram for 2264-02 Existing
Prepared by CES, Printed 3/25/2020
HydroCAD® 10.00-25 s/n 02074 © 2019 HydroCAD Software Solutions LLC

Summary for Subcatchment OFS1:

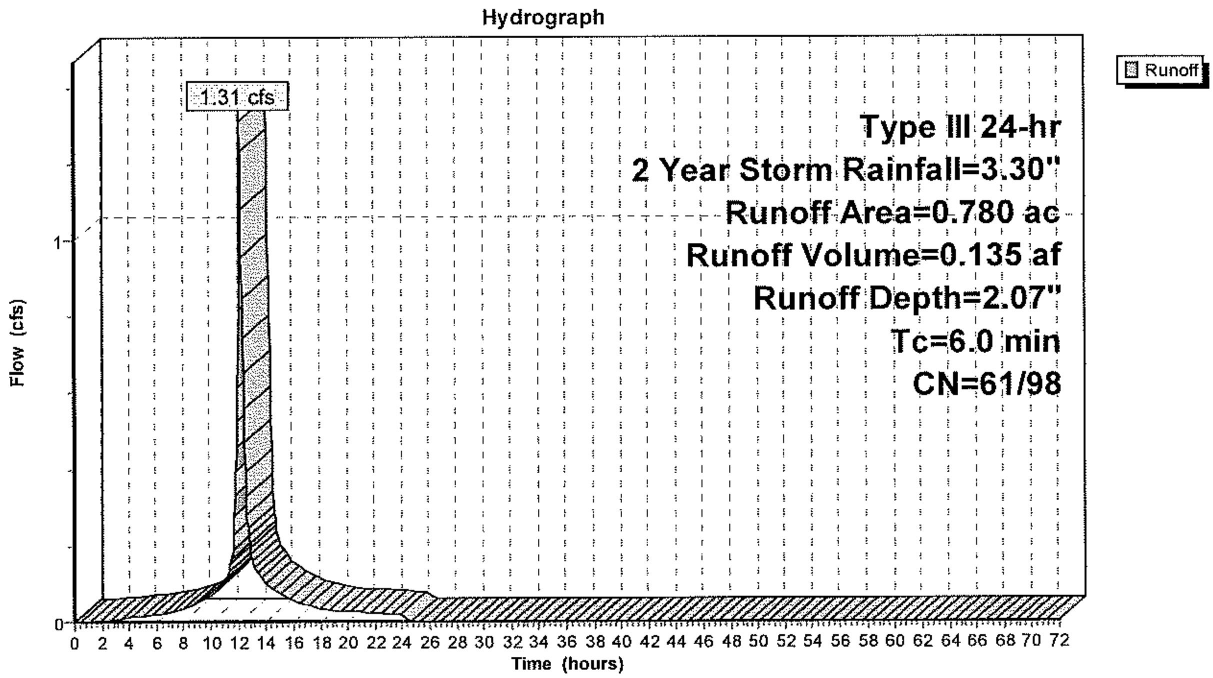
Runoff = 1.31 cfs @ 12.11 hrs, Volume= 0.135 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
0.480	98	Unconnected pavement, HSG B
0.300	61	>75% Grass cover, Good, HSG B
0.780	84	Weighted Average
0.300	61	38.46% Pervious Area
0.480	98	61.54% Impervious Area

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

Subcatchment OFS1:



Summary for Subcatchment OFS2:

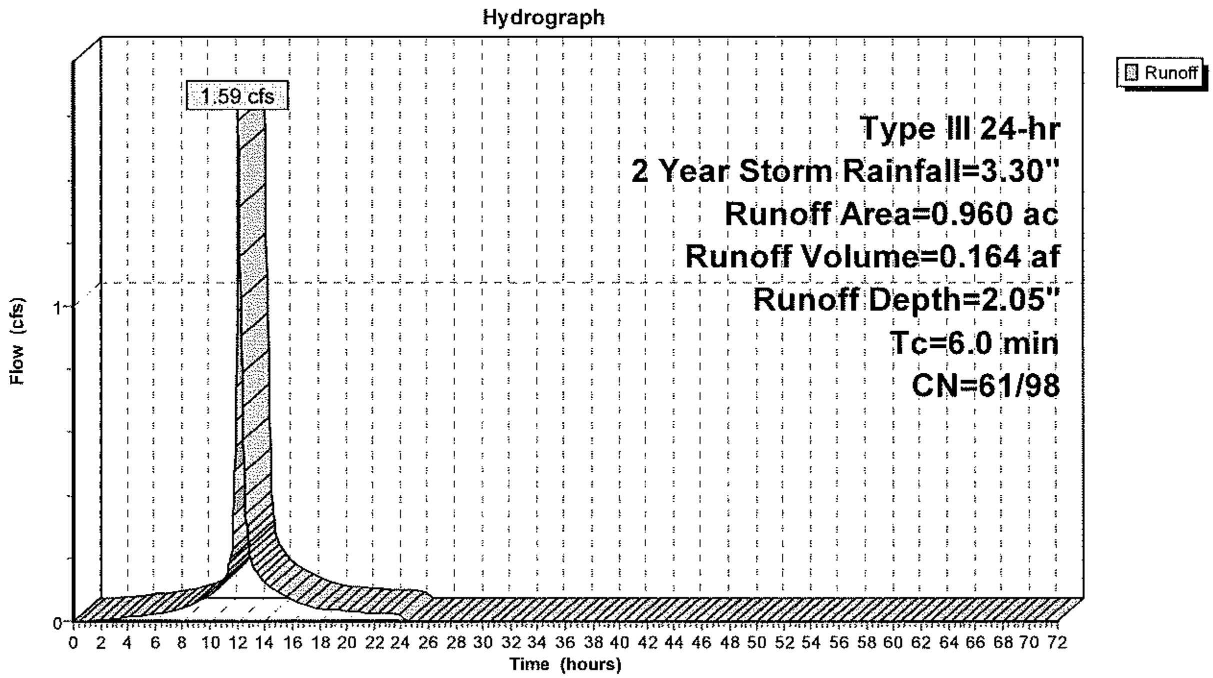
Runoff = 1.59 cfs @ 12.11 hrs, Volume= 0.164 af, Depth= 2.05"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
0.580	98	Unconnected pavement, HSG B
0.380	61	>75% Grass cover, Good, HSG B
0.960	83	Weighted Average
0.380	61	39.58% Pervious Area
0.580	98	60.42% Impervious Area

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

Subcatchment OFS2:



Summary for Subcatchment UNDIST1:

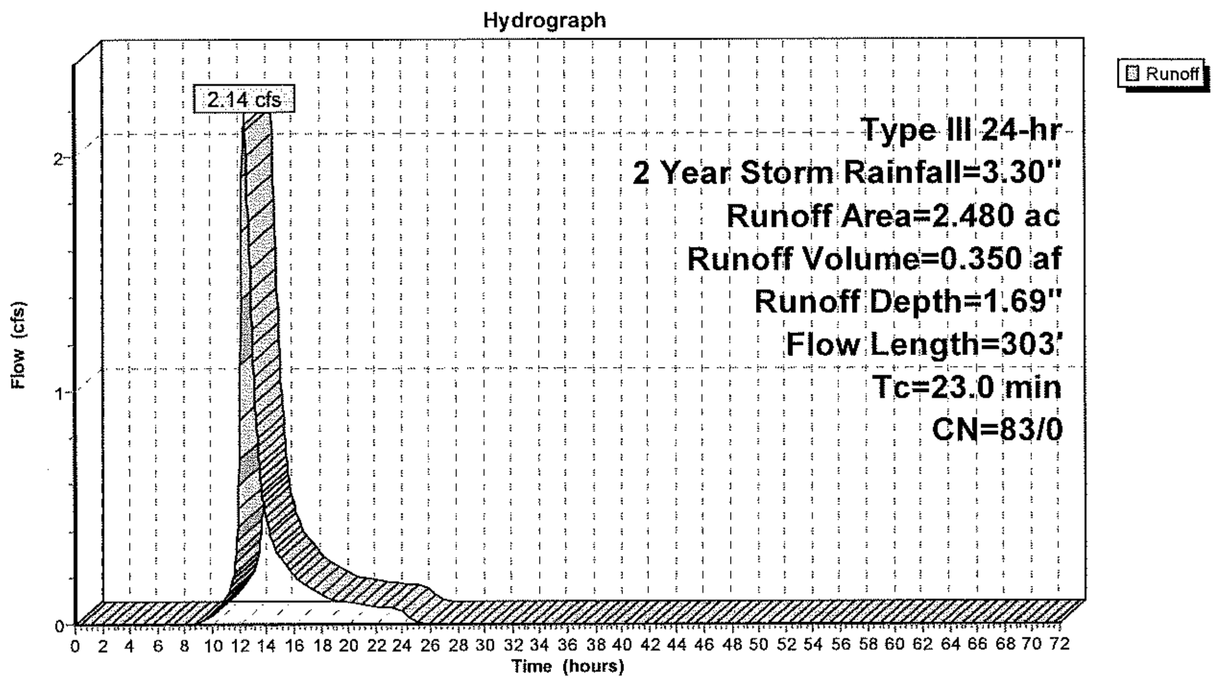
Runoff = 2.14 cfs @ 12.39 hrs, Volume= 0.350 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
2.480	83	Fallow, crop residue, Good, HSG B
2.480	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	150	0.0087	0.12		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
2.4	153	0.0111	1.05		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
23.0	303	Total			

Subcatchment UNDIST1:



Summary for Subcatchment UNDIST2:

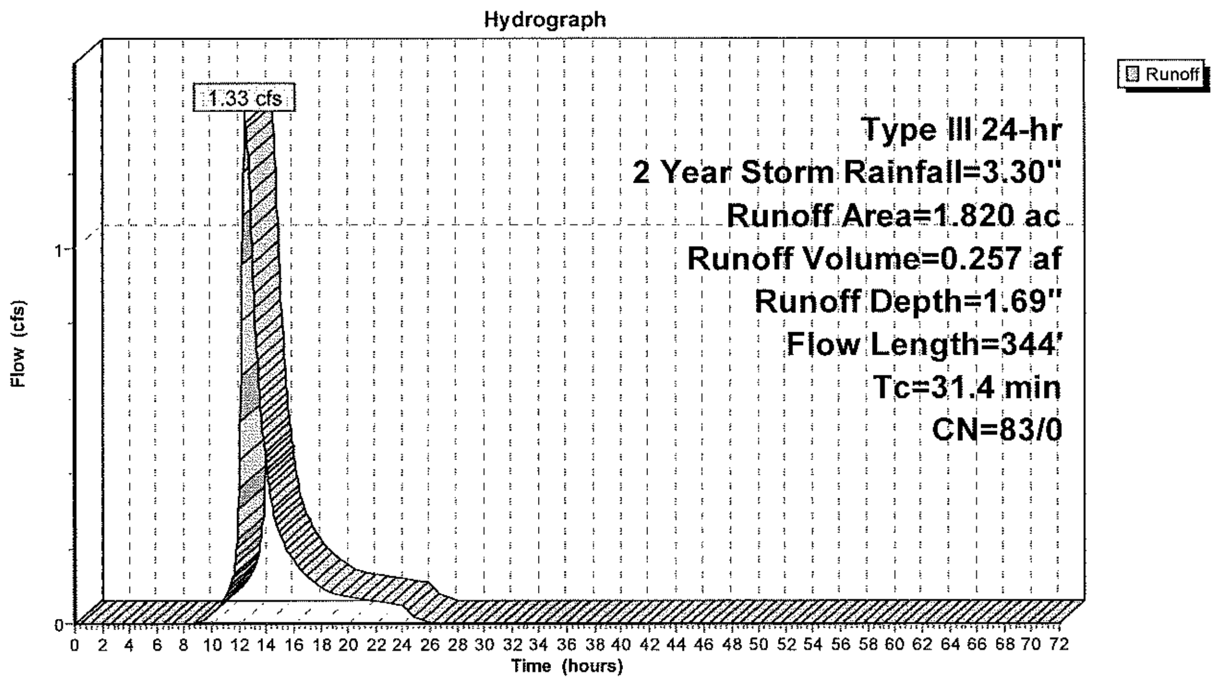
Runoff = 1.33 cfs @ 12.52 hrs, Volume= 0.257 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
1.820	83	Fallow, crop residue, Good, HSG B
1.820	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	150	0.0043	0.09		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
4.1	194	0.0062	0.79		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
31.4	344	Total			

Subcatchment UNDIST2:



Summary for Subcatchment X1:

