Prepared for:

FORT ARMISTEAD ROAD – LOT 15 LANDFILL, LLC
3601 Fort Armistead Road
Baltimore, Maryland 21226

RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN

Per Requirements of 40 CFR §257.81

Fort Armistead Road - Lot 15 Industrial Landfill Baltimore, Maryland

Prepared by:

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Geosyntec Project Number: ME1070C

September 30, 2026

Geosyntec consultants

Run-On Run-Off Control System Plan
Coal Combustion Residual (CCR) Unit: Fort Armistead Road - Lot 15 Industrial Landfill

Certification:

I, Carrie Pendleton, a registered professional engineer in the state of **Maryland** certify that this Run-On Run-Off System Control Plan fulfills the minimum requirements of 40 CFR §257.81. This certification is based on my review of design and operational information and/or data made available by site personnel about the CCR Unit.

Printed Name: Carrie Pendleton

PE License Number: 32252 State: Maryland

Signature: C. H. Pendleton

Date: 10/01/2026

Seal:

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1. INTRODUCTION

1.1 Organization and Terms of Reference

Geosyntec Consultants (Geosyntec) has prepared this document for Fort Armistead Road – Lot 15 Landfill, LLC (a wholly owned subsidiary of Raven Power) for the Fort Armistead Road - Lot 15 Industrial Landfill (Lot 15 or the Site), located in Baltimore City, Maryland, to address the Run-On and Run-Off Control System Plan requirements in the Federal Coal Combustion Residuals (CCR) Rule specified in Title 40 of the Code of Federal Regulations (CFR), Section (§) 257.81. On 17 April 2015, the USEPA published the final rule for disposal of CCR from electric power utilities under Subtitle D of the Resource Conservation and Recovery Act (RCRA), contained in Section 257 of Title 40 of the Code of Federal Regulations (40 CFR 257 Subpart D), referred to here as the CCR Rule. Section 257.81 contains the requirements for run-on and run-off controls of CCR landfills. In this Run-on and Run-off Control System Plan, the specific requirements of §257.81 are identified and addressed. This plan has been prepared as a periodic revision of the original plan certified in October 2016 in accordance with the CCR Rule.

This Run-on and Run-off Control System Plan revision was prepared by Gregory Krasnoff, P.E. and was reviewed in accordance with Geosyntec's internal review policy by Carrie Pendleton, P.E. Gregory Krasnoff and Carrie Pendleton are both registered Professional Engineers in the State of Maryland.

1.2 Site Location

The Site consists of 65 acres with a total planned landfill footprint of 32.4 acres. The Site is located in the Curtis Bay area on the southeast quadrant of the intersection of Fort Smallwood Road and Fort Armistead Road in Baltimore, Maryland. The Site is bounded to the north by Fort Armistead Road, to the east by CSX railroad tracks, to the west by Fort Smallwood Road, and to the south by a light industrial business park.

1.3 Landfill Description and Permit Status

The on-site landfill was originally permitted as the Hawkins Point Plant (HPP) Landfill and consisted of two parcels, one 30 acres in size and one 65 acres in size bisected by a CSX Railroad right-of way, effectively resulting in two separate landfills. In 2009, the 65-acre parcel had not yet been developed as a landfill and was split off from the 30-acre parcel and re-permitted as the Lot 15 Industrial Landfill to serve as a coal combustion byproduct (CCB)/CCR landfill under MDE solid waste regulations.

The Site became operational in 2011 and is currently permitted (Refuse Disposal Permit Number 2023-WIF-0653) through March 2029 to receive CCR and other compatible and approved materials generated from the Brandon Shores energy generating plant. The maximum inventory of CCRs to be contained in the 32.4-acre disposal area at the time of closure is estimated to be 6.4

million cubic yards. Assuming a compacted density of 1.1 tons per cubic yard, this is equivalent to 7.0 million tons of CCRs. The largest area of the landfill ever requiring a final cover is estimated to be 1.2 million square feet (i.e., 27.5 acres).

1.4 2026 Periodic Update

In accordance with the requirements of §257.81(c)(4) of the CCR Rule, Geosyntec performed a periodic revision to the Run-on and Run-off Control System Plan in October 2026. The approach for the update was as follows:

- Verify the current provisions of the CCR rule regarding run-on and run-off control systems;
- Perform a site visit to evaluate current site conditions, run-on and run-off controls, and stormwater management practices; and
- Review the information in the plan for correctness and accuracy relative to the conditions observed during the site visit.

The periodic update was prepared based on review of the following information:

- The initial Run-on and Run-off Control System Plan, dated October 2016, prepared by Geosyntec Consultants;
- The last periodic revision to the Run-on and Run-off Control System Plan, dated October 2021, prepared by Geosyntec Consultants;
- The most recent construction drawings, *Cell 3 Construction Drawings, Lot 15 Landfill – Baltimore, Maryland* (Geosyntec, 2017);
- The most recent Cell 3 As-built drawings from January 2026;
- Observations made by Gregory Krasnoff, P.E. and Carrie Pendleton, P.E., during a June 1st 2026 site visit; and
- Personal communications with site operations personnel.

Based on the outcomes of the above tasks, Geosyntec found that Lot 15 Industrial Landfill, at the time of the preparation of this periodic revision, was operated in accordance with the provisions of the initial Run-on and Run-off Control System Plan. Site operations since the last periodic revision in 2021 were limited to the continued filling of Cell 3. Cells 1 and 2 are inactive and have a temporary soil cover.

2. CCR RULE REQUIREMENTS FOR RUN-ON/ RUN-OFF CONTROLS (§257.81)

2.1 Run-On and Run-Off Control Requirements for CCR Landfills

As described in §257.81, the rule requires that Lot 15 be designed, constructed, operated, and maintained to collect and control at least the water volume resulting from a 24-hour, 25-year storm (§257.81(a)). Additionally, the CCR landfill must comply with 40 CFR §257.3-3 which regulates discharge of pollutants into the waters of the United States (§257.81(b)). Section 257.81(c) of the rule requires that the owner or operator of a CCR landfill prepare an initial run-on and run-off control system plan documenting, with supporting engineering calculations, how the control systems have been designed and constructed to meet the requirements of §257.81(a). Section 257.81(c)(4) of the rule requires that the owner or operator of a CCR landfill prepare periodic run-on and run-off control system plans required by paragraph (c)(1) every five years.

2.2 Compliance with Run-On and Run-Off Controls Requirements

Specific documentation required in the Run-on and Run-Off Control System Plan is described in the CCR Rule Preamble at pages 21389-21390. The table below summarizes the minimum CCR Rule requirements for a run-on and run-off control system plan from §257.81(c) and the Preamble, and the location in this document where those requirements are addressed.

RULE SECTION	RULE REQUIREMENT	LOCATION WHERE ADDRESSED IN DOCUMENT
§257.81(c)(1)	Owner or operator must prepare initial and periodic run-on and run-off control plans for the unit	Part 3, Section 3.1
	Document how the run-on and run-off controls have been designed and constructed.	Section 3.2
Preamble Pages 21389-21390	Identification of 24-hr, 25-yr Storm	Section 3.3
	Characterization of Rainfall Abstractions	Section 3.4
	Selection and Basis of Run-Off Model	Section 3.5
	Selection and Basis of Run-On and Run-Off Routing Model	Section 3.6
	Selection and design Run-On and Run-Off Management System	Section 3.7
	Supporting Engineering Calculations.	Section 3.8
§257.81(c)(5)	Written Certification from qualified professional engineer that initial Run-On and Run-Off Control System Plan meets the requirements of §257.81(c).	Preface
§257.81(c)(4)	Periodic run-on and run-off control system plans required by paragraph (c)(1) every five years.	Section 1.4

3. RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN

3.1 Introduction

As part of the State of Maryland Phase III Waste Disposal Permit Application for the Lot 15 Landfill, stormwater management plans were prepared to address run-on and run-off at the initial and final development stages of the project. Using the information and computations contained in the Phase III Permit Application and additional documentation presented herein, the following sections demonstrate compliance with the requirements of the CCR Rule §257.81 and preamble.

The Lot 15 development plan includes a total of six adjoining landfill containment cells spanning an area of approximately 32.4 acres. Because the landfill has been designed to operate over an extended period of time (i.e., more than a decade), full development of all six cells in a single construction campaign is not necessary. Rather, the site is designed to be developed in multiple stages that create disposal capacity in incremental steps. The final stage includes construction of a mechanically stabilized earth (MSE) berm around a majority of the landfill perimeter to achieve the total permitted disposal capacity. Construction of the MSE berm is an option that may or may not be implemented based on future disposal needs.

Because the site will be developed incrementally, the Phase III Permit Application only includes drawings and analysis which document design of a stormwater control system associated with the initial stages of site development and a stormwater control system associated with the final site conditions (i.e., after CCR placement ceases). The initial stages of site development are discussed in the initial Run-On and Run-Off Control Plan (Geosyntec, 2016). In this Run-On and Run-Off Control Plan update, additional analysis is presented for stormwater during the current development stage and an intermediate grading stage, which would occur after development and partial filling of the six landfill cells, but before construction of the MSE berm.

The conceptual plan for an intermediate stage of development presented herein is intended to define the maximum drainage areas and therefore, maximum dimensions of stormwater controls necessary to be implemented during any intermediate stage of site development. Future stormwater management plans, prepared during each stage of Site development, will utilize the same design criteria as the Phase III Permit Application and will be consistent with this Stormwater Run-On and Run-Off Control System Plan.

In this plan, the following three stages of site development are addressed:

- Current Development Stage, Post-Cell 3 Construction;
- Intermediate Grading/Development Stage (after landfill cell construction, before MSE berm construction); and
- Final Grading/Development Stage.

Design computations and drawings for each of the three stages of development are provided in Appendices A through C.

3.2 Description of Run-On and Run-Off Controls Design and Construction

3.2.1 Introduction

The design of the initial and final conditions Run-On and Run-Off Control System Plan for the Lot 15 Landfill are presented in the Phase III Permit Application. That stormwater design was prepared to control on-site drainage, drainage leaving the site, and drainage onto the site from adjacent properties, in conformance with Maryland State requirements, COMAR 26.04.07.08.B (12) and COMAR 26.17.02.

The most recent stormwater management analysis was completed in 2017 during the permitting of Cell 3, and more closely represents the present site conditions. Relevant excerpts that define stormwater run-on and run-off from the report titled, *Stormwater Management Plan, Cell 3 Construction – Lot 15 Landfill, Baltimore, Maryland,* (Geosyntec, 2017) are presented in **Appendix A**.

Concept layout of the intermediate stage run-off controls, constructed following development of the six disposal cells, but before construction of the MSE berm is presented in **Appendix B**.

In the final condition, water will be conveyed from the cover terraces through a landfill perimeter channel to one of three outlets. The layout and features of the stormwater management system are shown on Drawing 20 of *Application for an Industrial Landfill Permit: Phase III Permit Drawings, Lot 15 Fort Armistead Road Landfill, Baltimore, Maryland* (Geosyntec, 2012). The entire series of stormwater management drawings and computations prepared for the Phase III Permit Application are presented in **Appendix C**.

3.2.2 Design of Run-On Run-Off Controls

The stormwater controls for the site are designed to: (i) provide stormwater conveyance; and, (ii) provide quantity and quality management of stormwater runoff. The stormwater features include:

- Intermediate diversions sized to convey the peak flow form the 100-year, 24-hour design storm;
- Perimeter channels, cover terraces and downchutes, which are sized to convey the peak flow from the 100-year, 24-hour storm without overtopping;
- Two wet detention stormwater management ponds that detain surface water runoff from the 2-year frequency storm event and safely passes the peak runoff from the 100-year frequency storm event. Both ponds discharge to onsite natural stream channels; and

- One stormwater management outlet (drop structure) that conveys stormwater runoff from the 2-year frequency storm event and safely passes the peak runoff from the 100-year frequency storm event prior to discharging to an existing on-site natural wetland.

Topography surrounding the site is generally level and therefore, design of specific run-on controls is not necessary for protection or function of the landfill. In addition, the site design includes construction of an MSE berm around a majority of the landfill. With a maximum height of approximately 60 ft, the berm also provides a barrier to stormwater run-on.

3.2.3 Construction and Permitting of Run-On and Run-Off Controls

Construction of the landfill is performed under the oversight of MDE Land Management Administration, which reviews and approves construction drawings for each stage of the development. In addition, each set of construction drawings is reviewed and approved by the Baltimore City Department of Public Works as part of the City's Grading Permit and Erosion and Sediment Control programs. Based on the project size, each stage of construction will be required to obtain permit coverage under Maryland's General Permit for Stormwater Associated with Construction Activity.

As of June 2026, construction has progressed through development and partial filling of disposal Cells 3. Cells 1 and 2 are inactive with a temporary soil cover. The Cell 3 construction drawings for site grading and erosion and sediment control were approved by Baltimore City on December 18th, 2017. An as-built survey of Cell 3 was completed in January 2026 by CCJM and is included as **Appendix D**.

In accordance with approved construction plans and Phase III Permit Application, rainfall which contacts CCR is collected and managed in combination with leachate collected from the landfill sumps. All stormwater runoff from the Cell 3 floor enters the leachate system. Runoff from the adjacent northern and western side slopes flow into the intercell perimeter channel and to a stormwater sump. It is then conveyed via a sump pump and 3" HDPE force main into Sediment Basin 2. Stormwater discharges from the site are permitted under the Maryland General Discharge Permit for Stormwater Associated with Industrial Activities. **Appendix E** provides an exhibit showing the stormwater discharge from the active construction area.

3.3 Identification of the Design Storm

As described in the Phase III Permit Application, the design storm for the Site is the 100-year, 24-hour duration storm. The CCR Rule requires the run-on/run-off plans be designed for a 25-year, 24-hour rainfall event; however, these plans were designed to meet more conservative criteria applicable in Baltimore City and the State of Maryland.

3.4 Characterization of Rainfall Abstractions

For each analysis of stormwater runoff, rainfall abstractions are characterized through use of a runoff curve number (RCN). For current and intermediate conditions when a fully unvegetated surface is expected, the selected RCN is 86. For final conditions when a fully vegetated surface is expected, the selected RCN is 76.

3.5 Selection and Basis of Run-Off Model

The run-off model used for the design of the final development conditions is described in the Phase III Permit Application, which provides the following statement regarding model selection.

> *The hydrologic model used was HydroCAD®, published by Applied Microcomputer Systems. This program is an enhanced, more user-friendly version of the Soil Conservation Service (SCS) program TR-20 and uses the SCS version TR-55 method of estimating flow from individual drainage areas. The program also performs basic hydraulic calculations to evaluate the required sizes of surface-water conveyance features (i.e., culverts, channels, etc.).*

3.6 Selection and Basis of Run-On and Run-Off Routing Model

The routing models are selected to evaluate capacity of the conveyance features for each of the three stages of development considered in this plan, assuming a maximum contributing drainage area. In **Appendix A**, the existing and proposed development drainage area maps for the current development conditions are provided on Drawings 13 and 14. In **Appendix B**, the assumed maximum drainage area and corresponding node model for stormwater design at the intermediate development condition are presented as part of the calculation package. In **Appendix C**, the drainage area and node model for stormwater design at the final development condition are presented as calculation Figures 4 and 5.

3.7 Selection and Design of Run-On and Run-Off Management System

The run-on and run-off system for the Lot 15 landfill is based on standard erosion and sediment control and stormwater management features described in the *2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control* and *2000 Maryland Stormwater Design Manual*. Throughout the project development, stormwater will predominately be managed by gravity; pumps are used to evacuate water from below grade areas prior to the point when the elevation of CCR fill matches or exceeds the perimeter grades.

Stormwater that percolates through the CCRs is collected within the landfill leachate collection system and transported off-site for treatment and disposal.

3.8 Supporting Engineering Calculations

Engineering calculations supporting design of stormwater features during the current, intermediate, and final development stages are provided in **Appendices A**, **B**, and **C.2**.

4. REFERENCES

Geosyntec (2012). *"Application for an Industrial Landfill Permit Phase III Report, Fort Armistead Road – Lot 15 Landfill, Baltimore, Maryland."* Geosyntec Consultants, Inc. March 2012.

Geosyntec (2017). *"Cell 3 Construction Drawings Lot 15 Landfill – Baltimore, Maryland."* Geosyntec Consultants, Inc. December 2017.

Geosyntec (2016) *"RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN, Per Requirements of 40 CFR §257.81, Fort Armistead Road - Lot 15 Industrial Landfill, Baltimore, Maryland"* Geosyntec Consultants, Inc. October 2016.

MDE (2011). *"2011 Maryland Standards and Specifications for Erosion and Sediment Control."* Maryland Department of Environment (MDE) Water Management Administration. December 2011.

MDE (2009). *"Maryland Stormwater Design Manual, Volume I and II."* MDE Water Management Administration. Revised May 2009.

United States Environmental Protection Agency (USEPA) (2015). "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule." Chapter 40 Code of Federal Regulations, Parts 257 and 261. 17 April 2015.

APPENDIX A

CURRENT DEVELOPMENT STAGE HYDRAULIC CALCULATIONS

Prepared for:
Talen Energy
1005 Brandon Shores Road, Suite 100
Baltimore, Maryland 21226

STORMWATER MANAGEMENT PLAN

CELL 3 CONSTRUCTION - LOT 15
LANDFILL
BALTIMORE, MARYLAND

BALTIMORE CITY ESD No. 6179A

Professional Certification: I hereby certify that this document was approved by me, and that I am a duly licensed Professional Engineer under the laws of the State of Maryland,
License No. ____22181____,
Expiration Date: ___12-2-2018___.

Prepared by:

Geosyntec consultants

10211 Wincopin Circle, Floor 4
Columbia, Maryland 21044

Project Number: ME1400

December 2017

Prepared for:
Talen Energy
1005 Brandon Shores Road, Suite 100
Baltimore, Maryland 21226

STORMWATER MANAGEMENT PLAN

CELL 3 CONSTRUCTION - LOT 15 LANDFILL BALTIMORE, MARYLAND

BALTIMORE CITY ESD No. 6179A

Professional Certification: I hereby certify that this document was approved by me, and that I am a duly licensed Professional Engineer under the laws of the State of Maryland,
License No. ____22181____,
Expiration Date: ___12-2-2018___.

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December 2017

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Appendix E: Erosion and Sediment Control HydroCAD Report

Appendix F: Geotechnical Certification

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Appendix H: Maryland NOI Application Documentation

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1. INTRODUCTION

1.1 Organization and Terms of Reference

Raven Power, a wholly owned subsidiary of Talen Energy (Talen), Talen Energyplans to construct Cell 3 of the currently permitted Lot 15 landfill on the 65-acre parcel located in Hawkins Point, Baltimore, Maryland. The proposed construction will add Cell 3 to the southwest corner of the landfill and stockpile soil along the western half of the landfill. Additionally, the proposed perimeter road for the entire landfill will be constructed as well as Ponds 1 and 2. The overall footprint will have a total area of approximately 41.5 acres. This report presents a stormwater management (SWM) plan for the entire facility during the construction of Cell 3 and during operations of the landfill.

The SWM plan report is limited to Ponds 1 and 2 during landfill Cell 3 construction and operations as well as ensuring the project will not adversely impact downstream areas. Flow charts determining Maryland pond design criteria are included in Appendix A. Hydrology and hydraulics computations (Appendix B) are included and analyze the discharge rates at Points of Interest (POI) 1 and 2. Outfall protection computations (Appendix C) determine adequate design for stabilized outfalls. A dam breach analysis of the Pond 2 embankment (Appendix D) is included to assign the appropriate pond hazard classification. Appendix E includes hydrology and hydraulics computations for Ponds 1 and 2 while acting as sediment basins during construction and operations of Cell 3. A geotechnical certification is attached (Appendix F), as well as a digital copy of the Phase II Report: Site Geologic Study, demonstrating adequate geotechnical site design. Included in Appendix G is the Maryland Department of the Environment (MDE) approved Stormwater Pollution Prevention Plan (SWPPP) prepared as part of compliance with the Maryland General Discharge Permit for Storm Water Associated with Industrial Activities, Permit No. 12SW. This design process will ensure that all available resources have been considered in order to protect streams, waterways, and adjacent properties from the impact of the proposed land development activities.

Additional information included in this report is documentation of the Maryland Notice of Intent (NOI) application (Appendix H), Federal and State wetland permit authorizations (Appendix I), and a site photographic record (Appendix J).

This report and set of Drawings (Appendix K) was prepared by Geosyntec Consultants (Geosyntec) on behalf of Talen and was reviewed in accordance with Geosyntec's internal review policy.

1.2 Regulatory Compliance

The site is currently operating under the Maryland General Discharge Permit for Storm Water Associated with Industrial Activities, Permit No. 12SW, and has a Stormwater Pollution Prevention Plan approved by MDE (Appendix G). Additionally, a Notice of Intent (NOI) has been submitted for coverage under the Maryland General Permit for Stormwater Associated with Construction Activity for this project (Appendix H). Approval is awaiting Baltimore City Erosion and Sediment Control Plan approval. The project is considered exempt from Baltimore City strormwater management requirements under Baltimore City Code Article 7, Division II, Subtitle 21-6 (b)(5) which states that "development that the State Water Management Administration determines will be regulated under specific state laws that provide for managing stormwater runoff" is exempt.

1.3 Site Description

The site is approximately 65 acres and is bounded by Fort Armistead Road to the north, Fort Smallwood Road to the west, an industrial area to the south, and CSX railroad tracks to the east (see Figure 1). A wetland mitigation area constructed in 1992 is near the facility entrance (see Drawing 2). The current topography in the vicinity of the 65-acre parcel is shown in Drawing 3. As shown in Drawing 3, the site consists of forests and open areas for mining and landfill construction/operation activities. The forested areas are located mostly along the west side of the site. Site access from Fort Armistead Road is provided at the northeastern corner of the property. A sediment pond is currently located in the southeast corner of the site. Based on the USGS topographic map for the area, several field investigations, and a site walk inspection, no sinkholes, seeps, springs, or rocky outcrops are present on or near the site.

The United States Department of Agriculture (USDA) soil distribution map for the site and surrounding area is shown as Figure 2. According to the map, the proposed development area and the surrounding area have top soils classified as loamy sand. The results of several field investigations indicated that the upper 100 ft of soils at the site are primarily fine-grain material with some lenses of silt and sands. Most of the soils are classified as clay (CL) according to the Unified Soil Classification System (USCS). As shown in Figure 3, there are no tidal wetlands at the 65-acre site. However, as shown in Drawing 2, non-tidal wetlands were identified in the west and southeast portions of the site. No 100-year floodplain exists at the site (see Figure 4).

Cells 1 and 2 were previously approved and constructed and are currently receiving landfill waste. The current phase of the project includes the construction of Cell 3, the perimeter access road, and two sediment basins, which are proposed to be converted to stormwater management ponds upon landfill completion. One pond will be located on the southeast side of the landfill and the other one on the northwest side. Runoff from the landfill will also be controlled using appropriately designed side slope benches and drainage channels. Runoff from these features

will be directed to the basins. The site development will entail clearing approximately 18.31 acres of the existing forest. A Forest Stand Delineation and Forest Conservation Plan have been approved by the Baltimore City Department of Planning.

2. POND DESIGN

2.1 Applicability of MD Pond Code 378

In order to determine MD Pond Code 378 applicability for Ponds 1 and 2 the Conduits Penetrating Embankments – Applicability of MD Pond Code 378 flow charts were completed (Appendix A). It is determined that Pond 1 is exempt from Code 378 since it is an excavated pond, however, the pond has been designed to Code 378 standards. However, since the pond is excavated, no impervious core, cutoff trench, or drainage diaphragm are included in the design. It is determined that Pond 2 is required to be designed in accordance with Code 378, which it has. The ponds were analyzed and designed based on ultimate developed conditions for the site.

2.2 No Adverse Impact

The method used to show no adverse impact to downstream areas is to design for the proposed condition 2-year, 10-year, and 100-year storm discharge rates to be less than or equal to the existing condition discharge rates. Appendix B includes hydrology and hydraulics computations and summary showing that the design discharge rates are less than the existing discharge rates. Outlet protection computations (Appendix C) were also performed per the 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control, Section D-4-1 Rock Outlet Protection, to reduce the velocity of the discharge from the outfall to a non-erosive rate. A dam breach analysis for Pond 2 (Appendix D) is attached which demonstrates that downstream flooding associated with a modeled dam breach does not affect downstream structures or roadways.

2.3 Sediment Basin Design

The sediment basins were designed in accordance with the 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control, Section G-2. Hydrologic and hydraulics computations used to determine the design discharge rate are included in Appendix E. Additional design data for the basins can be found on Drawings 15 and 16 in Appendix K. Hydrologic and hydraulics computations used to determine adequate 100-year storm capacity, by modeling the outlet structure with the low flow orifice blocked, are also included in Appendix E. The models show that the 100-year storm does not overtop either of the ponds when the low flow orifice is blocked.

2.4 Geotechnical Requirements

The site has been approved by MDE for use as a landfill since 1992 with several groundwater and soil studies and evaluations conducted since then. Furthermore, recent excavations onsite have confirmed the previous subsurface investigations. The project geotechnical engineer, Dr. R. David Espinoza, P.E., has included a Geotechnical Certification certifying the geotechnical design of Ponds 1 and 2 for the project. Additionally, an electronic copy of the 2012 Phase II Report: Site Geologic Study, by Geosyntec Consultants, is attached to this report in Appendix F.

3. OTHER PERMITS AND APPROVALS

3.1 Permit No. 12SW

A NOI was accepted by MDE for registration under the General Discharge Permit for Storm Water Associated with Industrial Activities, Permit No. 12SW for discharges into the Baltimore Harbor – 02130903 on 20 November 2014 with Registration of Application Number 12SR2438 and NPDES Number MDR002438. A copy of the approved SWPPP and MDE acceptance letter is attached in Appendix G. This permit approval is documentation that MDE determined that the project "will be regulated under specific state laws that provide for managing stormwater runoff" and therefore exempt from Baltimore City strormwater management requirements under Baltimore City Code Article 7, Division II, Subtitle 21-6 (b)(5).

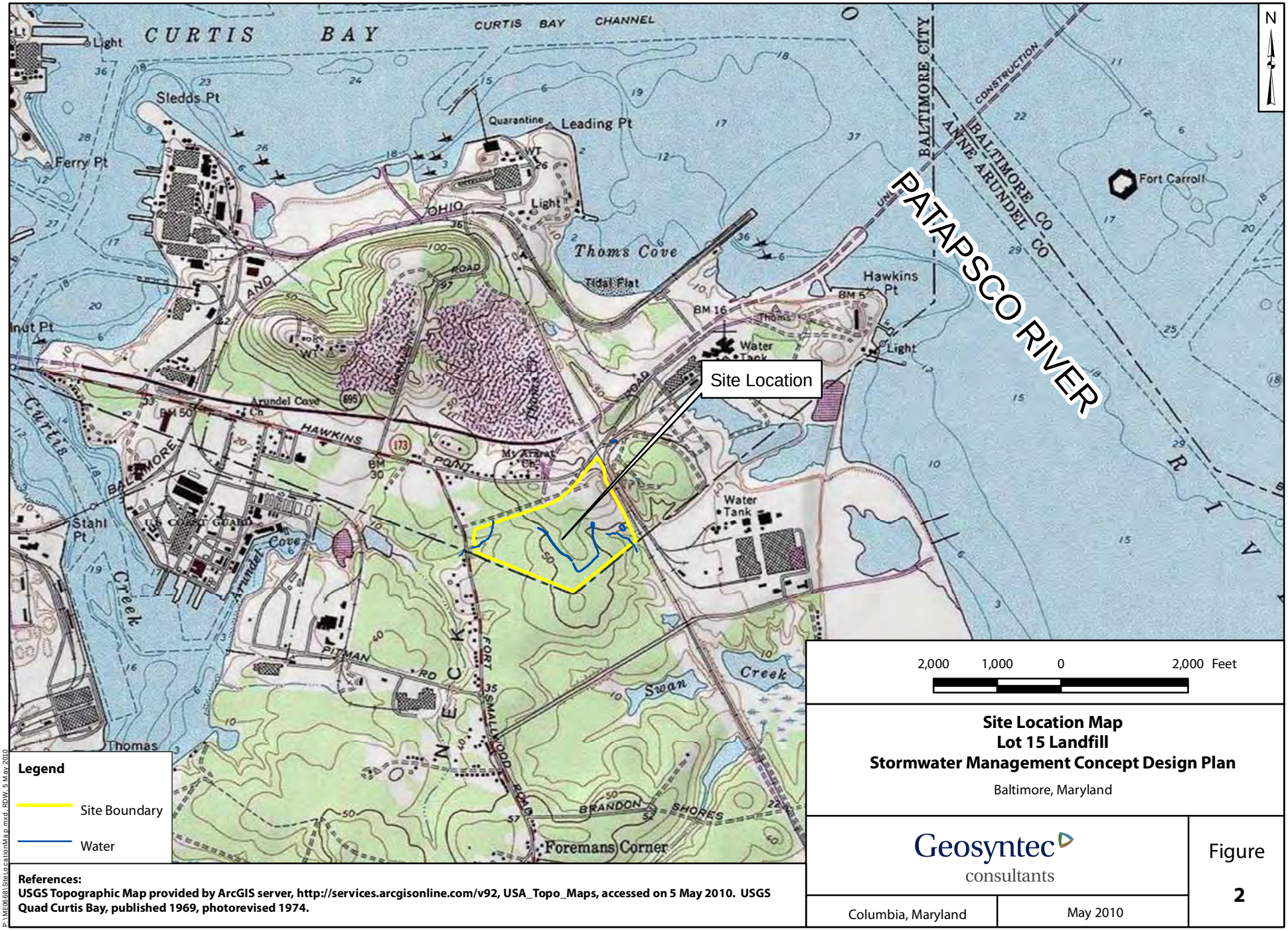
3.2 General Permit for Stormwater Associated with Construction Activity

A NOI is submitted to MDE for coverage under the General Permit for Stormwater Associated with Construction Activity. The public notice period ended 29 September 2017 without comment. The approval is awaiting Baltimore City Erosion and Sediment Control approval. A copy of MDE's application acceptance email is attached in Appendix H.

3.3 Federal / State Wetland Permit Approvals

Wetland impacts resulting from this project require both U.S. Army Corps of Engineers and MDE approval. Department of the Army authorization for application CENAB-OP-RMN (Constellation Power Source Generation/Fort Armistead Road, Lot 15) 2009-62272-M39 was granted 14 June 2017 under the Maryland State Programmatic General Permit-5 (MDSPGP-5), and is valid until 30 September 2021. A MDE Letter of Authorization, authorization number 09-NT-0229/200962255, was granted 9 March 2017, and expires 9 March 2027. Copies of both authorizations are included in Appendix I.

Figures



Legend

- Site Boundary
- Water

References:
USGS Topographic Map provided by ArcGIS server, http://services.arcgisonline.com/v92, USA_Topo_Maps, accessed on 5 May 2010. USGS Quad Curtis Bay, published 1969, photorevised 1974.

Site Location Map
Lot 15 Landfill
Stormwater Management Concept Design Plan

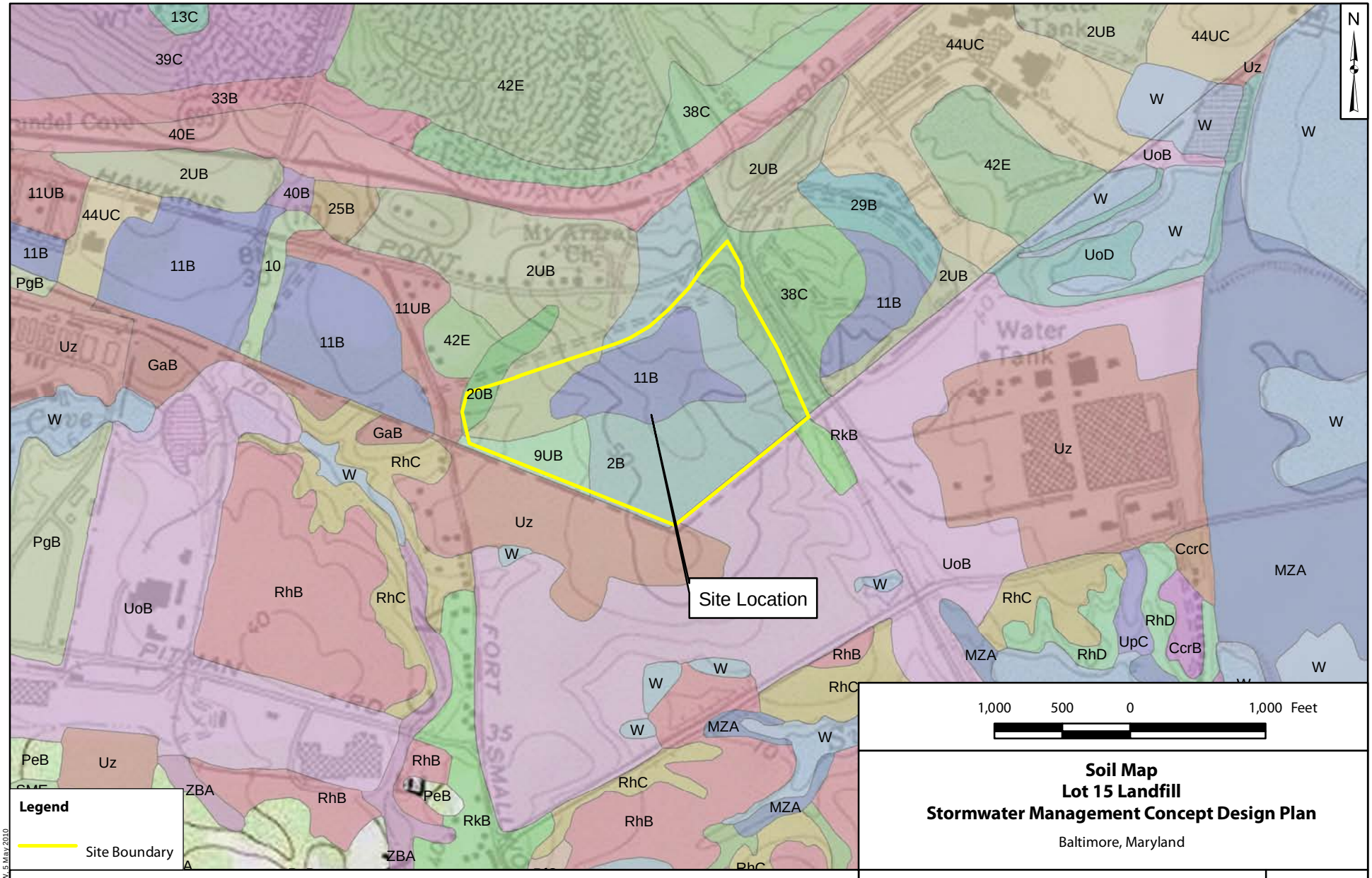
Baltimore, Maryland

Geosyntec consultants

Columbia, Maryland | May 2010

Figure **2**

P:\ME0568\SiteLocationMap.mxd, RDW, 5 May 2010



Soil Map
Lot 15 Landfill
Stormwater Management Concept Design Plan

Baltimore, Maryland

References:
USGS Topographic Map provided by ArcGIS server, http://services.arcgisonline.com/v92, USA_Topo_Maps, accessed on 5 May 2010. USGS Quad Curtis Bay, published 1969, photorevised 1974.

Soils data downloaded from http://SoilDataMart.nrcs.usda.gov/, titled Soil Survey Geographic (SSURGO) database for Anne Arundel County and Baltimore City, Maryland, published 16 February 2010.

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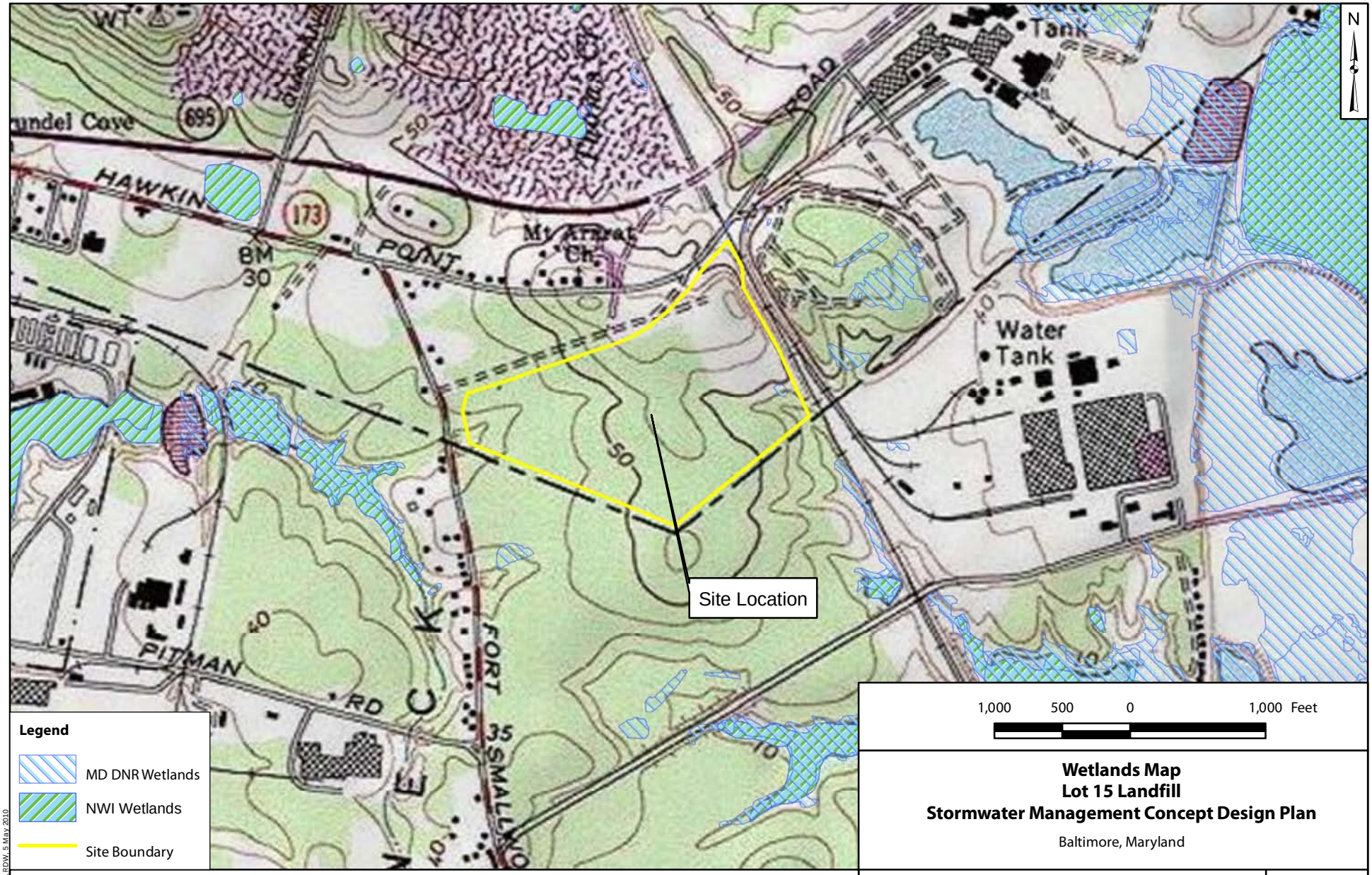
Figure **3**

P:\ME0668\SoilsMap.mxd, RDW, 5 May 2010



Wetlands Map
Lot 15 Landfill
Stormwater Management Concept Design Plan

Baltimore, Maryland

References:
USGS Topographic Map provided by ArcGIS server, http://services.arcgisonline.com/v92, USA_Topo_Maps, accessed on 5 May 2010. USGS Quad Curtis Bay, published 1969, photorevised 1974.

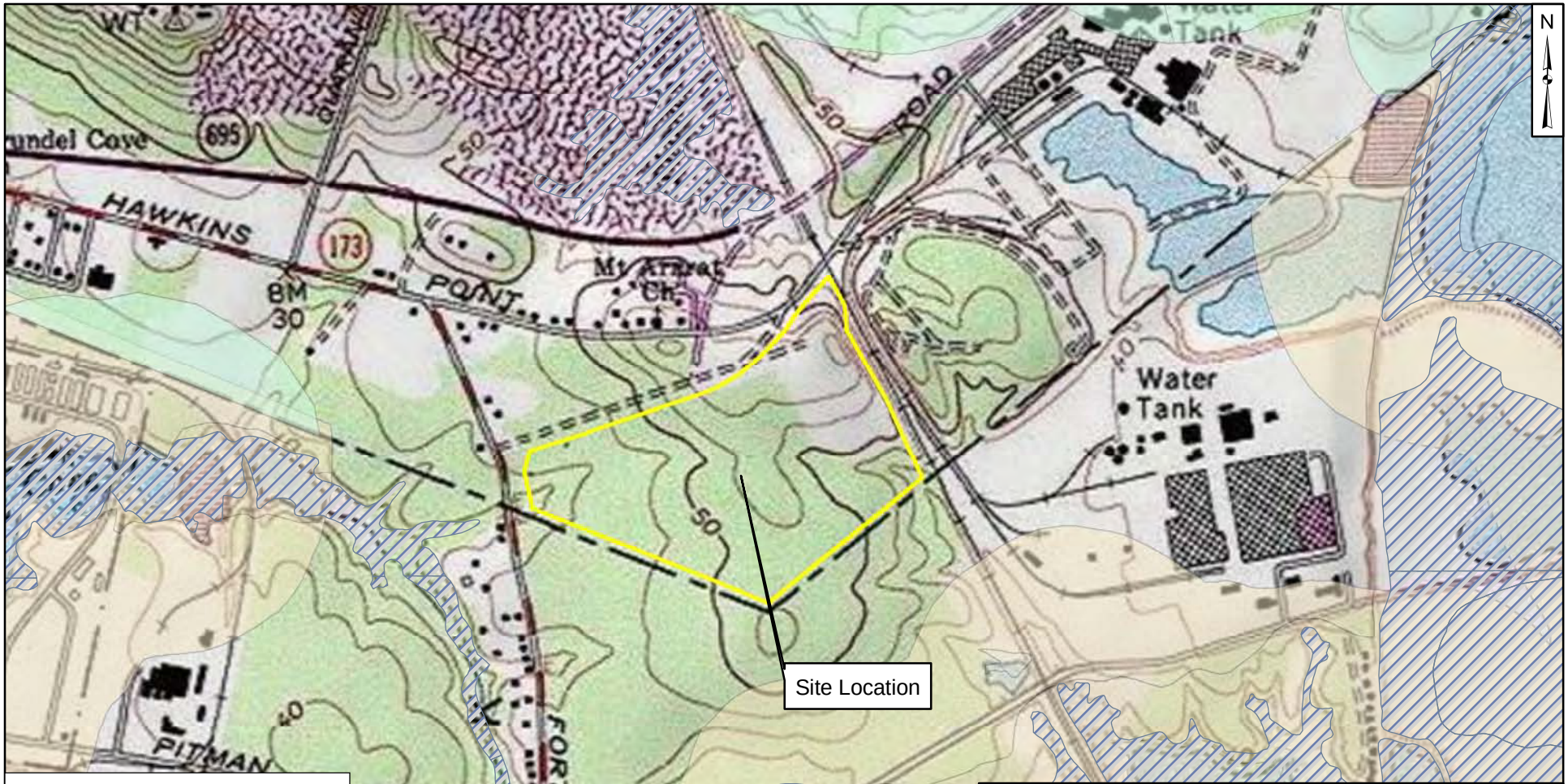
National Wetlands data downloaded from http://www.fws.gov/wetlands/, National Wetlands Inventory (NWI). U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC. Published to the internet on 22 January 2010.

Geosyntec consultants

Columbia, Maryland | May 2010

Figure 4

P:\ME0868\Wetlands\Map.mxd, RDW, 5 May 2010



Floodplains Map
Lot 15 Landfill
Stormwater Management Concept Design Plan

Baltimore, Maryland

References:
USGS Topographic Map provided by ArcGIS server, http://services.arcgisonline.com/v92, USA_Topo_Maps, accessed on 5 May 2010. USGS Quad Curtis Bay, published 1969, photorevised 1974.

State Wetlands data downloaded from http://dnrweb.dnr.state.md.us/gis/data/data.asp, Maryland Department of Natural Resources (MD DNR), Annapolis, MD. Published 1996.

Geosyntec consultants

Columbia, Maryland | May 2010

Figure **5**

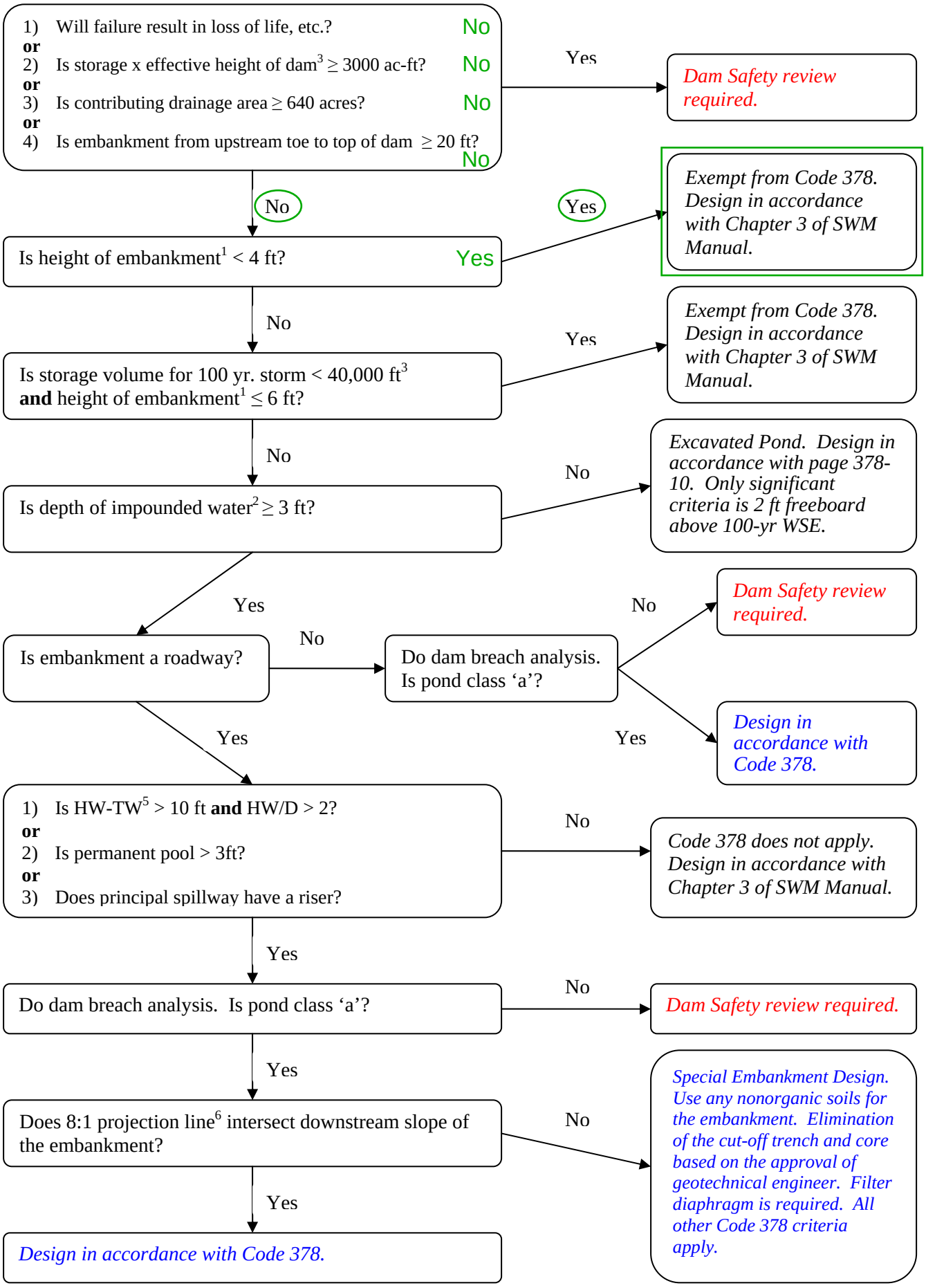
P:\ME0568\Flood plainsMap.mxd, RDW, 25 May 2010

Appendix A

MD 378 Flow Charts for Ponds 1 and 2

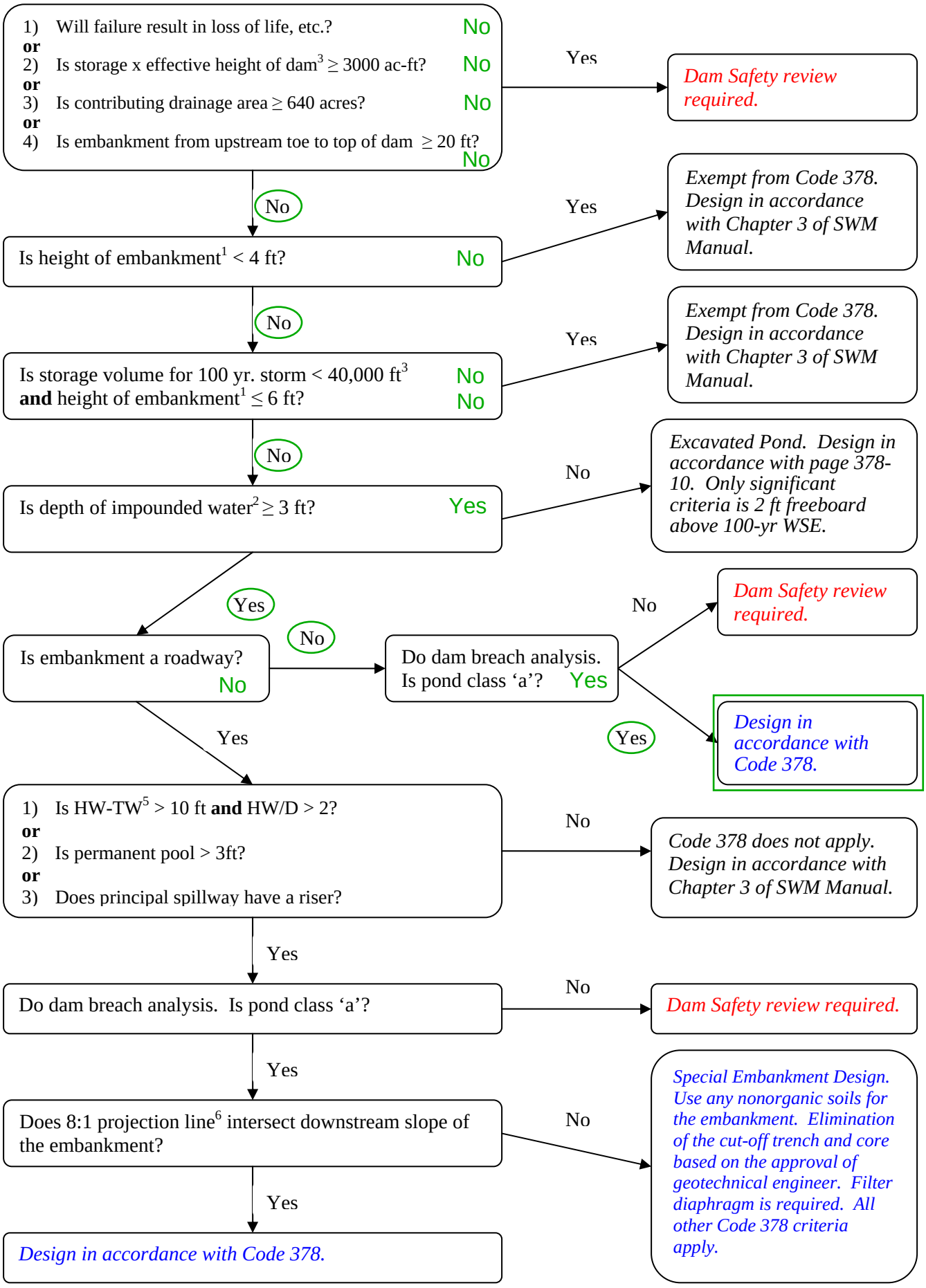
Conduits Penetrating Embankments
Applicability of MD Pond Code 378

Lot 15 Landfill Pond 1 (Baltimore City ESD# 6179A)



Conduits Penetrating Embankments
Applicability of MD Pond Code 378

Lot 15 Landfill Pond 2 (Baltimore City ESD# 6179A)



Appendix B

Hydrologic and Hydraulics Computations
for POI's 1 and 2

Written by: _____ **Date:** _____ **Reviewed by:** _____ **Date:** _____

Client: Talen Energy **Project:** Lot 15 Landfill **Project/Proposal No.:** ME1400 **Task No.:** _____

PRELIMINARY WATER QUANTITY MANAGEMENT ANALYSIS RESULTS

The site stormwater hydrology model was used to determine the pre-development and predict the post-development peak flow conditions for three different storm events, including:

- The 100-year, 24-hour storm event, to verify that the conveyance and pond spillway systems are adequately designed to safely pass the flows from a large storm event that will likely occur during the life of the facility;
- The 10-year, 24-hour storm event, to design the conveyance structures (cover terraces, downchutes, channels, culverts …); and,
- The 2-year, 24-hour storm event, to verify the flow that is discharged from the site under post-development conditions is no greater than the flow that is discharged from the site under pre-development conditions.

The 100-year, 24-hour storm event was used because a storm having this return frequency could reasonably be expected to occur during the life of the landfill. In addition the stormwater management pond must be designed to meet the criteria of MD 378 to safely pass the runoff from a 100-year frequency 24-hour storm event.

The watershed division done by SCM Chemicals, INC (1992) was used as illustrated in the attached Existing Conditions Drainage Area Map (Drawing 21). Pre-development values for drainage area, runoff curve number, and time of concentration were taken from SCM Chemicals, INC report (Tables 1 and 2), 1992, and used to calculate the pre-development discharge rates. The proposed condition represents the hypothetical condition at the conclusion of the Cell 3 construction, filling, and capping. This scenario is included to show that stormwater management conversion could take place at the end of the current phase of landfill construction, as shown on the Proposed Conditions Drainage Area Map (Drawing 21). Proposed conditions includes modeling and routing stormwater through the outlet control structure of the proposed stormwater management ponds.

Output files for the hydraulic and hydrologic analysis performed in HydroCAD® are provided following this analysis in Appendix A. Output includes 2, 10 and 100 -year design event runoff conditions for the entire site at existing and proposed conditions. Table 1 shows the expected discharge rate at each Point of Investigation for 2 -year, 10-year and 100-year 24-hour design storm events under existing and proposed conditions.

Written by: _____ **Date:** _____ **Reviewed by:** _____ **Date:** _____

Client: Talen Energy **Project:** Lot 15 Landfill **Project/Proposal No.:** ME1400 **Task No.:** _____

Table 1 RESULTS SUMMARY

			EXISTING HYDROCAD *	PROPOSED HYDROCAD
2 Year, 24 Hour Frequency Storm				
POI 1	Peak Flow	(cfs)	10.16	9.06
POI 2	Peak Flow	(cfs)	1.70	1.69
10 Year, 24 Hour Freqency Storm				
POI 1	Peak Flow	(cfs)	32.83	25.39
POI 2	Peak Flow	(cfs)	10.72	10.59
100 Year, 24 Hour Frequency Storm				
POI 1	Peak Flow	(cfs)	61.76	45.14
POI 2	Peak Flow	(cfs)	24.99	24.10

* PRE-DEVELOPMENT VALUES FROM TABLES 1 & 2 FOR DRAINAGE AREA, RUNOFF CURVE NUMBER, AND TIME OF CONCENTRATION USED IN EXISTING CONDITION HYDROCAD MODEL FROM FILE: Stormwater Summary Tables.pdf by SCM Chemicals, INC (1992)

REFERENCES

Applied Microcomputer Systems, "*HydroCAD® Stormwater Modeling System*", Version 7.10, Chocorua, New Hampshire 2005.

Center for Watershed Protection, District Department of the Environment, Environmental Health Administration, Bureau of Environmental Quality, and Watershed Protection Division, *"District of Columbia Storm Water Management Guidebook"*, April 2003.

Maryland Department of the Environment, Water Management Administration. *"2000 Maryland Stormwater Design Manual Volumes I & II"*, 2000.

TABLE 1: PRE-DEVELOPMENT CN
SCM CHEMICALS, INC.
HPP LANDFILL

Basin No. (1)	Soil Type (2)	Hydrologic Group (3)	CN (4)	Area (Ac.) (5)	Sum of Area (Ac.) (6)	CN x Area [4 x 5] (7)	Sum of CN x Area (8)	Av. CN [8/6] (9)
1	BeB	C	73	7.22	26.0	527.06	1721.44	66.2 ≈ 67
	GaB	A	36	4.99		179.64		
	EnB	C/D	76	2.69		204.44		
	BkB	C	73	11.10		810.3		
2	BkB	C	73	5.18	15.89	378.14	893.94	56.26 ≈ 57
	GaB	A	36	7.19		258.84		
	BkC	C	73	1.71		124.83		
	U3C	C	73	1.81		132.13		
3	BeB	C	73	2.84	29.8	207.32	1852.64	62.17 ≈ 63
	SaB	B	65	3.53		229.45		
	U3C	C	73	15.47		1129.31		
	GaB	A	36	7.96		286.56		

TABLE 2: PRE-DEVELOPMENT T_c
SCM CHEMICALS, INC.
HPP LANDFILL

BASIN NO.	WATERSHED AREA	T_c (hr.)	LOCATION
1	30-1	1.09	2-14" pipe near railroad track
2	65-1	0.86	Southeast corner of 65-Ac. site at property line
3	65-2	0.67	Southeast stream at property line
	65-3	0.67	Culvert at Fort Smallwood Road

Subcat Reach Pond Link

Routing Diagram for ME1400 PreDevelopment
Prepared by {enter your company name here}, Printed 12/6/2017
HydroCAD® 10.00-18 s/n 00663 © 2016 HydroCAD Software Solutions LLC

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment B1: POI-1 Runoff Area=26.000 ac 0.00% Impervious Runoff Depth>0.59"
Tc=40.2 min CN=67 Runoff=10.16 cfs 1.289 af

Subcatchment B2: POI-2 Runoff Area=15.890 ac 0.00% Impervious Runoff Depth>0.25"
Tc=40.2 min CN=57 Runoff=1.70 cfs 0.334 af

Total Runoff Area = 41.890 ac Runoff Volume = 1.623 af Average Runoff Depth = 0.46"
100.00% Pervious = 41.890 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment B1: POI-1

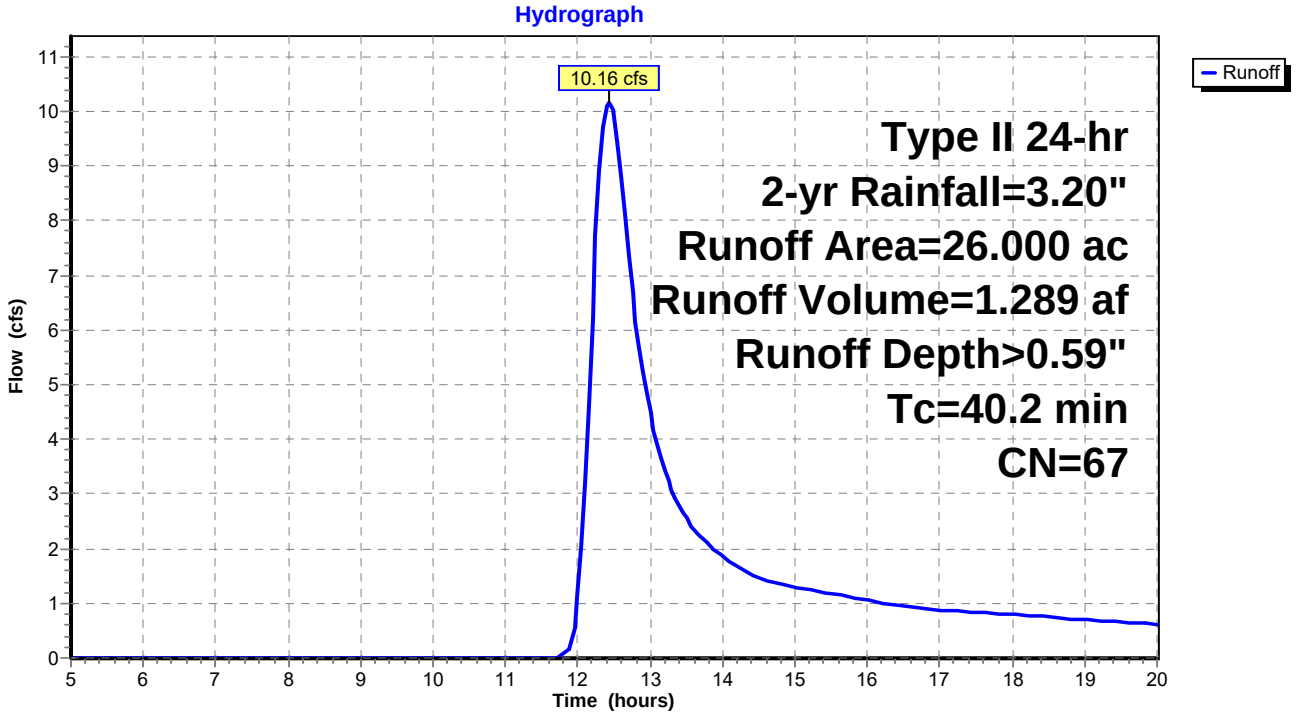
Runoff = 10.16 cfs @ 12.44 hrs, Volume= 1.289 af, Depth> 0.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=3.20"

	Area (ac)	CN	Description
*	26.000	67	From Table 1
	26.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.2					**Direct Entry, From Table 2**

Subcatchment B1: POI-1



Summary for Subcatchment B2: POI-2

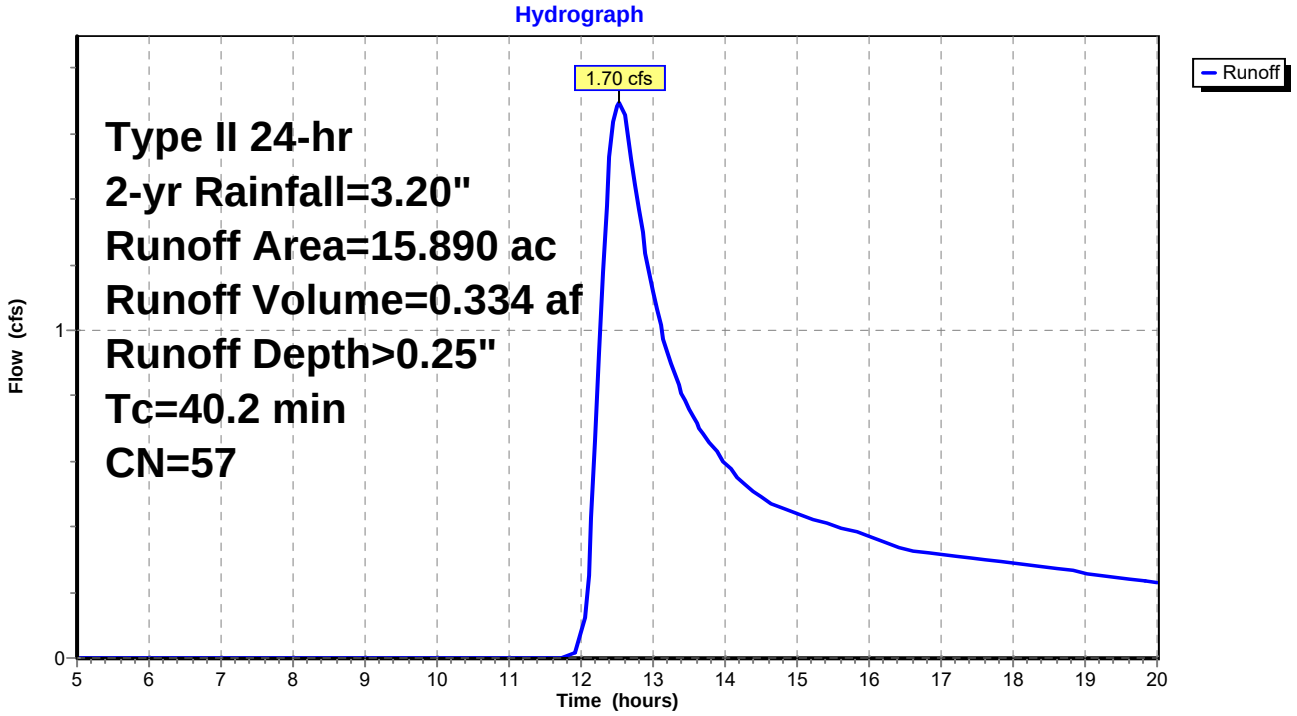
Runoff = 1.70 cfs @ 12.54 hrs, Volume= 0.334 af, Depth> 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=3.20"

	Area (ac)	CN	Description
*	15.890	57	From Table 1
	15.890		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.2					**Direct Entry, From Table 2**

Subcatchment B2: POI-2



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment B1: POI-1 Runoff Area=26.000 ac 0.00% Impervious Runoff Depth>1.67"
Tc=40.2 min CN=67 Runoff=32.83 cfs 3.627 af

Subcatchment B2: POI-2 Runoff Area=15.890 ac 0.00% Impervious Runoff Depth>1.01"
Tc=40.2 min CN=57 Runoff=10.72 cfs 1.333 af

Total Runoff Area = 41.890 ac Runoff Volume = 4.959 af Average Runoff Depth = 1.42"
100.00% Pervious = 41.890 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment B1: POI-1

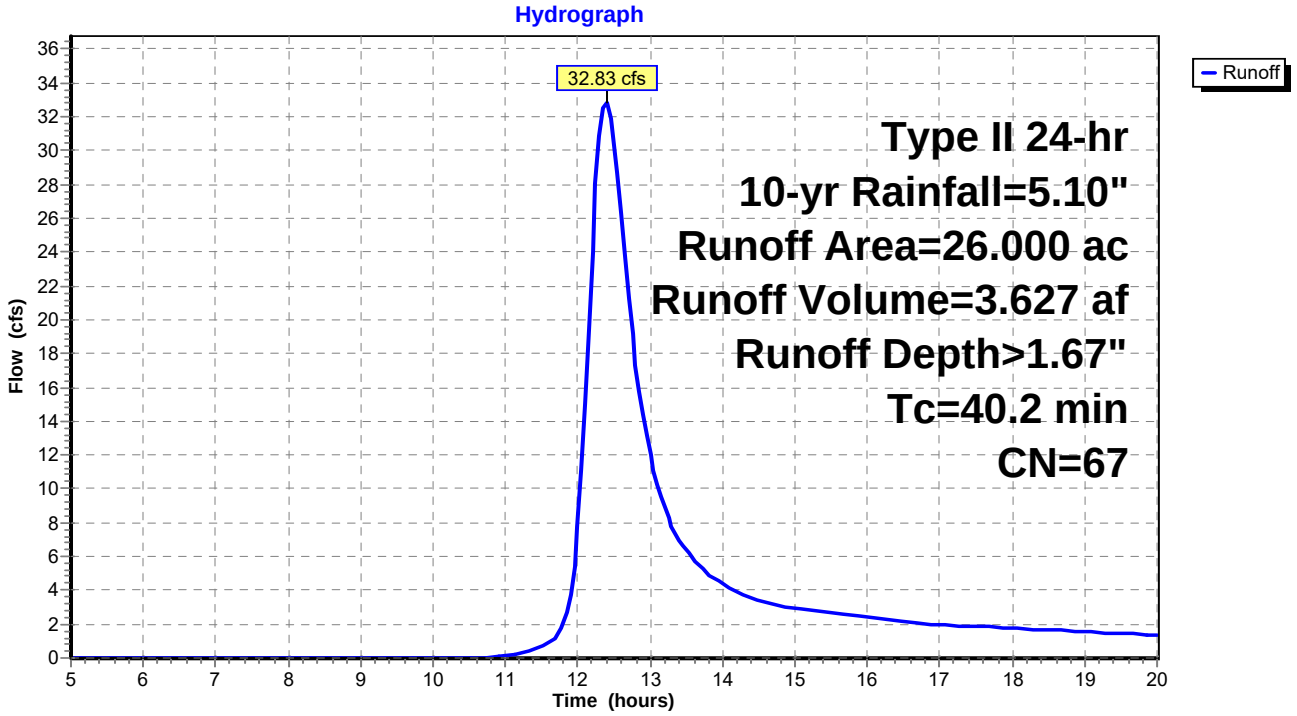
Runoff = 32.83 cfs @ 12.39 hrs, Volume= 3.627 af, Depth> 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=5.10"

	Area (ac)	CN	Description
*	26.000	67	From Table 1
	26.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.2					**Direct Entry, From Table 2**

Subcatchment B1: POI-1



Summary for Subcatchment B2: POI-2

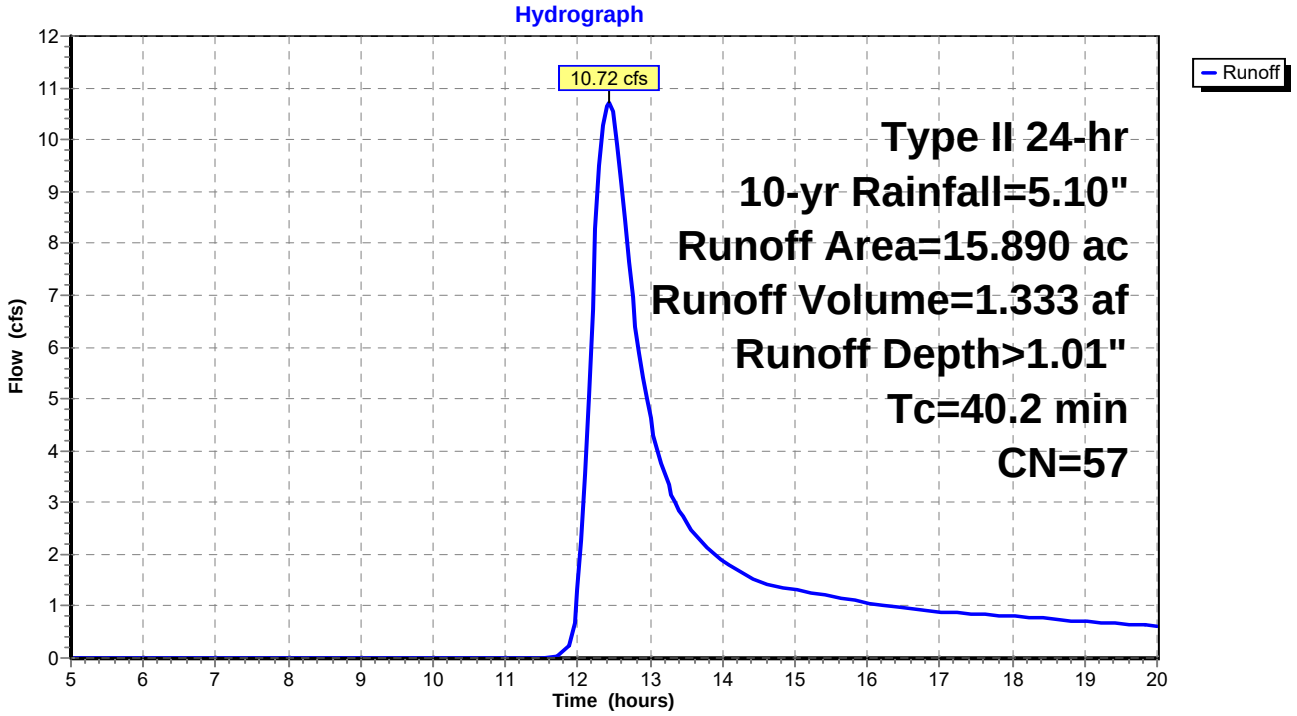
Runoff = 10.72 cfs @ 12.43 hrs, Volume= 1.333 af, Depth> 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=5.10"

	Area (ac)	CN	Description
*	15.890	57	From Table 1
	15.890		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.2					**Direct Entry, From Table 2**

Subcatchment B2: POI-2



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment B1: POI-1 Runoff Area=26.000 ac 0.00% Impervious Runoff Depth>3.07"
Tc=40.2 min CN=67 Runoff=61.76 cfs 6.651 af

Subcatchment B2: POI-2 Runoff Area=15.890 ac 0.00% Impervious Runoff Depth>2.12"
Tc=40.2 min CN=57 Runoff=24.99 cfs 2.802 af

Total Runoff Area = 41.890 ac Runoff Volume = 9.453 af Average Runoff Depth = 2.71"
100.00% Pervious = 41.890 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment B1: POI-1

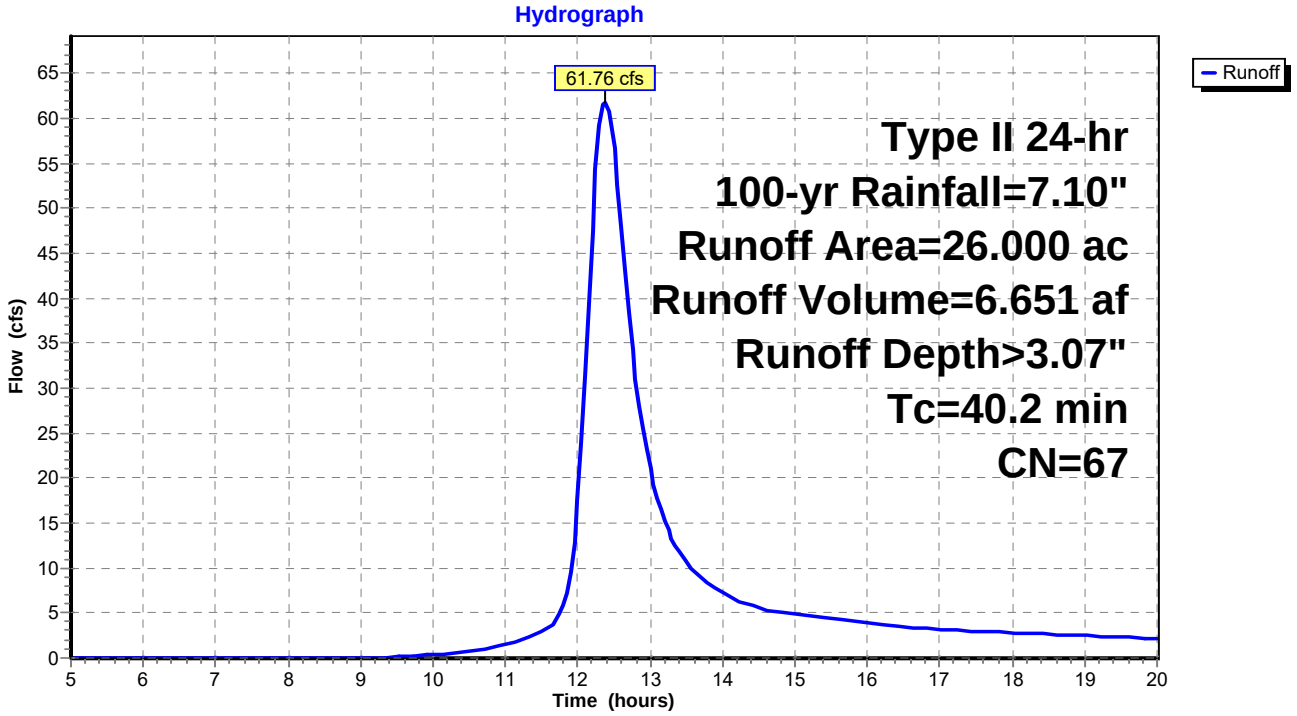
Runoff = 61.76 cfs @ 12.38 hrs, Volume= 6.651 af, Depth> 3.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.10"

	Area (ac)	CN	Description
*	26.000	67	From Table 1
	26.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.2					**Direct Entry, From Table 2**

Subcatchment B1: POI-1



Summary for Subcatchment B2: POI-2

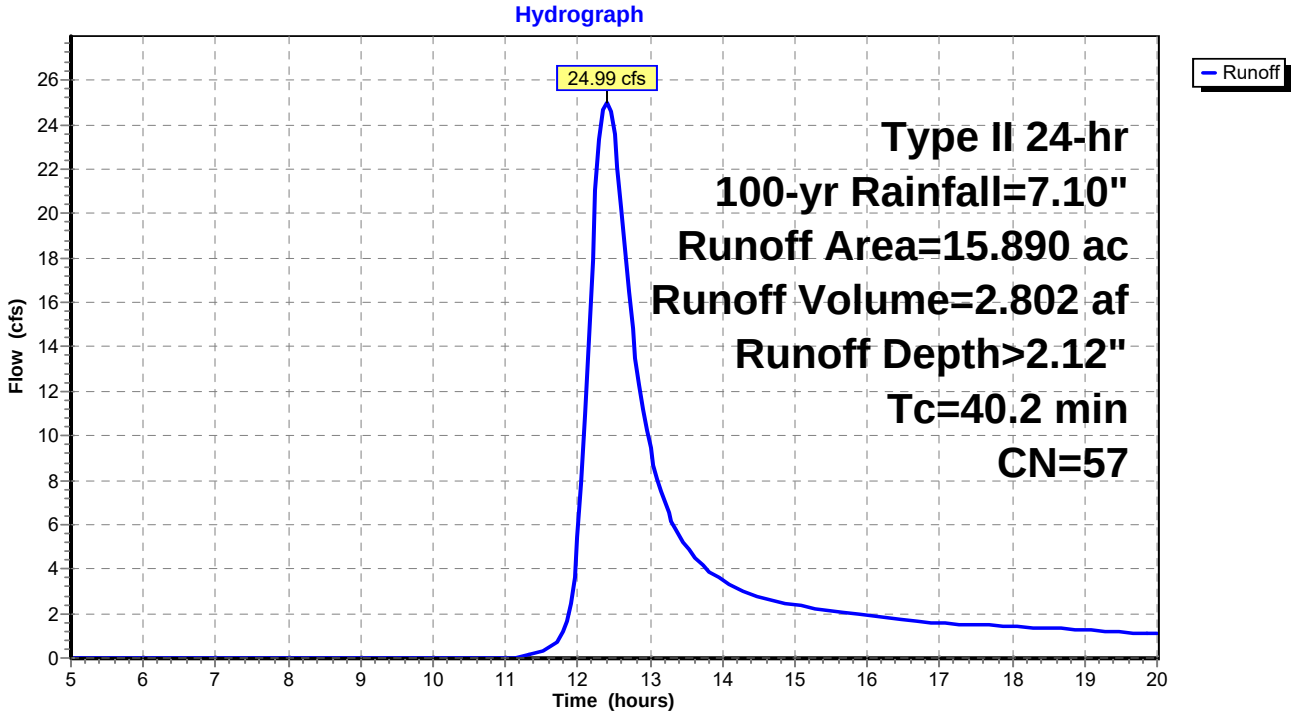
Runoff = 24.99 cfs @ 12.40 hrs, Volume= 2.802 af, Depth> 2.12"

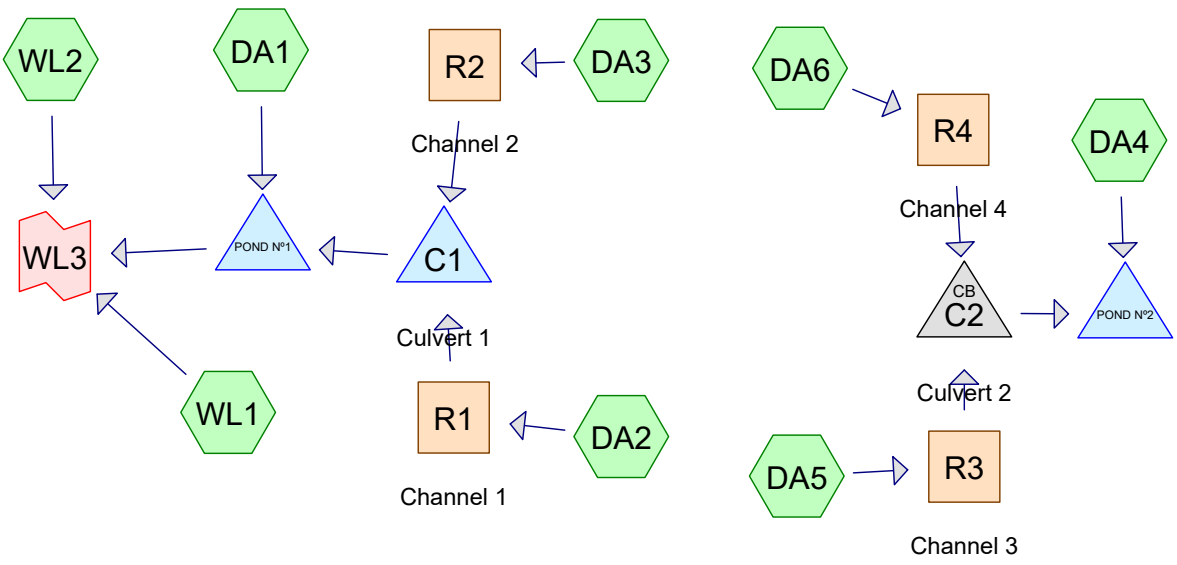
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.10"

	Area (ac)	CN	Description
*	15.890	57	From Table 1
	15.890		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.2					**Direct Entry, From Table 2**

Subcatchment B2: POI-2





Subcat Reach Pond Link

Routing Diagram for ME1400 Final Conditions SWM
Prepared by {enter your company name here}, Printed 12/6/2017
HydroCAD® 10.00-18 s/n 00663 © 2016 HydroCAD Software Solutions LLC

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA1: Runoff Area=1.430 ac 62.94% Impervious Runoff Depth>1.94"
Flow Length=43' Tc=1.4 min CN=89 Runoff=5.64 cfs 0.231 af

Subcatchment DA2: Runoff Area=22.780 ac 0.00% Impervious Runoff Depth>0.93"
Flow Length=980' Tc=22.3 min CN=74 Runoff=23.22 cfs 1.764 af

Subcatchment DA3: Runoff Area=2.170 ac 0.00% Impervious Runoff Depth>0.94"
Flow Length=200' Tc=4.5 min CN=74 Runoff=4.11 cfs 0.169 af

Subcatchment DA4: Runoff Area=0.820 ac 60.98% Impervious Runoff Depth>1.94"
Flow Length=34' Slope=0.5000 '/' Tc=1.1 min CN=89 Runoff=3.28 cfs 0.133 af

Subcatchment DA5: Runoff Area=3.500 ac 0.00% Impervious Runoff Depth>0.94"
Flow Length=250' Slope=0.3333 '/' Tc=3.8 min CN=74 Runoff=6.85 cfs 0.273 af

Subcatchment DA6: Runoff Area=5.230 ac 0.00% Impervious Runoff Depth>0.94"
Flow Length=330' Slope=0.2050 '/' Tc=5.1 min CN=74 Runoff=9.60 cfs 0.408 af

Subcatchment WL1: Runoff Area=9.380 ac 0.00% Impervious Runoff Depth>0.58"
Flow Length=940' Tc=81.5 min CN=67 Runoff=2.17 cfs 0.452 af

Subcatchment WL2: Runoff Area=1.420 ac 0.00% Impervious Runoff Depth>0.60"
Flow Length=330' Tc=31.0 min CN=67 Runoff=0.67 cfs 0.071 af

Reach R1: Channel 1 Avg. Flow Depth=1.29' Max Vel=3.60 fps Inflow=23.22 cfs 1.764 af
n=0.030 L=2,370.0' S=0.0101 '/' Capacity=104.71 cfs Outflow=17.98 cfs 1.730 af

Reach R2: Channel 2 Avg. Flow Depth=0.55' Max Vel=3.61 fps Inflow=4.11 cfs 0.169 af
n=0.030 L=1,100.0' S=0.0318 '/' Capacity=102.37 cfs Outflow=3.19 cfs 0.168 af

Reach R3: Channel 3 Avg. Flow Depth=0.78' Max Vel=3.10 fps Inflow=6.85 cfs 0.273 af
n=0.030 L=750.0' S=0.0147 '/' Capacity=69.50 cfs Outflow=5.49 cfs 0.271 af

Reach R4: Channel 4 Avg. Flow Depth=0.81' Max Vel=4.15 fps Inflow=9.60 cfs 0.408 af
n=0.030 L=1,070.0' S=0.0252 '/' Capacity=91.16 cfs Outflow=7.79 cfs 0.405 af

Pond C1: Culvert 1 Peak Elev=31.22' Storage=449 cf Inflow=18.56 cfs 1.897 af
30.0" Round Culvert x 2.00 n=0.011 L=53.0' S=0.0100 '/' Outflow=18.56 cfs 1.897 af

Pond C2: Culvert 2 Peak Elev=39.54' Inflow=13.13 cfs 0.676 af
30.0" Round Culvert n=0.011 L=34.0' S=0.0118 '/' Outflow=13.13 cfs 0.676 af

Pond POND Nº1: Peak Elev=25.22' Storage=36,545 cf Inflow=18.94 cfs 2.129 af
Outflow=6.71 cfs 1.824 af

Pond POND Nº2: Peak Elev=34.72' Storage=16,498 cf Inflow=13.48 cfs 0.809 af
Outflow=1.69 cfs 0.663 af

Link WL3: Inflow=9.06 cfs 2.347 af
Primary=9.06 cfs 2.347 af

Total Runoff Area = 46.730 ac Runoff Volume = 3.502 af Average Runoff Depth = 0.90"
97.00% Pervious = 45.330 ac 3.00% Impervious = 1.400 ac

Summary for Subcatchment DA1:

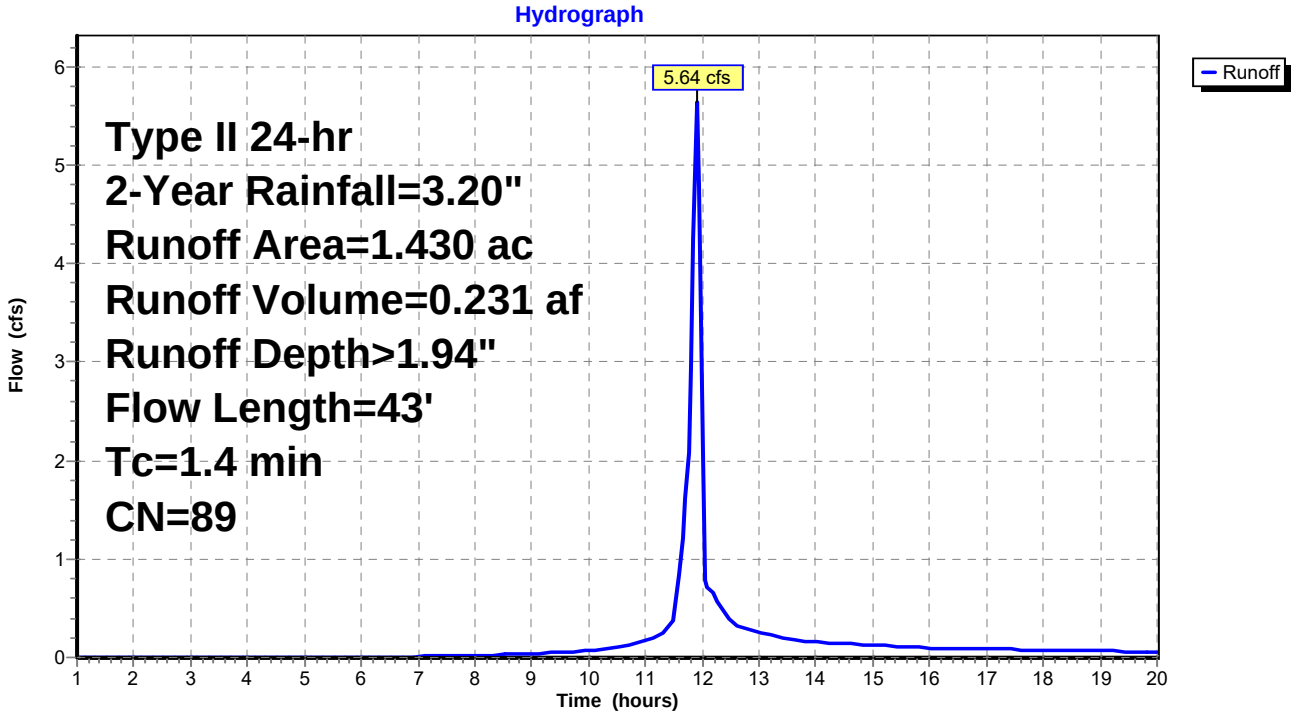
Runoff = 5.64 cfs @ 11.91 hrs, Volume= 0.231 af, Depth> 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.20"

Area (ac)	CN	Description
0.530	74	>75% Grass cover, Good, HSG C
0.130	98	Paved parking, HSG C
0.770	98	Water Surface, HSG C
1.430	89	Weighted Average
0.530		37.06% Pervious Area
0.900		62.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	18	0.0100	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
1.0	25	0.3670	0.41		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.4	43	Total			

Subcatchment DA1:



Summary for Subcatchment DA2:

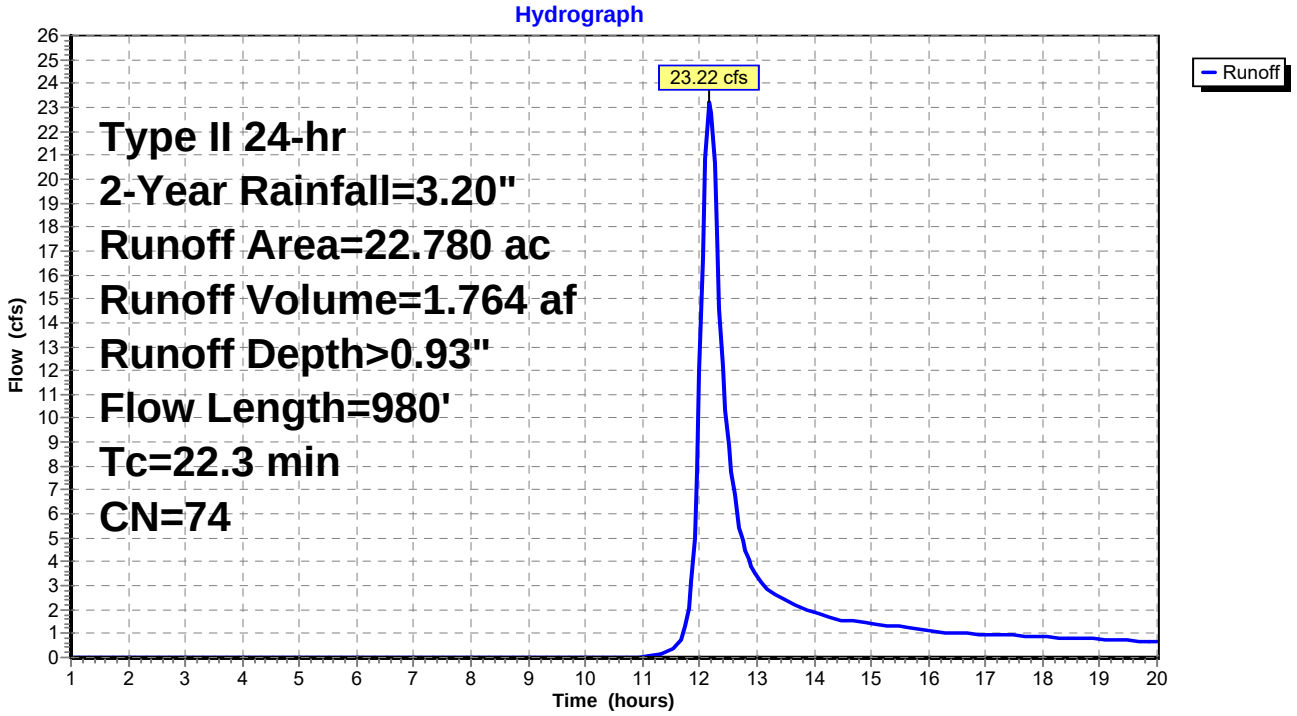
Runoff = 23.22 cfs @ 12.17 hrs, Volume= 1.764 af, Depth> 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.20"

Area (ac)	CN	Description
22.780	74	>75% Grass cover, Good, HSG C
22.780		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
5.7	340	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	120	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.1	360	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	60	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
22.3	980	Total			

Subcatchment DA2:



Summary for Subcatchment DA3:

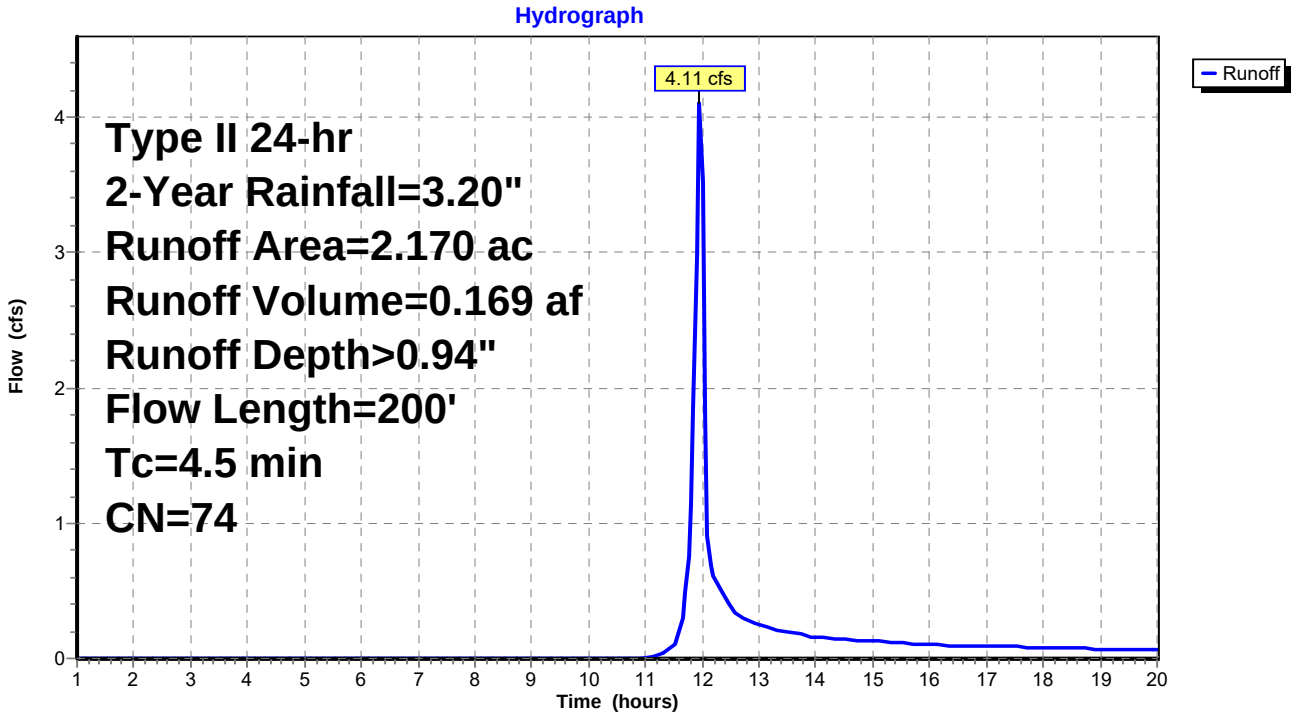
Runoff = 4.11 cfs @ 11.96 hrs, Volume= 0.169 af, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.20"

Area (ac)	CN	Description
2.170	74	>75% Grass cover, Good, HSG C
2.170		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	100	0.3333	0.52		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.1	30	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	70	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.5	200	Total			

Subcatchment DA3:



Summary for Subcatchment DA4:

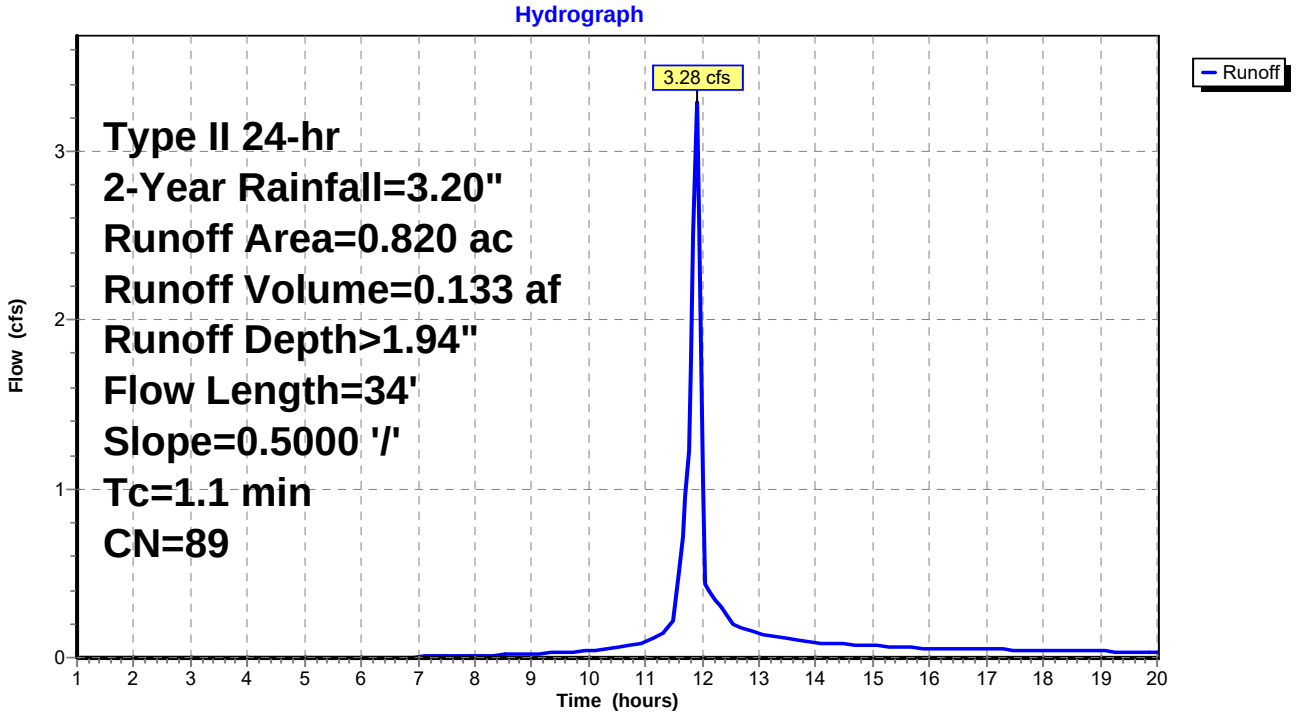
Runoff = 3.28 cfs @ 11.90 hrs, Volume= 0.133 af, Depth> 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.20"

Area (ac)	CN	Description
0.320	74	>75% Grass cover, Good, HSG C
0.110	98	Paved parking, HSG C
0.390	98	Water Surface, HSG C
0.820	89	Weighted Average
0.320		39.02% Pervious Area
0.500		60.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	34	0.5000	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment DA4:



Summary for Subcatchment DA5:

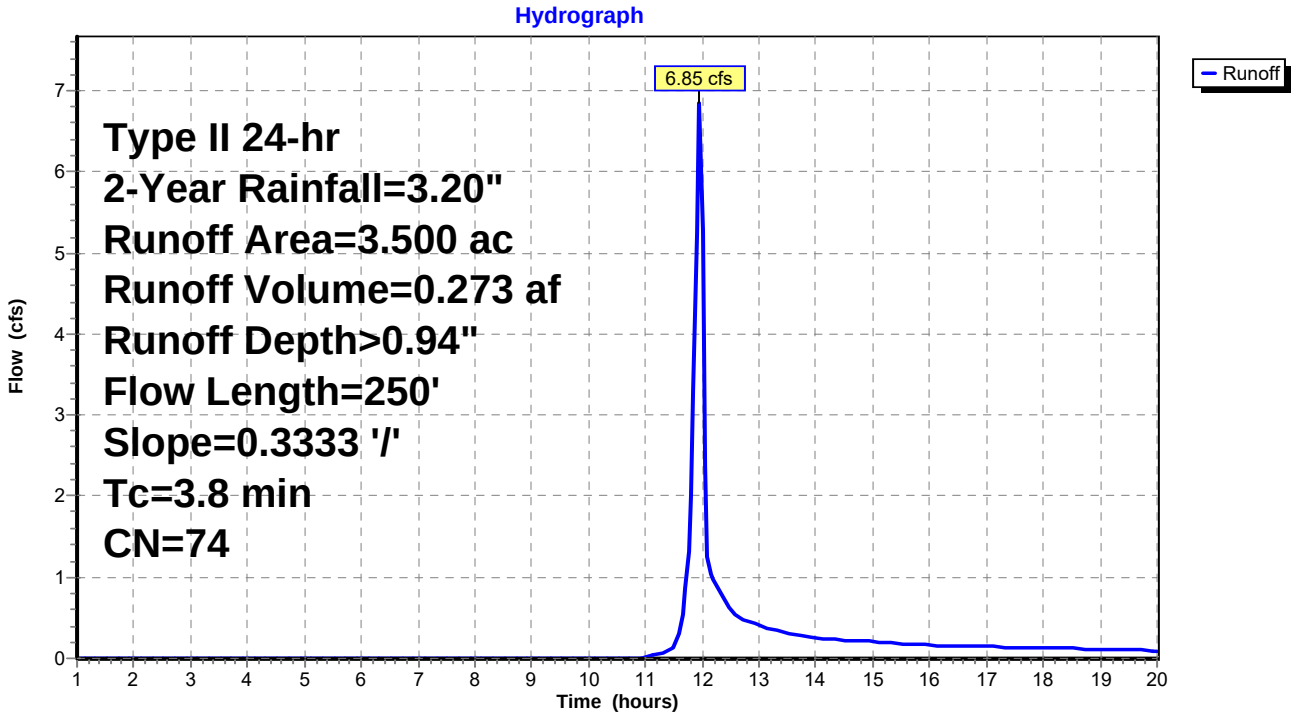
Runoff = 6.85 cfs @ 11.95 hrs, Volume= 0.273 af, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.20"

Area (ac)	CN	Description
3.500	74	>75% Grass cover, Good, HSG C
3.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	100	0.3333	0.52		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.6	150	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.8	250	Total			

Subcatchment DA5:



Summary for Subcatchment DA6:

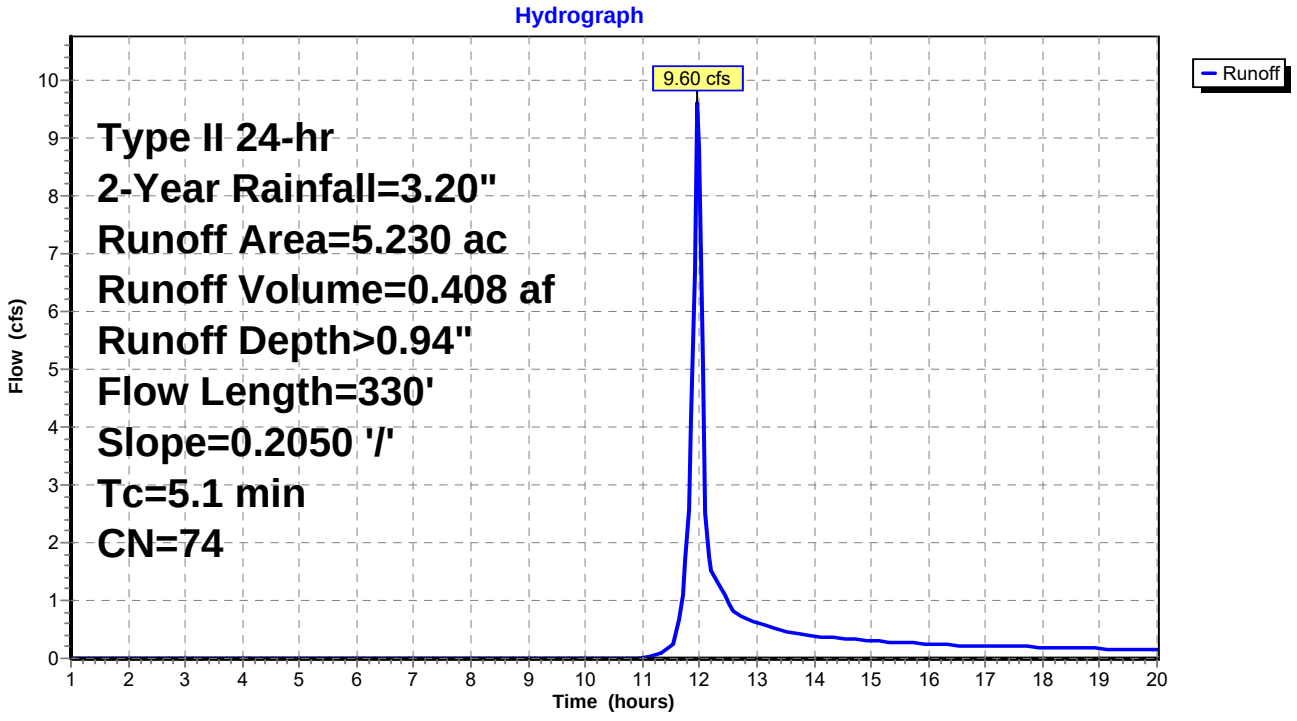
Runoff = 9.60 cfs @ 11.97 hrs, Volume= 0.408 af, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.20"

Area (ac)	CN	Description
5.230	74	>75% Grass cover, Good, HSG C
5.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	100	0.2050	0.43		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	230	0.2050	3.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.1	330	Total			

Subcatchment DA6:



Summary for Subcatchment WL1:

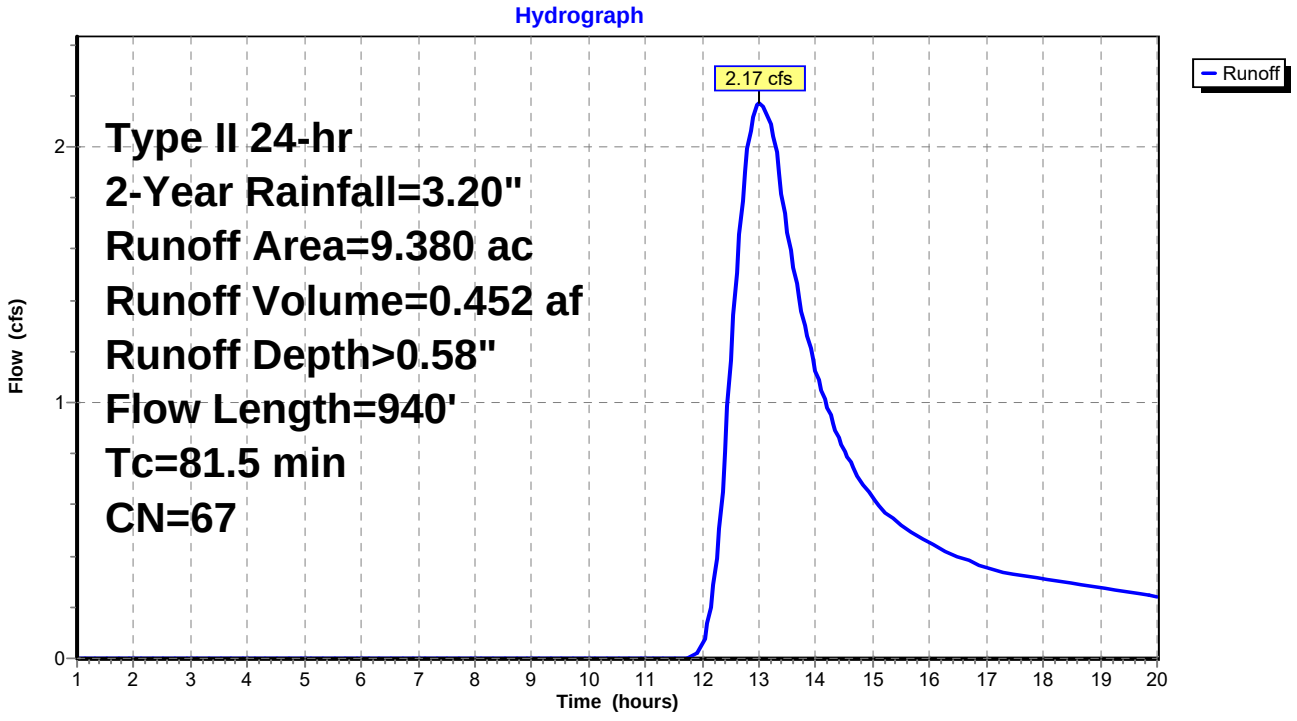
Runoff = 2.17 cfs @ 13.01 hrs, Volume= 0.452 af, Depth> 0.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.20"

	Area (ac)	CN	Description
*	9.380	67	
	9.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.2	100	0.0250	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.20"
47.3	840	0.0140	0.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
81.5	940	Total			

Subcatchment WL1:



Summary for Subcatchment WL2:

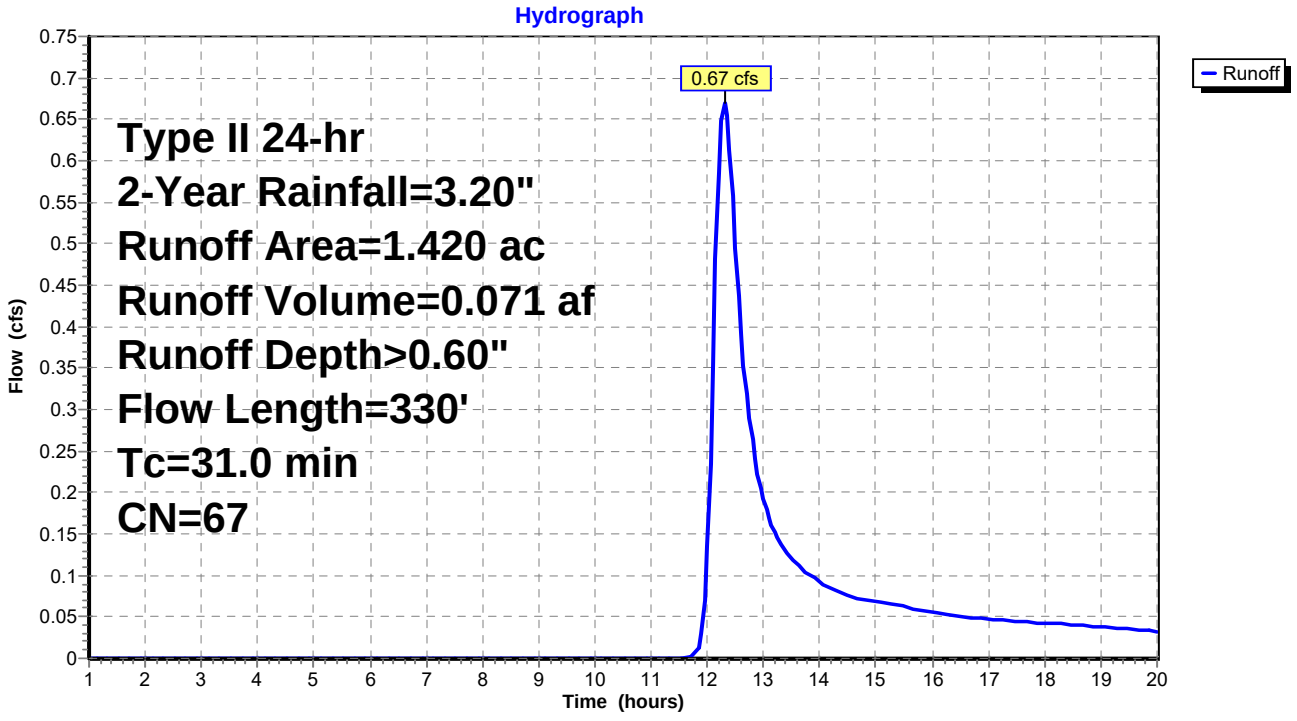
Runoff = 0.67 cfs @ 12.30 hrs, Volume= 0.071 af, Depth> 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.20"

	Area (ac)	CN	Description
*	1.420	67	
	1.420		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.5	100	0.0800	0.08		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.20"
9.5	230	0.0260	0.40		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
31.0	330	Total			

Subcatchment WL2:



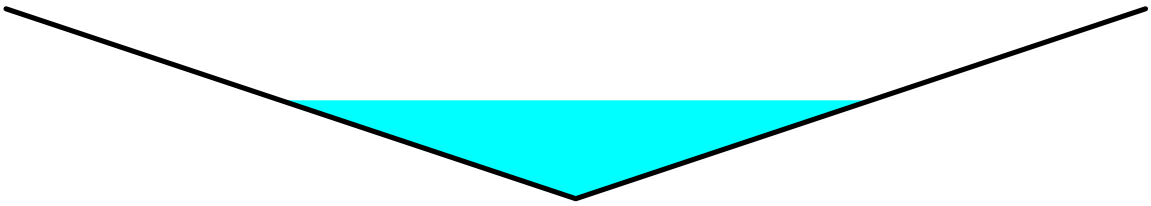
Summary for Reach R1: Channel 1

Inflow Area = 22.780 ac, 0.00% Impervious, Inflow Depth > 0.93" for 2-Year event
Inflow = 23.22 cfs @ 12.17 hrs, Volume= 1.764 af
Outflow = 17.98 cfs @ 12.48 hrs, Volume= 1.730 af, Atten= 23%, Lag= 18.6 min

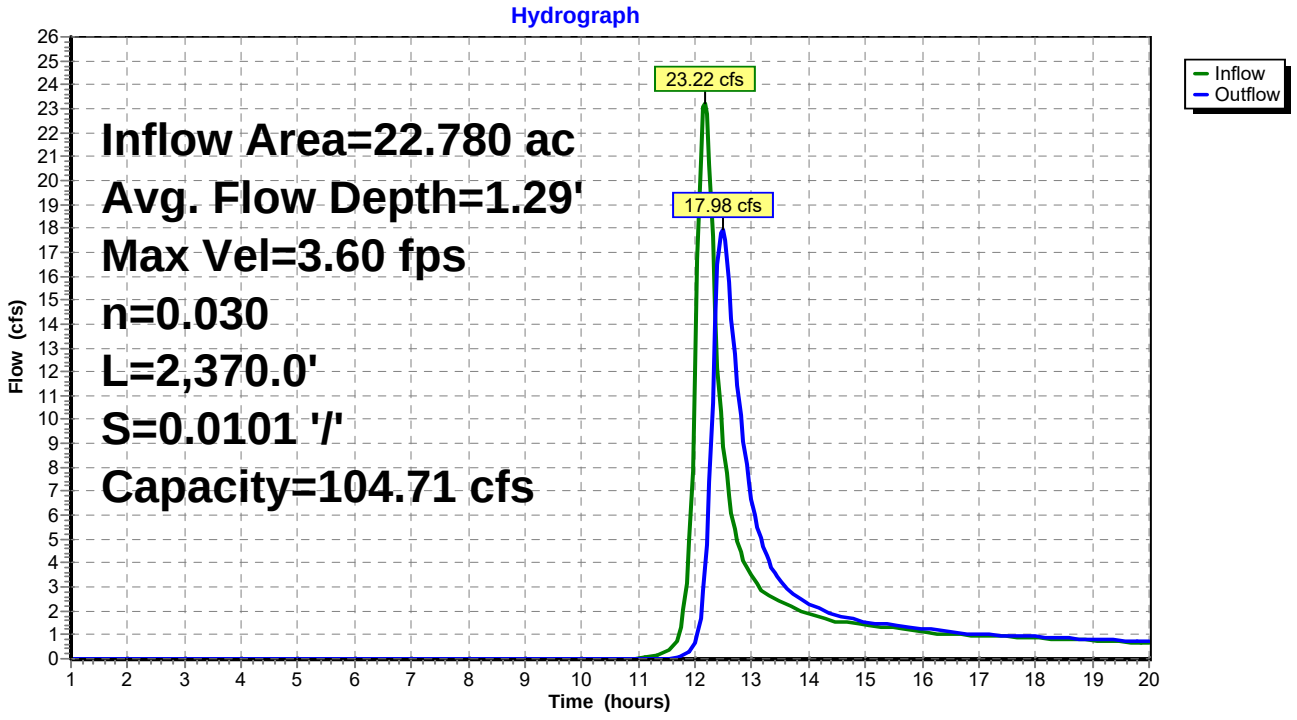
Routing by Stor-Ind+Trans method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.60 fps, Min. Travel Time= 11.0 min
Avg. Velocity = 1.89 fps, Avg. Travel Time= 20.9 min

Peak Storage= 11,921 cf @ 12.30 hrs
Average Depth at Peak Storage= 1.29'
Bank-Full Depth= 2.50' Flow Area= 18.8 sf, Capacity= 104.71 cfs

0.00' x 2.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 15.00'
Length= 2,370.0' Slope= 0.0101 '/'
Inlet Invert= 54.00', Outlet Invert= 30.00'



Reach R1: Channel 1



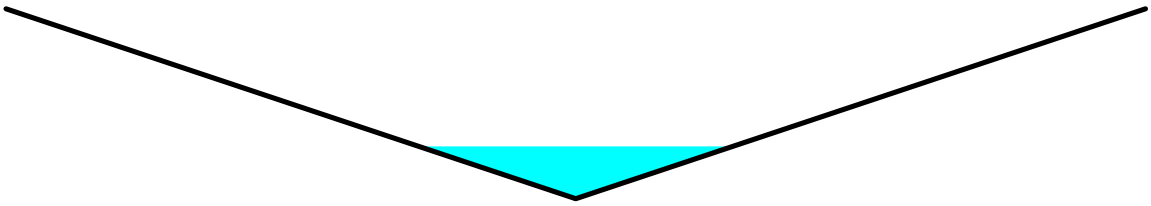
Summary for Reach R2: Channel 2

Inflow Area = 2.170 ac, 0.00% Impervious, Inflow Depth > 0.94" for 2-Year event
Inflow = 4.11 cfs @ 11.96 hrs, Volume= 0.169 af
Outflow = 3.19 cfs @ 12.10 hrs, Volume= 0.168 af, Atten= 22%, Lag= 8.2 min

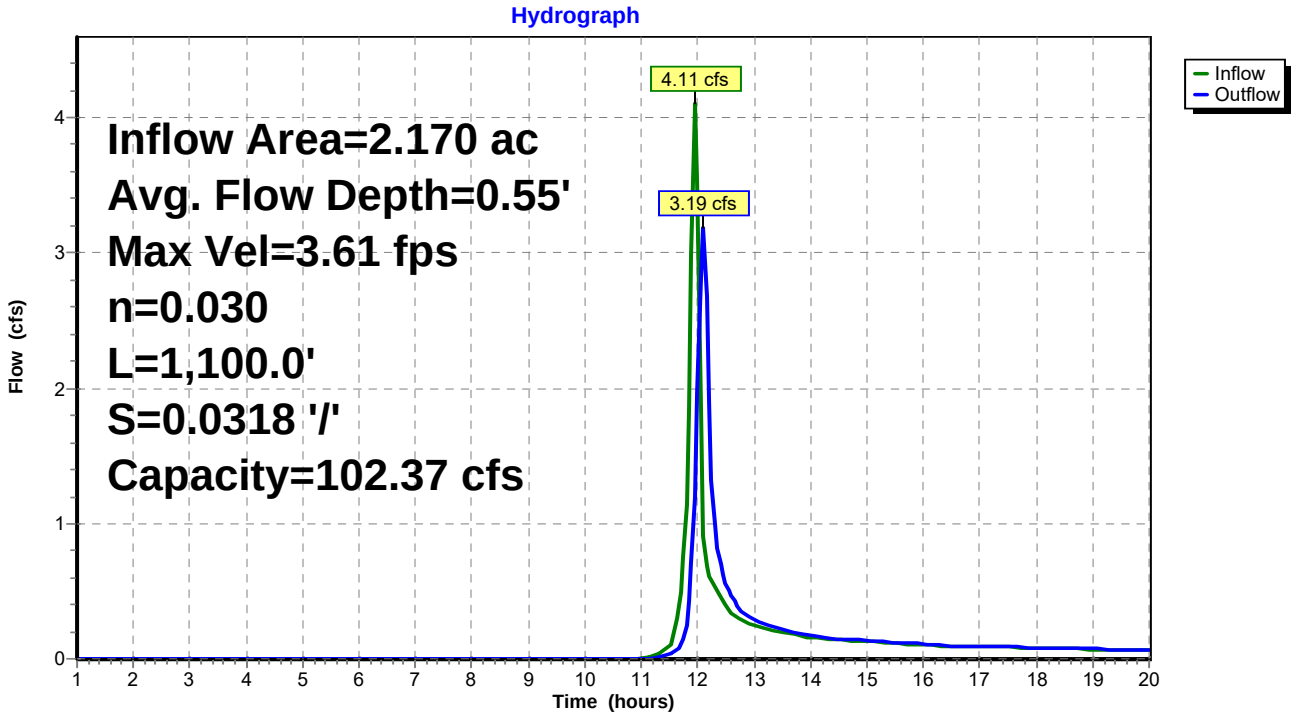
Routing by Stor-Ind+Trans method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.61 fps, Min. Travel Time= 5.1 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 11.3 min

Peak Storage= 1,004 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.55'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 102.37 cfs

0.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 1,100.0' Slope= 0.0318 '/'
Inlet Invert= 65.00', Outlet Invert= 30.00'



Reach R2: Channel 2



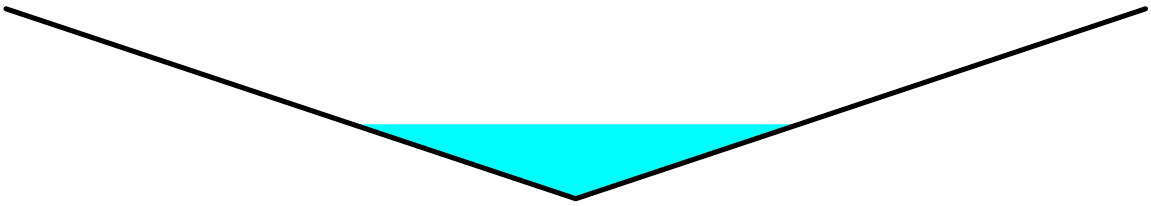
Summary for Reach R3: Channel 3

Inflow Area = 3.500 ac, 0.00% Impervious, Inflow Depth > 0.94" for 2-Year event
Inflow = 6.85 cfs @ 11.95 hrs, Volume= 0.273 af
Outflow = 5.49 cfs @ 12.06 hrs, Volume= 0.271 af, Atten= 20%, Lag= 6.4 min

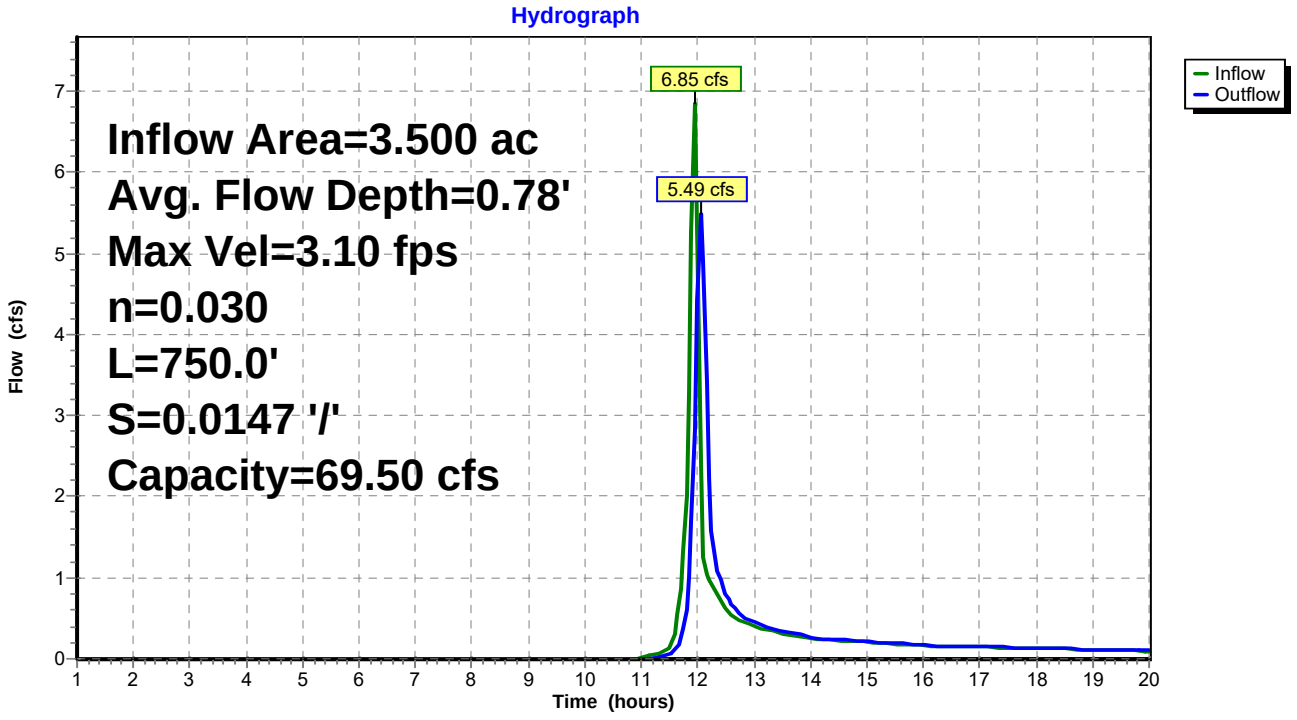
Routing by Stor-Ind+Trans method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.10 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 1.36 fps, Avg. Travel Time= 9.2 min

Peak Storage= 1,384 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.78'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 69.50 cfs

0.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 750.0' Slope= 0.0147 '/'
Inlet Invert= 49.00', Outlet Invert= 38.00'



Reach R3: Channel 3



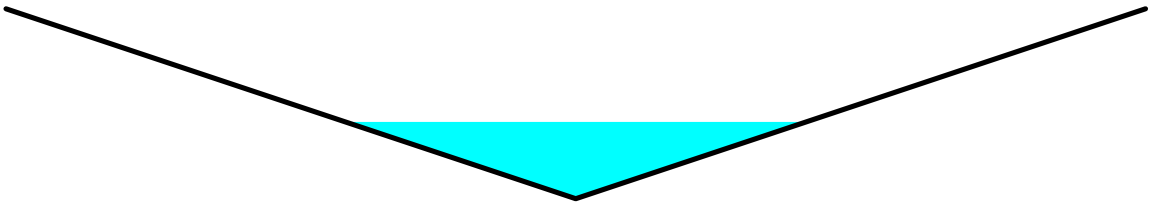
Summary for Reach R4: Channel 4

Inflow Area = 5.230 ac, 0.00% Impervious, Inflow Depth > 0.94" for 2-Year event
Inflow = 9.60 cfs @ 11.97 hrs, Volume= 0.408 af
Outflow = 7.79 cfs @ 12.08 hrs, Volume= 0.405 af, Atten= 19%, Lag= 7.1 min

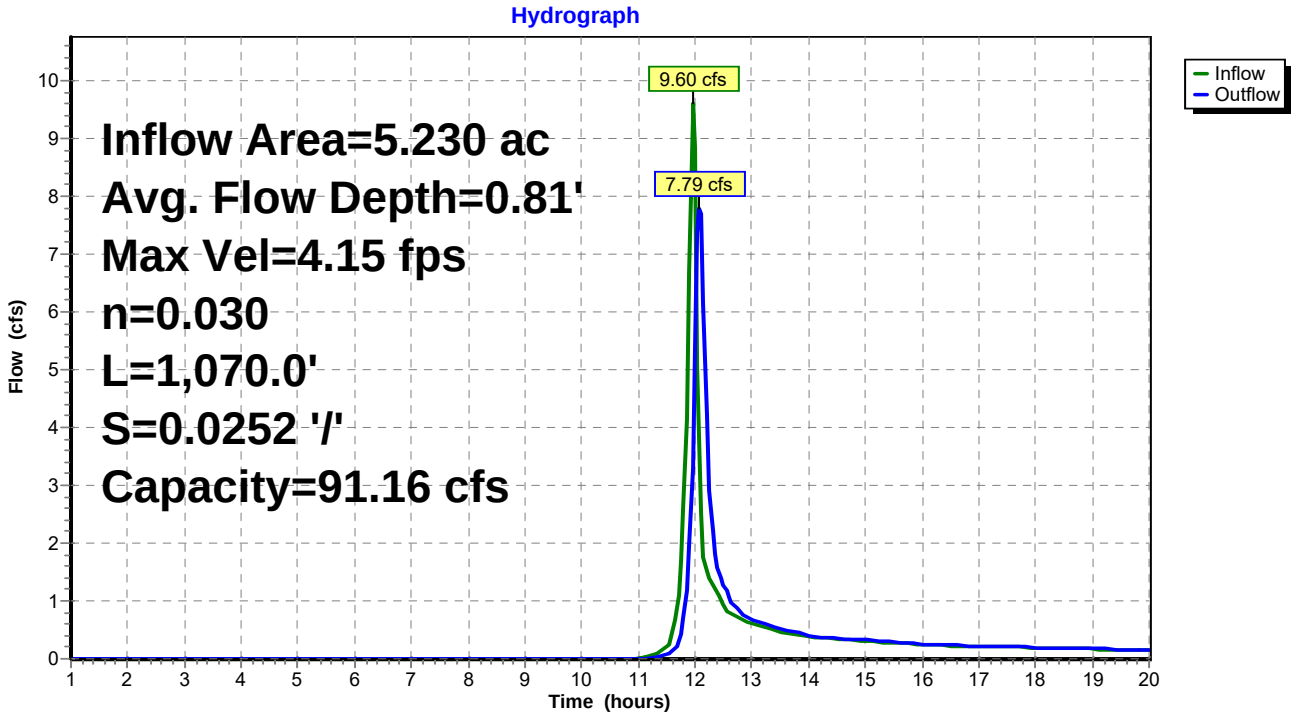
Routing by Stor-Ind+Trans method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.15 fps, Min. Travel Time= 4.3 min
Avg. Velocity = 1.84 fps, Avg. Travel Time= 9.7 min

Peak Storage= 2,099 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.81'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 91.16 cfs

0.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 1,070.0' Slope= 0.0252 '/'
Inlet Invert= 65.00', Outlet Invert= 38.00'



Reach R4: Channel 4



Summary for Pond C1: Culvert 1

Inflow Area = 24.950 ac, 0.00% Impervious, Inflow Depth > 0.91" for 2-Year event
Inflow = 18.56 cfs @ 12.48 hrs, Volume= 1.897 af
Outflow = 18.56 cfs @ 12.49 hrs, Volume= 1.897 af, Atten= 0%, Lag= 0.6 min
Primary = 18.56 cfs @ 12.49 hrs, Volume= 1.897 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 31.22' @ 12.49 hrs Surf.Area= 734 sf Storage= 449 cf
Flood Elev= 35.30' Surf.Area= 9,822 sf Storage= 17,098 cf

Plug-Flow detention time= 0.4 min calculated for 1.897 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (838.9 - 838.6)

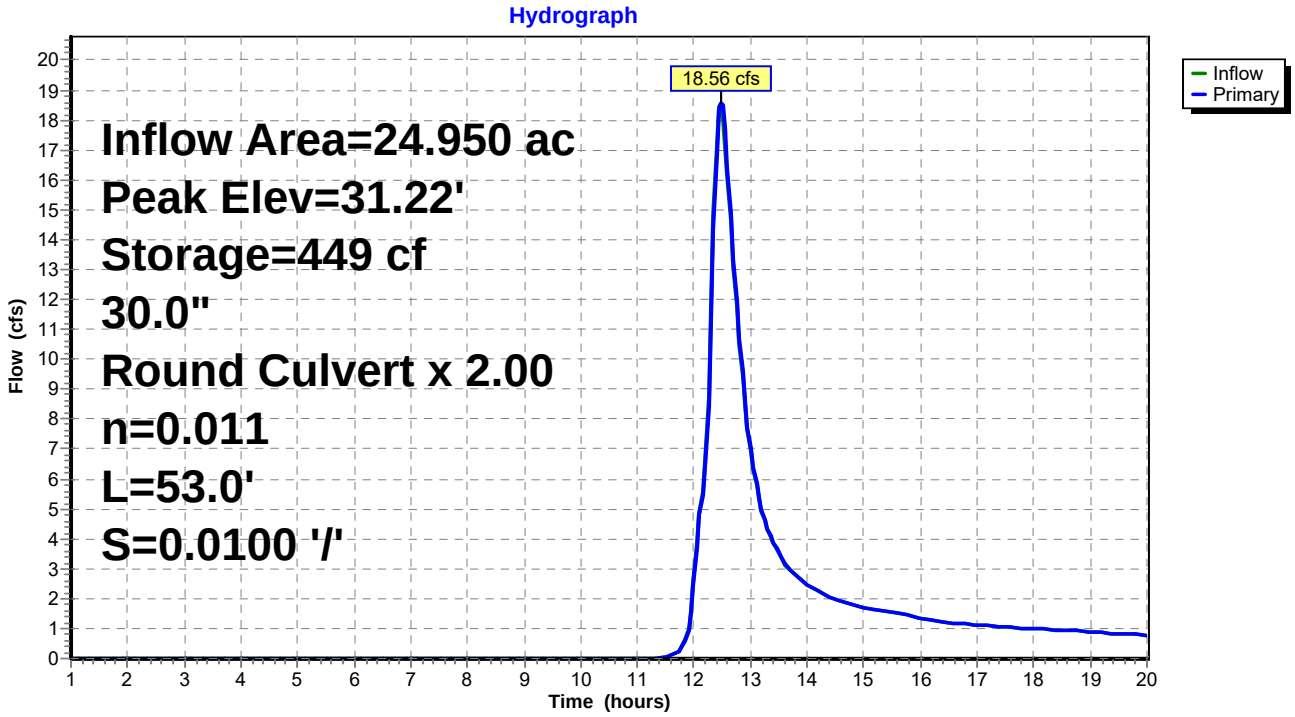
Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	24,875 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
30.00	0	0	0
32.00	1,200	1,200	1,200
34.00	5,039	6,239	7,439
35.00	8,718	6,879	14,318
36.00	12,397	10,558	24,875

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	**30.0" Round Culvert X 2.00** L= 53.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 30.00' / 29.47' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 4.91 sf

Primary OutFlow Max=18.46 cfs @ 12.49 hrs HW=31.22' (Free Discharge)
1=Culvert (Barrel Controls 18.46 cfs @ 5.67 fps)

Pond C1: Culvert 1



Summary for Pond C2: Culvert 2

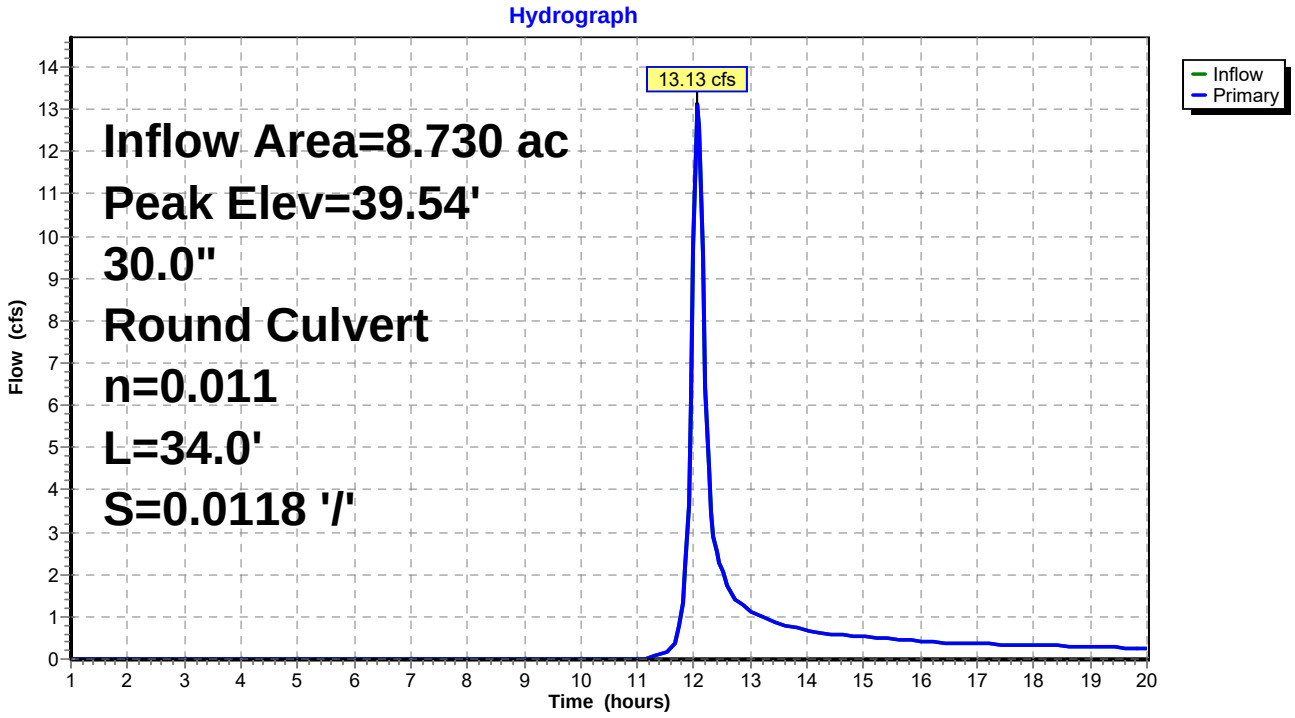
Inflow Area = 8.730 ac, 0.00% Impervious, Inflow Depth > 0.93" for 2-Year event
Inflow = 13.13 cfs @ 12.07 hrs, Volume= 0.676 af
Outflow = 13.13 cfs @ 12.07 hrs, Volume= 0.676 af, Atten= 0%, Lag= 0.0 min
Primary = 13.13 cfs @ 12.07 hrs, Volume= 0.676 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 39.54' @ 12.07 hrs
Flood Elev= 42.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	38.00'	**30.0" Round Culvert** L= 34.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 38.00' / 37.60' S= 0.0118 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 4.91 sf

Primary OutFlow Max=12.72 cfs @ 12.07 hrs HW=39.51' (Free Discharge)
└**1=Culvert** (Barrel Controls 12.72 cfs @ 5.89 fps)

Pond C2: Culvert 2



Summary for Pond POND Nº1:

Inflow Area = 26.380 ac, 3.41% Impervious, Inflow Depth > 0.97" for 2-Year event
Inflow = 18.94 cfs @ 12.48 hrs, Volume= 2.129 af
Outflow = 6.71 cfs @ 13.05 hrs, Volume= 1.824 af, Atten= 65%, Lag= 33.7 min
Primary = 6.71 cfs @ 13.05 hrs, Volume= 1.824 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 25.22' @ 13.05 hrs Surf.Area= 30,846 sf Storage= 36,545 cf

Plug-Flow detention time= 110.0 min calculated for 1.824 af (86% of inflow)
Center-of-Mass det. time= 67.4 min (898.4 - 831.0)

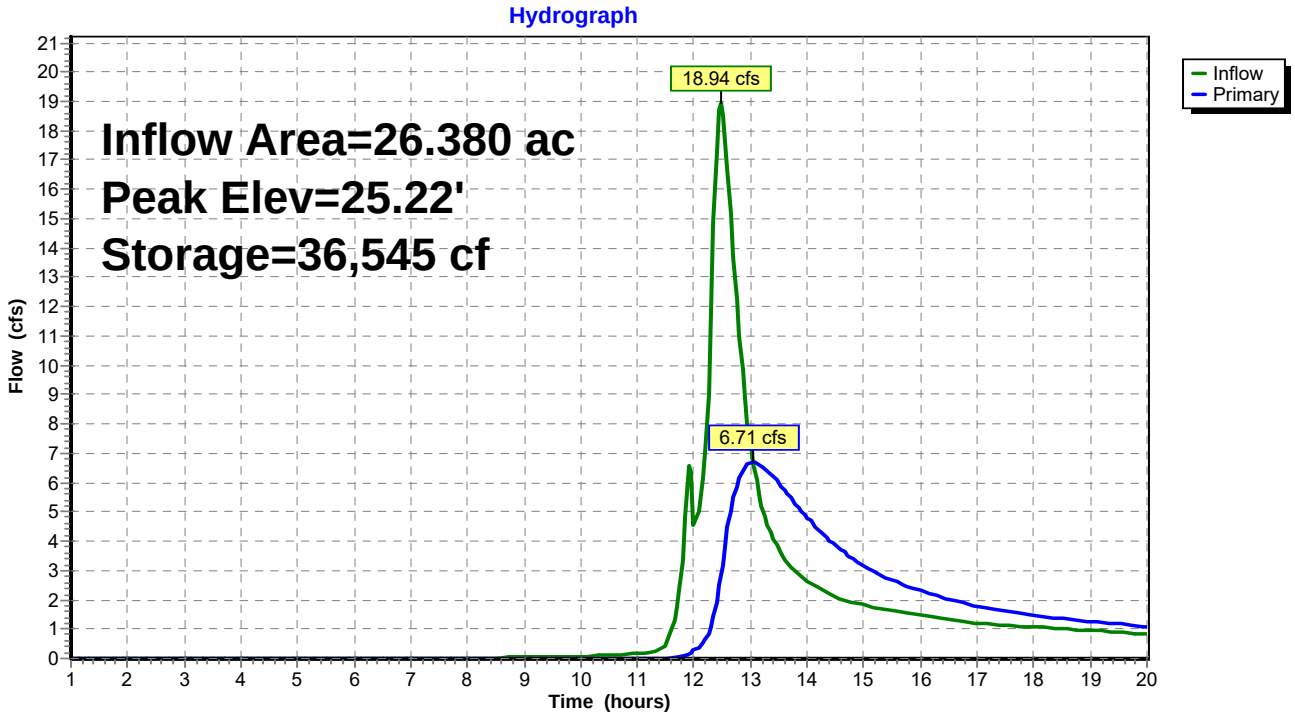
Volume	Invert	Avail.Storage	Storage Description
#1	24.00'	203,192 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
24.00	28,828	0	0
26.00	32,123	60,951	60,951
28.00	35,532	67,655	128,606
30.00	39,054	74,586	203,192

Device	Routing	Invert	Outlet Devices
#1	Primary	24.00'	**24.0" Round Culvert** L= 84.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 24.00' / 23.40' S= 0.0071 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Primary	28.00'	**Special & User-Defined** Head (feet) 0.00 0.72 0.97 1.32 1.64 1.84 Disch. (cfs) 0.000 5.900 15.500 32.500 51.800 65.200

Primary OutFlow Max=6.70 cfs @ 13.05 hrs HW=25.22' (Free Discharge)
└**1=Culvert** (Inlet Controls 6.70 cfs @ 3.32 fps)
└**2=Special & User-Defined** (Controls 0.00 cfs)

Pond POND Nº1:



Summary for Pond POND Nº2:

Inflow Area = 9.550 ac, 5.24% Impervious, Inflow Depth > 1.02" for 2-Year event
Inflow = 13.48 cfs @ 12.07 hrs, Volume= 0.809 af
Outflow = 1.69 cfs @ 12.68 hrs, Volume= 0.663 af, Atten= 87%, Lag= 36.8 min
Primary = 1.69 cfs @ 12.68 hrs, Volume= 0.663 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 34.72' @ 12.68 hrs Surf.Area= 11,072 sf Storage= 16,498 cf

Plug-Flow detention time= 151.6 min calculated for 0.661 af (82% of inflow)
Center-of-Mass det. time= 98.6 min (906.3 - 807.8)

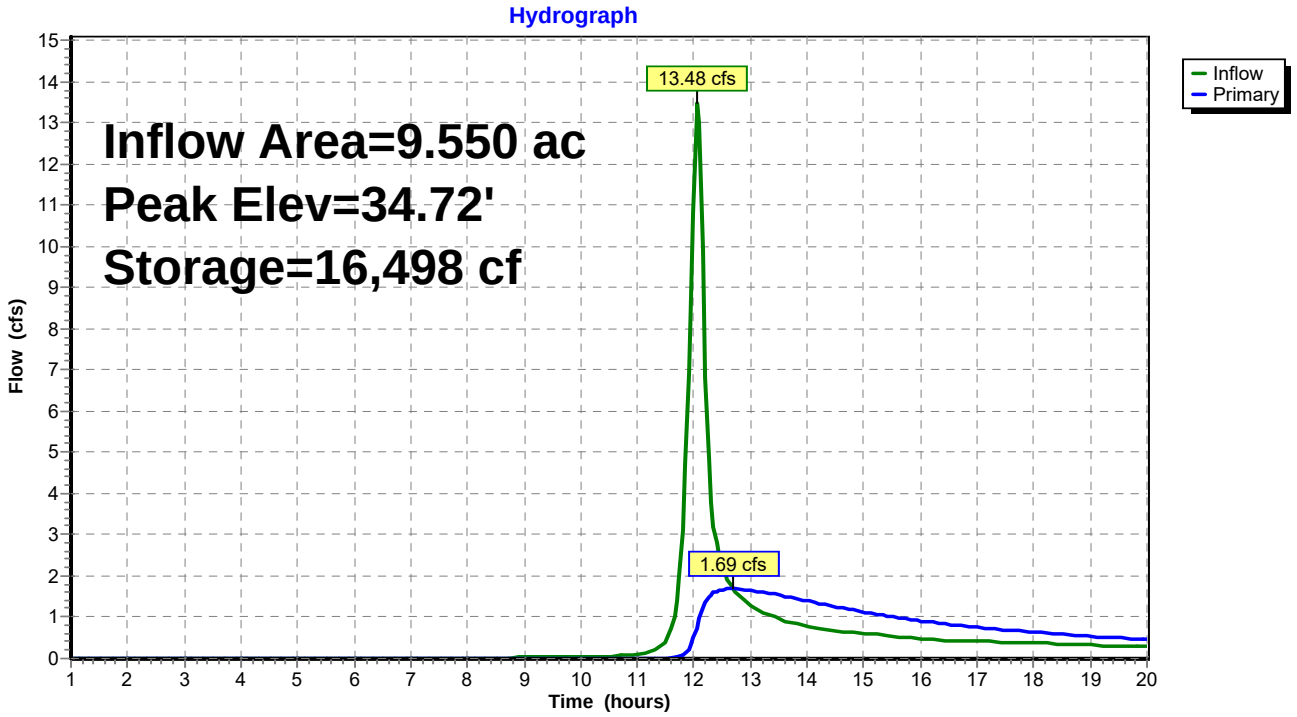
Volume	Invert	Avail.Storage	Storage Description
#1	33.00'	99,765 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.00	8,168	0	0
34.00	9,838	9,003	9,003
36.00	13,282	23,120	32,123
38.00	16,874	30,156	62,279
40.00	20,612	37,486	99,765

Device	Routing	Invert	Outlet Devices
#1	Primary	33.00'	**24.0" Round Culvert** L= 58.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 33.00' / 26.00' S= 0.1207 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	33.00'	**3.0" W x 44.4" H Vert. Orifice/Grate X 0.00** C= 0.600
#3	Device 1	36.70'	**48.0" x 48.0" Horiz. Orifice/Grate X 0.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	33.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.75 Width (feet) 0.23 0.23
#5	Device 1	34.75'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.85 Width (feet) 1.33 1.33
#6	Device 1	37.60'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.40 Width (feet) 16.00 16.00

Primary OutFlow Max=1.69 cfs @ 12.68 hrs HW=34.72' (Free Discharge)
└**1=Culvert** (Passes 1.69 cfs of 12.80 cfs potential flow)
  ├**2=Orifice/Grate** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  ├**4=Custom Weir/Orifice** (Weir Controls 1.69 cfs @ 4.29 fps)
  ├**5=Custom Weir/Orifice** (Controls 0.00 cfs)
  └**6=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond POND Nº2:

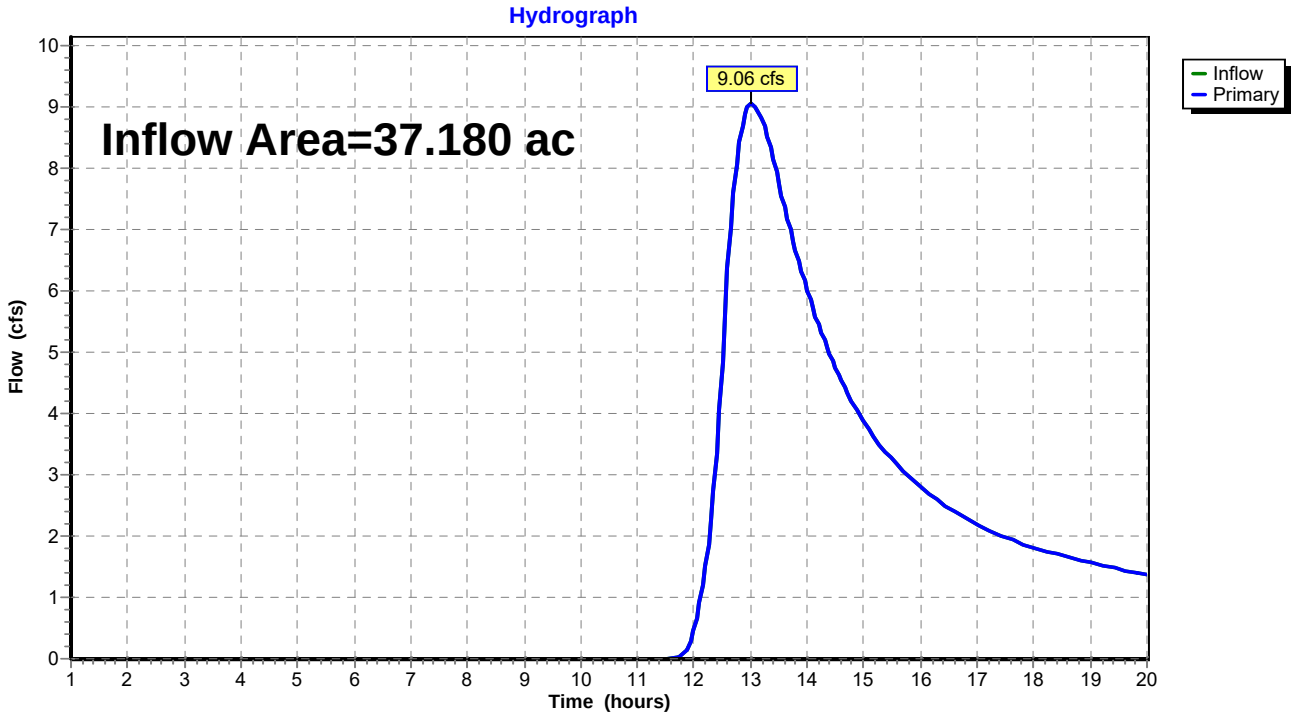


Summary for Link WL3:

Inflow Area = 37.180 ac, 2.42% Impervious, Inflow Depth > 0.76" for 2-Year event
Inflow = 9.06 cfs @ 13.02 hrs, Volume= 2.347 af
Primary = 9.06 cfs @ 13.02 hrs, Volume= 2.347 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Link WL3:



Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA1: Runoff Area=1.430 ac 62.94% Impervious Runoff Depth>3.63"
Flow Length=43' Tc=1.4 min CN=89 Runoff=10.10 cfs 0.433 af

Subcatchment DA2: Runoff Area=22.780 ac 0.00% Impervious Runoff Depth>2.23"
Flow Length=980' Tc=22.3 min CN=74 Runoff=57.64 cfs 4.237 af

Subcatchment DA3: Runoff Area=2.170 ac 0.00% Impervious Runoff Depth>2.25"
Flow Length=200' Tc=4.5 min CN=74 Runoff=9.77 cfs 0.406 af

Subcatchment DA4: Runoff Area=0.820 ac 60.98% Impervious Runoff Depth>3.63"
Flow Length=34' Slope=0.5000 '/' Tc=1.1 min CN=89 Runoff=5.88 cfs 0.248 af

Subcatchment DA5: Runoff Area=3.500 ac 0.00% Impervious Runoff Depth>2.25"
Flow Length=250' Slope=0.3333 '/' Tc=3.8 min CN=74 Runoff=16.21 cfs 0.656 af

Subcatchment DA6: Runoff Area=5.230 ac 0.00% Impervious Runoff Depth>2.25"
Flow Length=330' Slope=0.2050 '/' Tc=5.1 min CN=74 Runoff=22.92 cfs 0.979 af

Subcatchment WL1: Runoff Area=9.380 ac 0.00% Impervious Runoff Depth>1.64"
Flow Length=940' Tc=81.5 min CN=67 Runoff=7.04 cfs 1.281 af

Subcatchment WL2: Runoff Area=1.420 ac 0.00% Impervious Runoff Depth>1.68"
Flow Length=330' Tc=31.0 min CN=67 Runoff=2.15 cfs 0.199 af

Reach R1: Channel 1 Avg. Flow Depth=1.88' Max Vel=4.62 fps Inflow=57.64 cfs 4.237 af
n=0.030 L=2,370.0' S=0.0101 '/' Capacity=104.71 cfs Outflow=48.67 cfs 4.182 af

Reach R2: Channel 2 Avg. Flow Depth=0.78' Max Vel=4.57 fps Inflow=9.77 cfs 0.406 af
n=0.030 L=1,100.0' S=0.0318 '/' Capacity=102.37 cfs Outflow=8.10 cfs 0.404 af

Reach R3: Channel 3 Avg. Flow Depth=1.11' Max Vel=3.88 fps Inflow=16.21 cfs 0.656 af
n=0.030 L=750.0' S=0.0147 '/' Capacity=69.50 cfs Outflow=14.12 cfs 0.652 af

Reach R4: Channel 4 Avg. Flow Depth=1.14' Max Vel=5.23 fps Inflow=22.92 cfs 0.979 af
n=0.030 L=1,070.0' S=0.0252 '/' Capacity=91.16 cfs Outflow=20.18 cfs 0.974 af

Pond C1: Culvert 1 Peak Elev=32.29' Storage=1,634 cf Inflow=50.01 cfs 4.586 af
30.0" Round Culvert x 2.00 n=0.011 L=53.0' S=0.0100 '/' Outflow=49.85 cfs 4.586 af

Pond C2: Culvert 2 Peak Elev=41.00' Inflow=34.12 cfs 1.626 af
30.0" Round Culvert n=0.011 L=34.0' S=0.0118 '/' Outflow=34.12 cfs 1.626 af

Pond POND Nº1: Peak Elev=26.78' Storage=86,690 cf Inflow=50.61 cfs 5.019 af
Outflow=17.83 cfs 4.600 af

Pond POND Nº2: Peak Elev=36.20' Storage=34,788 cf Inflow=34.97 cfs 1.874 af
Outflow=10.59 cfs 1.657 af

Link WL3: Inflow=25.39 cfs 6.080 af
Primary=25.39 cfs 6.080 af

Total Runoff Area = 46.730 ac Runoff Volume = 8.439 af Average Runoff Depth = 2.17"
97.00% Pervious = 45.330 ac 3.00% Impervious = 1.400 ac

Summary for Subcatchment DA1:

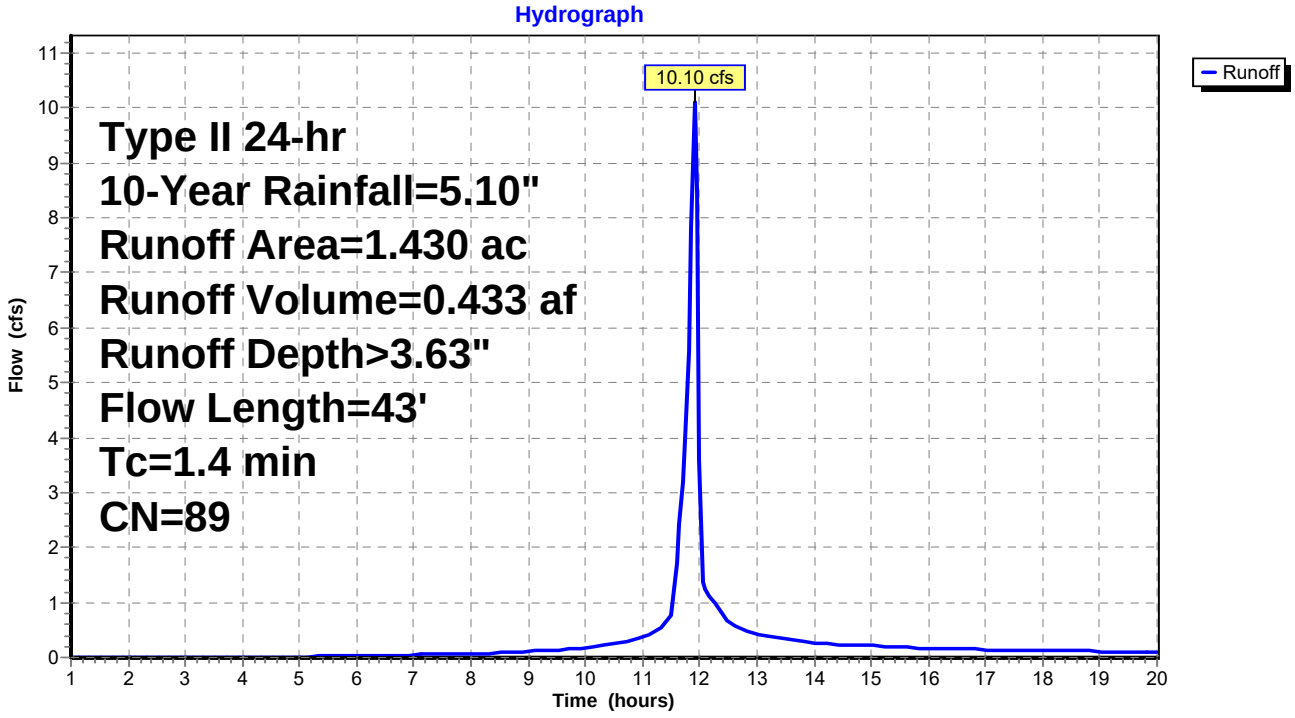
Runoff = 10.10 cfs @ 11.90 hrs, Volume= 0.433 af, Depth> 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
0.530	74	>75% Grass cover, Good, HSG C
0.130	98	Paved parking, HSG C
0.770	98	Water Surface, HSG C
1.430	89	Weighted Average
0.530		37.06% Pervious Area
0.900		62.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	18	0.0100	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
1.0	25	0.3670	0.41		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.4	43	Total			

Subcatchment DA1:



Summary for Subcatchment DA2:

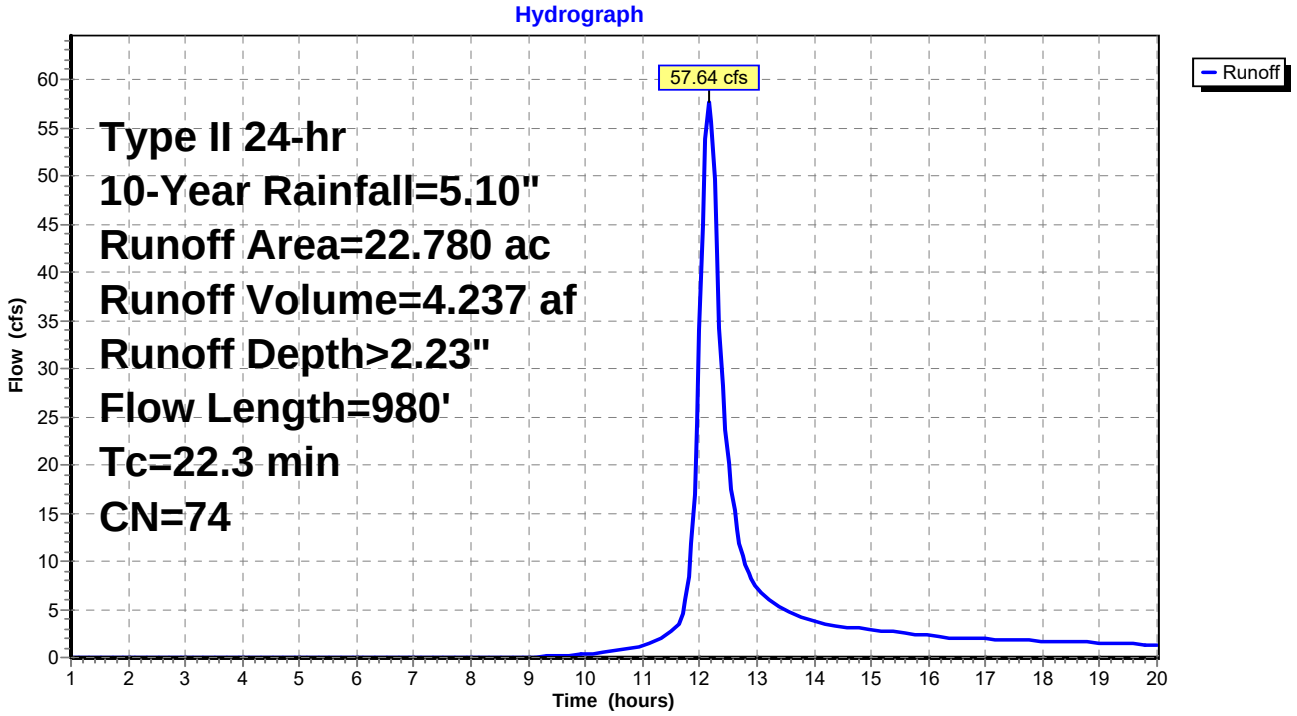
Runoff = 57.64 cfs @ 12.16 hrs, Volume= 4.237 af, Depth> 2.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
22.780	74	>75% Grass cover, Good, HSG C
22.780		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
5.7	340	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	120	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.1	360	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	60	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
22.3	980	Total			

Subcatchment DA2:



Summary for Subcatchment DA3:

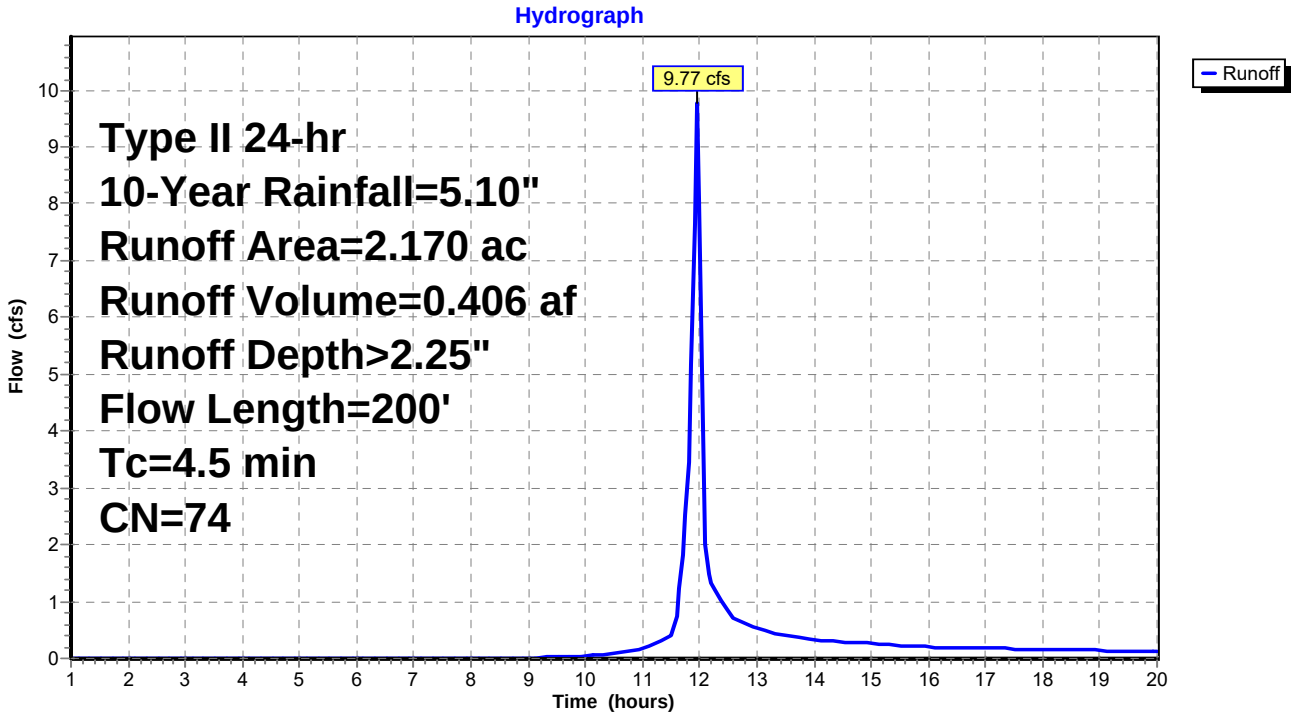
Runoff = 9.77 cfs @ 11.95 hrs, Volume= 0.406 af, Depth> 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
2.170	74	>75% Grass cover, Good, HSG C
2.170		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	100	0.3333	0.52		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.1	30	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	70	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.5	200	Total			

Subcatchment DA3:



Summary for Subcatchment DA4:

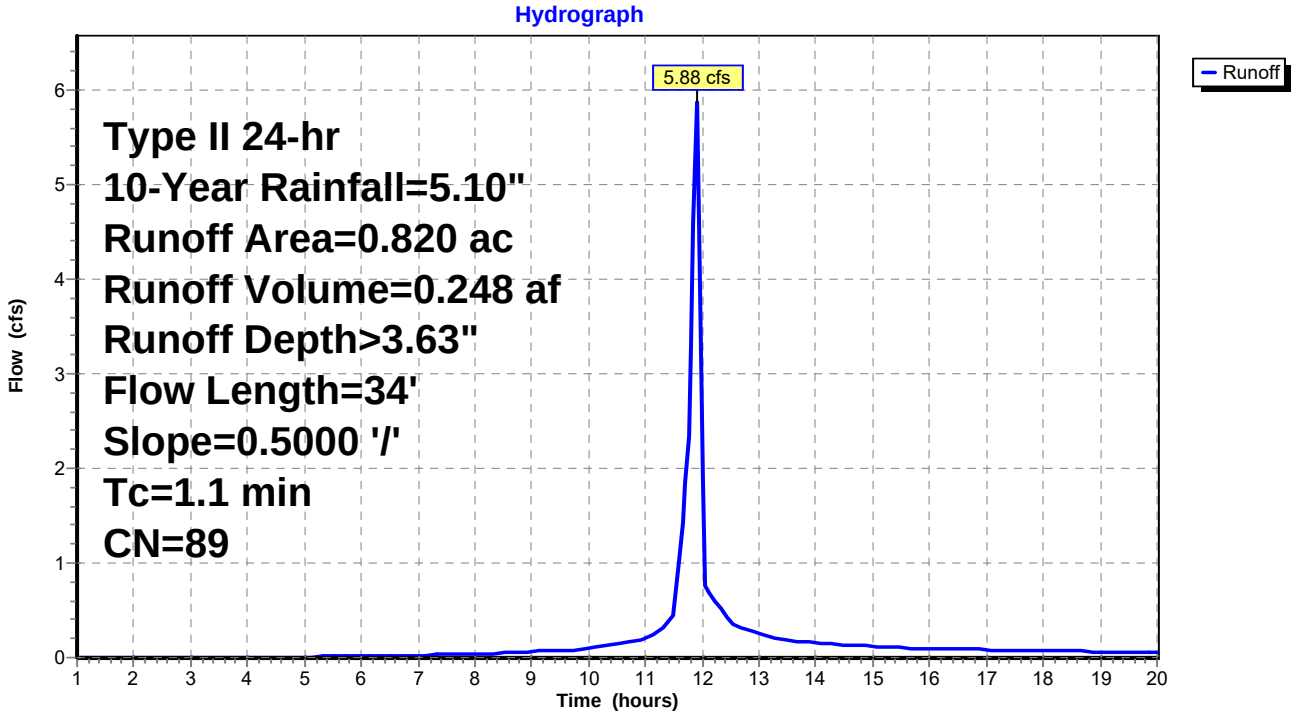
Runoff = 5.88 cfs @ 11.90 hrs, Volume= 0.248 af, Depth> 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
0.320	74	>75% Grass cover, Good, HSG C
0.110	98	Paved parking, HSG C
0.390	98	Water Surface, HSG C
0.820	89	Weighted Average
0.320		39.02% Pervious Area
0.500		60.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	34	0.5000	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment DA4:



Summary for Subcatchment DA5:

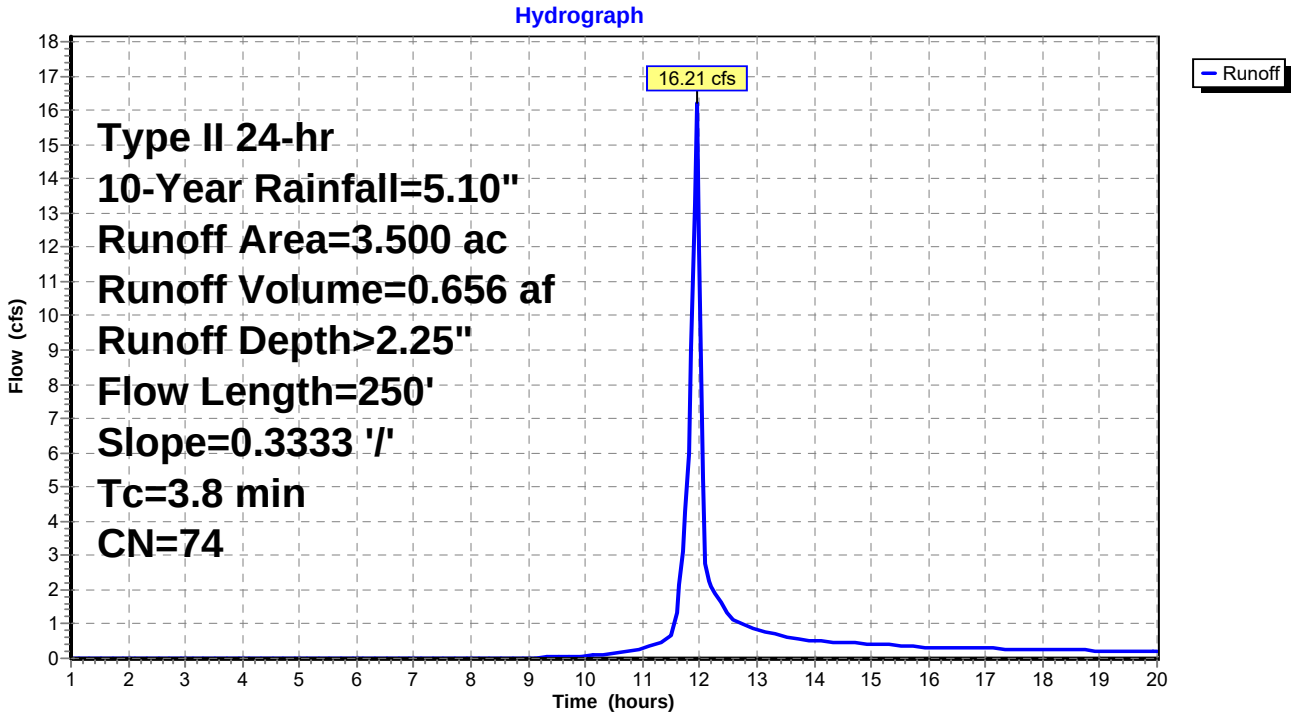
Runoff = 16.21 cfs @ 11.95 hrs, Volume= 0.656 af, Depth> 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
3.500	74	>75% Grass cover, Good, HSG C
3.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	100	0.3333	0.52		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.6	150	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.8	250	Total			

Subcatchment DA5:



Summary for Subcatchment DA6:

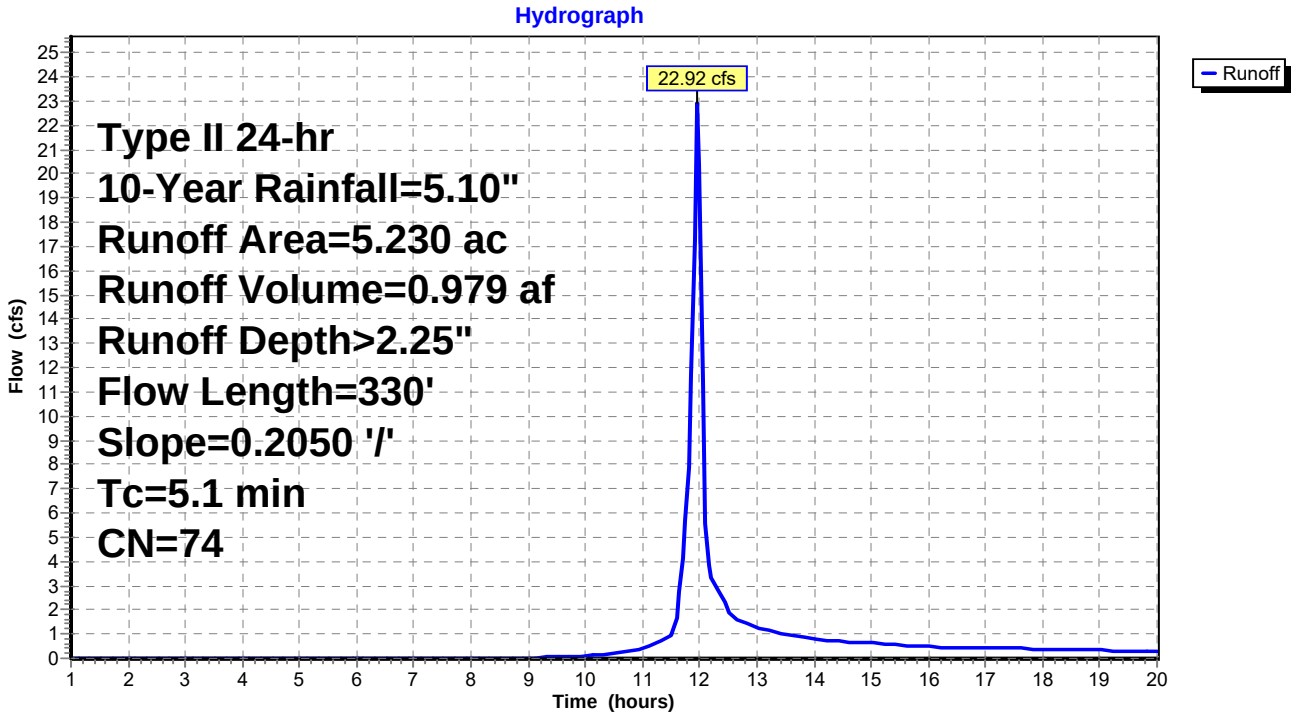
Runoff = 22.92 cfs @ 11.96 hrs, Volume= 0.979 af, Depth> 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
5.230	74	>75% Grass cover, Good, HSG C
5.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	100	0.2050	0.43		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	230	0.2050	3.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.1	330	Total			

Subcatchment DA6:



Summary for Subcatchment WL1:

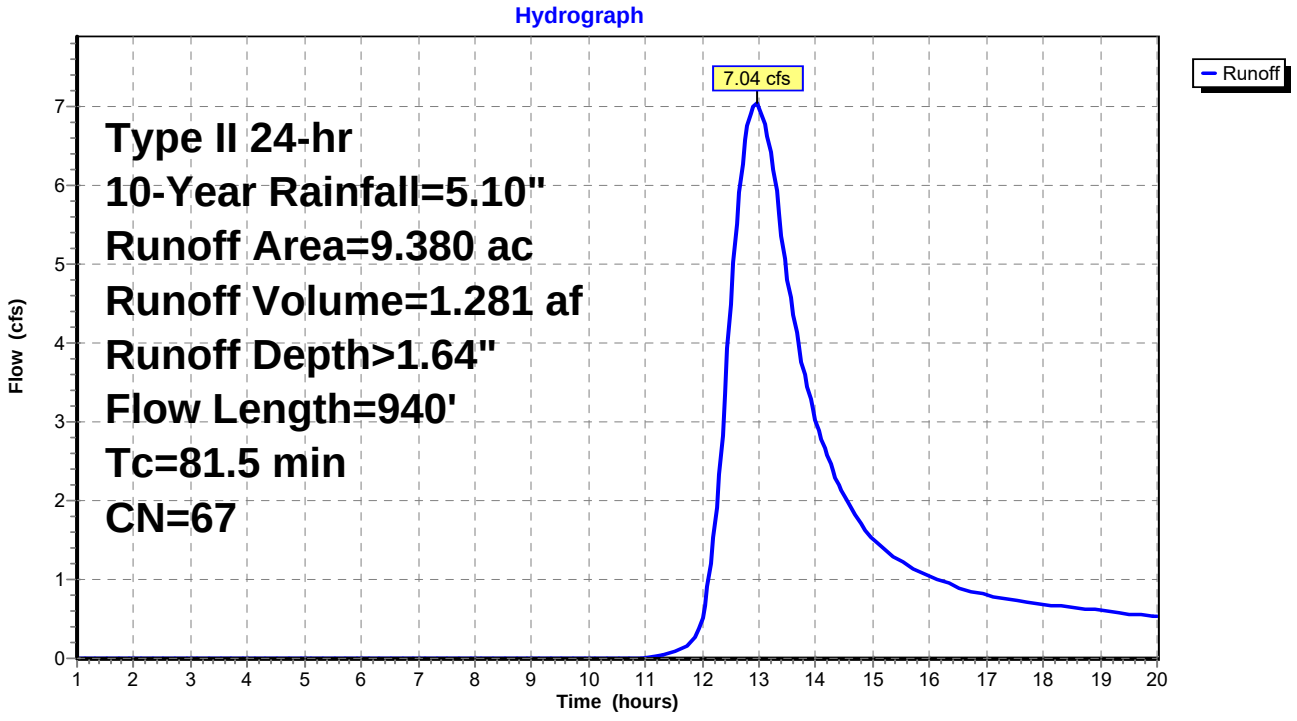
Runoff = 7.04 cfs @ 12.95 hrs, Volume= 1.281 af, Depth> 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

	Area (ac)	CN	Description
*	9.380	67	
	9.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.2	100	0.0250	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.20"
47.3	840	0.0140	0.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
81.5	940	Total			

Subcatchment WL1:



Summary for Subcatchment WL2:

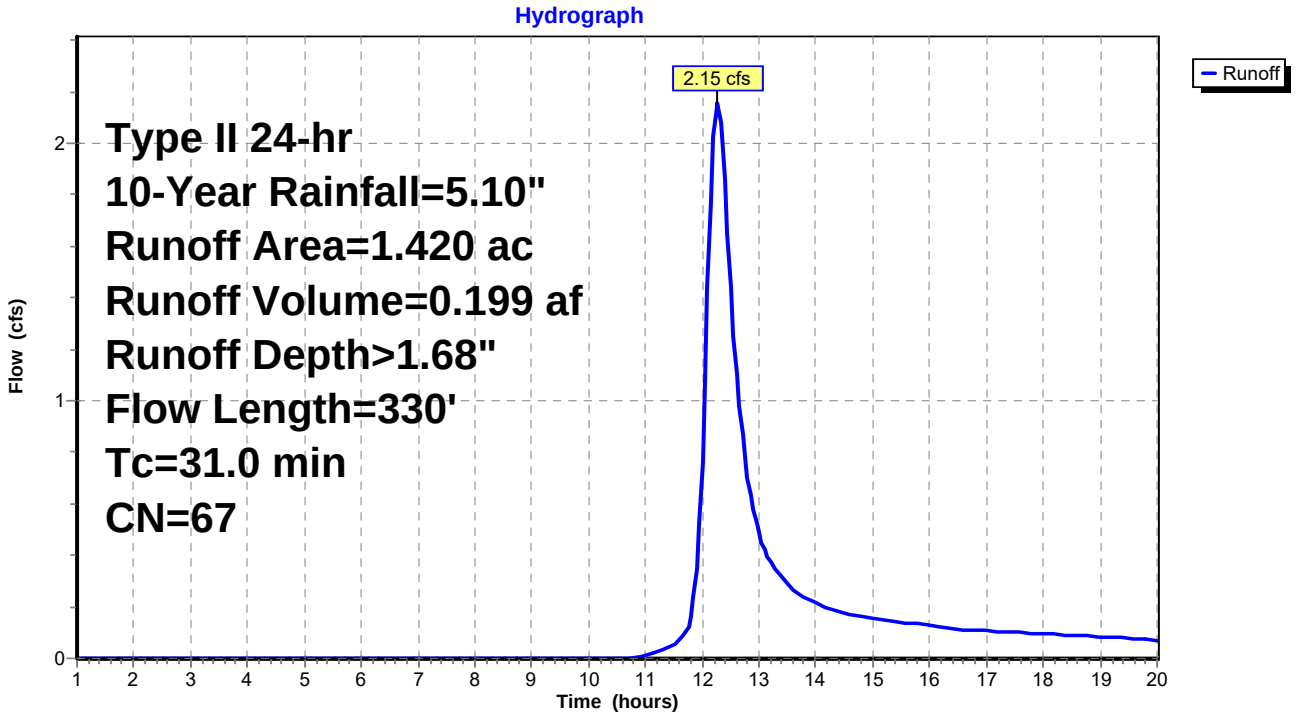
Runoff = 2.15 cfs @ 12.27 hrs, Volume= 0.199 af, Depth> 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

	Area (ac)	CN	Description
*	1.420	67	
	1.420		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.5	100	0.0800	0.08		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.20"
9.5	230	0.0260	0.40		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
31.0	330	Total			

Subcatchment WL2:



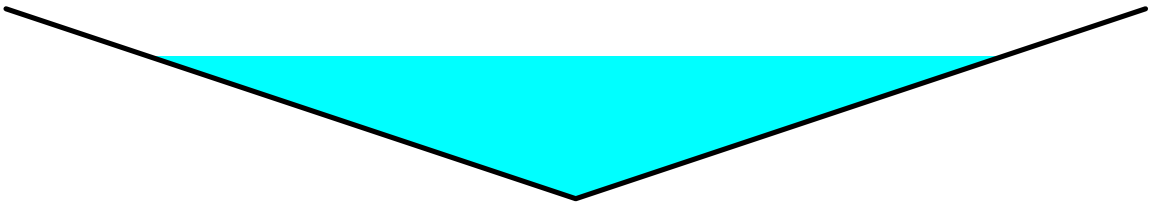
Summary for Reach R1: Channel 1

Inflow Area = 22.780 ac, 0.00% Impervious, Inflow Depth > 2.23" for 10-Year event
Inflow = 57.64 cfs @ 12.16 hrs, Volume= 4.237 af
Outflow = 48.67 cfs @ 12.40 hrs, Volume= 4.182 af, Atten= 16%, Lag= 14.6 min

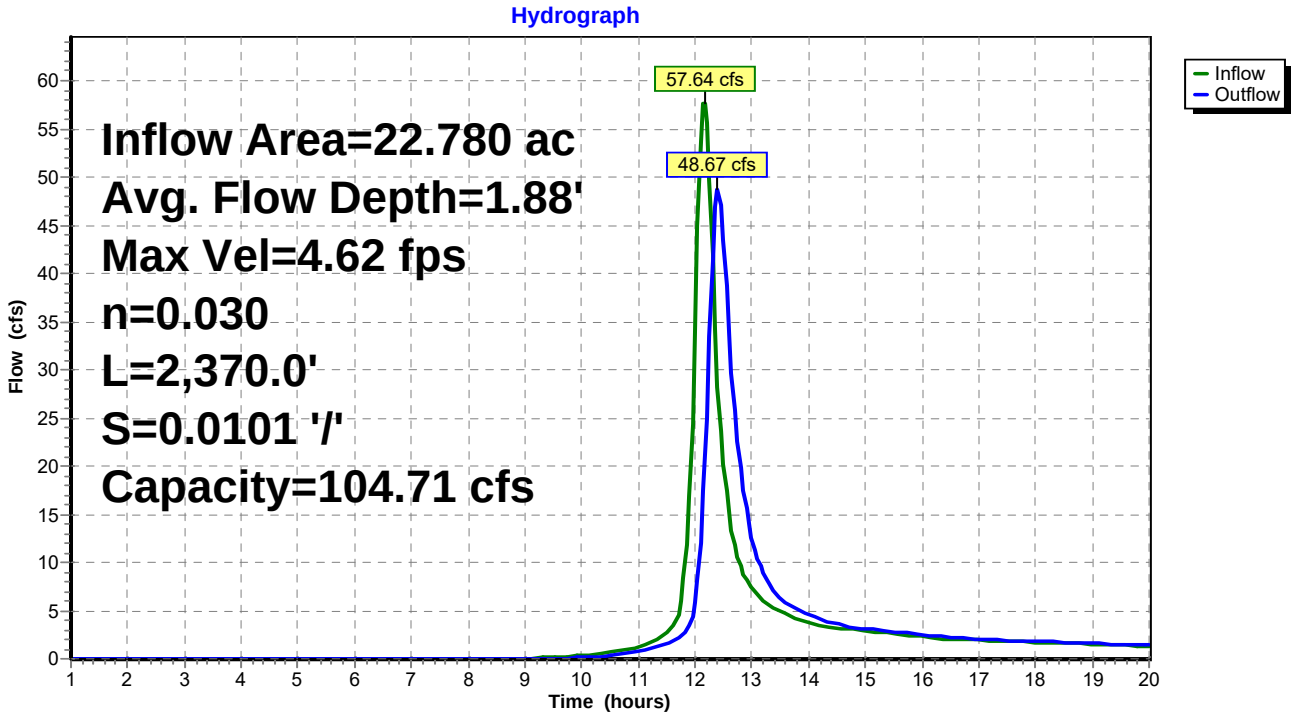
Routing by Stor-Ind+Trans method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.62 fps, Min. Travel Time= 8.6 min
Avg. Velocity = 2.13 fps, Avg. Travel Time= 18.5 min

Peak Storage= 25,098 cf @ 12.26 hrs
Average Depth at Peak Storage= 1.88'
Bank-Full Depth= 2.50' Flow Area= 18.8 sf, Capacity= 104.71 cfs

0.00' x 2.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 15.00'
Length= 2,370.0' Slope= 0.0101 '/'
Inlet Invert= 54.00', Outlet Invert= 30.00'



Reach R1: Channel 1



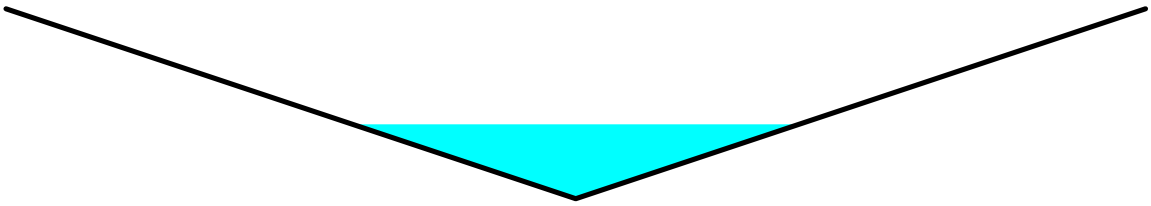
Summary for Reach R2: Channel 2

Inflow Area = 2.170 ac, 0.00% Impervious, Inflow Depth > 2.25" for 10-Year event
Inflow = 9.77 cfs @ 11.95 hrs, Volume= 0.406 af
Outflow = 8.10 cfs @ 12.06 hrs, Volume= 0.404 af, Atten= 17%, Lag= 6.4 min

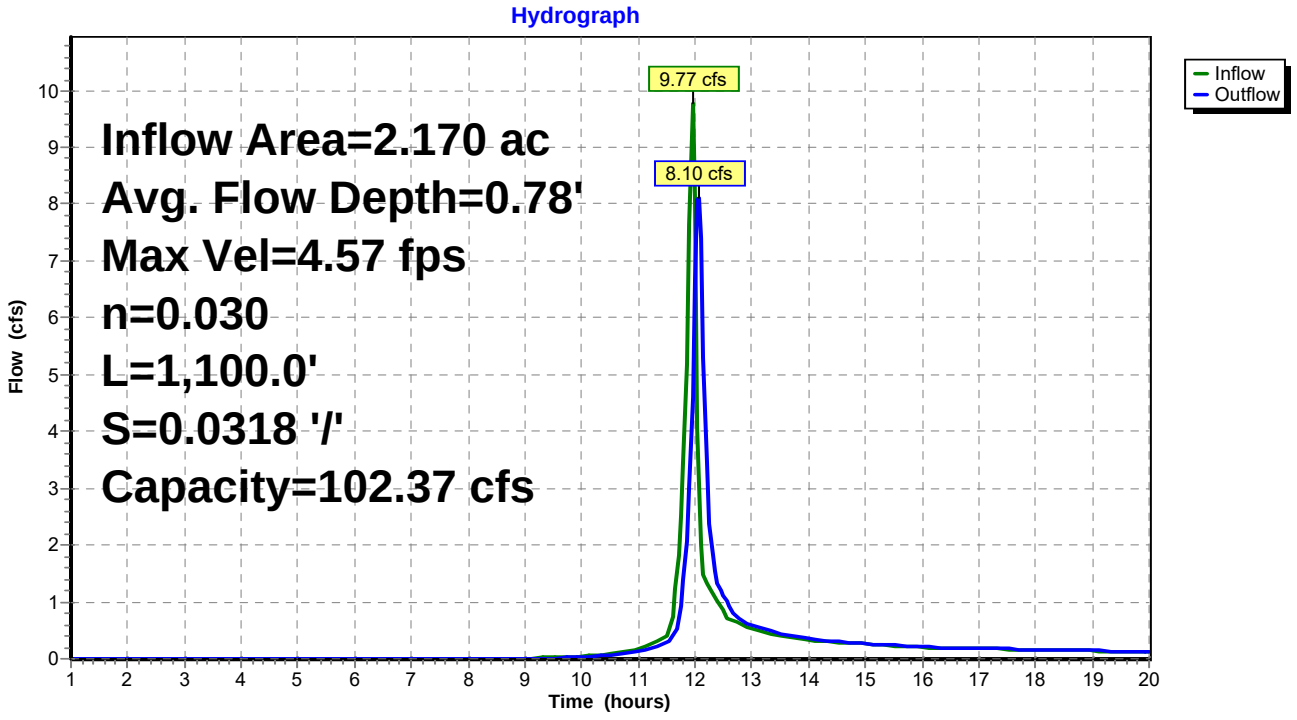
Routing by Stor-Ind+Trans method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.57 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 1.83 fps, Avg. Travel Time= 10.0 min

Peak Storage= 2,027 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.78'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 102.37 cfs

0.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 1,100.0' Slope= 0.0318 '/'
Inlet Invert= 65.00', Outlet Invert= 30.00'



Reach R2: Channel 2



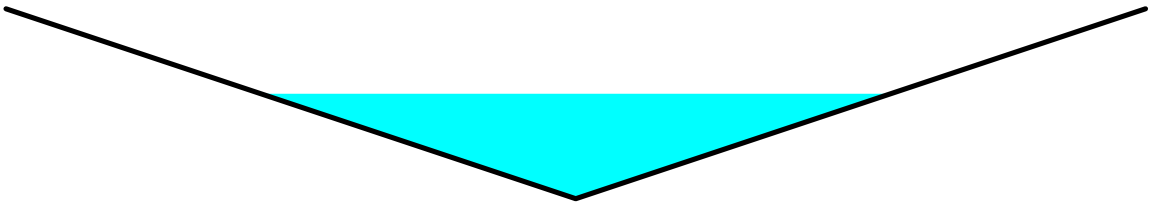
Summary for Reach R3: Channel 3

Inflow Area = 3.500 ac, 0.00% Impervious, Inflow Depth > 2.25" for 10-Year event
Inflow = 16.21 cfs @ 11.95 hrs, Volume= 0.656 af
Outflow = 14.12 cfs @ 12.03 hrs, Volume= 0.652 af, Atten= 13%, Lag= 5.3 min

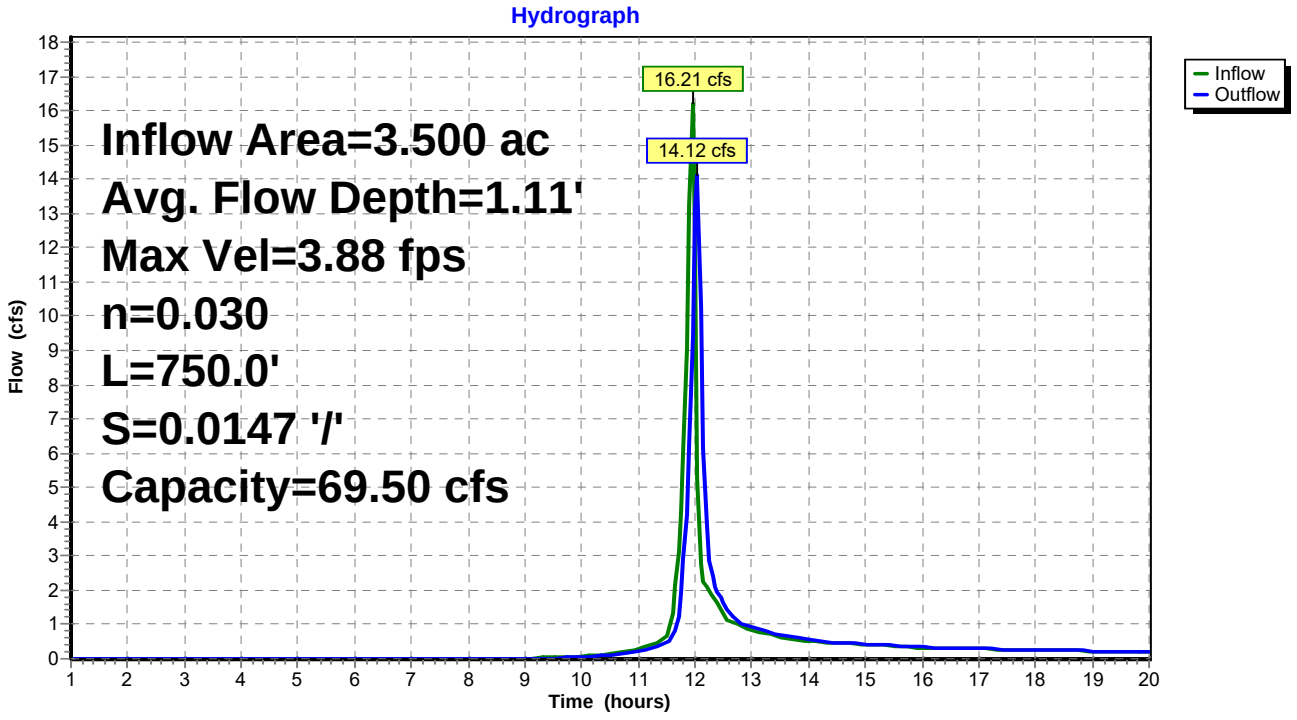
Routing by Stor-Ind+Trans method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.88 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 1.54 fps, Avg. Travel Time= 8.1 min

Peak Storage= 2,746 cf @ 11.98 hrs
Average Depth at Peak Storage= 1.11'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 69.50 cfs

0.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 750.0' Slope= 0.0147 '/'
Inlet Invert= 49.00', Outlet Invert= 38.00'



Reach R3: Channel 3



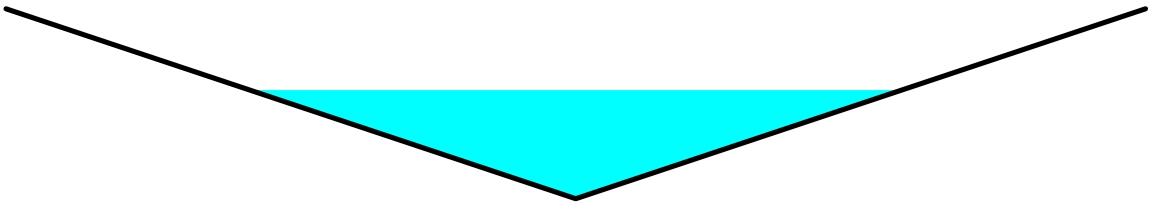
Summary for Reach R4: Channel 4

Inflow Area = 5.230 ac, 0.00% Impervious, Inflow Depth > 2.25" for 10-Year event
Inflow = 22.92 cfs @ 11.96 hrs, Volume= 0.979 af
Outflow = 20.18 cfs @ 12.05 hrs, Volume= 0.974 af, Atten= 12%, Lag= 5.6 min

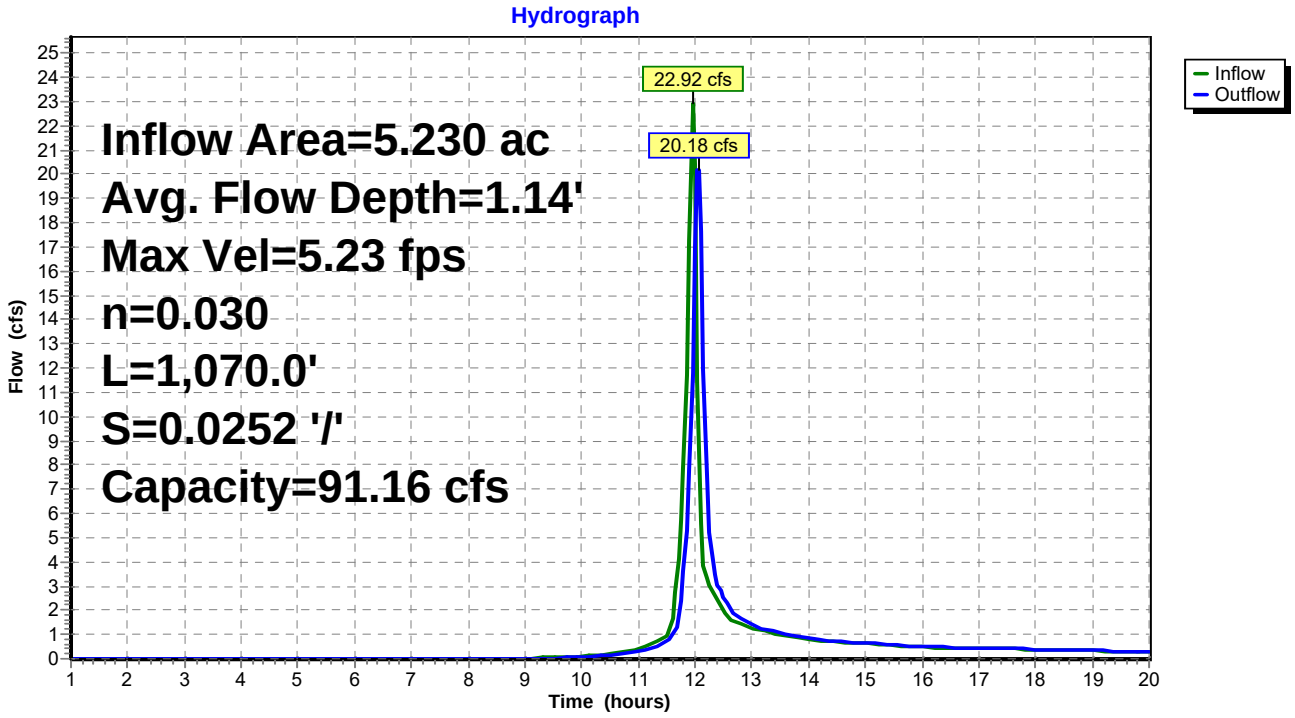
Routing by Stor-Ind+Trans method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.23 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 2.09 fps, Avg. Travel Time= 8.5 min

Peak Storage= 4,202 cf @ 12.00 hrs
Average Depth at Peak Storage= 1.14'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 91.16 cfs

0.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 1,070.0' Slope= 0.0252 '/'
Inlet Invert= 65.00', Outlet Invert= 38.00'



Reach R4: Channel 4



Summary for Pond C1: Culvert 1

Inflow Area = 24.950 ac, 0.00% Impervious, Inflow Depth > 2.21" for 10-Year event
Inflow = 50.01 cfs @ 12.40 hrs, Volume= 4.586 af
Outflow = 49.85 cfs @ 12.41 hrs, Volume= 4.586 af, Atten= 0%, Lag= 0.9 min
Primary = 49.85 cfs @ 12.41 hrs, Volume= 4.586 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 32.29' @ 12.41 hrs Surf.Area= 1,762 sf Storage= 1,634 cf
Flood Elev= 35.30' Surf.Area= 9,822 sf Storage= 17,098 cf

Plug-Flow detention time= 0.4 min calculated for 4.573 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (817.7 - 817.4)

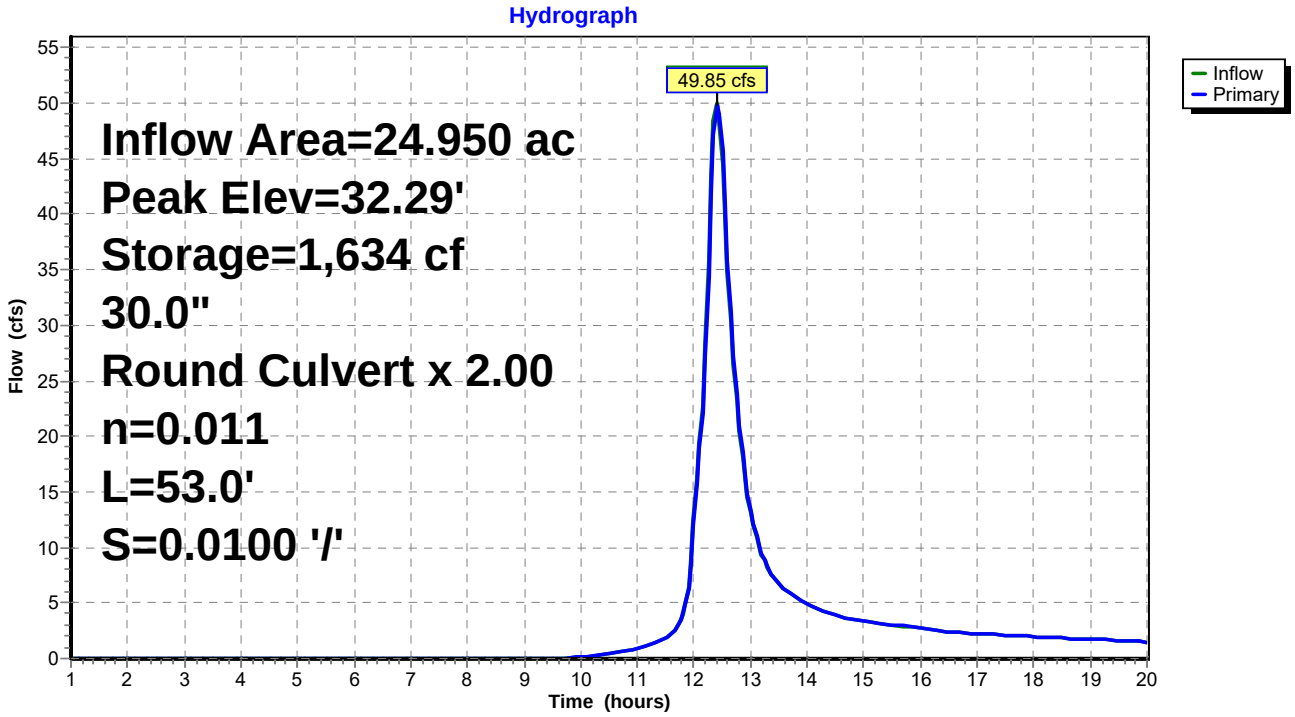
Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	24,875 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
30.00	0	0	0
32.00	1,200	1,200	1,200
34.00	5,039	6,239	7,439
35.00	8,718	6,879	14,318
36.00	12,397	10,558	24,875

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	**30.0" Round Culvert X 2.00** L= 53.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 30.00' / 29.47' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 4.91 sf

Primary OutFlow Max=49.52 cfs @ 12.41 hrs HW=32.28' (Free Discharge)
1=Culvert (Barrel Controls 49.52 cfs @ 6.91 fps)

Pond C1: Culvert 1



Summary for Pond C2: Culvert 2

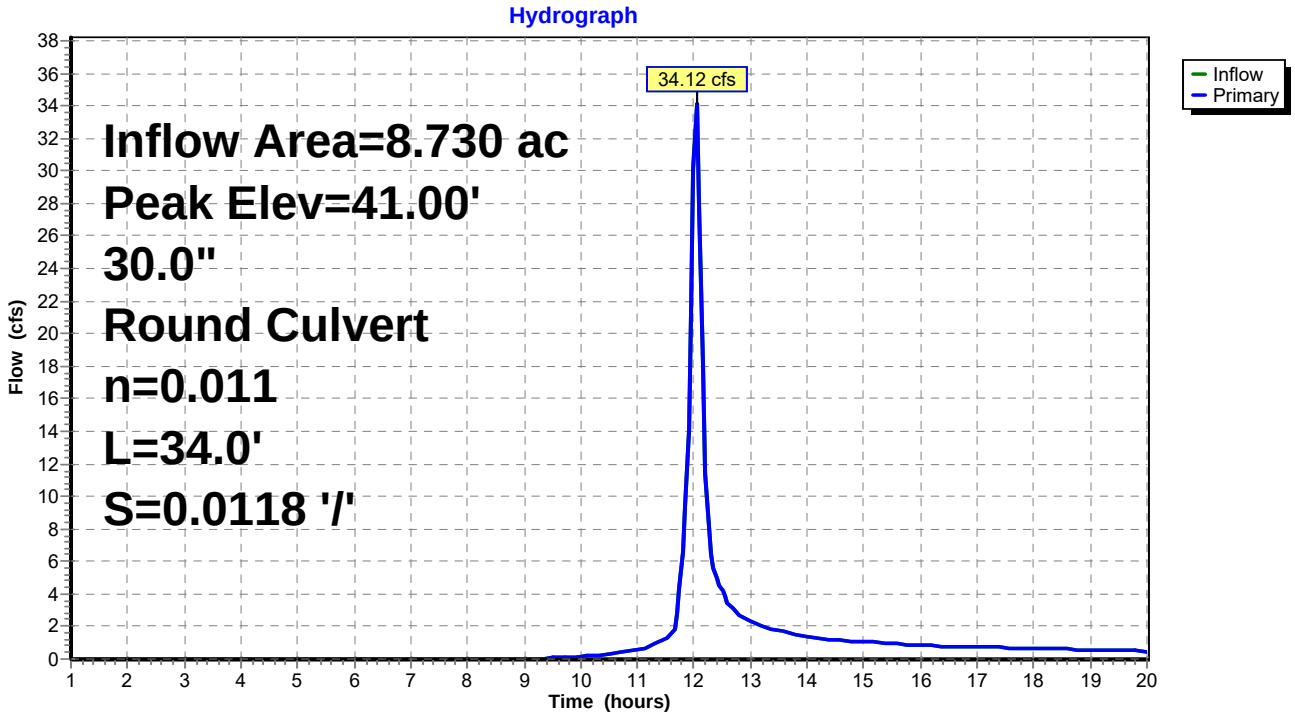
Inflow Area = 8.730 ac, 0.00% Impervious, Inflow Depth > 2.24" for 10-Year event
Inflow = 34.12 cfs @ 12.04 hrs, Volume= 1.626 af
Outflow = 34.12 cfs @ 12.04 hrs, Volume= 1.626 af, Atten= 0%, Lag= 0.0 min
Primary = 34.12 cfs @ 12.04 hrs, Volume= 1.626 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 41.00' @ 12.04 hrs
Flood Elev= 42.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	38.00'	**30.0" Round Culvert** L= 34.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 38.00' / 37.60' S= 0.0118 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 4.91 sf

Primary OutFlow Max=33.66 cfs @ 12.04 hrs HW=40.96' (Free Discharge)
1=Culvert (Barrel Controls 33.66 cfs @ 7.30 fps)

Pond C2: Culvert 2



Summary for Pond POND Nº1:

Inflow Area = 26.380 ac, 3.41% Impervious, Inflow Depth > 2.28" for 10-Year event
Inflow = 50.61 cfs @ 12.41 hrs, Volume= 5.019 af
Outflow = 17.83 cfs @ 12.88 hrs, Volume= 4.600 af, Atten= 65%, Lag= 28.0 min
Primary = 17.83 cfs @ 12.88 hrs, Volume= 4.600 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 26.78' @ 12.88 hrs Surf.Area= 33,461 sf Storage= 86,690 cf

Plug-Flow detention time= 86.8 min calculated for 4.600 af (92% of inflow)
Center-of-Mass det. time= 59.3 min (871.3 - 812.0)

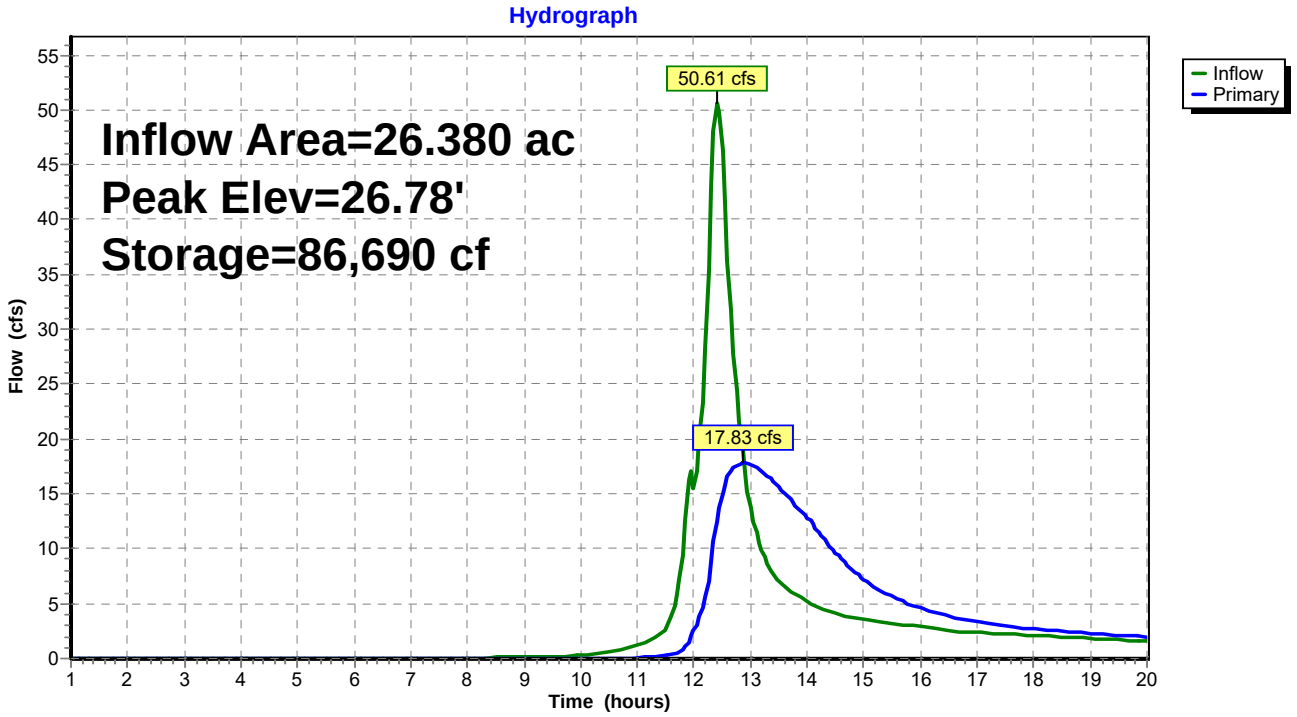
Volume	Invert	Avail.Storage	Storage Description
#1	24.00'	203,192 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
24.00	28,828	0	0
26.00	32,123	60,951	60,951
28.00	35,532	67,655	128,606
30.00	39,054	74,586	203,192

Device	Routing	Invert	Outlet Devices
#1	Primary	24.00'	**24.0" Round Culvert** L= 84.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 24.00' / 23.40' S= 0.0071 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Primary	28.00'	**Special & User-Defined** Head (feet) 0.00 0.72 0.97 1.32 1.64 1.84 Disch. (cfs) 0.000 5.900 15.500 32.500 51.800 65.200

Primary OutFlow Max=17.83 cfs @ 12.88 hrs HW=26.78' (Free Discharge)
└**1=Culvert** (Inlet Controls 17.83 cfs @ 5.67 fps)
└**2=Special & User-Defined** (Controls 0.00 cfs)

Pond POND Nº1:



Summary for Pond POND Nº2:

Inflow Area = 9.550 ac, 5.24% Impervious, Inflow Depth > 2.36" for 10-Year event
Inflow = 34.97 cfs @ 12.04 hrs, Volume= 1.874 af
Outflow = 10.59 cfs @ 12.22 hrs, Volume= 1.657 af, Atten= 70%, Lag= 11.0 min
Primary = 10.59 cfs @ 12.22 hrs, Volume= 1.657 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 36.20' @ 12.22 hrs Surf.Area= 13,638 sf Storage= 34,788 cf

Plug-Flow detention time= 102.2 min calculated for 1.657 af (88% of inflow)
Center-of-Mass det. time= 64.3 min (854.5 - 790.2)

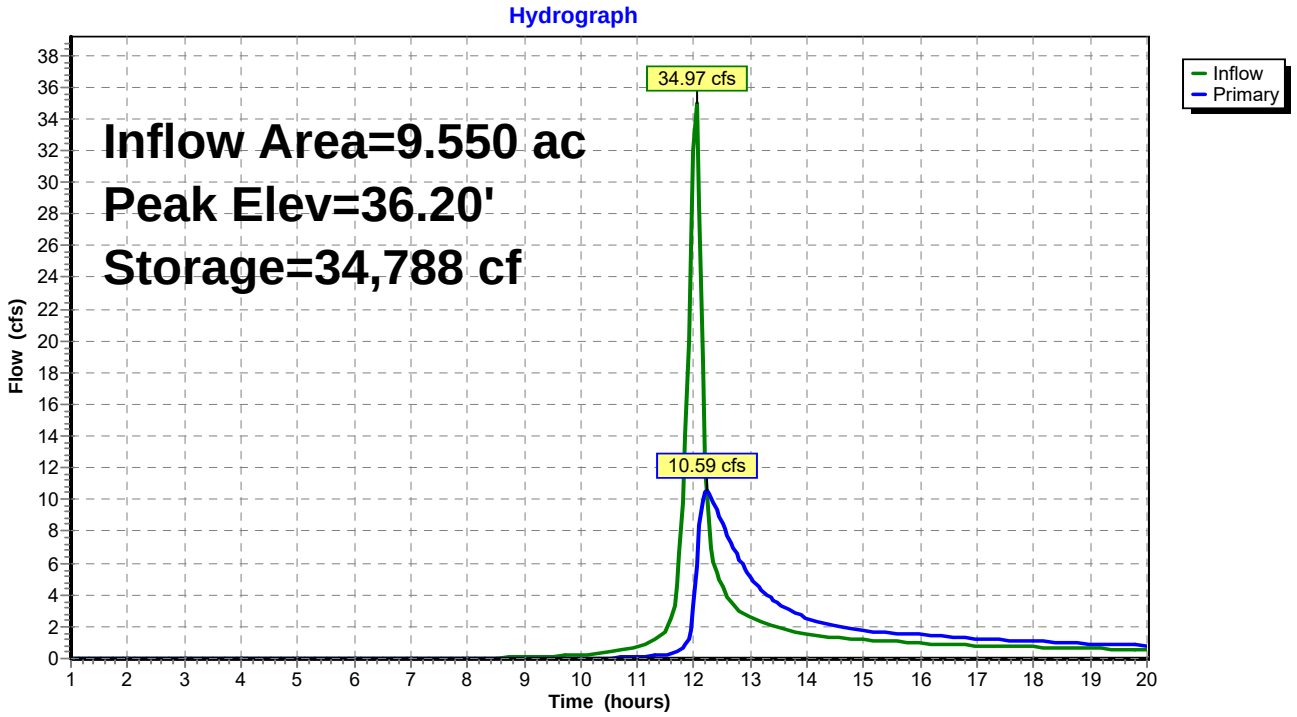
Volume	Invert	Avail.Storage	Storage Description
#1	33.00'	99,765 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.00	8,168	0	0
34.00	9,838	9,003	9,003
36.00	13,282	23,120	32,123
38.00	16,874	30,156	62,279
40.00	20,612	37,486	99,765

Device	Routing	Invert	Outlet Devices
#1	Primary	33.00'	**24.0" Round Culvert** L= 58.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 33.00' / 26.00' S= 0.1207 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	33.00'	**3.0" W x 44.4" H Vert. Orifice/Grate X 0.00** C= 0.600
#3	Device 1	36.70'	**48.0" x 48.0" Horiz. Orifice/Grate X 0.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	33.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.75 Width (feet) 0.23 0.23
#5	Device 1	34.75'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.85 Width (feet) 1.33 1.33
#6	Device 1	37.60'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.40 Width (feet) 16.00 16.00

Primary OutFlow Max=10.51 cfs @ 12.22 hrs HW=36.19' (Free Discharge)
└**1=Culvert** (Passes 10.51 cfs of 22.38 cfs potential flow)
  ├**2=Orifice/Grate** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  ├**4=Custom Weir/Orifice** (Orifice Controls 2.99 cfs @ 7.43 fps)
  ├**5=Custom Weir/Orifice** (Weir Controls 7.52 cfs @ 3.93 fps)
  └**6=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond POND Nº2:

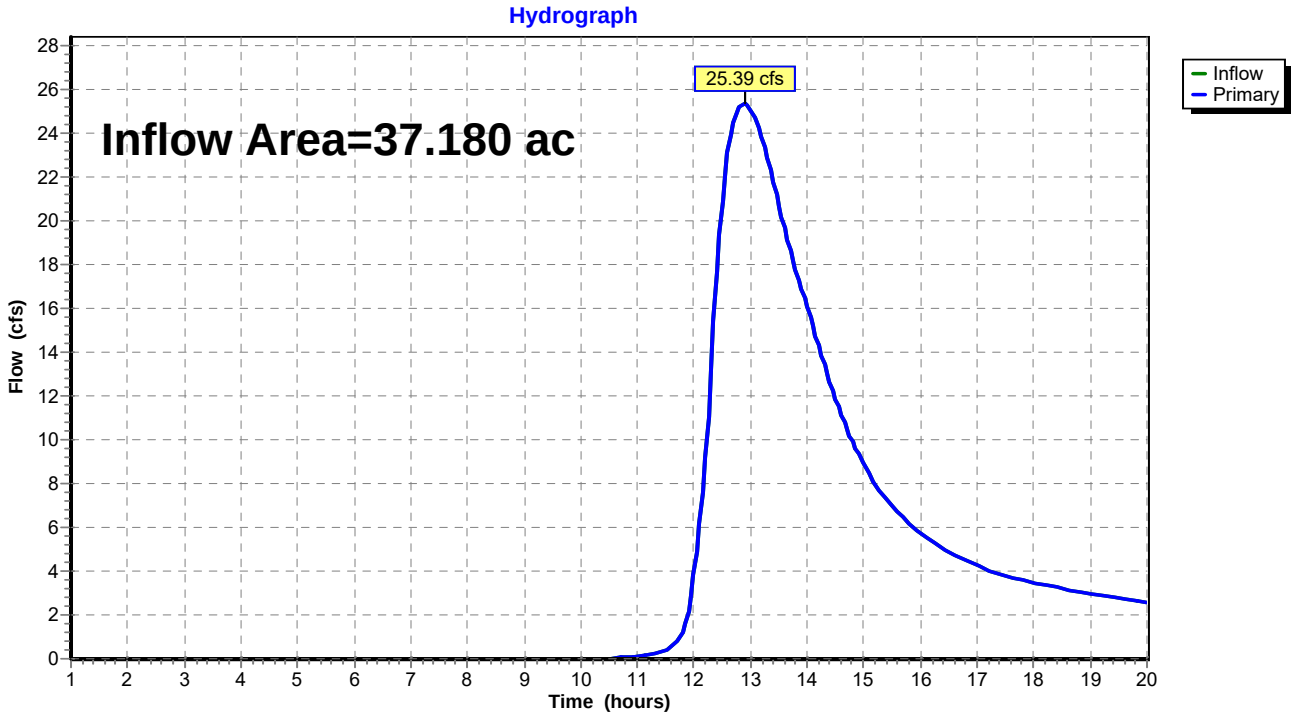


Summary for Link WL3:

Inflow Area = 37.180 ac, 2.42% Impervious, Inflow Depth > 1.96" for 10-Year event
Inflow = 25.39 cfs @ 12.90 hrs, Volume= 6.080 af
Primary = 25.39 cfs @ 12.90 hrs, Volume= 6.080 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Link WL3:



Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA1: Runoff Area=1.430 ac 62.94% Impervious Runoff Depth>5.47"
Flow Length=43' Tc=1.4 min CN=89 Runoff=14.76 cfs 0.652 af

Subcatchment DA2: Runoff Area=22.780 ac 0.00% Impervious Runoff Depth>3.81"
Flow Length=980' Tc=22.3 min CN=74 Runoff=97.92 cfs 7.226 af

Subcatchment DA3: Runoff Area=2.170 ac 0.00% Impervious Runoff Depth>3.83"
Flow Length=200' Tc=4.5 min CN=74 Runoff=16.29 cfs 0.692 af

Subcatchment DA4: Runoff Area=0.820 ac 60.98% Impervious Runoff Depth>5.47"
Flow Length=34' Slope=0.5000 '/' Tc=1.1 min CN=89 Runoff=8.58 cfs 0.374 af

Subcatchment DA5: Runoff Area=3.500 ac 0.00% Impervious Runoff Depth>3.83"
Flow Length=250' Slope=0.3333 '/' Tc=3.8 min CN=74 Runoff=26.96 cfs 1.117 af

Subcatchment DA6: Runoff Area=5.230 ac 0.00% Impervious Runoff Depth>3.83"
Flow Length=330' Slope=0.2050 '/' Tc=5.1 min CN=74 Runoff=38.26 cfs 1.669 af

Subcatchment WL1: Runoff Area=9.380 ac 0.00% Impervious Runoff Depth>3.01"
Flow Length=940' Tc=81.5 min CN=67 Runoff=13.30 cfs 2.356 af

Subcatchment WL2: Runoff Area=1.420 ac 0.00% Impervious Runoff Depth>3.08"
Flow Length=330' Tc=31.0 min CN=67 Runoff=4.04 cfs 0.365 af

Reach R1: Channel 1 Avg. Flow Depth=2.32' Max Vel=5.31 fps Inflow=97.92 cfs 7.226 af
n=0.030 L=2,370.0' S=0.0101 '/' Capacity=104.71 cfs Outflow=85.19 cfs 7.152 af

Reach R2: Channel 2 Avg. Flow Depth=0.96' Max Vel=5.22 fps Inflow=16.29 cfs 0.692 af
n=0.030 L=1,100.0' S=0.0318 '/' Capacity=102.37 cfs Outflow=14.12 cfs 0.689 af

Reach R3: Channel 3 Avg. Flow Depth=1.34' Max Vel=4.41 fps Inflow=26.96 cfs 1.117 af
n=0.030 L=750.0' S=0.0147 '/' Capacity=69.50 cfs Outflow=23.86 cfs 1.113 af

Reach R4: Channel 4 Avg. Flow Depth=1.40' Max Vel=5.98 fps Inflow=38.26 cfs 1.669 af
n=0.030 L=1,070.0' S=0.0252 '/' Capacity=91.16 cfs Outflow=35.03 cfs 1.661 af

Pond C1: Culvert 1 Peak Elev=33.76' Storage=6,293 cf Inflow=87.36 cfs 7.841 af
30.0" Round Culvert x 2.00 n=0.011 L=53.0' S=0.0100 '/' Outflow=84.68 cfs 7.840 af

Pond C2: Culvert 2 Peak Elev=43.24' Inflow=58.64 cfs 2.774 af
30.0" Round Culvert n=0.011 L=34.0' S=0.0118 '/' Outflow=58.64 cfs 2.774 af

Pond POND Nº1: Peak Elev=28.66' Storage=152,365 cf Inflow=85.78 cfs 8.492 af
Outflow=30.92 cfs 7.974 af

Pond POND Nº2: Peak Elev=37.54' Storage=54,750 cf Inflow=60.13 cfs 3.148 af
Outflow=24.10 cfs 2.869 af

Link WL3: Inflow=45.14 cfs 10.694 af
Primary=45.14 cfs 10.694 af

Total Runoff Area = 46.730 ac Runoff Volume = 14.451 af Average Runoff Depth = 3.71"
97.00% Pervious = 45.330 ac 3.00% Impervious = 1.400 ac

Summary for Subcatchment DA1:

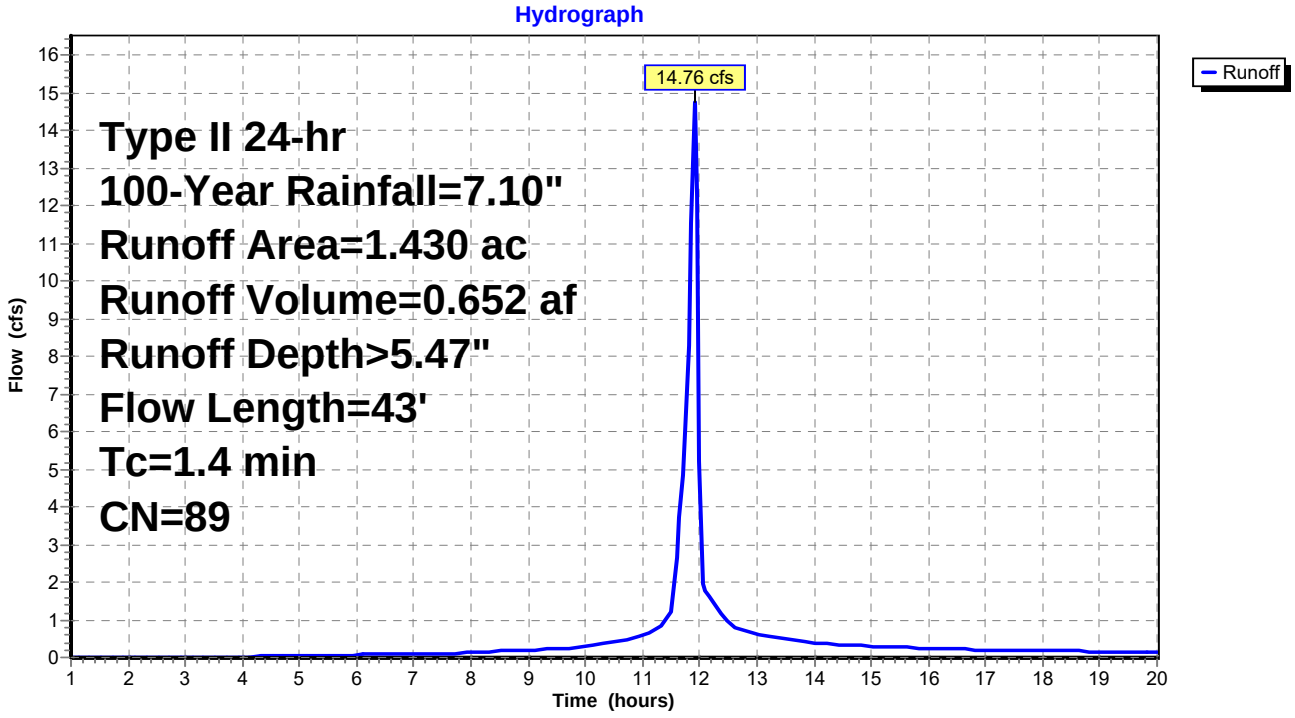
Runoff = 14.76 cfs @ 11.90 hrs, Volume= 0.652 af, Depth> 5.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.10"

Area (ac)	CN	Description
0.530	74	>75% Grass cover, Good, HSG C
0.130	98	Paved parking, HSG C
0.770	98	Water Surface, HSG C
1.430	89	Weighted Average
0.530		37.06% Pervious Area
0.900		62.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	18	0.0100	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
1.0	25	0.3670	0.41		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.4	43	Total			

Subcatchment DA1:



Summary for Subcatchment DA2:

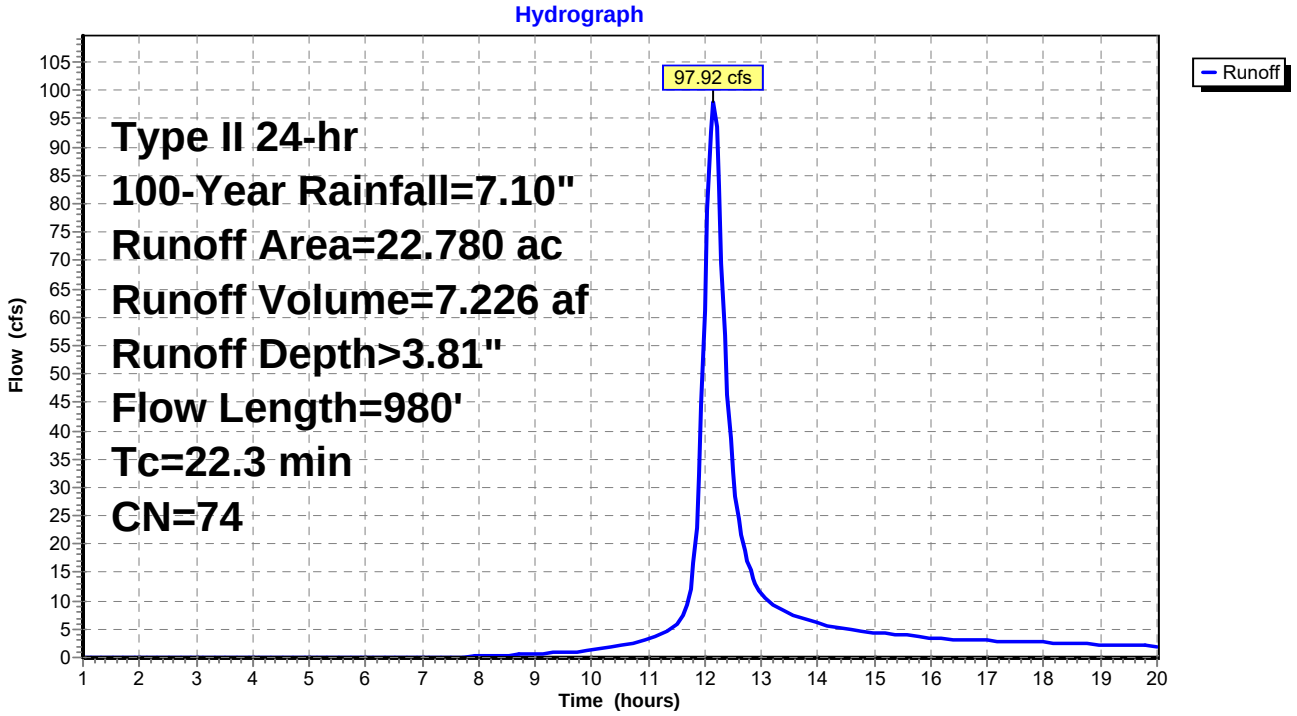
Runoff = 97.92 cfs @ 12.15 hrs, Volume= 7.226 af, Depth> 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.10"

Area (ac)	CN	Description
22.780	74	>75% Grass cover, Good, HSG C
22.780		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
5.7	340	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	120	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.1	360	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	60	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
22.3	980	Total			

Subcatchment DA2:



Summary for Subcatchment DA3:

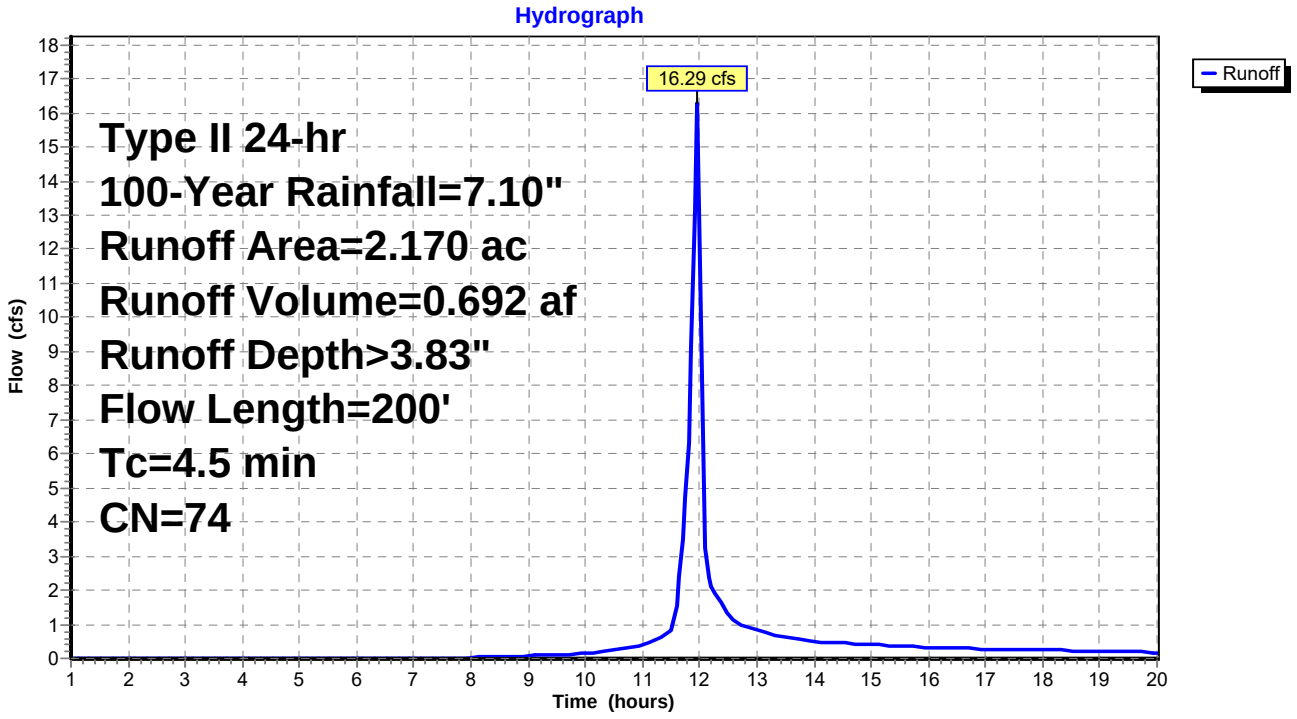
Runoff = 16.29 cfs @ 11.95 hrs, Volume= 0.692 af, Depth> 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.10"

Area (ac)	CN	Description
2.170	74	>75% Grass cover, Good, HSG C
2.170		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	100	0.3333	0.52		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.1	30	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	70	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.5	200	Total			

Subcatchment DA3:



Summary for Subcatchment DA4:

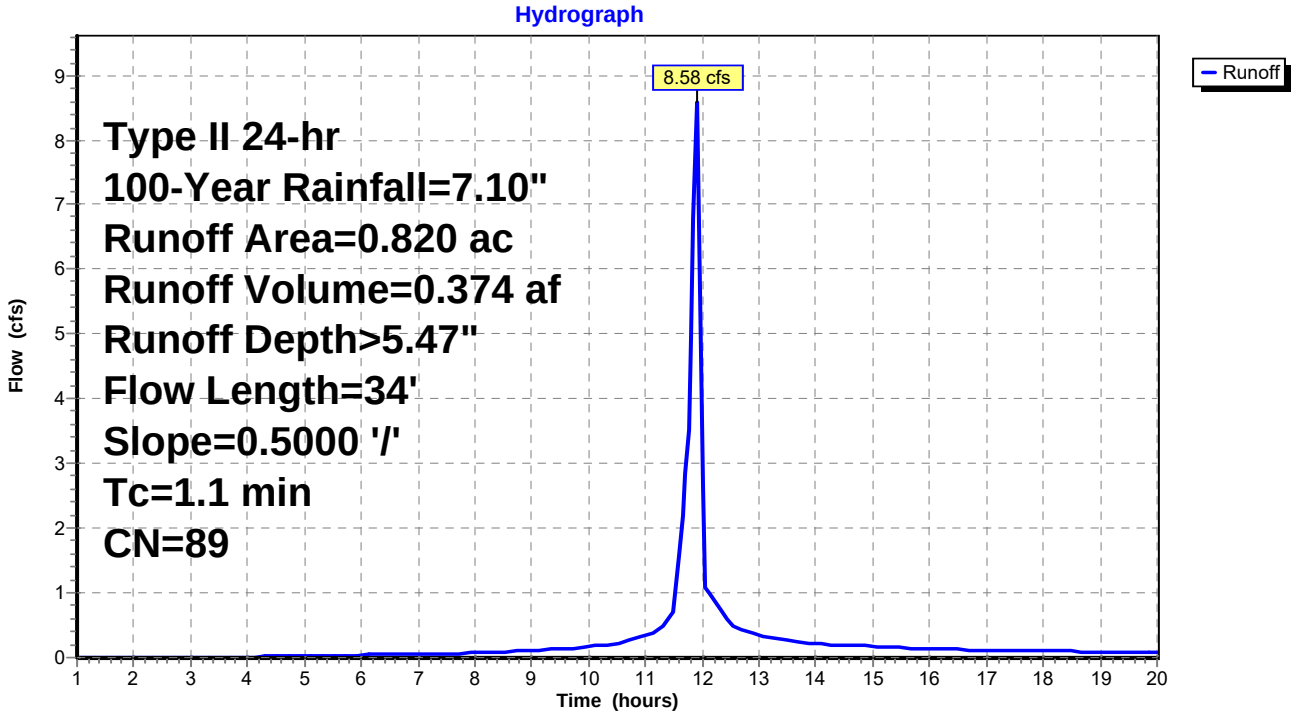
Runoff = 8.58 cfs @ 11.90 hrs, Volume= 0.374 af, Depth> 5.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.10"

Area (ac)	CN	Description
0.320	74	>75% Grass cover, Good, HSG C
0.110	98	Paved parking, HSG C
0.390	98	Water Surface, HSG C
0.820	89	Weighted Average
0.320		39.02% Pervious Area
0.500		60.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	34	0.5000	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment DA4:



Summary for Subcatchment DA5:

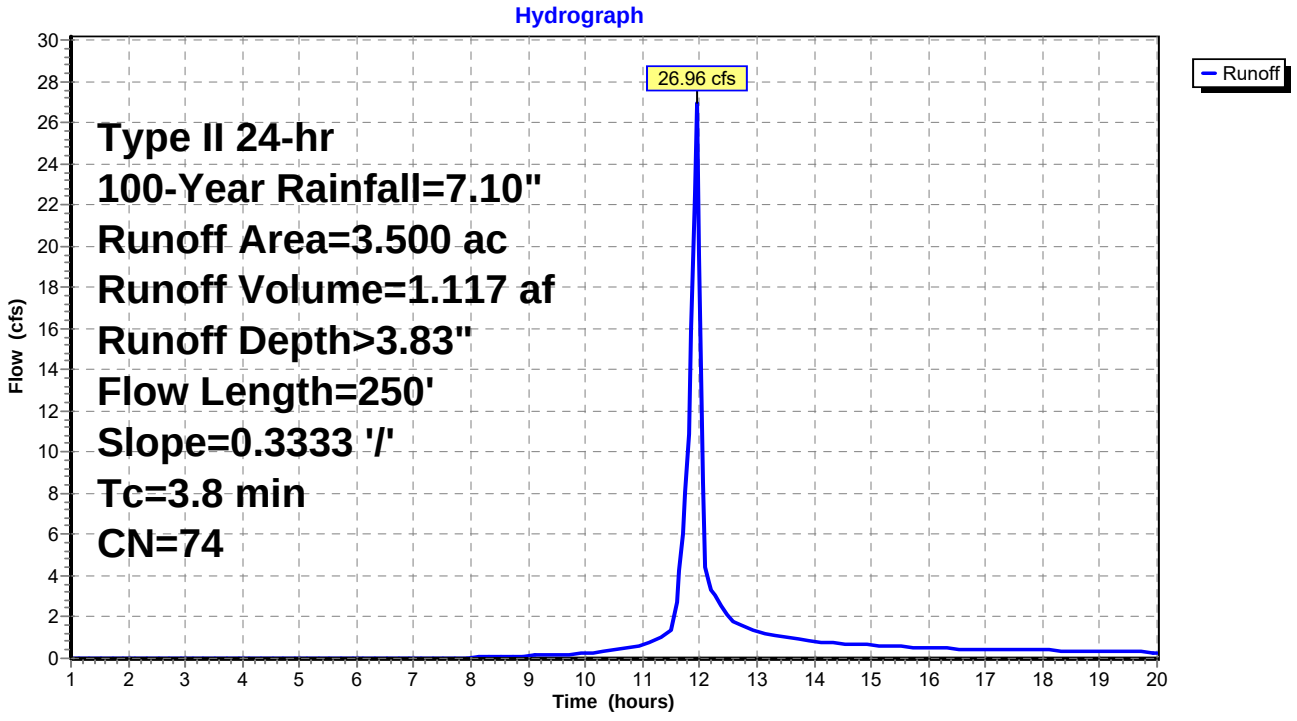
Runoff = 26.96 cfs @ 11.94 hrs, Volume= 1.117 af, Depth> 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.10"

Area (ac)	CN	Description
3.500	74	>75% Grass cover, Good, HSG C
3.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	100	0.3333	0.52		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.6	150	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.8	250	Total			

Subcatchment DA5:



Summary for Subcatchment DA6:

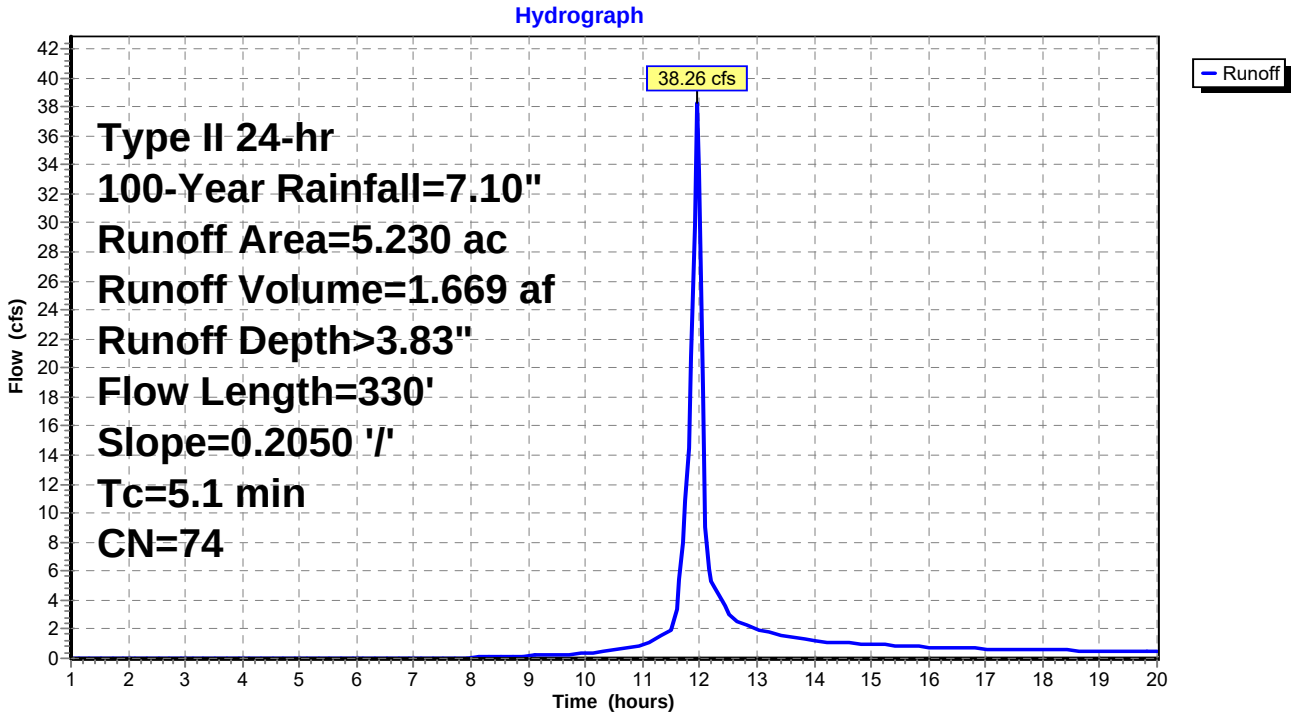
Runoff = 38.26 cfs @ 11.96 hrs, Volume= 1.669 af, Depth> 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.10"

Area (ac)	CN	Description
5.230	74	>75% Grass cover, Good, HSG C
5.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	100	0.2050	0.43		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	230	0.2050	3.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.1	330	Total			

Subcatchment DA6:



Summary for Subcatchment WL1:

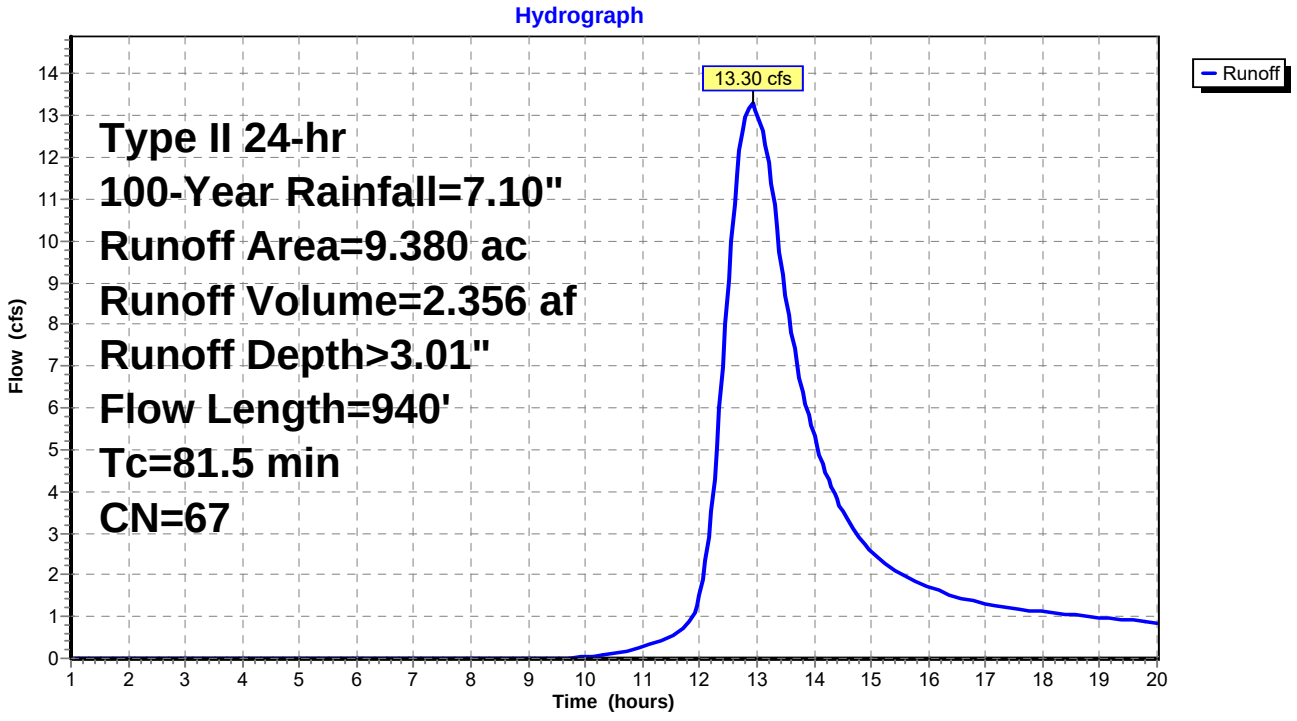
Runoff = 13.30 cfs @ 12.93 hrs, Volume= 2.356 af, Depth> 3.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.10"

	Area (ac)	CN	Description
*	9.380	67	
	9.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.2	100	0.0250	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.20"
47.3	840	0.0140	0.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
81.5	940	Total			

Subcatchment WL1:



Summary for Subcatchment WL2:

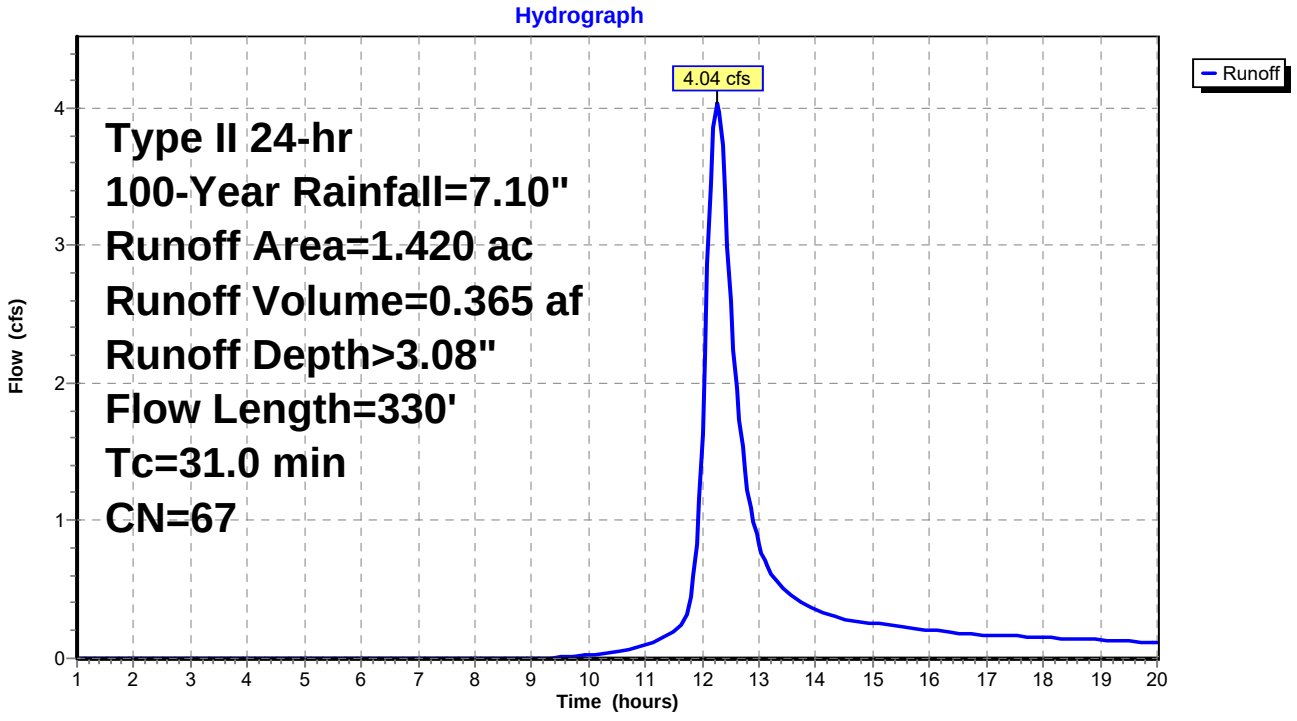
Runoff = 4.04 cfs @ 12.26 hrs, Volume= 0.365 af, Depth> 3.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.10"

	Area (ac)	CN	Description
*	1.420	67	
	1.420		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.5	100	0.0800	0.08		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.20"
9.5	230	0.0260	0.40		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
31.0	330	Total			

Subcatchment WL2:



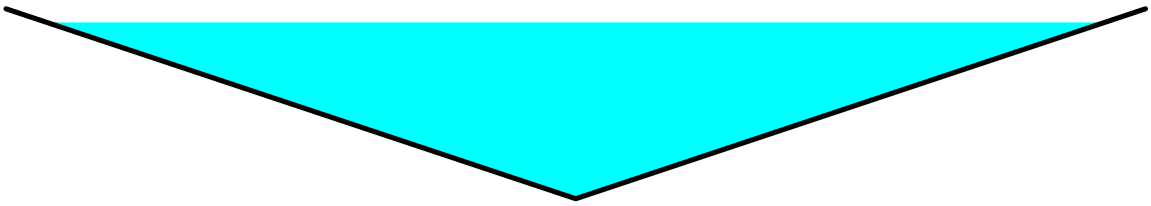
Summary for Reach R1: Channel 1

Inflow Area = 22.780 ac, 0.00% Impervious, Inflow Depth > 3.81" for 100-Year event
Inflow = 97.92 cfs @ 12.15 hrs, Volume= 7.226 af
Outflow = 85.19 cfs @ 12.37 hrs, Volume= 7.152 af, Atten= 13%, Lag= 12.8 min

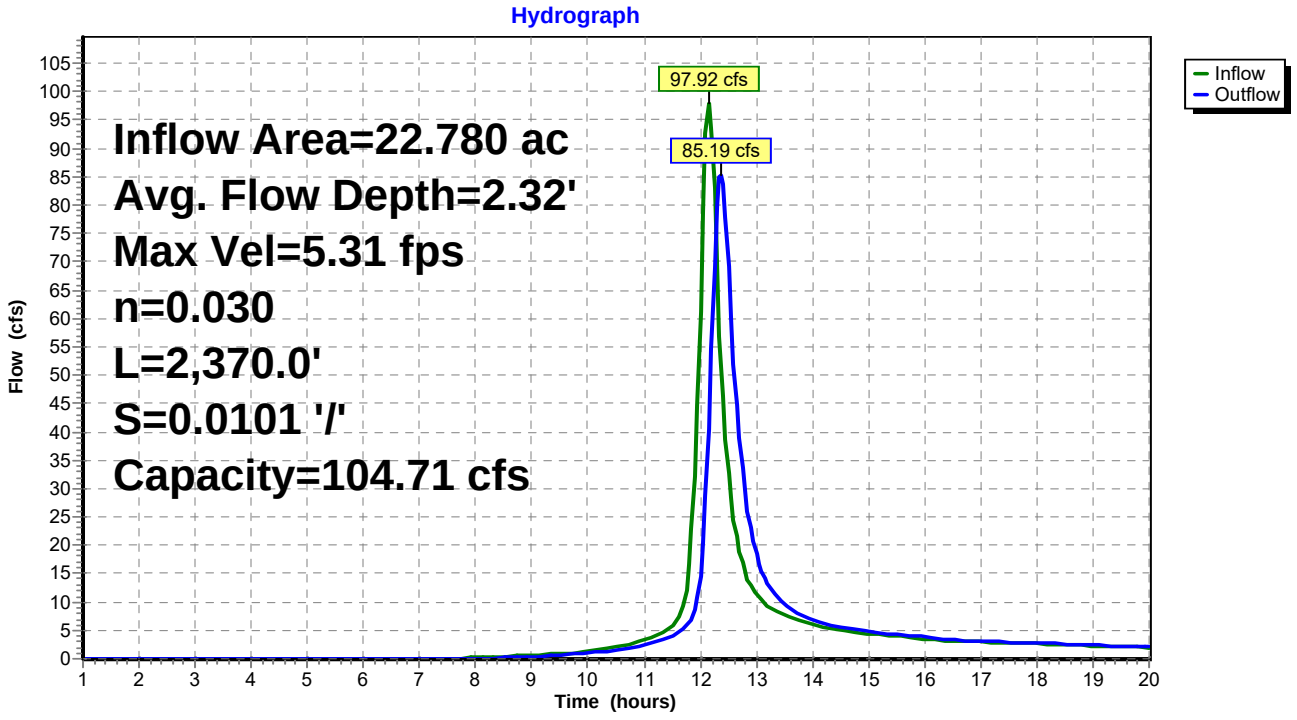
Routing by Stor-Ind+Trans method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.31 fps, Min. Travel Time= 7.4 min
Avg. Velocity = 2.30 fps, Avg. Travel Time= 17.1 min

Peak Storage= 38,300 cf @ 12.24 hrs
Average Depth at Peak Storage= 2.32'
Bank-Full Depth= 2.50' Flow Area= 18.8 sf, Capacity= 104.71 cfs

0.00' x 2.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 15.00'
Length= 2,370.0' Slope= 0.0101 '/'
Inlet Invert= 54.00', Outlet Invert= 30.00'



Reach R1: Channel 1



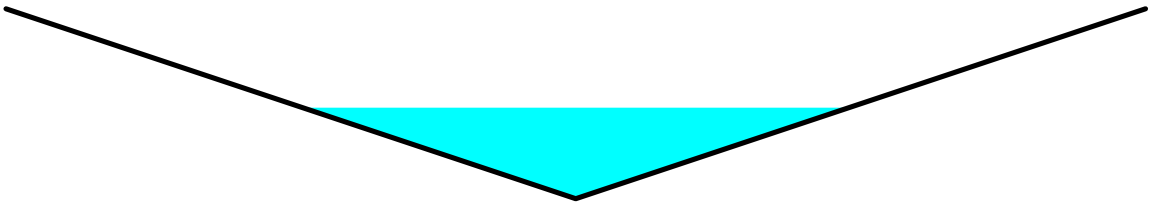
Summary for Reach R2: Channel 2

Inflow Area = 2.170 ac, 0.00% Impervious, Inflow Depth > 3.83" for 100-Year event
Inflow = 16.29 cfs @ 11.95 hrs, Volume= 0.692 af
Outflow = 14.12 cfs @ 12.04 hrs, Volume= 0.689 af, Atten= 13%, Lag= 5.7 min

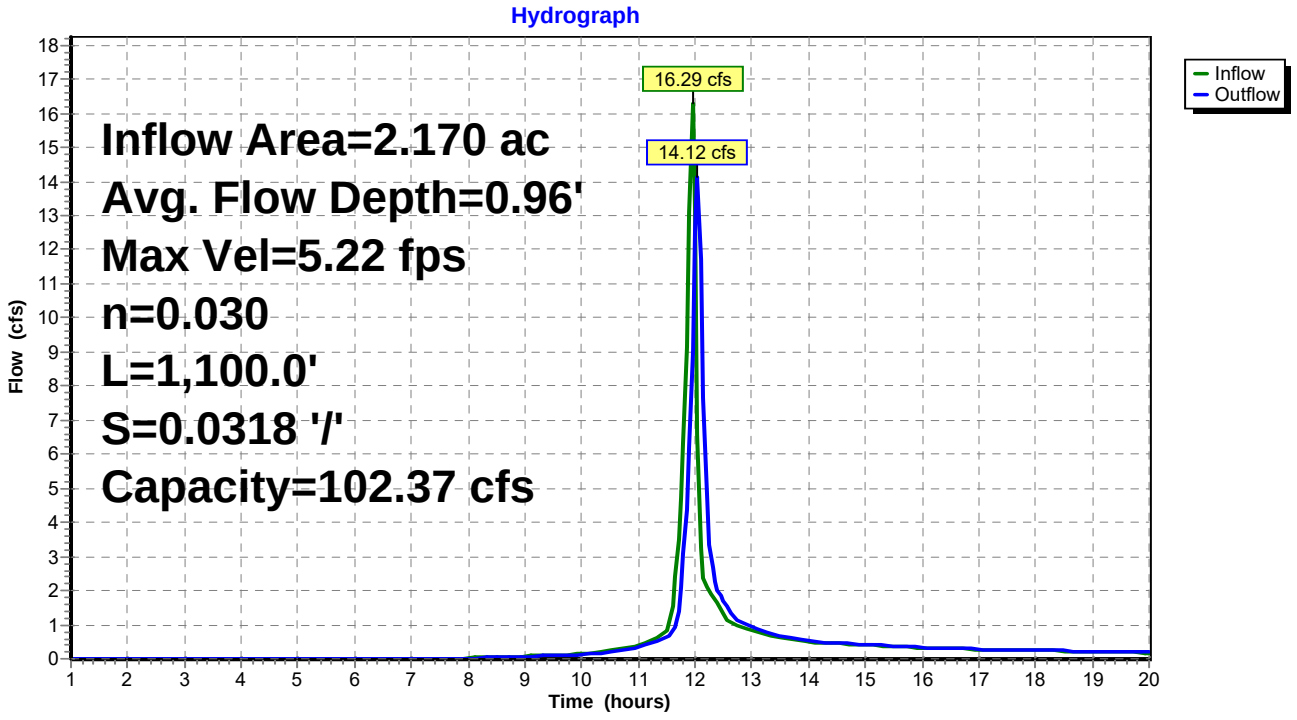
Routing by Stor-Ind+Trans method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.22 fps, Min. Travel Time= 3.5 min
Avg. Velocity = 1.99 fps, Avg. Travel Time= 9.2 min

Peak Storage= 3,035 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.96'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 102.37 cfs

0.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 1,100.0' Slope= 0.0318 '/'
Inlet Invert= 65.00', Outlet Invert= 30.00'



Reach R2: Channel 2



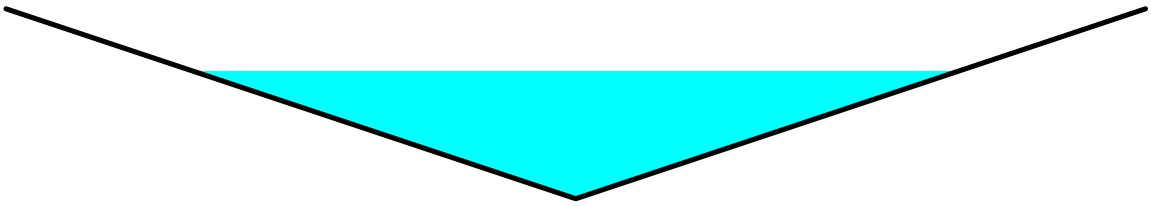
Summary for Reach R3: Channel 3

Inflow Area = 3.500 ac, 0.00% Impervious, Inflow Depth > 3.83" for 100-Year event
Inflow = 26.96 cfs @ 11.94 hrs, Volume= 1.117 af
Outflow = 23.86 cfs @ 12.02 hrs, Volume= 1.113 af, Atten= 12%, Lag= 4.6 min

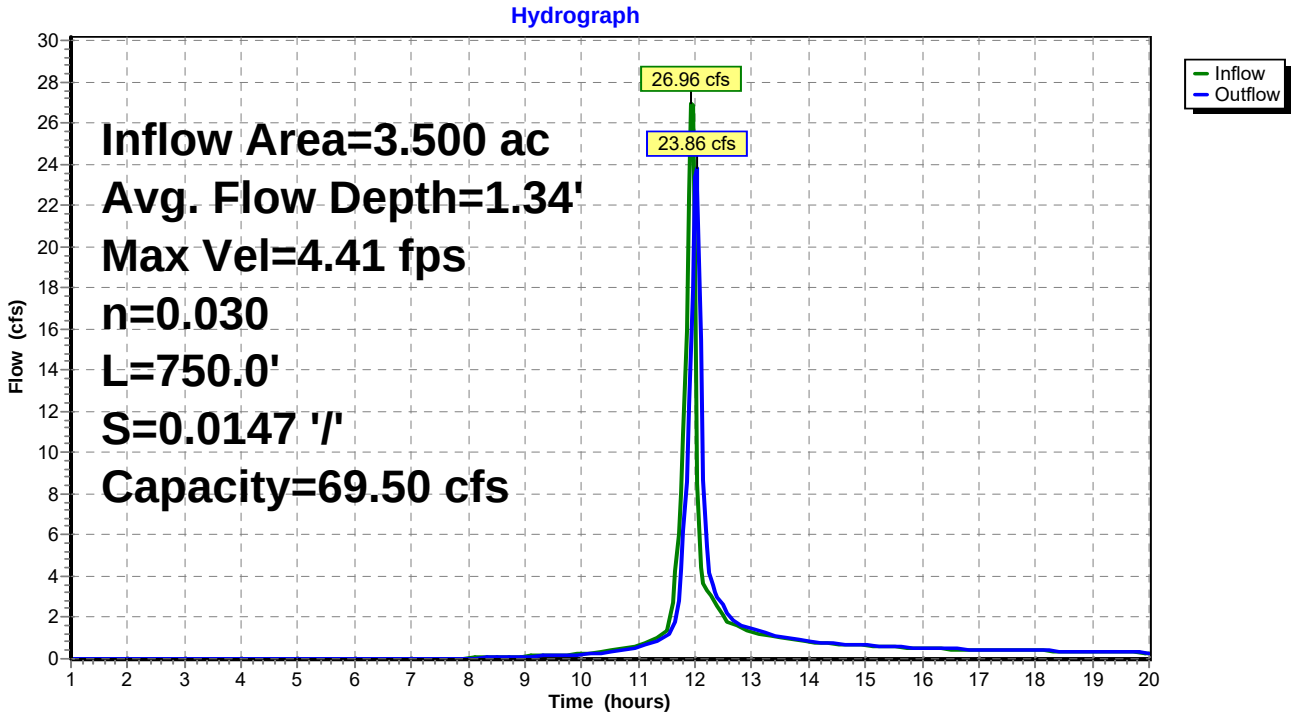
Routing by Stor-Ind+Trans method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.41 fps, Min. Travel Time= 2.8 min
Avg. Velocity = 1.67 fps, Avg. Travel Time= 7.5 min

Peak Storage= 4,062 cf @ 11.97 hrs
Average Depth at Peak Storage= 1.34'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 69.50 cfs

0.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 750.0' Slope= 0.0147 '/'
Inlet Invert= 49.00', Outlet Invert= 38.00'



Reach R3: Channel 3



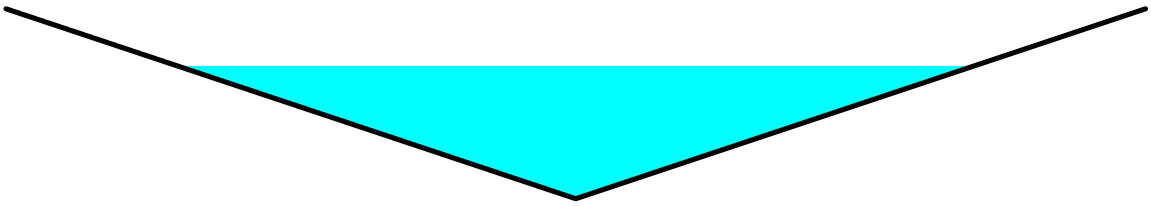
Summary for Reach R4: Channel 4

Inflow Area = 5.230 ac, 0.00% Impervious, Inflow Depth > 3.83" for 100-Year event
Inflow = 38.26 cfs @ 11.96 hrs, Volume= 1.669 af
Outflow = 35.03 cfs @ 12.04 hrs, Volume= 1.661 af, Atten= 8%, Lag= 5.1 min

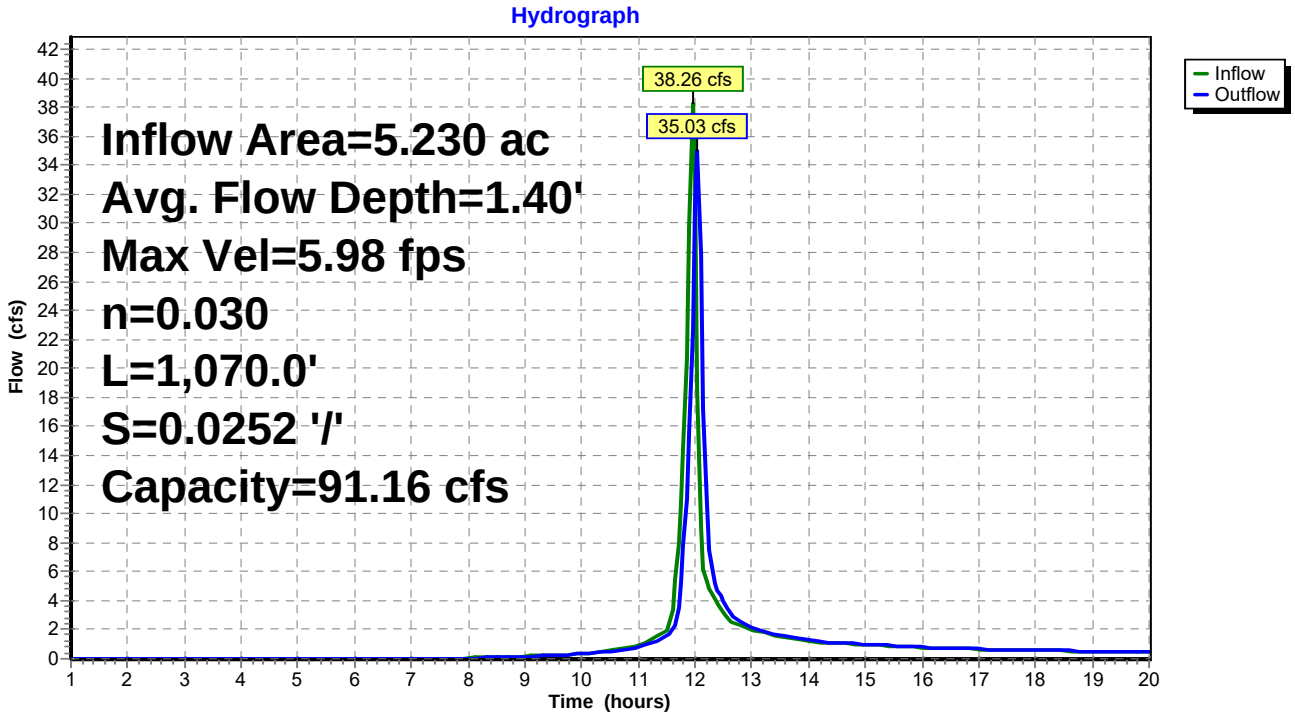
Routing by Stor-Ind+Trans method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.98 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 2.26 fps, Avg. Travel Time= 7.9 min

Peak Storage= 6,271 cf @ 11.99 hrs
Average Depth at Peak Storage= 1.40'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 91.16 cfs

0.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 1,070.0' Slope= 0.0252 '/'
Inlet Invert= 65.00', Outlet Invert= 38.00'



Reach R4: Channel 4



Summary for Pond C1: Culvert 1

Inflow Area = 24.950 ac, 0.00% Impervious, Inflow Depth > 3.77" for 100-Year event
Inflow = 87.36 cfs @ 12.36 hrs, Volume= 7.841 af
Outflow = 84.68 cfs @ 12.41 hrs, Volume= 7.840 af, Atten= 3%, Lag= 3.0 min
Primary = 84.68 cfs @ 12.41 hrs, Volume= 7.840 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 33.76' @ 12.41 hrs Surf.Area= 4,582 sf Storage= 6,293 cf
Flood Elev= 35.30' Surf.Area= 9,822 sf Storage= 17,098 cf

Plug-Flow detention time= 0.6 min calculated for 7.819 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (805.0 - 804.5)

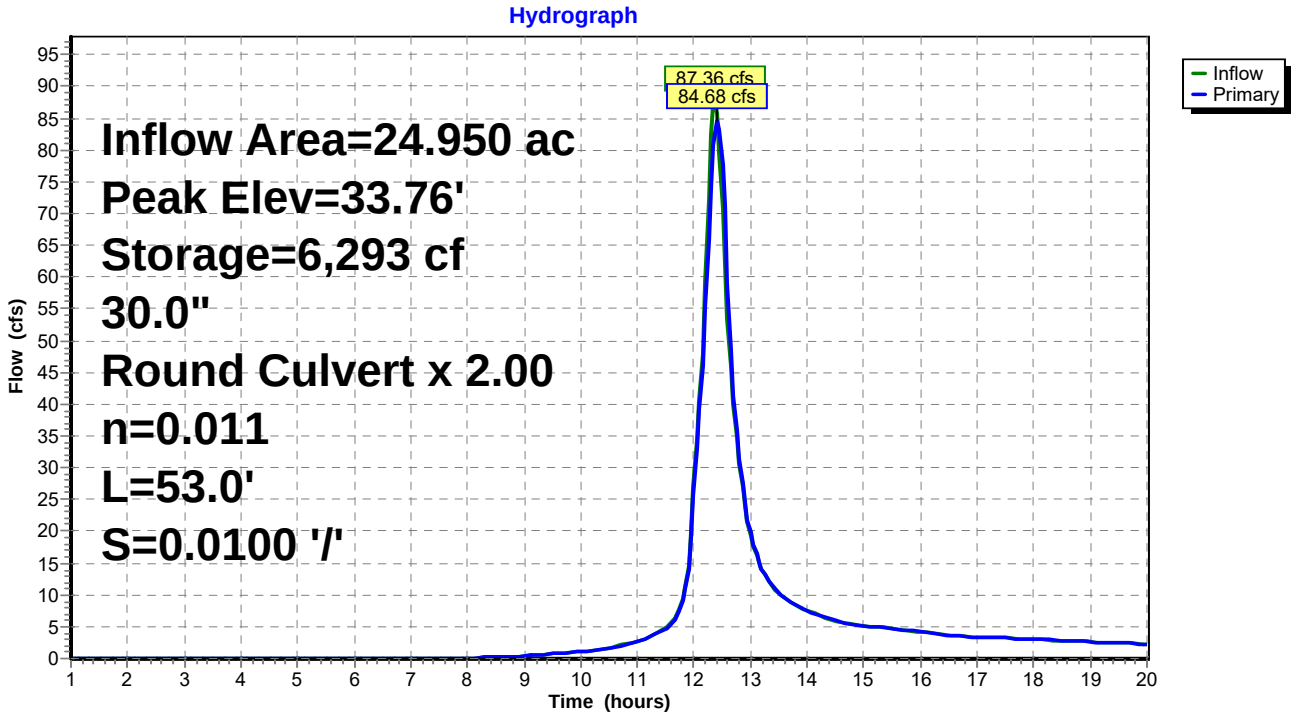
Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	24,875 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
30.00	0	0	0
32.00	1,200	1,200	1,200
34.00	5,039	6,239	7,439
35.00	8,718	6,879	14,318
36.00	12,397	10,558	24,875

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	**30.0" Round Culvert X 2.00** L= 53.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 30.00' / 29.47' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 4.91 sf

Primary OutFlow Max=84.21 cfs @ 12.41 hrs HW=33.74' (Free Discharge)
1=Culvert (Barrel Controls 84.21 cfs @ 8.58 fps)

Pond C1: Culvert 1



Summary for Pond C2: Culvert 2

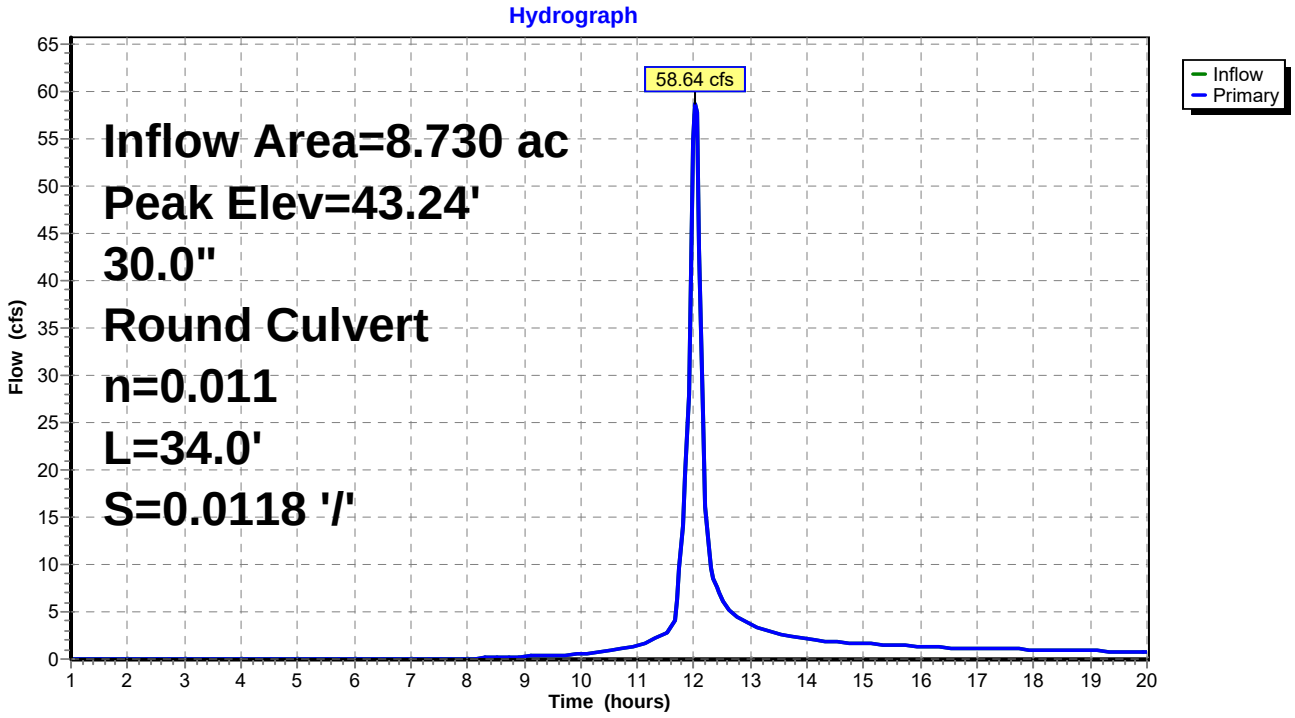
Inflow Area = 8.730 ac, 0.00% Impervious, Inflow Depth > 3.81" for 100-Year event
Inflow = 58.64 cfs @ 12.03 hrs, Volume= 2.774 af
Outflow = 58.64 cfs @ 12.03 hrs, Volume= 2.774 af, Atten= 0%, Lag= 0.0 min
Primary = 58.64 cfs @ 12.03 hrs, Volume= 2.774 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 43.24' @ 12.03 hrs
Flood Elev= 42.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	38.00'	**30.0" Round Culvert** L= 34.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 38.00' / 37.60' S= 0.0118 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 4.91 sf

Primary OutFlow Max=56.73 cfs @ 12.03 hrs HW=43.06' (Free Discharge)
1=Culvert (Barrel Controls 56.73 cfs @ 11.56 fps)

Pond C2: Culvert 2



Summary for Pond POND Nº1:

Inflow Area = 26.380 ac, 3.41% Impervious, Inflow Depth > 3.86" for 100-Year event
Inflow = 85.78 cfs @ 12.41 hrs, Volume= 8.492 af
Outflow = 30.92 cfs @ 12.82 hrs, Volume= 7.974 af, Atten= 64%, Lag= 24.3 min
Primary = 30.92 cfs @ 12.82 hrs, Volume= 7.974 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 28.66' @ 12.82 hrs Surf.Area= 36,691 sf Storage= 152,365 cf

Plug-Flow detention time= 86.1 min calculated for 7.974 af (94% of inflow)
Center-of-Mass det. time= 64.8 min (865.0 - 800.2)

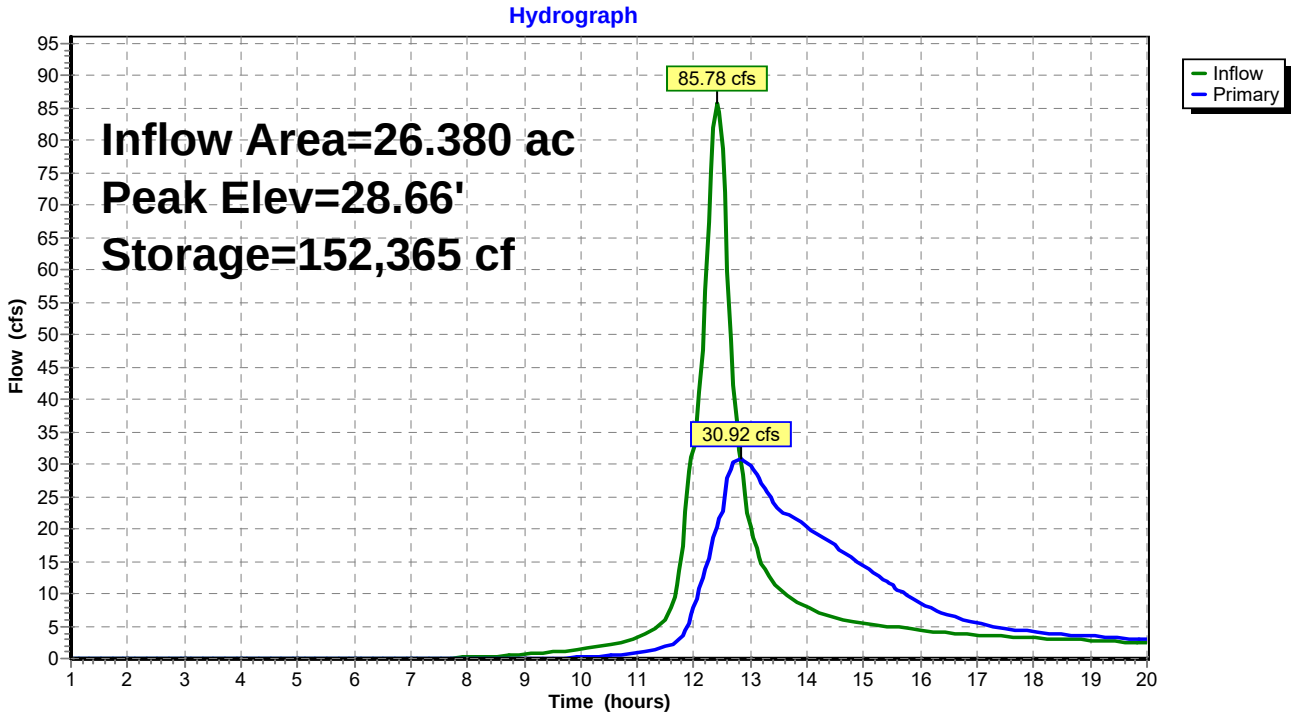
Volume	Invert	Avail.Storage	Storage Description
#1	24.00'	203,192 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
24.00	28,828	0	0
26.00	32,123	60,951	60,951
28.00	35,532	67,655	128,606
30.00	39,054	74,586	203,192

Device	Routing	Invert	Outlet Devices
#1	Primary	24.00'	**24.0" Round Culvert** L= 84.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 24.00' / 23.40' S= 0.0071 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Primary	28.00'	**Special & User-Defined** Head (feet) 0.00 0.72 0.97 1.32 1.64 1.84 Disch. (cfs) 0.000 5.900 15.500 32.500 51.800 65.200

Primary OutFlow Max=30.89 cfs @ 12.82 hrs HW=28.66' (Free Discharge)
└**1=Culvert** (Inlet Controls 25.52 cfs @ 8.12 fps)
└**2=Special & User-Defined** (Custom Controls 5.37 cfs)

Pond POND Nº1:



Summary for Pond POND Nº2:

Inflow Area = 9.550 ac, 5.24% Impervious, Inflow Depth > 3.96" for 100-Year event
Inflow = 60.13 cfs @ 12.03 hrs, Volume= 3.148 af
Outflow = 24.10 cfs @ 12.17 hrs, Volume= 2.869 af, Atten= 60%, Lag= 8.3 min
Primary = 24.10 cfs @ 12.17 hrs, Volume= 2.869 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 37.54' @ 12.17 hrs Surf.Area= 16,053 sf Storage= 54,750 cf

Plug-Flow detention time= 79.3 min calculated for 2.861 af (91% of inflow)
Center-of-Mass det. time= 48.9 min (827.8 - 778.9)

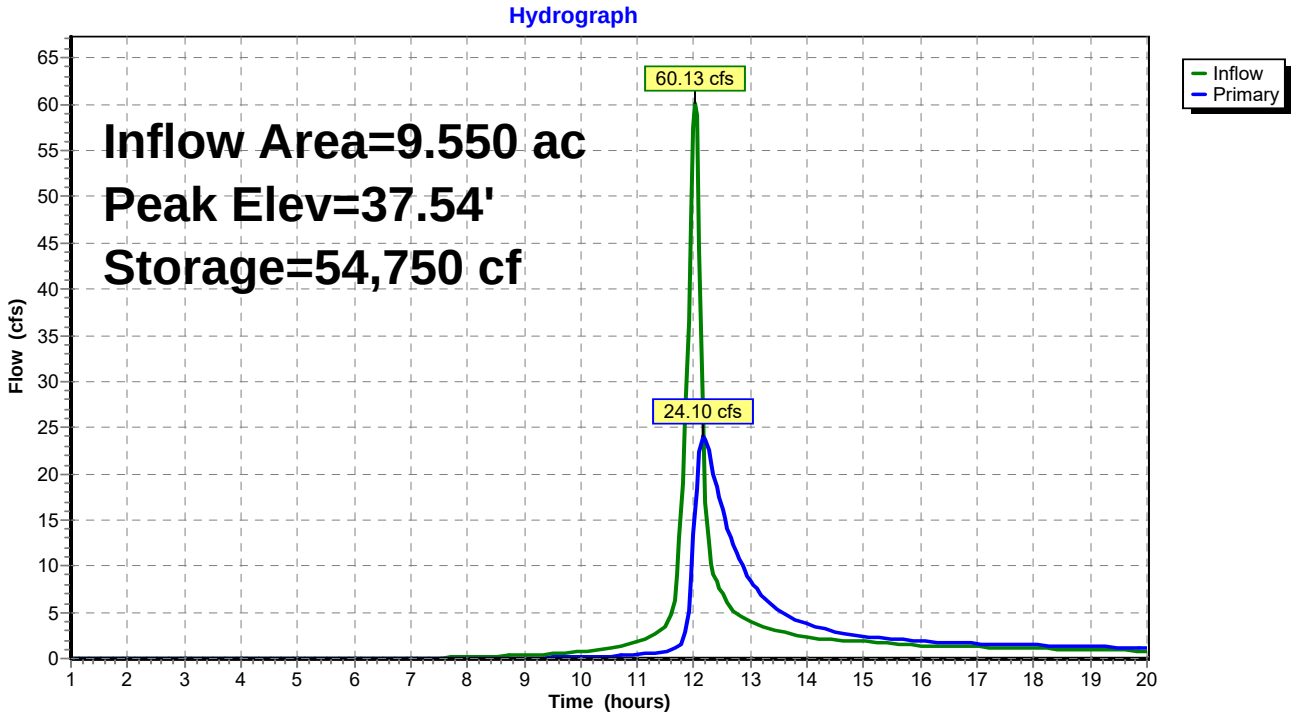
Volume	Invert	Avail.Storage	Storage Description
#1	33.00'	99,765 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.00	8,168	0	0
34.00	9,838	9,003	9,003
36.00	13,282	23,120	32,123
38.00	16,874	30,156	62,279
40.00	20,612	37,486	99,765

Device	Routing	Invert	Outlet Devices
#1	Primary	33.00'	**24.0" Round Culvert** L= 58.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 33.00' / 26.00' S= 0.1207 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	33.00'	**3.0" W x 44.4" H Vert. Orifice/Grate X 0.00** C= 0.600
#3	Device 1	36.70'	**48.0" x 48.0" Horiz. Orifice/Grate X 0.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	33.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.75 Width (feet) 0.23 0.23
#5	Device 1	34.75'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.85 Width (feet) 1.33 1.33
#6	Device 1	37.60'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.40 Width (feet) 16.00 16.00

Primary OutFlow Max=23.89 cfs @ 12.17 hrs HW=37.52' (Free Discharge)
└**1=Culvert** (Passes 23.89 cfs of 28.40 cfs potential flow)
  ├**2=Orifice/Grate** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  ├**4=Custom Weir/Orifice** (Orifice Controls 3.77 cfs @ 9.36 fps)
  ├**5=Custom Weir/Orifice** (Weir Controls 20.12 cfs @ 5.45 fps)
  └**6=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond POND Nº2:

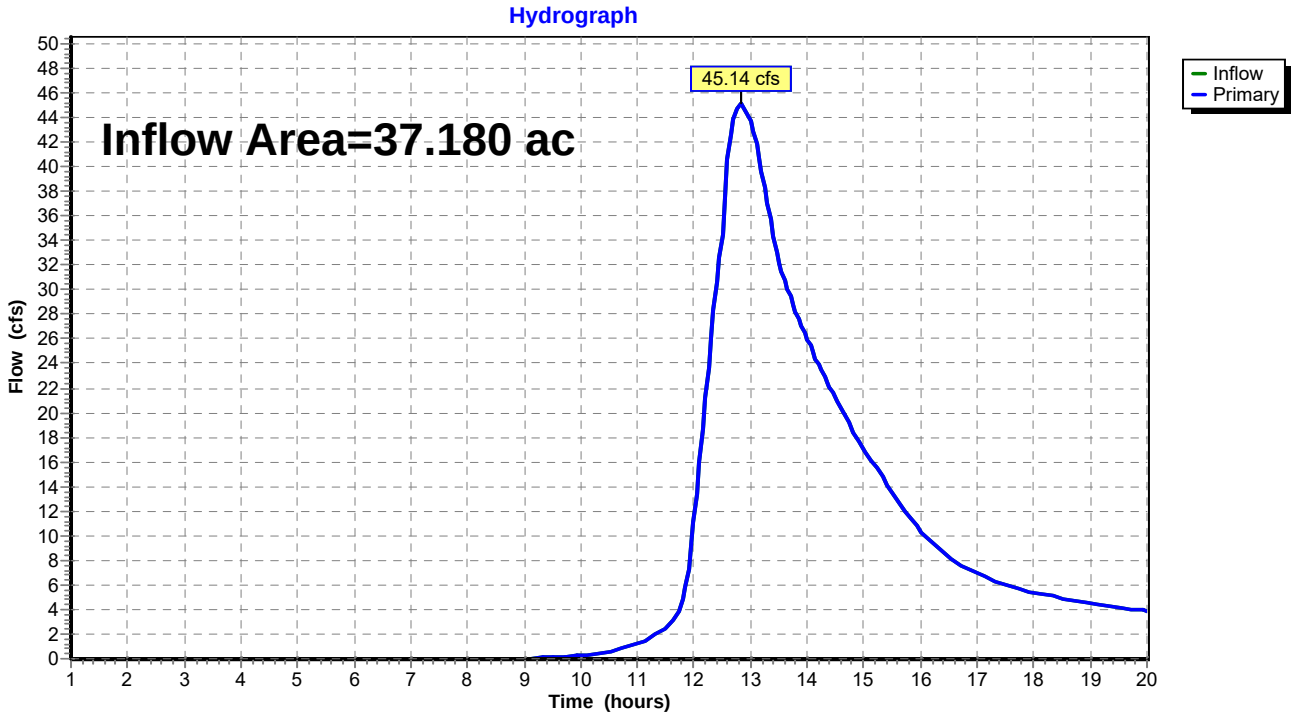


Summary for Link WL3:

Inflow Area = 37.180 ac, 2.42% Impervious, Inflow Depth > 3.45" for 100-Year event
Inflow = 45.14 cfs @ 12.83 hrs, Volume= 10.694 af
Primary = 45.14 cfs @ 12.83 hrs, Volume= 10.694 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Link WL3:



Appendix C

Outlet Protection Computations

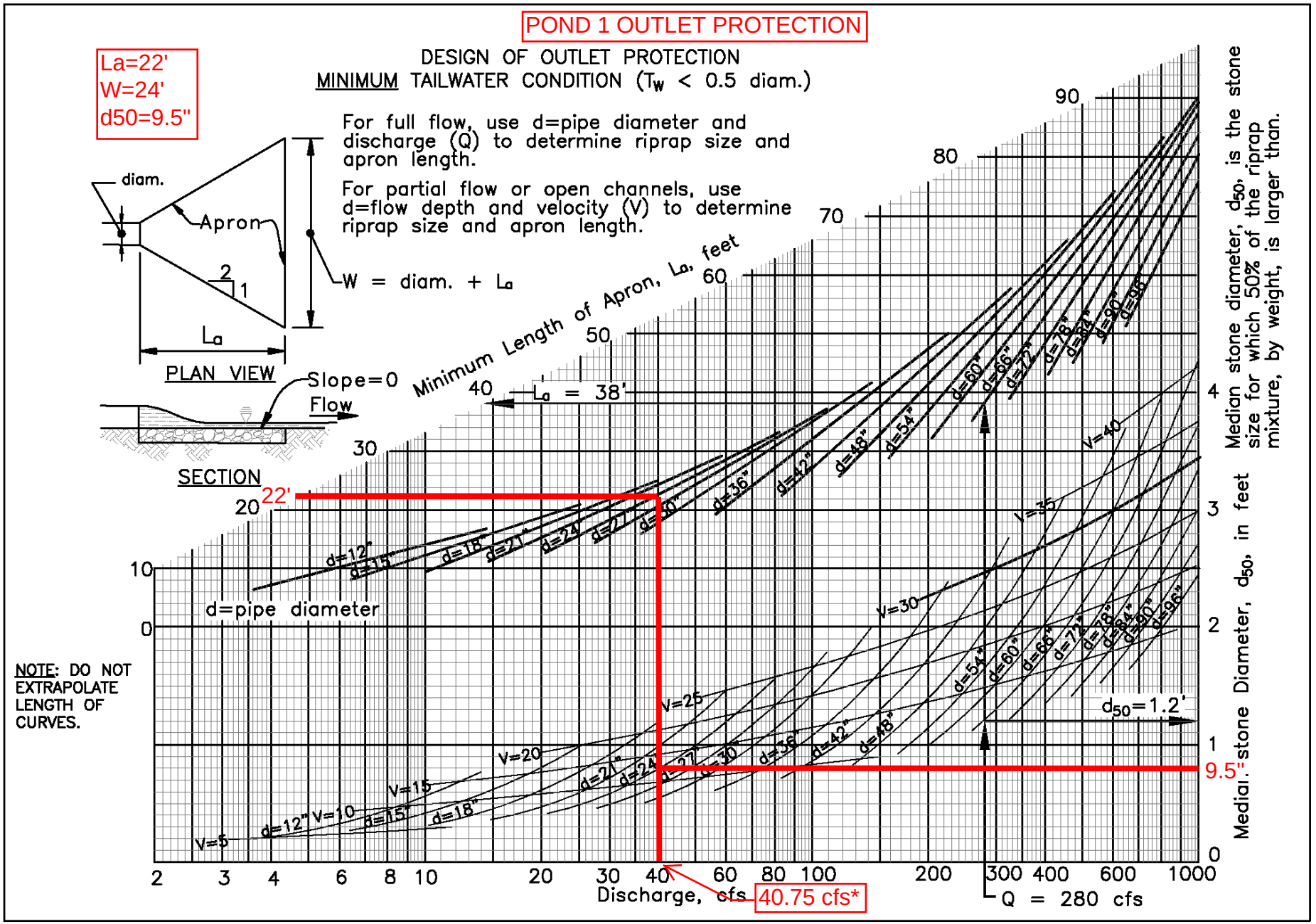


Figure D.2: Design of Outlet Protection – Minimum Tailwater Condition

*NOTE: INTERMEDIATE CONDITION Q100 USED.

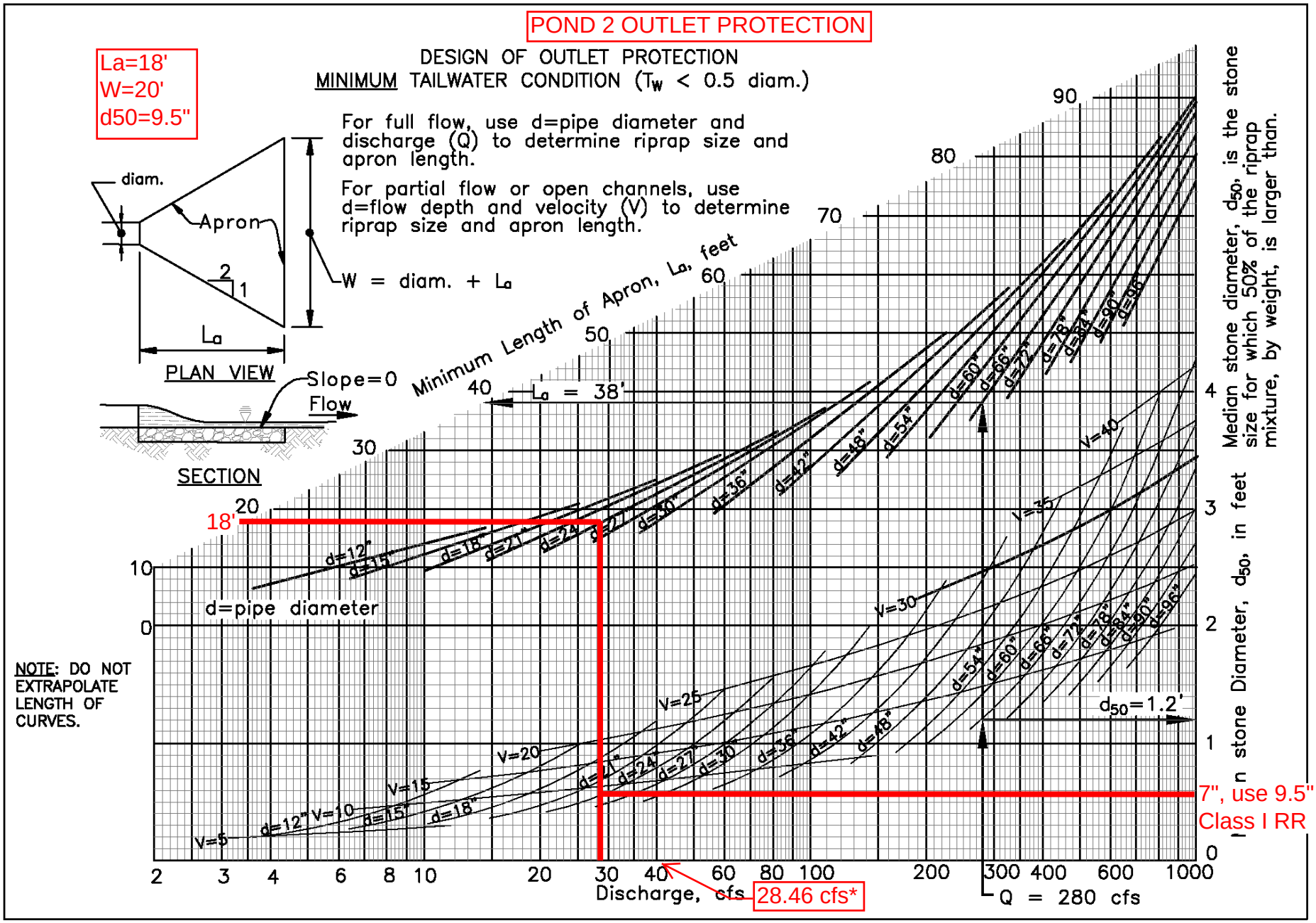


Figure D.2: Design of Outlet Protection – Minimum Tailwater Condition

*NOTE: INTERMEDIATE CONDITION Q100 USED.

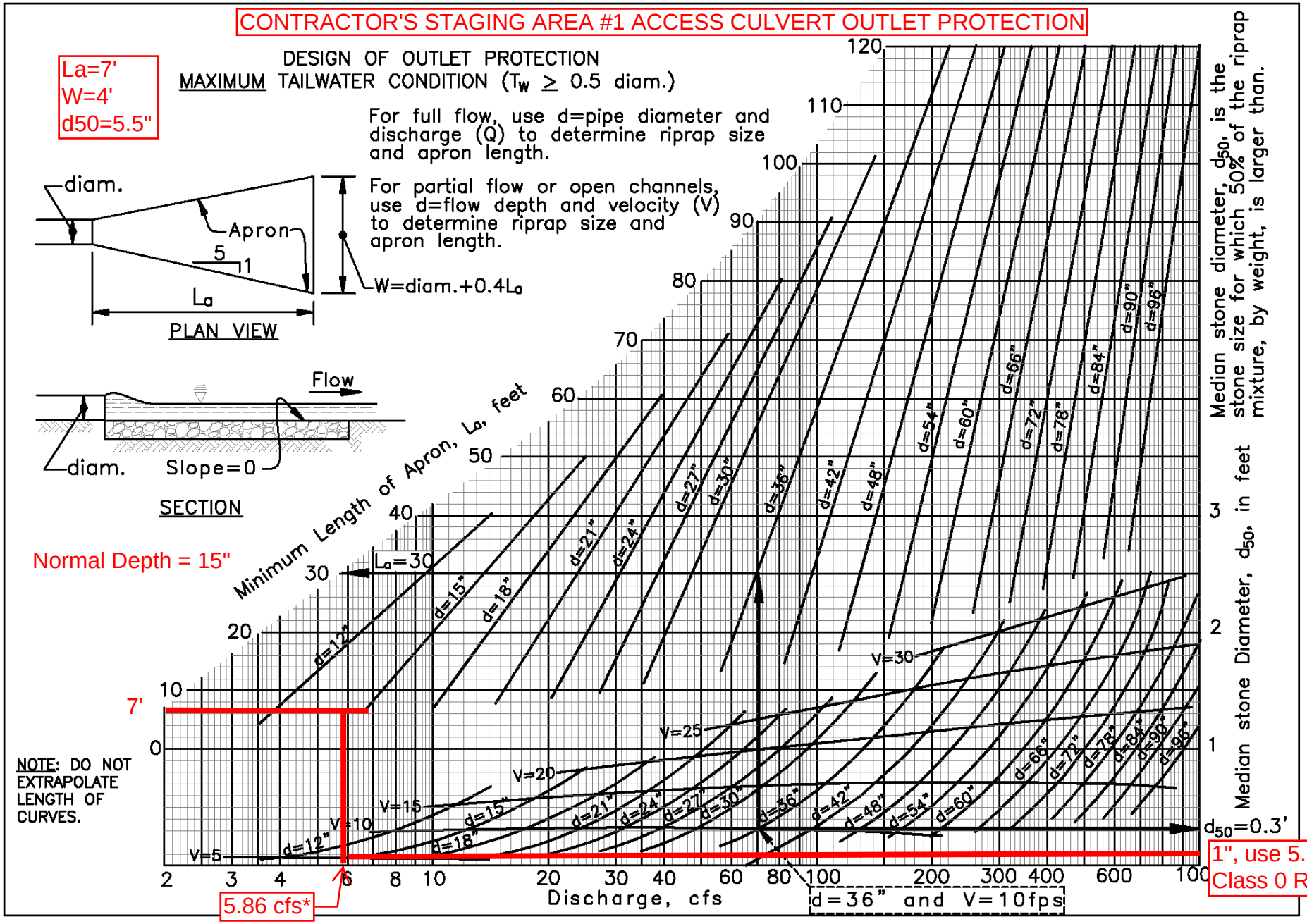


Figure D.3: Design of Outlet Protection – Maximum Tailwater Condition

*NOTE: CELL 3 E&S CONDITION Q10 USED.

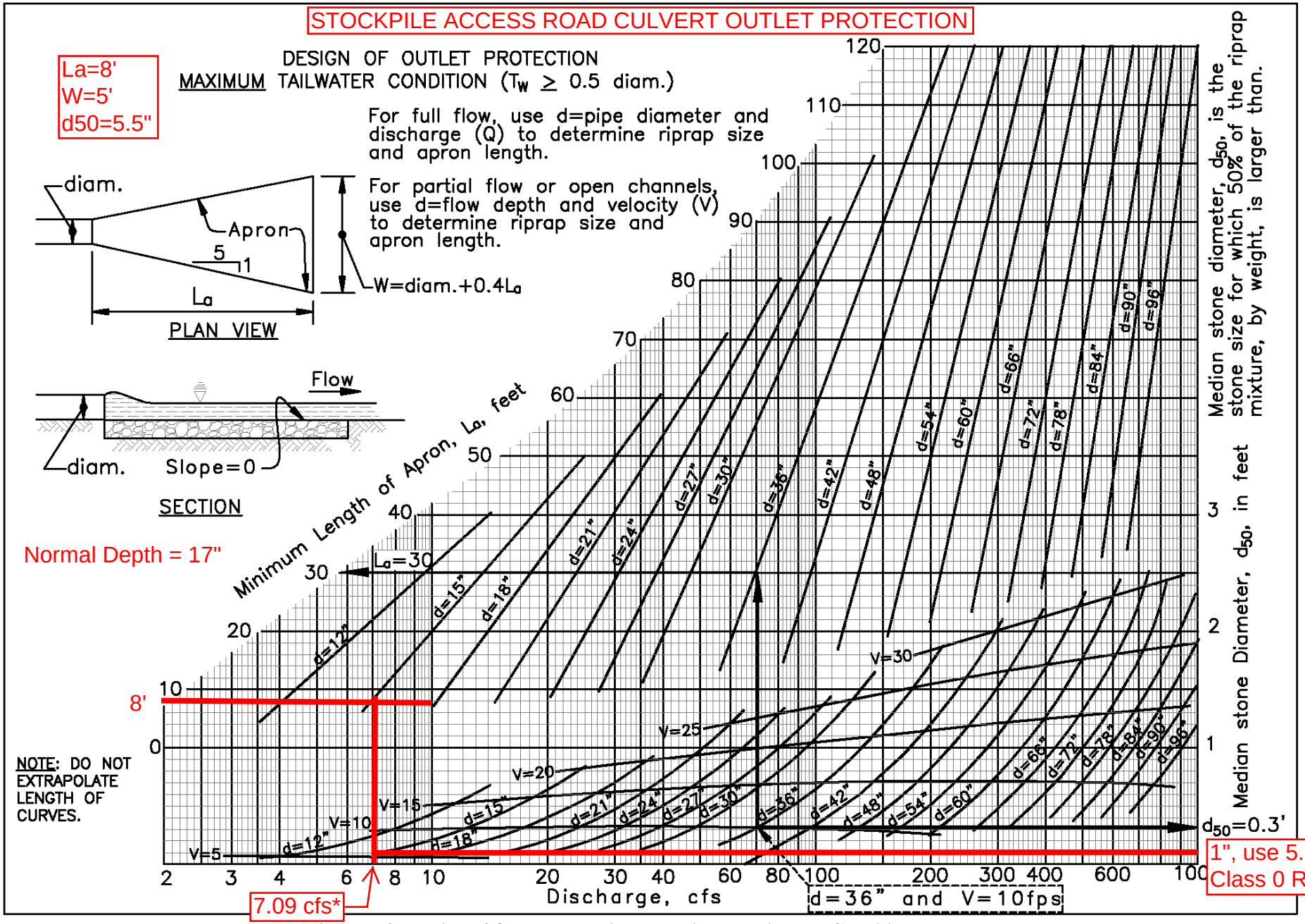


Figure D.3: Design of Outlet Protection – Maximum Tailwater Condition

*NOTE: CELL 3 E&S CONDITION Q10 USED.

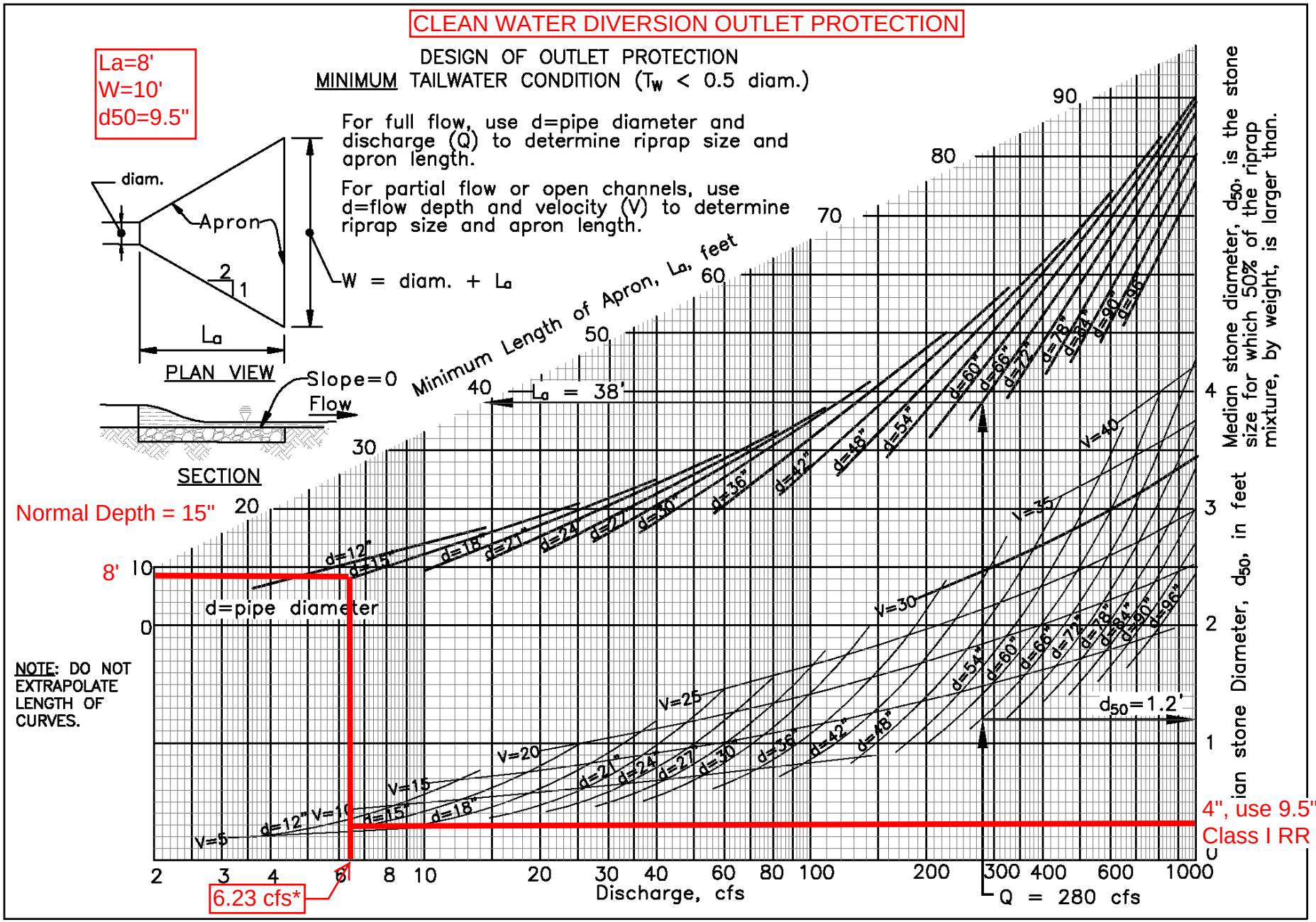
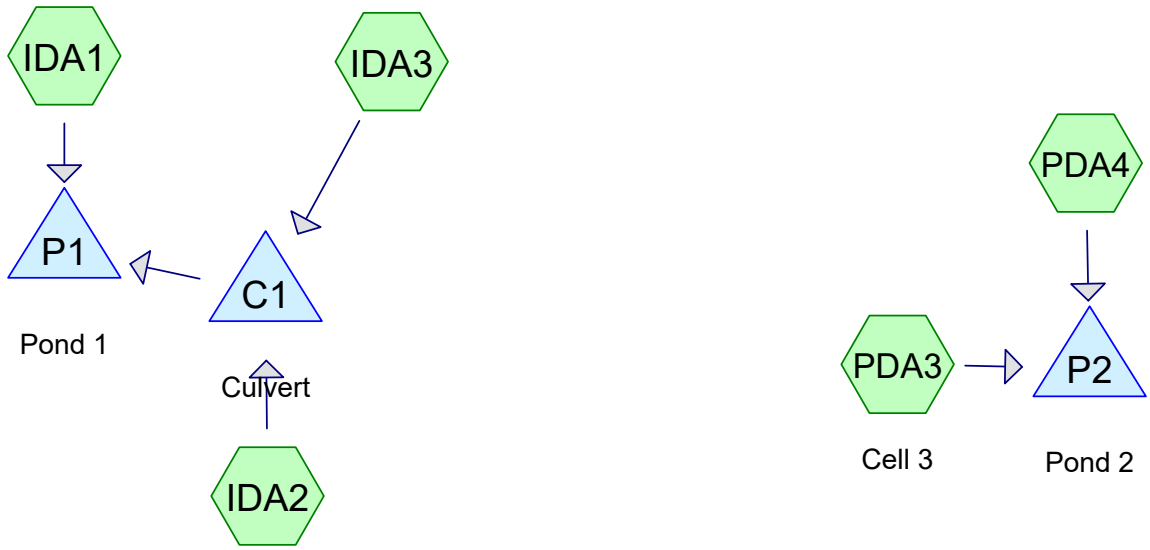


Figure D.2: Design of Outlet Protection – Minimum Tailwater Condition

*NOTE: CELL 3 E&S CONDITION Q10 USED.

Appendix E

Erosion and Sediment Control
HydroCAD Reports



Subcat Reach Pond Link

Routing Diagram for ME1400 ESC
Prepared by {enter your company name here}, Printed 8/10/2017
HydroCAD® 10.00-18 s/n 00663 © 2016 HydroCAD Software Solutions LLC

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment IDA1: Runoff Area=1.850 ac 100.00% Impervious Runoff Depth>4.62"
Flow Length=48' Tc=1.6 min CN=98 Runoff=14.48 cfs 0.712 af

Subcatchment IDA2: Runoff Area=10.590 ac 0.00% Impervious Runoff Depth>3.84"
Flow Length=1,690' Tc=6.8 min CN=91 Runoff=67.89 cfs 3.386 af

Subcatchment IDA3: Runoff Area=8.130 ac 0.00% Impervious Runoff Depth>3.84"
Flow Length=875' Tc=4.1 min CN=91 Runoff=56.96 cfs 2.601 af

Subcatchment PDA3: Cell 3 Runoff Area=9.760 ac 0.00% Impervious Runoff Depth>3.84"
Flow Length=500' Tc=3.3 min CN=91 Runoff=69.71 cfs 3.123 af

Subcatchment PDA4: Runoff Area=0.840 ac 100.00% Impervious Runoff Depth>4.62"
Flow Length=34' Slope=0.5000 '/' Tc=1.1 min CN=98 Runoff=6.73 cfs 0.323 af

Pond C1: Culvert Peak Elev=34.69' Storage=11,826 cf Inflow=122.04 cfs 5.987 af
30.0" Round Culvert x 2.00 n=0.011 L=53.0' S=0.0100 '/' Outflow=104.41 cfs 5.986 af

Pond P1: Pond 1 Peak Elev=29.27' Storage=175,170 cf Inflow=111.17 cfs 6.698 af
Outflow=35.96 cfs 5.631 af

Pond P2: Pond 2 Peak Elev=38.62' Storage=72,991 cf Inflow=75.57 cfs 3.446 af
Outflow=32.50 cfs 2.954 af

Total Runoff Area = 31.170 ac Runoff Volume = 10.145 af Average Runoff Depth = 3.91"
91.37% Pervious = 28.480 ac 8.63% Impervious = 2.690 ac

Summary for Subcatchment IDA1:

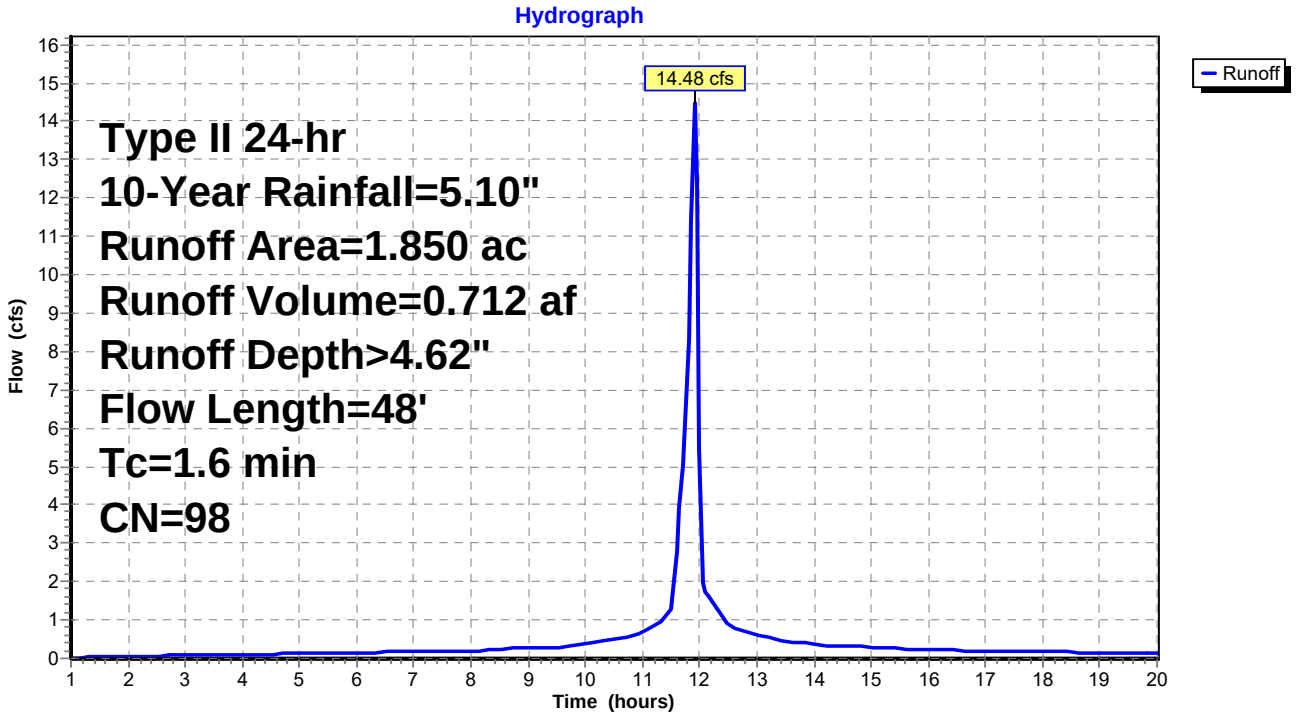
Runoff = 14.48 cfs @ 11.90 hrs, Volume= 0.712 af, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
1.850	98	Water Surface, HSG C
1.850		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	18	0.0100	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
1.2	30	0.3670	0.43		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.6	48	Total			

Subcatchment IDA1:



Summary for Subcatchment IDA2:

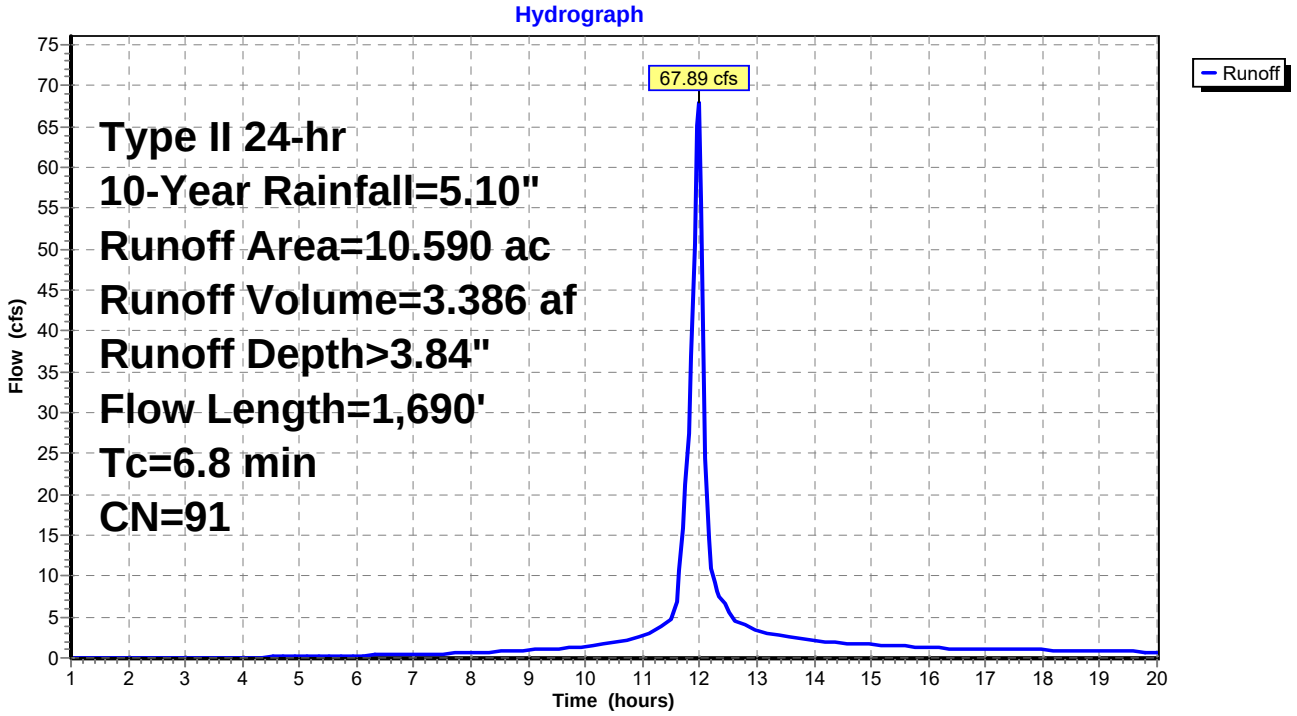
Runoff = 67.89 cfs @ 11.98 hrs, Volume= 3.386 af, Depth> 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
10.590	91	Newly graded area, HSG C
10.590		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.1400	0.89		**Sheet Flow,** Fallow n= 0.050 P2= 3.20"
1.6	280	0.0320	2.88		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.3	1,310	0.0100	6.54	78.46	**Channel Flow,** Area= 12.0 sf Perim= 12.6' r= 0.95' n= 0.022 Earth, clean & straight
6.8	1,690	Total			

Subcatchment IDA2:



Summary for Subcatchment IDA3:

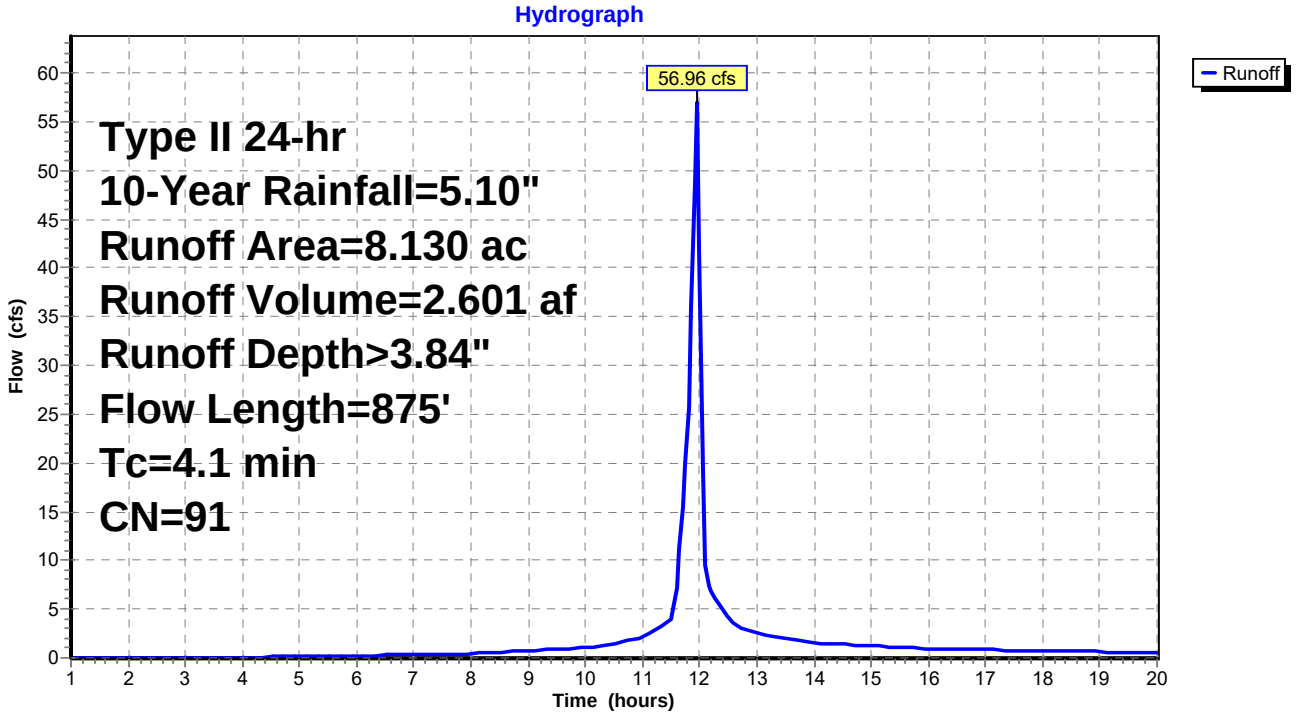
Runoff = 56.96 cfs @ 11.94 hrs, Volume= 2.601 af, Depth> 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
8.130	91	Newly graded area, HSG C
8.130		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.5000	1.48		**Sheet Flow,** Fallow n= 0.050 P2= 3.20"
0.1	35	0.5000	11.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.9	740	0.0050	4.21	50.52	**Channel Flow,** Area= 12.0 sf Perim= 14.5' r= 0.83' n= 0.022 Earth, clean & straight
4.1	875	Total			

Subcatchment IDA3:



Summary for Subcatchment PDA3: Cell 3

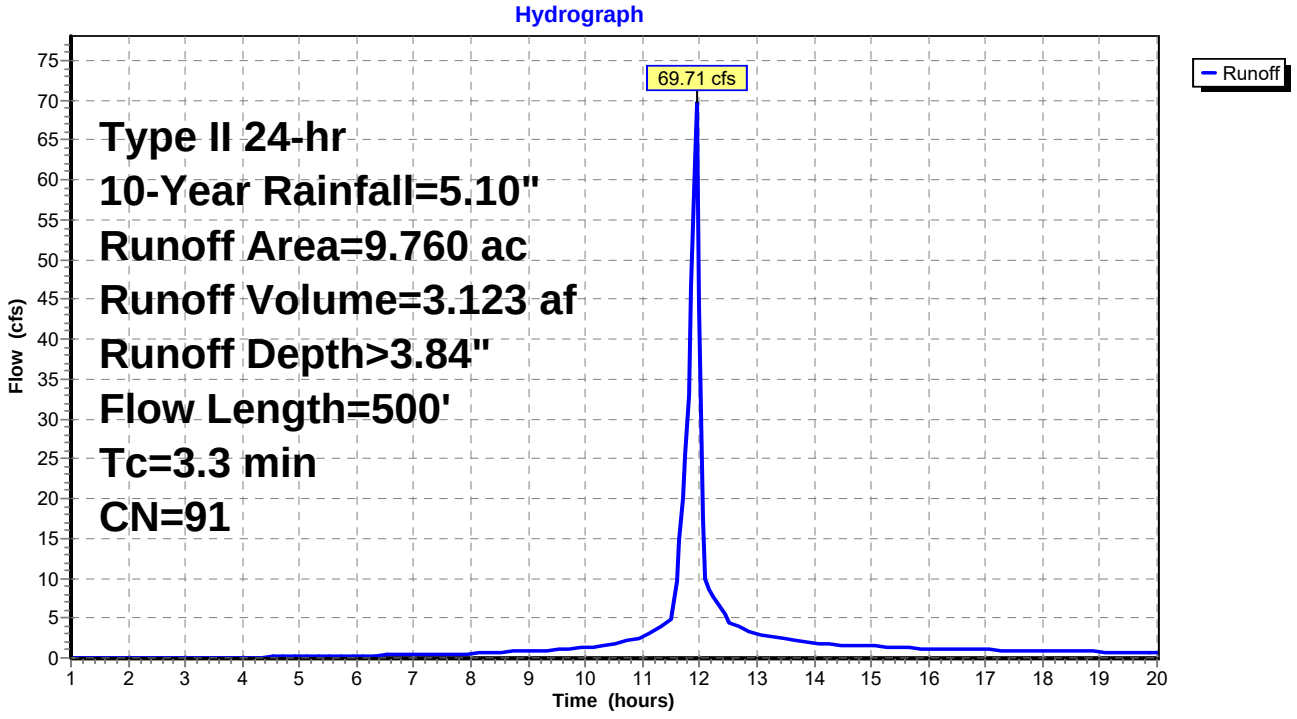
Runoff = 69.71 cfs @ 11.94 hrs, Volume= 3.123 af, Depth> 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
9.760	91	Newly graded area, HSG C
9.760		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0250	1.50		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
1.6	250	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.6	150	0.0100	4.26	185.66	**Channel Flow,** Area= 43.6 sf Perim= 87.1' r= 0.50' n= 0.022 Earth, clean & straight
3.3	500	Total			

Subcatchment PDA3: Cell 3



Summary for Subcatchment PDA4:

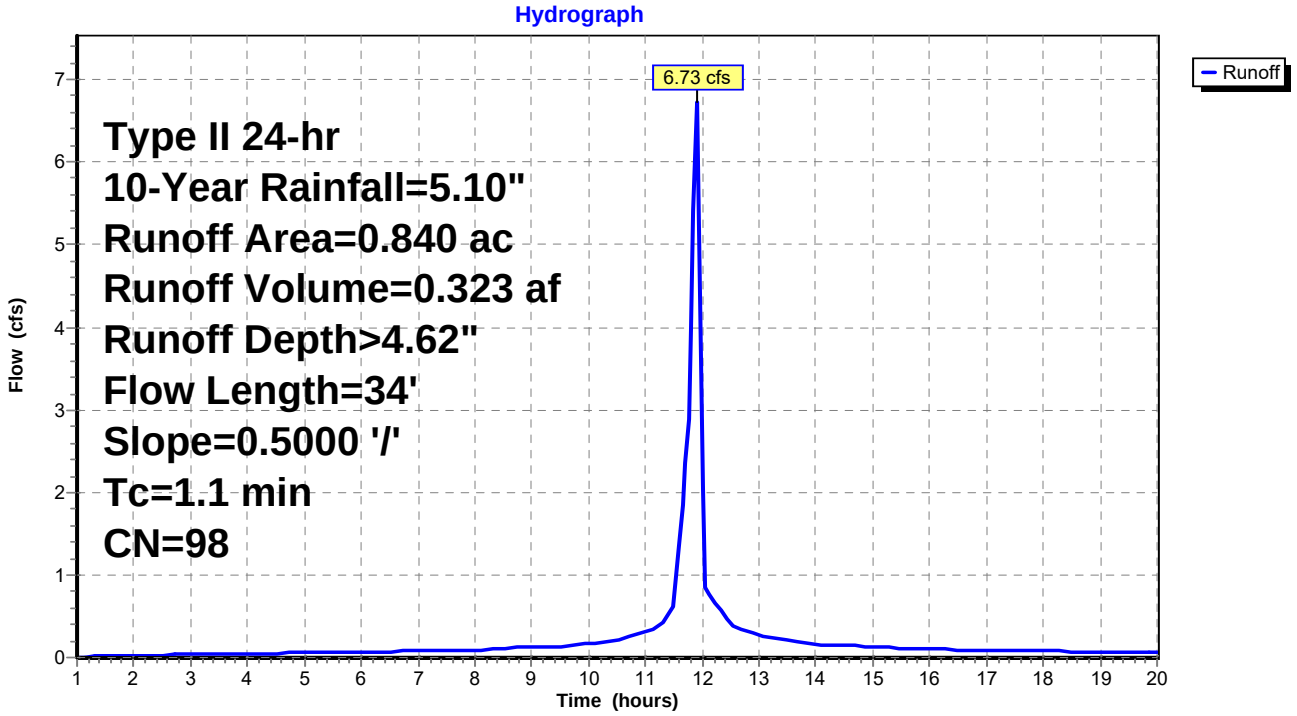
Runoff = 6.73 cfs @ 11.90 hrs, Volume= 0.323 af, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
0.840	98	Water Surface, HSG C
0.840		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	34	0.5000	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PDA4:



Summary for Pond C1: Culvert

Inflow Area = 18.720 ac, 0.00% Impervious, Inflow Depth > 3.84" for 10-Year event
Inflow = 122.04 cfs @ 11.96 hrs, Volume= 5.987 af
Outflow = 104.41 cfs @ 12.00 hrs, Volume= 5.986 af, Atten= 14%, Lag= 2.6 min
Primary = 104.41 cfs @ 12.00 hrs, Volume= 5.986 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 34.69' @ 12.00 hrs Surf.Area= 7,594 sf Storage= 11,826 cf
Flood Elev= 35.30' Surf.Area= 9,822 sf Storage= 17,098 cf

Plug-Flow detention time= 0.7 min calculated for 5.986 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (749.4 - 748.7)

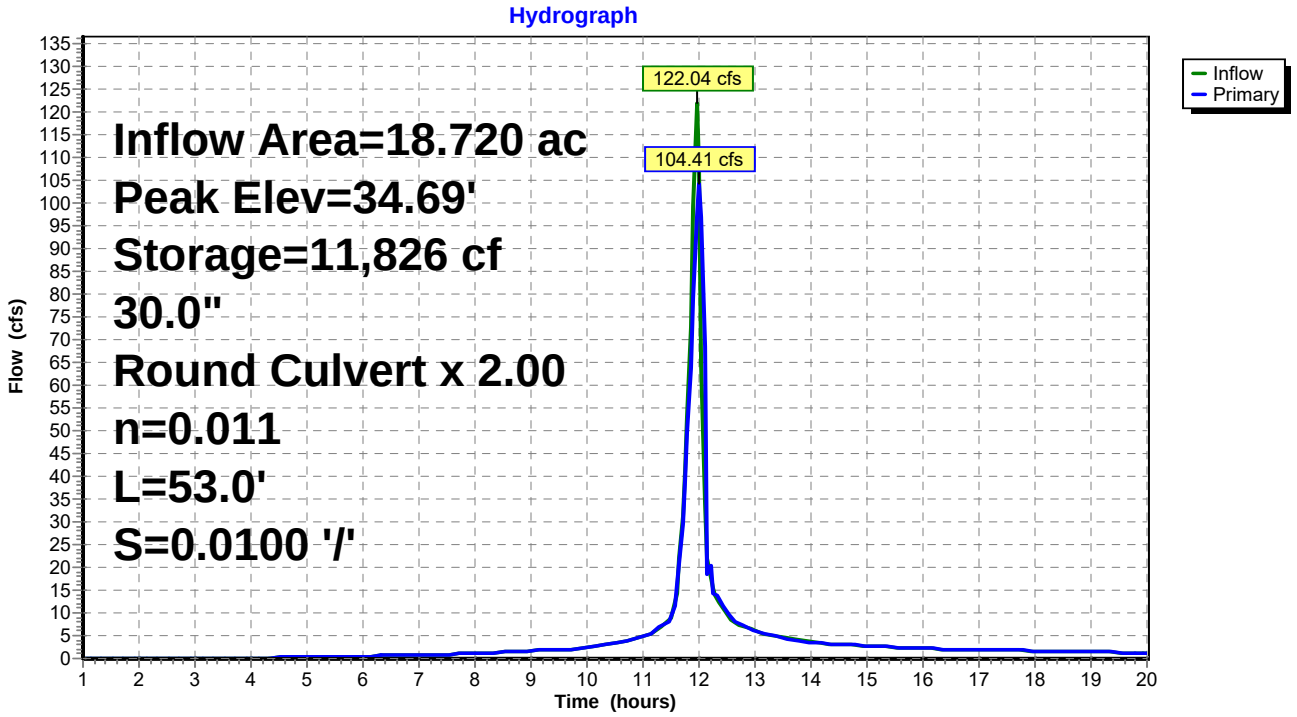
Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	24,875 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
30.00	0	0	0
32.00	1,200	1,200	1,200
34.00	5,039	6,239	7,439
35.00	8,718	6,879	14,318
36.00	12,397	10,558	24,875

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	**30.0" Round Culvert X 2.00** L= 53.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 30.00' / 29.47' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 4.91 sf

Primary OutFlow Max=104.32 cfs @ 12.00 hrs HW=34.69' (Free Discharge)
1=Culvert (Barrel Controls 104.32 cfs @ 10.63 fps)

Pond C1: Culvert



Summary for Pond P1: Pond 1

Inflow Area = 20.570 ac, 8.99% Impervious, Inflow Depth > 3.91" for 10-Year event
Inflow = 111.17 cfs @ 11.98 hrs, Volume= 6.698 af
Outflow = 35.96 cfs @ 12.14 hrs, Volume= 5.631 af, Atten= 68%, Lag= 10.1 min
Primary = 35.96 cfs @ 12.14 hrs, Volume= 5.631 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 25.40' Surf.Area= 31,130 sf Storage= 41,957 cf
Peak Elev= 29.27' @ 12.14 hrs Surf.Area= 37,761 sf Storage= 175,170 cf (133,213 cf above start)
Flood Elev= 29.30' Surf.Area= 37,812 sf Storage= 176,236 cf (134,278 cf above start)

Plug-Flow detention time= 143.7 min calculated for 4.656 af (70% of inflow)
Center-of-Mass det. time= 54.4 min (799.5 - 745.1)

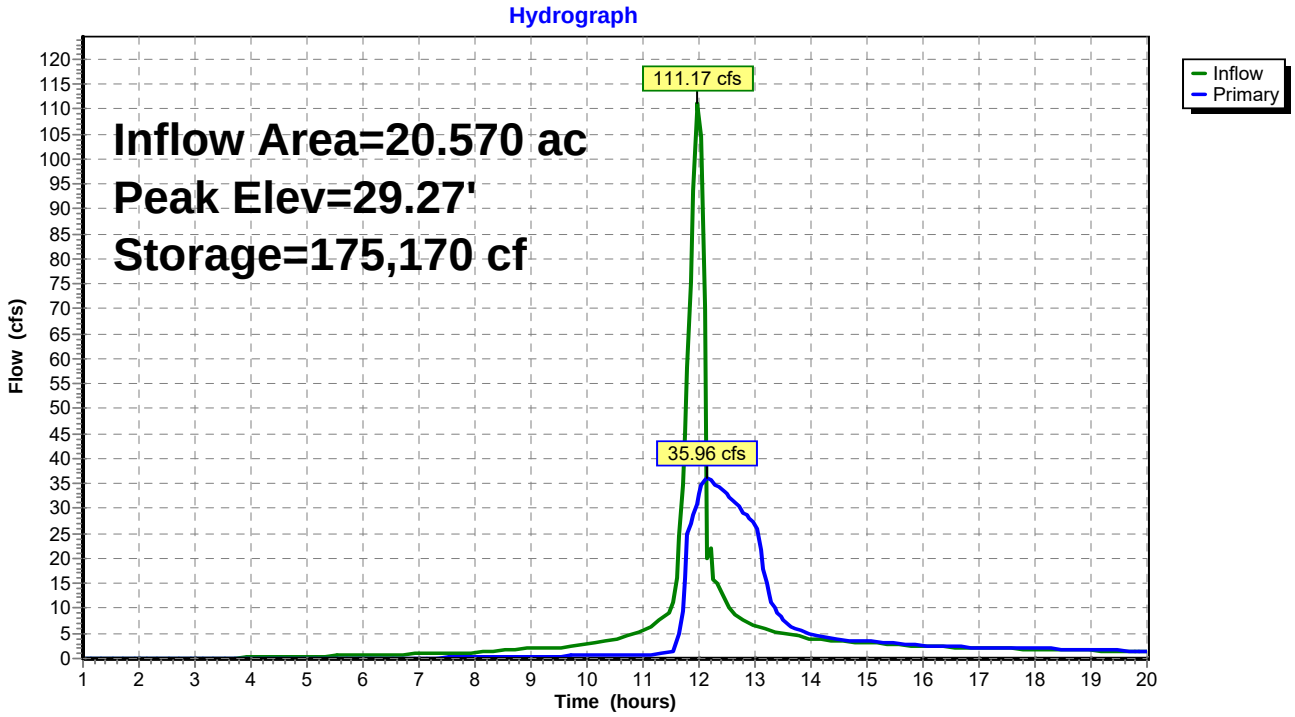
Volume	Invert	Avail.Storage	Storage Description
#1	24.00'	203,139 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
24.00	28,828	0	0
24.70	29,960	20,576	20,576
25.40	31,130	21,381	41,957
26.00	32,123	18,976	60,933
26.80	33,465	26,235	87,168
28.00	35,532	41,398	128,567
29.00	37,279	36,406	164,972
30.00	39,054	38,167	203,139

Device	Routing	Invert	Outlet Devices
#1	Primary	24.04'	**24.0" Round RCP_Round** L= 90.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 24.04' / 23.40' S= 0.0071 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	25.40'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	26.80'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=35.93 cfs @ 12.14 hrs HW=29.27' (Free Discharge)
└─**1=RCP_Round** (Barrel Controls 35.93 cfs @ 11.44 fps)
  ├─**2=Orifice/Grate** (Passes < 1.80 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 120.98 cfs potential flow)

Pond P1: Pond 1



Summary for Pond P2: Pond 2

Inflow Area = 10.600 ac, 7.92% Impervious, Inflow Depth > 3.90" for 10-Year event
Inflow = 75.57 cfs @ 11.93 hrs, Volume= 3.446 af
Outflow = 32.50 cfs @ 12.02 hrs, Volume= 2.954 af, Atten= 57%, Lag= 5.6 min
Primary = 32.50 cfs @ 12.02 hrs, Volume= 2.954 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 35.10' Surf.Area= 11,712 sf Storage= 20,854 cf
Peak Elev= 38.62' @ 12.02 hrs Surf.Area= 18,014 sf Storage= 72,991 cf (52,137 cf above start)
Flood Elev= 39.00' Surf.Area= 18,724 sf Storage= 80,041 cf (59,187 cf above start)

Plug-Flow detention time= 123.8 min calculated for 2.468 af (72% of inflow)
Center-of-Mass det. time= 39.6 min (782.8 - 743.2)

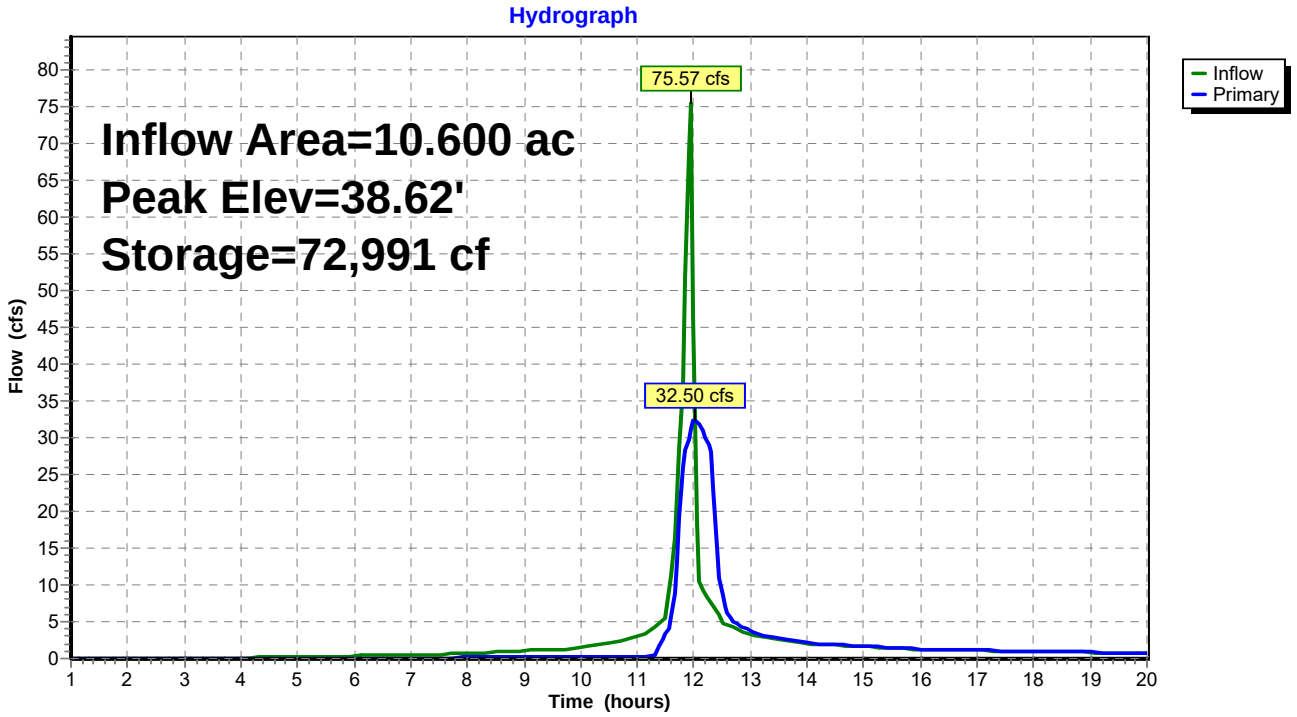
Volume	Invert	Avail.Storage	Storage Description
#1	33.00'	99,709 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

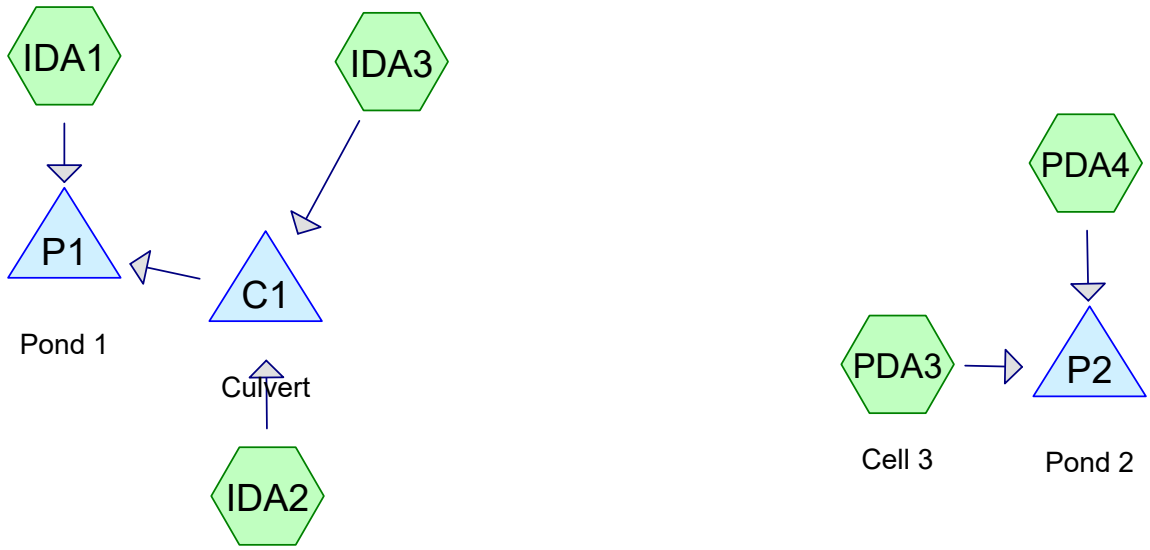
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.00	8,168	0	0
34.00	9,838	9,003	9,003
34.10	10,006	992	9,995
35.10	11,712	10,859	20,854
36.00	13,282	11,247	32,101
36.70	14,524	9,732	41,834
38.00	16,874	20,409	62,242
39.00	18,724	17,799	80,041
40.00	20,612	19,668	99,709

Device	Routing	Invert	Outlet Devices
#1	Primary	33.00'	**24.0" Round Culvert** L= 58.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 33.00' / 26.00' S= 0.1207 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	35.10'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	36.70'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=32.37 cfs @ 12.02 hrs HW=38.58' (Free Discharge)
└**1=Culvert** (Inlet Controls 32.37 cfs @ 10.30 fps)
  ├**2=Orifice/Grate** (Passes < 0.43 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 105.64 cfs potential flow)

Pond P2: Pond 2





Subcat Reach Pond Link

Routing Diagram for ME1400 ESC
Prepared by {enter your company name here}, Printed 8/10/2017
HydroCAD® 10.00-18 s/n 00663 © 2016 HydroCAD Software Solutions LLC

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment IDA1: Runoff Area=1.850 ac 100.00% Impervious Runoff Depth>4.62"
Flow Length=48' Tc=1.6 min CN=98 Runoff=14.48 cfs 0.712 af

Subcatchment IDA2: Runoff Area=10.590 ac 0.00% Impervious Runoff Depth>3.84"
Flow Length=1,690' Tc=6.8 min CN=91 Runoff=67.89 cfs 3.386 af

Subcatchment IDA3: Runoff Area=8.130 ac 0.00% Impervious Runoff Depth>3.84"
Flow Length=875' Tc=4.1 min CN=91 Runoff=56.96 cfs 2.601 af

Subcatchment PDA3: Cell 3 Runoff Area=9.760 ac 0.00% Impervious Runoff Depth>3.84"
Flow Length=500' Tc=3.3 min CN=91 Runoff=69.71 cfs 3.123 af

Subcatchment PDA4: Runoff Area=0.840 ac 100.00% Impervious Runoff Depth>4.62"
Flow Length=34' Slope=0.5000 '/' Tc=1.1 min CN=98 Runoff=6.73 cfs 0.323 af

Pond C1: Culvert Peak Elev=34.69' Storage=11,826 cf Inflow=122.04 cfs 5.987 af
30.0" Round Culvert x 2.00 n=0.011 L=53.0' S=0.0100 '/' Outflow=104.41 cfs 5.986 af

Pond P1: Pond 1 Peak Elev=29.33' Storage=177,430 cf Inflow=111.17 cfs 6.698 af
Outflow=36.24 cfs 5.591 af

Pond P2: Pond 2 Peak Elev=38.62' Storage=73,081 cf Inflow=75.57 cfs 3.446 af
Outflow=32.52 cfs 2.948 af

Total Runoff Area = 31.170 ac Runoff Volume = 10.145 af Average Runoff Depth = 3.91"
91.37% Pervious = 28.480 ac 8.63% Impervious = 2.690 ac

Summary for Subcatchment IDA1:

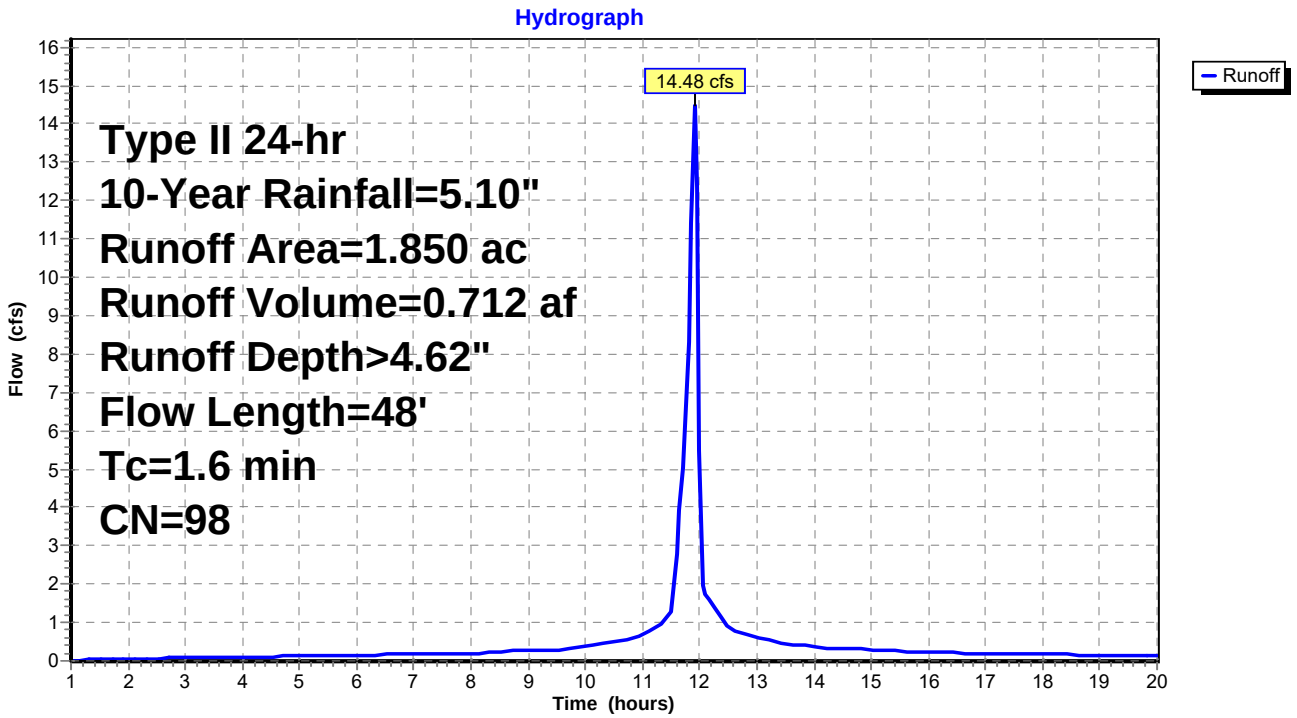
Runoff = 14.48 cfs @ 11.90 hrs, Volume= 0.712 af, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
1.850	98	Water Surface, HSG C
1.850		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	18	0.0100	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
1.2	30	0.3670	0.43		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.6	48	Total			

Subcatchment IDA1:



Summary for Subcatchment IDA2:

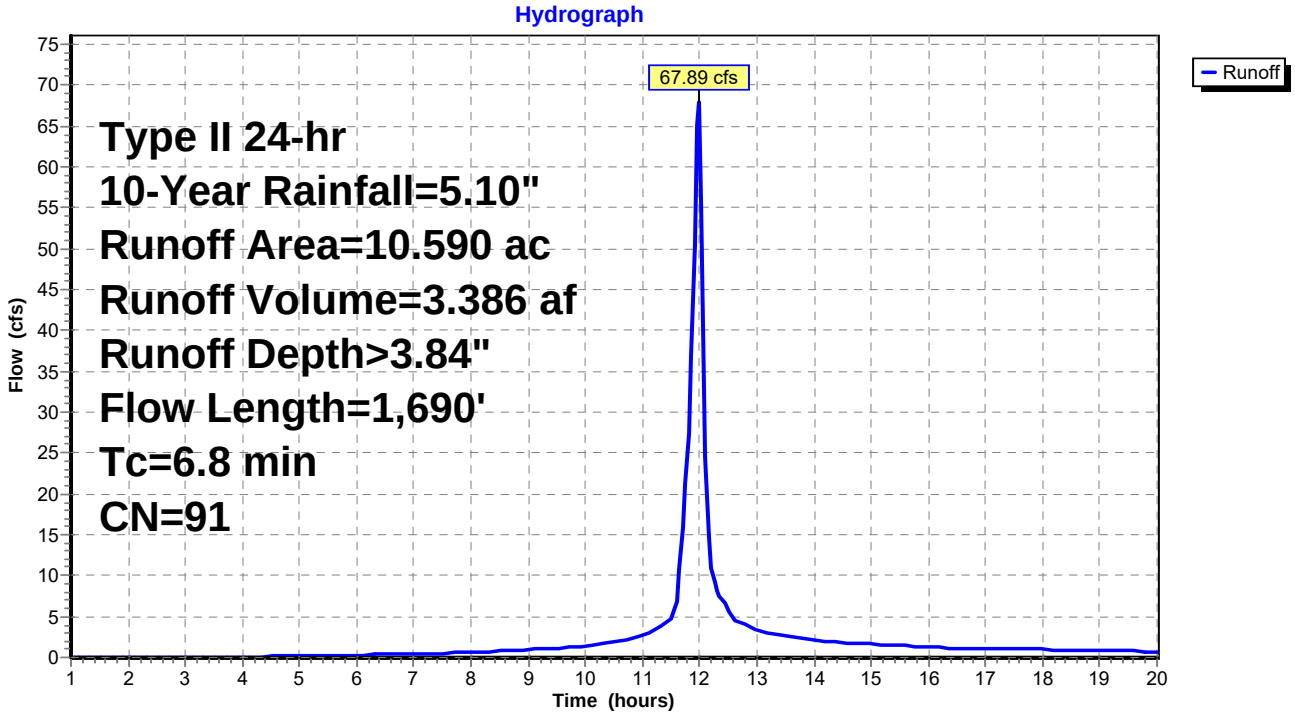
Runoff = 67.89 cfs @ 11.98 hrs, Volume= 3.386 af, Depth> 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
10.590	91	Newly graded area, HSG C
10.590		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.1400	0.89		**Sheet Flow,** Fallow n= 0.050 P2= 3.20"
1.6	280	0.0320	2.88		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.3	1,310	0.0100	6.54	78.46	**Channel Flow,** Area= 12.0 sf Perim= 12.6' r= 0.95' n= 0.022 Earth, clean & straight
6.8	1,690	Total			

Subcatchment IDA2:



Summary for Subcatchment IDA3:

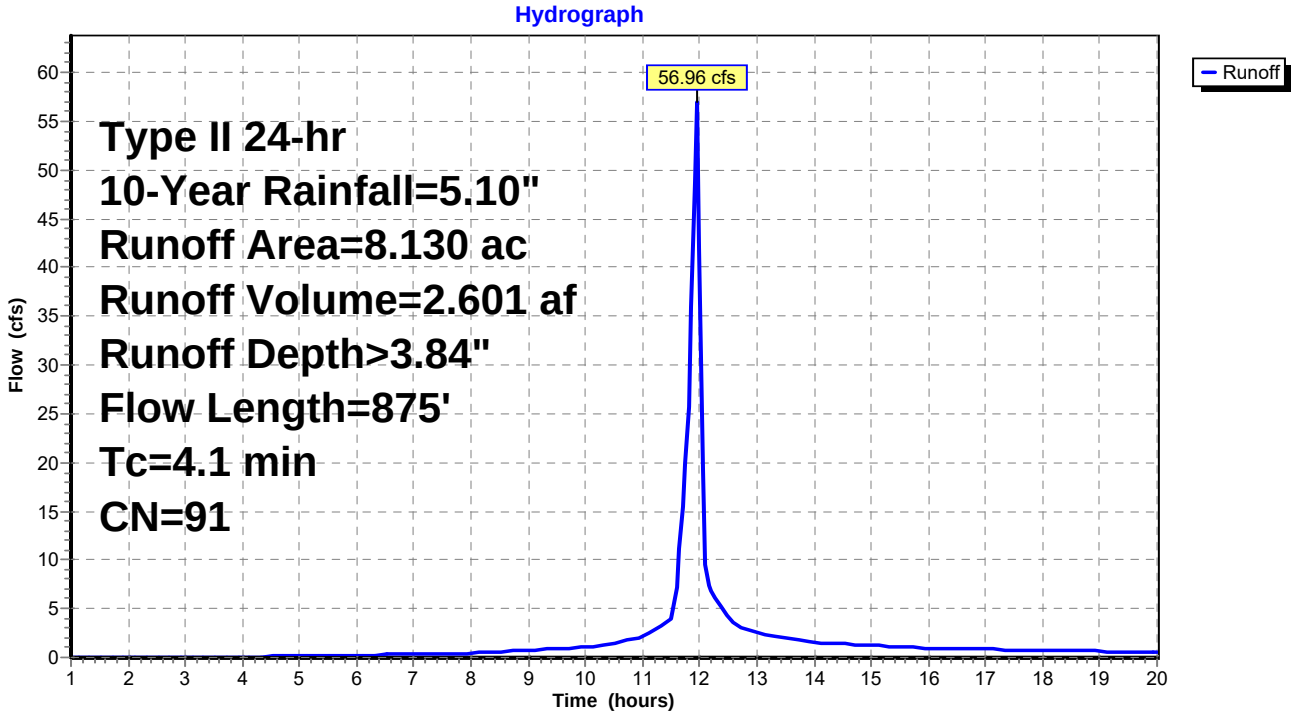
Runoff = 56.96 cfs @ 11.94 hrs, Volume= 2.601 af, Depth> 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
8.130	91	Newly graded area, HSG C
8.130		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.5000	1.48		**Sheet Flow,** Fallow n= 0.050 P2= 3.20"
0.1	35	0.5000	11.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.9	740	0.0050	4.21	50.52	**Channel Flow,** Area= 12.0 sf Perim= 14.5' r= 0.83' n= 0.022 Earth, clean & straight
4.1	875	Total			

Subcatchment IDA3:



Summary for Subcatchment PDA3: Cell 3

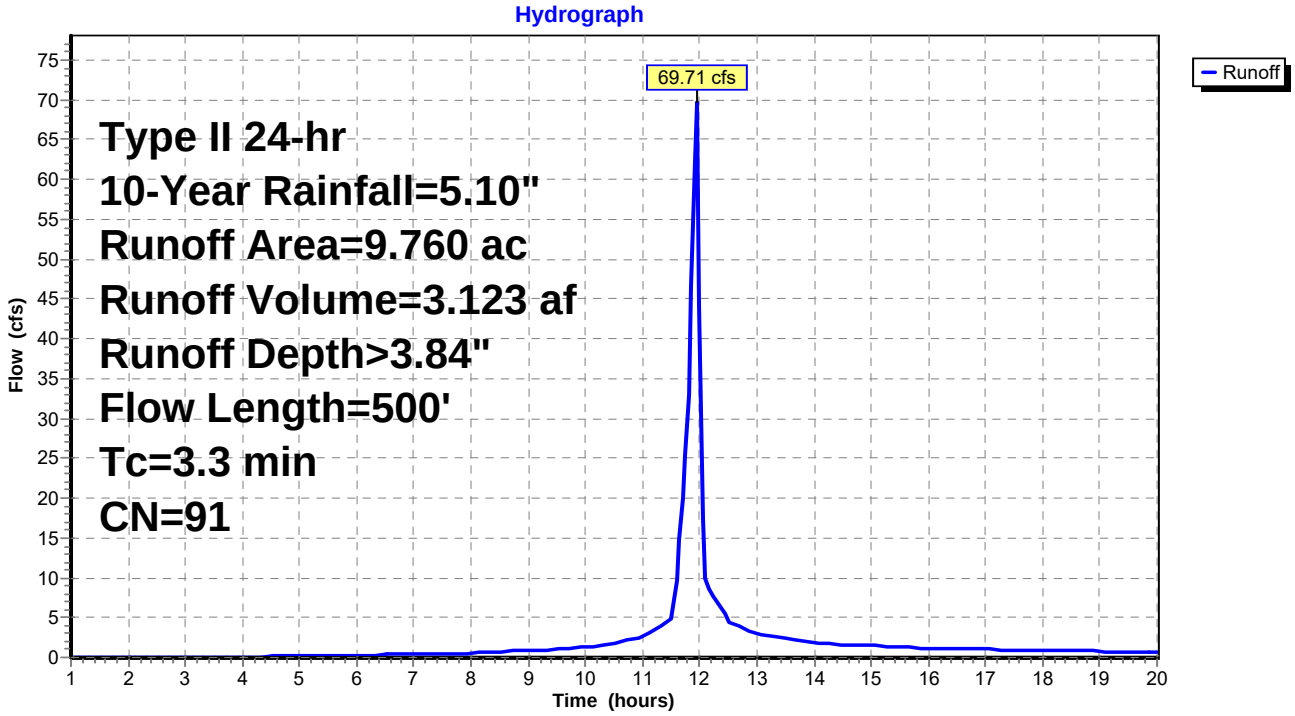
Runoff = 69.71 cfs @ 11.94 hrs, Volume= 3.123 af, Depth> 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
9.760	91	Newly graded area, HSG C
9.760		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0250	1.50		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
1.6	250	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.6	150	0.0100	4.26	185.66	**Channel Flow,** Area= 43.6 sf Perim= 87.1' r= 0.50' n= 0.022 Earth, clean & straight
3.3	500	Total			

Subcatchment PDA3: Cell 3



Summary for Subcatchment PDA4:

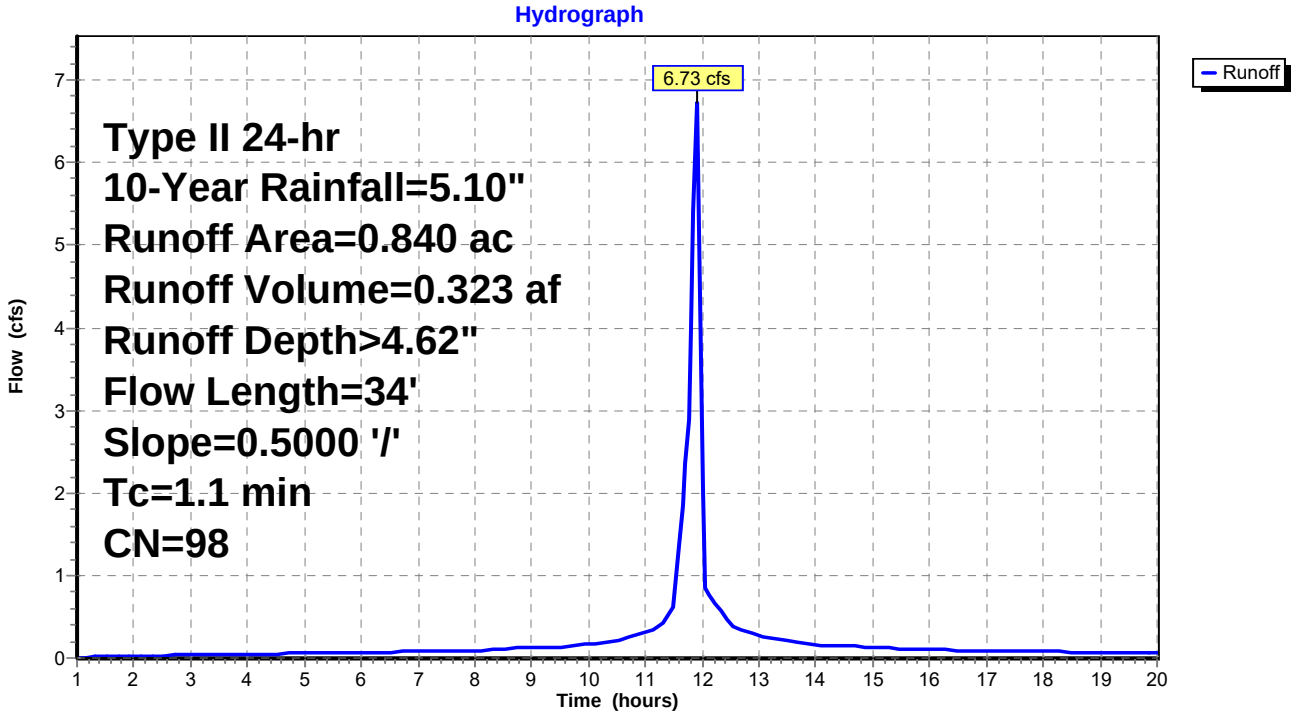
Runoff = 6.73 cfs @ 11.90 hrs, Volume= 0.323 af, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.10"

Area (ac)	CN	Description
0.840	98	Water Surface, HSG C
0.840		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	34	0.5000	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PDA4:



Summary for Pond C1: Culvert

Inflow Area = 18.720 ac, 0.00% Impervious, Inflow Depth > 3.84" for 10-Year event
Inflow = 122.04 cfs @ 11.96 hrs, Volume= 5.987 af
Outflow = 104.41 cfs @ 12.00 hrs, Volume= 5.986 af, Atten= 14%, Lag= 2.6 min
Primary = 104.41 cfs @ 12.00 hrs, Volume= 5.986 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 34.69' @ 12.00 hrs Surf.Area= 7,594 sf Storage= 11,826 cf
Flood Elev= 35.30' Surf.Area= 9,822 sf Storage= 17,098 cf

Plug-Flow detention time= 0.7 min calculated for 5.986 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (749.4 - 748.7)

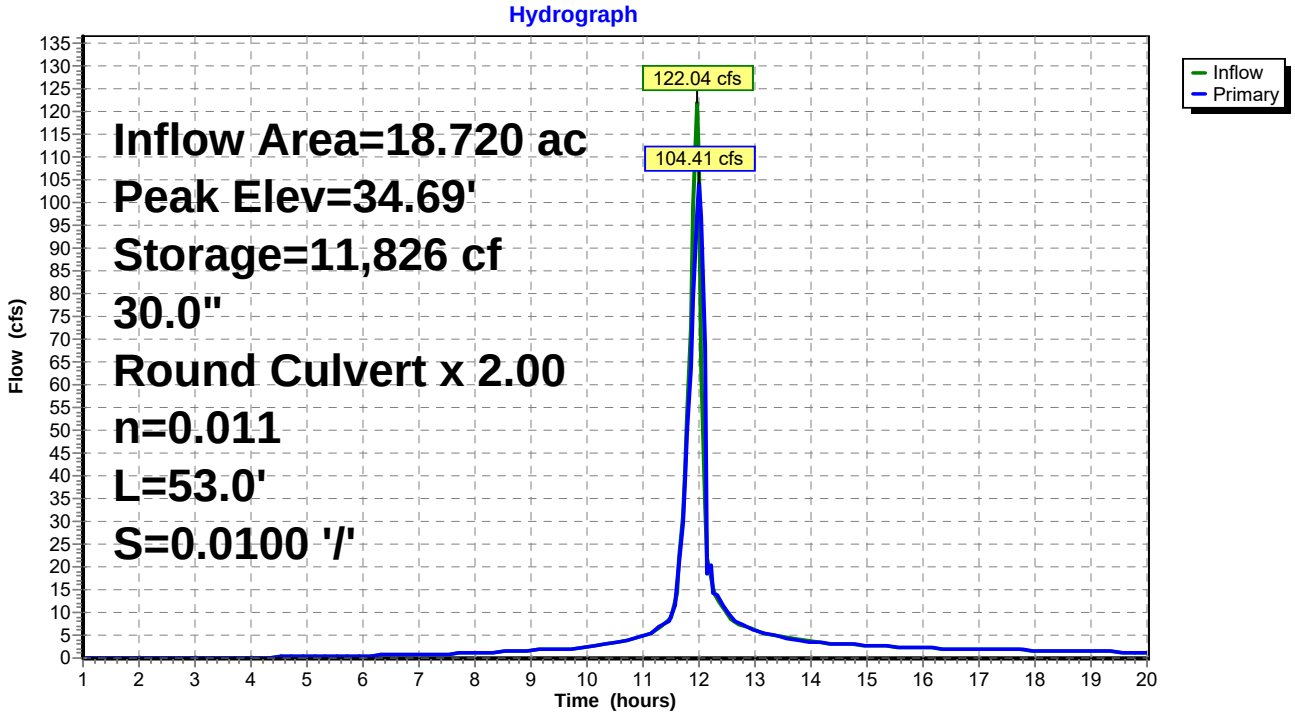
Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	24,875 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
30.00	0	0	0
32.00	1,200	1,200	1,200
34.00	5,039	6,239	7,439
35.00	8,718	6,879	14,318
36.00	12,397	10,558	24,875

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	**30.0" Round Culvert X 2.00** L= 53.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 30.00' / 29.47' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 4.91 sf

Primary OutFlow Max=104.32 cfs @ 12.00 hrs HW=34.69' (Free Discharge)
1=Culvert (Barrel Controls 104.32 cfs @ 10.63 fps)

Pond C1: Culvert



Summary for Pond P1: Pond 1

Inflow Area = 20.570 ac, 8.99% Impervious, Inflow Depth > 3.91" for 10-Year event
Inflow = 111.17 cfs @ 11.98 hrs, Volume= 6.698 af
Outflow = 36.24 cfs @ 12.14 hrs, Volume= 5.591 af, Atten= 67%, Lag= 10.0 min
Primary = 36.24 cfs @ 12.14 hrs, Volume= 5.591 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 25.40' Surf.Area= 31,130 sf Storage= 41,957 cf
Peak Elev= 29.33' @ 12.14 hrs Surf.Area= 37,868 sf Storage= 177,430 cf (135,472 cf above start)
Flood Elev= 29.30' Surf.Area= 37,812 sf Storage= 176,236 cf (134,278 cf above start)

Plug-Flow detention time= 144.3 min calculated for 4.615 af (69% of inflow)
Center-of-Mass det. time= 58.4 min (803.5 - 745.1)

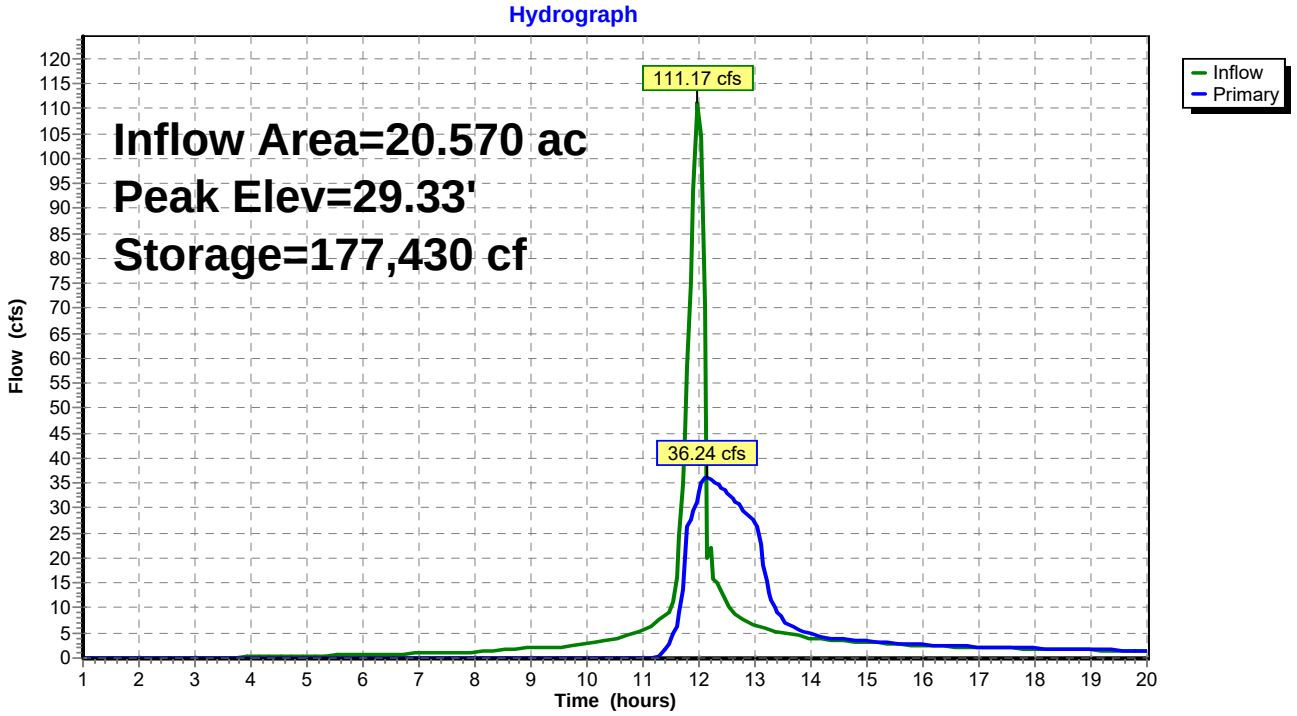
Volume	Invert	Avail.Storage	Storage Description
#1	24.00'	203,139 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
24.00	28,828	0	0
24.70	29,960	20,576	20,576
25.40	31,130	21,381	41,957
26.00	32,123	18,976	60,933
26.80	33,465	26,235	87,168
28.00	35,532	41,398	128,567
29.00	37,279	36,406	164,972
30.00	39,054	38,167	203,139

Device	Routing	Invert	Outlet Devices
#1	Primary	24.04'	**24.0" Round RCP_Round** L= 90.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 24.04' / 23.40' S= 0.0071 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	25.40'	**6.0" Vert. Orifice/Grate X 0.00** C= 0.600
#3	Device 1	26.80'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=36.21 cfs @ 12.14 hrs HW=29.33' (Free Discharge)
└─**1=RCP_Round** (Barrel Controls 36.21 cfs @ 11.53 fps)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Passes 36.21 cfs of 122.42 cfs potential flow)

Pond P1: Pond 1



Summary for Pond P2: Pond 2

Inflow Area = 10.600 ac, 7.92% Impervious, Inflow Depth > 3.90" for 10-Year event
Inflow = 75.57 cfs @ 11.93 hrs, Volume= 3.446 af
Outflow = 32.52 cfs @ 12.02 hrs, Volume= 2.948 af, Atten= 57%, Lag= 5.6 min
Primary = 32.52 cfs @ 12.02 hrs, Volume= 2.948 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 35.10' Surf.Area= 11,712 sf Storage= 20,854 cf
Peak Elev= 38.62' @ 12.02 hrs Surf.Area= 18,023 sf Storage= 73,081 cf (52,227 cf above start)
Flood Elev= 39.00' Surf.Area= 18,724 sf Storage= 80,041 cf (59,187 cf above start)

Plug-Flow detention time= 123.9 min calculated for 2.462 af (71% of inflow)
Center-of-Mass det. time= 42.7 min (785.9 - 743.2)

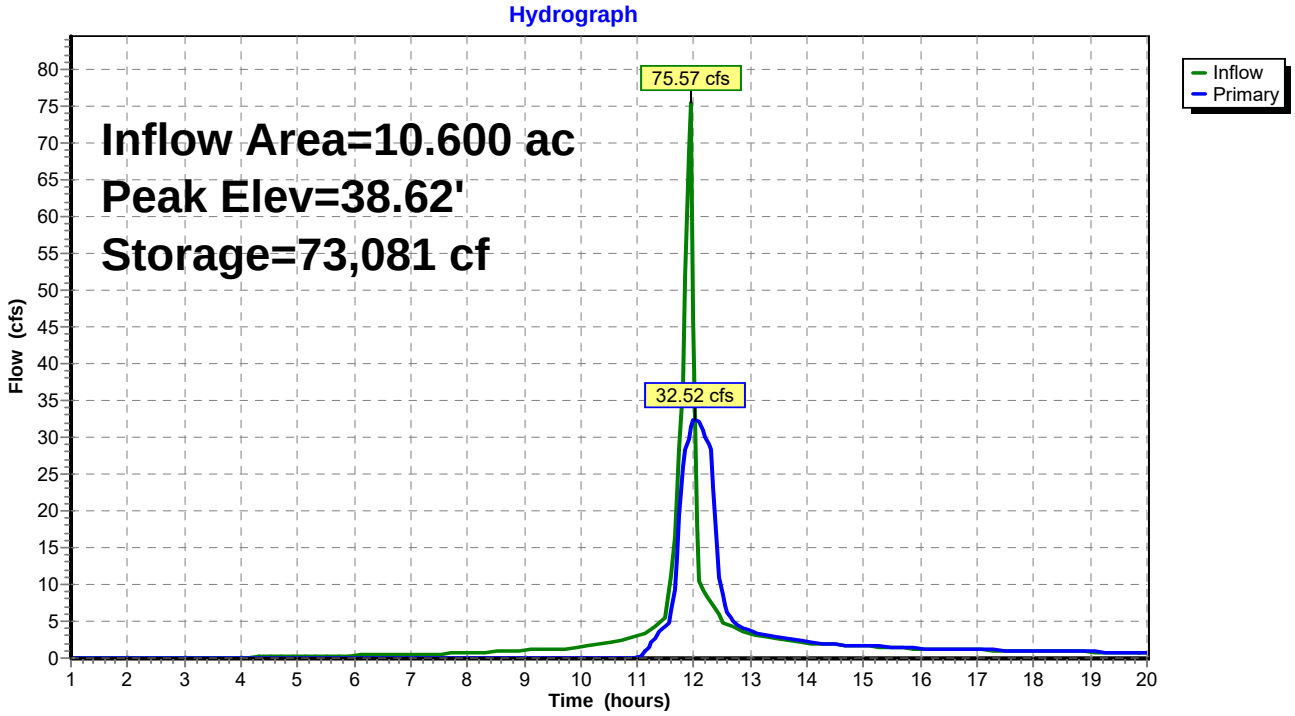
Volume	Invert	Avail.Storage	Storage Description
#1	33.00'	99,709 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.00	8,168	0	0
34.00	9,838	9,003	9,003
34.10	10,006	992	9,995
35.10	11,712	10,859	20,854
36.00	13,282	11,247	32,101
36.70	14,524	9,732	41,834
38.00	16,874	20,409	62,242
39.00	18,724	17,799	80,041
40.00	20,612	19,668	99,709

Device	Routing	Invert	Outlet Devices
#1	Primary	33.00'	**24.0" Round Culvert** L= 58.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 33.00' / 26.00' S= 0.1207 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	35.10'	**3.0" Vert. Orifice/Grate X 0.00** C= 0.600
#3	Device 1	36.70'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=32.39 cfs @ 12.02 hrs HW=38.59' (Free Discharge)
└**1=Culvert** (Inlet Controls 32.39 cfs @ 10.31 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Passes 32.39 cfs of 105.78 cfs potential flow)

Pond P2: Pond 2



Appendix K

Reduced Size Drawing Set

CELL 3 CONSTRUCTION DRAWINGS

LOT 15 LANDFILL
BALTIMORE, MARYLAND

DECEMBER 2017

SOURCE: GOOGLE MAPS, 2017

APPROXIMATE SCALE: 1" = 1000'

VICINITY MAP

LIST OF DRAWINGS

DRAWING NO.	DESCRIPTION
1	COVER SHEET
2	EXISTING SITE CONDITIONS
3	SITE DEVELOPMENT PLAN
4	BASE GRADING PLAN
5	LEACHATE TRANSMISSION PLAN
6	LINER SYSTEM DETAILS
7	LEACHATE SUMP AND RISER PLAN
8	LEACHATE SUMP AND RISER SECTIONS
9	LEACHATE COLLECTION SYSTEM DETAILS
10	FUTURE FINAL GRADES
11	EROSION AND SEDIMENT CONTROL EXISTING CONDITIONS DRAINAGE AREA MAP
12	EROSION AND SEDIMENT CONTROL INTERMEDIATE CONDITIONS DRAINAGE AREA MAP
13	EROSION AND SEDIMENT CONTROL PROPOSED CONDITIONS DRAINAGE AREA MAP
14	EROSION AND SEDIMENT CONTROL PLAN
15	SEDIMENT BASIN 1 PLAN
16	SEDIMENT BASIN 2 PLAN
17	EROSION AND SEDIMENT CONTROL DETAILS I
18	EROSION AND SEDIMENT CONTROL DETAILS II
19	EROSION AND SEDIMENT CONTROL NOTES I
20	EROSION AND SEDIMENT CONTROL NOTES II
21	EROSION AND SEDIMENT CONTROL NOTES III
22	ELECTRICAL - COVER SHEET
23	ELECTRICAL - SITE PLAN
24	ELECTRICAL - ENLARGED PARTIAL SITE PLAN
25	ELECTRICAL - ENLARGED PARTIAL SITE PLANS
26	ELECTRICAL - SINGLE LINE DIAGRAMS & DETAILS
27	ELECTRICAL - SCHEDULES AND DETAILS
28	ELECTRICAL - MAINTENANCE BUILDING FLOOR PLAN & SCHEDULES
29	ELECTRICAL - SCHEDULES AND DETAILS
30	MAINTENANCE BUILDING STRUCTURAL DRAWING 1
31	MAINTENANCE BUILDING STRUCTURAL DRAWING 2
32	MAINTENANCE BUILDING STRUCTURAL DRAWING 3
33	MAINTENANCE BUILDING STRUCTURAL DRAWING 4

PREPARED FOR:

TALEN ENERGY
1005 BRANDON SHORES ROAD, SUITE 100
BALTIMORE, MARYLAND 21226

PREPARED BY:

GEOSYNTEC CONSULTANTS
10221 WINCOPIN CIRCLE, FLOOR 4
COLUMBIA, MARYLAND 21044
PHONE: (410) 381-4333

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

REV	DATE	DESCRIPTION	DRN	APP

ENGINEER
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OWNER / DEVELOPER / APPLICANT
TALEN ENERGY
BRANDON SHORES ROAD, SUITE 100
BALTIMORE, MARYLAND 21226 USA
CONTACT: BRIAN HOYT
PHONE: 410.787.6431

TITLE: COVER SHEET

PROJECT: CELL 3 CONSTRUCTION DRAWINGS

SITE: LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

PROFESSIONAL CERTIFICATION:

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND,
LICENSE No. 22181
EXPIRATION DATE 12-2-2018

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE
DECEMBER 15, 2017
DATE

STATE OF MARYLAND — ROBERT D. ESPINOZA — REG. NO. 22181 — PROFESSIONAL ENGINEER

DESIGNED BY:	RDE	DATE:	DECEMBER 2017
DRAWN BY:	JSW	PROJECT NO.:	ME1400
CHECKED BY:	MEP	FILE:	1400-001
REVIEWED BY:	RDE	DRAWING NO.:	1 OF 33
APPROVED BY:			

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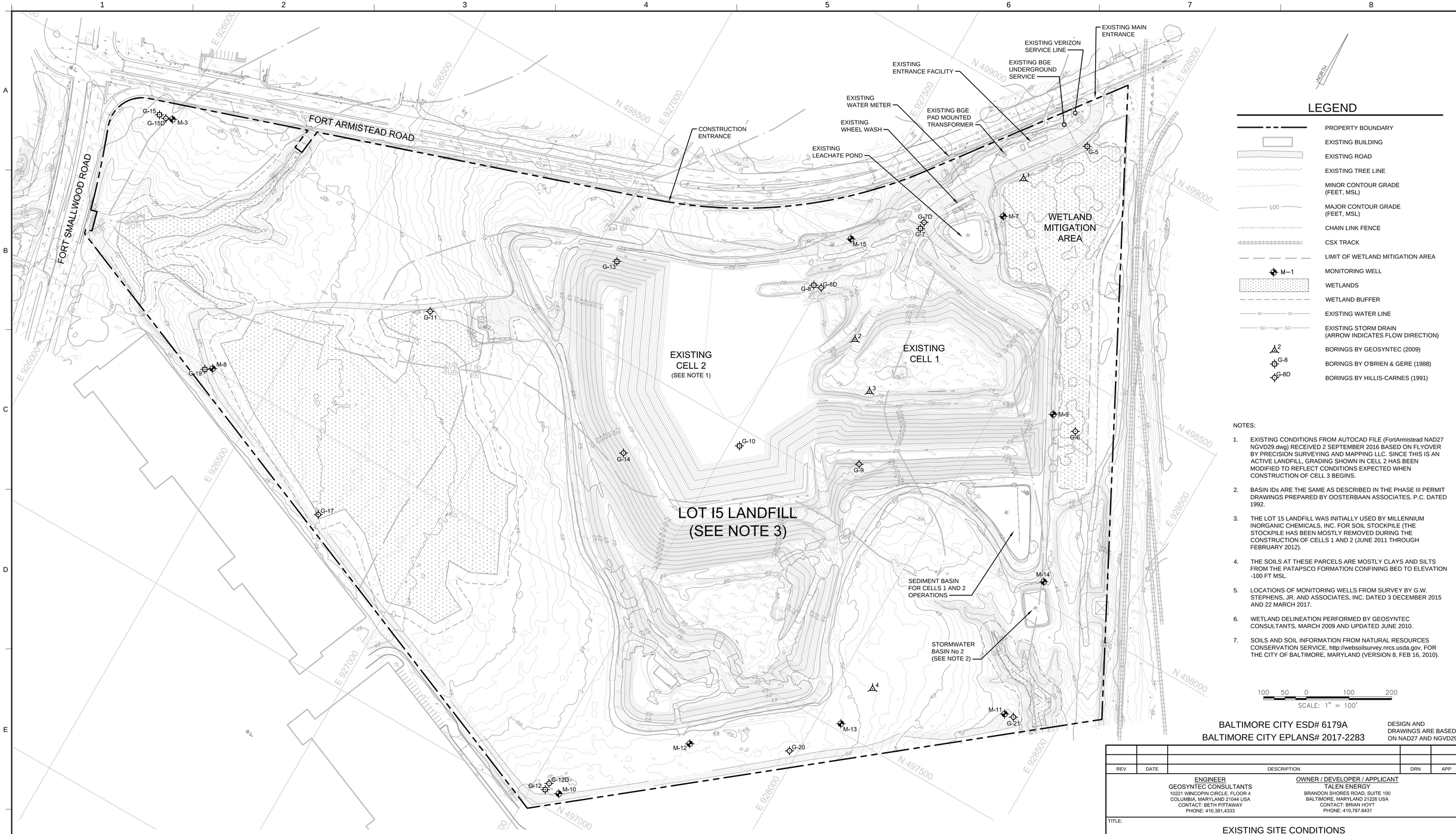

NORTH

LEGEND

- PROPERTY BOUNDARY
- EXISTING BUILDING
- EXISTING ROAD
- EXISTING TREE LINE
- MINOR CONTOUR GRADE (FEET, MSL)
- 100 — MAJOR CONTOUR GRADE (FEET, MSL)
- CHAIN LINK FENCE
- CSX TRACK
- LIMIT OF WETLAND MITIGATION AREA
- M–1 — MONITORING WELL
- WETLANDS
- WETLAND BUFFER
- W — W — EXISTING WATER LINE
- SD — SD — EXISTING STORM DRAIN (ARROW INDICATES FLOW DIRECTION)
- 2 — BORINGS BY GEOSYNTEC (2009)
- G-8 — BORINGS BY O'BRIEN & GERE (1988)
- G-8D — BORINGS BY HILLIS-CARNES (1991)

NOTES:

1. EXISTING CONDITIONS FROM AUTOCAD FILE (FortArmistead NAD27 NGVD29.dwg) RECEIVED 2 SEPTEMBER 2016 BASED ON FLYOVER BY PRECISION SURVEYING AND MAPPING LLC. SINCE THIS IS AN ACTIVE LANDFILL, GRADING SHOWN IN CELL 2 HAS BEEN MODIFIED TO REFLECT CONDITIONS EXPECTED WHEN CONSTRUCTION OF CELL 3 BEGINS.
2. BASIN IDs ARE THE SAME AS DESCRIBED IN THE PHASE III PERMIT DRAWINGS PREPARED BY OOSTERBAAN ASSOCIATES, P.C. DATED 1992.
3. THE LOT 15 LANDFILL WAS INITIALLY USED BY MILLENNIUM INORGANIC CHEMICALS, INC. FOR SOIL STOCKPILE (THE STOCKPILE HAS BEEN MOSTLY REMOVED DURING THE CONSTRUCTION OF CELLS 1 AND 2 (JUNE 2011 THROUGH FEBRUARY 2012).
4. THE SOILS AT THESE PARCELS ARE MOSTLY CLAYS AND SILTS FROM THE PATAPSCO FORMATION CONFINING BED TO ELEVATION -100 FT MSL.
5. LOCATIONS OF MONITORING WELLS FROM SURVEY BY G.W. STEPHENS, JR. AND ASSOCIATES, INC. DATED 3 DECEMBER 2015 AND 22 MARCH 2017.
6. WETLAND DELINEATION PERFORMED BY GEOSYNTEC CONSULTANTS, MARCH 2009 AND UPDATED JUNE 2010.
7. SOILS AND SOIL INFORMATION FROM NATURAL RESOURCES CONSERVATION SERVICE, http://websoilsurvey.nrcs.usda.gov, FOR THE CITY OF BALTIMORE, MARYLAND (VERSION 8, FEB 16, 2010).

100 50 0 100 200
SCALE: 1" = 100'

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

REV	DATE	DESCRIPTION	DRN	APP

ENGINEER
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CONTACT: BETH PITTAWAY
PHONE: 410.381.4333

OWNER / DEVELOPER / APPLICANT
TALEN ENERGY
BRANDON SHORES ROAD, SUITE 100
BALTIMORE, MARYLAND 21226 USA
CONTACT: BRIAN HOYT
PHONE: 410.787.6431

TITLE: EXISTING SITE CONDITIONS

PROJECT: CELL 3 CONSTRUCTION DRAWINGS

SITE: LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

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SIGNATURE
DECEMBER 15, 2017
DATE

STATE OF MARYLAND — R. DAVID ESPINOZA — 22181 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY:	RDE	DATE:	DECEMBER 2017
DRAWN BY:	JSW	PROJECT NO.:	ME1400
CHECKED BY:	MEP	FILE:	1400-002
REVIEWED BY:	RDE	DRAWING NO.:	2 OF 33
APPROVED BY:			

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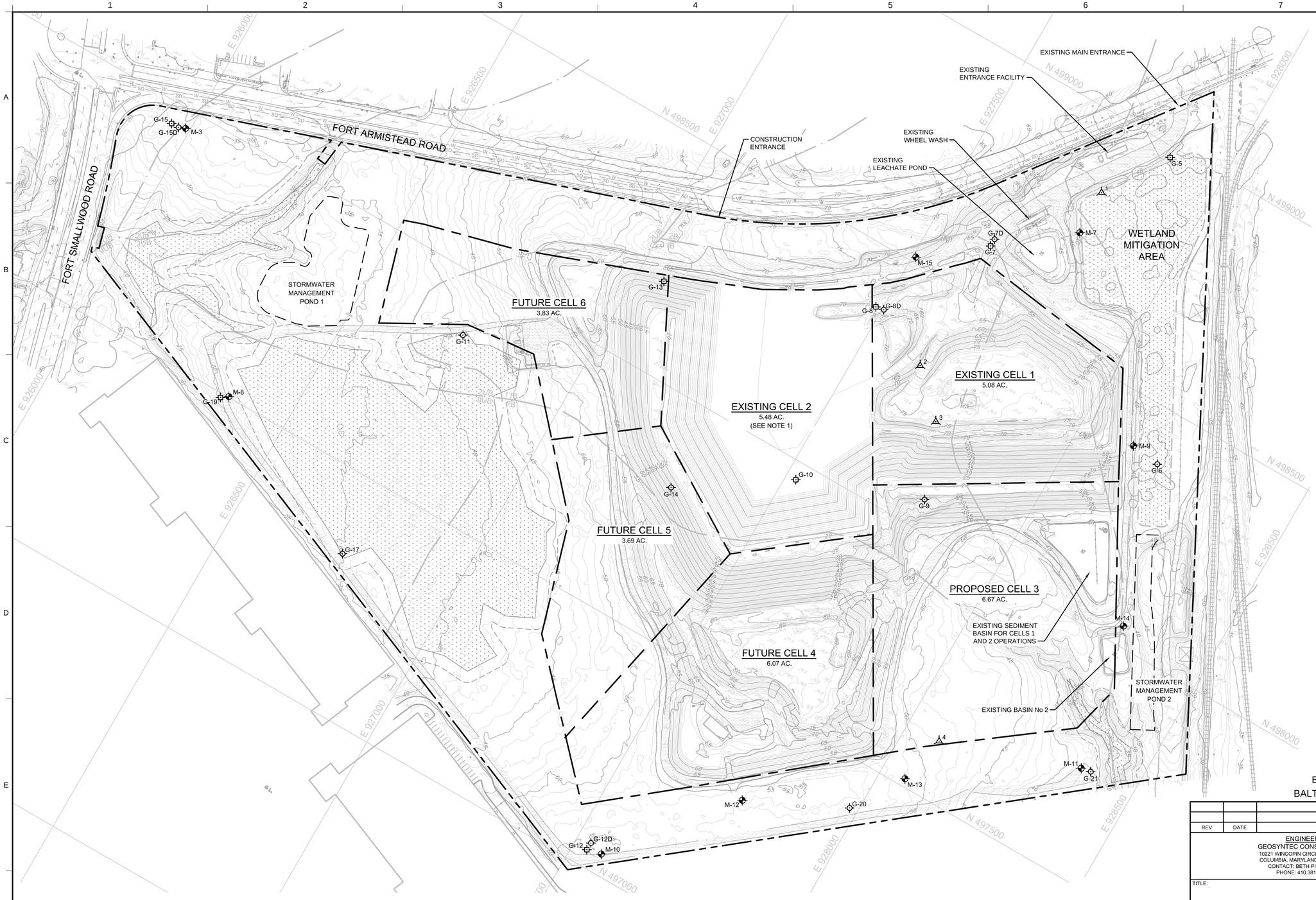

NORTH

LEGEND

- PROPERTY BOUNDARY
- EXISTING BUILDING
- EXISTING ROAD
- EXISTING TREE LINE
- MINOR CONTOUR GRADE (FEET, MSL)
- 100 MAJOR CONTOUR GRADE (FEET, MSL)
- CHAIN LINK FENCE
- CSX TRACK
- LIMIT OF WETLAND MITIGATION AREA
- M–1 MONITORING WELL
- WETLANDS
- WETLAND BUFFER
- PERMITTED DISPOSAL LIMIT
- PROPOSED CELL BOUNDARY
- PROPOSED STORMWATER MANAGEMENT FACILITIES
- 2 BORINGS BY GEOSYNTEC (2009)
- G-8 BORINGS BY O'BRIEN & GERE (1988)
- G-8D BORINGS BY HILLIS-CARNES (1991)

NOTES:

1. EXISTING CONDITIONS FROM AUTOCAD FILE (FortArmistead NAD27 NGVD29.dwg) RECEIVED 2 SEPTEMBER 2016 BASED ON FLYOVER BY PRECISION SURVEYING AND MAPPING LLC. SINCE THIS IS AN ACTIVE LANDFILL, GRADING SHOWN IN CELL 2 HAS BEEN MODIFIED TO REFLECT CONDITIONS EXPECTED WHEN CONSTRUCTION OF CELL 3 BEGINS.
2. PERMITTED DISPOSAL LIMIT AND PROPOSED CELL BOUNDARY FROM DRAWINGS ENTITLED APPLICATION FOR AN INDUSTRIAL LANDFILL PERMIT: PHASE III PERMIT DRAWINGS, FORT ARMISTEAD ROAD LOT 15 LANDFILL, BY GEOSYNTEC CONSULTANTS, DATED MARCH 2012.
3. LOCATIONS OF MONITORING WELLS FROM SURVEY BY G.W. STEPHENS, JR. AND ASSOCIATES, INC. DATED 3 DECEMBER 2015 AND 22 MARCH 2017.
4. WETLAND DELINEATION PERFORMED BY GEOSYNTEC CONSULTANTS, MARCH 2009 AND UPDATED JUNE 2010.

100 50 0 100 200
SCALE: 1" = 100'

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

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ENGINEER
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TALEN ENERGY
BRANDON SHORES ROAD, SUITE 100
BALTIMORE, MARYLAND 21226 USA
CONTACT: BRIAN HOYT
PHONE: 410.787.6431

TITLE: SITE DEVELOPMENT PLAN

PROJECT: CELL 3 CONSTRUCTION DRAWINGS

SITE: LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

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DATE

STATE OF MARYLAND · R. DAVID ESPINOZA · REGISTERED PROFESSIONAL ENGINEER

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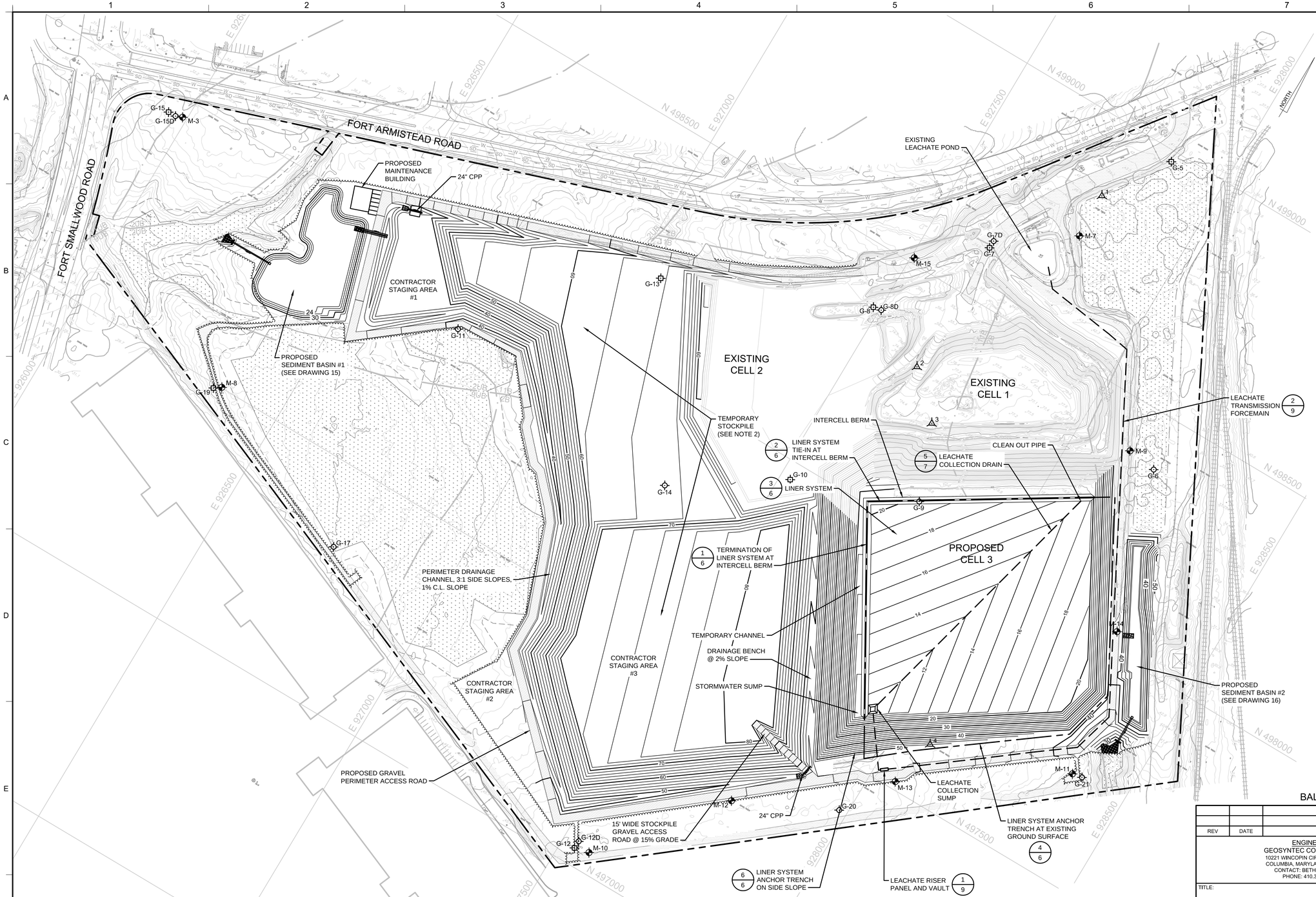
DRAWN BY:	JSW	PROJECT NO.:	ME1400
CHECKED BY:	MEP	FILE:	1400-003
REVIEWED BY:	RDE	DRAWING NO.:	3 OF 33
APPROVED BY:			



LEGEND

- PROPERTY BOUNDARY
- EXISTING BUILDING
- EXISTING ROAD
- EXISTING TREE LINE
- MINOR CONTOUR GRADE (FEET, MSL)
- 100 — MAJOR CONTOUR GRADE (FEET, MSL)
- CHAIN LINK FENCE
- CSX TRACK
- LIMIT OF WETLAND MITIGATION AREA
- M-1 — MONITORING WELL
- WETLANDS
- WETLAND BUFFER
- 12 / 10 — PROPOSED CONTOURS
- PROPOSED PERIMETER ROAD
- 2 — BORINGS BY GEOSYNTEC (2009)
- G-8 — BORINGS BY O'BRIEN & GERE (1988)
- G-8D — BORINGS BY HILLIS-CARNES (1991)

NOTES:

1. EXISTING CONDITIONS FROM AUTOCAD FILE (FortArmistead NAD27 NGVD29.dwg) RECEIVED 2 SEPTEMBER 2016 BASED ON FLYOVER BY PRECISION SURVEYING AND MAPPING LLC. SINCE THIS IS AN ACTIVE LANDFILL, GRADING SHOWN IN CELL 2 HAS BEEN MODIFIED TO REFLECT CONDITIONS EXPECTED WHEN CONSTRUCTION OF CELL 3 BEGINS.
2. EXCAVATED CLAY MATERIAL SHALL BE TESTED PRIOR TO STOCKPILING INTO THE CELL 4, 5, AND 6 AREA. REPRESENTATIVE SAMPLES SHALL BE COLLECTED FROM THE FIELD AND SENT TO THE LABORATORY TO PERFORM ATTERBERG LIMITS (3), UNCONSOLIDATED UNDRAINED (UU) SHEAR STRENGTH (3), STANDARD PROCTOR TESTS (3), AND A CONSOLIDATED UNDRAINED (1) SHEAR STRENGTH TEST. SAMPLES SHALL BE SELECTED BY ENGINEER. PRIOR TO PERFORMING SHEAR STRENGTH TESTS, SAMPLES SHALL BE COMPACTED TO 95% DRY DENSITY AT MOISTURE CONTENTS RANGING BETWEEN -4 +2 PERCENT OF THE OPTIMUM MOISTURE CONTENT. THE MINIMUM UNDRAINED SHEAR STRENGTH SHALL BE 1000 PSF.
3. CELLS 1 AND 2 WERE PERMITTED FOR CONSTRUCTION BY THE CITY OF BALTIMORE DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT, DIVISION OF CONSTRUCTION AND BUILDING INSPECTION ON JUNE 2, 2011, PERMIT NO. COM2011-11016.
4. LOCATIONS OF MONITORING WELLS FROM SURVEY BY G.W. STEPHENS, JR. AND ASSOCIATES, INC. DATED 3 DECEMBER 2015 AND 22 MARCH 2017.
5. WETLAND DELINEATION PERFORMED BY GEOSYNTEC CONSULTANTS, MARCH 2009 AND UPDATED JUNE 2010.
6. SOILS AND SOIL INFORMATION FROM NATURAL RESOURCES CONSERVATION SERVICE, http://websoilsurvey.nrcs.usda.gov, FOR THE CITY OF BALTIMORE, MARYLAND (VERSION 8, FEB 16, 2010).
7. STORMWATER MANAGEMENT CONCEPT WAS APPROVED BY THE CITY OF BALTIMORE, DEPARTMENT OF PUBLIC WORKS ON APRIL 25, 2012, ESD #6179.
8. AFTER SOUTHERN TEMPORARY STOCKPILE IS AT FINAL GRADE THE CONTRACTOR SHALL UTILIZE THE TOP FOR ADDITIONAL CONSTRUCTION STAGING. CONTRACTOR MUST MAINTAIN PROPER DRAINAGE AND EROSION CONTROLS ADJACENT TO ALL STAGING AREAS.

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

REV	DATE	DESCRIPTION	DRN	APP

ENGINEER
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CONTACT: BRIAN HOYT
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TITLE: BASE GRADING PLAN

PROJECT: CELL 3 CONSTRUCTION DRAWINGS

SITE: LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

PROFESSIONAL CERTIFICATION:

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SIGNATURE
DECEMBER 15, 2017
DATE

STATE OF MARYLAND — DAVID ESPINOZA — 22181 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY:	RDE	DATE:	DECEMBER 2017
DRAWN BY:	JSW	PROJECT NO.:	ME1400
CHECKED BY:	MEP	FILE:	1400-004
REVIEWED BY:	RDE	DRAWING NO.:	4 OF 33
APPROVED BY:			

SCALE: 1" = 100'

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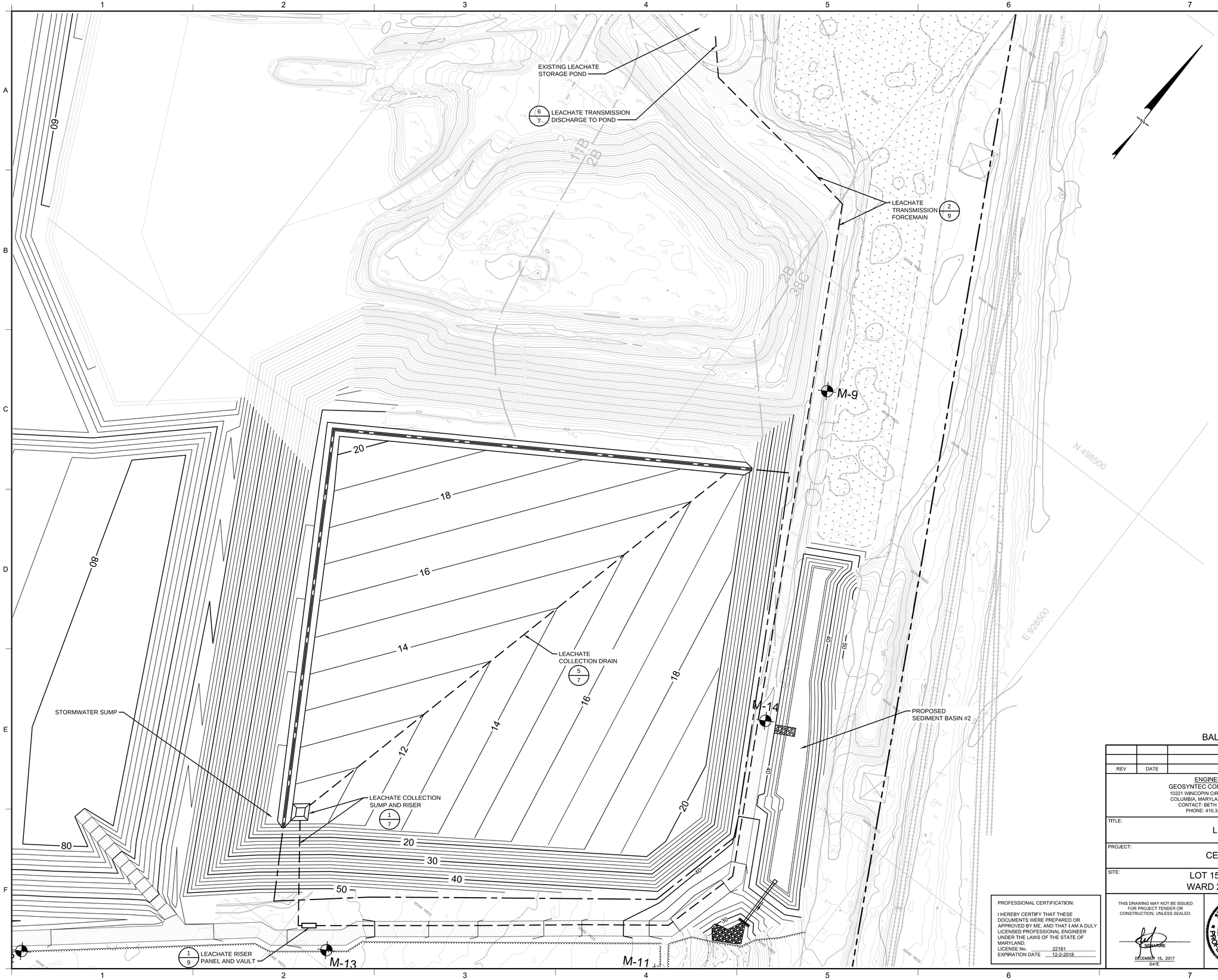

LEGEND

- PROPERTY BOUNDARY
- EXISTING BUILDING
- EXISTING ROAD
- EXISTING TREE LINE
- MINOR CONTOUR GRADE (FEET, MSL)
- 100 MAJOR CONTOUR GRADE (FEET, MSL)
- CHAIN LINK FENCE
- CSX TRACK
- LIMIT OF WETLAND MITIGATION AREA
- M-1 MONITORING WELL
- WETLANDS
- WETLAND BUFFER
- 12 10 PROPOSED CONTOURS
- PROPOSED PERIMETER ROAD
- LEACHATE TRANSMISSION PIPE
- LIMIT OF LINER SYSTEM

0 50' 100'
SCALE IN FEET

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

REV	DATE	DESCRIPTION	DRN	APP

ENGINEER
GEOSYNTEC CONSULTANTS
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COLUMBIA, MARYLAND 21044 USA
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PHONE: 410.381.4333

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BRANDON SHORES ROAD, SUITE 100
BALTIMORE, MARYLAND 21226 USA
CONTACT: BRIAN HOYT
PHONE: 410.787.6431

TITLE: LEACHATE TRANSMISSION PLAN

PROJECT: CELL 3 CONSTRUCTION DRAWINGS

SITE: LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

PROFESSIONAL CERTIFICATION:

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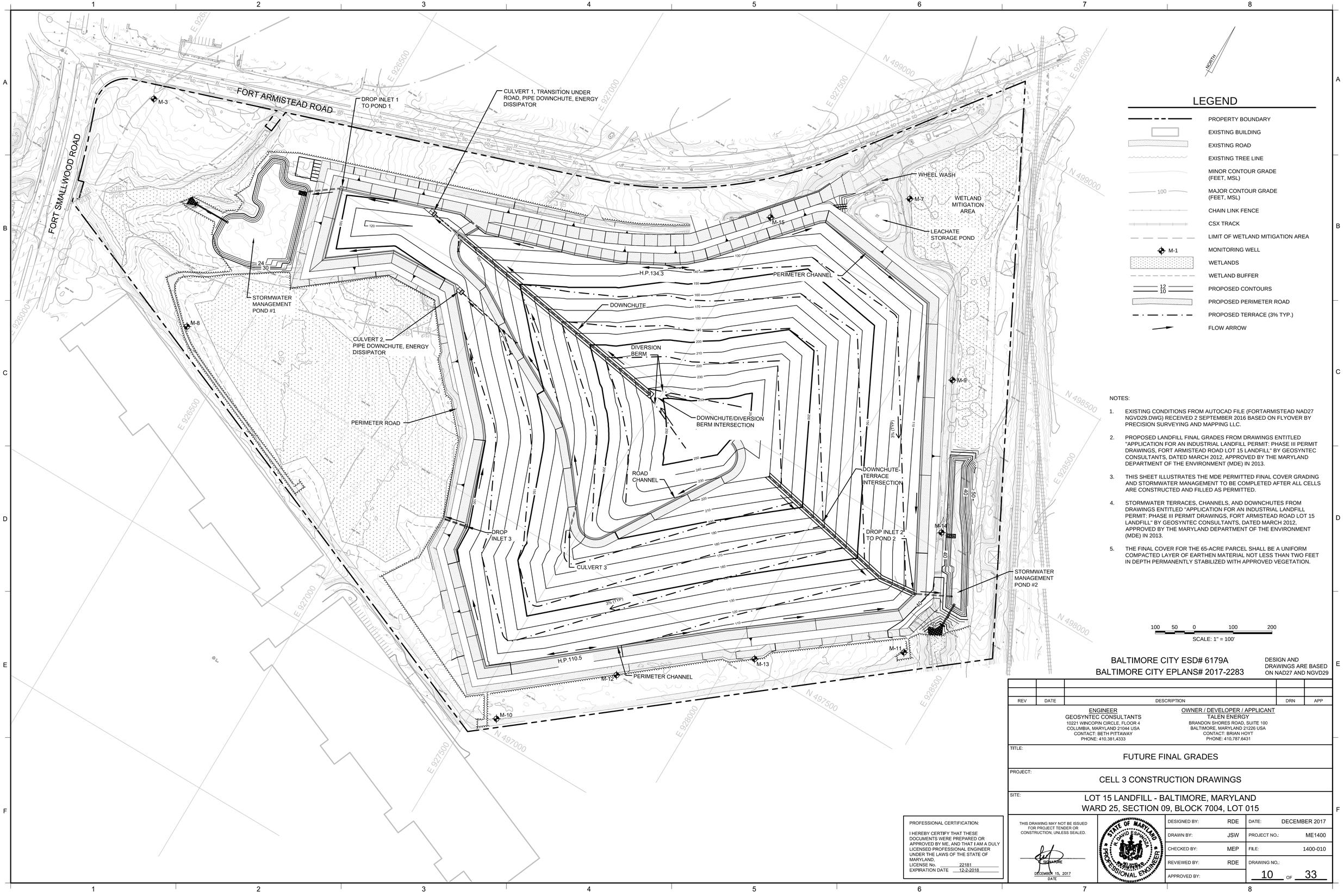
STATE OF MARYLAND R. DAVID ESPINOZA REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY:	RDE	DATE:	DECEMBER 2017
DRAWN BY:	JSW	PROJECT NO.:	ME1400
CHECKED BY:	MEP	FILE:	1400-005
REVIEWED BY:	RDE	DRAWING NO.:	5 OF 33
APPROVED BY:			



NORTH

LEGEND

- PROPERTY BOUNDARY
- EXISTING BUILDING
- EXISTING ROAD
- EXISTING TREE LINE
- MINOR CONTOUR GRADE (FEET, MSL)
- 100 — MAJOR CONTOUR GRADE (FEET, MSL)
- CHAIN LINK FENCE
- CSX TRACK
- LIMIT OF WETLAND MITIGATION AREA
- M-1 — MONITORING WELL
- WETLANDS
- WETLAND BUFFER
- 12 / 10 — PROPOSED CONTOURS
- PROPOSED PERIMETER ROAD
- PROPOSED TERRACE (3% TYP.)
- FLOW ARROW

NOTES:

1. EXISTING CONDITIONS FROM AUTOCAD FILE (FORTARMISTEAD NAD27 NGVD29.DWG) RECEIVED 2 SEPTEMBER 2016 BASED ON FLYOVER BY PRECISION SURVEYING AND MAPPING LLC.
2. PROPOSED LANDFILL FINAL GRADES FROM DRAWINGS ENTITLED "APPLICATION FOR AN INDUSTRIAL LANDFILL PERMIT: PHASE III PERMIT DRAWINGS, FORT ARMISTEAD ROAD LOT 15 LANDFILL" BY GEOSYNTEC CONSULTANTS, DATED MARCH 2012, APPROVED BY THE MARYLAND DEPARTMENT OF THE ENVIRONMENT (MDE) IN 2013.
3. THIS SHEET ILLUSTRATES THE MDE PERMITTED FINAL COVER GRADING AND STORMWATER MANAGEMENT TO BE COMPLETED AFTER ALL CELLS ARE CONSTRUCTED AND FILLED AS PERMITTED.
4. STORMWATER TERRACES, CHANNELS, AND DOWNCHUTES FROM DRAWINGS ENTITLED "APPLICATION FOR AN INDUSTRIAL LANDFILL PERMIT: PHASE III PERMIT DRAWINGS, FORT ARMISTEAD ROAD LOT 15 LANDFILL" BY GEOSYNTEC CONSULTANTS, DATED MARCH 2012, APPROVED BY THE MARYLAND DEPARTMENT OF THE ENVIRONMENT (MDE) IN 2013.
5. THE FINAL COVER FOR THE 65-ACRE PARCEL SHALL BE A UNIFORM COMPACTED LAYER OF EARTHEN MATERIAL NOT LESS THAN TWO FEET IN DEPTH PERMANENTLY STABILIZED WITH APPROVED VEGETATION.