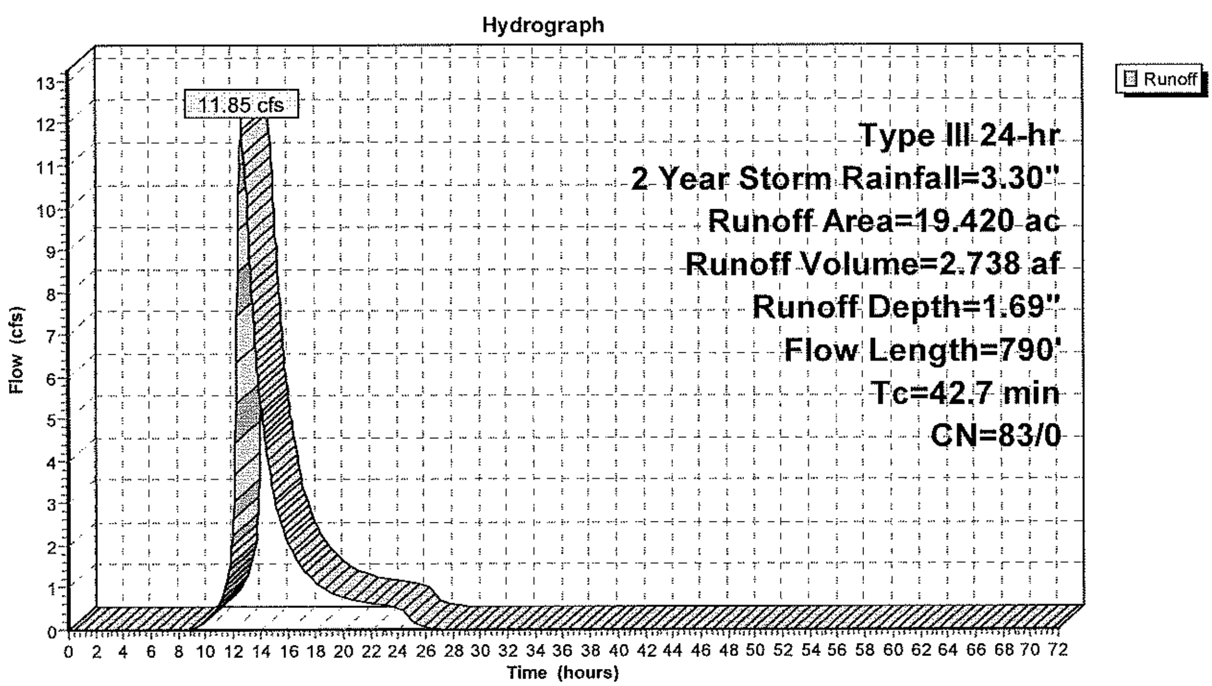
Runoff = 11.85 cfs @ 12.67 hrs, Volume= 2.738 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
18.890	83	Fallow, crop residue, Good, HSG B
0.520	82	Dirt roads, HSG B
0.010	96	Gravel surface, HSG B
19.420	83	Weighted Average
19.420	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	150	0.0030	0.08		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
11.2	640	0.0090	0.95		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
42.7	790	Total			

Subcatchment X1:



Summary for Subcatchment X1a:

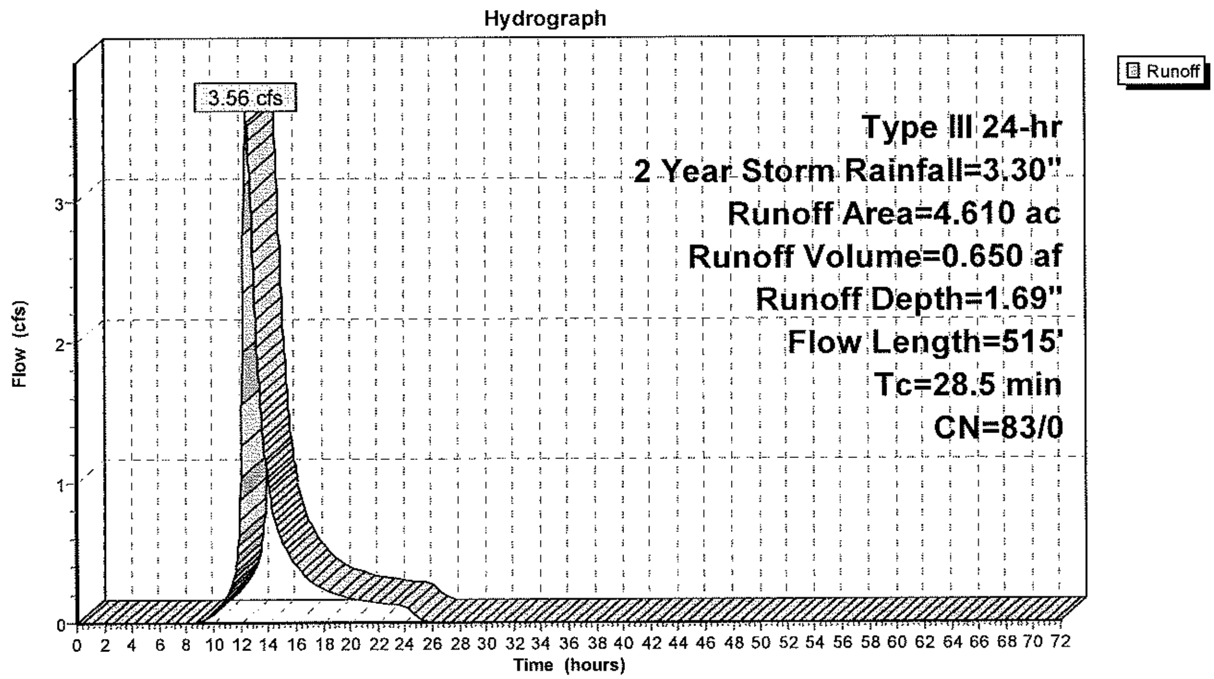
Runoff = 3.56 cfs @ 12.48 hrs, Volume= 0.650 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
4.580	83	Fallow, crop residue, Good, HSG B
0.030	96	Gravel surface, HSG B
4.610	83	Weighted Average
4.610	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4	150	0.0070	0.11		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
6.1	365	0.0100	1.00		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
28.5	515	Total			

Subcatchment X1a:



Summary for Subcatchment X2:

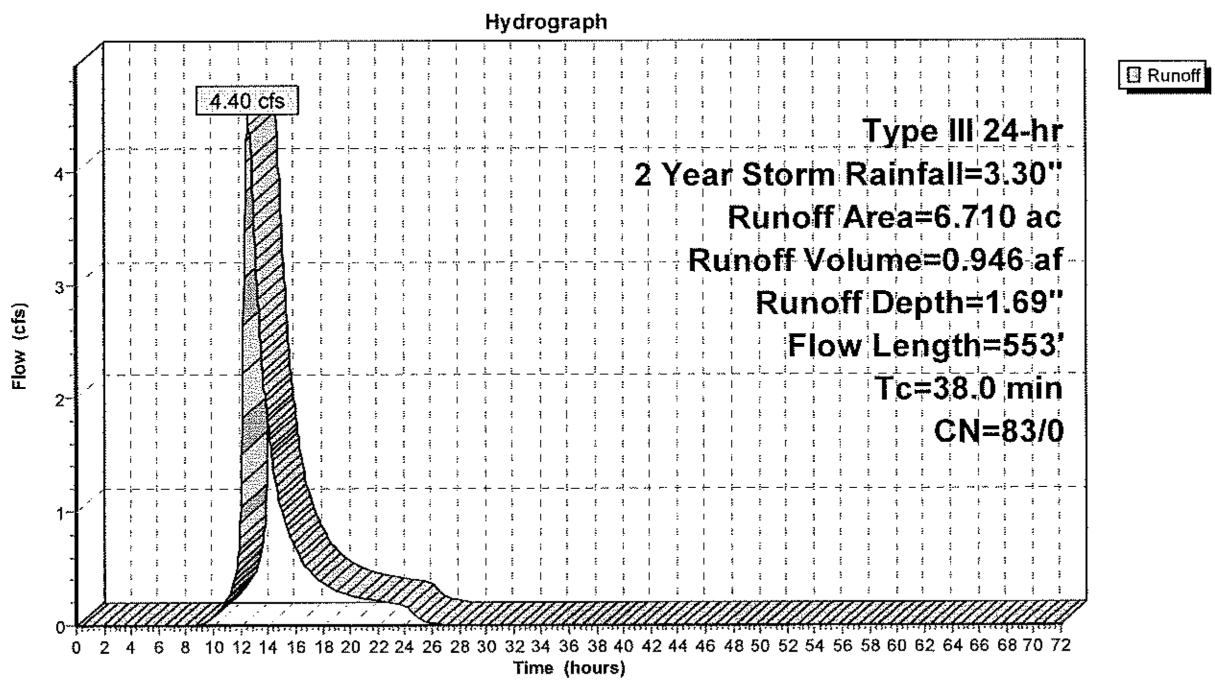
Runoff = 4.40 cfs @ 12.61 hrs, Volume= 0.946 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
0.120	82	Dirt roads, HSG B
6.590	83	Fallow, crop residue, Good, HSG B
6.710	83	Weighted Average
6.710	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.7	150	0.0050	0.10		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
12.3	403	0.0030	0.55		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
38.0	553	Total			

Subcatchment X2:



Summary for Subcatchment X3:

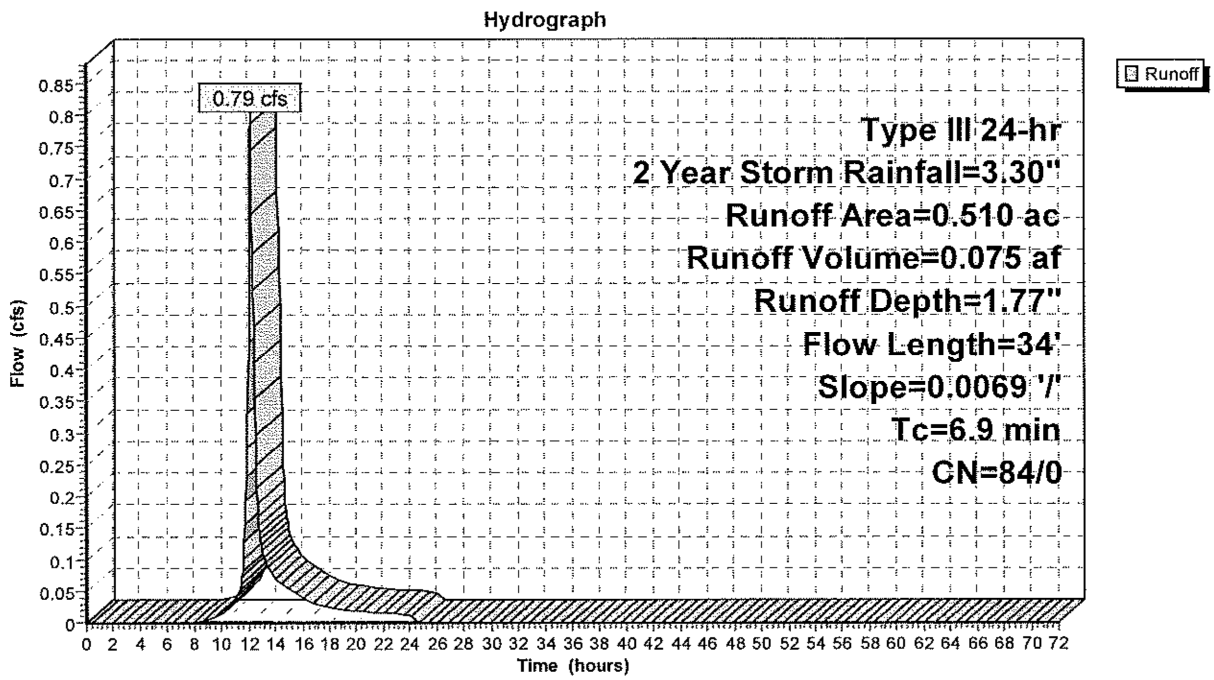
Runoff = 0.79 cfs @ 12.13 hrs, Volume= 0.075 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
0.040	96	Gravel surface, HSG B
0.470	83	Fallow, crop residue, Good, HSG B
0.510	84	Weighted Average
0.510	84	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	34	0.0069	0.08		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"

Subcatchment X3:

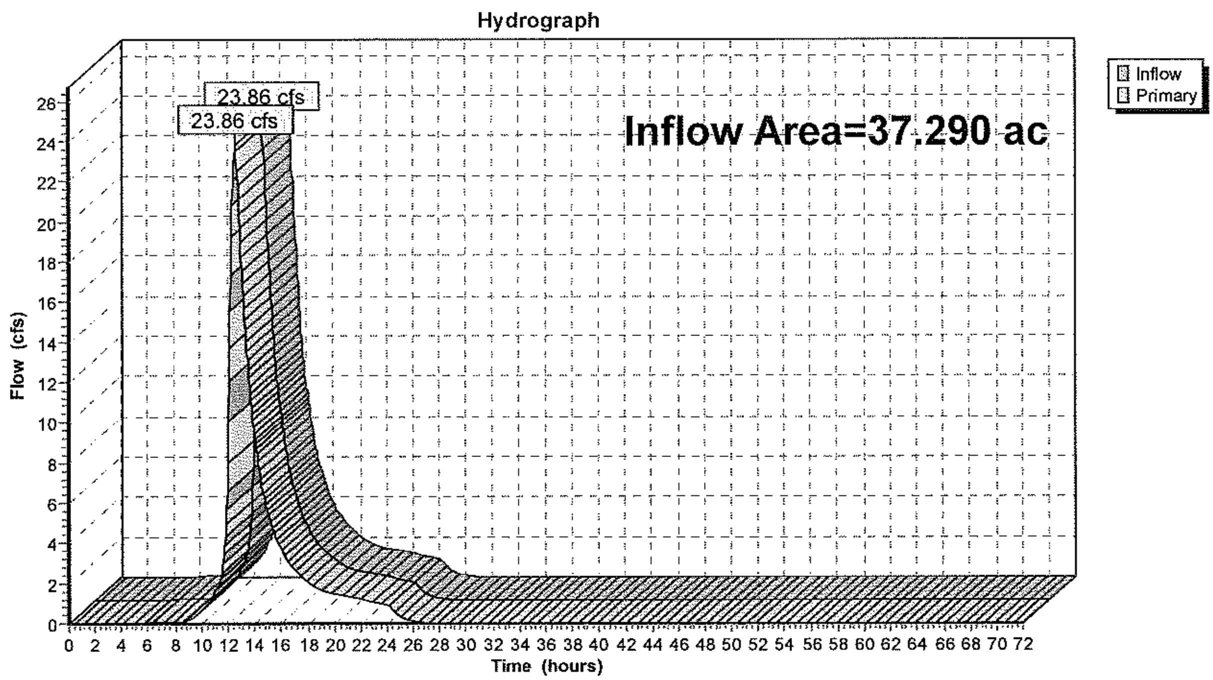


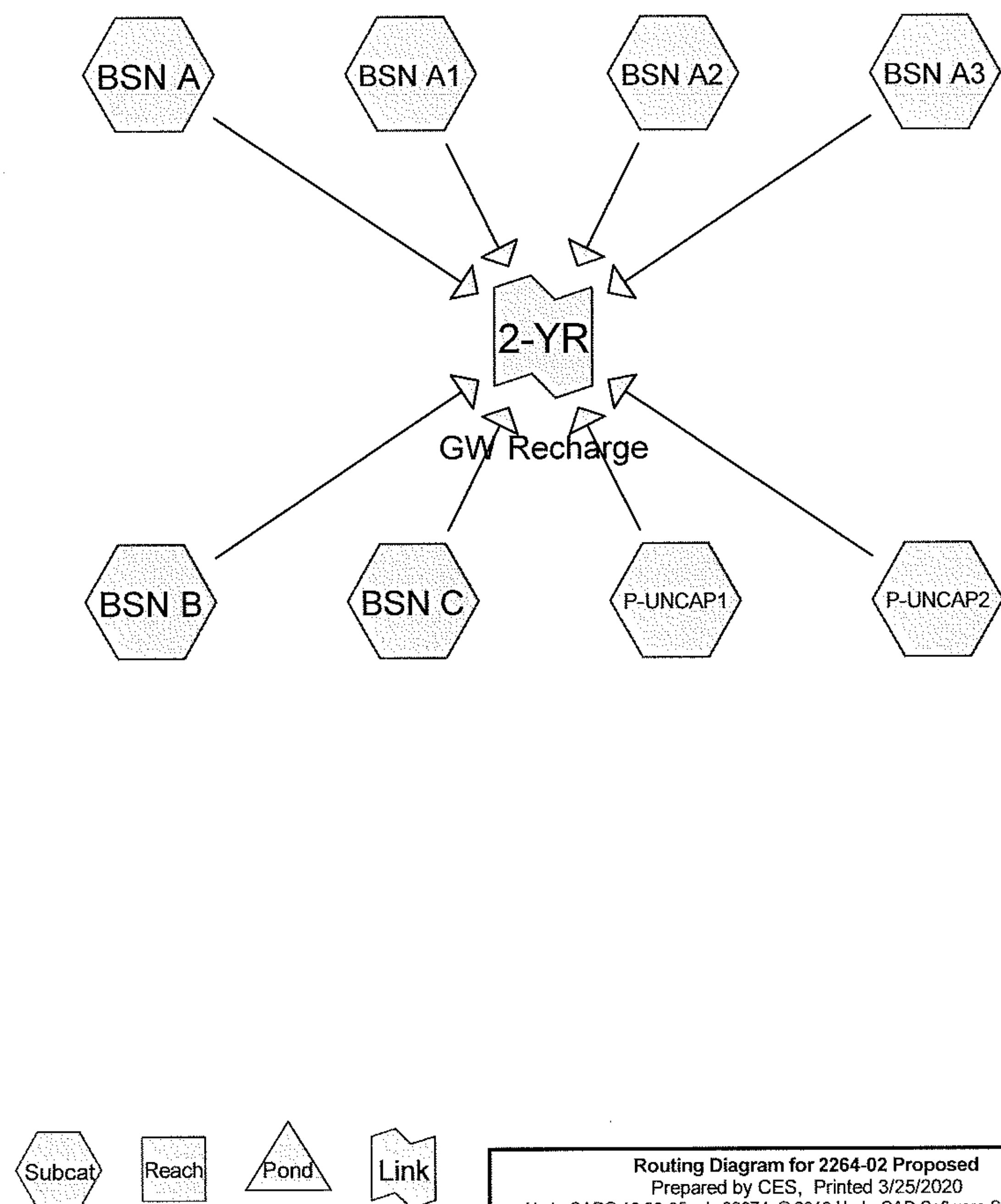
Summary for Link 2-YR: Groundwater Recharge

Inflow Area =	37.290 ac,	2.84% Impervious, Inflow Depth = 1.71"	for 2 Year Storm event	
Inflow =	23.86 cfs @	12.56 hrs, Volume=	5.313 af	
Primary =	23.86 cfs @	12.56 hrs, Volume=	5.313 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link 2-YR: Groundwater Recharge





Routing Diagram for 2264-02 Proposed
Prepared by CES, Printed 3/25/2020
HydroCAD® 10.00-25 s/n 02074 © 2019 HydroCAD Software Solutions LLC

Summary for Subcatchment BSN A:

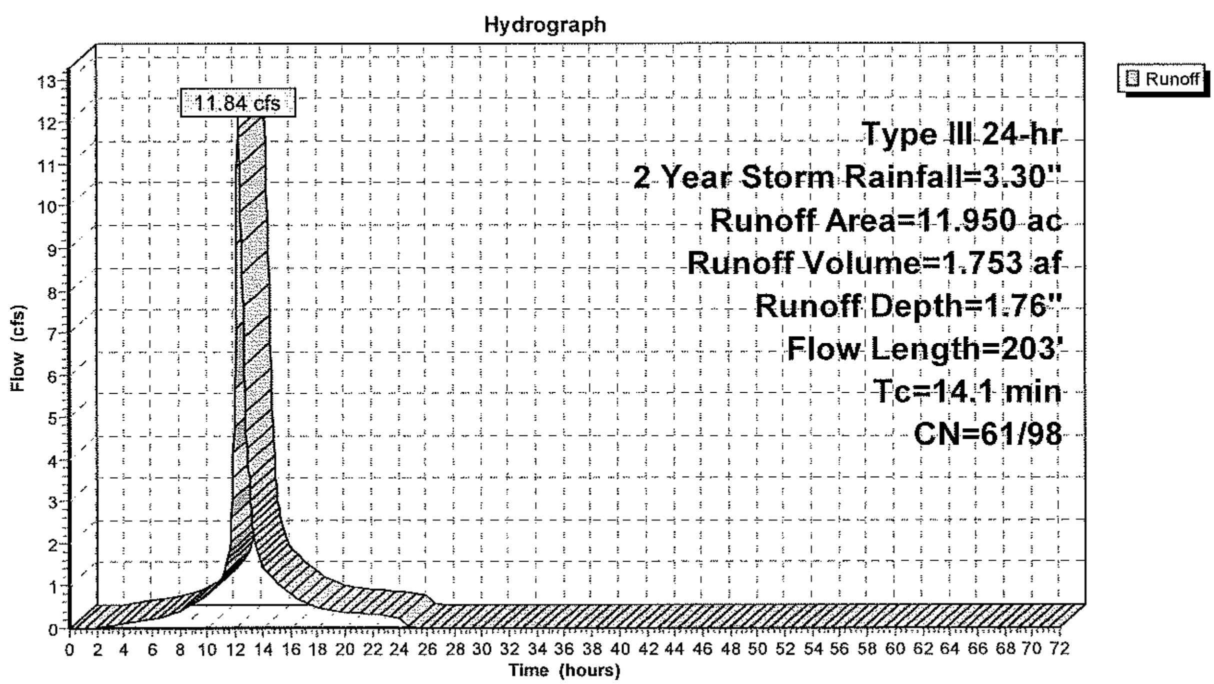
Runoff = 11.84 cfs @ 12.23 hrs, Volume= 1.753 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
6.050	61	>75% Grass cover, Good, HSG B
5.900	98	Paved roads w/curbs & sewers
11.950	79	Weighted Average
6.050		50.63% Pervious Area
5.900		49.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	18	0.0089	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.3	132	0.0069	0.96		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.5	53	0.0069	1.69		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.9					**Direct Entry, from pipe calcs**
14.1	203	Total			

Subcatchment BSN A:



Summary for Subcatchment BSN A1:

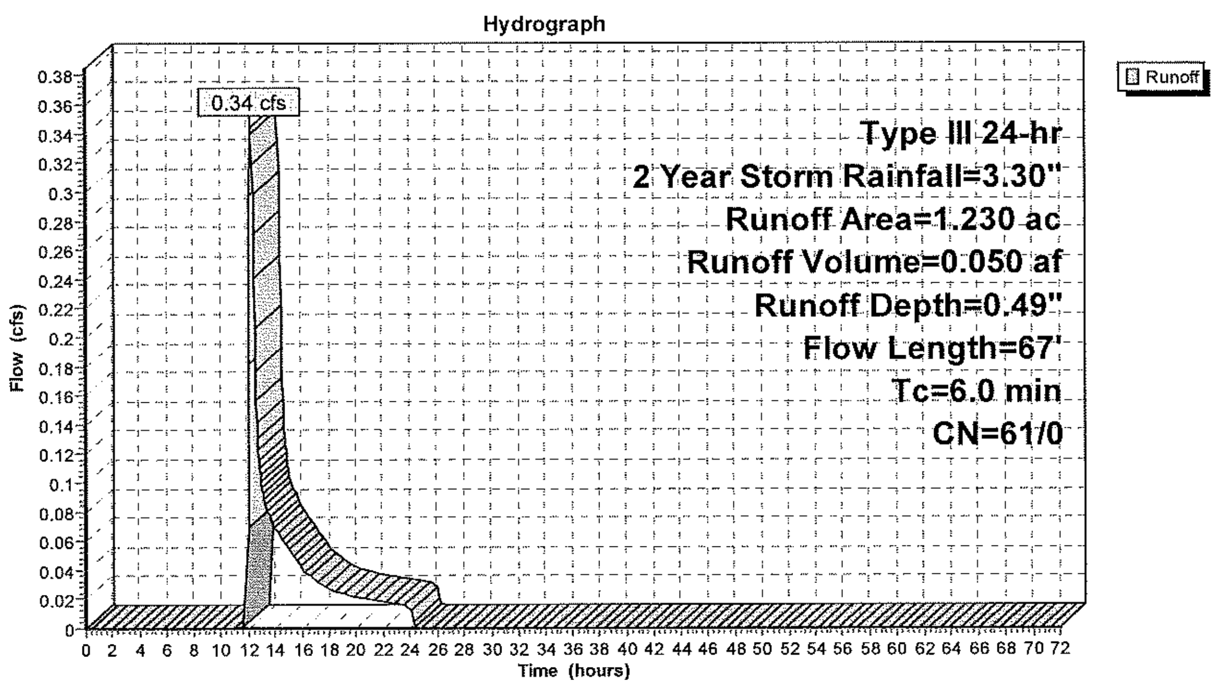
Runoff = 0.34 cfs @ 12.20 hrs, Volume= 0.050 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
1.230	61	>75% Grass cover, Good, HSG B
1.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	18	0.0560	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.6	12	0.3333	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
1.1	13	0.0784	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
1.0	24	0.3333	0.40		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
4.3	67	Total, Increased to minimum Tc = 6.0 min			