100 50 0 100 200
SCALE: 1" = 100'

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

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BRANDON SHORES ROAD, SUITE 100
BALTIMORE, MARYLAND 21226 USA
CONTACT: BRIAN HOYT
PHONE: 410.787.6431

TITLE:
FUTURE FINAL GRADES

PROJECT:
CELL 3 CONSTRUCTION DRAWINGS

SITE:
LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

PROFESSIONAL CERTIFICATION:

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND,
LICENSE No. 22181
EXPIRATION DATE 12-2-2018

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SIGNATURE
DECEMBER 15, 2017
DATE

STATE OF MARYLAND — RUDOLPH DE ESPINOSA — REG. NO. 22181 — PROFESSIONAL ENGINEER

DESIGNED BY:	RDE	DATE:	DECEMBER 2017
DRAWN BY:	JSW	PROJECT NO.:	ME1400
CHECKED BY:	MEP	FILE:	1400-010
REVIEWED BY:	RDE	DRAWING NO.:	10 OF 33
APPROVED BY:			

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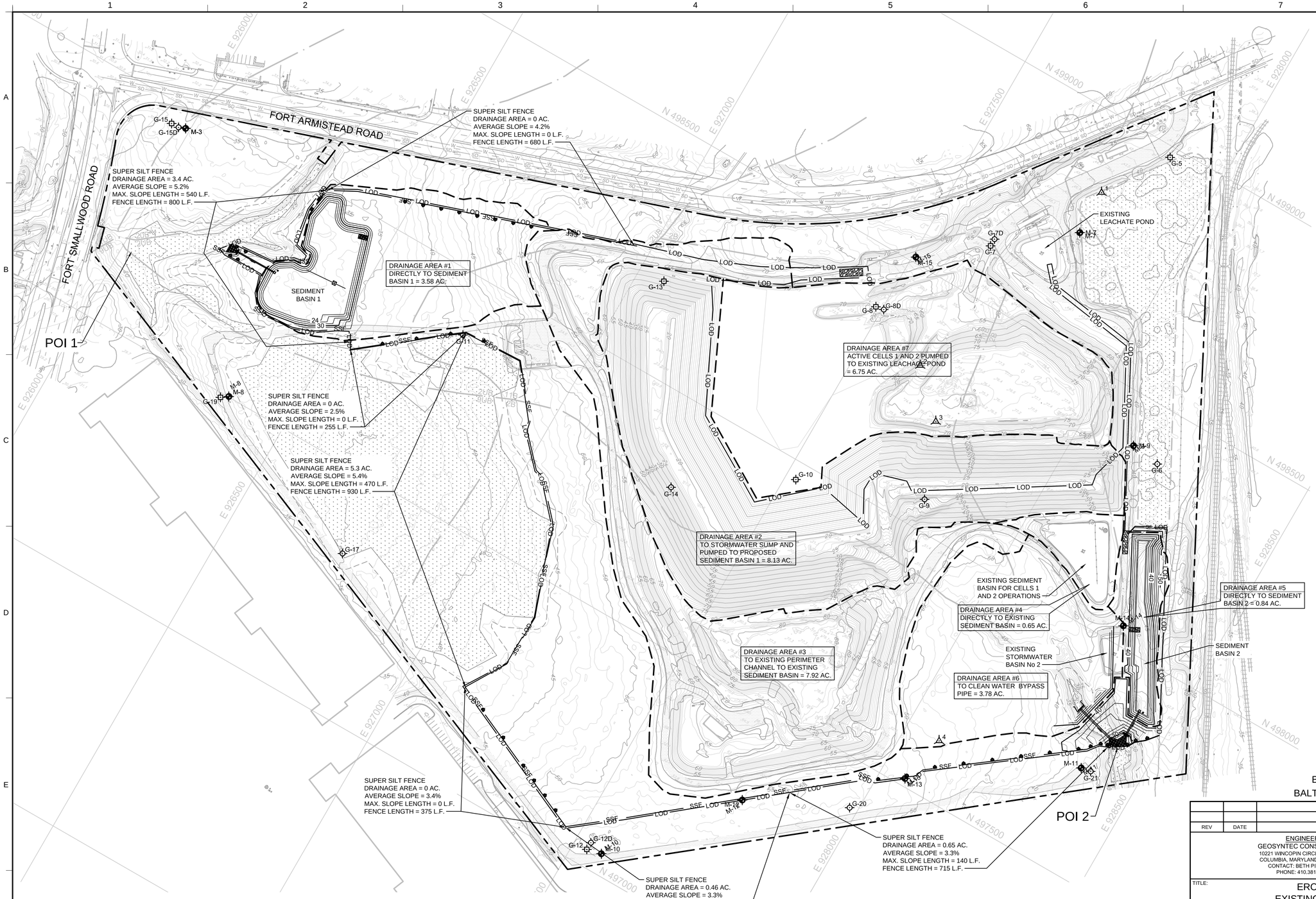

LEGEND

- PROPERTY BOUNDARY
- EXISTING BUILDING
- EXISTING ROAD
- EXISTING TREE LINE
- MINOR CONTOUR GRADE (FEET, MSL)
- 100 — MAJOR CONTOUR GRADE (FEET, MSL)
- CHAIN LINK FENCE
- CSX TRACK
- LIMIT OF WETLAND MITIGATION AREA
- M–1 — MONITORING WELL
- WETLANDS
- WETLAND BUFFER
- LOD — LIMIT OF DISTURBANCE
- SF — SILT FENCE
- SSF — SUPER SILT FENCE
- STABILIZED CONSTRUCTION ENTRANCE
- DRAINAGE AREA BOUNDARY
- 2 — BORINGS BY GEOSYNTEC (2009)
- G-8 — BORINGS BY O'BRIEN & GERE (1988)
- G-8D — BORINGS BY HILLIS-CARNES (1991)

NORTH

100 50 0 100 200
SCALE: 1" = 100'

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

REV	DATE	DESCRIPTION	DRN	APP

ENGINEER
GEOSYNTEC CONSULTANTS
10221 WINCOPIN CIRCLE, FLOOR 4
COLUMBIA, MARYLAND 21044 USA
CONTACT: BETH PITTAWAY
PHONE: 410.381.4333

OWNER / DEVELOPER / APPLICANT
TALEN ENERGY
BRANDON SHORES ROAD, SUITE 100
BALTIMORE, MARYLAND 21226 USA
CONTACT: BRIAN HOYT
PHONE: 410.787.6431

TITLE:
EROSION AND SEDIMENT CONTROL
EXISTING CONDITIONS DRAINAGE AREA MAP

PROJECT:
CELL 3 CONSTRUCTION DRAWINGS

SITE:
LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

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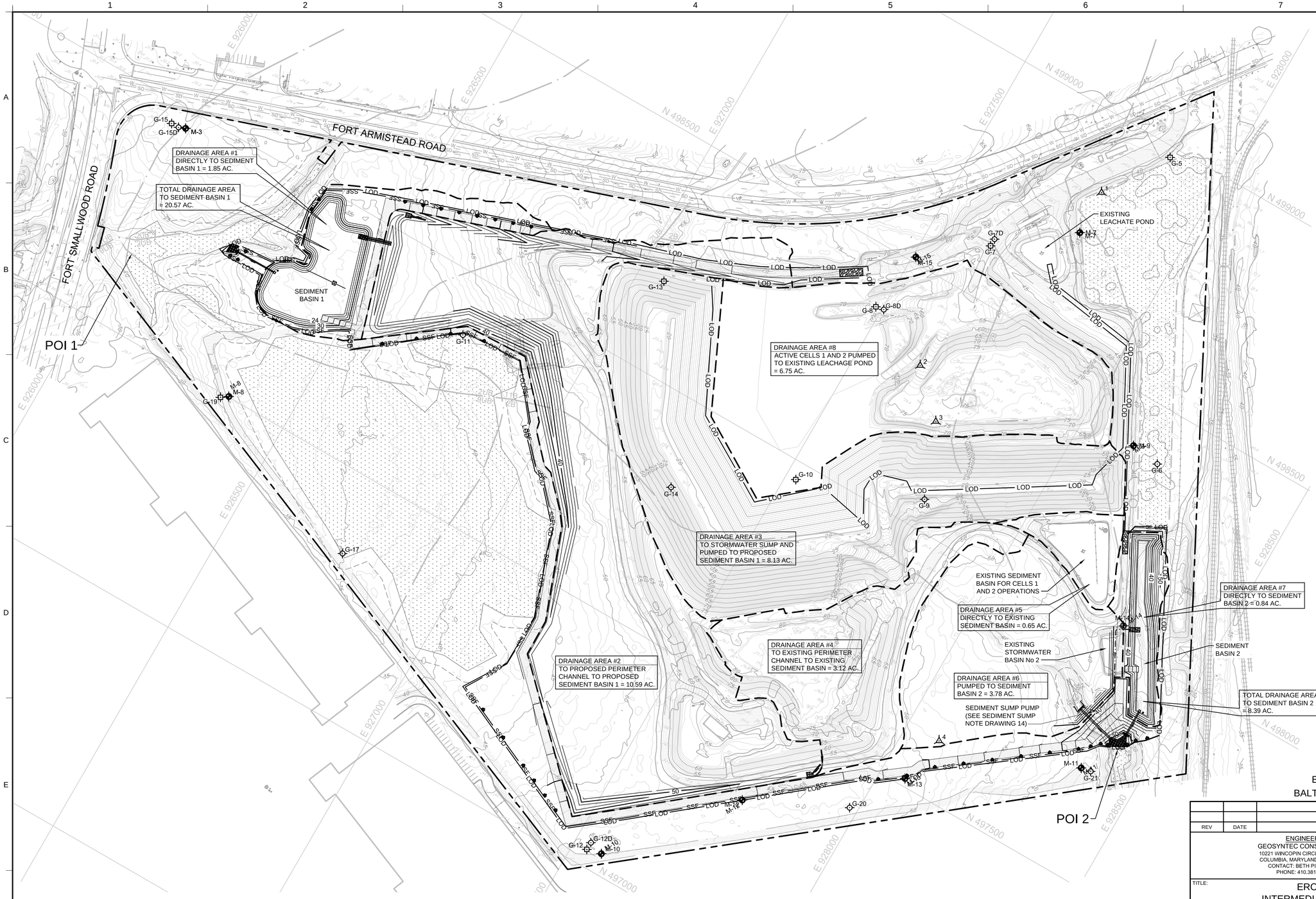
STATE OF MARYLAND
RUDOLPH DESPINOZA
REG. NO. 22181
PROFESSIONAL ENGINEER

DESIGNED BY:	JSW	DATE:	DECEMBER 2017
DRAWN BY:	JSW	PROJECT NO.:	ME1400
CHECKED BY:	MEP	FILE:	1400-011
REVIEWED BY:	RDE	DRAWING NO.:	11 OF 33
APPROVED BY:			



LEGEND

- PROPERTY BOUNDARY
- EXISTING BUILDING
- EXISTING ROAD
- EXISTING TREE LINE
- MINOR CONTOUR GRADE (FEET, MSL)
- MAJOR CONTOUR GRADE (FEET, MSL)
- CHAIN LINK FENCE
- CSX TRACK
- LIMIT OF WETLAND MITIGATION AREA
- M-1 MONITORING WELL
- WETLANDS
- WETLAND BUFFER
- LOD LIMIT OF DISTURBANCE
- SF SILT FENCE
- SSF SUPER SILT FENCE
- STABILIZED CONSTRUCTION ENTRANCE
- DRAINAGE AREA BOUNDARY
- SEDIMENT SUMP PUMP HOSE
- 2 BORINGS BY GEOSYNTEC (2009)
- G-8 BORINGS BY O'BRIEN & GERE (1988)
- G-8D BORINGS BY HILLIS-CARNES (1991)

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

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CONTACT: BRIAN HOYT
PHONE: 410.787.6431

TITLE: EROSION AND SEDIMENT CONTROL INTERMEDIATE CONDITIONS DRAINAGE AREA MAP

PROJECT: CELL 3 CONSTRUCTION DRAWINGS

SITE: LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

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STATE OF MARYLAND
R. DAVID ESPINOZA
REGISTERED PROFESSIONAL ENGINEER

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DRAWN BY:	JSW	PROJECT NO.:	ME1400
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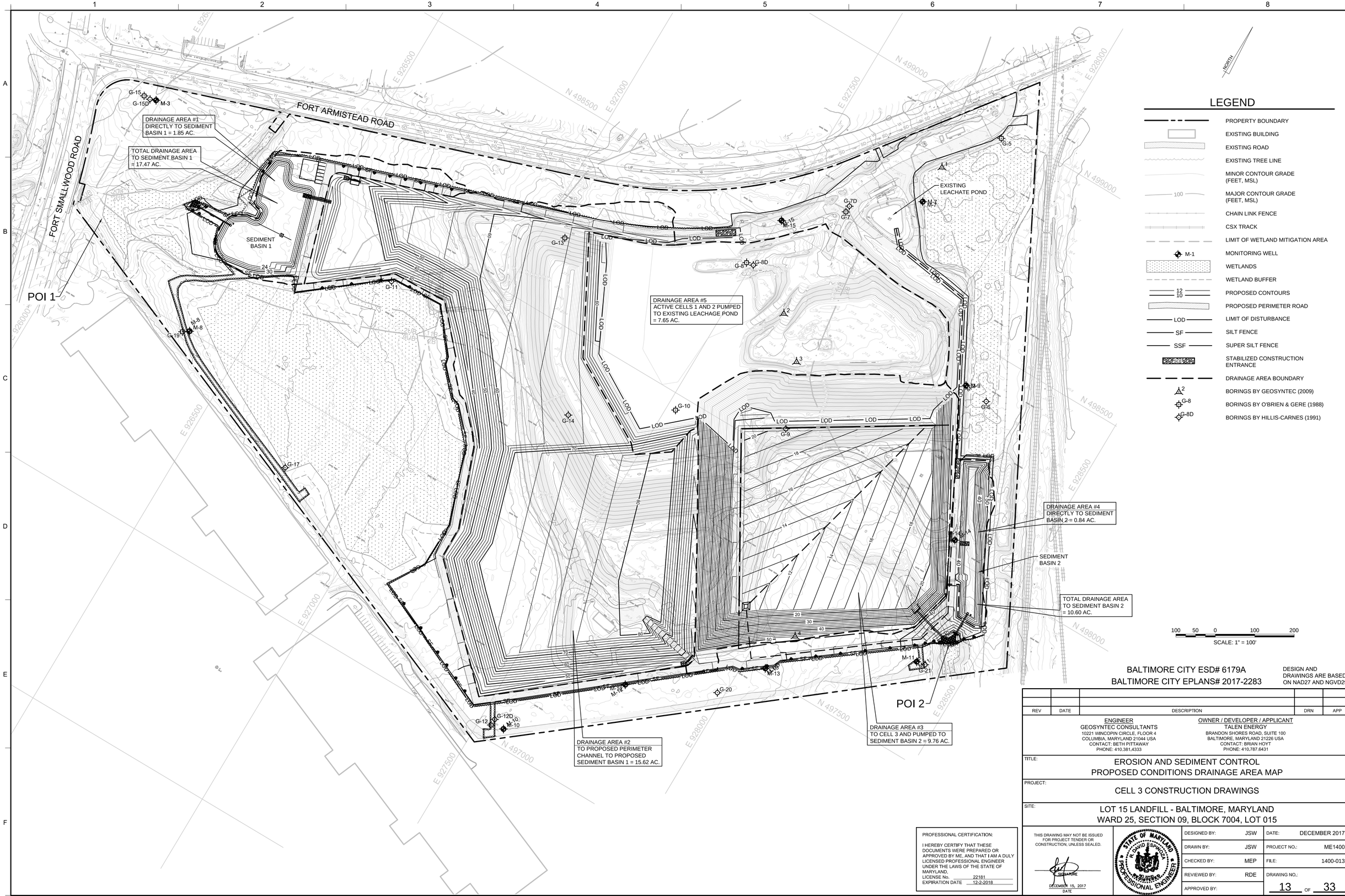
REVIEWED BY:	RDE	DRAWING NO.:	12 OF 33
APPROVED BY:			



BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

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BALTIMORE, MARYLAND 21226 USA
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TITLE:
EROSION AND SEDIMENT CONTROL
PROPOSED CONDITIONS DRAINAGE AREA MAP

PROJECT:
CELL 3 CONSTRUCTION DRAWINGS

SITE:
LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

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R. DAVID ESPINOZA
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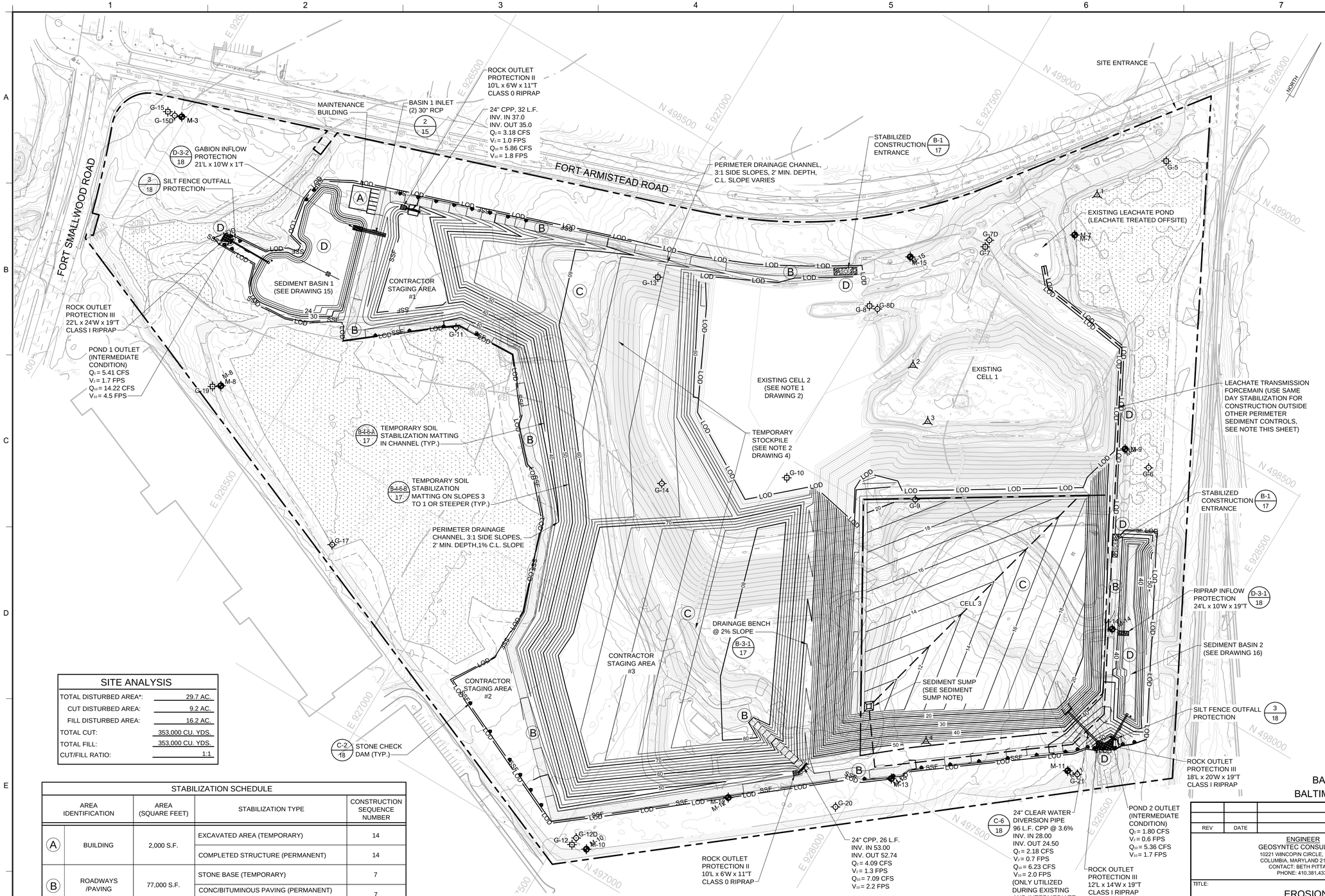

LEGEND

- PROPERTY BOUNDARY
- EXISTING BUILDING
- EXISTING ROAD
- EXISTING TREE LINE
- MINOR CONTOUR GRADE (FEET, MSL)
- MAJOR CONTOUR GRADE (FEET, MSL) — 100
- CHAIN LINK FENCE
- CSX TRACK
- LIMIT OF WETLAND MITIGATION AREA
- M-1 MONITORING WELL
- WETLANDS
- WETLAND BUFFER
- PROPOSED CONTOURS — 12 / 10
- PROPOSED PERIMETER ROAD
- 2 BORINGS BY GEOSYNTEC (2009)
- G-8 BORINGS BY O'BRIEN & GERE (1988)
- G-8D BORINGS BY HILLIS-CARNES (1991)
- LOD — LIMIT OF DISTURBANCE
- SF — SILT FENCE
- SSF — SUPER SILT FENCE
- STABILIZED CONSTRUCTION ENTRANCE
- STONE CHECK DAM
- RIPRAP INFLOW PROTECTION

SITE ANALYSIS

TOTAL DISTURBED AREA*:	29.7 AC.
CUT DISTURBED AREA:	9.2 AC.
FILL DISTURBED AREA:	16.2 AC.
TOTAL CUT:	353,000 CU. YDS.
TOTAL FILL:	353,000 CU. YDS.
CUT/FILL RATIO:	1:1

STABILIZATION SCHEDULE

	AREA IDENTIFICATION	AREA (SQUARE FEET)	STABILIZATION TYPE	CONSTRUCTION SEQUENCE NUMBER
A	BUILDING	2,000 S.F.	EXCAVATED AREA (TEMPORARY)	14
			COMPLETED STRUCTURE (PERMANENT)	14
B	ROADWAYS /PAVING	77,000 S.F.	STONE BASE (TEMPORARY)	7
			CONC/BITUMINOUS PAVING (PERMANENT) GRAVEL	7
C	PERVIOUS AREAS	1,051,100 S.F.	SEEDING (TEMPORARY)	11
			SEED/SOD/LANDSCAPING (PERMANENT)	15
D	SEDIMENT CONTROLS	163,600 S.F.	SEEDING/STONE (TEMPORARY)	3,5,7,8
			PERMANENT SEED/SOD (PERMANENT)	13,16

STANDARD STABILIZATION NOTE
FOLLOWING INITIAL SOIL DISTURBANCE OR REDISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES GREATER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1); AND SEVEN (7) DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE.

SAME DAY STABILIZATION / UTILITY NOTES
1. CONTRACTOR SHOULD OPEN ONLY THAT SECTION OF TRENCH THAT CAN BE BACKFILLED AND STABILIZED EACH DAY. IF TRENCH MUST REMAIN OPEN LONGER THAN ONE DAY, SILT FENCE SHALL BE PLACED BELOW (DOWNSLOPE OF) THE TRENCH.
2. PLACE ALL EXCAVATED MATERIAL ON UPHILL SIDE OF TRENCH.
3. ANY SEDIMENT CONTROLS DISTURBED BY UTILITY CONSTRUCTION ARE TO BE REPAIRED IMMEDIATELY.

SEDIMENT SUMP NOTE
RUNOFF ACCUMULATED IN THE SEDIMENT SUMPS SHALL BE PUMPED INTO THE TEMPORARY SEDIMENT BASIN #2 DURING EACH STORM EVENT. PUMPS SHALL BE CAPABLE OF PUMPING A MINIMUM OF 750 GPM. AN OPERATOR SHALL BE ON SITE DURING ANY PUMPING OPERATION AND SHALL CONTINUOUSLY MONITOR PUMP TO ENSURE THEIR CONTINUOUS OPERATION.

DISTURBED AREA ACCESS NOTE
SEDIMENT SHALL NOT BE TRACKED OUTSIDE OF THE LIMIT OF DISTURBANCE (LOD). EQUIPMENT ENTERING THE LOD SHALL BE CLEANED OF SEDIMENT PRIOR TO EXITING. ANY SEDIMENT TRACKED OUT OF THE LOD MUST BE SWEPT CLEAN IMMEDIATELY.

MAINTENANCE OF SEDIMENT CONTROL
CONTRACTOR SHALL, WITHOUT EXTRA COST TO THE PROJECT, REPAIR AND MAINTAIN EXISTING SEDIMENT CONTROL DEVICES UNTIL ALL AREAS WITHIN LIMITS OF CONSTRUCTION ARE STABILIZED. ALL SEDIMENT CONTROL MEASURES REFERRED TO ON THESE PLANS SHALL BE IN ACCORDANCE WITH THE PUBLICATION ENTITLED "2011 MARYLAND STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL."

100 50 0 100 200
SCALE: 1" = 100'

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

STORMWATER MANAGEMENT NOTE:

THIS PROJECT IS EXEMPT FROM BALTIMORE CITY STORMWATER MANAGEMENT REQUIREMENTS PER CITY CODE ARTICLE 7, DIVISION II, SUBTITLE 21-6(b)(5). FINAL STORMWATER MANAGEMENT WILL NOT OCCUR UNTIL ALL CELLS OF THE LANDFILL ARE CONSTRUCTED.

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EXPIRATION DATE 12-2-2018

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TALEN ENERGY
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BALTIMORE, MARYLAND 21226 USA
CONTACT: BRIAN HOYT
PHONE: 410.787.6431

TITLE:
EROSION AND SEDIMENT CONTROL PLAN

PROJECT:
CELL 3 CONSTRUCTION DRAWINGS

SITE:
LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

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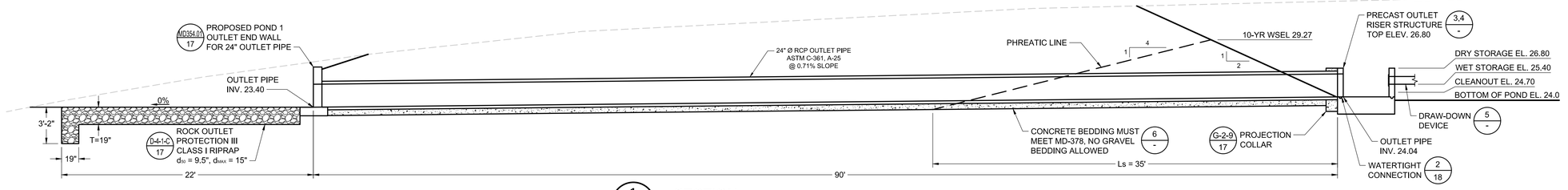
SIGNATURE
DECEMBER 15, 2017
DATE

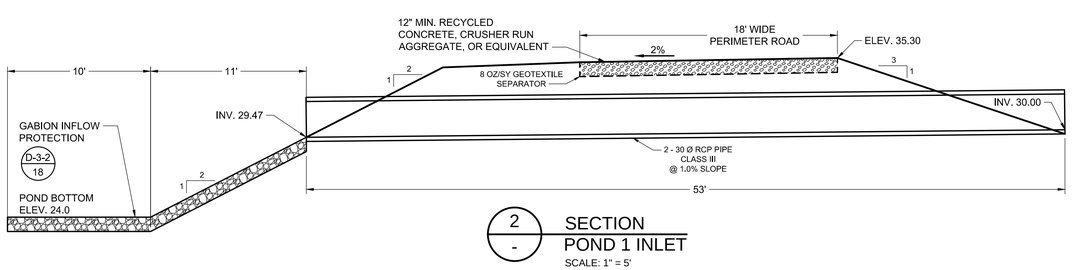
STATE OF MARYLAND — RONALD ESPINOSA — REG. NO. 21181 — PROFESSIONAL ENGINEER

DESIGNED BY:	JSW	DATE:	DECEMBER 2017
DRAWN BY:	JSW	PROJECT NO.:	ME1400
CHECKED BY:	MEP	FILE:	1400-014
REVIEWED BY:	RDE	DRAWING NO.:	14 OF 33
APPROVED BY:			



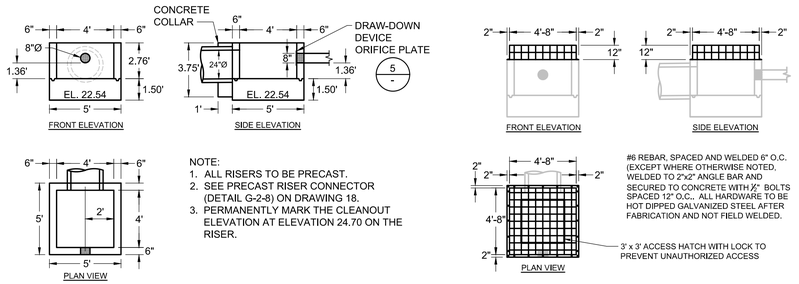
1 - SECTION POND 1 OUTLET

SCALE: 1" = 5'



2 - SECTION POND 1 INLET

SCALE: 1" = 5'



NOTE:
1. ALL RISERS TO BE PRECAST.
2. SEE PRECAST RISER CONNECTOR (DETAIL G-2-8) ON DRAWING 18.
3. PERMANENTLY MARK THE CLEANOUT ELEVATION AT ELEVATION 24.70 ON THE RISER.

3 - DETAIL PRECAST OUTLET RISER STRUCTURE

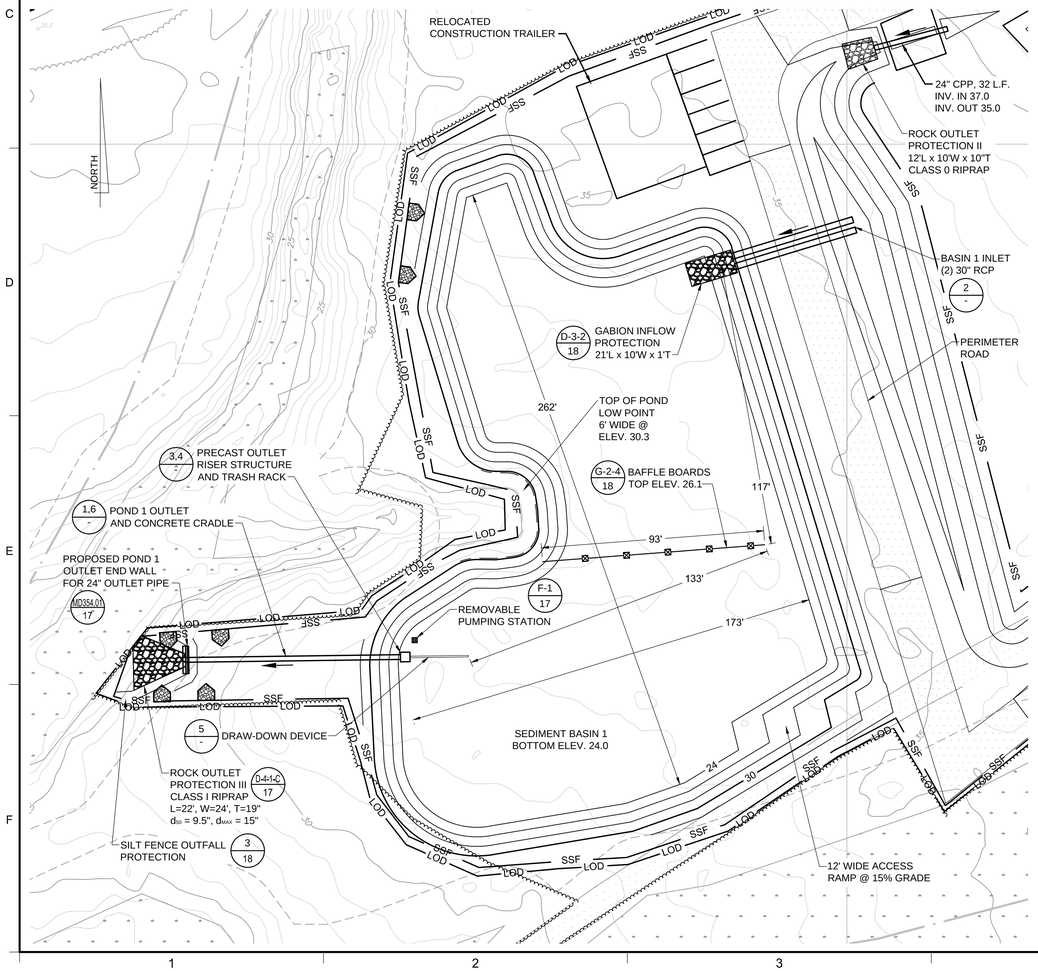
SCALE: 1" = 5'

4 - DETAIL TRASH RACK

SCALE: 1" = 5'

LEGEND

- PROPERTY BOUNDARY
- EXISTING BUILDING
- EXISTING ROAD
- EXISTING TREE LINE
- MINOR CONTOUR GRADE (FEET, MSL)
- MAJOR CONTOUR GRADE (FEET, MSL) (100)
- CHAIN LINK FENCE
- CSX TRACK
- LIMIT OF WETLAND MITIGATION AREA
- WETLANDS
- WETLAND BUFFER
- PROPOSED CONTOURS (12 / 10)
- PROPOSED PERIMETER ROAD
- LOD — LIMIT OF DISTURBANCE
- SSF — SUPER SILT FENCE
- STONE CHECK DAM



Sediment Basin #1 Design Data

Design Volumes and Elevations

1. Total area draining to basin: 20.57 acres (ac)
2. Required total storage volume = 3600 ft³/ac x 20.57 acres drainage area = 74,052 ft³
3. Required wet storage volume = 1800 ft³/ac x 20.57 acres drainage area = 37,026 ft³
4. Required dry storage volume = 1800 ft³/ac x 20.57 acres drainage area = 37,026 ft³
5. Basin bottom elevation = 24.0 ft
6. Riser or weir crest (total storage) elevation = 26.80 ft
7. Provided total storage volume = 87,168 ft³
8. Wet storage (permanent pool/draw-down) elevation = 25.40 ft
9. Provided wet storage volume = 41,957 ft³
10. Provided dry storage volume = 45,211 ft³
11. Basin cleanout elevation (located at ½ wet storage depth) = 24.70 ft
12. Distance from riser crest elevation to cleanout elevation = 2.10 ft.

Surface Area Design

13. Q_{10} = 111.17 cfs (peak inflow from 10-yr, 24-hr storm event, attach computations)
14. Minimum basin surface area ≥ 0.0035 x Q_{10} = 0.0035 x 111.17 cfs = 0.39 ac ≤ 0.71 ac
required provided

Principal Spillway (Q_{ps})
(See Figure G.1)

15. Design Q_{ps} for barrel = 3.60 cfs (min. 10% Q_{10})
16. Barrel head, H = 4.87 ft; Barrel length, L = 90 ft
17. Barrel dia. = 24 in. (min. 10 inch); Q_{ps} = Q (from Table G.7 or G.8) 33.3 x (length correction factor) 0.95 = 31.64 cfs Note: Q_{ps} must equal or exceed Design Q_{ps}
18. Riser dimensions 4 ft. x 4 ft.; Riser height 2.8 ft; Riser head (h) = 2.47 ft
19. Trash rack dimensions: see detail this sheet

Emergency Spillway (Q_{es})
(See Figures G.3 and G.4)

20. Emergency spillway capacity Q_{es} = Q_{10} - Q_{ps} = NA cfs
21. Width, b = NA ft; Hp = NA ft
22. Exit channel slope NA %
23. Emergency Spillway Crest = NA ft
24. Design High Water = 28.88 ft
25. Settled top of embankment elevation = 30 ft

Anti-Seep Collar Design (If Required)
(See Figures G.5 and G.6)

26. y = NA ft; z = NA : 1; pipe slope = NA%; Ls = NA ft
27. Use NA collars, NA ft - NA in. square; projection = NA ft

Draw-down Device
(See Table G.10 and Details G-2-6 and G-2-7)

28. Q_{d-d} = 1.03 cfs
29. Calculated A_o = 0.22 ft², use 0.20 ft²
30. Calculated d_o = 6.36 in, use 6.0 in
31. Maximum diameter from Table G.10 = 8 in
32. Design d_o = smaller of line 30 or line 31 = 6.36 in, use 6.0 in
33. Draw-down device pipe diameter = 8 in
34. Minimum A_f = total area of perforations = 4A_o = 0.80 ft²
35. Perforation diameter = 1 in
36. Minimum number of perforations = 146
37. Number of longitudinal rows = 4
38. Perforated pipe length = 19 ft
39. Actual A_f = (0.0055 ft²) x (line 37 / 0.5 ft) x (line 38) = 0.836 ft²

Baffle Board Design
(See Detail G-2-4)

40. A = surface area at wet storage elevation = 31,130 ft²
41. Effective width, W_e = (A/2)$^{0.5}$ = 125 ft
42. Flow length from inflow point to outlet = 193 ft
43. If line 42 is less than W_e x 2, provide baffle boards to lengthen flow path
44. Effective flow length, L_e = L_1 + L_2 = 250 ft (must be ≥ W_e x 2 = ft)

5 - DETAIL DRAW-DOWN DEVICE

NOT TO SCALE

6 - DETAIL CONCRETE CRADLE

SCALE: 1" = 3'

POND CLASSIFICATION

THIS POND MEETS ALL REQUIREMENTS FOR HAZARD CLASS A. [REQUIREMENTS AS STATED IN THE USDA NATURAL RESOURCES CONSERVATION SERVICE - MARYLAND CONSERVATION PRACTICE STANDARD POND, CODE 378, JANUARY 2000.]

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30 15 0 30 60

SCALE: 1" = 30'

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

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TALEN ENERGY
BRANDON SHORES ROAD, SUITE 100
BALTIMORE, MARYLAND 21226 USA
CONTACT: BRIAN HOYT
PHONE: 410.787.6431

TITLE:
SEDIMENT BASIN 1 PLAN

PROJECT:
CELL 3 CONSTRUCTION DRAWINGS

SITE:
LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

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SIGNATURE

DECEMBER 15, 2017
DATE

STATE OF MARYLAND — M. DAVID ESPINOZA — No. 22181 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY:	JSW	DATE:	DECEMBER 2017
DRAWN BY:	JSW	PROJECT NO.:	ME1400
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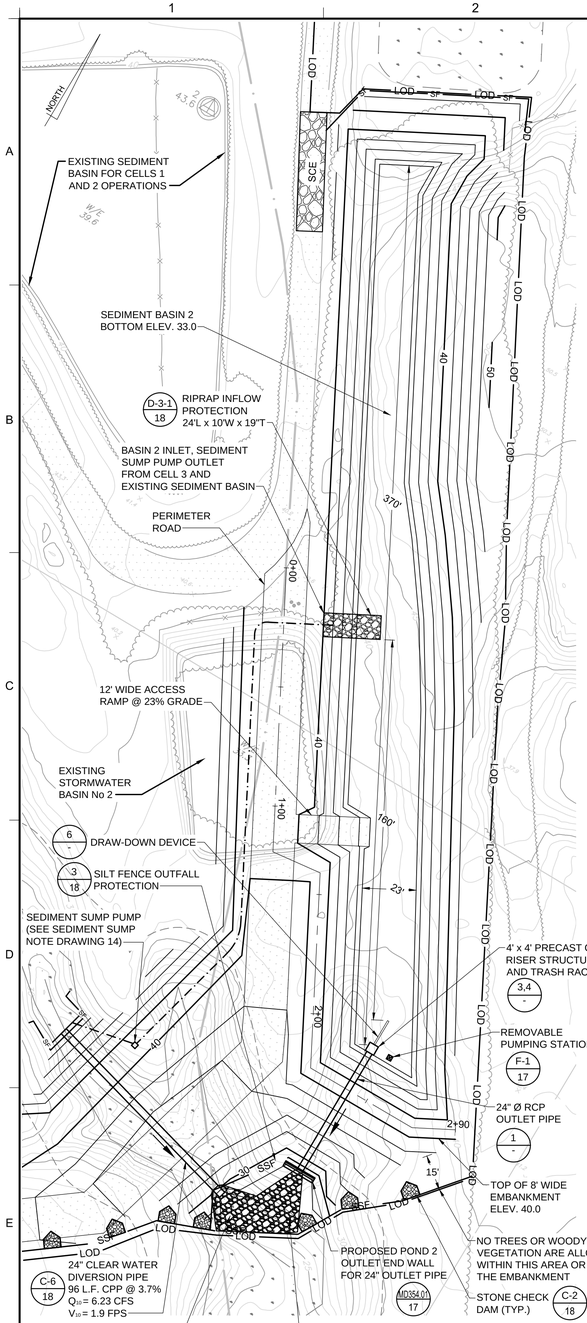
APPROVED BY:			



Sediment Basin #2 Design Data

Design Volumes and Elevations

1. Total area draining to basin: 10.60 acres (ac)
2. Required total storage volume = 3600 ft³/ac x 20.57 acres drainage area = 38,160 ft³
3. Required wet storage volume = 1800 ft³/ac x 20.57 acres drainage area = 19,080 ft³
4. Required dry storage volume = 1800 ft³/ac x 20.57 acres drainage area = 19,080 ft³
5. Basin bottom elevation = 33.0 ft
6. Riser or weir crest (total storage) elevation = 36.70 ft
7. Provided total storage volume = 41,834 ft³
8. Wet storage (permanent pool/draw-down) elevation = 35.10 ft
9. Provided wet storage volume = 20,854 ft³
10. Provided dry storage volume = 20,980 ft³
11. Basin cleanout elevation (located at ½ wet storage depth) = 34.10 ft
12. Distance from riser crest elevation to cleanout elevation = 2.60 ft.

Surface Area Design

13. Q_{10} = 75.57 cfs (peak inflow from 10-yr, 24-hr storm event, attach computations)
14. Minimum basin surface area ≥ 0.0035 x Q_{10} = 0.0035 x 75.57 cfs = 0.26 ac ≤ 0.47 ac required provided

Principal Spillway (Q_{ps})
(See Figure G.1)

15. Design Q_{ps} for barrel = 2.60 cfs (min. 10% Q_{10})
16. Barrel head, H = 12.0 ft; Barrel length, L = 58 ft
17. Barrel dia. = 21 in. (min. 10 inch); Q_{ps} = Q (from Table G.7 or G.8) 38.3 x (length correction factor) 1.03 = 39.4 cfs Note: Q_{ps} must equal or exceed Design Q_{ps}
18. Riser dimensions 4 ft. x 4 ft.; Riser height 3.7 ft; Riser head (h) = 2.21 ft
19. Trash rack dimensions: see detail this sheet

Emergency Spillway (Q_{es})
(See Figures G.3 and G.4)

20. Emergency spillway capacity Q_{es} = Q_{10} - Q_{ps} = NA cfs
21. Width, b = NA ft; Hp = NA ft
22. Exit channel slope NA %
23. Emergency Spillway Crest = NA ft
24. Design High Water = 38.91 ft
25. Settled top of embankment elevation = 40 ft

Anti-Seep Collar Design (If Required)
(See Figures G.5 and G.6)

26. y = NA ft; z = NA : 1; pipe slope = NA%; Ls = NA ft
27. Use NA collars, NA ft - NA in. square; projection = NA ft

Draw-down Device
(See Table G.10 and Details G-2-6 and G-2-7)

28. Q_{dd} = 0.53 cfs
29. Calculated A_o = 0.064 ft², use 0.05 ft²
30. Calculated d_o = 3.48 in, use 3 in
31. Maximum diameter from Table G.10 = 6 in
32. Design d_o = smaller of line 30 or line 31 = 3.48 in, use 3.0 in
33. Draw-down device pipe diameter = 6 in
34. Minimum A_t = total area of perforations = 4A_o = 0.20 ft²
35. Perforation diameter = 1 in
36. Minimum number of perforations = 37
37. Number of longitudinal rows = 3
38. Perforated pipe length = 6.5 ft
39. Actual A_t = (0.0055 ft²) x (line 37 / 0.5 ft) x (line 38) = 0.21 ft²

Baffle Board Design
(See Detail G-2-4)

40. A = surface area at wet storage elevation = 11,712 ft²
41. Effective width, W_e = $(A/2)^{0.5}$ = 77 ft
42. Flow length from inflow point to outlet = 160 ft
43. If line 42 is less than W_e x 2, provide baffle boards to lengthen flow path
44. Effective flow length, L_e = L_1 + L_2 + L_3 = ft (must be ≥ W_e x 2 = ft)

NOTE
THIS SEDIMENT BASIN WILL BE CONVERTED TO A PERMANENT STORMWATER MANAGEMENT FACILITY AND THEREFORE A DRAINAGE DIAPHRAGM IS PROPOSED IN LIEU OF ANTI-SEEP COLLARS.

POND CLASSIFICATION

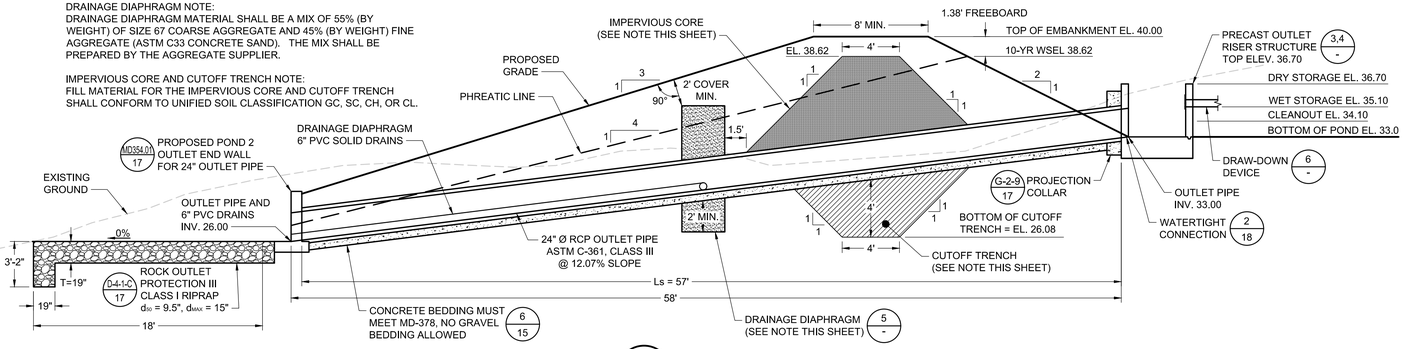
THIS POND MEETS ALL REQUIREMENTS FOR HAZARD CLASS A. [REQUIREMENTS AS STATED IN THE USDA NATURAL RESOURCES CONSERVATION SERVICE - MARYLAND CONSERVATION PRACTICE STANDARD POND, CODE 378, JANUARY 2000.]

LEGEND

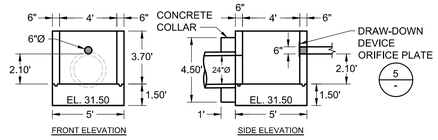
EXISTING ROAD
EXISTING TREE LINE
MINOR CONTOUR GRADE (FEET, MSL)
MAJOR CONTOUR GRADE (FEET, MSL)
LIMIT OF WETLAND MITIGATION AREA
WETLANDS
WETLAND BUFFER
PROPOSED CONTOURS
PROPOSED PERIMETER ROAD
LIMIT OF DISTURBANCE
SUPER SILT FENCE
STABILIZED CONSTRUCTION ENTRANCE
SEDIMENT SUMP PUMP HOSE
STONE CHECK DAM

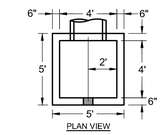
DRAINAGE DIAPHRAGM NOTE:
DRAINAGE DIAPHRAGM MATERIAL SHALL BE A MIX OF 55% (BY WEIGHT) OF SIZE 67 COARSE AGGREGATE AND 45% (BY WEIGHT) FINE AGGREGATE (ASTM C33 CONCRETE SAND). THE MIX SHALL BE PREPARED BY THE AGGREGATE SUPPLIER.

IMPERVIOUS CORE AND CUTOFF TRENCH NOTE:
FILL MATERIAL FOR THE IMPERVIOUS CORE AND CUTOFF TRENCH SHALL CONFORM TO UNIFIED SOIL CLASSIFICATION GC, SC, CH, OR CL.



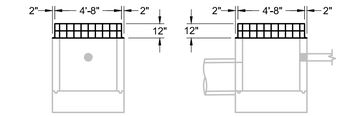
1 - SECTION
POND 2 OUTLET
SCALE: 1" = 5'

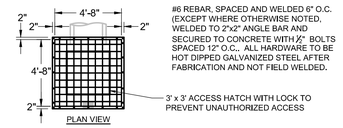




NOTE:
1. ALL RISERS TO BE PRECAST.
2. SEE PRECAST RISER CONNECTOR (DETAIL G-2-8) ON DRAWING 18.
3. PERMANENTLY MARK THE CLEANOUT ELEVATION AT ELEVATION 34.10 ON THE RISER.

3 - DETAIL
PRECAST OUTLET RISER STRUCTURE
SCALE: 1" = 5'



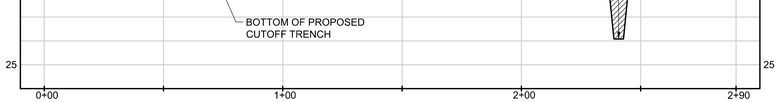


#6 REBAR, SPACED AND WELDED 6" O.C. (EXCEPT WHERE OTHERWISE NOTED, WELDED TO 2"x2" ANGLE BAR AND SECURED TO CONCRETE WITH ½" BOLTS SPACED 12" O.C., ALL HARDWARE TO BE HOT DIPPED GALVANIZED STEEL AFTER FABRICATION AND NOT FIELD WELDED.

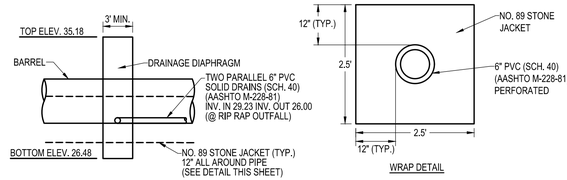
3' x 3' ACCESS HATCH WITH LOCK TO PREVENT UNAUTHORIZED ACCESS

4 - DETAIL
TRASH RACK
SCALE: 1" = 5'

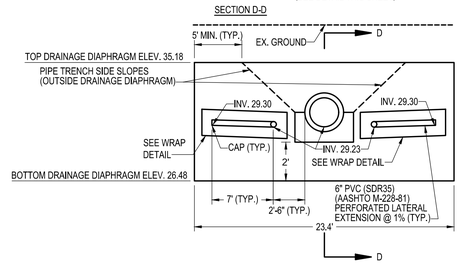
30 15 0 30 60
SCALE: 1" = 30'



2 - PROFILE
ALONG C.L. EMBANKMENT
SCALE: HOR. 1" = 30'
VER. 1" = 3'

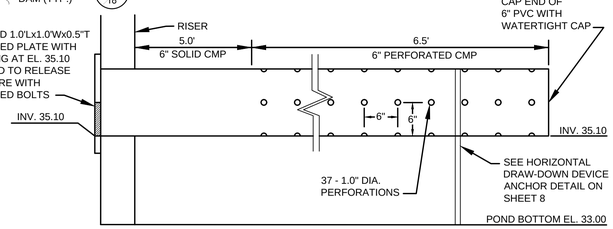


WRAP DETAIL



NOTES
1. FILTER MATERIAL SHALL CONFORM TO ASTM C-33 (CONCRETE SAND).
2. DRAINAGE DIAPHRAGM SHALL BE CONSTRUCTED IN CONTINUOUS HORIZONTAL LAYERS 12" THICK (BEFORE COMPACTION).
3. EACH LAYER SHALL BE HYDROCOMPACTED USING A SPRINKLER. MATERIAL MUST BE SATURATED.
4. CARE SHALL BE TAKEN SO THAT THE FILTER MATERIAL IS NOT CONTAMINATED.
5. ANY CONTAMINATED SAND SHALL BE REMOVED AND REPLACED WITH APPROVED MATERIAL.
6. PROTECTIVE COVERING OVER THE FILTER SAND MAY BE REQUIRED BETWEEN LIFTS.
7. ELBOWS SHALL BE USED FOR PVC INTERCONNECTIONS.
8. THE GEOTECHNICAL ENGINEER SHALL BE PRESENT DURING DRAINAGE DIAPHRAGM CONSTRUCTION.

5 - DETAIL
DRAINAGE DIAPHRAGM
NOT TO SCALE



6 - DETAIL
DRAW-DOWN DEVICE PERFORATIONS
NOT TO SCALE

PROFESSIONAL CERTIFICATION:

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE No. 22181 EXPIRATION DATE 12-2-2018

REV	DATE	DESCRIPTION	DRN	APP

ENGINEER
GEOSYNTEC CONSULTANTS
10221 WINCOPIN CIRCLE, FLOOR 4
COLUMBIA, MARYLAND 21044 USA
CONTACT: BETH PITTAWAY
PHONE: 410.381.4333

OWNER / DEVELOPER / APPLICANT
TALEN ENERGY
BRANDON SHORES ROAD, SUITE 100
BALTIMORE, MARYLAND 21226 USA
CONTACT: BRIAN HOYT
PHONE: 410.787.6431

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

TITLE:
SEDIMENT BASIN 2 PLAN

PROJECT:
CELL 3 CONSTRUCTION DRAWINGS

SITE:
LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

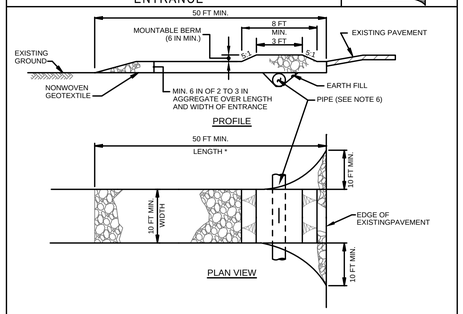
SIGNATURE
DECEMBER 15, 2017
DATE

STATE OF MARYLAND — RONALD ESPINOSA — No. 22181 — PROFESSIONAL ENGINEER

DESIGNED BY:	JSW	DATE:	DECEMBER 2017
DRAWN BY:	JSW	PROJECT NO.:	ME1400
CHECKED BY:	MEP	FILE:	1400-016
REVIEWED BY:	RDE	DRAWING NO.:	16 OF 33
APPROVED BY:			

DETAIL B-1 STABILIZED CONSTRUCTION ENTRANCE

STANDARD SYMBOL: SCE



CONSTRUCTION SPECIFICATIONS

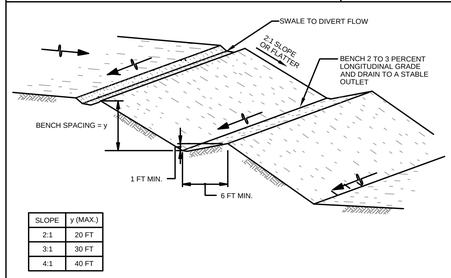
1. PLACE STABILIZED CONSTRUCTION ENTRANCE IN ACCORDANCE WITH THE APPROVED PLAN. VEHICLES MUST TRAVEL OVER THE ENTIRE LENGTH OF THE SCE. USE MINIMUM LENGTH OF 50 FEET (*30 FEET FOR SINGLE RESIDENCE LOT). USE MINIMUM WIDTH OF 10 FEET. FLARE SCE 10 FEET MINIMUM AT THE EXISTING ROAD TO PROVIDE A TURNING RADIUS.
2. PIPE ALL SURFACE WATER FLOWING TO OR DIVERTED TOWARD THE SCE UNDER THE ENTRANCE, MAINTAINING POSITIVE DRAINAGE. PROTECT PIPE INSTALLED THROUGH THE SCE WITH A MOUNTABLE BERM WITH 5:1 SLOPES AND A MINIMUM OF 12 INCHES OF STONE OVER THE PIPE. PROVIDE PIPE AS SPECIFIED ON APPROVED PLAN. WHEN THE SCE IS LOCATED AT A HIGH SPOT AND HAS NO DRAINAGE TO CONVEY, A PIPE IS NOT NECESSARY. A MOUNTABLE BERM IS REQUIRED WHEN SCE IS NOT LOCATED AT A HIGH SPOT.
3. PREPARE SUBGRADE AND PLACE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS.
4. PLACE CRUSHED AGGREGATE (2 TO 3 INCHES IN SIZE) OR EQUIVALENT RECYCLED CONCRETE (WITHOUT REBAR) AT LEAST 6 INCHES DEEP OVER THE LENGTH AND WIDTH OF THE SCE.
5. MAINTAIN ENTRANCE IN A CONDITION THAT MINIMIZES TRACKING OF SEDIMENT. ADD STONE OR MAKE OTHER REPAIRS AS CONDITIONS DEMAND TO MAINTAIN CLEAN SURFACE, MOUNTABLE BERM, AND SPECIFIED DIMENSIONS. IMMEDIATELY REMOVE STONE AND/OR SEDIMENT SPILLED, DROPPED, OR TRACKED ONTO ADJACENT ROADWAY BY VACUUMING, SCRAPING, AND/OR SWEEPING. WASHING ROADWAY TO REMOVE MUD TRACKED ONTO PAVEMENT IS NOT ACCEPTABLE UNLESS WASH WATER IS DIRECTED TO AN APPROVED SEDIMENT CONTROL PRACTICE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL B-3-1 BENCHING

STANDARD SYMBOL: BENCHING



SLOPE	y (MAX.)
2:1	20 FT
3:1	30 FT
4:1	40 FT

CONSTRUCTION SPECIFICATIONS

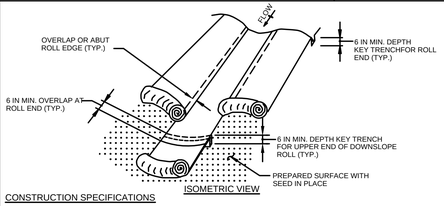
1. USE FILL MATERIAL FREE OF BRUSH, RUBBISH, ROCKS, LOGS, STUMPS, BUILDING DEBRIS, AND OTHER OBJECTIONABLE MATERIALS THAT WOULD INTERFERE WITH OR PREVENT CONSTRUCTION OF SATISFACTORY FILLS.
2. DO NOT INCORPORATE FROZEN, SOFT, MUCKY, OR HIGHLY COMPRESSIBLE MATERIALS INTO FILL SLOPES OR STRUCTURAL FILLS. DO NOT PLACE FILL ON A FROZEN FOUNDATION.
3. PLACE ALL FILL IN LOOSE LIFTS NOT TO EXCEED 8 INCHES AND THEN COMPACT.
4. COMPACT ALL FILLS AS REQUIRED TO REDUCE EROSION, SLIPPAGE, SETTLEMENT, OR OTHER RELATED PROBLEMS. COMPACT FILL INTENDED TO SUPPORT BUILDINGS, STRUCTURES, CONDUITS, ETC., IN ACCORDANCE WITH LOCAL REQUIREMENTS OR CODES.
5. HANDLE SEEPS OR SPRINGS ENCOUNTERED DURING CONSTRUCTION IN ACCORDANCE WITH SECTION H-2 SUBSURFACE DRAINS OR OTHER APPROVED METHODS.
6. MAINTAIN LINE, GRADE, AND CROSS SECTION OF BENCHING. STABILIZE IN ACCORDANCE WITH THE 3/7 DAY STABILIZATION CRITERIA OR AS SPECIFIED ON THE APPROVED EROSION AND SEDIMENT CONTROL PLAN. INSTALLATION OF EROSION CONTROL MATTING MAY BE NECESSARY IN BENCH/SWALE INVERTS. CONTINUOUSLY MEET REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT IN ACCORDANCE WITH SECTION B-4 VEGETATIVE STABILIZATION.
7. KEEP ALL BENCHES FREE OF SEDIMENT DURING ALL PHASES OF DEVELOPMENT.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL B-4-6-A TEMPORARY SOIL STABILIZATION MATTING CHANNEL APPLICATION

STANDARD SYMBOL: TSSMC - ✱ lb/ft² (✱ INCLUDE SHEAR STRESS)



CONSTRUCTION SPECIFICATIONS

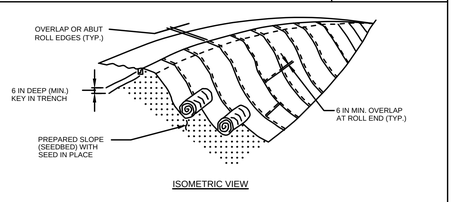
1. USE MATTING THAT HAS A DESIGN VALUE FOR SHEAR STRESS EQUAL TO OR HIGHER THAN THE SHEAR STRESS DESIGNATED ON APPROVED PLANS.
2. USE TEMPORARY SOIL STABILIZATION MATTING MADE OF DEGRADABLE (LASTS 6 MONTHS MINIMUM) NATURAL OR MAN-MADE FIBERS (MOSTLY ORGANIC). MAT MUST HAVE UNIFORM THICKNESS AND DISTRIBUTION OF FIBERS THROUGHOUT AND BE SMOLDER RESISTANT. CHEMICALS USED IN THE MAT MUST BE NON-LEACHING AND NON-TOXIC TO VEGETATION AND SEED GERMINATION AND NON-INJURIOUS TO THE SKIN. IF PRESENT, NETTING MUST BE EXTRUDED PLASTIC WITH A MAXIMUM MESH OPENING OF 2x2 INCHES AND SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL.
3. SECURE MATTING USING STEEL STAPLES, WOOD STAKES, OR BIODEGRADABLE EQUIVALENT. STAPLES MUST BE "U" OR "T" SHAPED STEEL WIRE HAVING A MINIMUM GAUGE OF NO. 11 AND NO. 8 RESPECTIVELY. "U" SHAPED STAPLES MUST AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES MUST HAVE A MINIMUM 8 INCH MAIN LEG, A MINIMUM 1 INCH SECONDARY LEG, AND A MINIMUM 4 INCH HEAD. WOOD STAKES MUST BE ROUGH-SAWN HARDWOOD, 12 TO 24 INCHES IN LENGTH, 1x3 INCH IN CROSS SECTION, AND WEDGE SHAPED AT THE BOTTOM.
4. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. PLACE MATTING WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
5. UNROLL MATTING IN DIRECTION OF WATER FLOW, CENTERING THE FIRST ROLL ON THE CHANNEL CENTERLINE. WORK FROM CENTER OF CHANNEL OUTWARD WHEN PLACING ROLLS. LAY MAT SMOOTHLY AND FIRMLY ON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.
6. KEY-IN UPSTREAM END OF EACH MAT ROLL BY DIGGING A 6 INCH (MINIMUM) TRENCH AT THE UPSTREAM END OF THE MATTING, PLACING THE ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL, AND TAMPING TO SECURE THE MAT END.
7. OVERLAP OR ABUT THE ROLL EDGES PER MANUFACTURER RECOMMENDATIONS. OVERLAP ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSTREAM MAT OVERLAPPING ON TOP OF THE NEXT DOWNSTREAM MAT.
8. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS, JOINTS, AND ROLL ENDS.
9. ESTABLISH AND MAINTAIN VEGETATION SO THAT REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT ARE CONTINUOUSLY MET IN ACCORDANCE WITH SECTION B-4 VEGETATIVE STABILIZATION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL B-4-6-B TEMPORARY SOIL STABILIZATION MATTING SLOPE APPLICATION

STANDARD SYMBOL: TSSMS - ✱ lb/ft² (✱ INCLUDE SHEAR STRESS)



CONSTRUCTION SPECIFICATIONS

1. USE MATTING THAT HAS A DESIGN VALUE FOR SHEAR STRESS EQUAL TO OR HIGHER THAN THE SHEAR STRESS DESIGNATED ON APPROVED PLANS.
2. USE TEMPORARY SOIL STABILIZATION MATTING MADE OF DEGRADABLE (LASTS 6 MONTHS MINIMUM) NATURAL OR MAN-MADE FIBERS (MOSTLY ORGANIC). MAT MUST HAVE UNIFORM THICKNESS AND DISTRIBUTION OF FIBERS THROUGHOUT AND BE SMOLDER RESISTANT. CHEMICALS USED IN THE MAT MUST BE NON-LEACHING AND NON-TOXIC TO VEGETATION AND SEED GERMINATION AND NON-INJURIOUS TO THE SKIN. IF PRESENT, NETTING MUST BE EXTRUDED PLASTIC WITH A MAXIMUM MESH OPENING OF 2x2 INCHES AND SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL.
3. SECURE MATTING USING STEEL STAPLES, WOOD STAKES, OR BIODEGRADABLE EQUIVALENT. STAPLES MUST BE "U" OR "T" SHAPED STEEL WIRE HAVING A MINIMUM GAUGE OF NO. 11 AND NO. 8 RESPECTIVELY. "U" SHAPED STAPLES MUST AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES MUST HAVE A MINIMUM 8 INCH MAIN LEG, A MINIMUM 1 INCH SECONDARY LEG, AND A MINIMUM 4 INCH HEAD. WOOD STAKES MUST BE ROUGH-SAWN HARDWOOD, 12 TO 24 INCHES IN LENGTH, 1x3 INCH IN CROSS SECTION, AND WEDGE SHAPED AT THE BOTTOM.
4. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. PLACE MATTING WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION & SEDIMENT CONTROL PLAN.
5. UNROLL MATTING DOWNSLOPE. LAY MAT SMOOTHLY AND FIRMLY UPON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.
6. OVERLAP OR ABUT ROLL EDGES PER MANUFACTURER RECOMMENDATIONS. OVERLAP ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSLOPE MAT OVERLAPPING ON TOP OF THE DOWNSLOPE MAT.
7. KEY IN THE UPSLOPE END OF MAT 6 INCHES (MINIMUM) BY DIGGING A TRENCH, PLACING THE MATTING ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL, AND TAMPING TO SECURE THE MAT END IN THE KEY.
8. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS, JOINTS, AND ROLL ENDS.
9. ESTABLISH AND MAINTAIN VEGETATION SO THAT REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT ARE CONTINUOUSLY MET IN ACCORDANCE WITH SECTION B-4 VEGETATIVE STABILIZATION.

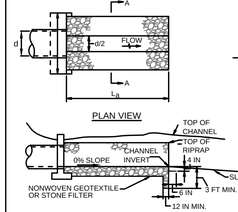
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-4-1-B ROCK OUTLET PROTECTION II

STANDARD SYMBOL: ROPII

DISCHARGE TO CONFINED CHANNEL SECTION



RIPRAP	
CLASS	THICKNESS (T)
I	19 IN
II	32 IN
III	46 IN

CONSTRUCTION SPECIFICATIONS

1. RIPRAP AND STONE MUST CONFORM TO THE SPECIFIED CLASS.
2. USE NONWOVEN GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS, AND PROTECT FROM PUNCTURING, CUTTING, OR TEARING. REPAIR ANY DAMAGE OTHER THAN AN OCCASIONAL SMALL HOLE BY PLACING ANOTHER PIECE OF GEOTEXTILE OVER THE DAMAGED PART OR BY COMPLETELY REPLACING THE GEOTEXTILE. PROVIDE A MINIMUM OF ONE FOOT OVERLAP FOR ALL REPAIRS AND FOR JOINING TWO PIECES OF GEOTEXTILE TOGETHER.
3. PREPARE THE SUBGRADE FOR GEOTEXTILE OR STONE FILTER (¼ TO 1½ INCH STONE FOR 6 INCH MINIMUM DEPTH) AND RIPRAP TO THE REQUIRED LINES AND GRADES. COMPACT ANY FILL REQUIRED IN THE SUBGRADE TO A DENSITY OF APPROXIMATELY THAT OF THE SURROUNDING UNDISTURBED MATERIAL.
4. EXTEND GEOTEXTILE AT LEAST 6 INCHES BEYOND EDGES OF RIPRAP AND EMBED AT LEAST 4 INCHES AT SIDES OF RIPRAP.
5. CONSTRUCT RIPRAP OUTLET TO FULL COURSE THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO AVOID DISPLACEMENT OF UNDERLYING MATERIALS. PLACE STONE FOR RIPRAP OUTLET IN A MANNER THAT WILL ENSURE THAT IT IS REASONABLY HOMOGENOUS WITH THE SMALLER STONES AND SPALLS FILLING THE VOIDS BETWEEN THE LARGER STONES. PLACE RIPRAP IN A MANNER TO PREVENT DAMAGE TO THE FILTER BLANKET OR GEOTEXTILE. HAND PLACE TO THE EXTENT NECESSARY.
6. WHERE NO ENDWALL IS USED, CONSTRUCT THE UPSTREAM END OF THE APRON SO THAT THE WIDTH IS TWO TIMES THE DIAMETER OF THE OUTLET PIPE, AND EXTEND THE STONE UNDER THE OUTLET BY A MINIMUM OF 18 INCHES.
7. CONSTRUCT APRON WITH 0% SLOPE ALONG ITS LENGTH AND WITHOUT OBSTRUCTIONS. PLACE STONE SO THAT IT BLENDS IN WITH EXISTING GROUND.
8. MAINTAIN LINE, GRADE, AND CROSS SECTION. KEEP OUTLET FREE OF EROSION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. AFTER HIGH FLOWS INSPECT FOR SCOUR AND DISLODGED RIPRAP. MAKE NECESSARY REPAIRS IMMEDIATELY.

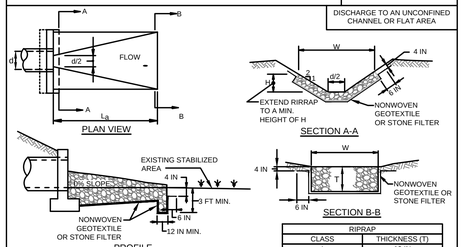
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-4-1-C ROCK OUTLET PROTECTION III

STANDARD SYMBOL: ROPIII

DISCHARGE TO AN UNCONFINED CHANNEL OR FLAT AREA



RIPRAP	
CLASS	THICKNESS (T)
I	19 IN
II	32 IN
III	46 IN

CONSTRUCTION SPECIFICATIONS

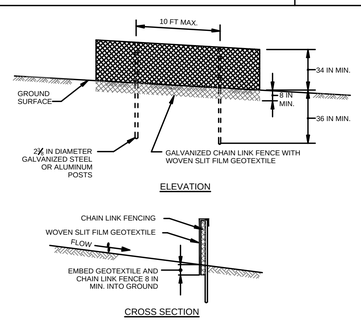
1. RIPRAP AND STONE MUST CONFORM TO THE SPECIFIED CLASS.
2. USE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS. AND PROTECT FROM PUNCTURING, CUTTING, OR TEARING. REPAIR ANY DAMAGE OTHER THAN AN OCCASIONAL SMALL HOLE BY PLACING ANOTHER PIECE OF GEOTEXTILE OVER THE DAMAGED PART OR BY COMPLETELY REPLACING THE GEOTEXTILE. PROVIDE A MINIMUM OF ONE FOOT OVERLAP FOR ALL REPAIRS AND FOR JOIINING TWO PIECES OF GEOTEXTILE TOGETHER.
3. PREPARE THE SUBGRADE FOR GEOTEXTILE OR STONE FILTER (¼ TO 1½ INCH MINIMUM STONE FOR 6 INCH MINIMUM DEPTH) AND RIPRAP TO THE REQUIRED LINES AND GRADES. COMPACT ANY FILL REQUIRED IN THE SUBGRADE TO A DENSITY OF APPROXIMATELY THAT OF THE SURROUNDING UNDISTURBED MATERIAL.
4. EXTEND GEOTEXTILE AT LEAST 6 INCHES BEYOND EDGES OF RIPRAP AND EMBED AT LEAST 4 INCHES AT SIDES OF RIPRAP.
5. CONSTRUCT RIPRAP OUTLET TO FULL COURSE THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO AVOID DISPLACEMENT OF UNDERLYING MATERIALS. PLACE STONE FOR RIPRAP OUTLET IN A MANNER THAT WILL ENSURE THAT IT IS REASONABLY HOMOGENOUS WITH THE SMALLER STONES AND SPALLS FILLING THE VOIDS BETWEEN THE LARGER STONES. PLACE RIPRAP IN A MANNER TO PREVENT DAMAGE TO THE FILTER BLANKET OR GEOTEXTILE. HAND PLACE TO THE EXTENT NECESSARY.
6. WHERE NO ENDWALL IS USED, CONSTRUCT THE UPSTREAM END OF THE APRON SO THAT THE WIDTH IS TWO TIMES THE DIAMETER OF THE OUTLET PIPE, AND EXTEND THE STONE UNDER THE OUTLET BY A MINIMUM OF 18 INCHES.
7. CONSTRUCT APRON WITH 0% SLOPE ALONG ITS LENGTH AND WITHOUT OBSTRUCTIONS. PLACE STONE SO THAT IT BLENDS IN WITH EXISTING GROUND.
8. MAINTAIN LINE, GRADE, AND CROSS SECTION. KEEP OUTLET FREE OF EROSION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. AFTER HIGH FLOWS INSPECT FOR SCOUR AND RIPRAP DISLODGED RIPRAP. MAKE NECESSARY REPAIRS IMMEDIATELY.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-3 SUPER SILT FENCE

STANDARD SYMBOL: SSF



CONSTRUCTION SPECIFICATIONS

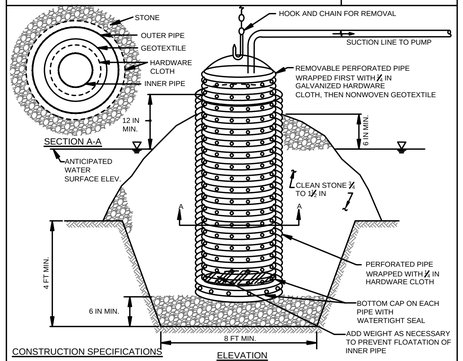
1. INSTALL 2½ INCH DIAMETER GALVANIZED STEEL POSTS OF 0.095 INCH WALL THICKNESS AND SIX FOOT LENGTH SPACED NO FURTHER THAN 10 FEET APART. DRIVE THE POSTS A MINIMUM OF 36 INCHES INTO THE GROUND.
2. FASTEN 9 GAUGE OR HEAVIER GALVANIZED CHAIN LINK FENCE (2½ INCH MAXIMUM OPENING) 42 INCHES IN HEIGHT SECURELY TO THE FENCE POSTS WITH WIRE TIES OR HUG RINGS.
3. FASTEN WOVEN SLIT FILM GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS, SECURELY TO THE UPSLOPE SIDE OF CHAIN LINK FENCE WITH TIES SPACED EVERY 24 INCHES AT THE TOP AND MID SECTION. EMBED GEOTEXTILE AND CHAIN LINK FENCE A MINIMUM OF 8 INCHES INTO THE GROUND.
4. WHERE ENDS OF THE GEOTEXTILE COME TOGETHER, THE ENDS SHALL BE OVERLAPPED BY 6 INCHES, FOLDED, AND STAPLED TO PREVENT SEDIMENT BY PASS.
5. EXTEND BOTH ENDS OF THE SUPER SILT FENCE A MINIMUM OF FIVE HORIZONTAL FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT TO PREVENT RUNOFF FROM GOING AROUND THE ENDS OF THE SUPER SILT FENCE.
6. PROVIDE MANUFACTURER CERTIFICATION TO THE INSPECTION/ENFORCEMENT AUTHORITY SHOWING THAT GEOTEXTILE USED MEETS THE REQUIREMENTS IN SECTION H-1 MATERIALS.
7. REMOVE ACCUMULATED SEDIMENT AND DEBRIS WHEN BULGES DEVELOP IN FENCE OR WHEN SEDIMENT REACHES 25% OF FENCE HEIGHT. REPLACE GEOTEXTILE IF TORN. IF UNDERMINING OCCURS, REINSTALL CHAIN LINK FENCING AND GEOTEXTILE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL F-1 REMOVABLE PUMPING STATION

STANDARD SYMBOL: ☒RPS



CONSTRUCTION SPECIFICATIONS

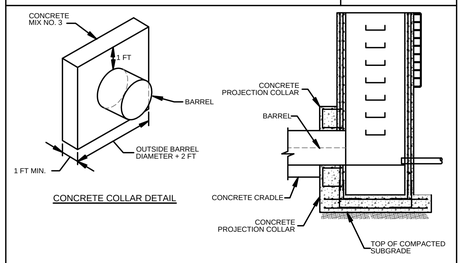
1. USE CORRUGATED METAL OR PLASTIC PIPE WITH 1 INCH DIAMETER PERFORATIONS 6 INCHES ON CENTER.
2. USE A MINIMUM 12 INCH DIAMETER INNER PIPE WITH AN OUTER PIPE A MINIMUM 6 INCHES LARGER IN DIAMETER. BOTTOM OF EACH PIPE MUST BE CAPPED WITH WATERTIGHT SEAL.
3. WRAP EACH PIPE WITH ¼ INCH GALVANIZED HARDWARE CLOTH. ON INNER PIPE WRAP NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS, OVER THE HARDWARE CLOTH.
4. EXCAVATE 8 FEET X 8 FEET X 4 FEET DEEP PIT FOR PIPE PLACEMENT. PLACE CLEAN ¼ TO 1½ INCH STONE OR EQUIVALENT RECYCLED CONCRETE, 6 INCHES IN DEPTH PRIOR TO PIPE PLACEMENT.
5. SET TOP OF INNER AND OUTER PIPES MINIMUM 12 INCHES ABOVE ANTICIPATED WATER SURFACE ELEVATION (OR RISER CREST ELEVATION WHEN DEWATERING A BASIN).
6. BACKFILL PIT AROUND THE OUTER PIPE WITH ¼ TO 1½ INCH CLEAN STONE OR EQUIVALENT RECYCLED CONCRETE AND EXTEND STONE A MINIMUM OF 6 INCHES ABOVE ANTICIPATED WATER SURFACE ELEVATION.
7. DISCHARGE TO A STABLE AREA AT A NONEROSIVE RATE.
8. A REMOVABLE PUMPING STATION REQUIRES FREQUENT MAINTENANCE. IF SYSTEM CLOGS, PULL OUT INNER PIPE AND REPLACE GEOTEXTILE. KEEP POINT OF DISCHARGE FREE OF EROSION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL G-2-9 PROJECTION COLLAR

STANDARD SYMBOL



CONSTRUCTION SPECIFICATIONS

1. CAST 1 FOOT THICK CONCRETE COLLAR TO OUTLET STRUCTURE WITH FOUR #4 U-SHAPED REBARS.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

REV	DATE	DESCRIPTION	DRN	APP

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OWNER / DEVELOPER / APPLICANT
TALEN ENERGY
BRANDON SHORES ROAD, SUITE 100
BALTIMORE, MARYLAND 21226 USA
CONTACT: BRIAN HOYT
PHONE: 410.787.6431

TITLE: EROSION AND SEDIMENT CONTROL DETAILS I

PROJECT: CELL 3 CONSTRUCTION DRAWINGS

SITE: LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

PROFESSIONAL CERTIFICATION:

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND,
LICENSE No. 22181
EXPIRATION DATE 12-2-2018

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE
DECEMBER 15, 2017
DATE

STATE OF MARYLAND · ROLAND ESPINOZA · 22181 · REGISTERED PROFESSIONAL ENGINEER

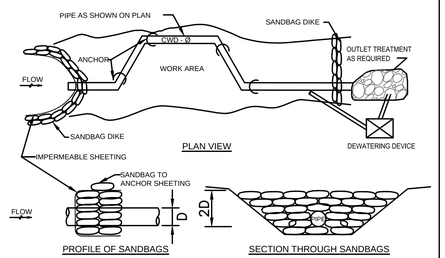
DESIGNED BY:	JSW	DATE:	DECEMBER 2017
DRAWN BY:	JSW	PROJECT NO.:	ME1400
CHECKED BY:	MEP	FILE:	1400-017
REVIEWED BY:	RDE	DRAWING NO.:	17 OF 33
APPROVED BY:			

DETAIL C-6 CLEAR WATER DIVERSION PIPE

STANDARD SYMBOL

CWD - 12

DESIGNATION CWD-12 REFERS TO 12 INCH CLEAR WATER DIVERSION.



CONSTRUCTION SPECIFICATIONS

1. FLEXIBLE PIPE IS PREFERRED. HOWEVER, CORRUGATED METAL PIPE OR EQUIVALENT PVC PIPE CAN BE USED. MAKE ALL JOINTS WATERTIGHT.
2. FOR SANDBAGS USE MATERIALS THAT ARE RESISTANT TO ULTRA-VIOLENT RADIATION, TEARING, AND PUNCTURE AND WOVEN TIGHTLY ENOUGH TO PREVENT LEAKAGE OF FILL MATERIAL.
3. USE 10 MIL OR THICKER, UV RESISTANT, IMPERMEABLE SHEETING OR OTHER APPROVED MATERIAL THAT IS IMPERMEABLE AND RESISTANT TO PUNTURING AND TEARING.
4. PLACE IMPERMEABLE SHEETING SUCH THAT UPGRADE PORTION OVERLAPS DOWNGRADE PORTION BY A MINIMUM OF 18 INCHES.
5. SET HEIGHT OF SANDBAG DIKE AT TWICE THE PIPE DIAMETER. MAINTAIN HEIGHT ALONG LENGTH OF SANDBAG DIKE. PLACE DOUBLE ROW OF SANDBAGS.
6. AT A MINIMUM, SECURELY ANCHOR DIVERSION PIPE AT EACH DOWNGRADE JOINT.
7. SET OUTLET END OF DIVERSION PIPE LOWER THAN INLET END.
8. PROVIDE OUTLET PROTECTION AS REQUIRED ON APPROVED PLAN.
9. DEWATER WORK AREA USING AN APPROVED EROSION AND SEDIMENT CONTROL PRACTICE AS SPECIFIED ON APPROVED PLAN.
10. KEEP POINT OF DISCHARGE FREE OF EROSION. MAINTAIN WATER TIGHT CONNECTIONS AND POSITIVE DRAINAGE. REPLACE SANDBAGS AND IMPERMEABLE SHEETING IF TORN.

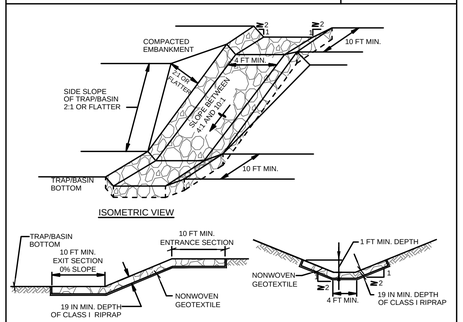
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-3-1 RIPRAP INFLOW PROTECTION

STANDARD SYMBOL

RRR-2



CONSTRUCTION SPECIFICATIONS

1. PROVIDE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS, UNDER THE BOTTOM AND ALONG SIDES OF ALL RIPRAP.
2. CONSTRUCT INFLOW CHANNEL WITH CLASS I RIPRAP OR EQUIVALENT RECYCLED CONCRETE LINING TO A MINIMUM DEPTH OF 19 INCHES (2 x D_{50}) AND A 1 FOOT DEEP FLOW CHANNEL. INFLOW RIPRAP PROTECTION CHANNEL MUST HAVE A TRAPEZOIDAL CROSS SECTION WITH 2:1 OR FLATTER SIDE SLOPES AND A 4 FOOT MINIMUM BOTTOM WIDTH.
3. INSTALL ENTRANCE AND EXIT SECTIONS AS SHOWN ON THE PROFILE.
4. BLEND RIPRAP INTO EXISTING GROUND.
5. MAINTAIN LINE, GRADE, AND CROSS SECTION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. KEEP POINTS OF INFLOW AND OUTFLOW FREE OF EROSION.

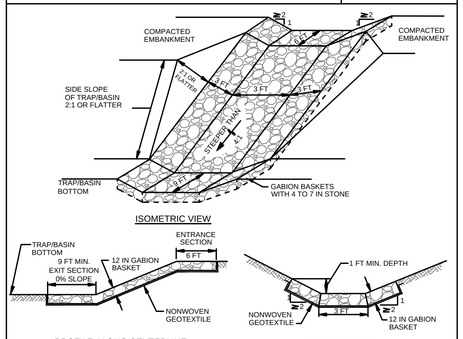
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-3-2 GABION INFLOW PROTECTION

STANDARD SYMBOL

GP-12



CONSTRUCTION SPECIFICATIONS

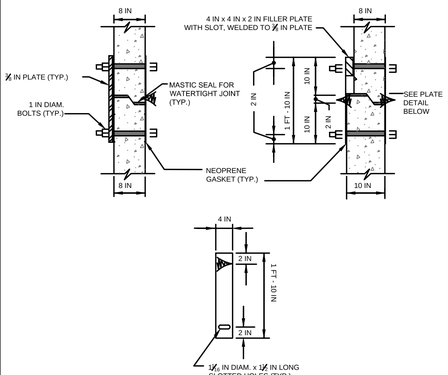
1. PROVIDE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS, UNDER THE BOTTOM AND ALONG SIDES OF ALL GABION BASKETS.
2. USE BASKETS MADE OF MINIMUM 11 GAUGE WIRE.
3. CONSTRUCT GABION INFLOW PROTECTION BY ARRANGING 9 X 3 X 1 FOOT GABION BASKETS TO FORM A TRAPEZOIDAL SECTION WITH A 3 FOOT BOTTOM WIDTH, 1 FOOT MINIMUM DEPTH, 3 FOOT SIDE WALLS, AND 2:1 OR FLATTER SIDE SLOPES. FILL GABION BASKETS WITH 4 TO 7 INCH STONE OR EQUIVALENT RECYCLED CONCRETE WITHOUT REBAR OR WEIR MESH.
4. INSTALL ENTRANCE AND EXIT SECTIONS AS SHOWN ON THE PROFILE.
5. INSTALL GABIONS IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.
6. BLEND GABIONS INTO EXISTING GROUND.
7. MAINTAIN LINE, GRADE, AND CROSS SECTION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. KEEP POINTS OF INFLOW AND OUTFLOW FREE OF EROSION

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL G-2-8 PRECAST RISER CONNECTOR

STANDARD SYMBOL



CONSTRUCTION SPECIFICATIONS

1. FABRICATE PLATE CONNECTORS FROM STAINLESS STEEL CONFORMING TO ASTM A666-72, GRADE A OR B.
2. USE TYPE 304 STAINLESS STEEL FOR BOLTS.
3. PROVIDE CONNECTORS AT CENTERLINE OF EACH PRECAST BOX FACE. FOR MANHOLES PROVIDE FOUR PLATES SPACED AT 90°.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

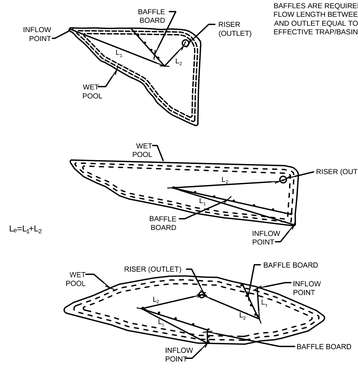
U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL G-2-4 BAFFLE BOARDS

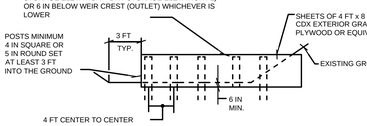
STANDARD SYMBOL

BB

BAFFLES ARE REQUIRED TO PROVIDE A FLOW LENGTH BETWEEN INFLOW POINT AND OUTLET EQUAL TO TWICE THE EFFECTIVE TRAP/BASIN WIDTH.

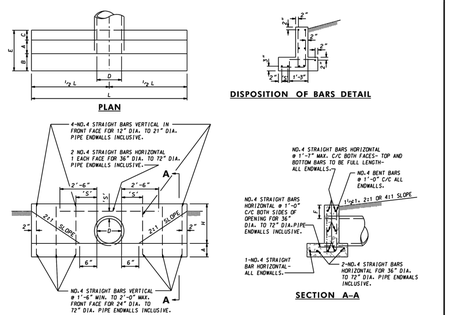


SET ELEVATION AT ½ OF THE DRY STORAGE (WET STORAGE ELEVATION + DRY STORAGE ELEVATION / 2) OR 6 IN BELOW WEIR CREST (OUTLET) WHICHEVER IS LOWER



MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION



QUANTITIES FOR ESTIMATING PURPOSES ONLY

OPENING		DIMENSIONS							QUANTITIES	
D INCHES	AREA SQ.FT.	A	B	C	E	F	H	L	CONC. C.Y.	STEEL LBS.
12	0.79	9"	6"	6"	1'-9"	9"	1'-9"	6'-6"	0.61	41
15	1.23	9"	6"	6"	1'-5"	9"	2'-0"	7'-0"	0.77	41
18	1.77	9"	6"	6"	1'-5"	9"	2'-3"	9'-0"	0.95	54
21	2.40	9"	6"	6"	1'-9"	9"	2'-6"	10'-3"	1.14	70
24	3.14	9"	14"	6"	2'-5"	9"	2'-9"	11'-6"	1.56	80
27	3.98	9"	14"	6"	2'-5"	9"	3'-0"	12'-10"	1.82	88
30	4.91	9"	14"	6"	2'-5"	12"	3'-6"	14'-2"	2.22	98
33	5.94	9"	14"	6"	2'-5"	12"	3'-9"	15'-5"	2.48	105
36	7.07	12"	16"	10"	3'-2"	12"	4'-0"	16'-8"	4.16	182
42	9.62	12"	16"	10"	3'-2"	12"	4'-6"	19'-2"	5.07	206
48	12.57	12"	16"	10"	3'-2"	12"	5'-0"	21'-8"	6.09	244
54	15.90	12"	20"	12"	3'-8"	12"	5'-6"	24'-2"	7.62	275
60	19.64	12"	20"	12"	3'-8"	12"	6'-0"	26'-8"	8.82	304
72	28.27	12"	20"	12"	3'-8"	12"	7'-0"	31'-8"	11.46	377

'S' DISTANCES

4" FOR 12" DIA. TO 21" DIA. PIPES INCLUSIVE.
6" FOR 24" DIA. TO 36" DIA. PIPES INCLUSIVE.
8" FOR 42" DIA. TO 72" DIA. PIPES INCLUSIVE.

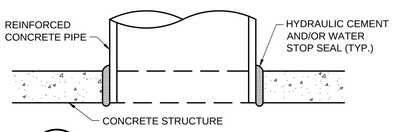
GENERAL NOTES

SPECIFICATIONS: LATEST S.H.A.
CONCRETE SHALL BE MIX NO.2
REINFORCING: DEFORMED STEEL BARS-NO.4
CHAMFER: ALL EXPOSED EDGES 1"x1" OR AS DIRECTED

SPECIFICATION 305	CATEGORY CODE ITEMS	Maryland Department of Transportation STATE HIGHWAY ADMINISTRATION
APPROVED	DIRECTOR - OFFICE OF HIGHWAY DEVELOPMENT	STANDARDS FOR HIGHWAYS AND INCIDENTAL STRUCTURES
SHA State Highway Administration	APPROVAL • SHA REVIEWING: APPROVAL 8-30-84; REVISED 10-1-85; REVISED; REVISED	APPROVAL • FEDERAL HIGHWAY ADMINISTRATION: APPROVAL 12-13-84; REVISED; REVISED; REVISED

STANDARD TYPE C ENDWALL
METAL OR CONCRETE ROUND PIPE

STANDARD NO. MD 354.01

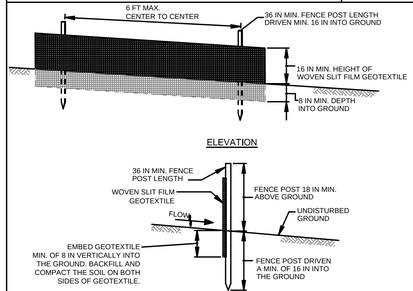


2 - DETAIL
WATERTIGHT CONNECTION
NOT TO SCALE

DETAIL E-1 SILT FENCE

STANDARD SYMBOL

SF



CONSTRUCTION SPECIFICATIONS

1. USE WOOD POSTS 1½ X 1½ X ½ INCH (MINIMUM) SQUARE CUT OF SOUND QUALITY HARDWOOD. AS AN ALTERNATIVE TO WOODEN POST USE STANDARD "T" OR "U" SECTION STEEL POSTS WEIGHING NOT LESS THAN 1 POUND PER LINEAR FOOT.
2. USE 36 INCH MINIMUM POSTS DRIVEN 16 INCH MINIMUM INTO GROUND NO MORE THAN 6 FEET APART.
3. USE WOVEN SLIT FILM GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS AND FASTEN GEOTEXTILE SECURELY TO UPSLOPE SIDE OF FENCE POSTS WITH WIRE TIES OR STAPLES AT TOP AND MID-SECTION.
4. PROVIDE MANUFACTURER CERTIFICATION TO THE AUTHORIZED REPRESENTATIVE OF THE INSPECTION/ENFORCEMENT AUTHORITY SHOWING THAT THE GEOTEXTILE USED MEETS THE REQUIREMENTS IN SECTION H-1 MATERIALS.
5. EMBED GEOTEXTILE A MINIMUM OF 8 INCHES VERTICALLY INTO THE GROUND. BACKFILL AND COMPACT THE SOIL ON BOTH SIDES OF FABRIC.
6. WHERE TWO SECTIONS OF GEOTEXTILE ADJOIN: OVERLAP, TWIST, AND STAPLE TO POST IN ACCORDANCE WITH THIS DETAIL.
7. EXTEND BOTH ENDS OF THE SILT FENCE A MINIMUM OF FIVE HORIZONTAL FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT TO PREVENT RUNOFF FROM GOING AROUND THE ENDS OF THE SILT FENCE.
8. REMOVE ACCUMULATED SEDIMENT AND DEBRIS WHEN BULGES DEVELOP IN SILT FENCE OR WHEN SEDIMENT REACHES 25% OF FENCE HEIGHT. REPLACE GEOTEXTILE IF TORN. IF UNDERMINING OCCURS, REINSTALL FENCE.

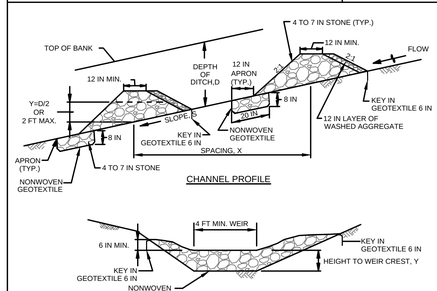
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-2 STONE CHECK DAM

STANDARD SYMBOL

CD

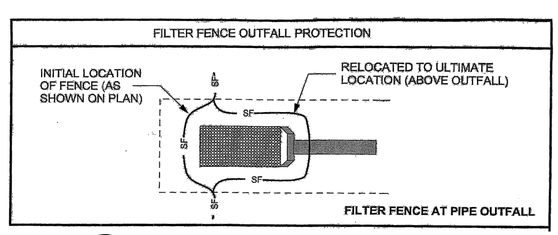


CONSTRUCTION SPECIFICATIONS

1. PREPARE SWALES IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS DESCRIBED IN SECTION C-2, STANDARDS AND SPECIFICATIONS FOR TEMPORARY SWALE, OR AS SPECIFIED ON PLAN.
2. PLACE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS, UNDER THE BOTTOM AND SIDES OF THE DAM PRIOR TO PLACEMENT OF STONE. CONSTRUCT THE CHECK DAM WITH WASHED 4 TO 7 INCH STONE OR EQUIVALENT RECYCLED CONCRETE (WITHOUT REBAR) WITH SIDE SLOPES OF 2:1 OR FLATTER AND A MINIMUM TOP WIDTH OF 12 INCHES. PLACE THE STONE SO THAT IT COMPLETELY COVERS THE WIDTH OF THE CHANNEL AND CHANNEL BANKS. FORM THE WEIR SO THAT TOP OF THE OUTLET CREST IS APPROXIMATELY 6 INCHES LOWER THAN THE OUTER EDGES. LINE THE UPSTREAM FACE OF THE DAM WITH A 1 FOOT THICK LAYER OF WASHED AGGREGATE (½ TO 1½ INCH).
3. SET THE HEIGHT FOR THE WEIR CREST EQUAL TO ONE-HALF THE DEPTH OF THE CHANNEL OR DITCH. TO AVOID SCOUR THE MAXIMUM HEIGHT OF THE WEIR CREST MUST NOT EXCEED 2.0 FEET.
4. REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES ONE-HALF OF THE HEIGHT OF THE WEIR CREST. MAINTAIN LINE, GRADE, AND CROSS SECTION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION



3 - DETAIL
SILT FENCE OUTFALL PROTECTION
NOT TO SCALE

1 - DETAIL
DRAW-DOWN DEVICE ANCHOR
NOT TO SCALE

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

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TITLE: EROSION AND SEDIMENT CONTROL DETAILS II

PROJECT: CELL 3 CONSTRUCTION DRAWINGS

SITE: LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

PROFESSIONAL CERTIFICATION:

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND,
LICENSE No. 22181
EXPIRATION DATE 12-2-2018

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE
DECEMBER 15, 2017
DATE

STATE OF MARYLAND — ROBERT DANIEL EGAN — 22181 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY:	JSW	DATE:	DECEMBER 2017
DRAWN BY:	JSW	PROJECT NO.:	ME1400
CHECKED BY:	MEP	FILE:	1400-017
REVIEWED BY:	RDE	DRAWING NO.:	18 OF 33
APPROVED BY:			

EROSION AND SEDIMENT CONTROL – STANDARD SPECIFICATIONS FOR BALTIMORE CITY PART 1 OF 2

SHEET REVISION DATE: MAY 11, 2017

B-4 STANDARDS AND SPECIFICATIONS FOR VEGETATIVE STABILIZATION

DEFINITION
USING VEGETATION AS COVER TO PROTECT EXPOSED SOIL FROM EROSION.

PURPOSE
TO PROMOTE THE ESTABLISHMENT OF VEGETATION ON EXPOSED SOIL.

CONDITIONS WHERE PRACTICE APPLIES
ON ALL DISTURBED AREAS NOT STABILIZED BY OTHER METHODS. THIS SPECIFICATION IS DIVIDED INTO SECTIONS ON INCREMENTAL STABILIZATION; SOIL PREPARATION, SOIL AMENDMENTS AND TOPSOILING; SEEDING AND MULCHING; TEMPORARY STABILIZATION; AND PERMANENT STABILIZATION.

EFFECTS ON WATER QUALITY AND QUANTITY
STABILIZATION PRACTICES ARE USED TO PROMOTE THE ESTABLISHMENT OF VEGETATION ON EXPOSED SOIL. WHEN SOIL IS STABILIZED WITH VEGETATION, THE SOIL IS LESS LIKELY TO ERODE AND MORE LIKELY TO ALLOW INFILTRATION OF RAINFALL, THEREBY REDUCING SEDIMENT LOADS AND RUNOFF TO DOWNSTREAM AREAS. PLANTING VEGETATION IN DISTURBED AREAS WILL HAVE AN EFFECT ON THE WATER BUDGET, ESPECIALLY ON VOLUMES AND RATES OF RUNOFF, INFILTRATION, EVAPORATION, TRANSPIRATION, PERCOLATION, AND GROUNDWATER RECHARGE. OVER TIME, VEGETATION WILL INCREASE ORGANIC MATTER CONTENT AND IMPROVE THE WATER HOLDING CAPACITY OF THE SOIL AND SUBSEQUENT PLANT GROWTH. VEGETATION WILL HELP REDUCE THE MOVEMENT OF SEDIMENT, NUTRIENTS, AND OTHER CHEMICALS CARRIED BY RUNOFF TO RECEIVING WATERS. PLANTS WILL ALSO HELP PROTECT GROUNDWATER SUPPLIES BY ASSIMILATING THOSE SUBSTANCES PRESENT WITHIN THE ROOT ZONE. SEDIMENT CONTROL PRACTICES MUST REMAIN IN PLACE DURING GRADING, SEEDBED PREPARATION, SEEDING, MULCHING, AND VEGETATIVE ESTABLISHMENT.

ADEQUATE VEGETATIVE ESTABLISHMENT
INSPECT SEEDED AREAS FOR VEGETATIVE ESTABLISHMENT AND MAKE NECESSARY REPAIRS, REPLACEMENTS, AND RESEEDINGS WITHIN THE PLANTING SEASON.

1. ADEQUATE VEGETATIVE STABILIZATION REQUIRES 95 PERCENT GROUNDCOVER.
2. IF AN AREA HAS LESS THAN 40 PERCENT GROUNDCOVER, RESTABILIZE FOLLOWING THE ORIGINAL RECOMMENDATIONS FOR LIME, FERTILIZER, SEEDBED PREPARATION, AND SEEDING.
3. IF AN AREA HAS BETWEEN 40 AND 94 PERCENT GROUNDCOVER, OVER-SEED AND FERTILIZE USING HALF OF THE RATES ORIGINALLY SPECIFIED.
4. MAINTENANCE FERTILIZER RATES FOR PERMANENT SEEDING ARE SHOWN IN TABLE B.6.

B-4-1 STANDARDS AND SPECIFICATIONS FOR INCREMENTAL STABILIZATION

DEFINITION
ESTABLISHMENT OF VEGETATIVE COVER ON CUT AND FILL SLOPES.

PURPOSE
TO PROVIDE TIMELY VEGETATIVE COVER ON CUT AND FILL SLOPES AS WORK PROGRESSES.

CONDITIONS WHERE PRACTICE APPLIES
ANY CUT OR FILL SLOPE GREATER THAN 15 FEET IN HEIGHT. THIS PRACTICE ALSO APPLIES TO STOCKPILES.

CRITERIA

A. INCREMENTAL STABILIZATION - CUT SLOPES
1. EXCAVATE AND STABILIZE CUT SLOPES IN INCREMENTS NOT TO EXCEED 15 FEET IN HEIGHT. PREPARE SEEDBED AND APPLY SEED AND MULCH ON ALL CUT SLOPES AS THE WORK PROGRESSES.
2. CONSTRUCTION SEQUENCE EXAMPLE (REFER TO FIGURE B.1):
   a. CONSTRUCT AND STABILIZE ALL TEMPORARY SWALES OR DIKES THAT WILL BE USED TO CONVEY RUNOFF AROUND THE EXCAVATION.
   b. PERFORM PHASE 1 EXCAVATION, PREPARE SEEDBED, AND STABILIZE.
   c. PERFORM PHASE 2 EXCAVATION, PREPARE SEEDBED, AND STABILIZE. OVERSEED PHASE 1 AREAS AS NECESSARY.
   d. PERFORM FINAL PHASE EXCAVATION, PREPARE SEEDBED, AND STABILIZE. OVERSEED PREVIOUSLY SEEDED AREAS AS NECESSARY.

NOTE: ONCE EXCAVATION HAS BEGUN THE OPERATION SHOULD BE CONTINUOUS FROM GRUBBING THROUGH THE COMPLETION OF GRADING AND PLACEMENT OF TOPSOIL (IF REQUIRED) AND PERMANENT SEED AND MULCH. ANY INTERRUPTIONS IN THE OPERATION OR COMPLETING THE OPERATION OUT OF THE SEEDING SEASON WILL NECESSITATE THE APPLICATION OF TEMPORARY STABILIZATION.

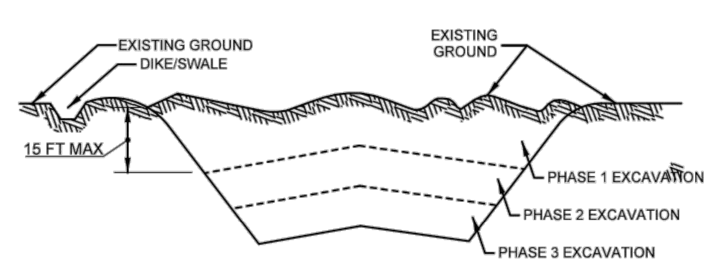

FIGURE B.1: INCREMENTAL STABILIZATION - CUT

B. INCREMENTAL STABILIZATION - FILL SLOPES
1. CONSTRUCT AND STABILIZE FILL SLOPES IN INCREMENTS NOT TO EXCEED 15 FEET IN HEIGHT. PREPARE SEEDBED AND APPLY SEED AND MULCH ON ALL SLOPES AS THE WORK PROGRESSES.
2. STABILIZE SLOPES IMMEDIATELY WHEN THE VERTICAL HEIGHT OF A LIFT REACHES 15 FEET, OR WHEN THE GRADING OPERATION CEASES AS PRESCRIBED IN THE PLANS.
3. AT THE END OF EACH DAY, INSTALL TEMPORARY WATER CONVEYANCE PRACTICE(S), AS NECESSARY, TO INTERCEPT SURFACE RUNOFF AND CONVEY IT DOWN THE SLOPE IN A NON-EROSIVE MANNER.
4. CONSTRUCTION SEQUENCE EXAMPLE (REFER TO FIGURE B.2):
   a. CONSTRUCT AND STABILIZE ALL TEMPORARY SWALES OR DIKES THAT WILL BE USED TO DIVERT RUNOFF AROUND THE FILL. CONSTRUCT SILT FENCE ON LOW SIDE OF FILL UNLESS OTHER METHODS SHOWN ON THE PLANS ADDRESS THIS AREA.
   b. AT THE END OF EACH DAY, INSTALL TEMPORARY WATER CONVEYANCE PRACTICE(S), AS NECESSARY, TO INTERCEPT SURFACE RUNOFF AND CONVEY IT DOWN THE SLOPE IN A NON-EROSIVE MANNER.
   c. PLACE PHASE 1 FILL, PREPARE SEEDBED, AND STABILIZE.
   d. PLACE PHASE 2 FILL, PREPARE SEEDBED, AND STABILIZE.
   e. PLACE FINAL PHASE FILL, PREPARE SEEDBED, AND STABILIZE. OVERSEED PREVIOUSLY SEEDED AREAS AS NECESSARY.

NOTE: ONCE THE PLACEMENT OF FILL HAS BEGUN THE OPERATION SHOULD BE CONTINUOUS FROM GRUBBING THROUGH THE COMPLETION OF GRADING AND PLACEMENT OF TOPSOIL (IF REQUIRED) AND PERMANENT SEED AND MULCH. ANY INTERRUPTIONS IN THE OPERATION OR COMPLETING THE OPERATION OUT OF THE SEEDING SEASON WILL NECESSITATE THE APPLICATION OF TEMPORARY STABILIZATION.B. INCREMENTAL STABILIZATION - FILL SLOPES

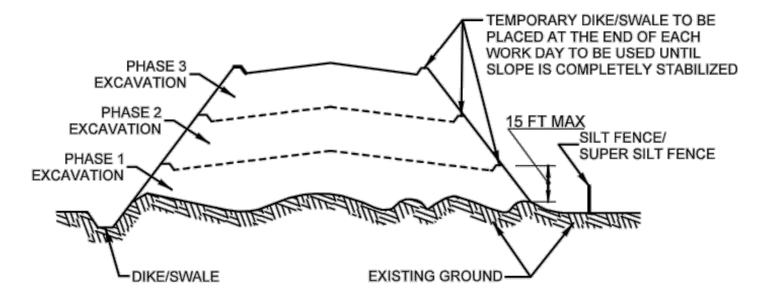

FIGURE B.2: INCREMENTAL STABILIZATION - FILL

B-4-2 STANDARDS AND SPECIFICATIONS FOR SOIL PREPARATION, TOPSOILING, AND SOIL AMENDMENTS

DEFINITION
THE PROCESS OF PREPARING THE SOILS TO SUSTAIN ADEQUATE VEGETATIVE STABILIZATION.

PURPOSE
TO PROVIDE A SUITABLE SOIL MEDIUM FOR VEGETATIVE GROWTH.

CONDITIONS WHERE PRACTICE APPLIES
WHERE VEGETATIVE STABILIZATION IS TO BE ESTABLISHED.

CRITERIA
A. SOIL PREPARATION
1. TEMPORARY STABILIZATION
   a. SEEDBED PREPARATION CONSISTS OF LOOSENING SOIL TO A DEPTH OF 3 TO 5 INCHES BY MEANS OF SUITABLE AGRICULTURAL OR CONSTRUCTION EQUIPMENT, SUCH AS DISC HARROWS OR CHISEL PLOWS OR RIPPERS MOUNTED ON CONSTRUCTION EQUIPMENT. AFTER THE SOIL IS LOOSENED, IT MUST NOT BE ROLLED OR DRAGGED SMOOTH BUT LEFT IN THE ROUGHENED CONDITION. SLOPES 3:1 OR FLATTER ARE TO BE TRACKED WITH RIDGES RUNNING PARALLEL TO THE CONTOUR OF THE SLOPE.
   b. APPLY FERTILIZER AND LIME AS PRESCRIBED ON THE PLANS.
   c. INCORPORATE LIME AND FERTILIZER INTO THE TOP 3 TO 5 INCHES OF SOIL BY DISKING OR OTHER SUITABLE MEANS.
2. PERMANENT STABILIZATION
   a. A SOIL TEST IS REQUIRED FOR ANY EARTH DISTURBANCE OF 5 ACRES OR MORE. THE MINIMUM SOIL CONDITIONS REQUIRED FOR PERMANENT VEGETATIVE ESTABLISHMENT ARE:
      i. SOIL PH BETWEEN 6.0 AND 7.0.
      ii SOLUBLE SALTS LESS THAN 500 PARTS PER MILLION (PPM).
      iii. SOIL CONTAINS LESS THAN 40 PERCENT CLAY BUT ENOUGH FINE GRAINED MATERIAL (GREATER THAN 30 PERCENT SILT PLUS CLAY)TO PROVIDE THE CAPACITY TO HOLD A MODERATE AMOUNT OF MOISTURE. AN EXCEPTION: IF LOVEGRASS WILL BE PLANTED, THEN A SANDY SOIL (LESS THAN 30 PERCENT SILT PLUS CLAY) WOULD BE ACCEPTABLE.
      iv. SOIL CONTAINS 1.5 PERCENT MINIMUM ORGANIC MATTER BY WEIGHT.
      v. SOIL CONTAINS SUFFICIENT PORE SPACE TO PERMIT ADEQUATE ROOT PENETRATION.
   b. APPLICATION OF AMENDMENTS OR TOPSOIL IS REQUIRED IF ON-SITE SOILS DO NOT MEET THE ABOVE CONDITIONS.
   c. GRADED AREAS MUST BE MAINTAINED IN A TRUE AND EVEN GRADE AS SPECIFIED ON THE APPROVED PLAN, THEN SCARIFIED OR OTHERWISE LOOSENED TO A DEPTH OF 3 TO 5 INCHES.
   d. APPLY SOIL AMENDMENTS AS SPECIFIED ON THE APPROVED PLAN OR AS INDICATED BY THE RESULTS OF A SOIL TEST.
   e. MIX SOIL AMENDMENTS INTO THE TOP 3 TO 5 INCHES OF SOIL BY DISKING OR OTHER SUITABLE MEANS. RAKE LAWN AREAS TO SMOOTH THE SURFACE, REMOVE LARGE OBJECTS LIKE STONES AND BRANCHES, AND READY THE AREA FOR SEED APPLICATION. LOOSEN SURFACE SOIL BY DRAGGING WITH A HEAVY CHAIN OR OTHER EQUIPMENT TO ROUGHEN THE SURFACE WHERE SITE CONDITIONS WILL NOT PERMIT NORMAL SEEDBED PREPARATION. TRACK SLOPES 3:1 OR FLATTER WITH TRACKED EQUIPMENT LEAVING THE SOIL IN AN IRREGULAR CONDITION WITH RIDGES RUNNING PARALLEL TO THE CONTOUR OF THE SLOPE. LEAVE THE TOP 1 TO 3 INCHES OF SOIL LOOSE AND FRIABLE. SEEDBED LOOSENING MAY BE UNNECESSARY ON NEWLY DISTURBED AREAS.

B. TOPSOILING
1. TOPSOIL IS PLACED OVER PREPARED SUBSOIL PRIOR TO ESTABLISHMENT OF PERMANENT VEGETATION. THE PURPOSE IS TO PROVIDE A SUITABLE SOIL MEDIUM FOR VEGETATIVE GROWTH. SOILS OF CONCERN HAVE LOW MOISTURE CONTENT, LOW NUTRIENT LEVELS, LOW PH, MATERIALS TOXIC TO PLANTS, AND/OR UNACCEPTABLE SOIL GRADATION.
2. TOPSOIL SALVAGED FROM AN EXISTING SITE MAY BE USED PROVIDED IT MEETS THE STANDARDS AS SET FORTH IN THESE SPECIFICATIONS. TYPICALLY, THE DEPTH OF TOPSOIL TO BE SALVAGED FOR A GIVEN SOIL TYPE CAN BE FOUND IN THE REPRESENTATIVE SOIL PROFILE SECTION IN THE SOIL SURVEY PUBLISHED BY USDA-NRCS.
3. TOPSOILING IS LIMITED TO AREAS HAVING 2:1 OR FLATTER SLOPES WHERE:
   a. THE TEXTURE OF THE EXPOSED SUBSOIL/PARENT MATERIAL IS NOT ADEQUATE TO PRODUCE VEGETATIVE GROWTH.
   b. THE SOIL MATERIAL IS SO SHALLOW THAT THE ROOTING ZONE IS NOT DEEP ENOUGH TO SUPPORT PLANTS OR FURNISH CONTINUING SUPPLIES OF MOISTURE AND PLANT NUTRIENTS.
   c. THE ORIGINAL SOIL TO BE VEGETATED CONTAINS MATERIAL TOXIC TO PLANT GROWTH.
   d. THE SOIL IS SO ACIDIC THAT TREATMENT WITH LIMESTONE IS NOT FEASIBLE.
4. AREAS HAVING SLOPES STEEPER THAN 2:1 REQUIRE SPECIAL CONSIDERATION AND DESIGN.
5. TOPSOIL SPECIFICATIONS: SOIL TO BE USED AS TOPSOIL MUST MEET THE FOLLOWING CRITERIA:
   a. TOPSOIL MUST BE A LOAM, SANDY LOAM, CLAY LOAM, SILT LOAM, SANDY CLAY LOAM, OR LOAMY SAND. OTHER SOILS MAY BE USED IF RECOMMENDED BY AN AGRONOMIST OR SOIL SCIENTIST AND APPROVED BY THE APPROPRIATE APPROVAL AUTHORITY. TOPSOIL MUST NOT BE A MIXTURE OF CONTRASTING TEXTURED SUBSOILS AND MUST CONTAIN LESS THAN 5 PERCENT BY VOLUME OF CINDERS, STONES, SLAG, COARSE FRAGMENTS, GRAVEL, STICKS, ROOTS, TRASH, OR OTHER MATERIALS LARGER THAN 1.5 INCHES IN DIAMETER.
   b. TOPSOIL MUST BE FREE OF NOXIOUS PLANTS OR PLANT PARTS SUCH AS BERMUDA GRASS, QUACK GRASS, JOHNSON GRASS, NUT SEDGE, POISON IVY, THISTLE, OR OTHERS AS SPECIFIED.
   c. TOPSOIL SUBSTITUTES OR AMENDMENTS, AS RECOMMENDED BY A QUALIFIED AGRONOMIST OR SOIL SCIENTIST AND APPROVED BY THE APPROPRIATE APPROVAL AUTHORITY, MAY BE USED IN LIEU OF NATURAL TOPSOIL.
6. TOPSOIL APPLICATION
   a. EROSION AND SEDIMENT CONTROL PRACTICES MUST BE MAINTAINED WHEN APPLYING TOPSOIL.
   b. UNIFORMLY DISTRIBUTE TOPSOIL IN A 5 TO 8 INCH LAYER AND LIGHTLY COMPACT TO A MINIMUM THICKNESS OF 4 INCHES. SPREADING IS TO BE PERFORMED IN SUCH A MANNER THAT SODDING OR SEEDING CAN PROCEED WITH A MINIMUM OF ADDITIONAL SOIL PREPARATION AND TILLAGE. ANY IRREGULARITIES IN THE SURFACE RESULTING FROM TOPSOILING OR OTHER OPERATIONS MUST BE CORRECTED IN ORDER TO PREVENT THE FORMATION OF DEPRESSIONS OR WATER POCKETS.
   c. TOPSOIL MUST NOT BE PLACED IF THE TOPSOIL OR SUBSOIL IS IN A FROZEN OR MUDDY CONDITION, WHEN THE SUBSOIL IS EXCESSIVELY WET OR IN A CONDITION THAT MAY OTHERWISE BE DETRIMENTAL TO PROPER GRADING AND SEEDBED PREPARATION.

C. SOIL AMENDMENTS (FERTILIZER AND LIME SPECIFICATIONS)
1. SOIL TESTS MUST BE PERFORMED TO DETERMINE THE EXACT RATIOS AND APPLICATION RATES FOR BOTH LIME AND FERTILIZER ON SITES HAVING DISTURBED AREAS OF 5 ACRES OR MORE. SOIL ANALYSIS MAY BE PERFORMED BY A RECOGNIZED PRIVATE OR COMMERCIAL LABORATORY. SOIL SAMPLES TAKEN FOR ENGINEERING PURPOSES MAY ALSO BE USED FOR CHEMICAL ANALYSES.
2. FERTILIZERS MUST BE UNIFORM IN COMPOSITION, FREE FLOWING AND SUITABLE FOR ACCURATE APPLICATION BY APPROPRIATE EQUIPMENT. MANURE MAY BE SUBSTITUTED FOR FERTILIZER WITH PRIOR APPROVAL FROM THE APPROPRIATE APPROVAL AUTHORITY. FERTILIZERS MUST ALL BE DELIVERED TO THE SITE FULLY LABELED ACCORDING TO THE APPLICABLE LAWS AND MUST BEAR THE NAME, TRADE NAME OR TRADEMARK AND WARRANTY OF THE PRODUCER.
3. LIME MATERIALS MUST BE GROUND LIMESTONE (HYDRATED OR BURNT LIME MAY BE SUBSTITUTED EXCEPT WHEN HYDROSEEDING) WHICH CONTAINS AT LEAST 50 PERCENT TOTAL OXIDES (CALCIUM OXIDE PLUS MAGNESIUM OXIDE). LIMESTONE MUST BE GROUND TO SUCH FINENESS THAT AT LEAST 50 PERCENT WILL PASS THROUGH A #100 MESH SIEVE AND 98 TO 100 PERCENT WILL PASS THROUGH A #20 MESH SIEVE.
4. LIME AND FERTILIZER ARE TO BE EVENLY DISTRIBUTED AND INCORPORATED INTO THE TOP 3 TO 5 INCHES OF SOIL BY DISKING OR OTHER SUITABLE MEANS.
5. WHERE THE SUBSOIL IS EITHER HIGHLY ACIDIC OR COMPOSED OF HEAVY CLAYS, SPREAD GROUND LIMESTONE AT THE RATE OF 4 TO 8 TONS/ACRE (200-400 POUNDS PER 1,000 SQUARE FEET) PRIOR TO THE PLACEMENT OF TOPSOIL.

B-4-3 STANDARDS AND SPECIFICATIONS FOR SEEDING AND MULCHING

DEFINITION
THE APPLICATION OF SEED AND MULCH TO ESTABLISH VEGETATIVE COVER.

PURPOSE
TO PROTECT DISTURBED SOILS FROM EROSION DURING AND AT THE END OF CONSTRUCTION.

CONDITIONS WHERE PRACTICE APPLIES
TO THE SURFACE OF ALL PERIMETER CONTROLS, SLOPES, AND ANY DISTURBED AREA NOT UNDER ACTIVE GRADING.

CRITERIA
A. SEEDING
1. SPECIFICATIONS
   a. ALL SEED MUST MEET THE REQUIREMENTS OF THE MARYLAND STATE SEED LAW. ALL SEED MUST BE SUBJECT TO RE-TESTING BY A RECOGNIZED SEED LABORATORY. ALL SEED USED MUST HAVE BEEN TESTED WITHIN THE 6 MONTHS IMMEDIATELY PRECEDING THE DATE OF SOWING SUCH MATERIAL ON ANY PROJECT. REFER TO TABLE B.4 REGARDING THE QUALITY OF SEED. SEED TAGS MUST BE AVAILABLE UPON REQUEST TO THE INSPECTOR TO VERIFY TYPE OF SEED AND SEEDING RATE.
   b. MULCH ALONE MAY BE APPLIED BETWEEN THE FALL AND SPRING SEEDING DATES ONLY IF THE GROUND IS FROZEN. THE APPROPRIATE SEEDING MIXTURE MUST BE APPLIED WHEN THE GROUND THAWS.
   c. INOCULANTS: THE INOCULANT FOR TREATING LEGUME SEED IN THE SEED MIXTURES MUST BE A PURE CULTURE OF NITROGEN FIXING BACTERIA PREPARED SPECIFICALLY FOR THE SPECIES. INOCULANTS MUST NOT BE USED LATER THAN THE DATE INDICATED ON THE CONTAINER. ADD FRESH INOCULANTS AS DIRECTED ON THE PACKAGE. USE FOUR TIMES THE RECOMMENDED RATE WHEN HYDROSEEDING. NOTE: IT IS VERY IMPORTANT TO KEEP INOCULANT AS COOL AS POSSIBLE UNTIL USED. TEMPERATURES ABOVE 75 TO 80 DEGREES FAHRENHEIT CAN WEAKEN BACTERIA AND MAKE THE INOCULANT LESS EFFECTIVE.
   d. SOD OR SEED MUST NOT BE PLACED ON SOIL WHICH HAS BEEN TREATED WITH SOIL STERILANTS OR CHEMICALS USED FOR WEED CONTROL UNTIL SUFFICIENT TIME HAS ELAPSED (14 DAYS MIN.) TO PERMIT DISSIPATION OF PHYTO-TOXIC MATERIALS.
2. APPLICATION
   a. DRY SEEDING: THIS INCLUDES USE OF CONVENTIONAL DROP OR BROADCAST SPREADERS.
      i. INCORPORATE SEED INTO THE SUBSOIL AT THE RATES PRESCRIBED ON TEMPORARY SEEDING TABLE B.1, PERMANENT SEEDING TABLE B.3, OR SITE-SPECIFIC SEEDING SUMMARIES.
      ii. APPLY SEED IN TWO DIRECTIONS, PERPENDICULAR TO EACH OTHER. APPLY HALF THE SEEDING RATE IN EACH DIRECTION. ROLL THE SEEDED AREA WITH A WEIGHTED ROLLER TO PROVIDE GOOD SEED TO SOIL CONTACT.
   b. DRILL OR CULTIPACKER SEEDING: MECHANIZED SEEDERS THAT APPLY AND COVER SEED WITH SOIL.
      i. CULTIPACKING SEEDERS ARE REQUIRED TO BURY THE SEED IN SUCH A FASHION AS TO PROVIDE AT LEAST 1/4 INCH OF SOIL COVERING. SEEDBED MUST BE FIRM AFTER PLANTING.
      ii. APPLY SEED IN TWO DIRECTIONS, PERPENDICULAR TO EACH OTHER. APPLY HALF THE SEEDING RATE IN EACH DIRECTION.
   c. HYDROSEEDING: APPLY SEED UNIFORMLY WITH HYDROSEEDER (SLURRY INCLUDES SEED AND FERTILIZER).
      i. IF FERTILIZER IS BEING APPLIED AT THE TIME OF SEEDING, THE APPLICATION RATES SHOULD NOT EXCEED THE FOLLOWING: NITROGEN, 100 POUNDS PER ACRE TOTAL OF SOLUBLE NITROGEN; P_2O_5 (PHOSPHOROUS), 200 POUNDS PER ACRE; K_2O (POTASSIUM), 200 POUNDS PER ACRE.
      ii. LIME: USE ONLY GROUND AGRICULTURAL LIMESTONE (UP TO 3 TONS PER ACRE MAY BE APPLIED BY HYDROSEEDING). NORMALLY, NOT MORE THAN 2 TONS ARE APPLIED BY HYDROSEEDING AT ANY ONE TIME. DO NOT USE BURNT OR HYDRATED LIME WHEN HYDROSEEDING.
      iii. MIX SEED AND FERTILIZER ON SITE AND SEED IMMEDIATELY AND WITHOUT INTERRUPTION.
      iv. WHEN HYDROSEEDING DO NOT INCORPORATE SEED INTO THE SOIL.

B. MULCHING
1. MULCH MATERIALS (IN ORDER OF PREFERENCE)
   a. STRAW CONSISTING OF THOROUGHLY THRESHED WHEAT, RYE, OAT, OR BARLEY AND REASONABLY BRIGHT IN COLOR. STRAW IS TO BE FREE OF NOXIOUS WEED SEEDS AS SPECIFIED IN THE MARYLAND SEED LAW AND NOT MUSTY, MOLDY, CAKED, DECAYED, OR EXCESSIVELY DUSTY. NOTE: USE ONLY STERILE STRAW MULCH IN AREAS WHERE ONE SPECIES OF GRASS IS DESIRED.
   b. WOOD CELLULOSE FIBER MULCH (WCFM) CONSISTING OF SPECIALLY PREPARED WOOD CELLULOSE PROCESSED INTO A UNIFORM FIBROUS PHYSICAL STATE.
      i. WCFM IS TO BE DYED GREEN OR CONTAIN A GREEN DYE IN THE PACKAGE THAT WILL PROVIDE AN APPROPRIATE COLOR TO FACILITATE VISUAL INSPECTION OF THE UNIFORMLY SPREAD SLURRY.
      ii. WCFM, INCLUDING DYE, MUST CONTAIN NO GERMINATION OR GROWTH INHIBITING FACTORS.
      iii. WCFM MATERIALS ARE TO BE MANUFACTURED AND PROCESSED IN SUCH A MANNER THAT THE WOOD CELLULOSE FIBER MULCH WILL REMAIN IN UNIFORM SUSPENSION IN WATER UNDER AGITATION AND WILL BLEND WITH SEED, FERTILIZER AND OTHER ADDITIVES TO FORM A HOMOGENEOUS SLURRY. THE MULCH MATERIAL MUST FORM A BLOTTER-LIKE GROUND COVER, ON APPLICATION, HAVING MOISTURE ABSORPTION AND PERCOLATION PROPERTIES AND MUST COVER AND HOLD GRASS SEED IN CONTACT WITH THE SOIL WITHOUT INHIBITING THE GROWTH OF THE GRASS SEEDLINGS.
      iv. WCFM MATERIAL MUST NOT CONTAIN ELEMENTS OR COMPOUNDS AT CONCENTRATION LEVELS THAT WILL BE PHYTO-TOXIC.
      v. WCFM MUST CONFORM TO THE FOLLOWING PHYSICAL REQUIREMENTS: FIBER LENGTH OF APPROXIMATELY 10 MILLIMETERS, DIAMETER APPROXIMATELY 1 MILLIMETER, PH RANGE OF 4.0 TO 8.5, ASH CONTENT OF 1.6 PERCENT MAXIMUM AND WATER HOLDING CAPACITY OF 90 PERCENT MINIMUM.
2. APPLICATION
   a. APPLY MULCH TO ALL SEEDED AREAS IMMEDIATELY AFTER SEEDING.
   b. WHEN STRAW MULCH IS USED, SPREAD IT OVER ALL SEEDED AREAS AT THE RATE OF 2 TONS PER ACRE TO A UNIFORM LOOSE DEPTH OF 1 TO 2 INCHES. APPLY MULCH TO ACHIEVE A UNIFORM DISTRIBUTION AND DEPTH SO THAT THE SOIL SURFACE IS NOT EXPOSED. WHEN USING A MULCH ANCHORING TOOL, INCREASE THE APPLICATION RATE TO 2.5 TONS PER ACRE.
   c. WOOD CELLULOSE FIBER USED AS MULCH MUST BE APPLIED AT A NET DRY WEIGHT OF 1500 POUNDS PER ACRE. MIX THE WOOD CELLULOSE FIBER WITH WATER TO ATTAIN A MIXTURE WITH A MAXIMUM OF 50 POUNDS OF WOOD CELLULOSE FIBER PER 100 GALLONS OF WATER.
3. ANCHORING
   a. PERFORM MULCH ANCHORING IMMEDIATELY FOLLOWING APPLICATION OF MULCH TO MINIMIZE LOSS BY WIND OR WATER. THIS MAY BE DONE BY ONE OF THE FOLLOWING METHODS (LISTED BY PREFERENCE), DEPENDING UPON THE SIZE OF THE AREA AND EROSION HAZARD:
      i. A MULCH ANCHORING TOOL IS A TRACTOR DRAWN IMPLEMENT DESIGNED TO PUNCH AND ANCHOR MULCH INTO THE SOIL SURFACE A MINIMUM OF 2 INCHES. THIS PRACTICE IS MOST EFFECTIVE ON LARGE AREAS, BUT IS LIMITED TO FLATTER SLOPES WHERE EQUIPMENT CAN OPERATE SAFELY. IF USED ON SLOPING LAND, THIS PRACTICE SHOULD FOLLOW THE CONTOUR.
      ii. WOOD CELLULOSE FIBER MAY BE USED FOR ANCHORING STRAW. APPLY THE FIBER BINDER AT A NET DRY WEIGHT OF 750 POUNDS PER ACRE. MIX THE WOOD CELLULOSE FIBER WITH WATER AT A MAXIMUM OF 50 POUNDS OF WOOD CELLULOSE FIBER PER 100 GALLONS OF WATER.
      iii. SYNTHETIC BINDERS SUCH AS ACRYLIC DLR (AGRO-TACK), DCA-70, PETROSET, TERRA TAX II, TERRA TACK AR OR OTHER APPROVED EQUAL MAY BE USED. FOLLOW APPLICATION RATES AS SPECIFIED BY THE MANUFACTURER. APPLICATION OF LIQUID BINDERS NEEDS TO BE HEAVIER AT THE EDGES WHERE WIND CATCHES MULCH, SUCH AS IN VALLEYS AND ON CRESTS OF BANKS. USE OF ASPHALT BINDERS IS STRICTLY PROHIBITED.
      iv. LIGHTWEIGHT PLASTIC NETTING MAY BE STAPLED OVER THE MULCH ACCORDING TO MANUFACTURER RECOMMENDATIONS. NETTING IS USUALLY AVAILABLE IN ROLLS 4 TO 15 FEET WIDE AND 300 TO 3,000 FEET LONG.

B-4-4 STANDARDS AND SPECIFICATIONS FOR TEMPORARY STABILIZATION

DEFINITION
TO STABILIZE DISTURBED SOILS WITH VEGETATION FOR UP TO 6 MONTHS.

PURPOSE
TO USE FAST GROWING VEGETATION THAT PROVIDES COVER ON DISTURBED SOILS.

CONDITIONS WHERE PRACTICE APPLIES
EXPOSED SOILS WHERE GROUND COVER IS NEEDED FOR A PERIOD OF 6 MONTHS OR LESS. FOR LONGER DURATION OF TIME, PERMANENT STABILIZATION PRACTICES ARE REQUIRED.

CRITERIA

1. SELECT ONE OR MORE OF THE SPECIES OR SEED MIXTURES LISTED IN TABLE B.1 FOR THE APPROPRIATE PLANT HARDINESS ZONE (FROM FIGURE B.3), AND ENTER THEM IN THE TEMPORARY SEEDING SUMMARY BELOW ALONG WITH APPLICATION RATES, SEEDING DATES AND SEEDING DEPTHS. IF THIS SUMMARY IS NOT PUT ON THE PLAN AND COMPLETED, THEN TABLE B.1 PLUS FERTILIZER AND LIME RATES MUST BE PUT ON THE PLAN.

2. FOR SITES HAVING SOIL TESTS PERFORMED, USE AND SHOW THE RECOMMENDED RATES BY THE TESTING AGENCY. SOIL TESTS ARE NOT REQUIRED FOR TEMPORARY SEEDING.

3. WHEN STABILIZATION IS REQUIRED OUTSIDE OF A SEEDING SEASON, APPLY SEED AND MULCH OR STRAW MULCH ALONE AS PRESCRIBED IN SECTION B-4-3.A.1.B AND MAINTAIN UNTIL THE NEXT SEEDING SEASON.

TEMPORARY SEEDING SUMMARY

HARDINESS ZONE (FROM FIGURE B.3): 7A SEED MIXTURE (FROM TABLE B.1): SEE BELOW					FERTILIZER RATE (10-20-20)	LIME RATE
NO.	SPECIES	APPLICATION RATE (LB/AC)	SEEDING DATES	SEEDING DEPTHS		
N/A	ANNUAL RYEGRASS	40	2/15-4/30 8/15-11/30	½IN.	436 LB/AC (10 LB/1000 SF)	2 TONS/AC (90 LB/1000 SF)
N/A	FOXTAIL MILLET (WARM SEASON)	30	5/1-8/14	½IN.		
N/A	PEARL MILLET (WARM SEASON)	20	5/1-8/14	½IN.		

EROSION AND SEDIMENT CONTROL SEQUENCE OF CONSTRUCTION

1. OBTAIN PROPER PERMITS.
2. SUBMIT WRITTEN NOTIFICATION TO: THE DEPARTMENT OF PUBLIC WORKS, OFFICE OF COMPLIANCE AND LABORATORIES: 3001 DRUID PARK DR., RM 228, BALTIMORE, MD 21215, PHONE NUMBER 410-396-0732, FAX 410-523-9047, DPW.ESCINSPECTIONS@BALTIMORECITY.GOV, AT LEAST 72 HOURS PRIOR TO START OF CONSTRUCTION STATING:
   A. A REQUEST FOR A PRECONSTRUCTION MEETING,
   B. WHEN CONTRACTOR INTENDS TO BEGIN CONSTRUCTION,
   C. WHEN CONTRACTOR INTENDS TO INSTALL STORMWATER MANAGEMENT FACILITIES,
   D. SOURCE OF BORROW MATERIAL,
   E. LOCATION OF DISPOSAL AREA OF SITE MATERIAL,
   F. CONTRACTOR'S TENTATIVE CLOSING DATE.
3. IN-STREAM WORK SHALL NOT BE CONDUCTED DURING THE PERIOD MARCH 1 THROUGH JUNE 15, INCLUSIVE DURING ANY YEAR.
4. INSTALL STABILIZED CONSTRUCTION ENTRANCES, SILT FENCE, SUPER SILT FENCE, CLEAR WATER DIVERSION PIPE WITH ROCK OUTLET PROTECTION III, AND ESTABLISH LIMITS OF CONTRACTOR'S STAGING AREA 2. STABILIZED DISTURBED AREAS PER THE STANDARD STABILIZATION NOTE AND STABILIZATION SCHEDULE ON DRAWING 14.
5. OBTAIN PERMISSION FROM THE EROSION AND SEDIMENT CONTROL INSPECTOR PRIOR TO PROCEEDING WITH INSTALLATION OF SEDIMENT BASINS.
6. CLEAR AND GRUB FOR SEDIMENT BASINS 1 AND 2. PRIOR TO INSTALLATION OF SEDIMENT BASIN 2, DEWATER THE ADJACENT EXISTING STORMWATER POND INTO THE EXISTING OPERATIONS SEDIMENT BASIN. NOTIFY ENGINEER OF RECORD AT LEAST 3 DAYS PRIOR TO BEGINNING SEDIMENT BASIN CONSTRUCTION TO SCHEDULE REQUIRED AS-BUILT INSPECTIONS. INSTALL SEDIMENT BASINS 1 AND 2. REFER TO SEDIMENT BASINS 1 AND 2 SEQUENCE OF CONSTRUCTION ON THIS SHEET FOR DETAILS. INSTALL OUTLET RISER STRUCTURES, OUTLET PIPES, ROCK OUTLET PROTECTION, REMOVABLE PUMPING STATIONS, RIPRAP INFLOW PROTECTION, AND BAFFLES.
7. OBTAIN PERMISSION FROM THE EROSION AND SEDIMENT CONTROL INSPECTOR PRIOR TO PROCEEDING WITH CONSTRUCTION.
8. INSTALL SEDIMENT BASIN 1 INLET PIPES (TWIN 30" RCP's) AND GABION INFLOW PROTECTION. CONSTRUCT PERIMETER ROAD AND PERIMETER DRAINAGE CHANNEL. PERMANENTLY STABILIZE IN ACCORDANCE WITH THE STABILIZATION SCHEDULE.
9. INSTALL STOCKPILE ACCESS ROAD CULVERT (24" CPP) WITH ROCK OUTLET PROTECTION II AND CONTRACTOR'S STAGING AREA 1 ACCESS CULVERT (24" CPP) WITH ROCK OUTLET PROTECTION II.
10. ESTABLISH LIMITS OF CONTRACTOR'S STAGING AREA 1.
11. BLOCK EXIT OF CLEAR WATER DIVERSION PIPE AND FILL WITH FLOWABLE FILL TO PREVENT DISCHARGE OF SEDIMENT FROM CELL 3 EXCAVATION. STORM WATER ACCUMULATED BEHIND PIPE IS TO BE PUMPED INTO SEDIMENT BASIN 2 AT RIPRAP INFLOW PROTECTION LOCATION.
12. BEGIN CELL 3 EXCAVATION AND STOCKPILE CONSTRUCTION. SEE NOTE 2, DRAWING 4. AS CELL 3 EXCAVATION AND STOCKPILE CONSTRUCTION CONTINUE, INSTALL DRAINAGE BENCH ON EASTERN FACE OF THE STOCKPILE. STABILIZE DISTURBED AREAS PER THE STANDARD STABILIZATION NOTE AND STABILIZATION SCHEDULE ON DRAWING 14.
13. STORMWATER REMOVAL FROM CELL 3 EXCAVATION TO BE ACCOMPLISHED AS DESCRIBED IN THE SEDIMENT SUMP NOTE ON DRAWING 14.
14. INSTALL LEACHATE TRANSMISSION FORCEMAIN AND ELECTRIC SERVICE PER THE SAME DAY STABILIZATION NOTE ON DRAWING 14.
15. INSTALL MAINTENANCE BUILDING.
16. ONCE CONSTRUCTION OF CELL 3,THE STOCKPILE, MAINTENANCE BUILDING, AND UTILITIES ARE COMPLETE PERMANENTLY STABILIZE IN ACCORDANCE WITH THE STABILIZATION SCHEDULE.
17. AFTER COMPLETION OF PERMANENT STABILIZATION NOTIFY THE INSPECTOR. WITH PERMISSION OF THE SEDIMENT CONTROL INSPECTOR REMOVE STABILIZED CONSTRUCTION ENTRANCES. STABILIZE AREAS DISTURBED DURING REMOVAL. ALL OTHER SEDIMENT CONTROLS ARE REQUIRED DURING LANDFILL OPERATIONS AND WILL REMAIN IN PLACE. SEDIMENT CONTROLS TO REMAIN INCLUDE SEDIMENT BASINS 1 AND 2 (INCLUDING OUTLET STRUCTURES, REMOVABLE PUMPING STATIONS, SEDIMENT BAFFLES, ETC.), SUPER SILT FENCE, AND INFLOW AND OUTLET PROTECTIONS.

SEDIMENT BASIN 1 SEQUENCE OF CONSTRUCTION

1. WITH PERMISSION OF THE SEDIMENT CONTROL INSPECTOR CLEAR AND GRUB FOR CONSTRUCTION OF SEDIMENT BASIN 1. NOTIFY ENGINEER OF RECORD AT LEAST 3 DAYS PRIOR TO BEGINNING SEDIMENT BASIN CONSTRUCTION TO SCHEDULE REQUIRED AS-BUILT INSPECTIONS.
2. EXCAVATE SEDIMENT BASIN TO ELEVATION 24.0 AND STABILIZE. EXCAVATED SOIL TO BE PLACED IN TEMPORARY STOCKPILE LOCATION AND PROTECTED WITH SILT FENCE.
3. EXCAVATE TRENCH FOR POND 1 OUTLET PIPE. INSTALL 24" CCP, CONCRETE CRADLE, ENDWALL, OUTLET PROTECTION, OUTLET STRUCTURE, AND CONCRETE COLLAR. NOTIFY THE ENGINEER FOR AS-BUILT INSPECTION BEFORE BACKFILLING TRENCH.
4. BACKFILL TRENCH AND PERMANENTLY STABILIZE THE DISTURBED AREA.
5. INSTALL DRAW DOWN DEVICE, TRASH RACK, REMOVABLE PUMPING STATION AND SEDIMENT BAFFLES.
6. NOTIFY ENGINEER FOR AS-BUILT INSPECTION.
7. AFTER COMPLETION OF PERMANENT STABILIZATION NOTIFY THE INSPECTOR. WITH PERMISSION OF THE SEDIMENT CONTROL INSPECTOR PROCEED WITH STEP 7 OF THE EROSION AND SEDIMENT CONTROL SEQUENCE OF CONSTRUCTION.

SEDIMENT BASIN 2 SEQUENCE OF CONSTRUCTION

1. WITH PERMISSION OF THE SEDIMENT CONTROL INSPECTOR CLEAR AND GRUB FOR CONSTRUCTION OF SEDIMENT BASIN 2. NOTIFY ENGINEER OF RECORD AT LEAST 3 DAYS PRIOR TO BEGINNING SEDIMENT BASIN CONSTRUCTION TO SCHEDULE REQUIRED AS-BUILT INSPECTIONS.
2. EXCAVATE SEDIMENT BASIN TO ELEVATION 33.0. EXCAVATED SOIL TO BE TO BE TESTED BY ENGINEER FOR SUITABILITY FOR IMPERVIOUS CORE AND CUTOFF TRENCH MATERIAL. EXCESS EXCAVATED SOIL TO BE PLACED IN TEMPORARY STOCKPILE LOCATION AND PROTECTED WITH SILT FENCE.
3. EXCAVATE FOR CUTOFF TRENCH. NOTIFY ENGINEER FOR AS-BUILT INSPECTION. INSTALL CUTOFF TRENCH AND IMPERVIOUS CORE.
4. EXCAVATE TRENCH FOR POND 2 OUTLET PIPE AND DRAINAGE DIAPHRAGM. NOTIFY ENGINEER FOR AS-BUILT INSPECTION. INSTALL DRAINAGE DIAPHRAGM, 6" PVC DRAINS, 24" CCP, CONCRETE CRADLE, ENDWALL, OUTLET PROTECTION, OUTLET STRUCTURE, AND CONCRETE COLLAR. NOTIFY THE ENGINEER FOR AS-BUILT INSPECTION BEFORE BACKFILLING TRENCH.
5. BACKFILL TRENCH AND PERMANENTLY STABILIZE THE DISTURBED AREA.
6. INSTALL DRAW DOWN DEVICE, TRASH RACK, REMOVABLE PUMPING STATION AND SEDIMENT BAFFLES.
7. NOTIFY ENGINEER FOR AS-BUILT INSPECTION.
8. AFTER COMPLETION OF PERMANENT STABILIZATION NOTIFY THE INSPECTOR. WITH PERMISSION OF THE SEDIMENT CONTROL INSPECTOR PROCEED WITH STEP 7 OF THE EROSION AND SEDIMENT CONTROL SEQUENCE OF CONSTRUCTION.

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

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TITLE: EROSION AND SEDIMENT CONTROL NOTES I

PROJECT: CELL 3 CONSTRUCTION DRAWINGS

SITE: LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

PROFESSIONAL CERTIFICATION:

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND,
LICENSE No. 22181
EXPIRATION DATE 12-2-2018

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE
DECEMBER 15, 2017
DATE

STATE OF MARYLAND
R. DAVID ESPINOZA
NO. 22181
REGISTERED
PROFESSIONAL ENGINEER

DESIGNED BY:	RSW	DATE:	DECEMBER 2017
DRAWN BY:	JSW	PROJECT NO.:	ME1400
CHECKED BY:	MEP	FILE:	1400-019
REVIEWED BY:	RDE	DRAWING NO.:	19 OF 33
APPROVED BY:			

EROSION AND SEDIMENT CONTROL – STANDARD SPECIFICATIONS FOR BALTIMORE CITY PART 2 OF 2

SHEET REVISION DATE: MAY 11, 2017

B-4-5 STANDARDS AND SPECIFICATIONS FOR PERMANENT STABILIZATION

DEFINITION
TO STABILIZE DISTURBED SOILS WITH PERMANENT VEGETATION.

PURPOSE
TO USE LONG-LIVED PERENNIAL GRASSES AND LEGUMES TO ESTABLISH PERMANENT GROUND COVER ON DISTURBED SOILS.

CONDITIONS WHERE PRACTICE APPLIES
EXPOSED SOILS WHERE GROUND COVER IS NEEDED FOR 6 MONTHS OR MORE.

CRITERIA
A. SEED MIXTURES
1. GENERAL USE
a. SELECT ONE OR MORE OF THE SPECIES OR MIXTURES LISTED IN TABLE B.3 FOR THE APPROPRIATE PLANT HARDINESS ZONE(FROM FIGURE B.3) AND BASED ON THE SITE CONDITION OR PURPOSE FOUND ON TABLE B.2. ENTER SELECTED MIXTURE(S), APPLICATION RATES, AND SEEDING DATES IN THE PERMANENT SEEDING SUMMARY. THE SUMMARY IS TO BE PLACED ON THE PLAN.
b. ADDITIONAL PLANTING SPECIFICATIONS FOR EXCEPTIONAL SITES SUCH AS SHORELINES, STREAM BANKS, OR DUNES OR FOR SPECIAL PURPOSES SUCH AS WILDLIFE OR AESTHETIC TREATMENT MAY BE FOUND IN USDA-NRCS TECHNICAL FIELD OFFICE GUIDE, SECTION 342 - CRITICAL AREA PLANTING.
c. FOR SITES HAVING DISTURBED AREA OVER 5 ACRES, USE AND SHOW THE RATES RECOMMENDED BY THE SOIL TESTING AGENCY.
d. FOR AREAS RECEIVING LOW MAINTENANCE, APPLY UREA FORM FERTILIZER (46-0-0) AT 3.5 POUNDS PER 1000 SQUARE FEET (150 POUNDS PER ACRE) AT THE TIME OF SEEDING IN ADDITION TO THE SOIL AMENDMENTS SHOWN IN THE PERMANENT SEEDING SUMMARY.
2. TURFGRASS MIXTURES
a. AREAS WHERE TURFGRASS MAY BE DESIRED INCLUDE LAWNS, PARKS, PLAYGROUNDS, AND COMMERCIAL SITES WHICH WILL RECEIVE A MEDIUM TO HIGH LEVEL OF MAINTENANCE.
b. SELECT ONE OR MORE OF THE SPECIES OR MIXTURES LISTED BELOW BASED ON THE SITE CONDITIONS OR PURPOSE. ENTER SELECTED MIXTURE(S), APPLICATION RATES, AND SEEDING DATES IN THE PERMANENT SEEDING SUMMARY. THE SUMMARY IS TO BE PLACED ON THE PLAN.
i. KENTUCKY BLUEGRASS: FULL SUN MIXTURE: FOR USE IN AREAS THAT RECEIVE INTENSIVE MANAGEMENT. IRRIGATION REQUIRED IN THE AREAS OF CENTRAL MARYLAND AND EASTERN SHORE. RECOMMENDED CERTIFIED KENTUCKY BLUEGRASS CULTIVARS SEEDING RATE: 1.5 TO 2.0 POUNDS PER 1000 SQUARE FEET. CHOOSE A MINIMUM OF THREE KENTUCKY BLUEGRASS CULTIVARS WITH EACH RANGING FROM 10 TO 35 PERCENT OF THE TOTAL MIXTURE BY WEIGHT.
ii. KENTUCKY BLUEGRASS/PERENNIAL RYE: FULL SUN MIXTURE: FOR USE IN FULL SUN AREAS WHERE RAPID ESTABLISHMENT IS NECESSARY AND WHEN TURF WILL RECEIVE MEDIUM TO INTENSIVE MANAGEMENT. CERTIFIED PERENNIAL RYEGRASS CULTIVARS/CERTIFIED KENTUCKY BLUEGRASS SEEDING RATE: 2 POUNDS MIXTURE PER 1000 SQUARE FEET. CHOOSE A MINIMUM OF THREE KENTUCKY BLUEGRASS CULTIVARS WITH EACH RANGING FROM 10 TO 35 PERCENT OF THE TOTAL MIXTURE BY WEIGHT.
iii. TALL FESCUE/KENTUCKY BLUEGRASS: FULL SUN MIXTURE: FOR USE IN DROUGHT PRONE AREAS AND/OR FOR AREAS RECEIVING LOW TO MEDIUM MANAGEMENT IN FULL SUN TO MEDIUM SHADE. RECOMMENDED MIXTURE INCLUDES; CERTIFIED TALL FESCUE CULTIVARS 95 TO 100 PERCENT, CERTIFIED KENTUCKY BLUEGRASS CULTIVARS 0 TO 5 PERCENT. SEEDING RATE: 5 TO 8 POUNDS PER 1000 SQUARE FEET. ONE OR MORE CULTIVARS MAY BE BLENDED.
iv. KENTUCKY BLUEGRASS/FINE FESCUE: SHADE MIXTURE: FOR USE IN AREAS WITH SHADE IN BLUEGRASS LAWNS. FOR ESTABLISHMENT IN HIGH QUALITY, INTENSIVELY MANAGED TURF AREA. MIXTURE INCLUDES; CERTIFIED KENTUCKY BLUEGRASS CULTIVARS 30 TO 40 PERCENT AND CERTIFIED FINE FESCUE AND 60 TO 70 PERCENT. SEEDING RATE: 1.5 TO 3 POUNDS PER 1000 SQUARE FEET. NOTES: SELECT TURFGRASS VARIETIES FROM THOSE LISTED IN THE MOST CURRENT UNIVERSITY OF MARYLAND PUBLICATION, AGRONOMY MEMO #77, "TURFGRASS CULTIVAR RECOMMENDATIONS FOR MARYLAND" CHOOSE CERTIFIED MATERIAL. CERTIFIED MATERIAL IS THE BEST GUARANTEE OF CULTIVAR PURITY. THE CERTIFICATION PROGRAM OF THE MARYLAND DEPARTMENT OF AGRICULTURE, TURF AND SEED SECTION, PROVIDES A RELIABLE MEANS OF CONSUMER PROTECTION AND ASSURES A PURE GENETIC LINE.
c. IDEAL TIMES OF SEEDING FOR TURF GRASS MIXTURES
- WESTERN MD:
MARCH 15 TO JUNE 1, AUGUST 1 TO OCTOBER 1 (HARDINESS ZONES: 5B, 6A)
- CENTRAL MD:
MARCH 1 TO MAY 15, AUGUST 15 TO OCTOBER 15 (HARDINESS ZONE: 6B)
- SOUTHERN MD, EASTERN SHORE:
MARCH 1 TO MAY 15, AUGUST 15 TO OCTOBER 1 (HARDINESS ZONES: 7A, 7B)
d. TILL AREAS TO RECEIVE SEED BY DISKING OR OTHER APPROVED METHODS TO A DEPTH OF 2 TO 4 INCHES, LEVEL AND RAKE THE AREAS TO PREPARE A PROPER SEEDBED. REMOVE STONES AND DEBRIS OVER 1.5 INCHES IN DIAMETER. THE RESULTING SEEDBED MUST BE IN SUCH CONDITION THAT FUTURE MOWING OF GRASSES WILL POSE NO DIFFICULTY.
e. IF SOIL MOISTURE IS DEFICIENT, SUPPLY NEW SEEDINGS WITH ADEQUATE WATER FOR PLANT GROWTH 0.5 TO 1 INCH EVERY 3 TO 4 DAYS DEPENDING ON SOIL TEXTURE) UNTIL THEY ARE FIRMLY ESTABLISHED. THIS IS ESPECIALLY TRUE WHEN SEEDINGS ARE MADE LATE IN THE PLANTING SEASON, IN ABNORMALLY DRY OR HOT SEASONS, OR ON ADVERSE SITES.

B. SOD: TO PROVIDE QUICK COVER ON DISTURBED AREAS (2:1 GRADE OR FLATTER).
1. GENERAL SPECIFICATIONS
a. CLASS OF TURFGRASS SOD MUST BE MARYLAND STATE CERTIFIED. SOD LABELS MUST BE MADE AVAILABLE TO THE JOB FOREMAN AND INSPECTOR.
b. SOD MUST BE MACHINE CUT AT A UNIFORM SOIL THICKNESS OF 0.75 INCH, PLUS OR MINUS 0.25 INCH, AT THE TIME OF CUTTING. MEASUREMENT FOR THICKNESS MUST EXCLUDE TOP GROWTH AND THATCH. BROKEN PADS AND TORN OR UNEVEN ENDS WILL NOT BE ACCEPTABLE.
c. STANDARD SIZE SECTIONS OF SOD MUST BE STRONG ENOUGH TO SUPPORT THEIR OWN WEIGHT AND RETAIN THEIR SIZE AND SHAPE WHEN SUSPENDED VERTICALLY WITH A FIRM GRASP ON THE UPPER 10 PERCENT OF THE SECTION.
d. SOD MUST NOT BE HARVESTED OR TRANSPLANTED WHEN MOISTURE CONTENT (EXCESSIVELY DRY OR WET) MAY ADVERSELY AFFECT ITS SURVIVAL.
e. SOD MUST BE HARVESTED, DELIVERED, AND INSTALLED WITHIN A PERIOD OF 36 HOURS. SOD NOT TRANSPLANTED WITHIN THIS PERIOD MUST BE APPROVED BY AN AGRONOMIST OR SOIL SCIENTIST PRIOR TO ITS INSTALLATION.
2. SOD INSTALLATION
a. DURING PERIODS OF EXCESSIVELY HIGH TEMPERATURE OR IN AREAS HAVING DRY SUBSOIL, LIGHTLY IRRIGATE THE SUBSOIL IMMEDIATELY PRIOR TO LAYING THE SOD.
b. LAY THE FIRST ROW OF SOD IN A STRAIGHT LINE WITH SUBSEQUENT ROWS PLACED PARALLEL TO IT AND TIGHTLY WEDGED AGAINST EACH OTHER. STAGGER LATERAL JOINTS TO PROMOTE MORE UNIFORM GROWTH AND STRENGTH. ENSURE THAT SOD IS NOT STRETCHED OR OVERLAPPED AND THAT ALL JOINTS ARE BUTTED TIGHT IN ORDER TO PREVENT VOIDS WHICH WOULD CAUSE AIR DRYING OF THE ROOTS.
c. WHEREVER POSSIBLE, LAY SOD WITH THE LONG EDGES PARALLEL TO THE CONTOUR AND WITH STAGGERING JOINTS. ROLL AND TAMP, PEG OR OTHERWISE SECURE THE SOD TO PREVENT SLIPPAGE ON SLOPES. ENSURE SOLID CONTACT EXISTS BETWEEN SOD ROOTS AND THE UNDERLYING SOIL SURFACE.
d. WATER THE SOD IMMEDIATELY FOLLOWING ROLLING AND TAMPING UNTIL THE UNDERSIDE OF THE NEW SOD PAD AND SOIL SURFACE BELOW THE SOD ARE THOROUGHLY WET. COMPLETE THE OPERATIONS OF LAYING, TAMPING AND IRRIGATING FOR ANY PIECE OF SOD WITHIN EIGHT HOURS.
3. SOD MAINTENANCE
a. IN THE ABSENCE OF ADEQUATE RAINFALL, WATER DAILY DURING THE FIRST WEEK OR AS OFTEN AND SUFFICIENTLY AS NECESSARY TO MAINTAIN MOIST SOIL TO A DEPTH OF 4 INCHES. WATER SOD DURING THE HEAT OF THE DAY TO PREVENT WILTING.
b. AFTER THE FIRST WEEK, SOD WATERING IS REQUIRED AS NECESSARY TO MAINTAIN ADEQUATE MOISTURE CONTENT.
c. DO NOT MOW UNTIL THE SOD IS FIRMLY ROOTED. NO MORE THAN ONE THIRD OF THE GRASS LEAF MUST BE REMOVED BY THE INITIAL CUTTING OR SUBSEQUENT CUTTINGS. MAINTAIN A GRASS HEIGHT OF AT LEAST 3 INCHES UNLESS OTHERWISE SPECIFIED.

PERMANENT SEEDING SUMMARY

HARDINESS ZONE (FROM FIGURE B.3): 7A
SEED MIXTURE (FROM TABLE B.3): SEE BELOW

NO.	SPECIES	APPLICATION RATE (LB/AC)	SEEDING DATES	SEEDING DEPTHS	FERTILIZER RATE (10-20-20) N	P_2O_5	K_2O	LIME RATE
	TALL FESCUE	60	2/15-4/30 8/15-11/30	¼-½ IN.	45 POUNDS PER ACRE (1.0 LB/ 1000 SF)	90 POUNDS PER ACRE (2 LB/ 1000 SF)	90 POUNDS PER ACRE (2 LB/ 1000 SF)	2 TONS/AC (90 LB/ 1000 SF)
	PERENNIAL RYEGRASS	20		¼-½ IN.				
	KENTUCKY BLUEGRASS	40		¼-½ IN.				

B-4-7 STANDARDS AND SPECIFICATIONS FOR HEAVY USE AREA PROTECTION

DEFINITION
THE STABILIZATION OF AREAS FREQUENTLY AND INTENSIVELY USED BY SURFACING WITH SUITABLE MATERIALS (E.G., MULCH AND AGGREGATE).

PURPOSE
TO PROVIDE A STABLE, NON-ERODING SURFACE FOR AREAS FREQUENTLY USED AND TO IMPROVE WATER QUALITY FROM THE RUNOFF OF THESE AREAS.

CONDITIONS WHERE PRACTICE APPLIES
THIS PRACTICE APPLIES TO INTENSIVELY USED AREAS (E.G., EQUIPMENT AND MATERIAL STORAGE, STAGING AREAS, HEAVILY USED TRAVEL LANES).

CRITERIA

1. A MINIMUM 4-INCH BASE COURSE OF CRUSHED STONE OR OTHER SUITABLE MATERIALS INCLUDING WOOD CHIPS OVER NONWOVEN GEOTEXTILE SHOULD BE PROVIDED AS SPECIFIED IN SECTION H-1 MATERIALS
2. SELECT THE STABILIZING MATERIAL BASED ON THE INTENDED USE, DESIRED MAINTENANCE FREQUENCY, AND RUNOFF CONTROL.
3. THE TRANSPORT OF SEDIMENTS, NUTRIENTS, OILS, CHEMICALS, PARTICULATE MATTER ASSOCIATED WITH VEHICULAR TRAFFIC AND EQUIPMENT, AND MATERIAL STORAGE NEEDS TO BE CONSIDERED IN THE SELECTION OF MATERIAL. ADDITIONAL CONTROL MEASURES MAY BE NECESSARY TO CONTROL SOME OF THESE POTENTIAL POLLUTANTS.
4. SURFACE EROSION CAN BE A PROBLEM ON LARGE HEAVY USE AREAS. IN THESE SITUATIONS, MEASURES TO REDUCE THE FLOW LENGTH OF RUNOFF OR EROSIVE VELOCITIES NEED TO BE CONSIDERED.

MAINTENANCE
THE HEAVY USE AREAS MUST BE MAINTAINED IN A CONDITION THAT MINIMIZES EROSION. THIS MAY REQUIRE ADDING SUITABLE MATERIAL, AS SPECIFIED ON HE APPROVED PLANS, TO MAINTAIN A CLEAN SURFACE.

B-4-8 STANDARDS AND SPECIFICATIONS FOR STOCKPILE AREA

DEFINITION
A MOUND OR PILE OF SOIL PROTECTED BY APPROPRIATELY DESIGNED EROSION AND SEDIMENT CONTROL MEASURES.

PURPOSE
TO PROVIDE A DESIGNATED LOCATION FOR THE TEMPORARY STORAGE OF SOIL THAT CONTROLS THE POTENTIAL FOR EROSION, SEDIMENTATION, AND CHANGES TO DRAINAGE PATTERNS.

CONDITIONS WHERE PRACTICE APPLIES
STOCKPILE AREAS ARE UTILIZED WHEN IT IS NECESSARY TO SALVAGE AND STORE SOIL FOR LATER USE.

CRITERIA

1. THE STOCKPILE LOCATION AND ALL RELATED SEDIMENT CONTROL PRACTICES MUST BE CLEARLY INDICATED ON THE EROSION AND SEDIMENT CONTROL PLAN.

2. THE FOOTPRINT OF THE STOCKPILE MUST BE SIZED TO ACCOMMODATE THE ANTICIPATED VOLUME OF MATERIAL AND BASED ON A SIDE SLOPE RATIO NO STEEPER THAN 2:1. BENCHING MUST BE PROVIDED IN ACCORDANCE WITH SECTION B-3 LAND GRADING.

3. RUNOFF FROM THE STOCKPILE AREA MUST DRAIN TO A SUITABLE SEDIMENT CONTROL PRACTICE.

4. ACCESS THE STOCKPILE AREA FROM THE UPGRADE SIDE.

5. CLEAR WATER RUNOFF INTO THE STOCKPILE AREA MUST BE MINIMIZED BY USE OF A DIVERSION DEVICE SUCH AS AN EARTH DIKE, TEMPORARY SWALE OR DIVERSION FENCE. PROVISIONS MUST BE MADE FOR DISCHARGING CONCENTRATED FLOW IN A NON-EROSIVE MANNER.

6. WHERE RUNOFF CONCENTRATES ALONG THE TOE OF THE STOCKPILE FILL, AN APPROPRIATE EROSION/SEDIMENT CONTROL PRACTICE MUST BE USED TO INTERCEPT THE DISCHARGE.

7. STOCKPILES MUST BE STABILIZED IN ACCORDANCE WITH THE 3/7 DAY STABILIZATION REQUIREMENT AS WELL AS STANDARD B-4-1 INCREMENTAL STABILIZATION AND STANDARD B-4-4 TEMPORARY STABILIZATION.

8. IF THE STOCKPILE IS LOCATED ON AN IMPERVIOUS SURFACE, A LINER SHOULD BE PROVIDED BELOW THE STOCKPILE TO FACILITATE CLEANUP. STOCKPILES CONTAINING CONTAMINATED MATERIAL MUST BE COVERED WITH IMPERMEABLE SHEETING.

MAINTENANCE
THE STOCKPILE AREA MUST CONTINUOUSLY MEET THE REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT IN ACCORDANCE WITH SECTION B-4 VEGETATIVE STABILIZATION. SIDE SLOPES MUST BE MAINTAINED AT NO STEEPER THAN A 2:1 RATIO. THE STOCKPILE AREA MUST BE KEPT FREE OF EROSION. IF THE VERTICAL HEIGHT OF A STOCKPILE EXCEEDS 20 FEET FOR 2:1 SLOPES, 30 FEET FOR 3:1 SLOPES, OR 40 FEET FOR 4:1 SLOPES, BENCHING MUST BE PROVIDED IN ACCORDANCE WITH SECTION B-3 LAND GRADING.

H-5 STANDARDS AND SPECIFICATIONS FOR DUST CONTROL

DEFINITION
CONTROLLING THE SUSPENSION OF DUST PARTICLES FROM CONSTRUCTION ACTIVITIES.

PURPOSE
TO PREVENT BLOWING AND MOVEMENT OF DUST FROM EXPOSED SOIL SURFACE TO REDUCE ON AND OFF-SITE DAMAGE INCLUDING HEALTH AND TRAFFIC HAZARDS.

CONDITIONS WHERE PRACTICE APPLIES
AREAS SUBJECT TO DUST BLOWING AND MOVEMENT WHERE ON AND OFF-SITE DAMAGE IS LIKELY WITHOUT TREATMENT.

SPECIFICATIONS

1. MULCHES: SEE SECTION B-4-2 SOIL PREPARATION, TOPSOILING, AND SOIL AMENDMENTS, SECTION B-4-3 SEEDING AND MULCHING, AND SECTION B-4-4 TEMPORARY STABILIZATION. MULCH MUST BE ANCHORED TO PREVENT BLOWING.

2. VEGETATIVE COVER: SEE SECTION B-4-4 TEMPORARY STABILIZATION.

3. TILLAGE: TILL TO ROUGHEN SURFACE AND BRING CLODS TO THE SURFACE. BEGIN PLOWING ON WINDWARD SIDE OF SITE. CHISEL-TYPE PLOWS SPACED ABOUT 12 INCHES APART, SPRING-TOOTHED HARROWS, AND SIMILAR PLOWS ARE EXAMPLES OF EQUIPMENT THAT MAY PRODUCE THE DESIRED EFFECT.

4. IRRIGATION: SPRINKLE SITE WITH WATER UNTIL THE SURFACE IS MOIST. REPEAT AS NEEDED. THE SITE MUST NOT BE IRRIGATED TO THE POINT THAT RUNOFF OCCURS.

5. BARRIERS: SOLID BOARD FENCES, SILT FENCES, SNOW FENCES, BURLAP FENCES, STRAW BALES, AND SIMILAR MATERIAL CAN BE USED TO CONTROL AIR CURRENTS AND SOIL BLOWING.

6. CHEMICAL TREATMENT: USE OF CHEMICAL TREATMENT REQUIRES APPROVAL BY THE APPROPRIATE PLAN REVIEW AUTHORITY.

SUPPLEMEAL EROSION AND SEDIMENT CONTROL NOTES

NOTES

1. FOR UTILITY TRENCHES OUTSIDE THE DRAINAGE AREA LIMITS OF EROSION AND SEDIMENT CONTROL (ESC) CONTROLS, THE CONTRACTOR SHALL OPEN ONLY A SECTION OF TRENCH THAT CAN BE BACKFILLED AND STABILIZED AT THE END OF EACH WORKDAY. NO DISTURBED AREA SHALL BE LEFT UNSTABILIZED OVERNIGHT. ANY EXCESS STOCKPILE MATERIAL SHALL BE REMOVED FROM THE SITE AT THE END OF EACH WORKDAY. FOR PERVIOUS SURFACES, THE USE OF ANY VEHICLE TRAFFIC IS PROHIBITED THE FIRST 24 HOURS AFTER A RAIN EVENT.

2. IF A STOCKPILE AREA IS NOT SHOWN ON THE APPROVED ESC PLAN, NO STOCKPILING SHALL BE ALLOWED. ALL EXCESS MATERIAL SHALL BE REMOVED FROM THE SITE AT THE END OF EACH WORK DAY AND SENT TO A DISPOSAL SITE GOVERNED BY AN APPROVED EROSION AND SEDIMENT CONTROL PLAN.

3. IF A STAGING AREA IS NOT SHOWN ON THE APPROVED ESC PLAN, NO STAGING AREA SHALL BE ALLOWED ON SITE. STAGING AREAS OUTSIDE OF THE LOD MUST BE LOCATED ON AN IMPERVIOUS SURFACE, AND SHALL NOT RESULT IN EARTH DISTURBANCE. STOCKPILES OF ERODIBLE MATERIAL WILL NOT BE PERMITTED AT A STAGING AREA

4. ALL DISTURBED AREAS SHALL BE STABILIZED PER THE STABILIZATION SCHEDULE.

5. THE ESC INSPECTOR HAS AUTHORITY TO REQUIRE ADDITIONAL ESC CONTROLS BEYOND THOSE SHOWN ON THE APPROVED ESC PLAN. ANY ADDITIONAL CONTROLS REQUIRED BY THE INSPECTOR SHALL BE PROVIDED BY THE CONTRACTOR AT THE DIRECTION OF THE INSPECTOR WITH 24 HOURS OF VERBAL NOTIFICATION BY THE ESC INSPECTOR.

6. WHERE NO STABILIZED CONSTRUCTION ENTRANCE (SCE) IS PROVIDED, THE CONTRACTOR SHALL DESIGNATE PIECES OF CONSTRUCTION EQUIPMENT THAT SHALL BE ALLOWED WITHIN THE LOD. THIS EQUIPMENT SHALL BE KEPT WITHIN THE LOD UNTIL THE PROPOSED WORK IS COMPLETE, AND SHALL HAVE TREADS/TIRES CLEANED PRIOR TO LEAVING THE LOD. ALL MATERIAL REMOVAL OR DELIVERY SHALL BE EITHER LIFTED FROM OR INTO THE LOD; AND, ANY SEDIMENT TRACKED OR DROPPED OUTSIDE THE LOD CLEANED IMMEDIATELY. FLUSHING WILL NOT BE PERMITTED.

7. WHERE SAME DAY STABILIZATION IS SPECIFIED ON THE ESC PLAN, IT SHALL BE CONSIDERED THE PRIMARY ESC CONTROL. ANY CONTROLS PROVIDED DOWNSTREAM OF AREAS SPECIFIED FOR SAME DAY STABILIZATION SHALL BE CONSIDERED SECONDARY CONTROLS UNLESS SPECIFIED OTHERWISE. (SECONDARY CONTROLS ARE DEFINED AS CONTROLS PROVIDED AS BACKUP MEASURES TO A PRIMARY CONTROL).

8. SAME DAY STABILIZATION IS DEFINED AS THE COMPLETION OF PROPOSED WORK WITHIN A DEFINED AREA WITH THE STIPULATION OF A NON-ERODIBLE SURFACE AT THE END OF EACH WORK DAY. EXAMPLES OF ACCEPTABLE NON-ERODIBLE SURFACES INCLUDE PAVEMENT, STEEL PLATES, A 2IMINIMUM STONE LAYER, OR STABILIZATION MATTING OVER PERMANENT SEEDING. THIRTY (30) MIL PLASTIC SHEETING WITH ANCHORING MAY BE CONSIDERED ACCEPTABLE IF EITHER SPECIFIED ON AN APPROVED PLAN, OR APPROVED BY THE ESC INSPECTOR. TEMPORARY SEEDNG AND MUCLH IS NOT CONSIDERED AN ACCETPABLE SAME DAY STABILIZATION PRACTICE.

ESC CERTIFICATIONS

OWNER'S CERTIFICATION
I/WE DO HEREBY CERTIFY THAT ANY CLEARING, GRADING , CONSTRUCTION, AND/OR DEVELOPMENT WILL BE DONE PURSUANT TO THIS APPROVED PLAN AND ALL RESPONSIBLE PERSONNEL INVOLVED IN THE CONSTRUCTION PROJECT WILL HAVE CERTIFICATION OFF ATTENDANCE AT AN APPROVED MARYLAND DEPARTMENT OF THE ENVIRONMENTAL SEDIMENT AND EROSION CONTROL TRAINING PROGRAM PRIOR TO THE BEGINNING OF WORK. THE CITY'S DPW AND DHCD AND MDE WILL BE ALLOWED RIGHT OF ENTRY FOR PERIODIC ON-SITE EVALUATION.

BRIAN HOYT — PRINT NAME
SIGNATURE — DATE: 12/18/17
1005 BRANDON SHORES RD, STE 100, BALTIMORE, MD 21226 — ADDRESS
410-787-6431 — TELEPHONE NUMBER

ENGINEERS CERTIFICATION
I DO HEREBY CERTIFY THAT THIS PLAN FOR EROSION SEDIMENT CONTROL REPRESENTS A PRACTICAL AND WORKABLE PLAN BASED UPON PERSONAL KNOWLEDGE OF THE SITE CONDITIONS AND THAT IT WAS PREPARED ON ACCORDANCE WITH THE REQUIREMENTS OF THE BALTIMORE CITY OFFICE OF COMPLIANCE AND LABORATORIES.

R. DAVID ESPINOZA, P.E. — PRINT NAME
SIGNATURE — DATE: 12/18/17
10211 WINCOPIN CIRCLE, FLOOR 4, COLUMBIA, MD 21044 — ADDRESS
410-381-4333 — TELEPHONE NUMBER

STANDARD STABILIZATION NOTE

FOLLOWING INITIAL SOIL DISTURBANCE OR RE-DISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION MUST BE COMPLETED WITHIN:

a. THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES STEEPER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1); AND

b. SEVEN (7) CALENDAR DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE NOT UNDER ACTIVE GRADING

MAINTENANCE OF SEDIMENT CONTROL

CONTRACTOR SHALL, WITHOUT EXTRA COST TO THE PROJECT, REPAIR AND MAINTAIN EXISTING SEDIMENT CONTROL DEVICES UNTIL ALL AREAS WITHIN LIMITS OF CONSTRUCTION ARE STABILIZED. ALL SEDIMENT CONTROL MEASURES REFERRED TO ON THESE PLANS SHALL BE IN ACCORDANCE WITH THE PUBLICATION ENTITLED "2011 MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL".

EROSION AND SEDIMENT CONTROL NOTES

1. THE CONTRACTOR WILL COMPLY WITH ALL REQUIREMENTS OF SEDIMENT AND EROSION CONTROL AS SET FORTH IN THE MARYLAND SEDIMENT AND EROSION MANUAL AND BALTIMORE CITY CODE ARTICLE 7.

2. SUBMIT A WRITTEN NOTIFICATION TO: THE DEPARTMENT OF PUBLIC WORKS, OFFICE OF COMPLIANCE AND LABORATORIES: 3001 DRUID PARK DRIVE, ROOM 228, BALTIMORE, MD 21215, PHONE NUMBER, 410-396-0732, FAX 410-523-9047, DPW.ESCINSPECTIONS@BALTIMORECITY.GOV, AT LEAST 72 HOURS PRIOR TO START OF CONSTRUCTION STATING:
A. A REQUEST FOR A PRECONSTRUCTION MEETING,
B. WHEN CONTRACTOR INTENDS TO BEGIN CONSTRUCTION,
C. WHEN CONTRACTOR INTENDS TO INSTALL STORMWATER MANAGEMENT FACILITIES,
D. SOURCE OF BORROW MATERIAL,
E. LOCATION OF DISPOSAL AREA OF SITE MATERIAL,
F. CONTRACTOR'S TENTATIVE CLOSING DATE.

3. INITIAL DISTURBANCE WILL BE LIMITED TO THAT NECESSARY TO GAIN ENTRANCE TO THE SITE AND INSTALL NECESSARY SEDIMENT CONTROLS AS PER THE APPROVED PLANS.

4. ALL SEDIMENT CONTROLS AND CRITICAL SLOPES MUST BE STABILIZED WITHIN THREE (3) CALENDAR DAYS. ALL OTHER INACTIVE DISTURBED AREAS ON THE PROJECT SITE MUST BE STABILIZED WITHIN SEVEN (7) CALENDAR DAYS.

5. ALL EXCAVATED MATERIAL SHALL BE PLACED ON THE HIGH SIDE WHENEVER POSSIBLE AND CONFINED TO AN AREA WHERE IT WILL NOT BE OBSTRUCT THE NORMAL COURSE OF DRAINAGE.

6. PUMPING OF SEDIMENT LADEN WATER WILL NOT BE ALLOWED UNLESS IT IS FILTERED BY WAY OF AN APPROVED SEDIMENT TRAPPING DEVICE.

7. CONTINUOUS INSPECTION AND MAINTENANCE OF ALL SEDIMENT CONTROL DEVICES IS MANDATORY.

8. ANY SEDIMENT CONTROL DEVICES DISTURBED DURING UTILITY CONSTRUCTION MUST BE RESTORED IMMEDIATELY.

9. ALL POINTS OF INGRESS AND EGRESS SHALL BE PROTECTED TO MINIMIZE TRACKING OF MUD ON TO PUBLIC RIGHT-OF-WAYS.

10. ANY EARTH, GRAVEL, AND/OR OTHER MATERIAL TRACKED, SPILLED OR WASHED ON TO ADJACENT ROADS MUST BE IMMEDIATELY REMOVED AND DISPOSED OF IN A PROPER MANNER. NO FLUSHING WILL BE PERMITTED. ALL MATERIAL MUST BE REMOVED BY MEANS OF SHOVELING AND SWEEPING.

11. ON ALL SITES WITH DISTURBED AREAS IN EXCESS OF 5,000 SQ. FT , THE CONTRACTOR SHALL HAVE A BALTIMORE CITY EROSION AND SEDIMENT CONTROL INSPECTOR INSPECT AND APPROVE THE WORK COMPLETED AT THE STAGES OF CONSTRUCTION SPECIFIED BELOW:
A. UPON COMPLETION OF THE INSTALLATION OF THE PERIMETER SEDIMENT CONTROLS;
B. DURING ALL GRADING AND BUILDING OPERATIONS;
C. UPON FINAL STABILIZATION OF THE ENTIRE SITE PRIOR TO REMOVAL OF THE SEDIMENT CONTROLS

12. THE CONTRACTOR SHALL NOT DEVIATE FROM THE APPROVED SEDIMENT AND EROSION CONTROL PLAN WITHOUT FIRST RECEIVING APPROVAL FROM THE OFFICE OF COMPLIANCE AND LABORATORIES. VARIATIONS TO THE ORIGINAL PLAN MUST BE SUBMITTED IN WRITING WITH ALL PROPOSED MODIFICATIONS STILL BEING HIGHLIGHTED. SUBSTANTIAL CHANGES WILL NECESSITATE AMENDMENT OF THE GRADING /BUILDING PERMIT.

EROSION AND SEDIMENT CONTROL WILL BE STRICTLY ENFORCED.

BEST MANAGEMENT PRACTICES FOR WORKING IN NONTIDAL WETLANDS, WETLAND BUFFERS, WATERWAYS AND 100-YEAR FLOODPLAIN

1. NO EXCESS FILL, CONSTRUCTION MATERIAL OR DEBRIS SHALL BE STOCKPILED OR STORED IN THE WETLANDS OR BUFFER.
2. PLACE MATERIALS IN A LOCATION AND MANNER WHICH DOES NOT ADVERSELY IMPACT SURFACE OR SUBSURFACE WATER FLOW INTO OR OUT OF THE NONTIDAL WETLAND.
3. DO NOT USE THE EXCAVATED MATERIAL AS BACKFILL IF IT CONTAINS WASTE METAL PRODUCTS, UNSIGHTLY DEBRIS, TOXIC MATERIAL OR ANY OTHER DELETERIOUS SUBSTANCE. IF ADDITIONAL BACKFILL IS REQUIRED, USE CLEAN MATERIAL FREE OF WASTE METAL PRODUCTS, UNSIGHTLY DEBRIS, TOXIC MATERIAL OR ANY OTHER DELETERIOUS SUBSTANCE.
4. PLACE HEAVY EQUIPMENT ON MATS OR SUITABLY OPERATE THE EQUIPMENT TO PREVENT DAMAGE TO THE NONTIDAL WETLANDS OR BUFFER.
5. REPAIR AND MAINTAIN ANY SERVICEABLE STRUCTURE OR FILL SO THERE IS NO PERMANENT LOSS OF NONTIDAL WETLANDS IN EXCESS OF NONTIDAL WETLANDS LOST UNDER THE ORIGINAL STRUCTURE OR FILL.
6. RECTIFY ANY NONTIDAL WETLANDS TEMPORARILY IMPACTED BY ANY CONSTRUCTION.
7. ALL STABILIZATION IN THE WETLAND AND BUFFER SHALL BE OF THE FOLLOWING RECOMMENDED SPECIES: ANNUAL RYEGRASS (Lolium multiflorum), MILLET (Setaria italica), BARLEY (Hordeum sp.), OATS (Uniola sp.) and/or RYE (Secale cereale). THESE SPECIES WILL ALLOW FOR THE STABILIZATION OF THE SITE WHILE ALSO ALLOWING FOR THE VOLUNTARY REVEGETATION OF NATURAL WETLAND SPECIES. OTHER NON-PERSISTENT VEGETATION MAY BE ACCEPTABLE, BUT MUST BE APPROVED BY THE DIVISION. KENTUCKY 31 FESCUE SHALL NOT BE UTILIZED IN THE WETLAND OR BUFFER AREAS. THE AREA SHOULD BE SEEDED AND MULCHED TO REDUCE EROSION AFTER CONSTRUCTION ACTIVITIES HAVE BEEN COMPLETED.
8. AFTER INSTALLATION HAS BEEN COMPLETED, MAKE POST CONSTRUCTION GRADES AND ELEVATIONS OF NONTIDAL WETLANDS THE SAME AS THE ORIGINAL GRADES AND ELEVATIONS IN TEMPORARILY IMPACTED AREAS.
9. TO PROTECT AQUATIC SPECIES, IN-STREAM WORK IS PROHIBITED AS DETERMINED BY THE CLASSIFICATION OF THE STREAM.
10. STORMWATER RUNOFF FROM IMPERVIOUS SURFACES SHALL BE CONTROLLED TO PREVENT THE WASHING OF DEBRIS INTO THE WATERWAY.
11. CULVERTS SHALL BE CONSTRUCTED AND ANY RIPRAP PLACED SO AS NOT TO OBSTRUCT THE MOVEMENT OF AQUATIC SPECIES, UNLESS THE PURPOSE OF THE ACTIVITY IS TO IMPOUND WATER.

NOTE: PROJECT INCLUDES WORK IN USE I WATERS. IN-STREAM WORK SHALL NOT BE CONDUCTED DURING THE PERIOD MARCH 1 THROUGH JUNE 15, INCLUSIVE DURING ANY YEAR.

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

REV	DATE	DESCRIPTION	DRN	APP

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OWNER / DEVELOPER / APPLICANT
TALEN ENERGY
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CONTACT: BRIAN HOYT
PHONE: 410.787.6431

TITLE: EROSION AND SEDIMENT CONTROL NOTES II

PROJECT: CELL 3 CONSTRUCTION DRAWINGS

SITE: LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

PROFESSIONAL CERTIFICATION:

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND,
LICENSE No. 22181
EXPIRATION DATE 12-2-2018

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE
DECEMBER 15, 2017
DATE

STATE OF MARYLAND · R. DAVID ESPINOZA · NO. 22181 · REGISTERED · PROFESSIONAL ENGINEER

DESIGNED BY:	JSW	DATE:	DECEMBER 2017
DRAWN BY:	JSW	PROJECT NO.:	ME1400
CHECKED BY:	MEP	FILE:	1400-019
REVIEWED BY:	RDE	DRAWING NO.:	
APPROVED BY:		20 OF 33	

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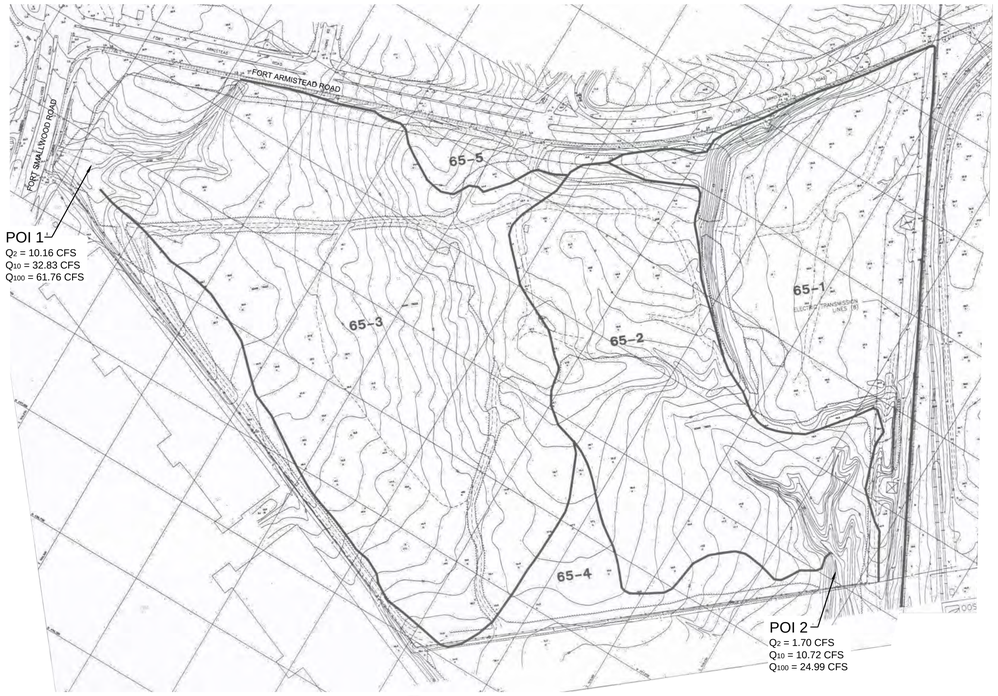
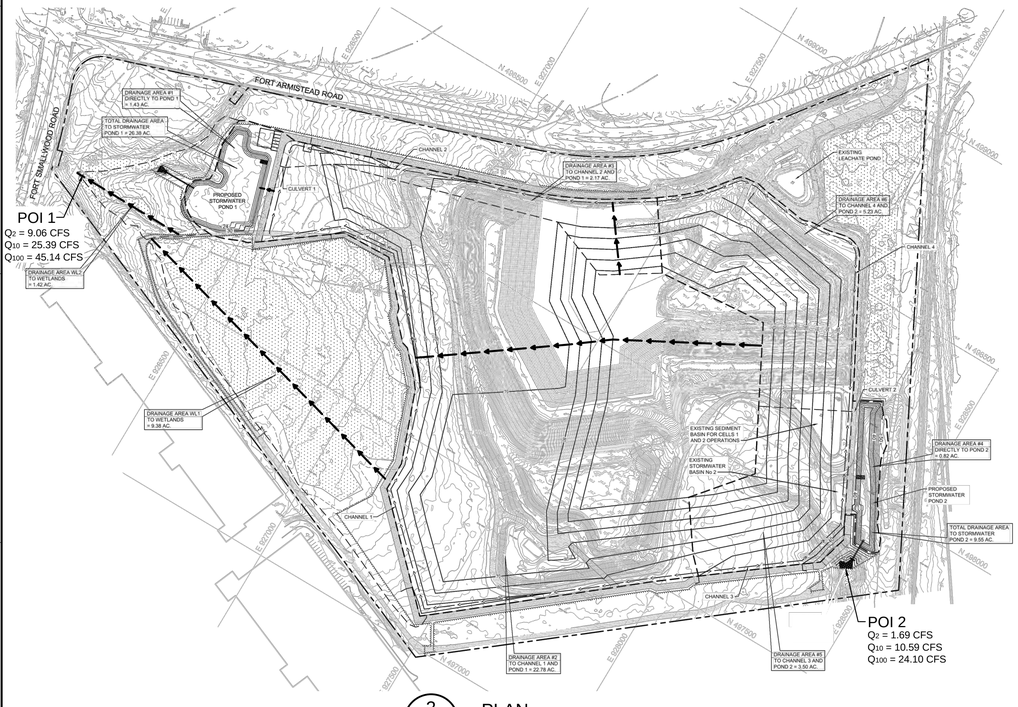


1 - PLAN

STORMWATER MANAGEMENT EXISTING CONDITION DRAINAGE AREA MAP

SCALE: 1" = 200'



2 - PLAN

STORMWATER MANAGEMENT PROPOSED CONDITION DRAINAGE AREA MAP

SCALE: 1" = 200'

LEGEND

- PROPERTY BOUNDARY
- EXISTING BUILDING
- EXISTING ROAD
- EXISTING TREE LINE
- MINOR CONTOUR GRADE (FEET, MSL)
- MAJOR CONTOUR GRADE (FEET, MSL)
- CHAIN LINK FENCE
- CSX TRACK
- LIMIT OF WETLAND MITIGATION AREA
- WETLANDS
- WETLAND BUFFER
- PROPOSED CONTOURS
- PROPOSED PERIMETER ROAD
- PROPOSED CONDITION DRAINAGE AREA
- PROPOSED TIME OF CONCENTRATION PATH

POI 1 DISCHARGE RATES		
DESIGN STORM	EXISTING CONDITION	PROPOSED CONDITION
Q_2	10.16 CFS	9.06 CFS
Q_{10}	32.83 CFS	25.39 CFS
Q_{100}	61.76 CFS	45.14 CFS

POI 2 DISCHARGE RATES		
DESIGN STORM	EXISTING CONDITION	PROPOSED CONDITION
Q_2	1.70 CFS	1.69 CFS
Q_{10}	10.72 CFS	10.59 CFS
Q_{100}	24.99 CFS	24.10 CFS

378 POND SPECIFICATIONS

CONSTRUCTION SPECIFICATIONS

These specifications are appropriate to all ponds within the scope of the Standard for practice MD-378. All references to ASTM and AASHTO specifications apply to the most recent version.

Site Preparation

Areas designated for borrow areas, embankment, and structural works shall be cleared, grubbed and stripped of topsoil. All trees, vegetation, roots and other objectionable material shall be removed. Channel banks and sharp breaks shall be sloped to no steeper than 1:1. All trees shall be cleared and grubbed within 15 feet of the toe of the embankment.

Areas to be covered by the reservoir will be cleared of all trees, brush, logs, fences, rubbish and other objectionable material unless otherwise designated on the plans. Trees, brush, and stumps shall be cut approximately level with the ground surface. For dry stormwater management ponds, a minimum of a 25-foot radius around the inlet structure shall be cleared.

All cleared and grubbed material shall be disposed of outside and below the limits of the dam and reservoir as directed by the owner or his representative. When specified, a sufficient quantity of topsoil will be stockpiled in a suitable location for use on the embankment and other designated areas.

Earth Fill

Material - The fill material shall be taken from approved designated borrow areas. It shall be free of roots, stumps, wood, rubbish, stones greater than 6", frozen or other objectionable materials. Fill material for the center of the embankment, and cut off trench shall conform to Unified Soil Classification GC, SC, CH, or CL and must have at least 30% passing the #200 sieve. Consideration may be given to the use of other materials in the embankment if designed by a geotechnical engineer. Such special designs must have construction supervised by a geotechnical engineer. Materials used in the outer shell of the embankment must have the capability to support vegetation of the quality required to prevent erosion of the embankment.

Placement - Areas on which fill is to be placed shall be scarified prior to placement of fill. Fill materials shall be placed in maximum 8 inch thick (before compaction) layers which are to be continuous over the entire length of the fill. The most permeable borrow material shall be placed in the downstream portions of the embankment. The principal spillway must be installed concurrently with fill placement and not excavated into the embankment.

Compaction - The movement of the hauling and spreading equipment over the fill shall be controlled so that the entire surface of each lift shall be traversed by not less than one tread track of heavy equipment or compaction shall be achieved by a minimum of four complete passes of a sheepsfoot, rubber tired or vibratory roller. Fill material shall contain sufficient moisture such that the required degree of compaction will be obtained with the equipment used. The fill material shall contain sufficient moisture so that if formed into a ball it will not crumble, yet not be so wet that water can be squeezed out.

When required by the reviewing agency the minimum required density shall not be less than 95% of maximum dry density with a moisture content within ±2% of the optimum. Each layer of fill shall be compacted as necessary to obtain that density, and is to be certified by the Engineer at the time of construction. All compaction is to be determined by AASHTO Method T-99 (Standard Proctor).

Cut Off Trench - The cutoff trench shall be excavated into impervious material along or parallel to the centerline of the embankment as shown on the plans. The bottom width of the trench shall be governed by the equipment used for excavation, with the minimum width being four feet. The depth shall be at least four feet below existing grade or as shown on the plans. The side slopes of the trench shall be 1 to 1 or flatter. The backfill shall be compacted with construction equipment, rollers, or hand tampers to assure maximum density and minimum permeability.

Embankment Core - The core shall be parallel to the centerline of the embankment as shown on the plans. The top width of the core shall be a minimum of four feet. The height shall extend up to at least the 10 year water elevation or as shown on the plans. The side slopes shall be 1 to 1 or flatter. The core shall be compacted with construction equipment, rollers, or hand tampers to assure maximum density and minimum permeability. In addition, the core shall be placed concurrently with the outer shell of the embankment.

Structure Backfill

Backfill adjacent to pipes or structures shall be of the type and quality conforming to that specified for the adjoining fill material. The fill shall be placed in horizontal layers not to exceed four inches in thickness and compacted by hand tampers or other manually directed compaction equipment. The material needs to fill completely all spaces under and adjacent to the pipe. At no time during the backfilling operation shall driven equipment be allowed to operate closer than four feet, measured horizontally, to any part of a structure. Under no circumstances shall equipment be driven over any part of a concrete structure or pipe, unless there is a compacted fill of 24" or greater over the structure or pipe.

Structure backfill may be flowable fill meeting the requirements of Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, Section 313 as modified. The mixture shall have a 100-200 psi; 28 day unconfined compressive strength. The flowable fill shall have a minimum pH of 4.0 and a minimum resistivity of 2,000 ohm-cm. Material shall be placed such that a minimum of 6" (measured perpendicular to the outside of the pipe) of flowable fill shall be under (bedding), over and, on the sides of the pipe. It only needs to extend up to the spring line for rigid conduits. Average slump of the fill shall be 7" to assure flowability of the material. Adequate measures shall be taken (sand bags, etc.) to prevent floating the pipe. When using flowable fill, all metal pipe shall be bituminous coated. Any adjoining soil fill shall be placed in horizontal layers not to exceed four inches in thickness and compacted by hand tampers or other manually directed compaction equipment. The material shall completely fill all voids adjacent to the flowable fill zone. At no time during the backfilling operation shall driven equipment be allowed to operate closer than four feet, measured horizontally, to any part of a structure. Under no circumstances shall equipment be driven over any part of a concrete structure or pipe, unless there is a compacted fill of 24" or greater over the structure or pipe.

Backfill material outside the structural backfill (flowable fill) zone shall be of the type and quality conforming to that specified for the core of the embankment or other embankment materials.

Pipe Conduits

All pipes shall be circular in cross section.

Corrugated Metal Pipe - All of the following criteria shall apply for corrugated metal pipe:

1. Materials - (Polymer Coated steel pipe) - Steel pipes with polymeric coatings shall have a minimum coating thickness of 0.01 inch (10 mil) on both sides of the pipe. This pipe and its appurtenances shall conform to the requirements of AASHTO Specifications M-245 & M-246 with watertight coupling bands or flanges.
   Materials - (Aluminum Coated Steel Pipe) - This pipe and its appurtenances shall conform to the requirements of AASHTO Specification M-274 with watertight coupling bands or flanges. Aluminum Coated Steel Pipe, when used with flowable fill or when soil and/or water conditions warrant the need for increased durability, shall be fully bituminous coated per requirements of AASHTO Specification M-190 Type A. Any aluminum coating damaged or otherwise removed shall be replaced with cold applied bituminous coating compound. Aluminum surfaces that are to be in contact with concrete shall be painted with one coat of zinc chromate primer or two coats of asphalt.
   Materials - (Aluminum Pipe) - This pipe and its appurtenances shall conform to the requirements of AASHTO Specification M-196 or M-211 with watertight coupling bands or flanges. Aluminum Pipe, when used with flowable fill or when soil and/or water conditions warrant for increased durability, shall be fully bituminous coated per requirements of AASHTO Specification M-190 Type A. Aluminum surfaces that are to be in contact with concrete shall be painted with one coat of zinc chromate primer or two coats of asphalt. Hot dip galvanized bolts may be used for connections. The pH of the surrounding soils shall be between 4 and 9.

2. Coupling bands, anti-seep collars, end sections, etc., must be composed of the same material and coatings as the pipe. Metals must be insulated from dissimilar materials with use of rubber or plastic insulating materials at least 24 mils in thickness.

3. Connections - All connections with pipes must be completely watertight. The drain pipe or barrel connection to the riser shall be welded all around when the pipe and riser are metal. Anti-seep collars shall be connected to the pipe in such a manner as to be completely watertight. Dimple bands are not considered to be watertight.

All connections shall use a rubber or neoprene gasket when joining pipe sections. The end of each pipe shall be re-rolled an adequate number of corrugations to accommodate the bandwidth. The following type connections are acceptable for pipes less than 24 inches in diameter: flanges on both ends of the pipe with a circular 3/8 inch closed cell neoprene gasket, prepunched to the flange bolt circle, sandwiched between adjacent flanges; a 12-inch wide standard lap type band with 12- inch wide by 3/8-inch thick closed cell circular neoprene gasket; and a 12-inch wide hugger type band with o-ring gaskets having a minimum diameter of 1/2 inch greater than the corrugation depth. Pipes 24 inches in diameter and larger shall be connected by a 24 inch long annular corrugated band using a minimum of 4 (four) rods and lugs, 2 on each connecting pipe end. A 24-inch wide by 3/8-inch thick closed cell circular neoprene gasket will be installed with 12 inches on the end of each pipe. Flanged joints with 3/8 inch closed cell gaskets the full width of the flange is also acceptable. Helically corrugated pipe shall have either continuously welded seams or have lock seams with internal caulking or a neoprene bead.

4. Bedding - The pipe shall be firmly and uniformly bedded throughout its entire length. Where rock or soft, spongy or other unstable soil is encountered, all such material shall be removed and replaced with suitable earth compacted to provide adequate support.

5. Backfilling shall conform to "**Structure Backfill**".

6. Other details (anti-seep collars, valves, etc.) shall be as shown on the drawings.

Reinforced Concrete Pipe - All of the following criteria shall apply for reinforced concrete pipe:

1. Materials - Reinforced concrete pipe shall have bell and spigot joints with rubber gaskets and shall equal or exceed ASTM C-361.

2. Bedding - Reinforced concrete pipe conduits shall be laid in a concrete bedding / cradle for their entire length. This bedding / cradle shall consist of high slump concrete placed under the pipe and up the sides of the pipe at least 50% of its outside diameter with a minimum thickness of 6 inches. Where a concrete cradle is not needed for structural reasons, flowable fill may be used as described in the "Structure Backfill" section of this standard. Gravel bedding is not permitted.

3. Laying pipe - Bell and spigot pipe shall be placed with the bell end upstream. Joints shall be made in accordance with recommendations of the manufacturer of the material. After the joints are sealed for the entire line, the bedding shall be placed so that all spaces under the pipe are filled. Care shall be exercised to prevent any deviation from the original line and grade of the pipe. The first joint must be located within 4 feet from the riser.

4. Backfilling shall conform to "**Structure Backfill**".

5. Other details (anti-seep collars, valves, etc.) shall be as shown on the drawings.

Plastic Pipe - The following criteria shall apply for plastic pipe:

1. Materials - PVC pipe shall be PVC-1120 or PVC-1220 conforming to ASTM D- 1785 or ASTM D-2241. Corrugated High Density Polyethylene (HDPE) pipe, couplings and fittings shall conform to the following: 4" – 10" inch pipe shall meet the requirements of AASHTO M252 Type S, and 12" through 24" inch shall meet the requirements of AASHTO M294 Type S.

2. Joints and connections to anti-seep collars shall be completely watertight.

3. Bedding -The pipe shall be firmly and uniformly bedded throughout its entire length. Where rock or soft, spongy or other unstable soil is encountered, all such material shall be removed and replaced with suitable earth compacted to provide adequate support.

4. Backfilling shall conform to "**Structure Backfill**".

5. Other details (anti-seep collars, valves, etc.) shall be as shown on the drawings.

Drainage Diaphragms - When a drainage diaphragm is used, a registered professional engineer will supervise the design and construction inspection.

Concrete

Concrete shall meet the requirements of Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, Section 414, Mix No. 3.

Rock Riprap

Rock riprap shall meet the requirements of Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, Section 311.

Geotextile shall be placed under all riprap and shall meet the requirements of Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, Section 921.09, Class SE.

Care of Water during Construction

All work on permanent structures shall be carried out in areas free from water. The Contractor shall construct and maintain all temporary dikes, levees, cofferdams, drainage channels, and stream diversions necessary to protect the areas to be occupied by the permanent works. The contractor shall also furnish, install, operate, and maintain all necessary pumping and other equipment required for removal of water from various parts of the work and for maintaining the excavations, foundation, and other parts of the work free from water as required or directed by the engineer for constructing each part of the work. After having served their purpose, all temporary protective works shall be removed or leveled and graded to the extent required to prevent obstruction in any degree whatsoever of the flow of water to the spillway or outlet works and so as not to interfere in any way with the operation or maintenance of the structure. Stream diversions shall be maintained until the full flow can be passed through the permanent works. The removal of water from the required excavation and the foundation shall be accomplished in a manner and to the extent that will maintain stability of the excavated slopes and bottom required excavations and will allow satisfactory performance of all construction operations. During the the placing and compacting of material in required excavations, the water level at the locations being refilled shall be maintained below the bottom of the excavation at such locations which may require draining the water sumps from which the water shall be pumped.

Stabilization

All borrow areas shall be graded to provide proper drainage and left in a sightly condition. All exposed surfaces of the embankment, spillway, spoil and borrow areas, and berms shall be stabilized by seeding, liming, fertilizing and mulching in accordance with the Natural Resources Conservation Service Standards and Specifications for Critical Area Planting (MD-342) or as shown on the accompanying drawings.

Erosion and Sediment Control

Construction operations will be carried out in such a manner that erosion will be controlled and water and air pollution minimized. State and local laws concerning pollution abatement will be followed. Construction plans shall detail erosion and sediment control measures.

PROFESSIONAL CERTIFICATION:

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND,
LICENSE No. 22181
EXPIRATION DATE 12-2-2018

BALTIMORE CITY ESD# 6179A
BALTIMORE CITY EPLANS# 2017-2283

DESIGN AND DRAWINGS ARE BASED ON NAD27 AND NGVD29

REV	DATE	DESCRIPTION	DRN	APP

ENGINEER
GEOSYNTEC CONSULTANTS
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OWNER / DEVELOPER / APPLICANT
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CONTACT: BRIAN HOYT
PHONE: 410.787.6431

TITLE: EROSION AND SEDIMENT CONTROL NOTES III

PROJECT: CELL 3 CONSTRUCTION DRAWINGS

SITE: LOT 15 LANDFILL - BALTIMORE, MARYLAND
WARD 25, SECTION 09, BLOCK 7004, LOT 015

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DECEMBER 15, 2017
DATE

STATE OF MARYLAND — DAVID ESPINOZA — PROFESSIONAL ENGINEER

DESIGNED BY:	JSW	DATE:	DECEMBER 2017
DRAWN BY:	JSW	PROJECT NO.:	ME1400
CHECKED BY:	MEP	FILE:	1400-019
REVIEWED BY:	RDE	DRAWING NO.:	
APPROVED BY:			21 OF 33

APPENDIX B

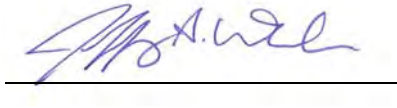
INTERMEDIATE DEVELOPMENT STAGE HYDRAULIC CALCULATIONS

Geosyntec consultants

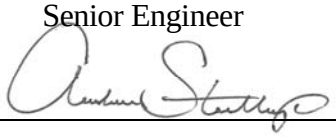
COMPUTATION COVER SHEET

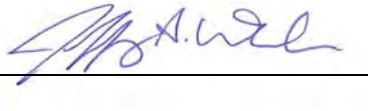
Client: Raven **Project:** Lot 15 Landfill **Project #:** MR1352A **Task #:** 04

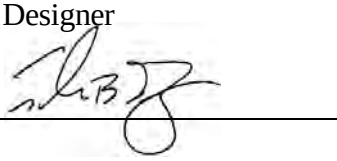
TITLE OF COMPUTATIONS **INTERMEDIATE STAGE STORMWATER MANAGEMENT ANALYSIS**

COMPUTATIONS BY:
Signature  9/7/2016 DATE
Printed Name and Title: Jeffrey Wheeler, Designer

ASSUMPTIONS AND PROCEDURES CHECKED BY: (Peer Reviewer)
Signature 9/7/2016 DATE
Printed Name and Title: William M. Steier, P.E., Senior Engineer

COMPUTATIONS CHECKED BY:
Signature  9/7/2016 DATE
Printed Name and Title: Andrew Stallings, Staff Engineer

COMPUTATIONS BACKCHECKED BY: (Originator)
Signature  9/7/2016 DATE
Printed Name and Title: Jeffrey Wheeler, Designer

APPROVED BY: (PM or Designate)
Signature  9/7/2016 DATE
Printed Name and Title: Thomas B. Ramsey, P.E., Principal

APPROVAL NOTES:

REVISIONS (Number and initial all revisions)

NO.	SHEET	DATE	BY	CHECKED BY	APPROVAL

INTERMEDIATE STAGE STORMWATER MANAGEMENT ANALYSIS

INTRODUCTION

The purpose of this calculation package is to evaluate a conceptual intermediate stage of site development which will occur after development of six landfill cells associated with the Fort Armistead Road Lot 15 Landfill, but before construction of the mechanical stabilized earth (MSE) berm. This calculation is prepared in fulfilment of the requirements of the Coal Combustion Residual (CCR) Rule (40 CFR 257.81).

This calculation package addresses the peak discharge, velocity, and flow depth from a conceptual intermediate grading plan. The runoff control system for the Fort Armistead Road - Lot 15 Landfill is designed to control the 100-year, 24-hour design storm event, which exceeds the CCR Rule requirement for control of the 25-year, 24-hour design storm.

METHODOLOGY

Watershed analysis is performed using procedures described in the documents, "Urban Hydrology for Small Watersheds, Technical Release 55", (USDA-SCS, 1986) and "Computer Program for Project Formulation Hydrology, Technical Release 20", (USDA-SCS, 1982). The computer program HydroCAD® Version 10.00 (Applied Micro-Computer Systems, 2012) was used to perform the analysis.

The intermediate site configuration grading plan and delineation of the subcatchment watersheds evaluated are shown on Figure 1. As identified on Figure 1, the subcatchments discharge into either Stormwater Management Ponds No. 1 or No. 2. The flow within each drainage area is conveyed by various stormwater drainage features, which include: (i) perimeter landfill drainage channels; and (ii) temporary culverts entering each basin. The central portion of the facility will be graded to a low point where stormwater runoff will be detained and allowed to infiltrate, or pumped to the perimeter drainage channel for discharge to the stormwater management ponds. In this calculation, the hydraulic function and performance of the stormwater management ponds is evaluated based upon the final stormwater management configuration as presented in the report, *Application for an Industrial Landfill Permit: Phase III Report, Fort Armistead Road – Lot 15 Landfill Baltimore, Maryland* by Geosyntec Consultants (2012). At the time of development, evaluation of the pond function for the erosion and sediment control outlet configuration must be prepared.

Each of the subcatchments and drainage features analyzed for this calculation are modeled by defining the specific characteristics of the feature using one of three general node types that are defined by the HydroCAD modeling software. The model node types include: (i) subcatchment nodes, which model runoff from defined drainage areas; (ii) reach nodes, which model flow though channels and downchutes; and (iii) pond nodes, which model flow at culverts for this calculation.

CALCULATION PARAMETERS

The following describes the selection of the various hydrologic parameters used for the stormwater analysis.

- **Rainfall Distribution and Depth**: Based on precipitation data from the *"Precipitation-Frequency Atlas of the United States"*, (NOAA National Weather Service, 2004); the 24-hour precipitation magnitudes for the 2-year, 25-year, and 100 year return periods are 3.20 inches, 5.90 inches, and 7.30 inches, respectively.
- **Unit Hydrograph**: The Standard SCS Type II unit hydrograph was used for calculation of the peak runoff volumes.
- **Hydrologic Soil Group**: Hydrologic Soils Group (HSG) B is assumed to be representative of the compacted ash disposed within the landfill.
- **Curve Number (CN):** Runoff curve numbers used in the calculation are selected based on the anticipated characteristics of the areas corresponding to the intermediate conditions. The following describes the curve numbers selected for this calculation.
  - **Bare surface**: For subcatchments in the landfill footprint, a CN of 86 is selected, corresponding to bare surfce.
- **Subcatchment Drainage Areas**: As previously described, the drainage areas modeled using HydroCAD are shown in Figure 1.
- **Time of Concentration (T_c):** The T_c value represents the total time for stormwater runoff to travel from the hydraulically most distant point of a watershed or drainage area to a point of interest. Factors affecting T_c include surface roughness, channel shape, flow patterns, and slope. For this analysis, the calculation of T_c evaluates three different types of stormwater runoff flow:
  - **Sheet Flow** – flow over plane surfaces, which is limited to a maximum length of 100 ft;
  - **Shallow Concentrated Flow** – after about 100 ft, sheet flow will begin to concentrate, but is not necessarily defined in a specific channel; and
  - **Channel Flow** – flow that is confined to a defined channel section.

The T_c value for a drainage area is the sum of the individual various travel time (T_t) values of the above flow types. The equations for calculating the T_t are presented below:

- **Sheet Flow:** $T_t = 0.007\ (nL)^{0.8}/[\ (P_2)^{0.5}\ s^{0.4}]$

where: T_t = travel time (hours);
n = Manning's roughness coefficient (dimensionless);
- n = 0.05 for fallow, open land
- n = 0.03 for grassed earth channel

L = length of flow (ft.);
P_2 = rainfall from a 2-year, 24-hour storm (in.); and
s = bed or surface slope in the flow direction (ft/ft).

TR-55 provides a graphical solution for T_t for shallow concentrated flow over "paved" and "unpaved areas". The "*National Engineering Handbook, Section 4 Hydrology (NEH-4)*", (SCS, 1985) provides the following equation for flow velocity, V:

$$V = K_v \sqrt{s}$$

where K_v is a velocity factor based on various surface conditions (i.e., paved, unpaved, grassed waterway, short grass pasture, etc.) and s is the slope of the land surface. HydroCAD® provides a table of velocity factors (K_v), which are used to calculate V in the above equation. The value of K_V used for these calculations:

- K_V = 16.1 ft/sec for unpaved, grassed waterways.

- **Drainage Features**: Drainage features are used to convey stormwater away from the landfill and into the existing stormwater management ponds. A general description of the physical characteristics of each feature type is provided below.
  - **Culvert Entrances/Exits:** Perimeter channel culvert entrances are modeled using pond nodes, which account for head losses at the inlet entrances and outlet exits. Headwalls are included in the intermediate stage. Culverts are also designed as new corrugated plastic pipes (CPP) with smooth interior.
  - **Perimeter Channels:** The intermediate perimeter channels are trapezoidal-shaped, and the lining is a vegetated surfce. The existing channels are modeled using reach nodes within the HydroCAD® model.

RESULTS

HydroCAD model output is provided in Attachment 1. Under the 100-year, 24-hour storm event, the model results indicate the following: peak flow depths range from 0.9 ft to 1.6 ft; velocities range from 4.8 fps to 7.8 fps; and tractive stresses range from 1.1 psf to 2.0 psf. Temporary culverts pass all flows without overtopping the channel. Stormwater management ponds (modeled in the final stormwater management configuration) are adequately sized to pass the 100-year design storm without overtopping.

In summary, the computations demonstrates that the channels and temporary culverts are adequately sized to convey the 100-year, 24-hour design storm.

REFERENCES

Applied Microcomputer Systems, "*HydroCAD® Stormwater Modeling System*", Version 10, Chocorua, New Hampshire, 2012.

Federal Highway Administration, Hydraulics Engineering. "*Urban Drainage Design Manual – Storm Drains*" Updated 07 September 2011.

Geosyntec Consultants, "*Application for an Industrial Landfill Permit: Phase III Report, Fort Armistead Road – Lot 15 Landfill Baltimore, Maryland"*, Columbia, Maryland, 2012.

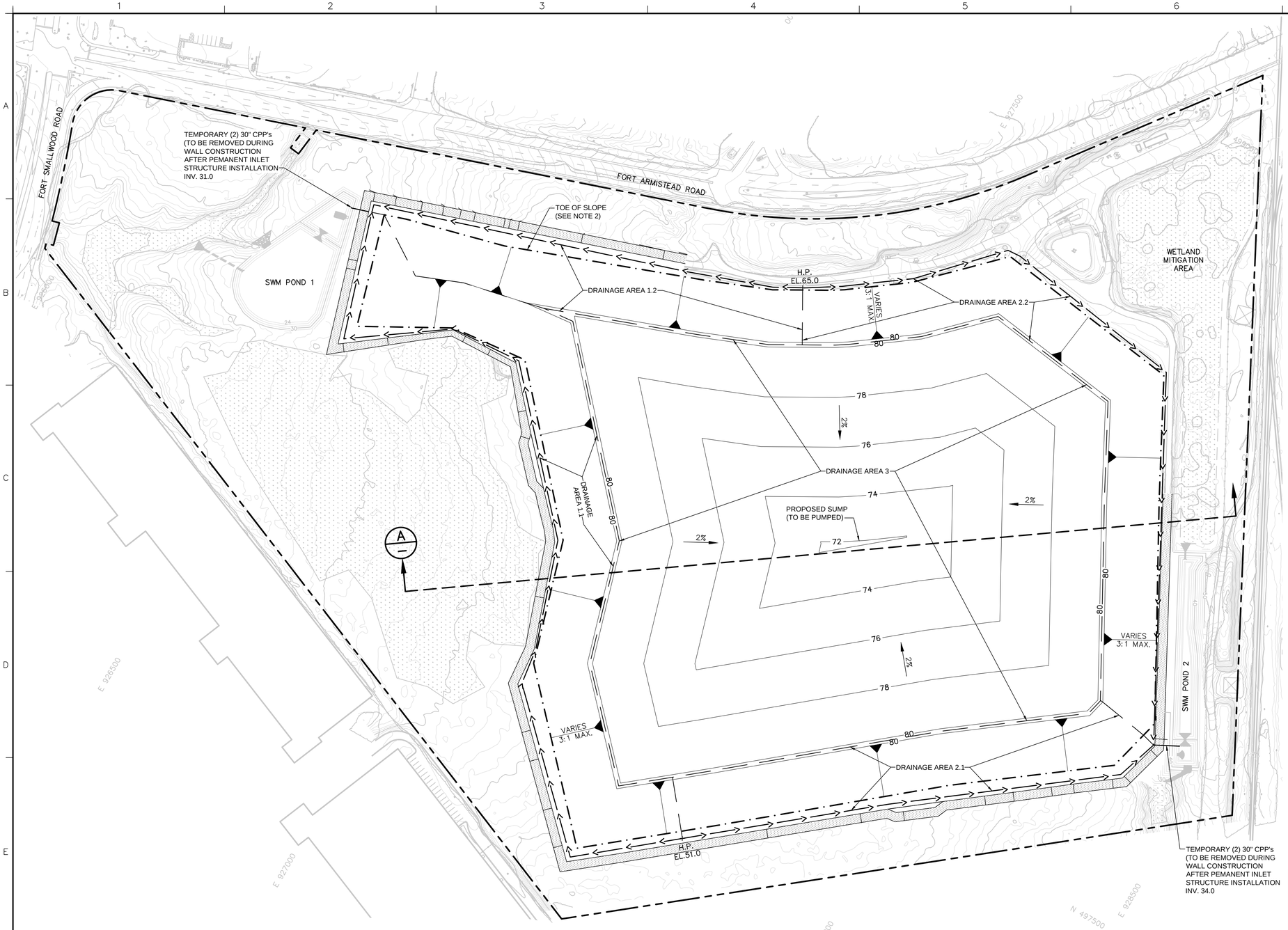
NOAA National Weather Service, *"Precipitation-Frequency Atlas of the United States"* Atlas 14, Volume 2, Version 3, Silver Spring Maryland, 2004.

United States Department of Agriculture, Soil Conservation Service (USDA-SCS), "*Computer Program for Project Formulation Hydrology, Technical Release 20*", Washington D.C., 1982.

United States Department of Agriculture, Soil Conservation Service (USDA-SCS), *"National Engineering Handbook, Section 4 Hydrology (NEH-4)"*, National Technical Information Service, 1985.

United States Department of Agriculture, Soil Conservation Service (USDA-SCS), "*Urban Hydrology for Small Watersheds, Technical Release 55*", 2nd ed., Washington, D.C., 1986.

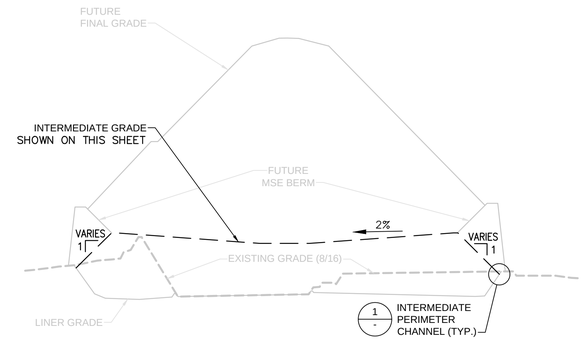
United States Department of Agriculture, Natural Resources Conservation Service (NRCS) "Soil Survey of Talbot County, Maryland", Washington D.C., 1997.



NORTH

LEGEND

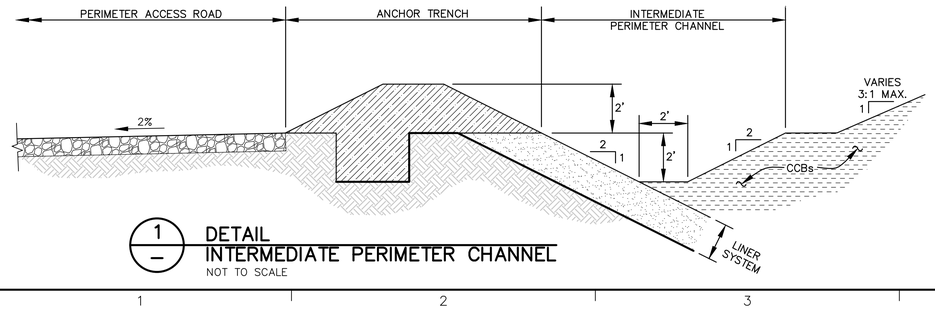
- PROPERTY BOUNDARY
- EXISTING BUILDING
- EXISTING ROAD
- EXISTING TREE LINE
- 100 — EXISTING CONTOUR GRADE (FEET, MSL)
- 70 — PROPOSED INTERMEDIATE GRADE CONTOUR (FEET, MSL) (SEE NOTE 2)
- CHAIN LINK FENCE
- CSX TRACK
- EXISTING CULVERT
- LIMIT OF WETLAND MITIGATION AREA
- WETLAND
- INTERMEDIATE PERIMETER CHANNEL (1/-)
- INTERMEDIATE GRADING DRAINAGE AREAS
- TOE OF SLOPE (SEE NOTE 2)



GRADING KEY

SECTION A
NOT TO SCALE

100 50 0 100 200
SCALE: 1" = 100'



1/- DETAIL
INTERMEDIATE PERIMETER CHANNEL
NOT TO SCALE

NOTES:

1. EXISTING TOPOGRAPHY SHOWN HEREON FROM AN AERIAL SURVEY CONDUCTED BY PRECISION SURVEYING AND MAPPING LLC, BALTIMORE MARYLAND, DATED AUGUST 22, 2016.
2. TOE OF SLOPE WILL BE SET BASED UPON MSE BERM REINFORCEMENT DESIGN AS PRESENTED IN THE APPLICATION FOR AN INDUSTRIAL LANDFILL PERMIT, PHASE III, PERMIT DRAWINGS 13 AND 14, BY GEOSYNTEC, DATED MARCH 2012.

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10211 WINCOPIN CIRCLE, FLOOR 4
COLUMBIA, MARYLAND 21044 USA
PHONE: 410.381.4333

RAVEN POWER | FORT SMALLWOOD
1005 BRANDON SHORES ROAD, SUITE 100
BALTIMORE, MD 21226 USA

TITLE: INTERMEDIATE GRADING

PROJECT: RUNON / RUNOFF ANALYSIS

SITE: LOT 15 LANDFILL – BALTIMORE CITY, MARYLAND

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

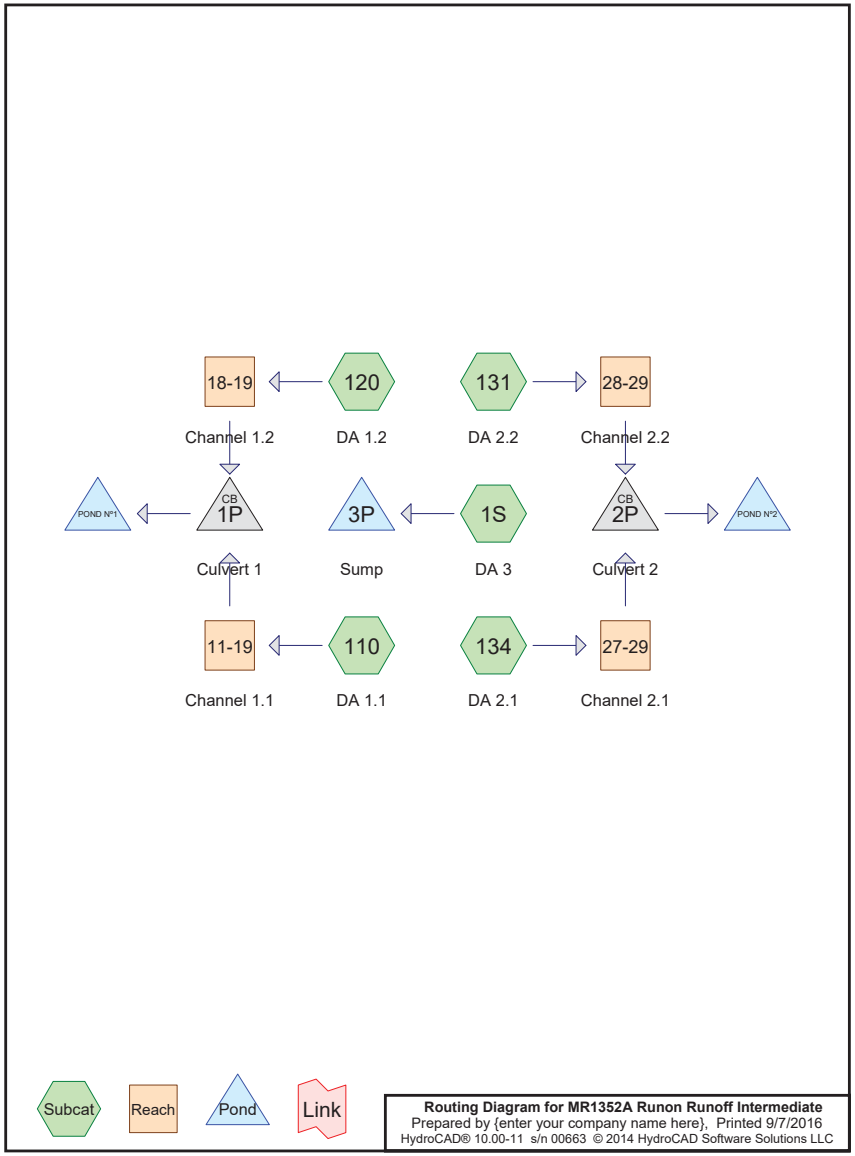
DATE

DESIGNED BY:	WMS	DATE:	SEPTEMBER 2016
DRAWN BY:	JSW	PROJECT NO.:	MR1352A
CHECKED BY:	WMS	FILE:	1352A–002
REVIEWED BY:			
APPROVED BY:			

FIG.1

ATTACHMENT 1

HYDROCAD® OUTPUT, 25-YR AND 100-YR STORM



Time span=2.00-32.00 hrs, dt=0.04 hrs, 751 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA 3 Runoff Area=19.010 ac 0.00% Impervious Runoff Depth=4.31"
Flow Length=200' Slope=0.0200 '/' Tc=4.8 min CN=86 Runoff=142.99 cfs 6.835 af

Subcatchment 110: DA 1.1 Runoff Area=4.830 ac 0.00% Impervious Runoff Depth=4.31"
Flow Length=125' Slope=0.3333 '/' Tc=1.3 min CN=86 Runoff=39.99 cfs 1.737 af

Subcatchment 120: DA 1.2 Runoff Area=2.620 ac 0.00% Impervious Runoff Depth=4.31"
Flow Length=125' Slope=0.3333 '/' Tc=1.3 min CN=86 Runoff=21.69 cfs 0.942 af

Subcatchment 131: DA 2.2 Runoff Area=4.200 ac 0.00% Impervious Runoff Depth=4.31"
Flow Length=125' Slope=0.3333 '/' Tc=1.3 min CN=86 Runoff=34.77 cfs 1.510 af

Subcatchment 134: DA 2.1 Runoff Area=2.960 ac 0.00% Impervious Runoff Depth=4.31"
Flow Length=125' Slope=0.3333 '/' Tc=1.3 min CN=86 Runoff=24.51 cfs 1.064 af

Reach 11-19: Channel 1.1 Avg. Flow Depth=1.39' Max Vel=4.46 fps Inflow=39.99 cfs 1.737 af
n=0.030 L=1,860.0' S=0.0108 '/' Capacity=65.54 cfs Outflow=29.49 cfs 1.737 af

Reach 18-19: Channel 1.2 Avg. Flow Depth=0.77' Max Vel=7.24 fps Inflow=21.69 cfs 0.942 af
n=0.025 L=913.0' S=0.0372 '/' Capacity=146.36 cfs Outflow=19.67 cfs 0.942 af

Reach 27-29: Channel 2.1 Avg. Flow Depth=1.08' Max Vel=4.75 fps Inflow=24.51 cfs 1.064 af
n=0.030 L=976.0' S=0.0164 '/' Capacity=80.92 cfs Outflow=20.77 cfs 1.064 af

Reach 28-29: Channel 2.2 Avg. Flow Depth=1.18' Max Vel=5.52 fps Inflow=34.77 cfs 1.510 af
n=0.030 L=1,570.0' S=0.0197 '/' Capacity=88.81 cfs Outflow=28.51 cfs 1.510 af

Pond 1P: Culvert 1 Peak Elev=32.99' Inflow=40.16 cfs 2.679 af
30.0" Round Culvert x 2.00 n=0.013 L=50.0' S=0.1000 '/' Outflow=40.16 cfs 2.679 af

Pond 2P: Culvert 2 Peak Elev=36.27' Inflow=48.21 cfs 2.574 af
30.0" Round Culvert x 2.00 n=0.011 L=60.0' S=0.0167 '/' Outflow=48.21 cfs 2.574 af

Pond 3P: Sump Peak Elev=75.62' Storage=297,691 cf Inflow=142.99 cfs 6.835 af
Outflow=0.00 cfs 0.000 af

Pond POND Nº1: Peak Elev=25.79' Storage=1.247 af Inflow=40.16 cfs 2.679 af
Outflow=10.58 cfs 2.402 af

Pond POND Nº2: Peak Elev=38.43' Storage=1.315 af Inflow=48.21 cfs 2.574 af
Outflow=7.65 cfs 1.984 af

Total Runoff Area = 33.620 ac Runoff Volume = 12.088 af Average Runoff Depth = 4.31"
100.00% Pervious = 33.620 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: DA 3

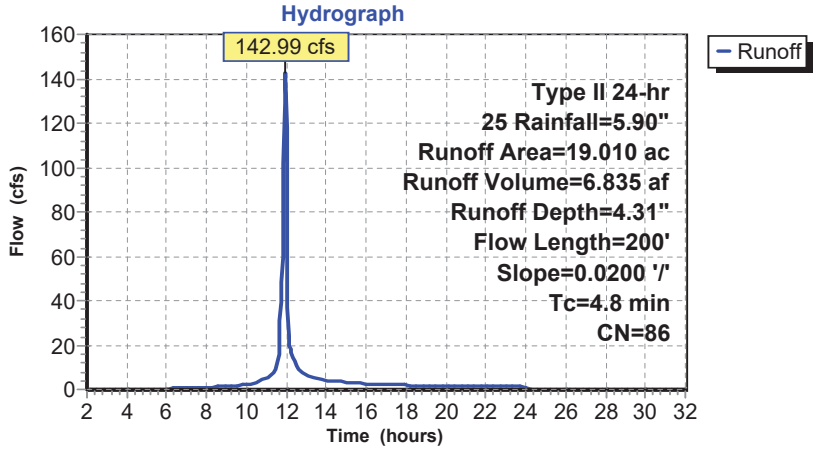
Runoff = 142.99 cfs @ 11.95 hrs, Volume= 6.835 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Type II 24-hr 25 Rainfall=5.90"

	Area (ac)	CN	Description
*	19.010	86	
	19.010		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	100	0.0200	0.41		**Sheet Flow,** Fallow n= 0.050 P2= 3.20"
0.7	100	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.8	200	Total			

Subcatchment 1S: DA 3



Summary for Subcatchment 110: DA 1.1

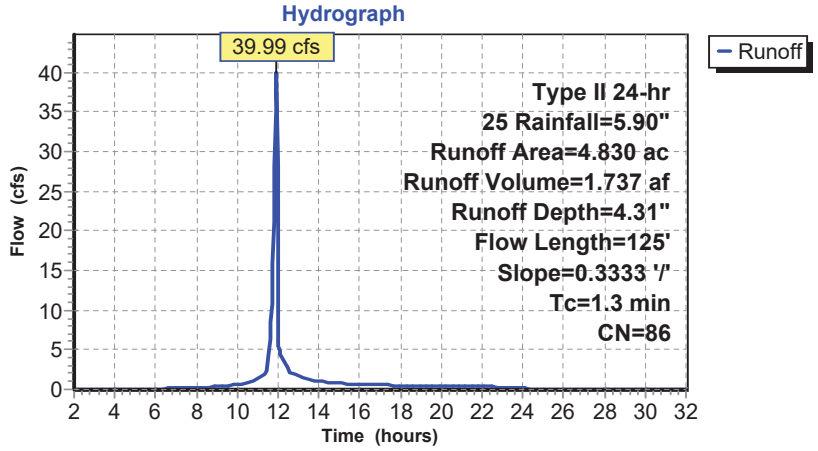
Runoff = 39.99 cfs @ 11.91 hrs, Volume= 1.737 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Type II 24-hr 25 Rainfall=5.90"

	Area (ac)	CN	Description
*	4.830	86	
	4.830		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.3333	1.26		**Sheet Flow,** Fallow n= 0.050 P2= 3.20"
0.0	25	0.3333	9.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.3	125	Total			

Subcatchment 110: DA 1.1



Summary for Subcatchment 120: DA 1.2

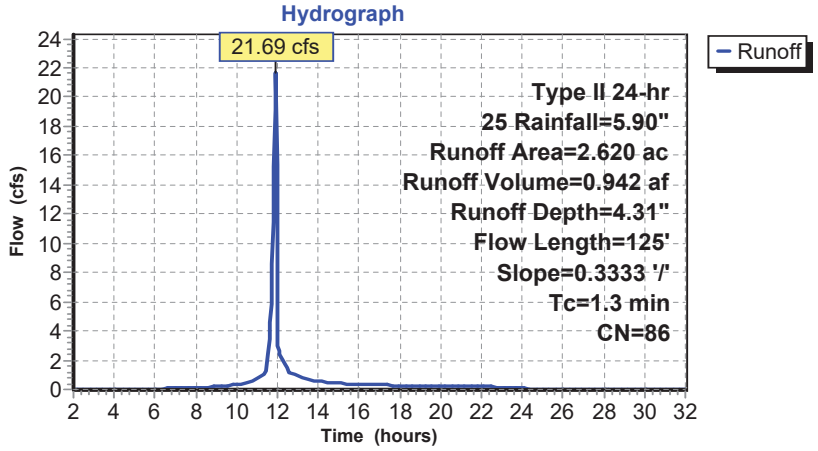
Runoff = 21.69 cfs @ 11.91 hrs, Volume= 0.942 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Type II 24-hr 25 Rainfall=5.90"

	Area (ac)	CN	Description
*	2.620	86	
	2.620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.3333	1.26		**Sheet Flow,** Fallow n= 0.050 P2= 3.20"
0.0	25	0.3333	9.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.3	125	Total			

Subcatchment 120: DA 1.2



Summary for Subcatchment 131: DA 2.2

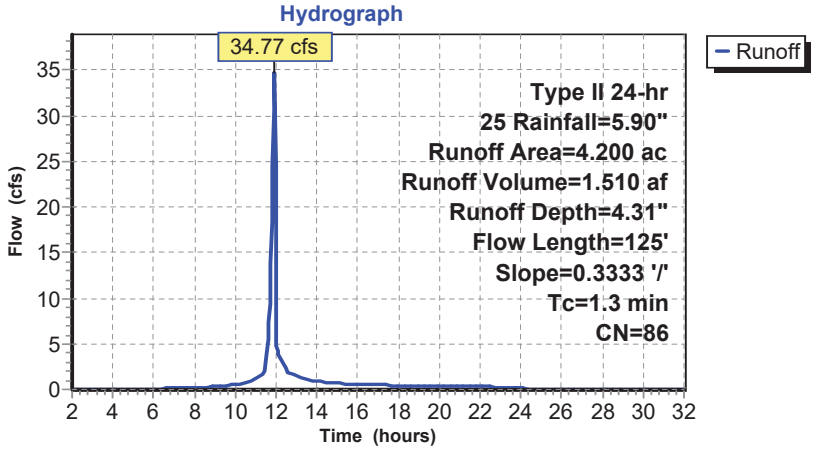
Runoff = 34.77 cfs @ 11.91 hrs, Volume= 1.510 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Type II 24-hr 25 Rainfall=5.90"

	Area (ac)	CN	Description
*	4.200	86	
	4.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.3333	1.26		**Sheet Flow,** Fallow n= 0.050 P2= 3.20"
0.0	25	0.3333	9.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.3	125	Total			

Subcatchment 131: DA 2.2



Summary for Subcatchment 134: DA 2.1

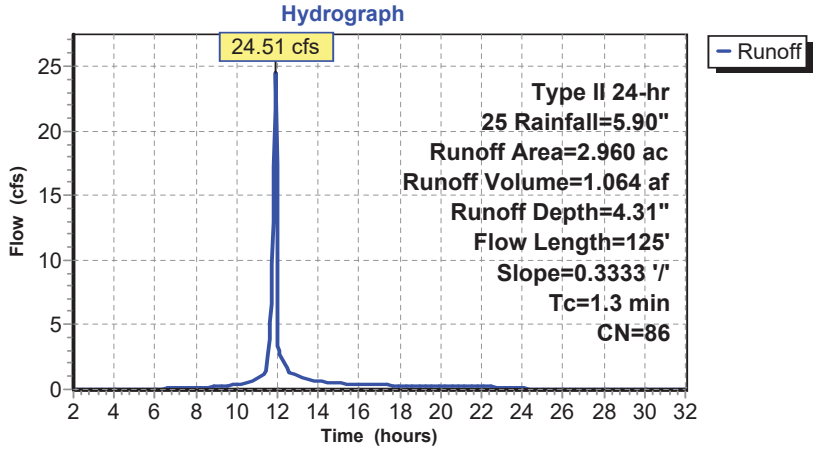
Runoff = 24.51 cfs @ 11.91 hrs, Volume= 1.064 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Type II 24-hr 25 Rainfall=5.90"

	Area (ac)	CN	Description
*	2.960	86	
	2.960		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.3333	1.26		**Sheet Flow,** Fallow n= 0.050 P2= 3.20"
0.0	25	0.3333	9.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.3	125	Total			

Subcatchment 134: DA 2.1



Summary for Reach 11-19: Channel 1.1

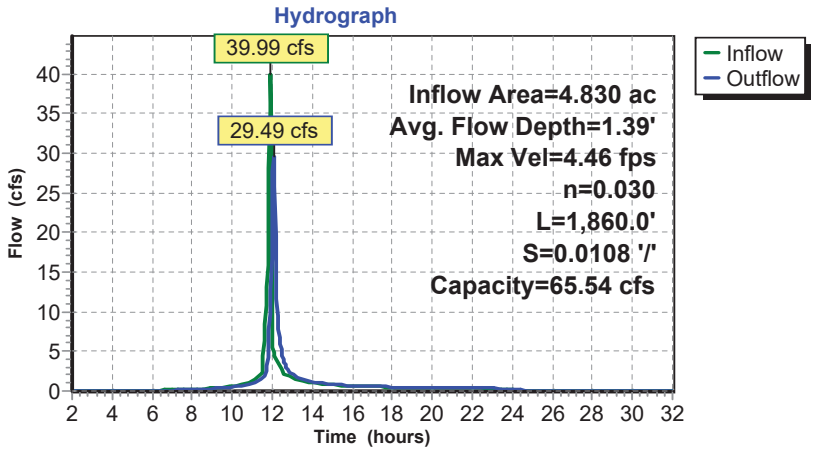
Inflow Area = 4.830 ac, 0.00% Impervious, Inflow Depth = 4.31" for 25 event
Inflow = 39.99 cfs @ 11.91 hrs, Volume= 1.737 af
Outflow = 29.49 cfs @ 12.07 hrs, Volume= 1.737 af, Atten= 26%, Lag= 9.7 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Max. Velocity= 4.46 fps, Min. Travel Time= 6.9 min
Avg. Velocity = 1.10 fps, Avg. Travel Time= 28.3 min

Peak Storage= 12,411 cf @ 11.96 hrs
Average Depth at Peak Storage= 1.39'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 65.54 cfs

2.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 1,860.0' Slope= 0.0108 '/'
Inlet Invert= 51.00', Outlet Invert= 31.00'

Reach 11-19: Channel 1.1



Summary for Reach 18-19: Channel 1.2

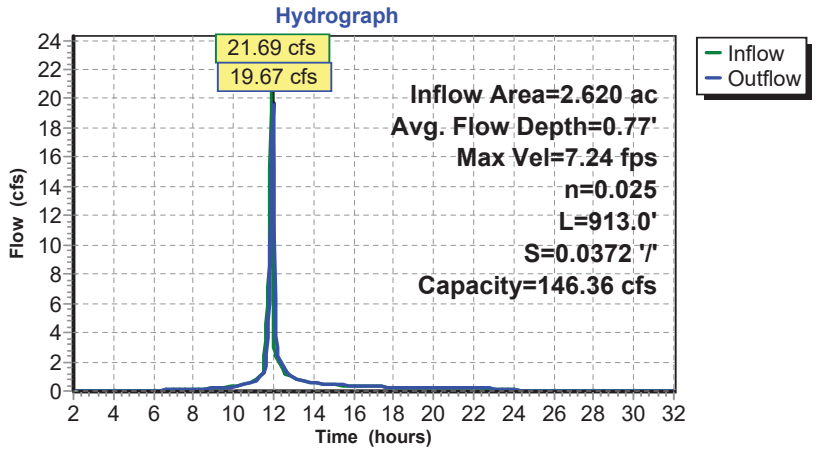
Inflow Area = 2.620 ac, 0.00% Impervious, Inflow Depth = 4.31" for 25 event
Inflow = 21.69 cfs @ 11.91 hrs, Volume= 0.942 af
Outflow = 19.67 cfs @ 11.96 hrs, Volume= 0.942 af, Atten= 9%, Lag= 3.2 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Max. Velocity= 7.24 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 1.82 fps, Avg. Travel Time= 8.4 min

Peak Storage= 2,508 cf @ 11.93 hrs
Average Depth at Peak Storage= 0.77'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 146.36 cfs

2.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 913.0' Slope= 0.0372 '/'
Inlet Invert= 65.00', Outlet Invert= 31.00'

Reach 18-19: Channel 1.2



Summary for Reach 27-29: Channel 2.1

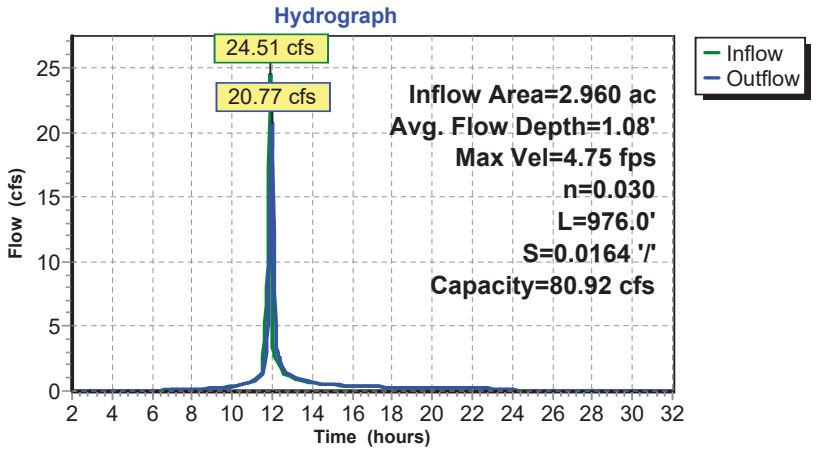
Inflow Area = 2.960 ac, 0.00% Impervious, Inflow Depth = 4.31" for 25 event
Inflow = 24.51 cfs @ 11.91 hrs, Volume= 1.064 af
Outflow = 20.77 cfs @ 11.99 hrs, Volume= 1.064 af, Atten= 15%, Lag= 5.0 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Max. Velocity= 4.75 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 1.20 fps, Avg. Travel Time= 13.6 min

Peak Storage= 4,361 cf @ 11.94 hrs
Average Depth at Peak Storage= 1.08'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 80.92 cfs

2.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 976.0' Slope= 0.0164 '/'
Inlet Invert= 50.00', Outlet Invert= 34.00'

Reach 27-29: Channel 2.1



Summary for Reach 28-29: Channel 2.2

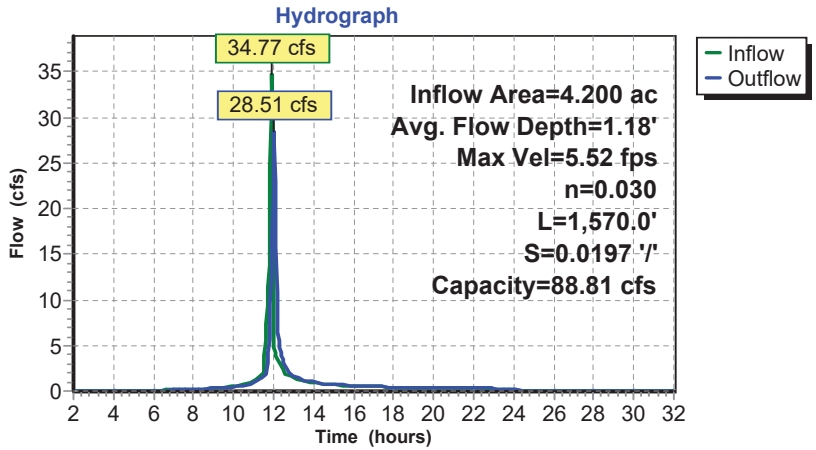
Inflow Area = 4.200 ac, 0.00% Impervious, Inflow Depth = 4.31" for 25 event
Inflow = 34.77 cfs @ 11.91 hrs, Volume= 1.510 af
Outflow = 28.51 cfs @ 12.03 hrs, Volume= 1.510 af, Atten= 18%, Lag= 7.0 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Max. Velocity= 5.52 fps, Min. Travel Time= 4.7 min
Avg. Velocity = 1.36 fps, Avg. Travel Time= 19.3 min

Peak Storage= 8,118 cf @ 11.95 hrs
Average Depth at Peak Storage= 1.18'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 88.81 cfs

2.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 1,570.0' Slope= 0.0197 '/'
Inlet Invert= 65.00', Outlet Invert= 34.00'

Reach 28-29: Channel 2.2



Summary for Pond 1P: Culvert 1

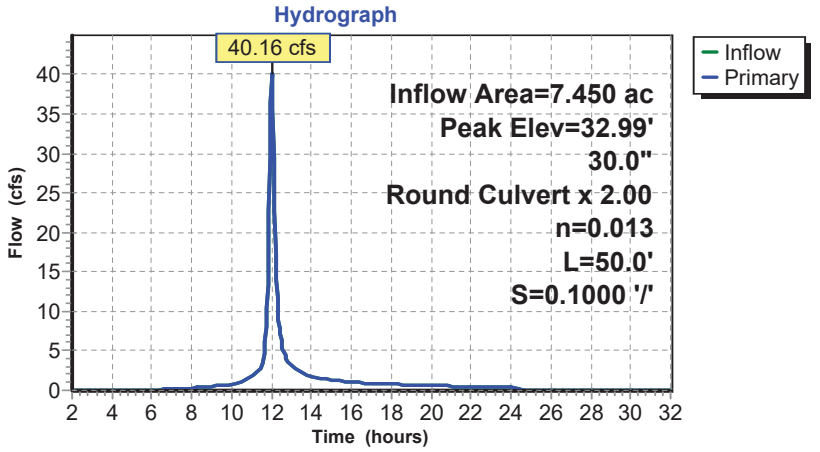
Inflow Area = 7.450 ac, 0.00% Impervious, Inflow Depth = 4.31" for 25 event
Inflow = 40.16 cfs @ 12.01 hrs, Volume= 2.679 af
Outflow = 40.16 cfs @ 12.01 hrs, Volume= 2.679 af, Atten= 0%, Lag= 0.0 min
Primary = 40.16 cfs @ 12.01 hrs, Volume= 2.679 af

Routing by Stor-Ind method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Peak Elev= 32.99' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	31.00'	**30.0" Round Culvert X 2.00** L= 50.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 31.00' / 26.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=39.69 cfs @ 12.01 hrs HW=32.97' (Free Discharge)
↑**1=Culvert** (Inlet Controls 39.69 cfs @ 4.78 fps)

Pond 1P: Culvert 1



Summary for Pond 2P: Culvert 2

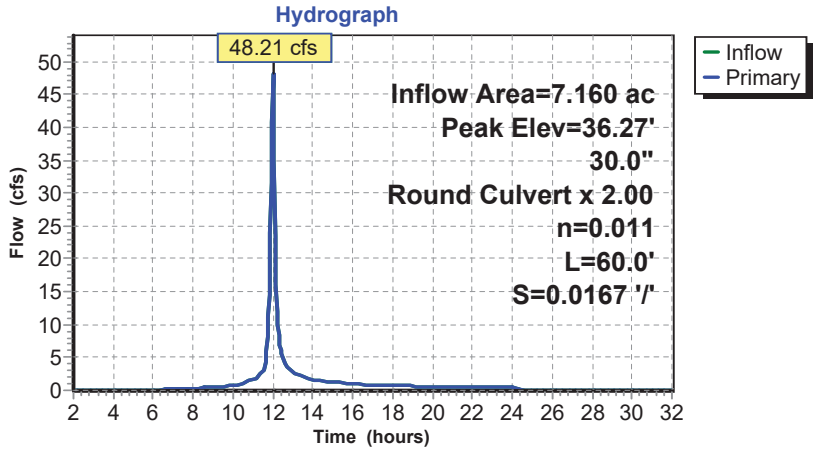
Inflow Area = 7.160 ac, 0.00% Impervious, Inflow Depth = 4.31" for 25 event
Inflow = 48.21 cfs @ 12.01 hrs, Volume= 2.574 af
Outflow = 48.21 cfs @ 12.01 hrs, Volume= 2.574 af, Atten= 0%, Lag= 0.0 min
Primary = 48.21 cfs @ 12.01 hrs, Volume= 2.574 af

Routing by Stor-Ind method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 36.27' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	34.00'	**30.0" Round Culvert X 2.00** L= 60.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 34.00' / 33.00' S= 0.0167 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 4.91 sf

Primary OutFlow Max=47.31 cfs @ 12.01 hrs HW=36.24' (Free Discharge)
1=Culvert (Inlet Controls 47.31 cfs @ 5.10 fps)

Pond 2P: Culvert 2



Summary for Pond 3P: Sump

Inflow Area = 19.010 ac, 0.00% Impervious, Inflow Depth = 4.31" for 25 event
Inflow = 142.99 cfs @ 11.95 hrs, Volume= 6.835 af
Outflow = 0.00 cfs @ 2.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

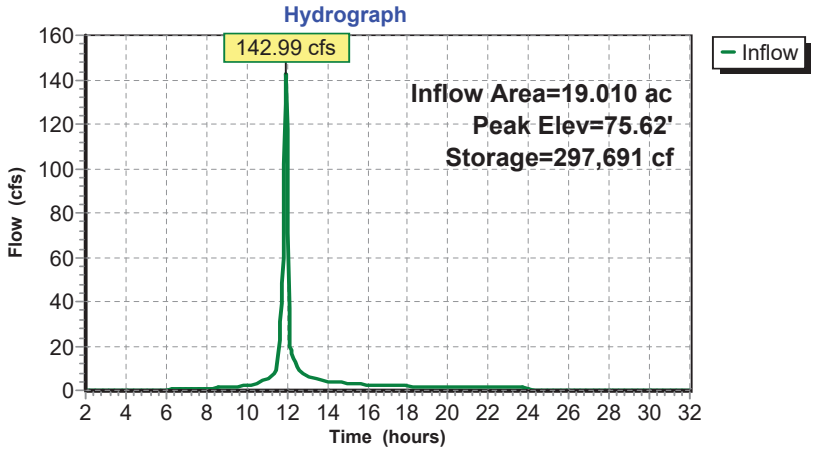
Routing by Stor-Ind method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Peak Elev= 75.62' @ 24.32 hrs Surf.Area= 204,262 sf Storage= 297,691 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	72.00'	1,097,483 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
72.00	1,770	0	0
74.00	71,896	73,666	73,666
76.00	235,066	306,962	380,628
78.00	481,789	716,855	1,097,483

Pond 3P: Sump



Summary for Pond POND Nº1:

Inflow Area = 7.450 ac, 0.00% Impervious, Inflow Depth = 4.31" for 25 event
Inflow = 40.16 cfs @ 12.01 hrs, Volume= 2.679 af
Outflow = 10.58 cfs @ 12.31 hrs, Volume= 2.402 af, Atten= 74%, Lag= 17.7 min
Primary = 10.58 cfs @ 12.31 hrs, Volume= 2.402 af

Routing by Stor-Ind method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Peak Elev= 25.79' @ 12.31 hrs Surf.Area= 0.724 ac Storage= 1.247 af

Plug-Flow detention time= 178.8 min calculated for 2.402 af (90% of inflow)
Center-of-Mass det. time= 125.4 min (932.7 - 807.3)

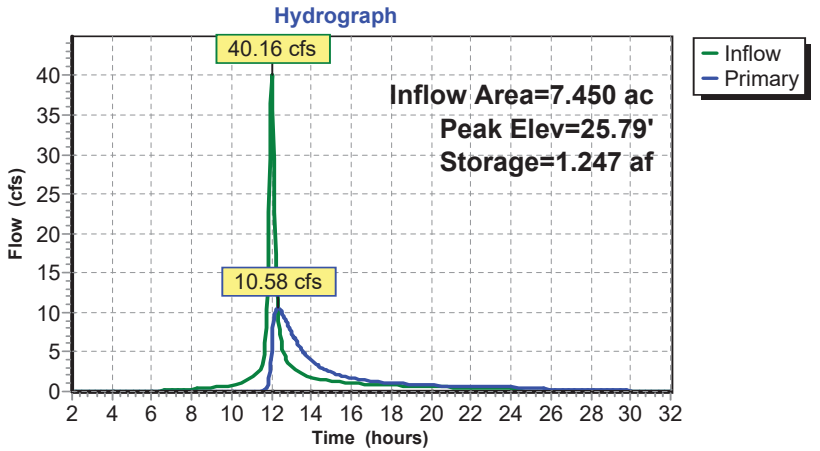
Volume	Invert	Avail.Storage	Storage Description
#1	24.00'	4.638 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
24.00	0.670	728.0	0.000	0.000	0.670
26.00	0.730	755.0	1.400	1.400	0.751
28.00	0.810	781.0	1.539	2.939	0.832
30.00	0.890	807.0	1.699	4.638	0.915

Device	Routing	Invert	Outlet Devices
#1	Primary	24.30'	**18.0" Round Culvert X 2.00** L= 97.0' Ke= 0.900 Inlet / Outlet Invert= 24.30' / 23.23' S= 0.0110 '/' Cc= 0.900 n= 0.024, Flow Area= 1.77 sf
#2	Primary	28.90'	**13.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=10.58 cfs @ 12.31 hrs HW=25.79' (Free Discharge)
└**1=Culvert** (Barrel Controls 10.58 cfs @ 3.75 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond POND Nº1:



Summary for Pond POND Nº2:

Inflow Area = 7.160 ac, 0.00% Impervious, Inflow Depth = 4.31" for 25 event
Inflow = 48.21 cfs @ 12.01 hrs, Volume= 2.574 af
Outflow = 7.65 cfs @ 12.31 hrs, Volume= 1.984 af, Atten= 84%, Lag= 18.2 min
Primary = 7.65 cfs @ 12.31 hrs, Volume= 1.984 af

Routing by Stor-Ind method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 38.43' @ 12.31 hrs Surf.Area= 0.356 ac Storage= 1.315 af

Plug-Flow detention time= 193.7 min calculated for 1.982 af (77% of inflow)
Center-of-Mass det. time= 106.8 min (911.0 - 804.3)

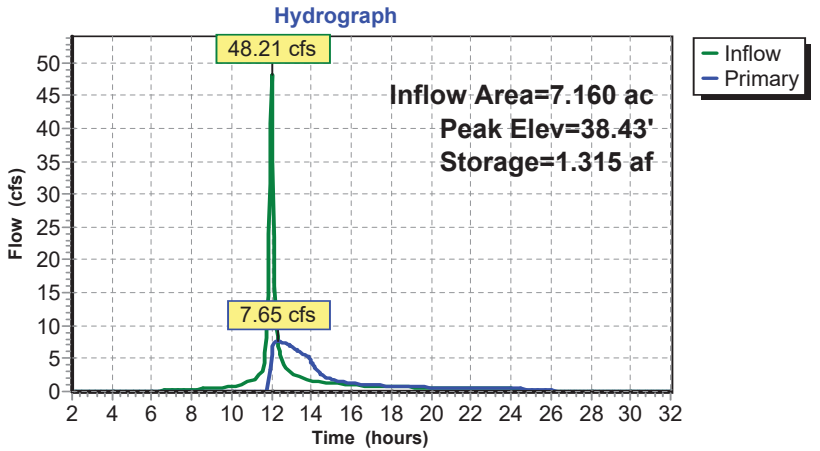
Volume	Invert	Avail.Storage	Storage Description
#1	33.00'	1.925 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
33.00	0.135	833.8	0.000	0.000	0.135
34.00	0.174	851.5	0.154	0.154	0.193
35.00	0.213	870.3	0.193	0.347	0.255
36.00	0.250	890.0	0.231	0.579	0.322
38.00	0.340	924.0	0.588	1.166	0.442
40.00	0.420	958.0	0.759	1.925	0.566

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	**12.0" Round Culvert X 2.00** L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 36.00' / 35.10' S= 0.0200 '/' Cc= 0.900 n= 0.024, Flow Area= 0.79 sf
#2	Primary	39.60'	**12.0' long x 6.0' 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 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=7.65 cfs @ 12.31 hrs HW=38.43' (Free Discharge)
└**1=Culvert** (Barrel Controls 7.65 cfs @ 4.87 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond POND Nº2:



Time span=2.00-32.00 hrs, dt=0.04 hrs, 751 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA 3 Runoff Area=19.010 ac 0.00% Impervious Runoff Depth=5.65"
Flow Length=200' Slope=0.0200 '/' Tc=4.8 min CN=86 Runoff=184.13 cfs 8.958 af

Subcatchment 110: DA 1.1 Runoff Area=4.830 ac 0.00% Impervious Runoff Depth=5.65"
Flow Length=125' Slope=0.3333 '/' Tc=1.3 min CN=86 Runoff=51.41 cfs 2.276 af

Subcatchment 120: DA 1.2 Runoff Area=2.620 ac 0.00% Impervious Runoff Depth=5.65"
Flow Length=125' Slope=0.3333 '/' Tc=1.3 min CN=86 Runoff=27.89 cfs 1.235 af

Subcatchment 131: DA 2.2 Runoff Area=4.200 ac 0.00% Impervious Runoff Depth=5.65"
Flow Length=125' Slope=0.3333 '/' Tc=1.3 min CN=86 Runoff=44.70 cfs 1.979 af

Subcatchment 134: DA 2.1 Runoff Area=2.960 ac 0.00% Impervious Runoff Depth=5.65"
Flow Length=125' Slope=0.3333 '/' Tc=1.3 min CN=86 Runoff=31.50 cfs 1.395 af

Reach 11-19: Channel 1.1 Avg. Flow Depth=1.58' Max Vel=4.79 fps Inflow=51.41 cfs 2.276 af
n=0.030 L=1,860.0' S=0.0108 '/' Capacity=65.54 cfs Outflow=38.27 cfs 2.276 af

Reach 18-19: Channel 1.2 Avg. Flow Depth=0.88' Max Vel=7.77 fps Inflow=27.89 cfs 1.235 af
n=0.025 L=913.0' S=0.0372 '/' Capacity=146.36 cfs Outflow=25.35 cfs 1.235 af

Reach 27-29: Channel 2.1 Avg. Flow Depth=1.22' Max Vel=5.09 fps Inflow=31.50 cfs 1.395 af
n=0.030 L=976.0' S=0.0164 '/' Capacity=80.92 cfs Outflow=27.11 cfs 1.395 af

Reach 28-29: Channel 2.2 Avg. Flow Depth=1.35' Max Vel=5.91 fps Inflow=44.70 cfs 1.979 af
n=0.030 L=1,570.0' S=0.0197 '/' Capacity=88.81 cfs Outflow=36.55 cfs 1.979 af

Pond 1P: Culvert 1 Peak Elev=33.53' Inflow=53.54 cfs 3.511 af
30.0" Round Culvert x 2.00 n=0.013 L=50.0' S=0.1000 '/' Outflow=53.54 cfs 3.511 af

Pond 2P: Culvert 2 Peak Elev=37.01' Inflow=62.81 cfs 3.374 af
30.0" Round Culvert x 2.00 n=0.011 L=60.0' S=0.0167 '/' Outflow=62.81 cfs 3.374 af

Pond 3P: Sump Peak Elev=76.04' Storage=390,152 cf Inflow=184.13 cfs 8.958 af
Outflow=0.00 cfs 0.000 af

Pond POND Nº1: Peak Elev=26.30' Storage=1.619 af Inflow=53.54 cfs 3.511 af
Outflow=13.13 cfs 3.231 af

Pond POND Nº2: Peak Elev=39.57' Storage=1.747 af Inflow=62.81 cfs 3.374 af
Outflow=9.34 cfs 2.783 af

Total Runoff Area = 33.620 ac Runoff Volume = 15.842 af Average Runoff Depth = 5.65"
100.00% Pervious = 33.620 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: DA 3

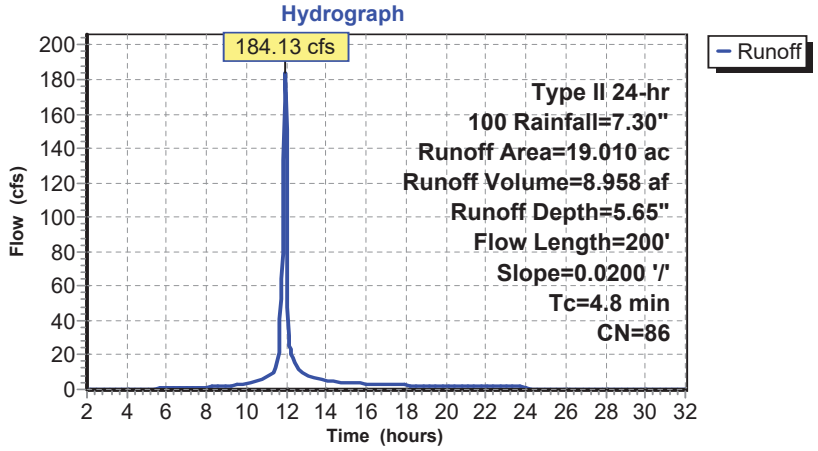
Runoff = 184.13 cfs @ 11.95 hrs, Volume= 8.958 af, Depth= 5.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Type II 24-hr 100 Rainfall=7.30"

	Area (ac)	CN	Description
*	19.010	86	
	19.010		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	100	0.0200	0.41		**Sheet Flow,** Fallow n= 0.050 P2= 3.20"
0.7	100	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.8	200	Total			

Subcatchment 1S: DA 3



Summary for Subcatchment 110: DA 1.1

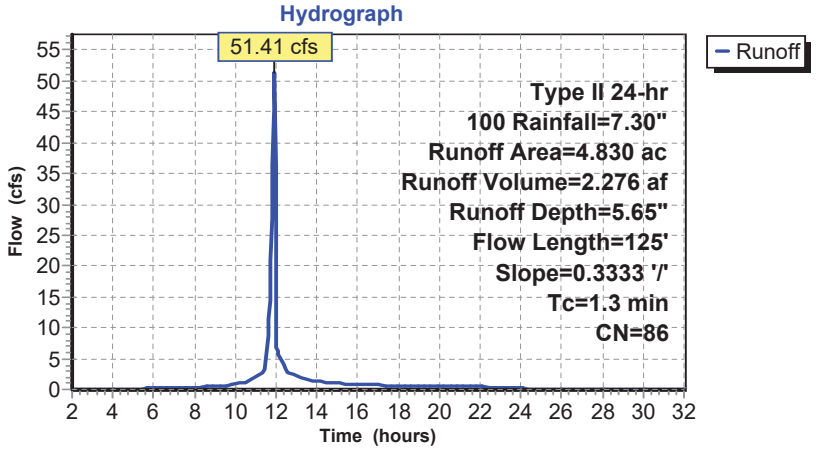
Runoff = 51.41 cfs @ 11.91 hrs, Volume= 2.276 af, Depth= 5.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Type II 24-hr 100 Rainfall=7.30"

	Area (ac)	CN	Description
*	4.830	86	
	4.830		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.3333	1.26		**Sheet Flow,** Fallow n= 0.050 P2= 3.20"
0.0	25	0.3333	9.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.3	125	Total			

Subcatchment 110: DA 1.1



Summary for Subcatchment 120: DA 1.2

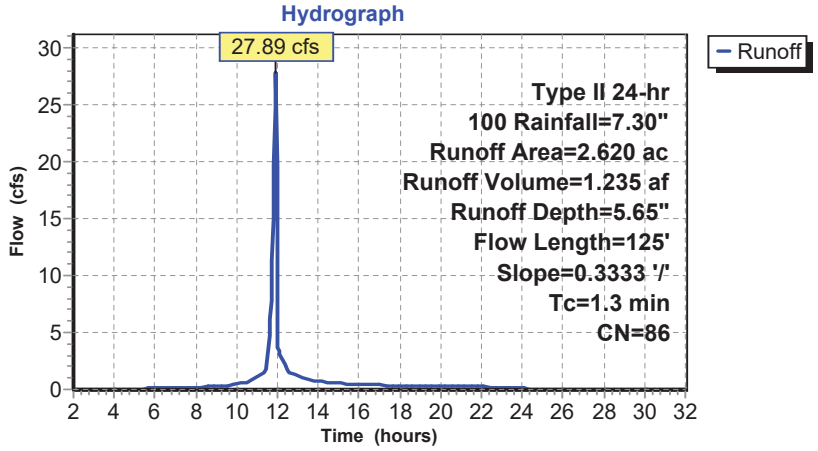
Runoff = 27.89 cfs @ 11.91 hrs, Volume= 1.235 af, Depth= 5.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Type II 24-hr 100 Rainfall=7.30"

	Area (ac)	CN	Description
*	2.620	86	
	2.620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.3333	1.26		**Sheet Flow,** Fallow n= 0.050 P2= 3.20"
0.0	25	0.3333	9.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.3	125	Total			

Subcatchment 120: DA 1.2



Summary for Subcatchment 131: DA 2.2

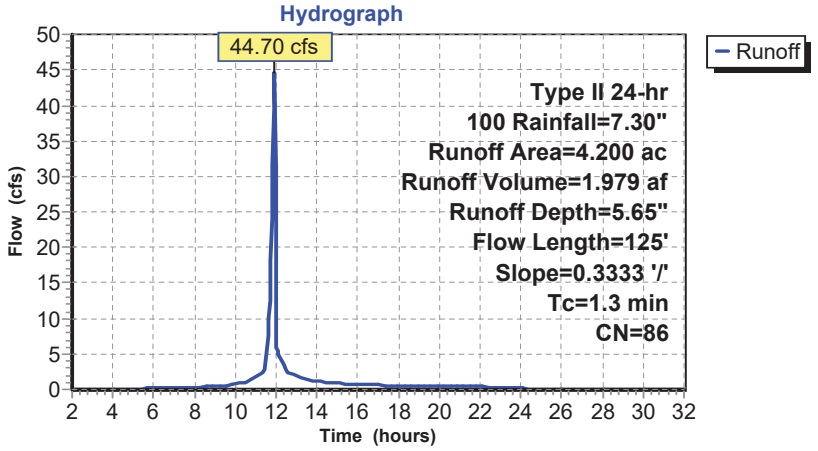
Runoff = 44.70 cfs @ 11.91 hrs, Volume= 1.979 af, Depth= 5.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Type II 24-hr 100 Rainfall=7.30"

	Area (ac)	CN	Description
*	4.200	86	
	4.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.3333	1.26		**Sheet Flow,** Fallow n= 0.050 P2= 3.20"
0.0	25	0.3333	9.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.3	125	Total			

Subcatchment 131: DA 2.2



Summary for Subcatchment 134: DA 2.1

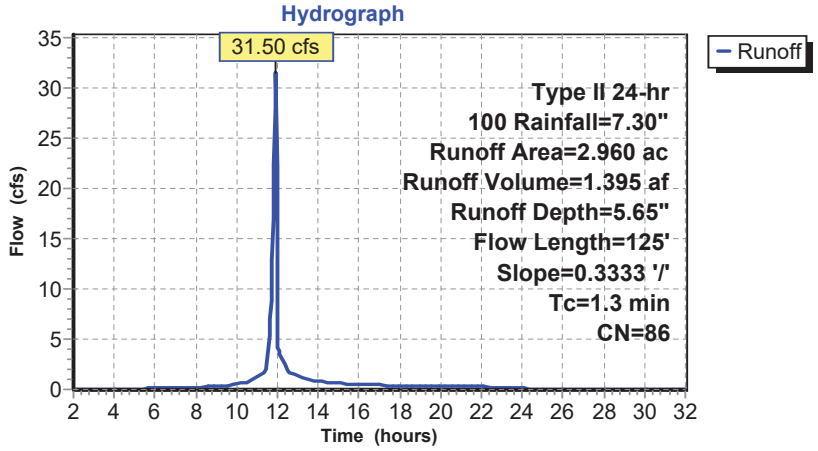
Runoff = 31.50 cfs @ 11.91 hrs, Volume= 1.395 af, Depth= 5.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Type II 24-hr 100 Rainfall=7.30"

	Area (ac)	CN	Description
*	2.960	86	
	2.960		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.3333	1.26		**Sheet Flow,** Fallow n= 0.050 P2= 3.20"
0.0	25	0.3333	9.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.3	125	Total			

Subcatchment 134: DA 2.1



Summary for Reach 11-19: Channel 1.1

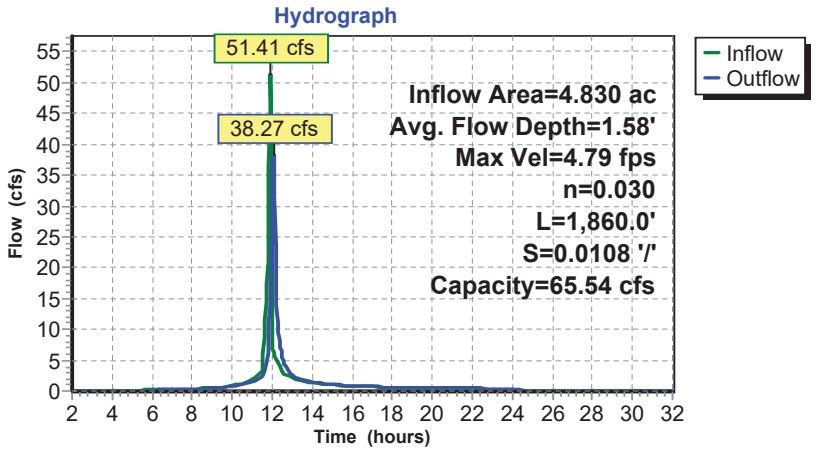
Inflow Area = 4.830 ac, 0.00% Impervious, Inflow Depth = 5.65" for 100 event
Inflow = 51.41 cfs @ 11.91 hrs, Volume= 2.276 af
Outflow = 38.27 cfs @ 12.06 hrs, Volume= 2.276 af, Atten= 26%, Lag= 9.1 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Max. Velocity= 4.79 fps, Min. Travel Time= 6.5 min
Avg. Velocity = 1.18 fps, Avg. Travel Time= 26.2 min

Peak Storage= 15,236 cf @ 11.95 hrs
Average Depth at Peak Storage= 1.58'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 65.54 cfs

2.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 1,860.0' Slope= 0.0108 '/'
Inlet Invert= 51.00', Outlet Invert= 31.00'

Reach 11-19: Channel 1.1



Summary for Reach 18-19: Channel 1.2

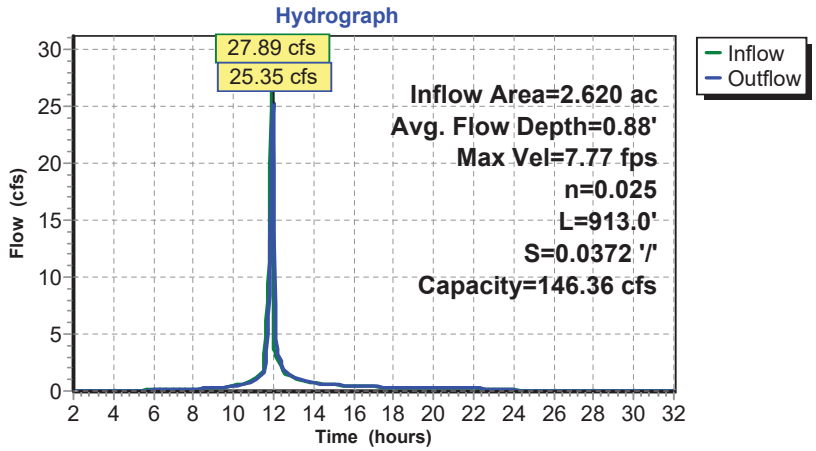
Inflow Area = 2.620 ac, 0.00% Impervious, Inflow Depth = 5.65" for 100 event
Inflow = 27.89 cfs @ 11.91 hrs, Volume= 1.235 af
Outflow = 25.35 cfs @ 11.96 hrs, Volume= 1.235 af, Atten= 9%, Lag= 3.0 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Max. Velocity= 7.77 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 1.96 fps, Avg. Travel Time= 7.8 min

Peak Storage= 3,030 cf @ 11.93 hrs
Average Depth at Peak Storage= 0.88'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 146.36 cfs

2.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 913.0' Slope= 0.0372 '/'
Inlet Invert= 65.00', Outlet Invert= 31.00'

Reach 18-19: Channel 1.2



Summary for Reach 27-29: Channel 2.1

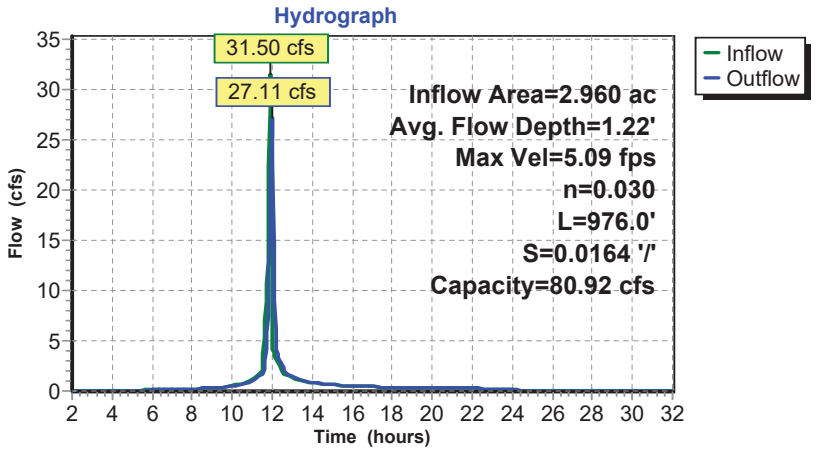
Inflow Area = 2.960 ac, 0.00% Impervious, Inflow Depth = 5.65" for 100 event
Inflow = 31.50 cfs @ 11.91 hrs, Volume= 1.395 af
Outflow = 27.11 cfs @ 11.99 hrs, Volume= 1.395 af, Atten= 14%, Lag= 4.7 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Max. Velocity= 5.09 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 1.30 fps, Avg. Travel Time= 12.5 min

Peak Storage= 5,264 cf @ 11.94 hrs
Average Depth at Peak Storage= 1.22'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 80.92 cfs

2.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 976.0' Slope= 0.0164 '/'
Inlet Invert= 50.00', Outlet Invert= 34.00'

Reach 27-29: Channel 2.1



Summary for Reach 28-29: Channel 2.2

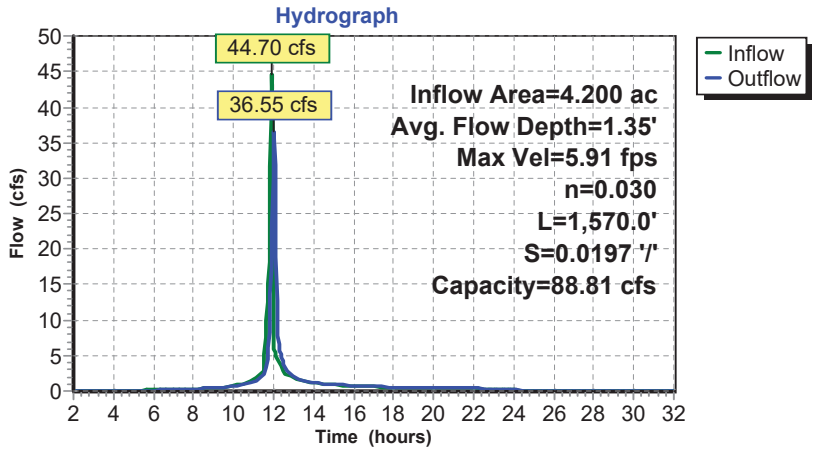
Inflow Area = 4.200 ac, 0.00% Impervious, Inflow Depth = 5.65" for 100 event
Inflow = 44.70 cfs @ 11.91 hrs, Volume= 1.979 af
Outflow = 36.55 cfs @ 12.02 hrs, Volume= 1.979 af, Atten= 18%, Lag= 6.5 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Max. Velocity= 5.91 fps, Min. Travel Time= 4.4 min
Avg. Velocity = 1.47 fps, Avg. Travel Time= 17.8 min

Peak Storage= 9,898 cf @ 11.95 hrs
Average Depth at Peak Storage= 1.35'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 88.81 cfs

2.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 1,570.0' Slope= 0.0197 '/'
Inlet Invert= 65.00', Outlet Invert= 34.00'

Reach 28-29: Channel 2.2



Summary for Pond 1P: Culvert 1

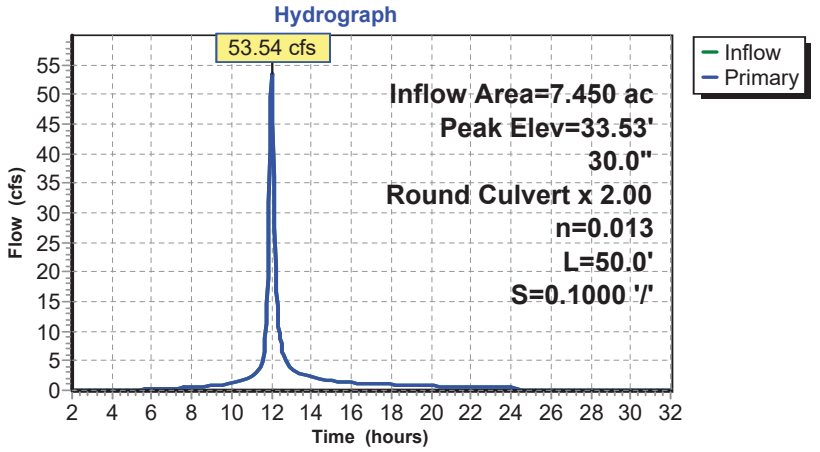
Inflow Area = 7.450 ac, 0.00% Impervious, Inflow Depth = 5.65" for 100 event
Inflow = 53.54 cfs @ 12.01 hrs, Volume= 3.511 af
Outflow = 53.54 cfs @ 12.01 hrs, Volume= 3.511 af, Atten= 0%, Lag= 0.0 min
Primary = 53.54 cfs @ 12.01 hrs, Volume= 3.511 af

Routing by Stor-Ind method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Peak Elev= 33.53' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	31.00'	**30.0" Round Culvert X 2.00** L= 50.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 31.00' / 26.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=53.09 cfs @ 12.01 hrs HW=33.51' (Free Discharge)
1=Culvert (Inlet Controls 53.09 cfs @ 5.41 fps)

Pond 1P: Culvert 1



Summary for Pond 2P: Culvert 2

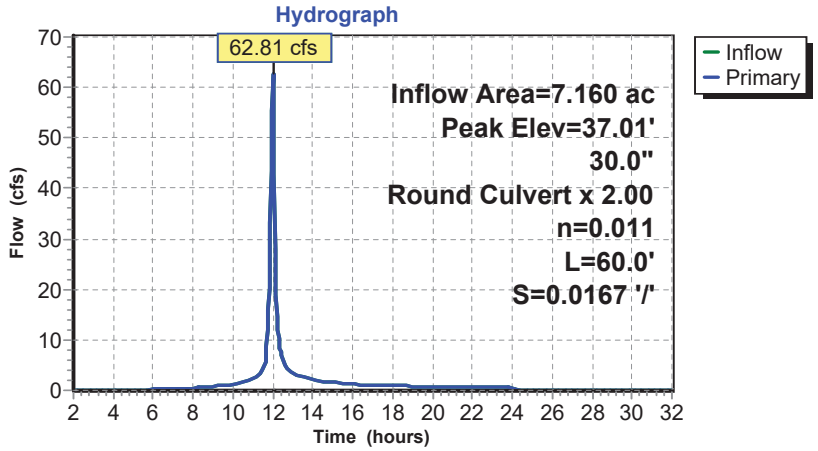
Inflow Area = 7.160 ac, 0.00% Impervious, Inflow Depth = 5.65" for 100 event
Inflow = 62.81 cfs @ 12.00 hrs, Volume= 3.374 af
Outflow = 62.81 cfs @ 12.00 hrs, Volume= 3.374 af, Atten= 0%, Lag= 0.0 min
Primary = 62.81 cfs @ 12.00 hrs, Volume= 3.374 af

Routing by Stor-Ind method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 37.01' @ 12.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	34.00'	**30.0" Round Culvert X 2.00** L= 60.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 34.00' / 33.00' S= 0.0167 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 4.91 sf

Primary OutFlow Max=62.28 cfs @ 12.00 hrs HW=36.99' (Free Discharge)
1=Culvert (Inlet Controls 62.28 cfs @ 6.34 fps)

Pond 2P: Culvert 2



Summary for Pond 3P: Sump

Inflow Area = 19.010 ac, 0.00% Impervious, Inflow Depth = 5.65" for 100 event
Inflow = 184.13 cfs @ 11.95 hrs, Volume= 8.958 af
Outflow = 0.00 cfs @ 2.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

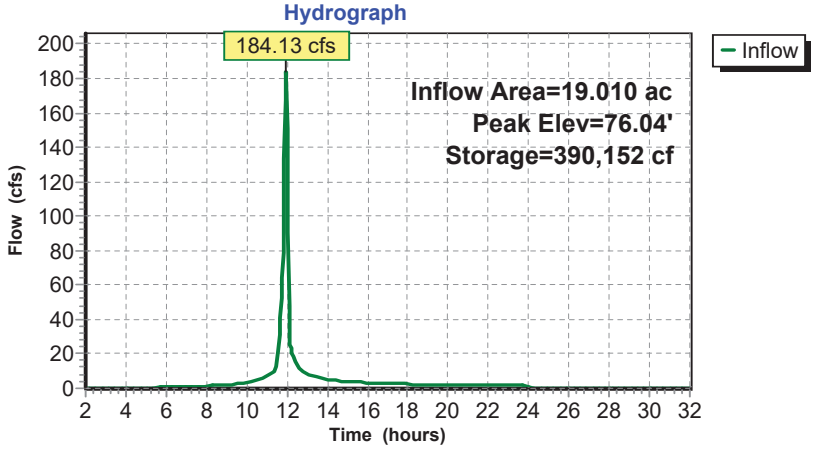
Routing by Stor-Ind method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Peak Elev= 76.04' @ 24.32 hrs Surf.Area= 240,012 sf Storage= 390,152 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	72.00'	1,097,483 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
72.00	1,770	0	0
74.00	71,896	73,666	73,666
76.00	235,066	306,962	380,628
78.00	481,789	716,855	1,097,483

Pond 3P: Sump



Summary for Pond POND Nº1:

Inflow Area = 7.450 ac, 0.00% Impervious, Inflow Depth = 5.65" for 100 event
Inflow = 53.54 cfs @ 12.01 hrs, Volume= 3.511 af
Outflow = 13.13 cfs @ 12.52 hrs, Volume= 3.231 af, Atten= 75%, Lag= 30.8 min
Primary = 13.13 cfs @ 12.52 hrs, Volume= 3.231 af

Routing by Stor-Ind method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs
Peak Elev= 26.30' @ 12.30 hrs Surf.Area= 0.742 ac Storage= 1.619 af

Plug-Flow detention time= 159.8 min calculated for 3.231 af (92% of inflow)
Center-of-Mass det. time= 116.2 min (914.8 - 798.6)

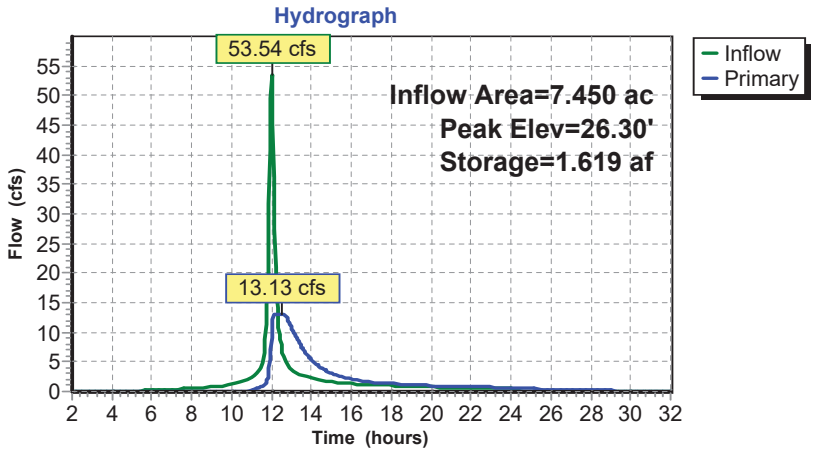
Volume	Invert	Avail.Storage	Storage Description
#1	24.00'	4.638 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
24.00	0.670	728.0	0.000	0.000	0.670
26.00	0.730	755.0	1.400	1.400	0.751
28.00	0.810	781.0	1.539	2.939	0.832
30.00	0.890	807.0	1.699	4.638	0.915

Device	Routing	Invert	Outlet Devices
#1	Primary	24.30'	**18.0" Round Culvert X 2.00** L= 97.0' Ke= 0.900 Inlet / Outlet Invert= 24.30' / 23.23' S= 0.0110 '/' Cc= 0.900 n= 0.024, Flow Area= 1.77 sf
#2	Primary	28.90'	**13.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=13.14 cfs @ 12.52 hrs HW=26.21' (Free Discharge)
└**1=Culvert** (Barrel Controls 13.14 cfs @ 3.77 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond POND Nº1:



Summary for Pond POND Nº2:

Inflow Area = 7.160 ac, 0.00% Impervious, Inflow Depth = 5.65" for 100 event
Inflow = 62.81 cfs @ 12.00 hrs, Volume= 3.374 af
Outflow = 9.34 cfs @ 12.31 hrs, Volume= 2.783 af, Atten= 85%, Lag= 18.7 min
Primary = 9.34 cfs @ 12.31 hrs, Volume= 2.783 af

Routing by Stor-Ind method, Time Span= 2.00-32.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 39.57' @ 12.31 hrs Surf.Area= 0.402 ac Storage= 1.747 af

Plug-Flow detention time= 181.8 min calculated for 2.779 af (82% of inflow)
Center-of-Mass det. time= 107.3 min (903.0 - 795.8)

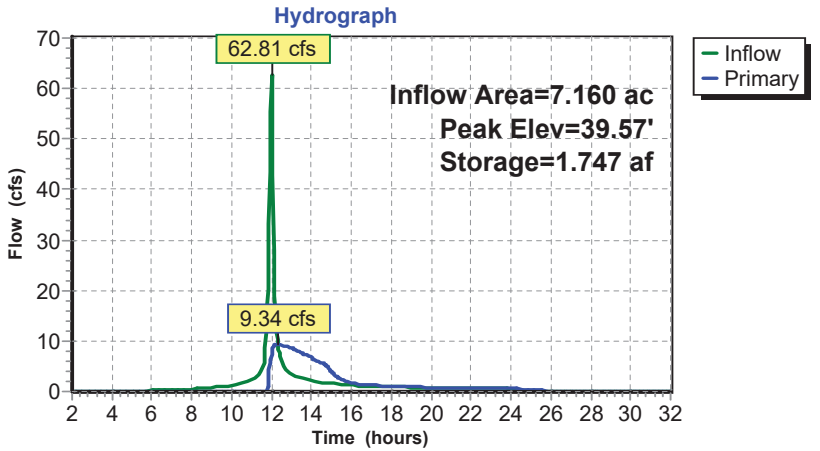
Volume	Invert	Avail.Storage	Storage Description
#1	33.00'	1.925 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
33.00	0.135	833.8	0.000	0.000	0.135
34.00	0.174	851.5	0.154	0.154	0.193
35.00	0.213	870.3	0.193	0.347	0.255
36.00	0.250	890.0	0.231	0.579	0.322
38.00	0.340	924.0	0.588	1.166	0.442
40.00	0.420	958.0	0.759	1.925	0.566

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	**12.0" Round Culvert X 2.00** L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 36.00' / 35.10' S= 0.0200 '/' Cc= 0.900 n= 0.024, Flow Area= 0.79 sf
#2	Primary	39.60'	**12.0' long x 6.0' 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 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=9.34 cfs @ 12.31 hrs HW=39.57' (Free Discharge)
└**1=Culvert** (Barrel Controls 9.34 cfs @ 5.95 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

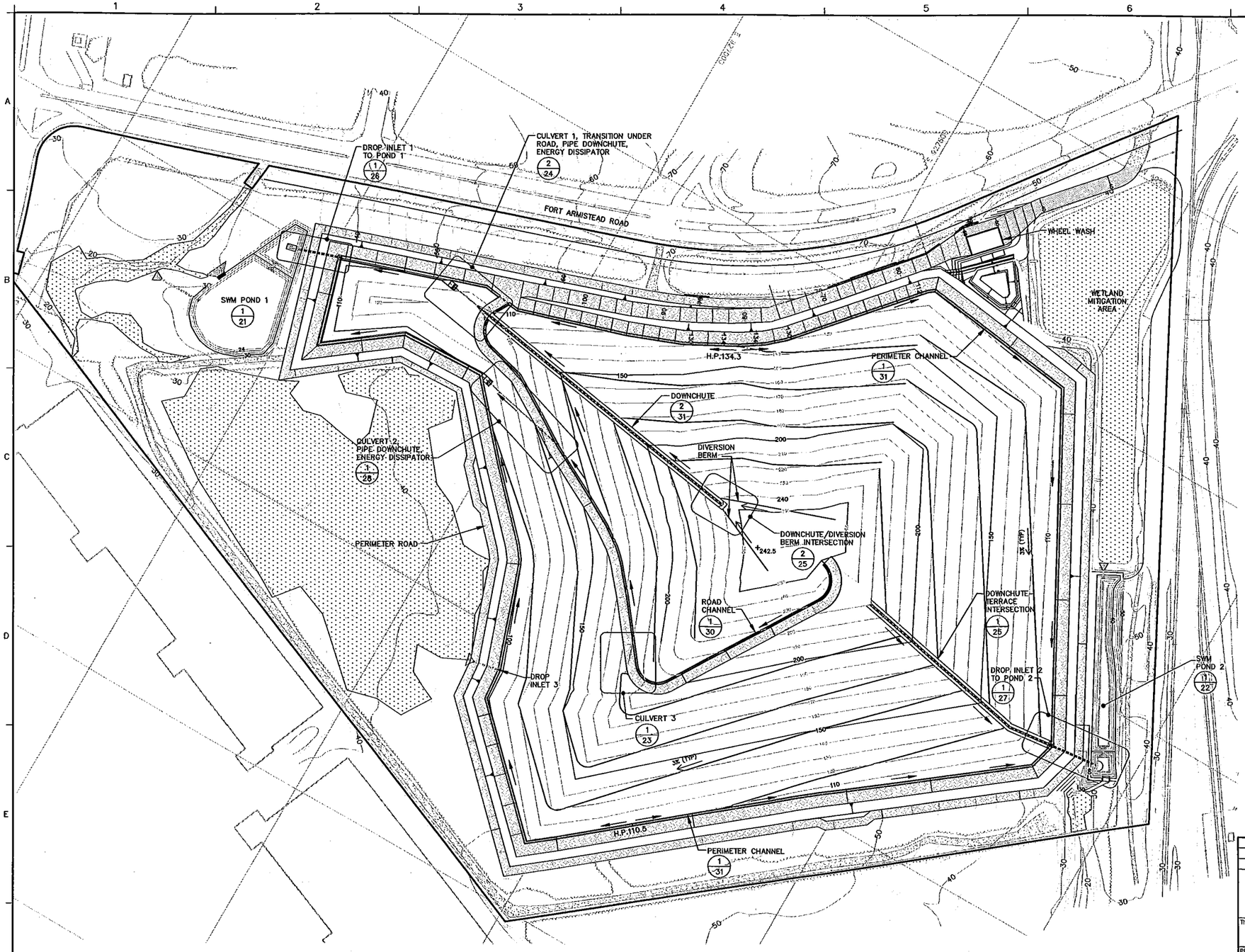
Pond POND Nº2:



APPENDIX C.1

FINAL DEVELOPMENT STAGE DRAWINGS

Application for an Industrial Landfill Permit: Phase III Permit Drawings, Fort Armistead Road – Lot 15 Landfill (Drawings 20-31)



NORTH

LEGEND

- EXISTING BUILDING
- EXISTING ROAD
- EXISTING TREE LINE
- 100 — EXISTING GRAOE CONTOUR (FEET, MSL)
- 50 — PROPOSED FINAL GRADE CONTOUR (FEET, MSL)
- CHAIN LINK FENCE
- CSX TRACK
- EXISTING CULVERT
- LIMIT OF WETLAND MITIGATION AREA
- EXISTING WETLANDS
- TERRACE (3% SLOPE TYPICAL)

NOTES:

1. SEE DRAWING 2 FOR GENERAL NOTES.
2. IMPACTS TO THE EXISTING WETLAND WILL BE MINIMIZED (LESS THAN 5,000 SF).
3. A 65-FT HEIGHT (MAXIMUM) MECHANICALLY STABILIZED EARTH (MSE) BERM WILL BE BUILT AROUND THE PROPOSED FACILITY. MSE BERM WILL BE CONSTRUCTED AFTER AIRSPACE HAS BEEN FILLED TO REACH THE PROPOSED INTERMEDIATE GRADE (DRAWING 6).

100 50 0 100 200
SCALE: 1" = 100'

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10220 OLD COLUMBIA ROAD, SUITE A
COLUMBIA, MARYLAND 21046 USA
PHONE: 410.381.4333

CONSTELLATION POWER SOURCE GENERATION, INC.
1005 BRANDON SHORES ROAD
BALTIMORE, MD 21226 USA

TITLE: STORMWATER MANAGEMENT PLAN

PROJECT: PERMIT DRAWINGS

SITE: LOT 15 LANDFILL – BALTIMORE, MARYLAND

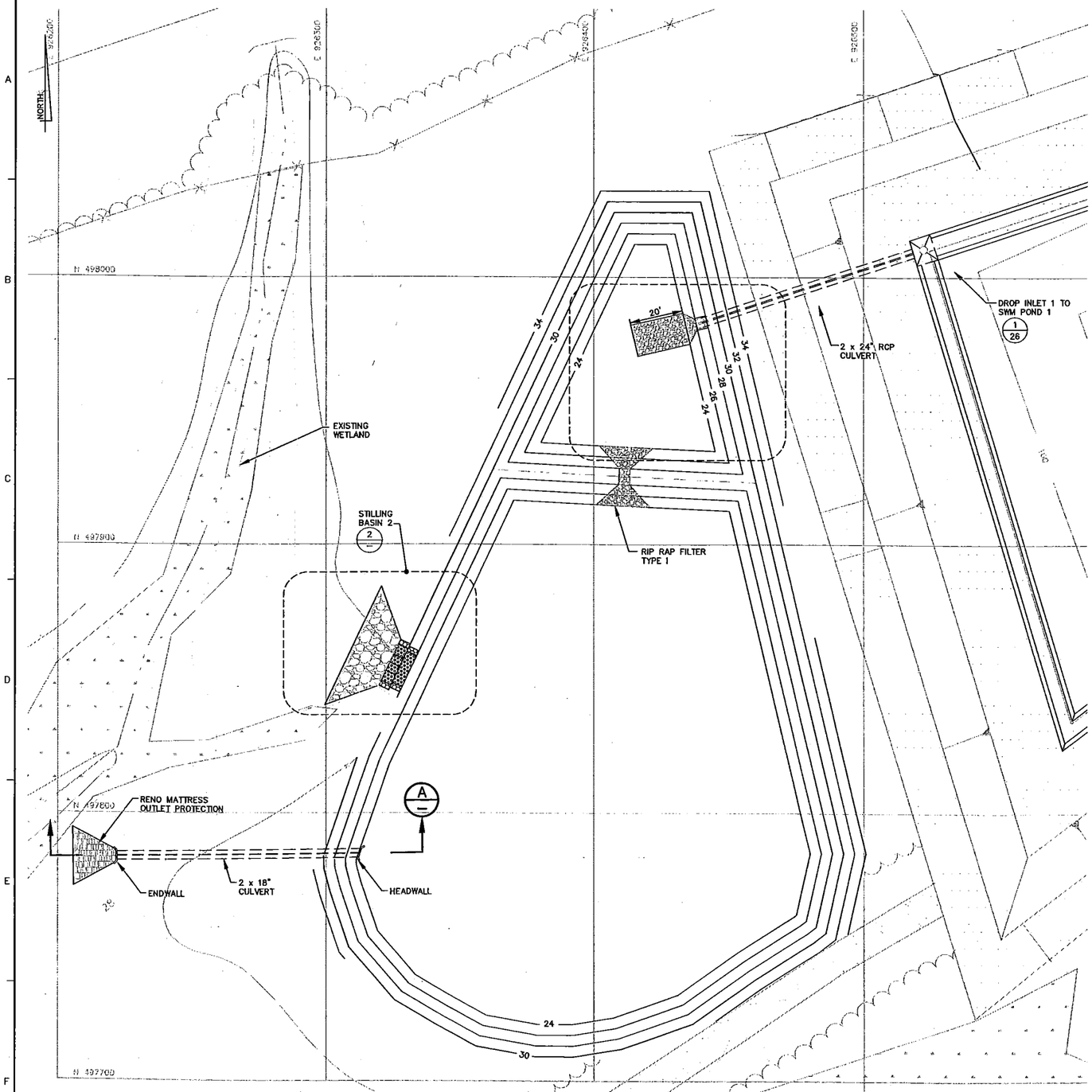
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

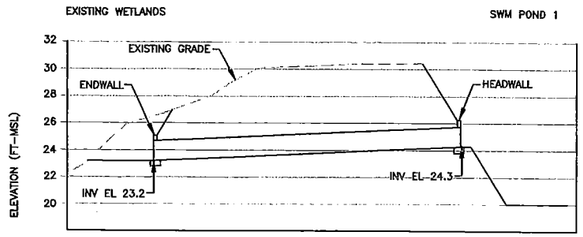
DATE

DESIGNED BY:	RDE	DATE:	MARCH 2012
DRAWN BY:	JOC	PROJECT NO.:	ME0668
CHECKED BY:	RDE	FILE:	0668P120
REVIEWED BY:		DRAWING NO.:	
APPROVED BY:		20 OF 42	

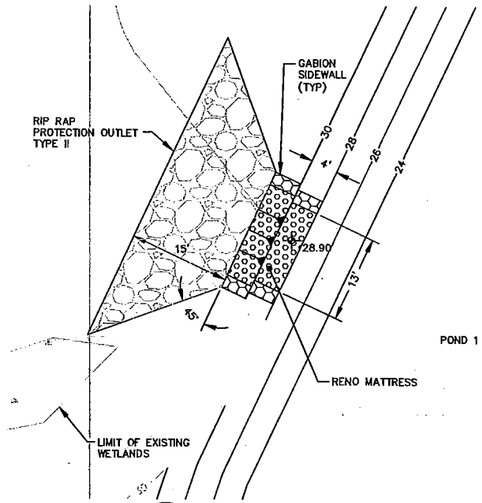
PERMIT DRAWINGS



1/20 PLAN
SWM POND 1
SCALE : 1" = 20'



A/— SECTION
POND 1 CULVERT OUTLET
HORIZONTAL SCALE : 1" = 20'
VERTICAL SCALE 1" = 20'



2/— DETAIL
STILLING BASIN 2
SCALE : 1" = 10'

LEGEND

- EXISTING ROAD
- EXISTING TREE LINE
- 100 — EXISTING GRADE CONTOUR (FEET, MSL)
- 50 — PROPOSED FINAL GRADE CONTOUR (FEET, MSL)
- EXISTING WETLANDS

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10220 OLD COLUMBIA ROAD, SUITE A
COLUMBIA, MARYLAND 21046 USA
PHONE: 410.381.4333

CONSTELLATION POWER SOURCE GENERATION, INC.
1005 BRANDON SHORES ROAD
BALTIMORE, MD 21226 USA

TITLE: STORMWATER MANAGEMENT DETAILS I

PROJECT: PERMIT DRAWINGS

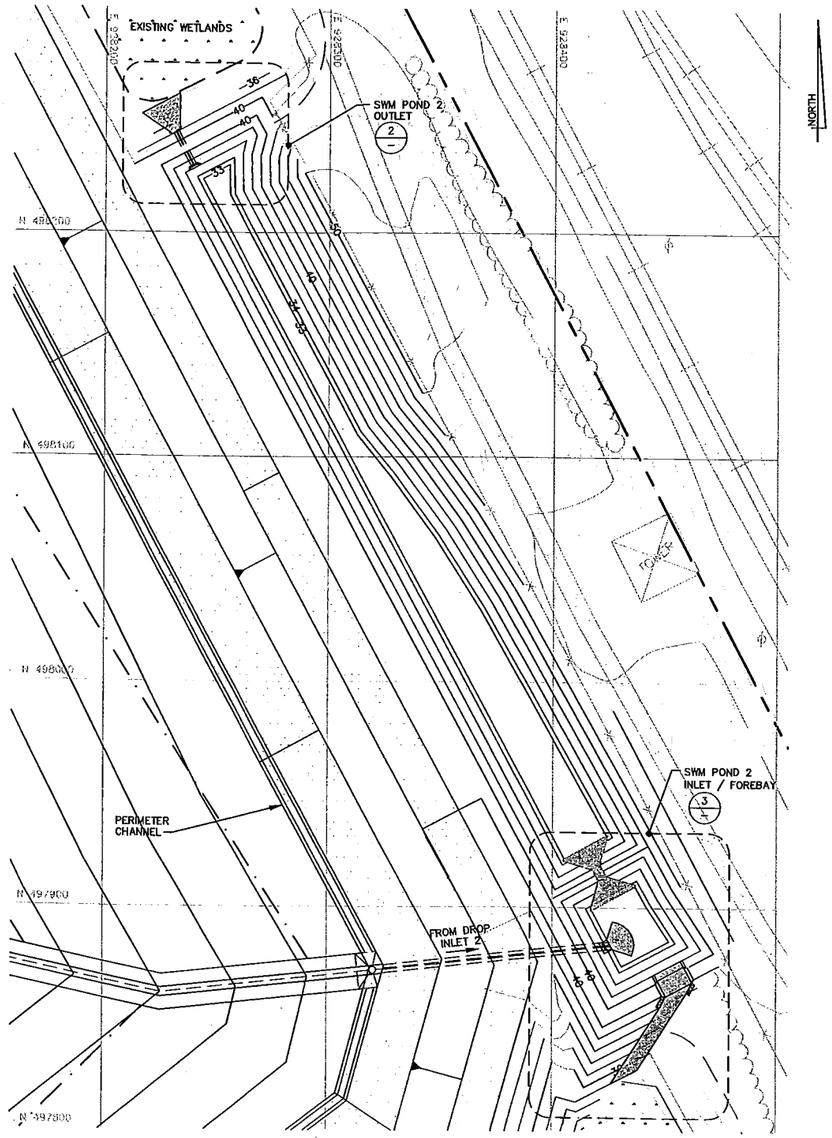
SITE: LOT 15 LANDFILL – BALTIMORE, MARYLAND

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

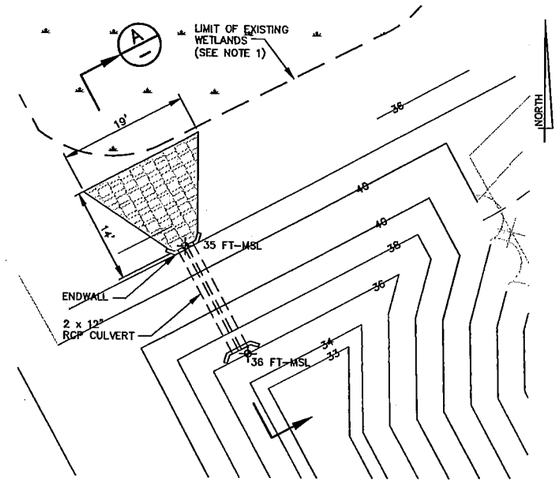
SIGNATURE

DATE

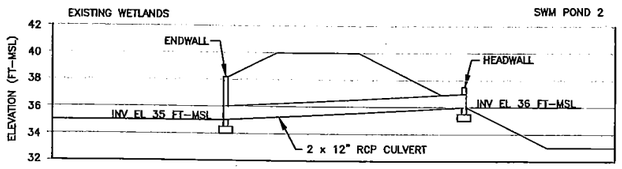
DESIGNED BY:	RDE	DATE:	MARCH 2012
DRAWN BY:	JOC	PROJECT NO.:	ME0688
CHECKED BY:	RDE	FILE:	0668p121
REVIEWED BY:		DRAWING NO.:	21 OF 42
APPROVED BY:			



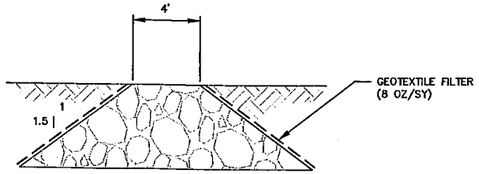
1/20 PLAN
SWM POND 2
SCALE : 1" = 30'



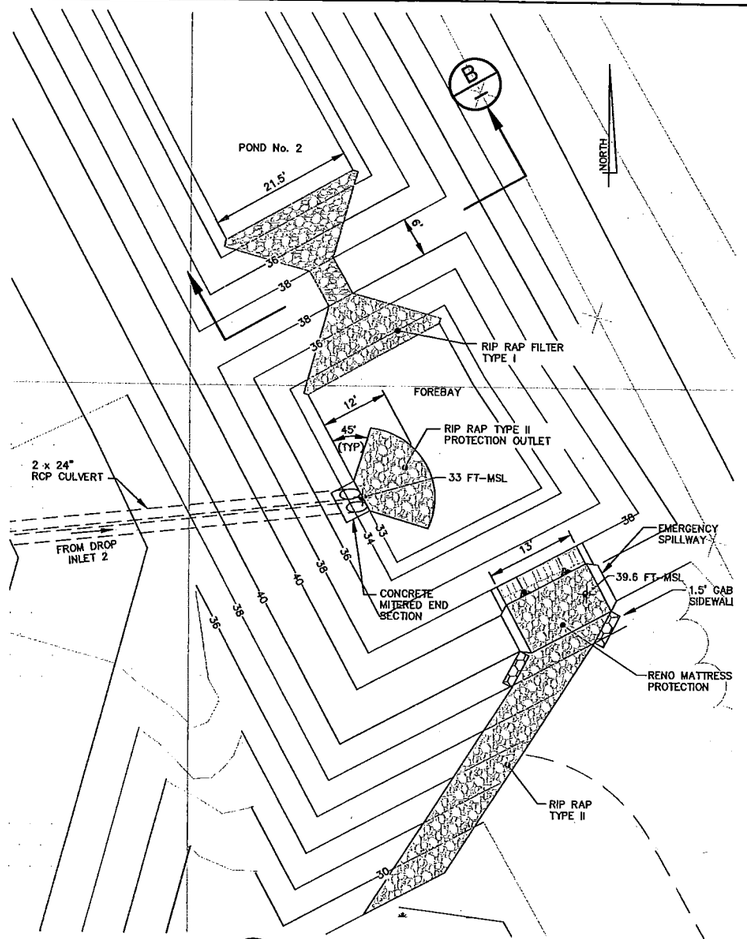
2/— DETAIL
SWM POND 2 OUTLET
SCALE : 1" = 10'



A/— SECTION
SWM POND 2 CULVERT OUTLET
HORIZONTAL SCALE : 1" = 5'
VERTICAL SCALE: 1" = 5'



B/— SECTION
FOREBAY
SCALE : 1" = 4'



3/— DETAIL
SWM POND 2 INLET / FOREBAY
SCALE : 1" = 10'

LEGEND

- EXISTING ROAD
- EXISTING TREE LINE
- 100 — EXISTING GRADE CONTOUR (FEET, MSL)
- 50 — PROPOSED FINAL GRADE CONTOUR (FEET, MSL)
- TERRACE
- EXISTING WETLANDS

NOTES:

1. CONTRACTOR SHALL VERIFY LIMITS OF EXISTING WETLANDS PRIOR TO BEGINNING CONSTRUCTION OF POND 2.

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10220 OLD COLUMBIA ROAD, SUITE A
COLUMBIA, MARYLAND 21046 USA
PHONE: 410.381.4333

CONSTELLATION POWER SOURCE GENERATION, INC.
1005 BRANDON SHORES ROAD
BALTIMORE, MD 21226 USA

TITLE: STORMWATER MANAGEMENT DETAILS II

PROJECT: PERMIT DRAWINGS

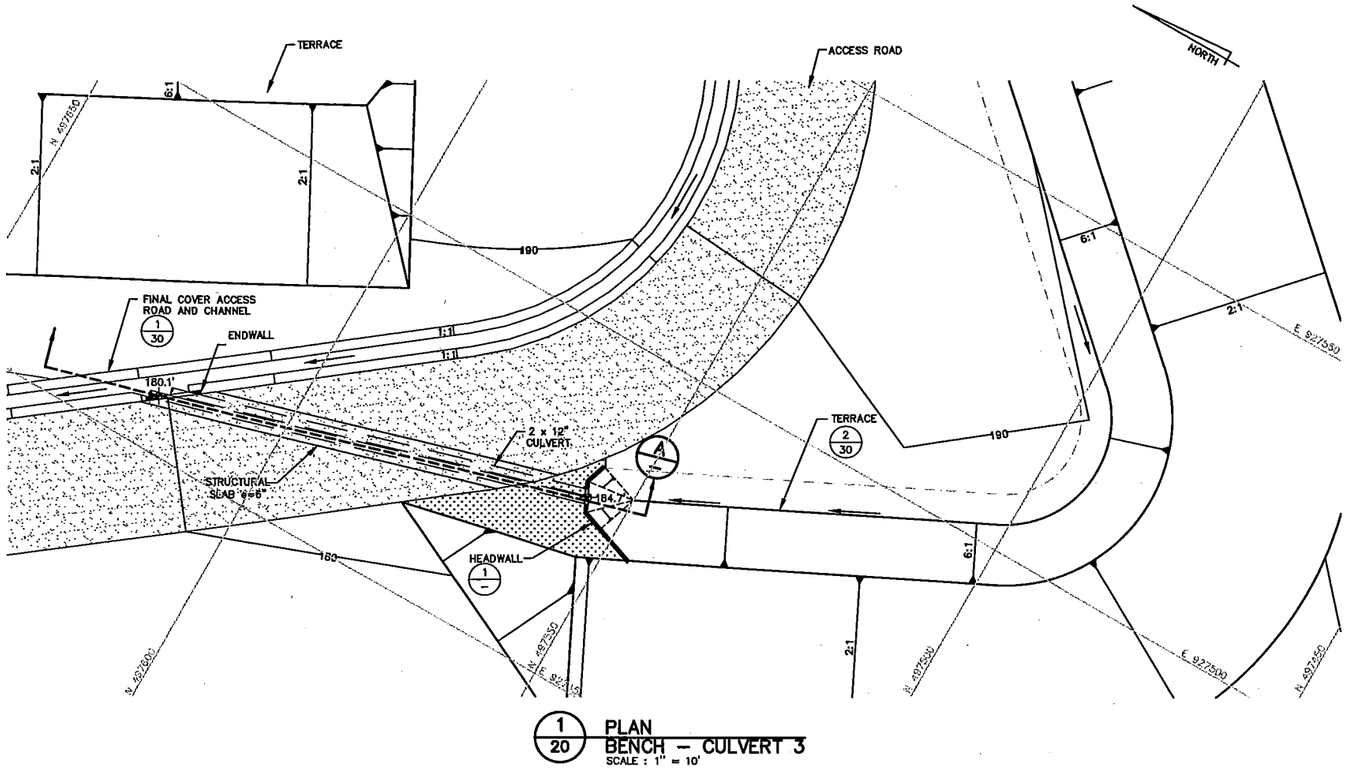
SITE: LOT 15 LANDFILL – BALTIMORE, MARYLAND

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

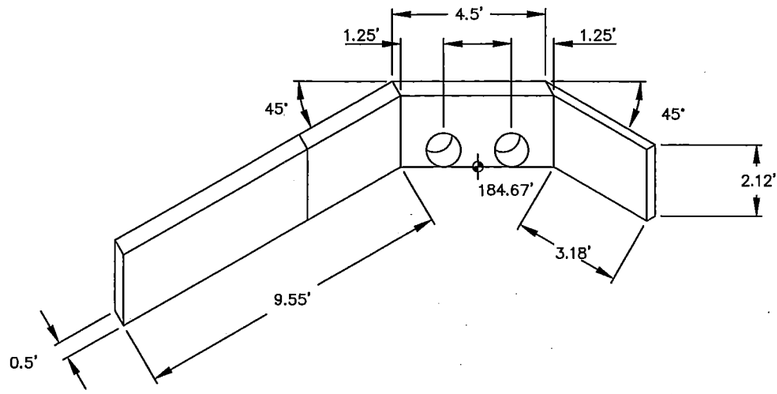
SIGNATURE

DATE

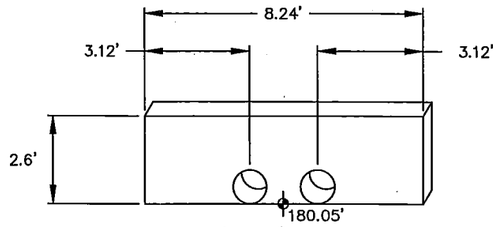
DESIGNED BY:	RDE	DATE:	MARCH 2012
DRAWN BY:	JOC	PROJECT NO.:	ME0668
CHECKED BY:	RDE	FILE:	0668p122
REVIEWED BY:		DRAWING NO.:	22 OF 42
APPROVED BY:			



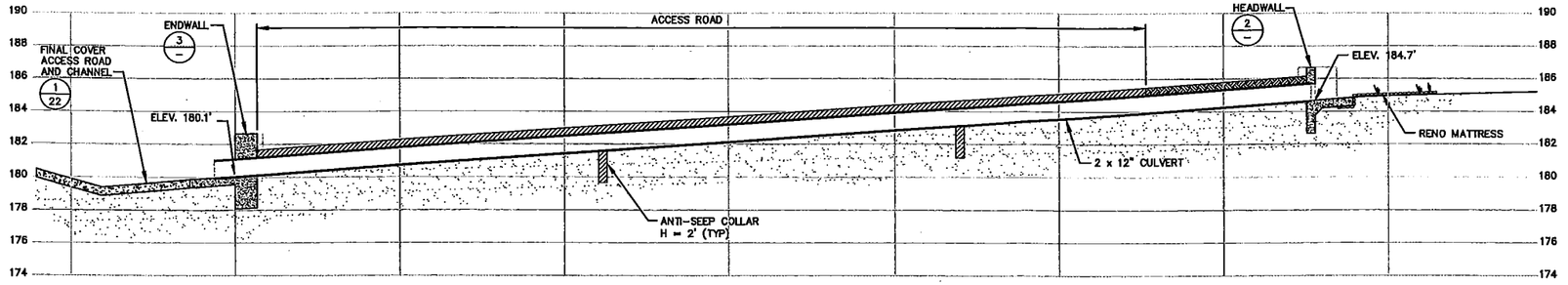
1/20 PLAN
BENCH – CULVERT 3
SCALE : 1" = 10'



2/— DETAIL
HEADWALL
SCALE : 1" = 2'



3/— DETAIL
ENDWALL
SCALE : 1" = 2'



A/— SECTION
CULVERT 3
SCALE : 1" = 4'

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10220 OLD COLUMBIA ROAD, SUITE A
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PHONE: 410.381.4333

CONSTELLATION POWER SOURCE GENERATION, INC.
1005 BRANDON SHORES ROAD
BALTIMORE, MD 21226 USA

TITLE: STORMWATER MANAGEMENT DETAILS III

PROJECT: PERMIT DRAWINGS

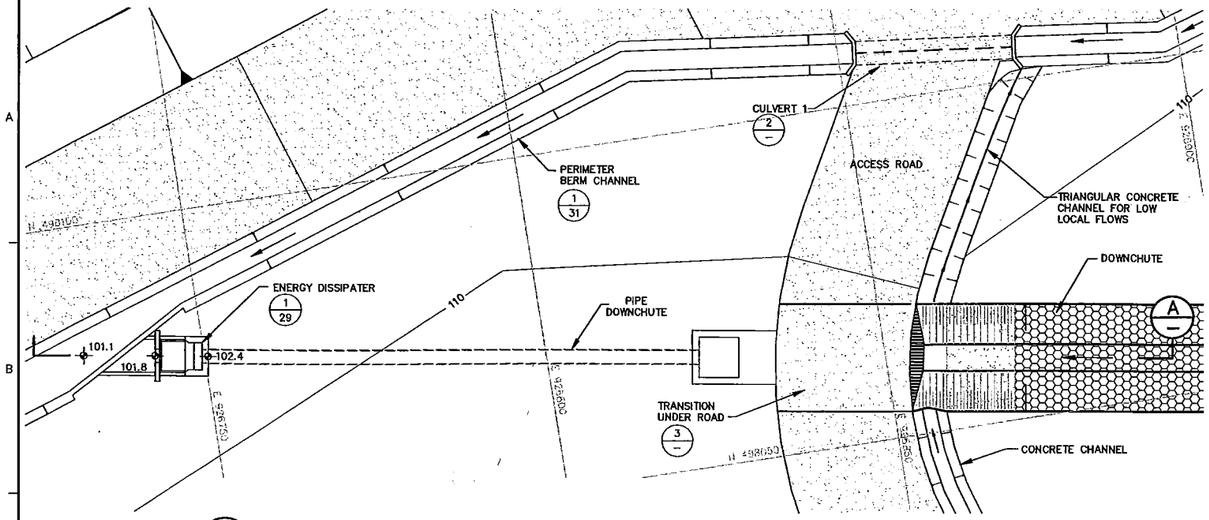
SITE: LOT 15 LANDFILL – BALTIMORE, MARYLAND

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

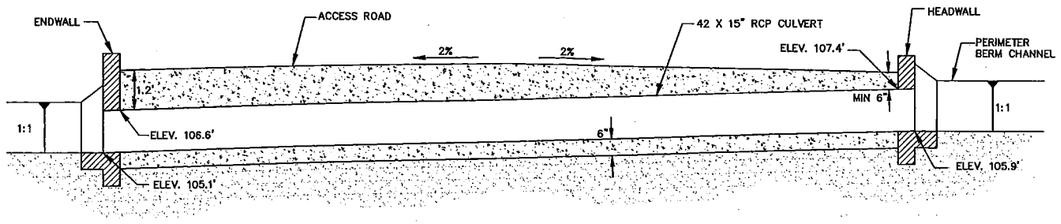
SIGNATURE

DATE

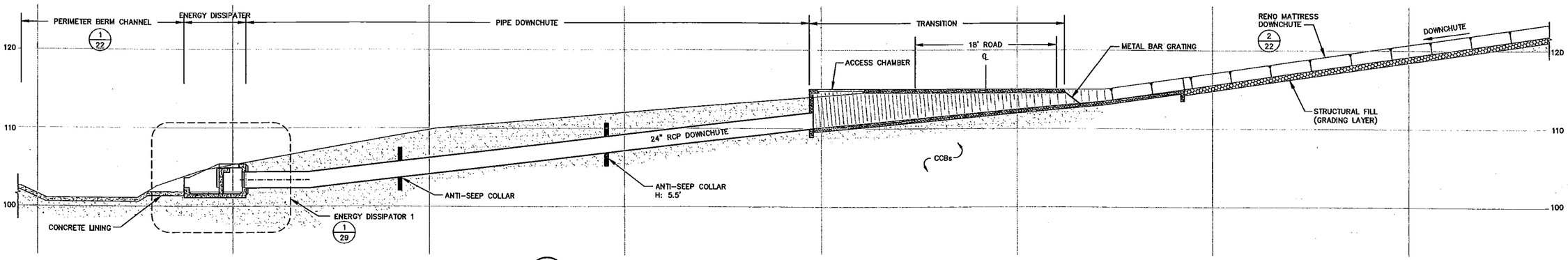
DESIGNED BY:	RDE	DATE:	MARCH 2012
DRAWN BY:	JOC	PROJECT NO.:	ME0668
CHECKED BY:	RDE	FILE:	0668p123
REVIEWED BY:		DRAWING NO.:	
APPROVED BY:		23 OF 42	



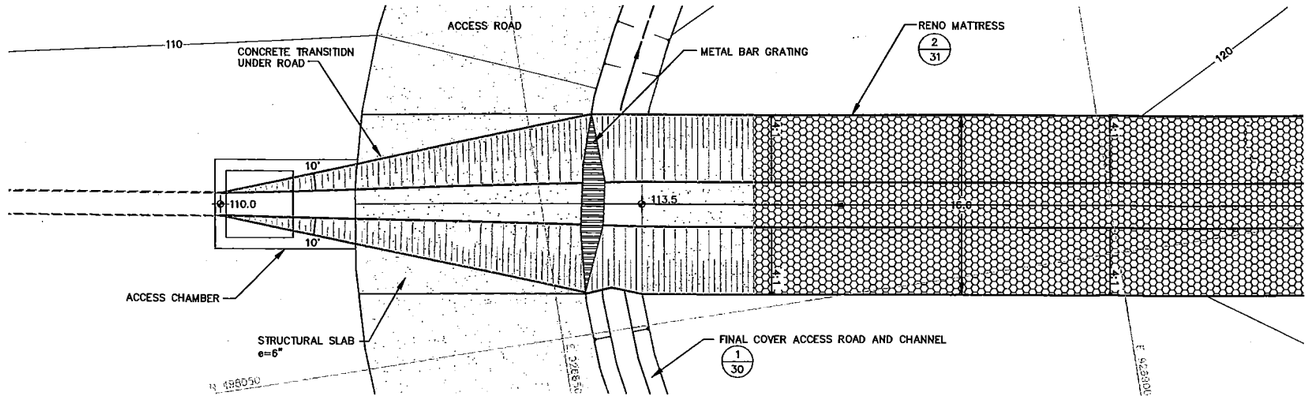
1/20 PLAN
CULVERT 1 / TRANSITION UNDER ROAD / PIPE DOWNCHUTE / ENERGY DISSIPATOR
SCALE : 1" = 10'



2/— DETAIL
CULVERT 1
SCALE : 1" = 2'



A/— SECTION
TRANSITION UNDER ROAD / PIPE DOWNCHUTE / ENERGY DISSIPATOR
SCALE : 1" = 6'



3/— PLAN
TRANSITION UNDER ROAD
SCALE : 1" = 6'

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10220 OLD COLUMBIA ROAD, SUITE A
COLUMBIA, MARYLAND 21046 USA
PHONE: 410.381.4333

CONSTELLATION POWER SOURCE GENERATION, INC.
1005 BRANDON SHORES ROAD
BALTIMORE, MD 21226 USA

TITLE: STORMWATER MANAGEMENT DETAILS IV

PROJECT: PERMIT DRAWINGS

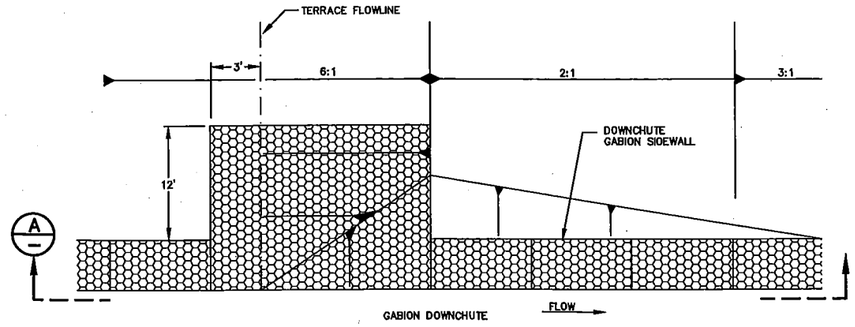
SITE: LOT 15 LANDFILL – BALTIMORE, MARYLAND

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

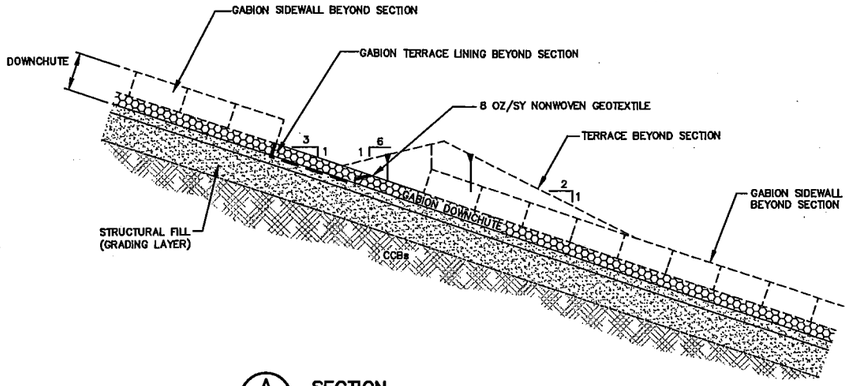
SIGNATURE

DATE

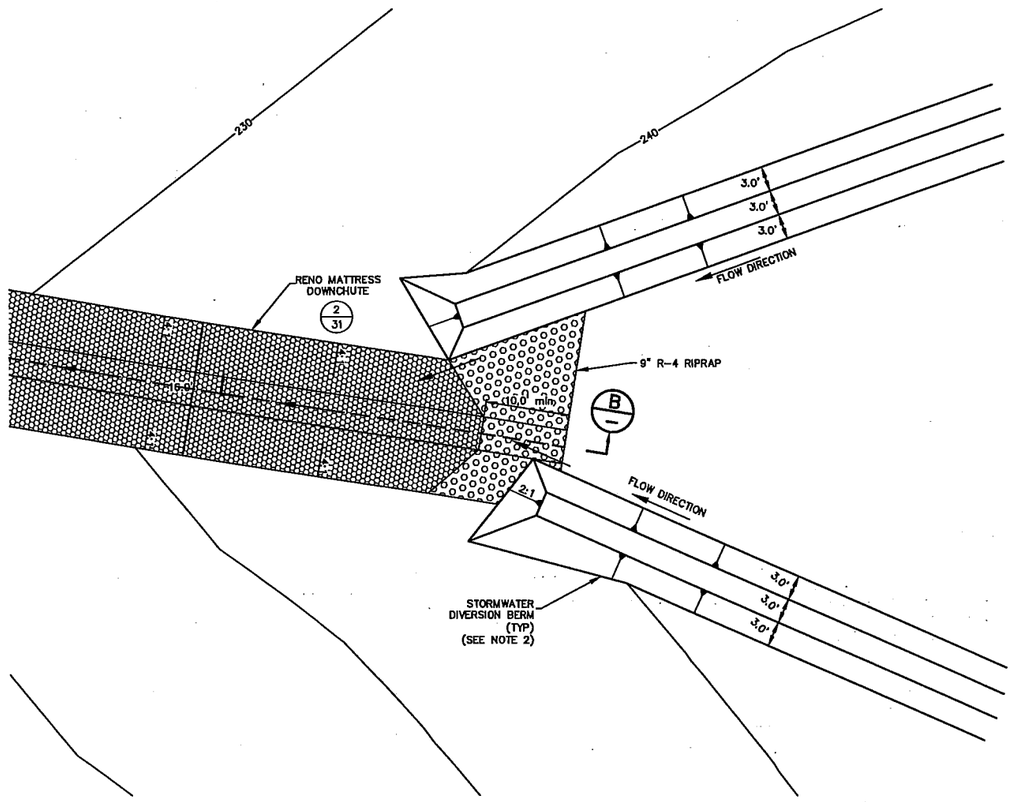
DESIGNED BY:	RDE	DATE:	MARCH 2012
DRAWN BY:	JOC	PROJECT NO.:	ME0665
CHECKED BY:	RDE	FILE:	0668p124
REVIEWED BY:		DRAWING NO.:	
APPROVED BY:			24 OF 42



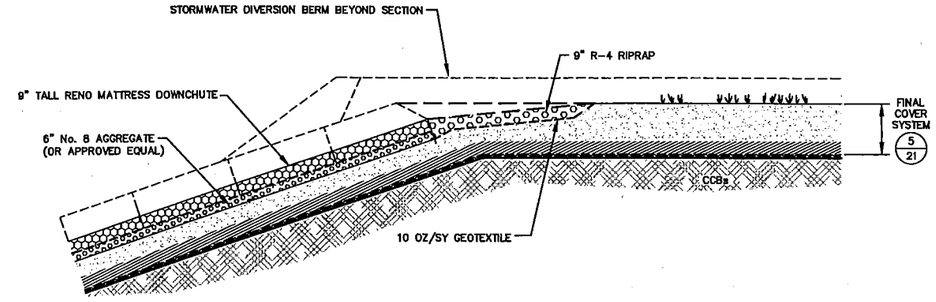
1/20 PLAN
DOWNCHUTE TERRACE INTERSECTION
SCALE NTS



A/— SECTION
DOWNCHUTE TERRACE INTERSECTION
SCALE NTS



2/20 DETAIL
DOWNCHUTE / DIVERSION BERM INTERSECTION
SCALE: 1" = 8'



B/— SECTION
DOWNCHUTE / DIVERSION BERM INTERSECTION
SCALE NTS

NOTES:

1. RIPRAP SHALL BE PLACED MANUALLY OR USING A PIECE OF EQUIPMENT APPROVED BY ENGINEER. MAXIMUM DROP HEIGHT SHALL BE 18 INCHES.
2. A 1.5 FT HIGH STORMWATER DIVERSION BERM SHALL BE CONSTRUCTED WITH STRUCTURAL FILL.

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
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COLUMBIA, MARYLAND 21046 USA
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CONSTELLATION POWER SOURCE GENERATION, INC.
1005 BRANDON SHORES ROAD
BALTIMORE, MD 21226 USA

TITLE: STORMWATER MANAGEMENT DETAILS V

PROJECT: PERMIT DRAWINGS

SITE: LOT 15 LANDFILL – BALTIMORE, MARYLAND

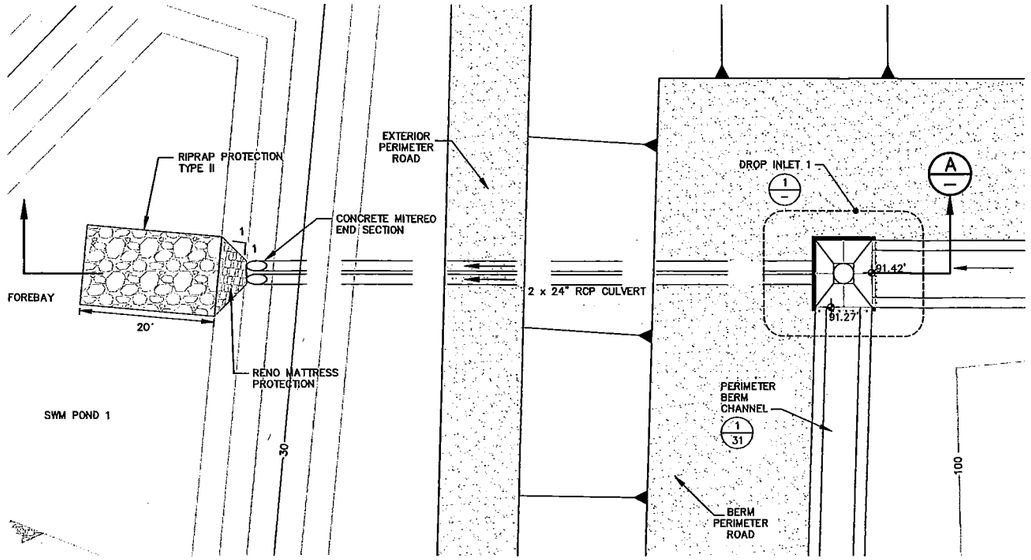
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

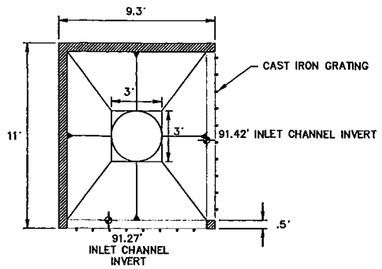
DATE

DESIGNED BY:	RDE	DATE:	MARCH 2012
DRAWN BY:	SR	PROJECT NO.:	ME0668
CHECKED BY:	JOC	FILE:	0668p125
REVIEWED BY:		DRAWING NO.:	25 OF 42
APPROVED BY:			

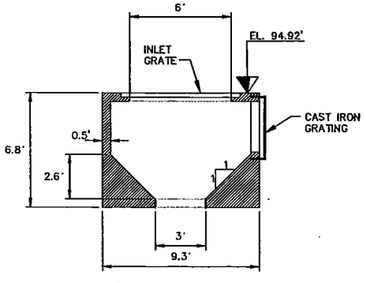
PERMIT DRAWINGS



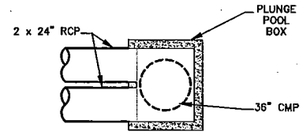
1/20 PLAN
DROP INLET 1 TO POND 1
SCALE : 1" = 10'



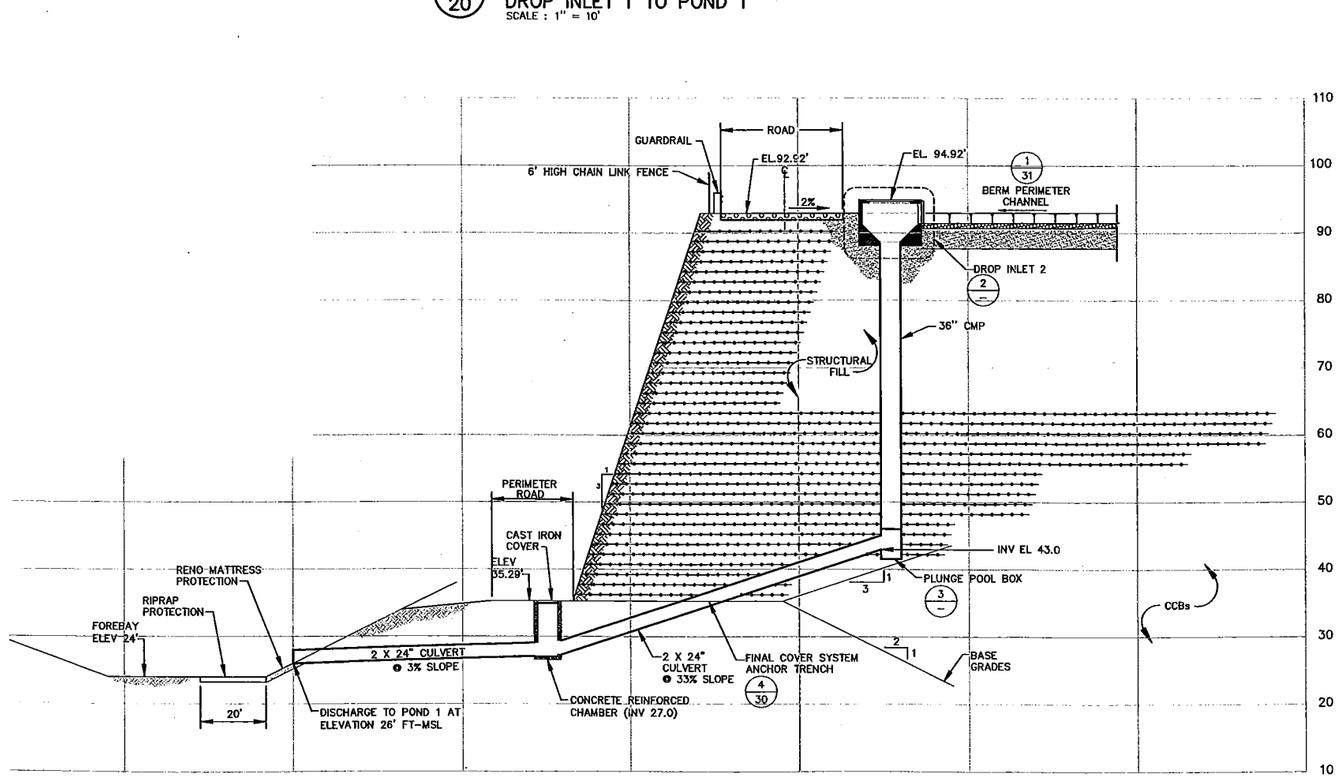
1/- PLAN
PLAN DROP INLET 1
SCALE : 1" = 4'



2/- DETAIL
DROP INLET 1
SCALE : 1" = 4'



3/- DETAIL
PLUNGE POOL BOX
SCALE : 1" = 4'



A/- SECTION
DROP INLET 1 TO POND 1
SCALE : 1" = 10'

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10220 OLD COLUMBIA ROAD, SUITE A
COLUMBIA, MARYLAND 21046 USA
PHONE: 410.381.4333

CONSTELLATION POWER SOURCE GENERATION, INC.
1005 BRANDON SHORES ROAD
BALTIMORE, MD 21226 USA

TITLE: STORMWATER MANAGEMENT DETAILS VI

PROJECT: PERMIT DRAWINGS

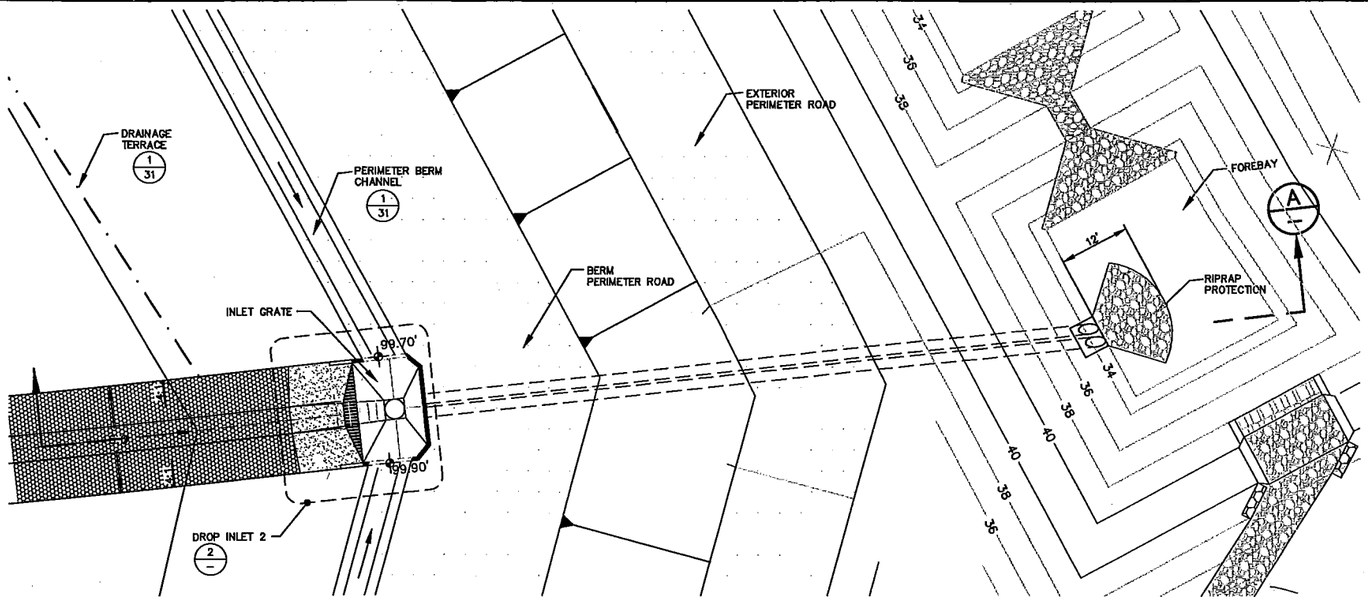
SITE: LOT 15 LANDFILL – BALTIMORE, MARYLAND

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

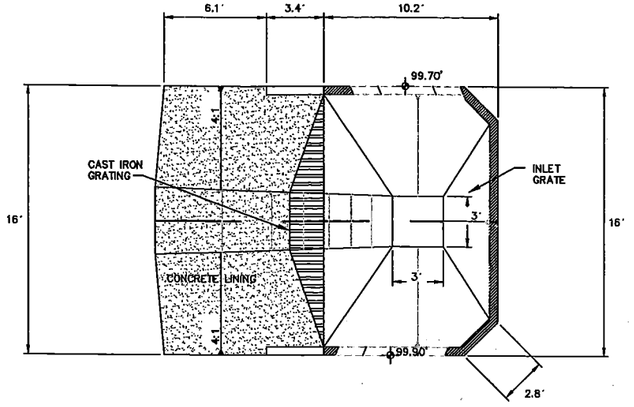
SIGNATURE

DATE

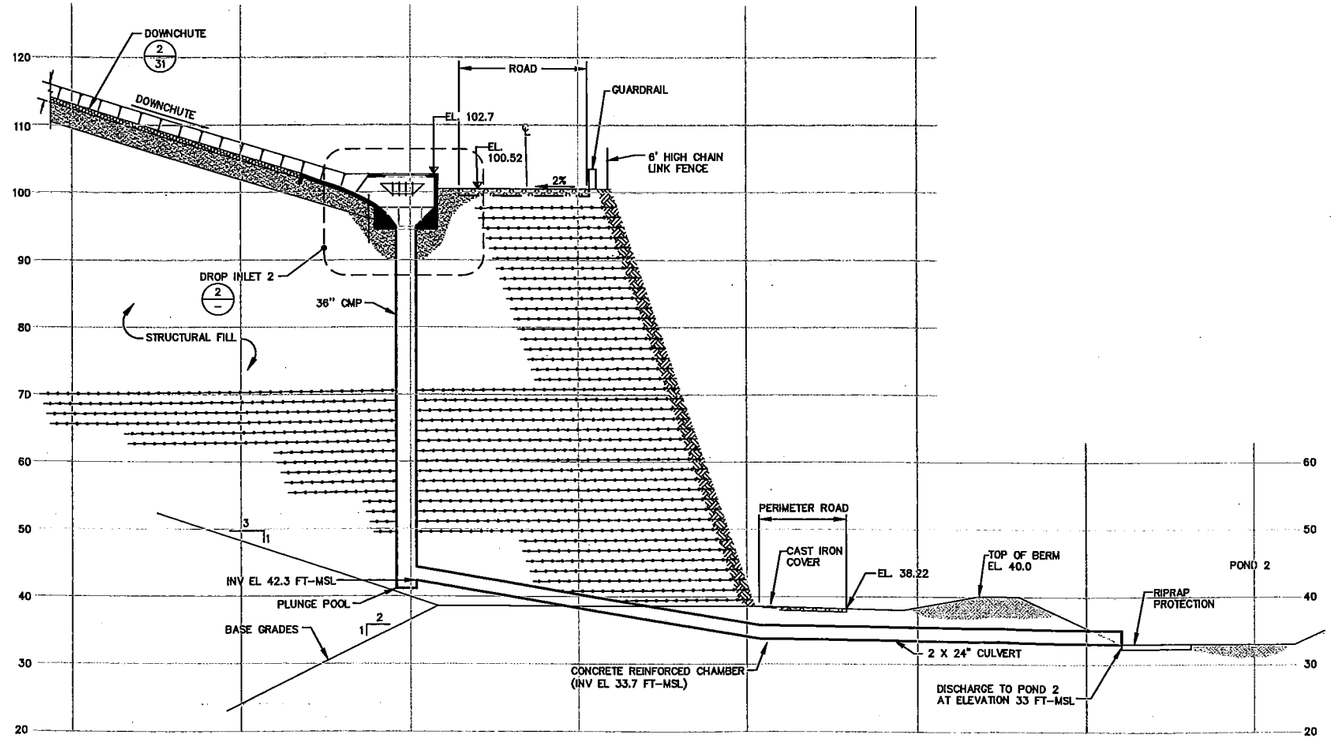
DESIGNED BY:	RDE	DATE:	MARCH 2012
DRAWN BY:	JOC	PROJECT NO.:	ME0688
CHECKED BY:	RDE	FILE:	0668p126
REVIEWED BY:		DRAWING NO.:	
APPROVED BY:			26 OF 42



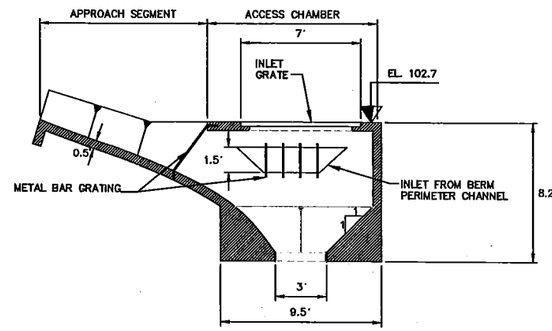
1/20 PLAN
DROP INLET 2 TO POND 2
SCALE : 1" = 10'



2/— PLAN
DROP INLET 2
SCALE : 1" = 4'



A/— SECTION
DROP INLET 2 TO POND 2
SCALE : 1" = 10'



3/— DETAIL
DROP INLET 2
SCALE : 1" = 4'

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10220 OLD COLUMBIA ROAD, SUITE A
COLUMBIA, MARYLAND 21046 USA
PHONE: 410.381.4333

CONSTELLATION POWER SOURCE GENERATION, INC.
1005 BRANDON SHORES ROAD
BALTIMORE, MD 21226 USA

TITLE: STORMWATER MANAGEMENT DETAILS VII

PROJECT: PERMIT DRAWINGS

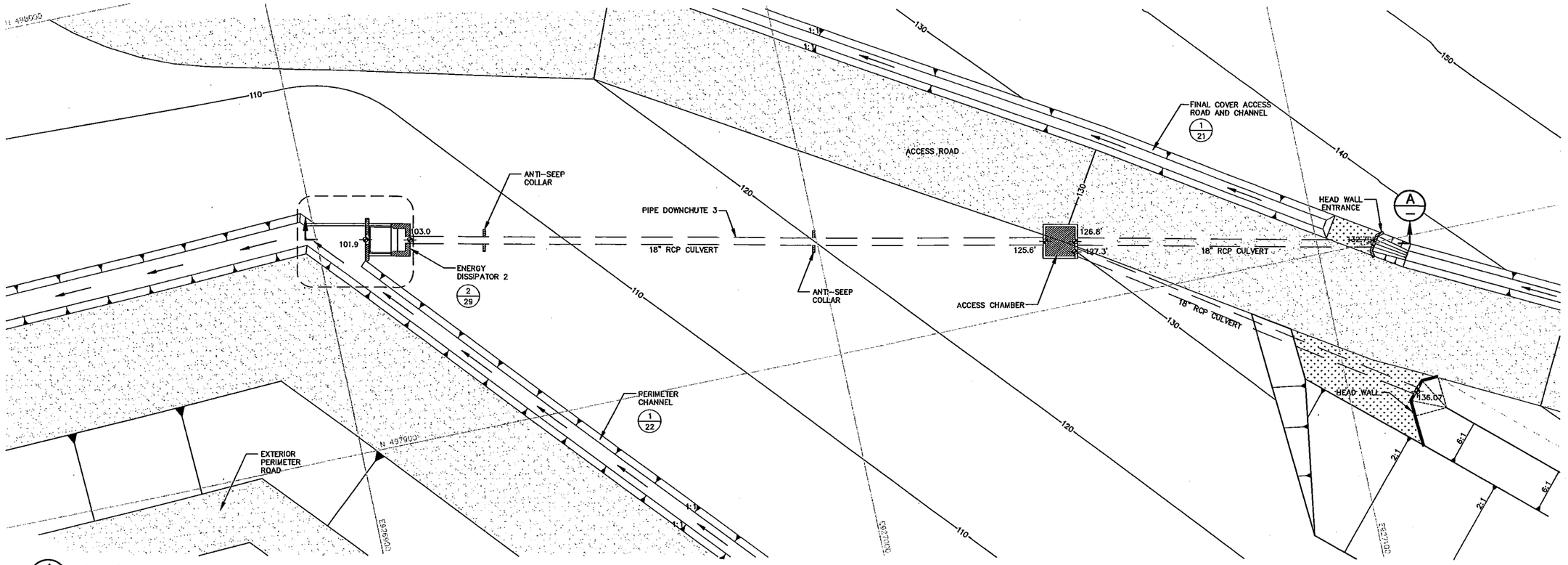
SITE: LOT 15 LANDFILL – BALTIMORE, MARYLAND

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

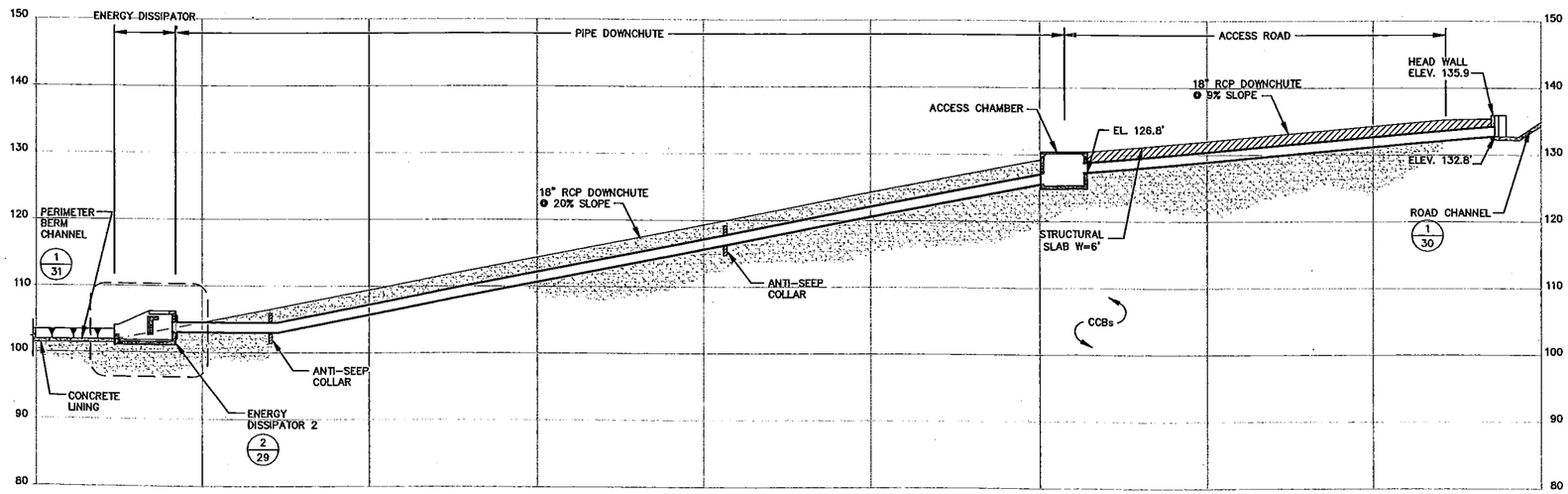
SIGNATURE

DATE

DESIGNED BY:	RDE	DATE:	MARCH 2012
DRAWN BY:	JOC	PROJECT NO.:	ME0658
CHECKED BY:	RDE	FILE:	0668p127
REVIEWED BY:		DRAWING NO.:	27 OF 42
APPROVED BY:			



1/20 DETAIL
CULVERT 2 / PIPE DOWNCHUTE / ENERGY DISSIPATOR 2
SCALE : 1" = 10'



A/- SECTION
CULVERT / DOWNCHUTE / ENERGY DISSIPATOR 2
SCALE : 1" = 10'

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10220 OLD COLUMBIA ROAD, SUITE A
COLUMBIA, MARYLAND 21046 USA
PHONE: 410.381.4333

CONSTELLATION POWER SOURCE GENERATION, INC.
1005 BRANDON SHORES ROAD
BALTIMORE, MD 21226 USA

TITLE: STORMWATER MANAGEMENT DETAILS VIII

PROJECT: PERMIT DRAWINGS

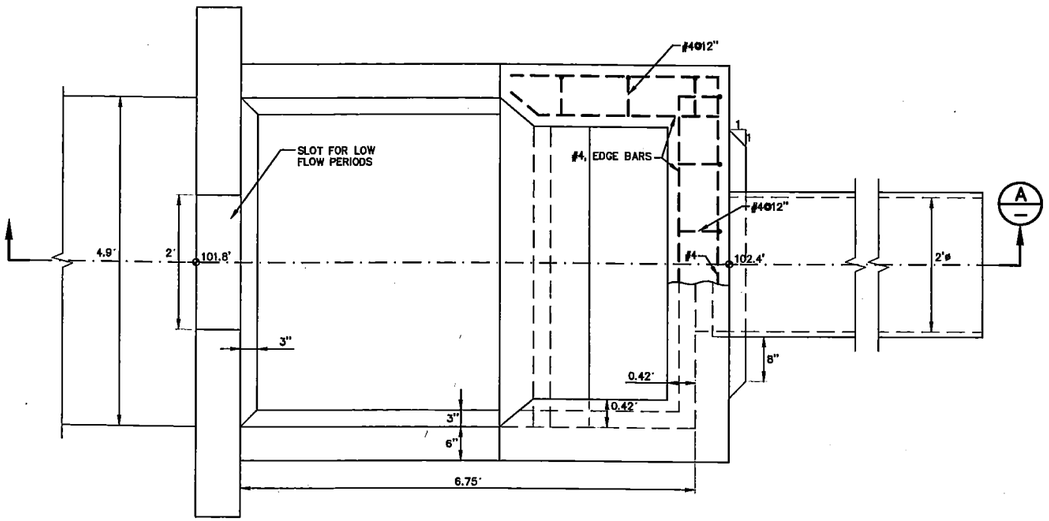
SITE: LOT 15 LANDFILL – BALTIMORE, MARYLAND

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

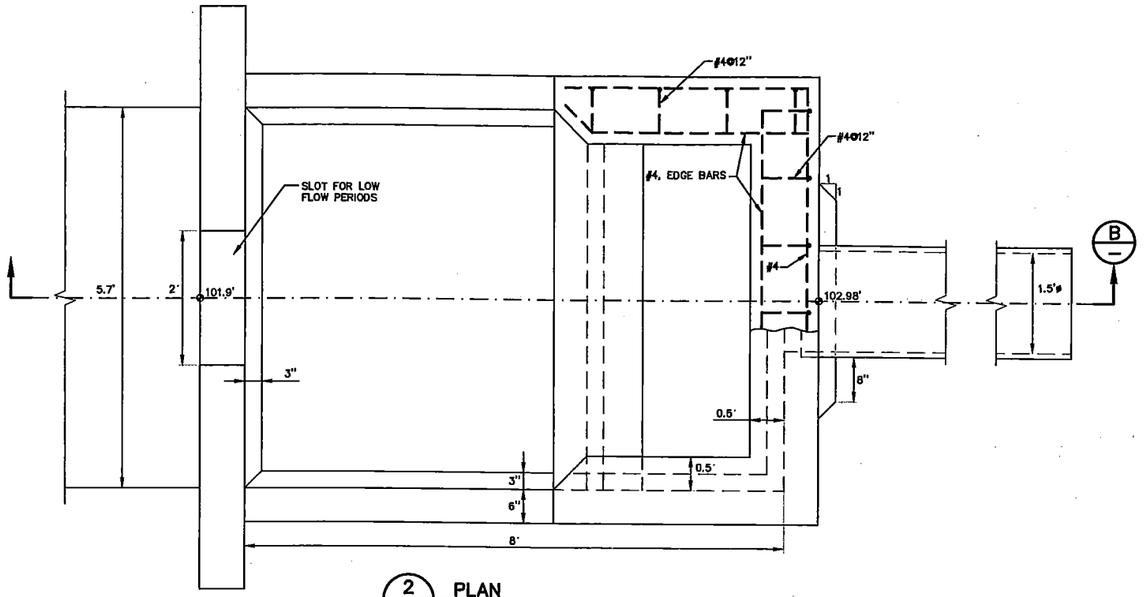
SIGNATURE

DATE

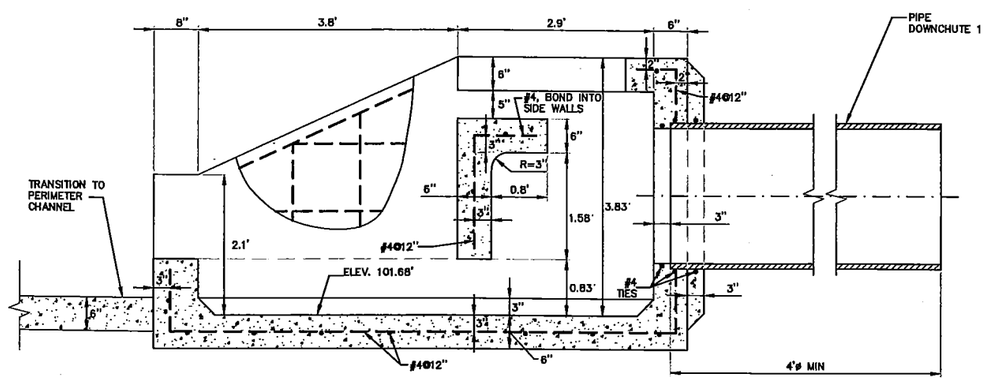
DESIGNED BY:	RDE	DATE:	MARCH 2012
DRAWN BY:	JOC	PROJECT NO.:	ME0688
CHECKED BY:	ROE	FILE:	0668p128
REVIEWED BY:		DRAWING NO.:	28 OF 42
APPROVED BY:			



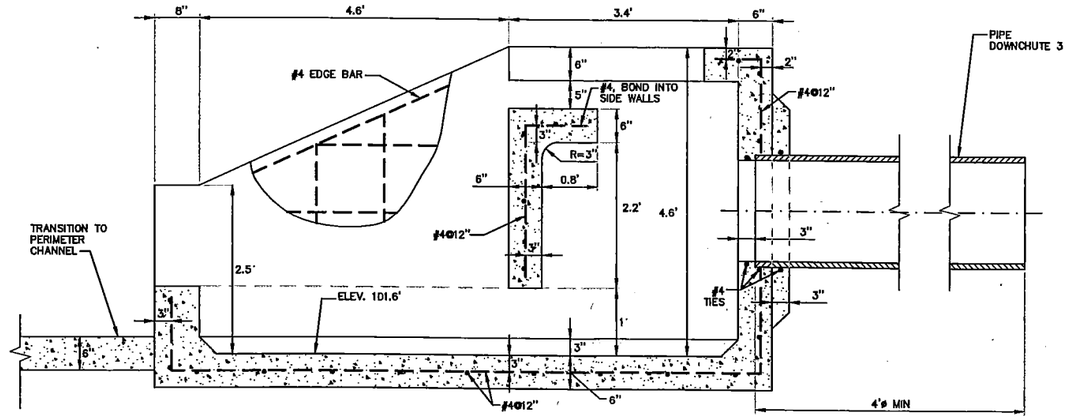
1/24 PLAN
ENERGY DISSIPATOR 1
SCALE : 1" = 1'



2/28 PLAN
ENERGY DISSIPATOR 2
SCALE : 1" = 1'



A/- SECTION
ENERGY DISSIPATOR 1
SCALE : 1" = 1'



B/- SECTION
ENERGY DISSIPATOR 2
SCALE : 1" = 1'

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10220 OLD COLUMBIA ROAD, SUITE A
COLUMBIA, MARYLAND 21046 USA
PHONE: 410.381.4333

CONSTELLATION POWER SOURCE GENERATION, INC.
1005 BRANDON SHORES ROAD
BALTIMORE, MD 21226 USA

TITLE: STORMWATER MANAGEMENT DETAILS IX

PROJECT: PERMIT DRAWINGS

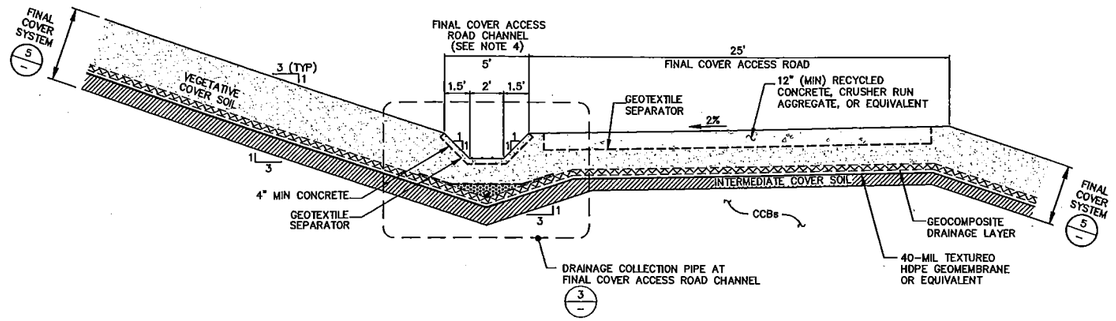
SITE: LOT 15 LANDFILL – BALTIMORE, MARYLAND

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

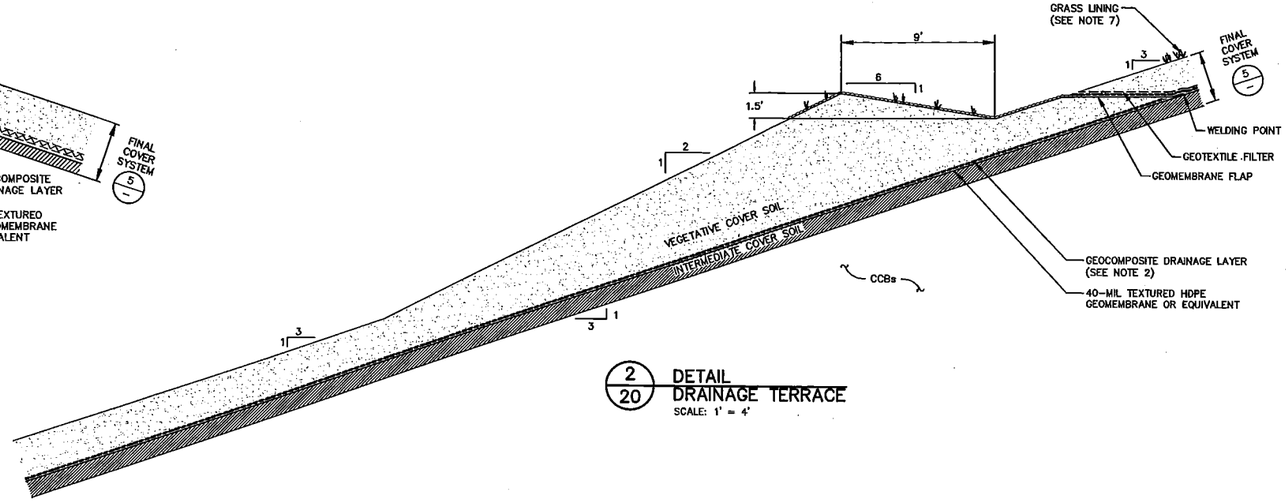
SIGNATURE

DATE

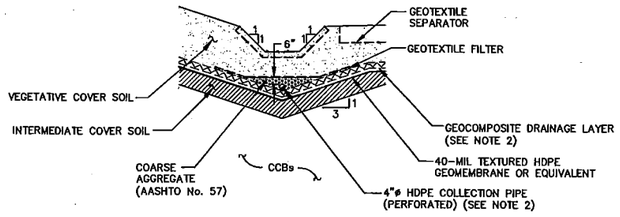
DESIGNED BY:	RDE	DATE:	MARCH 2012
DRAWN BY:	JOC	PROJECT NO.:	ME0668
CHECKED BY:	RDE	FILE:	0668p129
REVIEWED BY:		DRAWING NO.:	
APPROVED BY:			29 OF 42



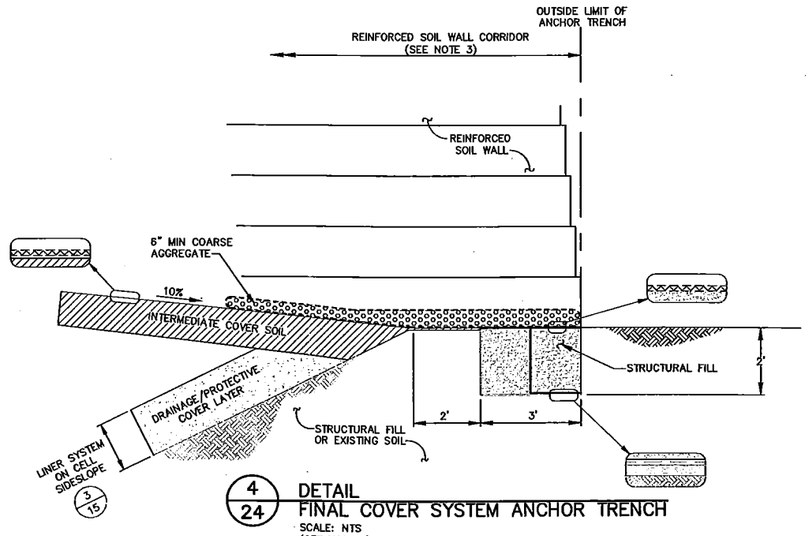
1/20 DETAIL
FINAL COVER ACCESS ROAD AND CHANNEL
SCALE: 1" = 4'



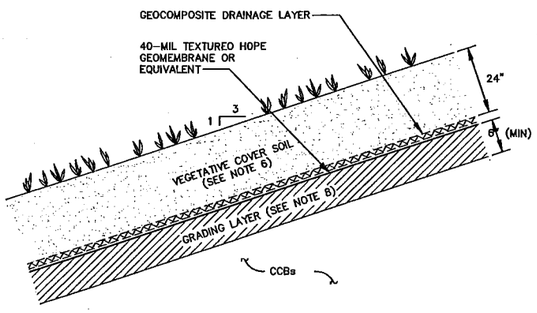
2/20 DETAIL
DRAINAGE TERRACE
SCALE: 1" = 4'



3/— DETAIL
DRAINAGE COLLECTION PIPE AT FINAL COVER ACCESS ROAD CHANNEL
SCALE: NTS



4/24 DETAIL
FINAL COVER SYSTEM ANCHOR TRENCH
SCALE: NTS
(SEE NOTE 1)



5/— DETAIL
FINAL COVER SYSTEM
SCALE: NTS

GEOSYNTHETIC LEGEND

- GEOCOMPOSITE DRAINAGE LAYER
- 60-MIL TEXTURED HDPE GEOMEMBRANE (UNLESS OTHERWISE NOTED)
- 40-MIL TEXTURED HDPE GEOMEMBRANE OR EQUIVALENT
- GEOTEXTILE CUSHION (NON-WOVEN 8 OZ/SY MIN.)
- GEOTEXTILE FILTER (NON-WOVEN 6 OZ/YD MIN.)

NOTES:

1. TYPICAL GEOSYNTHETIC CROSS SECTIONS ARE SHOWN IN ENLARGED BOXES. GEOSYNTHETICS COMPONENTS ARE NOT INDIVIDUALLY LABELED AFTER THE FIRST PRESENTATION OF A TYPICAL CROSS SECTION. ALL VARIATIONS FROM THE TYPICAL CROSS SECTIONS ARE SHOWN IN ENLARGED BOXES. SCREENED LINES REPRESENT EXISTING FEATURES.
2. THE COLLECTION PIPE AND UNDERLYING GEOCOMPOSITE SHALL DISCHARGE INTO THE PERIMETER BERM CHANNEL.
3. THE DISTANCE BETWEEN TOE OF REINFORCED SOIL WALL AND EDGE OF ANCHOR TRENCH VARIES FROM 0 TO 3 FEET DEPENDING ON THE HEIGHT OF THE WALL. FROM STATION 28+00 TO 46+00 THE REINFORCED SOIL WALL IS SET BACK 50 FT FROM THE ANCHOR TRENCH. IN THIS AREA, THE GEOMEMBRANE AND GEOCOMPOSITE COMPONENTS OF THE FINAL COVER SYSTEM WILL BE COVERED WITH 2 FT OF VEGETATIVE COVER SOIL.
4. CONCRETE LINING MAY BE REPLACED WITH AN ALTERNATIVE LINING THAT PROVIDES SIMILAR OR BETTER EROSION PROTECTION AND HYDRAULIC CAPACITY.
5. TEMPORARY END OF 40-MIL HDPE GEOMEMBRANE LINER (OR EQUIVALENT) SHALL BE A MINIMUM OF 6 FEET FROM CREST OF 1.5H:1V SLOPE BUT NO MORE THAN 9'-6". THE CALCULATIONS THAT SUPPORT THE DESIGN OF THIS TEMPORARY TERMINATION ARE PRESENTED IN THE DESIGN REPORT.
6. THE 24 INCH-THICK VEGETATIVE COVER SOIL LAYER MEETS THE REGULATORY REQUIREMENTS OF SECTION 5.2.E.1.b.(1) FOR THE (i) 18 INCH-THICK INFILTRATION LAYER; AND (ii) 6 INCH-THICK EROSION LAYER THAT IS CAPABLE OF SUSTAINING PLANT GROWTH. THE MATERIAL REQUIREMENTS FOR THE VEGETATIVE COVER SOIL ARE PRESENTED IN SECTION 02223 OF THE TECHNICAL SPECIFICATIONS.
7. GRASS LINED TERRACES/CHANNELS MUST BE STABILIZED IMMEDIATELY AFTER SEEDING.
8. GRADING LAYER SHALL BE FREE OF PARTICLES GREATER THAN 2 INCHES.

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10220 OLD COLUMBIA ROAD, SUITE A
COLUMBIA, MARYLAND 21046 USA
PHONE: 410.381.4333

CONSTELLATION POWER SOURCE GENERATION, INC.
1005 BRANDON SHORES ROAD
BALTIMORE, MD 21226 USA

TITLE: STORMWATER MANGEMENT DETAILS X AND FINAL COVER DETAILS I

PROJECT: PERMIT DRAWINGS

SITE: LOT 15 LANDFILL – BALTIMORE, MARYLAND

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

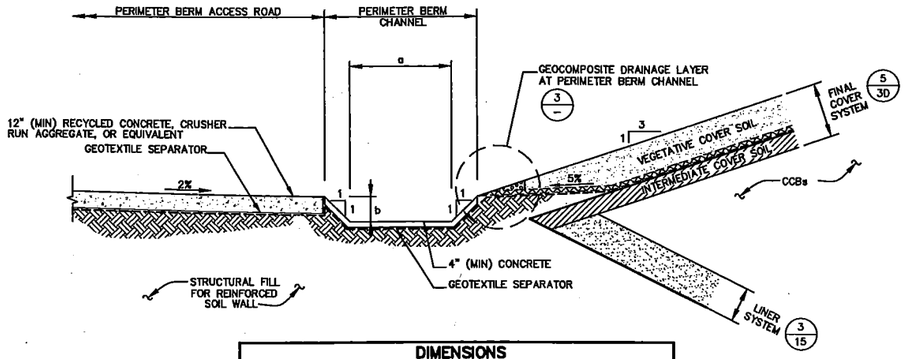
SIGNATURE

DATE

DESIGNED BY:	RDE	DATE:	MARCH 2012
DRAWN BY:	SR	PROJECT NO.:	ME0668
CHECKED BY:	JOC	FILE:	0668p130
REVIEWED BY:		DRAWING NO.:	
APPROVED BY:			30 OF 42

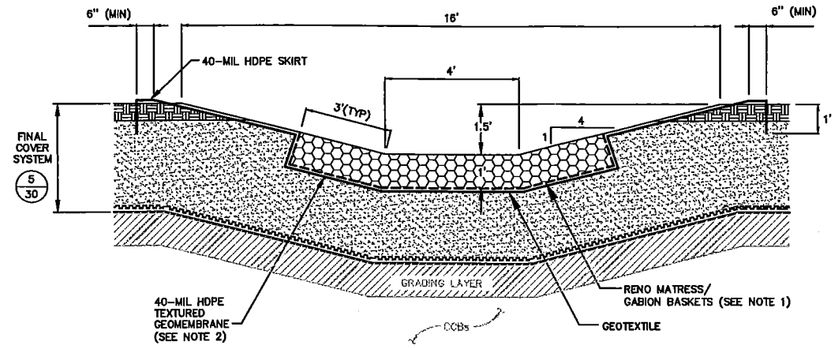
PERMIT DRAWINGS

P:\ngm\milwaukee\0668 stormwater 3 permit\0668p130.dgn 5/16/2012 2:21:13 PM gene.sier (smartsheet_ansi_d.dgn)

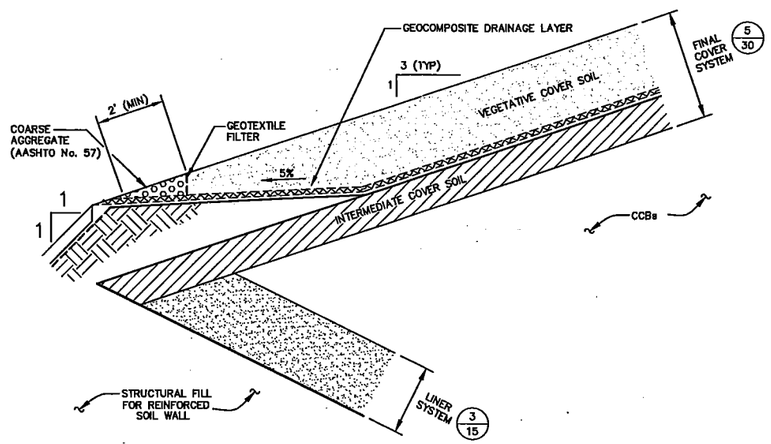


DIMENSIONS PERIMETER BERM CHANNEL		
STATION	a (FT)	b (FT)
FROM OUTLET PIPE DOWNCHUTE 3 TO DROP INLET 1	5	1.65
FROM OUTLET PIPE DOWNCHUTE 1 TO DROP INLET 1	7	1.50
REMAINING PERIMETER BERM CHANNEL	3	1.50

1/20 DETAIL
PERIMETER BERM CHANNEL
SCALE: 1" = 4'



2/20 DETAIL
DOWNCHUTE
SCALE: NTS



3/— DETAIL
GEOCOMPOSITE DRAINAGE LAYER
AT PERIMETER BERM CHANNEL
SCALE: NTS

NOTES:

1. STONE SIZES SHALL RANGE BETWEEN 4 IN AND 6 IN WITH D50 EQUAL TO 5.5 IN.
2. 40-MIL HDPE MAY BE REPLACED WITH A 6" LAYER OF AASHTO No. 57 STONE.

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10220 OLD COLUMBIA ROAD, SUITE A
COLUMBIA, MARYLAND 21046 USA
PHONE: 410.381.4333

CONSTELLATION POWER SOURCE GENERATION, INC.
1005 BRANDON SHORES ROAD
BALTIMORE, MD 21226 USA

TITLE: FINAL COVER DETAILS II

PROJECT: PERMIT DRAWINGS

SITE: LOT 15 LANDFILL – BALTIMORE, MARYLAND

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGNED BY:	RDE	DATE:	MARCH 2012
DRAWN BY:	SR	PROJECT NO.:	ME0668
CHECKED BY:	JOC	FILE:	0668p131
REVIEWED BY:		DRAWING NO.:	31 OF 42
APPROVED BY:			

PERMIT DRAWINGS

APPENDIX C.2

FINAL DEVELOPMENT STAGE CALCULATIONS

Application for an Industrial Landfill Permit: Phase III Report, Fort Armistead Road – Lot 15 Landfill (Appendix G.1 and G.2)

Geosyntec consultants

COMPUTATION COVER SHEET

Client: Constellation **Project:** Lot 15 Landfill **Project #:** ME0668 **Task #:** 06

TITLE OF COMPUTATIONS STORMWATER MANAGEMENT POND DESIGN

COMPUTATIONS BY:
Signature _____ 1/31/2012 DATE
Printed Name and Title: Fabián Fulginiti, Senior Staff Engineer

ASSUMPTIONS AND PROCEDURES CHECKED BY: (Peer Reviewer)
Signature _____ 1/31/2012 DATE
Printed Name and Title: Teresa María Reyna, Senior Engineer

COMPUTATIONS CHECKED BY:
Signature _____ 1/31/2012 DATE
Printed Name and Title: Teresa María Reyna, Senior Engineer

COMPUTATIONS BACKCHECKED BY: (Originator)
Signature _____ 1/31/2012 DATE
Printed Name and Title: Fabián Fulginiti, Senior Staff Engineer

APPROVED BY: (PM or Designate)
Signature _____ 3/12/2012 DATE
Printed Name and Title: R. David Espinoza, Principal

APPROVAL NOTES: _____

REVISIONS (Number and initial all revisions)

NO.	SHEET	DATE	BY	CHECKED BY	APPROVAL

STORMWATER MANAGEMENT POND DESIGN

PURPOSE

The purpose of this calculation package is to conduct a hydrologic and hydraulic model and water quality management design of the stormwater management features associated with existing and proposed conditions of the Lot 15 Landfill site. For the purposes of designing for water quantity management, a static model was developed in "*HydroCAD® Stormwater Modeling System*", version 7.10 (HydroCAD®) to verify the existing conditions on-site. A second HydroCAD® model was developed to determine the expected runoff from the site following development. The 65 acre site was divided into 39 subcatchment areas based on existing and proposed topography. The components addressed in this package include hydraulic and hydrologic modeling basis, input and output.

WATER QUANTITY MODELING BASIS

Prior to development, the existing hydrologic and hydraulic conditions must be modeled to determine expected runoff from the site under existing conditions. The Maryland Department of Environment (MDE) and the City of Baltimore require that the post-development peak discharge for the 2-year, 24 hour storms be maintained at or below pre-development levels through the use of Best Management Practices (BMPs). In addition, these regulations require that adequate storage is provided to capture and treat the runoff from 90 percent of the average annual rainfall to provide water quality volume (WQ_v).

Maryland 378 Small Pond Design requires that any pond that requires small pond design review must safely pass the 100-year, 24-hour storm through a spillway while maintaining one (1) foot of freeboard between the 100-year water surface elevation in the pond and the embankment top elevation.

HYDROLOGIC PARAMETERS

The input parameters described in this calculation were established based on values provided in the *2000 Maryland Stormwater Management Design Manual Volumes I & II* as determined from the Existing and Proposed Computer Aided Design (CAD) drawings of the site. The parameters described in this calculation are used to present the hydrologic and hydraulic analysis and stormwater routing for the existing and proposed conditions.

The following describes the selection of the various hydrologic parameters used for this analysis that are similar to the entire site.

- **Rainfall Distribution Type and Depth:** A 24-hour duration SCS Type II rainfall distribution is selected (see Figure 1). The following rainfall magnitudes are used in the hydrologic analyses:

Return Period (years)	Rainfall Depth* (in.)
2	3.2
10	5.1
100	7.1

* Values from Table 2.2 of the 2000 Maryland Stormwater Management Design Manual Volumes I & II.

- **Curve Number (*CN*):** Based on field observations and previous design reports, the pre-development on-site conditions are assumed to consist of woods and wetlands (good, hydrologic soil group B) with a CN of 67. For the proposed vegetated conditions, a CN of 76 was used to model the area occupied by the landfill.

- **Time of Concentration (T_c):** The T_c value is a representation of the shortest time necessary for all areas upstream of a specified point in the watershed to contribute flow to that point. Factors affecting T_c include surface roughness, channel shape and flow patterns, and slope. The T_c value for a drainage area is the sum of the individual travel times (T_t) for different flow types along the drainage pathway. According to the *2000 Maryland Stormwater Design Manual Volumes I & II*, "the standard for characterizing pre development hydrologic land use for non-forested vegetated area (including agriculture) shall be meadow in good hydrologic condition". The Manning's n-value and velocity factor chosen for existing conditions corresponds to grass cover, as required. For the proposed conditions the Manning's n-value was decreased and velocity factor was increased due to grading activities and work in the project area.

  The following outlines methods utilized in the "HydroCAD® Stormwater Modeling System", version 7.10 [Applied Microcomputer Systems, 2005] (HydroCAD®) computer model to quantify T_t for different types of stormwater runoff flow, where:

  T_t = travel time (hours)
  n = Manning's roughness coefficient (dimensionless)
  - n = 0.24 corresponding to grass dense
  - n = 0.15 corresponding to grass short
  - n = 0.014 corresponding to concrete
  - n = 0.035 corresponding to erosion control mat
  - n = 0.20 corresponding to final cover

  L = length of flow (ft)

P_2 = rainfall from a 2-year, 24-hour storm (3.2 in)
s = Bed or surface slope in the flow direction (ft/ft)
K_V = Velocity Factor (5.0 corresponding to "woodland" for benches)

A. *Sheet flow (Flow over plane surfaces less than 100 feet in length)*: The *2000 Maryland Stormwater Management Design Manual* requires that sheet flow length shall be less than 100 feet, after which it is assumed to become shallow concentrated flow. HydroCAD® calculates the T_t of sheet flow using the TR-55 Sheet Flow procedure. For the existing and proposed models a maximum flow length of 100 feet was used for all subcatchments.

B. *Shallow Concentrated Flow (Flow over plane surfaces greater than 100 feet in length):* HydroCAD® calculates the T_t of shallow concentrated flow using the TR-55 Shallow Concentrated Flow procedure.

C. *Open Channel Flow* (Flow that is confined to a defined channel): HydroCAD® calculates open channel flow using the Manning's Equation. Because the stormwater management system is designed to avoid surcharging of any closed conduits (i.e. culverts), flow through all conveyances is treated as open channel flow.

PREDEVELOPMENT CONDITIONS

The predevelopment conditions was obtained from the 1992 Permit Application package prepared for SCM Chemicals, Inc. The watershed division used is illustrated in the Pre-Developed Conditions Drainage Area Map in Figure 2. The Corresponding pre-development HydroCAD model diagram is shown on Figure 3. Excerpts of the results of the analysis are included as Attachment 1 and included in Table 1 below.

WATER QUANTITY MANAGEMENT ANALYSIS

The site stormwater hydrology model was used to determine the pre-development and predict the post-development peak flow conditions for three different storm events, including:

- The 100-year, 24-hour storm event, to verify that the conveyance and pond spillway systems are adequately designed to safely pass the flows from a large storm event that will likely occur during the life of the facility;
- The 10-year, 24-hour storm event, to design the conveyance structures (cover terraces, downchutes, channels, culverts …); and
- The 2-year, 24-hour storm event, to verify the flow that is discharged from the site under post-development conditions is no greater than the flow that is discharged from the site under pre-development conditions.

The 100-year, 24-hour storm event was used because a storm having this return frequency could reasonably be expected to occur during the life of the landfill. In addition the stormwater management pond must be designed to meet the criteria of MD 378 to safely pass the runoff from a 100-year frequency 24-hour storm event.

The proposed site was subdivided into 39 drainage areas under post development conditions, as illustrated in the Post Development Drainage Area Map (Figure 4). The Post-development HydroCAD model diagram is shown on Figure 5. Post developed conditions included modeling and routing stormwater through the outlet control structure of the proposed stormwater management ponds.

Output files for the hydraulic and hydrologic analysis performed in HydroCAD® are provided in Attachment 2. Output includes 2, 10, 25 and 100 -year design event runoff conditions for the entire site at existing and proposed conditions. Table 1 shows the expected runoff from each general drainage area for 2-year, 10-year and 100-year 24-hour design storm events under existing and proposed conditions.

Table 1: RESULTS SUMMARY

Storm Event	Discharge Point	Table 6 from SCM [1992]*		Proposed Post Development (see Attachment 1)
		Pre	Post	
2 Years	WL : Southeast corner of the 65 Ac. Site at property line	13.43	9.61	5.3
	OUTLET-1 / POND 1: Culvert at Fort Smallwood Road west of the 65 Ac. Site	25.76	19.38	6.1
	OUTLET-2 / POND 2: Southest stream of the 65 Ac. Site at property line	2.01	1.76	0.3
10 Years	WL : Southeast corner of the 65 Ac. Site at property line	40.72	29.17	16.2
	OUTLET-1 / POND 1: Culvert at Fort Smallwood Road west of the 65 Ac. Site	82.68	63.55	15.2
	OUTLET-2 / POND 2: Southest stream of the 65 Ac. Site at property line	11.06	9.69	5.4
100 Years	WL : Southeast corner of the 65 Ac. Site at property line	79.46	67.49	29.3
	OUTLET-1 / POND 1: Culvert at Fort Smallwood Road west of the 65 Ac. Site	164.71	128.27	21.2
	OUTLET-2 / POND 2: Southest stream of the 65 Ac. Site at property line	26.5	22.29	8.5
* Values from Table 6 from a SWM report prepared by SCM Chemicals, Inc. (1992), some excerpts are included as Attachment 1.				

Table 2 shows the modeled water surface elevation for 100 -year, 24-hour design storm event and the embankment elevations for Ponds 1 and 2 (the complete HydroCAD® model output can be found in Attachment 2).

Table 2: WATER QUANTITY MODELING RESULTS SUMMARY

Outlet ID	Water Surface Elevation 100 yr, 24 hr storm event. (ft-msl)	Embankment Elevation 100-YR (ft-msl)
Pond 1	29.2	28.0
Pond 2	39.00	40.0

WATER QUALITY MANAGEMENT VOLUME COMPUTATIONS

The *2000 Maryland Stormwater Management Design Manual* requires that runoff from 90% of the average annual rainfall be captured and treated. This volume, known as the Water Quality Volume (*WQv*) to be treated is calculated using the following equation:

$$WQ_v = [(P / 12)(R_v)(A)]$$

where: P = rainfall depth (in), equal to 1.0" in the Eastern Rainfall Zone
R_v = volumetric runoff coefficient = 0.05+0.009(I) where I is percent impervious cover
A = area in acres.

For Pond 1 (see Figure 6 for areas definition):

A total= 24,59 ac
A impervious= 2.7 ac (i.e., perimeter and access roads)
I= 11 %
R_v = 0.05+0.009(I) = 0.149
WQv= 0.305 ac-feet

For Pond 2:

A total= 7,99 ac
A impervious= 0.85 ac
I= 11 %
R_v = 0.05+0.009(I) = 0.149
WQv= 0.1 ac-feet

A minimum WQ_v of 0.2 inches per acre must be provided sites that have less than 15% impervious cover. For this project, the only impervious area is associated with the access roads (i.e., 2.7 ac. for the area that drains to Pond 1 and 0.85 for Pond 2). Hence, the minimum required water quality volume for Pond 1 should be 0.2"×24.59 ac/12 = 0.41 ac-ft whereas for Pond 2 should be 0.2"×24.59 ac/12 =0.13 ac-ft. Thus, for each pond, the WQ_v is governed by the required minimum. As Pond 1 culvert outlet elevation is 24.3 fsl, its volume is about 0.42 ac-ft and meet the *WQv* criteria. As Pont 2 culvert outlet elevation is 36 ftl, its volume is 0.6 ac-ft and also meet the *WQv* criteria.

The forebay´s volume (which counts toward the total *WQv* requirement) at the inlet of each pond was calculated as:

$$f_v = 0.1\ [(A)(I)]\ /12$$

where: f_v = forebay volume (acre-feet)
I = percent of impervious cover
A = area in acres

For Pond 1:

A total= 24,59 Ac
I= 11 %
f_v = 0.02 ac-feet

For Pond 2:

A total= 7,99 Ac
I= 11 %
f_v = 0.007 ac-feet

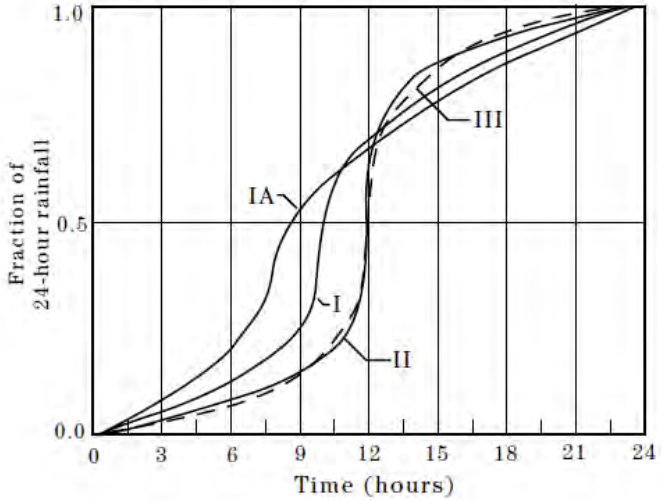
REFERENCES

Applied Microcomputer Systems, "*HydroCAD® Stormwater Modeling System*", Version 7.10, Chocorua, New Hampshire 2005.

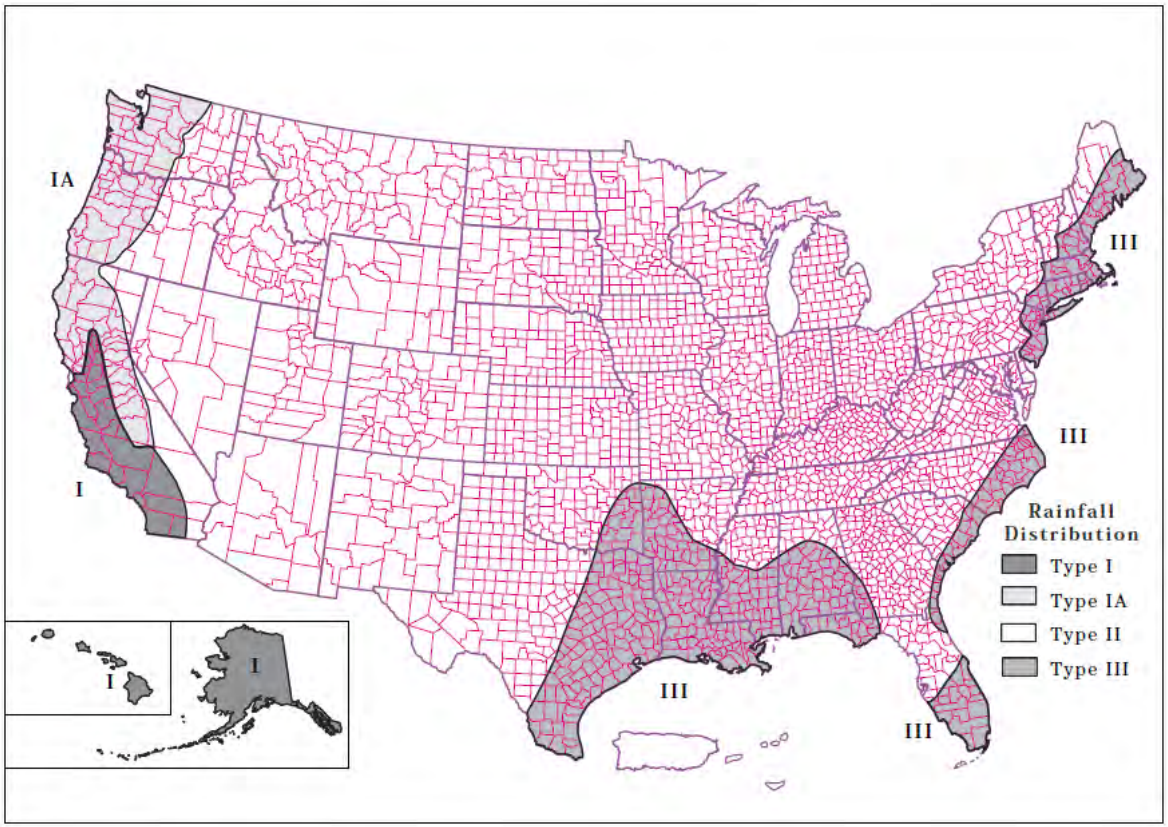
Center for Watershed Protection, District Department of the Environment, Environmental Health Administration, Bureau of Environmental Quality, and Watershed Protection Division, *"District of Columbia Storm Water Management Guidebook"*, April 2003.

Maryland Department of the Environment, Water Management Administration. "*2000 Maryland Stormwater Design Manual Volumes I & II*", 2000.

FIGURES



(a) SCS 24-hour rainfall distributions



(b) Approximate geographic boundaries for NRCS (SCS) rainfall distributions (TR55)

Figure 1: Rainfall Distribution Type

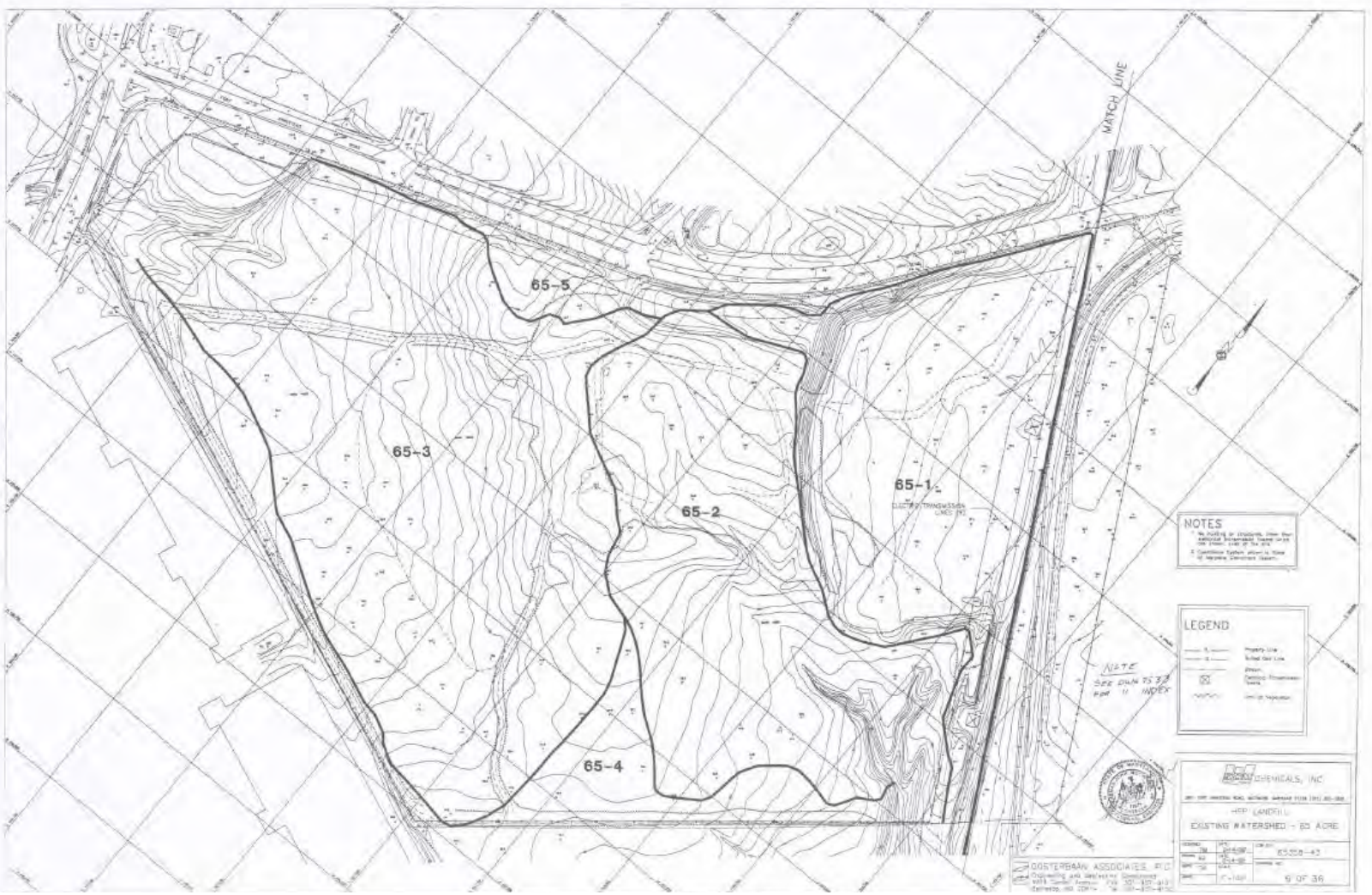


Figure 2: Pre-Development Conditions Drainage Area Map (from SCM Chemicals, Inc. HPP Industrial Waste Landfill. Phase III Landfill Design Drawings)

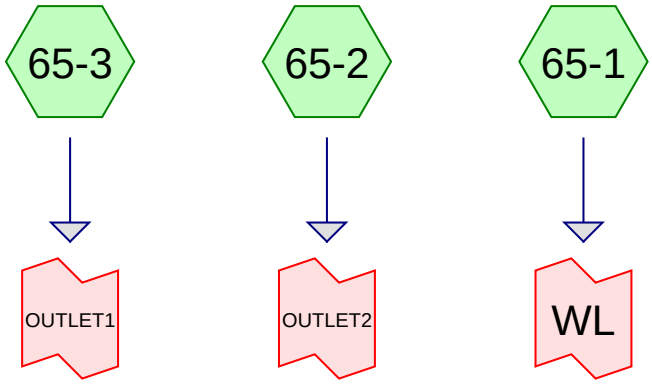


Figure 3: Pre-Development HydroCAD model diagram

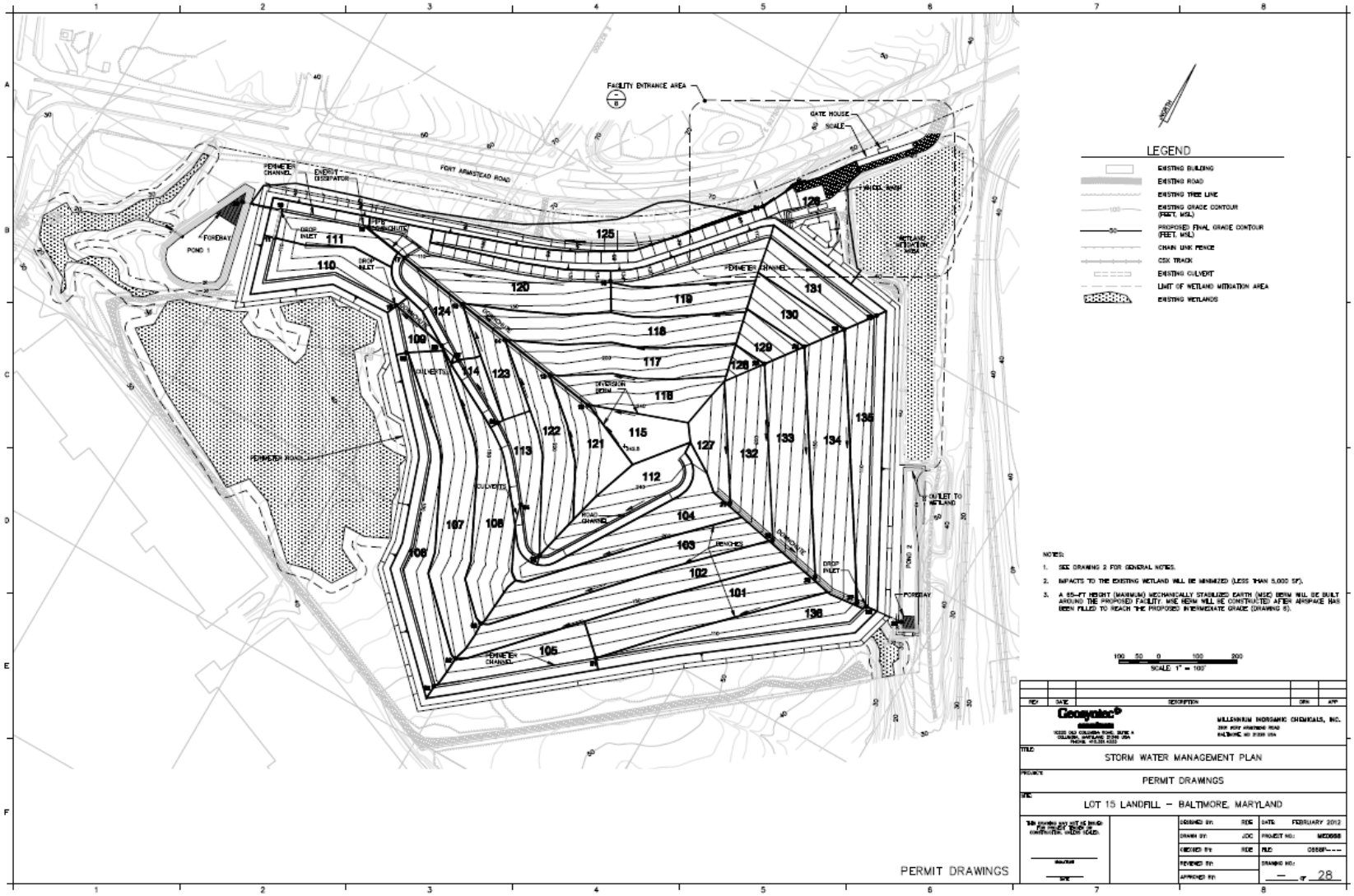


Figure 4: Pos-Developed Conditions Drainage Area Map. Source: CEAS S.A.

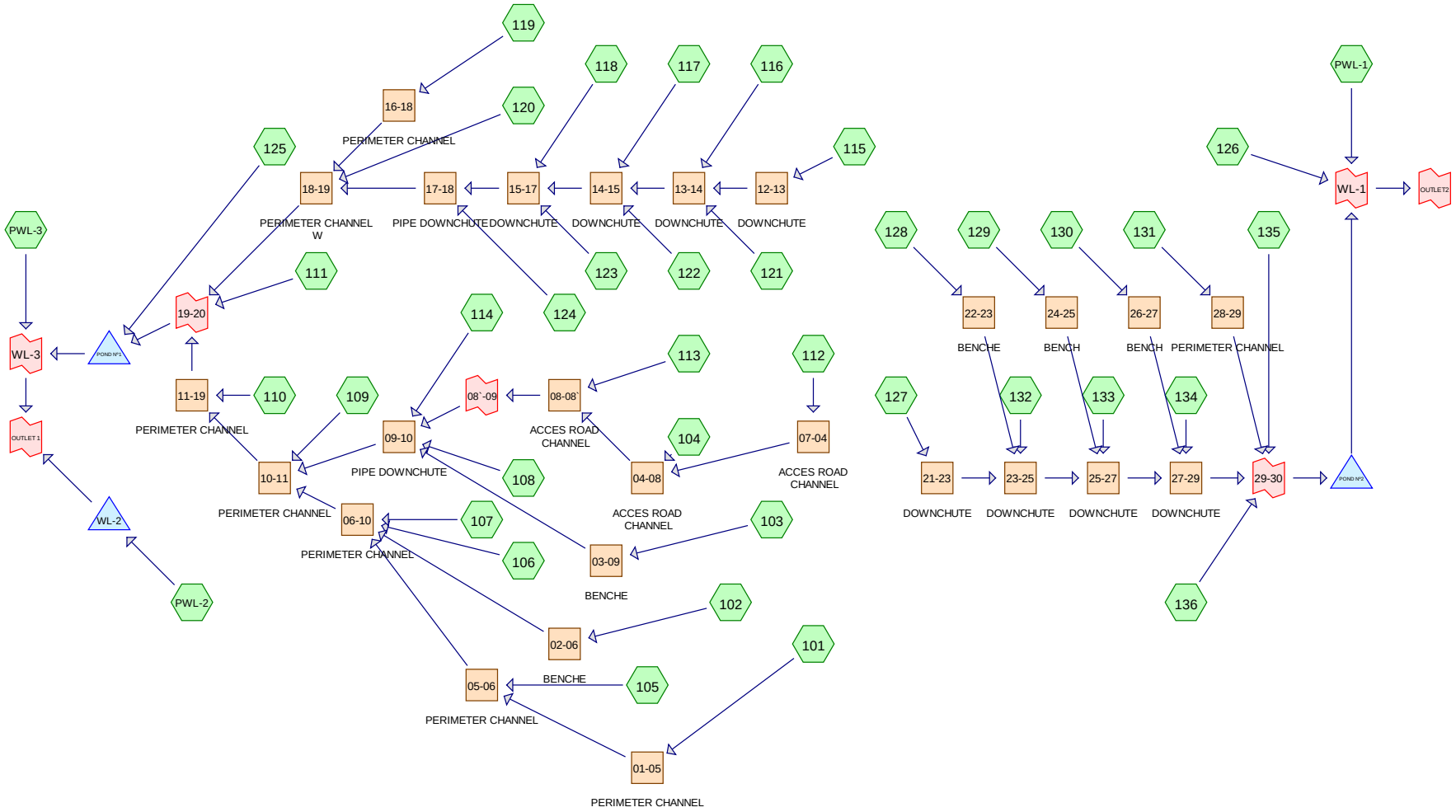


Figure 5: Pos-Developed HydroCAD model diagram.

Figure 6: Pos-Developed HydroCAD model diagram.

ATTACHMENT 1
EXCERPTS FROM
SCM Chemicals, Inc. (1992)

TABLE 1: PRE-DEVELOPMENT CN
SCM CHEMICALS, INC.
HPP LANDFILL

Basin No. (1)	Soil Type (2)	Hydrologic Group (3)	CN (4)	Area (Ac.) (5)	Sum of Area (Ac.) (6)	CN x Area [4 x 5] (7)	Sum of CN x Area (8)	Av. CN [8/6] (9)
1	BeB	C	73	7.22	26.0	527.06	1721.44	66.2 ≈ 67
	GaB	A	36	4.99		179.64		
	EnB	C/D	76	2.69		204.44		
	BkB	C	73	11.10		810.3		
2	BkB	C	73	5.18	15.89	378.14	893.94	56.26 ≈ 57
	GaB	A	36	7.19		258.84		
	BkC	C	73	1.71		124.83		
	U3C	C	73	1.81		132.13		
3	BeB	C	73	2.84	29.8	207.32	1852.64	62.17 ≈ 63
	SaB	B	65	3.53		229.45		
	U3C	C	73	15.47		1129.31		
	GaB	A	36	7.96		286.56		

TABLE 2: PRE-DEVELOPMENT T_c
SCM CHEMICALS, INC.
HPP LANDFILL

BASIN NO.	WATERSHED AREA	T_c (hr.)	LOCATION
1	30-1	1.09	2-14" pipe near railroad track
2	65-1	0.86	Southeast corner of 65-Ac. site at property line
3	65-2	0.67	Southeast stream at property line
	65-3	0.67	Culvert at Fort Smallwood Road

TABLE 3A: POST-DEVELOPMENT CN & T_c
SCM CHEMICALS, INC.
HPP LANDFILL

BASIN NO.	DOWNSLOPE PIPE LOCATION*	AREA (Ac.)	CN	T_c**
1		0.38	71	0.094
	P-9	0.69		0.156
	P-10	1.09		0.231
	P-11	1.44		0.317
	P-12	1.90		0.409
	P-13	2.46		0.476
	P-14	2.77		0.617
	P-15	1.84		0.379
	P-16	3.75		0.439
		0.73		0.107

* Downslope pipe locations shown on Drawing 24.
** T_c includes time for 40 feet of downslope (overland) flow plus bench (channel) flow.

TABLE 3B: POST-DEVELOPMENT CN & T_c
SCM CHEMICALS, INC.
HPP LANDFILL

BASIN NO.	DOWNSLOPE PIPE LOCATION*	AREA (Ac.)	CN	T_c**
2		0.36	71	0.084
	P-1	0.72		0.131
	P-2	1.34		0.288
	P-3	1.89		0.330
	P-4	2.14		0.412
	P-5	2.45		0.362
	P-6	2.18		0.437
	P-7	1.64		0.113
	P-8	3.24		0.277
		0.63		0.305

* Downslope pipe locations hown on Drawing 24.
** T_c includes time for 40 feet of downslope (overland) flow plus bench (channel) flow.

TABLE 3C: POST-DEVELOPMENT CN & T_c
SCM CHEMICALS, INC.
HPP LANDFILL

BASIN NO.	DOWNSLOPE PIPE LOCATION*	AREA (Ac.)	CN	T_c**
3		0.47	71	0.099
	P-1	0.75		0.124
	P-2	1.09		0.218
	P-3	1.36		0.238
	P-4	1.51		0.300
	P-5	1.73		0.325
	P-6	1.94		0.372
	P-7	4.23		0.255
		0.49		0.104
	P-8	0.83		0.124
	P-9	1.18		0.220
	P-10	1.53		0.255
	P-11	1.88		0.315
	P-12	2.11		0.342
	P-13	3.14		0.374
	P-14	3.57		0.503

* Downslope pipe locations shown on Drawing 23.
** T_c includes time for 40 feet of downslope (overland) flow plus bench (channel) flow.

TABLE 4: INITIAL DEVELOPMENT CN & T_c
SCM CHEMICALS, INC.
HPP LANDFILL

OUTFALL POINT	LOCATION	AREA (Ac.)	CN	T_c (hr)
1. 2-14" pipes near the railroad tracks west of 30 Ac. site.	Phase I	14.7	100	0.02
	Undisturbed Phase II	8.8	70	0.23
	Basin #3 Area	2.5	55	1.6
	Lowland - west of landfill footprint	4.5	69	1.11
2. Drainage Swale at southeast corner of the 65 Ac. site at property line	Stockpile Area 170 Bench	0.5	71	0.07
	Stockpile Area 15 Bench	1.1		0.22
	Stockpile Area 130 Bench	1.8		0.38
	Stockpile Area 110 Bench	2.5		0.51
	Stockpile Area 90 Bench	3.3		0.66
	Stockpile Area 70 Bench	3.4		0.45
	Lowland - East of landfill footprint	0.5	73	0.24
3. Railroad Drainage Swale at southeast corner of the 65 Ac. site at property line	Undisturbed Phase III Area	7.2	74	1.05
	Lowland - Adjacent and west of railroad tracks	7.5	63	0.30

Phase III Report
HPP Landfill
SCM Chemicals, Inc.

Errata No. 1
4 March 1992

Report	Replace with
Page 12	
B. Site Development, 5th line: ...landfill on the 65 site will...	...landfill on the 65 acre site will...
Page 14	
3. Stormwater Management Basins, 8th line: ...issued by the Soil conservation Service,	...issued by the Soil Conservation Service,
Page 18	
3. Initial Development Conditions - Phase I, 3rd paragraph, 4th line: ...which flow toward Basin 1. With...	...which flow toward Basin 3. With...
Page 21	
5. Stormwater Management Basin Design, 1st paragraph, 3rd line: ...As shown by the date in the table,...	...As shown by the data in the table,...
Page 23	
13. Leachate Collection and Management, 4th paragraph, 10th line: ...on the drawings for leachate pipe...	...on the drawings for leachate pipe.
Tables 1 through 8 inadvertently deleted	Tables included with Errata No. 1 - Insert after text and before Appendix A
Drawing No. 35 of 36 inadvertently deleted	Drawing No. 35 of 36 included with Errata No. 1

boundaries of which coincide approximately with the site boundaries. Surface runoff on the 65 acre tract occurs in three predominant watersheds. The limits of the primary watersheds, denoted as 30-1, 65-1, 65-2 and 65-3, are shown on Drawing Nos. 5 and 6. Composite runoff curve numbers (CN's) for the existing vegetative cover and the hydrologic soil categories for the soil types shown in the Baltimore City Interim Soil Survey Report of April, 1990, were computed to be 63 for the 30-1, 57 for 65-2, and 67 for 65-3, respectively.

B. Site Development:

The proposed general footprints of the landfill are shown on Drawing Nos. 7, 8, 10 and 11. Drainage of surface runoff on the completed project will consist of two watersheds on each tract. These watersheds will be entirely contained within the footprints of the landfill. The approximate northwest half of the landfill on the 65 acre site will drain to Basin No. 1 and the northeast half will drain to Basin No. 2. The two drainage areas on the completed landfill on the 30 acre site will drain to Basin No. 3. The basins are to be located at existing drainage outfall points on the 30 acre and 65 acre sites and their positions of Basin No. 1, Basin No. 2 and Basin No. 3 are shown on Drawing Nos. 23 and 24. The CN for the completed landfill used in all the post-development runoff computations is 71.

C. Stormwater Management Plan:

Stormwater management practices for the property, during and after placement of the landfill, will be consistent with COMAR 26.09.02 et. seg., the requirements of the City of Baltimore Storm Water Management Division, and the Section 401 Water Quality Certification, Stormwater Management Assessment Guidelines, Maryland Department of the Environment, (June 24, 1988). The primary design function is to settle solids and to discharge clean runoff from the site, for the 2-year and the

TABLE 5: HPP LANDFILL - PHASE I RUNOFF AT PROPERTY LINE BEFORE AND INITIAL DEVELOPMENT

LOCATION	CONDITION	PEAK DISCHARGE (CFS)		
		2-YR FREQUENCY	10-YR FREQUENCY	100-YR FREQUENCY
1. 2-14" pipes near the railroad tracks west of the 30 Ac. site	Pre-Development	6.07	22.02	45.92
	Interim-Development*	5.77	9.62	14.60
2. Drainage swale at southeast corner of the 65 Ac. site at property line	Pre-Development	2.01	11.06	26.50
	Interim-Development*	0.67**	7.12**	22.54**
3. Railroad drainage swale at southeast corner of the 65 Ac. site at property line	Pre-Development	13.43	40.72	79.46
	Interim-Development*	9.03	22.41	41.90

* Phase I Construction

** First inch of rainfall detained on the benches of stockpile area

TABLE 6: HPP LANDFILL - COMPLETED LANDFILL RUNOFF AT PROPERTY LINE BEFORE AND AFTER DEVELOPMENT

LOCATION	CONDITION	PEAK DISCHARGE (CFS)		
		2-YR FREQUENCY	10-YR FREQUENCY	100-YR FREQUENCY
1. 2-14" pipes near the railroad tracks west of the 30 Ac. site	Pre-Development	6.07	22.02	45.92
	Post-Development	6.03	20.60	51.33*
2. Southeast stream of the 65 Ac. site at property line	Pre-Development	2.01	11.06	26.50
	Post-Development	1.76	9.69	22.29
3. Southeast corner of the 65 Ac. site at property line	Pre-Development	13.43	40.72	79.46
	Post Development	9.61	29.17	67.49
4. Culvert at Fort Smallwood Road west of the 65 Ac. site	Pre-Development	25.76	82.68	164.71
	Post-Development	19.38	63.55	128.27

* Additional post development flow results in 4896 CF of additional storage upstream of pipe inlets. Due to large available surface area, the additional storage requirement results in only a 0.9 inch rise in water surface elevation.

The total capacity of the two pipes are 28 CFS x 2 = 56 CFS (Flowing Full)

The velocity at the end of the pipes at peak discharge increases from 29.17 fps (pre development) to 29.65 fps (post development)

TABLE 7: BASIN DESIGN SUMMARY
SCM Chemicals, Inc.
HPP Landfill
Storm Water Management Design

	SWM BASIN	No. 1	No. 2	No. 3
1.	Watershed Area (Pre-Development)	26.0 ac.	15.9 ac.	29.8 ac.
2.	Area Disturbed (Post Development Watershed)	16.6 ac.	16.4 ac.	26.8 ac.
3.	Existing Grade @ Storm Water Management Structure	El. 28±	El. 30±	El. 40±
4.	Required Sediment Volume (1800 C.F./Acre Disturbed)	29,880 cf	29,520 cf	48,240 cf
5.	Sediment Volume Provided @ El.	29,920 cf @ 30.2	42,000 cf @ 33.7 (1) 29,700 cf @ 32.7 (2)	49,660 cf @ 40.6
6.	2 Year Peak (Pre-Development)	10.89 cfs	2.01 cfs	6.07 cfs
7.	2 Year Peak Inflow (Post-Development)	5.09 cfs	3.11 cfs	7.70 cfs
8.	10 Year Peak Discharge (Pre-Development)	33.0 cfs	11.06 cfs	22.02 cfs
9.	10 Year Inflow (Post-Development)	14.35 cfs	10.66 cfs	23.78 cfs
10.	2 Year Storm Water Volume			
a)	Required	0	7,488 cf	2,160 cf
b)	Provided @ El.	N/A	7,700 cf @ 34.4	3,820 cf @ El. 41.2
11.	10 Year Storm Water Volume			
a)	Required	0	0	2,880 cf
b)	Provided @ El.	N/A	N/A	3,820 cf @ El. 41.4
12.	Basin Base El.	El. 26.9	El. 28.0	El. 38.0
13.	Primary Spillway			
a)	2 Year Inlet El.	El. 30.7	El. 33.7	El. 41.0
b)	10 Year Inlet El.	El. 30.7	El. 35.2	El. 41.6
c)	Outfall Invert El.	El. 28.0	El. 30.0	El. 39.4
14.	100 Year Peak Inflow (Pre Development)	63.8 cfs	26.5 cfs	45.9 cfs
15.	100 Year Peak Inflow (Post Development)	27.6 cfs	22.6 cfs	47.2 cfs
16.	Emergency Spillway			
a)	Crest El.	El. 33.0	El. 36.4	El. 43.2
b)	Capacity @ El.	28.7 cfs @ 33.8	28.7 cfs @ 37.2	57.5 cfs @ El. 44.0
c)	Width of Crest	5 ft.	5 ft.	5 ft.
d)	Length of Crest	15 ft.	15 ft.	30 ft.
e)	Depth of Flow (100 Year Storm)	0.8 ft.	0.8 ft.	0.8 ft.
17.	Dam Crest El.	36.0	39.0	46.0
18.	Freeboard	4.0 ft.	2.6 ft.	2.8 ft.

(1) Phase I construction condition governs design
(2) Final landfill configuration

TABLE 8: CONSTRUCTION SCHEDULE

HPP LANDFILL
SOLID WASTE PERMITTING & CONSTRUCTION SCHEDULE

Date	Event
27 February 1992	Phase III Permit Application Submitted to MDE.
27 February 1992	MDE distributes Phase III Permit Application to other interested agencies.
6 March 1992	Submission of Groundwater and Surface Water Impact Analysis.
11 March 1992	Supplemental Submission for Grading and Sediment & Erosion Control Permit - Phase I Work - City of Baltimore.
16 March 1992	Phase III Plan Review Meeting. Start process for Public Hearing.
3rd week in April 1992	Public Hearing.
1st week in May 1992	End of Comment Period. Issue Permit.
1st week in May 1992	Notice to Proceed with Phase I Construction.
1 October 1992	Complete Construction of Phase I Work.
1 October 1992	Begin Operations.

constructed as a series of check dams in zones where surficial sand, sandy silt or loam are confirmed during construction of the swales. The side of the swale closest to undisturbed surficial sand areas will be placed in hydraulic communication with permeable soils exposed during excavation of the swale by lining the swale side with filter fabric, stone, and rip-rap. Each check dam will hold a volume of runoff with a hydraulic head sufficient to induce infiltration.

During construction and operation of the landfill, some sediment load will be carried by the perimeter swales which will jeopardize the successful operation of the infiltration devices. The implementation of the infiltration practices will commence when all areas of disturbance within a channel subwatershed are stabilized. This sequence is in accordance with Section 2.5.1 Construction and Maintenance, Maryland Standards and Specifications for Stormwater Management Infiltration Practices, February, 1984 and Page 12, Paragraph (b), Item (3) of the Baltimore City Interim Stormwater Management Design Manual, June 29, 1984. It should be recognized that operation of the landfill in a particular phase could last eight years or more and infiltration would not be implemented for a considerable period after landfill construction commenced.

3. Stormwater Management Basins:

Considering that infiltration practices may not be implemented for a considerable period during a given phase, runoff which is pumped from the bottom of excavations and runoff from the portions of landfill not stabilized will be conveyed through conventional grass-lined or rip-rap swales to sediment/stormwater management basins. Stormwater management basins have been designed in accordance with the requirements of Baltimore City and the Stormwater Management Pond Design and Construction Manual issued by the Soil Conservation Service, Practice Code 378, January, 1991.

Frequency	Total Rainfall
2-year	3.3 inches
10-year	5.2 inches
100-year	7.4 inches

3. Initial Development Conditions - Phase I:

During the Phase I construction, existing soil will be excavated to El. 8 at the 30 acre site and the materials stockpiled in the 65 acre site for subsequent use. The Phase II area will be undisturbed during the initial development phase of the project. Watersheds discharging to Basin No. 3, located at the south corner of the 30 acre site, and Basin No. 2, located at the east corner of the 65 acre site, will be affected by the initial development and analyses were performed for the interim watershed conditions created during construction and operation of Phase I.

Stormwater in the Phase I area will be temporarily stored in a designated area at the northeast corner of the excavation. The stormwater management area in the excavation measures approximately 500 feet by 50 feet and is shown on Drawing No. 28. Based on the TR 20 analysis using a CN value equal to 100 to account for the presence of an impervious liner, approximately 87,840 cubic feet of inflow are expected for a 2 year storm event over a twenty-four hour period.

In order to remove the stormwater from the excavation in a timely fashion, two temporary 400 gpm pumps will be provided during the operation of Phase I. The pumps will discharge stormwater into the conveyance channels along the access road which flow toward Basin No. 3. With a discharge rate equal to 1.8 cfs, the pumps will remove stormwater in about 14 hours and the height of water in the stormwater management area of the excavation will be 3.7 feet. If the 10 year storm event occurs, the height of water will rise to 6.5 feet and stormwater will be removed after 24 hours of pumping.

5. Stormwater Management Basin Design:

The detailed analyses for the stormwater management basins are provided in Appendix C. A summary of the hydrologic and hydraulic analyses is presented in Table 7. As shown by the data in the table, Basin No. 1, Basin No. 2 and Basin No. 3 meet or exceed the regulatory stormwater management criteria.

A comparison of the pre- and post-inflow hydrographs in Appendix C indicate that the shapes are generally similar and the post-development peak discharges are generally lower than the pre-development peak discharge rates. By retarding flow and lengthening flow paths, the presence of the completed landfill improves peak runoff and reduces the potential for downstream flood conditions. The storage volumes for stormwater in the basins are therefore relatively small. Sediment storage is provided for all basins at the rate of 1800 cubic feet per acre of disturbed area. The volumes provided for sediment storage assume that the entire watershed will be disturbed at the same time, a condition which will not occur. Construction will proceed by the planned phases and the basins will provide more than ample sediment storage.

13. Leachate Collection and Management:

A leachate collection system, consisting of 12 inches of coarse sand, drained by a network of 6 to 8 inch perforated pipe will be placed over a prepared clay liner at the excavation floor. The thickness and gradation of the collection layer has been proportioned to convey leachate to a collection pipe network such that no more than a 30 cm head of leachate will exist above the liner. The pipe network was sized to efficiently transport leachate to a central collection location at each landfill site. After collection, the leachate will be pumped to the wastewater treatment facility at the adjacent SCM Hawkins Point Plant and eventually discharged through a NPDES permitted outfall. Computations for the leachate system are shown in

collection pipes fabricated from 16 gauge metal will be capable of withstanding in excess of 248 feet of cover with 120 pcf soil, a condition much more severe than the landfill loading condition. A minimum pipe metal thickness of 16 gauge has been specified on the drawings for leachate pipe.

Based on the area of landfill contributing to the leachate collection system, total inflows are calculated to be about 30 gallons per minute (gpm) for the 30 acre site and 40 gpm for the 65 acre site. Pumps with capacities of 60 and 80 gpm will be installed in the sumps for the 30 acre and 65 acre sites, respectively.

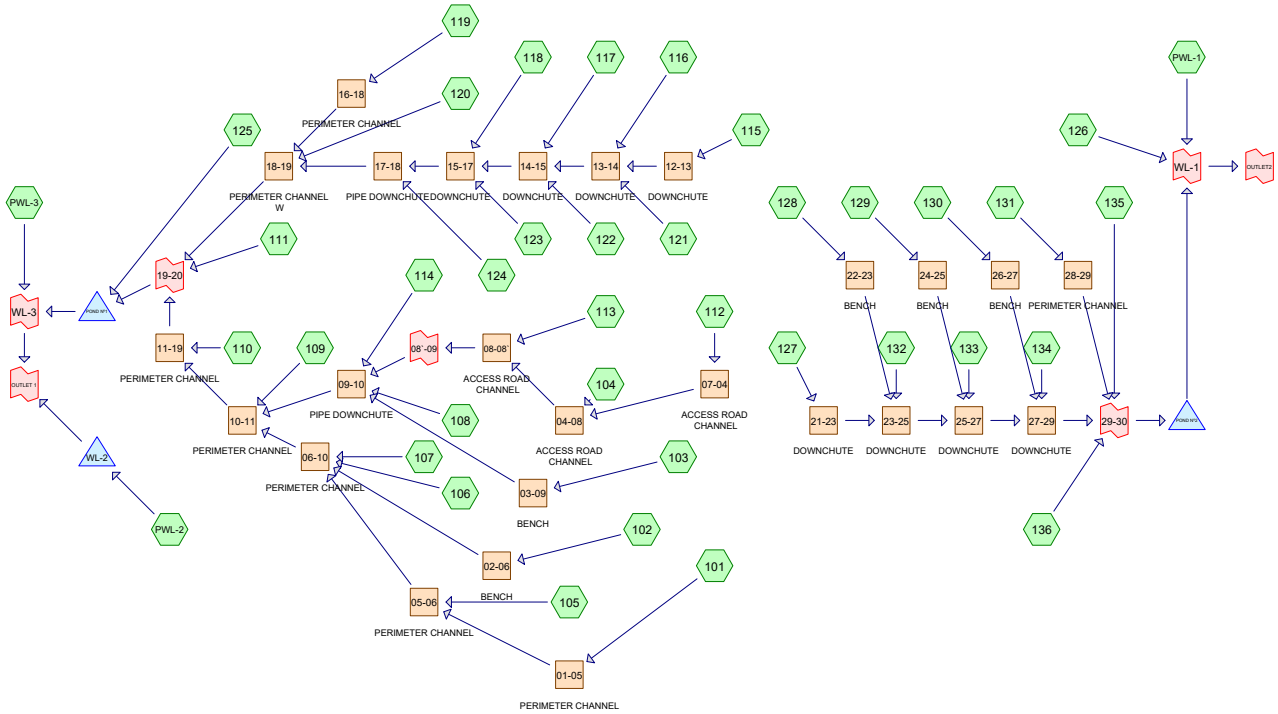
In order to check the height of leachate in the sand collection layer between pipes spaced every 100 feet, a method presented in Groundwater and Seepage by M. E. Harr, which accounts for continual vertical leachate seepage into the system, was utilized. The analysis is shown on pages L-2 and L-3 of Appendix D and the results indicate that leachate in the sand will rise to only about 3 inches for a sand with a hydraulic conductivity of 5×10^{-3} cm/sec or greater. This value has been specified on Drawing No. 19. The specified thickness of the collection layer is 18 inches.