Subcatchment BSN A1:



Summary for Subcatchment BSN A2:

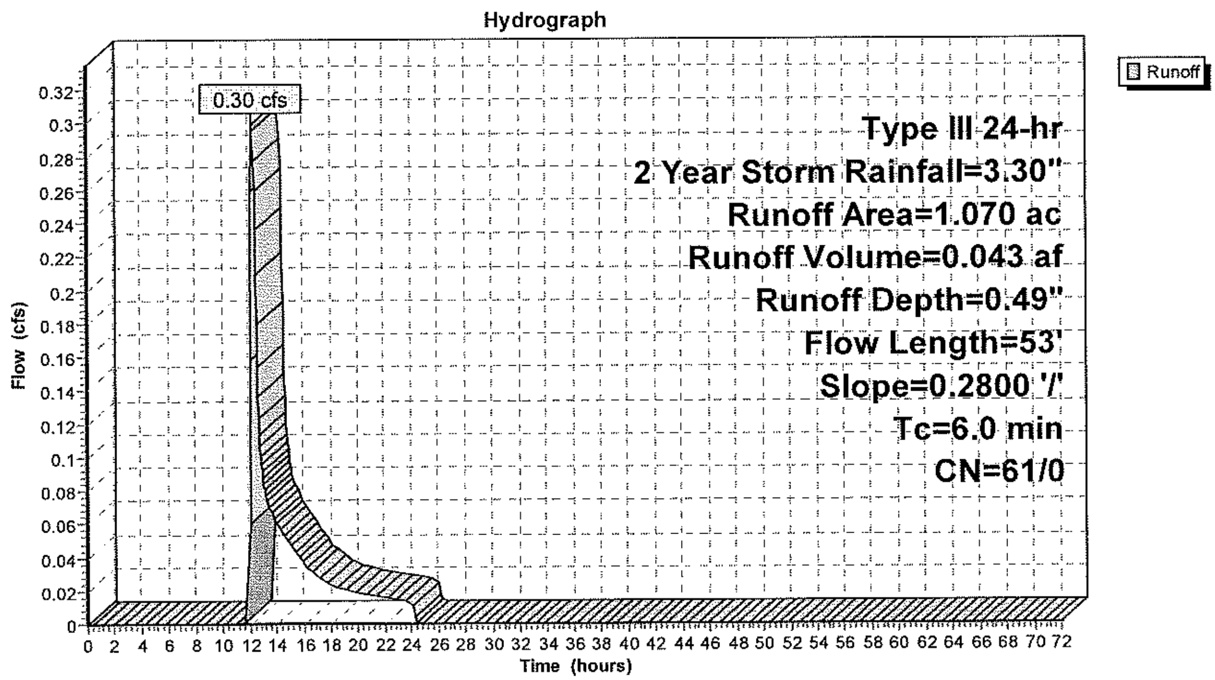
Runoff = 0.30 cfs @ 12.20 hrs, Volume= 0.043 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
1.070	61	>75% Grass cover, Good, HSG B
1.070		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	53	0.2800	0.44		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.0	53	Total, Increased to minimum Tc = 6.0 min			

Subcatchment BSN A2:



Summary for Subcatchment BSN A3:

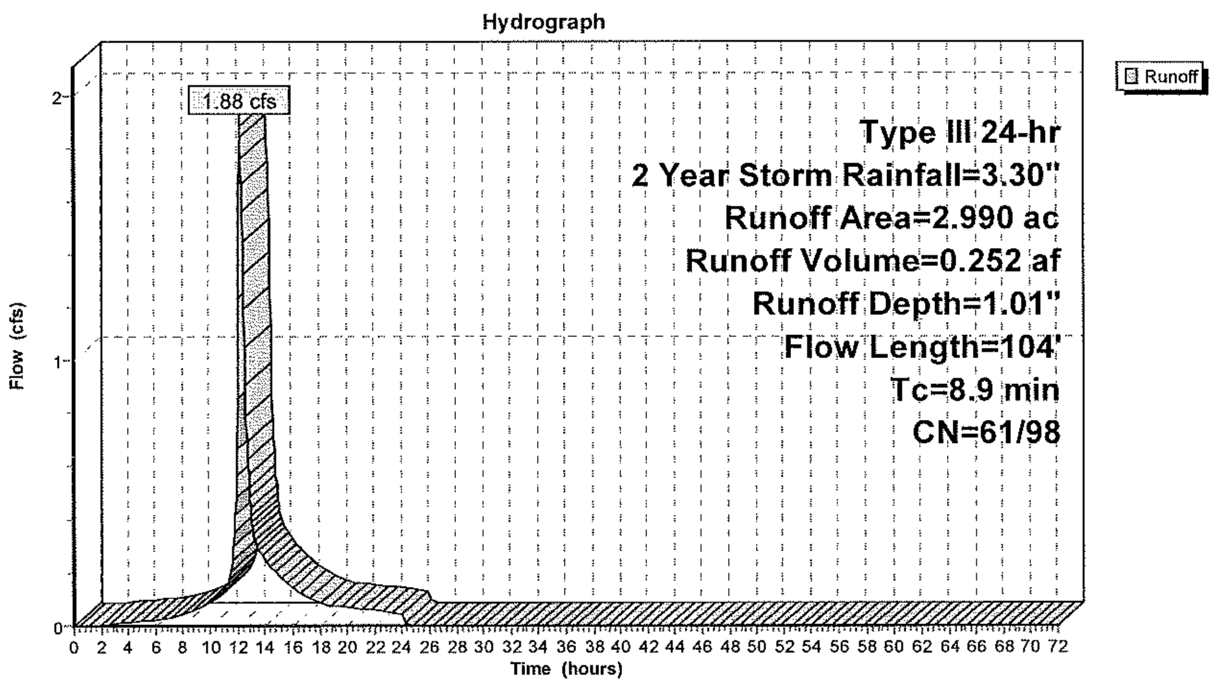
Runoff = 1.88 cfs @ 12.17 hrs, Volume= 0.252 af, Depth= 1.01"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
2.380	61	>75% Grass cover, Good, HSG B
0.610	98	Paved parking, HSG B
2.990	69	Weighted Average
2.380		79.60% Pervious Area
0.610		20.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	92	0.0249	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.6	12	0.3333	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
8.9	104	Total			

Subcatchment BSN A3:



Summary for Subcatchment BSN B:

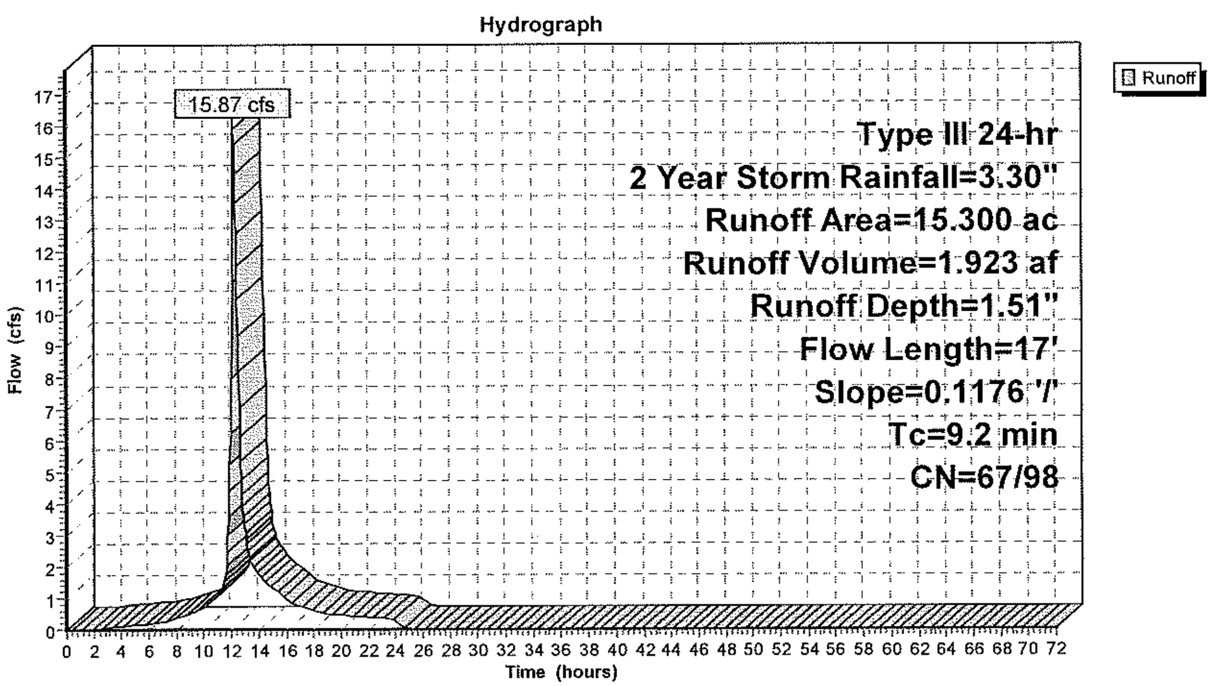
Runoff = 15.87 cfs @ 12.16 hrs, Volume= 1.923 af, Depth= 1.51"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
5.050	98	Paved parking & roofs
7.610	61	>75% Grass cover, Good, HSG B
2.640	83	Fallow, crop residue, Good, HSG B
15.300	77	Weighted Average
10.250		66.99% Pervious Area
5.050		33.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	17	0.1176	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
8.0					**Direct Entry, from pipe calcs**
9.2	17	Total			

Subcatchment BSN B:



Summary for Subcatchment BSN C:

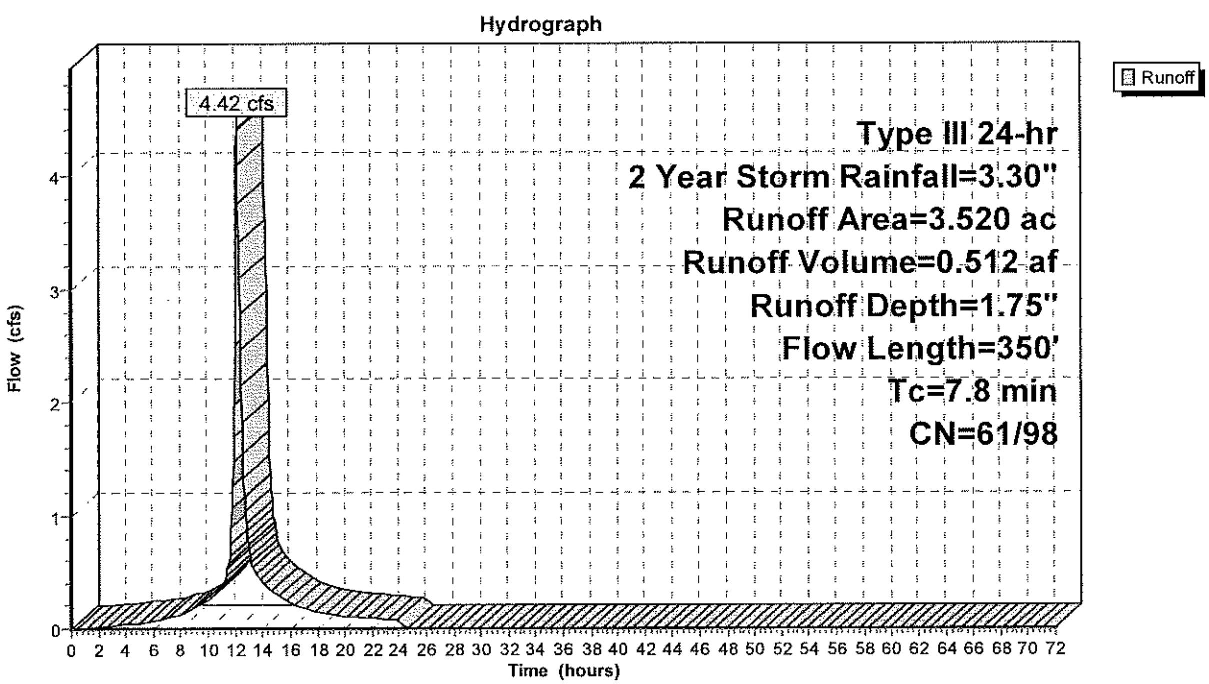
Runoff = 4.42 cfs @ 12.14 hrs, Volume= 0.512 af, Depth= 1.75"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
1.720	98	Paved parking & roofs
1.800	61	>75% Grass cover, Good, HSG B
3.520	79	Weighted Average
1.800		51.14% Pervious Area
1.720		48.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	25	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.4	125	0.0056	0.88		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
2.2	200	0.0056	1.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.8	350	Total			

Subcatchment BSN C:



Summary for Subcatchment P-UNCAP1:

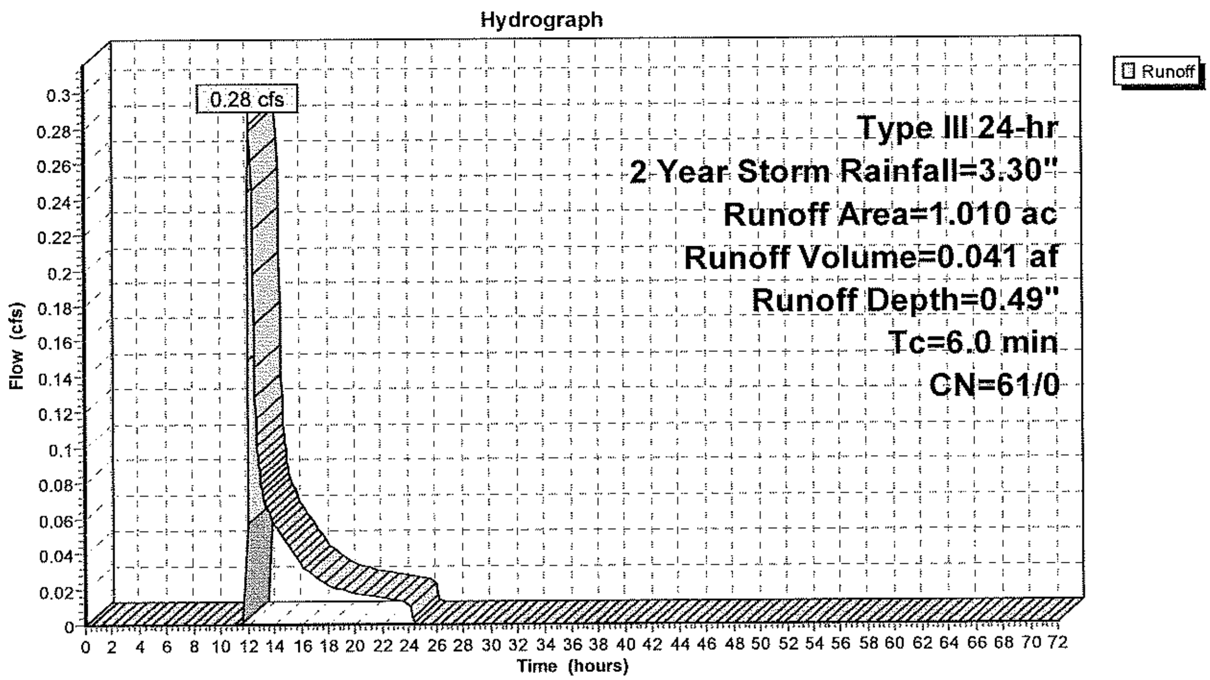
Runoff = 0.28 cfs @ 12.20 hrs, Volume= 0.041 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
1.010	61	>75% Grass cover, Good, HSG B
1.010		100.00% Pervious Area

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

Subcatchment P-UNCAP1:



Summary for Subcatchment P-UNCAP2:

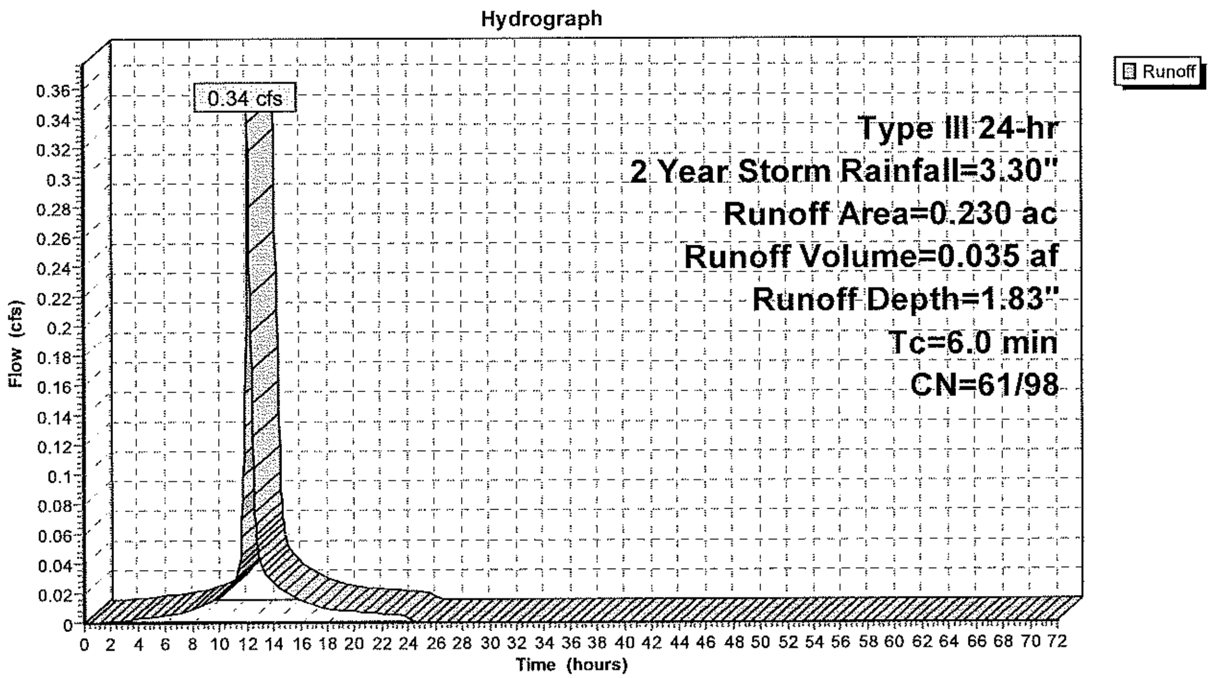
Runoff = 0.34 cfs @ 12.11 hrs, Volume= 0.035 af, Depth= 1.83"

Runoff by SCS TR-20 method, UH=Delmarva, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
0.120	98	Unconnected pavement, HSG B
0.110	61	>75% Grass cover, Good, HSG B
0.230	80	Weighted Average
0.110		47.83% Pervious Area
0.120		52.17% Impervious Area

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

Subcatchment P-UNCAP2:

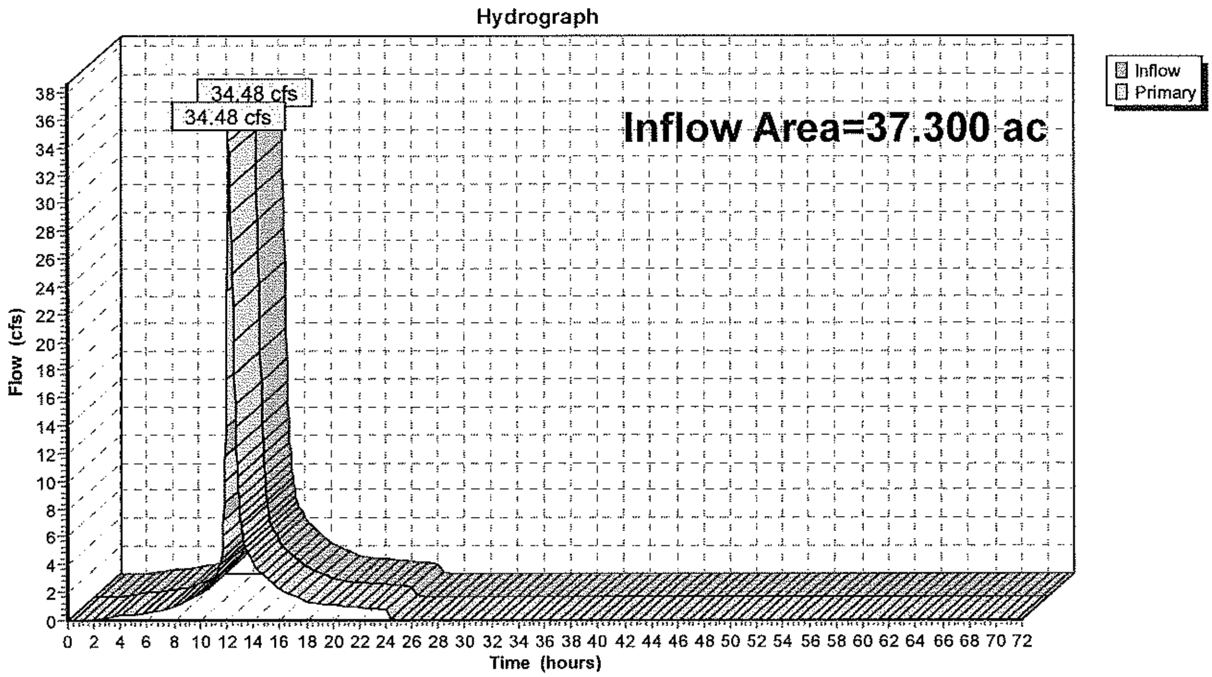


Summary for Link 2-YR: GW Recharge

Inflow Area =	37.300 ac, 35.92% Impervious, Inflow Depth = 1.48"	for 2 Year Storm event
Inflow =	34.48 cfs @ 12.18 hrs, Volume=	4.609 af
Primary =	34.48 cfs @ 12.18 hrs, Volume=	4.609 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link 2-YR: GW Recharge



APPENDIX I

GROUNDWATER MOUNDING ANALYSIS

Basin A

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changedotherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days or inches & hours)

Input Values			
3.0000	*R*	Recharge (infiltration) rate (feet/day)
0.250	Sy	Specific yield, Sy (dimensionless, between 0 and 1)
30.00	K	Horizontal hydraulic conductivity, Kh (feet/day)*
55.000	x	1/2 length of basin (x direction, in feet)
135.000	y	1/2 width of basin (y direction, in feet)
0.063	t	duration of infiltration period (days)
10.000	hi(0)	initial thickness of saturated zone (feet)

Conversion Table

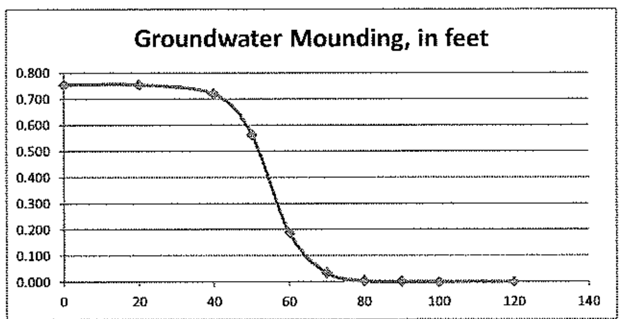
inch/hour	feet/day
0.67	1.33
2.00	4.00
hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

10.756	10.756	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
0.756	0.756	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)

	Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.756	0.756	0
0.756	0.756	20
0.720	0.720	40
0.566	0.566	50
0.189	0.189	60
0.035	0.035	70
0.004	0.004	80
0.001	0.001	90
0.000	0.000	100
0.000	0.000	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Basin A1

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changedotherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
13.2000	*R*	Recharge (infiltration) rate (feet/day)
0.250	Sy	Specific yield, Sy (dimensionless, between 0 and 1)
132.00	K	Horizontal hydraulic conductivity, Kh (feet/day)*
90.000	x	1/2 length of basin (x direction, in feet)
65.000	y	1/2 width of basin (y direction, in feet)
0.071	t	duration of infiltration period (days)
10.000	hi(0)	initial thickness of saturated zone (feet)

Conversion Table

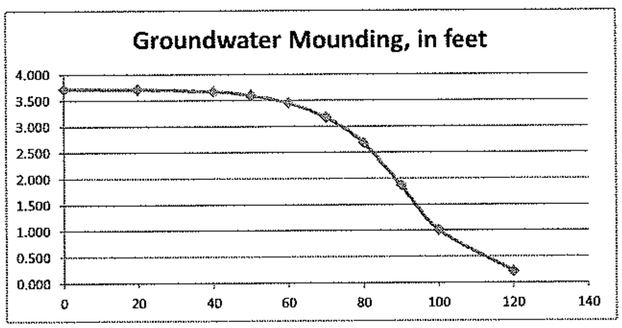
inch/hour	feet/day
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