14.) **Contingency Plan - Water Pollution Prevention and Abatement:**

A. The area surrounding the proposed HPP Landfill is served by the City of Baltimore municipal water supply providing fresh, potable water through a pressure distribution system. This supply will be unaffected by the proposed landfill.

B. Leachate will be pumped from sumps and discharged at the SCM Hawkins Point Plant (HPP) wastewater treatment facility operating under a NPDES permit. Leachate will not be stored at the HPP Landfill. Potential spills of leachate could possibly occur through leaking discharge lines between the pumps and HPP. As shown on Drawing No. 22, the discharge lines are located in prominent, easily observable locations, and leaks will be readily

ATTACHMENT 2
HYDROCAD RESULTS



Subcat Reach Pond Link

Drainage Diagram for 2011-5

Prepared by {enter your company name here} 3/9/2012

HydroCAD® 7.10 s/n 000663 © 2005 HydroCAD Software Solutions LLC

Time span=6.00-32.00 hrs, dt=0.05 hrs, 521 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 101: Runoff Area=1.330 ac Runoff Depth=1.15"
Flow Length=648' Tc=14.6 min CN=76 Runoff=1.94 cfs 0.128 af

Subcatchment 102: Runoff Area=1.280 ac Runoff Depth=1.15"
Flow Length=919' Tc=19.3 min CN=76 Runoff=1.61 cfs 0.123 af

Subcatchment 103: Runoff Area=1.230 ac Runoff Depth=1.15"
Flow Length=793' Tc=17.1 min CN=76 Runoff=1.66 cfs 0.118 af

Subcatchment 104: Runoff Area=0.930 ac Runoff Depth=1.15"
Flow Length=756' Tc=17.6 min CN=76 Runoff=1.23 cfs 0.089 af

Subcatchment 105: Runoff Area=0.930 ac Runoff Depth=1.15"
Flow Length=507' Tc=4.9 min CN=76 Runoff=1.93 cfs 0.089 af

Subcatchment 106: Runoff Area=1.400 ac Runoff Depth=1.15"
Flow Length=908' Tc=4.8 min CN=76 Runoff=2.92 cfs 0.134 af

Subcatchment 107: Runoff Area=1.600 ac Runoff Depth=1.15"
Flow Length=840' Tc=18.2 min CN=76 Runoff=2.08 cfs 0.154 af

Subcatchment 108: Runoff Area=1.100 ac Runoff Depth=1.15"
Flow Length=682' Tc=15.2 min CN=76 Runoff=1.58 cfs 0.106 af

Subcatchment 109: Runoff Area=0.290 ac Runoff Depth=1.15"
Flow Length=216' Tc=4.2 min CN=76 Runoff=0.62 cfs 0.028 af

Subcatchment 110: Runoff Area=0.980 ac Runoff Depth=1.15"
Flow Length=510' Tc=5.6 min CN=76 Runoff=1.97 cfs 0.094 af

Subcatchment 111: Runoff Area=0.660 ac Runoff Depth=1.15"
Flow Length=283' Tc=3.6 min CN=76 Runoff=1.45 cfs 0.063 af

Subcatchment 112: Runoff Area=0.980 ac Runoff Depth=1.15"
Flow Length=426' Tc=6.0 min CN=76 Runoff=1.96 cfs 0.094 af

Subcatchment 113: Runoff Area=0.690 ac Runoff Depth=1.15"
Flow Length=270' Tc=2.5 min CN=76 Runoff=1.56 cfs 0.066 af

Subcatchment 114: Runoff Area=0.240 ac Runoff Depth=1.15"
Flow Length=207' Tc=1.1 min CN=76 Runoff=0.55 cfs 0.023 af

Subcatchment 115: Runoff Area=0.480 ac Runoff Depth=1.15"
Flow Length=292' Tc=26.1 min CN=76 Runoff=0.50 cfs 0.046 af

Subcatchment 116: Runoff Area=0.770 ac Runoff Depth=1.15"
Flow Length=446' Tc=11.7 min CN=76 Runoff=1.25 cfs 0.074 af

Subcatchment 117: Runoff Area=0.960 ac Runoff Depth=1.15"
Flow Length=637' Tc=14.1 min CN=76 Runoff=1.43 cfs 0.092 af

Subcatchment 118: Runoff Area=1.180 ac Runoff Depth=1.15"
Flow Length=776' Tc=16.8 min CN=76 Runoff=1.61 cfs 0.113 af

Subcatchment 119: Runoff Area=0.640 ac Runoff Depth=1.15"
Flow Length=419' Tc=9.8 min CN=76 Runoff=1.11 cfs 0.061 af

Subcatchment 120: Runoff Area=1.570 ac Runoff Depth=1.15"
Flow Length=720' Tc=4.0 min CN=76 Runoff=3.40 cfs 0.151 af

Subcatchment 121: Runoff Area=0.670 ac Runoff Depth=1.15"
Flow Length=336' Tc=9.6 min CN=76 Runoff=1.17 cfs 0.064 af

Subcatchment 122: Runoff Area=0.880 ac Runoff Depth=1.15"
Flow Length=559' Tc=12.6 min CN=76 Runoff=1.39 cfs 0.084 af

Subcatchment 123: Runoff Area=0.430 ac Runoff Depth=1.15"
Flow Length=381' Tc=9.0 min CN=76 Runoff=0.77 cfs 0.041 af

Subcatchment 124: Runoff Area=0.570 ac Runoff Depth=1.15"
Flow Length=374' Tc=2.8 min CN=76 Runoff=1.28 cfs 0.055 af

Subcatchment 125: Runoff Area=1.640 ac Runoff Depth=1.15"
Flow Length=998' Tc=9.8 min CN=76 Runoff=2.84 cfs 0.157 af

Subcatchment 126: Runoff Area=1.830 ac Runoff Depth=1.40"
Flow Length=1,074' Tc=1.1 min CN=80 Runoff=5.11 cfs 0.214 af

Subcatchment 127: Runoff Area=0.440 ac Runoff Depth=1.15"
Flow Length=318' Tc=9.6 min CN=76 Runoff=0.77 cfs 0.042 af

Subcatchment 128: Runoff Area=0.090 ac Runoff Depth=1.15"
Flow Length=150' Tc=4.9 min CN=76 Runoff=0.19 cfs 0.009 af

Subcatchment 129: Runoff Area=0.280 ac Runoff Depth=1.15"
Flow Length=239' Tc=6.5 min CN=76 Runoff=0.55 cfs 0.027 af

Subcatchment 130: Runoff Area=0.470 ac Runoff Depth=1.15"
Flow Length=329' Tc=8.3 min CN=76 Runoff=0.87 cfs 0.045 af

Subcatchment 131: Runoff Area=0.800 ac Runoff Depth=1.15"
Flow Length=404' Tc=4.4 min CN=76 Runoff=1.70 cfs 0.077 af

Subcatchment 132: Runoff Area=0.940 ac Runoff Depth=1.15"
Flow Length=514' Tc=12.0 min CN=76 Runoff=1.51 cfs 0.090 af

Subcatchment 133: Runoff Area=1.270 ac Runoff Depth=1.15"
Flow Length=655' Tc=14.7 min CN=76 Runoff=1.85 cfs 0.122 af

Subcatchment 134: Runoff Area=1.590 ac Runoff Depth=1.15"
Flow Length=765' Tc=16.8 min CN=76 Runoff=2.17 cfs 0.153 af

Subcatchment 135: Runoff Area=1.340 ac Runoff Depth=1.15"
Flow Length=796' Tc=4.8 min CN=76 Runoff=2.79 cfs 0.129 af

Subcatchment 136: Runoff Area=1.170 ac Runoff Depth=1.15"
Flow Length=533' Tc=2.6 min CN=76 Runoff=2.64 cfs 0.112 af

Subcatchment PWL-1: Runoff Area=6.490 ac Runoff Depth=0.69"
Flow Length=300' Tc=31.1 min CN=67 Runoff=3.05 cfs 0.372 af

Subcatchment PWL-2: Runoff Area=6.490 ac Runoff Depth=0.69"
Flow Length=300' Tc=31.1 min CN=67 Runoff=3.05 cfs 0.372 af

Subcatchment PWL-3: Runoff Area=3.780 ac Runoff Depth=0.69"
Flow Length=300' Tc=17.9 min CN=67 Runoff=2.58 cfs 0.216 af

Reach 01-05: PERIMETER CHANNEL Peak Depth=0.23' Max Vel=2.6 fps Inflow=1.94 cfs 0.128 af
n=0.014 L=420.5' S=0.0050 '/' Capacity=48.31 cfs Outflow=1.87 cfs 0.128 af

Reach 02-06: BENCH Peak Depth=0.39' Max Vel=2.0 fps Inflow=1.61 cfs 0.123 af
n=0.045 L=818.0' S=0.0346 '/' Capacity=50.43 cfs Outflow=1.39 cfs 0.123 af

Reach 03-09: BENCH Peak Depth=0.40' Max Vel=1.9 fps Inflow=1.66 cfs 0.118 af
n=0.045 L=740.4' S=0.0300 '/' Capacity=46.95 cfs Outflow=1.42 cfs 0.118 af

Reach 04-08: ACCESS ROAD CHANNEL Peak Depth=0.15' Max Vel=8.3 fps Inflow=2.75 cfs 0.183 af
n=0.014 L=217.8' S=0.0872 '/' Capacity=146.64 cfs Outflow=2.70 cfs 0.183 af

Reach 05-06: PERIMETER CHANNEL Peak Depth=0.23' Max Vel=3.1 fps Inflow=2.57 cfs 0.217 af
n=0.014 L=886.1' S=0.0070 '/' Capacity=57.18 cfs Outflow=2.28 cfs 0.217 af

Reach 06-10: PERIMETER CHANNEL Peak Depth=0.37' Max Vel=4.4 fps Inflow=5.51 cfs 0.628 af
n=0.014 L=121.6' S=0.0085 '/' Capacity=62.91 cfs Outflow=5.50 cfs 0.628 af

Reach 07-04: ACCESS ROAD CHANNEL Peak Depth=0.11' Max Vel=8.0 fps Inflow=1.96 cfs 0.094 af
n=0.014 L=153.5' S=0.1173 '/' Capacity=170.02 cfs Outflow=1.93 cfs 0.094 af

Reach 08-08`: ACCESS ROAD CHANNEL Peak Depth=0.17' Max Vel=9.8 fps Inflow=3.74 cfs 0.250 af
n=0.014 L=190.2' S=0.1073 '/' Capacity=162.60 cfs Outflow=3.66 cfs 0.250 af

Reach 09-10: PIPE DOWNCHUTE Peak Depth=0.29' Max Vel=15.0 fps Inflow=5.26 cfs 0.496 af
D=36.0" n=0.014 L=154.6' S=0.1897 '/' Capacity=269.76 cfs Outflow=5.26 cfs 0.496 af

Reach 10-11: PERIMETER CHANNEL Peak Depth=0.55' Max Vel=3.5 fps Inflow=11.06 cfs 1.152 af
n=0.014 L=482.0' S=0.0030 '/' Capacity=69.51 cfs Outflow=10.73 cfs 1.152 af

Reach 11-19: PERIMETER CHANNEL Peak Depth=0.58' Max Vel=3.6 fps Inflow=11.68 cfs 1.246 af
n=0.014 L=71.8' S=0.0031 '/' Capacity=70.15 cfs Outflow=11.63 cfs 1.246 af

Reach 12-13: DOWNCHUTE Peak Depth=0.04' Max Vel=2.8 fps Inflow=0.50 cfs 0.046 af
n=0.028 L=124.2' S=0.2013 '/' Capacity=336.95 cfs Outflow=0.50 cfs 0.046 af

Reach 13-14: DOWNCHUTE Peak Depth=0.11' Max Vel=5.3 fps Inflow=2.64 cfs 0.184 af
n=0.028 L=146.8' S=0.2112 '/' Capacity=345.13 cfs Outflow=2.61 cfs 0.184 af

Reach 14-15: DOWNCHUTE Peak Depth=0.11' Max Vel=5.3 fps Inflow=5.41 cfs 0.361 af
n=0.028 L=141.3' S=0.2088 '/' Capacity=686.32 cfs Outflow=5.33 cfs 0.361 af

Reach 15-17: DOWNCHUTE Peak Depth=0.21' Max Vel=7.4 fps Inflow=7.52 cfs 0.516 af
n=0.028 L=189.9' S=0.1975 '/' Capacity=333.74 cfs Outflow=7.38 cfs 0.516 af

Reach 16-18: PERIMETER CHANNEL Peak Depth=0.08' Max Vel=4.4 fps Inflow=1.11 cfs 0.061 af
n=0.014 L=637.5' S=0.0521 '/' Capacity=156.00 cfs Outflow=1.05 cfs 0.061 af

Reach 17-18: PIPE DOWNCHUTE Peak Depth=0.43' Max Vel=12.3 fps Inflow=7.60 cfs 0.570 af
D=36.0" n=0.014 L=120.1' S=0.0791 '/' Capacity=174.19 cfs Outflow=7.59 cfs 0.570 af

Reach 18-19: PERIMETER CHANNEL W Peak Depth=0.26' Max Vel=5.3 fps Inflow=9.95 cfs 0.782 af
n=0.014 L=216.2' S=0.0162 '/' Capacity=187.26 cfs Outflow=9.76 cfs 0.782 af

Reach 21-23: DOWNCHUTE Peak Depth=0.05' Max Vel=3.6 fps Inflow=0.77 cfs 0.042 af
n=0.028 L=144.7' S=0.2626 '/' Capacity=384.87 cfs Outflow=0.75 cfs 0.042 af

Reach 22-23: BENCH Peak Depth=0.16' Max Vel=1.1 fps Inflow=0.19 cfs 0.009 af
n=0.045 L=454.4' S=0.0352 '/' Capacity=50.87 cfs Outflow=0.14 cfs 0.009 af

Reach 23-25: DOWNCHUTE Peak Depth=0.10' Max Vel=5.4 fps Inflow=2.36 cfs 0.141 af
n=0.028 L=144.0' S=0.2569 '/' Capacity=380.70 cfs Outflow=2.32 cfs 0.141 af

Reach 24-25: BENCH Peak Depth=0.25' Max Vel=1.5 fps Inflow=0.55 cfs 0.027 af
n=0.045 L=594.2' S=0.0337 '/' Capacity=49.74 cfs Outflow=0.41 cfs 0.027 af

Reach 25-27: DOWNCHUTE Peak Depth=0.14' Max Vel=6.9 fps Inflow=4.45 cfs 0.290 af
n=0.028 L=127.2' S=0.2752 '/' Capacity=393.96 cfs Outflow=4.39 cfs 0.290 af

Reach 26-27: BENCH Peak Depth=0.30' Max Vel=1.6 fps Inflow=0.87 cfs 0.045 af
n=0.045 L=704.7' S=0.0312 '/' Capacity=47.90 cfs Outflow=0.64 cfs 0.045 af

Reach 27-29: DOWNCHUTE Peak Depth=0.18' Max Vel=8.2 fps Inflow=6.97 cfs 0.488 af
n=0.028 L=25.7' S=0.2918 '/' Capacity=405.72 cfs Outflow=6.96 cfs 0.488 af

Reach 28-29: PERIMETER CHANNEL Peak Depth=0.18' Max Vel=2.6 fps Inflow=1.70 cfs 0.077 af
n=0.014 L=751.8' S=0.0067 '/' Capacity=55.92 cfs Outflow=1.36 cfs 0.077 af

Pond POND Nº1: Peak Elev=25.30' Storage=0.894 af Inflow=24.44 cfs 2.249 af
Outflow=5.76 cfs 1.970 af

Pond POND Nº2:	Peak Elev=36.22' Storage=0.634 af	Inflow=10.04 cfs 0.805 af Outflow=0.32 cfs 0.217 af
Pond WL-2:	Peak Elev=36.68' Storage=0.372 af	Inflow=3.05 cfs 0.372 af Outflow=0.00 cfs 0.000 af
Link 08`-09:		Inflow=3.66 cfs 0.250 af Primary=3.66 cfs 0.250 af
Link 19-20:		Inflow=21.70 cfs 2.092 af Primary=21.70 cfs 2.092 af
Link 29-30:		Inflow=10.04 cfs 0.805 af Primary=10.04 cfs 0.805 af
Link OUTLET 1:		Inflow=6.32 cfs 2.187 af Primary=6.32 cfs 2.187 af
Link OUTLET2:		Inflow=5.27 cfs 0.802 af Primary=5.27 cfs 0.802 af
Link WL-1:		Inflow=5.27 cfs 0.802 af Primary=5.27 cfs 0.802 af
Link WL-3:		Inflow=6.32 cfs 2.187 af Primary=6.32 cfs 2.187 af

Total Runoff Area = 50.410 ac Runoff Volume = 4.228 af Average Runoff Depth = 1.01"

Subcatchment 101:

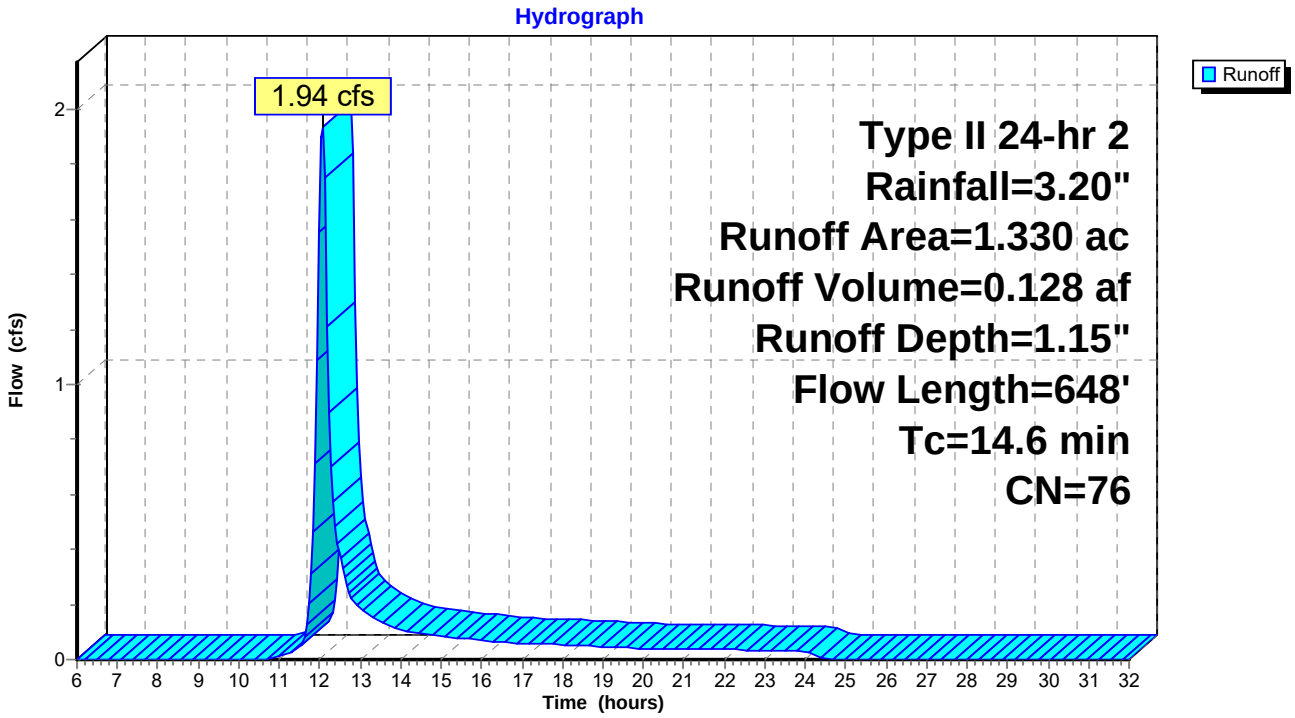
Runoff = 1.94 cfs @ 12.08 hrs, Volume= 0.128 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
1.330	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	99	0.3330	0.4		**Sheet Flow, Overland Flow** n= 0.200 P2= 3.20"
10.6	549	0.0300	0.9		**Shallow Concentrated Flow, BENCH** Kv= 5.0 fps
14.6	648	Total			

Subcatchment 101:



Subcatchment 102:

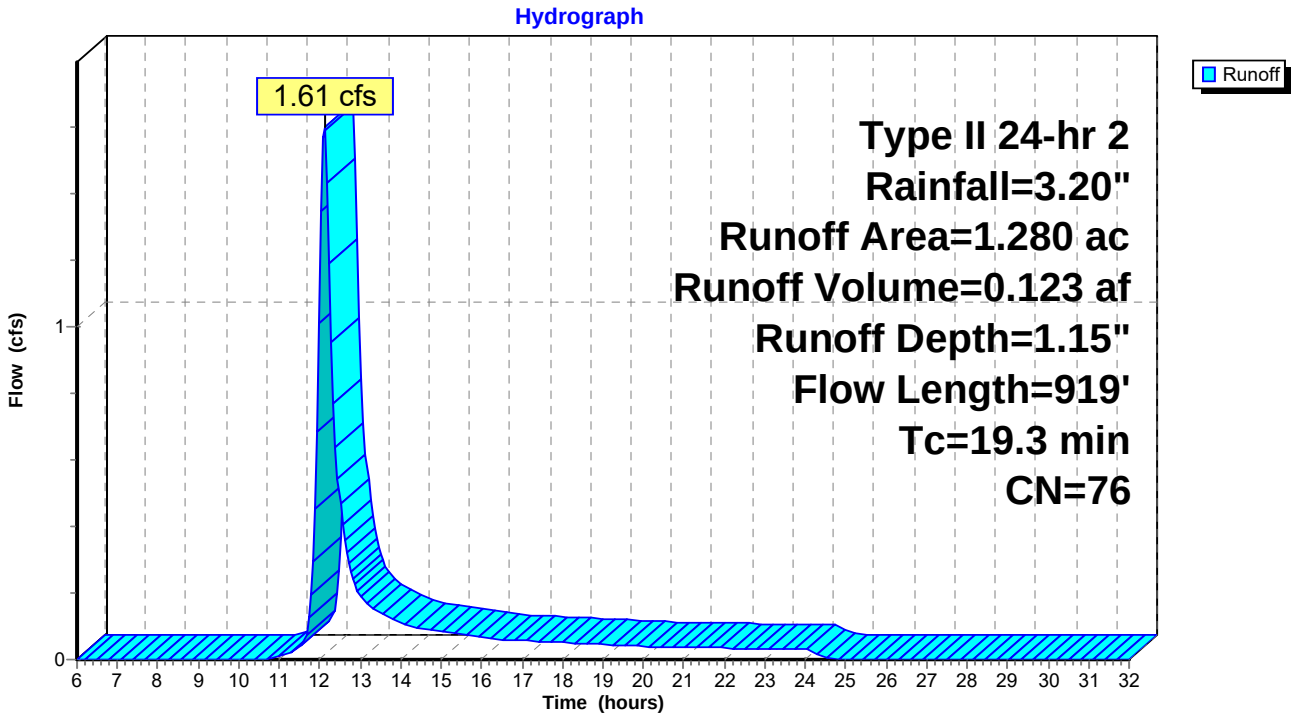
Runoff = 1.61 cfs @ 12.13 hrs, Volume= 0.123 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
1.280	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	67	0.3330	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
16.4	852	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
19.3	919	Total			

Subcatchment 102:



Subcatchment 103:

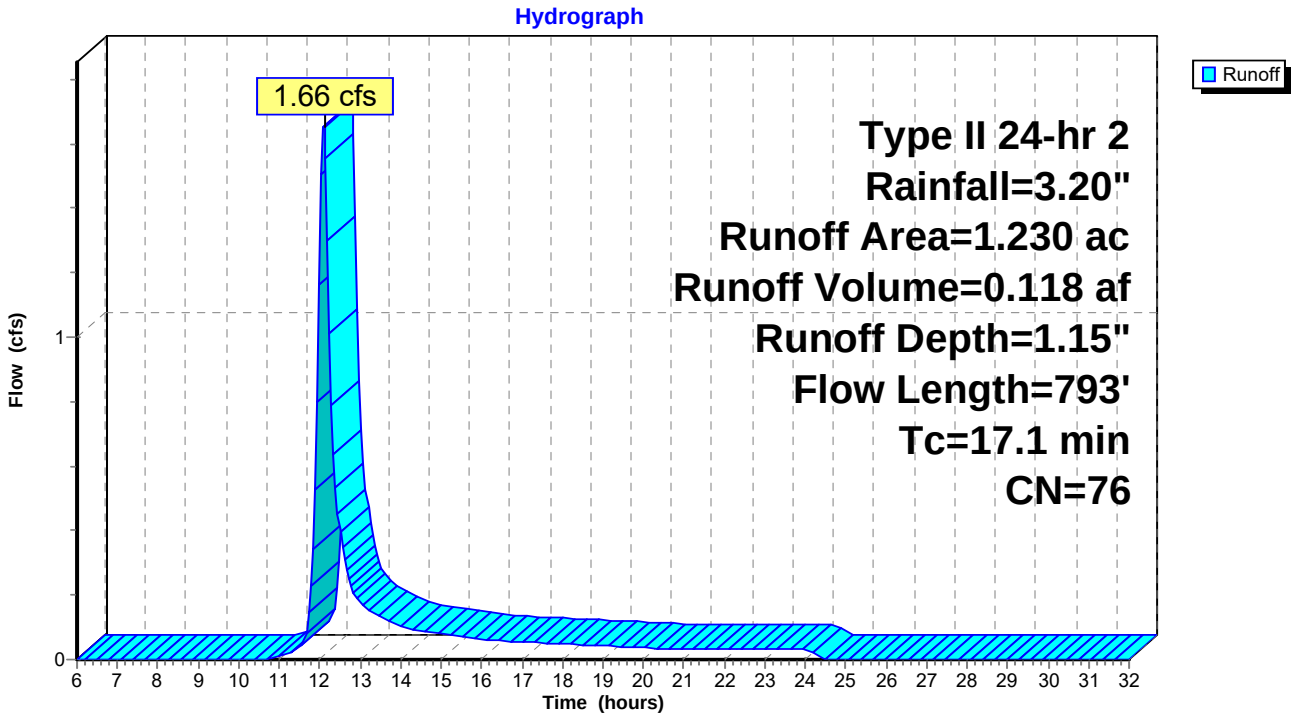
Runoff = 1.66 cfs @ 12.10 hrs, Volume= 0.118 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
1.230	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	77	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
13.8	716	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
17.1	793	Total			

Subcatchment 103:



Subcatchment 104:

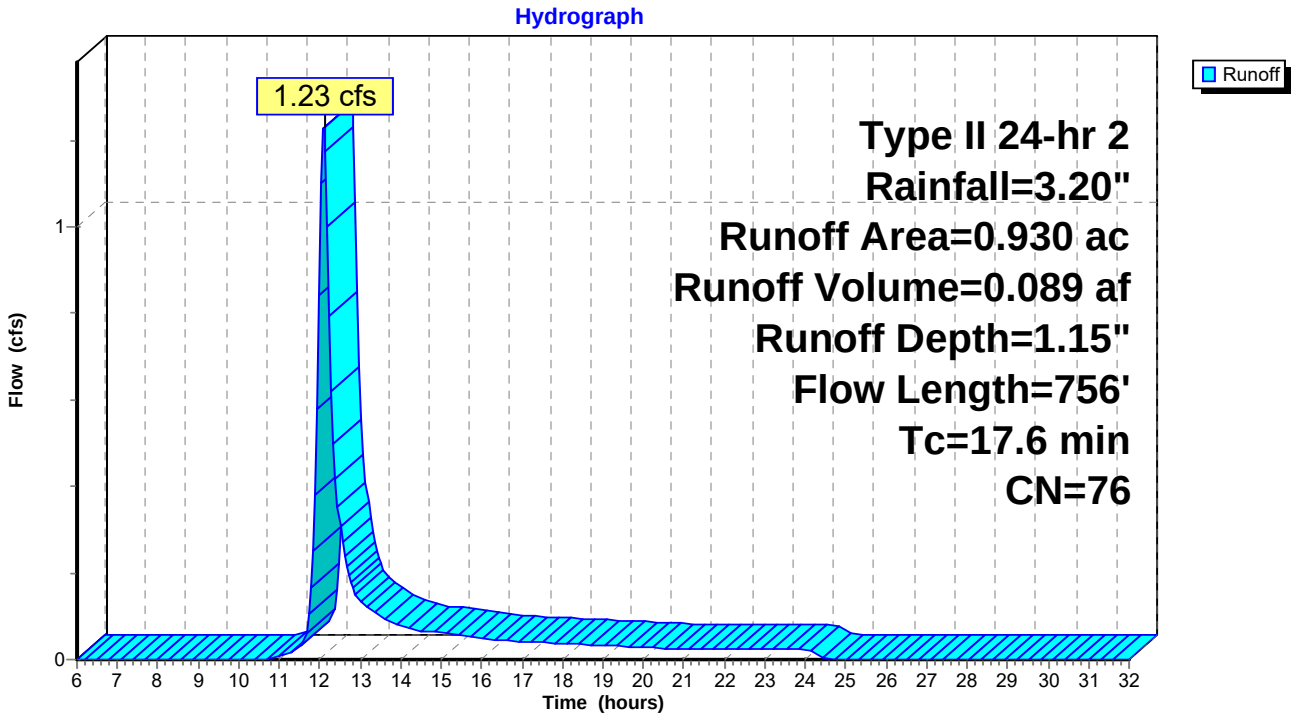
Runoff = 1.23 cfs @ 12.11 hrs, Volume= 0.089 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.930	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1900	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
12.6	656	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
17.6	756	Total			

Subcatchment 104:



Subcatchment 105:

[49] Hint: Tc<2dt may require smaller dt

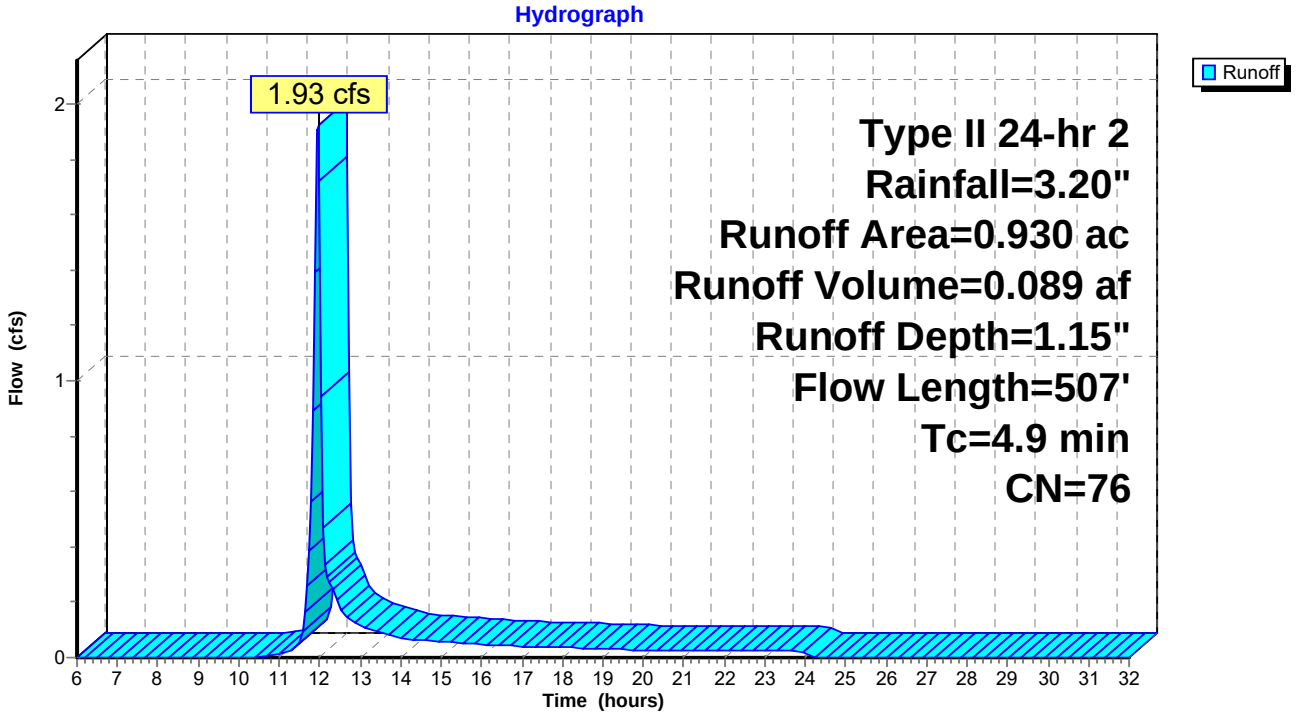
Runoff = 1.93 cfs @ 11.96 hrs, Volume= 0.089 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.930	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.9	407	0.0050	7.2	48.34	**Trap/Vee/Rect Channel Flow, PERIMETRAL CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.9	507	Total			

Subcatchment 105:



Subcatchment 106:

[49] Hint: Tc<2dt may require smaller dt

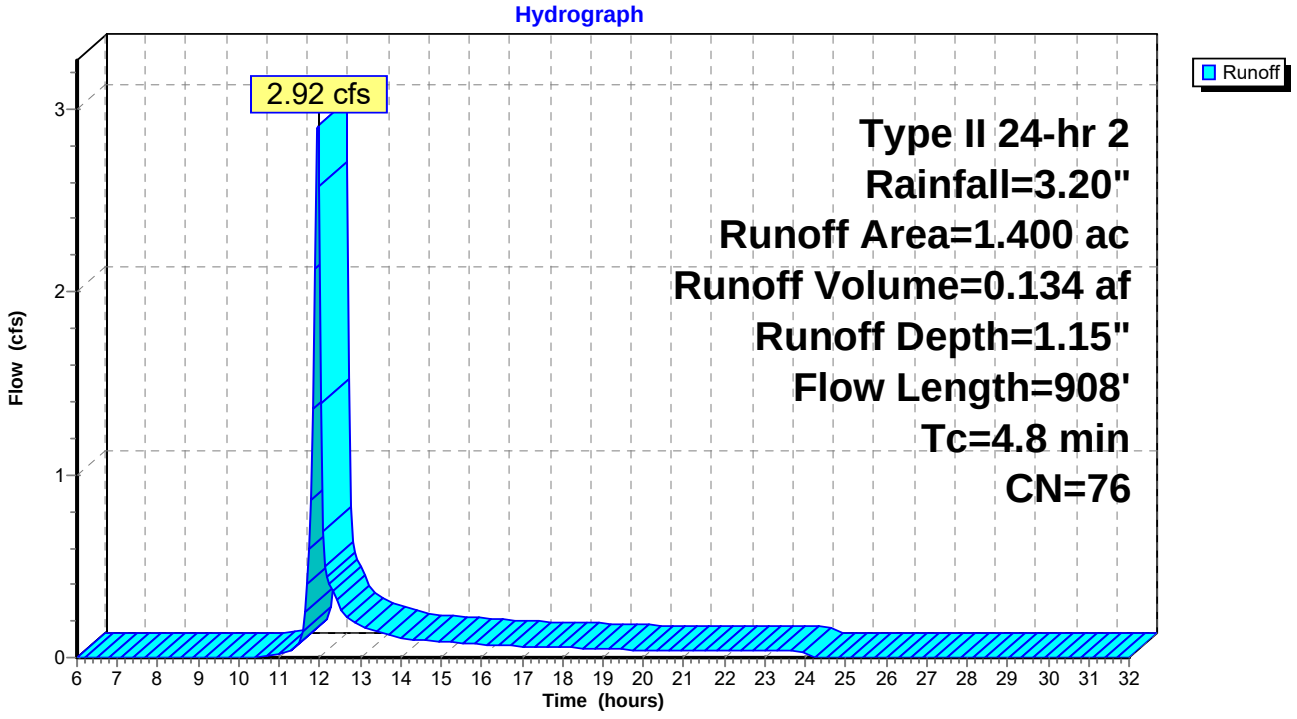
Runoff = 2.92 cfs @ 11.96 hrs, Volume= 0.134 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
1.400	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	74	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
1.6	834	0.0070	8.5	57.19	**Trap/Vee/Rect Channel Flow, PERIMETRAL CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.8	908	Total			

Subcatchment 106:



Subcatchment 107:

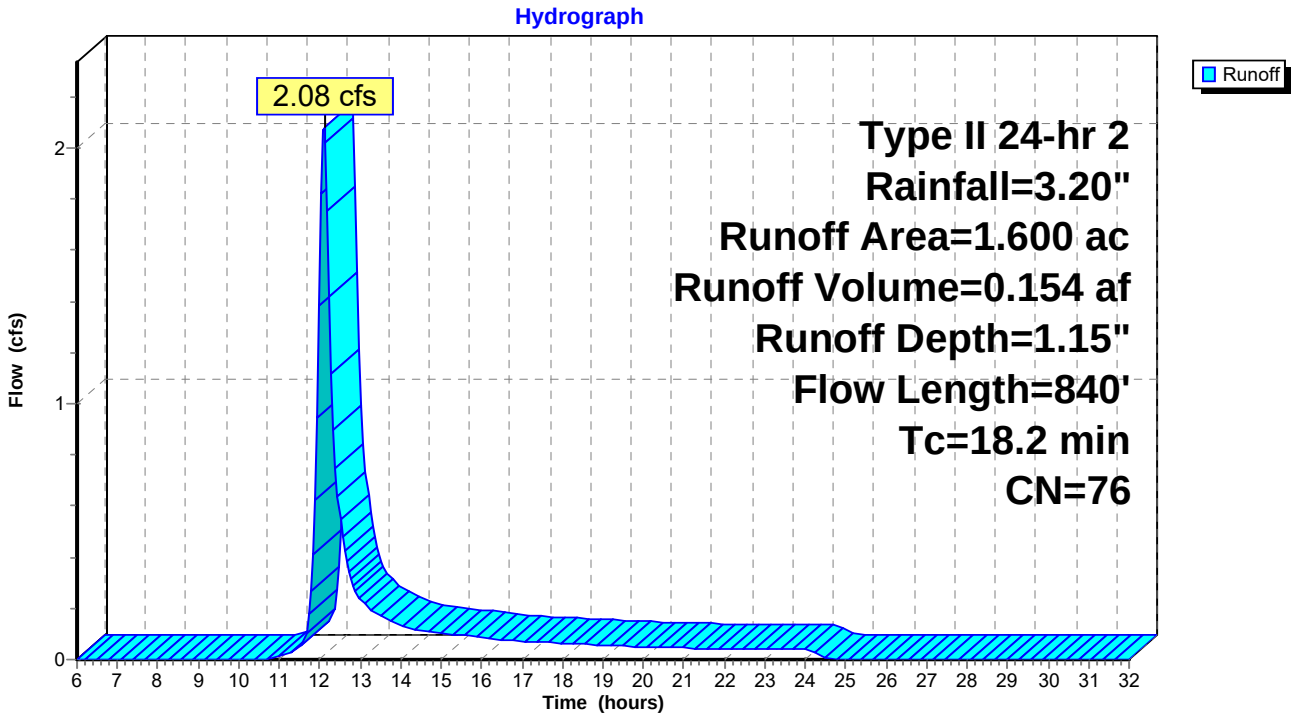
Runoff = 2.08 cfs @ 12.12 hrs, Volume= 0.154 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
1.600	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	94	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
14.4	746	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
18.2	840	Total			

Subcatchment 107:



Subcatchment 108:

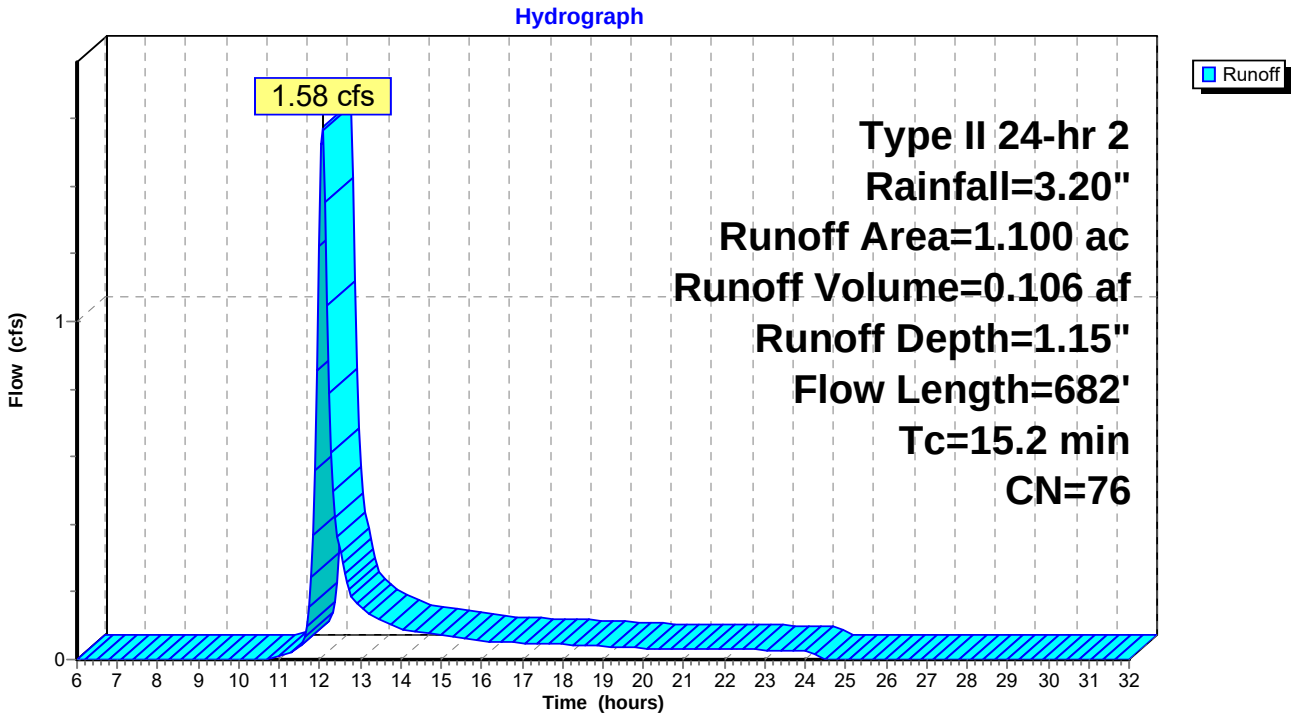
Runoff = 1.58 cfs @ 12.08 hrs, Volume= 0.106 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
1.100	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
11.2	582	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
15.2	682	Total			

Subcatchment 108:



Subcatchment 109:

[49] Hint: Tc<2dt may require smaller dt

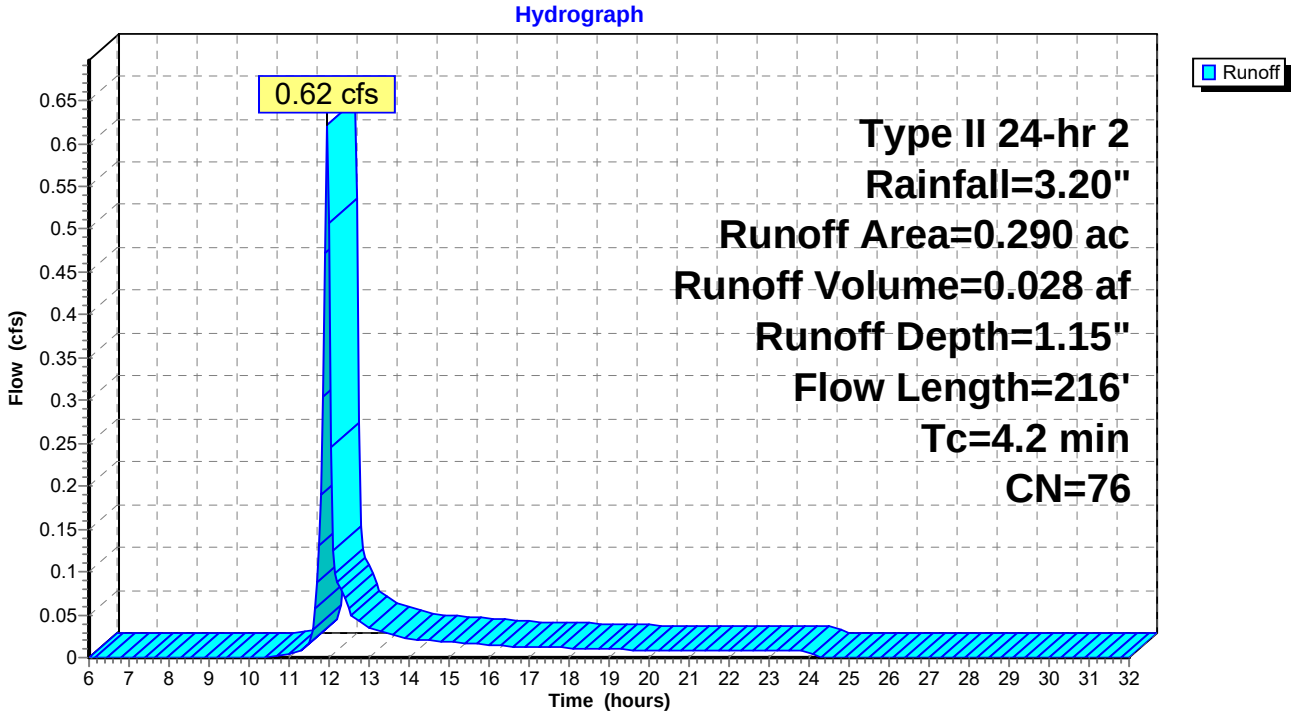
Runoff = 0.62 cfs @ 11.95 hrs, Volume= 0.028 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.290	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	94	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.4	122	0.0030	5.5	37.44	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.2	216	Total			

Subcatchment 109:



Subcatchment 110:

[49] Hint: Tc<2dt may require smaller dt

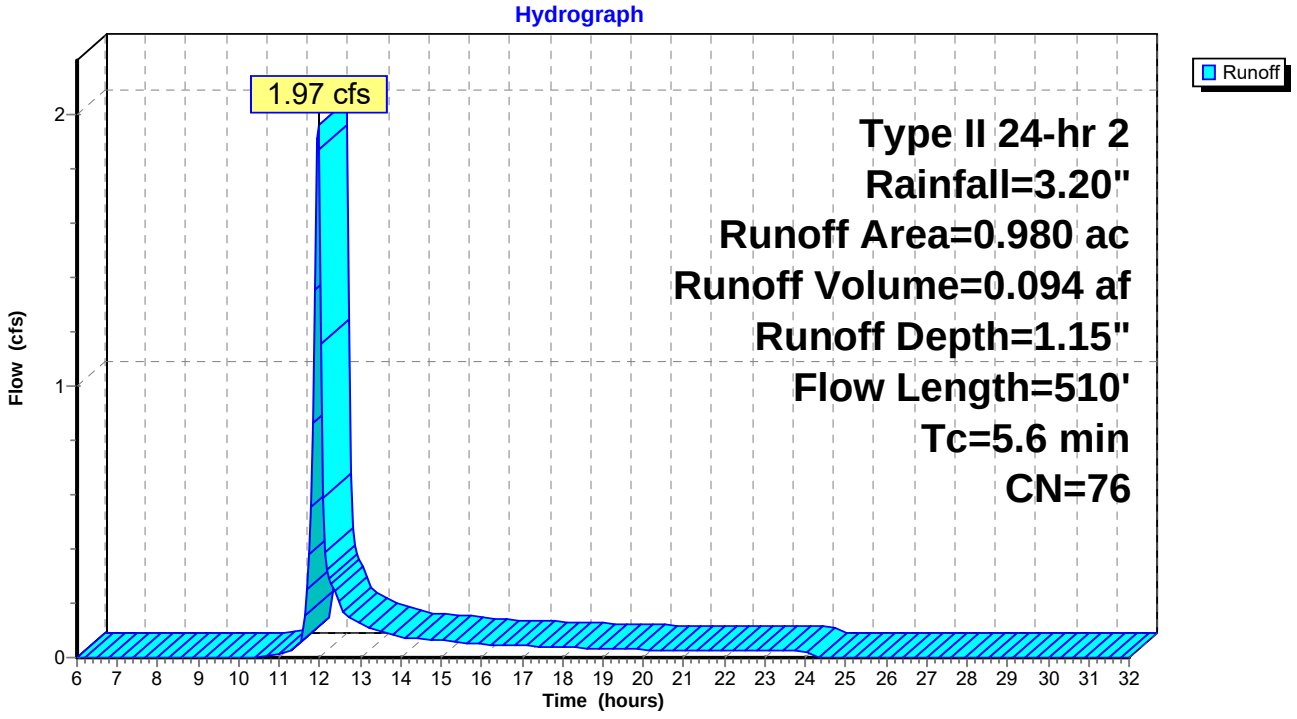
Runoff = 1.97 cfs @ 11.97 hrs, Volume= 0.094 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.980	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	84	0.2000	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
1.3	426	0.0030	5.5	37.44	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
5.6	510	Total			

Subcatchment 110:



Subcatchment 111:

[49] Hint: Tc<2dt may require smaller dt

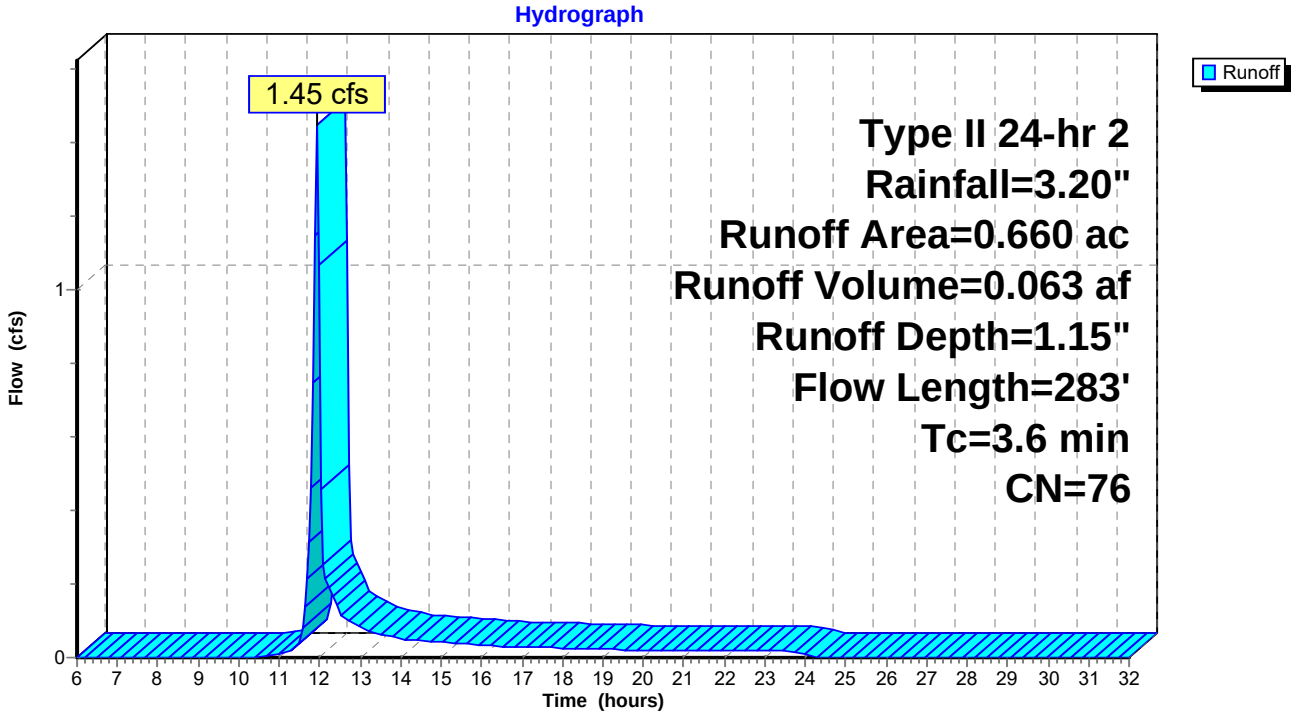
Runoff = 1.45 cfs @ 11.95 hrs, Volume= 0.063 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.660	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	67	0.2200	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.2	216	0.0310	20.3	259.13	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL W** Bot.W=7.00' D=1.50' Z= 1.0 '/' Top.W=10.00' n= 0.014
3.6	283	Total			

Subcatchment 111:



Subcatchment 112:

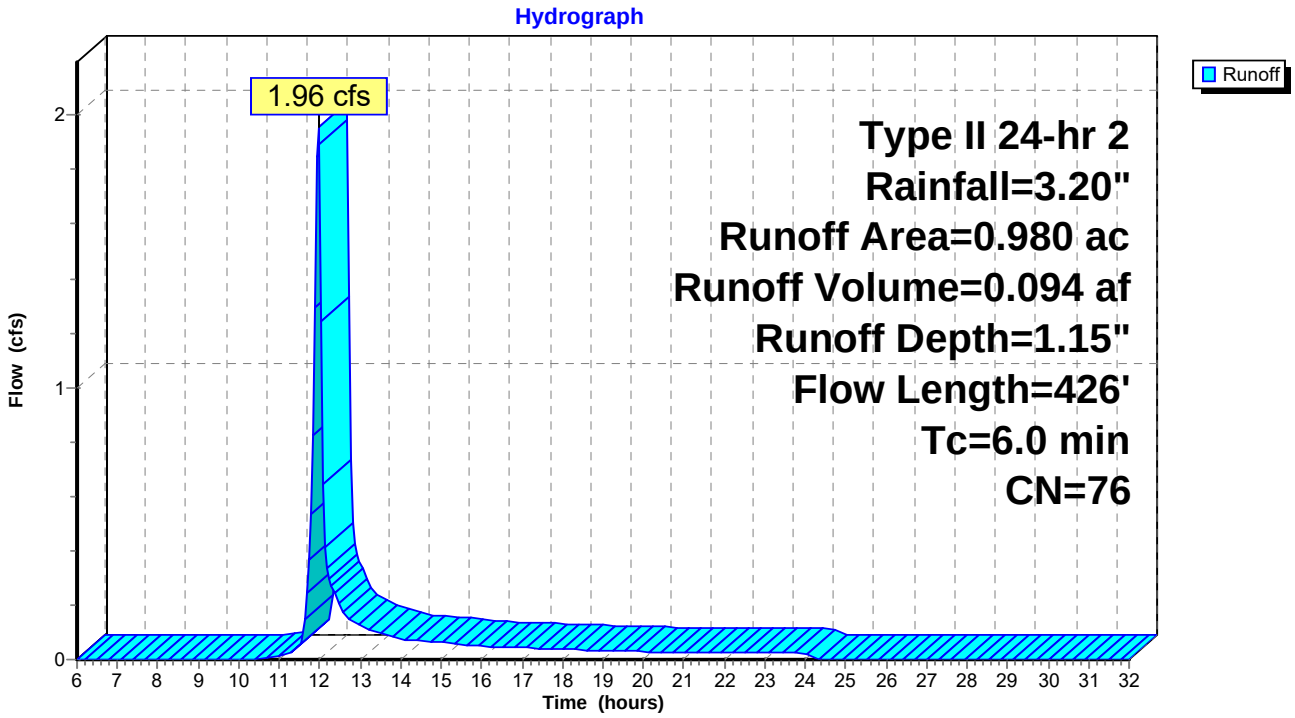
Runoff = 1.96 cfs @ 11.98 hrs, Volume= 0.094 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.980	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.1300	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.2	326	0.1060	30.8	161.65	**Trap/Vee/Rect Channel Flow, ACCES ROAD CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
6.0	426	Total			

Subcatchment 112:



Subcatchment 113:

[49] Hint: Tc<2dt may require smaller dt

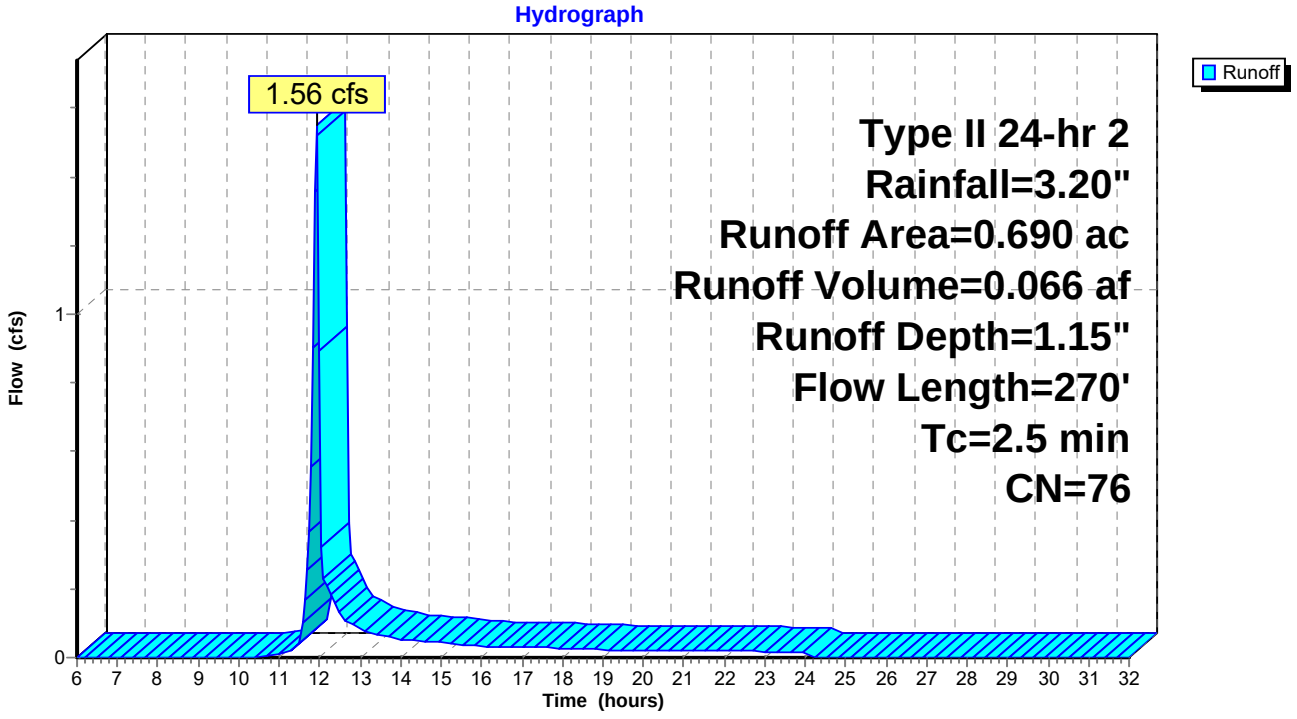
Runoff = 1.56 cfs @ 11.94 hrs, Volume= 0.066 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.690	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	52	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.1	218	0.0950	29.1	153.03	**Trap/Vee/Rect Channel Flow, ACCESS ROAD CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
2.5	270	Total			

Subcatchment 113:



Subcatchment 114:

[49] Hint: Tc<2dt may require smaller dt

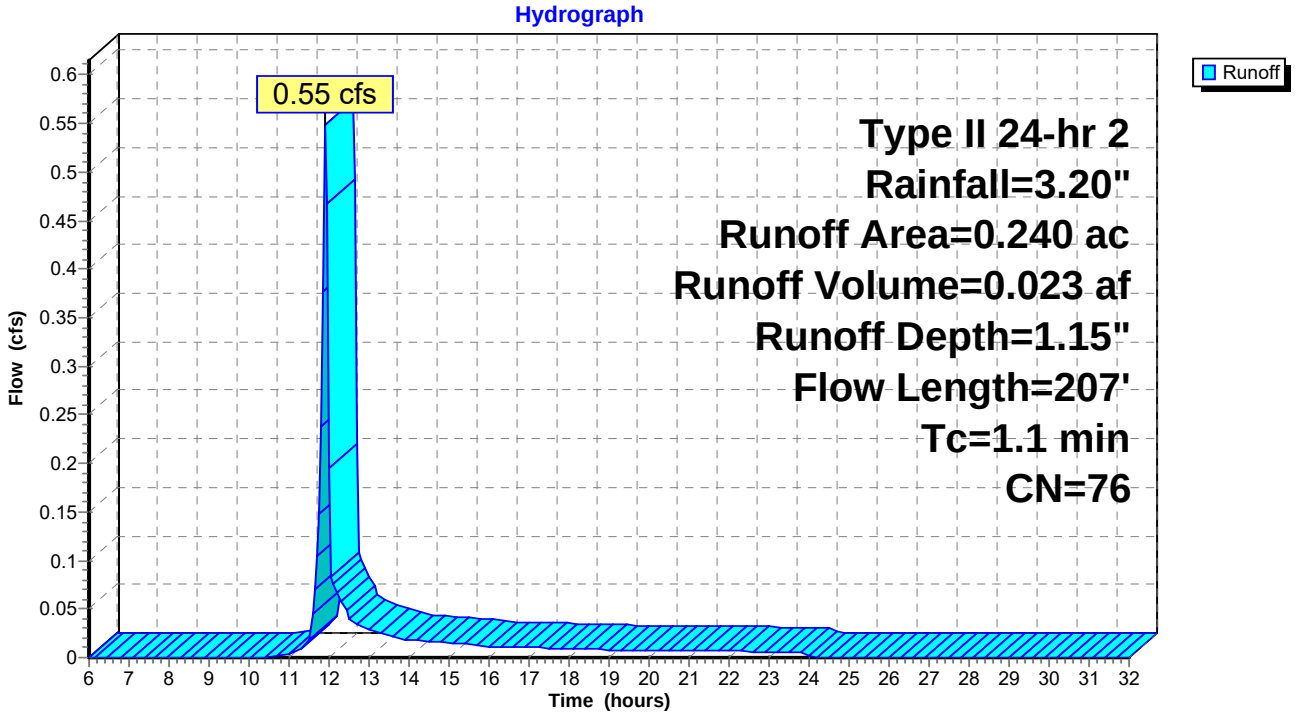
Runoff = 0.55 cfs @ 11.91 hrs, Volume= 0.023 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.240	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	17	0.3300	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.1	190	0.1050	30.6	160.88	**Trap/Vee/Rect Channel Flow, ACCESS ROAD CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
1.1	207	Total			

Subcatchment 114:



Subcatchment 115:

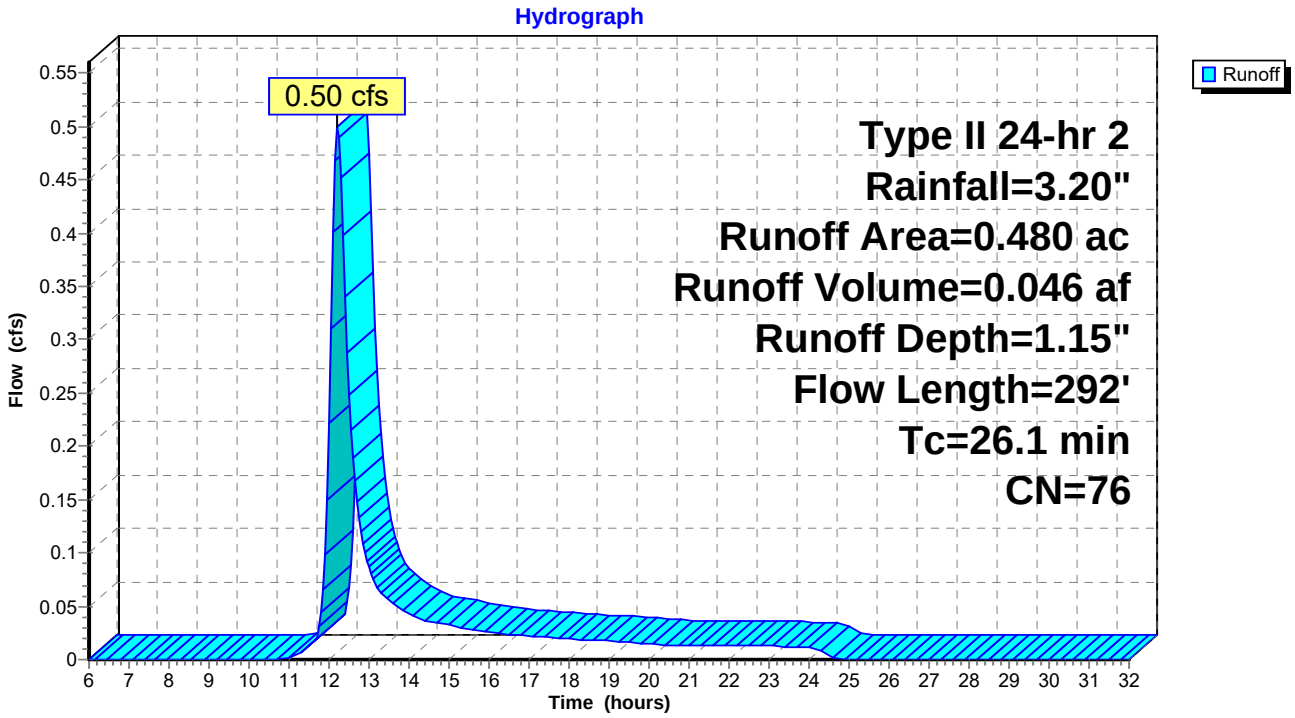
Runoff = 0.50 cfs @ 12.21 hrs, Volume= 0.046 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.480	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	74	0.0100	0.1		**Sheet Flow,** n= 0.200 P2= 3.20"
13.3	218	0.0030	0.3		**Shallow Concentrated Flow, DIVERSION BERM FLOW** Kv= 5.0 fps
26.1	292	Total			

Subcatchment 115:



Subcatchment 116:

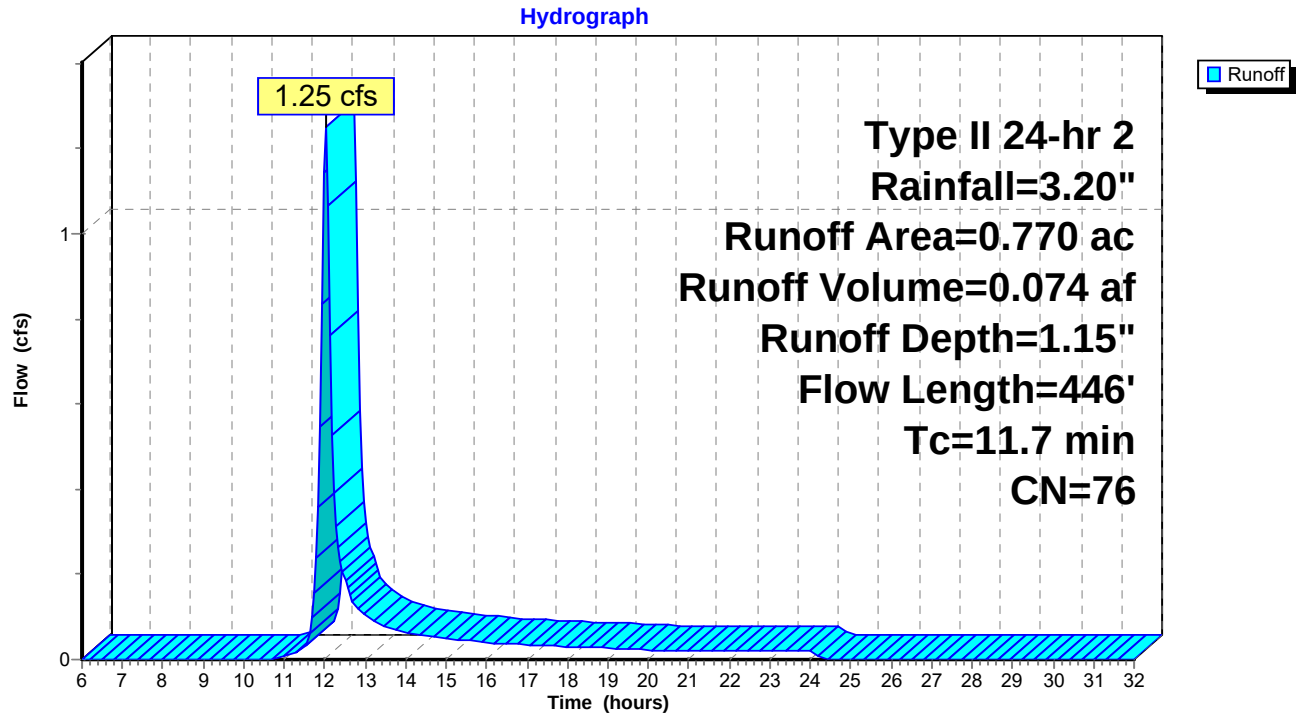
Runoff = 1.25 cfs @ 12.04 hrs, Volume= 0.074 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.770	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1600	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
6.3	346	0.0330	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
11.7	446	Total			

Subcatchment 116:



Subcatchment 117:

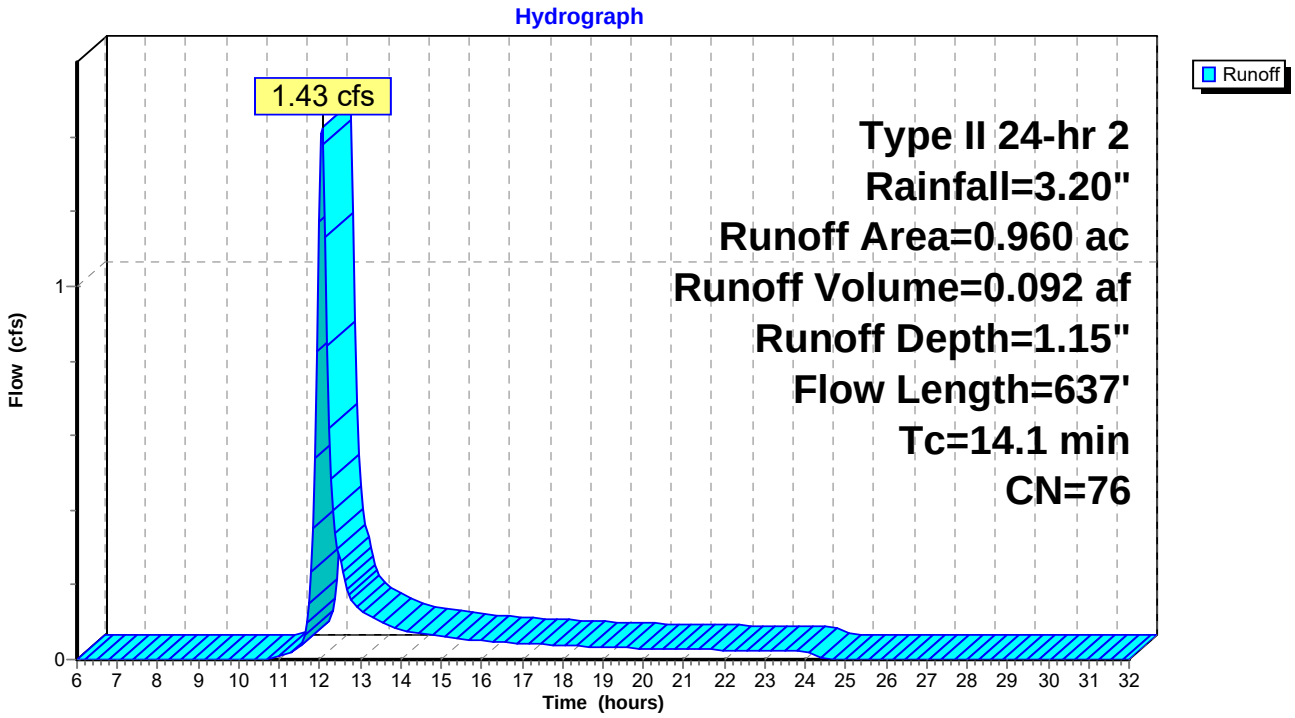
Runoff = 1.43 cfs @ 12.07 hrs, Volume= 0.092 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.960	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	82	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
10.7	555	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
14.1	637	Total			

Subcatchment 117:



Subcatchment 118:

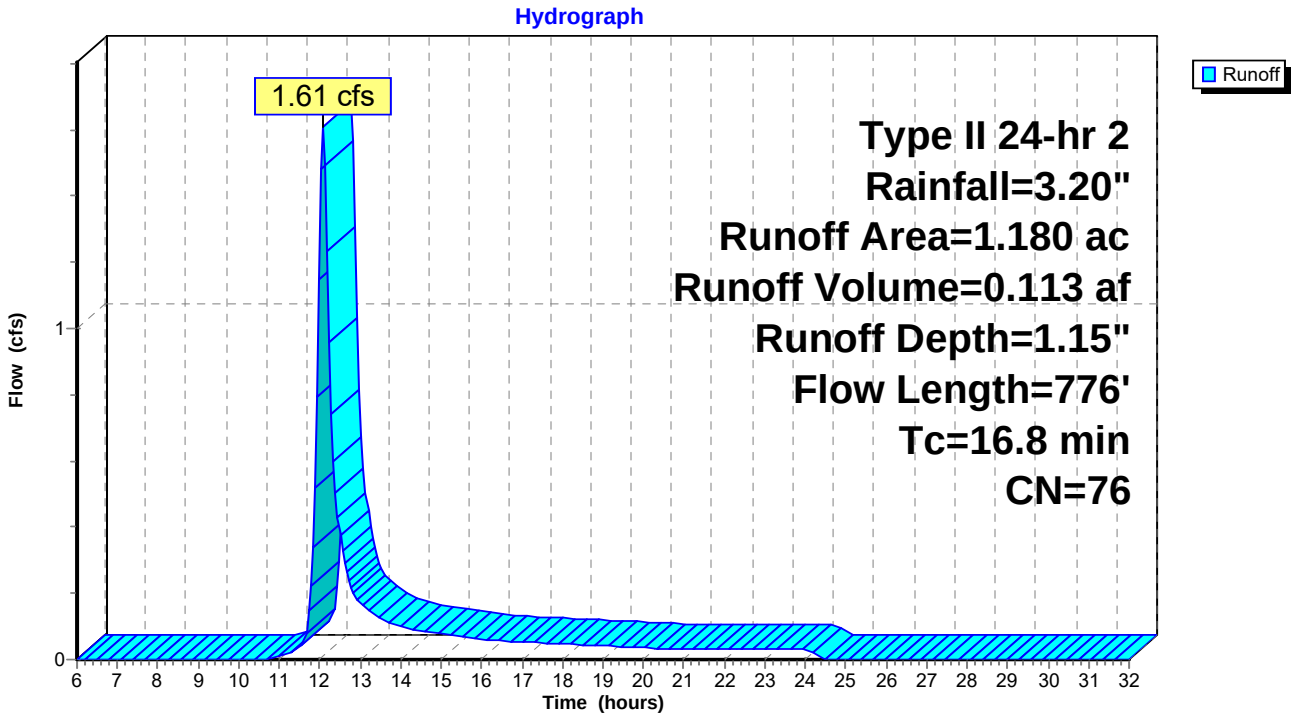
Runoff = 1.61 cfs @ 12.10 hrs, Volume= 0.113 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
1.180	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	80	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
13.4	696	0.0300	0.9		**Shallow Concentrated Flow,** Kv= 5.0 fps
16.8	776	Total			

Subcatchment 118:



Subcatchment 119:

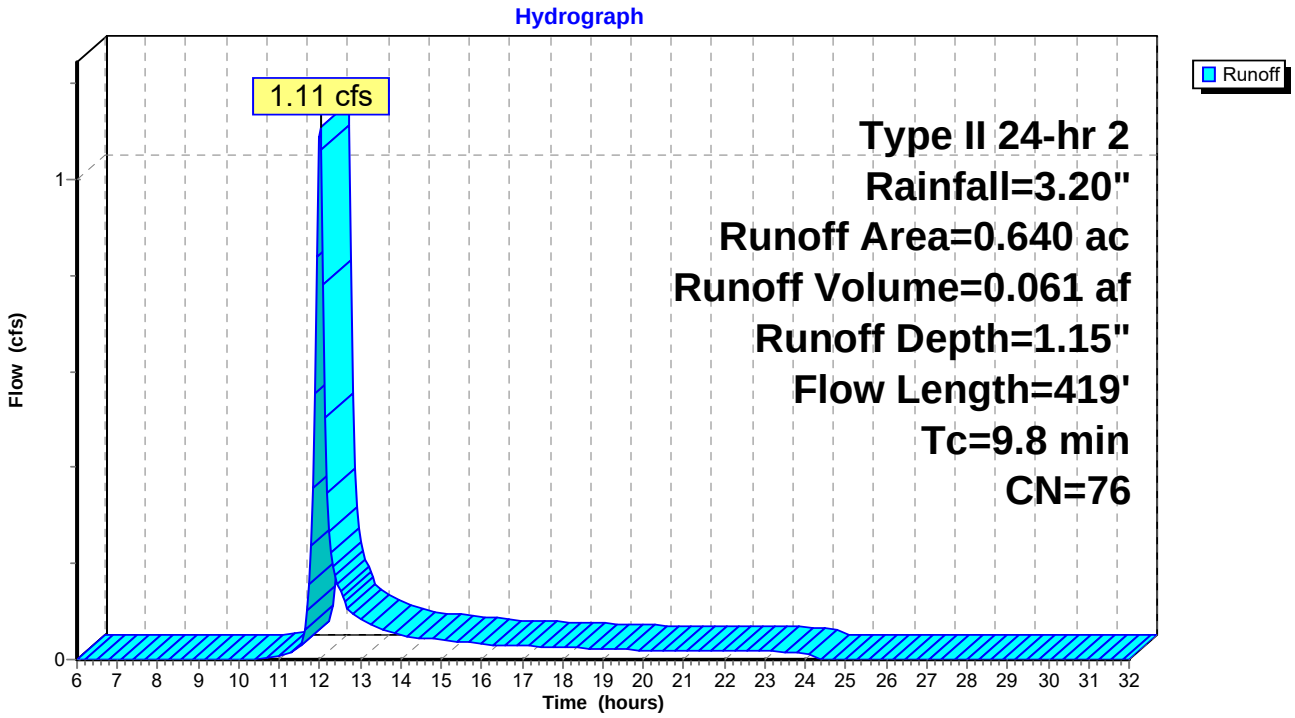
Runoff = 1.11 cfs @ 12.02 hrs, Volume= 0.061 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.640	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	79	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
6.5	340	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.8	419	Total			

Subcatchment 119:



Subcatchment 120:

[49] Hint: Tc<2dt may require smaller dt

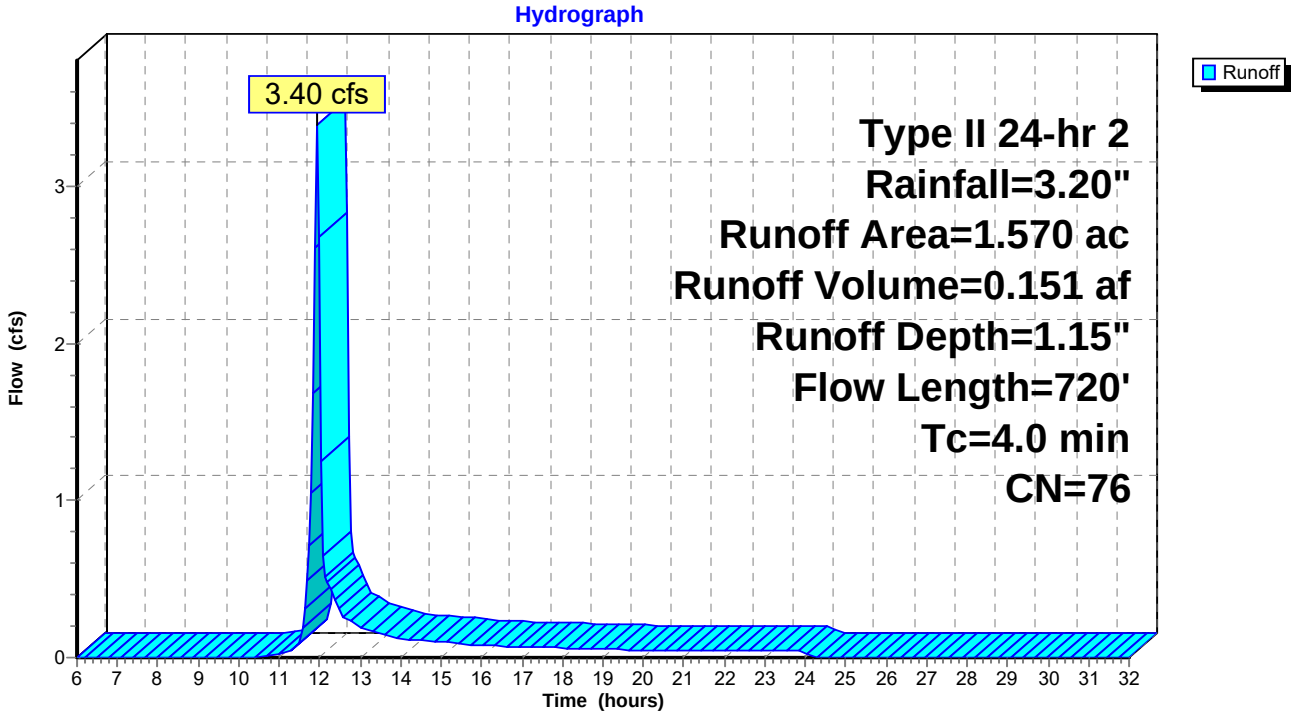
Runoff = 3.40 cfs @ 11.95 hrs, Volume= 0.151 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
1.570	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	83	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.5	637	0.0500	22.6	152.86	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.0	720	Total			

Subcatchment 120:



Subcatchment 121:

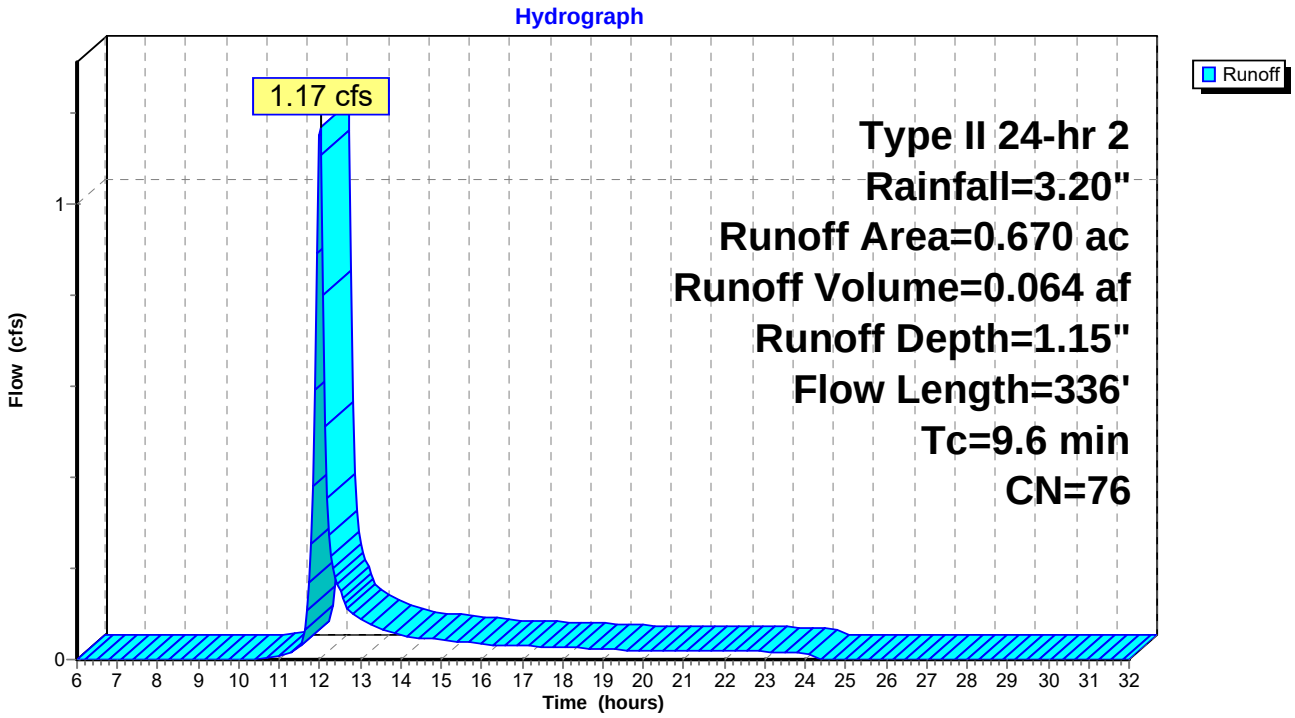
Runoff = 1.17 cfs @ 12.02 hrs, Volume= 0.064 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.670	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1600	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
4.2	236	0.0350	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.6	336	Total			

Subcatchment 121:



Subcatchment 122:

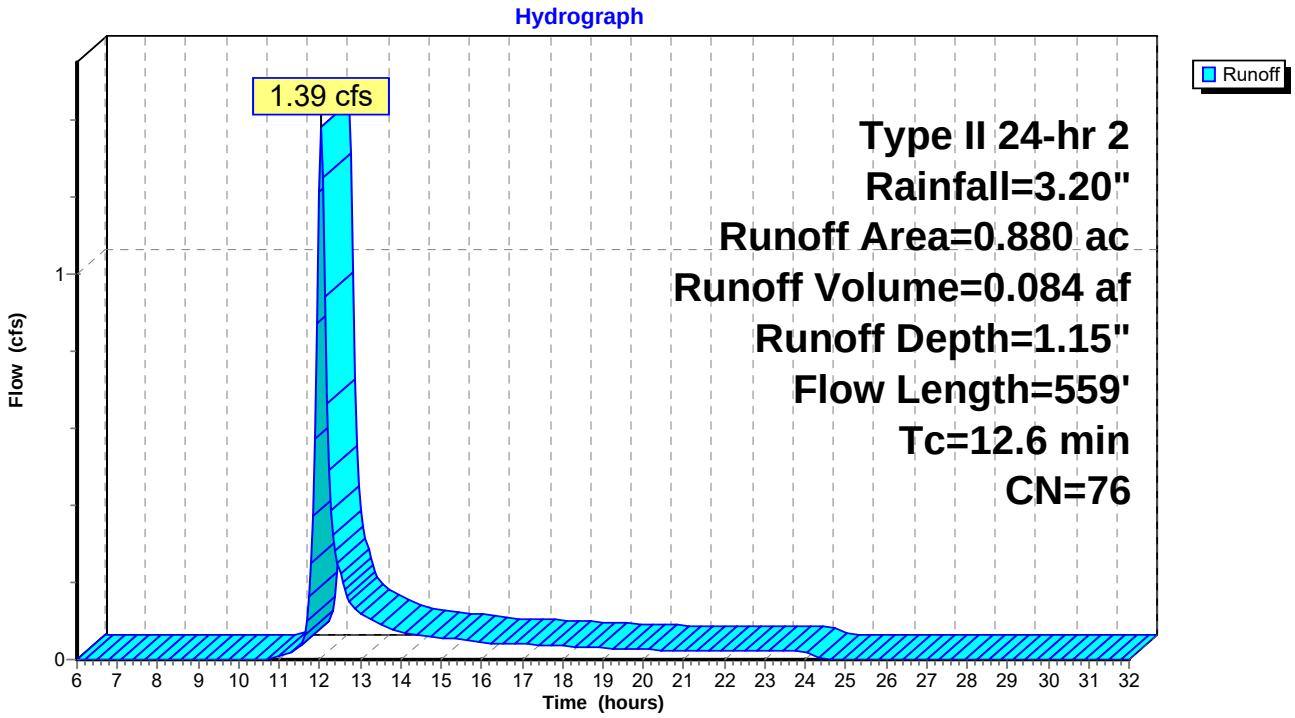
Runoff = 1.39 cfs @ 12.05 hrs, Volume= 0.084 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.880	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	84	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
9.1	475	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
12.6	559	Total			

Subcatchment 122:



Subcatchment 123:

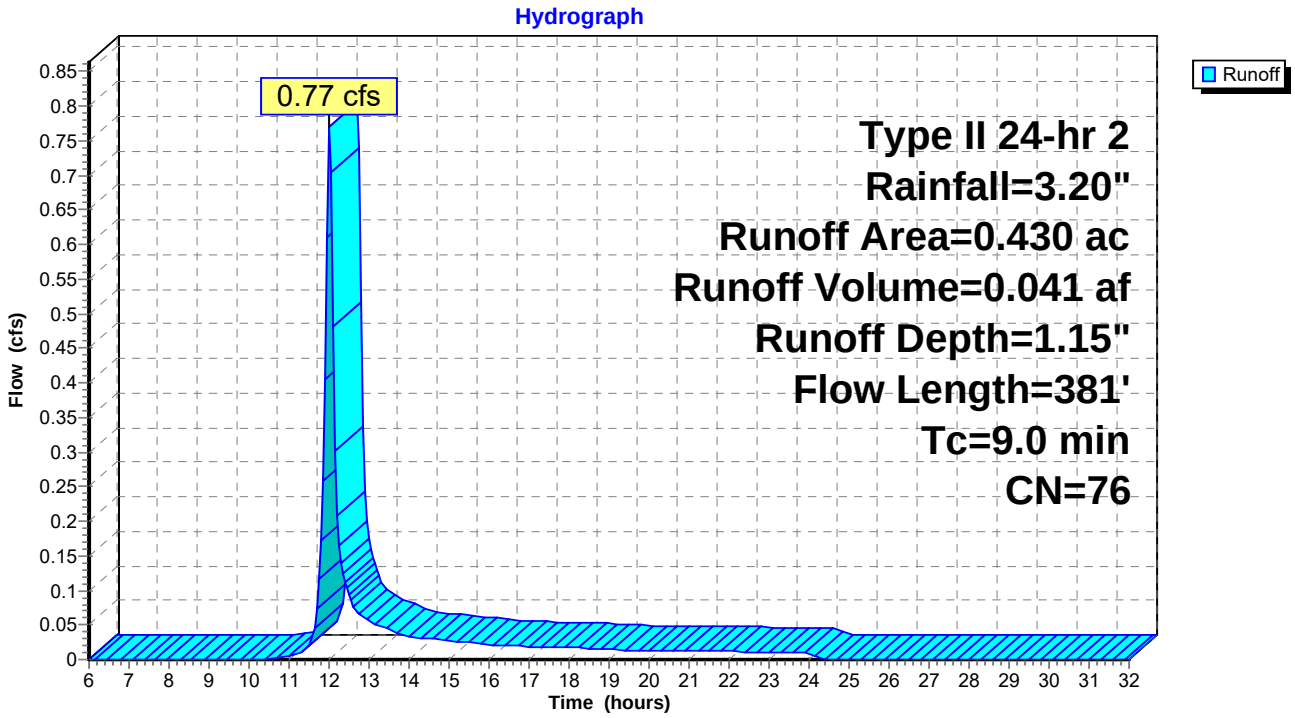
Runoff = 0.77 cfs @ 12.01 hrs, Volume= 0.041 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.430	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	72	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
5.9	309	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.0	381	Total			

Subcatchment 123:



Subcatchment 124:

[49] Hint: Tc<2dt may require smaller dt

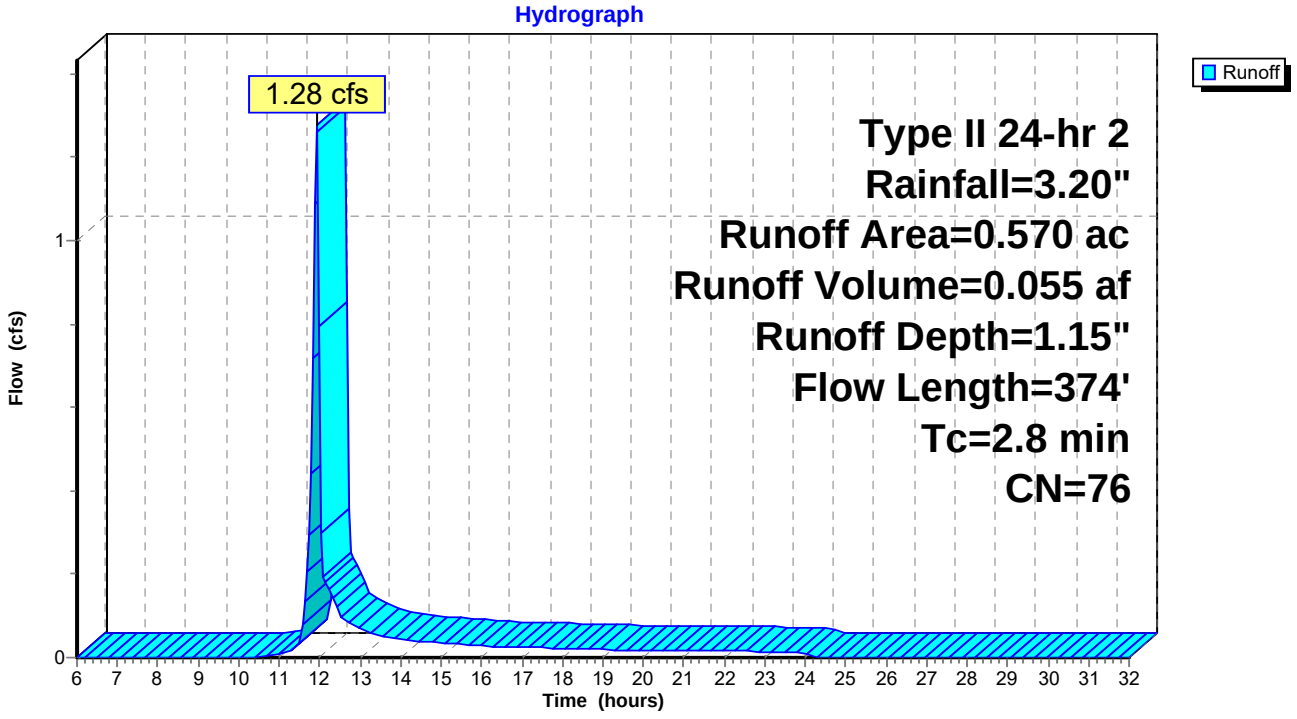
Runoff = 1.28 cfs @ 11.94 hrs, Volume= 0.055 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.570	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	58	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.2	316	0.0800	26.7	140.43	**Trap/Vee/Rect Channel Flow, MSE CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
2.8	374	Total			

Subcatchment 124:



Subcatchment 125:

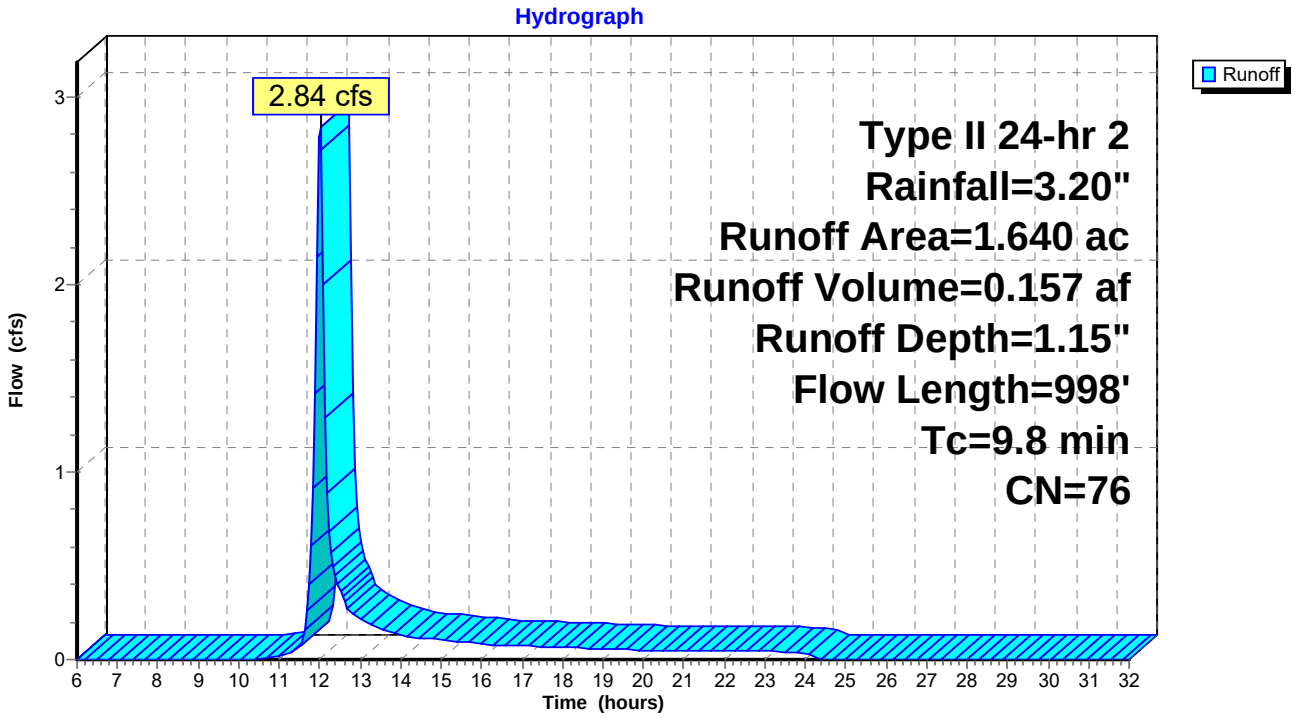
Runoff = 2.84 cfs @ 12.02 hrs, Volume= 0.157 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
1.640	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	62	0.0200	0.1		**Sheet Flow,** n= 0.200 P2= 3.20"
1.4	936	0.0800	11.5	80.16	**Trap/Vee/Rect Channel Flow, EXTERIOR CHANNEL** Bot.W=5.00' D=1.00' Z= 2.0 '/' Top.W=9.00' n= 0.030
9.8	998	Total			

Subcatchment 125:



Subcatchment 126:

[49] Hint: Tc<2dt may require smaller dt

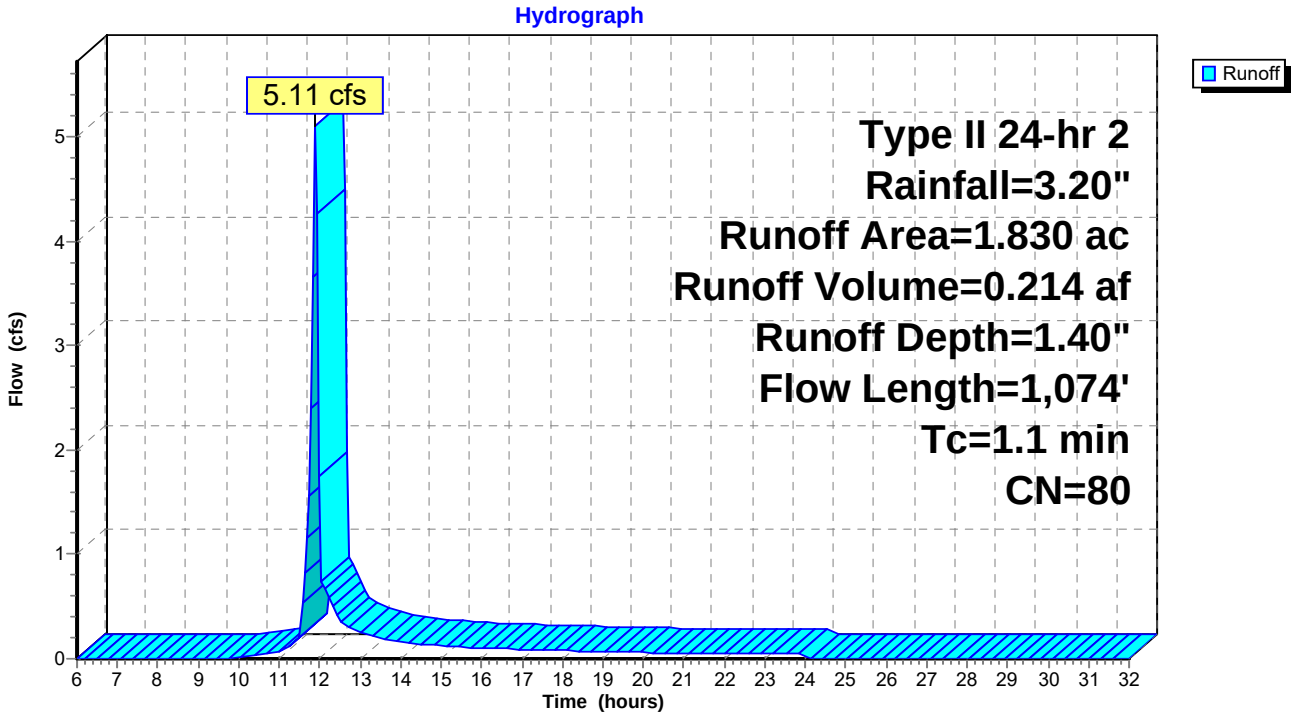
Runoff = 5.11 cfs @ 11.91 hrs, Volume= 0.214 af, Depth= 1.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
1.830	80	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	1,074	0.0600	16.4	51.46	**Circular Channel (pipe), PIPE** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.014

Subcatchment 126:



Subcatchment 127:

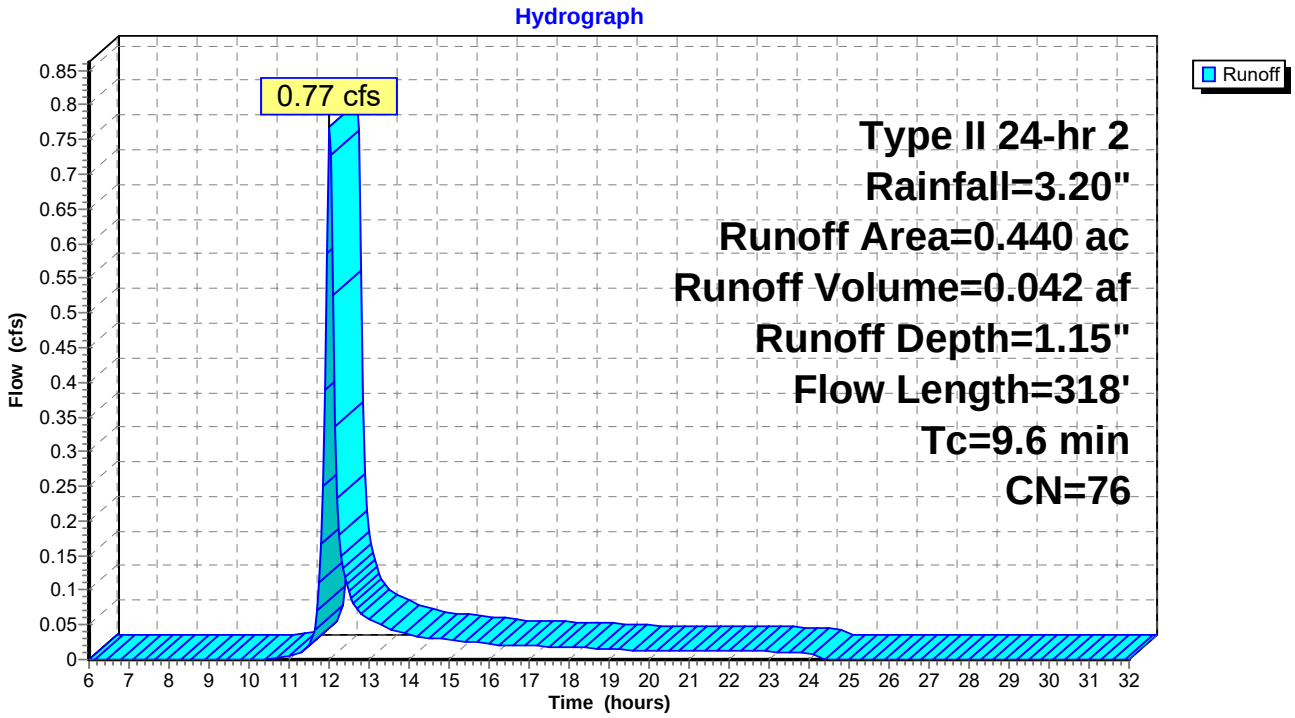
Runoff = 0.77 cfs @ 12.02 hrs, Volume= 0.042 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.440	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	98	0.1500	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
4.2	220	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.6	318	Total			

Subcatchment 127:



Subcatchment 128:

[49] Hint: Tc<2dt may require smaller dt

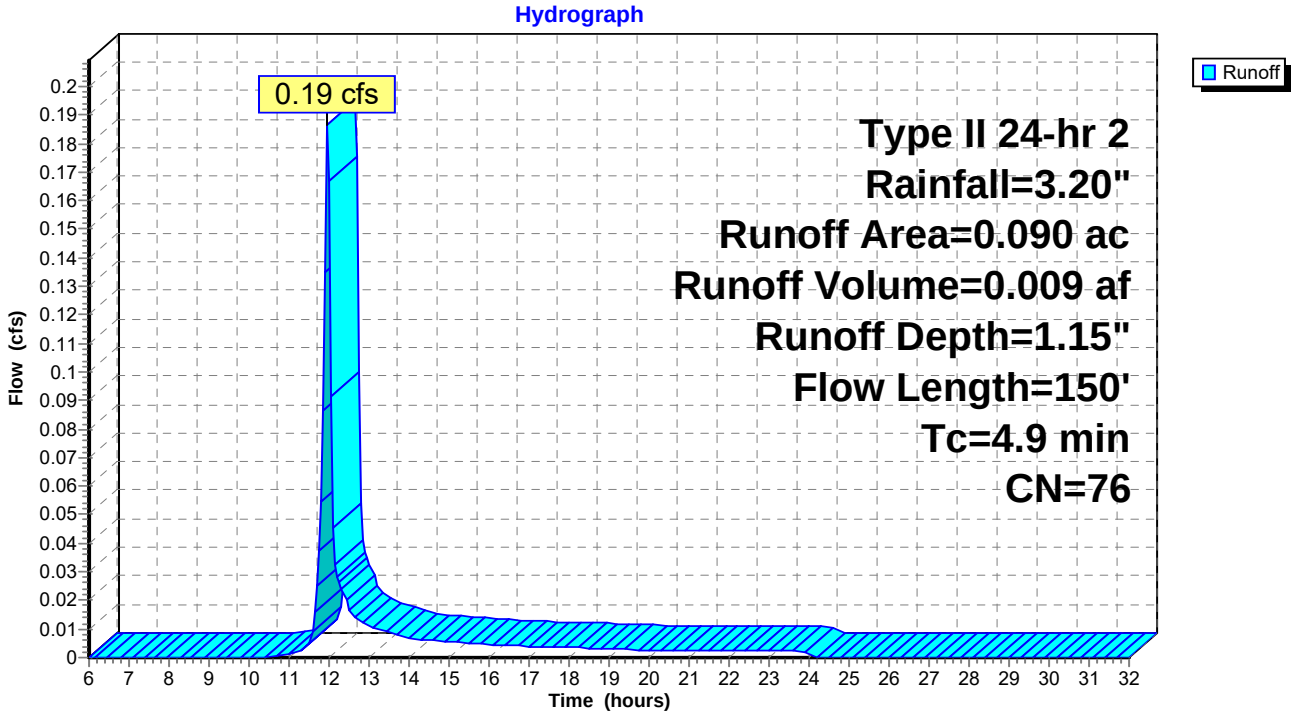
Runoff = 0.19 cfs @ 11.96 hrs, Volume= 0.009 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.090	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	93	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
1.1	57	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
4.9	150	Total			

Subcatchment 128:



Subcatchment 129:

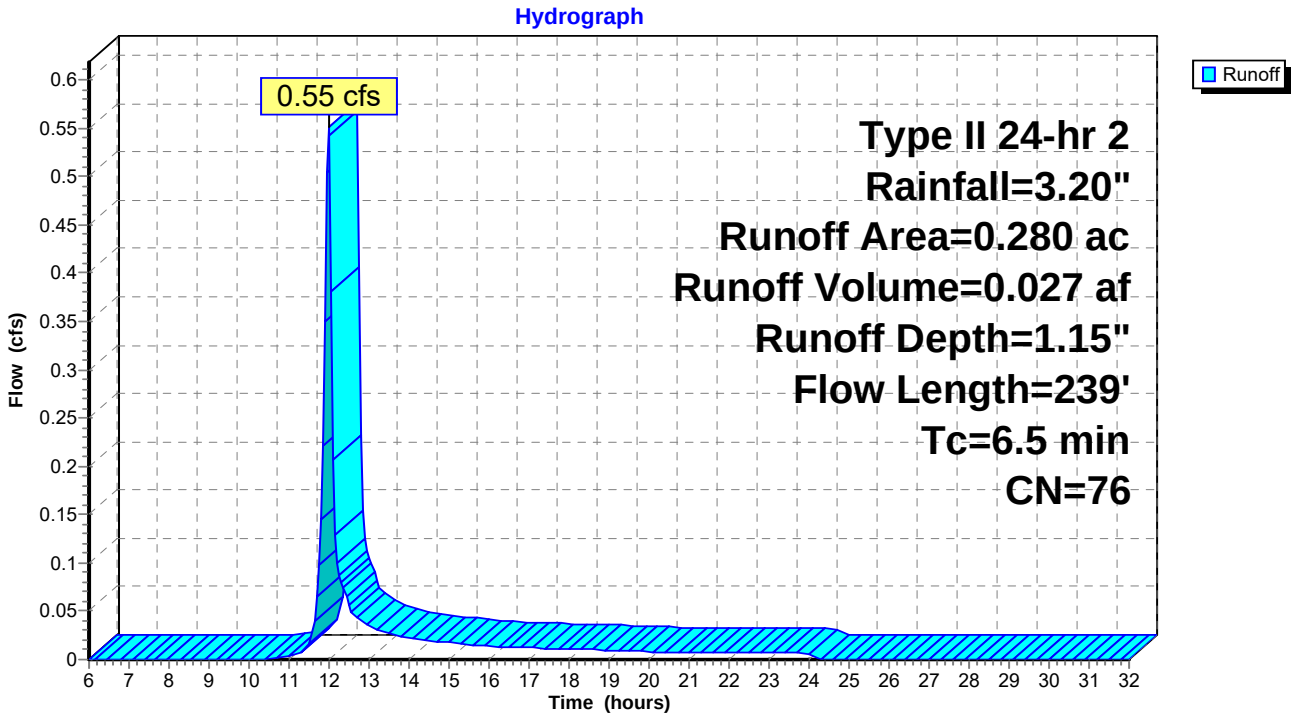
Runoff = 0.55 cfs @ 11.98 hrs, Volume= 0.027 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.280	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	91	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
2.8	148	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
6.5	239	Total			

Subcatchment 129:



Subcatchment 130:

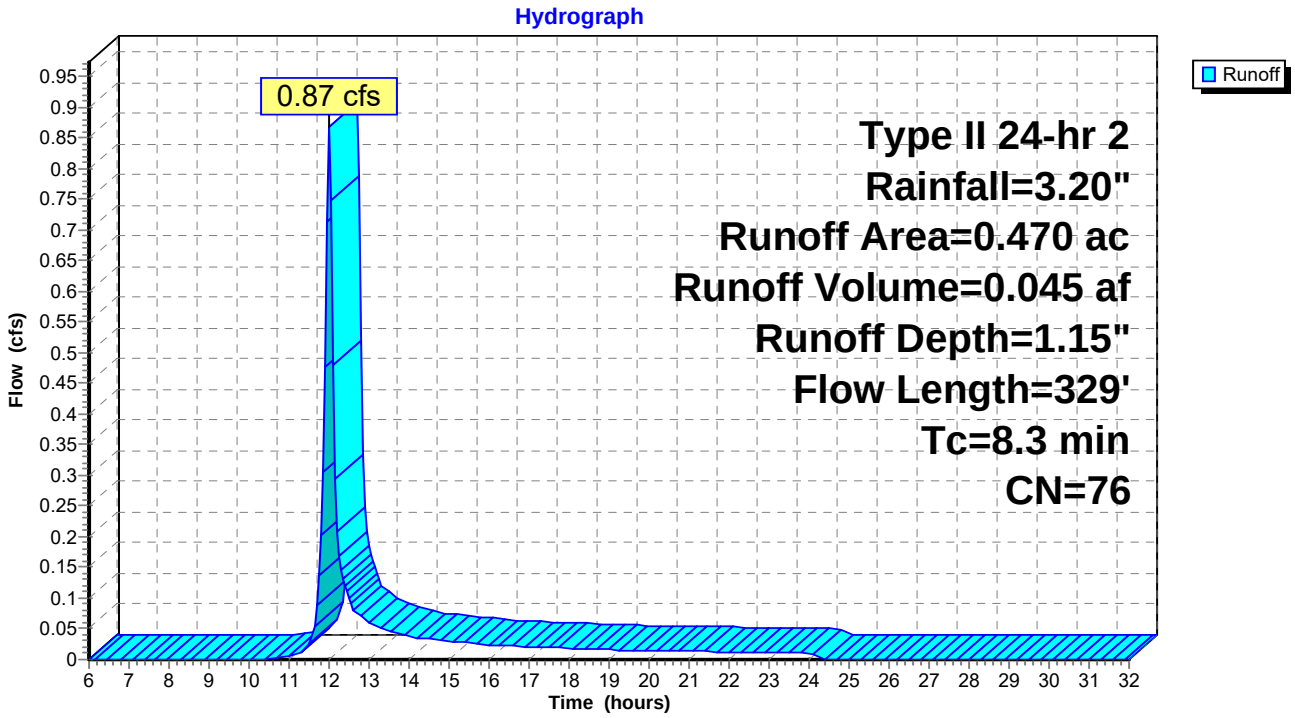
Runoff = 0.87 cfs @ 12.00 hrs, Volume= 0.045 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.470	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	94	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
4.5	235	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
8.3	329	Total			

Subcatchment 130:



Subcatchment 131:

[49] Hint: Tc<2dt may require smaller dt

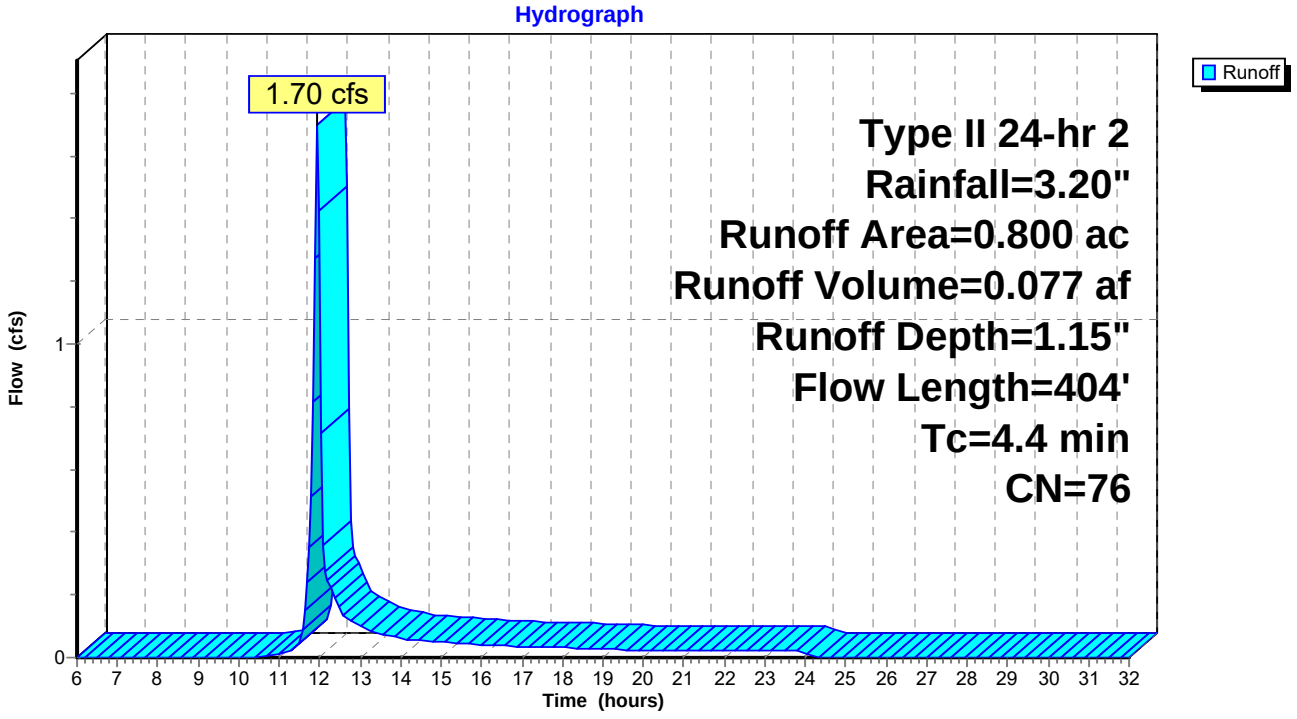
Runoff = 1.70 cfs @ 11.96 hrs, Volume= 0.077 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.800	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	97	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.5	307	0.0090	9.6	64.85	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.4	404	Total			

Subcatchment 131:



Subcatchment 132:

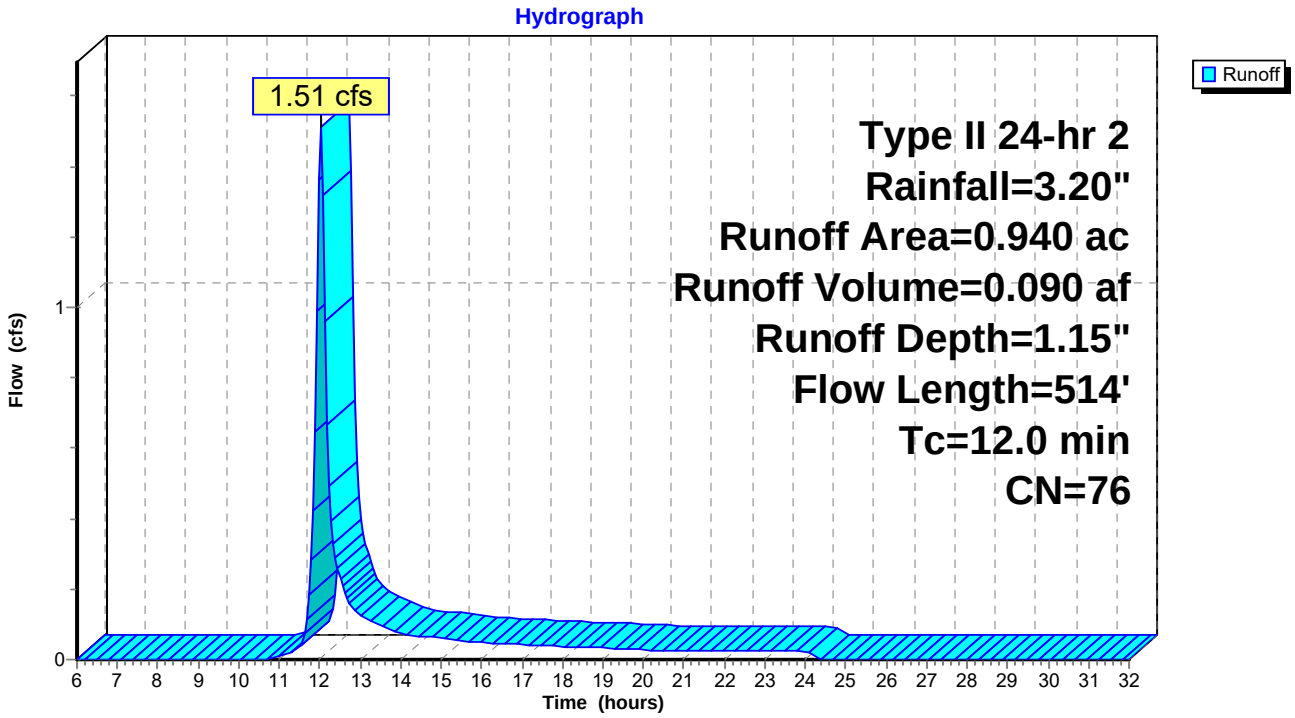
Runoff = 1.51 cfs @ 12.05 hrs, Volume= 0.090 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
0.940	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
8.0	414	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
12.0	514	Total			

Subcatchment 132:



Subcatchment 133:

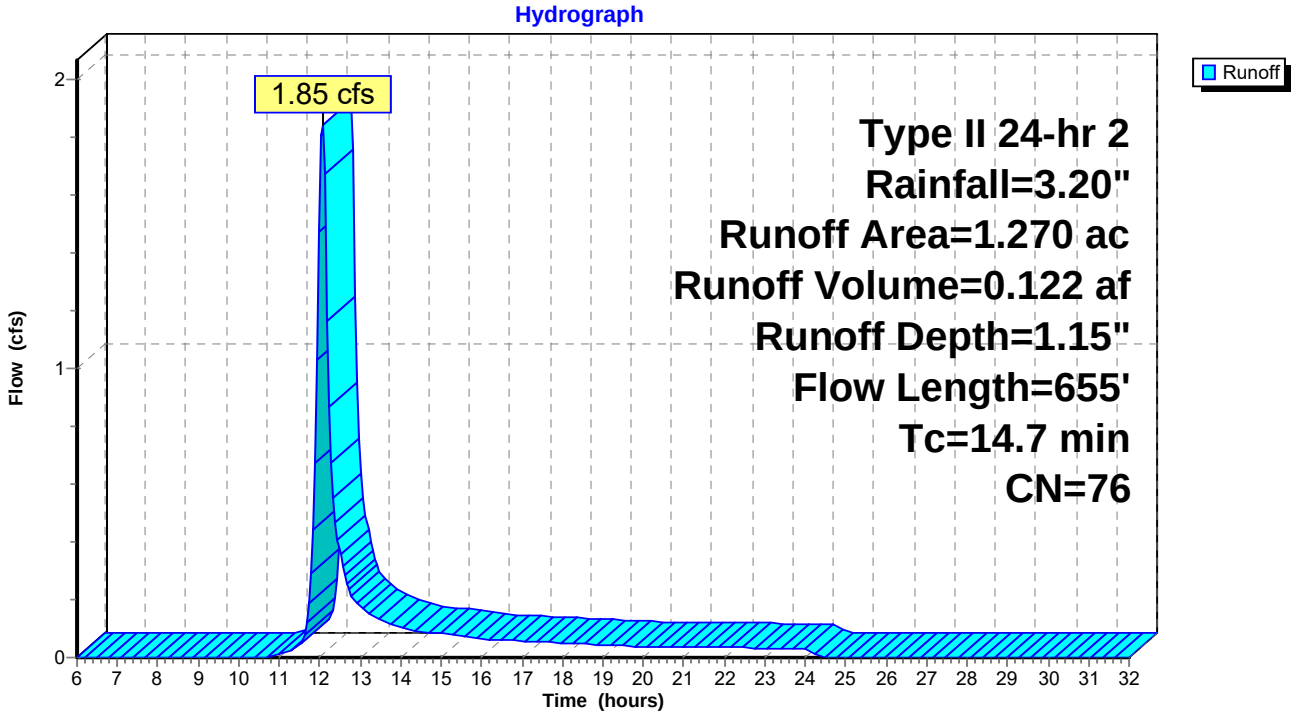
Runoff = 1.85 cfs @ 12.08 hrs, Volume= 0.122 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
1.270	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
10.7	555	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
14.7	655	Total			

Subcatchment 133:



Subcatchment 134:

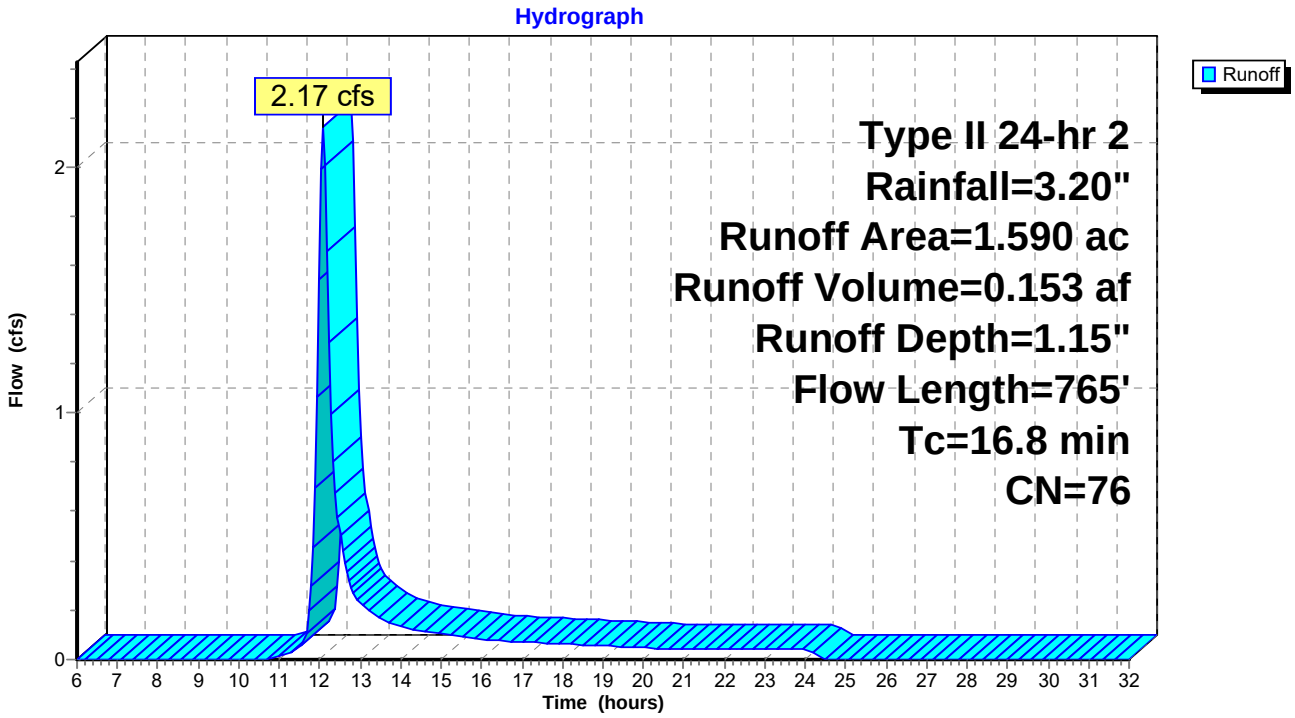
Runoff = 2.17 cfs @ 12.10 hrs, Volume= 0.153 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
1.590	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
12.8	665	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
16.8	765	Total			

Subcatchment 134:



Subcatchment 135:

[49] Hint: Tc<2dt may require smaller dt

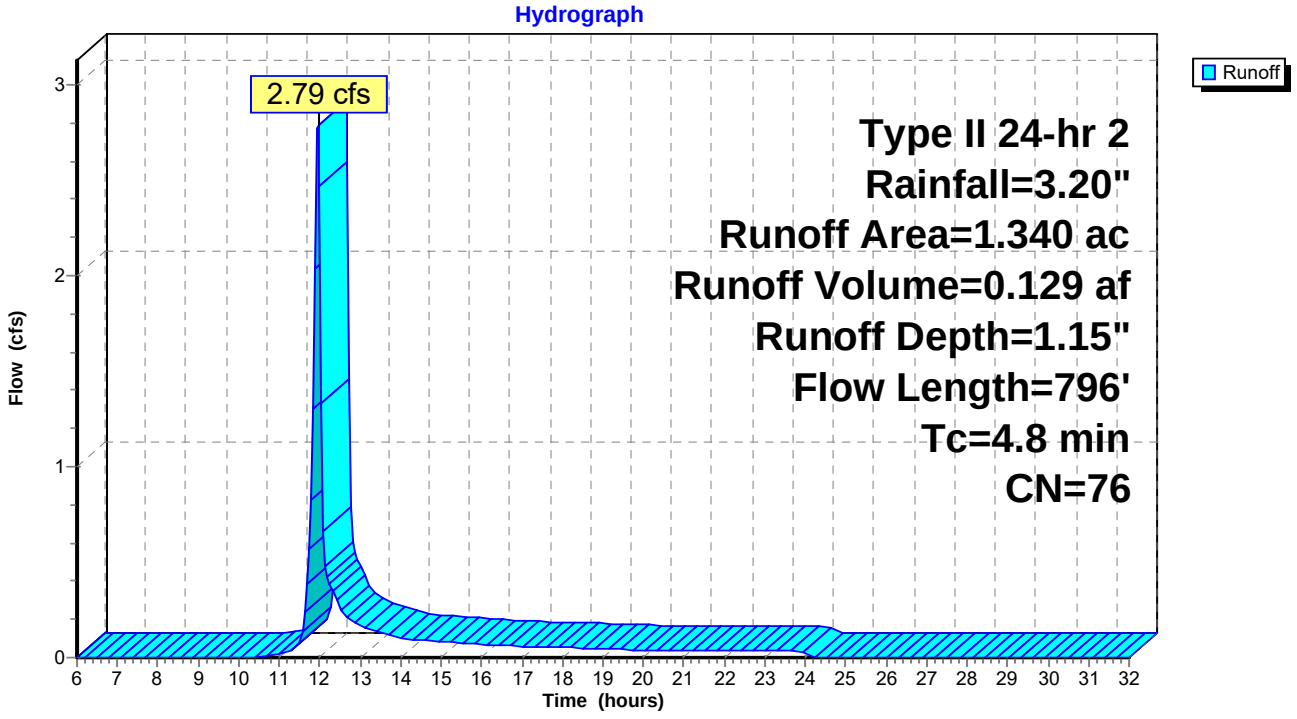
Runoff = 2.79 cfs @ 11.96 hrs, Volume= 0.129 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
1.340	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	82	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
1.4	714	0.0070	8.5	57.19	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.8	796	Total			

Subcatchment 135:



Subcatchment 136:

[49] Hint: Tc<2dt may require smaller dt

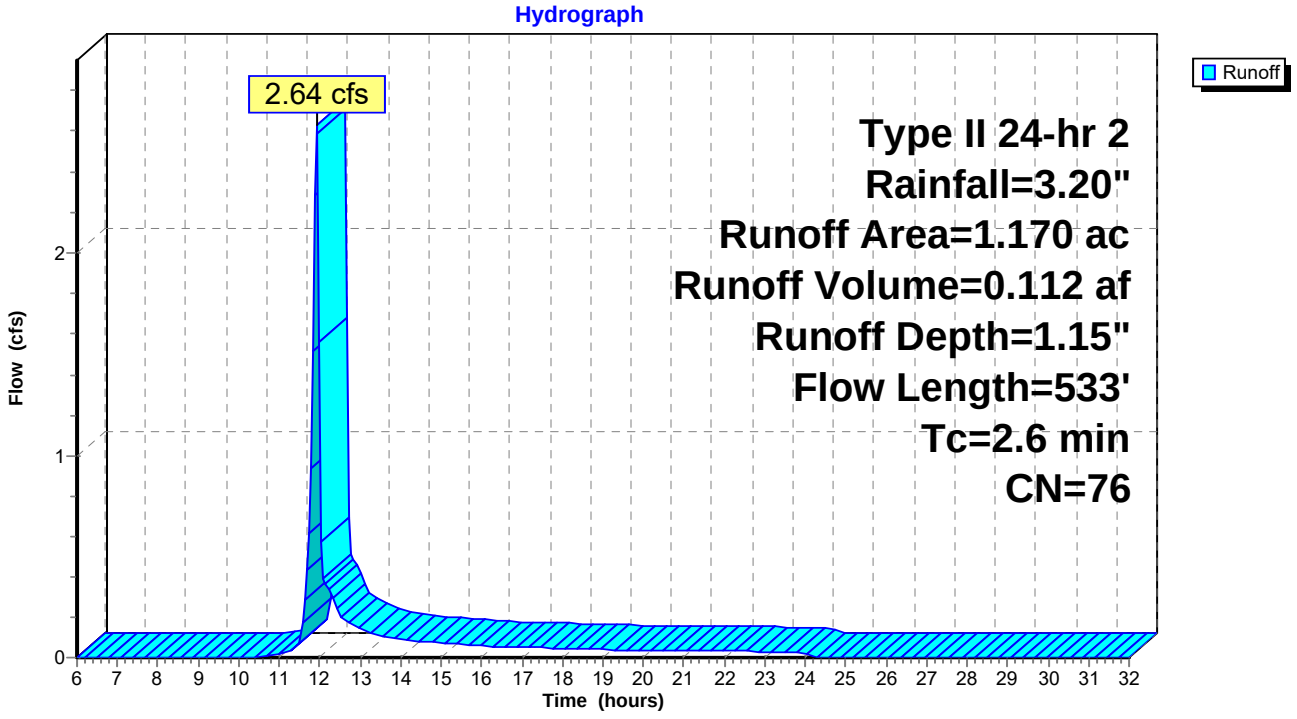
Runoff = 2.64 cfs @ 11.94 hrs, Volume= 0.112 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
1.170	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	36	0.3300	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.8	497	0.0100	10.1	68.36	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
2.6	533	Total			

Subcatchment 136:



Subcatchment PWL-1:

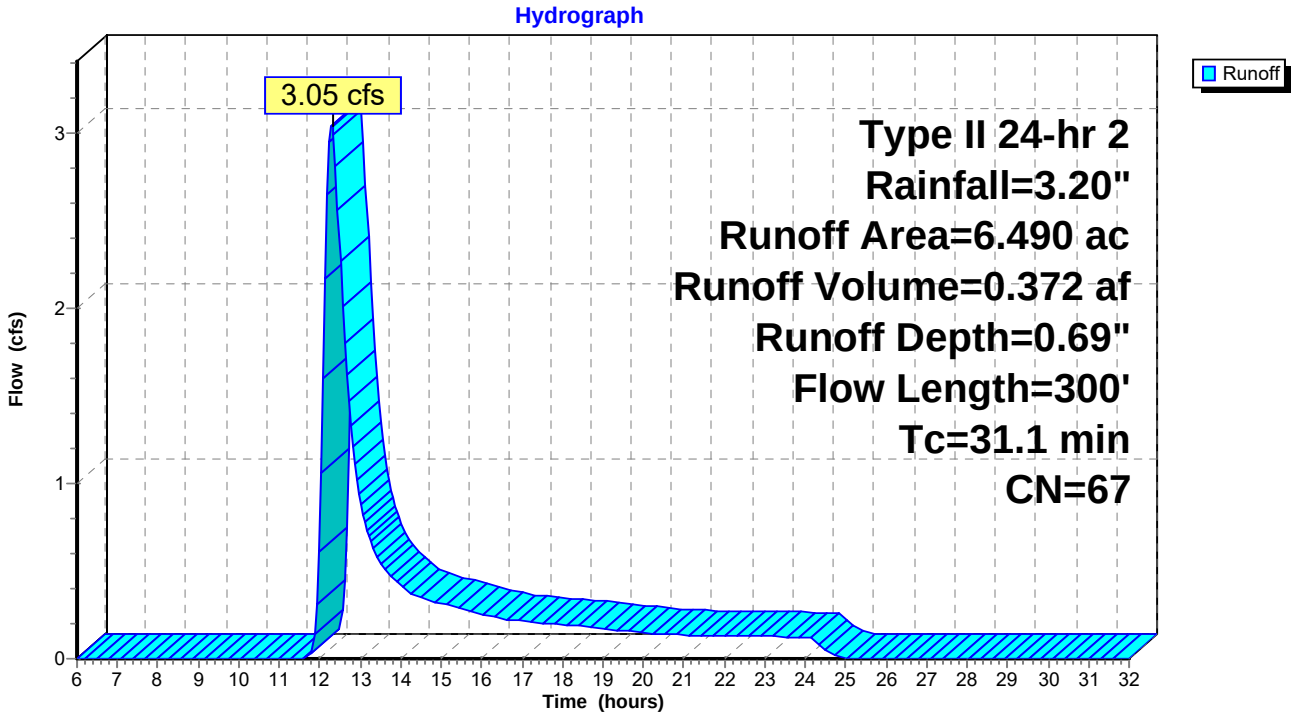
Runoff = 3.05 cfs @ 12.31 hrs, Volume= 0.372 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
6.490	67	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	300	0.0100	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PWL-1:



Subcatchment PWL-2:

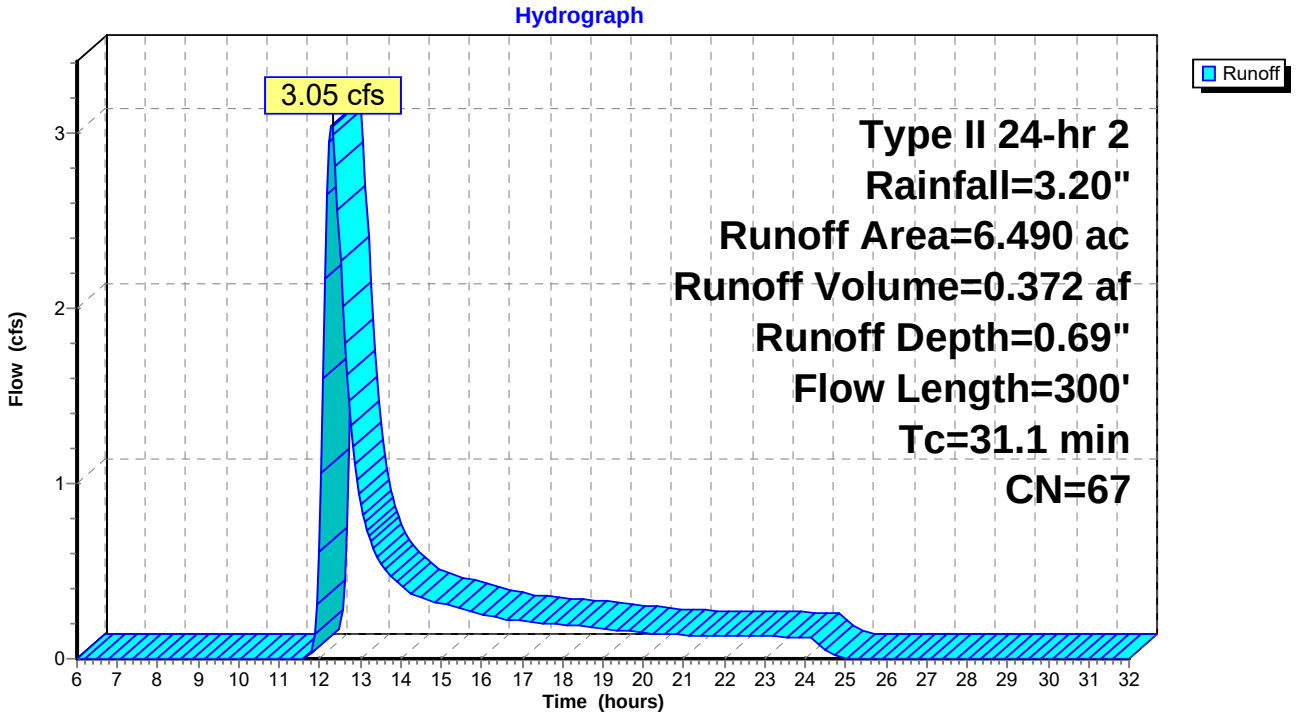
Runoff = 3.05 cfs @ 12.31 hrs, Volume= 0.372 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
6.490	67	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	300	0.0100	0.2		**Sheet Flow,** n= 0.150 P2= 3.20"

Subcatchment PWL-2:



Subcatchment PWL-3:

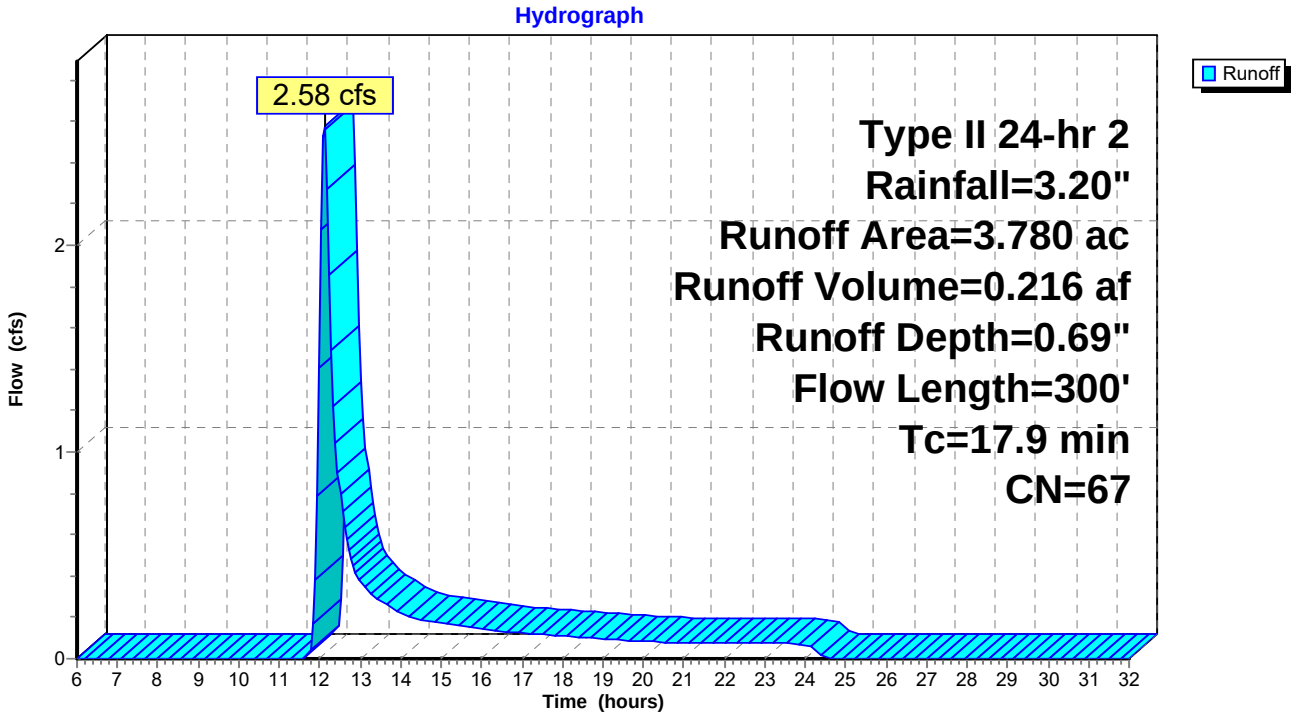
Runoff = 2.58 cfs @ 12.13 hrs, Volume= 0.216 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Rainfall=3.20"

Area (ac)	CN	Description
3.780	67	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	300	0.0400	0.3		**Sheet Flow,** n= 0.150 P2= 3.20"

Subcatchment PWL-3:



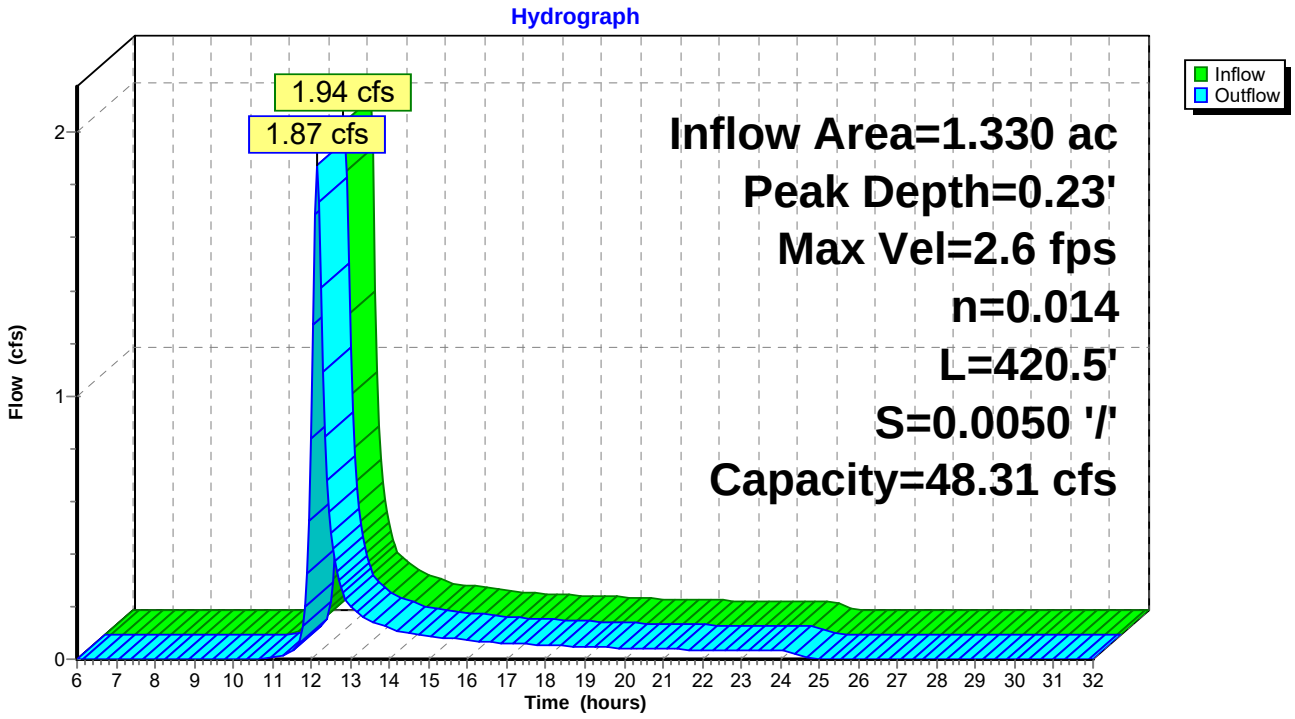
Reach 01-05: PERIMETER CHANNEL

Inflow Area = 1.330 ac, Inflow Depth = 1.15" for 2 event
Inflow = 1.94 cfs @ 12.08 hrs, Volume= 0.128 af
Outflow = 1.87 cfs @ 12.15 hrs, Volume= 0.128 af, Atten= 4%, Lag= 4.7 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.6 fps, Min. Travel Time= 2.7 min
Avg. Velocity = 0.7 fps, Avg. Travel Time= 9.6 min

Peak Depth= 0.23' @ 12.11 hrs
Capacity at bank full= 48.31 cfs
Inlet Invert= 110.00', Outlet Invert= 107.90'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 420.5' Slope= 0.0050 '/'

Reach 01-05: PERIMETER CHANNEL



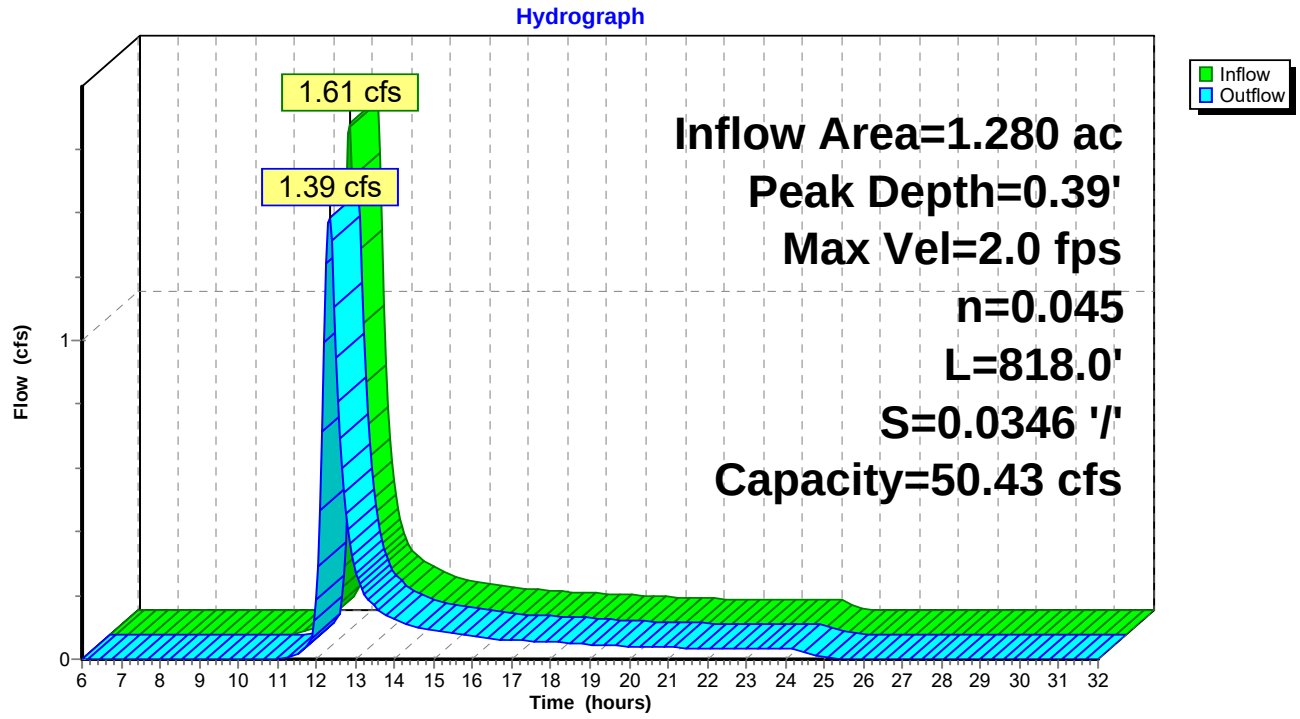
Reach 02-06: BENCH

Inflow Area = 1.280 ac, Inflow Depth = 1.15" for 2 event
Inflow = 1.61 cfs @ 12.13 hrs, Volume= 0.123 af
Outflow = 1.39 cfs @ 12.32 hrs, Volume= 0.123 af, Atten= 14%, Lag= 11.6 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.0 fps, Min. Travel Time= 6.7 min
Avg. Velocity = 0.8 fps, Avg. Travel Time= 17.3 min

Peak Depth= 0.39' @ 12.21 hrs
Capacity at bank full= 50.43 cfs
Inlet Invert= 130.00', Outlet Invert= 101.70'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 818.0' Slope= 0.0346 '/'

Reach 02-06: BENCH



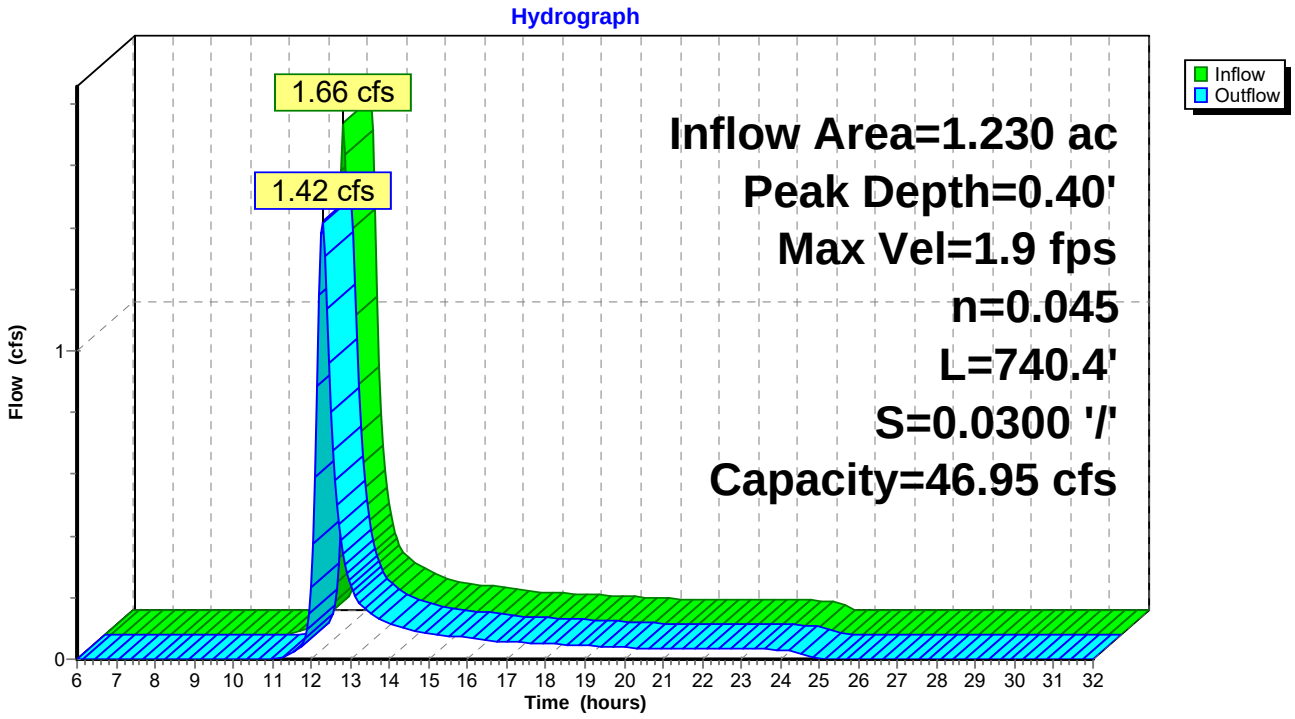
Reach 03-09: BENCH

Inflow Area = 1.230 ac, Inflow Depth = 1.15" for 2 event
Inflow = 1.66 cfs @ 12.10 hrs, Volume= 0.118 af
Outflow = 1.42 cfs @ 12.29 hrs, Volume= 0.118 af, Atten= 15%, Lag= 10.9 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.9 fps, Min. Travel Time= 6.4 min
Avg. Velocity = 0.7 fps, Avg. Travel Time= 16.6 min

Peak Depth= 0.40' @ 12.18 hrs
Capacity at bank full= 46.95 cfs
Inlet Invert= 152.21', Outlet Invert= 130.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 740.4' Slope= 0.0300 '/'

Reach 03-09: BENCH



Reach 04-08: ACCESS ROAD CHANNEL

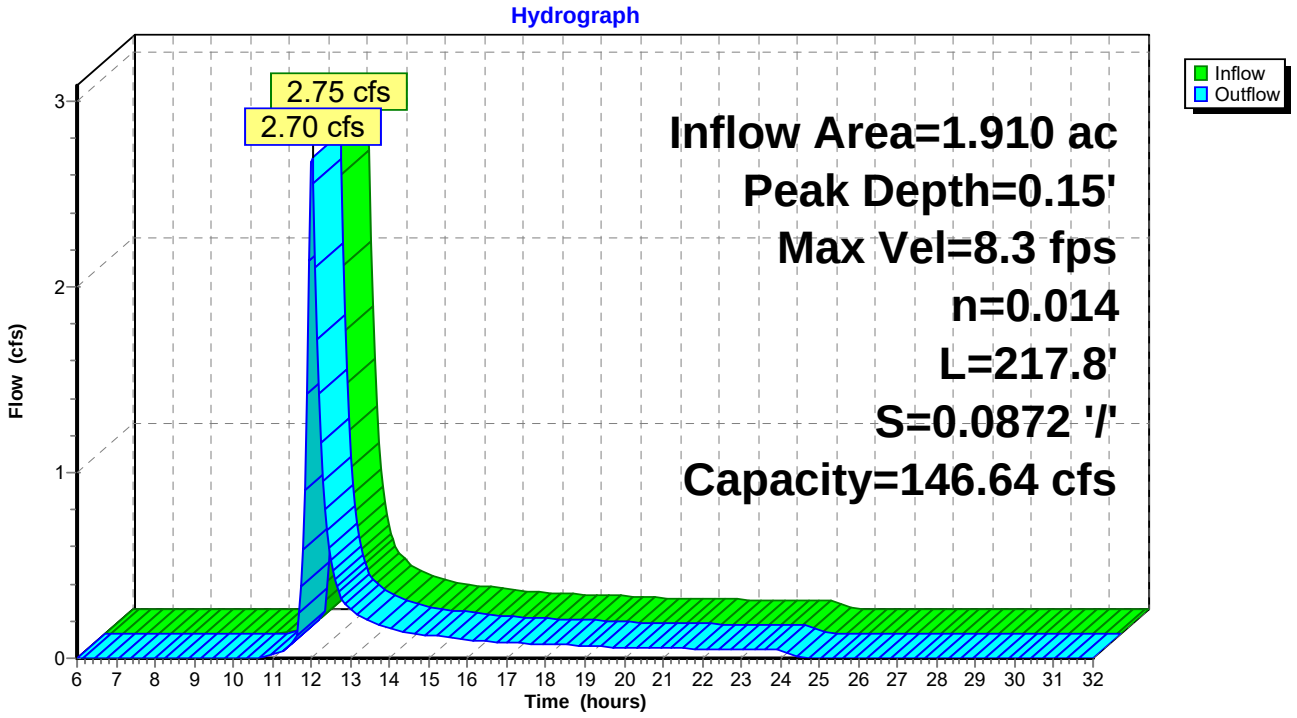
[61] Hint: Submerged 1% of Reach 07-04 bottom

Inflow Area = 1.910 ac, Inflow Depth = 1.15" for 2 event
Inflow = 2.75 cfs @ 12.01 hrs, Volume= 0.183 af
Outflow = 2.70 cfs @ 12.02 hrs, Volume= 0.183 af, Atten= 2%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.3 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.5 fps, Avg. Travel Time= 1.5 min

Peak Depth= 0.15' @ 12.01 hrs
Capacity at bank full= 146.64 cfs
Inlet Invert= 174.80', Outlet Invert= 155.80'
2.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 5.00'
Length= 217.8' Slope= 0.0872 '/'

Reach 04-08: ACCESS ROAD CHANNEL



Reach 05-06: PERIMETER CHANNEL

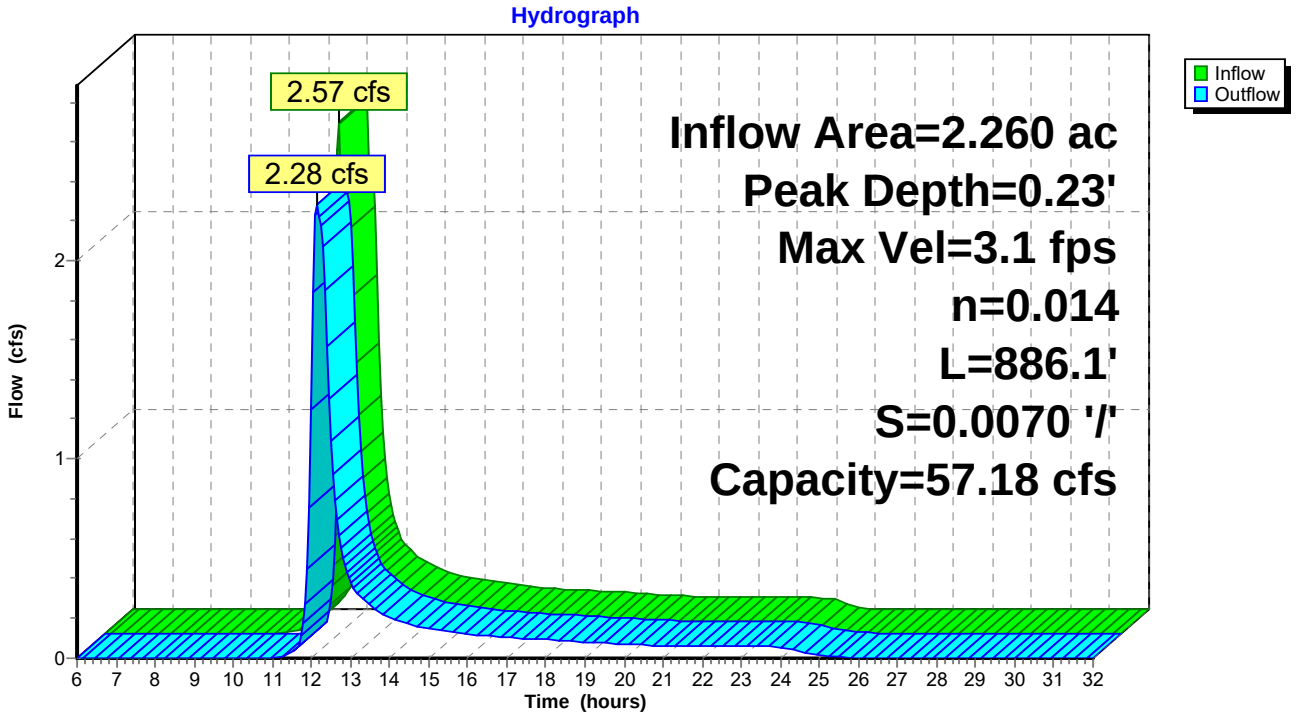
[61] Hint: Submerged 11% of Reach 01-05 bottom

Inflow Area = 2.260 ac, Inflow Depth = 1.15" for 2 event
Inflow = 2.57 cfs @ 11.99 hrs, Volume= 0.217 af
Outflow = 2.28 cfs @ 12.15 hrs, Volume= 0.217 af, Atten= 11%, Lag= 9.6 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.1 fps, Min. Travel Time= 4.8 min
Avg. Velocity = 0.9 fps, Avg. Travel Time= 15.8 min

Peak Depth= 0.23' @ 12.06 hrs
Capacity at bank full= 57.18 cfs
Inlet Invert= 107.90', Outlet Invert= 101.70'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 886.1' Slope= 0.0070 '/'

Reach 05-06: PERIMETER CHANNEL



Reach 06-10: PERIMETER CHANNEL

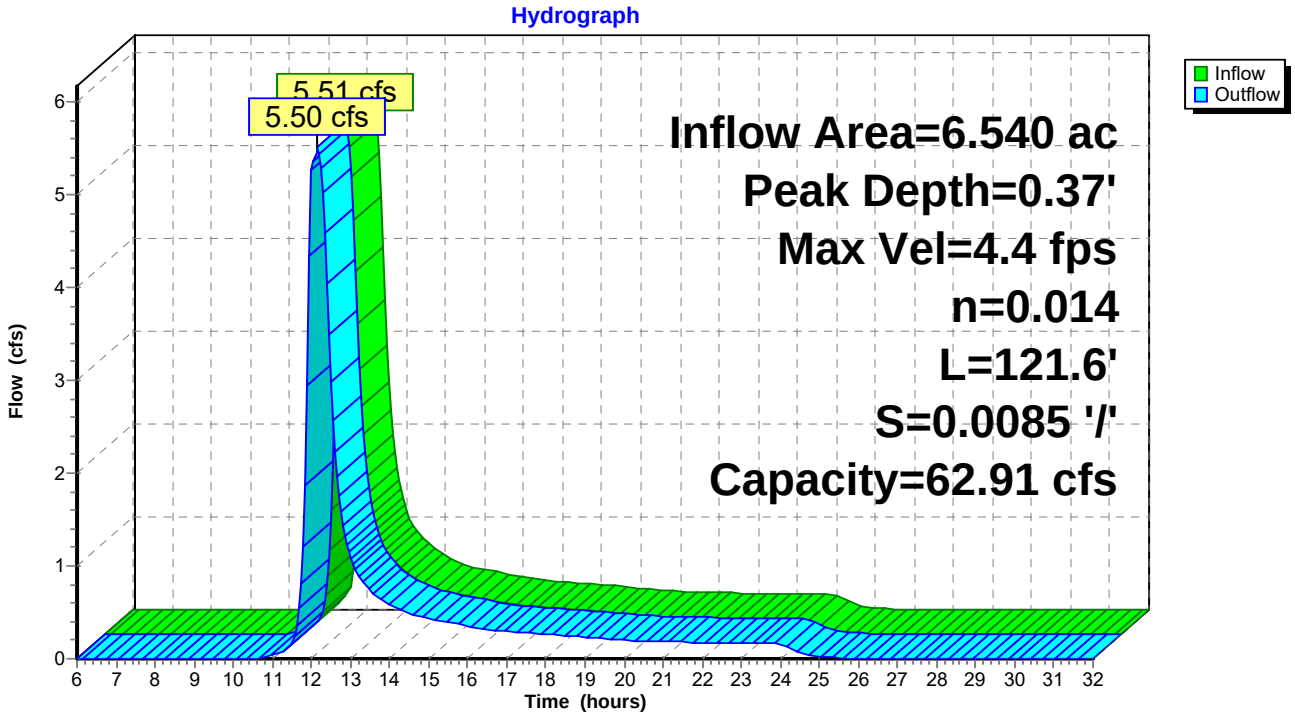
[61] Hint: Submerged 1% of Reach 02-06 bottom
[61] Hint: Submerged 6% of Reach 05-06 bottom

Inflow Area = 6.540 ac, Inflow Depth = 1.15" for 2 event
Inflow = 5.51 cfs @ 12.14 hrs, Volume= 0.628 af
Outflow = 5.50 cfs @ 12.15 hrs, Volume= 0.628 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.4 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.4 fps, Avg. Travel Time= 1.4 min

Peak Depth= 0.37' @ 12.15 hrs
Capacity at bank full= 62.91 cfs
Inlet Invert= 101.70', Outlet Invert= 100.67'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 121.6' Slope= 0.0085 '/'

Reach 06-10: PERIMETER CHANNEL



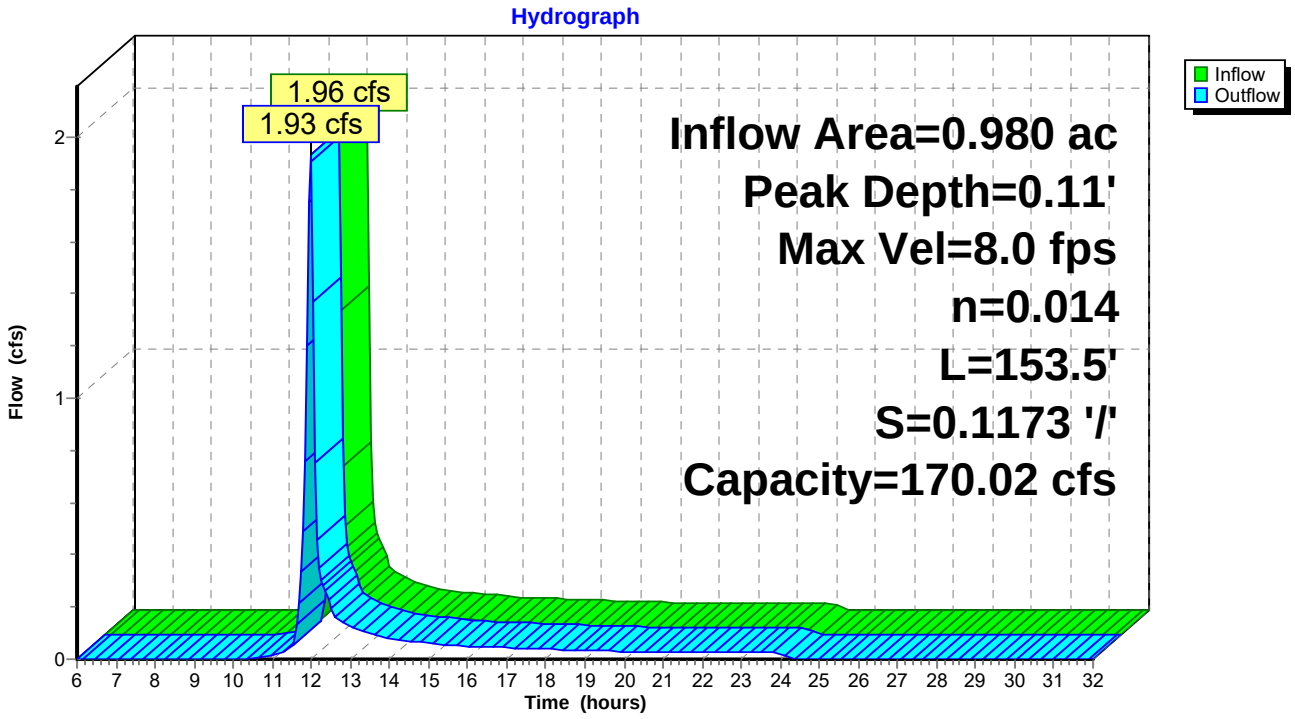
Reach 07-04: ACCESS ROAD CHANNEL

Inflow Area = 0.980 ac, Inflow Depth = 1.15" for 2 event
Inflow = 1.96 cfs @ 11.98 hrs, Volume= 0.094 af
Outflow = 1.93 cfs @ 11.99 hrs, Volume= 0.094 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.0 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.4 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.11' @ 11.98 hrs
Capacity at bank full= 170.02 cfs
Inlet Invert= 192.80', Outlet Invert= 174.80'
2.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 5.00'
Length= 153.5' Slope= 0.1173 '/'

Reach 07-04: ACCESS ROAD CHANNEL



Reach 08-08`: ACCESS ROAD CHANNEL

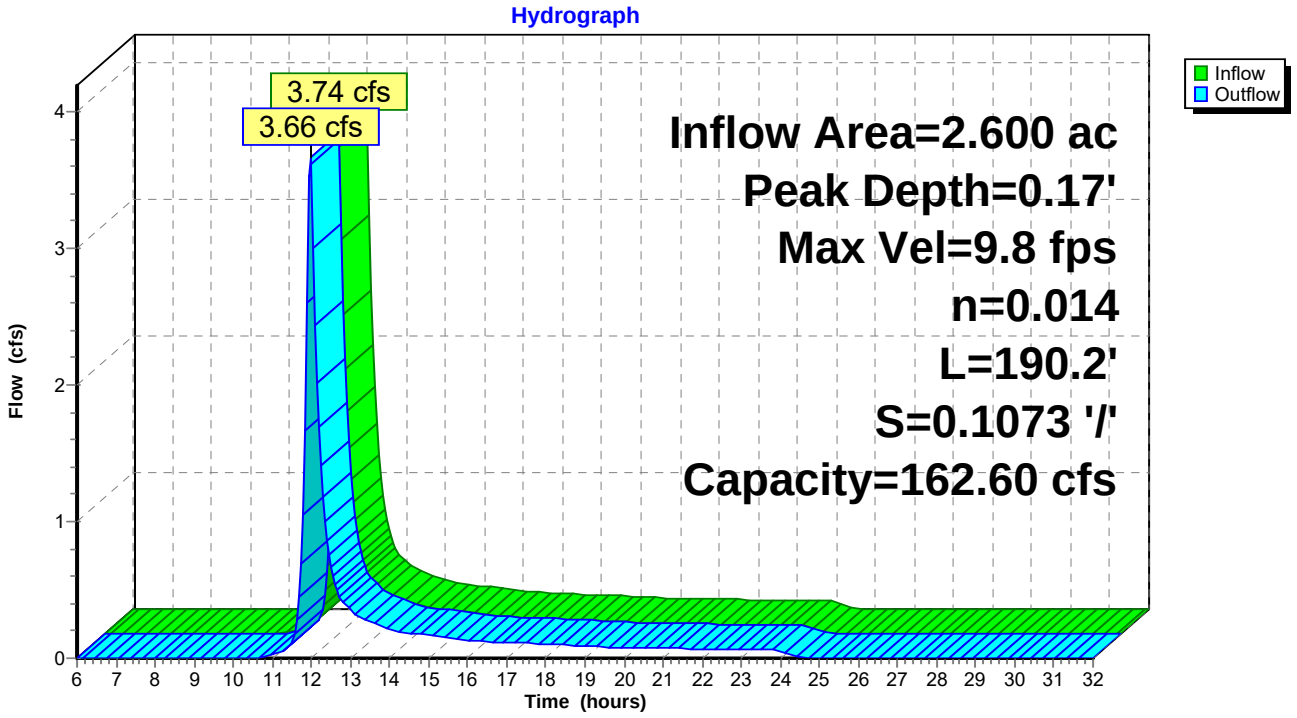
[61] Hint: Submerged 1% of Reach 04-08 bottom

Inflow Area = 2.600 ac, Inflow Depth = 1.15" for 2 event
Inflow = 3.74 cfs @ 11.97 hrs, Volume= 0.250 af
Outflow = 3.66 cfs @ 11.98 hrs, Volume= 0.250 af, Atten= 2%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.8 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.9 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.17' @ 11.97 hrs
Capacity at bank full= 162.60 cfs
Inlet Invert= 155.80', Outlet Invert= 135.40'
2.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 5.00'
Length= 190.2' Slope= 0.1073 '/'

Reach 08-08`: ACCESS ROAD CHANNEL



Reach 09-10: PIPE DOWNCHUTE

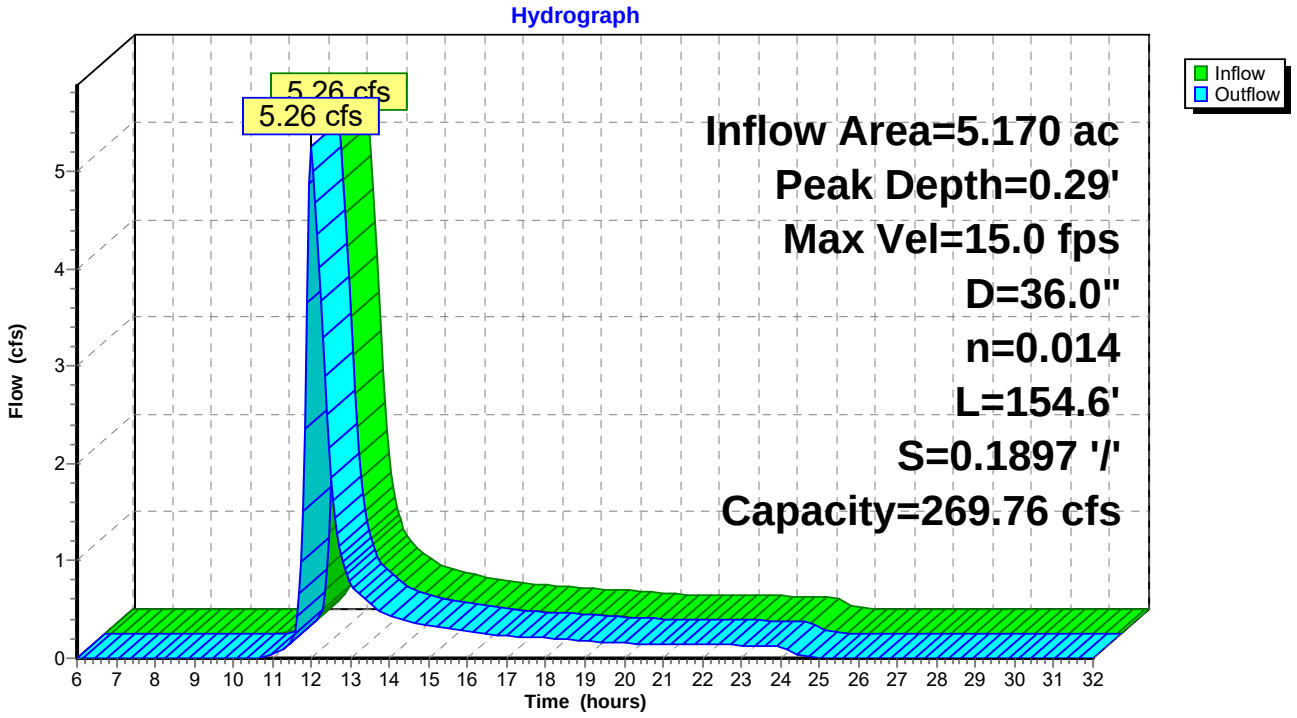
[52] Hint: Inlet conditions not evaluated
[61] Hint: Submerged 1% of Reach 03-09 bottom

Inflow Area = 5.170 ac, Inflow Depth = 1.15" for 2 event
Inflow = 5.26 cfs @ 12.00 hrs, Volume= 0.496 af
Outflow = 5.26 cfs @ 12.01 hrs, Volume= 0.496 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 15.0 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 5.9 fps, Avg. Travel Time= 0.4 min

Peak Depth= 0.29' @ 12.00 hrs
Capacity at bank full= 269.76 cfs
Inlet Invert= 130.00', Outlet Invert= 100.67'
36.0" Diameter Pipe, n= 0.014
Length= 154.6' Slope= 0.1897 '/'

Reach 09-10: PIPE DOWNCHUTE



Reach 10-11: PERIMETER CHANNEL

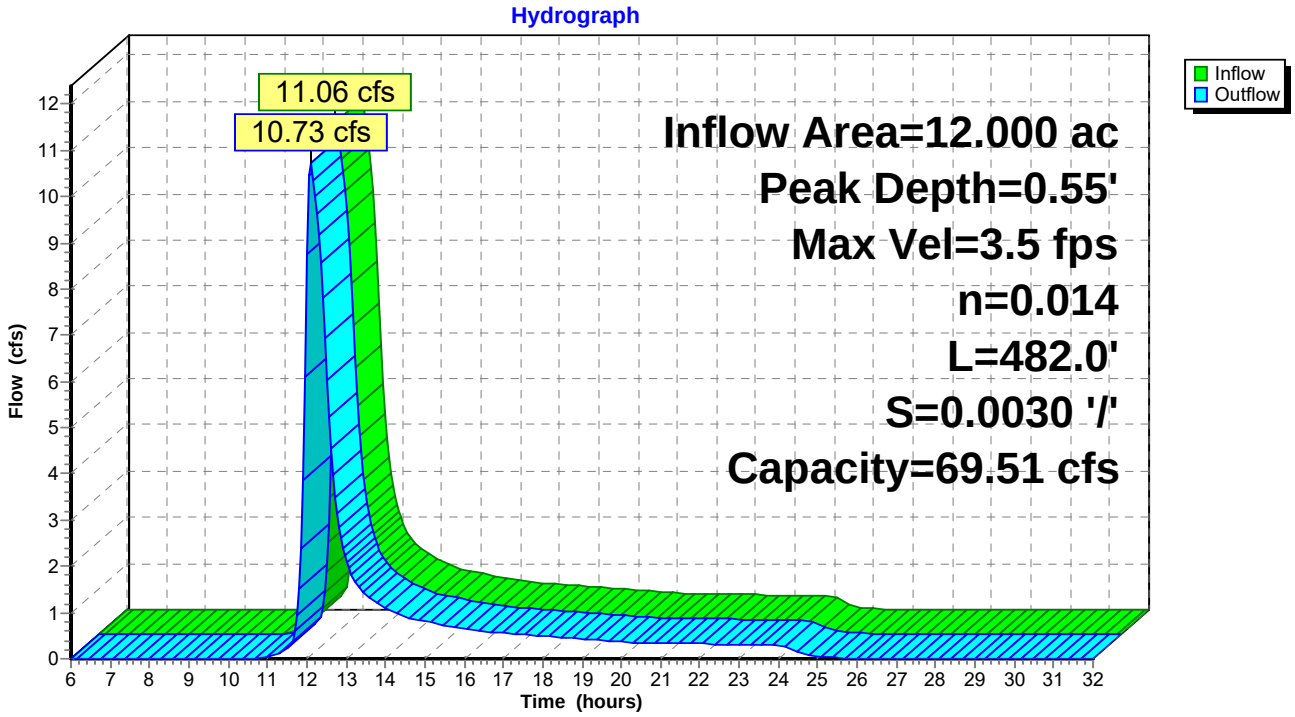
[61] Hint: Submerged 54% of Reach 06-10 bottom
[61] Hint: Submerged 2% of Reach 09-10 bottom

Inflow Area = 12.000 ac, Inflow Depth = 1.15" for 2 event
Inflow = 11.06 cfs @ 12.01 hrs, Volume= 1.152 af
Outflow = 10.73 cfs @ 12.09 hrs, Volume= 1.152 af, Atten= 3%, Lag= 4.9 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.5 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 8.0 min

Peak Depth= 0.55' @ 12.05 hrs
Capacity at bank full= 69.51 cfs
Inlet Invert= 100.67', Outlet Invert= 99.22'
5.00' x 1.65' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 8.30'
Length= 482.0' Slope= 0.0030 '/'

Reach 10-11: PERIMETER CHANNEL



Reach 11-19: PERIMETER CHANNEL

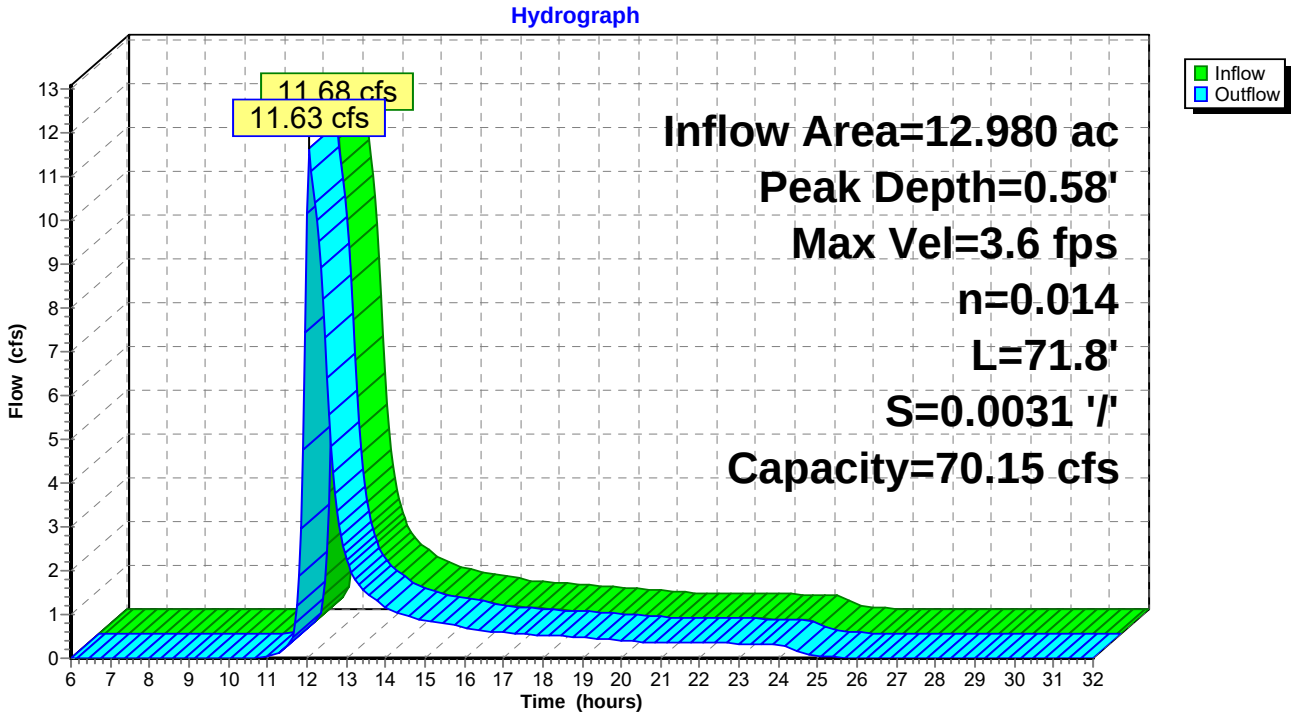
[61] Hint: Submerged 40% of Reach 10-11 bottom

Inflow Area = 12.980 ac, Inflow Depth = 1.15" for 2 event
Inflow = 11.68 cfs @ 12.06 hrs, Volume= 1.246 af
Outflow = 11.63 cfs @ 12.07 hrs, Volume= 1.246 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.6 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.58' @ 12.07 hrs
Capacity at bank full= 70.15 cfs
Inlet Invert= 99.22', Outlet Invert= 99.00'
5.00' x 1.65' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 8.30'
Length= 71.8' Slope= 0.0031 '/'

Reach 11-19: PERIMETER CHANNEL



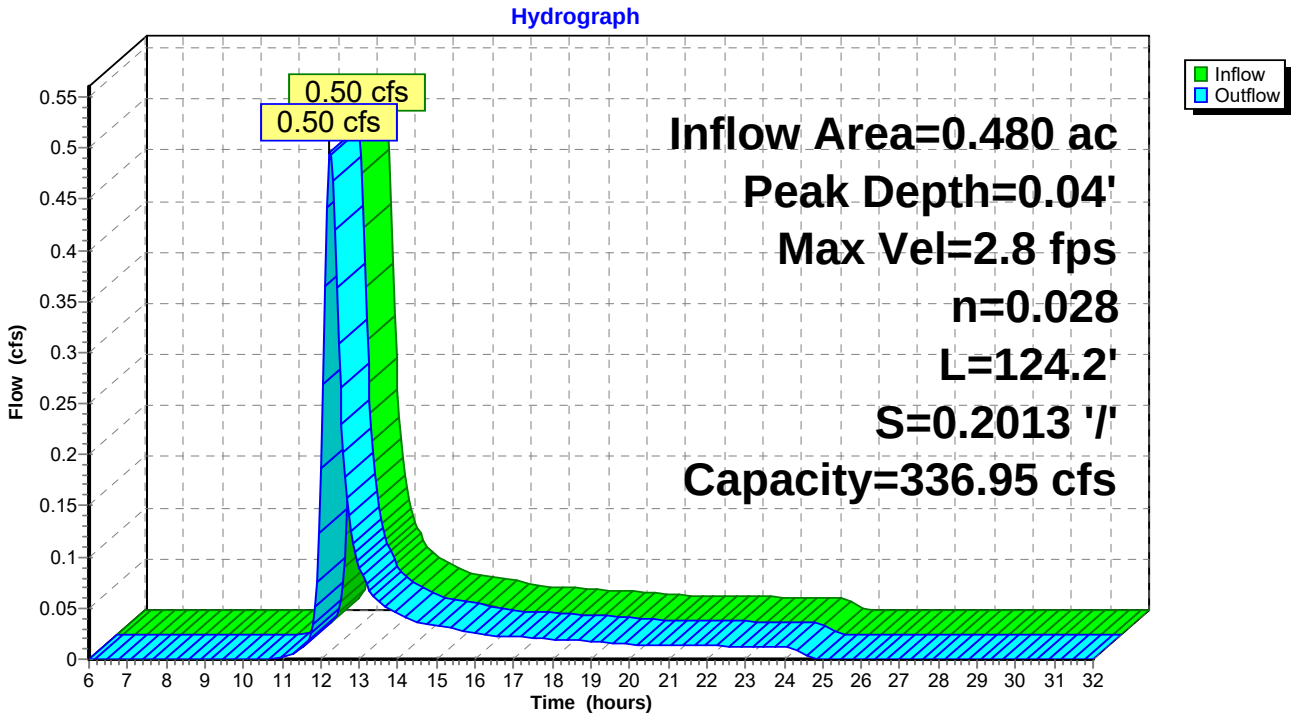
Reach 12-13: DOWNCHUTE

Inflow Area = 0.480 ac, Inflow Depth = 1.15" for 2 event
Inflow = 0.50 cfs @ 12.21 hrs, Volume= 0.046 af
Outflow = 0.50 cfs @ 12.23 hrs, Volume= 0.046 af, Atten= 1%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.8 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.5 fps, Avg. Travel Time= 1.4 min

Peak Depth= 0.04' @ 12.22 hrs
Capacity at bank full= 336.95 cfs
Inlet Invert= 235.00', Outlet Invert= 210.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 124.2' Slope= 0.2013 '/'

Reach 12-13: DOWNCHUTE



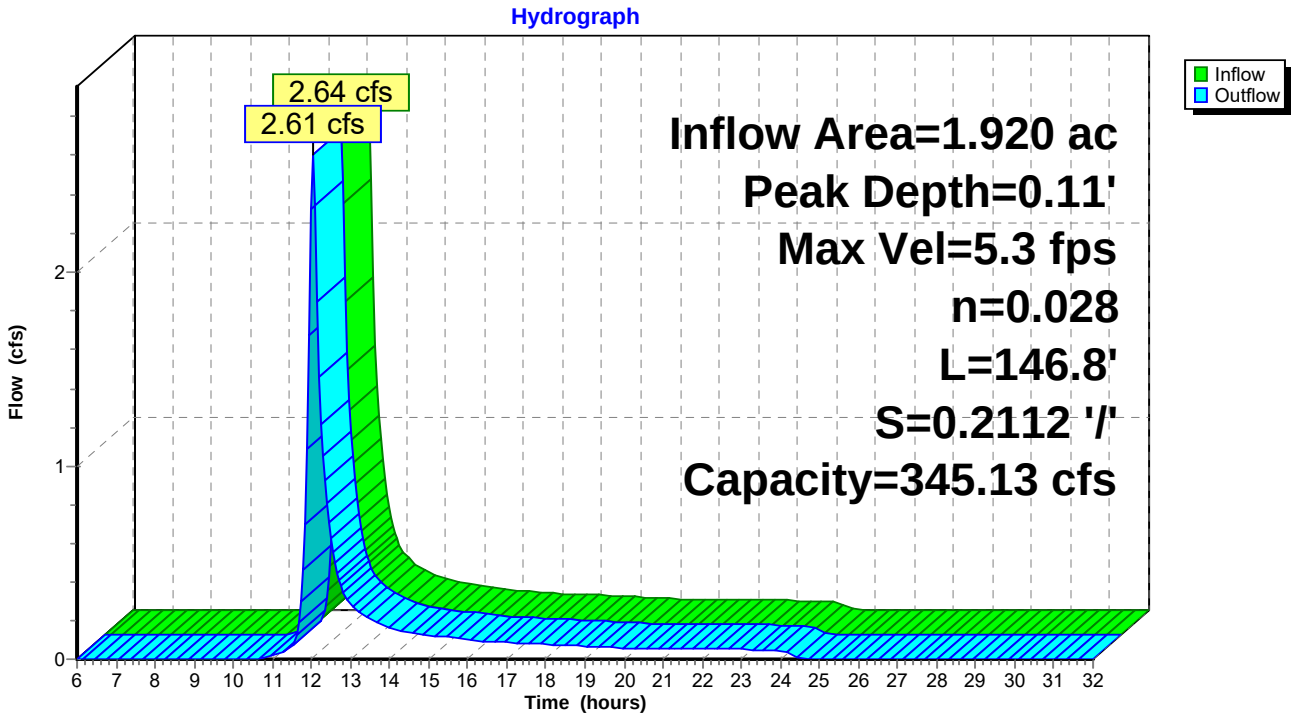
Reach 13-14: DOWNCHUTE

Inflow Area = 1.920 ac, Inflow Depth = 1.15" for 2 event
Inflow = 2.64 cfs @ 12.04 hrs, Volume= 0.184 af
Outflow = 2.61 cfs @ 12.05 hrs, Volume= 0.184 af, Atten= 1%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.3 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.7 fps, Avg. Travel Time= 1.4 min

Peak Depth= 0.11' @ 12.04 hrs
Capacity at bank full= 345.13 cfs
Inlet Invert= 210.00', Outlet Invert= 179.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 146.8' Slope= 0.2112 '/'

Reach 13-14: DOWNCHUTE



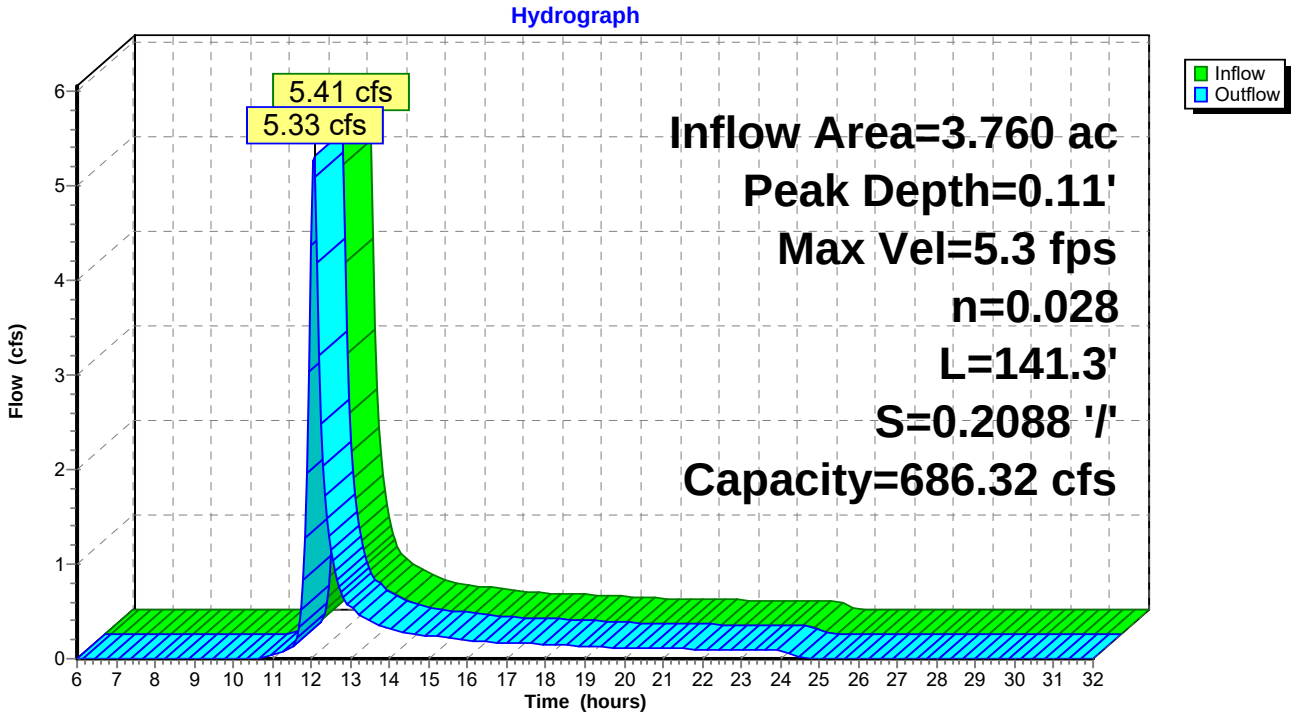
Reach 14-15: DOWNCHUTE

Inflow Area = 3.760 ac, Inflow Depth = 1.15" for 2 event
Inflow = 5.41 cfs @ 12.06 hrs, Volume= 0.361 af
Outflow = 5.33 cfs @ 12.07 hrs, Volume= 0.361 af, Atten= 2%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.3 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.7 fps, Avg. Travel Time= 1.4 min

Peak Depth= 0.11' @ 12.06 hrs
Capacity at bank full= 686.32 cfs
Inlet Invert= 179.00', Outlet Invert= 149.50'
A factor of 2.00 has been applied to the supplied storage and discharge data
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 141.3' Slope= 0.2088 '/'

Reach 14-15: DOWNCHUTE



Reach 15-17: DOWNCHUTE

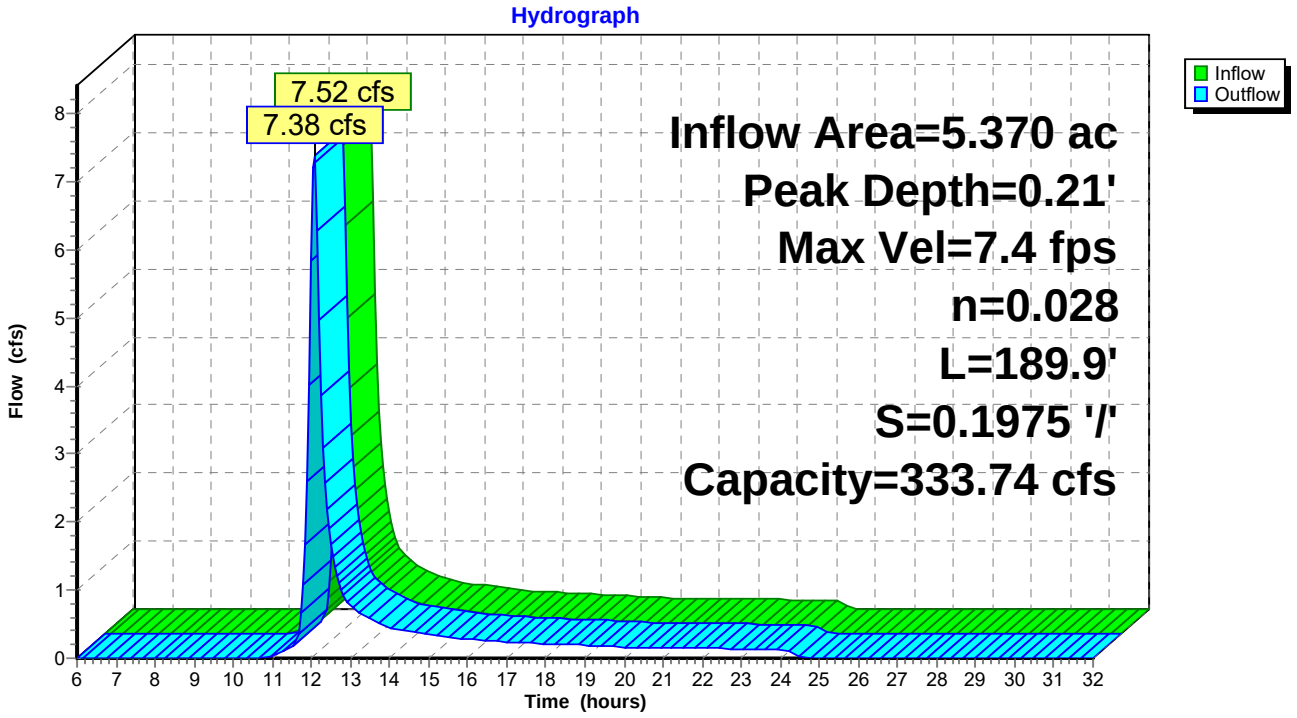
[61] Hint: Submerged 1% of Reach 14-15 bottom

Inflow Area = 5.370 ac, Inflow Depth = 1.15" for 2 event
Inflow = 7.52 cfs @ 12.07 hrs, Volume= 0.516 af
Outflow = 7.38 cfs @ 12.08 hrs, Volume= 0.516 af, Atten= 2%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.4 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.3 fps, Avg. Travel Time= 1.4 min

Peak Depth= 0.21' @ 12.07 hrs
Capacity at bank full= 333.74 cfs
Inlet Invert= 149.50', Outlet Invert= 112.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 189.9' Slope= 0.1975 '/'

Reach 15-17: DOWNCHUTE



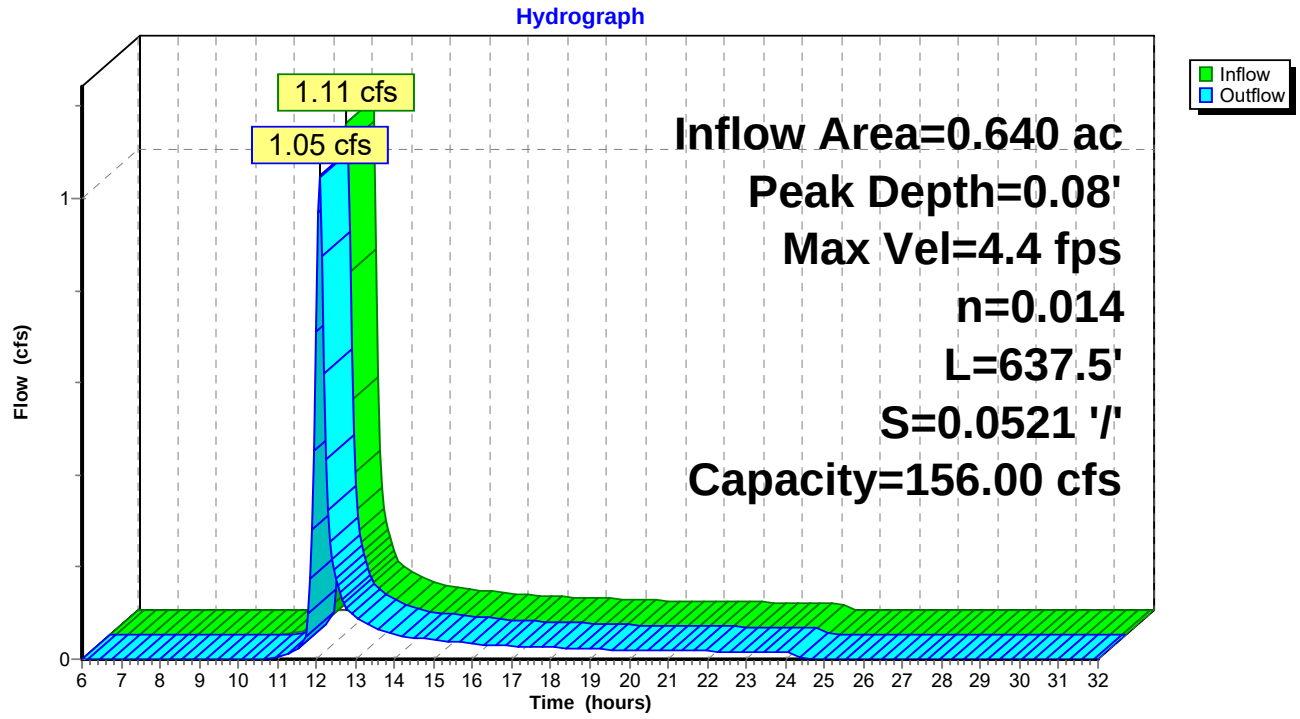
Reach 16-18: PERIMETER CHANNEL

Inflow Area = 0.640 ac, Inflow Depth = 1.15" for 2 event
Inflow = 1.11 cfs @ 12.02 hrs, Volume= 0.061 af
Outflow = 1.05 cfs @ 12.09 hrs, Volume= 0.061 af, Atten= 5%, Lag= 4.2 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.4 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 1.6 fps, Avg. Travel Time= 6.8 min

Peak Depth= 0.08' @ 12.05 hrs
Capacity at bank full= 156.00 cfs
Inlet Invert= 135.70', Outlet Invert= 102.50'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 637.5' Slope= 0.0521 '/'

Reach 16-18: PERIMETER CHANNEL



Reach 17-18: PIPE DOWNCHUTE

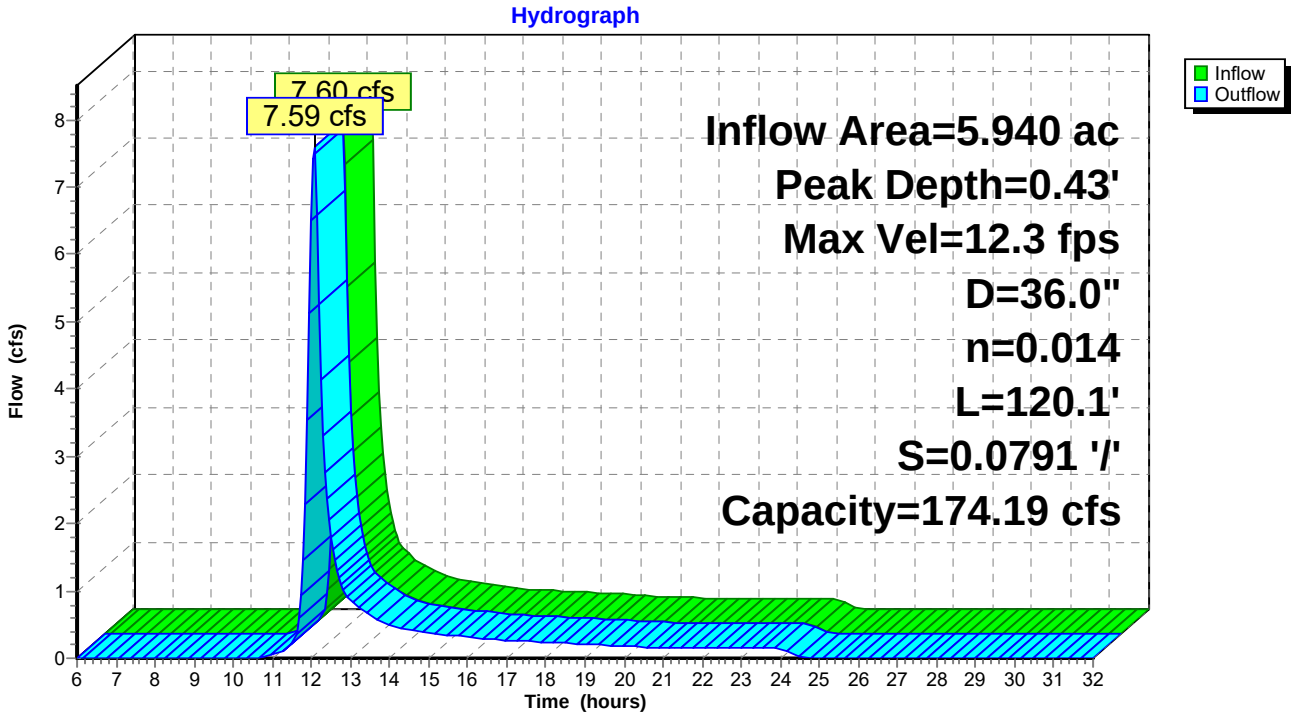
[52] Hint: Inlet conditions not evaluated
[61] Hint: Submerged 1% of Reach 15-17 bottom

Inflow Area = 5.940 ac, Inflow Depth = 1.15" for 2 event
Inflow = 7.60 cfs @ 12.07 hrs, Volume= 0.570 af
Outflow = 7.59 cfs @ 12.08 hrs, Volume= 0.570 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 12.3 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.6 fps, Avg. Travel Time= 0.4 min

Peak Depth= 0.43' @ 12.08 hrs
Capacity at bank full= 174.19 cfs
Inlet Invert= 112.00', Outlet Invert= 102.50'
36.0" Diameter Pipe, n= 0.014
Length= 120.1' Slope= 0.0791 '/'

Reach 17-18: PIPE DOWNCHUTE



Reach 18-19: PERIMETER CHANNEL W

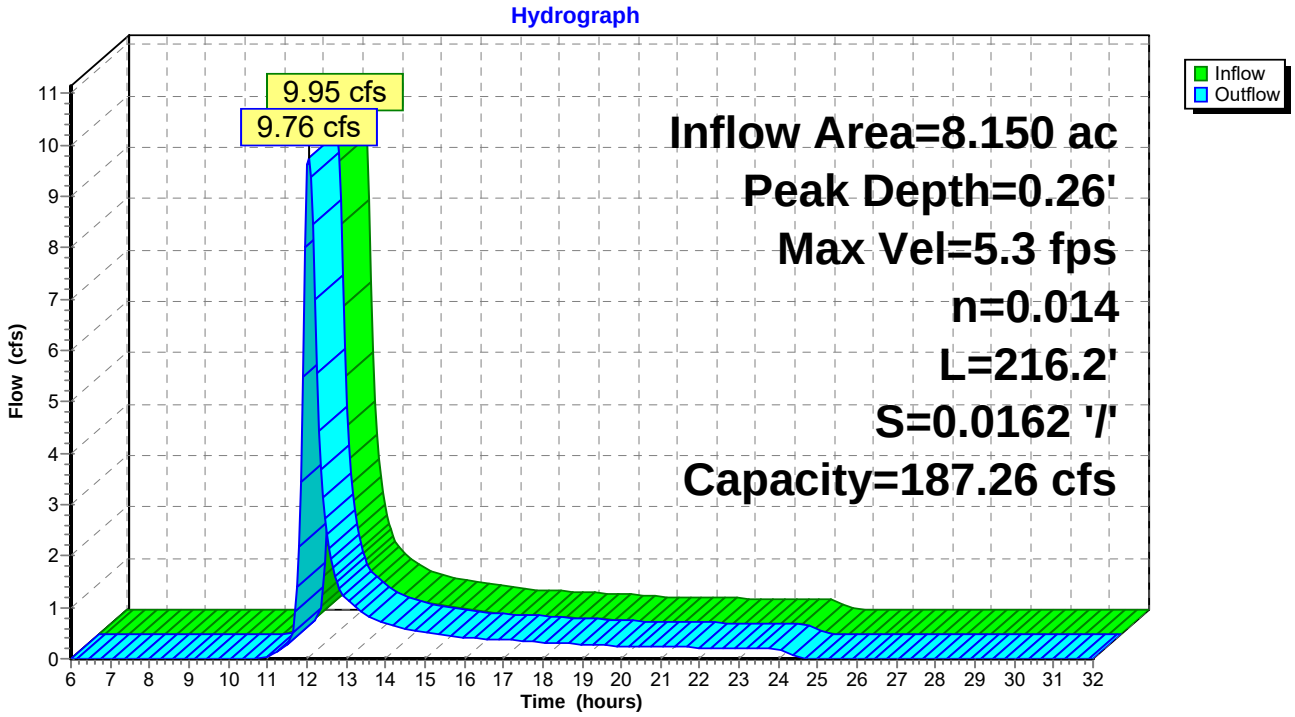
[61] Hint: Submerged 1% of Reach 16-18 bottom
[61] Hint: Submerged 3% of Reach 17-18 bottom

Inflow Area = 8.150 ac, Inflow Depth = 1.15" for 2 event
Inflow = 9.95 cfs @ 12.01 hrs, Volume= 0.782 af
Outflow = 9.76 cfs @ 12.04 hrs, Volume= 0.782 af, Atten= 2%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.3 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.5 fps, Avg. Travel Time= 2.4 min

Peak Depth= 0.26' @ 12.02 hrs
Capacity at bank full= 187.26 cfs
Inlet Invert= 102.50', Outlet Invert= 99.00'
7.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 10.00'
Length= 216.2' Slope= 0.0162 '/'