13.722	[illegible]	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
3.722	[illegible]	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)

	Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
3.722	[illegible]	0
3.716	[illegible]	20
3.671	[illegible]	40
3.599	[illegible]	50
3.453	[illegible]	60
3.175	[illegible]	70
2.656	[illegible]	80
1.866	[illegible]	90
1.020	[illegible]	100
0.231	[illegible]	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Basin A2

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days or inches & hours)

Input Values		
8.9000	R	**Recharge (infiltration) rate (feet/day)**
0.250	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
89.00	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
65.000	x	**1/2 length of basin (x direction, in feet)**
27.000	y	**1/2 width of basin (y direction, in feet)**
0.100	t	**duration of infiltration period (days)**
10.000	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

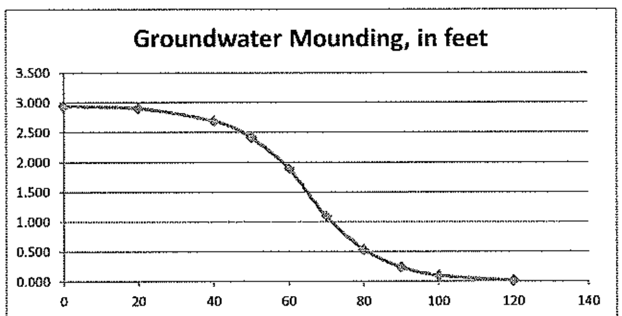
inch/hour	feet/day
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

12.942	12.942	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
2.942	2.942	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

	Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
2.942	2.942	0
2.907	2.907	20
2.697	2.697	40
2.416	2.416	50
1.895	1.895	60
1.092	1.092	70
0.541	0.541	80
0.245	0.245	90
0.101	0.101	100
0.014	0.014	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Basin A3

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
6.3300	*R*	**Recharge (infiltration) rate (feet/day)**
0.250	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
63.30	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
5.000	x	**1/2 length of basin (x direction, in feet)**
500.000	y	**1/2 width of basin (y direction, in feet)**
0.858	t	**duration of infiltration period (days)**
10.000	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

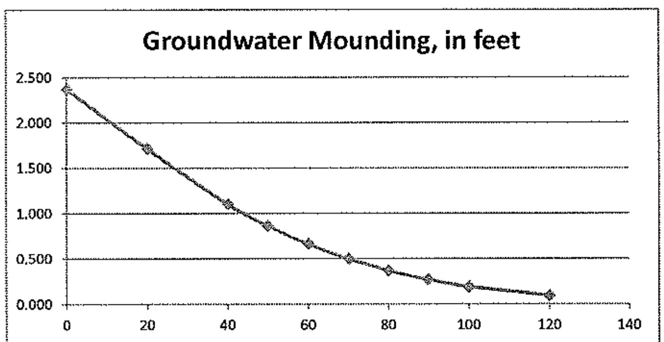
inch/hour	feet/day
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

12.377	[illegible]	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
2.377	[illegible]	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

	Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
2.377	[illegible]	0
1.718	[illegible]	20
1.108	[illegible]	40
0.866	[illegible]	50
0.656	[illegible]	60
0.502	[illegible]	70
0.373	[illegible]	80
0.272	[illegible]	90
0.196	[illegible]	100
0.098	[illegible]	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Basin B

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
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use consistent units (e.g. feet & days or inches & hours)

Input Values		
3.0000	*R*	Recharge (infiltration) rate (feet/day)
0.250	Sy	Specific yield, Sy (dimensionless, between 0 and 1)
30.00	K	Horizontal hydraulic conductivity, Kh (feet/day)*
55.000	x	1/2 length of basin (x direction, in feet)
40.000	y	1/2 width of basin (y direction, in feet)
0.317	t	duration of infiltration period (days)
10.000	hi(0)	initial thickness of saturated zone (feet)

Conversion Table

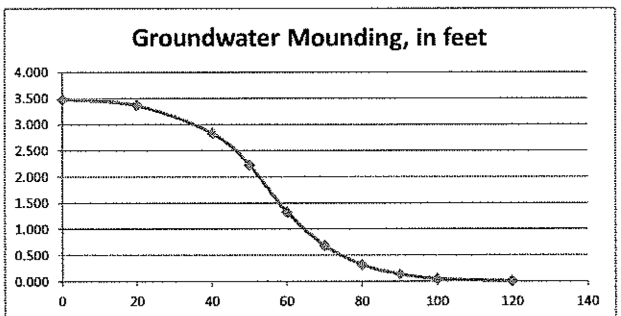
inch/hour	feet/day
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

13.483	[illegible]	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
3.483	[illegible]	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)

	Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
3.483	[illegible]	0
3.371	[illegible]	20
2.839	[illegible]	40
2.232	[illegible]	50
1.334	[illegible]	60
0.692	[illegible]	70
0.328	[illegible]	80
0.143	[illegible]	90
0.057	[illegible]	100
0.008	[illegible]	120

Re-Calculate Now



Disclaimer

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APPENDIX J

BASIN SUMMARY FORMS

Basin A

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Project Site Details

Chpt. 251 Application Number:

Start Date (if known): TBD

Street Address:Fries Mill Road (County Route 655) and Glassboro-Cross Keys Road (County Route 689)

County: Gloucester County

Municipality: Monroe Township

Block: 14801

Lot: 12

NJDEP Anderson Landuse Code (4 digits): 1110

Landuse description: Residential, high density

Site Centroid Location (NJ State Plane Feet): [1]

Northing: 319,622 Easting: 336,384

Project Contact Details

Applicant: N.W.D. Development, LLC

Address: 701 Cooper Street, Suite 7, Voorhees, NJ

Phone: (856) 346-4400

Email:

Post Construction Operation & Maintenance:[2]

Party Name: TBD

Address:

Phone:

Email:

Party type (HOA, government, private, etc): HOA

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Basin Details:[3]

Basin Centroid (NJ State Plane Feet):[4]

Northing: 319,918 Easting: 335,290

Basin Type: infiltration

Construction: excavated

Status phase:[5] Design ☒ As-built ☐

Dam Height (ft) top width (ft)

Dam Classification: choose an item

Drainage Area(s) to Basin [note- include any bypass areas][6]

Drainage Area Name	Drainage Area (acres)	Post-Development CN#	Percent Impervious	Time of Concentration (min)
BSN A	11.95	79	49.4%	14.1

Basin Outlet Structure(s)[7]

ID: OFSA

End of Pipe Location:[8] Northing: 319,821 Easting: 335,383

Discharge Type[9] (weir, orifice, etc)	Dimensions (diameter, length)	Elevation (USGS)	Discharge [10]Coefficient	Equation Used[11]
Culvert	24"	147.94	0.60	Orifice eqn.
Weir	0.5'Wx2.1'H	147.95	2.62	Weir eqn.
Culvert	15"	152.50	0.60	Orifice eqn.
Spillway	220'	154.00		

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Basin Outlet Structure(s)

ID:

End of Pipe Location: Northing: Easting:

Discharge Type (weir, orifice, etc)	Dimensions (diameter, length)	Elevation (USGS)	Discharge Coefficient	Equation Used

Basin Stage-Discharge Rating Table[12]

Elevation (USGS Feet)	Storage (Acre-Ft)	Total Outlet Structure Discharge (cfs)
146.25	0.00	0.00
147.00	0.53	0.00
148.00	1.28	0.01
149.00	2.08	1.77
150.00	2.95	4.80
151.00	3.88	7.21
152.00	4.86	8.89
153.00	5.91	11.15
154.00	7.03	16.10

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

NJDEP BMP Water Quality Structures[13]

Type (rain garden, green roof, seepage pit etc)	Size	Size Units (cu ft, sq ft etc)	Northing (SPF)	Easting (SPF)
choose an item				
choose an item				
choose an item				
choose an item				
choose an item				

Explanatory Notes-

[1] Approximate location of center of site, coordinates in state plane feet
[2] Indicate who will be responsible for permanent operation and maintenance
[3] Additional Basin Detail Pages can be used for more than one basin in a project.
[4] Approximate location of center of basin, coordinates in state plane feet
[5] Indicate "design" for basins not yet constructed
[6] Drainage areas which are modified by construction, but not directed to the basin should still be listed and described
[7] "Outlet structure" means the control box, outlet headwall, FES etc. This does not refer to an individual control on the structure such as a weir or orifice. There are two tables for more than one outlet structure
[8] Approximate location of terminal discharge end of basin outfall, coordinates instate plane feet
[9] Indicate the type of outlet – weir, orifice, hydro brake, etc.
[10] Discharge Coefficient specific to the type of outlet control i.e., 0.6 for circular orifice
[11] List the discharge equation for each outlet (weir, orifice etc) used
[12] For basins with dead storage below the primary outlet, indicate 0 cfs discharge until the lowest outlet is reached. Routing table should begin at the lowest basin elevation.
[13] Describe NJDEP BMP Manual water quality devices such as seepage pits, rain gardens etc. Size is appropriate for device – cubic feet, square feet or linear feet. Location of device using state plane feet coordinates.

Basin A1

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Project Site Details

Chpt. 251 Application Number:

Start Date (if known): TBD

Street Address:Fries Mill Road (County Route 655) and Glassboro-Cross Keys Road (County Route 689)

County: Gloucester County

Municipality: Monroe Township

Block: 14801

Lot: 12

NJDEP Anderson Landuse Code (4 digits): 1110

Landuse description: Residential, high density

Site Centroid Location (NJ State Plane Feet): [1]

Northing: 319,622 Easting: 336,384

Project Contact Details

Applicant: N.W.D. Development, LLC

Address: 701 Cooper Street, Suite 7, Voorhees, NJ

Phone: (856) 346-4400

Email:

Post Construction Operation & Maintenance:[2]

Party Name: TBD

Address:

Phone:

Email:

Party type (HOA, government, private, etc): HOA

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Basin Details:[3]

Basin Centroid (NJ State Plane Feet):[4]

Northing: 319,757 Easting: 335,412

Basin Type: infiltration

Construction: excavated

Status phase:[5] Design ☒ As-built ☐

Dam Height (ft) top width (ft)

Dam Classification: choose an item

Drainage Area(s) to Basin [note- include any bypass areas][6]

Drainage Area Name	Drainage Area (acres)	Post-Development CN#	Percent Impervious	Time of Concentration (min)
BSN A1	1.23	61	0.0%	6

Basin Outlet Structure(s)[7]

ID: OFSA1

End of Pipe Location:[8] Northing: 319,623 Easting: 335,552

Discharge Type[9] (weir, orifice, etc)	Dimensions (diameter, length)	Elevation (USGS)	Discharge [10]Coefficient	Equation Used[11]
Culvert	24"	147.75	0.60	Orifice eqn.
Weir	0.25'Wx0.75'H	148.75	2.62	Weir eqn.
Weir	1.0'Wx0.6'H	149.50	2.62	Weir eqn.
Spillway	68'	154.00		

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Basin Outlet Structure(s)

ID:

End of Pipe Location: Northing: Easting:

Discharge Type (weir, orifice, etc)	Dimensions (diameter, length)	Elevation (USGS)	Discharge Coefficient	Equation Used

Basin Stage-Discharge Rating Table[12]

Elevation (USGS Feet)	Storage (Acre-Ft)	Total Outlet Structure Discharge (cfs)
147.75	0.00	0.00
148.00	0.11	0.00
149.00	0.59	0.11
150.00	1.12	2.05
151.00	1.69	4.50
152.00	2.31	5.94
153.00	2.96	7.08
154.00	3.69	8.15
155.00	4.46	193.98

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

NJDEP BMP Water Quality Structures[13]

Type (rain garden, green roof, seepage pit etc)	Size	Size Units (cu ft, sq ft etc)	Northing (SPF)	Easting (SPF)
choose an item				
choose an item				
choose an item				
choose an item				
choose an item				

Explanatory Notes-

[1] Approximate location of center of site, coordinates in state plane feet
[2] Indicate who will be responsible for permanent operation and maintenance
[3] Additional Basin Detail Pages can be used for more than one basin in a project.
[4] Approximate location of center of basin, coordinates in state plane feet
[5] Indicate "design" for basins not yet constructed
[6] Drainage areas which are modified by construction, but not directed to the basin should still be listed and described
[7] "Outlet structure" means the control box, outlet headwall, FES etc. This does not refer to an individual control on the structure such as a weir or orifice. There are two tables for more than one outlet structure
[8] Approximate location of terminal discharge end of basin outfall, coordinates instate plane feet
[9] Indicate the type of outlet – weir, orifice, hydro brake, etc.
[10] Discharge Coefficient specific to the type of outlet control i.e., 0.6 for circular orifice
[11] List the discharge equation for each outlet (weir, orifice etc) used
[12] For basins with dead storage below the primary outlet, indicate 0 cfs discharge until the lowest outlet is reached. Routing table should begin at the lowest basin elevation.
[13] Describe NJDEP BMP Manual water quality devices such as seepage pits, rain gardens etc. Size is appropriate for device – cubic feet, square feet or linear feet. Location of device using state plane feet coordinates.