Reach 18-19: PERIMETER CHANNEL W



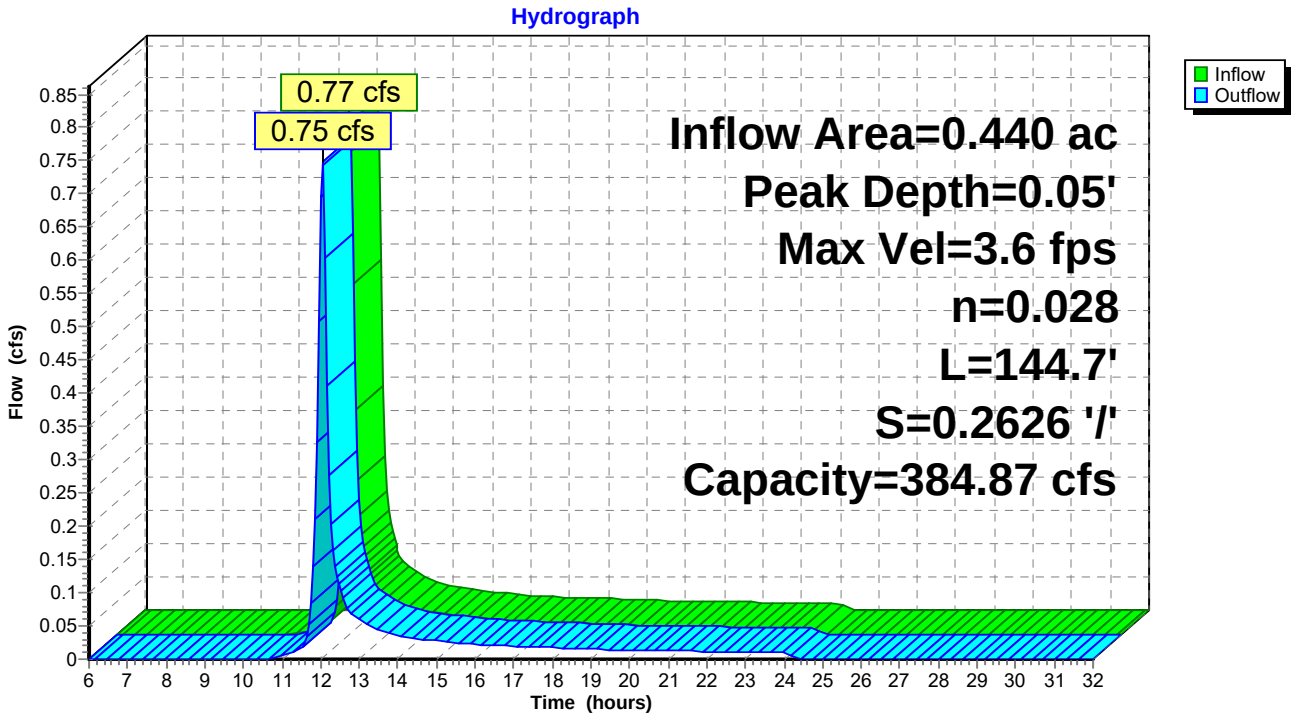
Reach 21-23: DOWNCHUTE

Inflow Area = 0.440 ac, Inflow Depth = 1.15" for 2 event
Inflow = 0.77 cfs @ 12.02 hrs, Volume= 0.042 af
Outflow = 0.75 cfs @ 12.04 hrs, Volume= 0.042 af, Atten= 3%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.6 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.7 fps, Avg. Travel Time= 1.4 min

Peak Depth= 0.05' @ 12.03 hrs
Capacity at bank full= 384.87 cfs
Inlet Invert= 219.00', Outlet Invert= 181.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 144.7' Slope= 0.2626 '/'

Reach 21-23: DOWNCHUTE



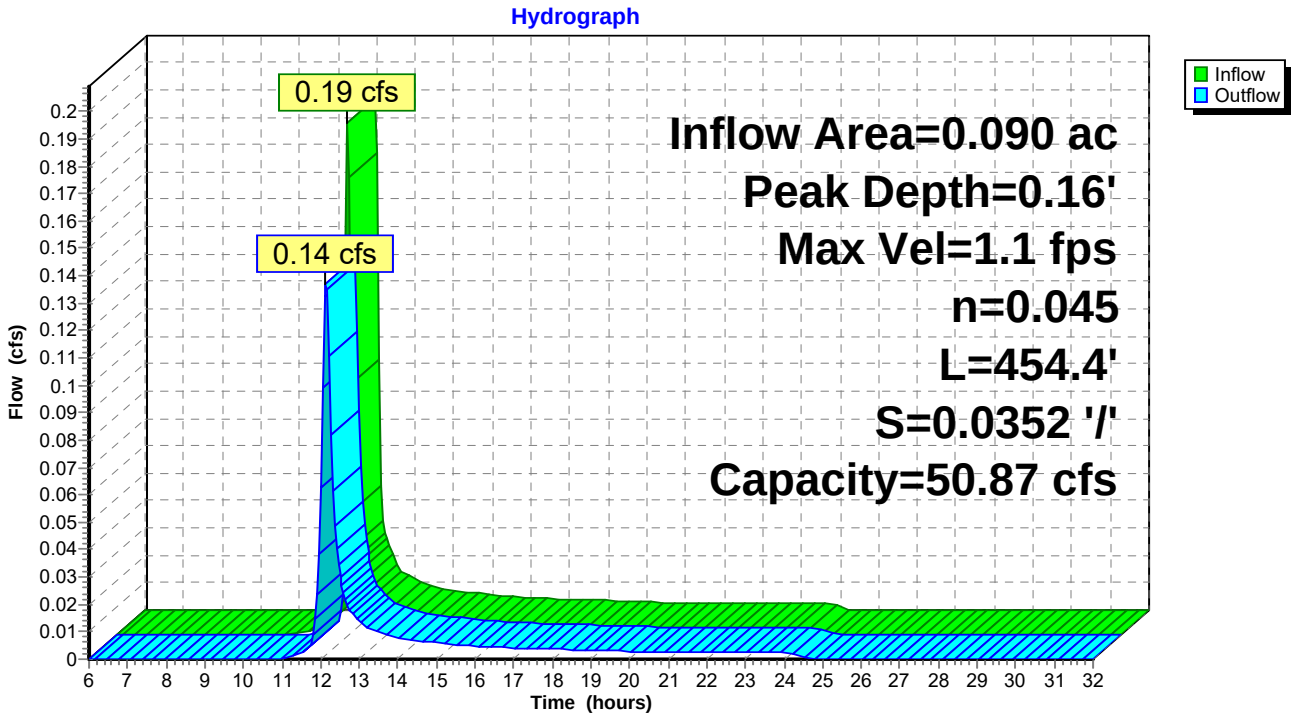
Reach 22-23: BENCH

Inflow Area = 0.090 ac, Inflow Depth = 1.15" for 2 event
Inflow = 0.19 cfs @ 11.96 hrs, Volume= 0.009 af
Outflow = 0.14 cfs @ 12.13 hrs, Volume= 0.009 af, Atten= 27%, Lag= 10.1 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.1 fps, Min. Travel Time= 6.6 min
Avg. Velocity = 0.5 fps, Avg. Travel Time= 16.2 min

Peak Depth= 0.16' @ 12.02 hrs
Capacity at bank full= 50.87 cfs
Inlet Invert= 197.00', Outlet Invert= 181.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 454.4' Slope= 0.0352 '/'

Reach 22-23: BENCH



Reach 23-25: DOWNCHUTE

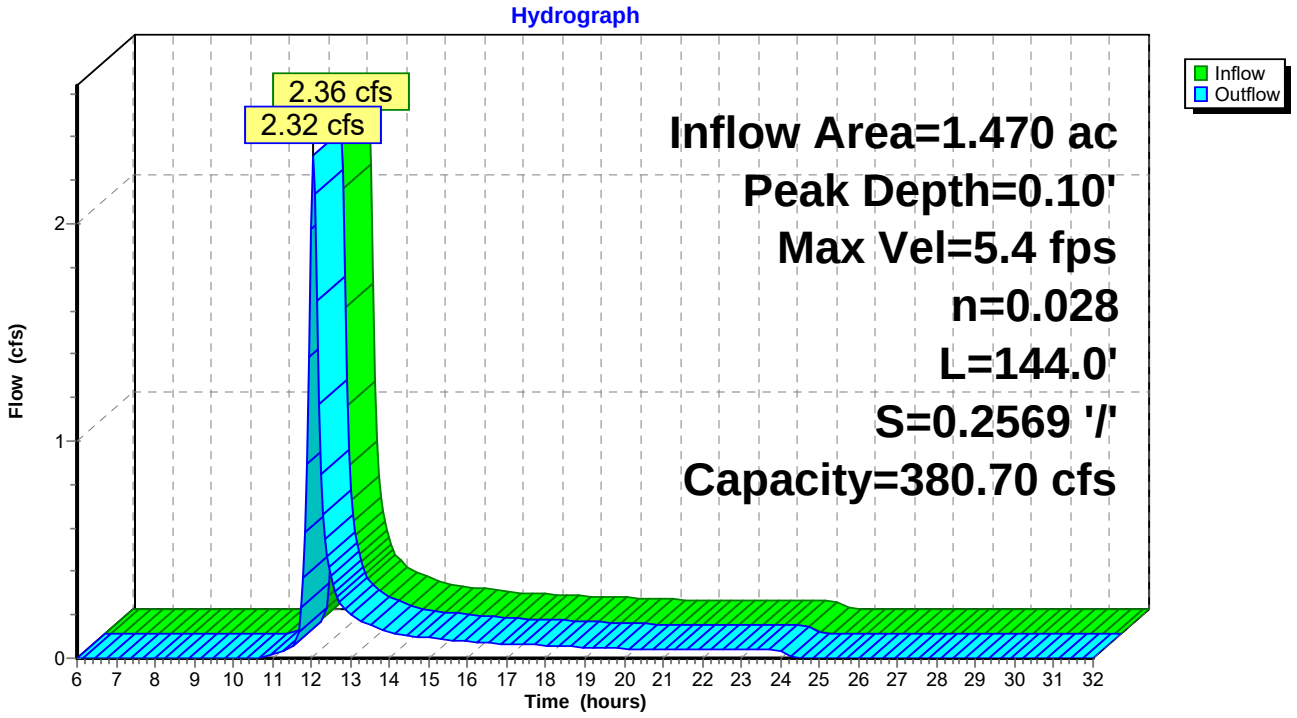
[61] Hint: Submerged 1% of Reach 22-23 bottom

Inflow Area = 1.470 ac, Inflow Depth = 1.15" for 2 event
Inflow = 2.36 cfs @ 12.05 hrs, Volume= 0.141 af
Outflow = 2.32 cfs @ 12.06 hrs, Volume= 0.141 af, Atten= 2%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.4 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 1.3 min

Peak Depth= 0.10' @ 12.05 hrs
Capacity at bank full= 380.70 cfs
Inlet Invert= 181.00', Outlet Invert= 144.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 144.0' Slope= 0.2569 '/'

Reach 23-25: DOWNCHUTE



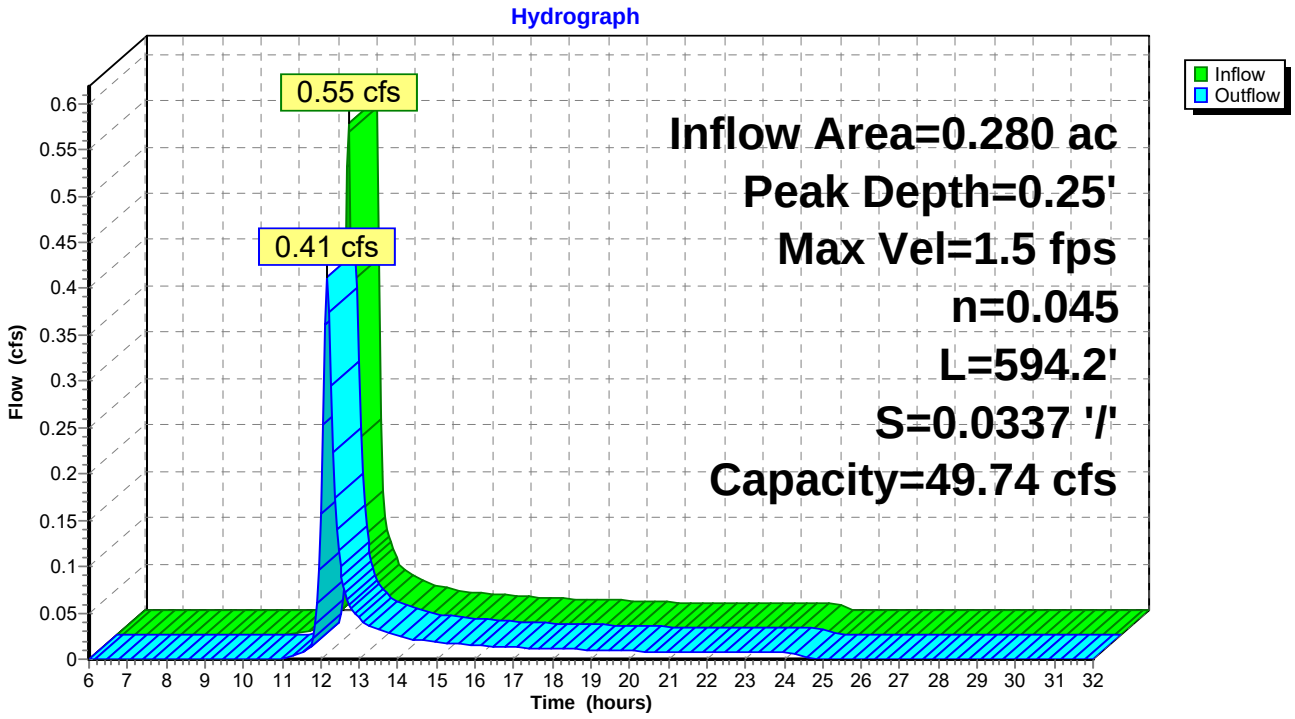
Reach 24-25: BENCH

Inflow Area = 0.280 ac, Inflow Depth = 1.15" for 2 event
Inflow = 0.55 cfs @ 11.98 hrs, Volume= 0.027 af
Outflow = 0.41 cfs @ 12.15 hrs, Volume= 0.027 af, Atten= 25%, Lag= 10.2 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.5 fps, Min. Travel Time= 6.6 min
Avg. Velocity = 0.6 fps, Avg. Travel Time= 17.2 min

Peak Depth= 0.25' @ 12.04 hrs
Capacity at bank full= 49.74 cfs
Inlet Invert= 164.00', Outlet Invert= 144.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 594.2' Slope= 0.0337 '/'

Reach 24-25: BENCH



Reach 25-27: DOWNCHUTE

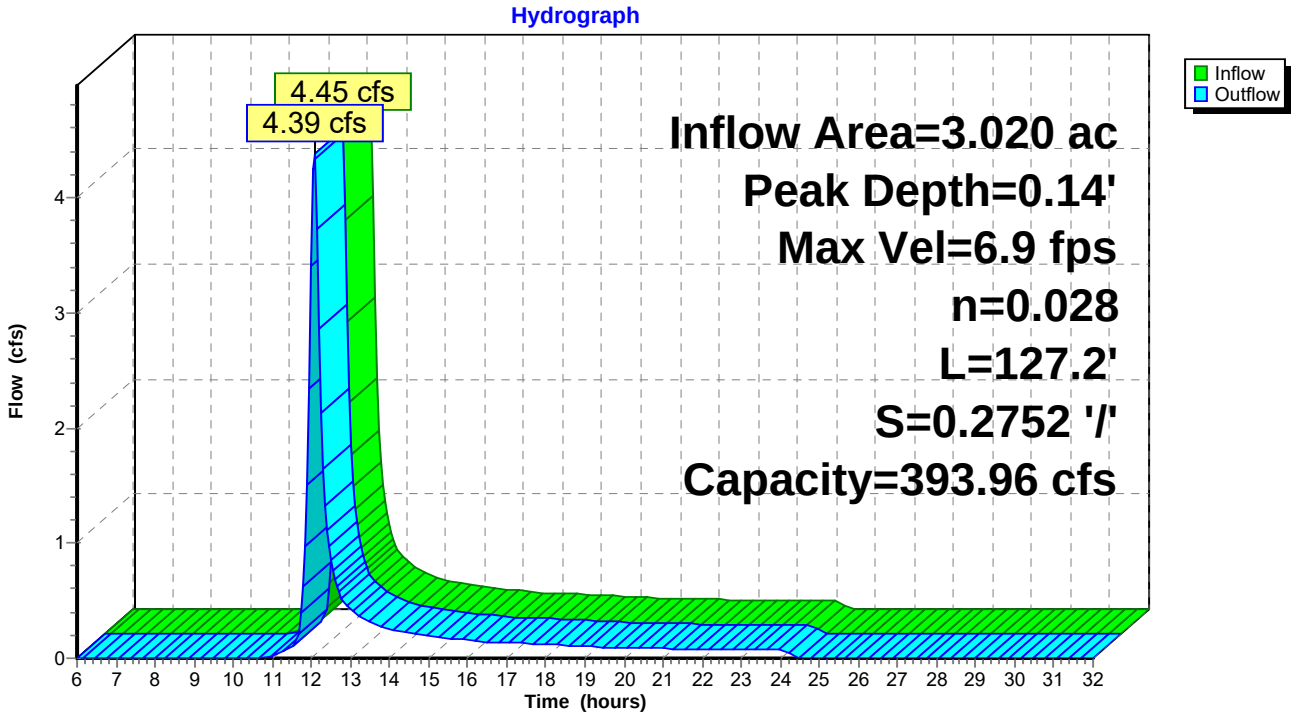
[61] Hint: Submerged 1% of Reach 24-25 bottom

Inflow Area = 3.020 ac, Inflow Depth = 1.15" for 2 event
Inflow = 4.45 cfs @ 12.07 hrs, Volume= 0.290 af
Outflow = 4.39 cfs @ 12.08 hrs, Volume= 0.290 af, Atten= 1%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.9 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.1 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.14' @ 12.08 hrs
Capacity at bank full= 393.96 cfs
Inlet Invert= 144.00', Outlet Invert= 109.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 127.2' Slope= 0.2752 '/'

Reach 25-27: DOWNCHUTE



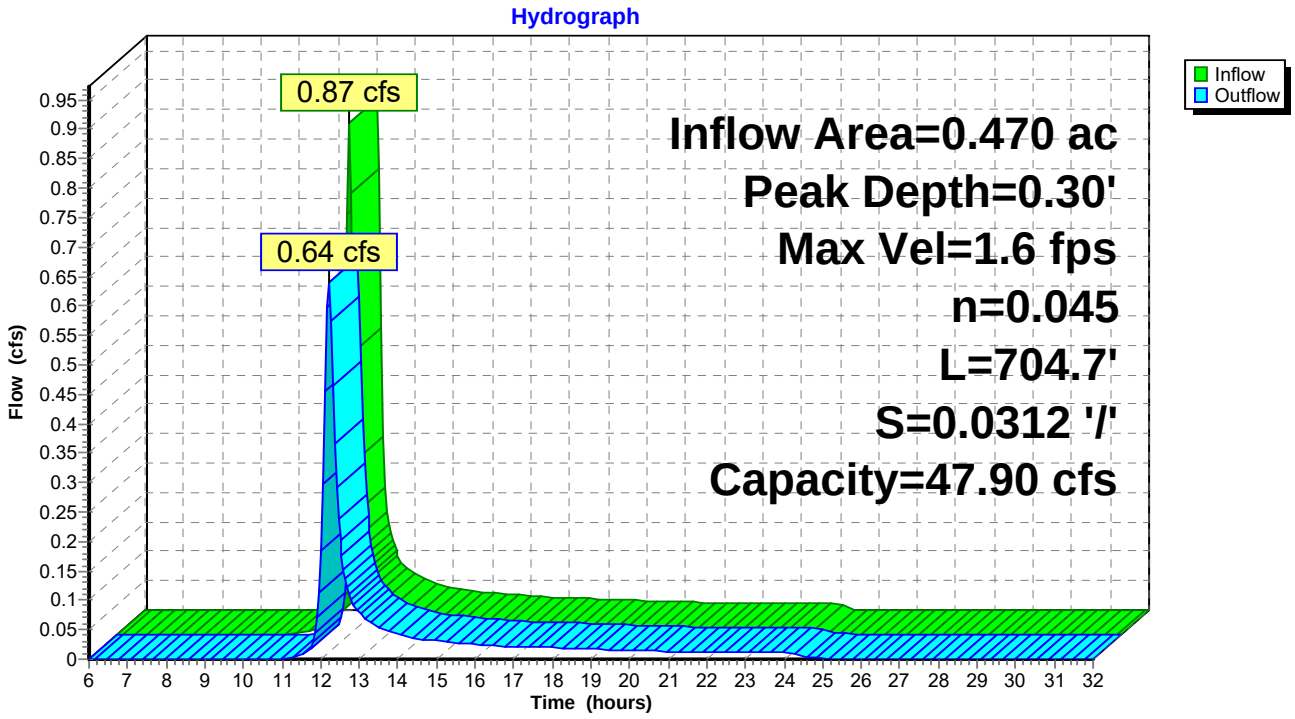
Reach 26-27: BENCH

Inflow Area = 0.470 ac, Inflow Depth = 1.15" for 2 event
Inflow = 0.87 cfs @ 12.00 hrs, Volume= 0.045 af
Outflow = 0.64 cfs @ 12.19 hrs, Volume= 0.045 af, Atten= 26%, Lag= 11.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.6 fps, Min. Travel Time= 7.3 min
Avg. Velocity = 0.6 fps, Avg. Travel Time= 19.1 min

Peak Depth= 0.30' @ 12.07 hrs
Capacity at bank full= 47.90 cfs
Inlet Invert= 131.00', Outlet Invert= 109.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 704.7' Slope= 0.0312 '/'

Reach 26-27: BENCH



Reach 27-29: DOWNCHUTE

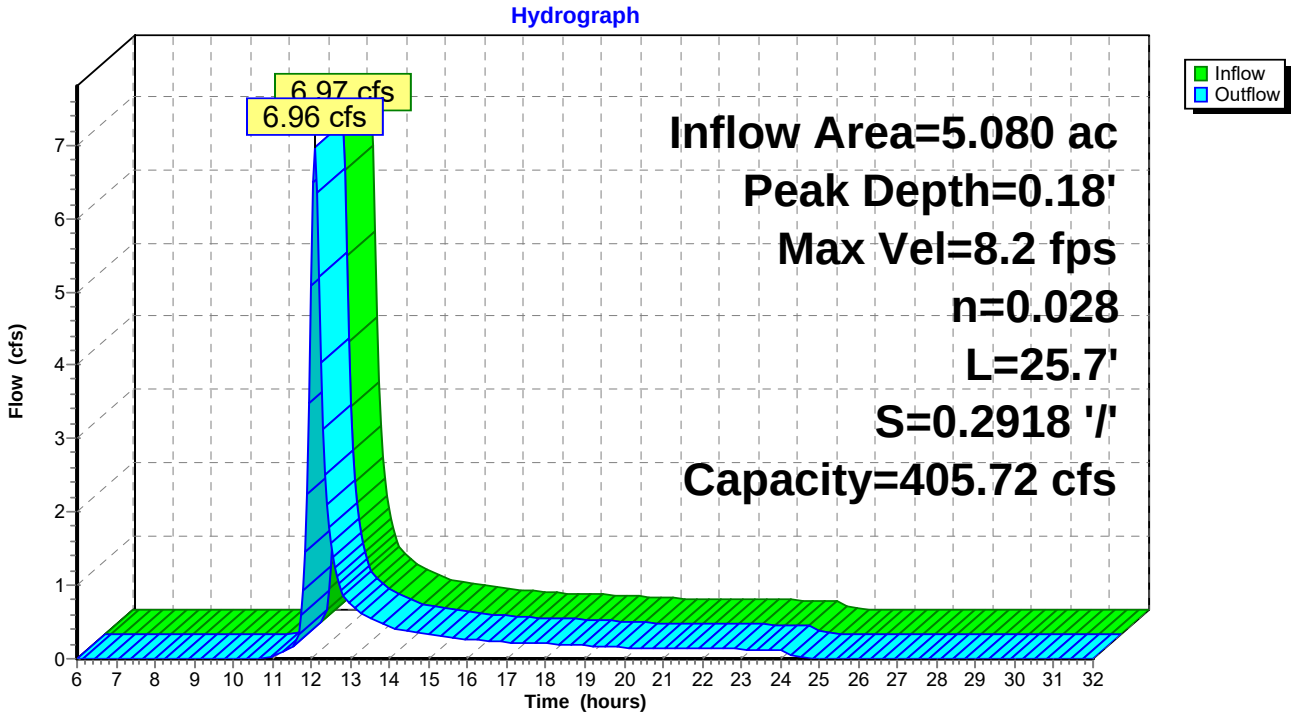
[61] Hint: Submerged 1% of Reach 25-27 bottom
[61] Hint: Submerged 1% of Reach 26-27 bottom

Inflow Area = 5.080 ac, Inflow Depth = 1.15" for 2 event
Inflow = 6.97 cfs @ 12.10 hrs, Volume= 0.488 af
Outflow = 6.96 cfs @ 12.10 hrs, Volume= 0.488 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.2 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.5 fps, Avg. Travel Time= 0.2 min

Peak Depth= 0.18' @ 12.10 hrs
Capacity at bank full= 405.72 cfs
Inlet Invert= 109.00', Outlet Invert= 101.50'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 25.7' Slope= 0.2918 '/'

Reach 27-29: DOWNCHUTE



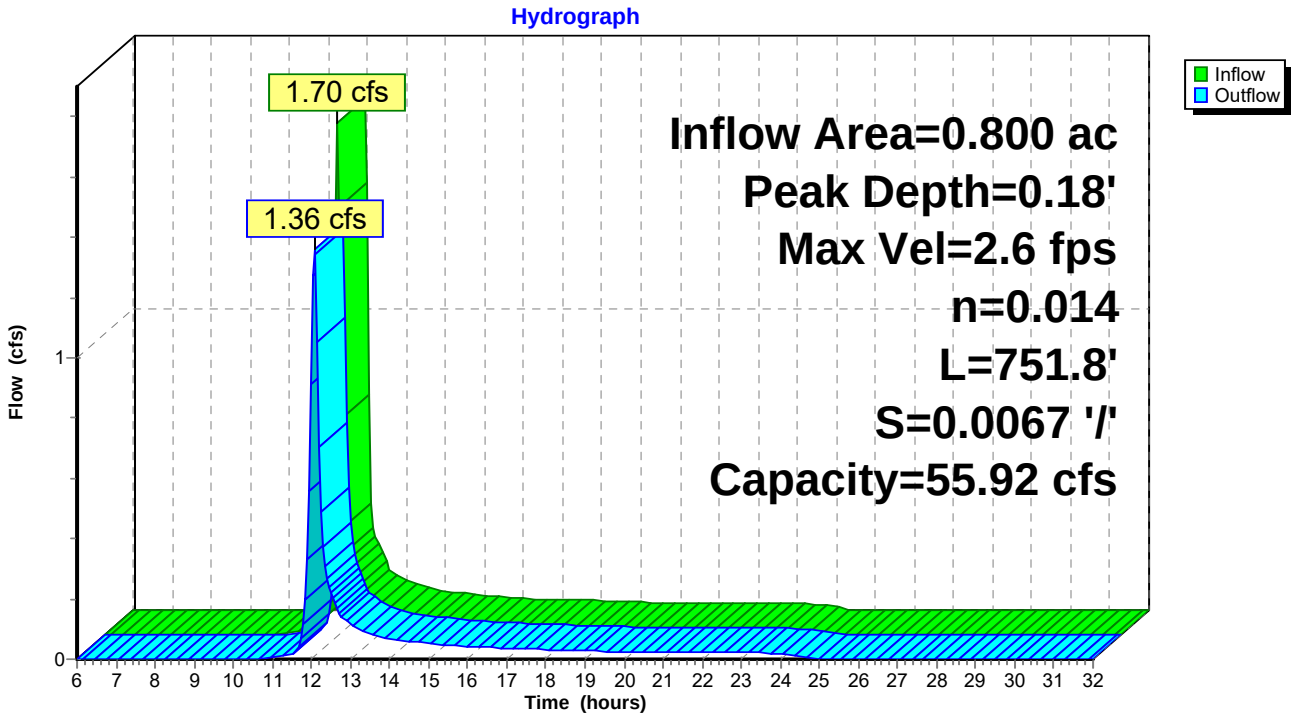
Reach 28-29: PERIMETER CHANNEL

Inflow Area = 0.800 ac, Inflow Depth = 1.15" for 2 event
Inflow = 1.70 cfs @ 11.96 hrs, Volume= 0.077 af
Outflow = 1.36 cfs @ 12.08 hrs, Volume= 0.077 af, Atten= 20%, Lag= 7.7 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.6 fps, Min. Travel Time= 4.9 min
Avg. Velocity = 0.7 fps, Avg. Travel Time= 18.7 min

Peak Depth= 0.18' @ 12.00 hrs
Capacity at bank full= 55.92 cfs
Inlet Invert= 106.53', Outlet Invert= 101.50'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 751.8' Slope= 0.0067 '/'

Reach 28-29: PERIMETER CHANNEL



Pond POND Nº1:

Inflow Area = 23.430 ac, Inflow Depth = 1.15" for 2 event
Inflow = 24.44 cfs @ 12.04 hrs, Volume= 2.249 af
Outflow = 5.76 cfs @ 12.70 hrs, Volume= 1.970 af, Atten= 76%, Lag= 39.5 min
Primary = 5.76 cfs @ 12.70 hrs, Volume= 1.970 af

Routing by Stor-Ind method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 25.30' @ 12.70 hrs Surf.Area= 0.709 ac Storage= 0.894 af
Plug-Flow detention time= 195.3 min calculated for 1.970 af (88% of inflow)
Center-of-Mass det. time= 133.5 min (1,001.1 - 867.6)

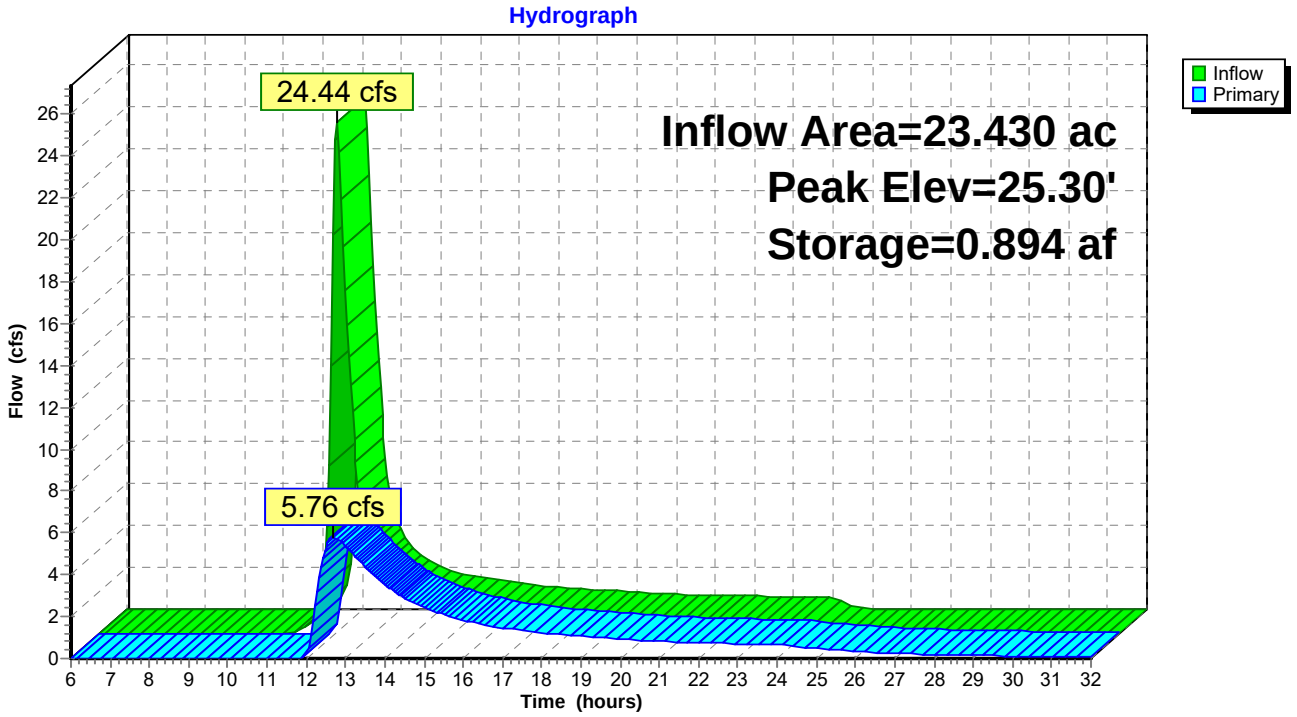
Volume	Invert	Avail.Storage	Storage Description
#1	24.00'	4.638 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
24.00	0.670	728.0	0.000	0.000	0.670
26.00	0.730	755.0	1.400	1.400	0.751
28.00	0.810	781.0	1.539	2.939	0.832
30.00	0.890	807.0	1.699	4.638	0.915

Device	Routing	Invert	Outlet Devices
#1	Primary	24.30'	**18.0" x 97.0' long Culvert X 2.00** Ke= 0.900 Outlet Invert= 23.23' S= 0.0110 '/' Cc= 0.900 n= 0.024
#2	Primary	28.90'	**13.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=5.76 cfs @ 12.70 hrs HW=25.30' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 5.76 cfs @ 3.3 fps)
└—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond POND Nº1:



Pond POND Nº2:

Inflow Area = 8.390 ac, Inflow Depth = 1.15" for 2 event
Inflow = 10.04 cfs @ 12.01 hrs, Volume= 0.805 af
Outflow = 0.32 cfs @ 18.45 hrs, Volume= 0.217 af, Atten= 97%, Lag= 386.8 min
Primary = 0.32 cfs @ 18.45 hrs, Volume= 0.217 af

Routing by Stor-Ind method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 36.22' @ 18.45 hrs Surf.Area= 0.259 ac Storage= 0.634 af
Plug-Flow detention time= 546.4 min calculated for 0.216 af (27% of inflow)
Center-of-Mass det. time= 402.3 min (1,262.3 - 859.9)

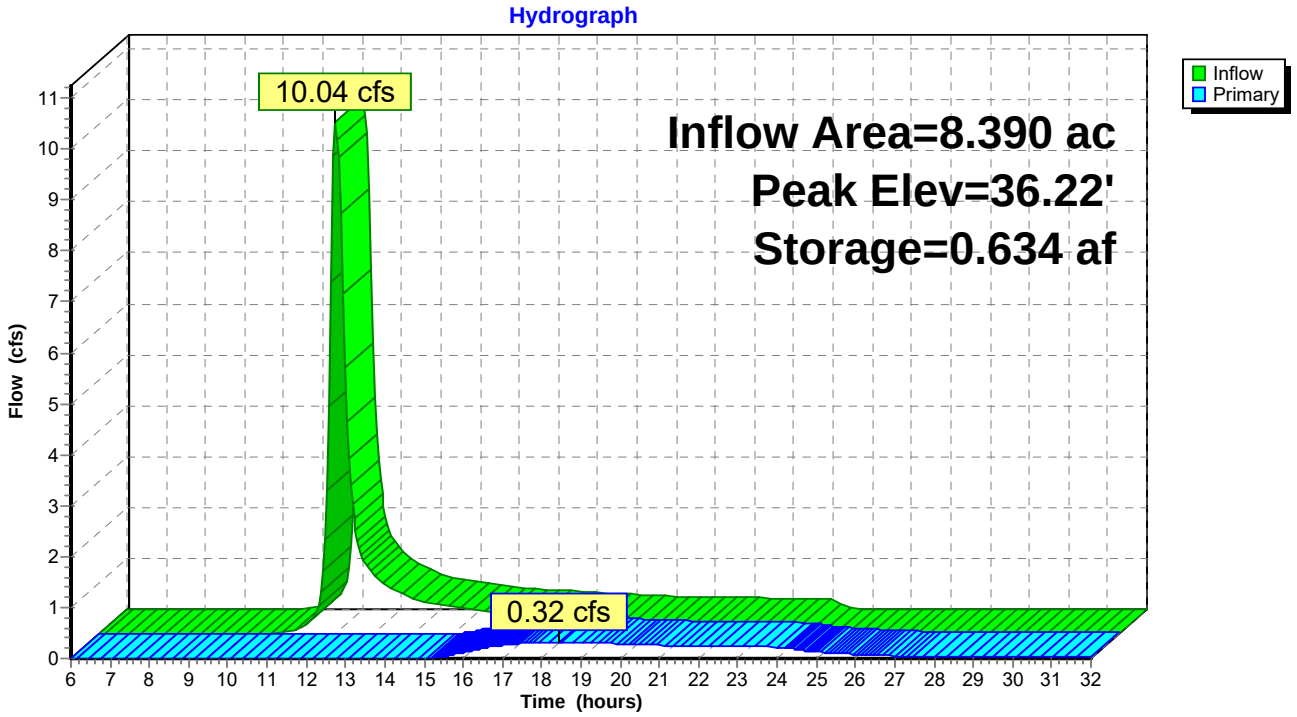
Volume	Invert	Avail.Storage	Storage Description
#1	33.00'	1.925 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
33.00	0.135	833.8	0.000	0.000	0.135
34.00	0.174	851.5	0.154	0.154	0.193
35.00	0.213	870.3	0.193	0.347	0.255
36.00	0.250	890.0	0.231	0.579	0.322
38.00	0.340	924.0	0.588	1.166	0.442
40.00	0.420	958.0	0.759	1.925	0.566

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	**12.0" x 45.0' long Culvert X 2.00** Ke= 0.500 Outlet Invert= 35.10' S= 0.0200 '/' Cc= 0.900 n= 0.024
#2	Primary	39.60'	**12.0' long x 6.0' 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 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.31 cfs @ 18.45 hrs HW=36.22' (Free Discharge)
└─**1=Culvert** (Barrel Controls 0.31 cfs @ 1.9 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond POND Nº2:



Pond WL-2:

Inflow Area = 6.490 ac, Inflow Depth = 0.69" for 2 event
Inflow = 3.05 cfs @ 12.31 hrs, Volume= 0.372 af
Outflow = 0.00 cfs @ 6.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 6.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 36.68' @ 25.85 hrs Surf.Area= 1.085 ac Storage= 0.372 af
Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

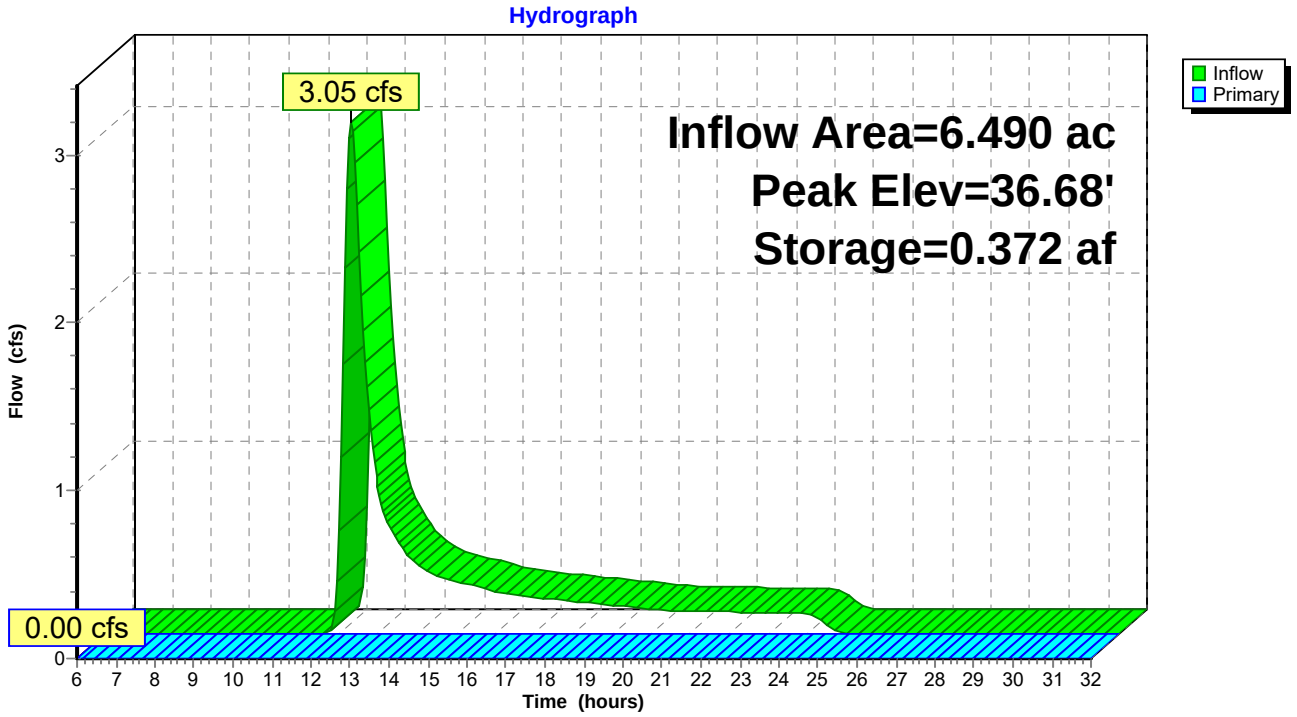
Volume	Invert	Avail.Storage	Storage Description
#1	36.00'	3.170 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
36.00	0.000	0.000	0.000
38.00	3.170	3.170	3.170

Device	Routing	Invert	Outlet Devices
#1	Primary	37.00'	**140.0' long x 30.0' 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 @ 6.00 hrs HW=36.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond WL-2:

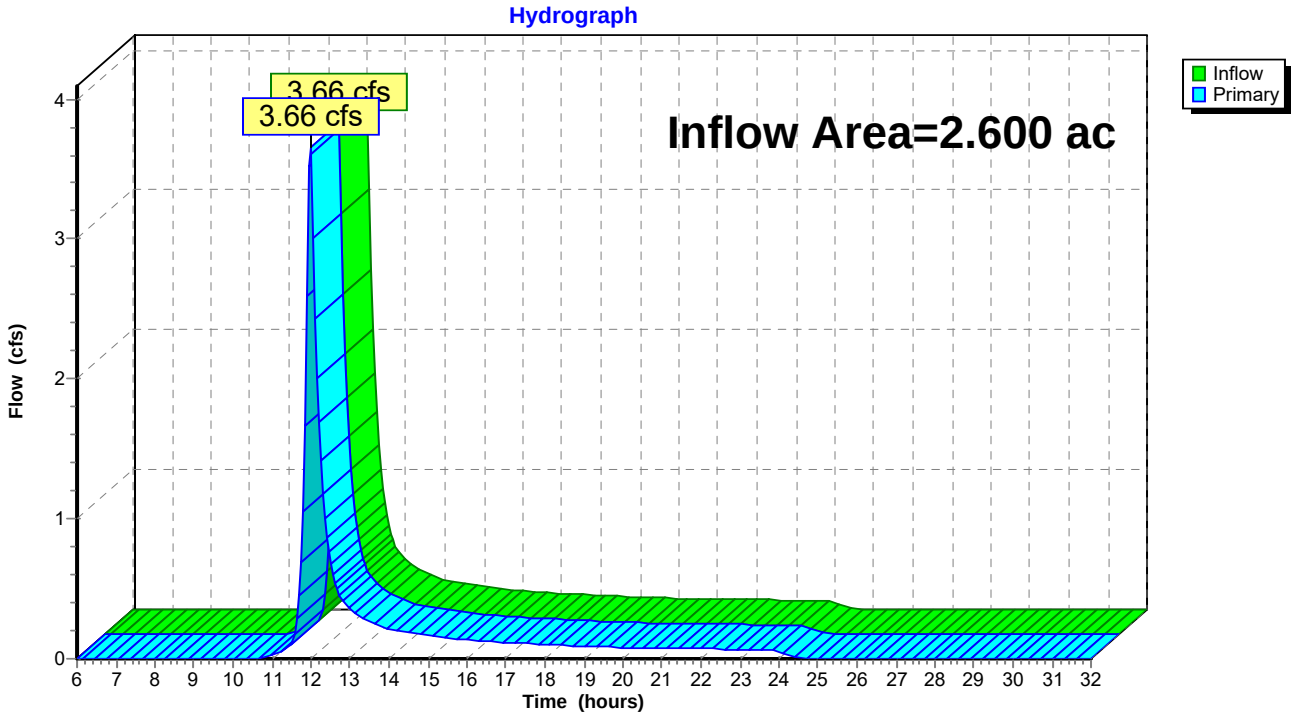

Hydrograph
3.05 cfs
0.00 cfs
Inflow Area=6.490 ac
Peak Elev=36.68'
Storage=0.372 af
Inflow
Primary
Flow (cfs)
Time (hours)
0
1
2
3
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

Link 08`-09:

Inflow Area = 2.600 ac, Inflow Depth = 1.15" for 2 event
Inflow = 3.66 cfs @ 11.98 hrs, Volume= 0.250 af
Primary = 3.66 cfs @ 11.98 hrs, Volume= 0.250 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link 08`-09:

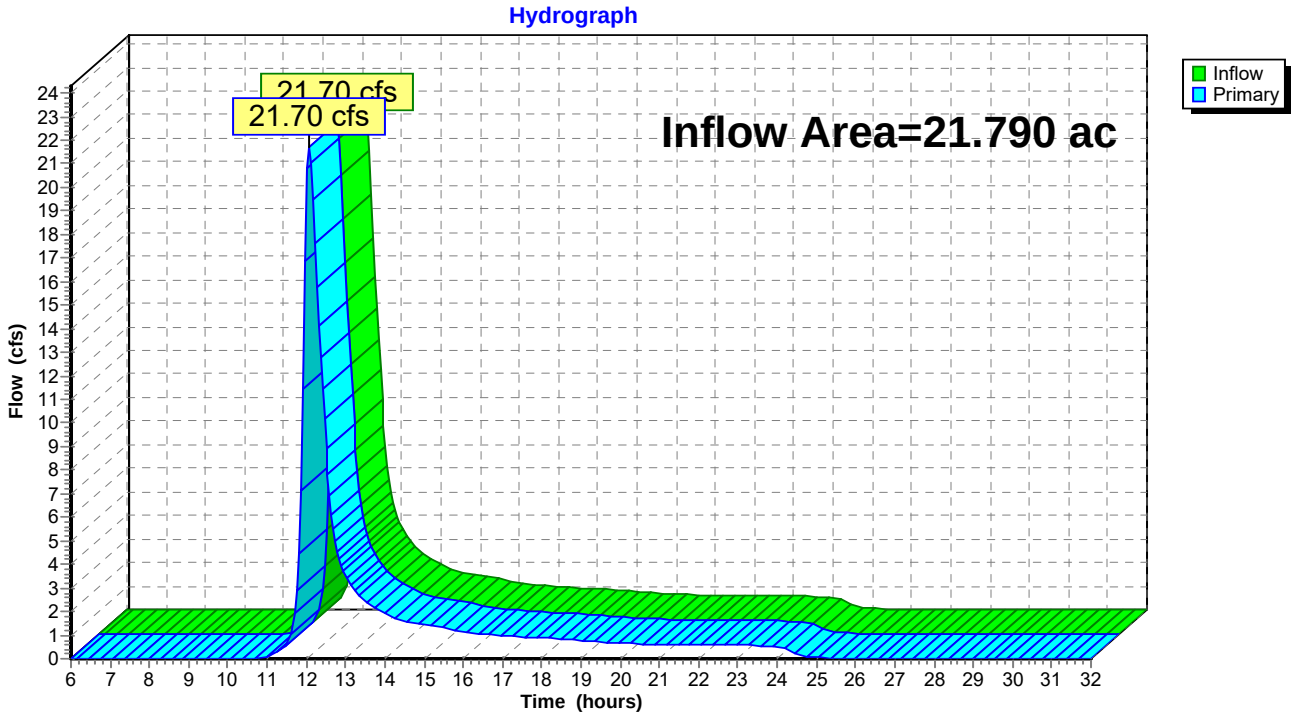


Link 19-20:

Inflow Area = 21.790 ac, Inflow Depth = 1.15" for 2 event
Inflow = 21.70 cfs @ 12.05 hrs, Volume= 2.092 af
Primary = 21.70 cfs @ 12.05 hrs, Volume= 2.092 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link 19-20:

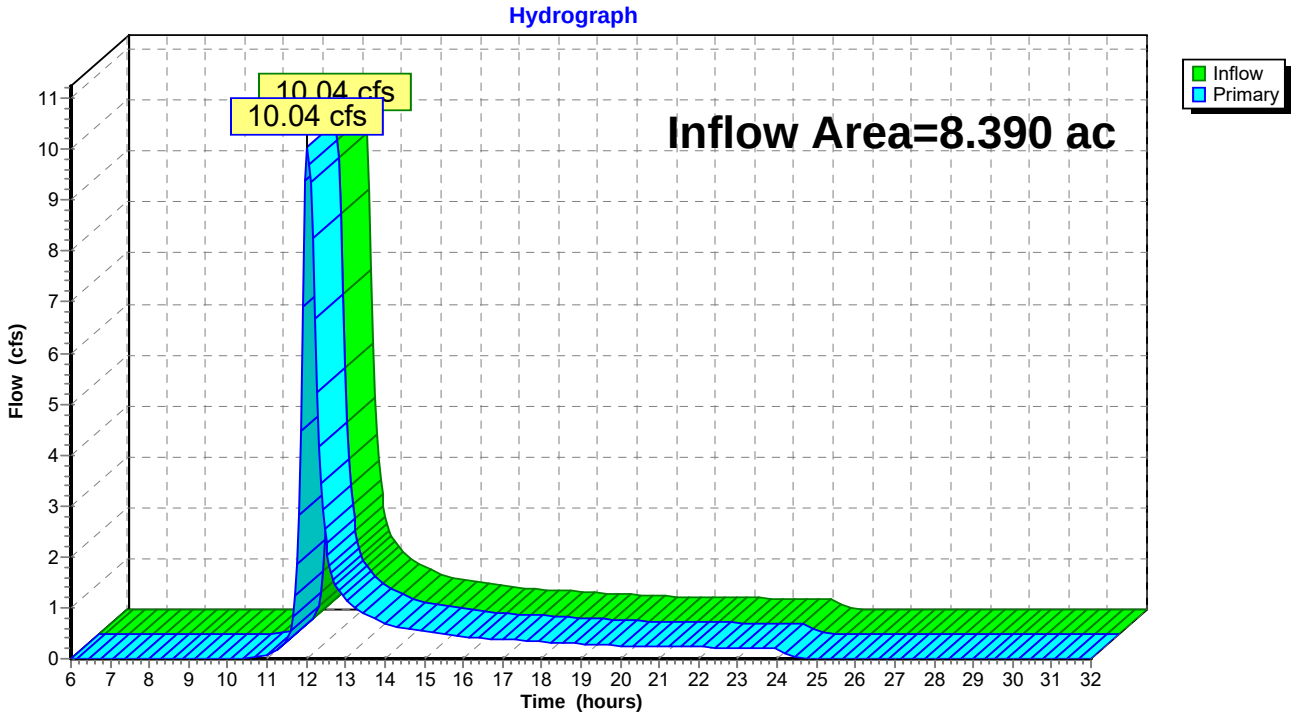


Link 29-30:

Inflow Area = 8.390 ac, Inflow Depth = 1.15" for 2 event
Inflow = 10.04 cfs @ 12.01 hrs, Volume= 0.805 af
Primary = 10.04 cfs @ 12.01 hrs, Volume= 0.805 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link 29-30:

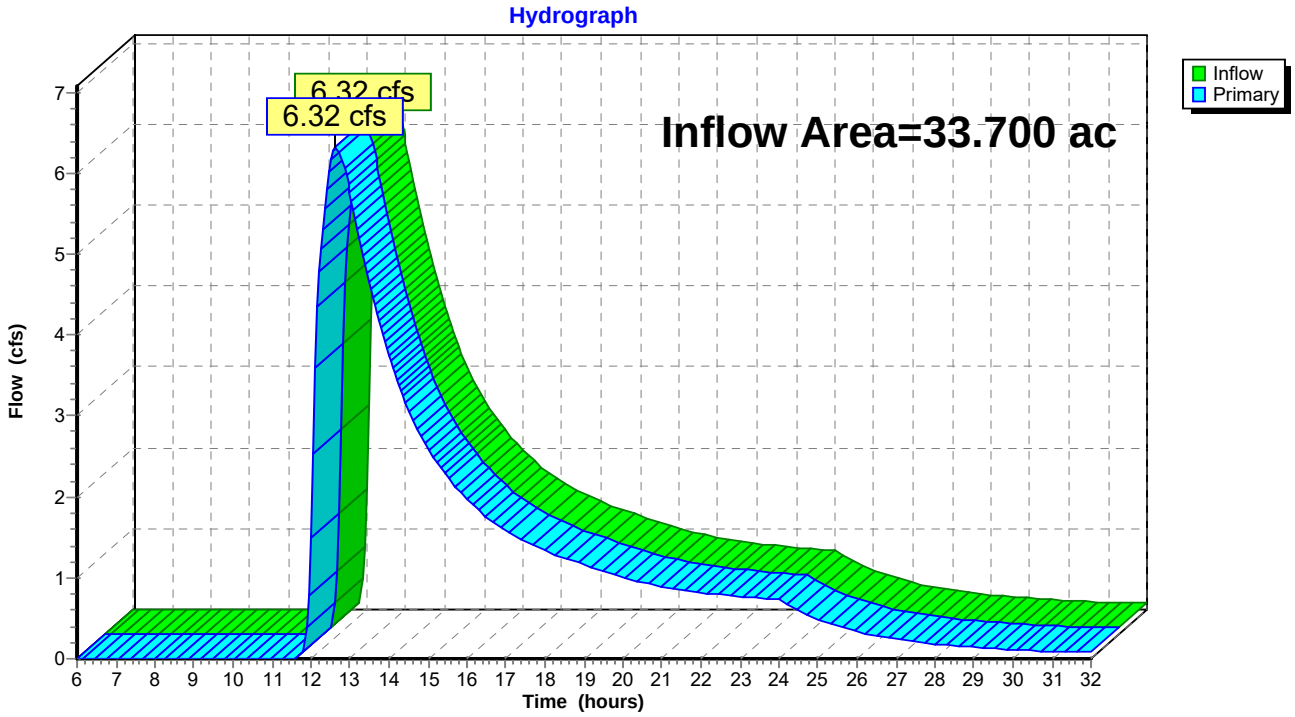


Link OUTLET 1:

Inflow Area = 33.700 ac, Inflow Depth > 0.78" for 2 event
Inflow = 6.32 cfs @ 12.62 hrs, Volume= 2.187 af
Primary = 6.32 cfs @ 12.62 hrs, Volume= 2.187 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link OUTLET 1:

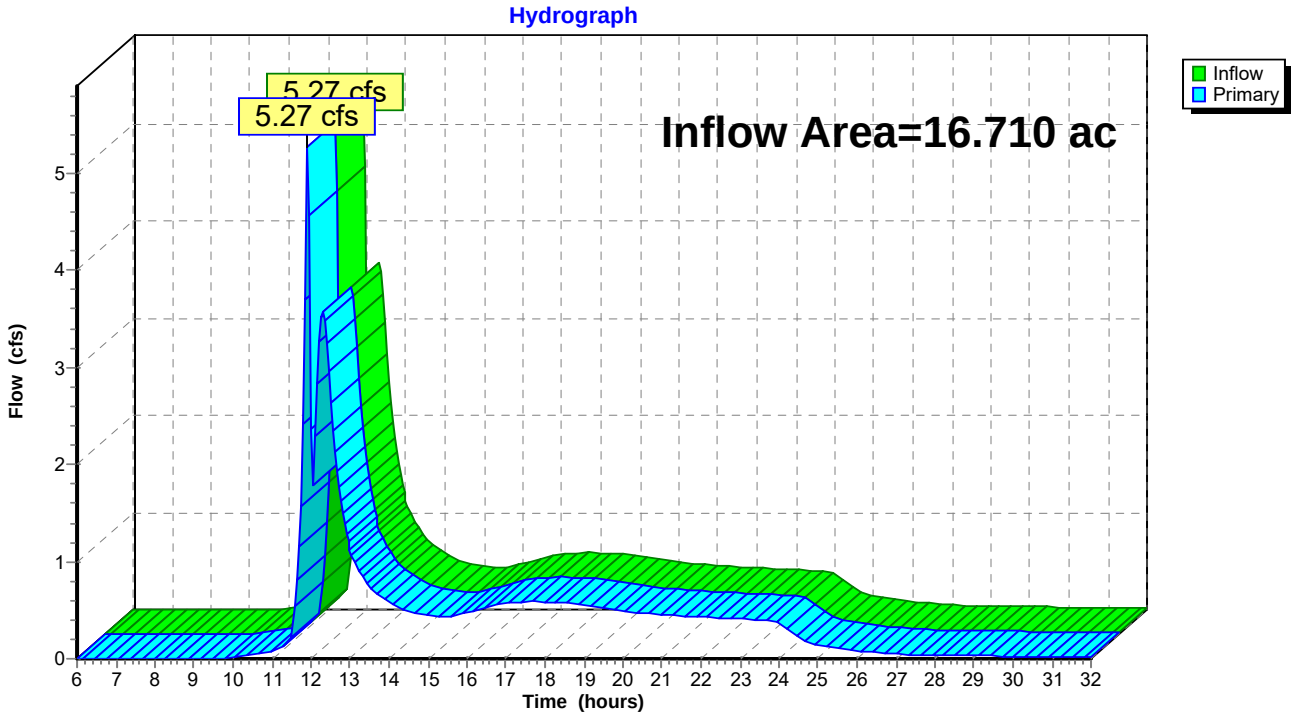


Link OUTLET2:

Inflow Area = 16.710 ac, Inflow Depth > 0.58" for 2 event
Inflow = 5.27 cfs @ 11.91 hrs, Volume= 0.802 af
Primary = 5.27 cfs @ 11.91 hrs, Volume= 0.802 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link OUTLET2:

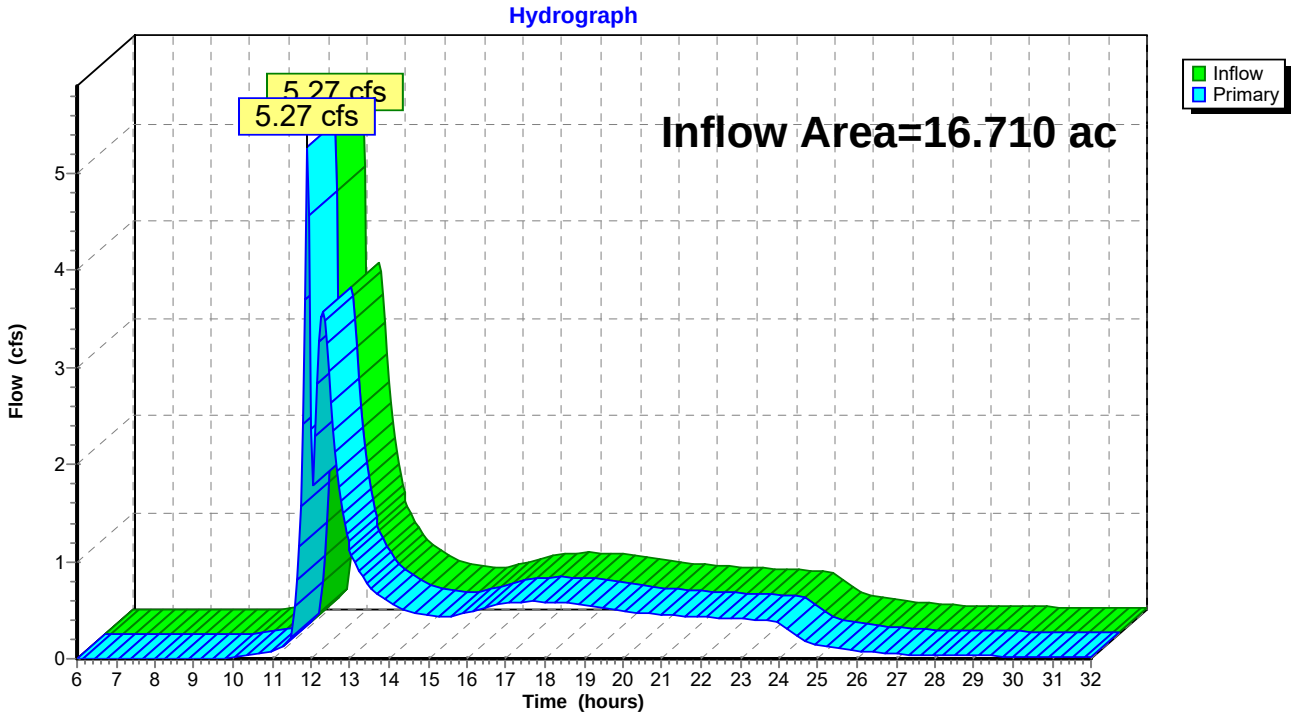


Link WL-1:

Inflow Area = 16.710 ac, Inflow Depth > 0.58" for 2 event
Inflow = 5.27 cfs @ 11.91 hrs, Volume= 0.802 af
Primary = 5.27 cfs @ 11.91 hrs, Volume= 0.802 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link WL-1:

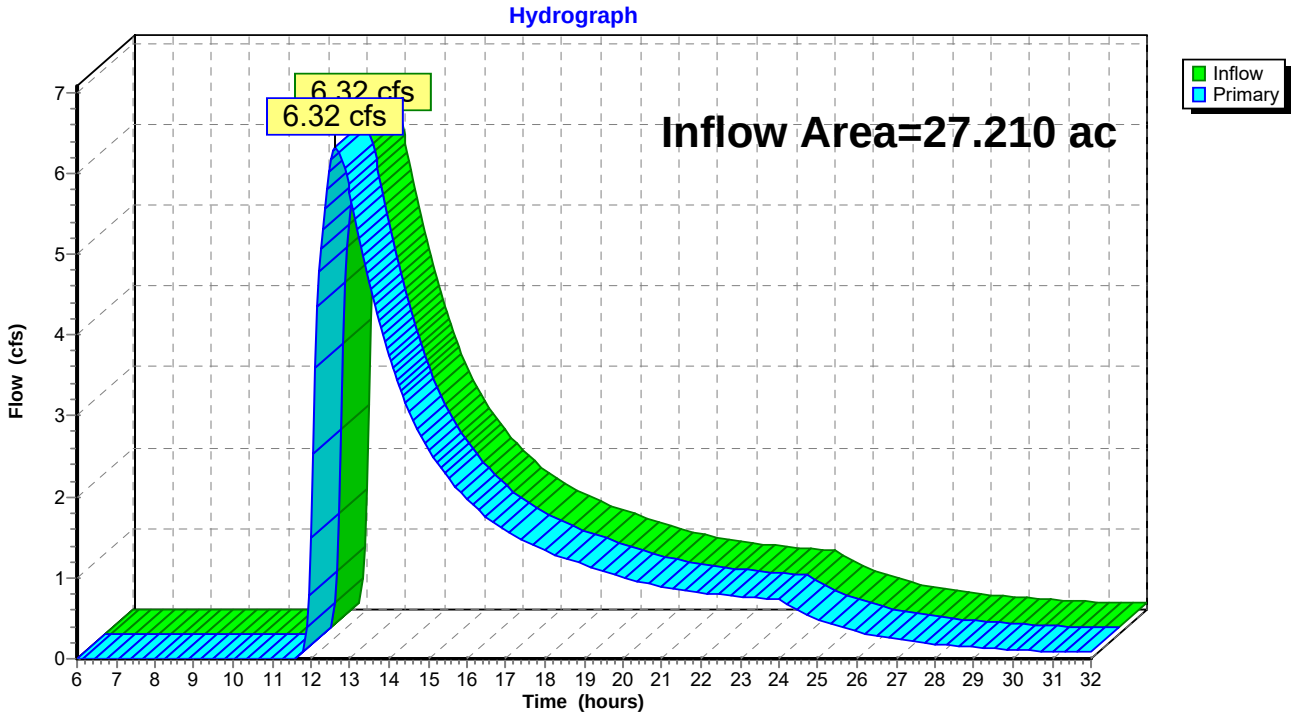


Link WL-3:

Inflow Area = 27.210 ac, Inflow Depth > 0.96" for 2 event
Inflow = 6.32 cfs @ 12.62 hrs, Volume= 2.187 af
Primary = 6.32 cfs @ 12.62 hrs, Volume= 2.187 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link WL-3:



Time span=6.00-32.00 hrs, dt=0.05 hrs, 521 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 101: Runoff Area=1.330 ac Runoff Depth=2.70"
Flow Length=648' Tc=14.6 min CN=76 Runoff=4.68 cfs 0.299 af

Subcatchment 102: Runoff Area=1.280 ac Runoff Depth=2.70"
Flow Length=919' Tc=19.3 min CN=76 Runoff=3.90 cfs 0.288 af

Subcatchment 103: Runoff Area=1.230 ac Runoff Depth=2.70"
Flow Length=793' Tc=17.1 min CN=76 Runoff=4.00 cfs 0.277 af

Subcatchment 104: Runoff Area=0.930 ac Runoff Depth=2.70"
Flow Length=756' Tc=17.6 min CN=76 Runoff=2.98 cfs 0.209 af

Subcatchment 105: Runoff Area=0.930 ac Runoff Depth=2.70"
Flow Length=507' Tc=4.9 min CN=76 Runoff=4.53 cfs 0.209 af

Subcatchment 106: Runoff Area=1.400 ac Runoff Depth=2.70"
Flow Length=908' Tc=4.8 min CN=76 Runoff=6.85 cfs 0.315 af

Subcatchment 107: Runoff Area=1.600 ac Runoff Depth=2.70"
Flow Length=840' Tc=18.2 min CN=76 Runoff=5.04 cfs 0.360 af

Subcatchment 108: Runoff Area=1.100 ac Runoff Depth=2.70"
Flow Length=682' Tc=15.2 min CN=76 Runoff=3.79 cfs 0.248 af

Subcatchment 109: Runoff Area=0.290 ac Runoff Depth=2.70"
Flow Length=216' Tc=4.2 min CN=76 Runoff=1.46 cfs 0.065 af

Subcatchment 110: Runoff Area=0.980 ac Runoff Depth=2.70"
Flow Length=510' Tc=5.6 min CN=76 Runoff=4.63 cfs 0.221 af

Subcatchment 111: Runoff Area=0.660 ac Runoff Depth=2.70"
Flow Length=283' Tc=3.6 min CN=76 Runoff=3.38 cfs 0.149 af

Subcatchment 112: Runoff Area=0.980 ac Runoff Depth=2.70"
Flow Length=426' Tc=6.0 min CN=76 Runoff=4.55 cfs 0.221 af

Subcatchment 113: Runoff Area=0.690 ac Runoff Depth=2.70"
Flow Length=270' Tc=2.5 min CN=76 Runoff=3.60 cfs 0.155 af

Subcatchment 114: Runoff Area=0.240 ac Runoff Depth=2.70"
Flow Length=207' Tc=1.1 min CN=76 Runoff=1.28 cfs 0.054 af

Subcatchment 115: Runoff Area=0.480 ac Runoff Depth=2.70"
Flow Length=292' Tc=26.1 min CN=76 Runoff=1.22 cfs 0.108 af

Subcatchment 116: Runoff Area=0.770 ac Runoff Depth=2.70"
Flow Length=446' Tc=11.7 min CN=76 Runoff=2.98 cfs 0.173 af

Subcatchment 117: Runoff Area=0.960 ac Runoff Depth=2.70"
Flow Length=637' Tc=14.1 min CN=76 Runoff=3.43 cfs 0.216 af

Subcatchment 118: Runoff Area=1.180 ac Runoff Depth=2.70"
Flow Length=776' Tc=16.8 min CN=76 Runoff=3.88 cfs 0.266 af

Subcatchment 119: Runoff Area=0.640 ac Runoff Depth=2.70"
Flow Length=419' Tc=9.8 min CN=76 Runoff=2.64 cfs 0.144 af

Subcatchment 120: Runoff Area=1.570 ac Runoff Depth=2.70"
Flow Length=720' Tc=4.0 min CN=76 Runoff=7.94 cfs 0.353 af

Subcatchment 121: Runoff Area=0.670 ac Runoff Depth=2.70"
Flow Length=336' Tc=9.6 min CN=76 Runoff=2.78 cfs 0.151 af

Subcatchment 122: Runoff Area=0.880 ac Runoff Depth=2.70"
Flow Length=559' Tc=12.6 min CN=76 Runoff=3.31 cfs 0.198 af

Subcatchment 123: Runoff Area=0.430 ac Runoff Depth=2.70"
Flow Length=381' Tc=9.0 min CN=76 Runoff=1.83 cfs 0.097 af

Subcatchment 124: Runoff Area=0.570 ac Runoff Depth=2.70"
Flow Length=374' Tc=2.8 min CN=76 Runoff=2.97 cfs 0.128 af

Subcatchment 125: Runoff Area=1.640 ac Runoff Depth=2.70"
Flow Length=998' Tc=9.8 min CN=76 Runoff=6.76 cfs 0.369 af

Subcatchment 126: Runoff Area=1.830 ac Runoff Depth=3.07"
Flow Length=1,074' Tc=1.1 min CN=80 Runoff=10.97 cfs 0.468 af

Subcatchment 127: Runoff Area=0.440 ac Runoff Depth=2.70"
Flow Length=318' Tc=9.6 min CN=76 Runoff=1.83 cfs 0.099 af

Subcatchment 128: Runoff Area=0.090 ac Runoff Depth=2.70"
Flow Length=150' Tc=4.9 min CN=76 Runoff=0.44 cfs 0.020 af

Subcatchment 129: Runoff Area=0.280 ac Runoff Depth=2.70"
Flow Length=239' Tc=6.5 min CN=76 Runoff=1.29 cfs 0.063 af

Subcatchment 130: Runoff Area=0.470 ac Runoff Depth=2.70"
Flow Length=329' Tc=8.3 min CN=76 Runoff=2.05 cfs 0.106 af

Subcatchment 131: Runoff Area=0.800 ac Runoff Depth=2.70"
Flow Length=404' Tc=4.4 min CN=76 Runoff=3.98 cfs 0.180 af

Subcatchment 132: Runoff Area=0.940 ac Runoff Depth=2.70"
Flow Length=514' Tc=12.0 min CN=76 Runoff=3.61 cfs 0.212 af

Subcatchment 133: Runoff Area=1.270 ac Runoff Depth=2.70"
Flow Length=655' Tc=14.7 min CN=76 Runoff=4.45 cfs 0.286 af

Subcatchment 134: Runoff Area=1.590 ac Runoff Depth=2.70"
Flow Length=765' Tc=16.8 min CN=76 Runoff=5.22 cfs 0.358 af

Subcatchment 135: Runoff Area=1.340 ac Runoff Depth=2.70"
Flow Length=796' Tc=4.8 min CN=76 Runoff=6.56 cfs 0.302 af

Subcatchment 136: Runoff Area=1.170 ac Runoff Depth=2.70"
Flow Length=533' Tc=2.6 min CN=76 Runoff=6.10 cfs 0.263 af

Subcatchment PWL-1: Runoff Area=6.490 ac Runoff Depth=1.94"
Flow Length=300' Tc=31.1 min CN=67 Runoff=10.21 cfs 1.051 af

Subcatchment PWL-2: Runoff Area=6.490 ac Runoff Depth=1.94"
Flow Length=300' Tc=31.1 min CN=67 Runoff=10.21 cfs 1.051 af

Subcatchment PWL-3: Runoff Area=3.780 ac Runoff Depth=1.94"
Flow Length=300' Tc=17.9 min CN=67 Runoff=8.43 cfs 0.612 af

Reach 01-05: PERIMETER CHANNEL Peak Depth=0.39' Max Vel=3.5 fps Inflow=4.68 cfs 0.299 af
n=0.014 L=420.5' S=0.0050 '/' Capacity=48.31 cfs Outflow=4.49 cfs 0.299 af

Reach 02-06: BENCH Peak Depth=0.55' Max Vel=2.6 fps Inflow=3.90 cfs 0.288 af
n=0.045 L=818.0' S=0.0346 '/' Capacity=50.43 cfs Outflow=3.52 cfs 0.288 af

Reach 03-09: BENCH Peak Depth=0.57' Max Vel=2.4 fps Inflow=4.00 cfs 0.277 af
n=0.045 L=740.4' S=0.0300 '/' Capacity=46.95 cfs Outflow=3.58 cfs 0.277 af

Reach 04-08: ACCESS ROAD CHANNEL Peak Depth=0.26' Max Vel=11.3 fps Inflow=6.62 cfs 0.430 af
n=0.014 L=217.8' S=0.0872 '/' Capacity=146.64 cfs Outflow=6.54 cfs 0.430 af

Reach 05-06: PERIMETER CHANNEL Peak Depth=0.42' Max Vel=4.4 fps Inflow=6.73 cfs 0.509 af
n=0.014 L=886.1' S=0.0070 '/' Capacity=57.18 cfs Outflow=6.27 cfs 0.509 af

Reach 06-10: PERIMETER CHANNEL Peak Depth=0.68' Max Vel=6.2 fps Inflow=15.43 cfs 1.472 af
n=0.014 L=121.6' S=0.0085 '/' Capacity=62.91 cfs Outflow=15.15 cfs 1.472 af

Reach 07-04: ACCESS ROAD CHANNEL Peak Depth=0.19' Max Vel=10.8 fps Inflow=4.55 cfs 0.221 af
n=0.014 L=153.5' S=0.1173 '/' Capacity=170.02 cfs Outflow=4.54 cfs 0.221 af

Reach 08-08`: ACCESS ROAD CHANNEL Peak Depth=0.30' Max Vel=13.4 fps Inflow=9.16 cfs 0.585 af
n=0.014 L=190.2' S=0.1073 '/' Capacity=162.60 cfs Outflow=9.04 cfs 0.585 af

Reach 09-10: PIPE DOWNCHUTE Peak Depth=0.45' Max Vel=19.8 fps Inflow=13.31 cfs 1.164 af
D=36.0" n=0.014 L=154.6' S=0.1897 '/' Capacity=269.76 cfs Outflow=13.30 cfs 1.164 af

Reach 10-11: PERIMETER CHANNEL Peak Depth=0.99' Max Vel=4.9 fps Inflow=29.49 cfs 2.701 af
n=0.014 L=482.0' S=0.0030 '/' Capacity=69.51 cfs Outflow=28.88 cfs 2.701 af

Reach 11-19: PERIMETER CHANNEL Peak Depth=1.04' Max Vel=5.0 fps Inflow=31.43 cfs 2.922 af
n=0.014 L=71.8' S=0.0031 '/' Capacity=70.15 cfs Outflow=31.36 cfs 2.922 af

Reach 12-13: DOWNCHUTE Peak Depth=0.07' Max Vel=4.0 fps Inflow=1.22 cfs 0.108 af
n=0.028 L=124.2' S=0.2013 '/' Capacity=336.95 cfs Outflow=1.22 cfs 0.108 af

Reach 13-14: DOWNCHUTE Peak Depth=0.19' Max Vel=7.2 fps Inflow=6.39 cfs 0.432 af
n=0.028 L=146.8' S=0.2112 '/' Capacity=345.13 cfs Outflow=6.33 cfs 0.432 af

Reach 14-15: DOWNCHUTE Peak Depth=0.19' Max Vel=7.2 fps Inflow=13.04 cfs 0.846 af
n=0.028 L=141.3' S=0.2088 '/' Capacity=686.32 cfs Outflow=12.91 cfs 0.846 af

Reach 15-17: DOWNCHUTE Peak Depth=0.34' Max Vel=9.8 fps Inflow=18.20 cfs 1.209 af
n=0.028 L=189.9' S=0.1975 '/' Capacity=333.74 cfs Outflow=18.02 cfs 1.209 af

Reach 16-18: PERIMETER CHANNEL Peak Depth=0.14' Max Vel=6.1 fps Inflow=2.64 cfs 0.144 af
n=0.014 L=637.5' S=0.0521 '/' Capacity=156.00 cfs Outflow=2.50 cfs 0.144 af

Reach 17-18: PIPE DOWNCHUTE Peak Depth=0.66' Max Vel=16.0 fps Inflow=18.55 cfs 1.337 af
D=36.0" n=0.014 L=120.1' S=0.0791 '/' Capacity=174.19 cfs Outflow=18.49 cfs 1.337 af

Reach 18-19: PERIMETER CHANNEL W Peak Depth=0.46' Max Vel=7.4 fps Inflow=25.14 cfs 1.835 af
n=0.014 L=216.2' S=0.0162 '/' Capacity=187.26 cfs Outflow=25.02 cfs 1.835 af

Reach 21-23: DOWNCHUTE Peak Depth=0.08' Max Vel=5.0 fps Inflow=1.83 cfs 0.099 af
n=0.028 L=144.7' S=0.2626 '/' Capacity=384.87 cfs Outflow=1.79 cfs 0.099 af

Reach 22-23: BENCH Peak Depth=0.23' Max Vel=1.5 fps Inflow=0.44 cfs 0.020 af
n=0.045 L=454.4' S=0.0352 '/' Capacity=50.87 cfs Outflow=0.35 cfs 0.020 af

Reach 23-25: DOWNCHUTE Peak Depth=0.17' Max Vel=7.4 fps Inflow=5.68 cfs 0.331 af
n=0.028 L=144.0' S=0.2569 '/' Capacity=380.70 cfs Outflow=5.62 cfs 0.331 af

Reach 24-25: BENCH Peak Depth=0.36' Max Vel=1.9 fps Inflow=1.29 cfs 0.063 af
n=0.045 L=594.2' S=0.0337 '/' Capacity=49.74 cfs Outflow=1.05 cfs 0.063 af

Reach 25-27: DOWNCHUTE Peak Depth=0.24' Max Vel=9.4 fps Inflow=10.93 cfs 0.680 af
n=0.028 L=127.2' S=0.2752 '/' Capacity=393.96 cfs Outflow=10.84 cfs 0.680 af

Reach 26-27: BENCH Peak Depth=0.43' Max Vel=2.1 fps Inflow=2.05 cfs 0.106 af
n=0.045 L=704.7' S=0.0312 '/' Capacity=47.90 cfs Outflow=1.68 cfs 0.106 af

Reach 27-29: DOWNCHUTE Peak Depth=0.30' Max Vel=11.1 fps Inflow=17.31 cfs 1.144 af
n=0.028 L=25.7' S=0.2918 '/' Capacity=405.72 cfs Outflow=17.29 cfs 1.144 af

Reach 28-29: PERIMETER CHANNEL Peak Depth=0.30' Max Vel=3.5 fps Inflow=3.98 cfs 0.180 af
n=0.014 L=751.8' S=0.0067 '/' Capacity=55.92 cfs Outflow=3.49 cfs 0.180 af

Pond POND Nº1: Peak Elev=27.03' Storage=2.171 af Inflow=64.71 cfs 5.274 af
Outflow=15.25 cfs 4.988 af

Pond POND Nº2:	Peak Elev=37.16' Storage=0.897 af	Inflow=26.00 cfs 1.889 af Outflow=5.53 cfs 1.299 af
Pond WL-2:	Peak Elev=37.01' Storage=0.807 af	Inflow=10.21 cfs 1.051 af Outflow=0.49 cfs 0.259 af
Link 08`-09:		Inflow=9.04 cfs 0.585 af Primary=9.04 cfs 0.585 af
Link 19-20:		Inflow=57.96 cfs 4.905 af Primary=57.96 cfs 4.905 af
Link 29-30:		Inflow=26.00 cfs 1.889 af Primary=26.00 cfs 1.889 af
Link OUTLET 1:		Inflow=21.47 cfs 5.859 af Primary=21.47 cfs 5.859 af
Link OUTLET2:		Inflow=16.48 cfs 2.818 af Primary=16.48 cfs 2.818 af
Link WL-1:		Inflow=16.48 cfs 2.818 af Primary=16.48 cfs 2.818 af
Link WL-3:		Inflow=21.47 cfs 5.600 af Primary=21.47 cfs 5.600 af

Total Runoff Area = 50.410 ac Runoff Volume = 10.345 af Average Runoff Depth = 2.46"

Subcatchment 101:

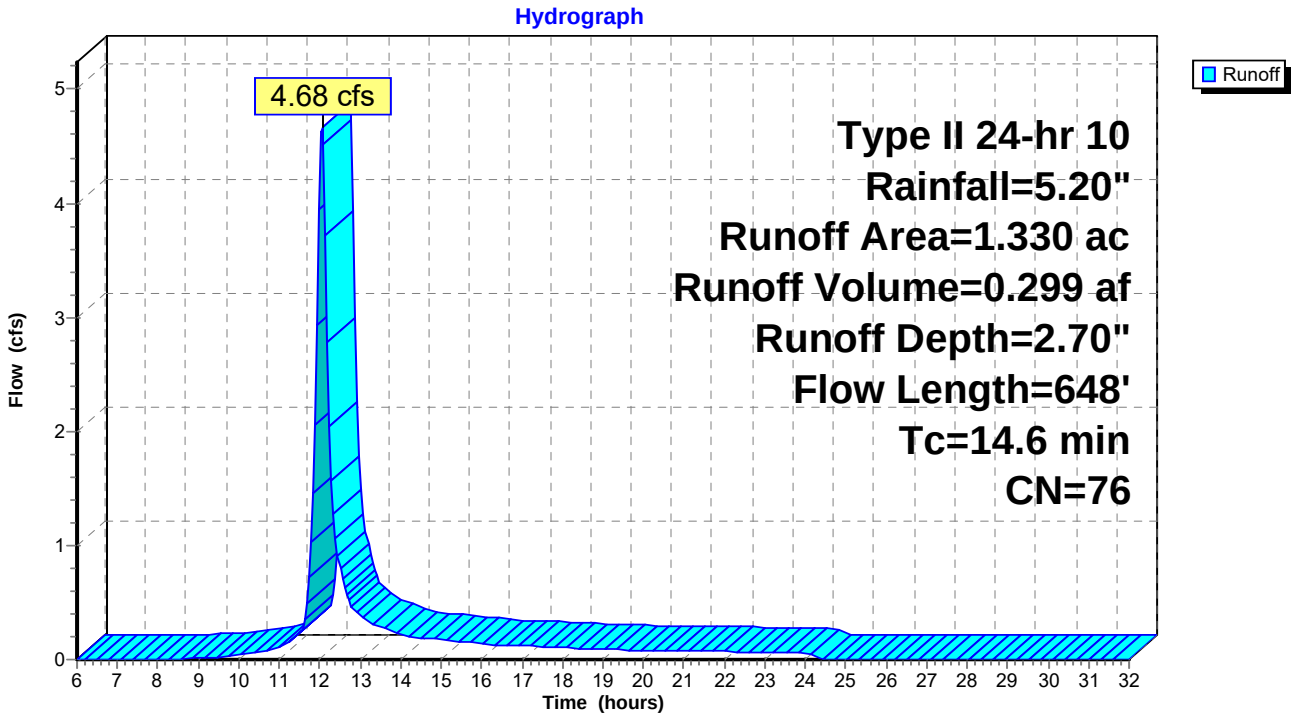
Runoff = 4.68 cfs @ 12.07 hrs, Volume= 0.299 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
1.330	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	99	0.3330	0.4		**Sheet Flow, Overland Flow** n= 0.200 P2= 3.20"
10.6	549	0.0300	0.9		**Shallow Concentrated Flow, BENCH** Kv= 5.0 fps
14.6	648	Total			

Subcatchment 101:



Subcatchment 102:

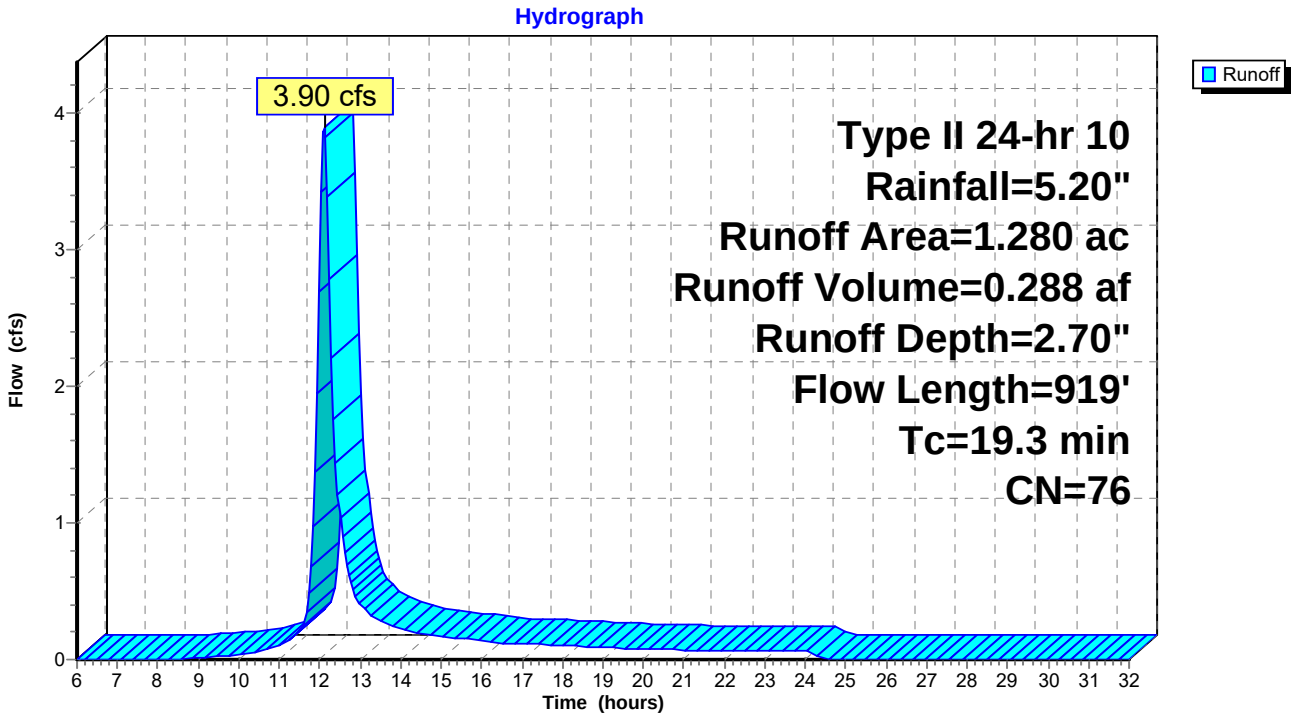
Runoff = 3.90 cfs @ 12.12 hrs, Volume= 0.288 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
1.280	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	67	0.3330	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
16.4	852	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
19.3	919	Total			

Subcatchment 102:



Subcatchment 103:

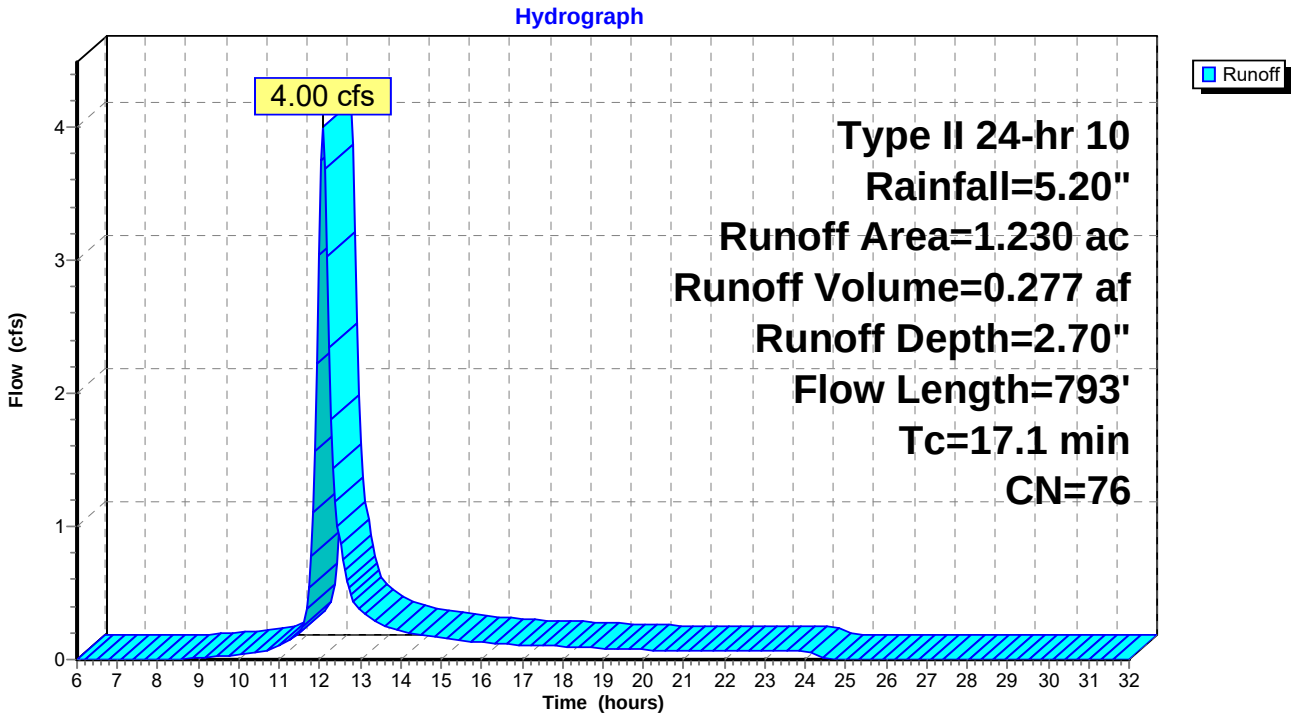
Runoff = 4.00 cfs @ 12.10 hrs, Volume= 0.277 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
1.230	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	77	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
13.8	716	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
17.1	793	Total			

Subcatchment 103:



Subcatchment 104:

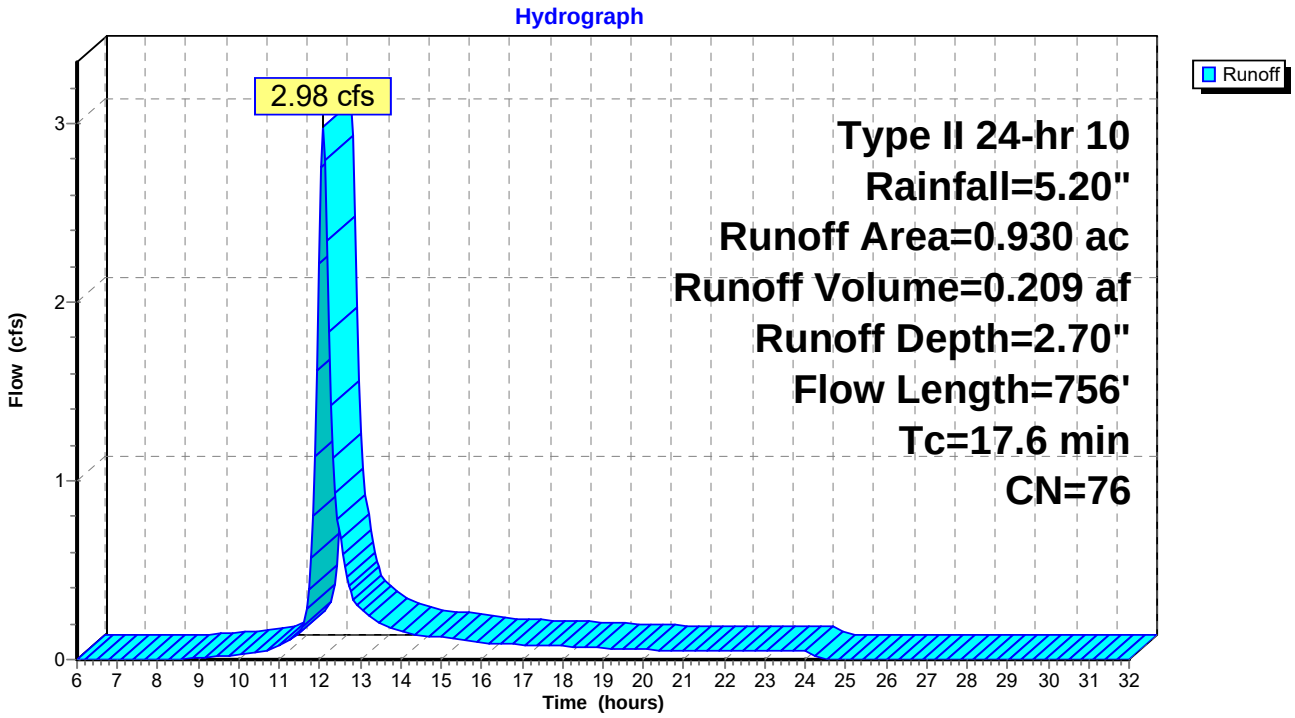
Runoff = 2.98 cfs @ 12.10 hrs, Volume= 0.209 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.930	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1900	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
12.6	656	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
17.6	756	Total			

Subcatchment 104:



Subcatchment 105:

[49] Hint: Tc<2dt may require smaller dt

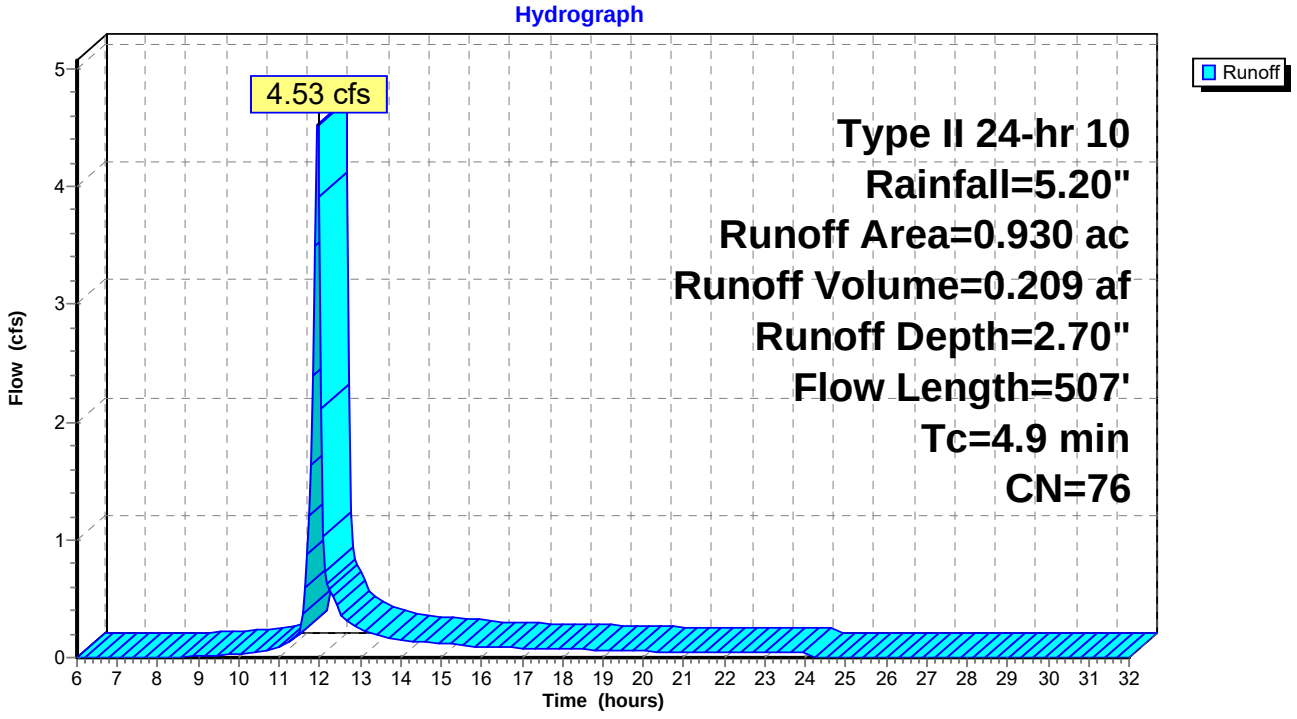
Runoff = 4.53 cfs @ 11.96 hrs, Volume= 0.209 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.930	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.9	407	0.0050	7.2	48.34	**Trap/Vee/Rect Channel Flow, PERIMETRAL CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.9	507	Total			

Subcatchment 105:



Subcatchment 106:

[49] Hint: Tc<2dt may require smaller dt

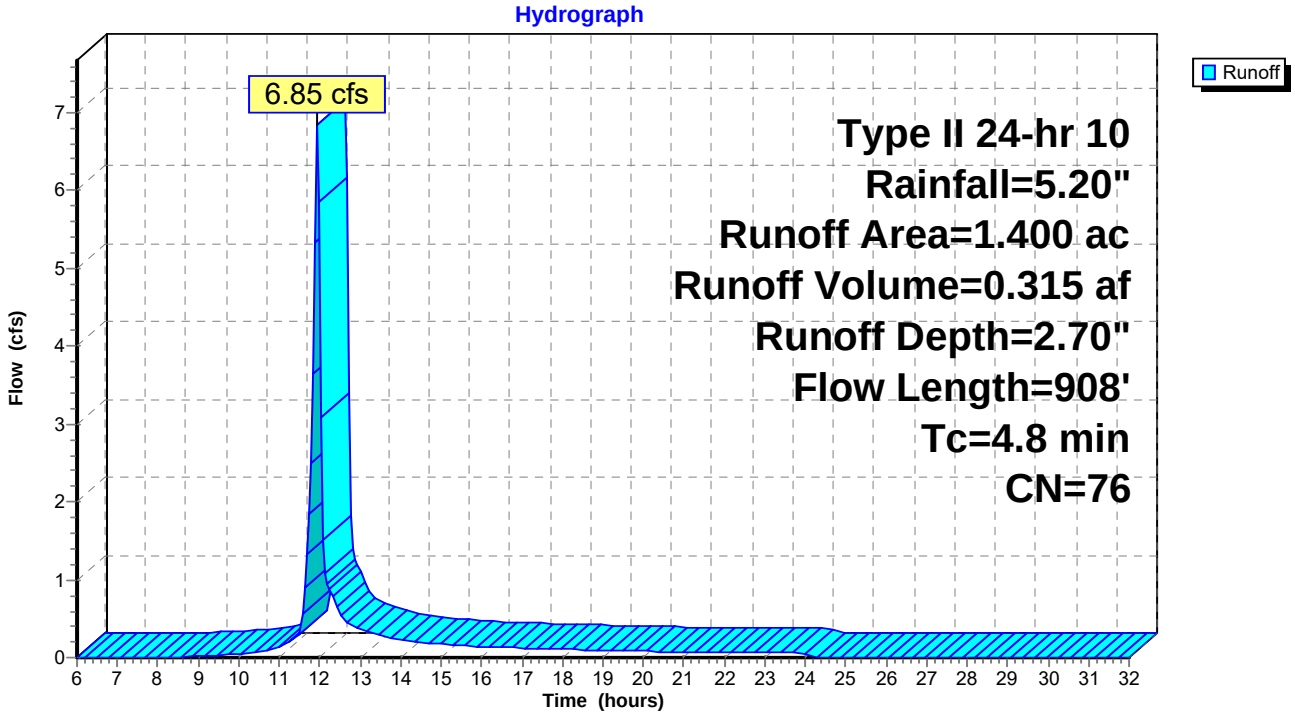
Runoff = 6.85 cfs @ 11.96 hrs, Volume= 0.315 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
1.400	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	74	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
1.6	834	0.0070	8.5	57.19	**Trap/Vee/Rect Channel Flow, PERIMETRAL CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.8	908	Total			

Subcatchment 106:



Subcatchment 107:

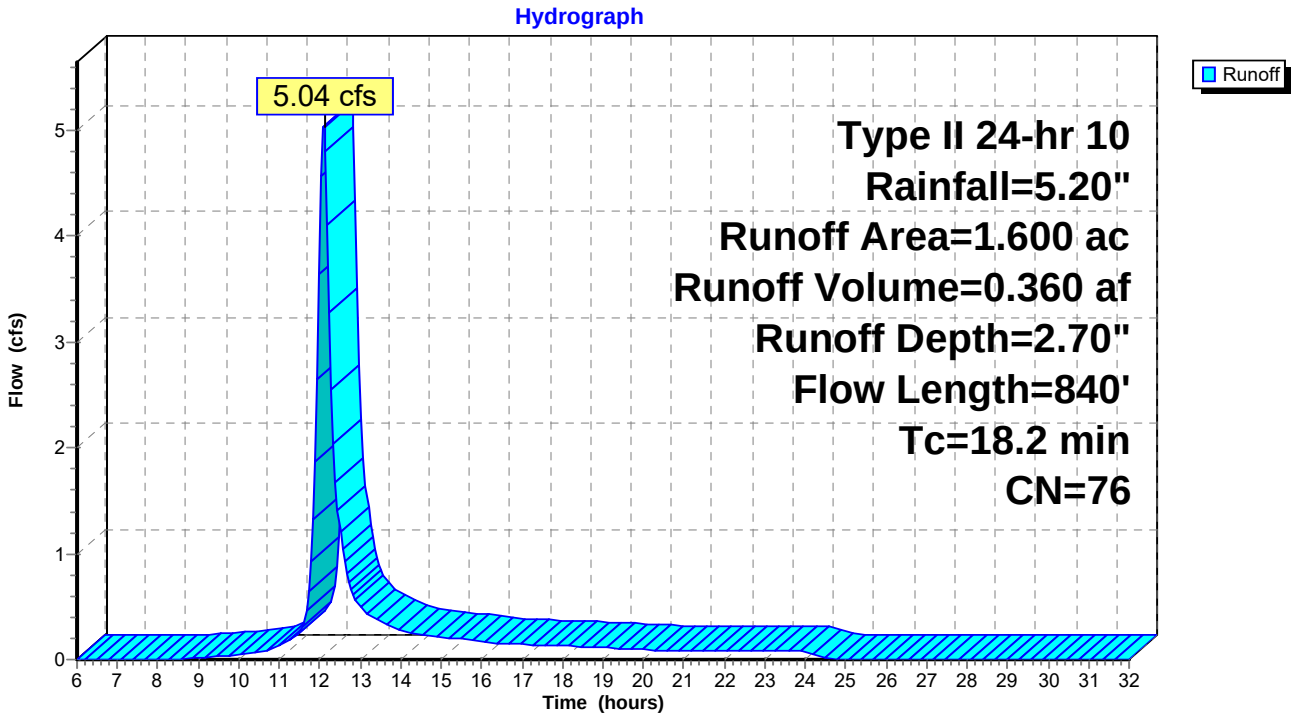
Runoff = 5.04 cfs @ 12.11 hrs, Volume= 0.360 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
1.600	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	94	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
14.4	746	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
18.2	840	Total			

Subcatchment 107:



Subcatchment 108:

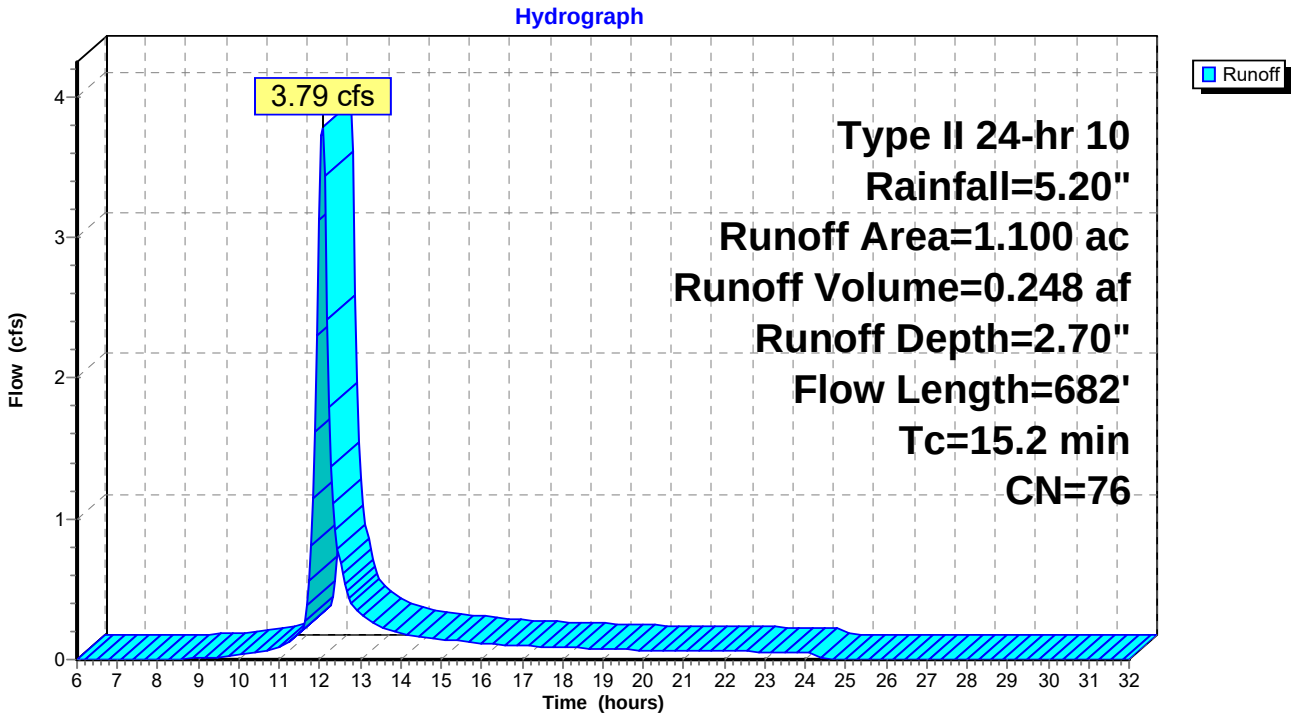
Runoff = 3.79 cfs @ 12.07 hrs, Volume= 0.248 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
1.100	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
11.2	582	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
15.2	682	Total			

Subcatchment 108:



Subcatchment 109:

[49] Hint: Tc<2dt may require smaller dt

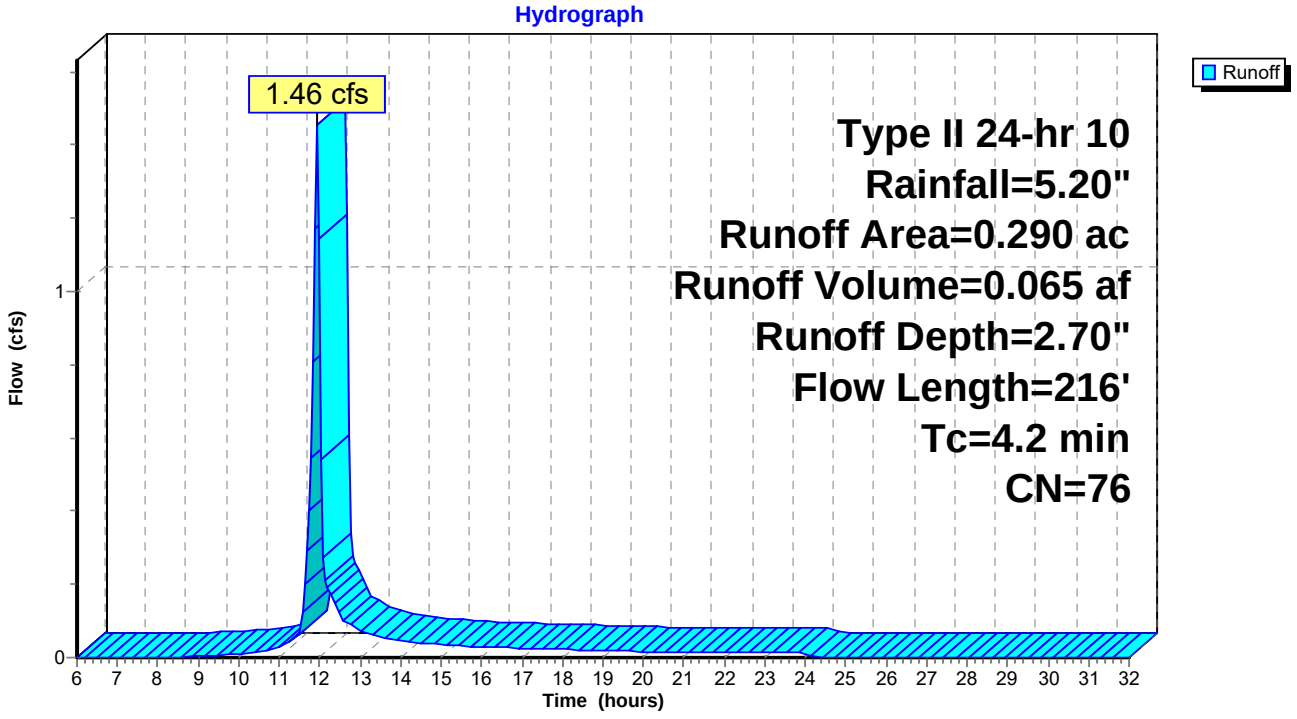
Runoff = 1.46 cfs @ 11.95 hrs, Volume= 0.065 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.290	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	94	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.4	122	0.0030	5.5	37.44	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.2	216	Total			

Subcatchment 109:



Subcatchment 110:

[49] Hint: Tc<2dt may require smaller dt

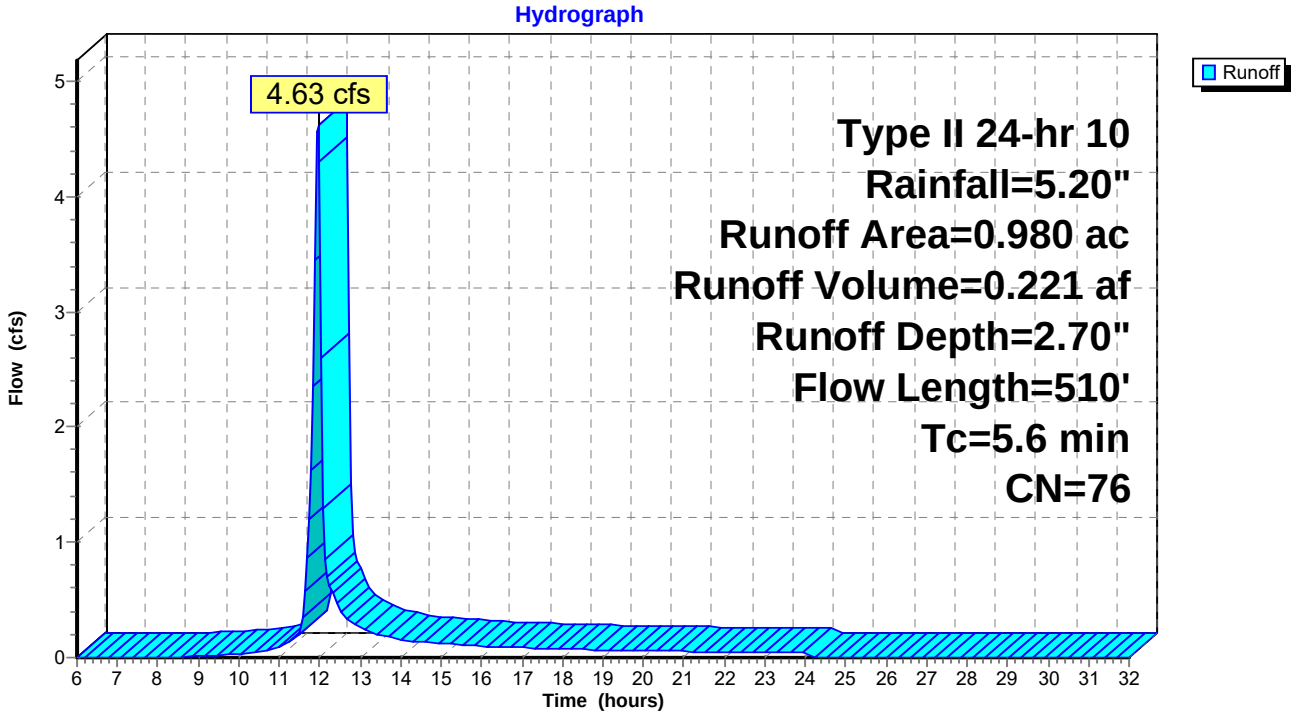
Runoff = 4.63 cfs @ 11.97 hrs, Volume= 0.221 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.980	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	84	0.2000	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
1.3	426	0.0030	5.5	37.44	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
5.6	510	Total			

Subcatchment 110:



Subcatchment 111:

[49] Hint: Tc<2dt may require smaller dt

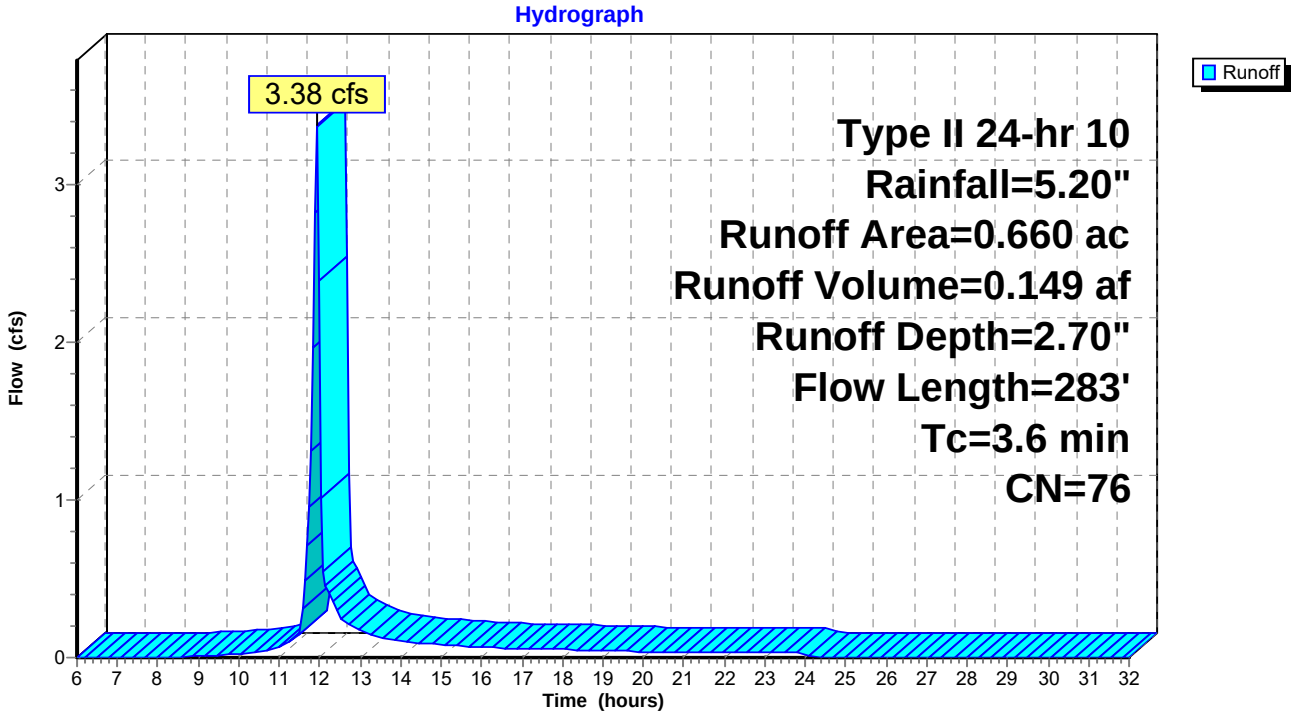
Runoff = 3.38 cfs @ 11.94 hrs, Volume= 0.149 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.660	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	67	0.2200	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.2	216	0.0310	20.3	259.13	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL W** Bot.W=7.00' D=1.50' Z= 1.0 '/' Top.W=10.00' n= 0.014
3.6	283	Total			

Subcatchment 111:



Subcatchment 112:

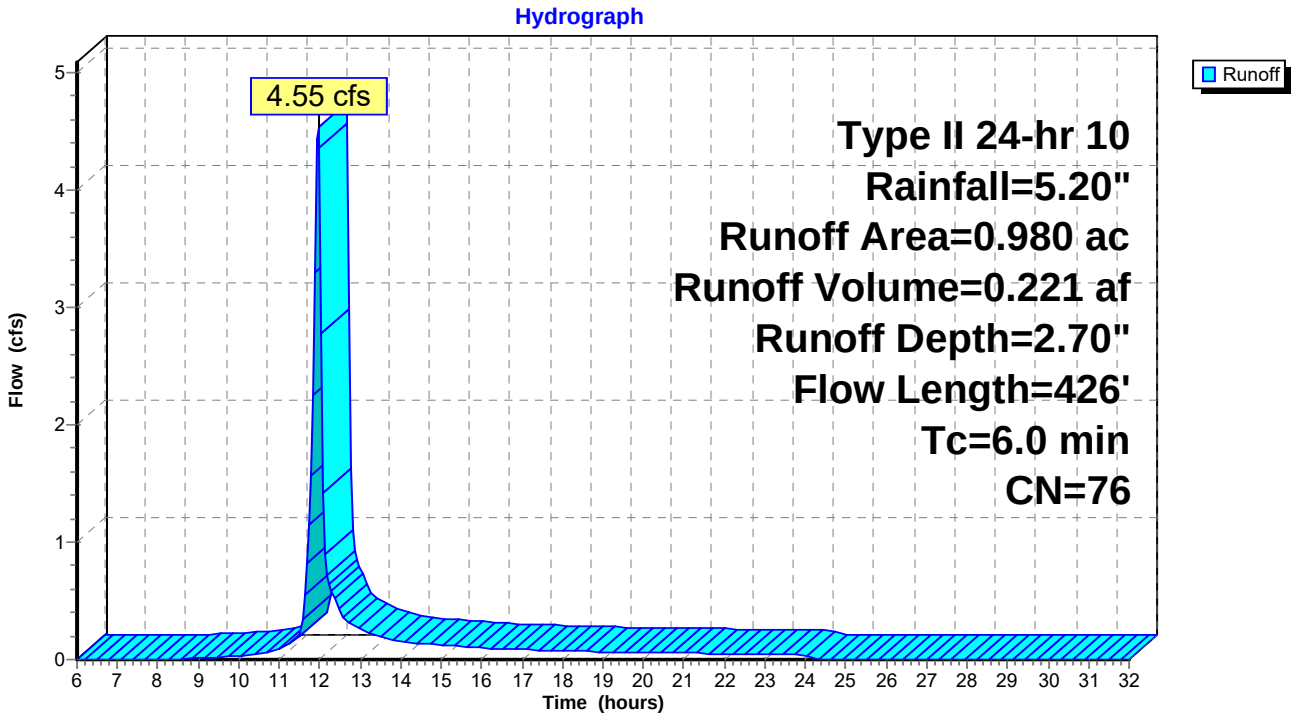
Runoff = 4.55 cfs @ 11.97 hrs, Volume= 0.221 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.980	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.1300	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.2	326	0.1060	30.8	161.65	**Trap/Vee/Rect Channel Flow, ACCES ROAD CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
6.0	426	Total			

Subcatchment 112:



Subcatchment 113:

[49] Hint: Tc<2dt may require smaller dt

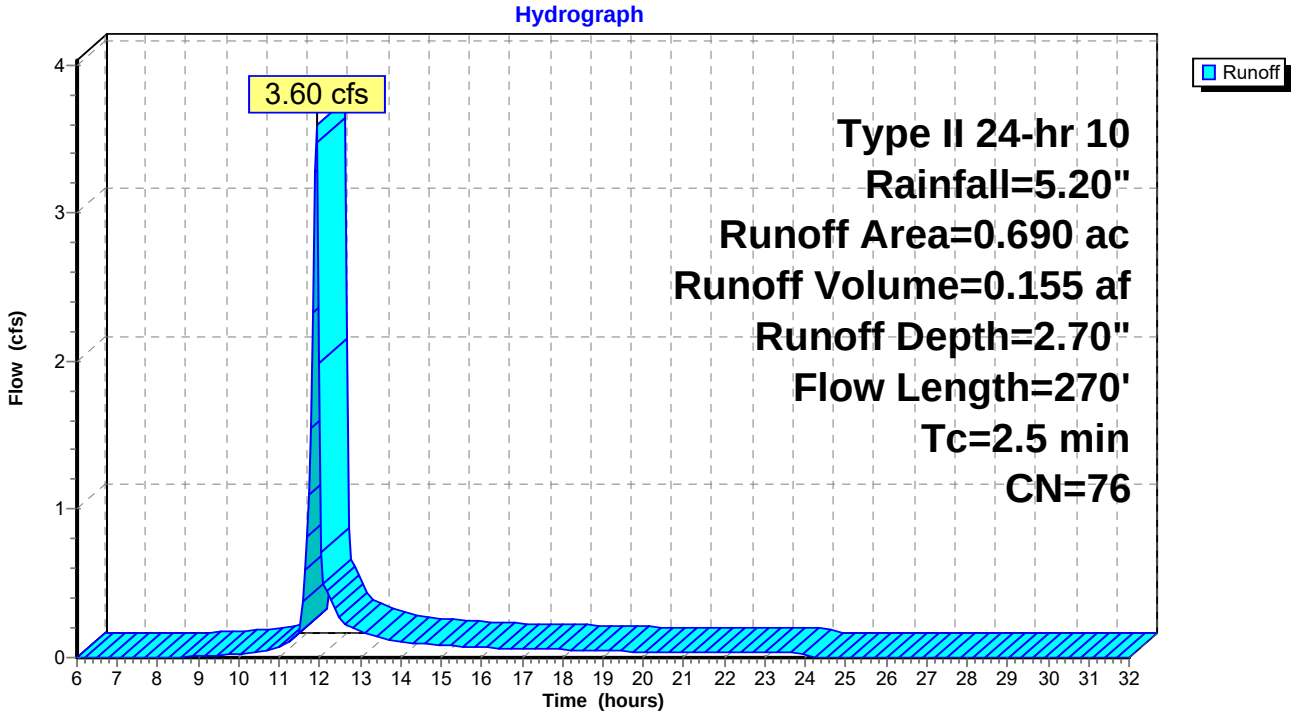
Runoff = 3.60 cfs @ 11.93 hrs, Volume= 0.155 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.690	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	52	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.1	218	0.0950	29.1	153.03	**Trap/Vee/Rect Channel Flow, ACCESS ROAD CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
2.5	270	Total			

Subcatchment 113:



Subcatchment 114:

[49] Hint: Tc<2dt may require smaller dt

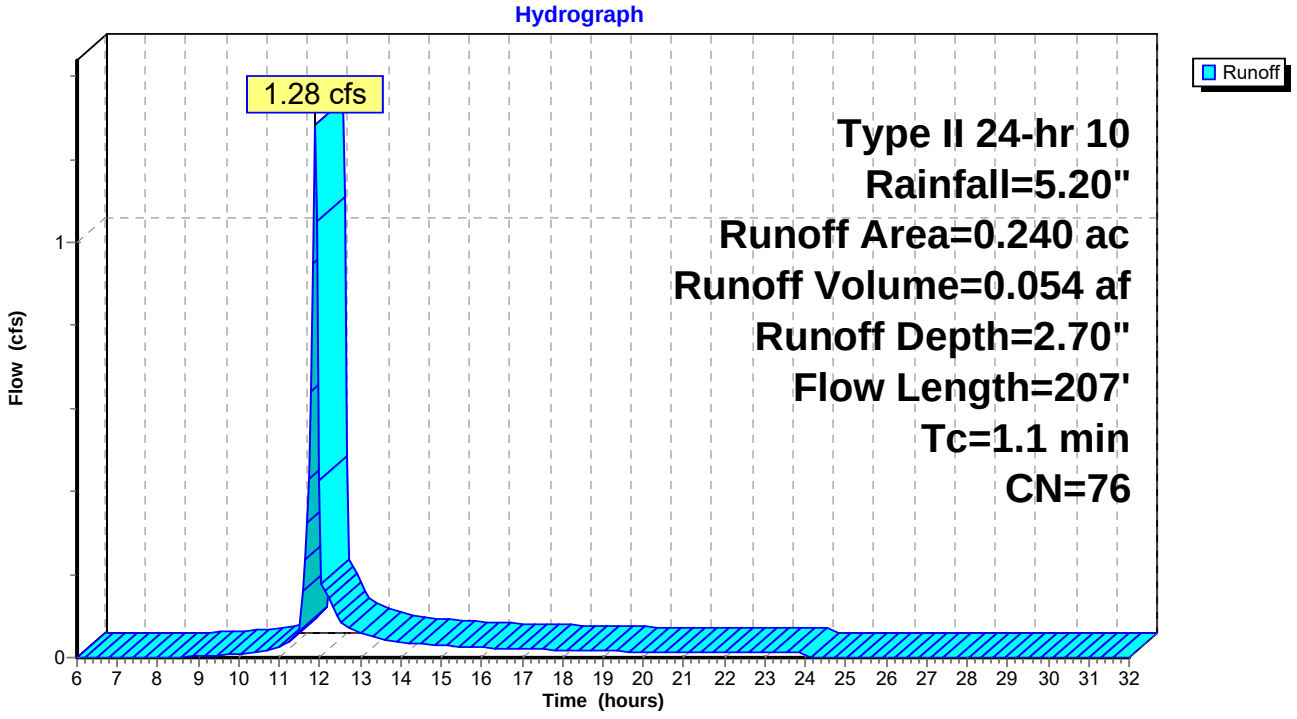
Runoff = 1.28 cfs @ 11.90 hrs, Volume= 0.054 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.240	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	17	0.3300	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.1	190	0.1050	30.6	160.88	**Trap/Vee/Rect Channel Flow, ACCESS ROAD CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
1.1	207	Total			

Subcatchment 114:



Subcatchment 115:

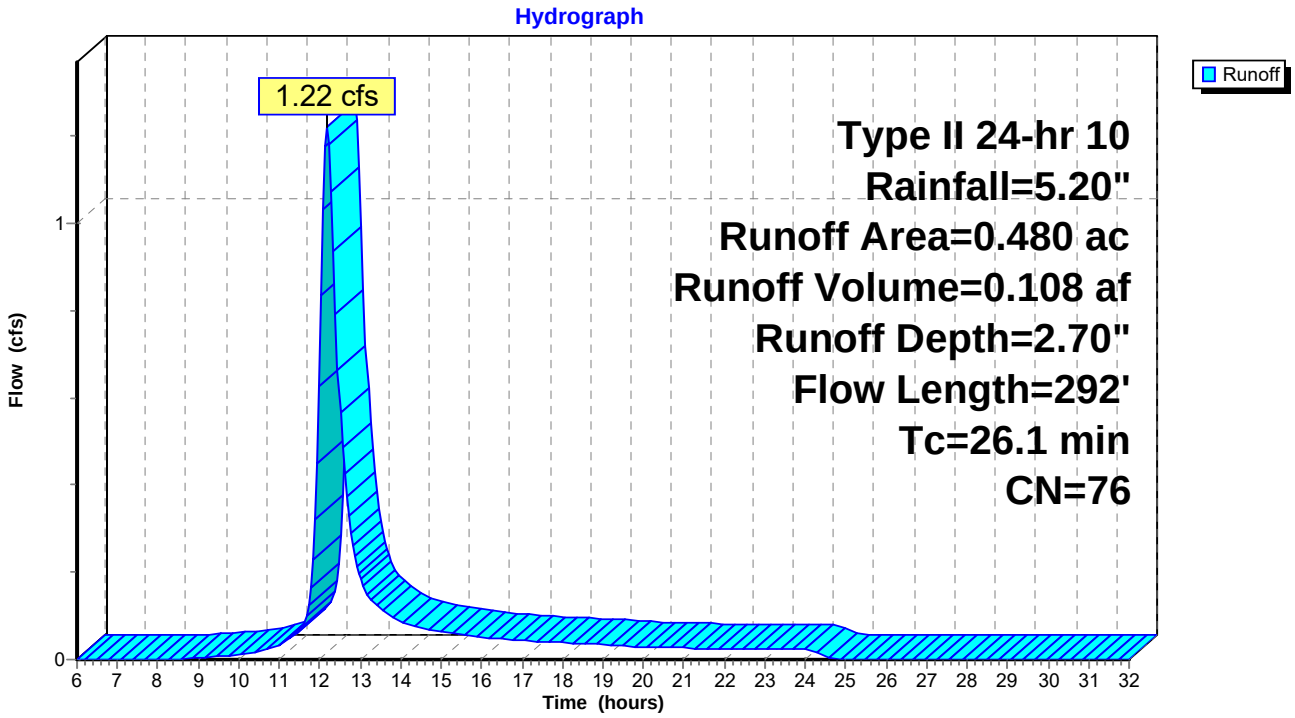
Runoff = 1.22 cfs @ 12.20 hrs, Volume= 0.108 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.480	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	74	0.0100	0.1		**Sheet Flow,** n= 0.200 P2= 3.20"
13.3	218	0.0030	0.3		**Shallow Concentrated Flow, DIVERSION BERM FLOW** Kv= 5.0 fps
26.1	292	Total			

Subcatchment 115:



Subcatchment 116:

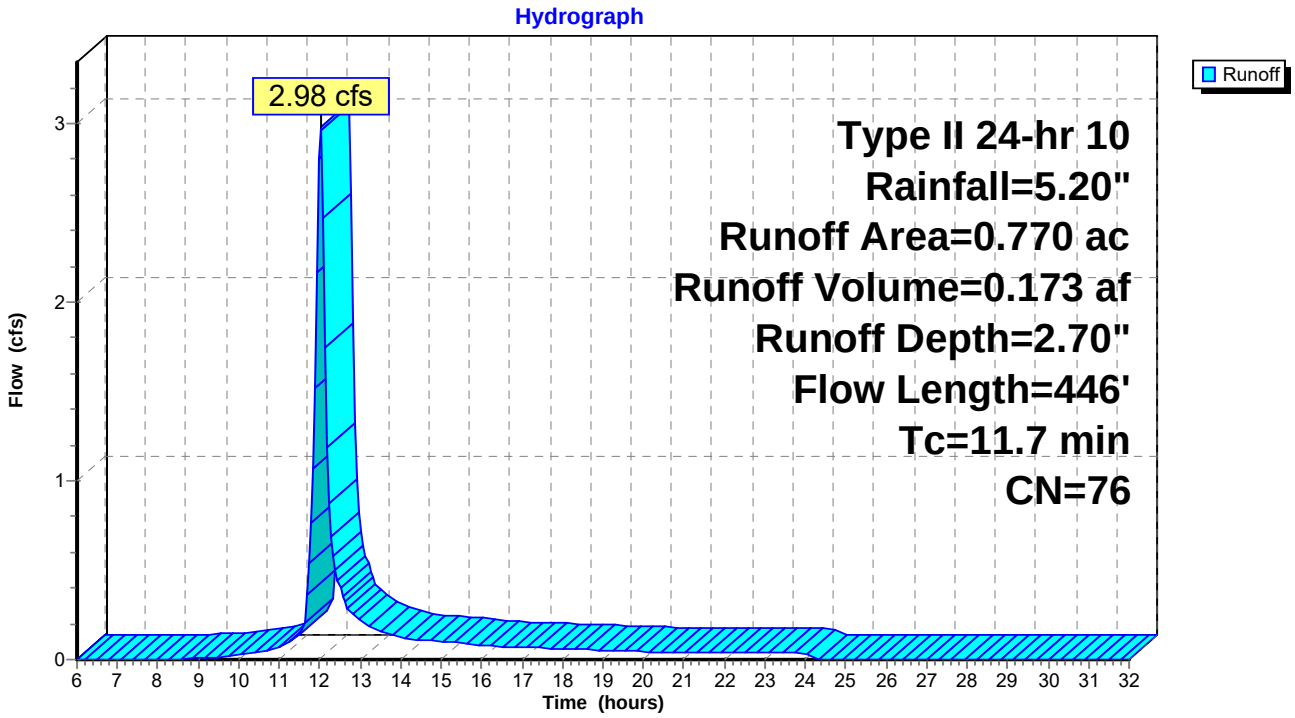
Runoff = 2.98 cfs @ 12.04 hrs, Volume= 0.173 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.770	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1600	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
6.3	346	0.0330	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
11.7	446	Total			

Subcatchment 116:



Subcatchment 117:

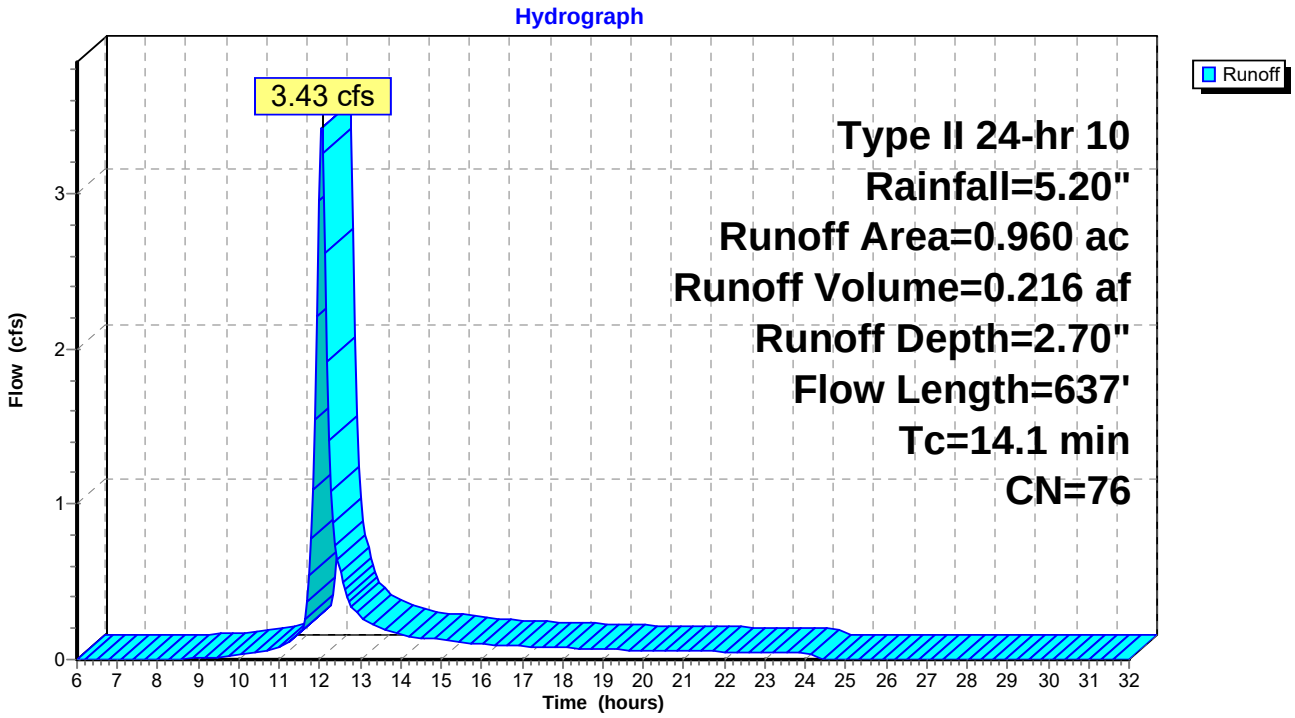
Runoff = 3.43 cfs @ 12.06 hrs, Volume= 0.216 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.960	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	82	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
10.7	555	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
14.1	637	Total			

Subcatchment 117:



Subcatchment 118:

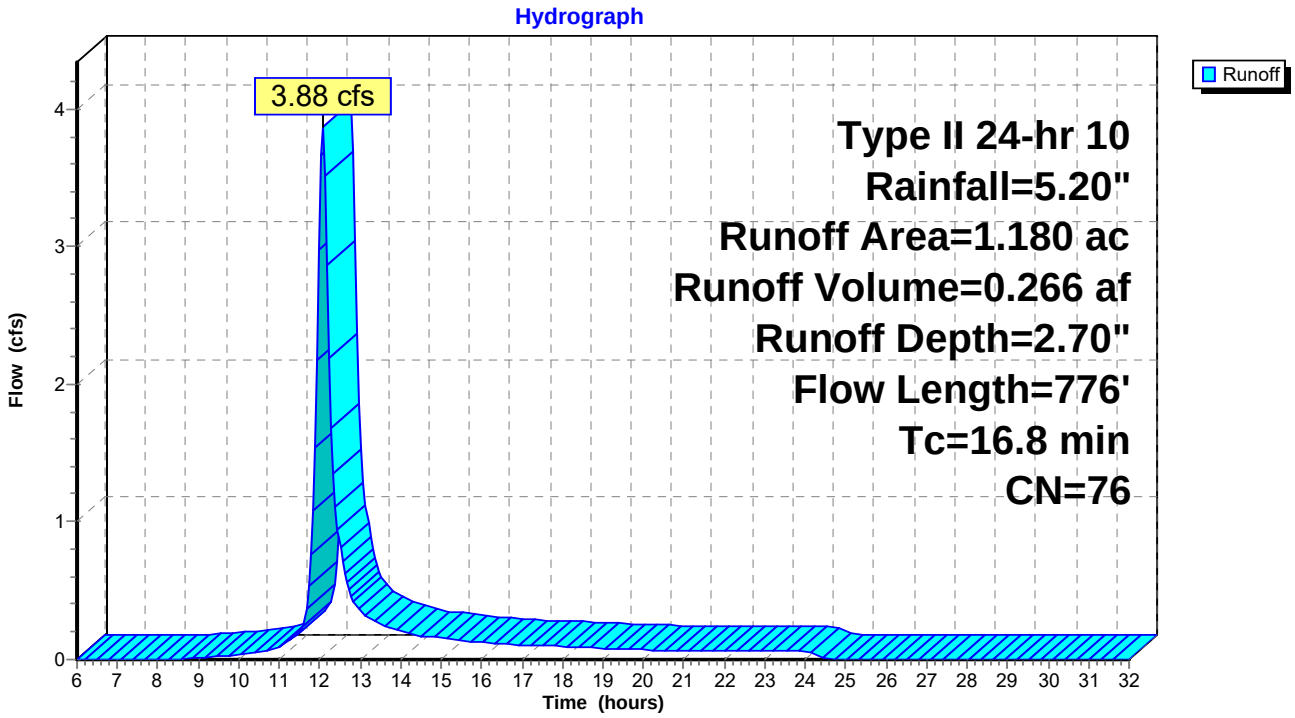
Runoff = 3.88 cfs @ 12.09 hrs, Volume= 0.266 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
1.180	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	80	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
13.4	696	0.0300	0.9		**Shallow Concentrated Flow,** Kv= 5.0 fps
16.8	776	Total			

Subcatchment 118:



Subcatchment 119:

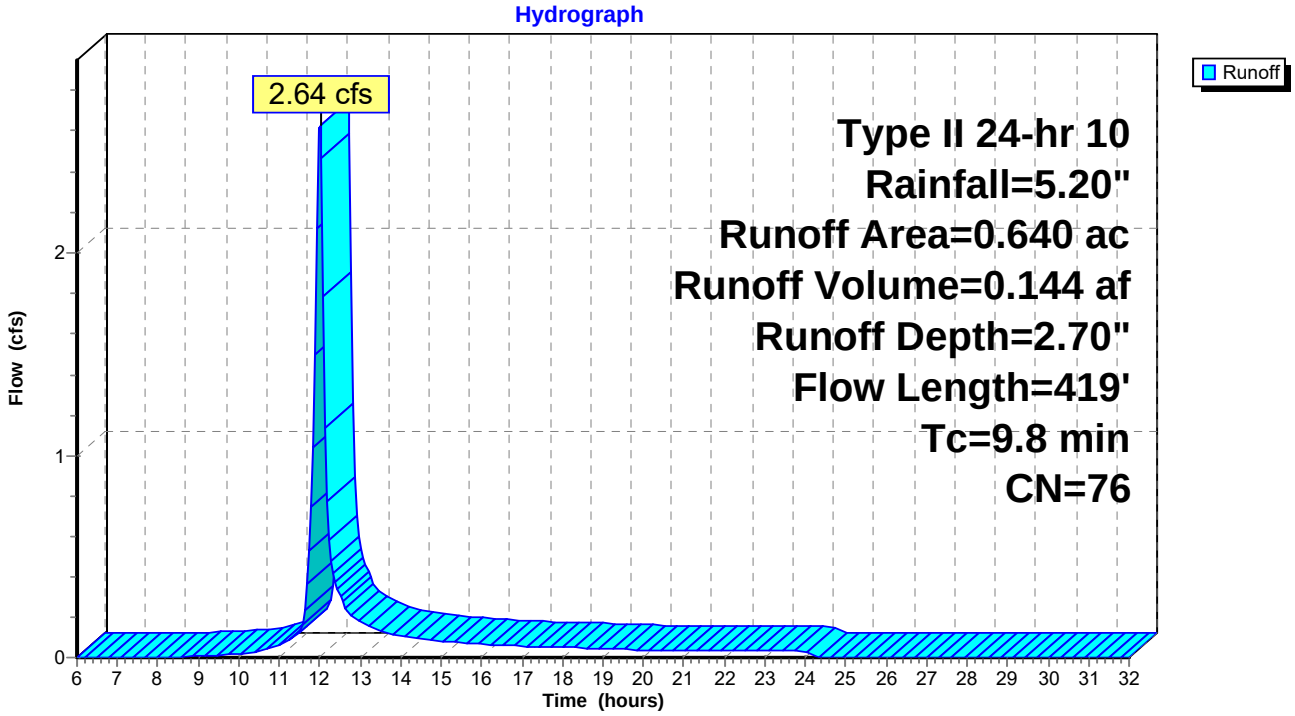
Runoff = 2.64 cfs @ 12.01 hrs, Volume= 0.144 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.640	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	79	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
6.5	340	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.8	419	Total			

Subcatchment 119:



Subcatchment 120:

[49] Hint: Tc<2dt may require smaller dt

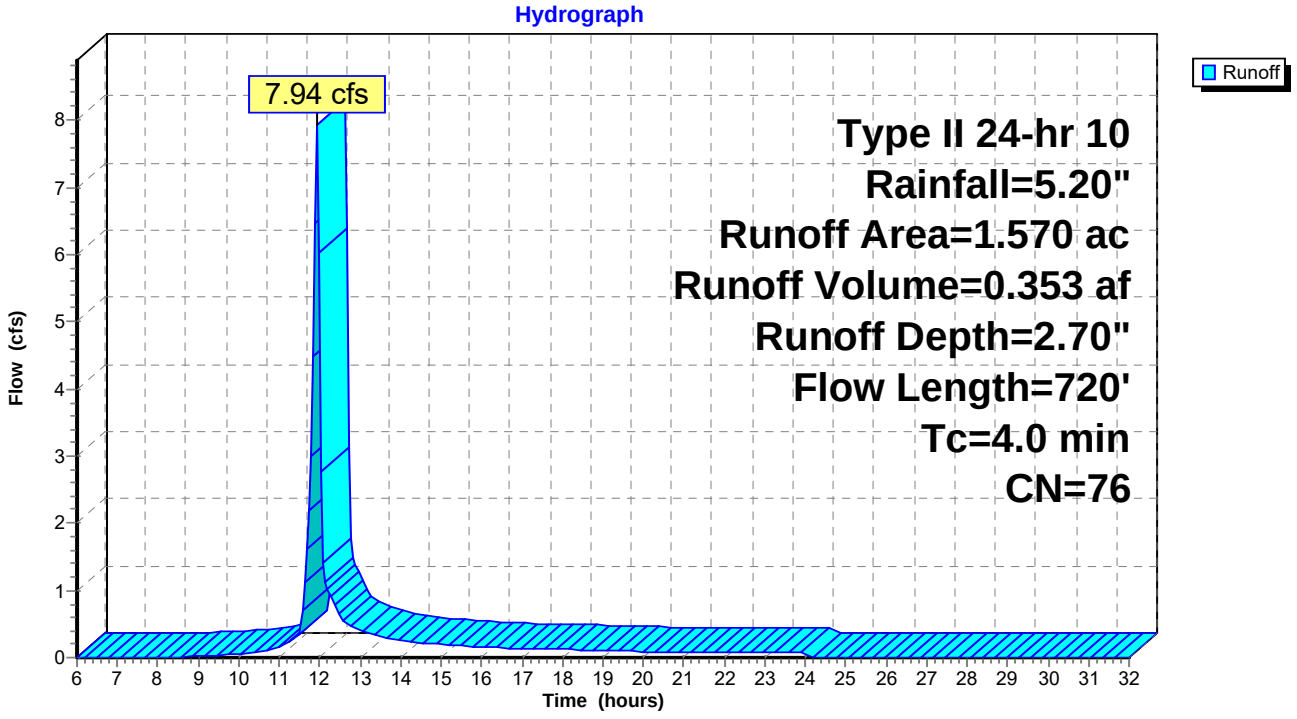
Runoff = 7.94 cfs @ 11.95 hrs, Volume= 0.353 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
1.570	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	83	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.5	637	0.0500	22.6	152.86	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.0	720	Total			

Subcatchment 120:



Subcatchment 121:

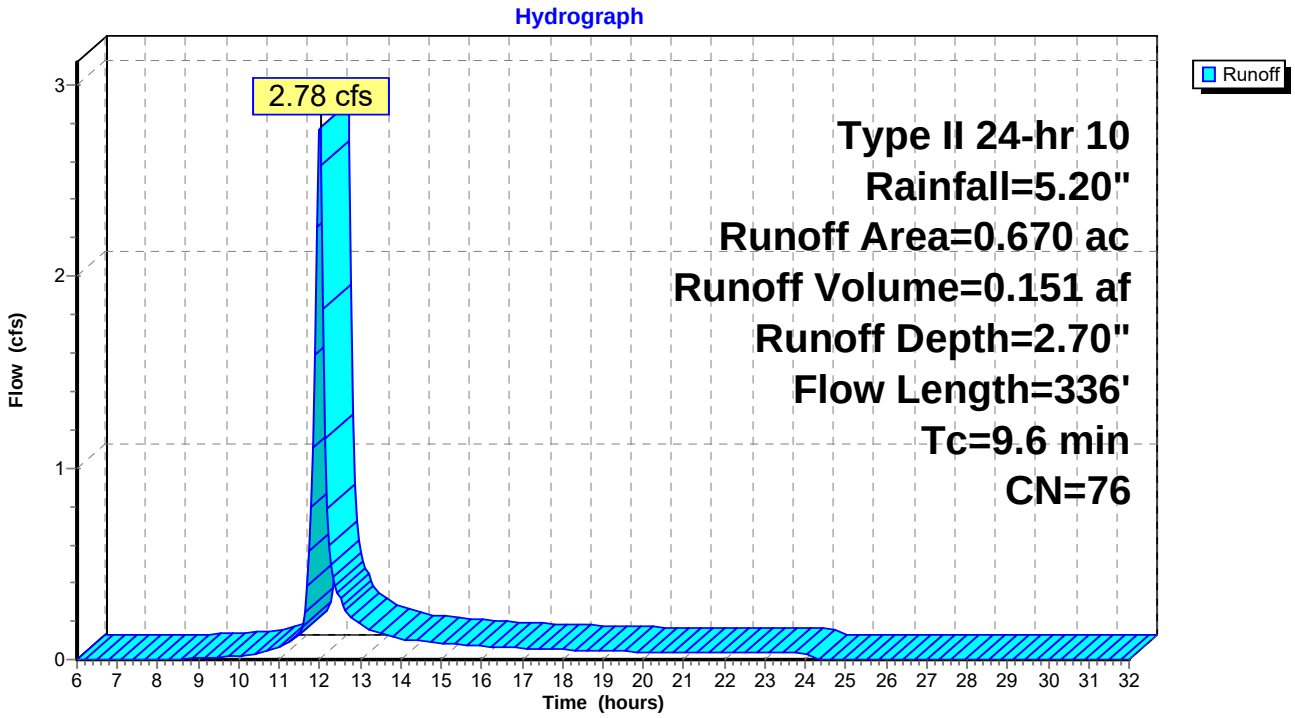
Runoff = 2.78 cfs @ 12.01 hrs, Volume= 0.151 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.670	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1600	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
4.2	236	0.0350	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.6	336	Total			

Subcatchment 121:



Subcatchment 122:

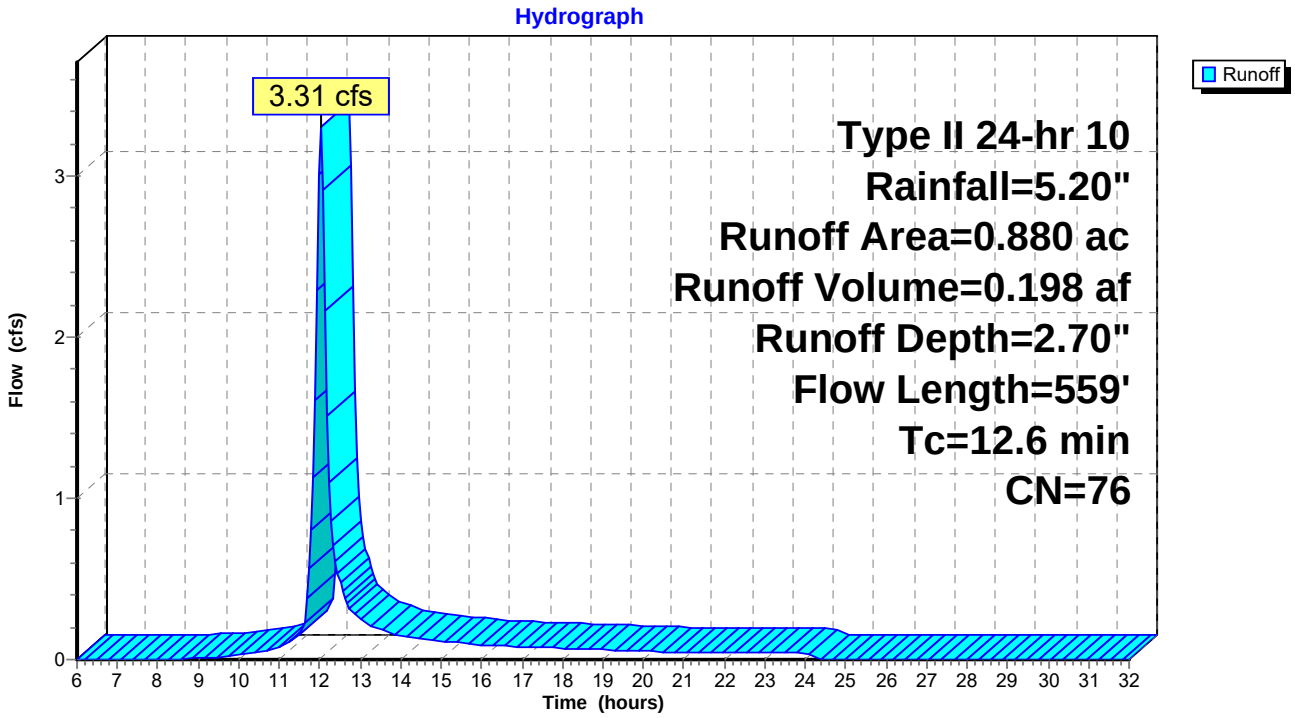
Runoff = 3.31 cfs @ 12.05 hrs, Volume= 0.198 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.880	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	84	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
9.1	475	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
12.6	559	Total			

Subcatchment 122:



Subcatchment 123:

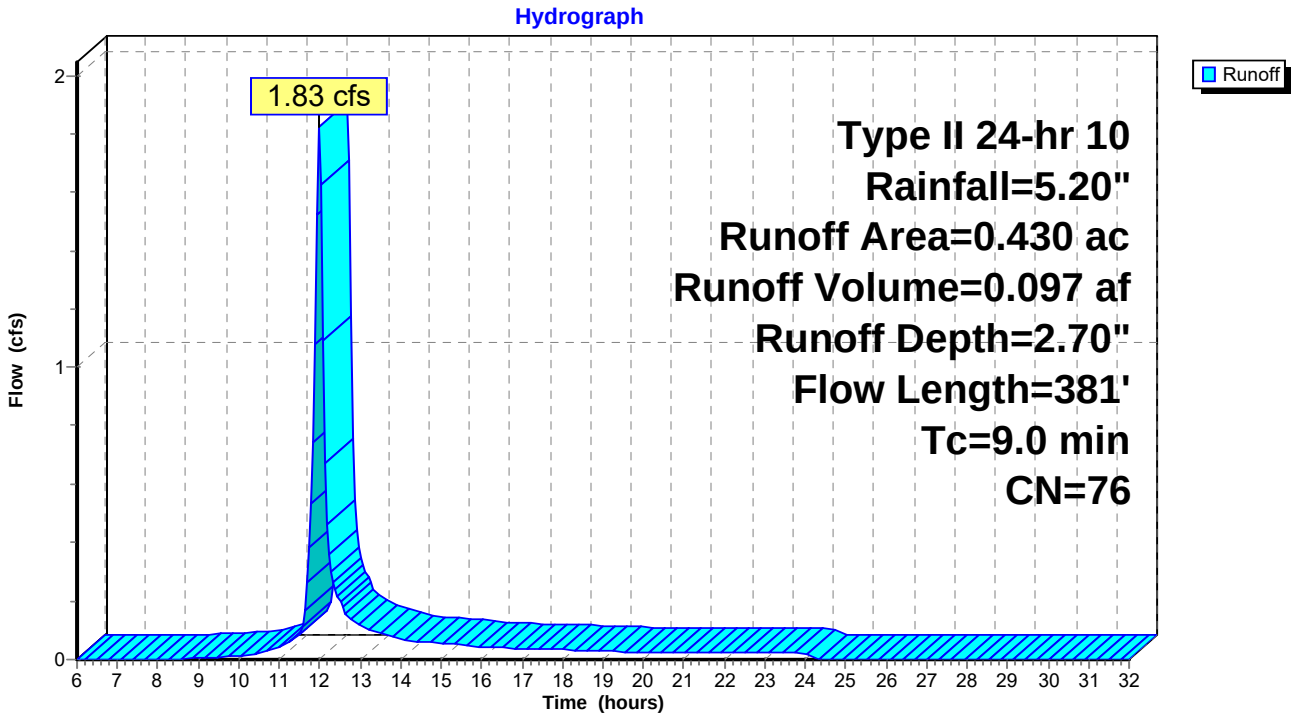
Runoff = 1.83 cfs @ 12.00 hrs, Volume= 0.097 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.430	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	72	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
5.9	309	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.0	381	Total			

Subcatchment 123:



Subcatchment 124:

[49] Hint: Tc<2dt may require smaller dt

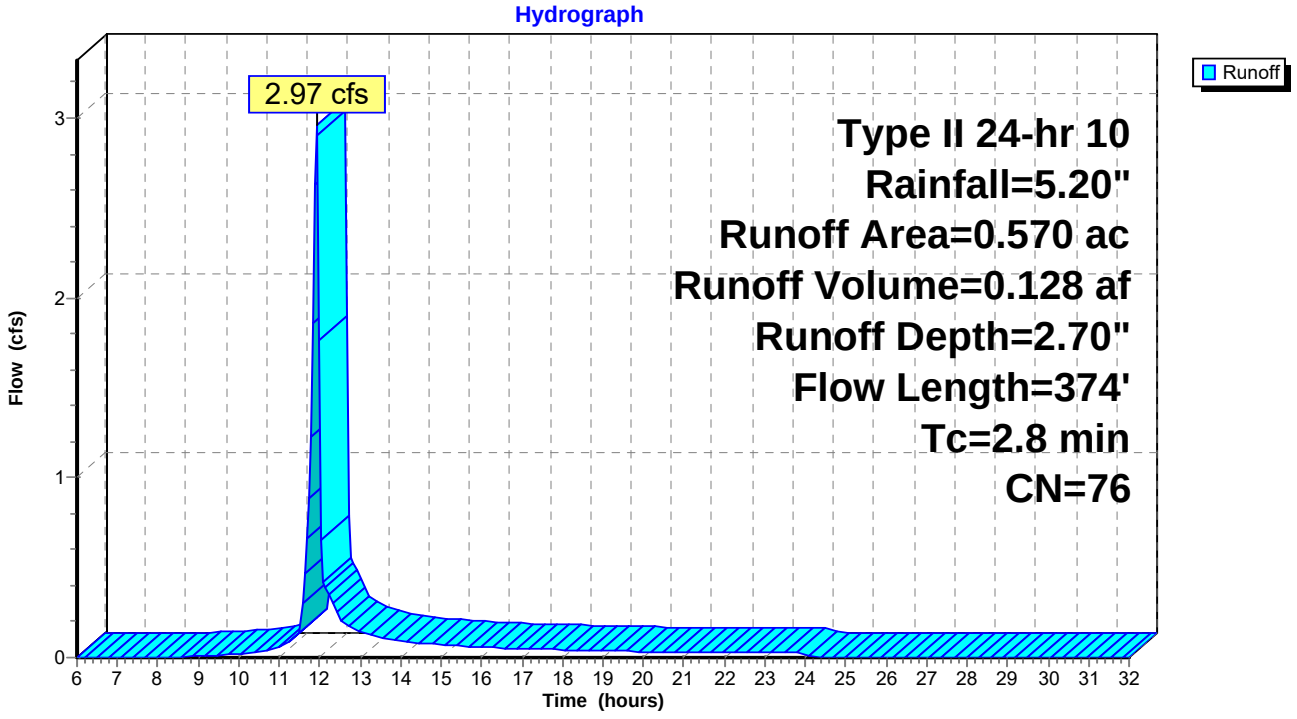
Runoff = 2.97 cfs @ 11.93 hrs, Volume= 0.128 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.570	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	58	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.2	316	0.0800	26.7	140.43	**Trap/Vee/Rect Channel Flow, MSE CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
2.8	374	Total			

Subcatchment 124:



Subcatchment 125:

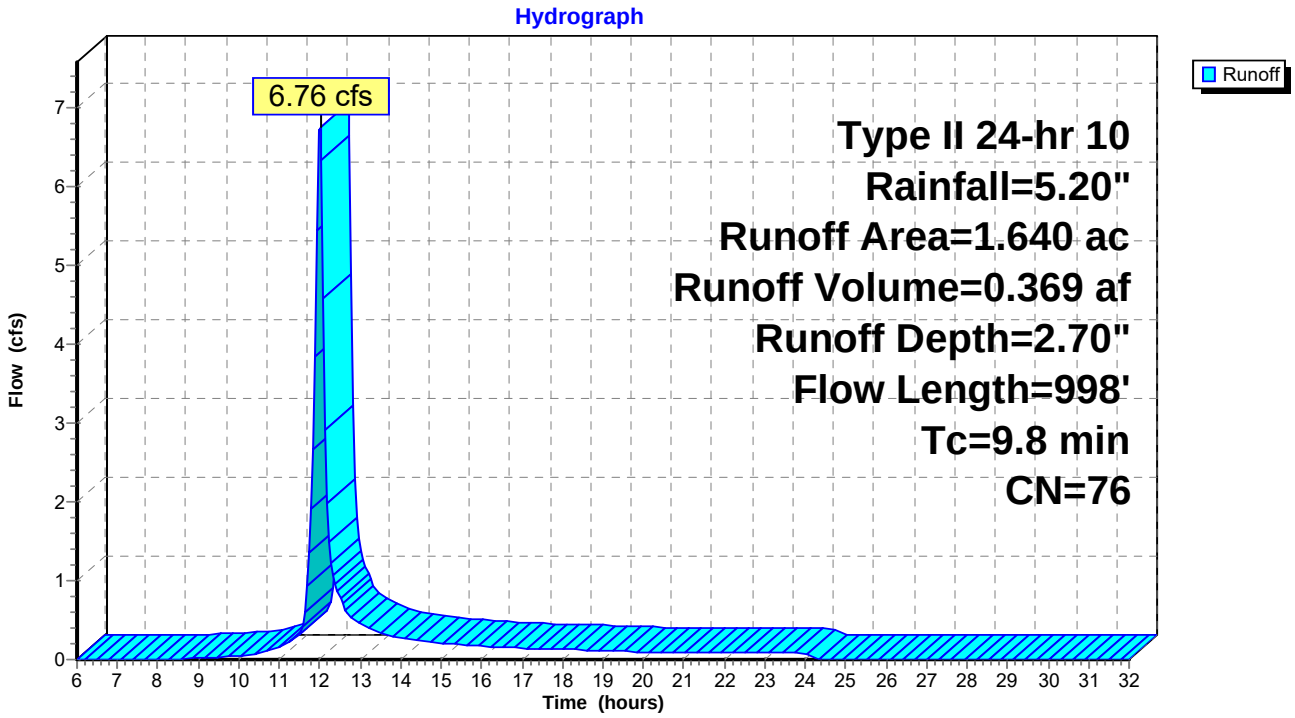
Runoff = 6.76 cfs @ 12.01 hrs, Volume= 0.369 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
1.640	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	62	0.0200	0.1		**Sheet Flow,** n= 0.200 P2= 3.20"
1.4	936	0.0800	11.5	80.16	**Trap/Vee/Rect Channel Flow, EXTERIOR CHANNEL** Bot.W=5.00' D=1.00' Z= 2.0 '/' Top.W=9.00' n= 0.030
9.8	998	Total			

Subcatchment 125:



Subcatchment 126:

[49] Hint: Tc<2dt may require smaller dt

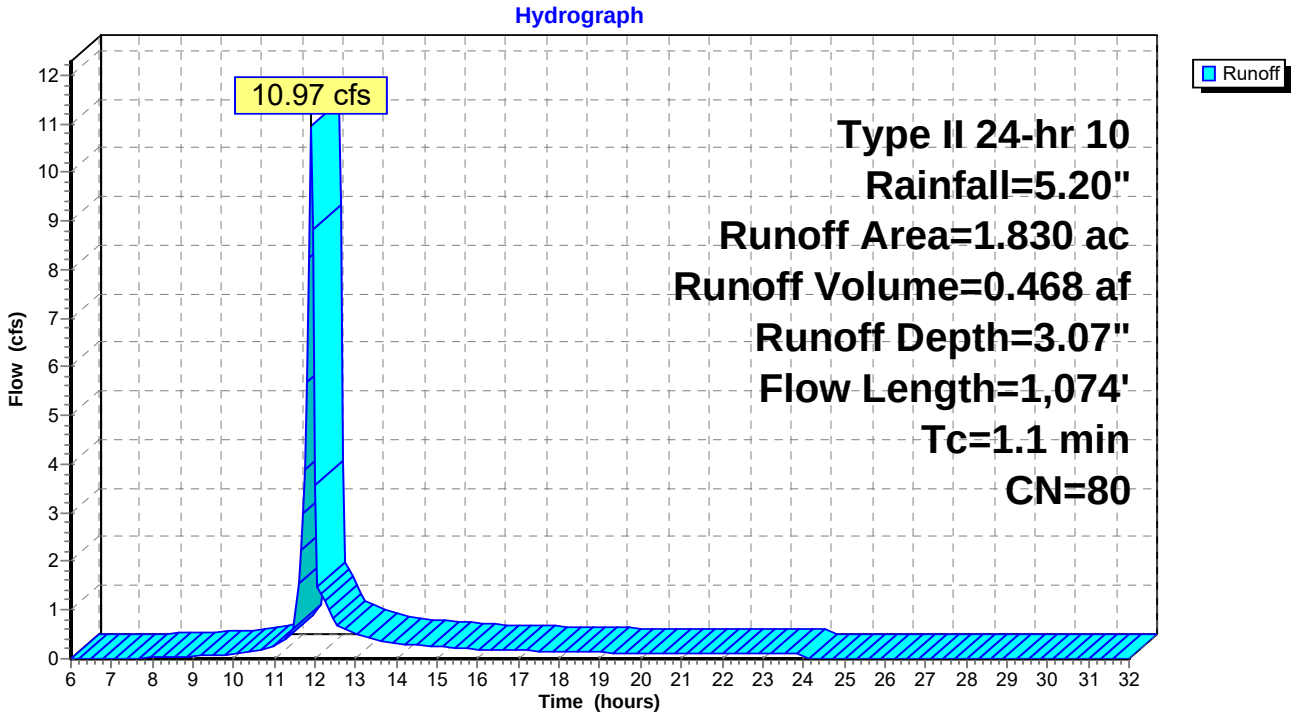
Runoff = 10.97 cfs @ 11.90 hrs, Volume= 0.468 af, Depth= 3.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
1.830	80	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	1,074	0.0600	16.4	51.46	**Circular Channel (pipe), PIPE** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.014

Subcatchment 126:



Subcatchment 127:

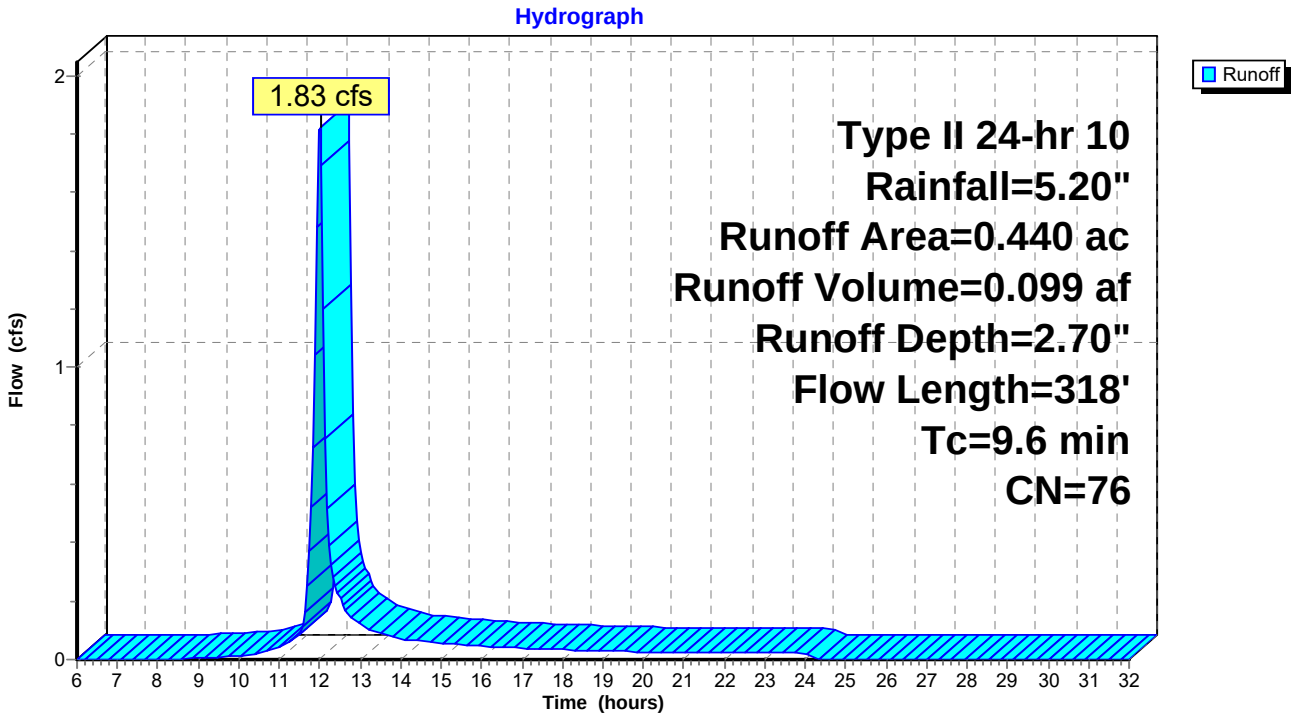
Runoff = 1.83 cfs @ 12.01 hrs, Volume= 0.099 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.440	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	98	0.1500	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
4.2	220	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.6	318	Total			

Subcatchment 127:



Subcatchment 128:

[49] Hint: Tc<2dt may require smaller dt

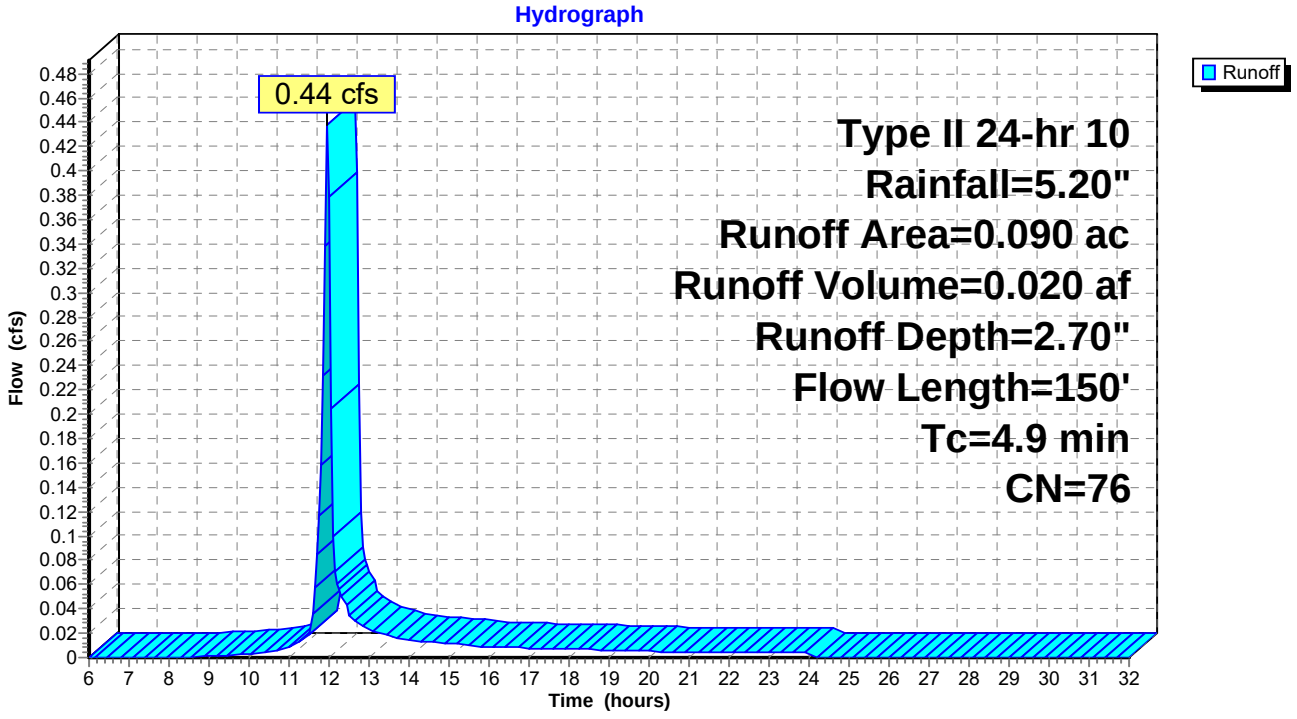
Runoff = 0.44 cfs @ 11.96 hrs, Volume= 0.020 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.090	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	93	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
1.1	57	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
4.9	150	Total			

Subcatchment 128:



Subcatchment 129:

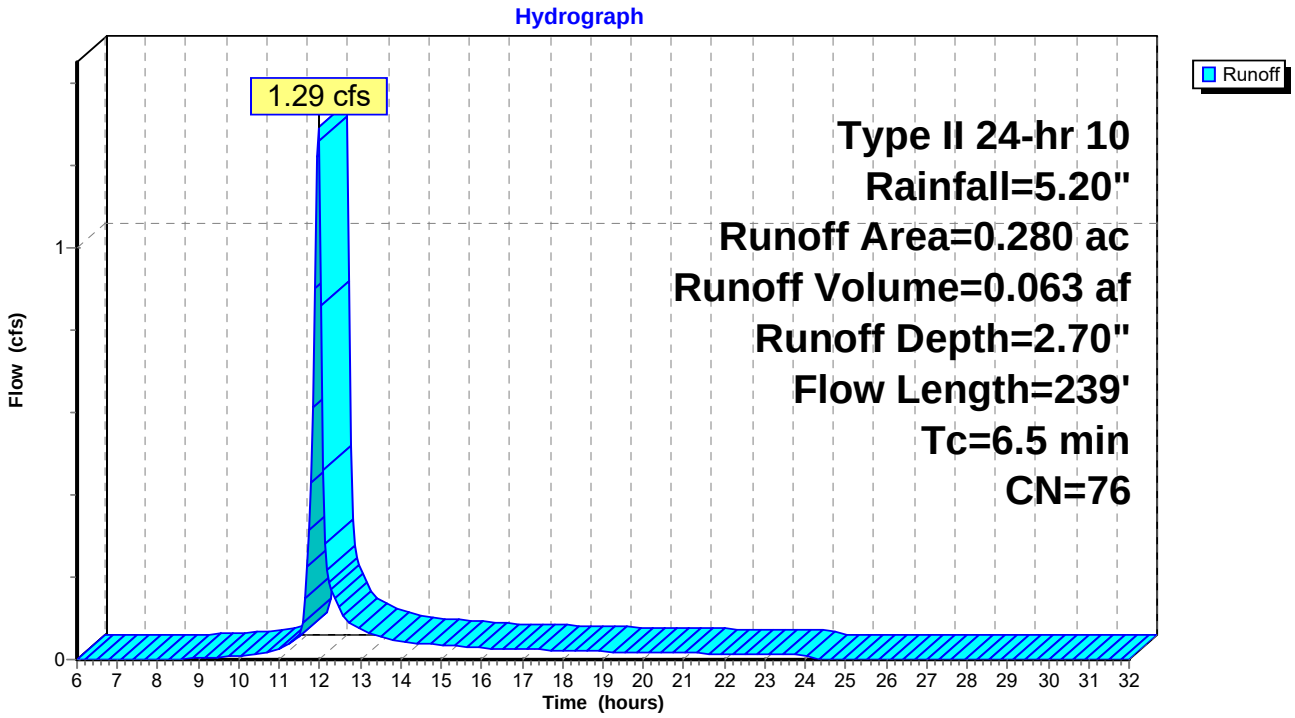
Runoff = 1.29 cfs @ 11.98 hrs, Volume= 0.063 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.280	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	91	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
2.8	148	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
6.5	239	Total			

Subcatchment 129:



Subcatchment 130:

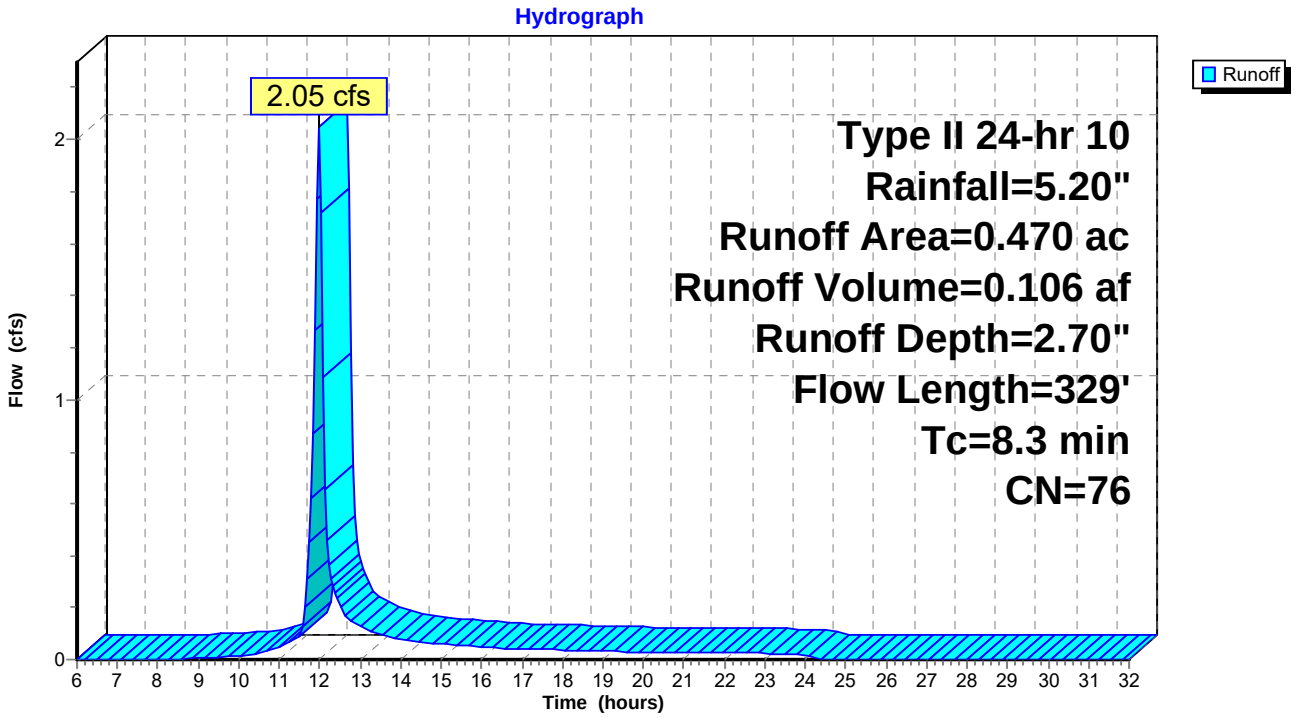
Runoff = 2.05 cfs @ 12.00 hrs, Volume= 0.106 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.470	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	94	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
4.5	235	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
8.3	329	Total			

Subcatchment 130:



Subcatchment 131:

[49] Hint: Tc<2dt may require smaller dt

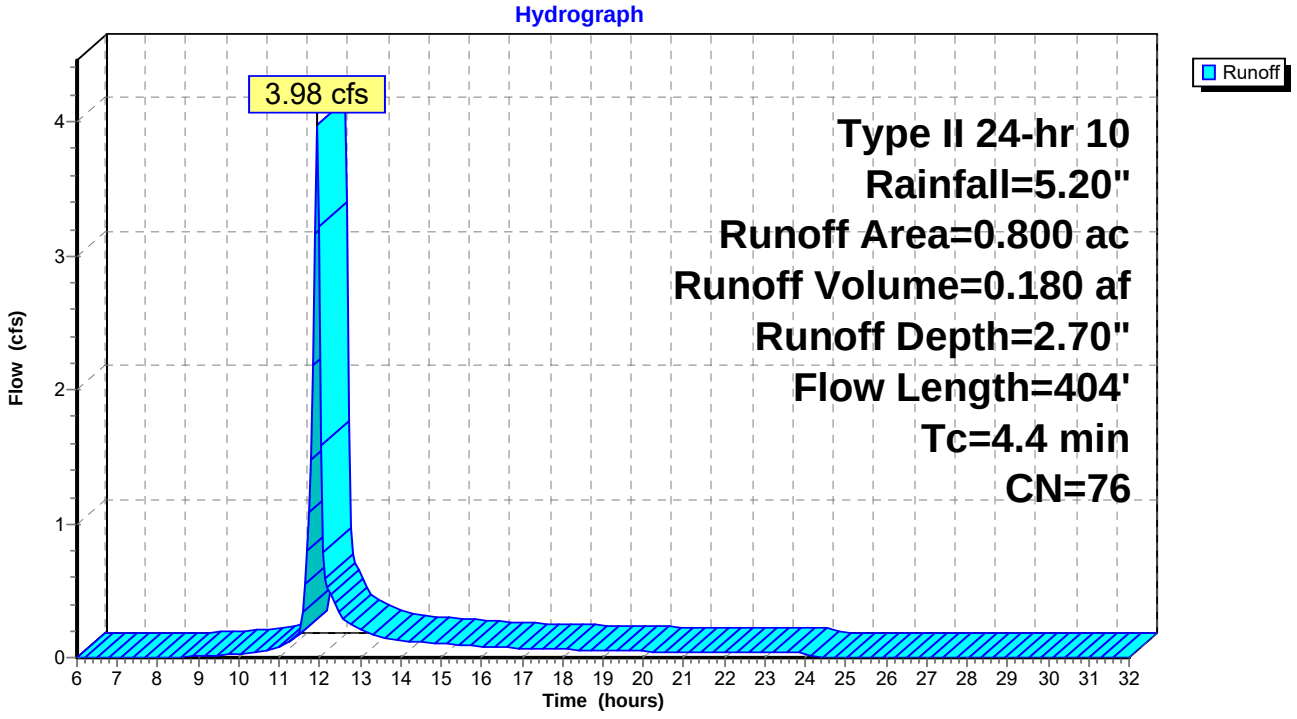
Runoff = 3.98 cfs @ 11.95 hrs, Volume= 0.180 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.800	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	97	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.5	307	0.0090	9.6	64.85	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.4	404	Total			

Subcatchment 131:



Subcatchment 132:

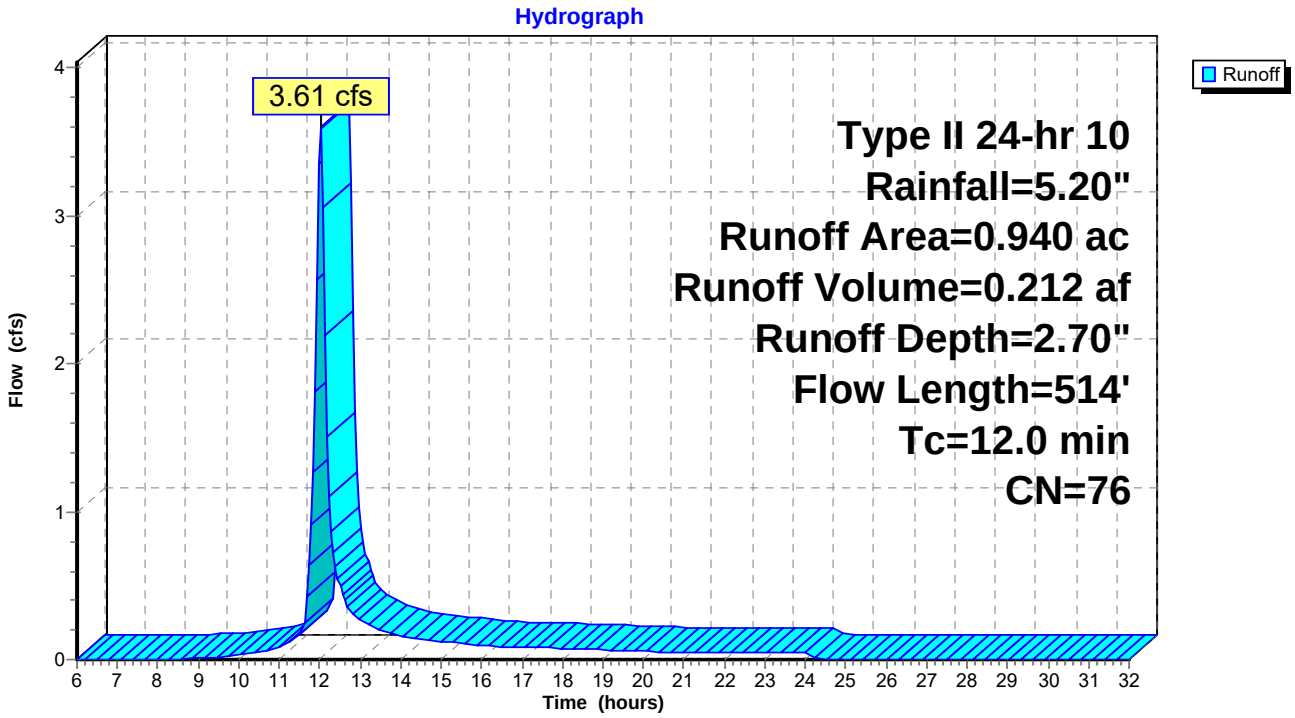
Runoff = 3.61 cfs @ 12.04 hrs, Volume= 0.212 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
0.940	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
8.0	414	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
12.0	514	Total			

Subcatchment 132:



Subcatchment 133:

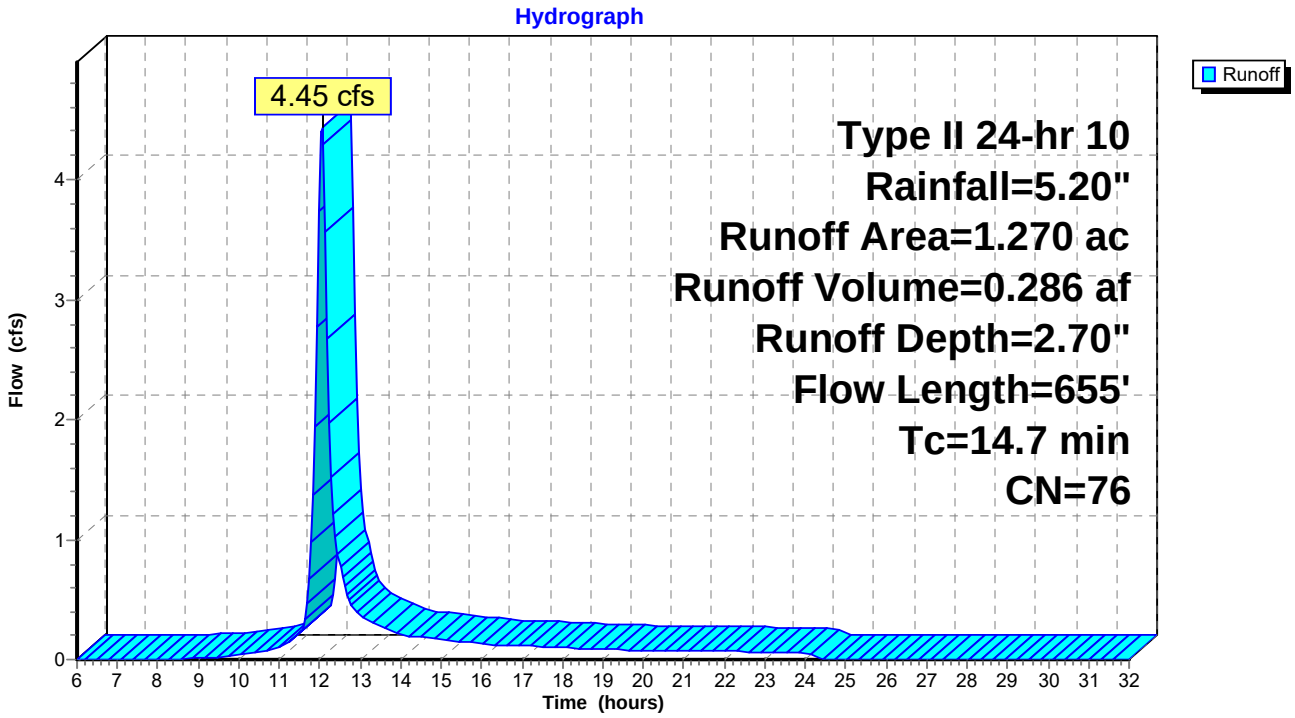
Runoff = 4.45 cfs @ 12.07 hrs, Volume= 0.286 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
1.270	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
10.7	555	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
14.7	655	Total			

Subcatchment 133:



Subcatchment 134:

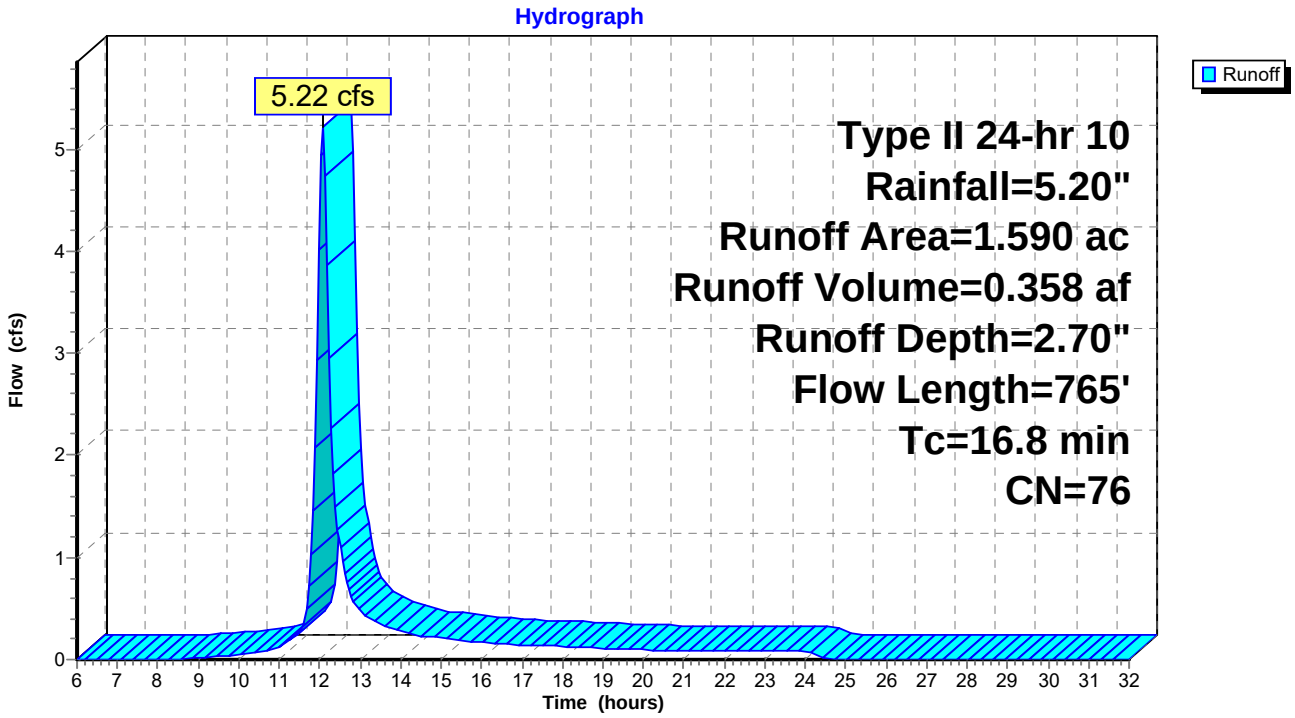
Runoff = 5.22 cfs @ 12.09 hrs, Volume= 0.358 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
1.590	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
12.8	665	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
16.8	765	Total			

Subcatchment 134:



Subcatchment 135:

[49] Hint: Tc<2dt may require smaller dt

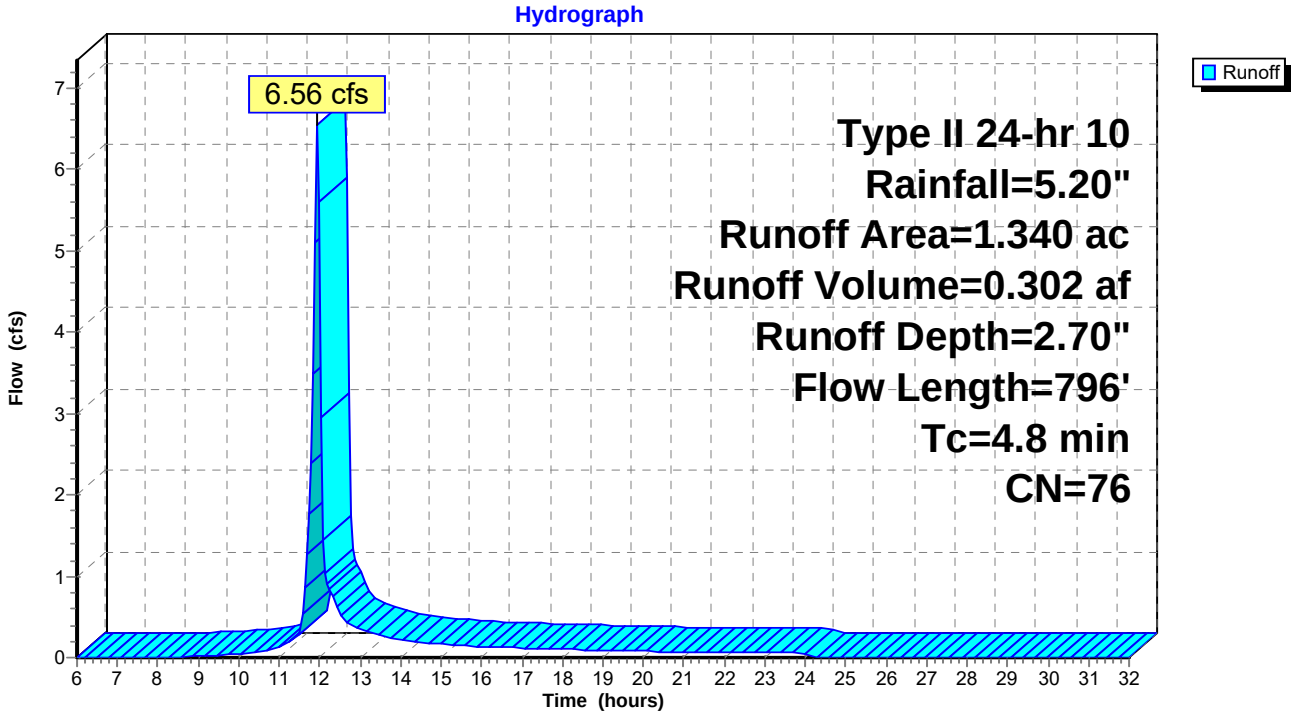
Runoff = 6.56 cfs @ 11.96 hrs, Volume= 0.302 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
1.340	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	82	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
1.4	714	0.0070	8.5	57.19	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.8	796	Total			

Subcatchment 135:



Subcatchment 136:

[49] Hint: Tc<2dt may require smaller dt

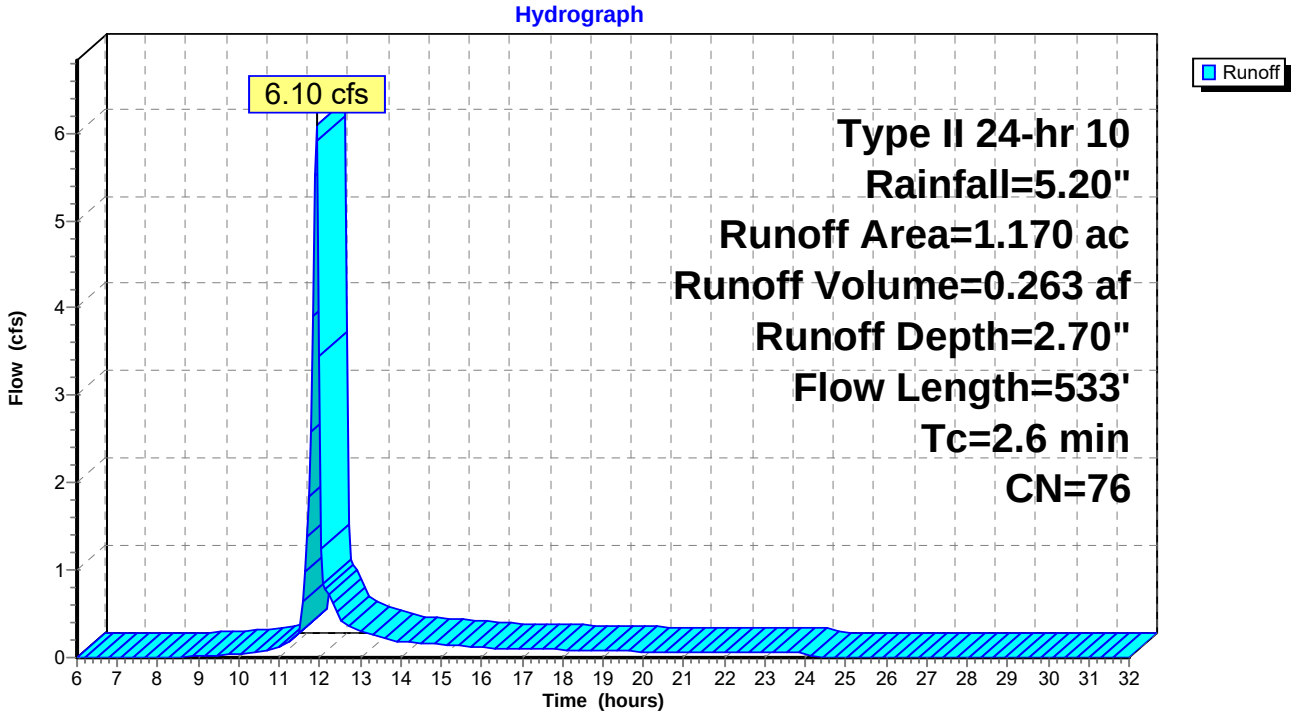
Runoff = 6.10 cfs @ 11.93 hrs, Volume= 0.263 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
1.170	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	36	0.3300	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.8	497	0.0100	10.1	68.36	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
2.6	533	Total			

Subcatchment 136:



Subcatchment PWL-1:

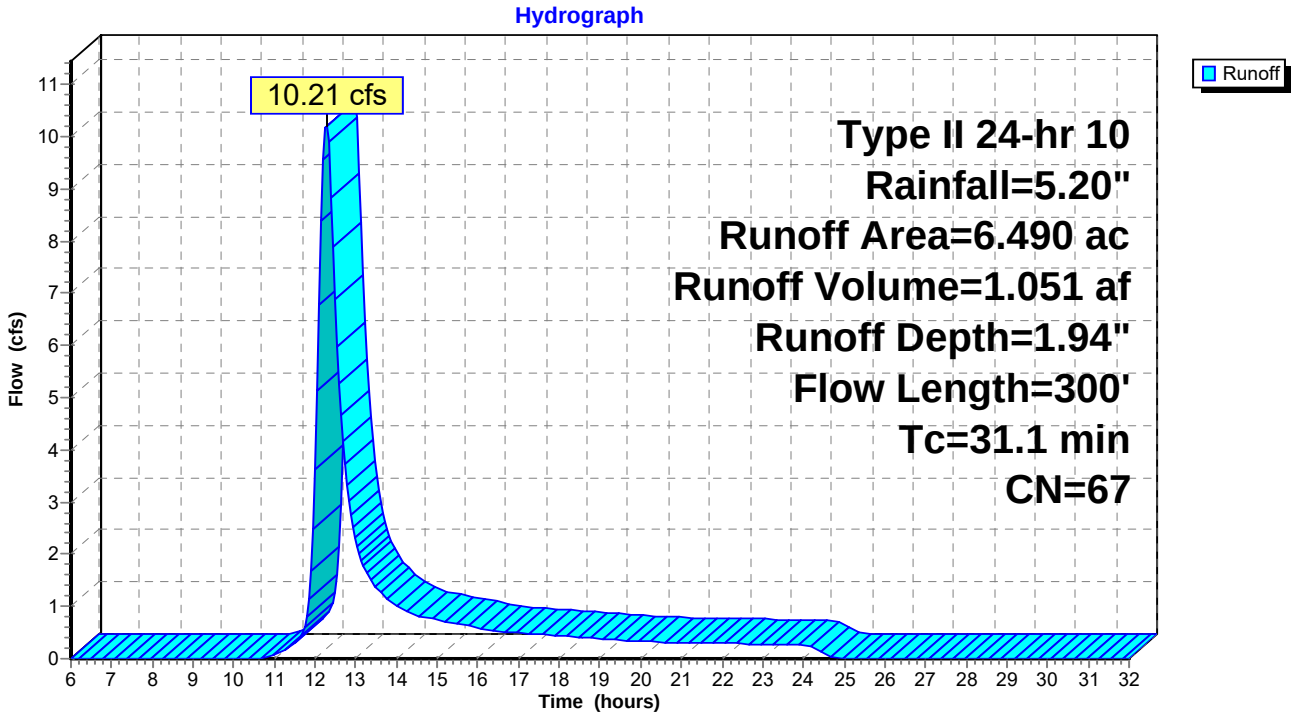
Runoff = 10.21 cfs @ 12.27 hrs, Volume= 1.051 af, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
6.490	67	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	300	0.0100	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PWL-1:



Subcatchment PWL-2:

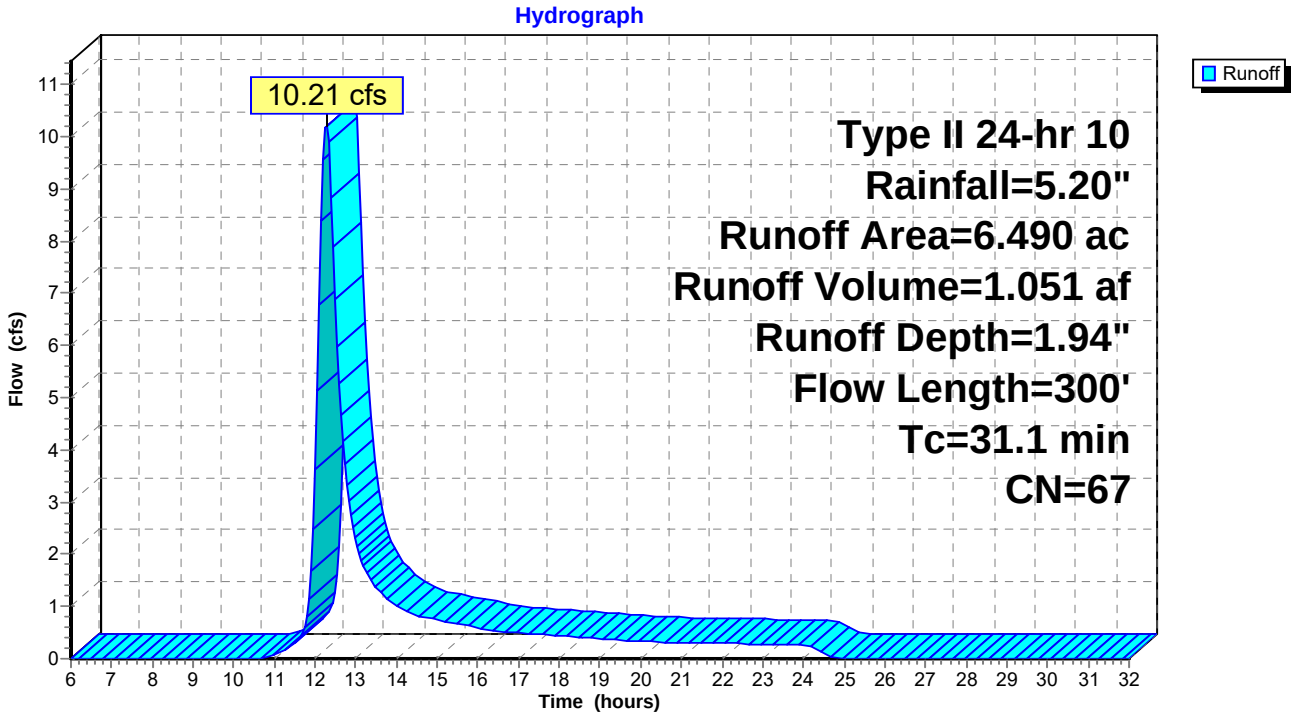
Runoff = 10.21 cfs @ 12.27 hrs, Volume= 1.051 af, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
6.490	67	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	300	0.0100	0.2		**Sheet Flow,** n= 0.150 P2= 3.20"

Subcatchment PWL-2:



Subcatchment PWL-3:

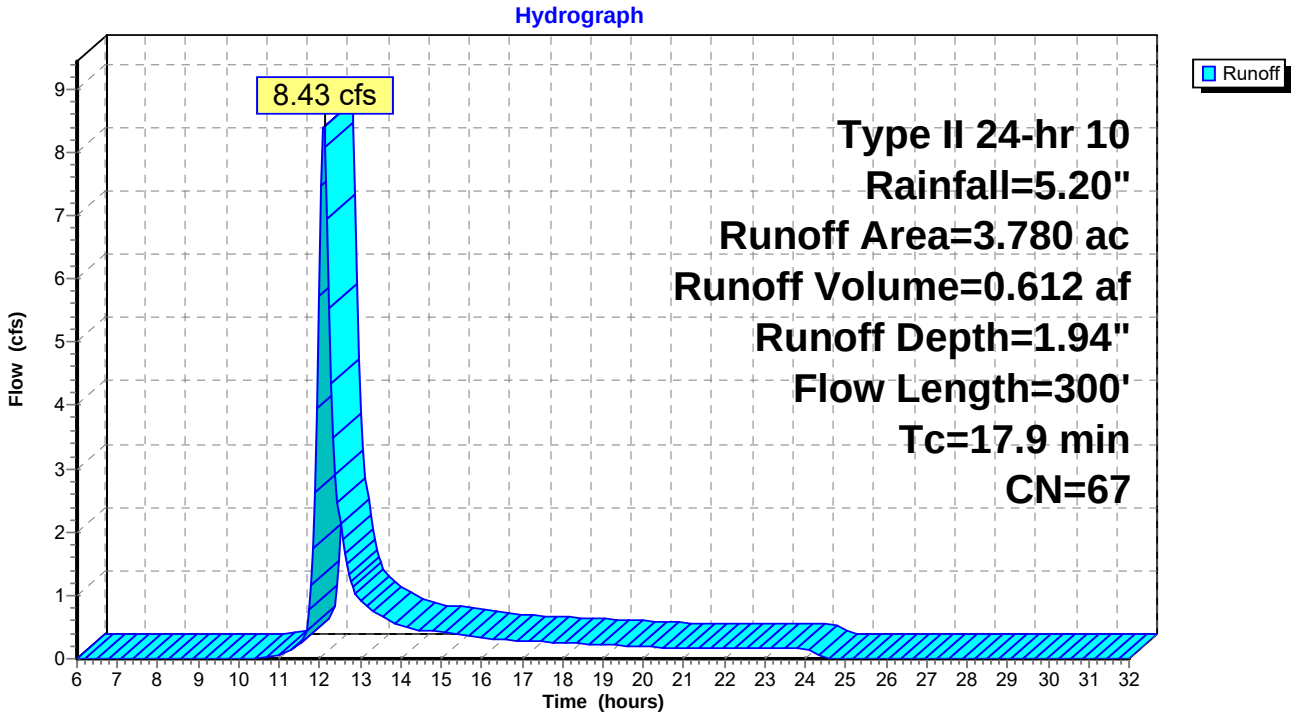
Runoff = 8.43 cfs @ 12.11 hrs, Volume= 0.612 af, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Rainfall=5.20"

Area (ac)	CN	Description
3.780	67	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	300	0.0400	0.3		**Sheet Flow,** n= 0.150 P2= 3.20"

Subcatchment PWL-3:



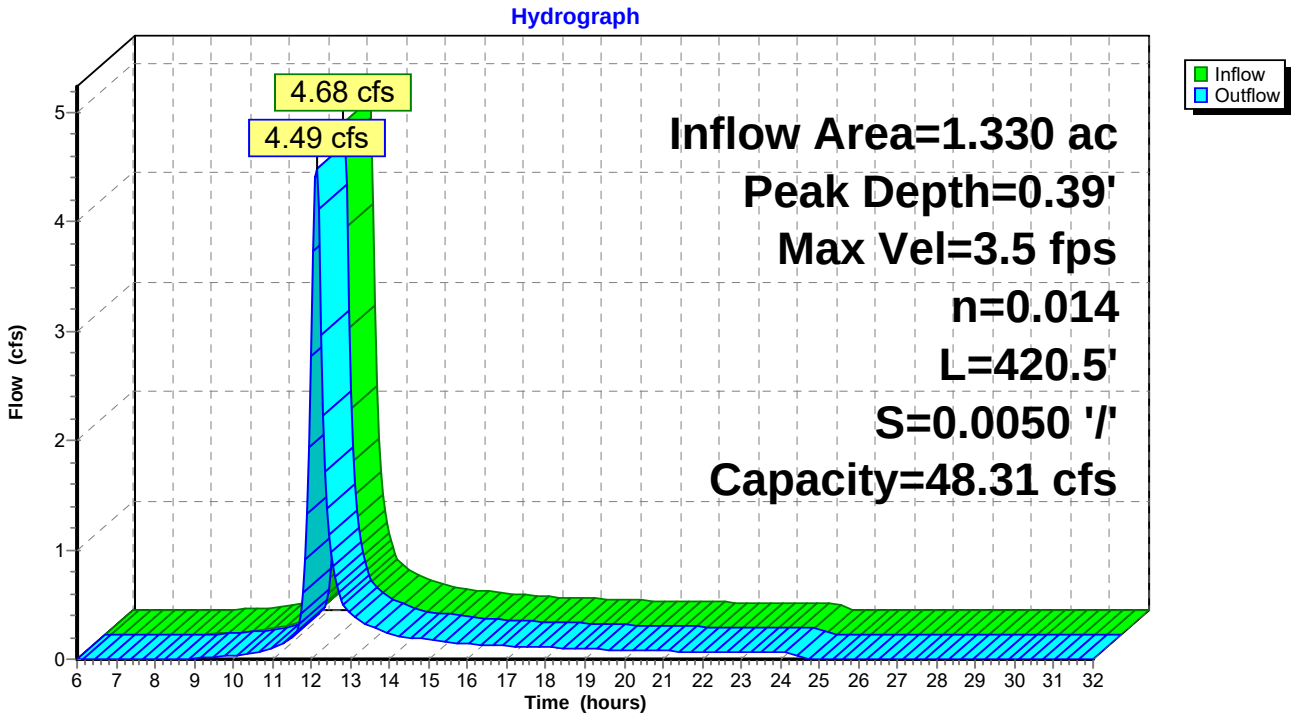
Reach 01-05: PERIMETER CHANNEL

Inflow Area = 1.330 ac, Inflow Depth = 2.70" for 10 event
Inflow = 4.68 cfs @ 12.07 hrs, Volume= 0.299 af
Outflow = 4.49 cfs @ 12.13 hrs, Volume= 0.299 af, Atten= 4%, Lag= 3.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.5 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 0.9 fps, Avg. Travel Time= 7.8 min

Peak Depth= 0.39' @ 12.09 hrs
Capacity at bank full= 48.31 cfs
Inlet Invert= 110.00', Outlet Invert= 107.90'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 420.5' Slope= 0.0050 '/'

Reach 01-05: PERIMETER CHANNEL



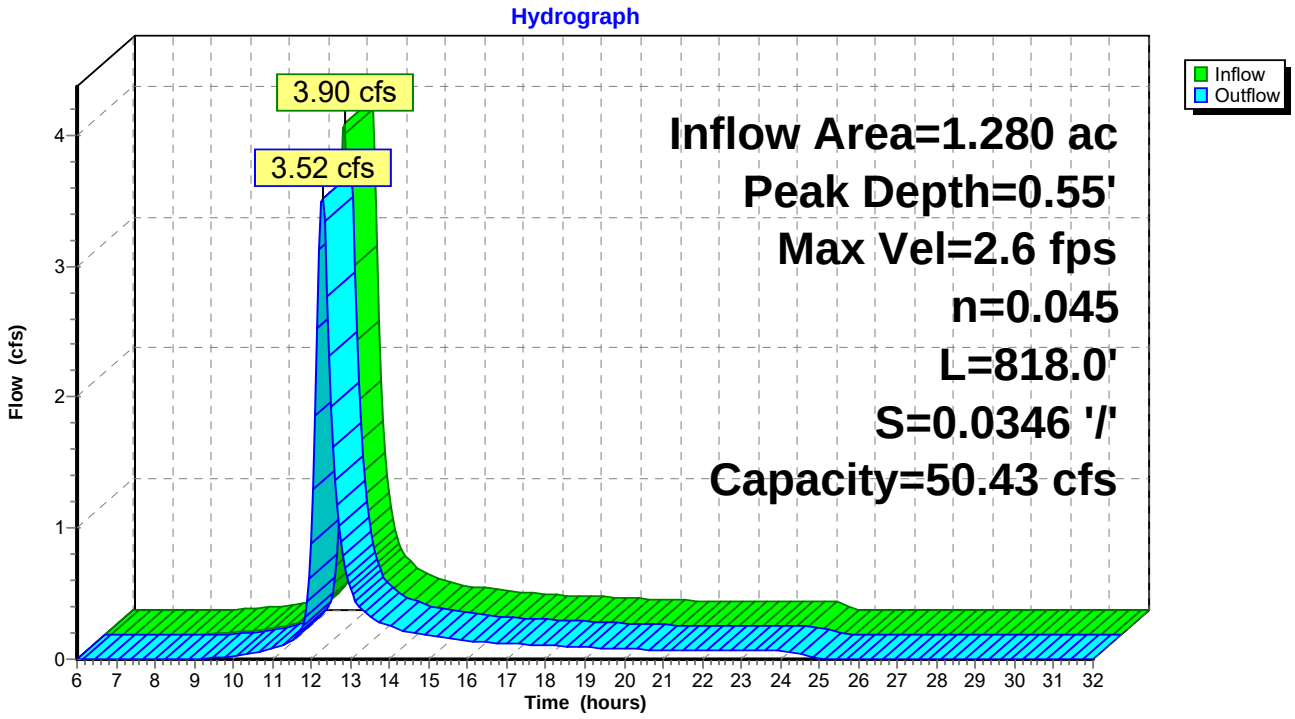
Reach 02-06: BENCH

Inflow Area = 1.280 ac, Inflow Depth = 2.70" for 10 event
Inflow = 3.90 cfs @ 12.12 hrs, Volume= 0.288 af
Outflow = 3.52 cfs @ 12.28 hrs, Volume= 0.288 af, Atten= 10%, Lag= 9.3 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.6 fps, Min. Travel Time= 5.3 min
Avg. Velocity = 0.9 fps, Avg. Travel Time= 14.8 min