Basin A2

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Project Site Details

Chpt. 251 Application Number:

Start Date (if known): TBD

Street Address:Fries Mill Road (County Route 655) and Glassboro-Cross Keys Road (County Route 689)

County: Gloucester County

Municipality: Monroe Township

Block: 14801

Lot: 12

NJDEP Anderson Landuse Code (4 digits): 1110

Landuse description: Residential, high density

Site Centroid Location (NJ State Plane Feet): [1]

Northing: 319,622 Easting: 336,384

Project Contact Details

Applicant: N.W.D. Development, LLC

Address: 701 Cooper Street, Suite 7, Voorhees, NJ

Phone: (856) 346-4400

Email:

Post Construction Operation & Maintenance:[2]

Party Name: TBD

Address:

Phone:

Email:

Party type (HOA, government, private, etc): HOA

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Basin Details:[3]

Basin Centroid (NJ State Plane Feet):[4]

Northing: 319,569 Easting: 335,634

Basin Type: infiltration

Construction: excavated

Status phase:[5] Design ☒ As-built ☐

Dam Height (ft) top width (ft)

Dam Classification: choose an item

Drainage Area(s) to Basin [note- include any bypass areas][6]

Drainage Area Name	Drainage Area (acres)	Post-Development CN#	Percent Impervious	Time of Concentration (min)
BSN A2	1.07	61	0.0%	6

Basin Outlet Structure(s)[7]

ID:

End of Pipe Location:[8] Northing: Easting:

Discharge Type[9] (weir, orifice, etc)	Dimensions (diameter, length)	Elevation (USGS)	Discharge [10]Coefficient	Equation Used[11]
Spilllway	154.00	20'		

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Basin Outlet Structure(s)

ID:

End of Pipe Location: Northing: Easting:

Discharge Type (weir, orifice, etc)	Dimensions (diameter, length)	Elevation (USGS)	Discharge Coefficient	Equation Used

Basin Stage-Discharge Rating Table[12]

Elevation (USGS Feet)	Storage (Acre-Ft)	Total Outlet Structure Discharge (cfs)
146.50	0.00	0.00
147.00	0.18	0.00
148.00	0.56	0.00
149.00	0.99	0.00
150.00	1.47	0.00
151.00	1.99	0.00
152.00	2.58	0.00
153.00	3.21	0.00
154.00	3.92	0.00

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

NJDEP BMP Water Quality Structures[13]

Type (rain garden, green roof, seepage pit etc)	Size	Size Units (cu ft, sq ft etc)	Northing (SPF)	Easting (SPF)
choose an item				
choose an item				
choose an item				
choose an item				
choose an item				

Explanatory Notes-

---

[1] Approximate location of center of site, coordinates in state plane feet
[2] Indicate who will be responsible for permanent operation and maintenance
[3] Additional Basin Detail Pages can be used for more than one basin in a project.
[4] Approximate location of center of basin, coordinates in state plane feet
[5] Indicate "design" for basins not yet constructed
[6] Drainage areas which are modified by construction, but not directed to the basin should still be listed and described
[7] "Outlet structure" means the control box, outlet headwall, FES etc. This does not refer to an individual control on the structure such as a weir or orifice. There are two tables for more than one outlet structure
[8] Approximate location of terminal discharge end of basin outfall, coordinates instate plane feet
[9] Indicate the type of outlet – weir, orifice, hydro brake, etc.
[10] Discharge Coefficient specific to the type of outlet control i.e., 0.6 for circular orifice
[11] List the discharge equation for each outlet (weir, orifice etc) used
[12] For basins with dead storage below the primary outlet, indicate 0 cfs discharge until the lowest outlet is reached. Routing table should begin at the lowest basin elevation.
[13] Describe NJDEP BMP Manual water quality devices such as seepage pits, rain gardens etc. Size is appropriate for device – cubic feet, square feet or linear feet. Location of device using state plane feet coordinates.

Basin A3

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Project Site Details

Chpt. 251 Application Number:

Start Date (if known): TBD

Street Address:Fries Mill Road (County Route 655) and Glassboro-Cross Keys Road (County Route 689)

County: Gloucester County

Municipality: Monroe Township

Block: 14801

Lot: 12

NJDEP Anderson Landuse Code (4 digits): 1110

Landuse description: Residential, high density

Site Centroid Location (NJ State Plane Feet): [1]

Northing: 319,622 Easting: 336,384

Project Contact Details

Applicant: N.W.D. Development, LLC

Address: 701 Cooper Street, Suite 7, Voorhees, NJ

Phone: (856) 346-4400

Email:

Post Construction Operation & Maintenance:[2]

Party Name: TBD

Address:

Phone:

Email:

Party type (HOA, government, private, etc): HOA

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Basin Details:[3]

Basin Centroid (NJ State Plane Feet):[4]

Northing: 319,207 Easting: 336.062

Basin Type: infiltration

Construction: excavated

Status phase:[5] Design ☒ As-built ☐

Dam Height (ft) top width (ft)

Dam Classification: choose an item

Drainage Area(s) to Basin [note- include any bypass areas][6]

Drainage Area Name	Drainage Area (acres)	Post-Development CN#	Percent Impervious	Time of Concentration (min)
BSN A3	2.99	69	20.4%	8.9

Basin Outlet Structure(s)[7]

ID:

End of Pipe Location:[8] Northing: Easting:

Discharge Type[9] (weir, orifice, etc)	Dimensions (diameter, length)	Elevation (USGS)	Discharge [10]Coefficient	Equation Used[11]
Spillway	233'	155.00		

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Basin Outlet Structure(s)

ID:

End of Pipe Location: Northing: Easting:

Discharge Type (weir, orifice, etc)	Dimensions (diameter, length)	Elevation (USGS)	Discharge Coefficient	Equation Used

Basin Stage-Discharge Rating Table[12]

Elevation (USGS Feet)	Storage (Acre-Ft)	Total Outlet Structure Discharge (cfs)
152.00	0.00	0.00
152.50	0.11	0.00
153.00	0.26	0.00
153.50	0.44	0.00
154.00	0.66	0.00
154.50	0.93	0.00
155.00	1.23	0.00
155.50	1.58	215.83
156.00	1.98	624.44

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

NJDEP BMP Water Quality Structures[13]

Type (rain garden, green roof, seepage pit etc)	Size	Size Units (cu ft, sq ft etc)	Northing (SPF)	Easting (SPF)
choose an item				
choose an item				
choose an item				
choose an item				
choose an item				

Explanatory Notes-

[1] Approximate location of center of site, coordinates in state plane feet
[2] Indicate who will be responsible for permanent operation and maintenance
[3] Additional Basin Detail Pages can be used for more than one basin in a project.
[4] Approximate location of center of basin, coordinates in state plane feet
[5] Indicate "design" for basins not yet constructed
[6] Drainage areas which are modified by construction, but not directed to the basin should still be listed and described
[7] "Outlet structure" means the control box, outlet headwall, FES etc. This does not refer to an individual control on the structure such as a weir or orifice. There are two tables for more than one outlet structure
[8] Approximate location of terminal discharge end of basin outfall, coordinates instate plane feet
[9] Indicate the type of outlet – weir, orifice, hydro brake, etc.
[10] Discharge Coefficient specific to the type of outlet control i.e., 0.6 for circular orifice
[11] List the discharge equation for each outlet (weir, orifice etc) used
[12] For basins with dead storage below the primary outlet, indicate 0 cfs discharge until the lowest outlet is reached. Routing table should begin at the lowest basin elevation.
[13] Describe NJDEP BMP Manual water quality devices such as seepage pits, rain gardens etc. Size is appropriate for device – cubic feet, square feet or linear feet. Location of device using state plane feet coordinates.

Basin B

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Project Site Details

Chpt. 251 Application Number:

Start Date (if known): TBD

Street Address:Fries Mill Road (County Route 655) and Glassboro-Cross Keys Road (County Route 689)

County: Gloucester County

Municipality: Monroe Township

Block: 14801

Lot: 12

NJDEP Anderson Landuse Code (4 digits): 1110

Landuse description: Residential, high density

Site Centroid Location (NJ State Plane Feet): [1]

Northing: 319,622 Easting: 336,384

Project Contact Details

Applicant: N.W.D. Development, LLC

Address: 701 Cooper Street, Suite 7, Voorhees, NJ

Phone: (856) 346-4400

Email:

Post Construction Operation & Maintenance:[2]

Party Name: TBD

Address:

Phone:

Email:

Party type (HOA, government, private, etc): HOA

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Basin Details:[3]

Basin Centroid (NJ State Plane Feet):[4]

Northing: 319,991 Easting: 336,102

Basin Type: infiltration

Construction: excavated

Status phase:[5] Design ☒ As-built ☐

Dam Height (ft) top width (ft)

Dam Classification: choose an item

Drainage Area(s) to Basin [note- include any bypass areas][6]

Drainage Area Name	Drainage Area (acres)	Post-Development CN#	Percent Impervious	Time of Concentration (min)
BSN B	15.30	77	33.0%	9.2

Basin Outlet Structure(s)[7]

ID: OFSB

End of Pipe Location:[8] Northing: 320,077 Easting: 336,040

Discharge Type[9] (weir, orifice, etc)	Dimensions (diameter, length)	Elevation (USGS)	Discharge [10]Coefficient	Equation Used[11]
Culvert	36"	148.00	0.60	Orifice eqn.
Weir	0.25'Wx1.5'H	149.50	2.62	Weir eqn.
Weir	1.0'Wx2.1'H	151.00	2.62	Weir eqn.

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Basin Outlet Structure(s)

ID:

End of Pipe Location: Northing: Easting:

Discharge Type (weir, orifice, etc)	Dimensions (diameter, length)	Elevation (USGS)	Discharge Coefficient	Equation Used

Basin Stage-Discharge Rating Table[12]

Elevation (USGS Feet)	Storage (Acre-Ft)	Total Outlet Structure Discharge (cfs)
148.50	0.00	0.00
149.50	0.25	0.00
150.50	0.54	0.82
151.50	0.87	3.18
152.50	1.25	8.77
153.50	1.67	15.43
154.50	2.15	19.81
155.50	2.67	23.30
156.50	3.27	52.02

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

NJDEP BMP Water Quality Structures[13]

Type (rain garden, green roof, seepage pit etc)	Size	Size Units (cu ft, sq ft etc)	Northing (SPF)	Easting (SPF)
choose an item				
choose an item				
choose an item				
choose an item				
choose an item				

Explanatory Notes-

[1] Approximate location of center of site, coordinates in state plane feet
[2] Indicate who will be responsible for permanent operation and maintenance
[3] Additional Basin Detail Pages can be used for more than one basin in a project.
[4] Approximate location of center of basin, coordinates in state plane feet
[5] Indicate "design" for basins not yet constructed
[6] Drainage areas which are modified by construction, but not directed to the basin should still be listed and described
[7] "Outlet structure" means the control box, outlet headwall, FES etc. This does not refer to an individual control on the structure such as a weir or orifice. There are two tables for more than one outlet structure
[8] Approximate location of terminal discharge end of basin outfall, coordinates instate plane feet
[9] Indicate the type of outlet – weir, orifice, hydro brake, etc.
[10] Discharge Coefficient specific to the type of outlet control i.e., 0.6 for circular orifice
[11] List the discharge equation for each outlet (weir, orifice etc) used
[12] For basins with dead storage below the primary outlet, indicate 0 cfs discharge until the lowest outlet is reached. Routing table should begin at the lowest basin elevation.
[13] Describe NJDEP BMP Manual water quality devices such as seepage pits, rain gardens etc. Size is appropriate for device – cubic feet, square feet or linear feet. Location of device using state plane feet coordinates.

Basin C

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Project Site Details

Chpt. 251 Application Number:

Start Date (if known): TBD

Street Address:Fries Mill Road (County Route 655) and Glassboro-Cross Keys Road (County Route 689)

County: Gloucester County

Municipality: Monroe Township

Block: 14801

Lot: 12

NJDEP Anderson Landuse Code (4 digits): 1110

Landuse description: Residential, high density

Site Centroid Location (NJ State Plane Feet): [1]

Northing: 319,622 Easting: 336,384

Project Contact Details

Applicant: N.W.D. Development, LLC

Address: 701 Cooper Street, Suite 7, Voorhees, NJ

Phone: (856) 346-4400

Email:

Post Construction Operation & Maintenance:[2]

Party Name: TBD

Address:

Phone:

Email:

Party type (HOA, government, private, etc): HOA

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Basin Details:[3]

Basin Centroid (NJ State Plane Feet):[4]

Northing: 318,822 Easting: 336,868

Basin Type: wet pond

Construction: excavated

Status phase:[5] Design ☒ As-built ☐

Dam Height (ft) top width (ft)

Dam Classification: choose an item

Drainage Area(s) to Basin [note- include any bypass areas][6]

Drainage Area Name	Drainage Area (acres)	Post-Development CN#	Percent Impervious	Time of Concentration (min)
BSN C	3.52	79	48.9%	7.8

Basin Outlet Structure(s)[7]

ID: FES3c

End of Pipe Location:[8] Northing: 318,899 Easting: 336,797

Discharge Type[9] (weir, orifice, etc)	Dimensions (diameter, length)	Elevation (USGS)	Discharge [10]Coefficient	Equation Used[11]
Culvert	15"	154.00	0.60	Orifice eqn.
Orifice	4"Wx3"H	154.00	0.60	Orifice eqn.
Weir	0.33' to 1.0'W	155.58	2.62	Weir eqn.
	by 1.0H			

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Basin Outlet Structure(s)

ID:

End of Pipe Location: Northing: Easting:

Discharge Type (weir, orifice, etc)	Dimensions (diameter, length)	Elevation (USGS)	Discharge Coefficient	Equation Used

Basin Stage-Discharge Rating Table[12]

Elevation (USGS Feet)	Storage (Acre-Ft)	Total Outlet Structure Discharge (cfs)
149.00	0.00	0.00
151.00	0.30	0.00
153.00	0.78	0.00
154.00	1.07	0.00
155.00	1.39	0.38
156.00	1.77	0.94
157.00	2.19	3.83
158.00	2.64	5.20
159.00	3.14	5.48

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

NJDEP BMP Water Quality Structures[13]

Type (rain garden, green roof, seepage pit etc)	Size	Size Units (cu ft, sq ft etc)	Northing (SPF)	Easting (SPF)
choose an item				
choose an item				
choose an item				
choose an item				
choose an item				

Explanatory Notes-

[1] Approximate location of center of site, coordinates in state plane feet
[2] Indicate who will be responsible for permanent operation and maintenance
[3] Additional Basin Detail Pages can be used for more than one basin in a project.
[4] Approximate location of center of basin, coordinates in state plane feet
[5] Indicate "design" for basins not yet constructed
[6] Drainage areas which are modified by construction, but not directed to the basin should still be listed and described
[7] "Outlet structure" means the control box, outlet headwall, FES etc. This does not refer to an individual control on the structure such as a weir or orifice. There are two tables for more than one outlet structure
[8] Approximate location of terminal discharge end of basin outfall, coordinates instate plane feet
[9] Indicate the type of outlet – weir, orifice, hydro brake, etc.
[10] Discharge Coefficient specific to the type of outlet control i.e., 0.6 for circular orifice
[11] List the discharge equation for each outlet (weir, orifice etc) used
[12] For basins with dead storage below the primary outlet, indicate 0 cfs discharge until the lowest outlet is reached. Routing table should begin at the lowest basin elevation.
[13] Describe NJDEP BMP Manual water quality devices such as seepage pits, rain gardens etc. Size is appropriate for device – cubic feet, square feet or linear feet. Location of device using state plane feet coordinates.

APPENDIX K

SEDIMENT BASIN CALCULATIONS

ADDED DECEMBER 23, 2020

CONSULTING ENGINEER SERVICES
Sediment Basin Design - Basin A

Project: The Greens **Date:** 12/23/20 **CES#** 2264-02
By: OAS

The proposed detention basin will serve as a temporary sediment basin during the construction of the development. The proposed sediment basin has been designed in accordance with the Standard for Sediment Basins, Section 26 of the "Standards for Soil Erosion and Sediment Control in New Jersey.

The total disturbed area draining to this basin is approximately 11.95 acres.

I. Determine the minimum basin volume to meet the 70% trap efficiency requirement.
The sediment basin will be normally dry. Incoming sediment will primarily be sandy loam.
Therefore, the trap efficiency for design purposes is 75 %.
From Curve 24-1 (median curve), C/I = 0.045
From Figure 24-1, the average annual surface runoff for Monroe Township

is 19 inches
= 19 inches x (1' / 12") 11.95 acres
I = 18.9 acre-feet

Required capacity of sediment basin, C = 0.045 x 18.9 ac-feet = 0.851 acre-feet

II. Determine the minimum basin volume required for sediment and temporary flood water storage.

1. Sediment storage capacity,
V = (DA)(A)(DR)(TE)(1/y)(2000lbs/T)(1/43,560 sf/ac)
A = 50 DR = 0.75 TE = 0.75 y = 85
V = 0.182 acre-feet

2. Temporary flood water storage:
Rainfall = 3.3 inches for a Type-III storm, 2-year frequency, 24-hour duration
CN = 79
Runoff = 1.45 " (from TR-55 Figure 2-1)
Minimum volume for flood water storage = 1.45 " (1'/12") x 11.95
= 1.444 acre-feet

3. Minimum basin volume to meet the requirements of 1 and 2, above:
V= 0.182 + 1.444
V= 1.626 acre-feet

Provide a sediment basin volume equal to the larger of I and II: V = 1.626 acre-feet

The lowest outlet, a weir, is set at 147.95. This provides 0.525 acre-feet of storage.
The basin provides 2.352 acre-feet of volume at an elevation of 149.31. There is adequate volume in this basin for it to serve as a temporary sediment basin. The basin outlet structure will be modified to provide an outlet at elevation of 149.36 providing 70% trap efficiency.

CONSULTING ENGINEER SERVICES
Sediment Basin Design - Basin A1

Project: The Greens **Date:** 12/22/20 **CES#** 2264-02
By: OAS

The proposed detention basin will serve as a temporary sediment basin during the construction of the development. The proposed sediment basin has been designed in accordance with the Standard for Sediment Basins, Section 26 of the "Standards for Soil Erosion and Sediment Control in New Jersey.

The total disturbed area draining to this basin is approximately 1.23 acres.

I. Determine the minimum basin volume to meet the 70% trap efficiency requirement.
The sediment basin will be normally dry. Incoming sediment will primarily be sandy loam.
Therefore, the trap efficiency for design purposes is 75 %.
From Curve 24-1 (median curve), C/I = 0.045
From Figure 24-1, the average annual surface runoff for Monroe Township

is 19 inches
= 19 inches x (1' / 12") 1.23 acres
I = 1.9 acre-feet

Required capacity of sediment basin, C = 0.045 x 1.9 ac-feet = 0.088 acre-feet

II. Determine the minimum basin volume required for sediment and temporary flood water storage.

1. Sediment storage capacity,
V = (DA)(A)(DR)(TE)(1/y)(2000lbs/T)(1/43,560 sf/ac)
A = 50 DR = 0.75 TE = 0.75 y = 85
V = 0.019 acre-feet

2. Temporary flood water storage:
Rainfall = 3.3 inches for a Type-III storm, 2-year frequency, 24-hour duration
CN = 61
Runoff = 0.5 " (from TR-55 Figure 2-1)
Minimum volume for flood water storage = 0.5 " (1'/12") x 1.23
= 0.051 acre-feet

3. Minimum basin volume to meet the requirements of 1 and 2, above:
V= 0.019 + 0.051
V= 0.070 acre-feet

Provide a sediment basin volume equal to the larger of I and II: V = 0.088 acre-feet

The lowest outlet, a weir, is set at 148.75. This provides 0.0 acre-feet of storage.
The basin provides 0.565 acre-feet of volume at an elevation of 148.95. There is adequate volume in this basin for it to serve as a temporary sediment basin. The basin outlet structure will be modified to provide an outlet at elevation of 149.00 providing 70% trap efficiency.

CONSULTING ENGINEER SERVICES
Sediment Basin Design - Basin A1

Project: The Greens **Date:** 12/23/20 **CES#** 2264-02
By: OAS

The proposed detention basin will serve as a temporary sediment basin during the construction of the development. The proposed sediment basin has been designed in accordance with the Standard for Sediment Basins, Section 26 of the "Standards for Soil Erosion and Sediment Control in New Jersey.

The total disturbed area draining to this basin is approximately 1.23 acres.

I. Determine the minimum basin volume to meet the 70% trap efficiency requirement.
The sediment basin will be normally dry. Incoming sediment will primarily be sandy loam.
Therefore, the trap efficiency for design purposes is 75 %.
From Curve 24-1 (median curve), C/I = 0.045
From Figure 24-1, the average annual surface runoff for Monroe Township

is 19 inches
= 19 inches x (1' / 12") 1.23 acres
I = 1.9 acre-feet

Required capacity of sediment basin, C = 0.045 x 1.9 ac-feet = 0.088 acre-feet

II. Determine the minimum basin volume required for sediment and temporary flood water storage.

1. Sediment storage capacity,
V = (DA)(A)(DR)(TE)(1/y)(2000lbs/T)(1/43,560 sf/ac)
A = 50 DR = 0.75 TE = 0.75 y = 85
V = 0.019 acre-feet

2. Temporary flood water storage:
Rainfall = 3.3 inches for a Type-III storm, 2-year frequency, 24-hour duration
CN = 61
Runoff = 0.5 " (from TR-55 Figure 2-1)
Minimum volume for flood water storage = 0.5 " (1'/12") x 1.23
= 0.051 acre-feet

3. Minimum basin volume to meet the requirements of 1 and 2, above:
V= 0.019 + 0.051
V= 0.070 acre-feet

Provide a sediment basin volume equal to the larger of I and II: V = 0.088 acre-feet

The lowest outlet, a weir, is set at 148.75. This provides 0.0 acre-feet of storage.
The basin provides 0.565 acre-feet of volume at an elevation of 148.95. There is adequate volume in this basin for it to serve as a temporary sediment basin. The basin outlet structure will be modified to provide an outlet at elevation of 149.00 providing 70% trap efficiency.

CONSULTING ENGINEER SERVICES
Sediment Basin Design - Basin B

Project: The Greens **Date:** 12/23/20 **CES#** 2264-02
By: OAS

The proposed detention basin will serve as a temporary sediment basin during the construction of the development. The proposed sediment basin has been designed in accordance with the Standard for Sediment Basins, Section 26 of the "Standards for Soil Erosion and Sediment Control in New Jersey.

The total disturbed area draining to this basin is approximately 15.30 acres.

I. Determine the minimum basin volume to meet the 70% trap efficiency requirement.
The sediment basin will be normally dry. Incoming sediment will primarily be sandy loam.
Therefore, the trap efficiency for design purposes is 75 %.
From Curve 24-1 (median curve), C/I = 0.045
From Figure 24-1, the average annual surface runoff for Monroe Township

is 19 inches
= 19 inches x (1' / 12") 15.30 acres
I = 24.2 acre-feet

Required capacity of sediment basin, C = 0.045 x 24.2 ac-feet = 1.090 acre-feet

II. Determine the minimum basin volume required for sediment and temporary flood water storage.

1. Sediment storage capacity,
V = (DA)(A)(DR)(TE)(1/y)(2000lbs/T)(1/43,560 sf/ac)
A = 50 DR = 0.75 TE = 0.75 y = 85
V = 0.232 acre-feet

2. Temporary flood water storage:
Rainfall = 3.3 inches for a Type-III storm, 2-year frequency, 24-hour duration
CN = 77
Runoff = 1.3 " (from TR-55 Figure 2-1)
Minimum volume for flood water storage = 1.3 " (1'/12") x 15.30
= 1.658 acre-feet

3. Minimum basin volume to meet the requirements of 1 and 2, above:
V= 0.232 + 1.658
V= 1.890 acre-feet

Provide a sediment basin volume equal to the larger of I and II: V = 1.890 acre-feet

The lowest outlet, a weir, is set at 149.5. This provides 0.0 acre-feet of storage.
The basin provides 2.146 acre-feet of volume at an elevation of 154.5. There is adequate volume in this basin for it to serve as a temporary sediment basin. The basin outlet structure provides the grate as an outlet at elevation of 155.85 providing 70% trap efficiency. AND

The sediment basin will be dewatered by a 4" hole in the riser. The hole will be at the elevation which results in 50% trap efficiency.

From Curve 26-1, C/I = 0.014
Therefore, C= 0.014 x 15.30 = 0.214 acre-feet
The elevation at the bottom of the dewatering hole = 150.26 ft