Peak Depth= 0.55' @ 12.19 hrs
Capacity at bank full= 50.43 cfs
Inlet Invert= 130.00', Outlet Invert= 101.70'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 818.0' Slope= 0.0346 '/'

Reach 02-06: BENCH



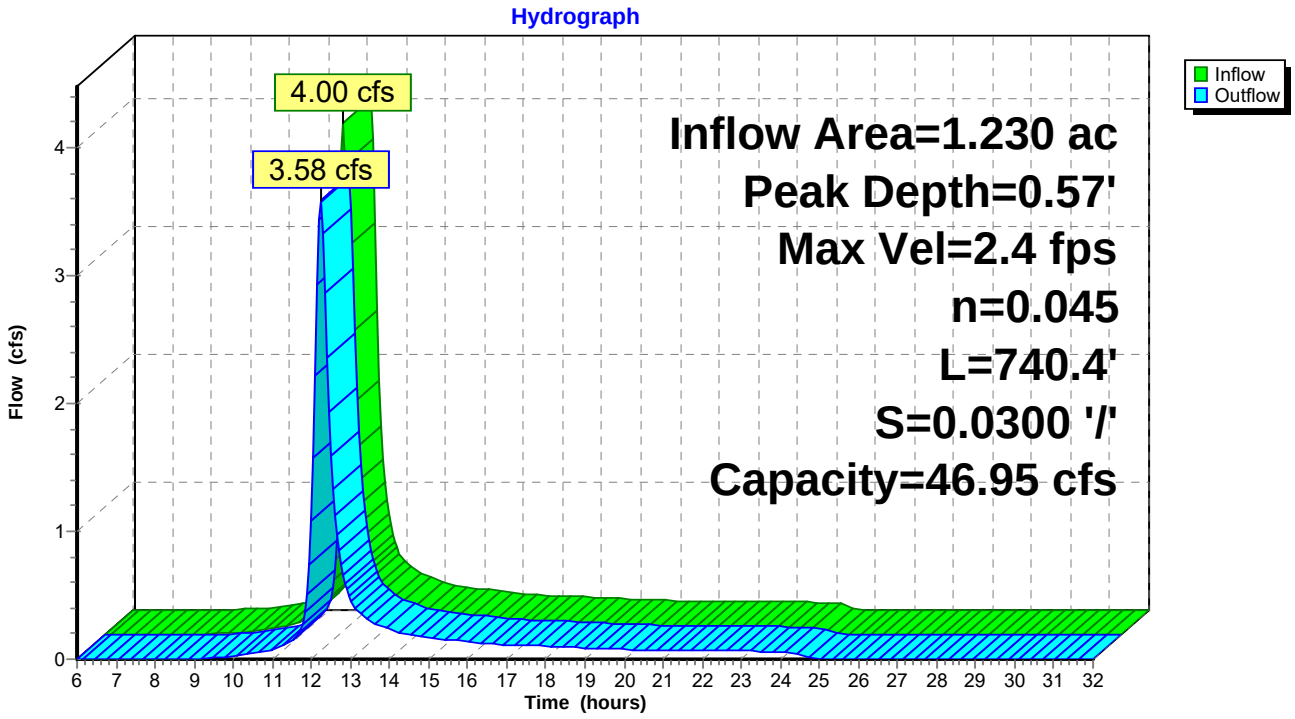
Reach 03-09: BENCH

Inflow Area = 1.230 ac, Inflow Depth = 2.70" for 10 event
Inflow = 4.00 cfs @ 12.10 hrs, Volume= 0.277 af
Outflow = 3.58 cfs @ 12.24 hrs, Volume= 0.277 af, Atten= 10%, Lag= 8.8 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.4 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 0.9 fps, Avg. Travel Time= 14.2 min

Peak Depth= 0.57' @ 12.16 hrs
Capacity at bank full= 46.95 cfs
Inlet Invert= 152.21', Outlet Invert= 130.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 740.4' Slope= 0.0300 '/'

Reach 03-09: BENCH



Reach 04-08: ACCESS ROAD CHANNEL

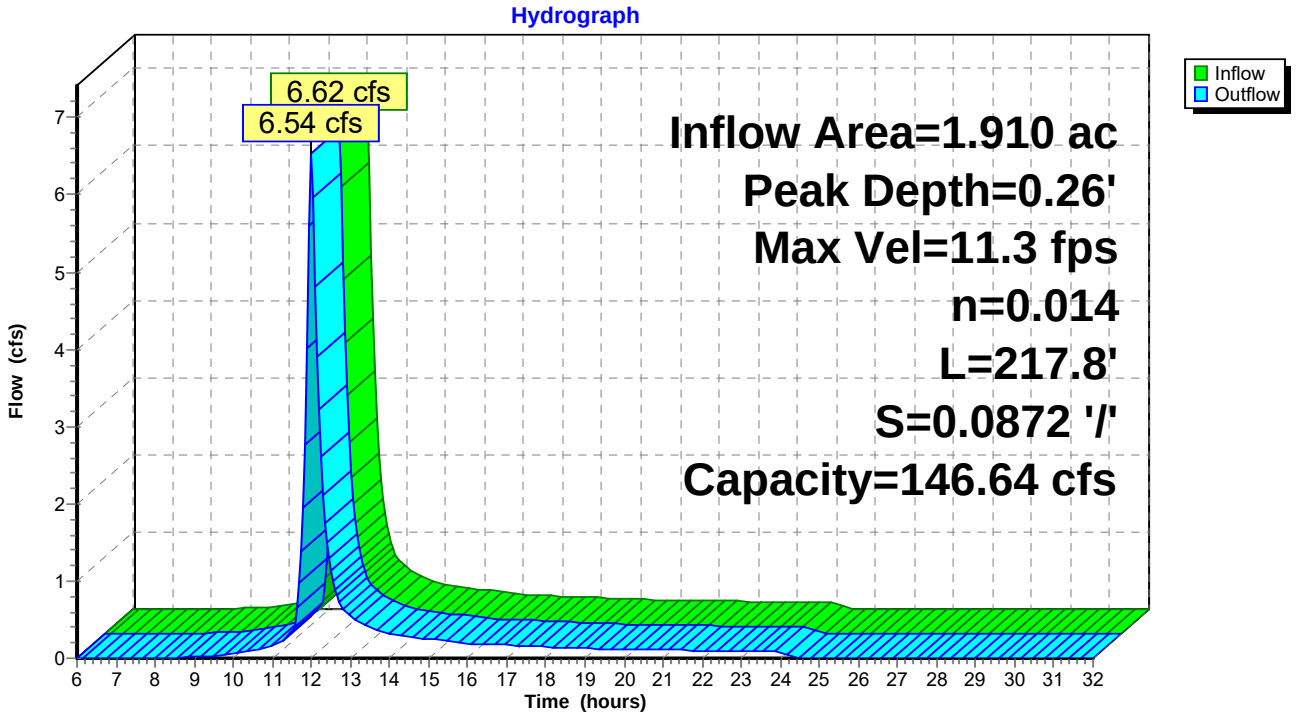
[61] Hint: Submerged 1% of Reach 07-04 bottom

Inflow Area = 1.910 ac, Inflow Depth = 2.70" for 10 event
Inflow = 6.62 cfs @ 12.00 hrs, Volume= 0.430 af
Outflow = 6.54 cfs @ 12.01 hrs, Volume= 0.430 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.3 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.1 fps, Avg. Travel Time= 1.2 min

Peak Depth= 0.26' @ 12.00 hrs
Capacity at bank full= 146.64 cfs
Inlet Invert= 174.80', Outlet Invert= 155.80'
2.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 5.00'
Length= 217.8' Slope= 0.0872 '/'

Reach 04-08: ACCESS ROAD CHANNEL



Reach 05-06: PERIMETER CHANNEL

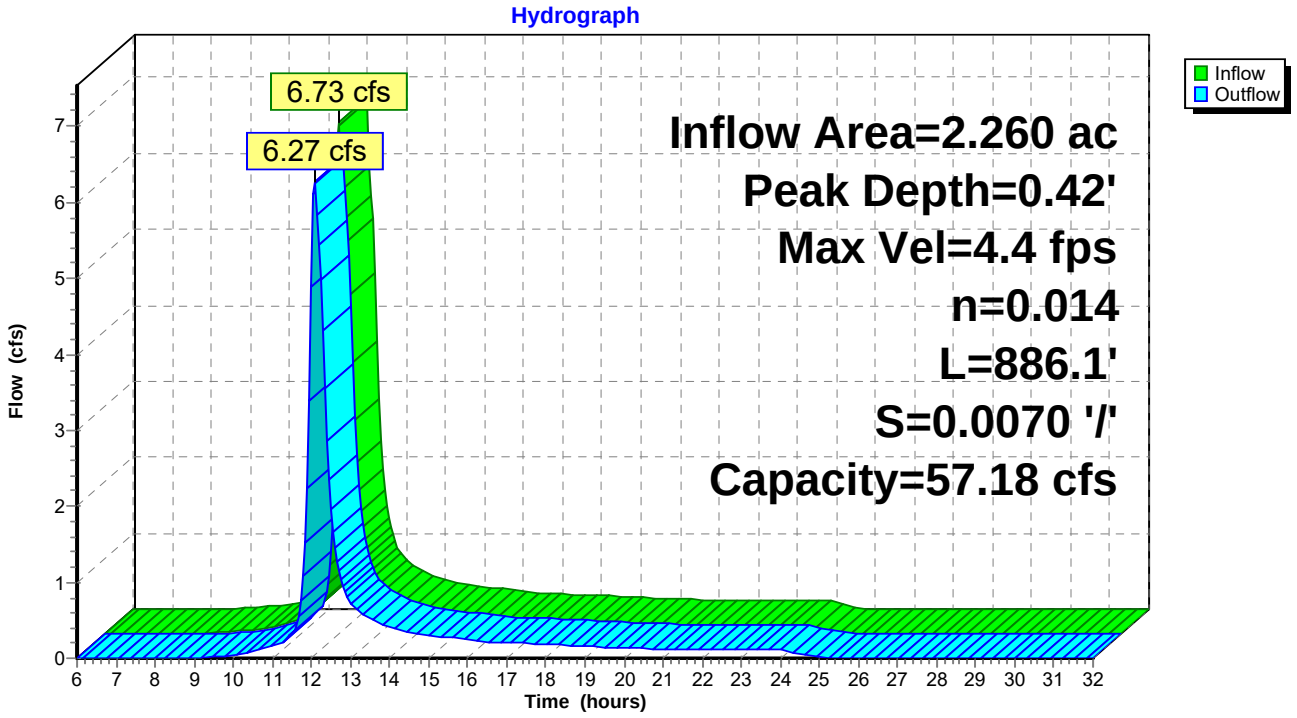
[61] Hint: Submerged 20% of Reach 01-05 bottom

Inflow Area = 2.260 ac, Inflow Depth = 2.70" for 10 event
Inflow = 6.73 cfs @ 11.99 hrs, Volume= 0.509 af
Outflow = 6.27 cfs @ 12.09 hrs, Volume= 0.509 af, Atten= 7%, Lag= 6.2 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.4 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 1.2 fps, Avg. Travel Time= 12.8 min

Peak Depth= 0.42' @ 12.03 hrs
Capacity at bank full= 57.18 cfs
Inlet Invert= 107.90', Outlet Invert= 101.70'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 886.1' Slope= 0.0070 '/'

Reach 05-06: PERIMETER CHANNEL



Reach 06-10: PERIMETER CHANNEL

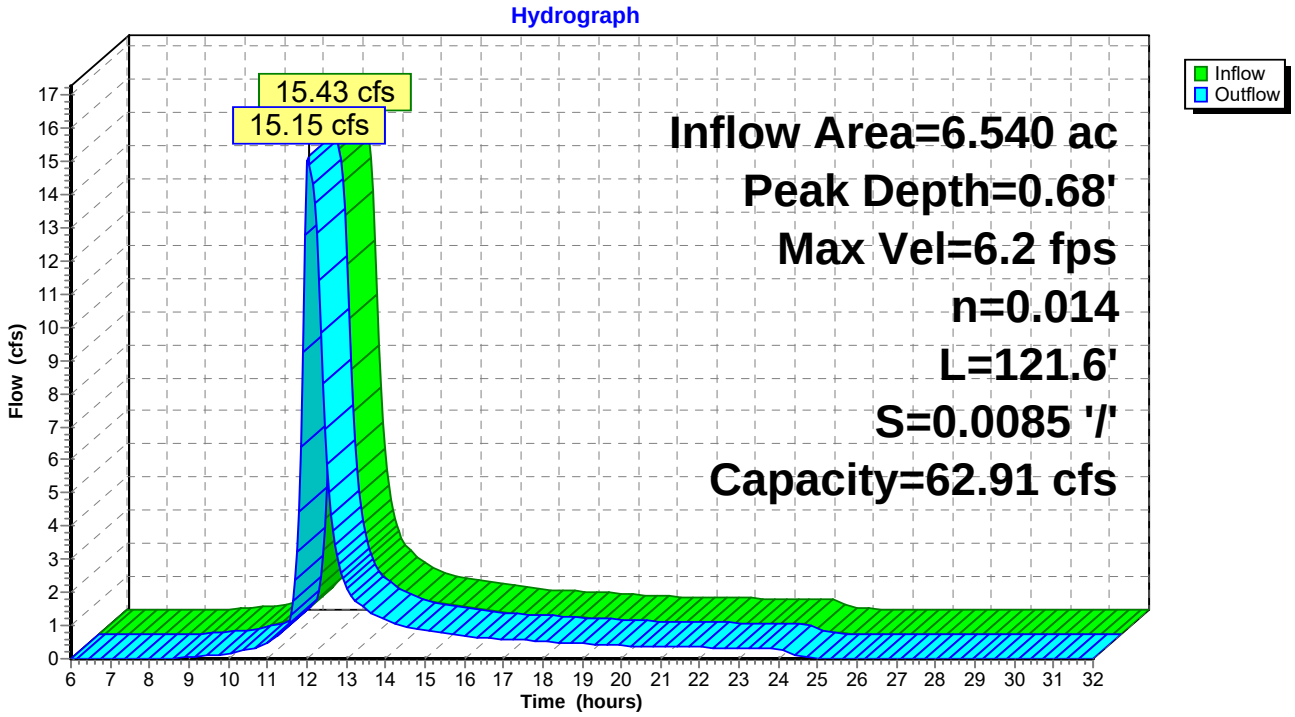
[61] Hint: Submerged 2% of Reach 02-06 bottom
[61] Hint: Submerged 11% of Reach 05-06 bottom

Inflow Area = 6.540 ac, Inflow Depth = 2.70" for 10 event
Inflow = 15.43 cfs @ 12.02 hrs, Volume= 1.472 af
Outflow = 15.15 cfs @ 12.03 hrs, Volume= 1.472 af, Atten= 2%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.2 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.7 fps, Avg. Travel Time= 1.2 min

Peak Depth= 0.68' @ 12.02 hrs
Capacity at bank full= 62.91 cfs
Inlet Invert= 101.70', Outlet Invert= 100.67'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 121.6' Slope= 0.0085 '/'

Reach 06-10: PERIMETER CHANNEL



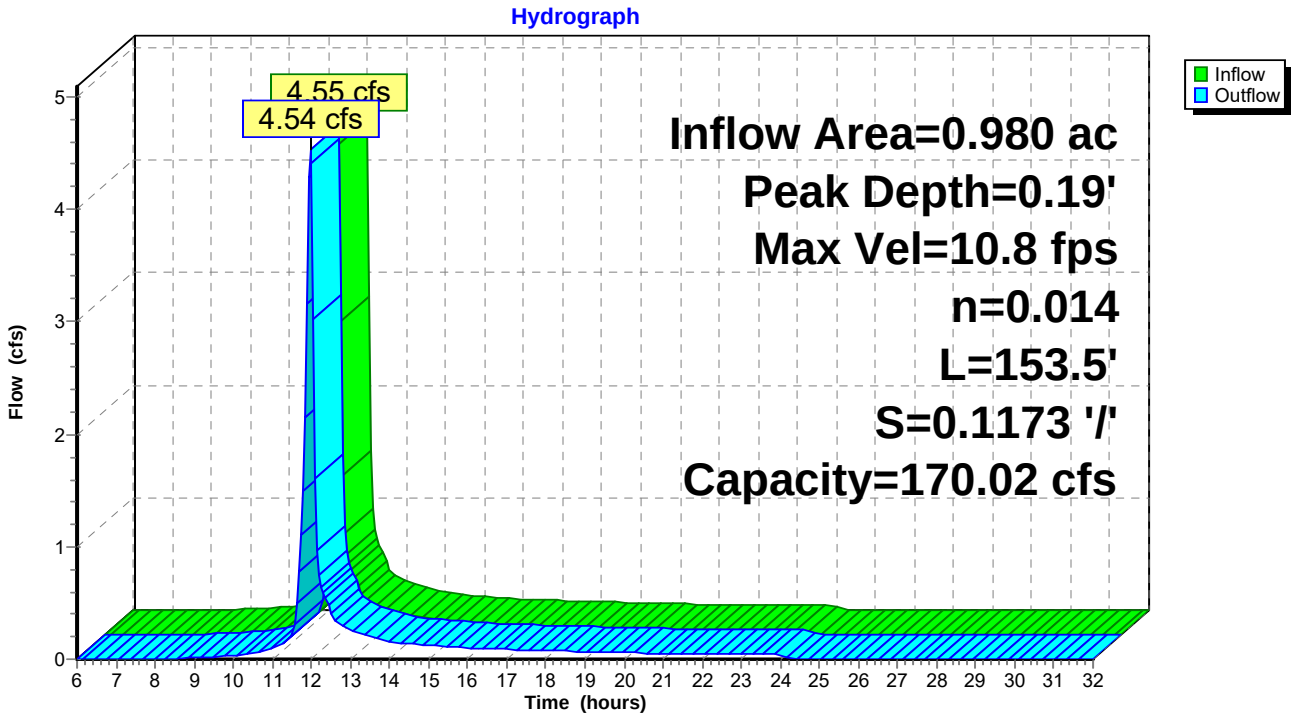
Reach 07-04: ACCESS ROAD CHANNEL

Inflow Area = 0.980 ac, Inflow Depth = 2.70" for 10 event
Inflow = 4.55 cfs @ 11.97 hrs, Volume= 0.221 af
Outflow = 4.54 cfs @ 11.98 hrs, Volume= 0.221 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.8 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.8 fps, Avg. Travel Time= 0.9 min

Peak Depth= 0.19' @ 11.98 hrs
Capacity at bank full= 170.02 cfs
Inlet Invert= 192.80', Outlet Invert= 174.80'
2.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 5.00'
Length= 153.5' Slope= 0.1173 '/'

Reach 07-04: ACCESS ROAD CHANNEL



Reach 08-08`: ACCESS ROAD CHANNEL

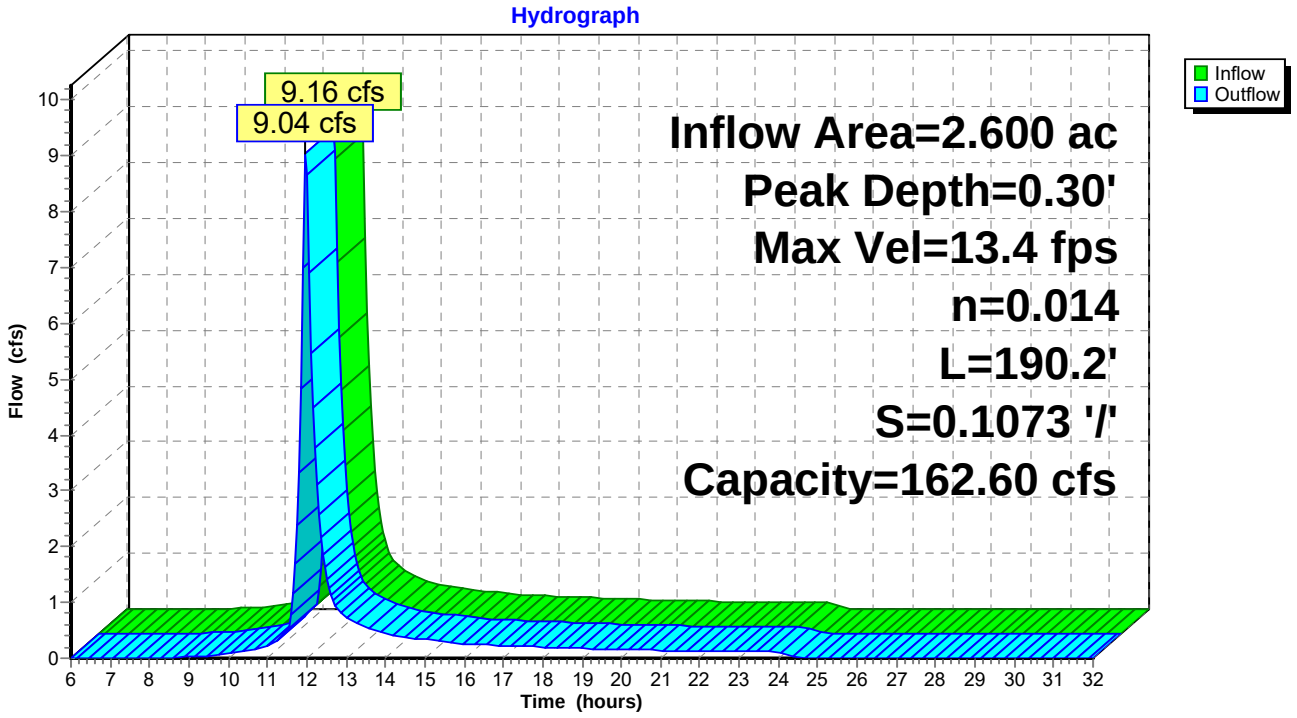
[61] Hint: Submerged 2% of Reach 04-08 bottom

Inflow Area = 2.600 ac, Inflow Depth = 2.70" for 10 event
Inflow = 9.16 cfs @ 11.96 hrs, Volume= 0.585 af
Outflow = 9.04 cfs @ 11.97 hrs, Volume= 0.585 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 13.4 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.7 fps, Avg. Travel Time= 0.9 min

Peak Depth= 0.30' @ 11.97 hrs
Capacity at bank full= 162.60 cfs
Inlet Invert= 155.80', Outlet Invert= 135.40'
2.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 5.00'
Length= 190.2' Slope= 0.1073 '/'

Reach 08-08`: ACCESS ROAD CHANNEL



Reach 09-10: PIPE DOWNCHUTE

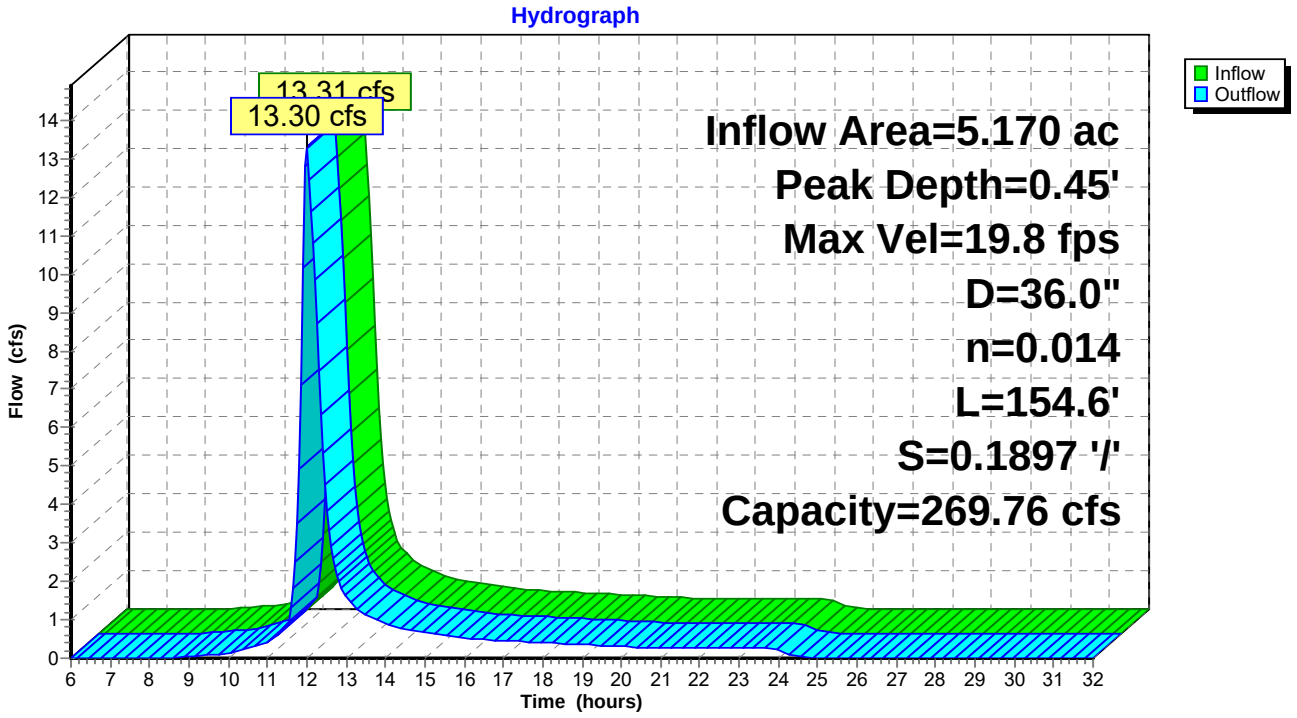
[52] Hint: Inlet conditions not evaluated
[61] Hint: Submerged 2% of Reach 03-09 bottom

Inflow Area = 5.170 ac, Inflow Depth = 2.70" for 10 event
Inflow = 13.31 cfs @ 11.99 hrs, Volume= 1.164 af
Outflow = 13.30 cfs @ 11.99 hrs, Volume= 1.164 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 19.8 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 6.9 fps, Avg. Travel Time= 0.4 min

Peak Depth= 0.45' @ 11.99 hrs
Capacity at bank full= 269.76 cfs
Inlet Invert= 130.00', Outlet Invert= 100.67'
36.0" Diameter Pipe, n= 0.014
Length= 154.6' Slope= 0.1897 '/'

Reach 09-10: PIPE DOWNCHUTE



Reach 10-11: PERIMETER CHANNEL

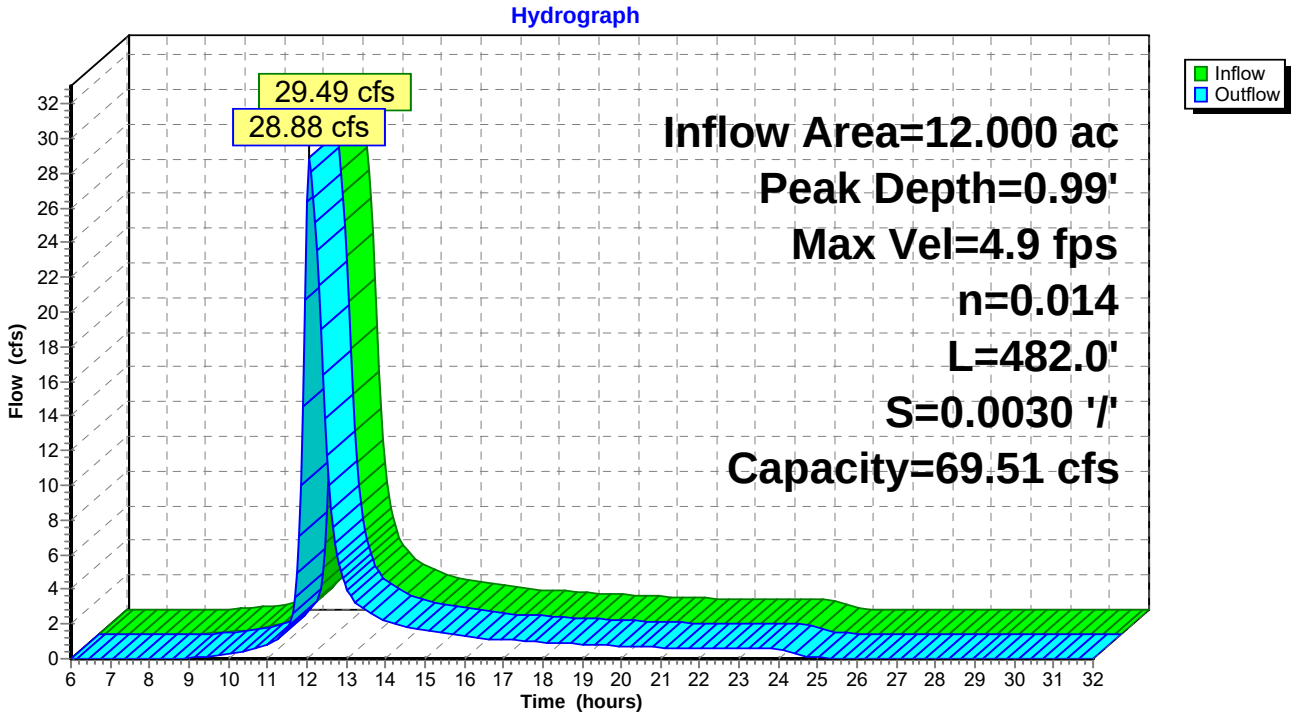
[61] Hint: Submerged 96% of Reach 06-10 bottom
[61] Hint: Submerged 3% of Reach 09-10 bottom

Inflow Area = 12.000 ac, Inflow Depth = 2.70" for 10 event
Inflow = 29.49 cfs @ 12.01 hrs, Volume= 2.701 af
Outflow = 28.88 cfs @ 12.06 hrs, Volume= 2.701 af, Atten= 2%, Lag= 3.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.9 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.3 fps, Avg. Travel Time= 6.4 min

Peak Depth= 0.99' @ 12.03 hrs
Capacity at bank full= 69.51 cfs
Inlet Invert= 100.67', Outlet Invert= 99.22'
5.00' x 1.65' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 8.30'
Length= 482.0' Slope= 0.0030 '/'

Reach 10-11: PERIMETER CHANNEL



Reach 11-19: PERIMETER CHANNEL

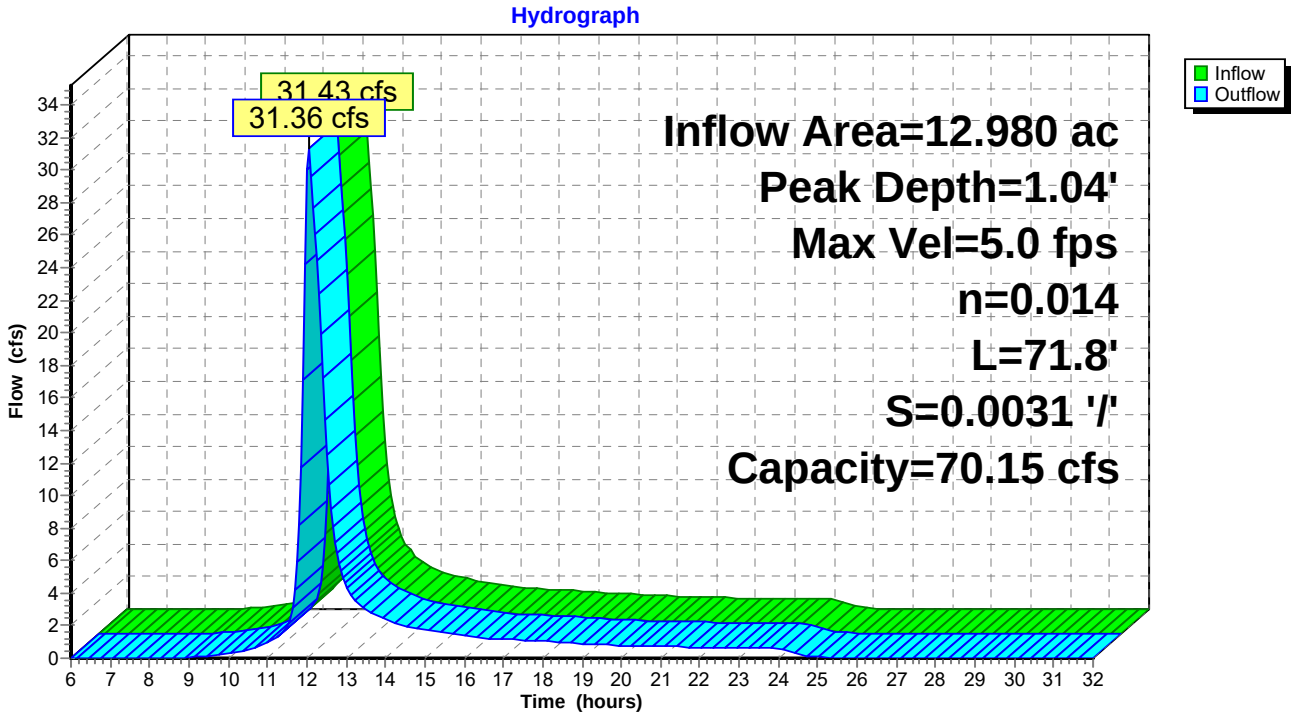
[61] Hint: Submerged 72% of Reach 10-11 bottom

Inflow Area = 12.980 ac, Inflow Depth = 2.70" for 10 event
Inflow = 31.43 cfs @ 12.04 hrs, Volume= 2.922 af
Outflow = 31.36 cfs @ 12.05 hrs, Volume= 2.922 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.0 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.3 fps, Avg. Travel Time= 0.9 min

Peak Depth= 1.04' @ 12.04 hrs
Capacity at bank full= 70.15 cfs
Inlet Invert= 99.22', Outlet Invert= 99.00'
5.00' x 1.65' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 8.30'
Length= 71.8' Slope= 0.0031 '/'

Reach 11-19: PERIMETER CHANNEL



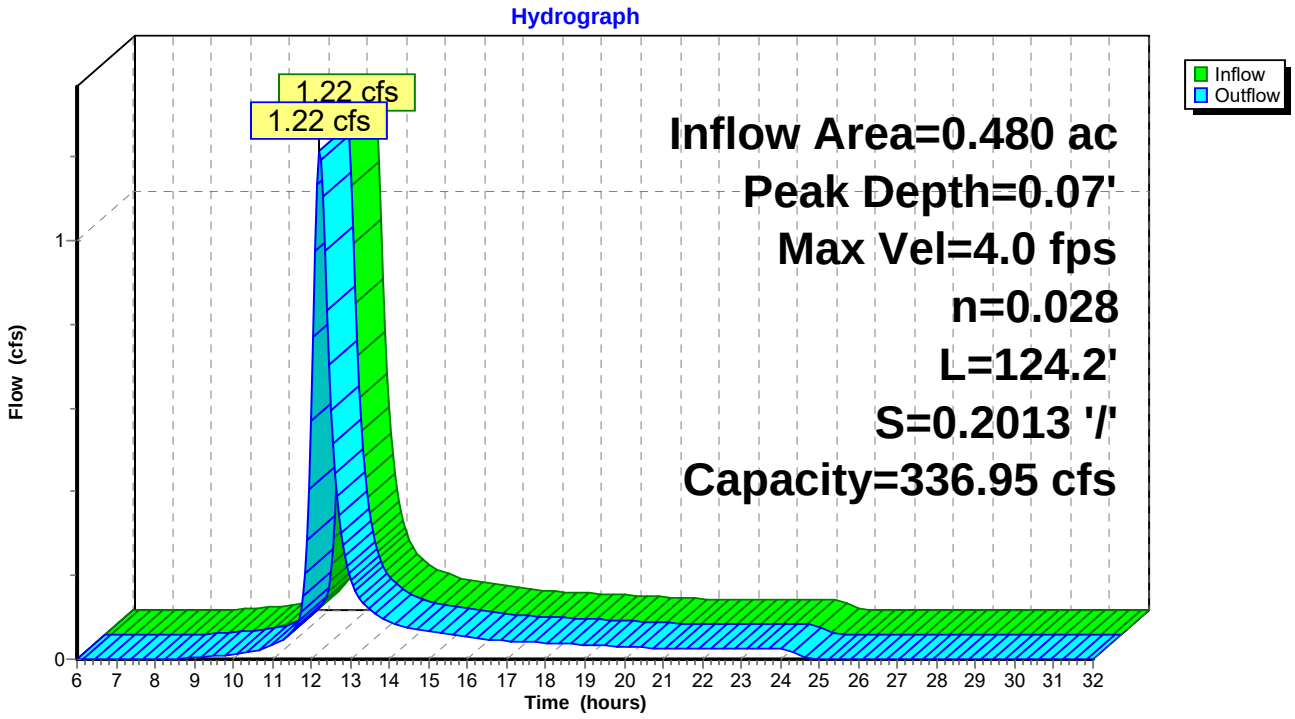
Reach 12-13: DOWNCHUTE

Inflow Area = 0.480 ac, Inflow Depth = 2.70" for 10 event
Inflow = 1.22 cfs @ 12.20 hrs, Volume= 0.108 af
Outflow = 1.22 cfs @ 12.22 hrs, Volume= 0.108 af, Atten= 1%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.0 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.6 fps, Avg. Travel Time= 1.3 min

Peak Depth= 0.07' @ 12.21 hrs
Capacity at bank full= 336.95 cfs
Inlet Invert= 235.00', Outlet Invert= 210.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 124.2' Slope= 0.2013 '/'

Reach 12-13: DOWNCHUTE



Reach 13-14: DOWNCHUTE

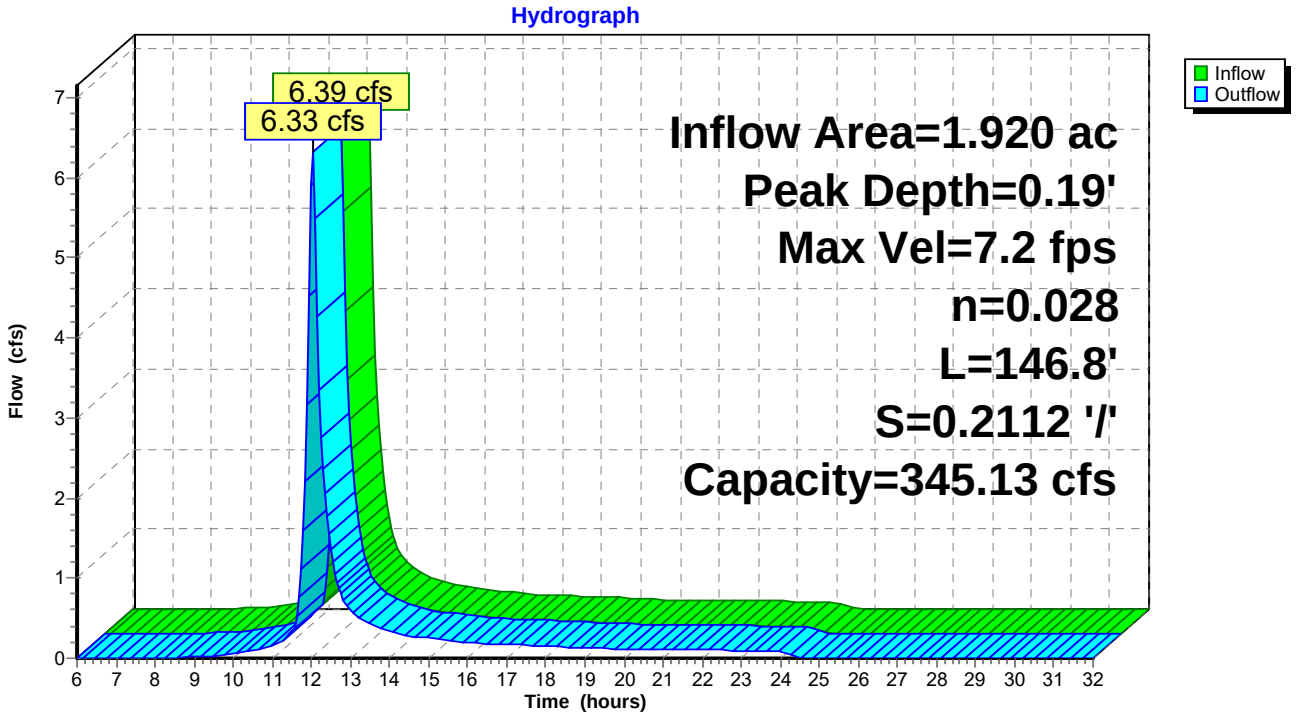
[61] Hint: Submerged 1% of Reach 12-13 bottom

Inflow Area = 1.920 ac, Inflow Depth = 2.70" for 10 event
Inflow = 6.39 cfs @ 12.03 hrs, Volume= 0.432 af
Outflow = 6.33 cfs @ 12.04 hrs, Volume= 0.432 af, Atten= 1%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.2 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.0 fps, Avg. Travel Time= 1.2 min

Peak Depth= 0.19' @ 12.04 hrs
Capacity at bank full= 345.13 cfs
Inlet Invert= 210.00', Outlet Invert= 179.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 146.8' Slope= 0.2112 '/'

Reach 13-14: DOWNCHUTE



Reach 14-15: DOWNCHUTE

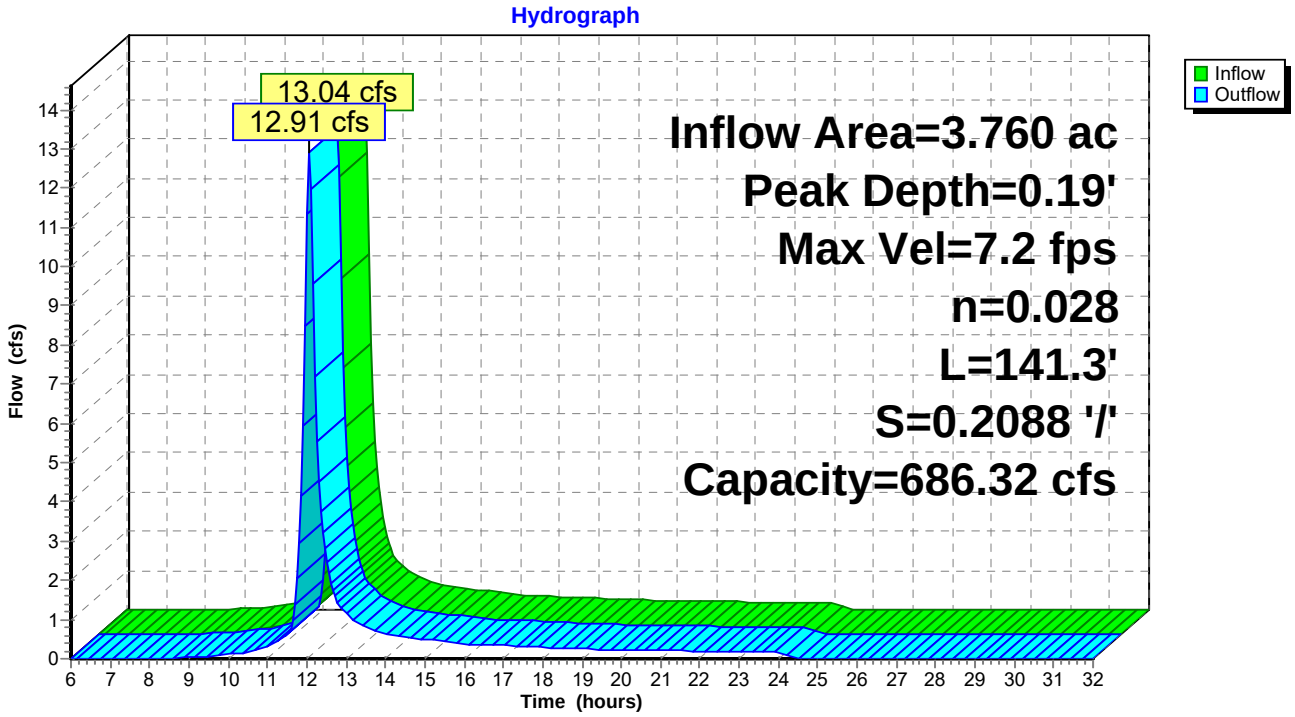
[61] Hint: Submerged 1% of Reach 13-14 bottom

Inflow Area = 3.760 ac, Inflow Depth = 2.70" for 10 event
Inflow = 13.04 cfs @ 12.05 hrs, Volume= 0.846 af
Outflow = 12.91 cfs @ 12.06 hrs, Volume= 0.846 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.2 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.0 fps, Avg. Travel Time= 1.2 min

Peak Depth= 0.19' @ 12.05 hrs
Capacity at bank full= 686.32 cfs
Inlet Invert= 179.00', Outlet Invert= 149.50'
A factor of 2.00 has been applied to the supplied storage and discharge data
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 141.3' Slope= 0.2088 '/'

Reach 14-15: DOWNCHUTE



Reach 15-17: DOWNCHUTE

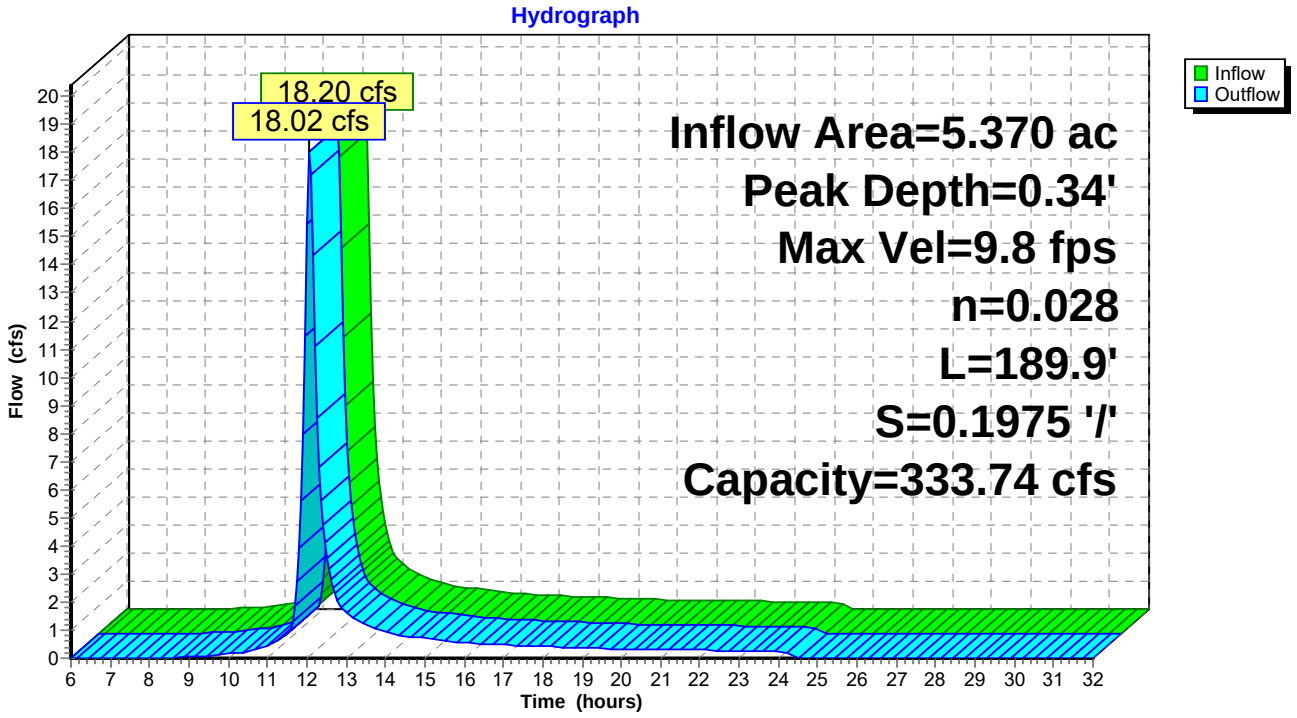
[61] Hint: Submerged 1% of Reach 14-15 bottom

Inflow Area = 5.370 ac, Inflow Depth = 2.70" for 10 event
Inflow = 18.20 cfs @ 12.06 hrs, Volume= 1.209 af
Outflow = 18.02 cfs @ 12.06 hrs, Volume= 1.209 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.8 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.8 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.34' @ 12.06 hrs
Capacity at bank full= 333.74 cfs
Inlet Invert= 149.50', Outlet Invert= 112.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 189.9' Slope= 0.1975 '/'

Reach 15-17: DOWNCHUTE



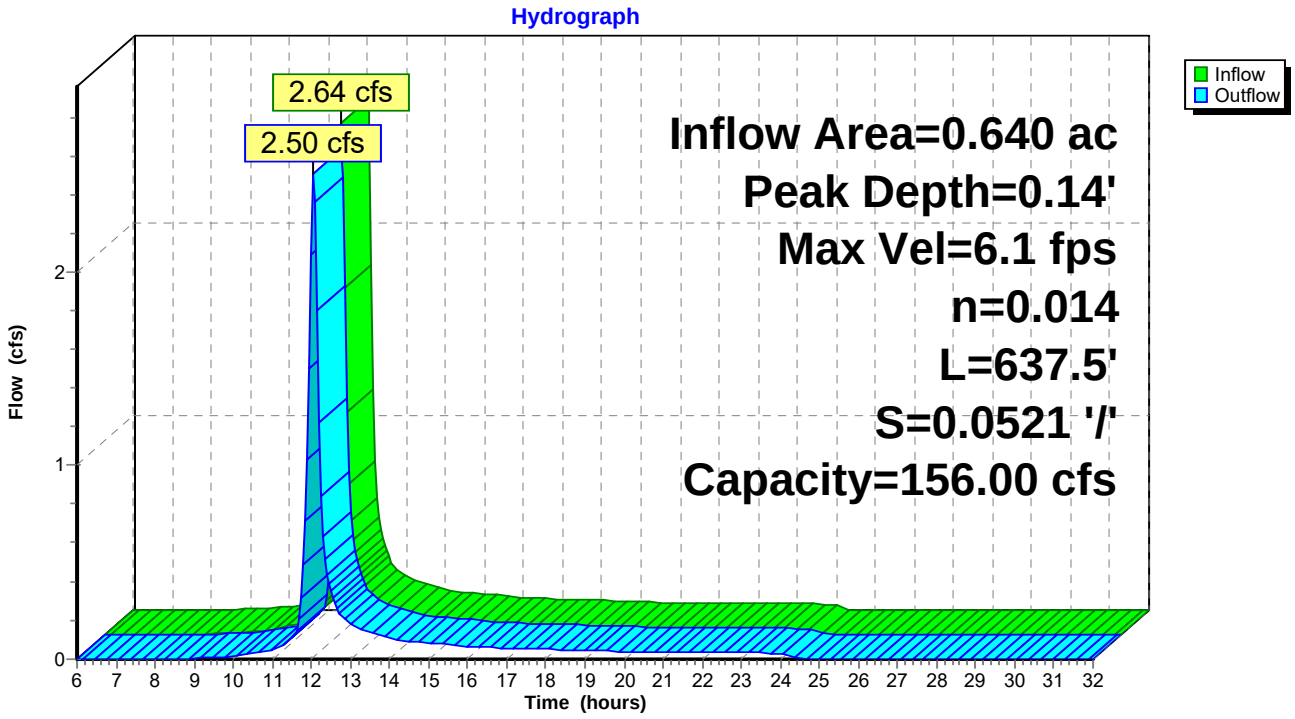
Reach 16-18: PERIMETER CHANNEL

Inflow Area = 0.640 ac, Inflow Depth = 2.70" for 10 event
Inflow = 2.64 cfs @ 12.01 hrs, Volume= 0.144 af
Outflow = 2.50 cfs @ 12.06 hrs, Volume= 0.144 af, Atten= 5%, Lag= 2.9 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.1 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 1.7 fps, Avg. Travel Time= 6.3 min

Peak Depth= 0.14' @ 12.04 hrs
Capacity at bank full= 156.00 cfs
Inlet Invert= 135.70', Outlet Invert= 102.50'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 637.5' Slope= 0.0521 '/'

Reach 16-18: PERIMETER CHANNEL



Reach 17-18: PIPE DOWNCHUTE

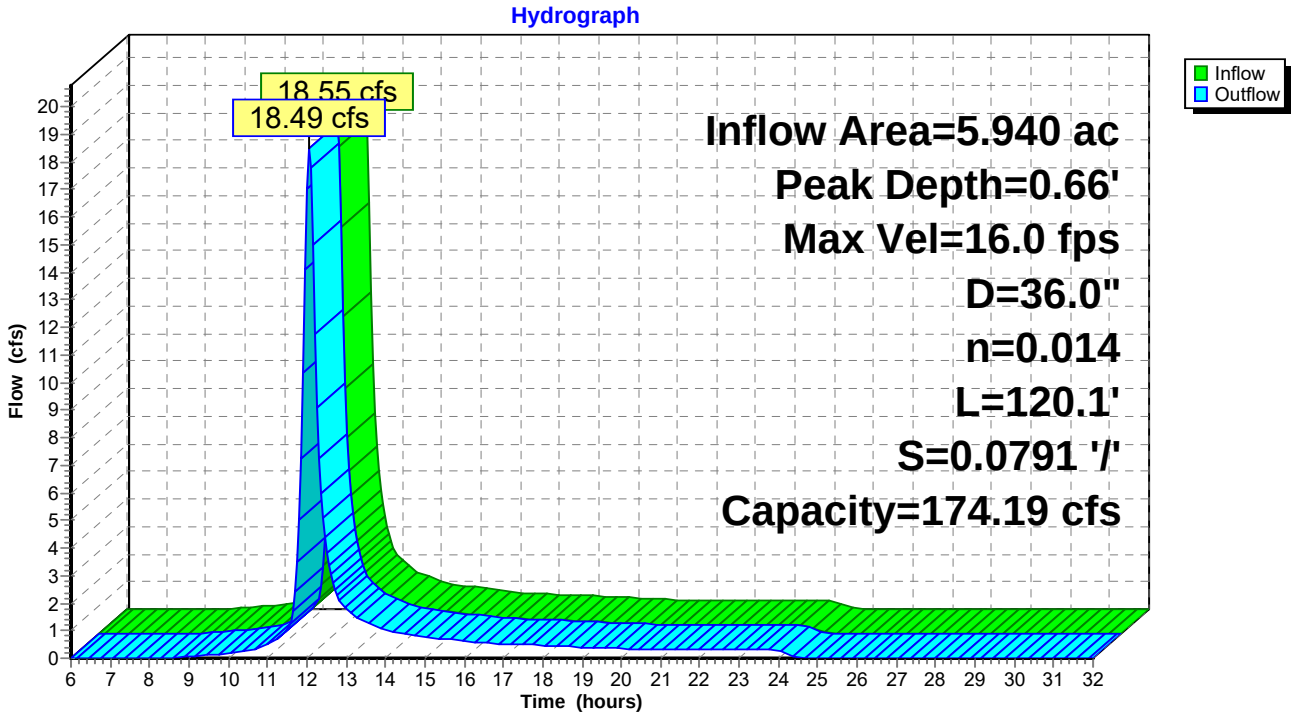
[52] Hint: Inlet conditions not evaluated
[61] Hint: Submerged 2% of Reach 15-17 bottom

Inflow Area = 5.940 ac, Inflow Depth = 2.70" for 10 event
Inflow = 18.55 cfs @ 12.06 hrs, Volume= 1.337 af
Outflow = 18.49 cfs @ 12.06 hrs, Volume= 1.337 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 16.0 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 5.4 fps, Avg. Travel Time= 0.4 min

Peak Depth= 0.66' @ 12.06 hrs
Capacity at bank full= 174.19 cfs
Inlet Invert= 112.00', Outlet Invert= 102.50'
36.0" Diameter Pipe, n= 0.014
Length= 120.1' Slope= 0.0791 '/'

Reach 17-18: PIPE DOWNCHUTE



Reach 18-19: PERIMETER CHANNEL W

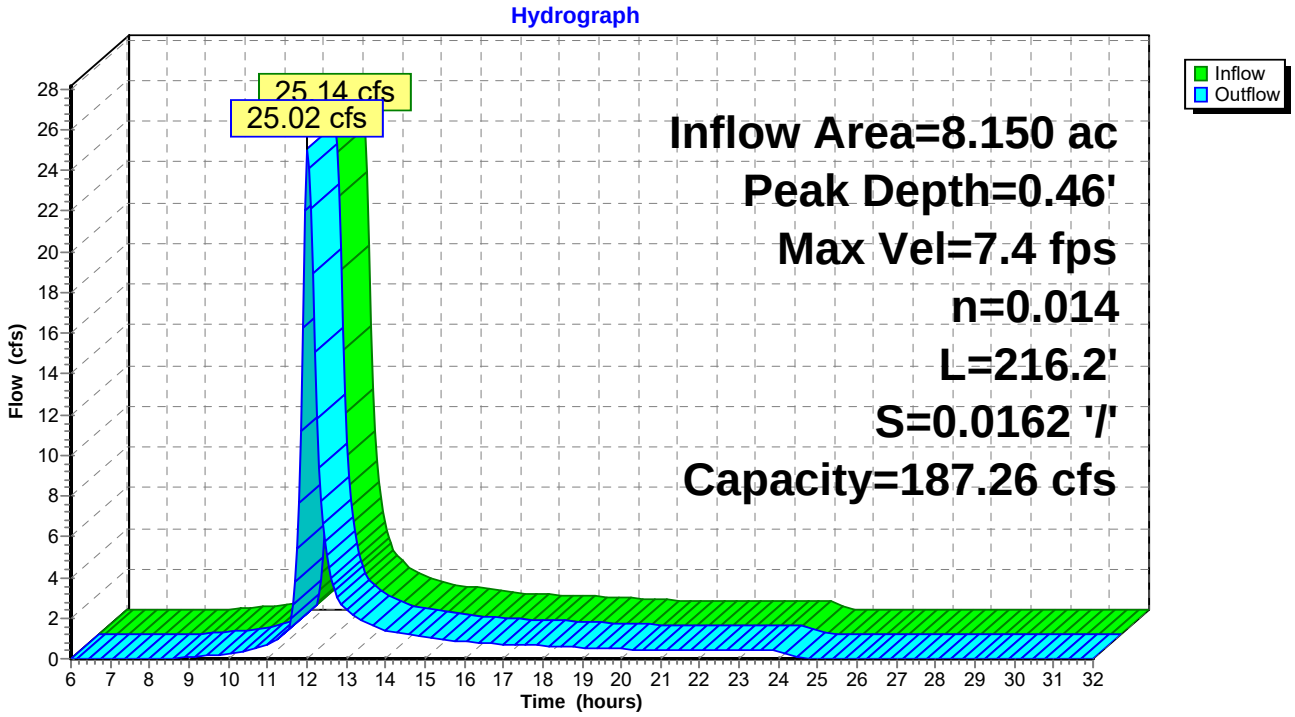
[61] Hint: Submerged 1% of Reach 16-18 bottom
[61] Hint: Submerged 5% of Reach 17-18 bottom

Inflow Area = 8.150 ac, Inflow Depth = 2.70" for 10 event
Inflow = 25.14 cfs @ 12.00 hrs, Volume= 1.835 af
Outflow = 25.02 cfs @ 12.01 hrs, Volume= 1.835 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.4 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 1.9 min

Peak Depth= 0.46' @ 12.01 hrs
Capacity at bank full= 187.26 cfs
Inlet Invert= 102.50', Outlet Invert= 99.00'
7.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 10.00'
Length= 216.2' Slope= 0.0162 '/'

Reach 18-19: PERIMETER CHANNEL W



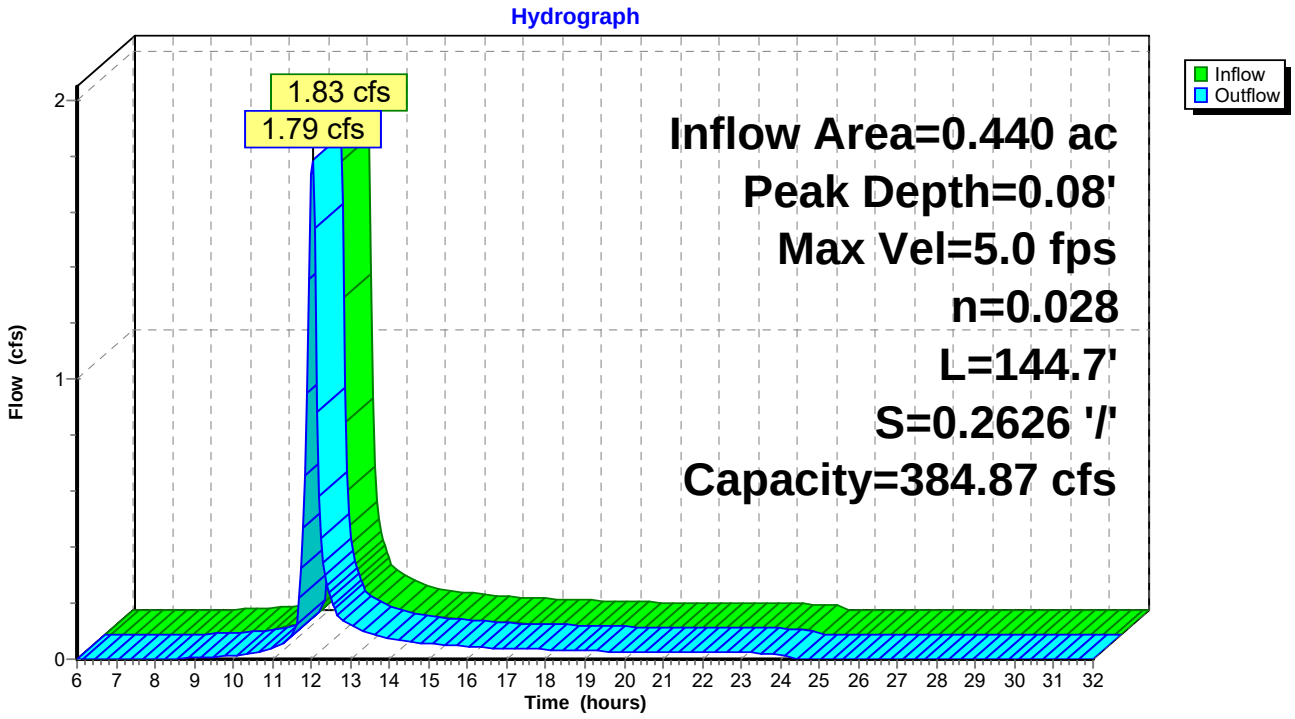
Reach 21-23: DOWNCHUTE

Inflow Area = 0.440 ac, Inflow Depth = 2.70" for 10 event
Inflow = 1.83 cfs @ 12.01 hrs, Volume= 0.099 af
Outflow = 1.79 cfs @ 12.03 hrs, Volume= 0.099 af, Atten= 2%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.0 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.7 fps, Avg. Travel Time= 1.4 min

Peak Depth= 0.08' @ 12.02 hrs
Capacity at bank full= 384.87 cfs
Inlet Invert= 219.00', Outlet Invert= 181.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 144.7' Slope= 0.2626 '/'

Reach 21-23: DOWNCHUTE



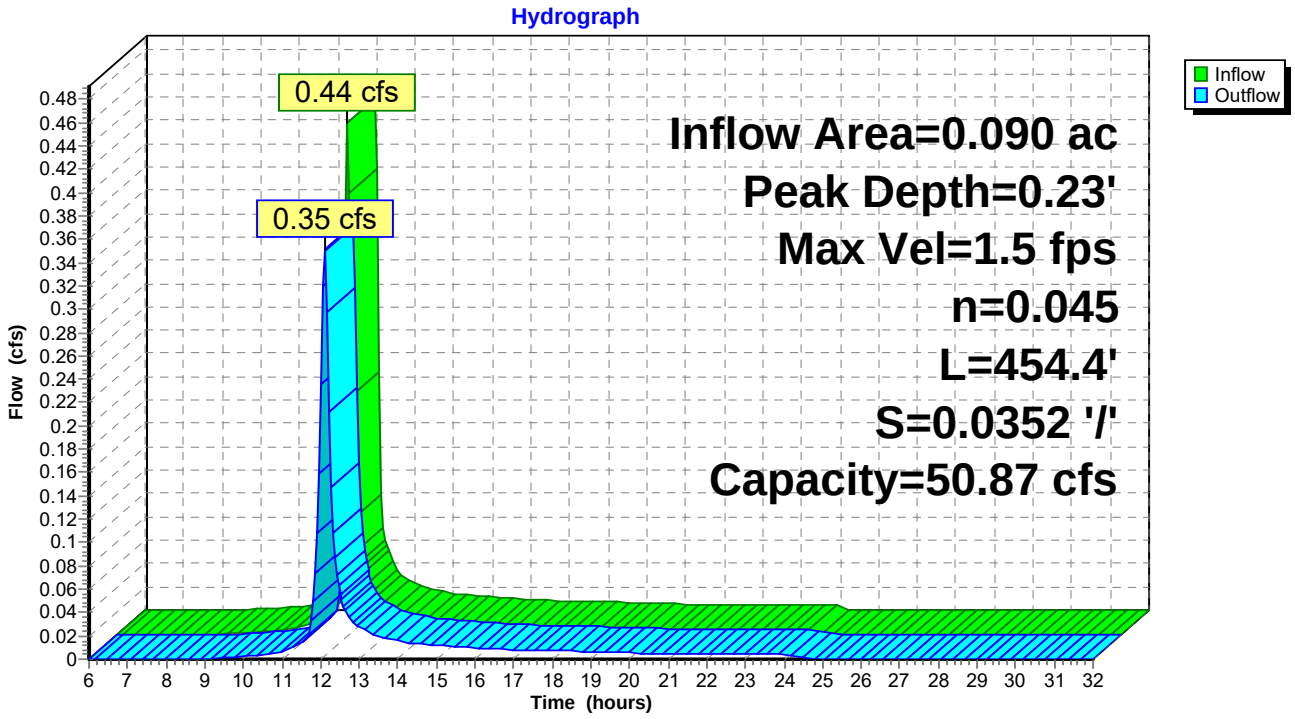
Reach 22-23: BENCH

Inflow Area = 0.090 ac, Inflow Depth = 2.70" for 10 event
Inflow = 0.44 cfs @ 11.96 hrs, Volume= 0.020 af
Outflow = 0.35 cfs @ 12.09 hrs, Volume= 0.020 af, Atten= 20%, Lag= 8.2 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.5 fps, Min. Travel Time= 5.2 min
Avg. Velocity = 0.5 fps, Avg. Travel Time= 14.1 min

Peak Depth= 0.23' @ 12.01 hrs
Capacity at bank full= 50.87 cfs
Inlet Invert= 197.00', Outlet Invert= 181.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 454.4' Slope= 0.0352 '/'

Reach 22-23: BENCH



Reach 23-25: DOWNCHUTE

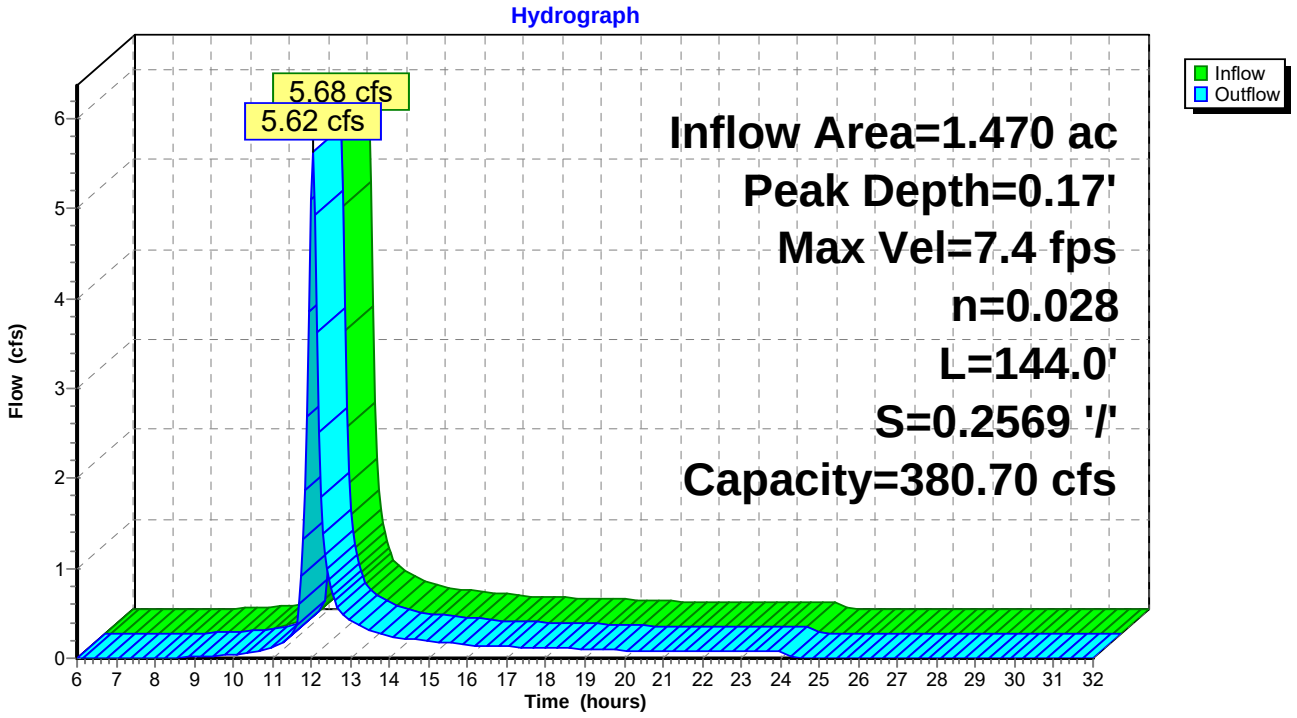
[61] Hint: Submerged 1% of Reach 22-23 bottom

Inflow Area = 1.470 ac, Inflow Depth = 2.70" for 10 event
Inflow = 5.68 cfs @ 12.04 hrs, Volume= 0.331 af
Outflow = 5.62 cfs @ 12.05 hrs, Volume= 0.331 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.4 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.0 fps, Avg. Travel Time= 1.2 min

Peak Depth= 0.17' @ 12.04 hrs
Capacity at bank full= 380.70 cfs
Inlet Invert= 181.00', Outlet Invert= 144.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 144.0' Slope= 0.2569 '/'

Reach 23-25: DOWNCHUTE



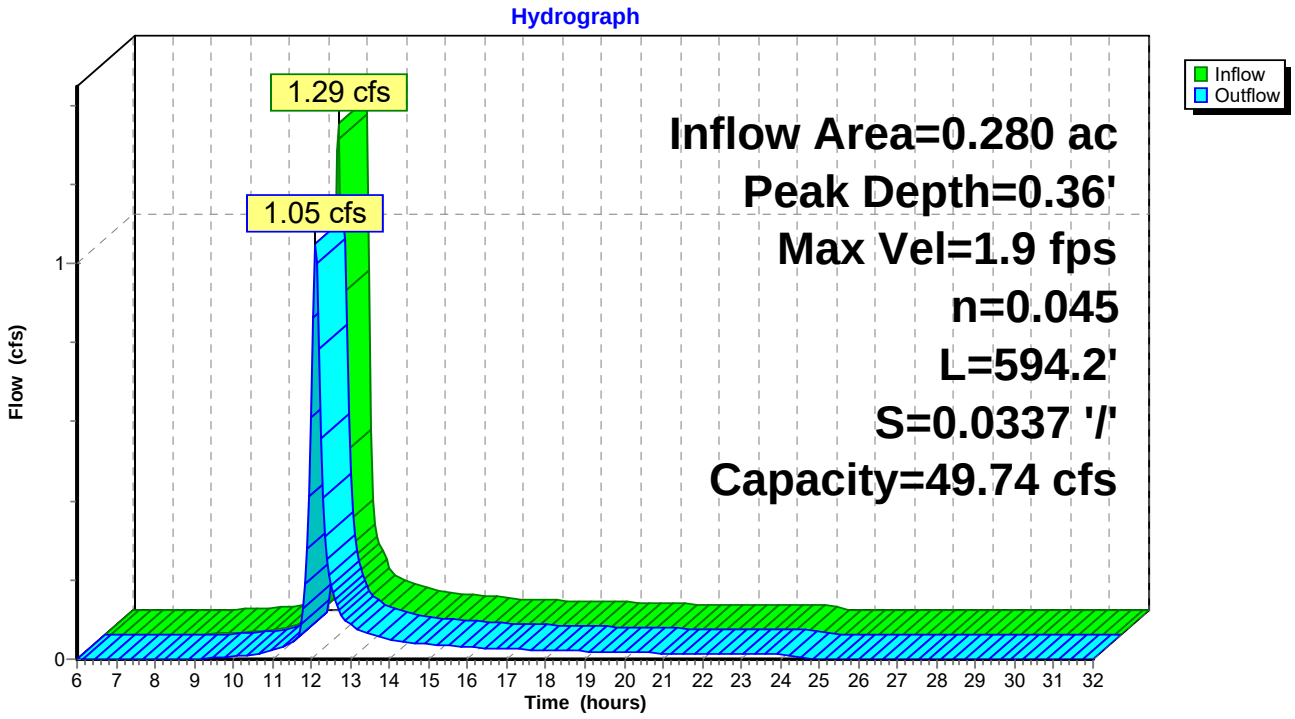
Reach 24-25: BENCH

Inflow Area = 0.280 ac, Inflow Depth = 2.70" for 10 event
Inflow = 1.29 cfs @ 11.98 hrs, Volume= 0.063 af
Outflow = 1.05 cfs @ 12.12 hrs, Volume= 0.063 af, Atten= 19%, Lag= 8.2 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.9 fps, Min. Travel Time= 5.3 min
Avg. Velocity = 0.7 fps, Avg. Travel Time= 14.9 min

Peak Depth= 0.36' @ 12.03 hrs
Capacity at bank full= 49.74 cfs
Inlet Invert= 164.00', Outlet Invert= 144.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 594.2' Slope= 0.0337 '/'

Reach 24-25: BENCH



Reach 25-27: DOWNCHUTE

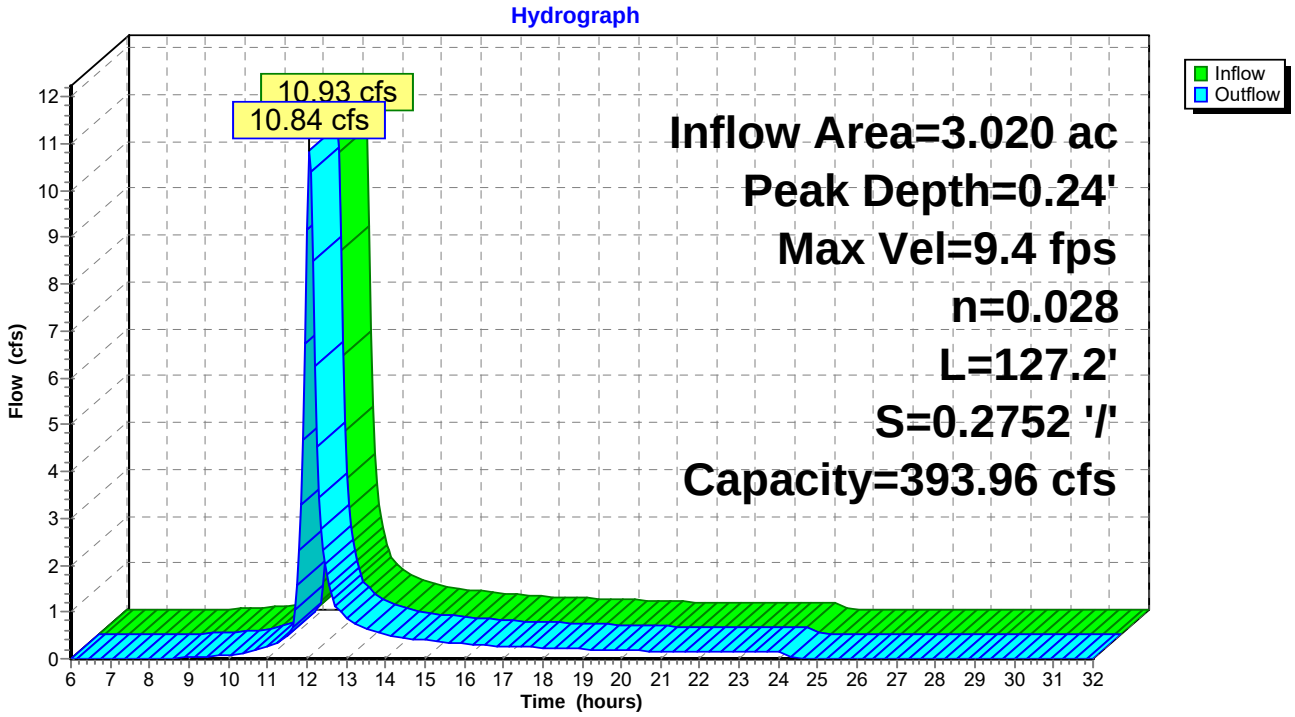
[61] Hint: Submerged 1% of Reach 23-25 bottom
[61] Hint: Submerged 1% of Reach 24-25 bottom

Inflow Area = 3.020 ac, Inflow Depth = 2.70" for 10 event
Inflow = 10.93 cfs @ 12.06 hrs, Volume= 0.680 af
Outflow = 10.84 cfs @ 12.07 hrs, Volume= 0.680 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.4 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.5 fps, Avg. Travel Time= 0.8 min

Peak Depth= 0.24' @ 12.06 hrs
Capacity at bank full= 393.96 cfs
Inlet Invert= 144.00', Outlet Invert= 109.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 127.2' Slope= 0.2752 '/'

Reach 25-27: DOWNCHUTE



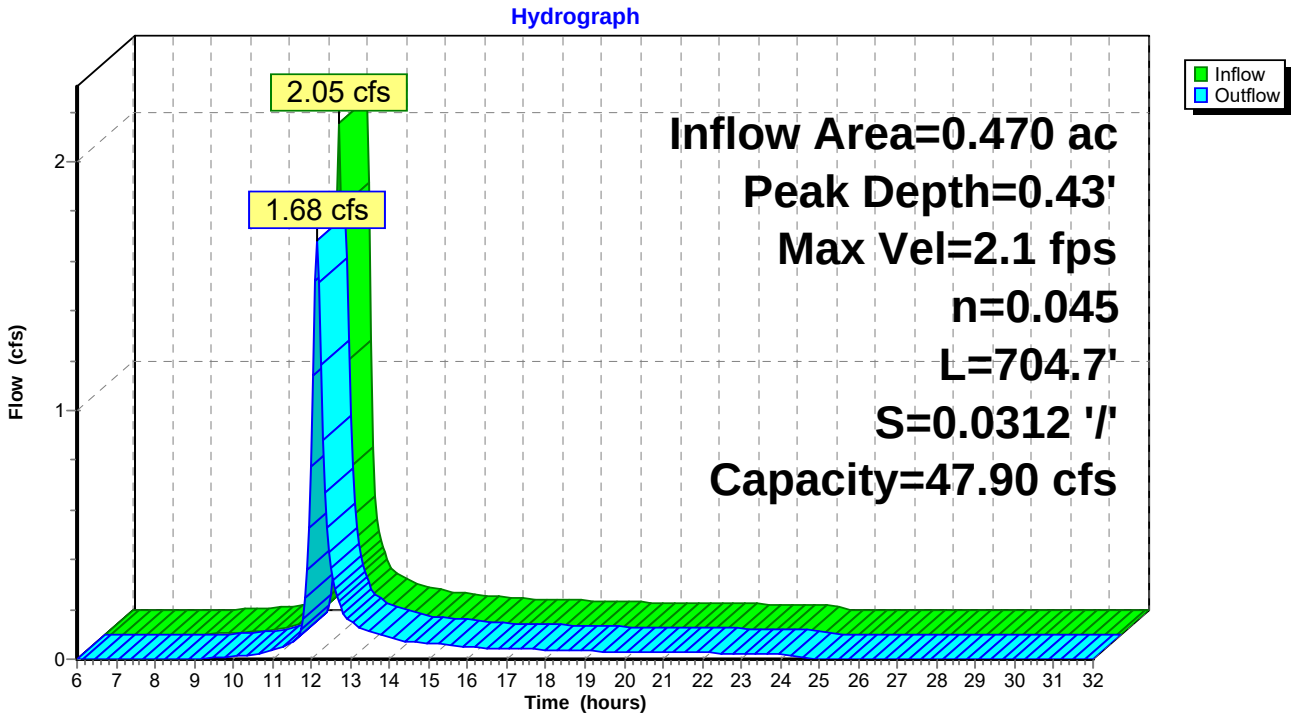
Reach 26-27: BENCH

Inflow Area = 0.470 ac, Inflow Depth = 2.70" for 10 event
Inflow = 2.05 cfs @ 12.00 hrs, Volume= 0.106 af
Outflow = 1.68 cfs @ 12.15 hrs, Volume= 0.106 af, Atten= 18%, Lag= 9.1 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.1 fps, Min. Travel Time= 5.7 min
Avg. Velocity = 0.7 fps, Avg. Travel Time= 16.5 min

Peak Depth= 0.43' @ 12.05 hrs
Capacity at bank full= 47.90 cfs
Inlet Invert= 131.00', Outlet Invert= 109.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 704.7' Slope= 0.0312 '/'

Reach 26-27: BENCH



Reach 27-29: DOWNCHUTE

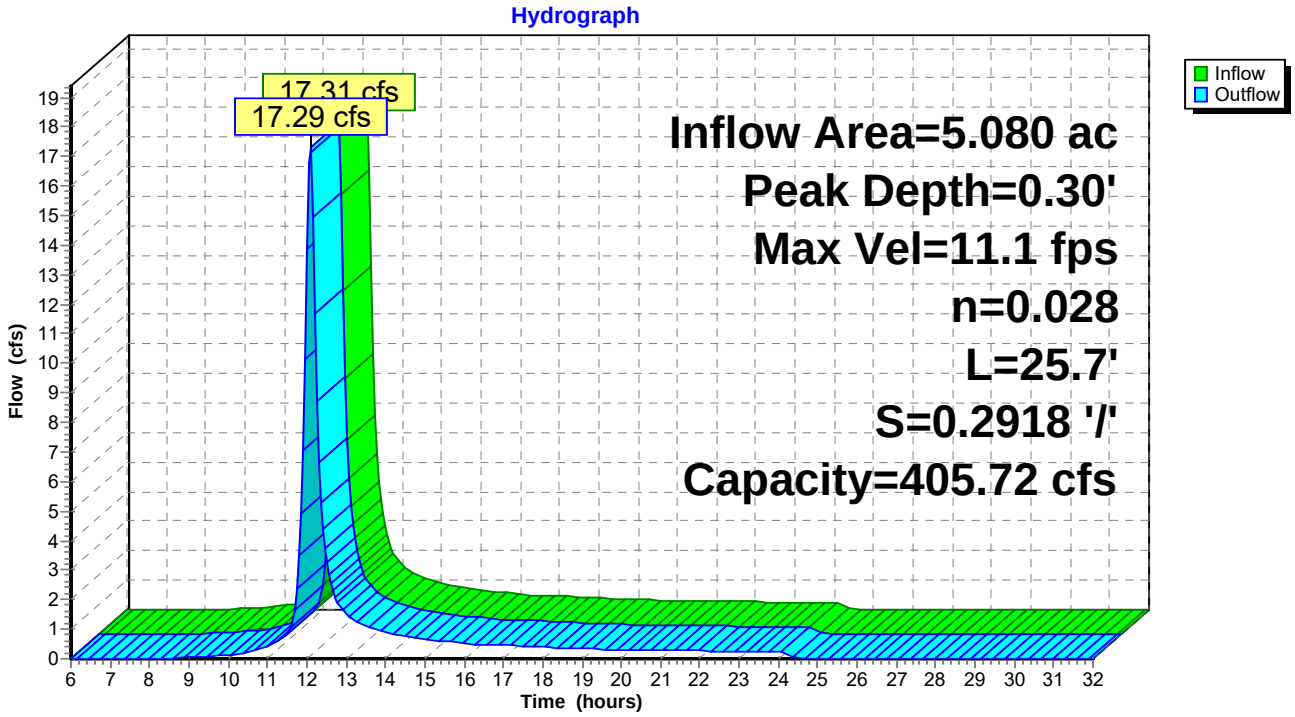
[61] Hint: Submerged 1% of Reach 25-27 bottom
[61] Hint: Submerged 1% of Reach 26-27 bottom

Inflow Area = 5.080 ac, Inflow Depth = 2.70" for 10 event
Inflow = 17.31 cfs @ 12.08 hrs, Volume= 1.144 af
Outflow = 17.29 cfs @ 12.08 hrs, Volume= 1.144 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.1 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.0 fps, Avg. Travel Time= 0.1 min

Peak Depth= 0.30' @ 12.08 hrs
Capacity at bank full= 405.72 cfs
Inlet Invert= 109.00', Outlet Invert= 101.50'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 25.7' Slope= 0.2918 '/'

Reach 27-29: DOWNCHUTE



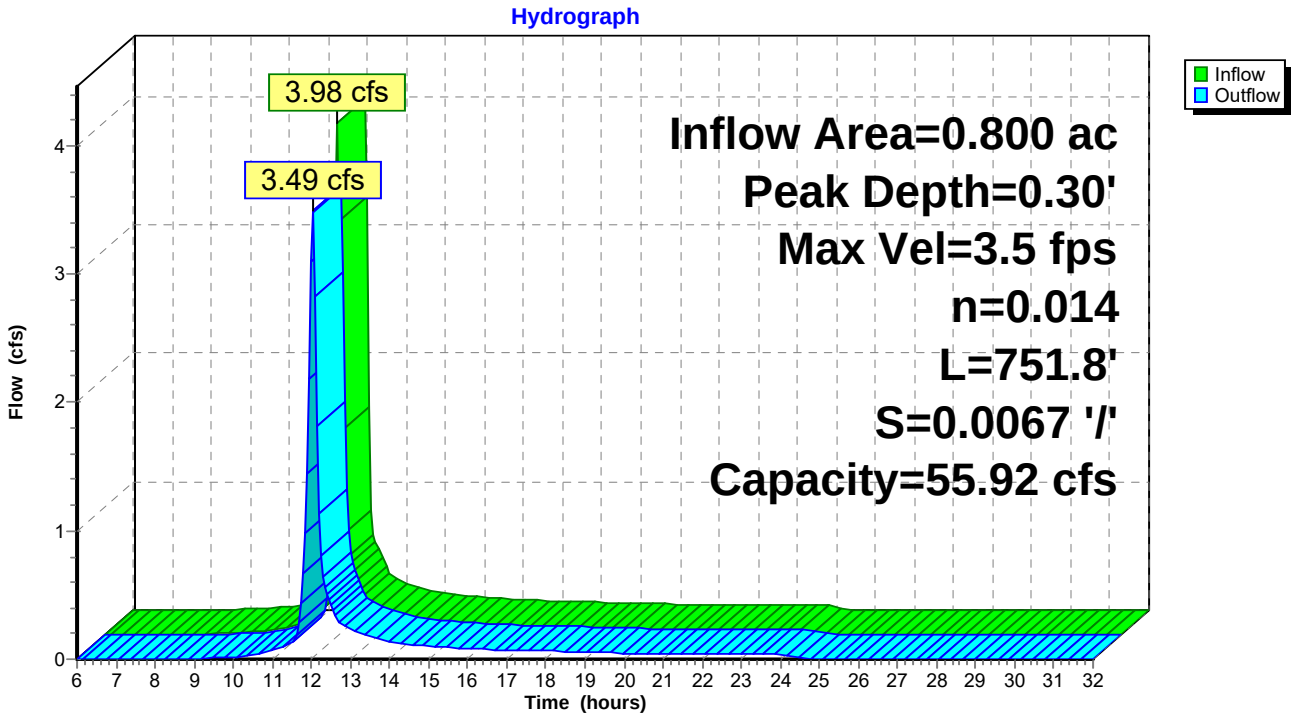
Reach 28-29: PERIMETER CHANNEL

Inflow Area = 0.800 ac, Inflow Depth = 2.70" for 10 event
Inflow = 3.98 cfs @ 11.95 hrs, Volume= 0.180 af
Outflow = 3.49 cfs @ 12.04 hrs, Volume= 0.180 af, Atten= 12%, Lag= 5.6 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.5 fps, Min. Travel Time= 3.6 min
Avg. Velocity = 0.8 fps, Avg. Travel Time= 15.2 min

Peak Depth= 0.30' @ 11.99 hrs
Capacity at bank full= 55.92 cfs
Inlet Invert= 106.53', Outlet Invert= 101.50'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 751.8' Slope= 0.0067 '/'

Reach 28-29: PERIMETER CHANNEL



Pond POND Nº1:

Inflow Area = 23.430 ac, Inflow Depth = 2.70" for 10 event
Inflow = 64.71 cfs @ 12.02 hrs, Volume= 5.274 af
Outflow = 15.25 cfs @ 12.57 hrs, Volume= 4.988 af, Atten= 76%, Lag= 33.1 min
Primary = 15.25 cfs @ 12.57 hrs, Volume= 4.988 af

Routing by Stor-Ind method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 27.03' @ 12.57 hrs Surf.Area= 0.771 ac Storage= 2.171 af
Plug-Flow detention time= 129.3 min calculated for 4.978 af (94% of inflow)
Center-of-Mass det. time= 99.7 min (939.7 - 840.1)

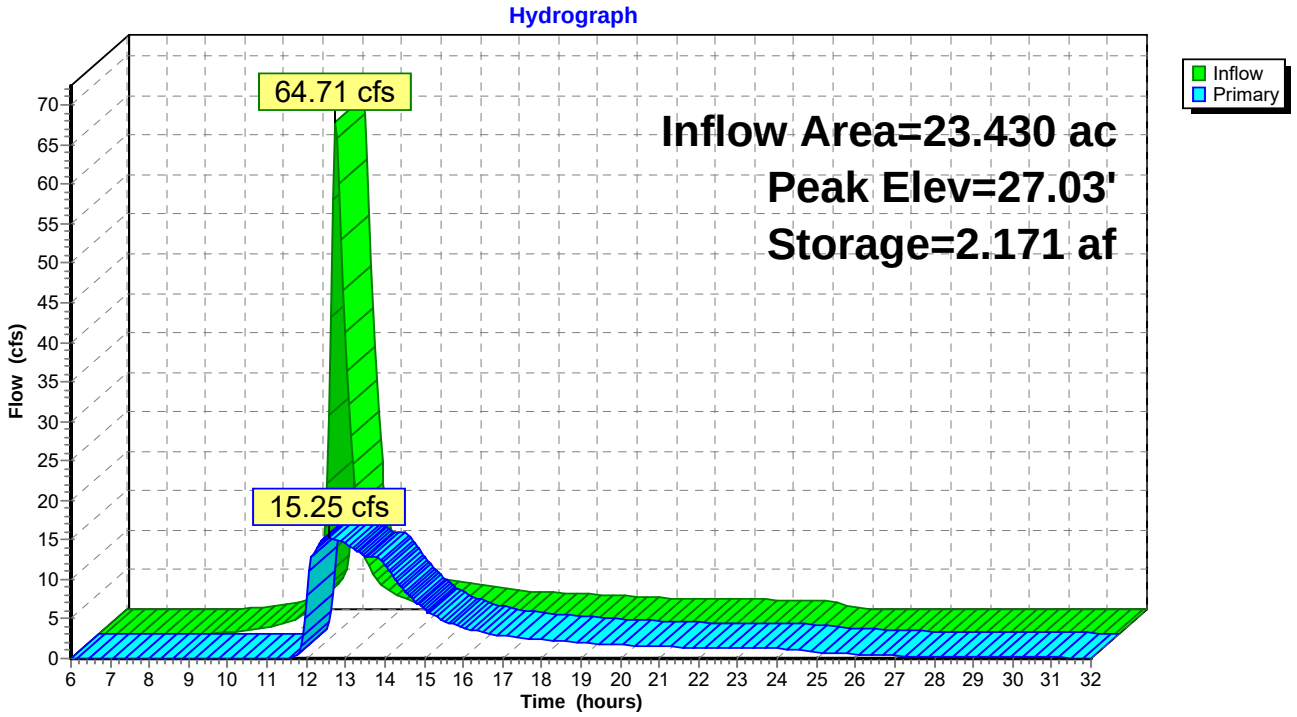
Volume	Invert	Avail.Storage	Storage Description
#1	24.00'	4.638 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
24.00	0.670	728.0	0.000	0.000	0.670
26.00	0.730	755.0	1.400	1.400	0.751
28.00	0.810	781.0	1.539	2.939	0.832
30.00	0.890	807.0	1.699	4.638	0.915

Device	Routing	Invert	Outlet Devices
#1	Primary	24.30'	**18.0" x 97.0' long Culvert X 2.00** Ke= 0.900 Outlet Invert= 23.23' S= 0.0110 '/' Cc= 0.900 n= 0.024
#2	Primary	28.90'	**13.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=15.25 cfs @ 12.57 hrs HW=27.03' (Free Discharge)
└**1=Culvert** (Barrel Controls 15.25 cfs @ 4.3 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond POND Nº1:



Pond POND Nº2:

Inflow Area = 8.390 ac, Inflow Depth = 2.70" for 10 event
Inflow = 26.00 cfs @ 12.00 hrs, Volume= 1.889 af
Outflow = 5.53 cfs @ 12.44 hrs, Volume= 1.299 af, Atten= 79%, Lag= 26.4 min
Primary = 5.53 cfs @ 12.44 hrs, Volume= 1.299 af

Routing by Stor-Ind method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 37.16' @ 12.44 hrs Surf.Area= 0.300 ac Storage= 0.897 af
Plug-Flow detention time= 223.7 min calculated for 1.296 af (69% of inflow)
Center-of-Mass det. time= 119.3 min (953.3 - 834.0)

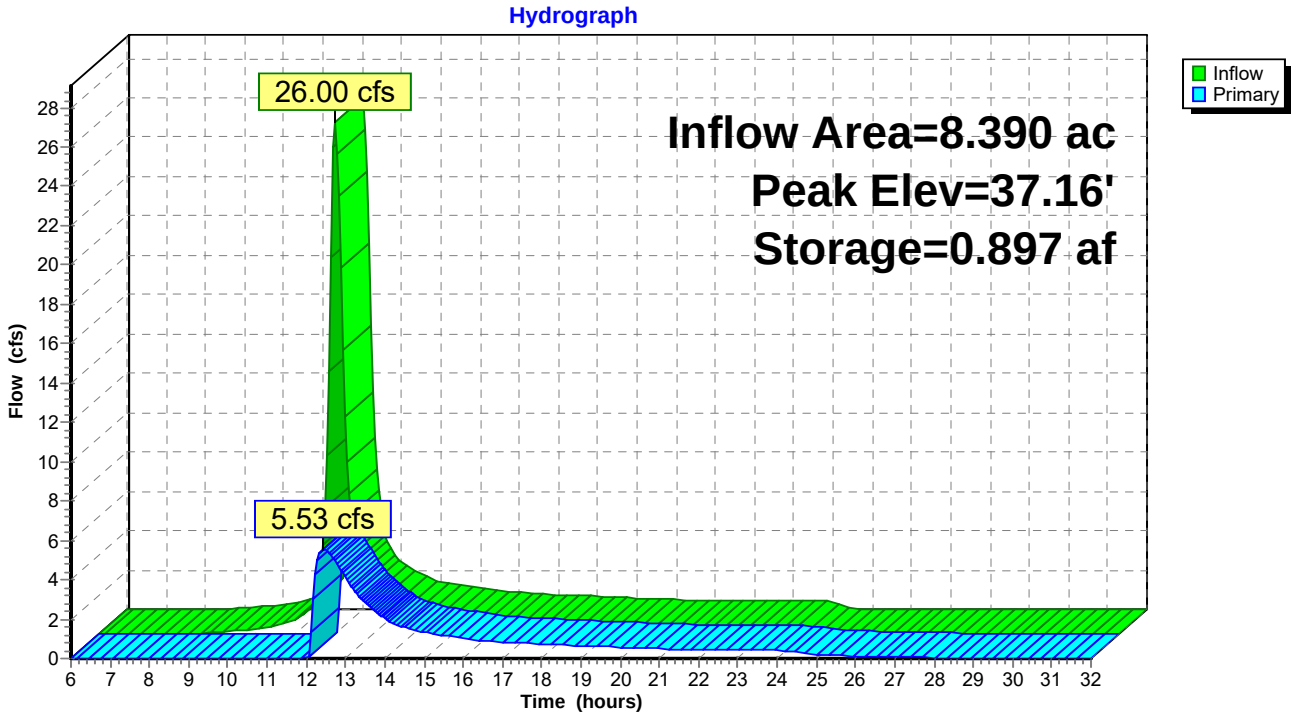
Volume	Invert	Avail.Storage	Storage Description
#1	33.00'	1.925 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
33.00	0.135	833.8	0.000	0.000	0.135
34.00	0.174	851.5	0.154	0.154	0.193
35.00	0.213	870.3	0.193	0.347	0.255
36.00	0.250	890.0	0.231	0.579	0.322
38.00	0.340	924.0	0.588	1.166	0.442
40.00	0.420	958.0	0.759	1.925	0.566

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	**12.0" x 45.0' long Culvert X 2.00** Ke= 0.500 Outlet Invert= 35.10' S= 0.0200 '/' Cc= 0.900 n= 0.024
#2	Primary	39.60'	**12.0' long x 6.0' 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 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=5.53 cfs @ 12.44 hrs HW=37.16' (Free Discharge)
└─**1=Culvert** (Barrel Controls 5.53 cfs @ 3.8 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond POND Nº2:



Pond WL-2:

Inflow Area = 6.490 ac, Inflow Depth = 1.94" for 10 event
Inflow = 10.21 cfs @ 12.27 hrs, Volume= 1.051 af
Outflow = 0.49 cfs @ 17.09 hrs, Volume= 0.259 af, Atten= 95%, Lag= 289.2 min
Primary = 0.49 cfs @ 17.09 hrs, Volume= 0.259 af

Routing by Stor-Ind method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 37.01' @ 17.09 hrs Surf.Area= 1.600 ac Storage= 0.807 af
Plug-Flow detention time= 472.1 min calculated for 0.259 af (25% of inflow)
Center-of-Mass det. time= 325.2 min (1,198.4 - 873.1)

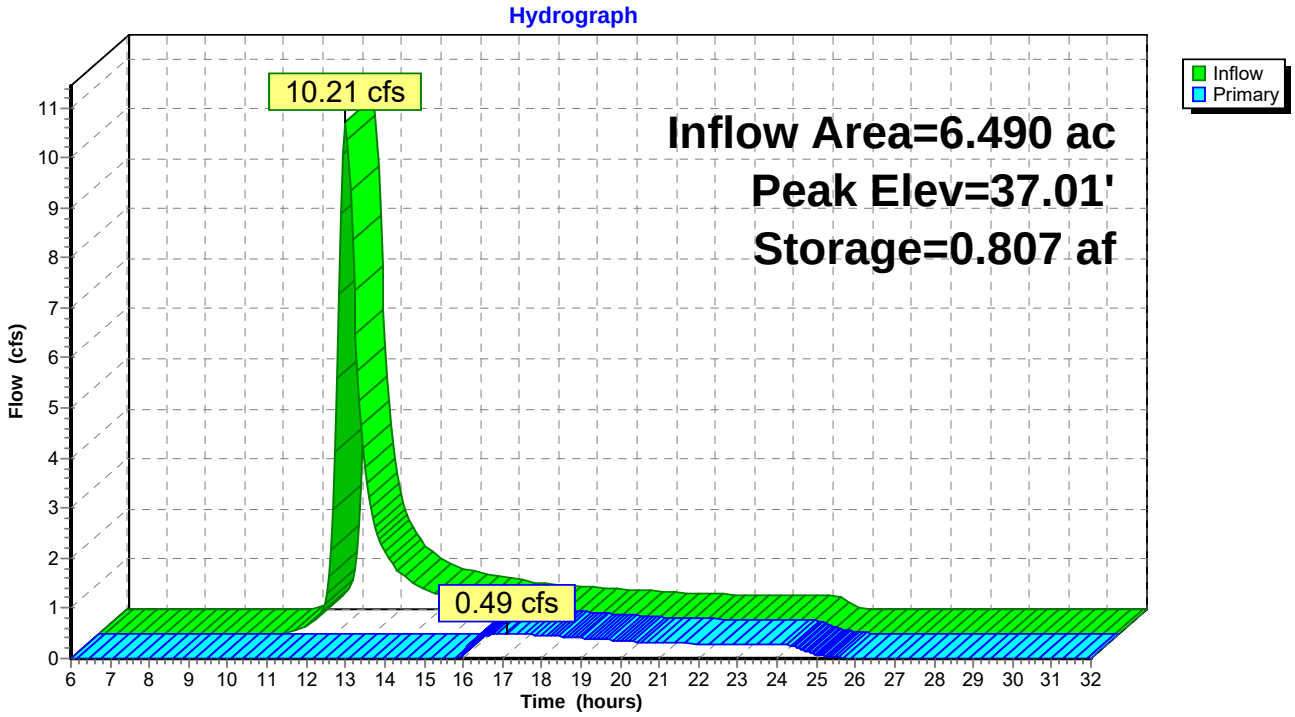
Volume	Invert	Avail.Storage	Storage Description
#1	36.00'	3.170 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
36.00	0.000	0.000	0.000
38.00	3.170	3.170	3.170

Device	Routing	Invert	Outlet Devices
#1	Primary	37.00'	**140.0' long x 30.0' 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=0.33 cfs @ 17.09 hrs HW=37.01' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.33 cfs @ 0.3 fps)

Pond WL-2:

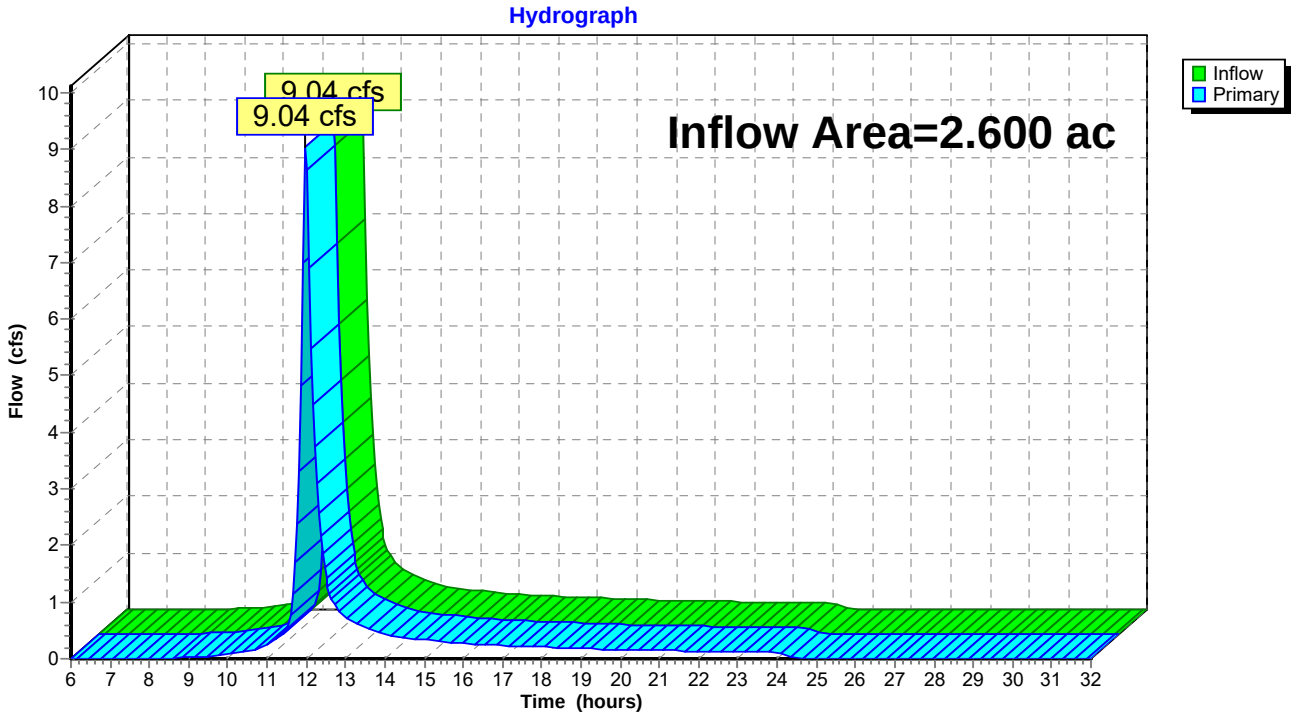

Hydrograph
10.21 cfs
0.49 cfs
Inflow Area=6.490 ac
Peak Elev=37.01'
Storage=0.807 af
Inflow
Primary
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

Link 08`-09:

Inflow Area = 2.600 ac, Inflow Depth = 2.70" for 10 event
Inflow = 9.04 cfs @ 11.97 hrs, Volume= 0.585 af
Primary = 9.04 cfs @ 11.97 hrs, Volume= 0.585 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link 08`-09:

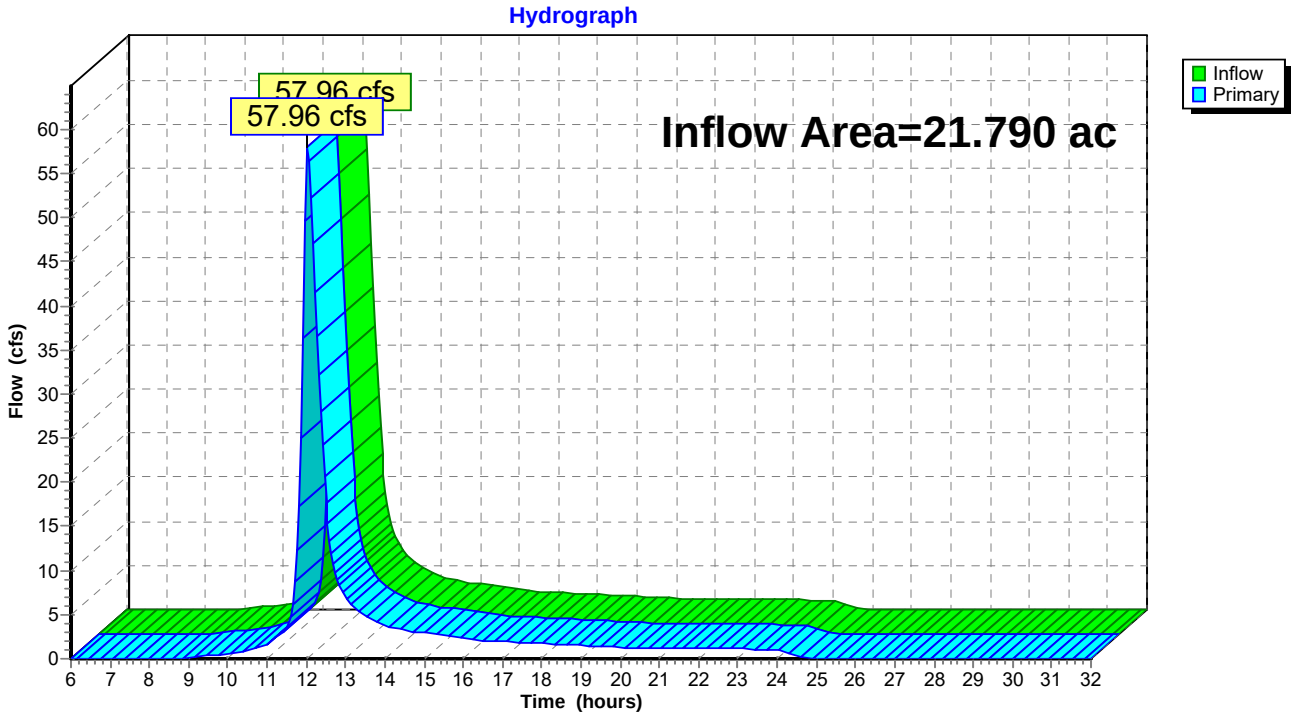


Link 19-20:

Inflow Area = 21.790 ac, Inflow Depth = 2.70" for 10 event
Inflow = 57.96 cfs @ 12.02 hrs, Volume= 4.905 af
Primary = 57.96 cfs @ 12.02 hrs, Volume= 4.905 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link 19-20:

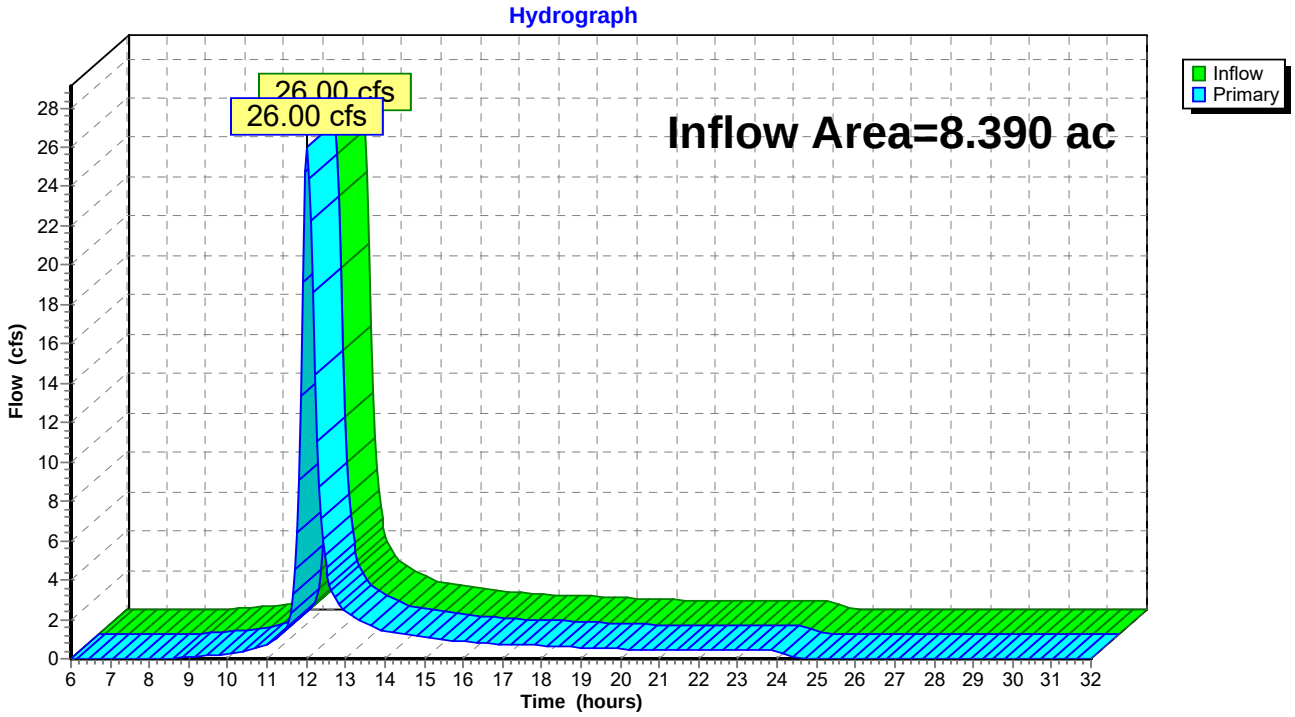


Link 29-30:

Inflow Area = 8.390 ac, Inflow Depth = 2.70" for 10 event
Inflow = 26.00 cfs @ 12.00 hrs, Volume= 1.889 af
Primary = 26.00 cfs @ 12.00 hrs, Volume= 1.889 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link 29-30:

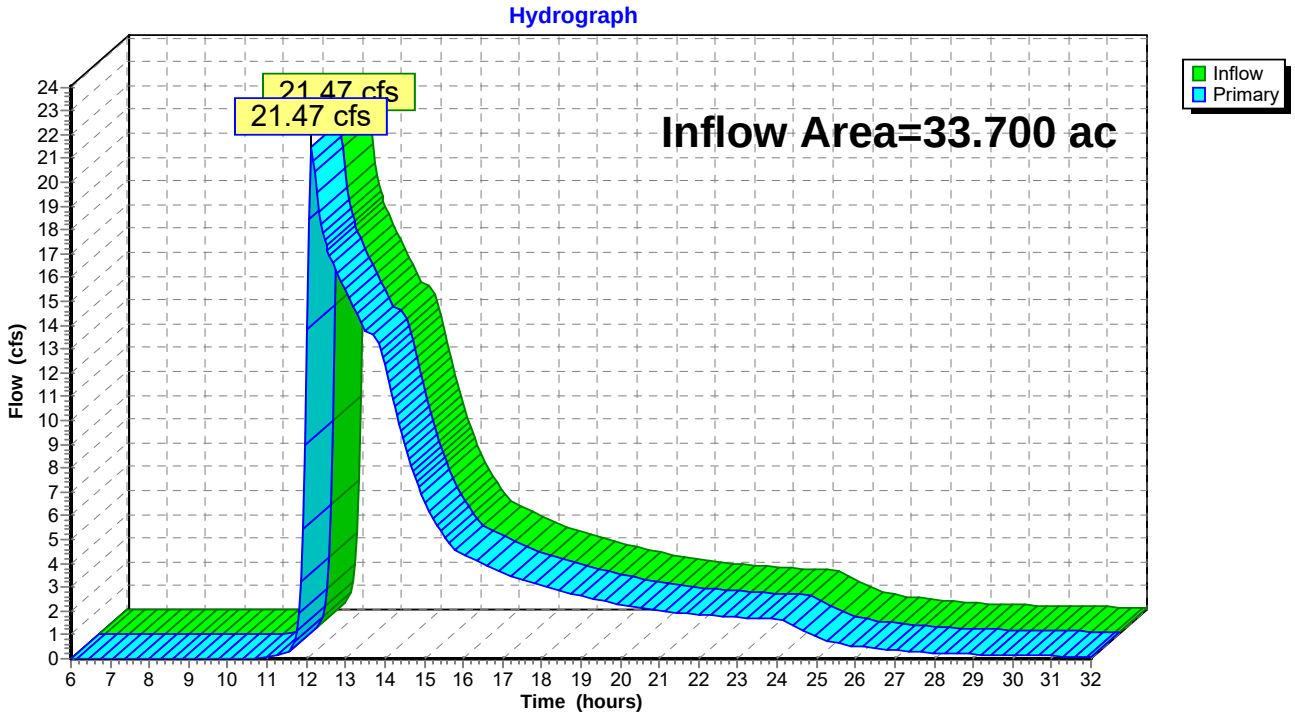


Link OUTLET 1:

Inflow Area = 33.700 ac, Inflow Depth > 2.09" for 10 event
Inflow = 21.47 cfs @ 12.12 hrs, Volume= 5.859 af
Primary = 21.47 cfs @ 12.12 hrs, Volume= 5.859 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link OUTLET 1:

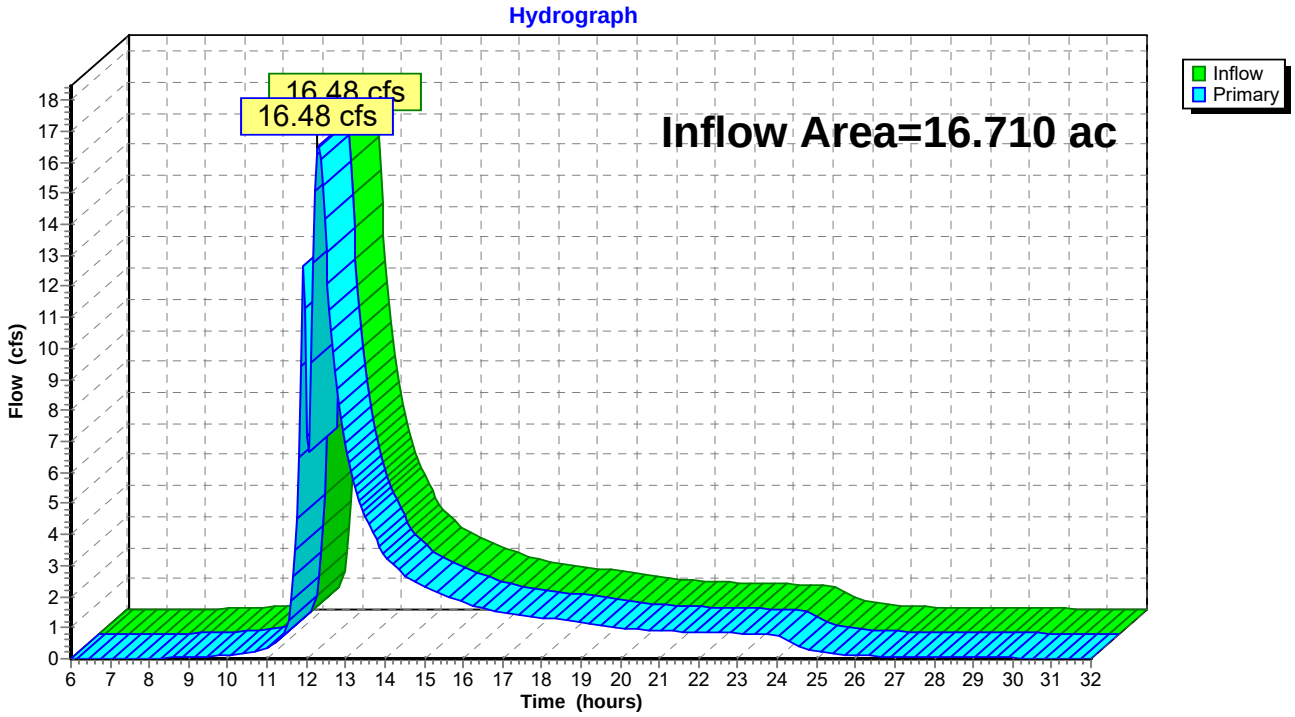


Link OUTLET2:

Inflow Area = 16.710 ac, Inflow Depth > 2.02" for 10 event
Inflow = 16.48 cfs @ 12.29 hrs, Volume= 2.818 af
Primary = 16.48 cfs @ 12.29 hrs, Volume= 2.818 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link OUTLET2:

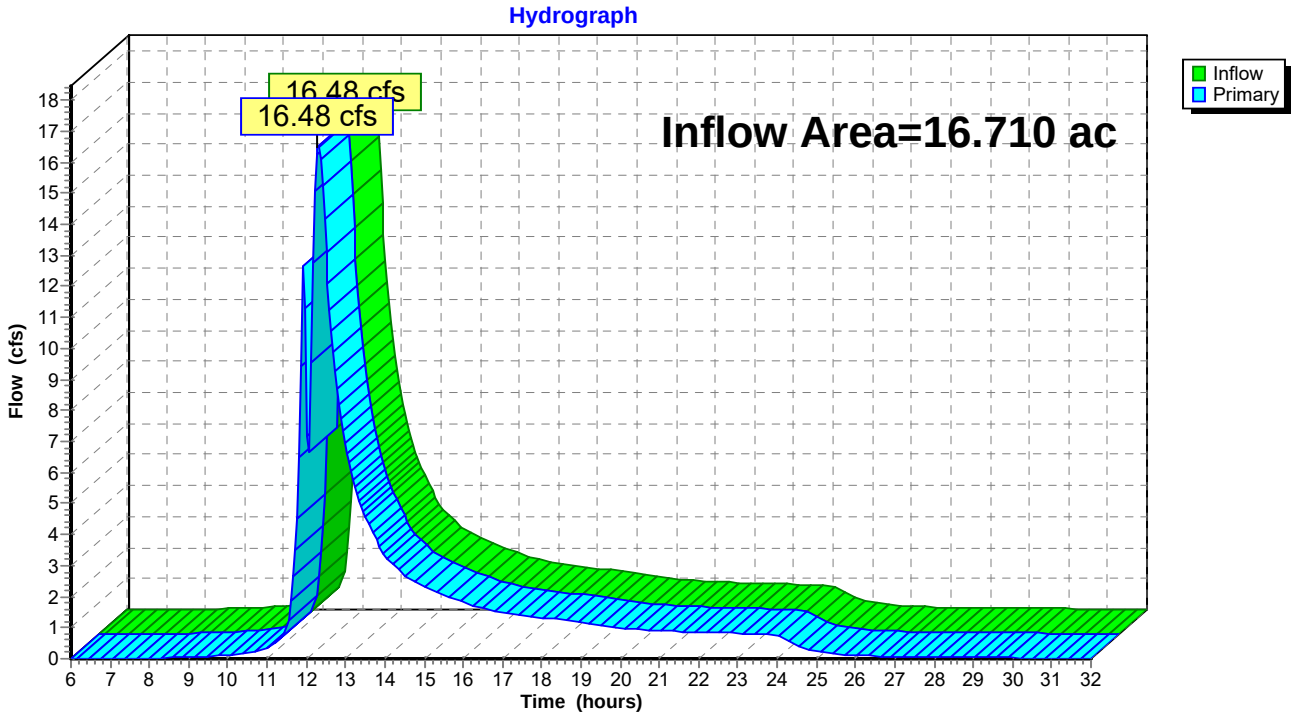


Link WL-1:

Inflow Area = 16.710 ac, Inflow Depth > 2.02" for 10 event
Inflow = 16.48 cfs @ 12.29 hrs, Volume= 2.818 af
Primary = 16.48 cfs @ 12.29 hrs, Volume= 2.818 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link WL-1:

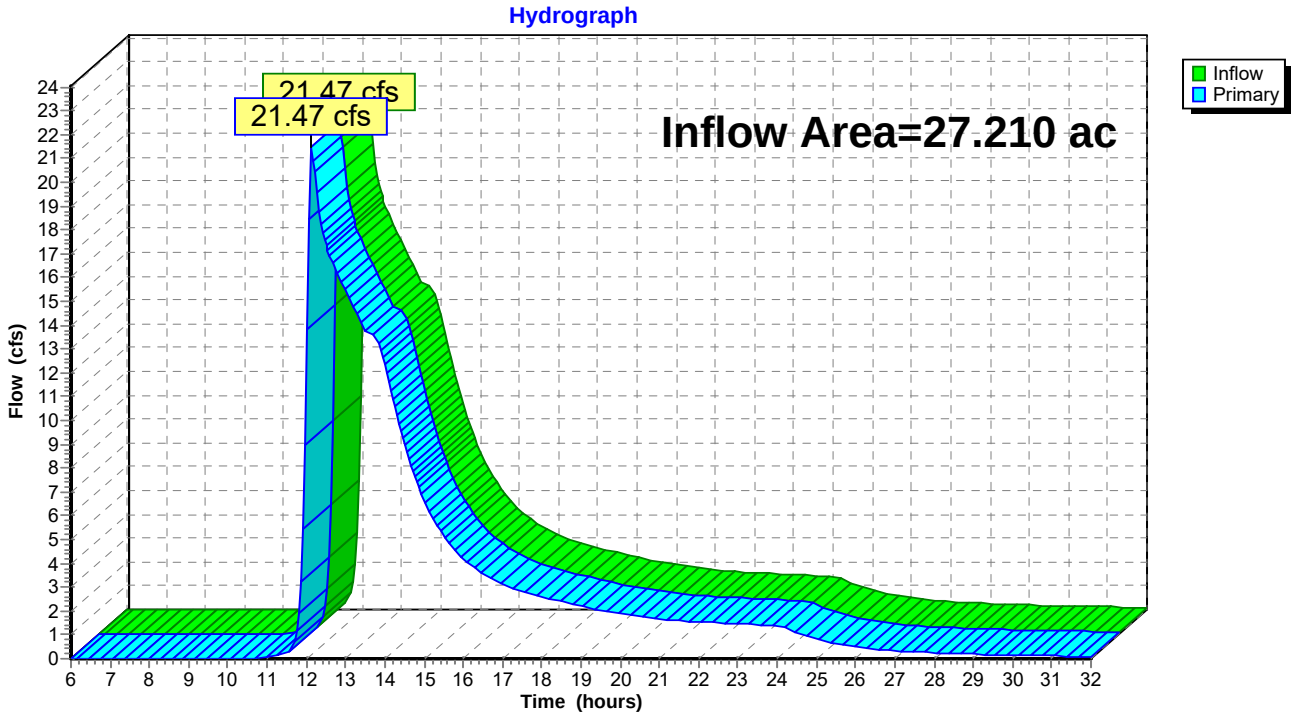


Link WL-3:

Inflow Area = 27.210 ac, Inflow Depth > 2.47" for 10 event
Inflow = 21.47 cfs @ 12.12 hrs, Volume= 5.600 af
Primary = 21.47 cfs @ 12.12 hrs, Volume= 5.600 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link WL-3:



Time span=6.00-32.00 hrs, dt=0.05 hrs, 521 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 101: Runoff Area=1.330 ac Runoff Depth=3.29"
Flow Length=648' Tc=14.6 min CN=76 Runoff=5.70 cfs 0.365 af

Subcatchment 102: Runoff Area=1.280 ac Runoff Depth=3.29"
Flow Length=919' Tc=19.3 min CN=76 Runoff=4.76 cfs 0.351 af

Subcatchment 103: Runoff Area=1.230 ac Runoff Depth=3.29"
Flow Length=793' Tc=17.1 min CN=76 Runoff=4.88 cfs 0.338 af

Subcatchment 104: Runoff Area=0.930 ac Runoff Depth=3.29"
Flow Length=756' Tc=17.6 min CN=76 Runoff=3.64 cfs 0.255 af

Subcatchment 105: Runoff Area=0.930 ac Runoff Depth=3.29"
Flow Length=507' Tc=4.9 min CN=76 Runoff=5.50 cfs 0.255 af

Subcatchment 106: Runoff Area=1.400 ac Runoff Depth=3.29"
Flow Length=908' Tc=4.8 min CN=76 Runoff=8.31 cfs 0.384 af

Subcatchment 107: Runoff Area=1.600 ac Runoff Depth=3.29"
Flow Length=840' Tc=18.2 min CN=76 Runoff=6.15 cfs 0.439 af

Subcatchment 108: Runoff Area=1.100 ac Runoff Depth=3.29"
Flow Length=682' Tc=15.2 min CN=76 Runoff=4.62 cfs 0.302 af

Subcatchment 109: Runoff Area=0.290 ac Runoff Depth=3.29"
Flow Length=216' Tc=4.2 min CN=76 Runoff=1.76 cfs 0.080 af

Subcatchment 110: Runoff Area=0.980 ac Runoff Depth=3.29"
Flow Length=510' Tc=5.6 min CN=76 Runoff=5.61 cfs 0.269 af

Subcatchment 111: Runoff Area=0.660 ac Runoff Depth=3.29"
Flow Length=283' Tc=3.6 min CN=76 Runoff=4.10 cfs 0.181 af

Subcatchment 112: Runoff Area=0.980 ac Runoff Depth=3.29"
Flow Length=426' Tc=6.0 min CN=76 Runoff=5.52 cfs 0.269 af

Subcatchment 113: Runoff Area=0.690 ac Runoff Depth=3.29"
Flow Length=270' Tc=2.5 min CN=76 Runoff=4.36 cfs 0.189 af

Subcatchment 114: Runoff Area=0.240 ac Runoff Depth=3.29"
Flow Length=207' Tc=1.1 min CN=76 Runoff=1.55 cfs 0.066 af

Subcatchment 115: Runoff Area=0.480 ac Runoff Depth=3.29"
Flow Length=292' Tc=26.1 min CN=76 Runoff=1.49 cfs 0.132 af

Subcatchment 116: Runoff Area=0.770 ac Runoff Depth=3.29"
Flow Length=446' Tc=11.7 min CN=76 Runoff=3.63 cfs 0.211 af

Subcatchment 117: Runoff Area=0.960 ac Runoff Depth=3.29"
Flow Length=637' Tc=14.1 min CN=76 Runoff=4.18 cfs 0.264 af

Subcatchment 118: Runoff Area=1.180 ac Runoff Depth=3.29"
Flow Length=776' Tc=16.8 min CN=76 Runoff=4.73 cfs 0.324 af

Subcatchment 119: Runoff Area=0.640 ac Runoff Depth=3.29"
Flow Length=419' Tc=9.8 min CN=76 Runoff=3.21 cfs 0.176 af

Subcatchment 120: Runoff Area=1.570 ac Runoff Depth=3.29"
Flow Length=720' Tc=4.0 min CN=76 Runoff=9.63 cfs 0.431 af

Subcatchment 121: Runoff Area=0.670 ac Runoff Depth=3.29"
Flow Length=336' Tc=9.6 min CN=76 Runoff=3.39 cfs 0.184 af

Subcatchment 122: Runoff Area=0.880 ac Runoff Depth=3.29"
Flow Length=559' Tc=12.6 min CN=76 Runoff=4.03 cfs 0.242 af

Subcatchment 123: Runoff Area=0.430 ac Runoff Depth=3.29"
Flow Length=381' Tc=9.0 min CN=76 Runoff=2.22 cfs 0.118 af

Subcatchment 124: Runoff Area=0.570 ac Runoff Depth=3.29"
Flow Length=374' Tc=2.8 min CN=76 Runoff=3.59 cfs 0.156 af

Subcatchment 125: Runoff Area=1.640 ac Runoff Depth=3.29"
Flow Length=998' Tc=9.8 min CN=76 Runoff=8.22 cfs 0.450 af

Subcatchment 126: Runoff Area=1.830 ac Runoff Depth=3.69"
Flow Length=1,074' Tc=1.1 min CN=80 Runoff=13.09 cfs 0.563 af

Subcatchment 127: Runoff Area=0.440 ac Runoff Depth=3.29"
Flow Length=318' Tc=9.6 min CN=76 Runoff=2.22 cfs 0.121 af

Subcatchment 128: Runoff Area=0.090 ac Runoff Depth=3.29"
Flow Length=150' Tc=4.9 min CN=76 Runoff=0.53 cfs 0.025 af

Subcatchment 129: Runoff Area=0.280 ac Runoff Depth=3.29"
Flow Length=239' Tc=6.5 min CN=76 Runoff=1.57 cfs 0.077 af

Subcatchment 130: Runoff Area=0.470 ac Runoff Depth=3.29"
Flow Length=329' Tc=8.3 min CN=76 Runoff=2.49 cfs 0.129 af

Subcatchment 131: Runoff Area=0.800 ac Runoff Depth=3.29"
Flow Length=404' Tc=4.4 min CN=76 Runoff=4.83 cfs 0.220 af

Subcatchment 132: Runoff Area=0.940 ac Runoff Depth=3.29"
Flow Length=514' Tc=12.0 min CN=76 Runoff=4.39 cfs 0.258 af

Subcatchment 133: Runoff Area=1.270 ac Runoff Depth=3.29"
Flow Length=655' Tc=14.7 min CN=76 Runoff=5.42 cfs 0.349 af

Subcatchment 134: Runoff Area=1.590 ac Runoff Depth=3.29"
Flow Length=765' Tc=16.8 min CN=76 Runoff=6.37 cfs 0.436 af

Subcatchment 135: Runoff Area=1.340 ac Runoff Depth=3.29"
Flow Length=796' Tc=4.8 min CN=76 Runoff=7.95 cfs 0.368 af

Subcatchment 136: Runoff Area=1.170 ac Runoff Depth=3.29"
Flow Length=533' Tc=2.6 min CN=76 Runoff=7.39 cfs 0.321 af

Subcatchment PWL-1: Runoff Area=6.490 ac Runoff Depth=2.45"
Flow Length=300' Tc=31.1 min CN=67 Runoff=13.12 cfs 1.328 af

Subcatchment PWL-2: Runoff Area=6.490 ac Runoff Depth=2.45"
Flow Length=300' Tc=31.1 min CN=67 Runoff=13.12 cfs 1.328 af

Subcatchment PWL-3: Runoff Area=3.780 ac Runoff Depth=2.45"
Flow Length=300' Tc=17.9 min CN=67 Runoff=10.77 cfs 0.773 af

Reach 01-05: PERIMETER CHANNEL Peak Depth=0.44' Max Vel=3.7 fps Inflow=5.70 cfs 0.365 af
n=0.014 L=420.5' S=0.0050 '/' Capacity=48.31 cfs Outflow=5.49 cfs 0.365 af

Reach 02-06: BENCH Peak Depth=0.60' Max Vel=2.7 fps Inflow=4.76 cfs 0.351 af
n=0.045 L=818.0' S=0.0346 '/' Capacity=50.43 cfs Outflow=4.33 cfs 0.351 af

Reach 03-09: BENCH Peak Depth=0.62' Max Vel=2.6 fps Inflow=4.88 cfs 0.338 af
n=0.045 L=740.4' S=0.0300 '/' Capacity=46.95 cfs Outflow=4.40 cfs 0.338 af

Reach 04-08: ACCESS ROAD CHANNEL Peak Depth=0.29' Max Vel=12.0 fps Inflow=8.07 cfs 0.524 af
n=0.014 L=217.8' S=0.0872 '/' Capacity=146.64 cfs Outflow=7.98 cfs 0.524 af

Reach 05-06: PERIMETER CHANNEL Peak Depth=0.49' Max Vel=4.7 fps Inflow=8.31 cfs 0.620 af
n=0.014 L=886.1' S=0.0070 '/' Capacity=57.18 cfs Outflow=7.92 cfs 0.620 af

Reach 06-10: PERIMETER CHANNEL Peak Depth=0.77' Max Vel=6.6 fps Inflow=19.31 cfs 1.795 af
n=0.014 L=121.6' S=0.0085 '/' Capacity=62.91 cfs Outflow=18.96 cfs 1.795 af

Reach 07-04: ACCESS ROAD CHANNEL Peak Depth=0.21' Max Vel=11.5 fps Inflow=5.52 cfs 0.269 af
n=0.014 L=153.5' S=0.1173 '/' Capacity=170.02 cfs Outflow=5.51 cfs 0.269 af

Reach 08-08`: ACCESS ROAD CHANNEL Peak Depth=0.33' Max Vel=14.3 fps Inflow=11.20 cfs 0.714 af
n=0.014 L=190.2' S=0.1073 '/' Capacity=162.60 cfs Outflow=11.06 cfs 0.714 af

Reach 09-10: PIPE DOWNCHUTE Peak Depth=0.50' Max Vel=21.1 fps Inflow=16.38 cfs 1.419 af
D=36.0" n=0.014 L=154.6' S=0.1897 '/' Capacity=269.76 cfs Outflow=16.37 cfs 1.419 af

Reach 10-11: PERIMETER CHANNEL Peak Depth=1.14' Max Vel=5.2 fps Inflow=36.60 cfs 3.294 af
n=0.014 L=482.0' S=0.0030 '/' Capacity=69.51 cfs Outflow=35.83 cfs 3.294 af

Reach 11-19: PERIMETER CHANNEL Peak Depth=1.18' Max Vel=5.4 fps Inflow=39.08 cfs 3.563 af
n=0.014 L=71.8' S=0.0031 '/' Capacity=70.15 cfs Outflow=38.99 cfs 3.563 af

Reach 12-13: DOWNCHUTE Peak Depth=0.08' Max Vel=4.3 fps Inflow=1.49 cfs 0.132 af
n=0.028 L=124.2' S=0.2013 '/' Capacity=336.95 cfs Outflow=1.49 cfs 0.132 af

Reach 13-14: DOWNCHUTE Peak Depth=0.21' Max Vel=7.7 fps Inflow=7.79 cfs 0.527 af
n=0.028 L=146.8' S=0.2112 '/' Capacity=345.13 cfs Outflow=7.73 cfs 0.527 af

Reach 14-15: DOWNCHUTE Peak Depth=0.21' Max Vel=7.7 fps Inflow=15.89 cfs 1.032 af
n=0.028 L=141.3' S=0.2088 '/' Capacity=686.32 cfs Outflow=15.75 cfs 1.032 af

Reach 15-17: DOWNCHUTE Peak Depth=0.38' Max Vel=10.5 fps Inflow=22.21 cfs 1.474 af
n=0.028 L=189.9' S=0.1975 '/' Capacity=333.74 cfs Outflow=22.00 cfs 1.474 af

Reach 16-18: PERIMETER CHANNEL Peak Depth=0.15' Max Vel=6.5 fps Inflow=3.21 cfs 0.176 af
n=0.014 L=637.5' S=0.0521 '/' Capacity=156.00 cfs Outflow=3.05 cfs 0.176 af

Reach 17-18: PIPE DOWNCHUTE Peak Depth=0.73' Max Vel=17.0 fps Inflow=22.67 cfs 1.631 af
D=36.0" n=0.014 L=120.1' S=0.0791 '/' Capacity=174.19 cfs Outflow=22.61 cfs 1.631 af

Reach 18-19: PERIMETER CHANNEL W Peak Depth=0.51' Max Vel=8.0 fps Inflow=30.88 cfs 2.237 af
n=0.014 L=216.2' S=0.0162 '/' Capacity=187.26 cfs Outflow=30.75 cfs 2.237 af

Reach 21-23: DOWNCHUTE Peak Depth=0.09' Max Vel=5.3 fps Inflow=2.22 cfs 0.121 af
n=0.028 L=144.7' S=0.2626 '/' Capacity=384.87 cfs Outflow=2.17 cfs 0.121 af

Reach 22-23: BENCH Peak Depth=0.25' Max Vel=1.5 fps Inflow=0.53 cfs 0.025 af
n=0.045 L=454.4' S=0.0352 '/' Capacity=50.87 cfs Outflow=0.43 cfs 0.025 af

Reach 23-25: DOWNCHUTE Peak Depth=0.19' Max Vel=7.9 fps Inflow=6.93 cfs 0.404 af
n=0.028 L=144.0' S=0.2569 '/' Capacity=380.70 cfs Outflow=6.86 cfs 0.404 af

Reach 24-25: BENCH Peak Depth=0.38' Max Vel=2.0 fps Inflow=1.57 cfs 0.077 af
n=0.045 L=594.2' S=0.0337 '/' Capacity=49.74 cfs Outflow=1.29 cfs 0.077 af

Reach 25-27: DOWNCHUTE Peak Depth=0.26' Max Vel=10.0 fps Inflow=13.36 cfs 0.829 af
n=0.028 L=127.2' S=0.2752 '/' Capacity=393.96 cfs Outflow=13.26 cfs 0.829 af

Reach 26-27: BENCH Peak Depth=0.46' Max Vel=2.2 fps Inflow=2.49 cfs 0.129 af
n=0.045 L=704.7' S=0.0312 '/' Capacity=47.90 cfs Outflow=2.06 cfs 0.129 af

Reach 27-29: DOWNCHUTE Peak Depth=0.34' Max Vel=11.8 fps Inflow=21.19 cfs 1.394 af
n=0.028 L=25.7' S=0.2918 '/' Capacity=405.72 cfs Outflow=21.18 cfs 1.394 af

Reach 28-29: PERIMETER CHANNEL Peak Depth=0.34' Max Vel=3.8 fps Inflow=4.83 cfs 0.220 af
n=0.014 L=751.8' S=0.0067 '/' Capacity=55.92 cfs Outflow=4.31 cfs 0.220 af

Pond POND Nº1: Peak Elev=27.75' Storage=2.741 af Inflow=80.07 cfs 6.432 af
Outflow=17.50 cfs 6.144 af

Pond POND Nº2:	Peak Elev=37.78' Storage=1.091 af	Inflow=32.09 cfs 2.303 af Outflow=6.49 cfs 1.713 af
Pond WL-2:	Peak Elev=37.02' Storage=0.827 af	Inflow=13.12 cfs 1.328 af Outflow=1.21 cfs 0.535 af
Link 08`-09:		Inflow=11.06 cfs 0.714 af Primary=11.06 cfs 0.714 af
Link 19-20:		Inflow=71.85 cfs 5.981 af Primary=71.85 cfs 5.981 af
Link 29-30:		Inflow=32.09 cfs 2.303 af Primary=32.09 cfs 2.303 af
Link OUTLET 1:		Inflow=25.22 cfs 7.452 af Primary=25.22 cfs 7.452 af
Link OUTLET2:		Inflow=20.73 cfs 3.604 af Primary=20.73 cfs 3.604 af
Link WL-1:		Inflow=20.73 cfs 3.604 af Primary=20.73 cfs 3.604 af
Link WL-3:		Inflow=25.22 cfs 6.917 af Primary=25.22 cfs 6.917 af

Total Runoff Area = 50.410 ac Runoff Volume = 12.726 af Average Runoff Depth = 3.03"

Subcatchment 101:

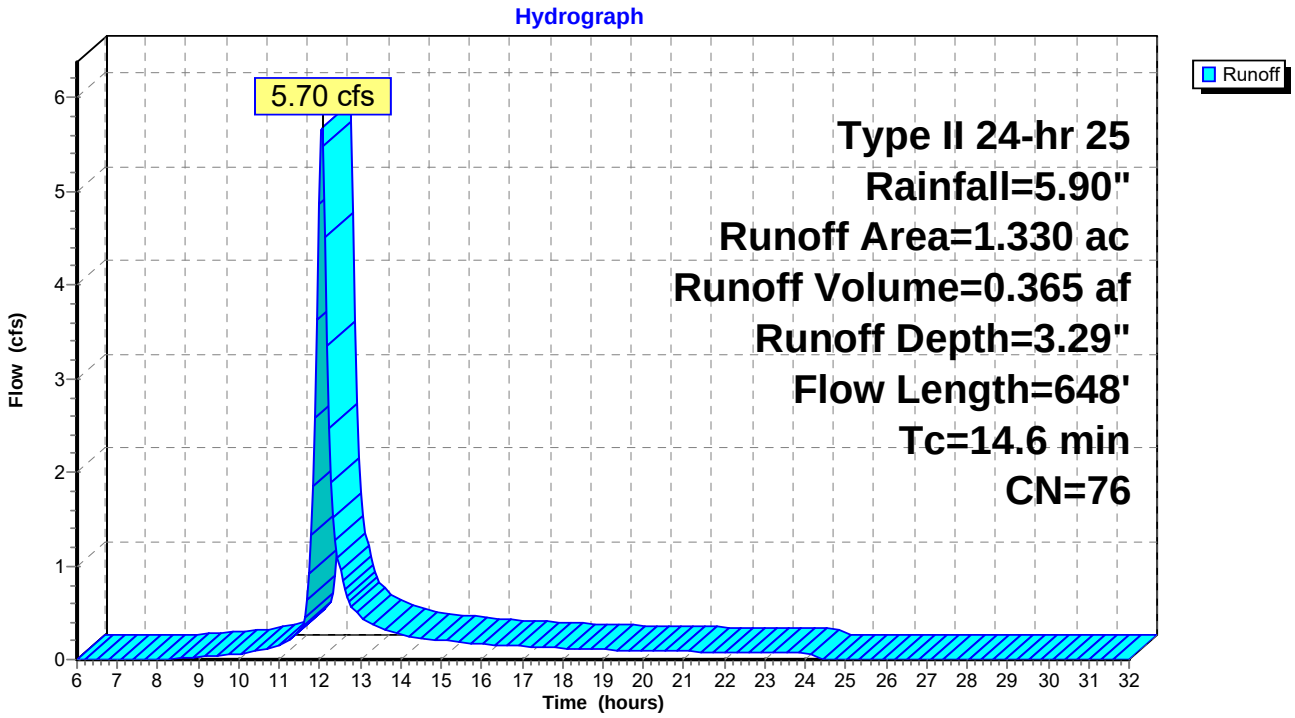
Runoff = 5.70 cfs @ 12.07 hrs, Volume= 0.365 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
1.330	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	99	0.3330	0.4		**Sheet Flow, Overland Flow** n= 0.200 P2= 3.20"
10.6	549	0.0300	0.9		**Shallow Concentrated Flow, BENCH** Kv= 5.0 fps
14.6	648	Total			

Subcatchment 101:



Subcatchment 102:

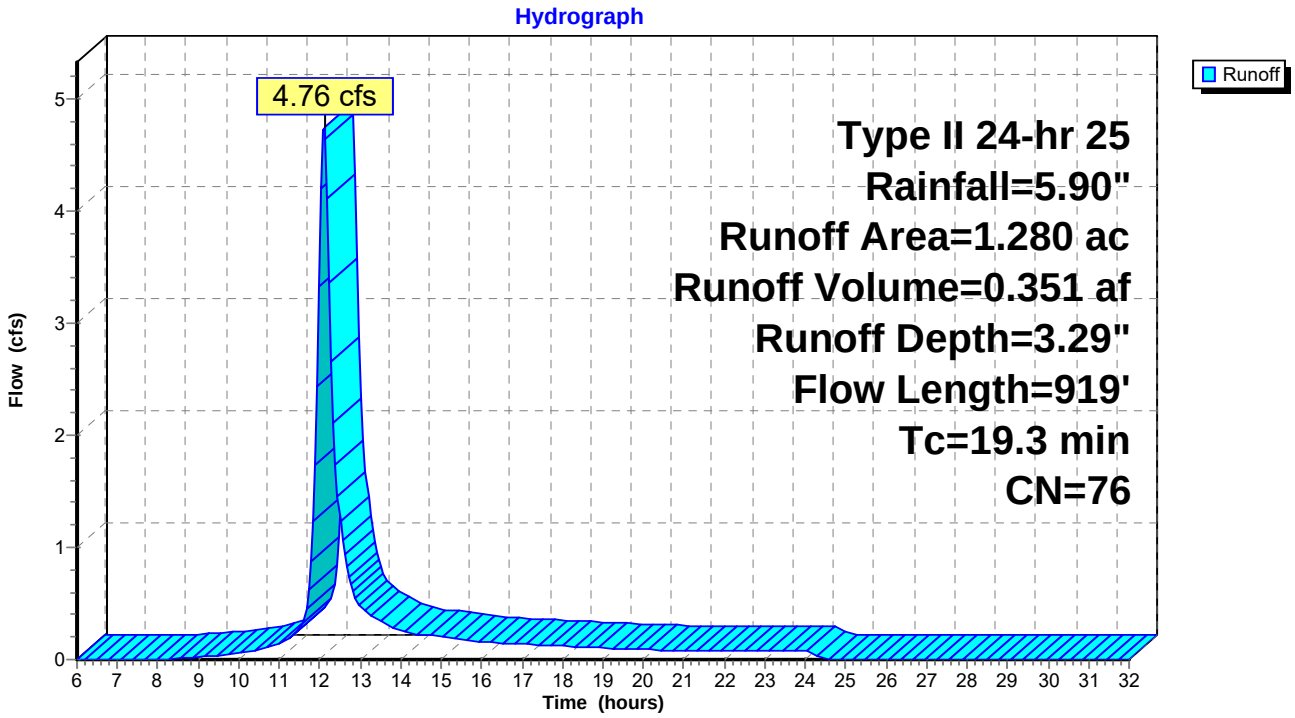
Runoff = 4.76 cfs @ 12.12 hrs, Volume= 0.351 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
1.280	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	67	0.3330	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
16.4	852	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
19.3	919	Total			

Subcatchment 102:



Subcatchment 103:

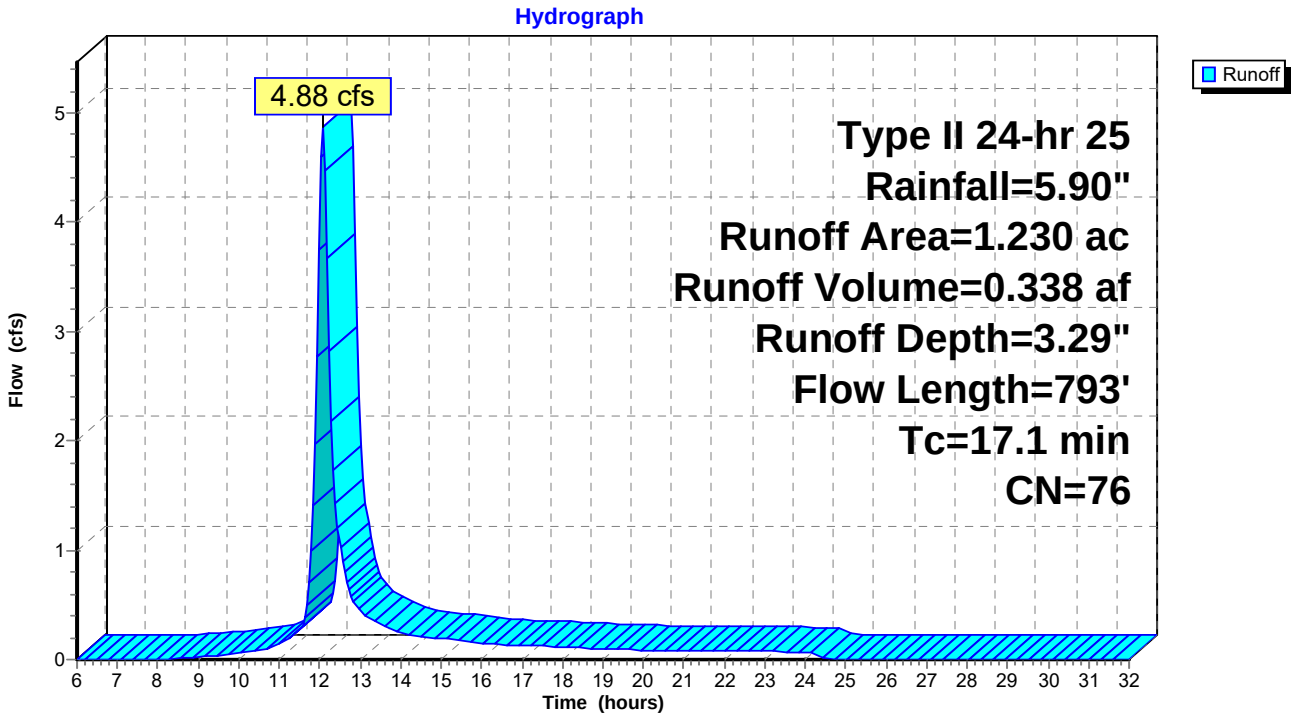
Runoff = 4.88 cfs @ 12.10 hrs, Volume= 0.338 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
1.230	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	77	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
13.8	716	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
17.1	793	Total			

Subcatchment 103:



Subcatchment 104:

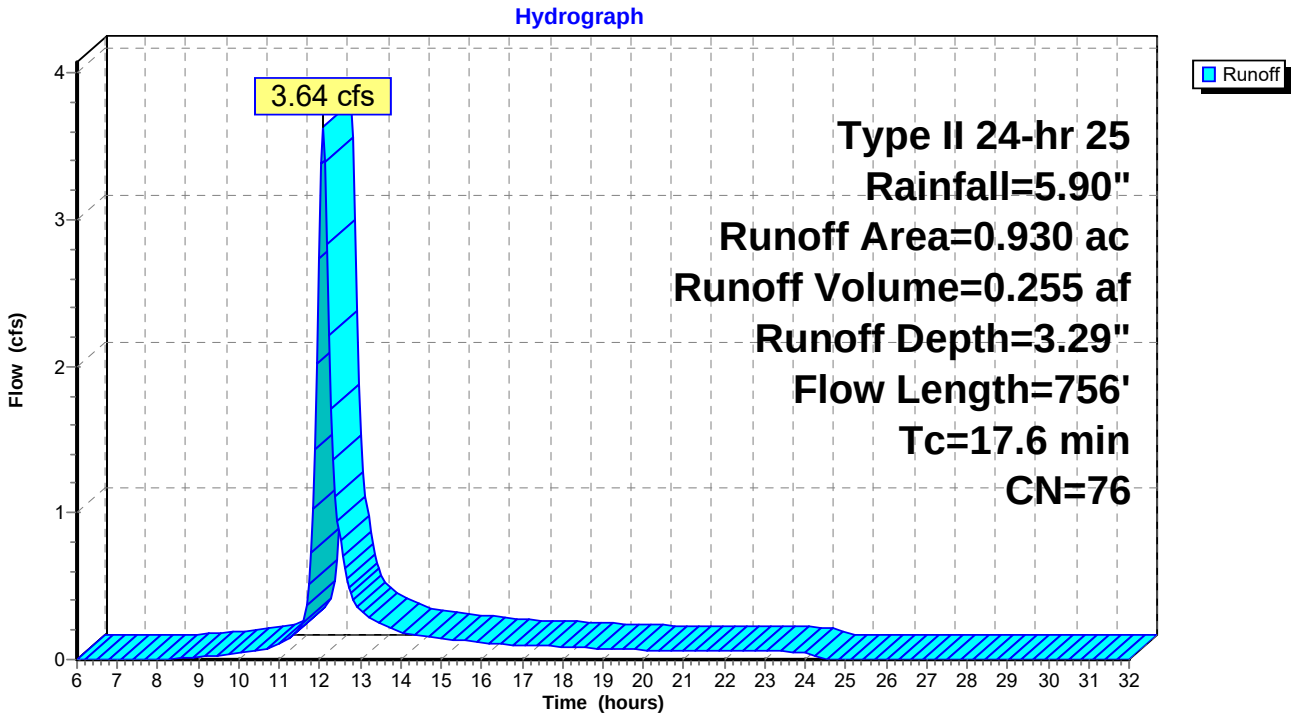
Runoff = 3.64 cfs @ 12.10 hrs, Volume= 0.255 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.930	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1900	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
12.6	656	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
17.6	756	Total			

Subcatchment 104:



Subcatchment 105:

[49] Hint: Tc<2dt may require smaller dt

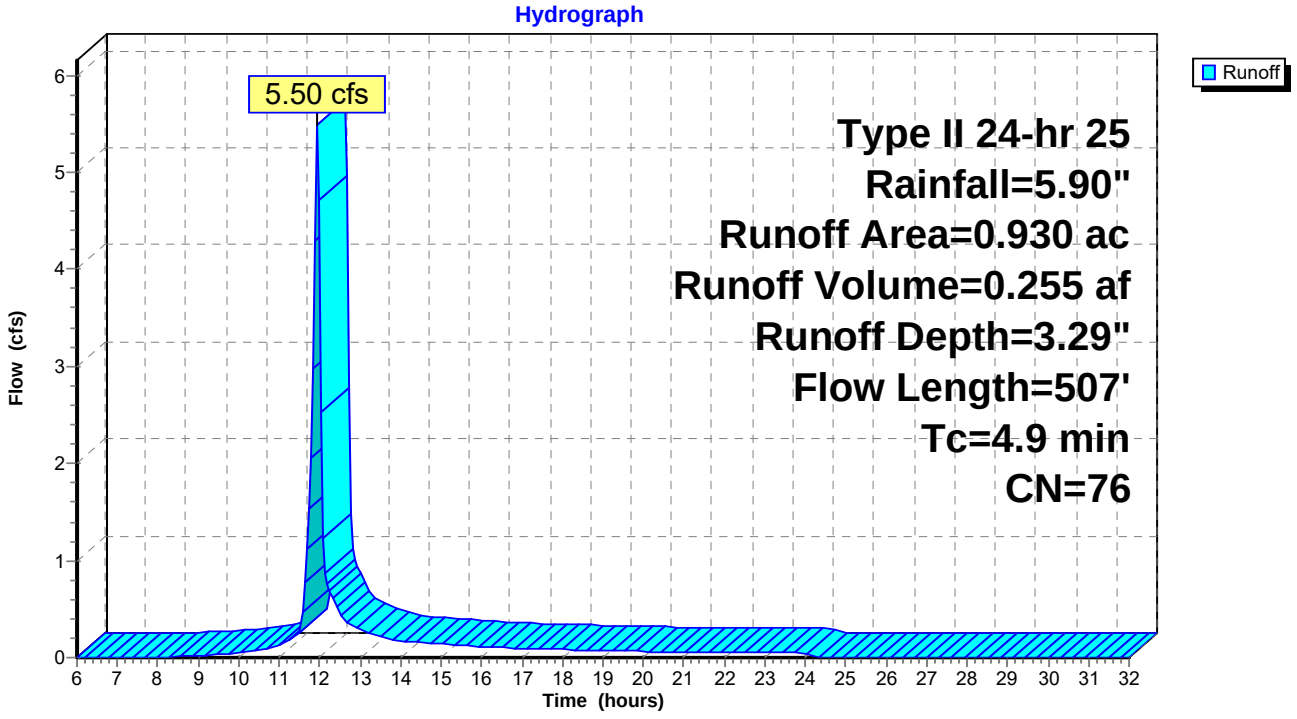
Runoff = 5.50 cfs @ 11.96 hrs, Volume= 0.255 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.930	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.9	407	0.0050	7.2	48.34	**Trap/Vee/Rect Channel Flow, PERIMETRAL CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.9	507	Total			

Subcatchment 105:



Subcatchment 106:

[49] Hint: Tc<2dt may require smaller dt

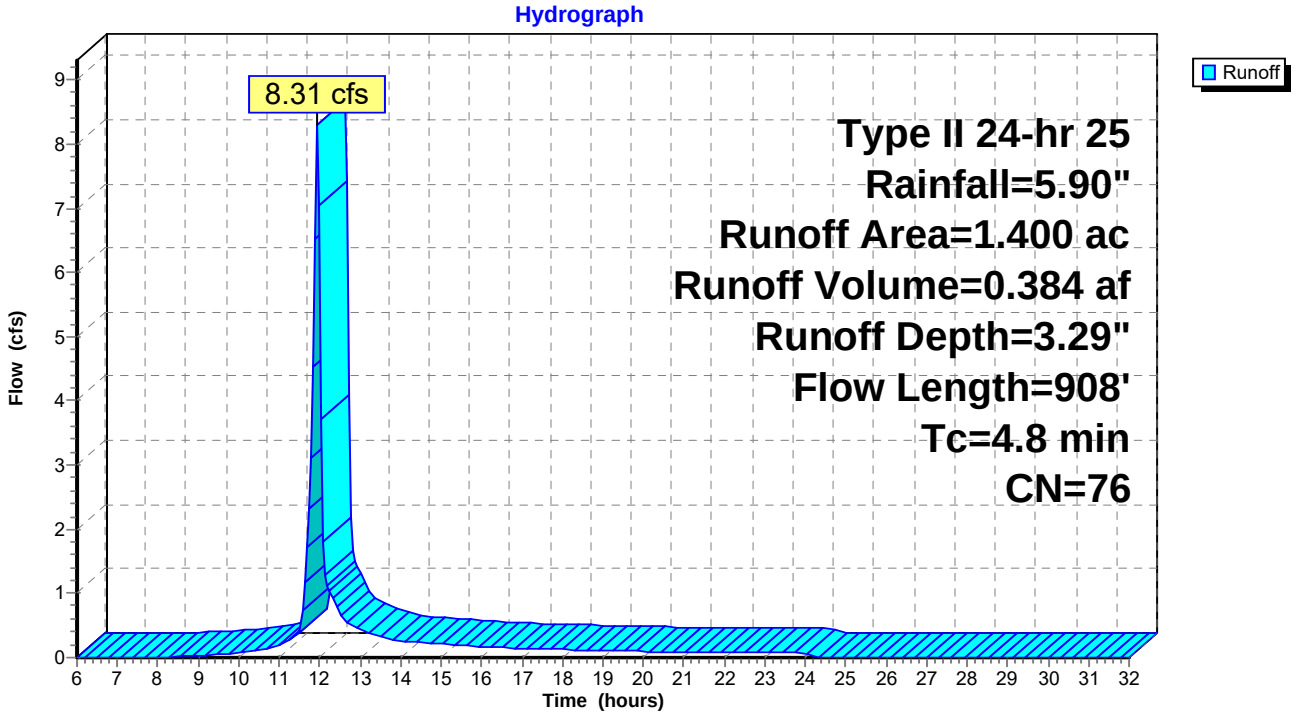
Runoff = 8.31 cfs @ 11.95 hrs, Volume= 0.384 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
1.400	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	74	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
1.6	834	0.0070	8.5	57.19	**Trap/Vee/Rect Channel Flow, PERIMETRAL CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.8	908	Total			

Subcatchment 106:



Subcatchment 107:

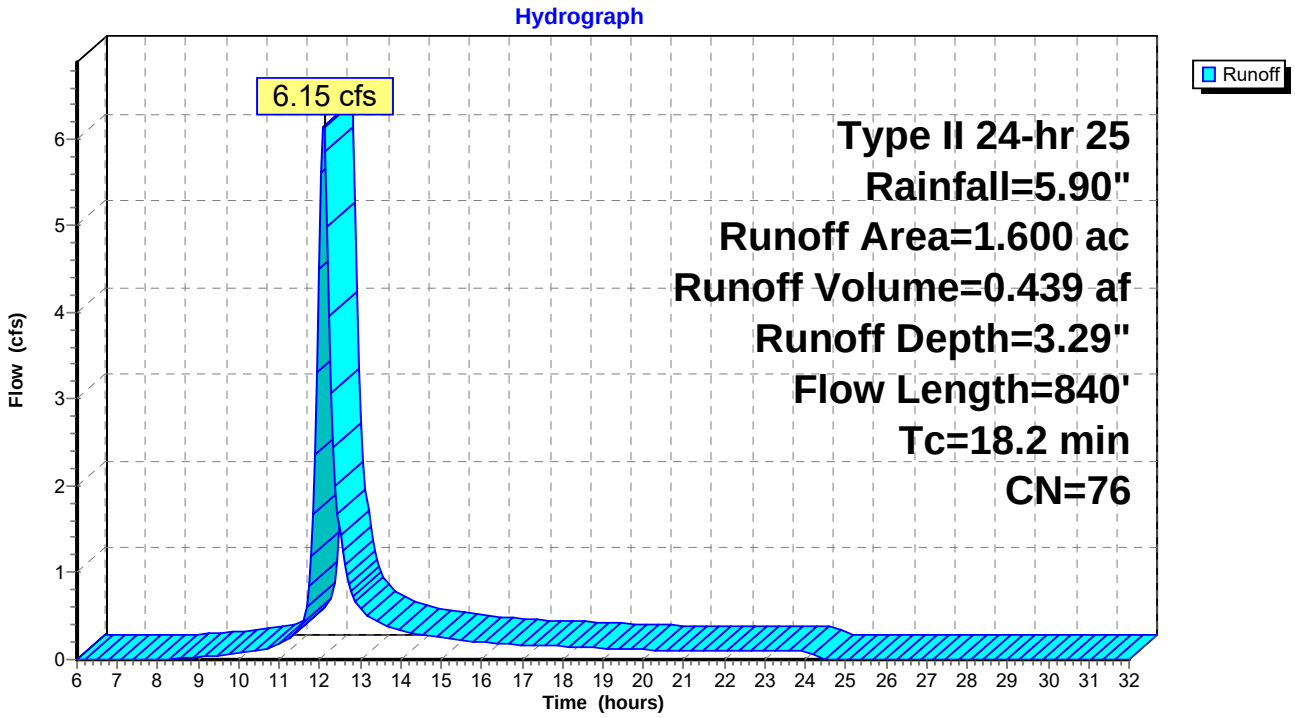
Runoff = 6.15 cfs @ 12.11 hrs, Volume= 0.439 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
1.600	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	94	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
14.4	746	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
18.2	840	Total			

Subcatchment 107:



Subcatchment 108:

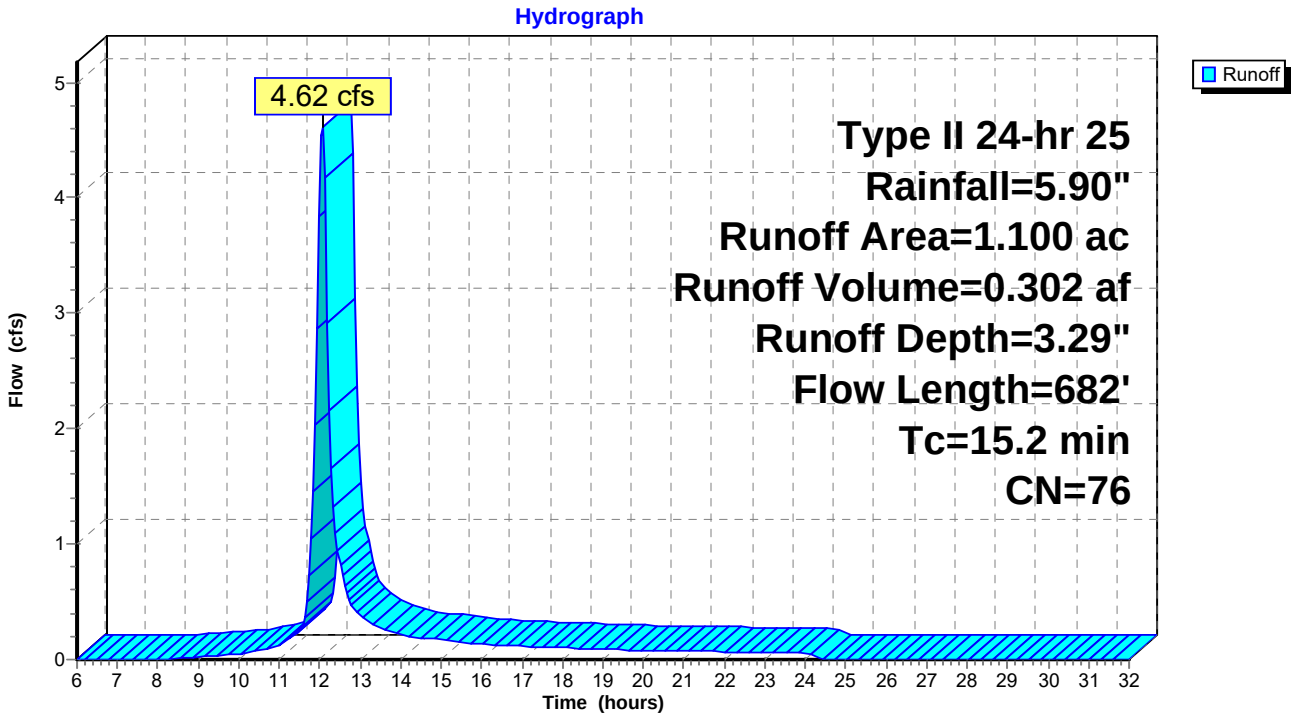
Runoff = 4.62 cfs @ 12.07 hrs, Volume= 0.302 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
1.100	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
11.2	582	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
15.2	682	Total			

Subcatchment 108:



Subcatchment 109:

[49] Hint: Tc<2dt may require smaller dt

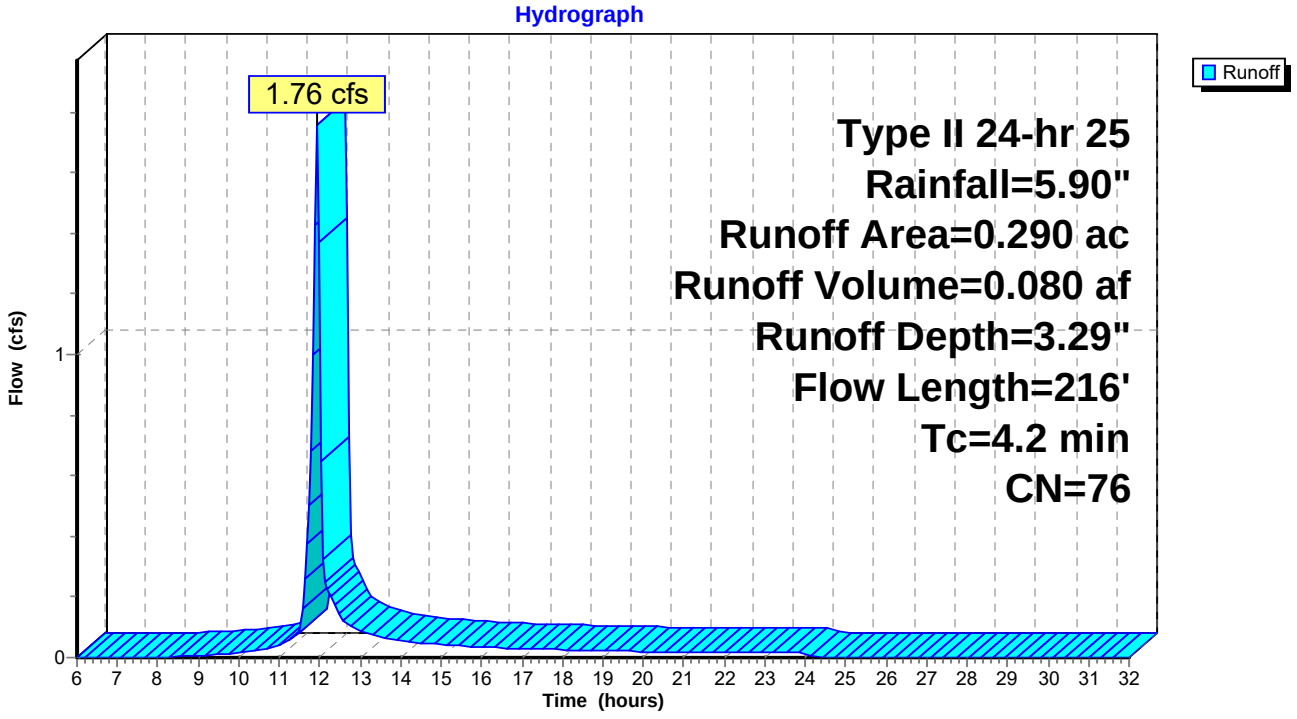
Runoff = 1.76 cfs @ 11.95 hrs, Volume= 0.080 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.290	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	94	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.4	122	0.0030	5.5	37.44	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.2	216	Total			

Subcatchment 109:



Subcatchment 110:

[49] Hint: Tc<2dt may require smaller dt

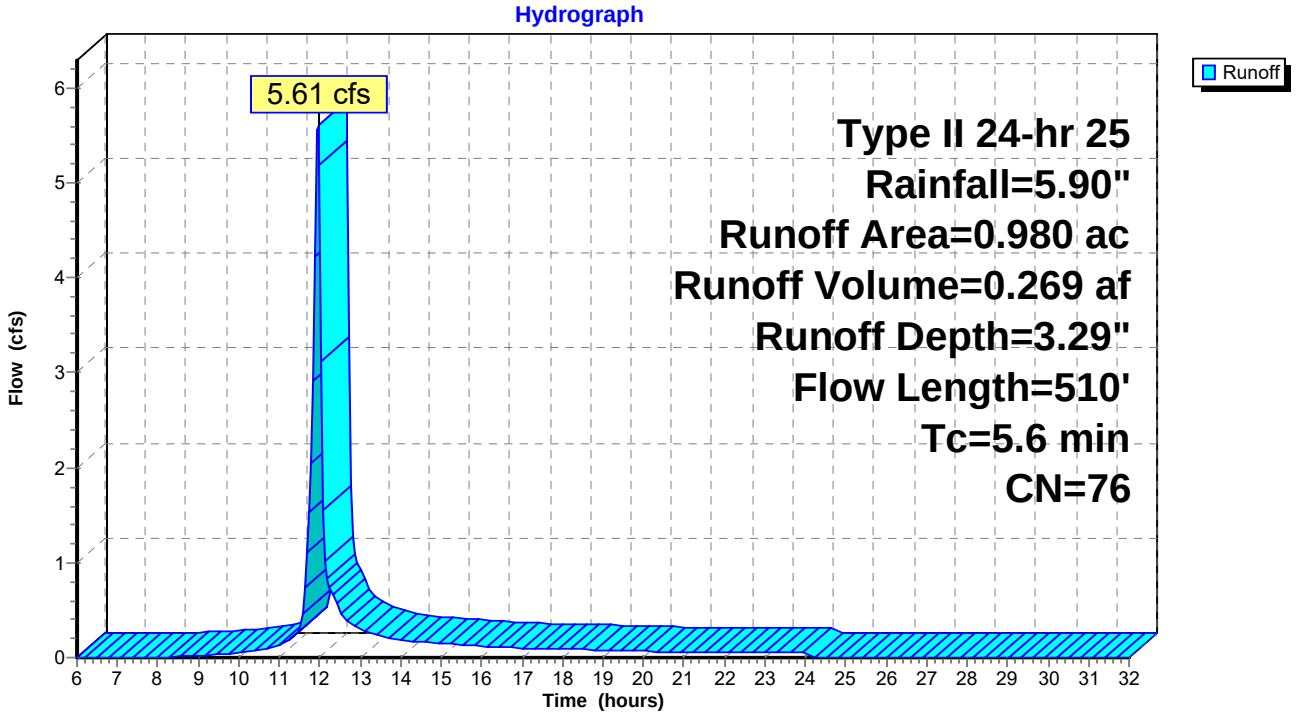
Runoff = 5.61 cfs @ 11.96 hrs, Volume= 0.269 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.980	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	84	0.2000	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
1.3	426	0.0030	5.5	37.44	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
5.6	510	Total			

Subcatchment 110:



Subcatchment 111:

[49] Hint: Tc<2dt may require smaller dt

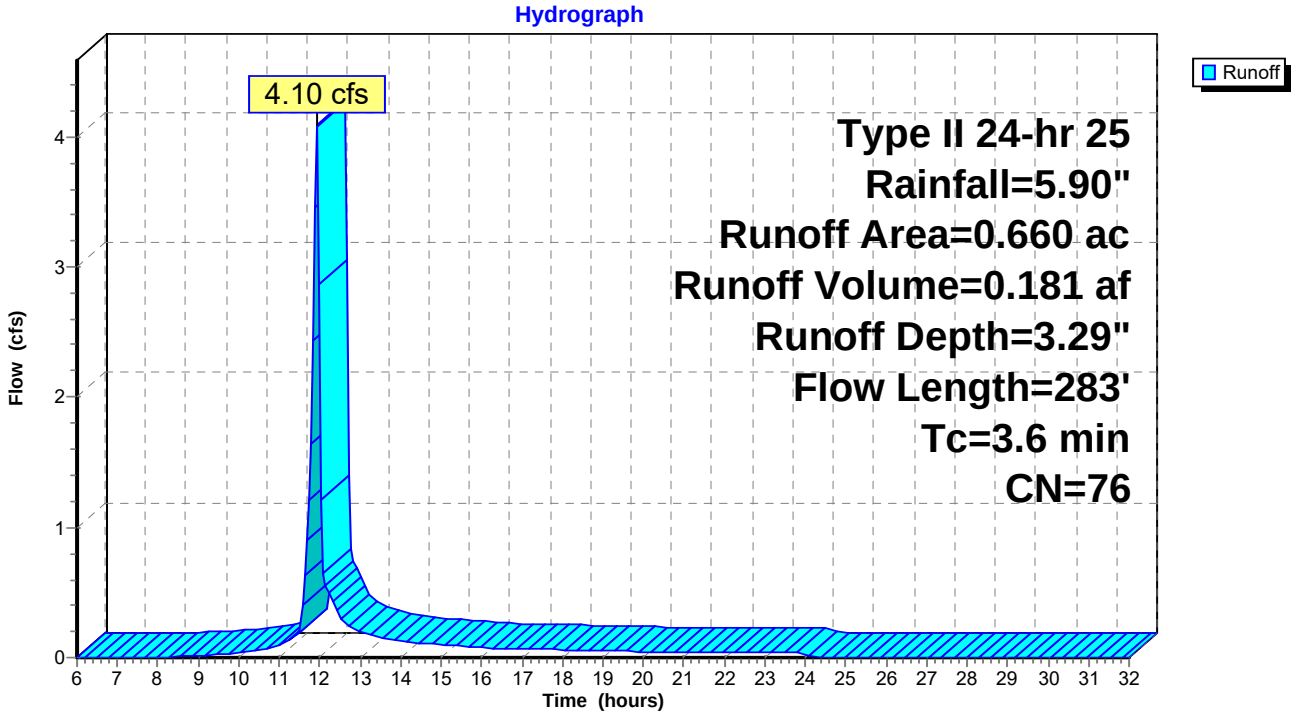
Runoff = 4.10 cfs @ 11.94 hrs, Volume= 0.181 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.660	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	67	0.2200	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.2	216	0.0310	20.3	259.13	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL W** Bot.W=7.00' D=1.50' Z= 1.0 '/' Top.W=10.00' n= 0.014
3.6	283	Total			

Subcatchment 111:



Subcatchment 112:

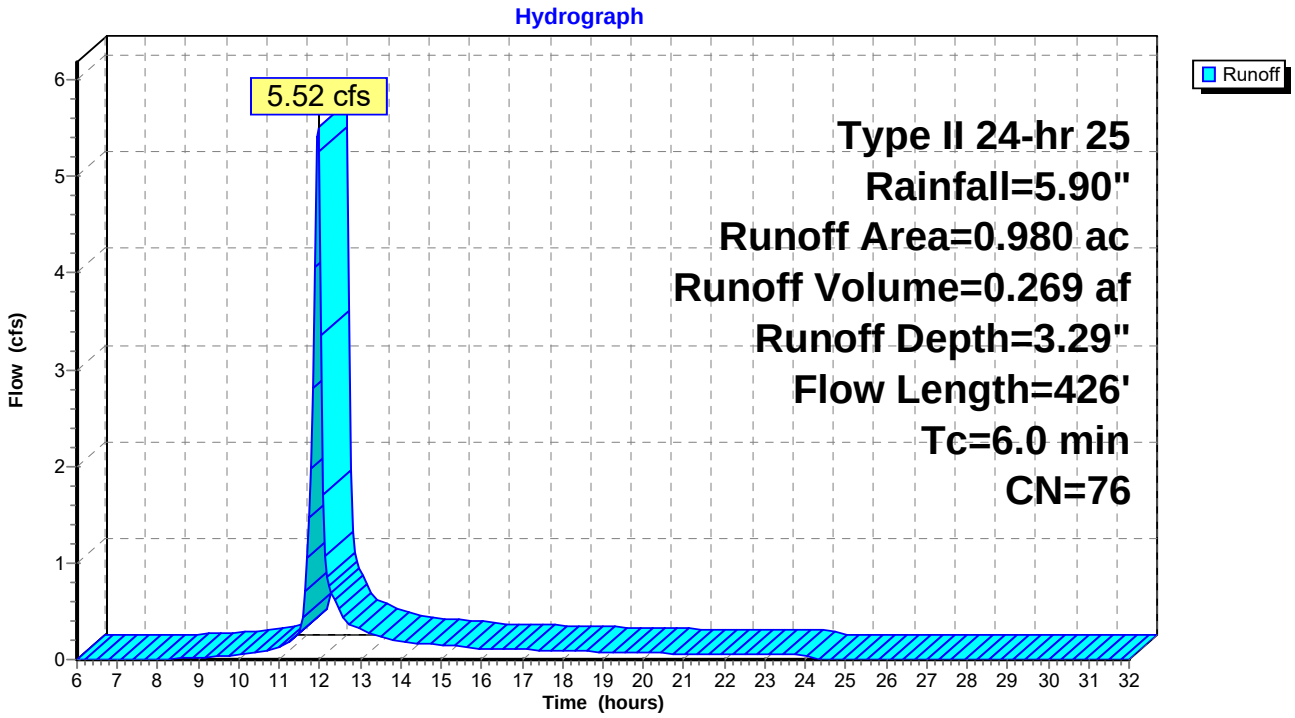
Runoff = 5.52 cfs @ 11.97 hrs, Volume= 0.269 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.980	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.1300	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.2	326	0.1060	30.8	161.65	**Trap/Vee/Rect Channel Flow, ACCES ROAD CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
6.0	426	Total			

Subcatchment 112:



Subcatchment 113:

[49] Hint: Tc<2dt may require smaller dt

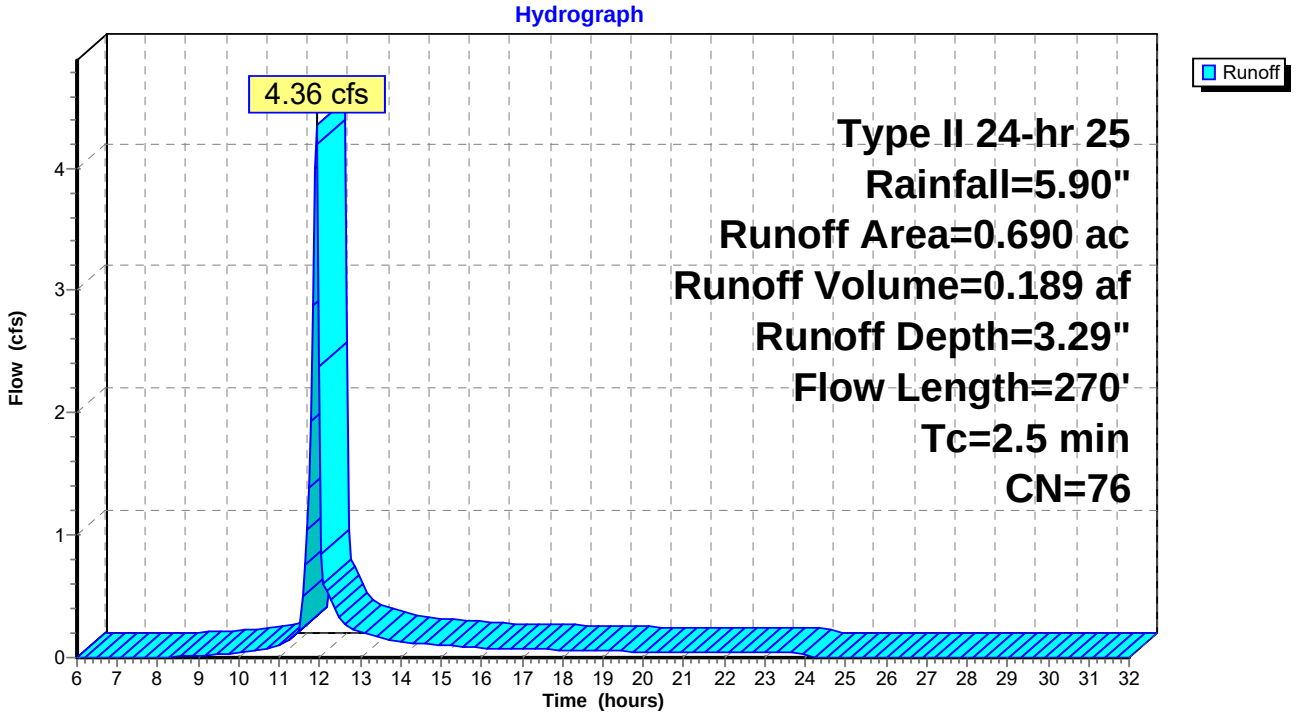
Runoff = 4.36 cfs @ 11.93 hrs, Volume= 0.189 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.690	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	52	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.1	218	0.0950	29.1	153.03	**Trap/Vee/Rect Channel Flow, ACCESS ROAD CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
2.5	270	Total			

Subcatchment 113:



Subcatchment 114:

[49] Hint: Tc<2dt may require smaller dt

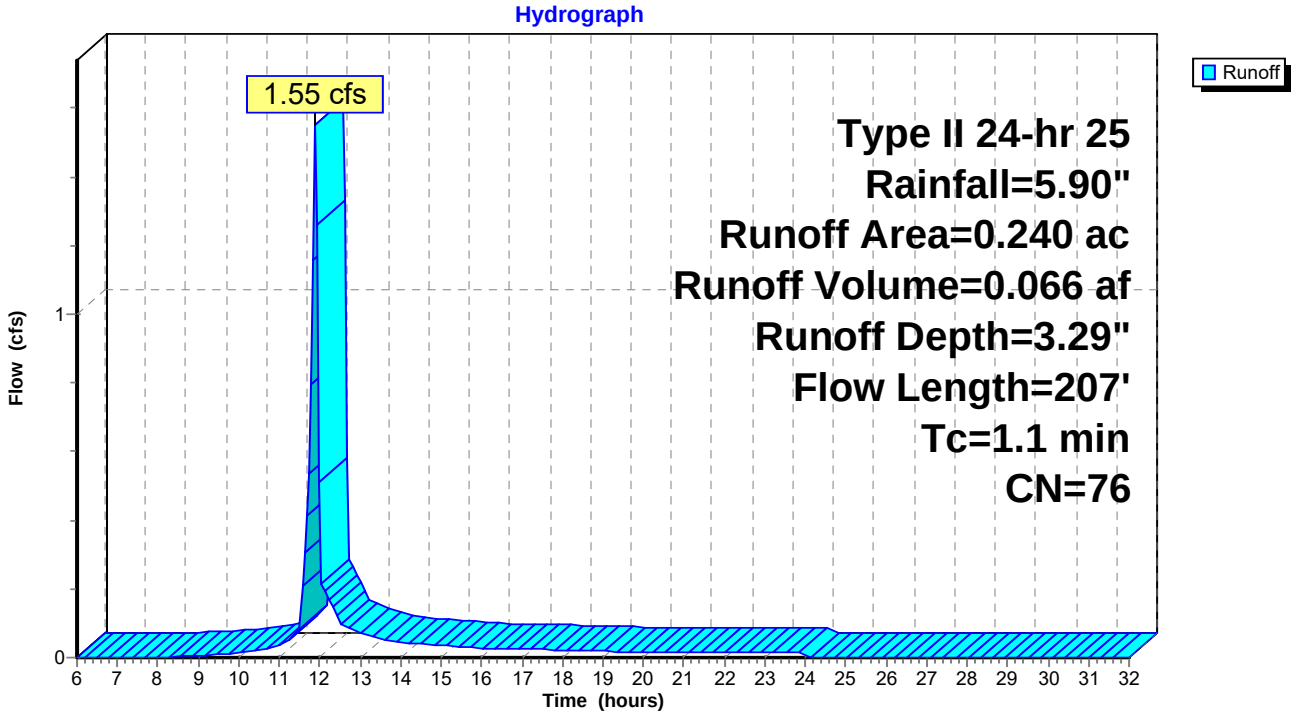
Runoff = 1.55 cfs @ 11.90 hrs, Volume= 0.066 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.240	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	17	0.3300	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.1	190	0.1050	30.6	160.88	**Trap/Vee/Rect Channel Flow, ACCESS ROAD CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
1.1	207	Total			

Subcatchment 114:



Subcatchment 115:

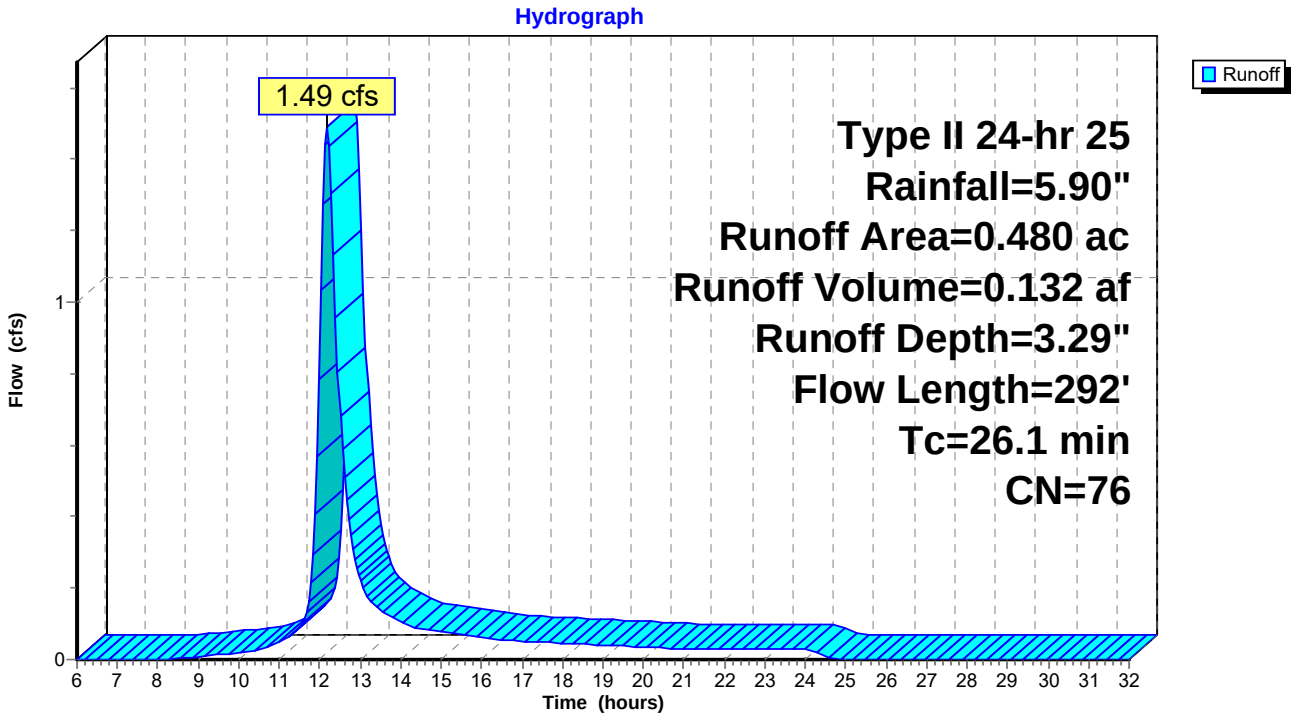
Runoff = 1.49 cfs @ 12.20 hrs, Volume= 0.132 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.480	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	74	0.0100	0.1		**Sheet Flow,** n= 0.200 P2= 3.20"
13.3	218	0.0030	0.3		**Shallow Concentrated Flow, DIVERSION BERM FLOW** Kv= 5.0 fps
26.1	292	Total			

Subcatchment 115:



Subcatchment 116:

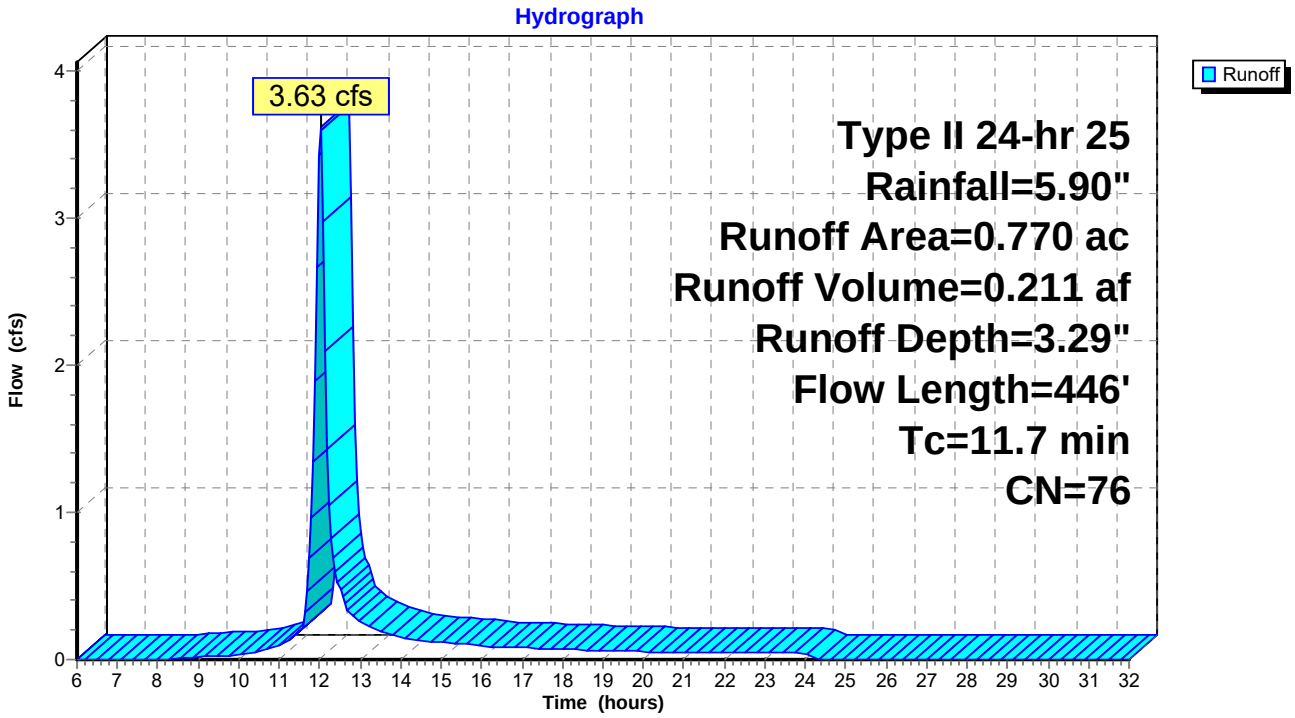
Runoff = 3.63 cfs @ 12.04 hrs, Volume= 0.211 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.770	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1600	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
6.3	346	0.0330	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
11.7	446	Total			

Subcatchment 116:



Subcatchment 117:

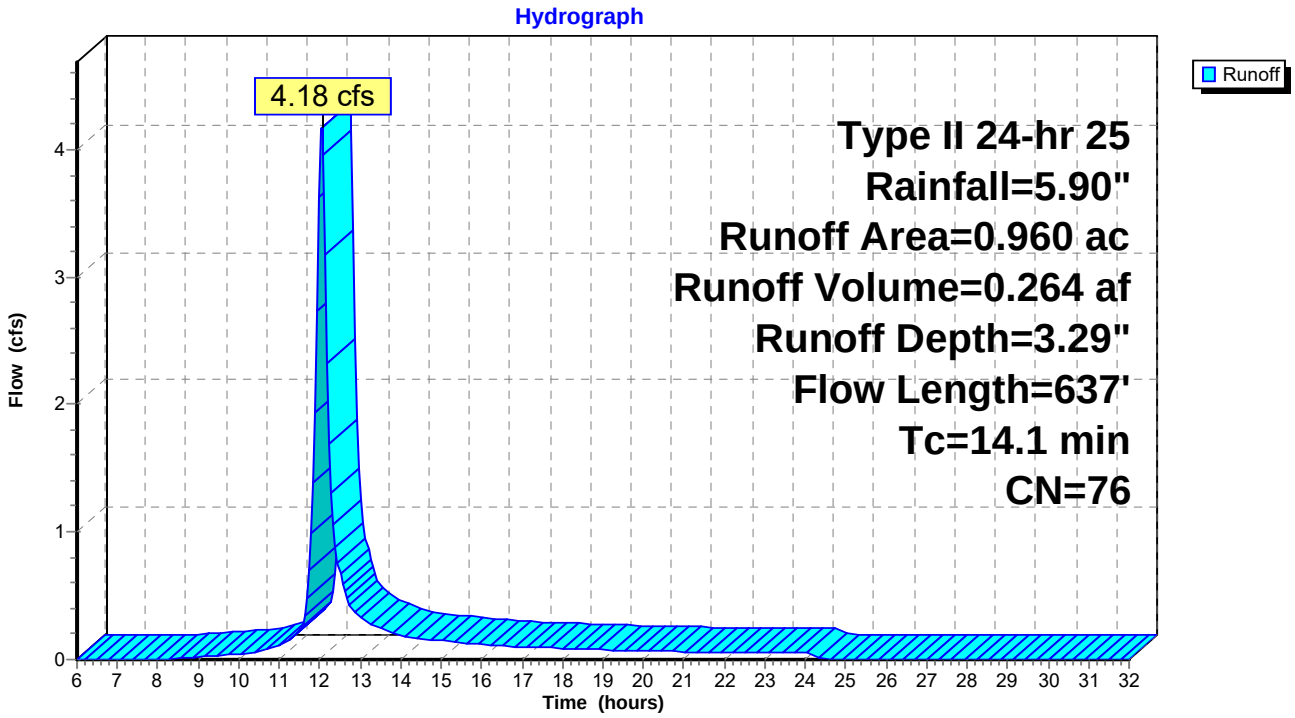
Runoff = 4.18 cfs @ 12.06 hrs, Volume= 0.264 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.960	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	82	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
10.7	555	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
14.1	637	Total			

Subcatchment 117:



Subcatchment 118:

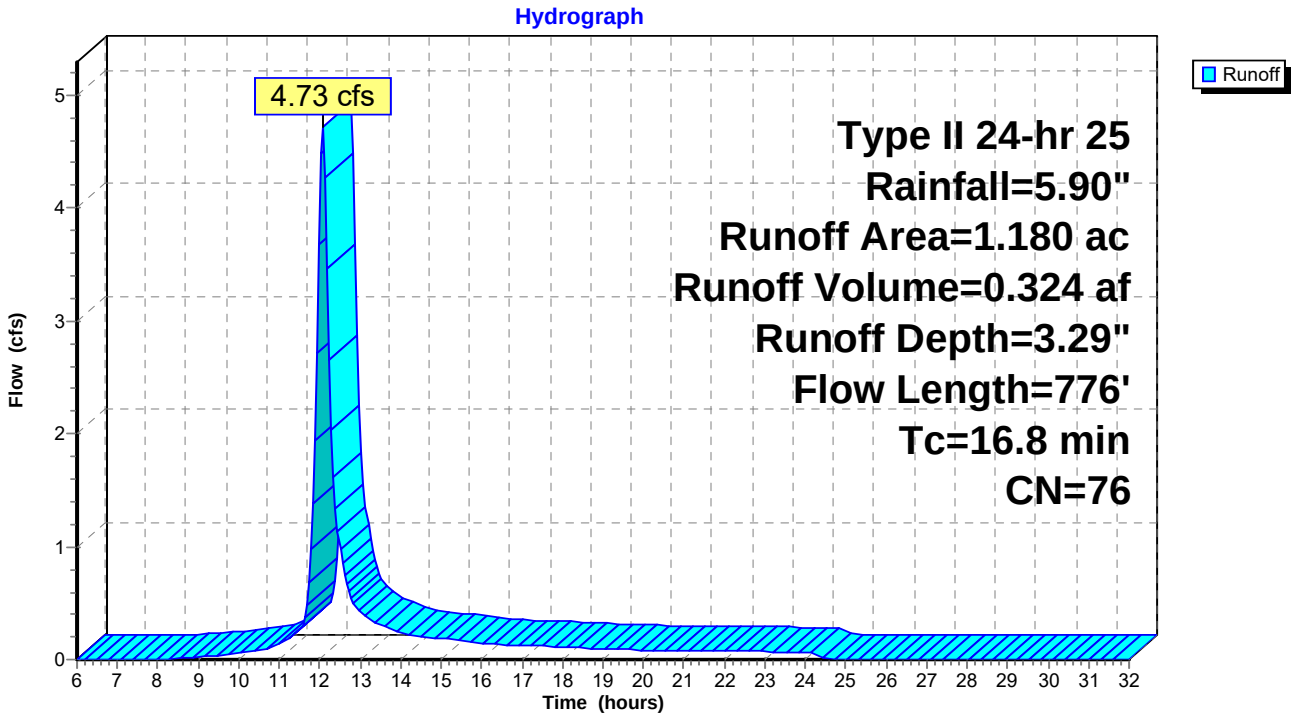
Runoff = 4.73 cfs @ 12.09 hrs, Volume= 0.324 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
1.180	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	80	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
13.4	696	0.0300	0.9		**Shallow Concentrated Flow,** Kv= 5.0 fps
16.8	776	Total			

Subcatchment 118:



Subcatchment 119:

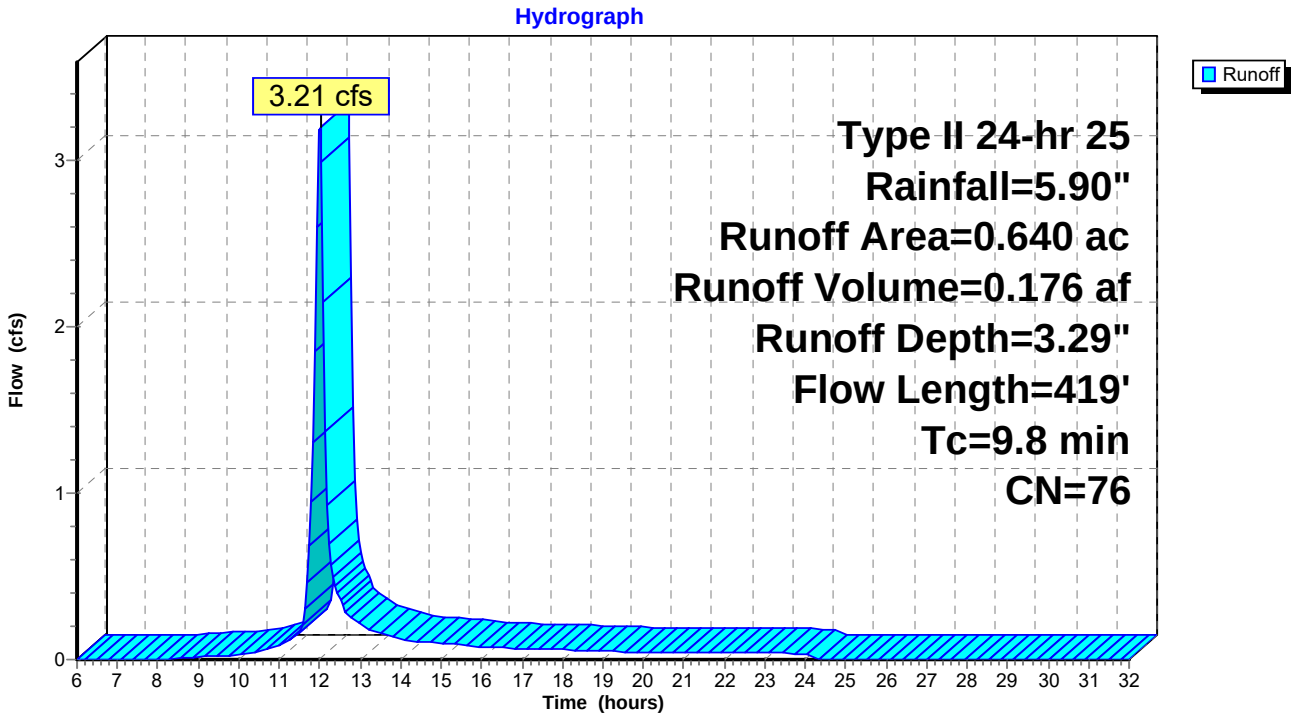
Runoff = 3.21 cfs @ 12.01 hrs, Volume= 0.176 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.640	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	79	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
6.5	340	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.8	419	Total			

Subcatchment 119:



Subcatchment 120:

[49] Hint: Tc<2dt may require smaller dt

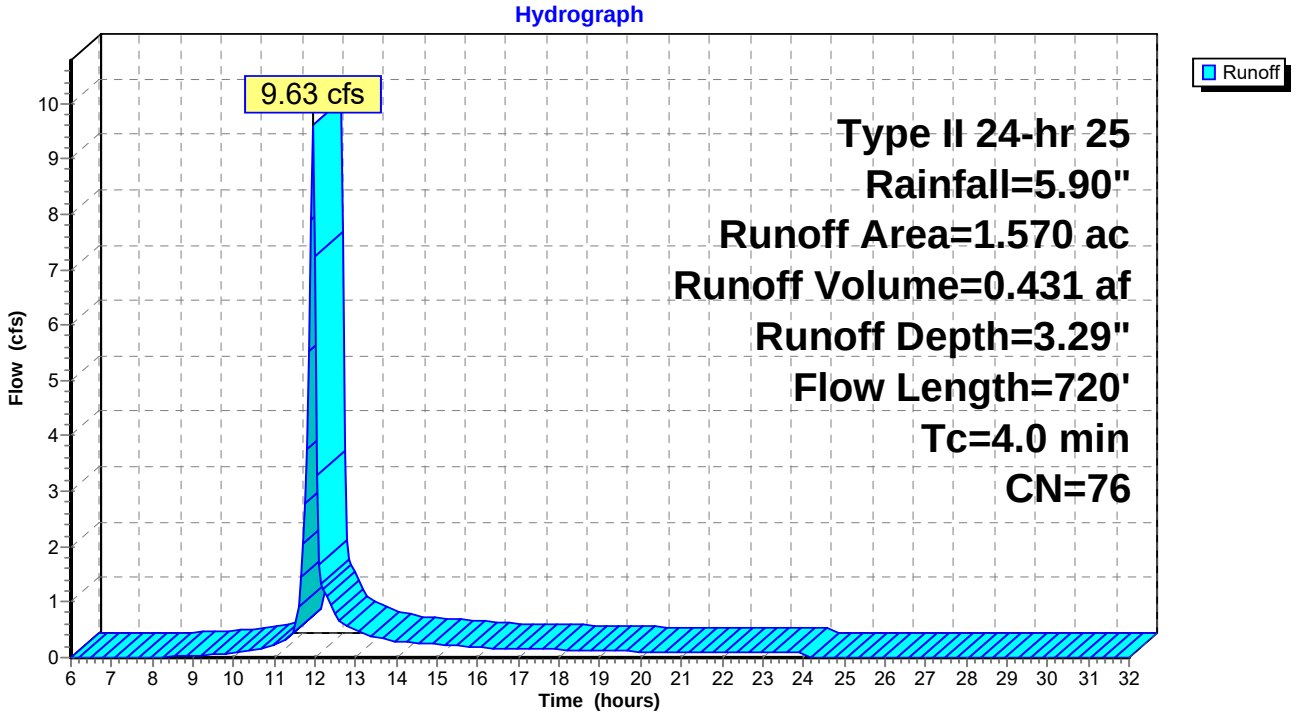
Runoff = 9.63 cfs @ 11.95 hrs, Volume= 0.431 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
1.570	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	83	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.5	637	0.0500	22.6	152.86	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.0	720	Total			

Subcatchment 120:



Subcatchment 121:

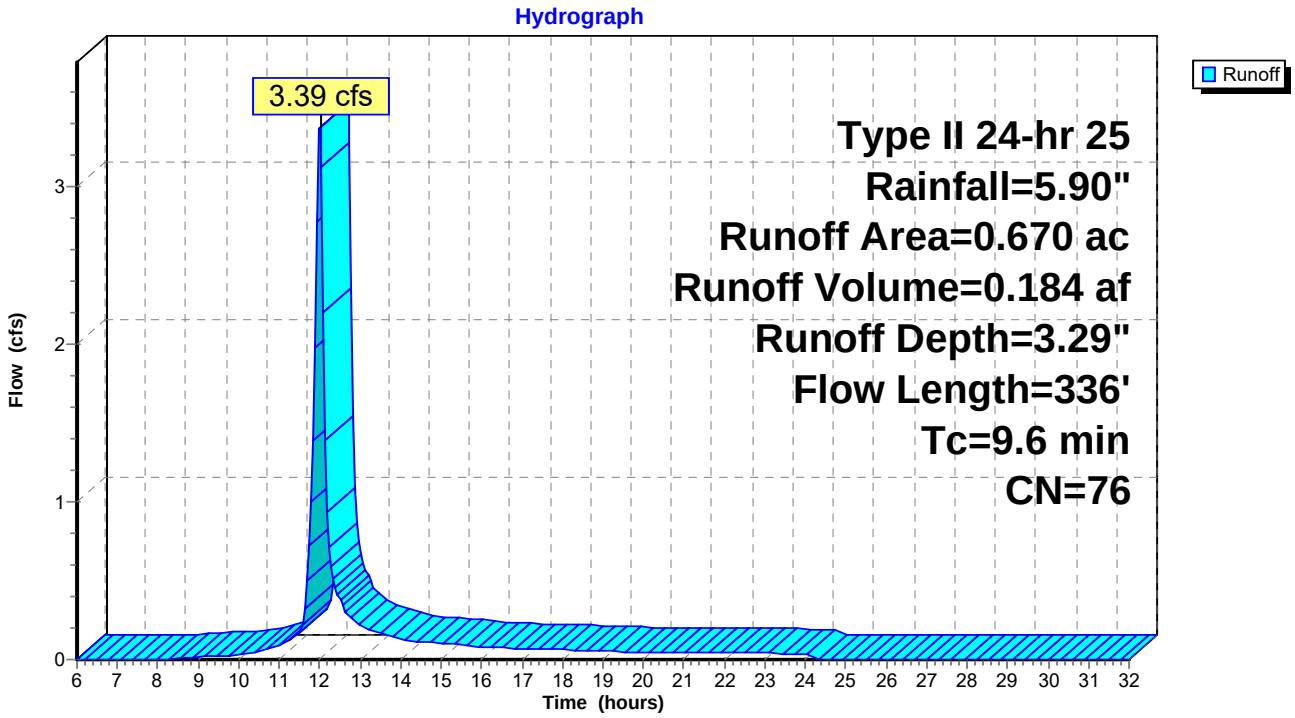
Runoff = 3.39 cfs @ 12.01 hrs, Volume= 0.184 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.670	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1600	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
4.2	236	0.0350	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.6	336	Total			

Subcatchment 121:



Subcatchment 122:

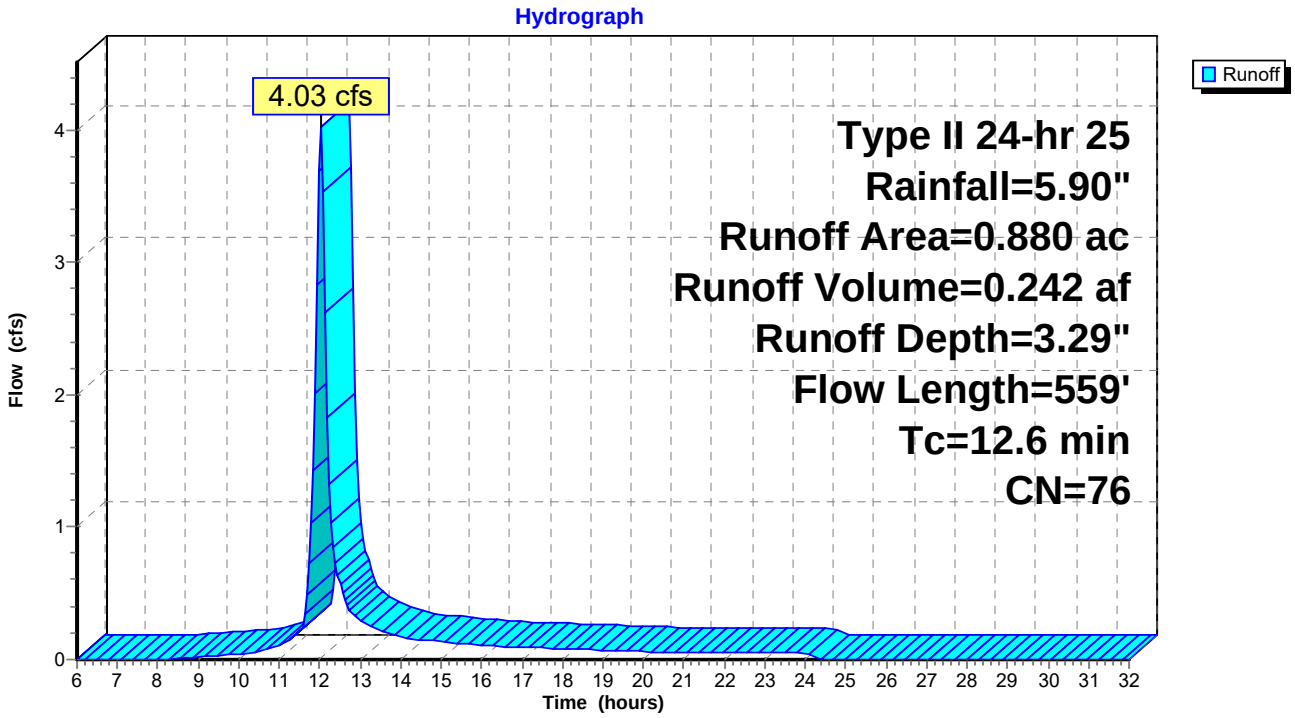
Runoff = 4.03 cfs @ 12.05 hrs, Volume= 0.242 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.880	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	84	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
9.1	475	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
12.6	559	Total			

Subcatchment 122:



Subcatchment 123:

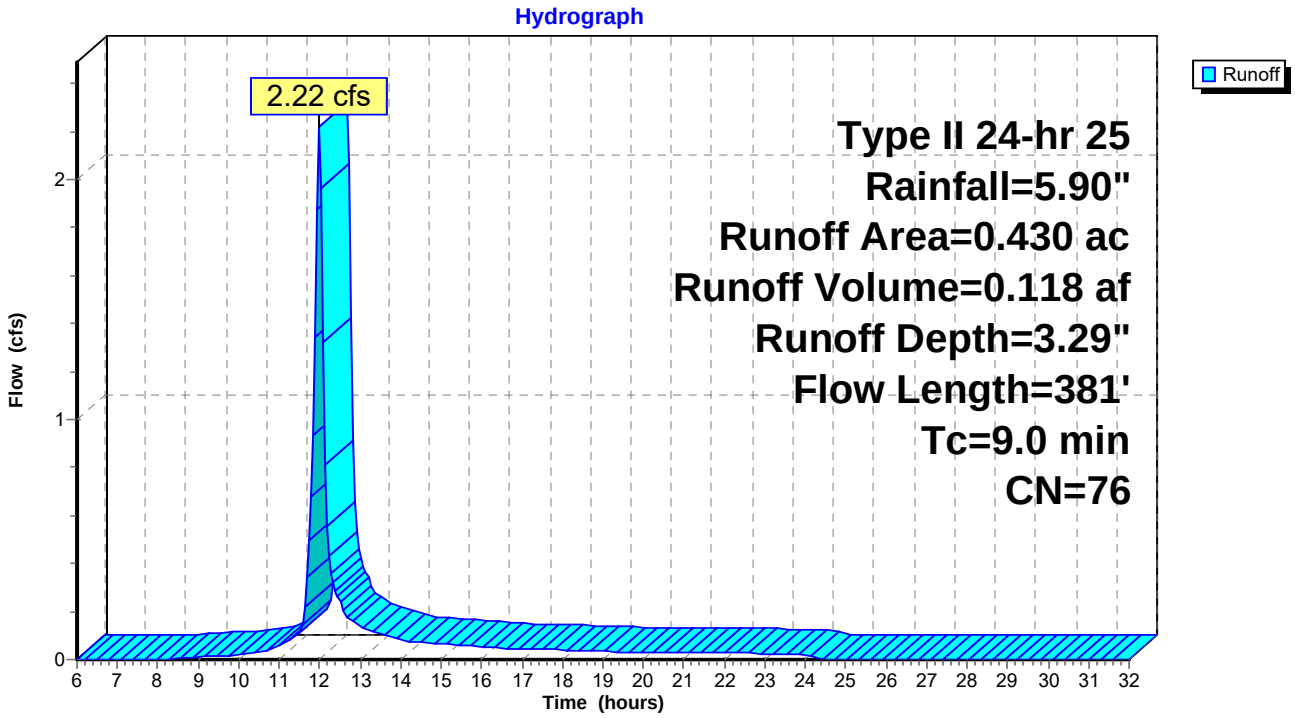
Runoff = 2.22 cfs @ 12.00 hrs, Volume= 0.118 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.430	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	72	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
5.9	309	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.0	381	Total			

Subcatchment 123:



Subcatchment 124:

[49] Hint: Tc<2dt may require smaller dt

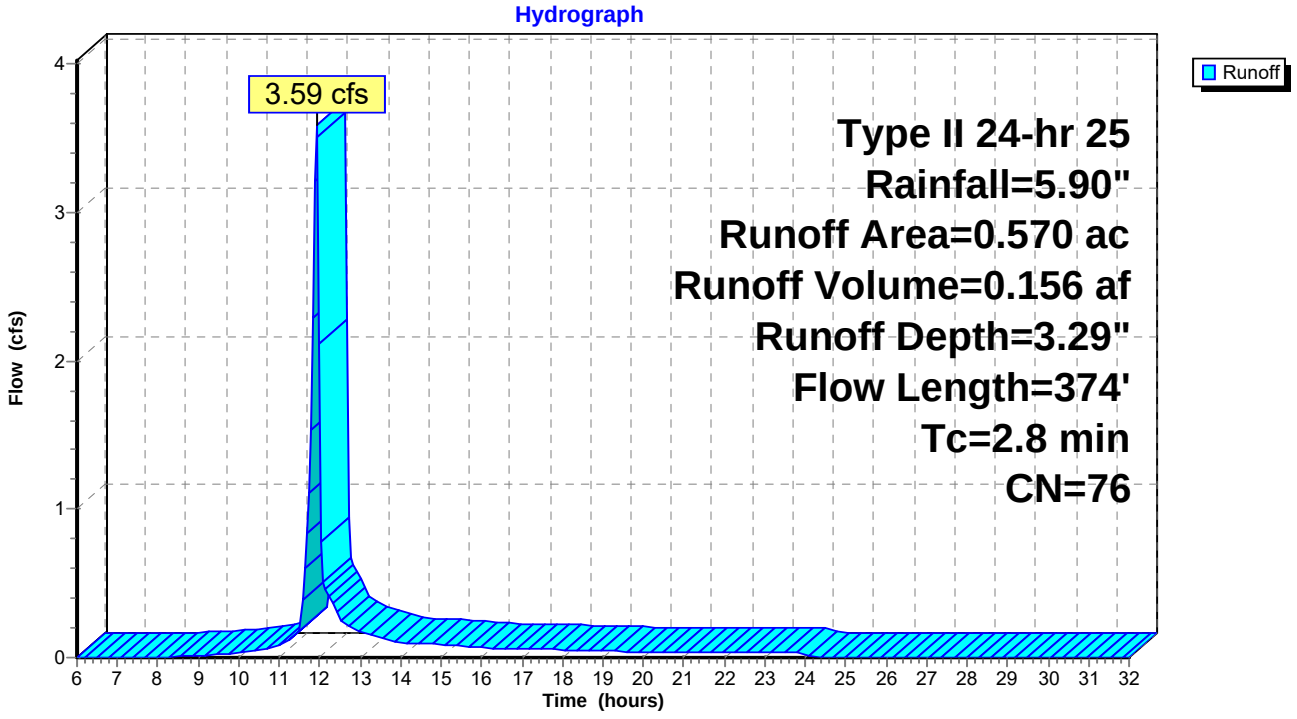
Runoff = 3.59 cfs @ 11.93 hrs, Volume= 0.156 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.570	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	58	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.2	316	0.0800	26.7	140.43	**Trap/Vee/Rect Channel Flow, MSE CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
2.8	374	Total			

Subcatchment 124:



Subcatchment 125:

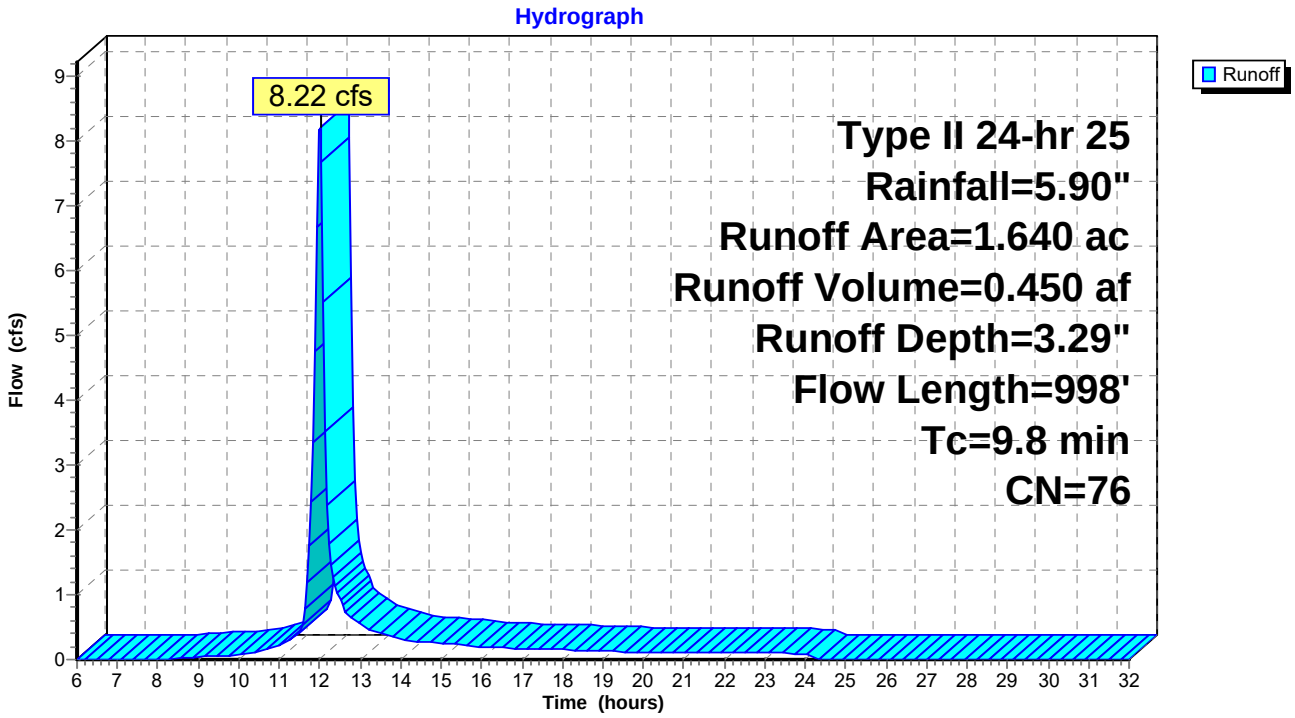
Runoff = 8.22 cfs @ 12.01 hrs, Volume= 0.450 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
1.640	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	62	0.0200	0.1		**Sheet Flow,** n= 0.200 P2= 3.20"
1.4	936	0.0800	11.5	80.16	**Trap/Vee/Rect Channel Flow, EXTERIOR CHANNEL** Bot.W=5.00' D=1.00' Z= 2.0 '/' Top.W=9.00' n= 0.030
9.8	998	Total			

Subcatchment 125:



Subcatchment 126:

[49] Hint: Tc<2dt may require smaller dt

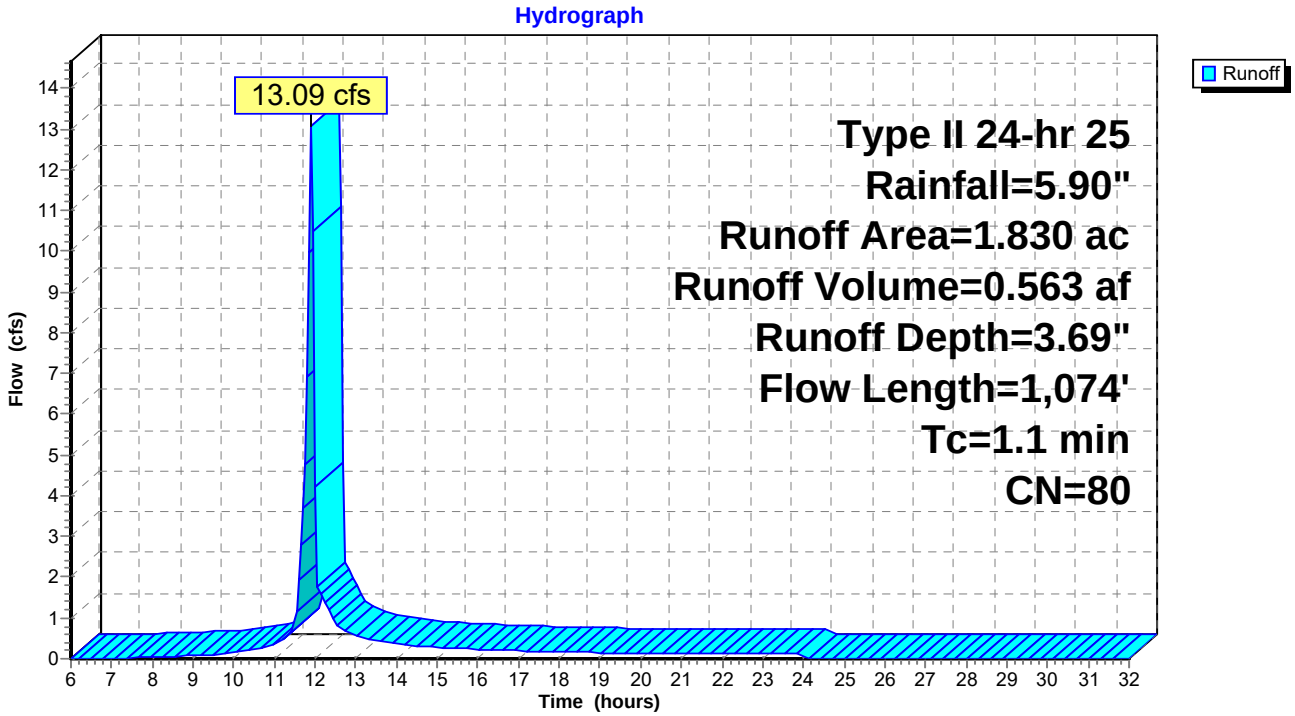
Runoff = 13.09 cfs @ 11.90 hrs, Volume= 0.563 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
1.830	80	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	1,074	0.0600	16.4	51.46	**Circular Channel (pipe), PIPE** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.014

Subcatchment 126:



Subcatchment 127:

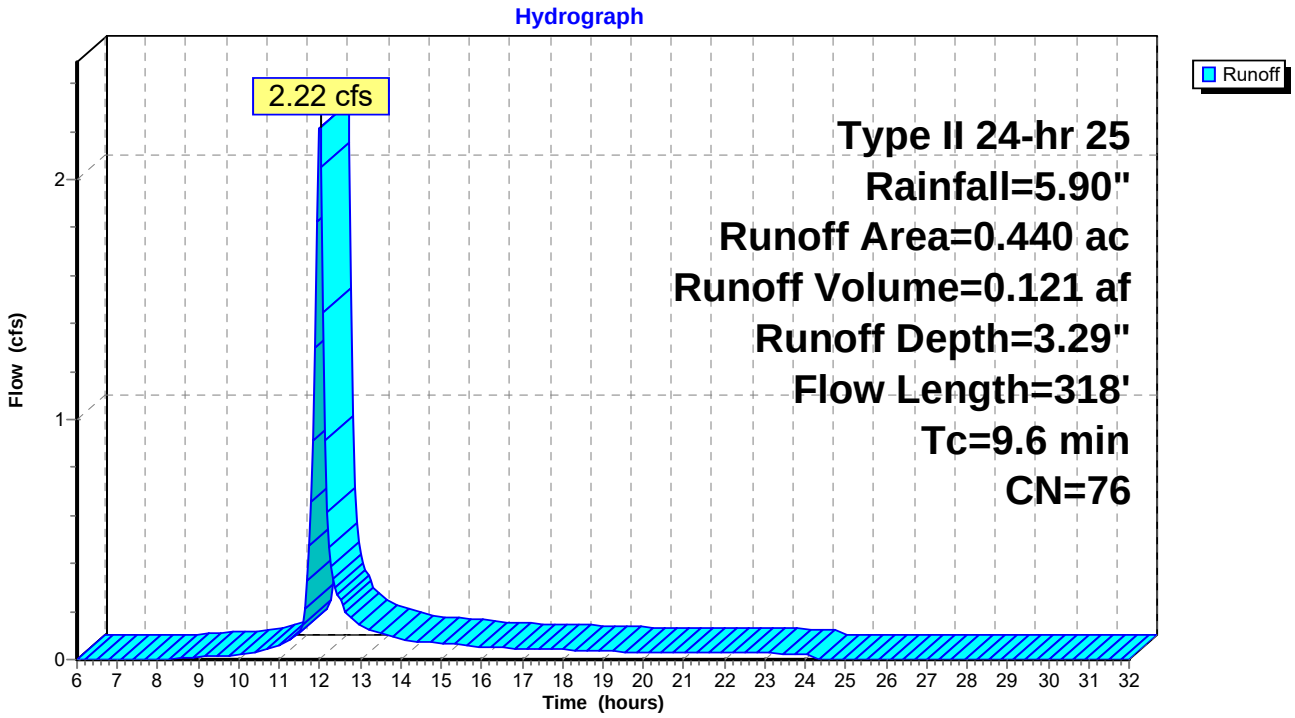
Runoff = 2.22 cfs @ 12.01 hrs, Volume= 0.121 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.440	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	98	0.1500	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
4.2	220	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.6	318	Total			

Subcatchment 127:



Subcatchment 128:

[49] Hint: Tc<2dt may require smaller dt

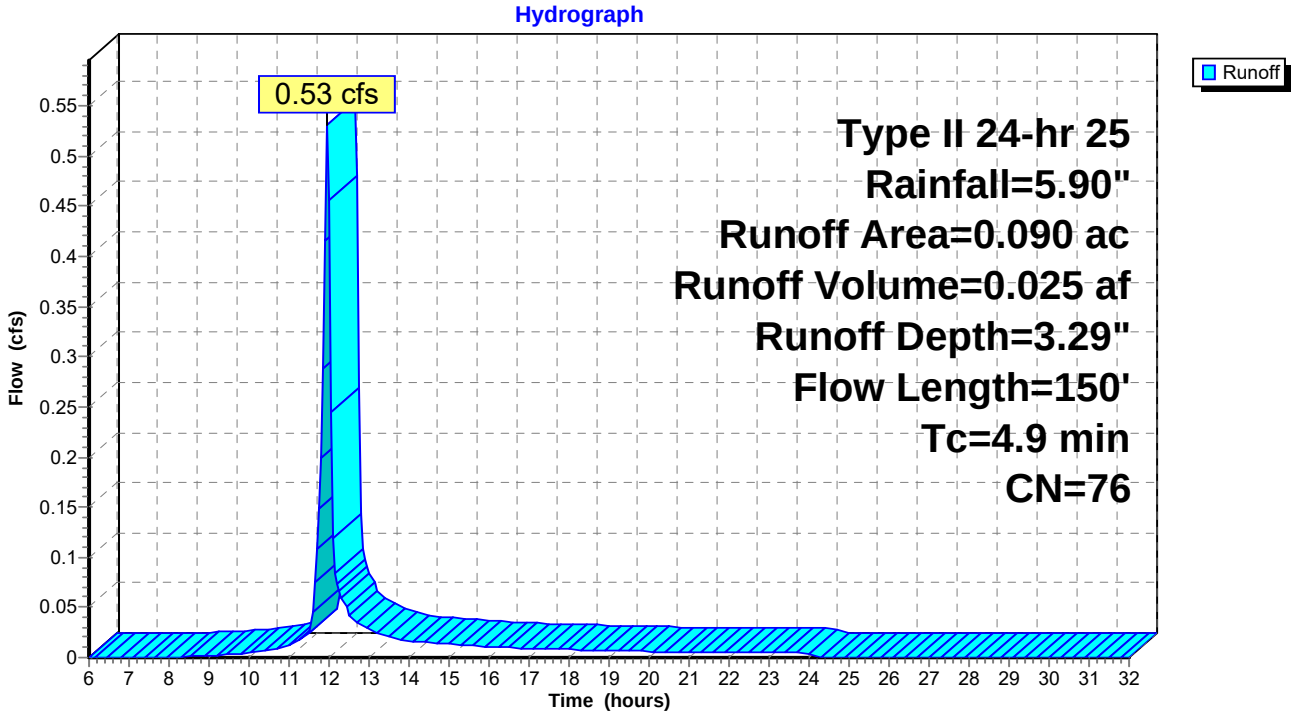
Runoff = 0.53 cfs @ 11.96 hrs, Volume= 0.025 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.090	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	93	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
1.1	57	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
4.9	150	Total			

Subcatchment 128:



Subcatchment 129:

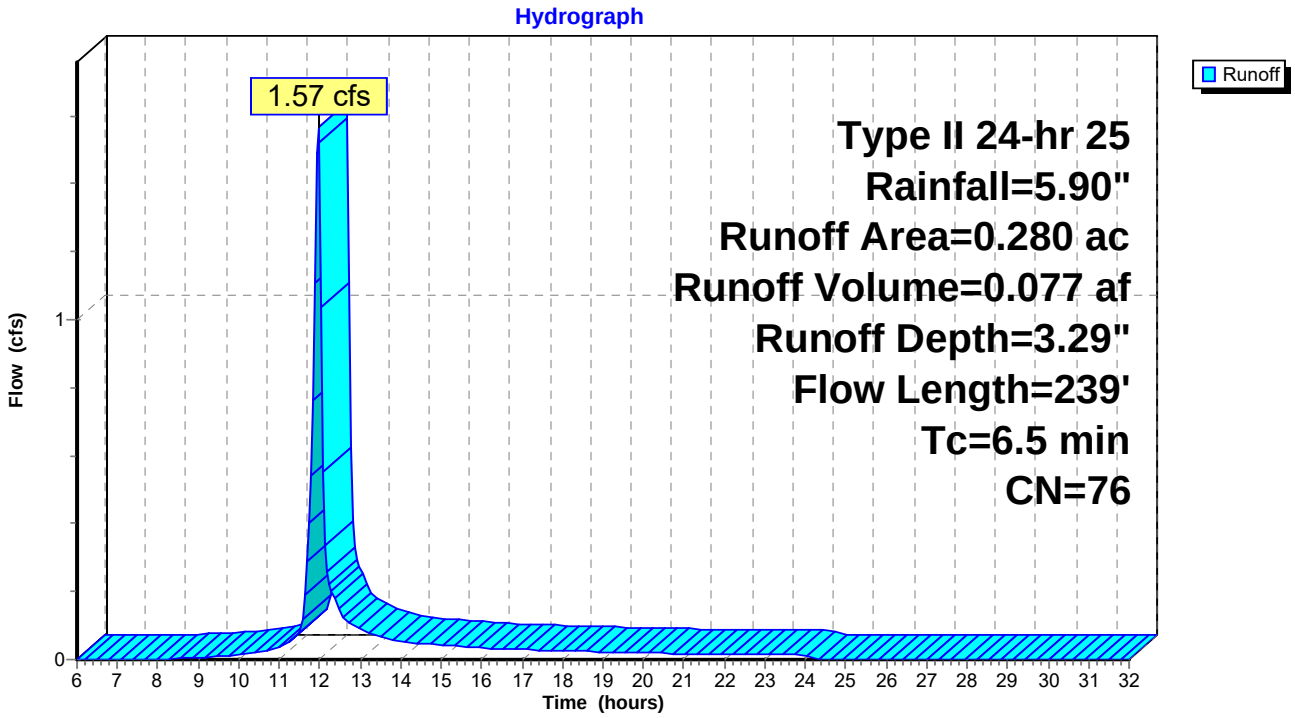
Runoff = 1.57 cfs @ 11.98 hrs, Volume= 0.077 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.280	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	91	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
2.8	148	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
6.5	239	Total			

Subcatchment 129:



Subcatchment 130:

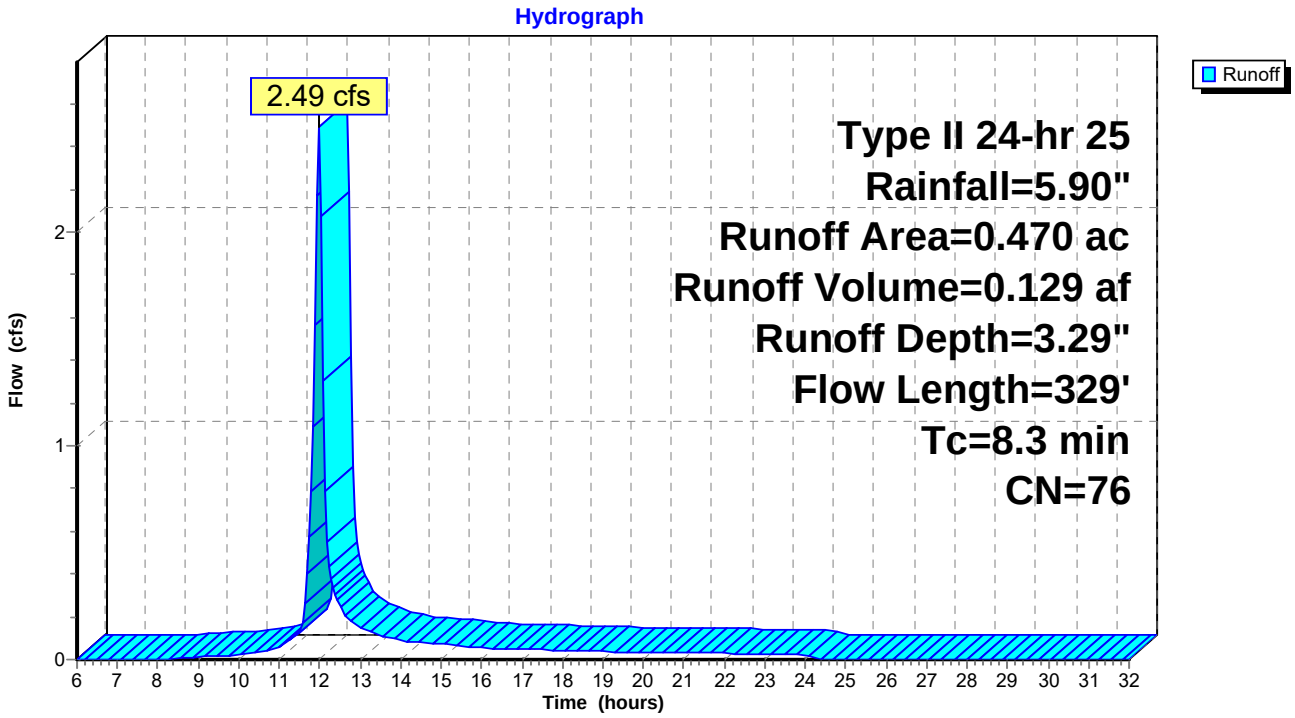
Runoff = 2.49 cfs @ 12.00 hrs, Volume= 0.129 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.470	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	94	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
4.5	235	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
8.3	329	Total			

Subcatchment 130:



Subcatchment 131:

[49] Hint: Tc<2dt may require smaller dt

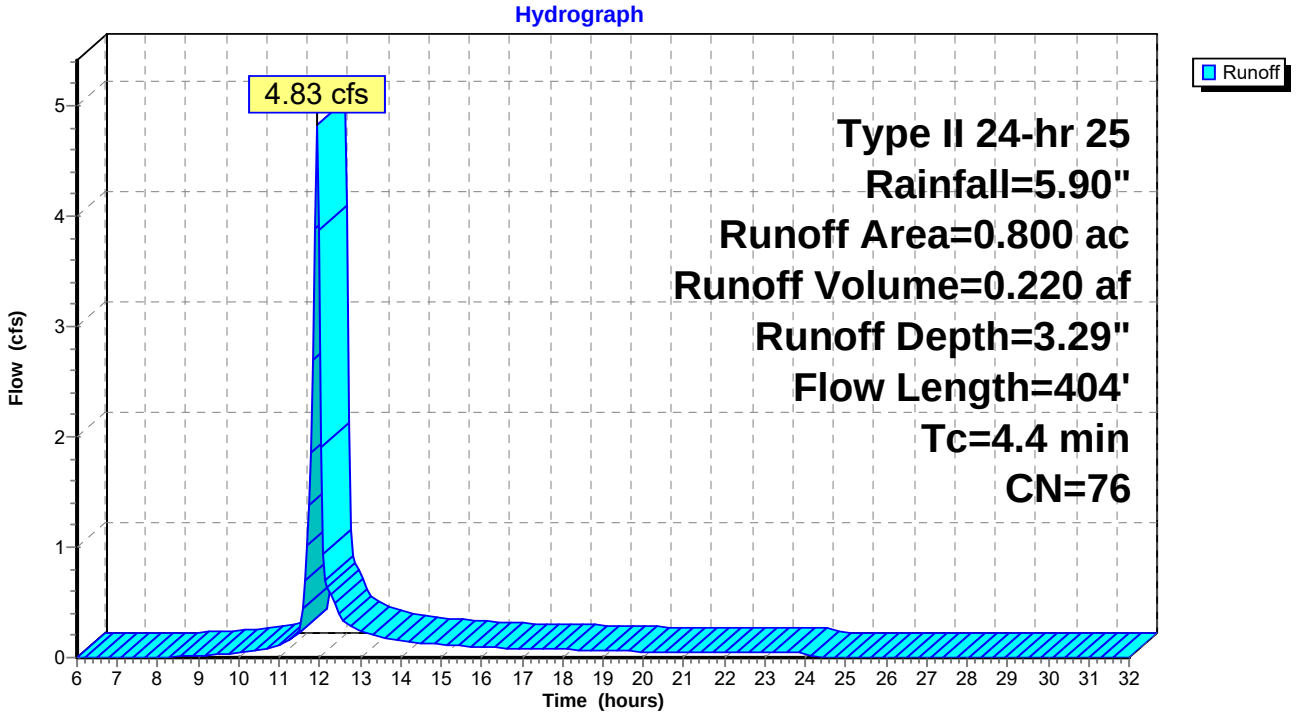
Runoff = 4.83 cfs @ 11.95 hrs, Volume= 0.220 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.800	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	97	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.5	307	0.0090	9.6	64.85	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.4	404	Total			

Subcatchment 131:



Subcatchment 132:

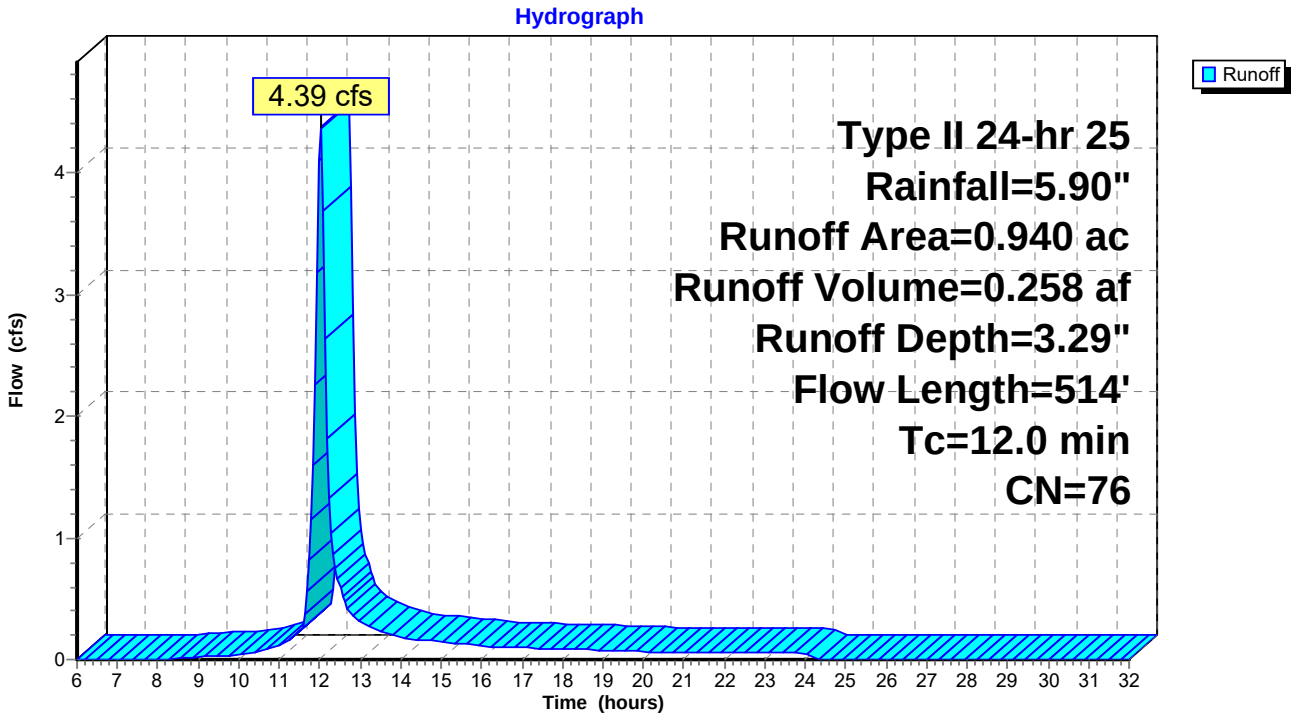
Runoff = 4.39 cfs @ 12.04 hrs, Volume= 0.258 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
0.940	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
8.0	414	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
12.0	514	Total			

Subcatchment 132:



Subcatchment 133:

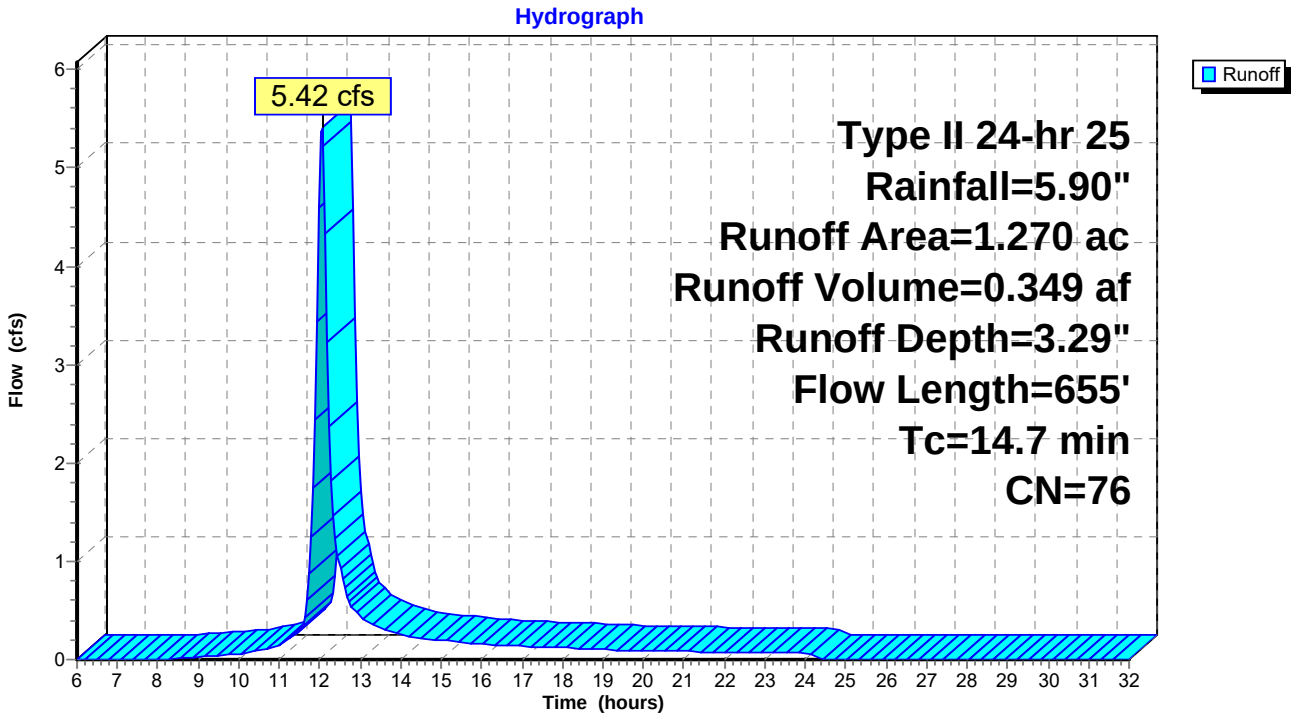
Runoff = 5.42 cfs @ 12.07 hrs, Volume= 0.349 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
1.270	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
10.7	555	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
14.7	655	Total			

Subcatchment 133:



Subcatchment 134:

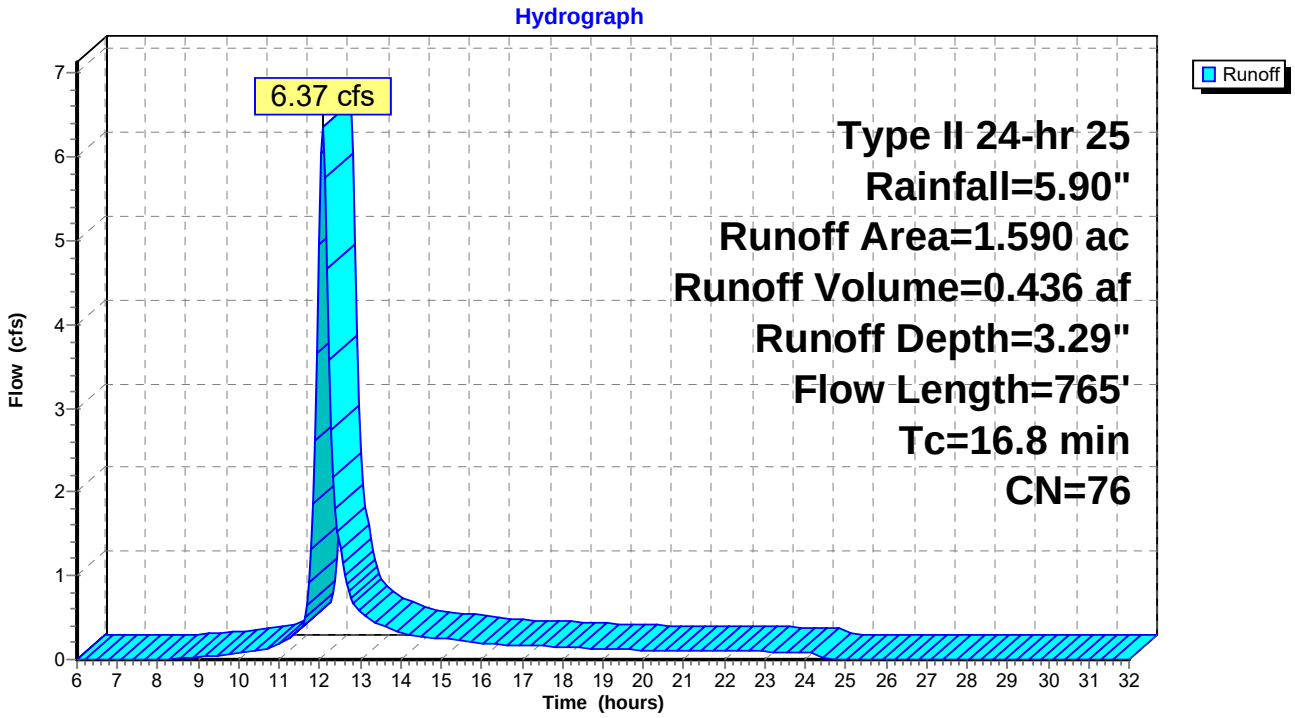
Runoff = 6.37 cfs @ 12.09 hrs, Volume= 0.436 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
1.590	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
12.8	665	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
16.8	765	Total			

Subcatchment 134:



Subcatchment 135:

[49] Hint: Tc<2dt may require smaller dt

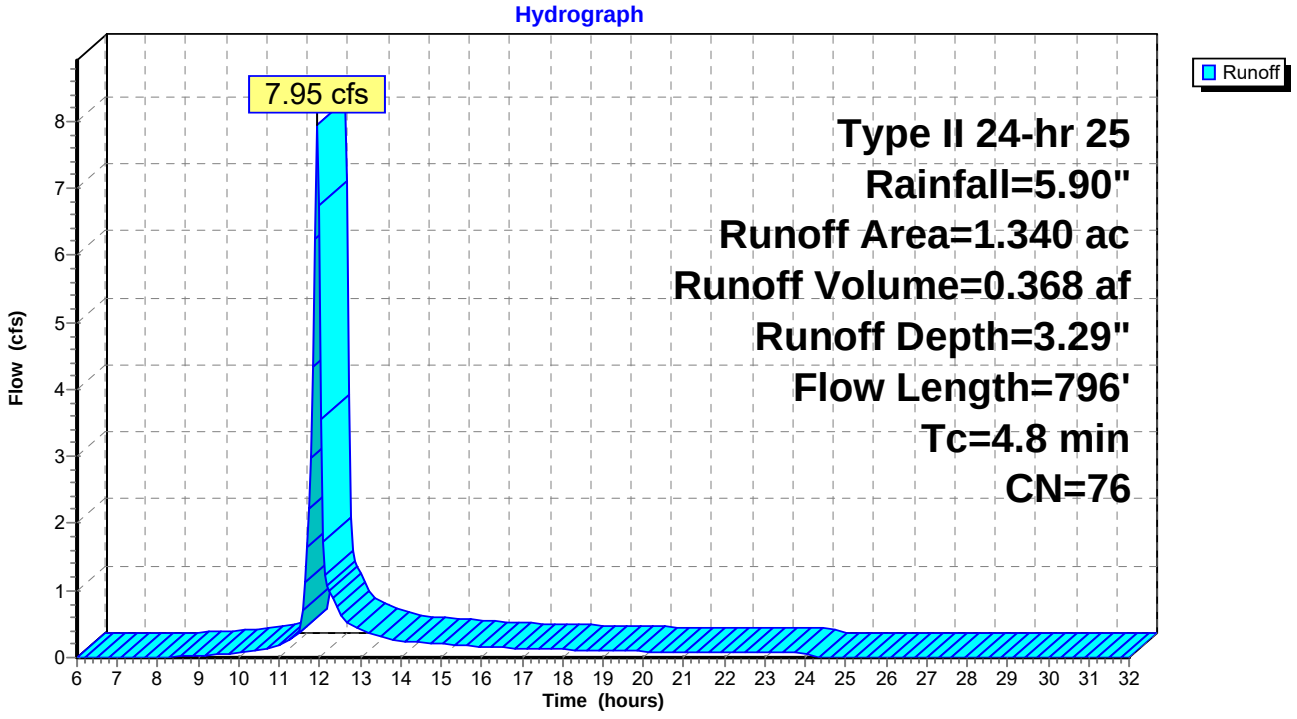
Runoff = 7.95 cfs @ 11.95 hrs, Volume= 0.368 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
1.340	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	82	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
1.4	714	0.0070	8.5	57.19	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.8	796	Total			

Subcatchment 135:



Subcatchment 136:

[49] Hint: Tc<2dt may require smaller dt

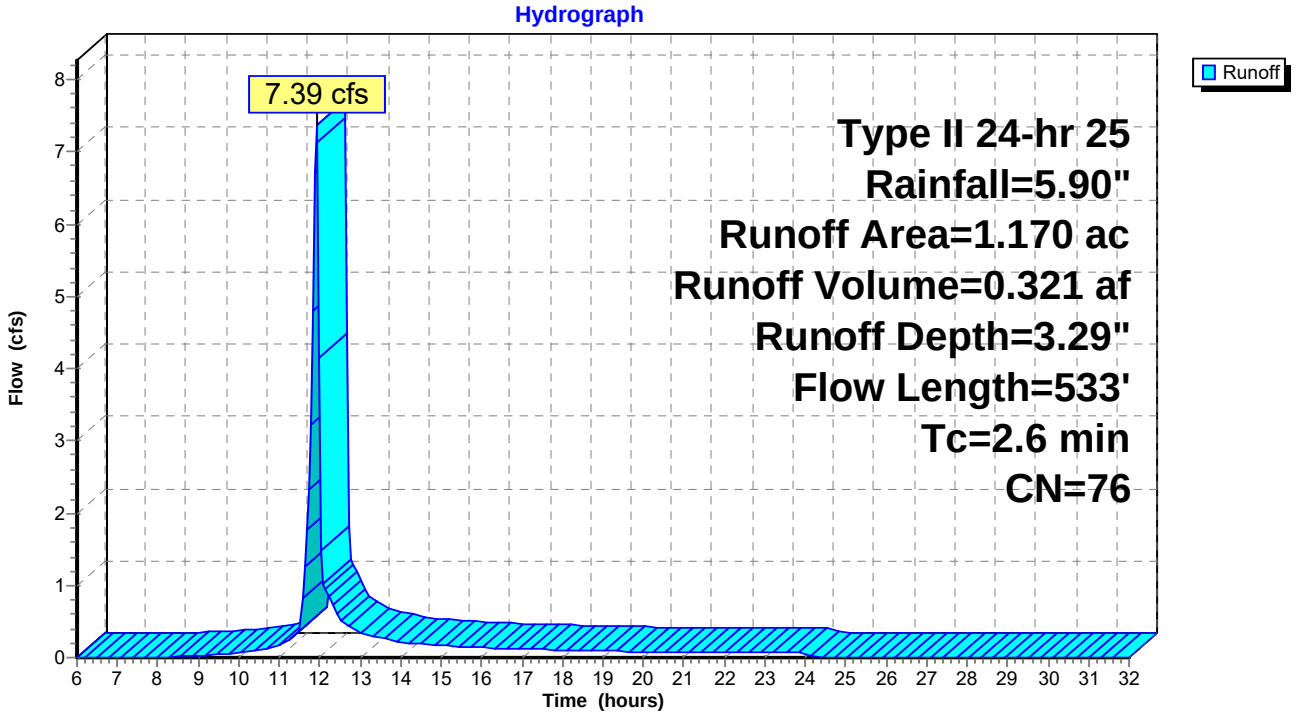
Runoff = 7.39 cfs @ 11.93 hrs, Volume= 0.321 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
1.170	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	36	0.3300	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.8	497	0.0100	10.1	68.36	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
2.6	533	Total			

Subcatchment 136:



Subcatchment PWL-1:

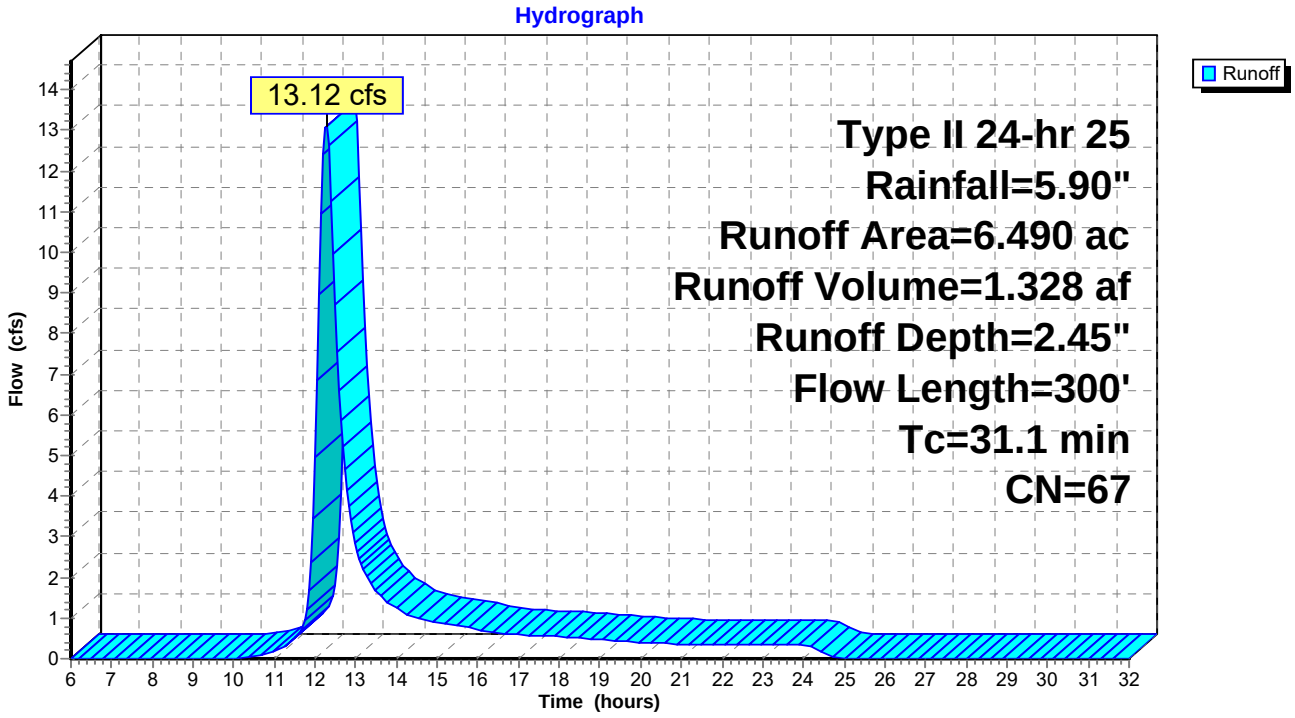
Runoff = 13.12 cfs @ 12.27 hrs, Volume= 1.328 af, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
6.490	67	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	300	0.0100	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PWL-1:



Subcatchment PWL-2:

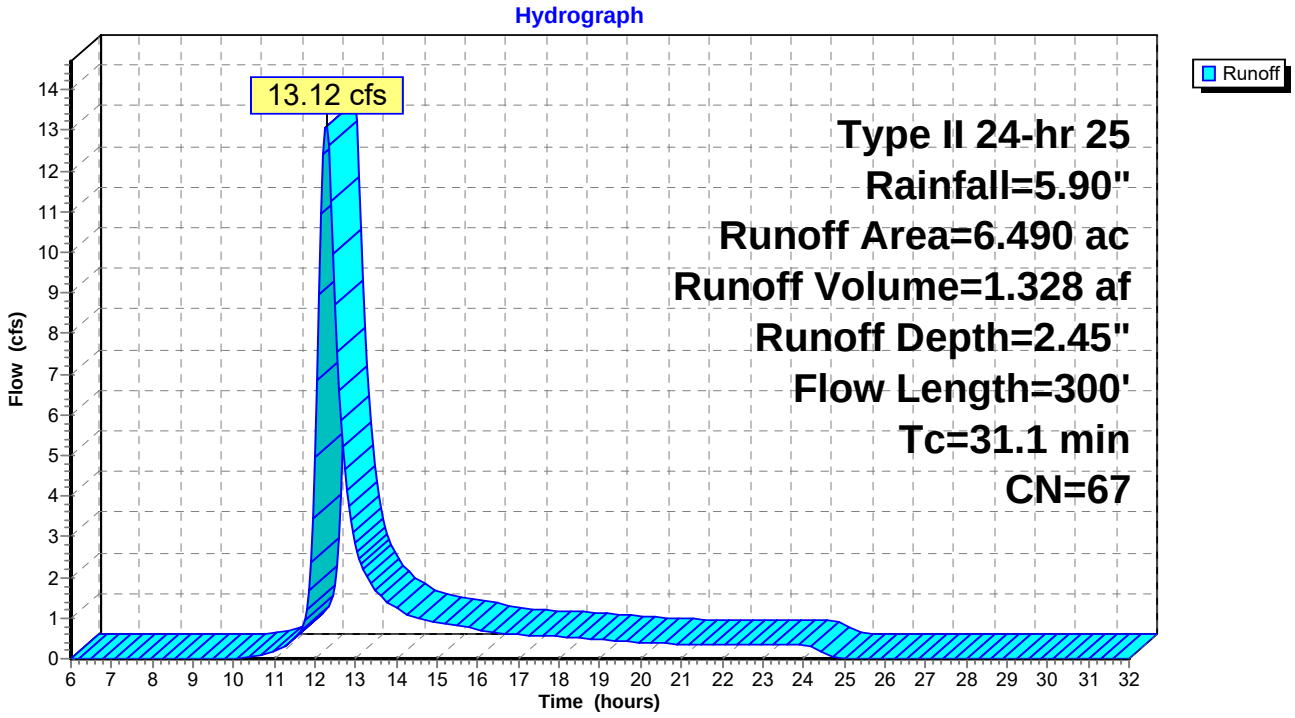
Runoff = 13.12 cfs @ 12.27 hrs, Volume= 1.328 af, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
6.490	67	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	300	0.0100	0.2		**Sheet Flow,** n= 0.150 P2= 3.20"

Subcatchment PWL-2:



Subcatchment PWL-3:

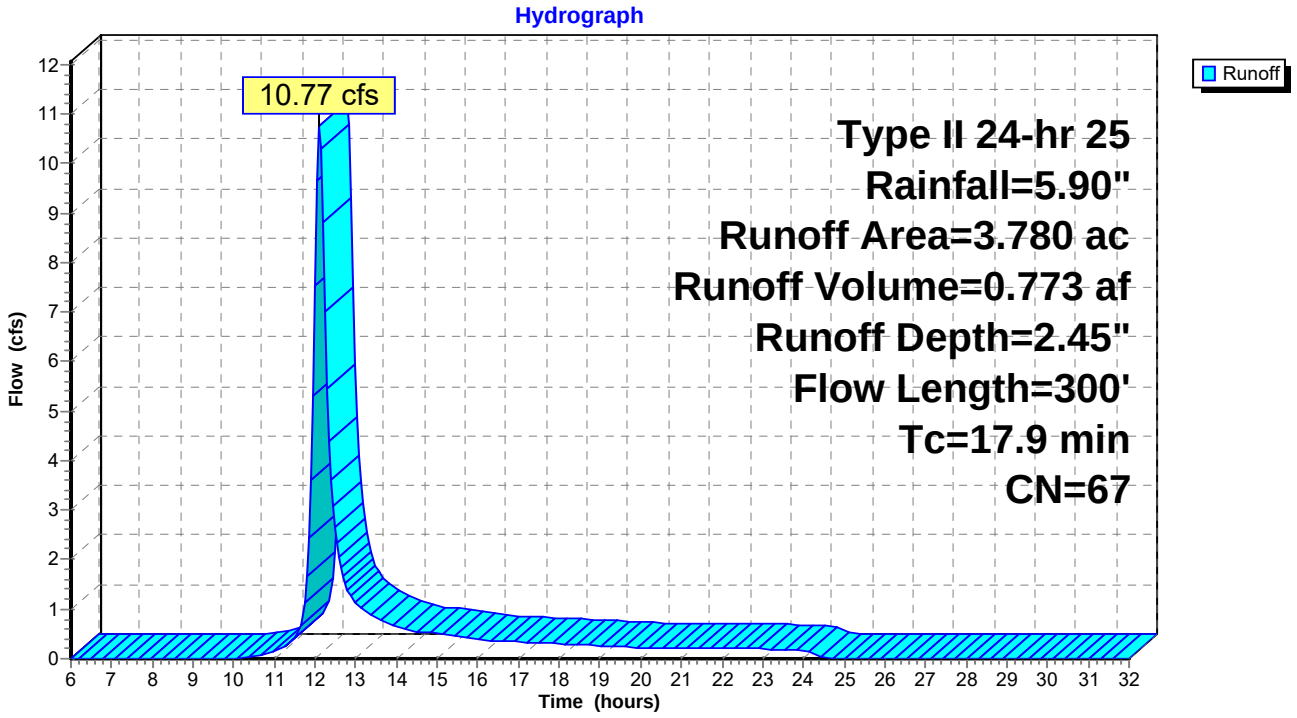
Runoff = 10.77 cfs @ 12.11 hrs, Volume= 0.773 af, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Rainfall=5.90"

Area (ac)	CN	Description
3.780	67	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	300	0.0400	0.3		**Sheet Flow,** n= 0.150 P2= 3.20"

Subcatchment PWL-3:



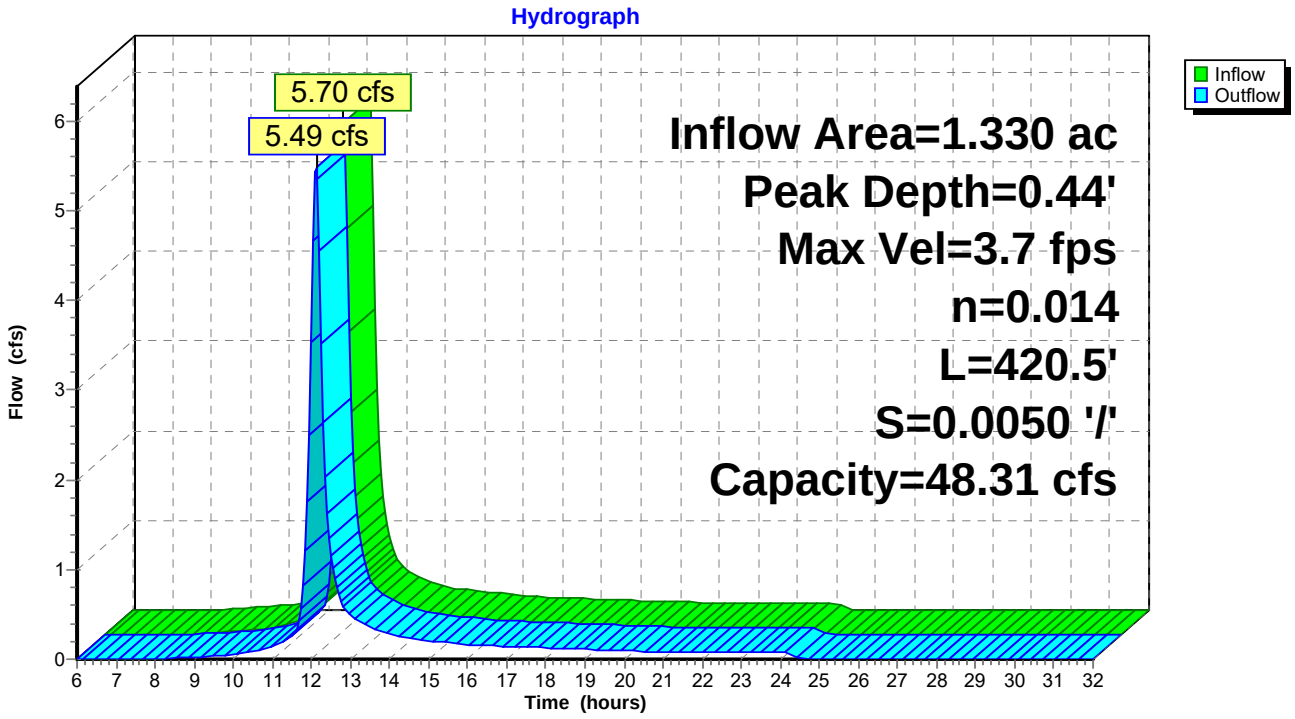
Reach 01-05: PERIMETER CHANNEL

Inflow Area = 1.330 ac, Inflow Depth = 3.29" for 25 event
Inflow = 5.70 cfs @ 12.07 hrs, Volume= 0.365 af
Outflow = 5.49 cfs @ 12.12 hrs, Volume= 0.365 af, Atten= 4%, Lag= 3.3 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.7 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 0.9 fps, Avg. Travel Time= 7.4 min

Peak Depth= 0.44' @ 12.09 hrs
Capacity at bank full= 48.31 cfs
Inlet Invert= 110.00', Outlet Invert= 107.90'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 420.5' Slope= 0.0050 '/'

Reach 01-05: PERIMETER CHANNEL



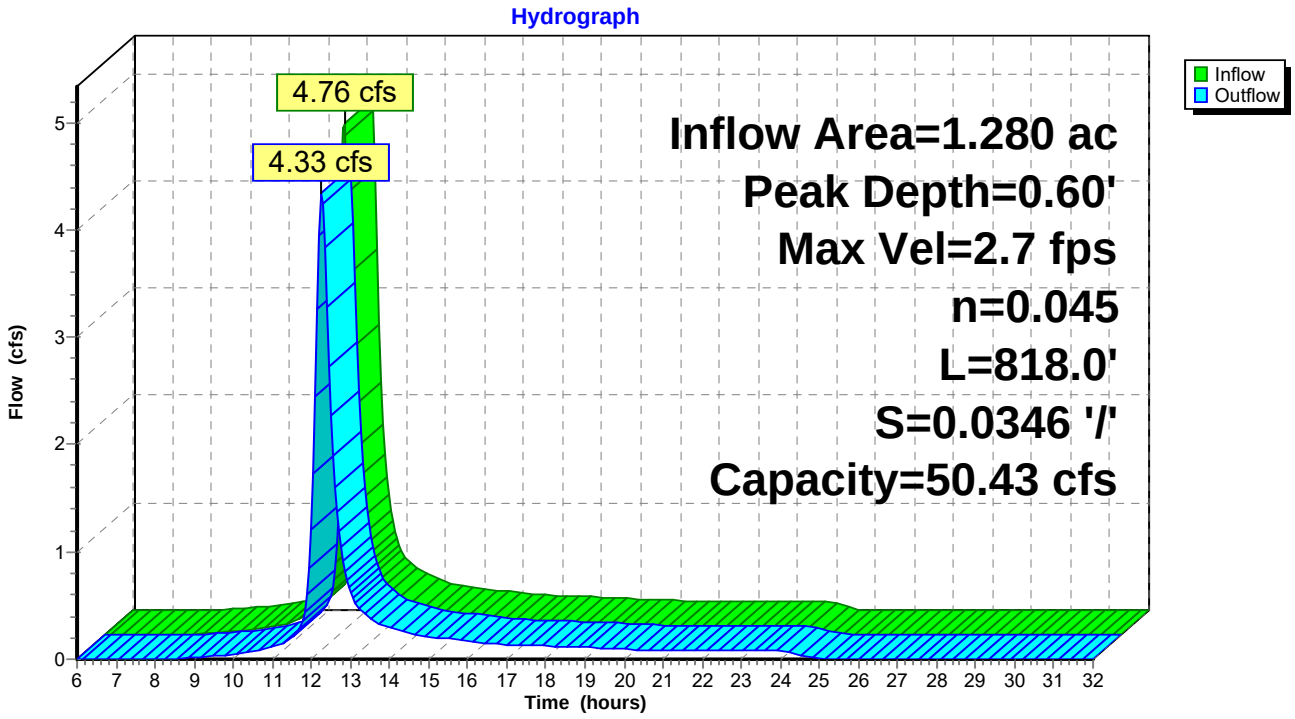
Reach 02-06: BENCH

Inflow Area = 1.280 ac, Inflow Depth = 3.29" for 25 event
Inflow = 4.76 cfs @ 12.12 hrs, Volume= 0.351 af
Outflow = 4.33 cfs @ 12.27 hrs, Volume= 0.351 af, Atten= 9%, Lag= 8.8 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.7 fps, Min. Travel Time= 5.1 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 14.3 min

Peak Depth= 0.60' @ 12.18 hrs
Capacity at bank full= 50.43 cfs
Inlet Invert= 130.00', Outlet Invert= 101.70'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 818.0' Slope= 0.0346 '/'

Reach 02-06: BENCH



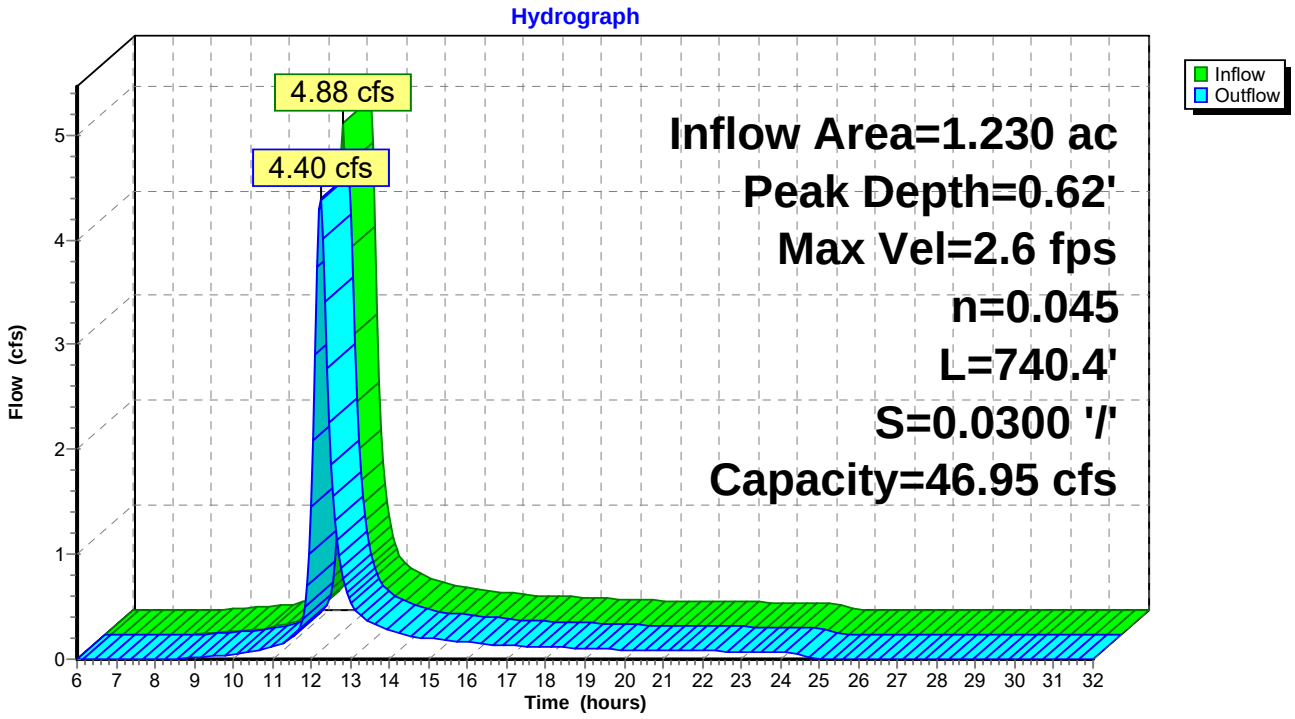
Reach 03-09: BENCH

Inflow Area = 1.230 ac, Inflow Depth = 3.29" for 25 event
Inflow = 4.88 cfs @ 12.10 hrs, Volume= 0.338 af
Outflow = 4.40 cfs @ 12.23 hrs, Volume= 0.338 af, Atten= 10%, Lag= 8.3 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.6 fps, Min. Travel Time= 4.8 min
Avg. Velocity = 0.9 fps, Avg. Travel Time= 13.8 min

Peak Depth= 0.62' @ 12.15 hrs
Capacity at bank full= 46.95 cfs
Inlet Invert= 152.21', Outlet Invert= 130.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 740.4' Slope= 0.0300 '/'

Reach 03-09: BENCH



Reach 04-08: ACCESS ROAD CHANNEL

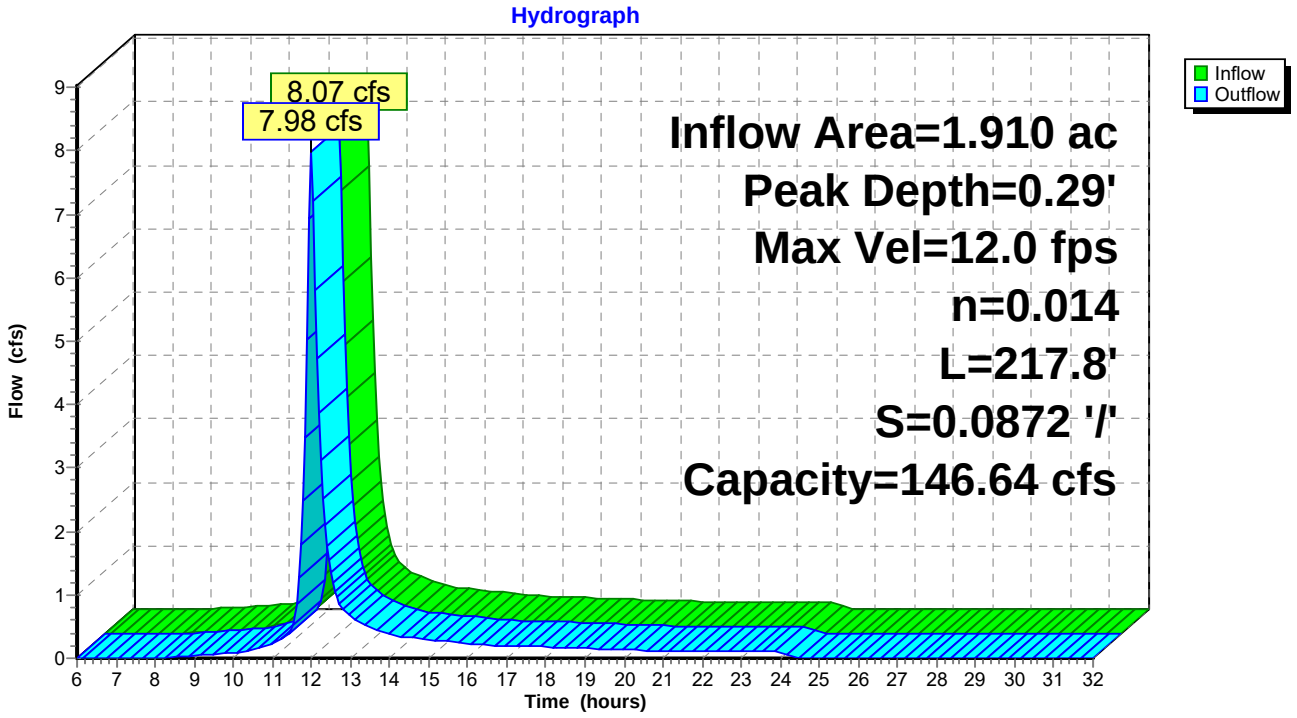
[61] Hint: Submerged 2% of Reach 07-04 bottom

Inflow Area = 1.910 ac, Inflow Depth = 3.29" for 25 event
Inflow = 8.07 cfs @ 12.00 hrs, Volume= 0.524 af
Outflow = 7.98 cfs @ 12.00 hrs, Volume= 0.524 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 12.0 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.2 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.29' @ 12.00 hrs
Capacity at bank full= 146.64 cfs
Inlet Invert= 174.80', Outlet Invert= 155.80'
2.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 5.00'
Length= 217.8' Slope= 0.0872 '/'

Reach 04-08: ACCESS ROAD CHANNEL



Reach 05-06: PERIMETER CHANNEL

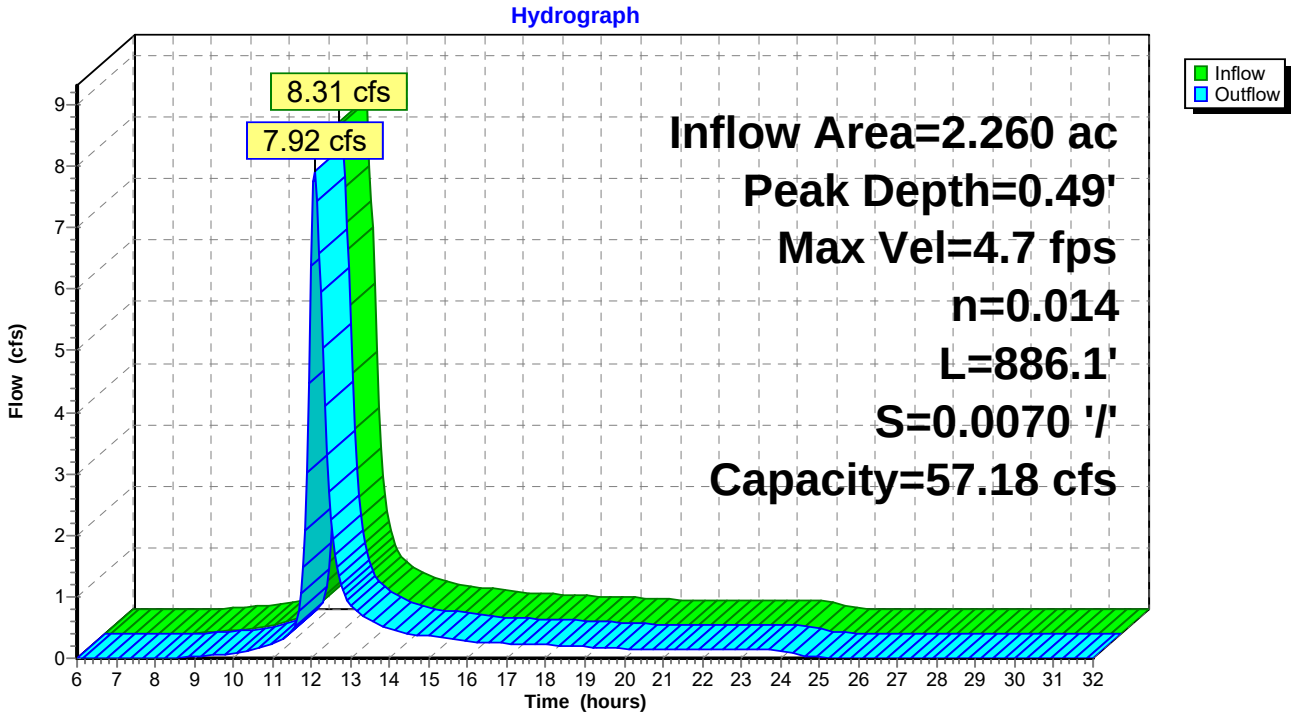
[61] Hint: Submerged 23% of Reach 01-05 bottom

Inflow Area = 2.260 ac, Inflow Depth = 3.29" for 25 event
Inflow = 8.31 cfs @ 11.99 hrs, Volume= 0.620 af
Outflow = 7.92 cfs @ 12.07 hrs, Volume= 0.620 af, Atten= 5%, Lag= 5.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.7 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 1.2 fps, Avg. Travel Time= 12.1 min

Peak Depth= 0.49' @ 12.02 hrs
Capacity at bank full= 57.18 cfs
Inlet Invert= 107.90', Outlet Invert= 101.70'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 886.1' Slope= 0.0070 '/'

Reach 05-06: PERIMETER CHANNEL



Reach 06-10: PERIMETER CHANNEL

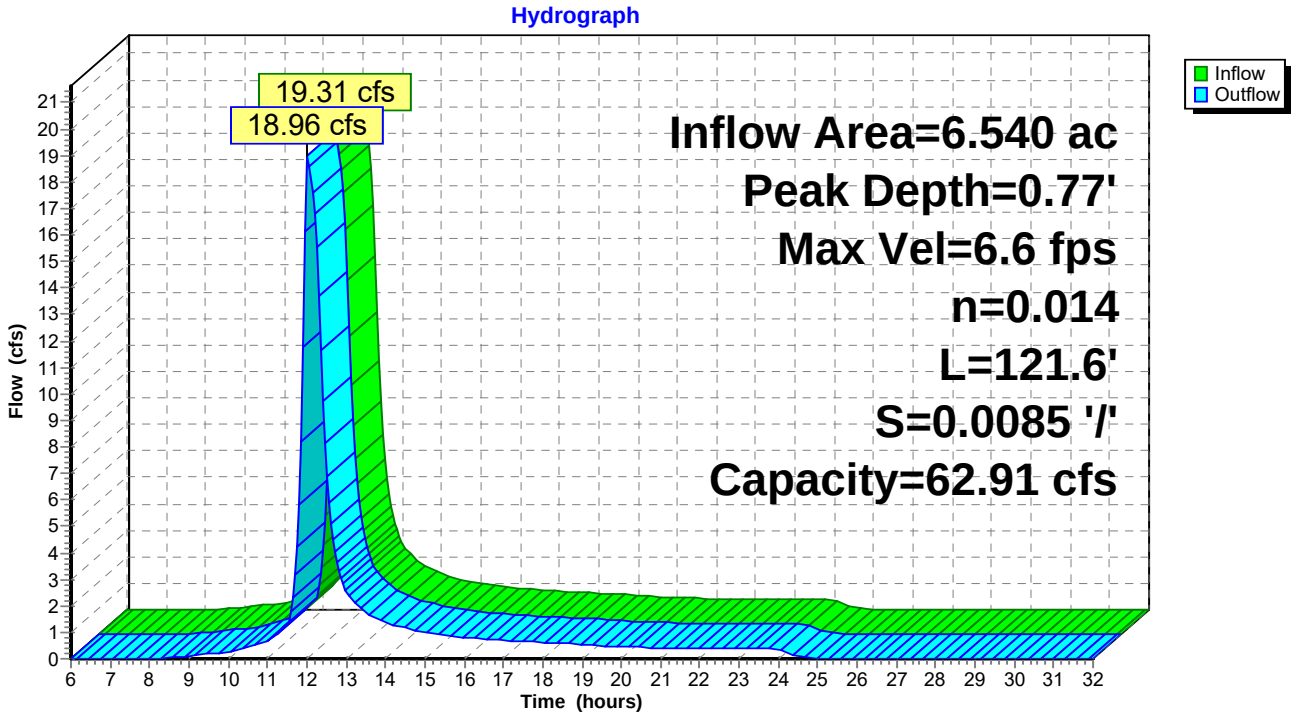
[61] Hint: Submerged 3% of Reach 02-06 bottom
[61] Hint: Submerged 12% of Reach 05-06 bottom

Inflow Area = 6.540 ac, Inflow Depth = 3.29" for 25 event
Inflow = 19.31 cfs @ 12.02 hrs, Volume= 1.795 af
Outflow = 18.96 cfs @ 12.03 hrs, Volume= 1.795 af, Atten= 2%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.6 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.77' @ 12.02 hrs
Capacity at bank full= 62.91 cfs
Inlet Invert= 101.70', Outlet Invert= 100.67'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 121.6' Slope= 0.0085 '/'

Reach 06-10: PERIMETER CHANNEL



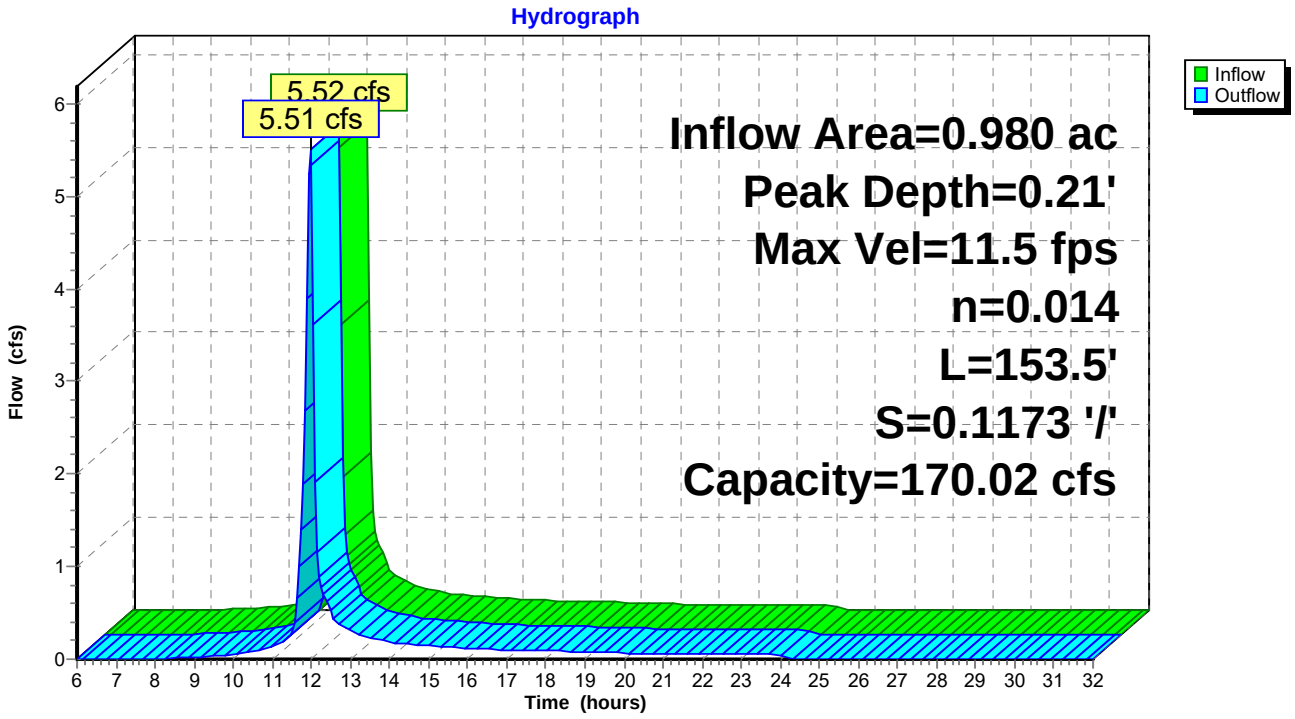
Reach 07-04: ACCESS ROAD CHANNEL

Inflow Area = 0.980 ac, Inflow Depth = 3.29" for 25 event
Inflow = 5.52 cfs @ 11.97 hrs, Volume= 0.269 af
Outflow = 5.51 cfs @ 11.98 hrs, Volume= 0.269 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.5 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.9 fps, Avg. Travel Time= 0.9 min

Peak Depth= 0.21' @ 11.97 hrs
Capacity at bank full= 170.02 cfs
Inlet Invert= 192.80', Outlet Invert= 174.80'
2.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 5.00'
Length= 153.5' Slope= 0.1173 '/'

Reach 07-04: ACCESS ROAD CHANNEL



Reach 08-08`: ACCESS ROAD CHANNEL

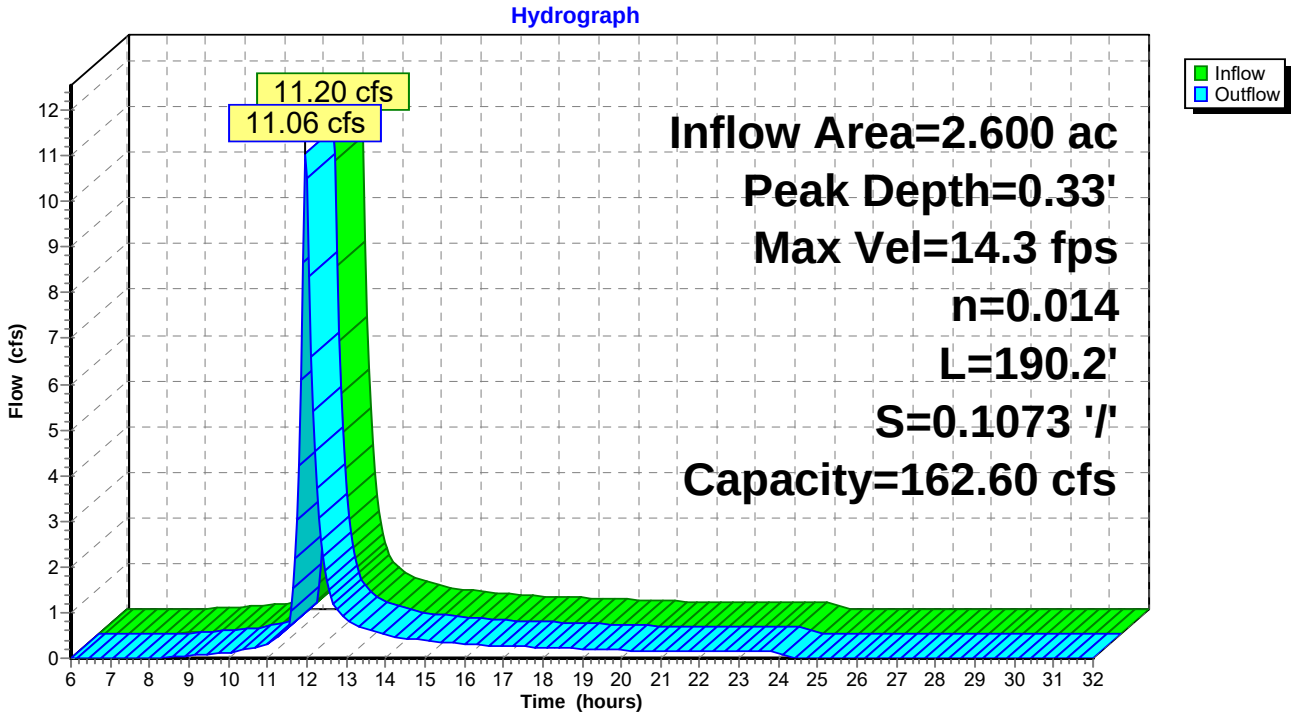
[61] Hint: Submerged 2% of Reach 04-08 bottom

Inflow Area = 2.600 ac, Inflow Depth = 3.29" for 25 event
Inflow = 11.20 cfs @ 11.96 hrs, Volume= 0.714 af
Outflow = 11.06 cfs @ 11.97 hrs, Volume= 0.714 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 14.3 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.8 fps, Avg. Travel Time= 0.8 min

Peak Depth= 0.33' @ 11.96 hrs
Capacity at bank full= 162.60 cfs
Inlet Invert= 155.80', Outlet Invert= 135.40'
2.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 5.00'
Length= 190.2' Slope= 0.1073 '/'

Reach 08-08`: ACCESS ROAD CHANNEL



Reach 09-10: PIPE DOWNCHUTE

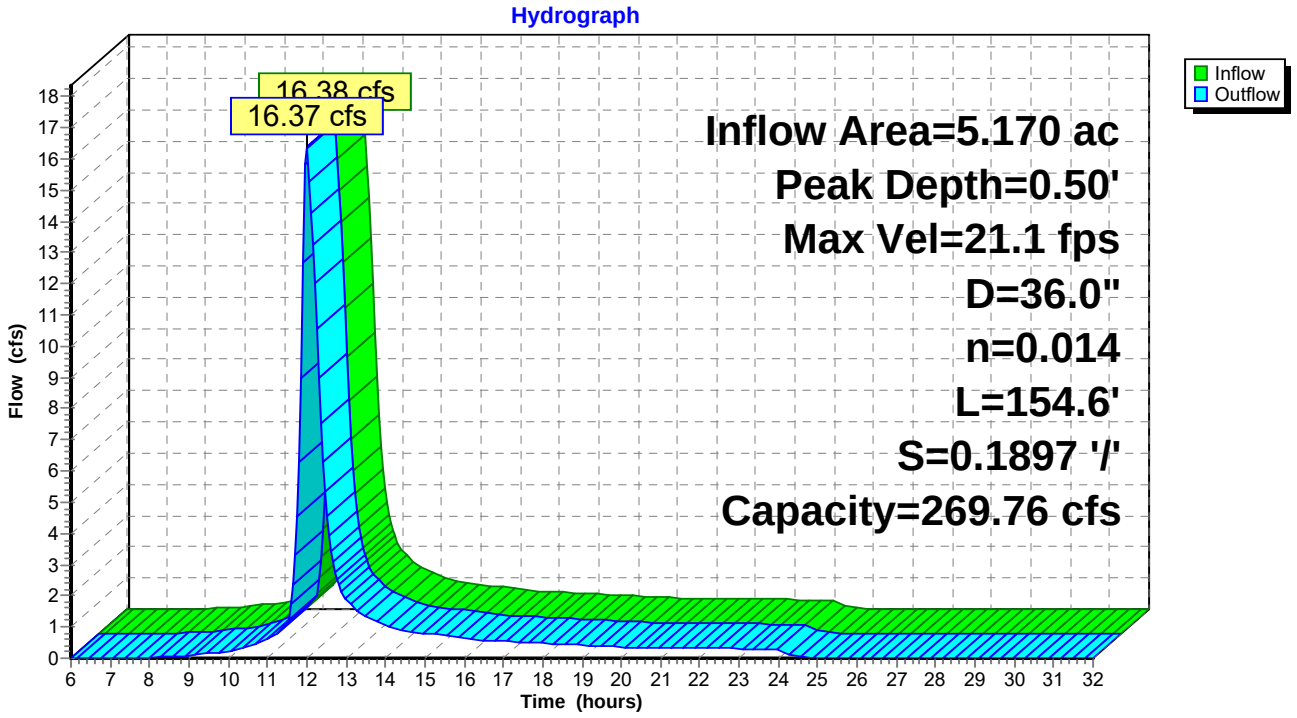
[52] Hint: Inlet conditions not evaluated
[61] Hint: Submerged 2% of Reach 03-09 bottom

Inflow Area = 5.170 ac, Inflow Depth = 3.29" for 25 event
Inflow = 16.38 cfs @ 11.99 hrs, Volume= 1.419 af
Outflow = 16.37 cfs @ 11.99 hrs, Volume= 1.419 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 21.1 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 7.2 fps, Avg. Travel Time= 0.4 min

Peak Depth= 0.50' @ 11.99 hrs
Capacity at bank full= 269.76 cfs
Inlet Invert= 130.00', Outlet Invert= 100.67'
36.0" Diameter Pipe, n= 0.014
Length= 154.6' Slope= 0.1897 '/'

Reach 09-10: PIPE DOWNCHUTE



Reach 10-11: PERIMETER CHANNEL

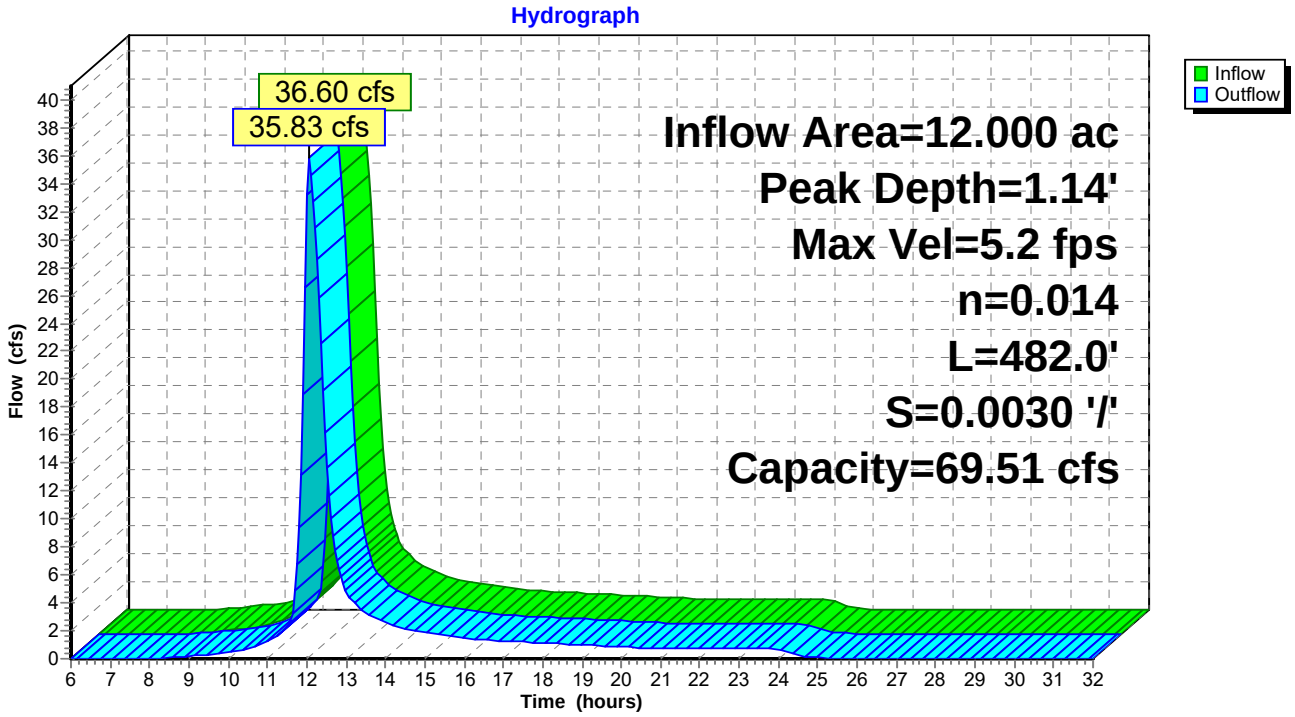
[62] Warning: Submerged 6% of Reach 06-10 inlet
[61] Hint: Submerged 4% of Reach 09-10 bottom

Inflow Area = 12.000 ac, Inflow Depth = 3.29" for 25 event
Inflow = 36.60 cfs @ 12.01 hrs, Volume= 3.294 af
Outflow = 35.83 cfs @ 12.06 hrs, Volume= 3.294 af, Atten= 2%, Lag= 3.2 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.2 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 1.3 fps, Avg. Travel Time= 6.0 min

Peak Depth= 1.14' @ 12.02 hrs
Capacity at bank full= 69.51 cfs
Inlet Invert= 100.67', Outlet Invert= 99.22'
5.00' x 1.65' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 8.30'
Length= 482.0' Slope= 0.0030 '/'

Reach 10-11: PERIMETER CHANNEL



Reach 11-19: PERIMETER CHANNEL

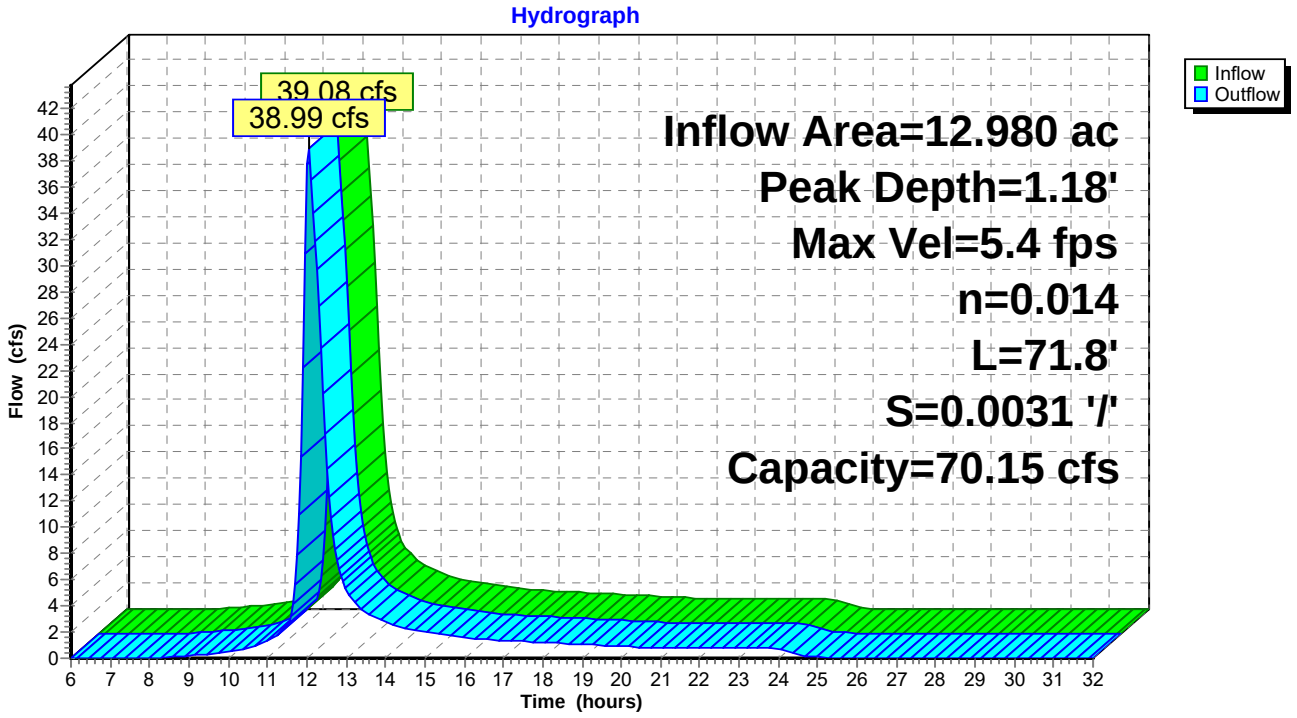
[61] Hint: Submerged 81% of Reach 10-11 bottom

Inflow Area = 12.980 ac, Inflow Depth = 3.29" for 25 event
Inflow = 39.08 cfs @ 12.03 hrs, Volume= 3.563 af
Outflow = 38.99 cfs @ 12.04 hrs, Volume= 3.563 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.4 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.4 fps, Avg. Travel Time= 0.9 min

Peak Depth= 1.18' @ 12.04 hrs
Capacity at bank full= 70.15 cfs
Inlet Invert= 99.22', Outlet Invert= 99.00'
5.00' x 1.65' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 8.30'
Length= 71.8' Slope= 0.0031 '/'

Reach 11-19: PERIMETER CHANNEL



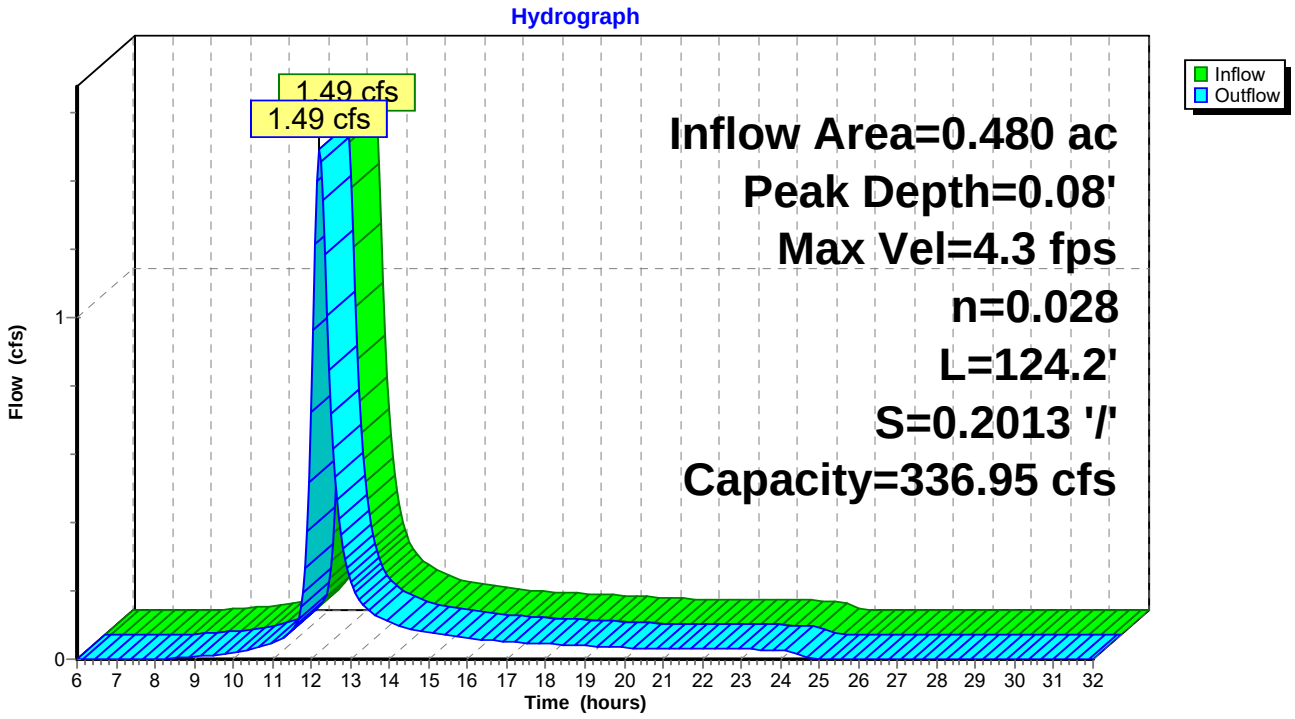
Reach 12-13: DOWNCHUTE

Inflow Area = 0.480 ac, Inflow Depth = 3.29" for 25 event
Inflow = 1.49 cfs @ 12.20 hrs, Volume= 0.132 af
Outflow = 1.49 cfs @ 12.21 hrs, Volume= 0.132 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.3 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.6 fps, Avg. Travel Time= 1.3 min

Peak Depth= 0.08' @ 12.20 hrs
Capacity at bank full= 336.95 cfs
Inlet Invert= 235.00', Outlet Invert= 210.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 124.2' Slope= 0.2013 '/'

Reach 12-13: DOWNCHUTE



Reach 13-14: DOWNCHUTE

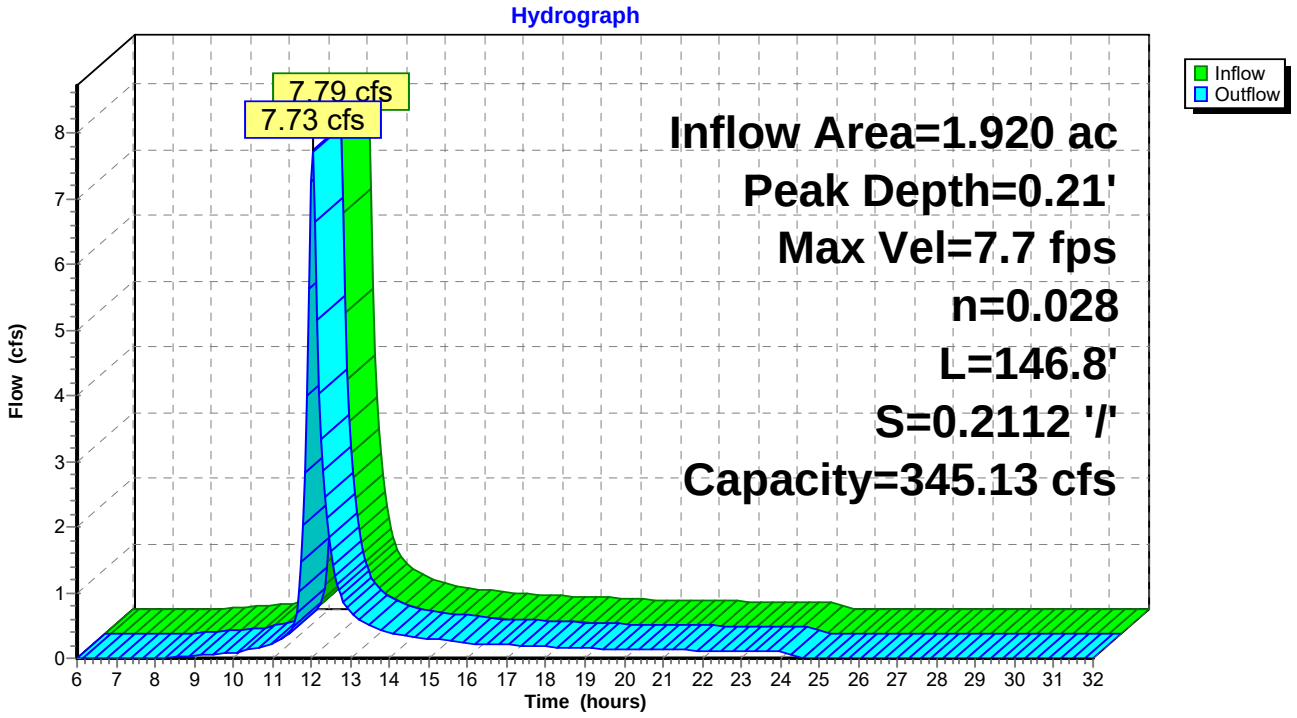
[61] Hint: Submerged 1% of Reach 12-13 bottom

Inflow Area = 1.920 ac, Inflow Depth = 3.29" for 25 event
Inflow = 7.79 cfs @ 12.03 hrs, Volume= 0.527 af
Outflow = 7.73 cfs @ 12.04 hrs, Volume= 0.527 af, Atten= 1%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.7 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.1 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.21' @ 12.03 hrs
Capacity at bank full= 345.13 cfs
Inlet Invert= 210.00', Outlet Invert= 179.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 146.8' Slope= 0.2112 '/'

Reach 13-14: DOWNCHUTE



Reach 14-15: DOWNCHUTE

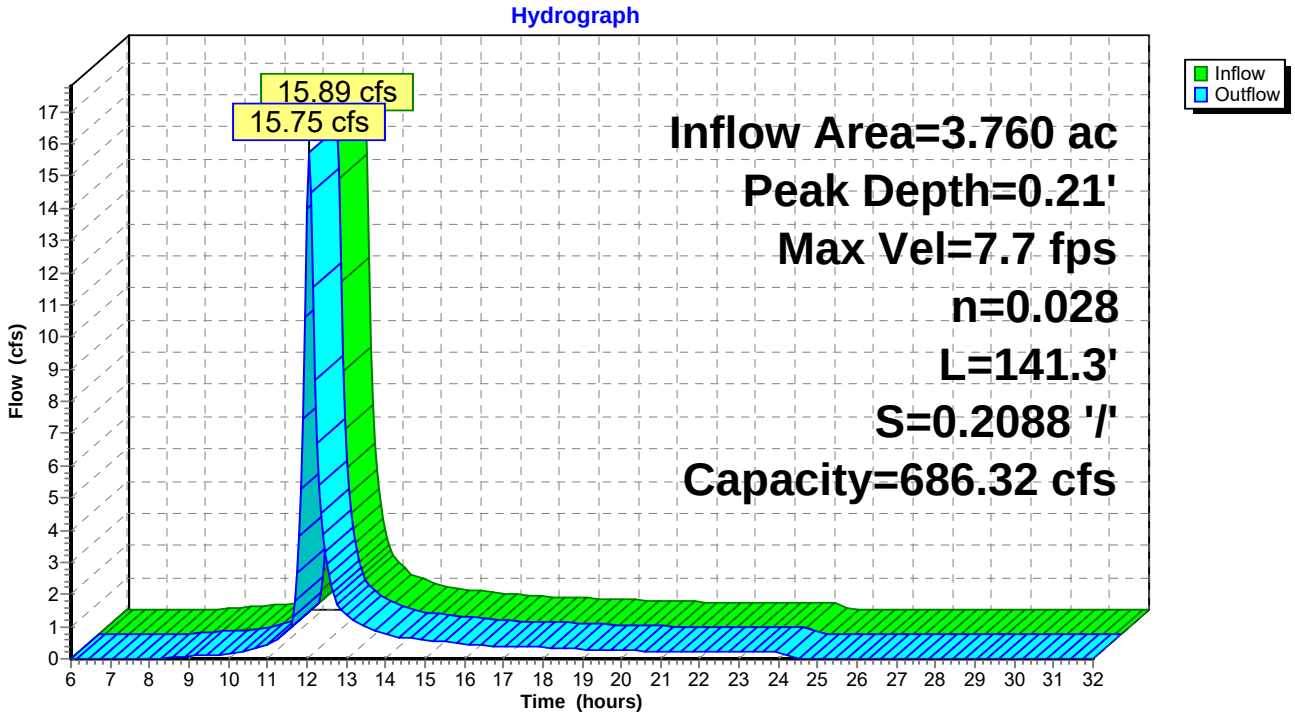
[61] Hint: Submerged 1% of Reach 13-14 bottom

Inflow Area = 3.760 ac, Inflow Depth = 3.29" for 25 event
Inflow = 15.89 cfs @ 12.05 hrs, Volume= 1.032 af
Outflow = 15.75 cfs @ 12.05 hrs, Volume= 1.032 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.7 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.1 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.21' @ 12.05 hrs
Capacity at bank full= 686.32 cfs
Inlet Invert= 179.00', Outlet Invert= 149.50'
A factor of 2.00 has been applied to the supplied storage and discharge data
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 141.3' Slope= 0.2088 '/'

Reach 14-15: DOWNCHUTE



Reach 15-17: DOWNCHUTE

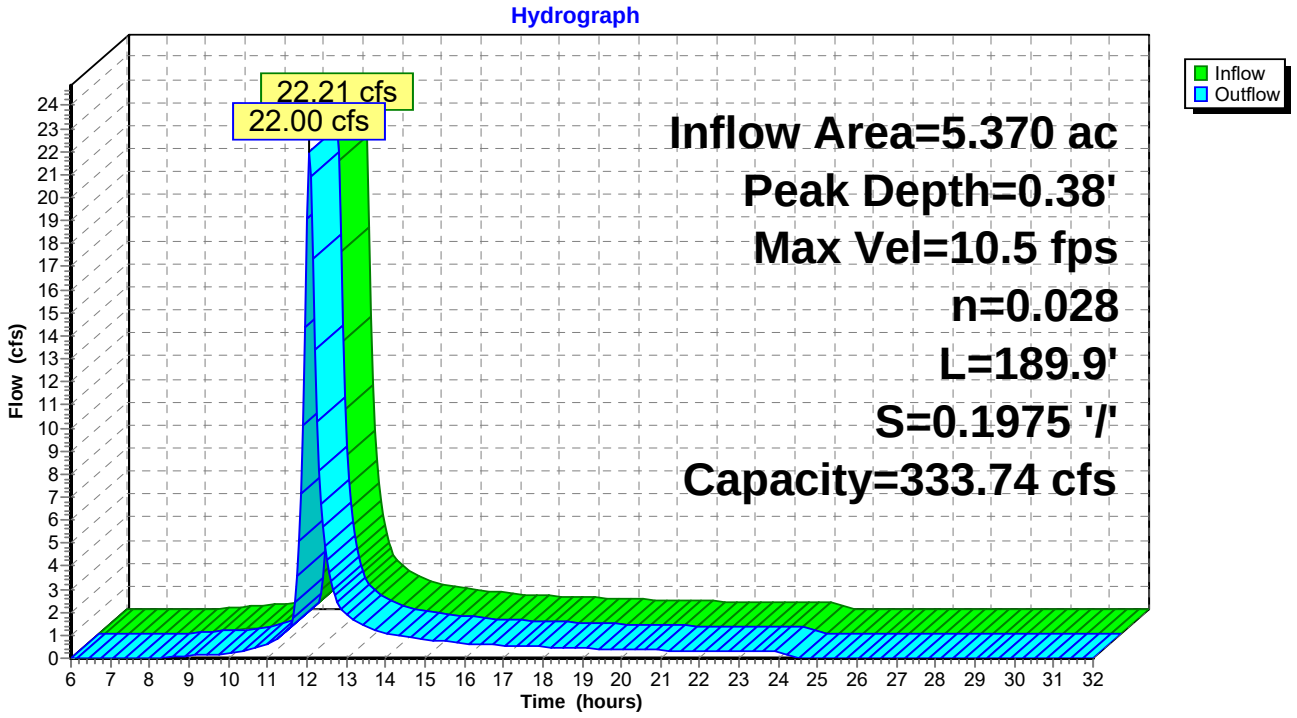
[61] Hint: Submerged 1% of Reach 14-15 bottom

Inflow Area = 5.370 ac, Inflow Depth = 3.29" for 25 event
Inflow = 22.21 cfs @ 12.05 hrs, Volume= 1.474 af
Outflow = 22.00 cfs @ 12.06 hrs, Volume= 1.474 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.5 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.9 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.38' @ 12.06 hrs
Capacity at bank full= 333.74 cfs
Inlet Invert= 149.50', Outlet Invert= 112.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 189.9' Slope= 0.1975 '/'

Reach 15-17: DOWNCHUTE



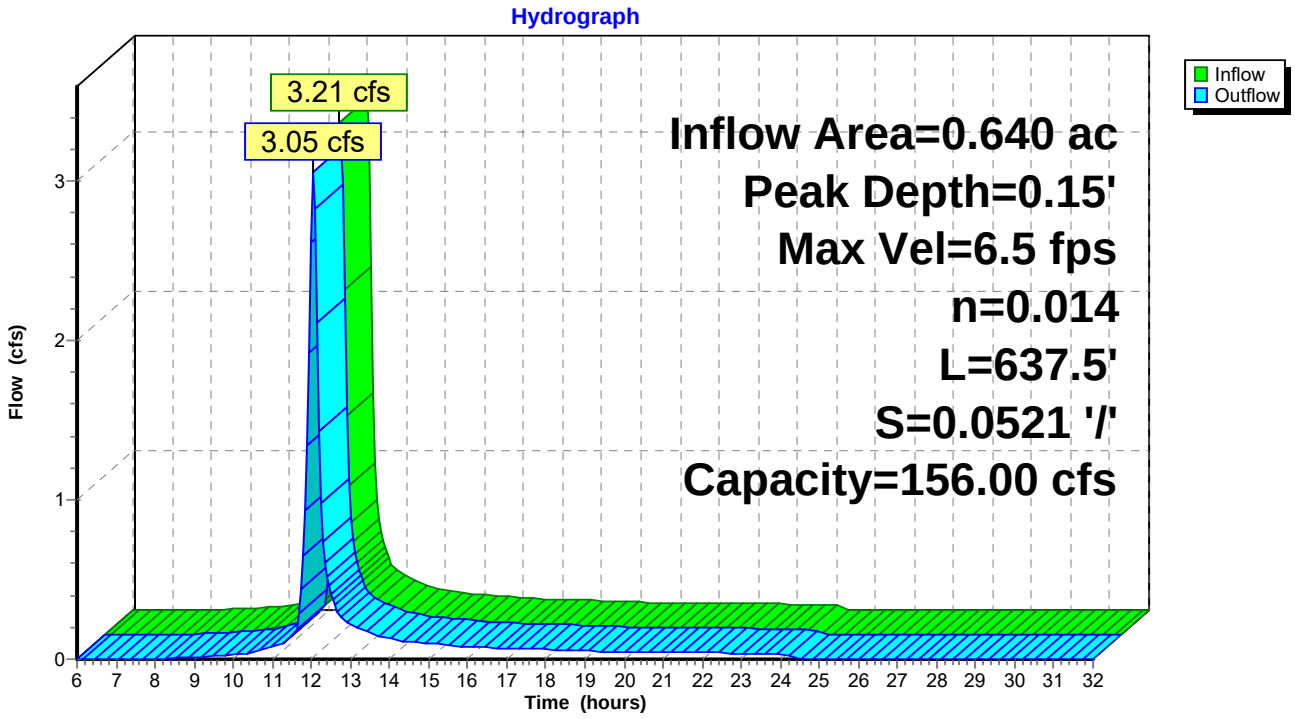
Reach 16-18: PERIMETER CHANNEL

Inflow Area = 0.640 ac, Inflow Depth = 3.29" for 25 event
Inflow = 3.21 cfs @ 12.01 hrs, Volume= 0.176 af
Outflow = 3.05 cfs @ 12.06 hrs, Volume= 0.176 af, Atten= 5%, Lag= 2.7 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.5 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 1.7 fps, Avg. Travel Time= 6.1 min

Peak Depth= 0.15' @ 12.03 hrs
Capacity at bank full= 156.00 cfs
Inlet Invert= 135.70', Outlet Invert= 102.50'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 637.5' Slope= 0.0521 '/'

Reach 16-18: PERIMETER CHANNEL



Reach 17-18: PIPE DOWNCHUTE

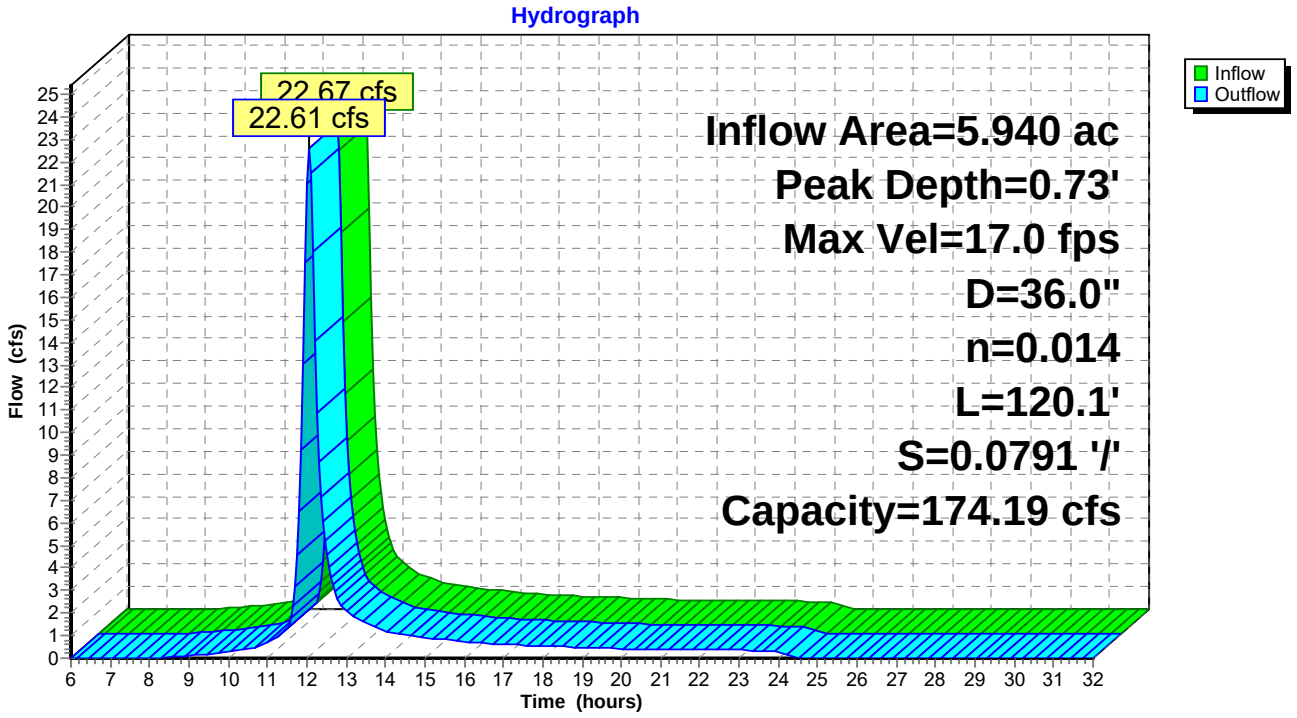
[52] Hint: Inlet conditions not evaluated
[61] Hint: Submerged 2% of Reach 15-17 bottom

Inflow Area = 5.940 ac, Inflow Depth = 3.29" for 25 event
Inflow = 22.67 cfs @ 12.05 hrs, Volume= 1.631 af
Outflow = 22.61 cfs @ 12.06 hrs, Volume= 1.631 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 17.0 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 5.6 fps, Avg. Travel Time= 0.4 min

Peak Depth= 0.73' @ 12.05 hrs
Capacity at bank full= 174.19 cfs
Inlet Invert= 112.00', Outlet Invert= 102.50'
36.0" Diameter Pipe, n= 0.014
Length= 120.1' Slope= 0.0791 '/'

Reach 17-18: PIPE DOWNCHUTE



Reach 18-19: PERIMETER CHANNEL W

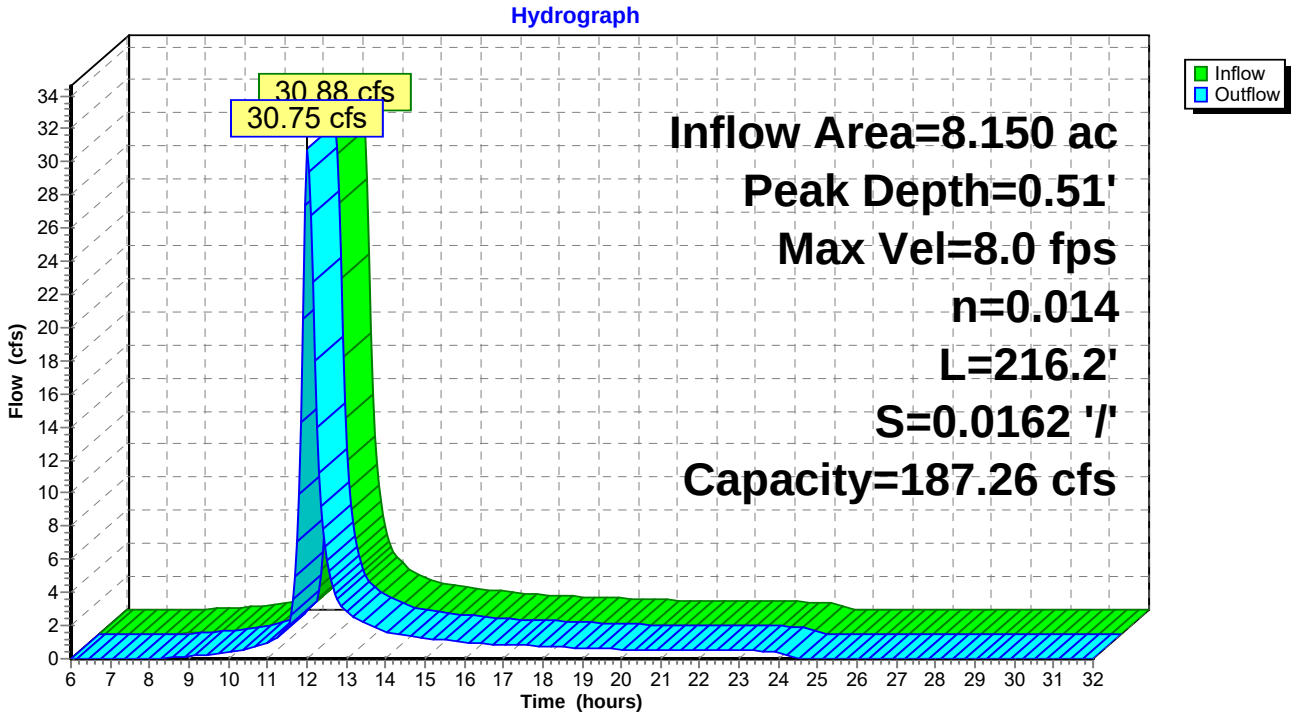
[61] Hint: Submerged 2% of Reach 16-18 bottom
[61] Hint: Submerged 5% of Reach 17-18 bottom

Inflow Area = 8.150 ac, Inflow Depth = 3.29" for 25 event
Inflow = 30.88 cfs @ 12.00 hrs, Volume= 2.237 af
Outflow = 30.75 cfs @ 12.01 hrs, Volume= 2.237 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.0 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.0 fps, Avg. Travel Time= 1.8 min

Peak Depth= 0.51' @ 12.00 hrs
Capacity at bank full= 187.26 cfs
Inlet Invert= 102.50', Outlet Invert= 99.00'
7.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 10.00'
Length= 216.2' Slope= 0.0162 '/'

Reach 18-19: PERIMETER CHANNEL W



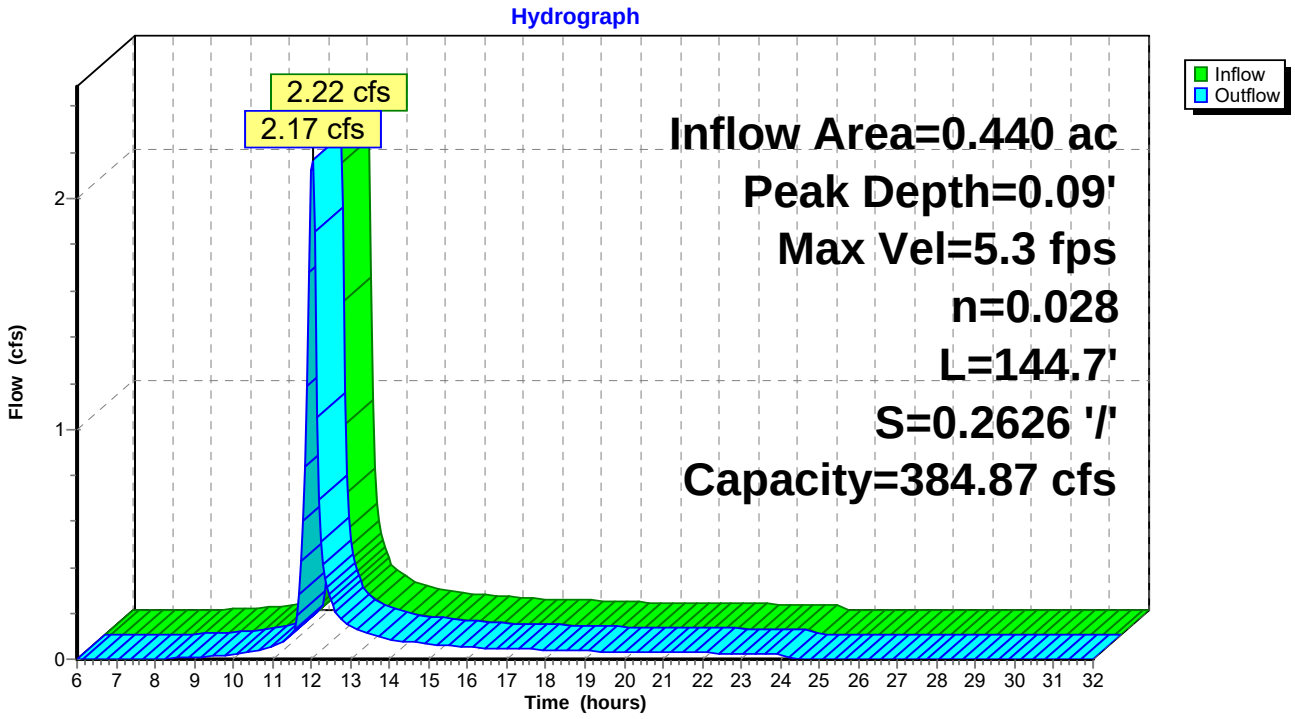
Reach 21-23: DOWNCHUTE

Inflow Area = 0.440 ac, Inflow Depth = 3.29" for 25 event
Inflow = 2.22 cfs @ 12.01 hrs, Volume= 0.121 af
Outflow = 2.17 cfs @ 12.02 hrs, Volume= 0.121 af, Atten= 2%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.3 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 1.4 min

Peak Depth= 0.09' @ 12.02 hrs
Capacity at bank full= 384.87 cfs
Inlet Invert= 219.00', Outlet Invert= 181.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 144.7' Slope= 0.2626 '/'

Reach 21-23: DOWNCHUTE



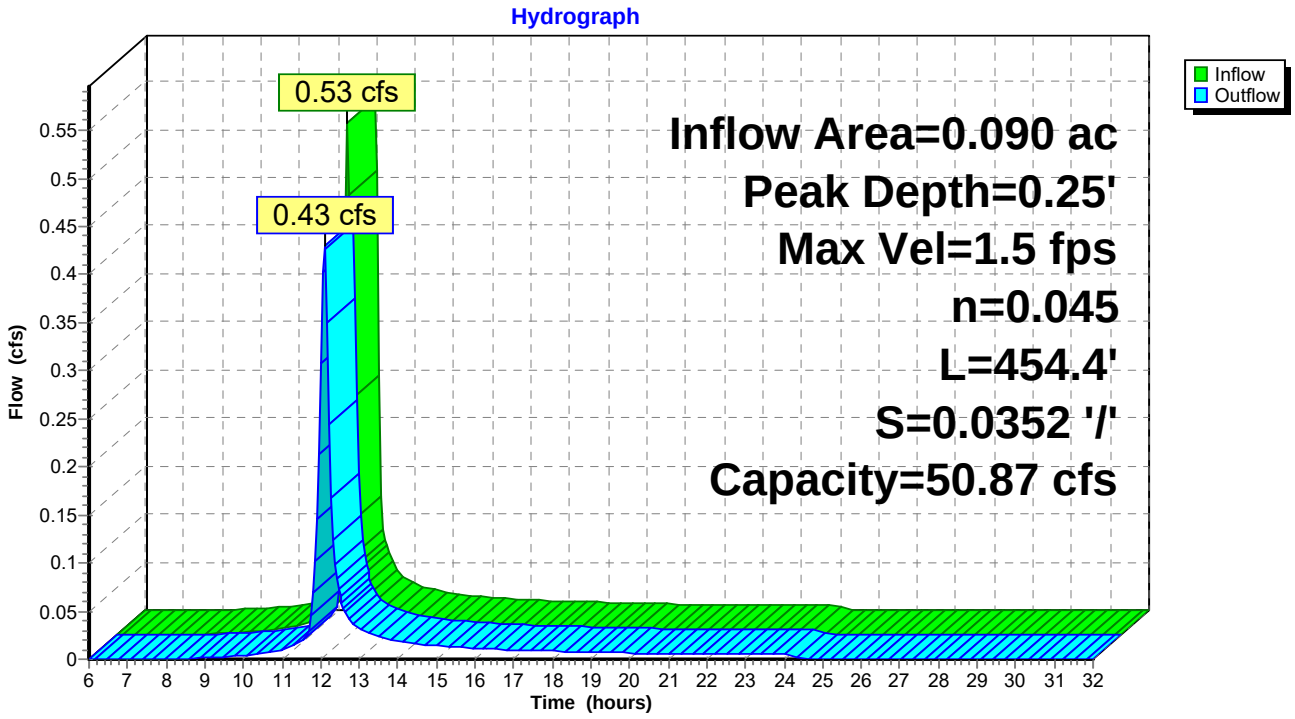
Reach 22-23: BENCH

Inflow Area = 0.090 ac, Inflow Depth = 3.29" for 25 event
Inflow = 0.53 cfs @ 11.96 hrs, Volume= 0.025 af
Outflow = 0.43 cfs @ 12.09 hrs, Volume= 0.025 af, Atten= 19%, Lag= 7.9 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.5 fps, Min. Travel Time= 4.9 min
Avg. Velocity = 0.6 fps, Avg. Travel Time= 13.7 min

Peak Depth= 0.25' @ 12.00 hrs
Capacity at bank full= 50.87 cfs
Inlet Invert= 197.00', Outlet Invert= 181.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 454.4' Slope= 0.0352 '/'

Reach 22-23: BENCH



Reach 23-25: DOWNCHUTE

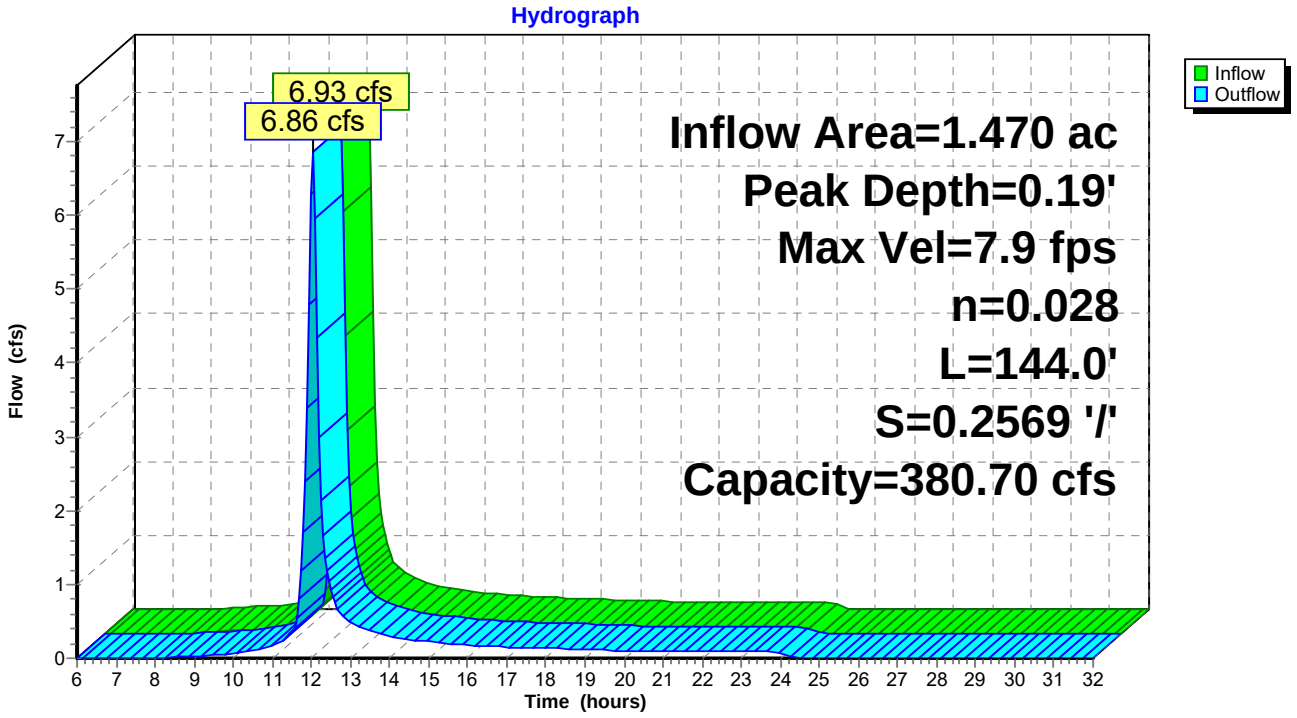
[61] Hint: Submerged 1% of Reach 22-23 bottom

Inflow Area = 1.470 ac, Inflow Depth = 3.29" for 25 event
Inflow = 6.93 cfs @ 12.04 hrs, Volume= 0.404 af
Outflow = 6.86 cfs @ 12.04 hrs, Volume= 0.404 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.9 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.1 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.19' @ 12.04 hrs
Capacity at bank full= 380.70 cfs
Inlet Invert= 181.00', Outlet Invert= 144.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 144.0' Slope= 0.2569 '/'

Reach 23-25: DOWNCHUTE



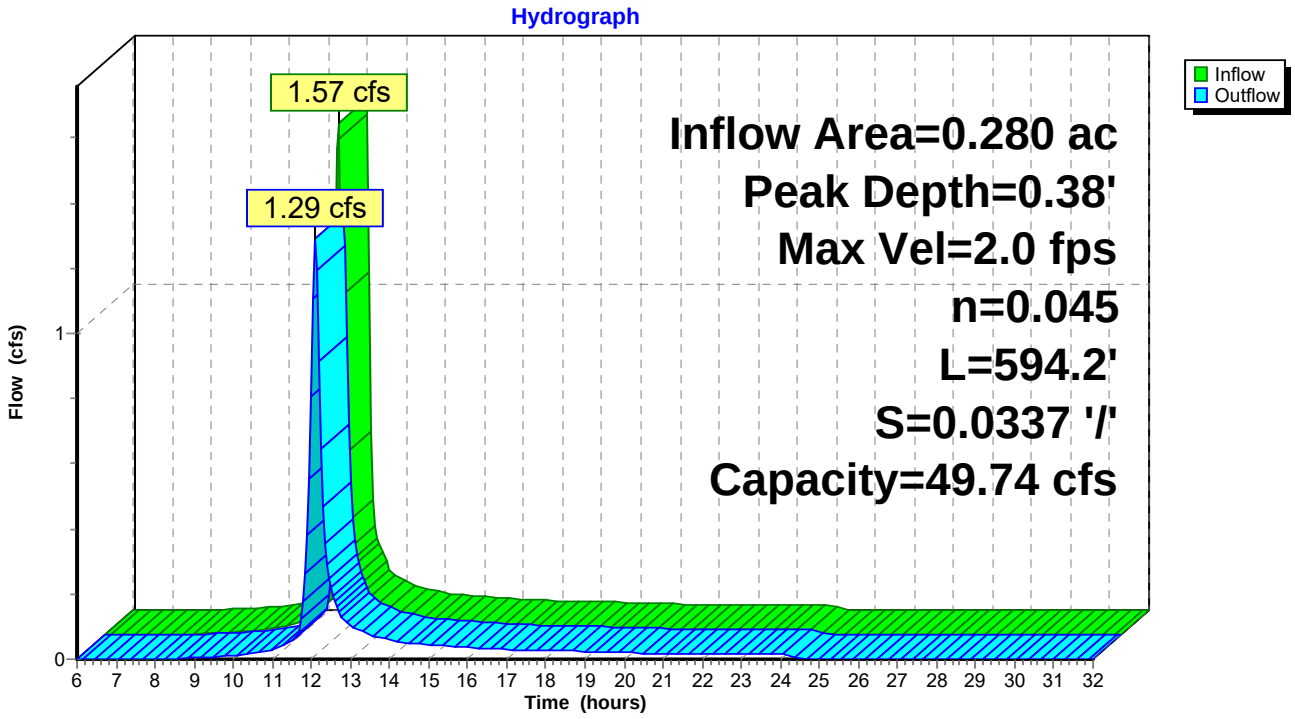
Reach 24-25: BENCH

Inflow Area = 0.280 ac, Inflow Depth = 3.29" for 25 event
Inflow = 1.57 cfs @ 11.98 hrs, Volume= 0.077 af
Outflow = 1.29 cfs @ 12.11 hrs, Volume= 0.077 af, Atten= 18%, Lag= 7.8 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.0 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 0.7 fps, Avg. Travel Time= 14.4 min

Peak Depth= 0.38' @ 12.02 hrs
Capacity at bank full= 49.74 cfs
Inlet Invert= 164.00', Outlet Invert= 144.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 594.2' Slope= 0.0337 '/'

Reach 24-25: BENCH



Reach 25-27: DOWNCHUTE

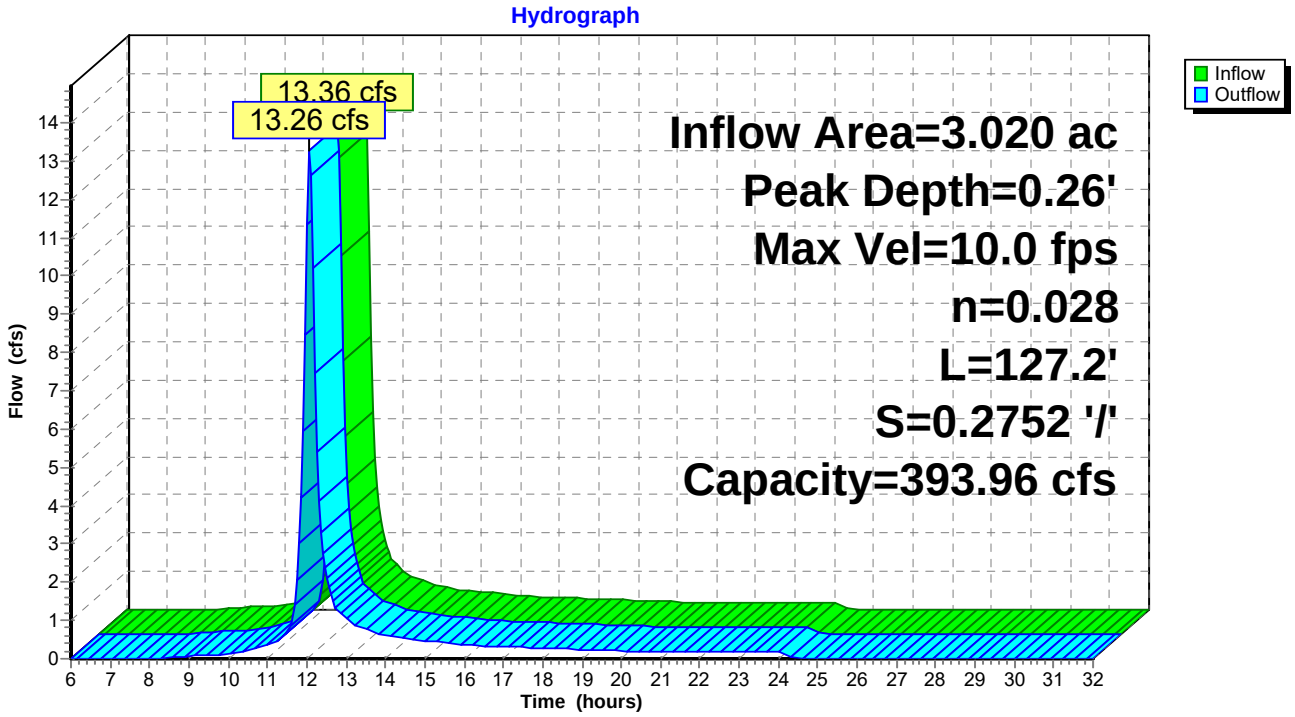
[61] Hint: Submerged 1% of Reach 23-25 bottom
[61] Hint: Submerged 1% of Reach 24-25 bottom

Inflow Area = 3.020 ac, Inflow Depth = 3.29" for 25 event
Inflow = 13.36 cfs @ 12.06 hrs, Volume= 0.829 af
Outflow = 13.26 cfs @ 12.06 hrs, Volume= 0.829 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.0 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.7 fps, Avg. Travel Time= 0.8 min

Peak Depth= 0.26' @ 12.06 hrs
Capacity at bank full= 393.96 cfs
Inlet Invert= 144.00', Outlet Invert= 109.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 127.2' Slope= 0.2752 '/'

Reach 25-27: DOWNCHUTE



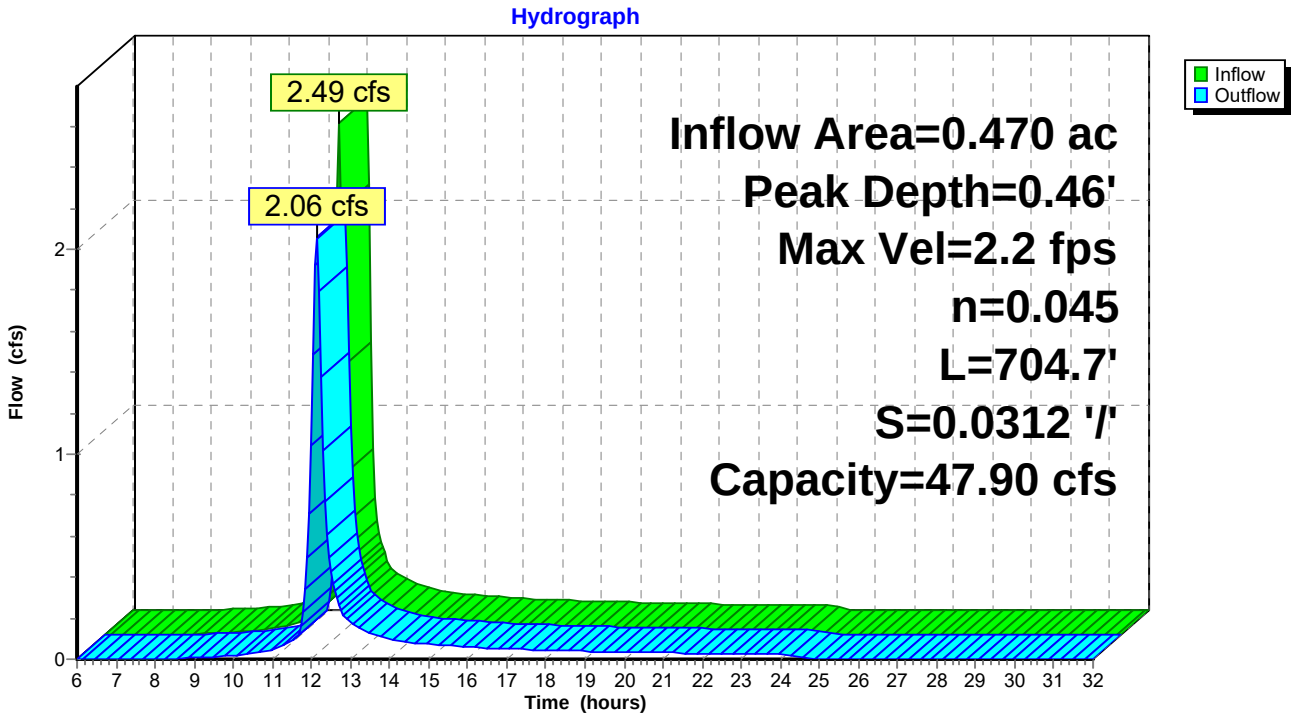
Reach 26-27: BENCH

Inflow Area = 0.470 ac, Inflow Depth = 3.29" for 25 event
Inflow = 2.49 cfs @ 12.00 hrs, Volume= 0.129 af
Outflow = 2.06 cfs @ 12.14 hrs, Volume= 0.129 af, Atten= 17%, Lag= 8.7 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.2 fps, Min. Travel Time= 5.4 min
Avg. Velocity = 0.7 fps, Avg. Travel Time= 15.9 min

Peak Depth= 0.46' @ 12.05 hrs
Capacity at bank full= 47.90 cfs
Inlet Invert= 131.00', Outlet Invert= 109.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 704.7' Slope= 0.0312 '/'

Reach 26-27: BENCH



Reach 27-29: DOWNCHUTE

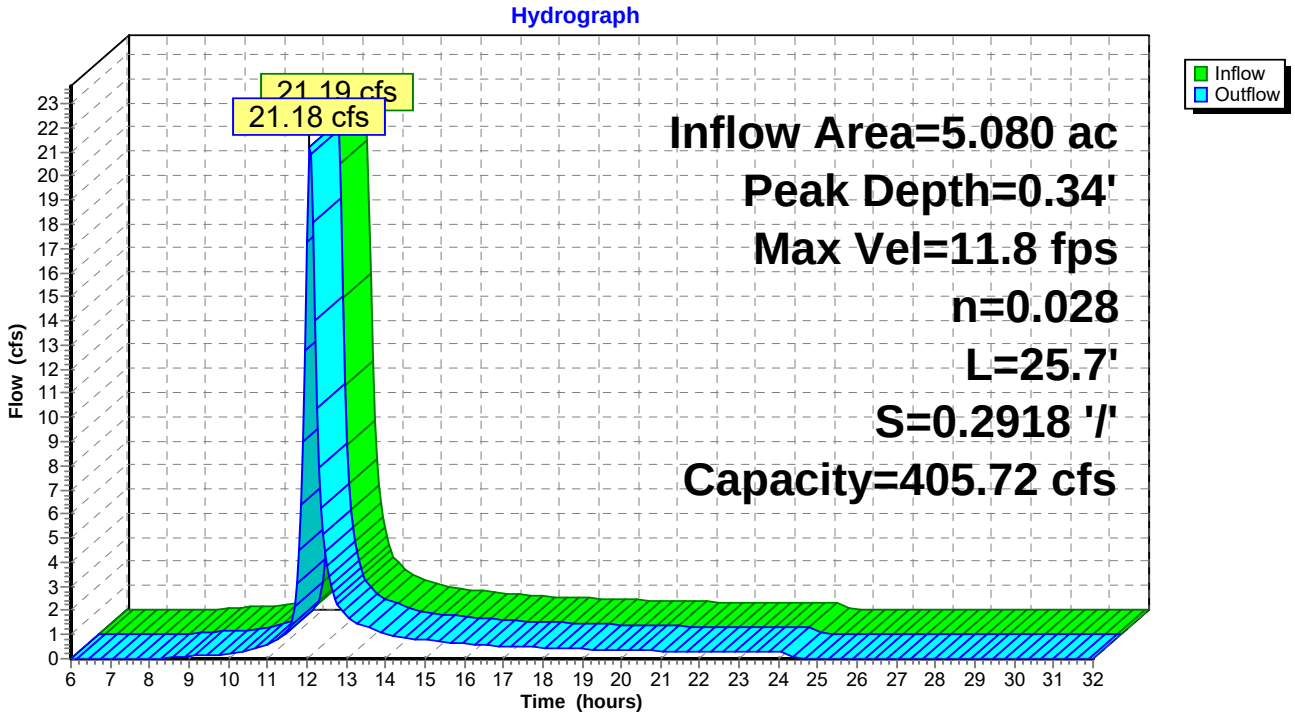
[61] Hint: Submerged 1% of Reach 25-27 bottom
[61] Hint: Submerged 2% of Reach 26-27 bottom

Inflow Area = 5.080 ac, Inflow Depth = 3.29" for 25 event
Inflow = 21.19 cfs @ 12.08 hrs, Volume= 1.394 af
Outflow = 21.18 cfs @ 12.08 hrs, Volume= 1.394 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.8 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.2 fps, Avg. Travel Time= 0.1 min

Peak Depth= 0.34' @ 12.08 hrs
Capacity at bank full= 405.72 cfs
Inlet Invert= 109.00', Outlet Invert= 101.50'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 25.7' Slope= 0.2918 '/'

Reach 27-29: DOWNCHUTE



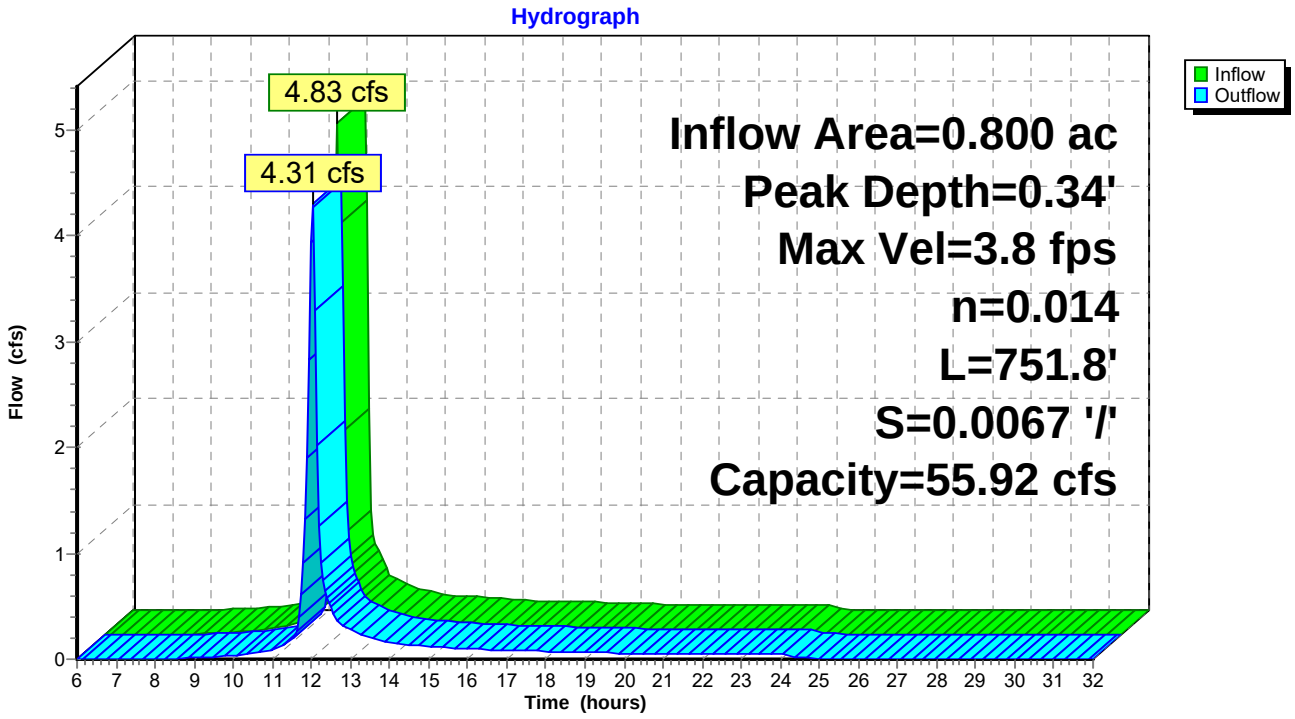
Reach 28-29: PERIMETER CHANNEL

Inflow Area = 0.800 ac, Inflow Depth = 3.29" for 25 event
Inflow = 4.83 cfs @ 11.95 hrs, Volume= 0.220 af
Outflow = 4.31 cfs @ 12.04 hrs, Volume= 0.220 af, Atten= 11%, Lag= 5.3 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.8 fps, Min. Travel Time= 3.3 min
Avg. Velocity = 0.9 fps, Avg. Travel Time= 14.5 min

Peak Depth= 0.34' @ 11.98 hrs
Capacity at bank full= 55.92 cfs
Inlet Invert= 106.53', Outlet Invert= 101.50'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 751.8' Slope= 0.0067 '/'

Reach 28-29: PERIMETER CHANNEL



Pond POND Nº1:

Inflow Area = 23.430 ac, Inflow Depth = 3.29" for 25 event
Inflow = 80.07 cfs @ 12.02 hrs, Volume= 6.432 af
Outflow = 17.50 cfs @ 12.58 hrs, Volume= 6.144 af, Atten= 78%, Lag= 33.7 min
Primary = 17.50 cfs @ 12.58 hrs, Volume= 6.144 af

Routing by Stor-Ind method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 27.75' @ 12.58 hrs Surf.Area= 0.800 ac Storage= 2.741 af
Plug-Flow detention time= 126.8 min calculated for 6.144 af (96% of inflow)
Center-of-Mass det. time= 101.0 min (934.9 - 833.9)

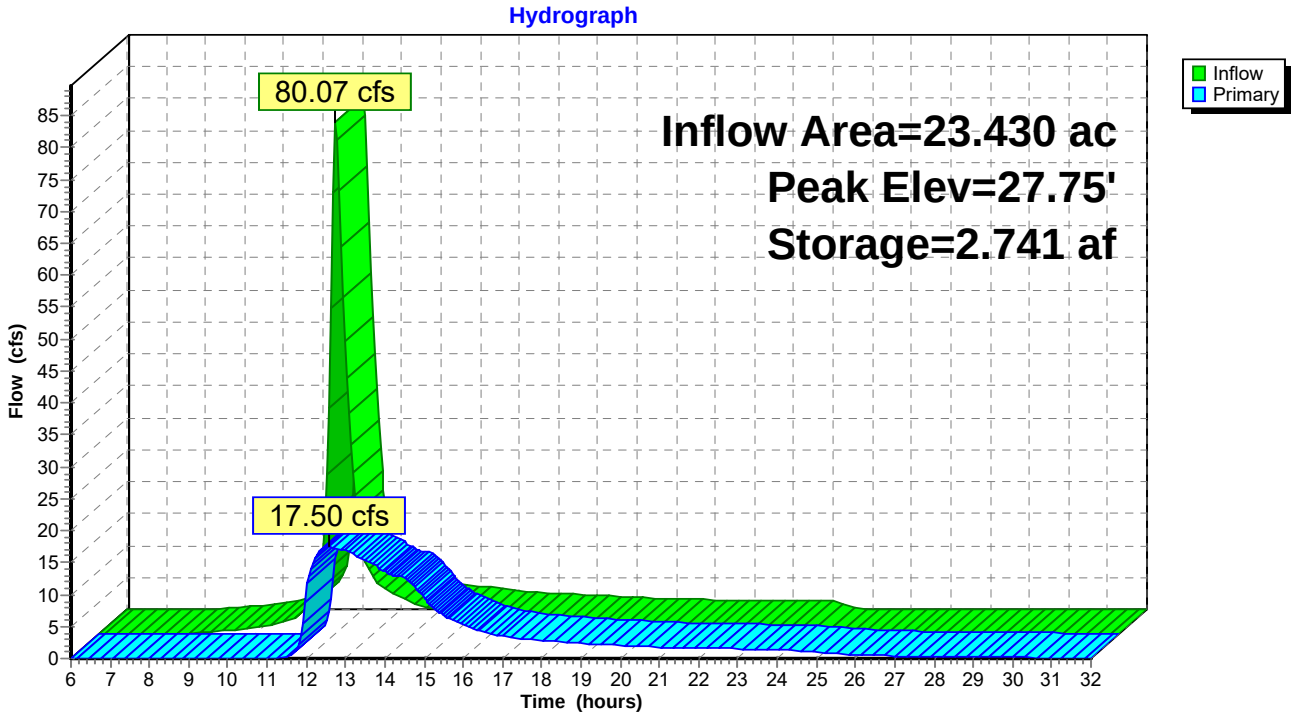
Volume	Invert	Avail.Storage	Storage Description
#1	24.00'	4.638 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
24.00	0.670	728.0	0.000	0.000	0.670
26.00	0.730	755.0	1.400	1.400	0.751
28.00	0.810	781.0	1.539	2.939	0.832
30.00	0.890	807.0	1.699	4.638	0.915

Device	Routing	Invert	Outlet Devices
#1	Primary	24.30'	**18.0" x 97.0' long Culvert X 2.00** Ke= 0.900 Outlet Invert= 23.23' S= 0.0110 '/' Cc= 0.900 n= 0.024
#2	Primary	28.90'	**13.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=17.49 cfs @ 12.58 hrs HW=27.75' (Free Discharge)
└**1=Culvert** (Barrel Controls 17.49 cfs @ 4.9 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond POND Nº1:



Pond POND Nº2:

Inflow Area = 8.390 ac, Inflow Depth = 3.29" for 25 event
Inflow = 32.09 cfs @ 11.99 hrs, Volume= 2.303 af
Outflow = 6.49 cfs @ 12.44 hrs, Volume= 1.713 af, Atten= 80%, Lag= 26.7 min
Primary = 6.49 cfs @ 12.44 hrs, Volume= 1.713 af

Routing by Stor-Ind method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 37.78' @ 12.44 hrs Surf.Area= 0.329 ac Storage= 1.091 af
Plug-Flow detention time= 200.5 min calculated for 1.713 af (74% of inflow)
Center-of-Mass det. time= 105.0 min (933.1 - 828.2)

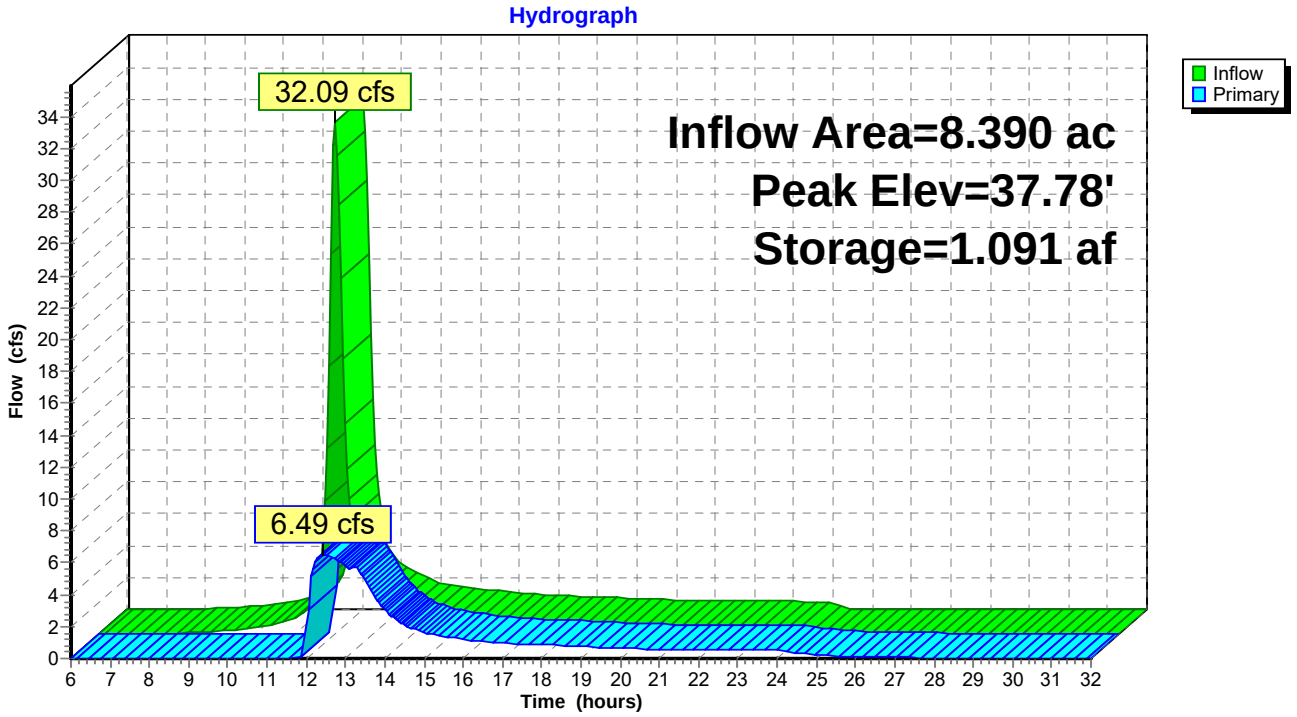
Volume	Invert	Avail.Storage	Storage Description
#1	33.00'	1.925 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
33.00	0.135	833.8	0.000	0.000	0.135
34.00	0.174	851.5	0.154	0.154	0.193
35.00	0.213	870.3	0.193	0.347	0.255
36.00	0.250	890.0	0.231	0.579	0.322
38.00	0.340	924.0	0.588	1.166	0.442
40.00	0.420	958.0	0.759	1.925	0.566

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	**12.0" x 45.0' long Culvert X 2.00** Ke= 0.500 Outlet Invert= 35.10' S= 0.0200 '/' Cc= 0.900 n= 0.024
#2	Primary	39.60'	**12.0' long x 6.0' 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 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=6.49 cfs @ 12.44 hrs HW=37.77' (Free Discharge)
└─**1=Culvert** (Barrel Controls 6.49 cfs @ 4.1 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond POND Nº2:



Pond WL-2:

Inflow Area = 6.490 ac, Inflow Depth = 2.45" for 25 event
Inflow = 13.12 cfs @ 12.27 hrs, Volume= 1.328 af
Outflow = 1.21 cfs @ 14.06 hrs, Volume= 0.535 af, Atten= 91%, Lag= 107.4 min
Primary = 1.21 cfs @ 14.06 hrs, Volume= 0.535 af

Routing by Stor-Ind method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 37.02' @ 14.06 hrs Surf.Area= 1.619 ac Storage= 0.827 af
Plug-Flow detention time= 338.0 min calculated for 0.535 af (40% of inflow)
Center-of-Mass det. time= 202.8 min (1,069.0 - 866.2)

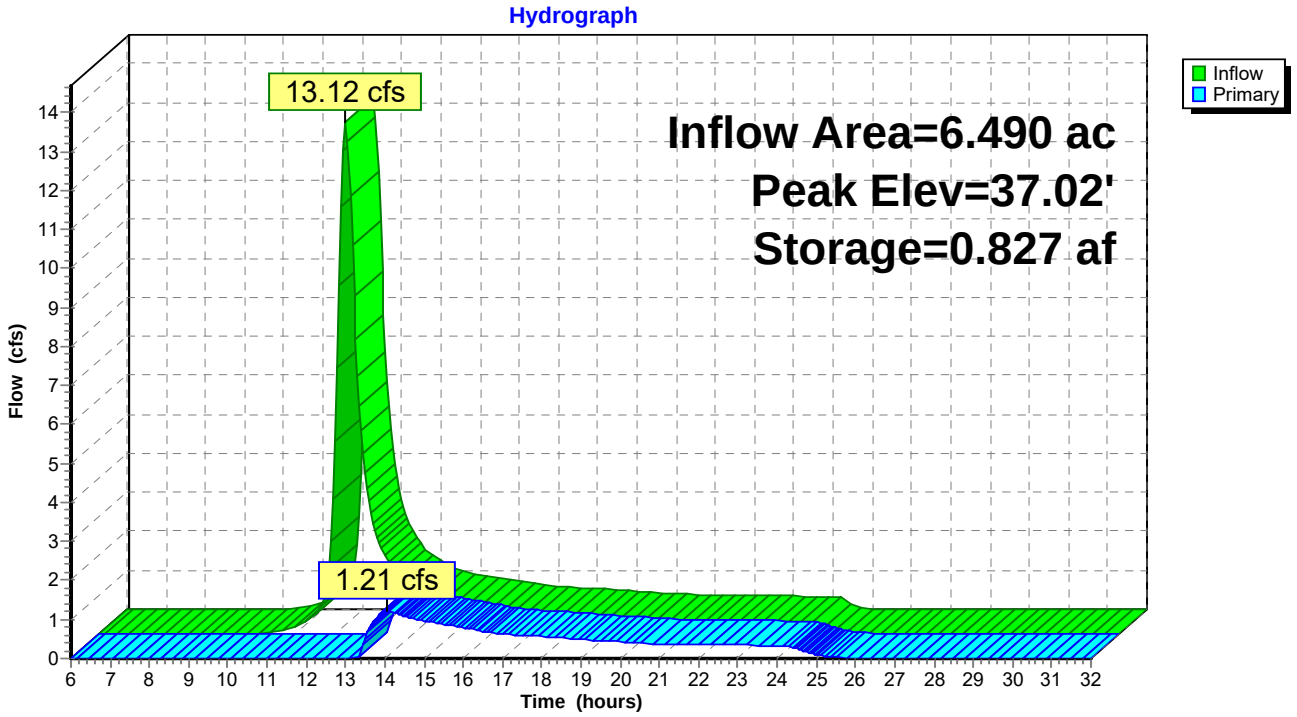
Volume	Invert	Avail.Storage	Storage Description
#1	36.00'	3.170 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
36.00	0.000	0.000	0.000
38.00	3.170	3.170	3.170

Device	Routing	Invert	Outlet Devices
#1	Primary	37.00'	**140.0' long x 30.0' 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=1.18 cfs @ 14.06 hrs HW=37.02' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.18 cfs @ 0.4 fps)

Pond WL-2:

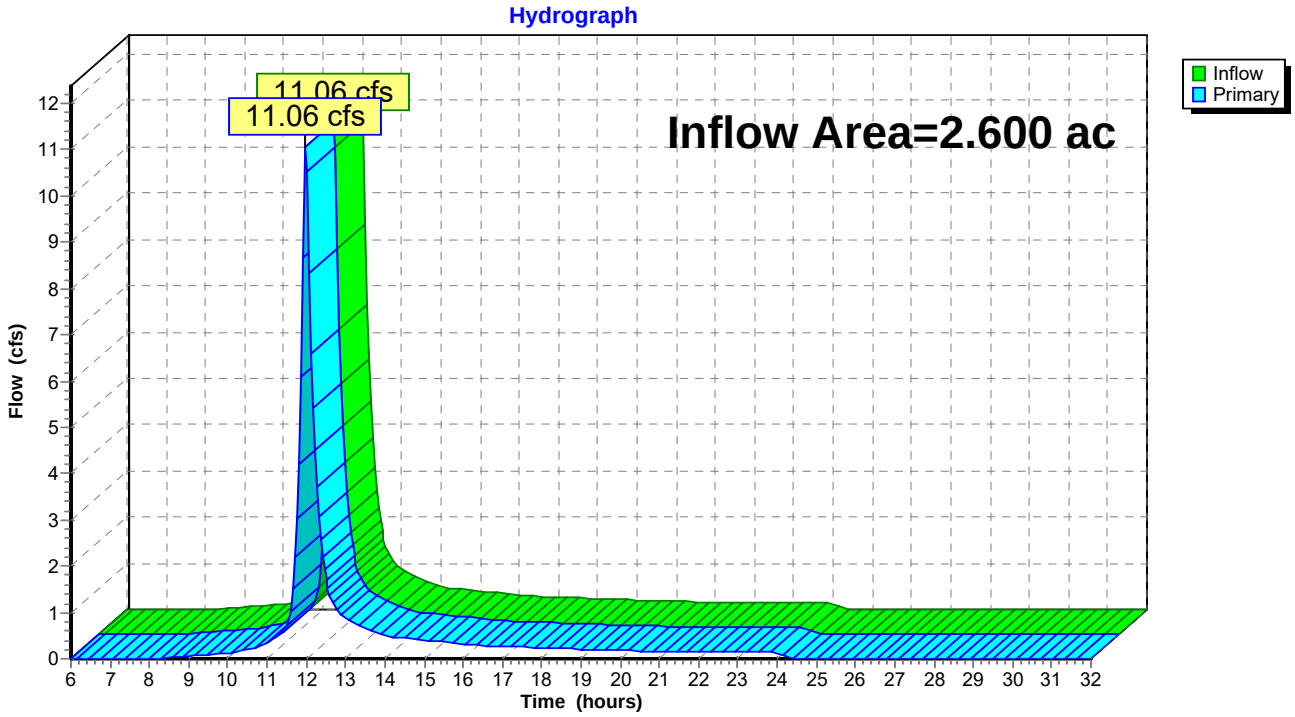

Hydrograph
13.12 cfs
1.21 cfs
Inflow Area=6.490 ac
Peak Elev=37.02'
Storage=0.827 af
Inflow
Primary
Flow (cfs)
Time (hours)

Link 08`-09:

Inflow Area = 2.600 ac, Inflow Depth = 3.29" for 25 event
Inflow = 11.06 cfs @ 11.97 hrs, Volume= 0.714 af
Primary = 11.06 cfs @ 11.97 hrs, Volume= 0.714 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link 08`-09:

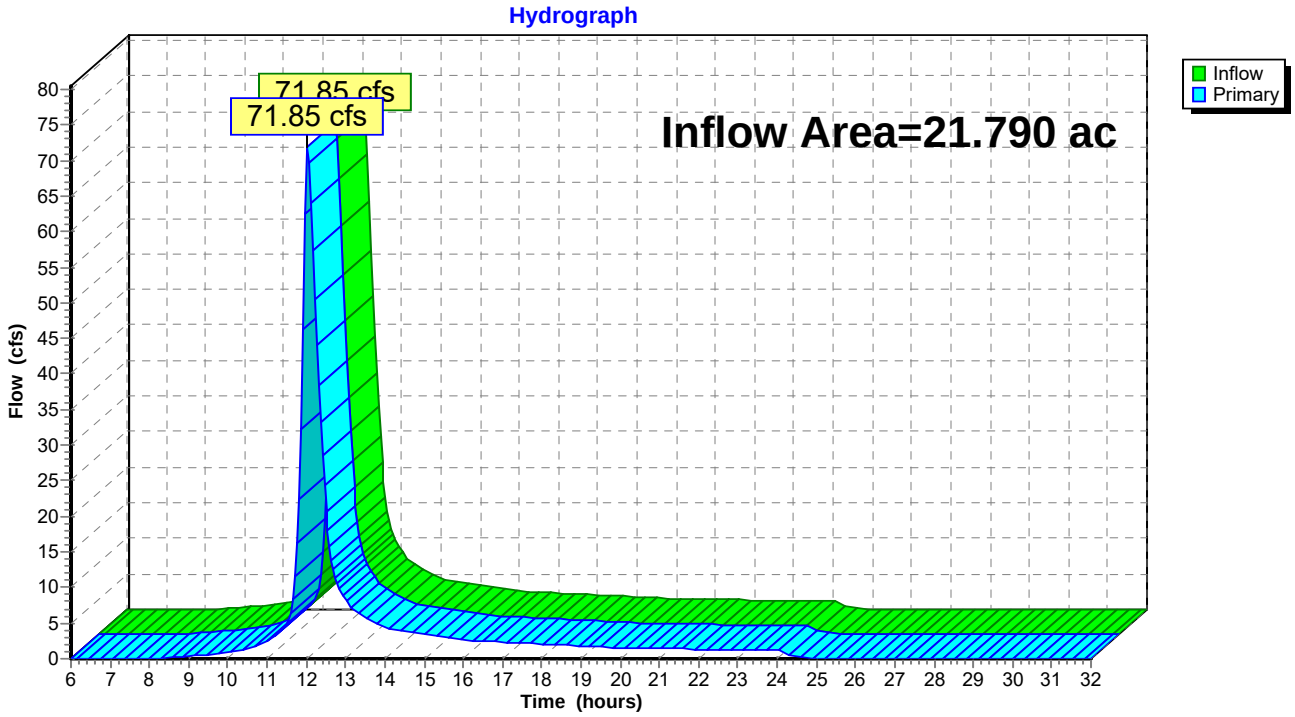


Link 19-20:

Inflow Area = 21.790 ac, Inflow Depth = 3.29" for 25 event
Inflow = 71.85 cfs @ 12.02 hrs, Volume= 5.981 af
Primary = 71.85 cfs @ 12.02 hrs, Volume= 5.981 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link 19-20:

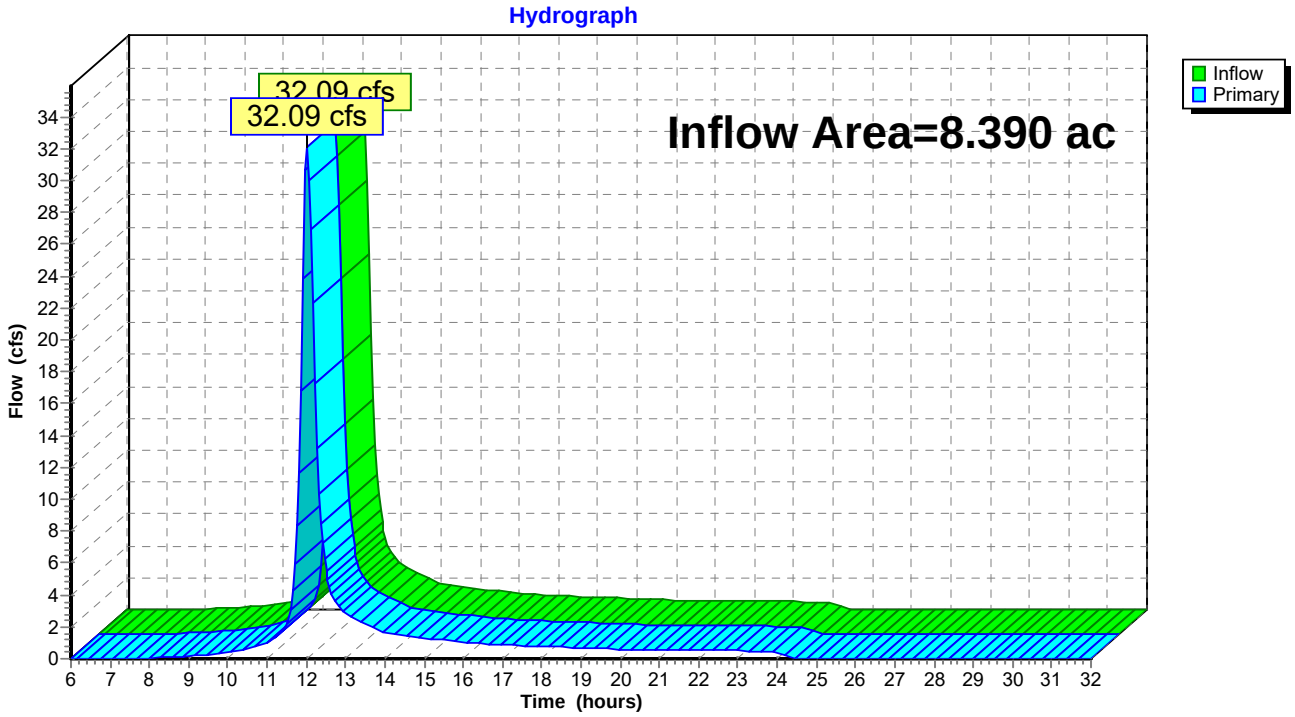


Link 29-30:

Inflow Area = 8.390 ac, Inflow Depth = 3.29" for 25 event
Inflow = 32.09 cfs @ 11.99 hrs, Volume= 2.303 af
Primary = 32.09 cfs @ 11.99 hrs, Volume= 2.303 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link 29-30:

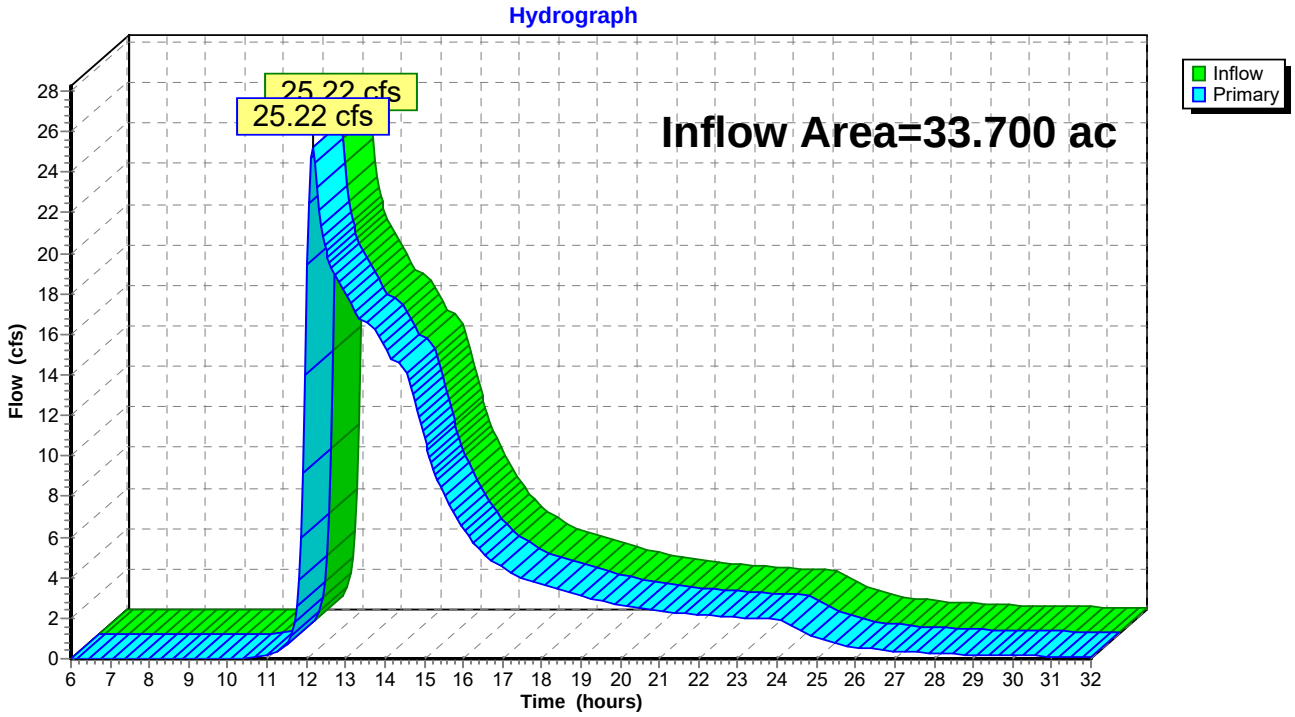


Link OUTLET 1:

Inflow Area = 33.700 ac, Inflow Depth > 2.65" for 25 event
Inflow = 25.22 cfs @ 12.15 hrs, Volume= 7.452 af
Primary = 25.22 cfs @ 12.15 hrs, Volume= 7.452 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link OUTLET 1:

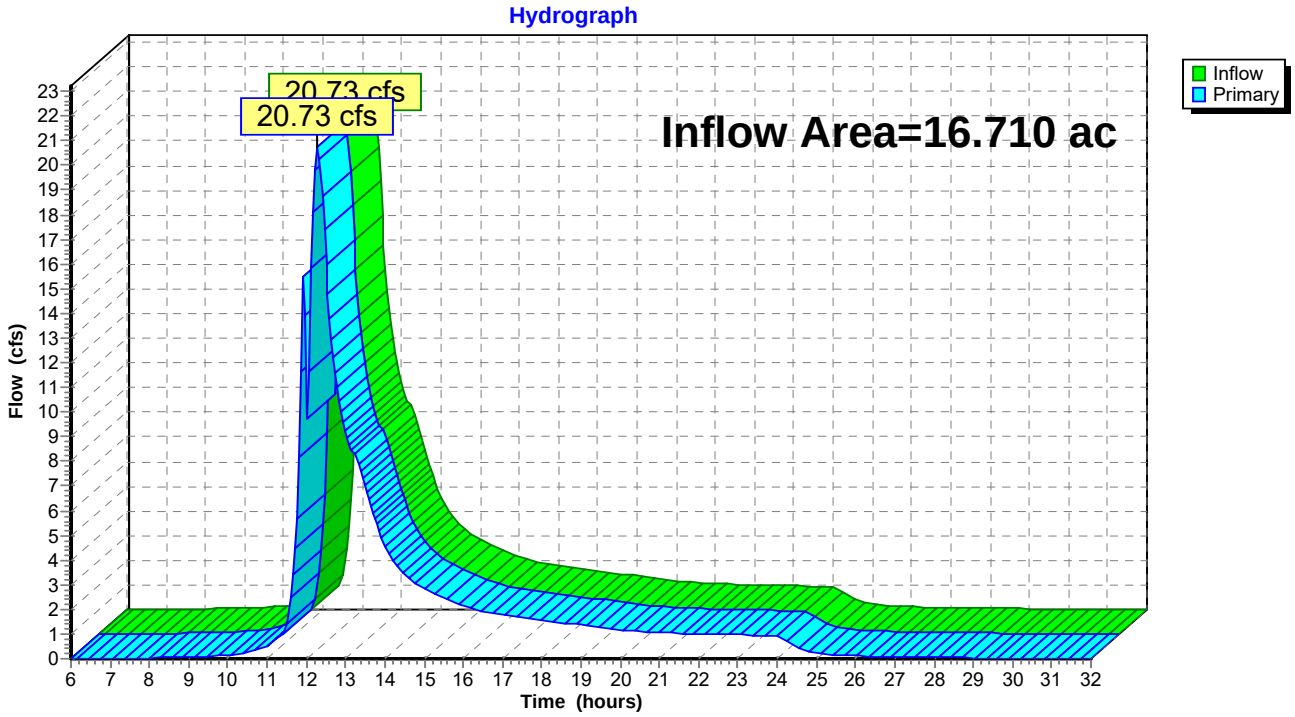


Link OUTLET2:

Inflow Area = 16.710 ac, Inflow Depth > 2.59" for 25 event
Inflow = 20.73 cfs @ 12.27 hrs, Volume= 3.604 af
Primary = 20.73 cfs @ 12.27 hrs, Volume= 3.604 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link OUTLET2:

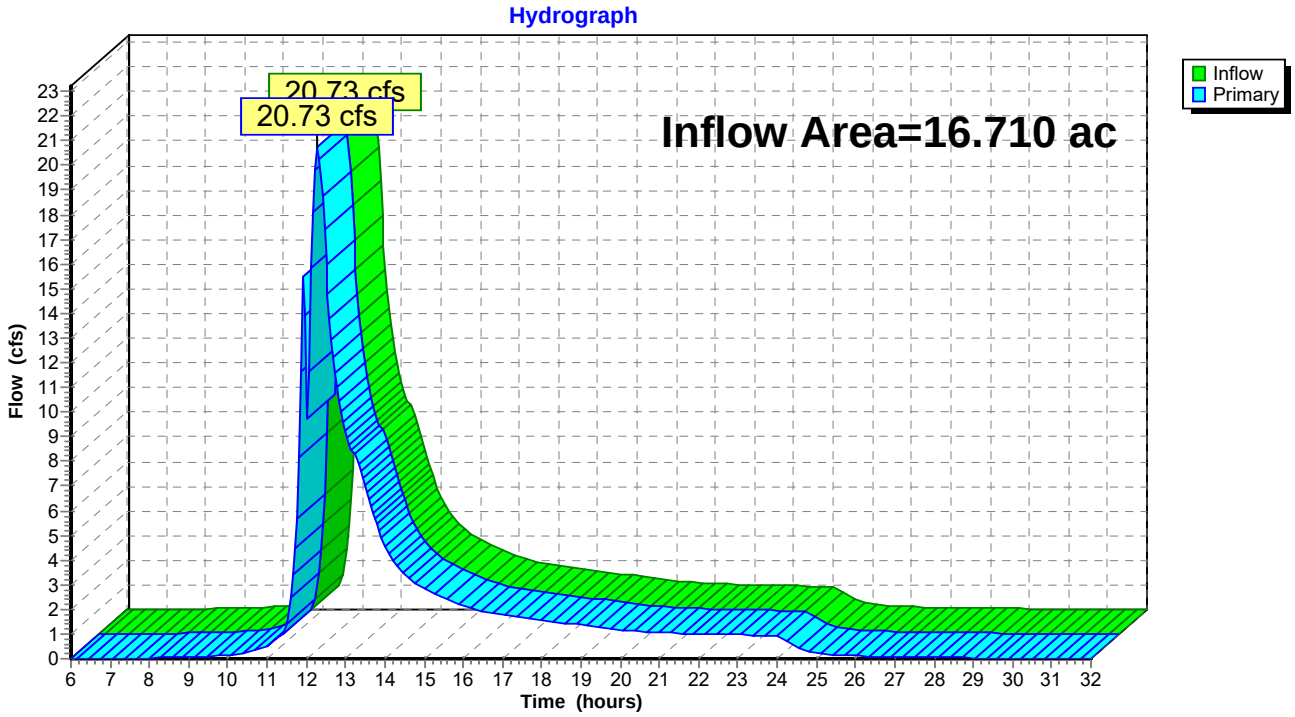


Link WL-1:

Inflow Area = 16.710 ac, Inflow Depth > 2.59" for 25 event
Inflow = 20.73 cfs @ 12.27 hrs, Volume= 3.604 af
Primary = 20.73 cfs @ 12.27 hrs, Volume= 3.604 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link WL-1:

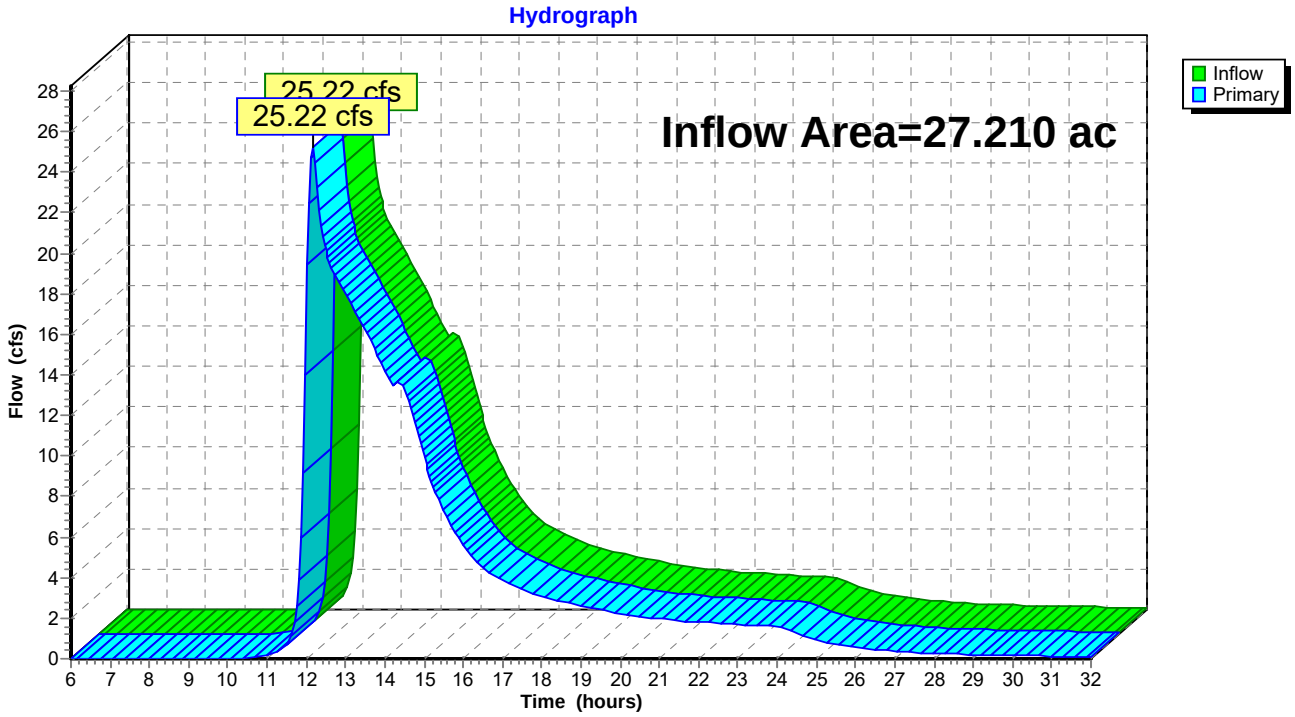


Link WL-3:

Inflow Area = 27.210 ac, Inflow Depth > 3.05" for 25 event
Inflow = 25.22 cfs @ 12.15 hrs, Volume= 6.917 af
Primary = 25.22 cfs @ 12.15 hrs, Volume= 6.917 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link WL-3:



Time span=6.00-32.00 hrs, dt=0.05 hrs, 521 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 101: Runoff Area=1.330 ac Runoff Depth=4.53"
Flow Length=648' Tc=14.6 min CN=76 Runoff=7.79 cfs 0.502 af

Subcatchment 102: Runoff Area=1.280 ac Runoff Depth=4.53"
Flow Length=919' Tc=19.3 min CN=76 Runoff=6.53 cfs 0.483 af

Subcatchment 103: Runoff Area=1.230 ac Runoff Depth=4.53"
Flow Length=793' Tc=17.1 min CN=76 Runoff=6.68 cfs 0.464 af

Subcatchment 104: Runoff Area=0.930 ac Runoff Depth=4.53"
Flow Length=756' Tc=17.6 min CN=76 Runoff=4.98 cfs 0.351 af

Subcatchment 105: Runoff Area=0.930 ac Runoff Depth=4.53"
Flow Length=507' Tc=4.9 min CN=76 Runoff=7.46 cfs 0.351 af

Subcatchment 106: Runoff Area=1.400 ac Runoff Depth=4.53"
Flow Length=908' Tc=4.8 min CN=76 Runoff=11.28 cfs 0.528 af

Subcatchment 107: Runoff Area=1.600 ac Runoff Depth=4.53"
Flow Length=840' Tc=18.2 min CN=76 Runoff=8.42 cfs 0.603 af

Subcatchment 108: Runoff Area=1.100 ac Runoff Depth=4.53"
Flow Length=682' Tc=15.2 min CN=76 Runoff=6.32 cfs 0.415 af

Subcatchment 109: Runoff Area=0.290 ac Runoff Depth=4.53"
Flow Length=216' Tc=4.2 min CN=76 Runoff=2.39 cfs 0.109 af

Subcatchment 110: Runoff Area=0.980 ac Runoff Depth=4.53"
Flow Length=510' Tc=5.6 min CN=76 Runoff=7.63 cfs 0.370 af

Subcatchment 111: Runoff Area=0.660 ac Runoff Depth=4.53"
Flow Length=283' Tc=3.6 min CN=76 Runoff=5.55 cfs 0.249 af

Subcatchment 112: Runoff Area=0.980 ac Runoff Depth=4.53"
Flow Length=426' Tc=6.0 min CN=76 Runoff=7.51 cfs 0.370 af

Subcatchment 113: Runoff Area=0.690 ac Runoff Depth=4.53"
Flow Length=270' Tc=2.5 min CN=76 Runoff=5.90 cfs 0.260 af

Subcatchment 114: Runoff Area=0.240 ac Runoff Depth=4.53"
Flow Length=207' Tc=1.1 min CN=76 Runoff=2.11 cfs 0.091 af

Subcatchment 115: Runoff Area=0.480 ac Runoff Depth=4.53"
Flow Length=292' Tc=26.1 min CN=76 Runoff=2.05 cfs 0.181 af

Subcatchment 116: Runoff Area=0.770 ac Runoff Depth=4.53"
Flow Length=446' Tc=11.7 min CN=76 Runoff=4.95 cfs 0.290 af

Subcatchment 117: Runoff Area=0.960 ac Runoff Depth=4.53"
Flow Length=637' Tc=14.1 min CN=76 Runoff=5.71 cfs 0.362 af

Subcatchment 118: Runoff Area=1.180 ac Runoff Depth=4.53"
Flow Length=776' Tc=16.8 min CN=76 Runoff=6.46 cfs 0.445 af

Subcatchment 119: Runoff Area=0.640 ac Runoff Depth=4.53"
Flow Length=419' Tc=9.8 min CN=76 Runoff=4.37 cfs 0.241 af

Subcatchment 120: Runoff Area=1.570 ac Runoff Depth=4.53"
Flow Length=720' Tc=4.0 min CN=76 Runoff=13.05 cfs 0.592 af

Subcatchment 121: Runoff Area=0.670 ac Runoff Depth=4.53"
Flow Length=336' Tc=9.6 min CN=76 Runoff=4.61 cfs 0.253 af

Subcatchment 122: Runoff Area=0.880 ac Runoff Depth=4.53"
Flow Length=559' Tc=12.6 min CN=76 Runoff=5.50 cfs 0.332 af

Subcatchment 123: Runoff Area=0.430 ac Runoff Depth=4.53"
Flow Length=381' Tc=9.0 min CN=76 Runoff=3.03 cfs 0.162 af

Subcatchment 124: Runoff Area=0.570 ac Runoff Depth=4.53"
Flow Length=374' Tc=2.8 min CN=76 Runoff=4.86 cfs 0.215 af

Subcatchment 125: Runoff Area=1.640 ac Runoff Depth=4.53"
Flow Length=998' Tc=9.8 min CN=76 Runoff=11.20 cfs 0.618 af

Subcatchment 126: Runoff Area=1.830 ac Runoff Depth>4.97"
Flow Length=1,074' Tc=1.1 min CN=80 Runoff=17.35 cfs 0.758 af

Subcatchment 127: Runoff Area=0.440 ac Runoff Depth=4.53"
Flow Length=318' Tc=9.6 min CN=76 Runoff=3.03 cfs 0.166 af

Subcatchment 128: Runoff Area=0.090 ac Runoff Depth=4.53"
Flow Length=150' Tc=4.9 min CN=76 Runoff=0.72 cfs 0.034 af

Subcatchment 129: Runoff Area=0.280 ac Runoff Depth=4.53"
Flow Length=239' Tc=6.5 min CN=76 Runoff=2.13 cfs 0.106 af

Subcatchment 130: Runoff Area=0.470 ac Runoff Depth=4.53"
Flow Length=329' Tc=8.3 min CN=76 Runoff=3.39 cfs 0.177 af

Subcatchment 131: Runoff Area=0.800 ac Runoff Depth=4.53"
Flow Length=404' Tc=4.4 min CN=76 Runoff=6.55 cfs 0.302 af

Subcatchment 132: Runoff Area=0.940 ac Runoff Depth=4.53"
Flow Length=514' Tc=12.0 min CN=76 Runoff=5.98 cfs 0.354 af

Subcatchment 133: Runoff Area=1.270 ac Runoff Depth=4.53"
Flow Length=655' Tc=14.7 min CN=76 Runoff=7.42 cfs 0.479 af

Subcatchment 134: Runoff Area=1.590 ac Runoff Depth=4.53"
Flow Length=765' Tc=16.8 min CN=76 Runoff=8.71 cfs 0.600 af

Subcatchment 135: Runoff Area=1.340 ac Runoff Depth=4.53"
Flow Length=796' Tc=4.8 min CN=76 Runoff=10.80 cfs 0.505 af

Subcatchment 136: Runoff Area=1.170 ac Runoff Depth=4.53"
Flow Length=533' Tc=2.6 min CN=76 Runoff=9.99 cfs 0.441 af

Subcatchment PWL-1: Runoff Area=6.490 ac Runoff Depth=3.55"
Flow Length=300' Tc=31.1 min CN=67 Runoff=19.30 cfs 1.919 af

Subcatchment PWL-2: Runoff Area=6.490 ac Runoff Depth=3.55"
Flow Length=300' Tc=31.1 min CN=67 Runoff=19.30 cfs 1.919 af

Subcatchment PWL-3: Runoff Area=3.780 ac Runoff Depth=3.55"
Flow Length=300' Tc=17.9 min CN=67 Runoff=15.74 cfs 1.118 af

Reach 01-05: PERIMETER CHANNEL Peak Depth=0.52' Max Vel=4.1 fps Inflow=7.79 cfs 0.502 af
n=0.014 L=420.5' S=0.0050 '/' Capacity=48.31 cfs Outflow=7.52 cfs 0.502 af

Reach 02-06: BENCH Peak Depth=0.68' Max Vel=2.9 fps Inflow=6.53 cfs 0.483 af
n=0.045 L=818.0' S=0.0346 '/' Capacity=50.43 cfs Outflow=5.99 cfs 0.483 af

Reach 03-09: BENCH Peak Depth=0.70' Max Vel=2.8 fps Inflow=6.68 cfs 0.464 af
n=0.045 L=740.4' S=0.0300 '/' Capacity=46.95 cfs Outflow=6.10 cfs 0.464 af

Reach 04-08: ACCESS ROAD CHANNEL Peak Depth=0.35' Max Vel=13.3 fps Inflow=11.03 cfs 0.720 af
n=0.014 L=217.8' S=0.0872 '/' Capacity=146.64 cfs Outflow=10.92 cfs 0.720 af

Reach 05-06: PERIMETER CHANNEL Peak Depth=0.59' Max Vel=5.2 fps Inflow=11.57 cfs 0.852 af
n=0.014 L=886.1' S=0.0070 '/' Capacity=57.18 cfs Outflow=11.14 cfs 0.852 af

Reach 06-10: PERIMETER CHANNEL Peak Depth=0.94' Max Vel=7.4 fps Inflow=27.30 cfs 2.466 af
n=0.014 L=121.6' S=0.0085 '/' Capacity=62.91 cfs Outflow=27.17 cfs 2.466 af

Reach 07-04: ACCESS ROAD CHANNEL Peak Depth=0.26' Max Vel=12.8 fps Inflow=7.51 cfs 0.370 af
n=0.014 L=153.5' S=0.1173 '/' Capacity=170.02 cfs Outflow=7.49 cfs 0.370 af

Reach 08-08`: ACCESS ROAD CHANNEL Peak Depth=0.40' Max Vel=15.8 fps Inflow=15.36 cfs 0.980 af
n=0.014 L=190.2' S=0.1073 '/' Capacity=162.60 cfs Outflow=15.19 cfs 0.980 af

Reach 09-10: PIPE DOWNCHUTE Peak Depth=0.59' Max Vel=23.2 fps Inflow=22.73 cfs 1.950 af
D=36.0" n=0.014 L=154.6' S=0.1897 '/' Capacity=269.76 cfs Outflow=22.70 cfs 1.950 af

Reach 10-11: PERIMETER CHANNEL Peak Depth=1.38' Max Vel=5.8 fps Inflow=51.28 cfs 4.525 af
n=0.014 L=482.0' S=0.0030 '/' Capacity=69.51 cfs Outflow=50.15 cfs 4.525 af

Reach 11-19: PERIMETER CHANNEL Peak Depth=1.44' Max Vel=5.9 fps Inflow=55.50 cfs 4.895 af
n=0.014 L=71.8' S=0.0031 '/' Capacity=70.15 cfs Outflow=54.78 cfs 4.895 af

Reach 12-13: DOWNCHUTE Peak Depth=0.10' Max Vel=4.8 fps Inflow=2.05 cfs 0.181 af
n=0.028 L=124.2' S=0.2013 '/' Capacity=336.95 cfs Outflow=2.04 cfs 0.181 af

Reach 13-14: DOWNCHUTE Peak Depth=0.25' Max Vel=8.5 fps Inflow=10.66 cfs 0.724 af
n=0.028 L=146.8' S=0.2112 '/' Capacity=345.13 cfs Outflow=10.58 cfs 0.724 af

Reach 14-15: DOWNCHUTE Peak Depth=0.25' Max Vel=8.5 fps Inflow=21.73 cfs 1.418 af
n=0.028 L=141.3' S=0.2088 '/' Capacity=686.32 cfs Outflow=21.56 cfs 1.418 af

Reach 15-17: DOWNCHUTE Peak Depth=0.45' Max Vel=11.5 fps Inflow=30.40 cfs 2.025 af
n=0.028 L=189.9' S=0.1975 '/' Capacity=333.74 cfs Outflow=30.15 cfs 2.025 af

Reach 16-18: PERIMETER CHANNEL Peak Depth=0.18' Max Vel=7.3 fps Inflow=4.37 cfs 0.241 af
n=0.014 L=637.5' S=0.0521 '/' Capacity=156.00 cfs Outflow=4.18 cfs 0.241 af

Reach 17-18: PIPE DOWNCHUTE Peak Depth=0.86' Max Vel=18.6 fps Inflow=31.12 cfs 2.240 af
D=36.0" n=0.014 L=120.1' S=0.0791 '/' Capacity=174.19 cfs Outflow=31.04 cfs 2.240 af

Reach 18-19: PERIMETER CHANNEL W Peak Depth=0.62' Max Vel=9.0 fps Inflow=42.68 cfs 3.073 af
n=0.014 L=216.2' S=0.0162 '/' Capacity=187.26 cfs Outflow=42.52 cfs 3.073 af

Reach 21-23: DOWNCHUTE Peak Depth=0.11' Max Vel=5.9 fps Inflow=3.03 cfs 0.166 af
n=0.028 L=144.7' S=0.2626 '/' Capacity=384.87 cfs Outflow=2.97 cfs 0.166 af

Reach 22-23: BENCH Peak Depth=0.29' Max Vel=1.7 fps Inflow=0.72 cfs 0.034 af
n=0.045 L=454.4' S=0.0352 '/' Capacity=50.87 cfs Outflow=0.59 cfs 0.034 af

Reach 23-25: DOWNCHUTE Peak Depth=0.22' Max Vel=8.7 fps Inflow=9.48 cfs 0.554 af
n=0.028 L=144.0' S=0.2569 '/' Capacity=380.70 cfs Outflow=9.40 cfs 0.554 af

Reach 24-25: BENCH Peak Depth=0.44' Max Vel=2.1 fps Inflow=2.13 cfs 0.106 af
n=0.045 L=594.2' S=0.0337 '/' Capacity=49.74 cfs Outflow=1.78 cfs 0.106 af

Reach 25-27: DOWNCHUTE Peak Depth=0.31' Max Vel=11.1 fps Inflow=18.36 cfs 1.139 af
n=0.028 L=127.2' S=0.2752 '/' Capacity=393.96 cfs Outflow=18.24 cfs 1.139 af

Reach 26-27: BENCH Peak Depth=0.52' Max Vel=2.3 fps Inflow=3.39 cfs 0.177 af
n=0.045 L=704.7' S=0.0312 '/' Capacity=47.90 cfs Outflow=2.83 cfs 0.177 af

Reach 27-29: DOWNCHUTE Peak Depth=0.40' Max Vel=13.0 fps Inflow=29.21 cfs 1.916 af
n=0.028 L=25.7' S=0.2918 '/' Capacity=405.72 cfs Outflow=29.19 cfs 1.916 af

Reach 28-29: PERIMETER CHANNEL Peak Depth=0.42' Max Vel=4.2 fps Inflow=6.55 cfs 0.302 af
n=0.014 L=751.8' S=0.0067 '/' Capacity=55.92 cfs Outflow=5.99 cfs 0.302 af

Pond POND Nº1: Peak Elev=29.14' Storage=3.888 af Inflow=111.77 cfs 8.836 af
Outflow=25.27 cfs 8.545 af

Pond POND Nº2:	Peak Elev=39.01' Storage=1.529 af	Inflow=44.64 cfs 3.164 af Outflow=8.56 cfs 2.574 af
Pond WL-2:	Peak Elev=37.07' Storage=0.902 af	Inflow=19.30 cfs 1.919 af Outflow=6.50 cfs 1.126 af
Link 08`-09:		Inflow=15.19 cfs 0.980 af Primary=15.19 cfs 0.980 af
Link 19-20:		Inflow=100.57 cfs 8.217 af Primary=100.57 cfs 8.217 af
Link 29-30:		Inflow=44.64 cfs 3.164 af Primary=44.64 cfs 3.164 af
Link OUTLET 1:		Inflow=33.52 cfs 10.789 af Primary=33.52 cfs 10.789 af
Link OUTLET2:		Inflow=29.39 cfs 5.250 af Primary=29.39 cfs 5.250 af
Link WL-1:		Inflow=29.39 cfs 5.250 af Primary=29.39 cfs 5.250 af
Link WL-3:		Inflow=33.52 cfs 9.663 af Primary=33.52 cfs 9.663 af

Total Runoff Area = 50.410 ac Runoff Volume = 17.713 af Average Runoff Depth = 4.22"

Subcatchment 101:

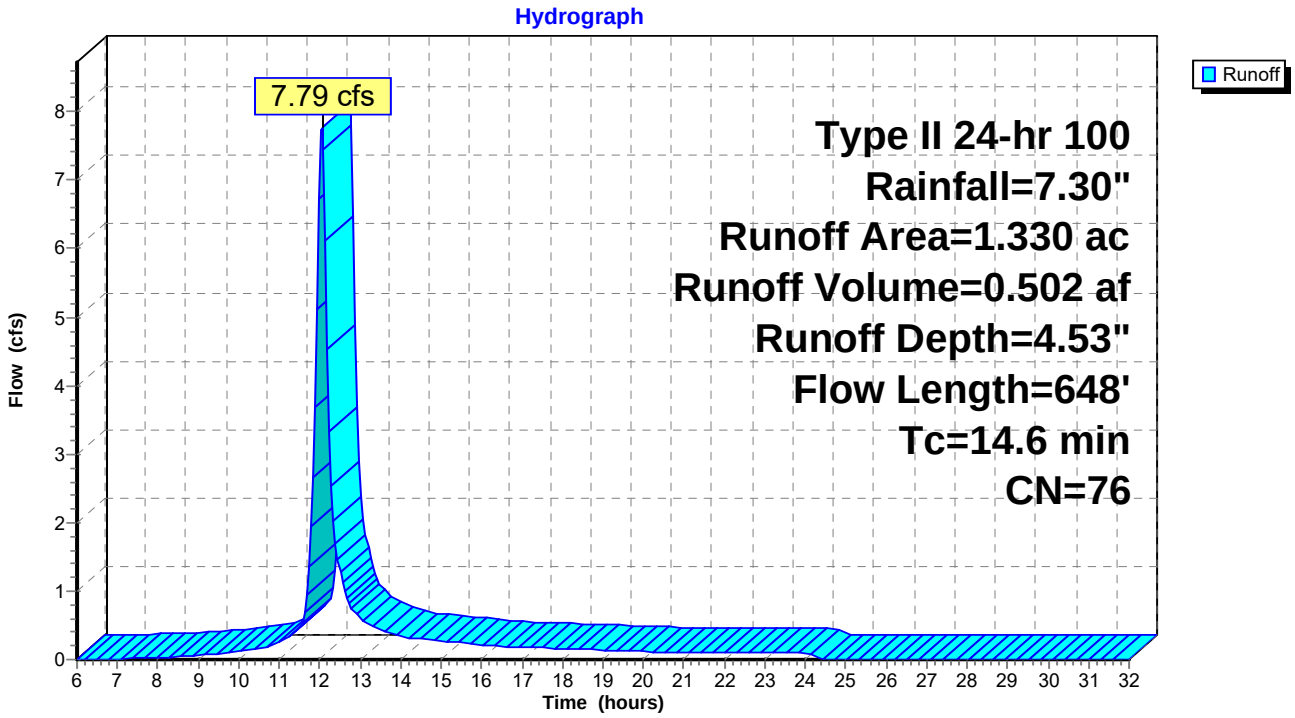
Runoff = 7.79 cfs @ 12.06 hrs, Volume= 0.502 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
1.330	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	99	0.3330	0.4		**Sheet Flow, Overland Flow** n= 0.200 P2= 3.20"
10.6	549	0.0300	0.9		**Shallow Concentrated Flow, BENCH** Kv= 5.0 fps
14.6	648	Total			

Subcatchment 101:



Subcatchment 102:

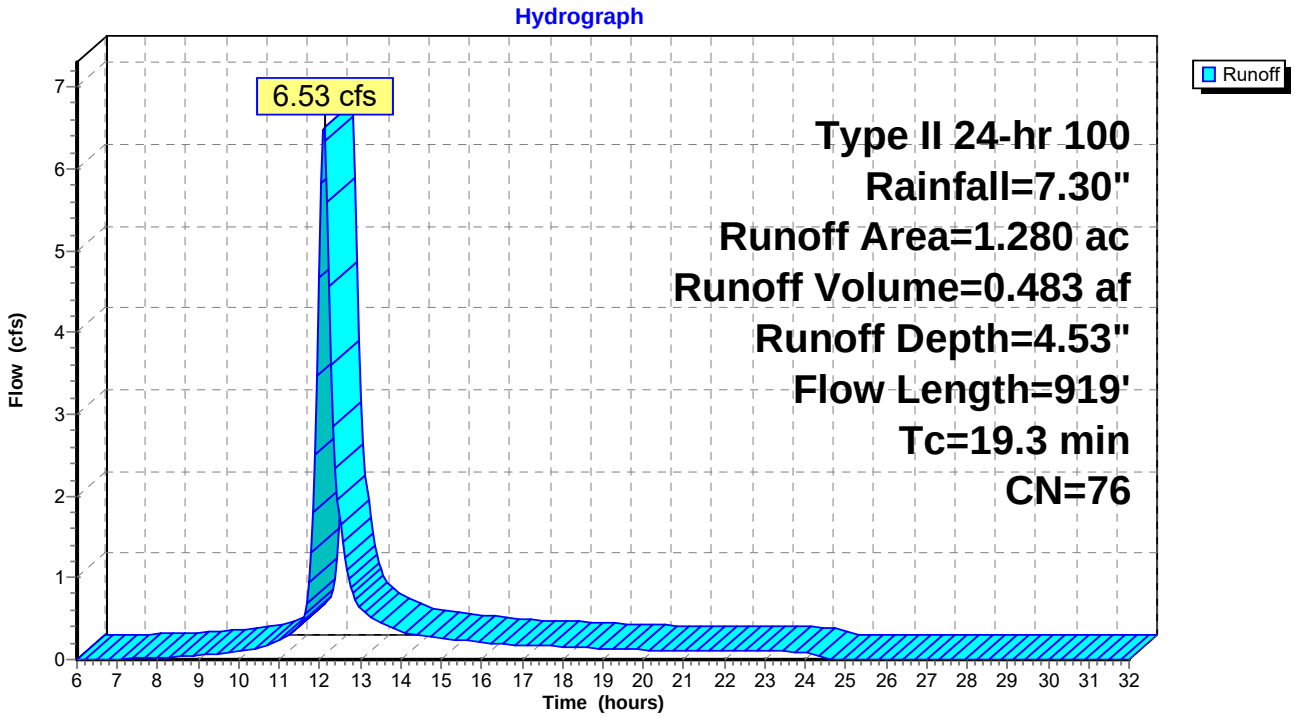
Runoff = 6.53 cfs @ 12.12 hrs, Volume= 0.483 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
1.280	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	67	0.3330	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
16.4	852	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
19.3	919	Total			

Subcatchment 102:



Subcatchment 103:

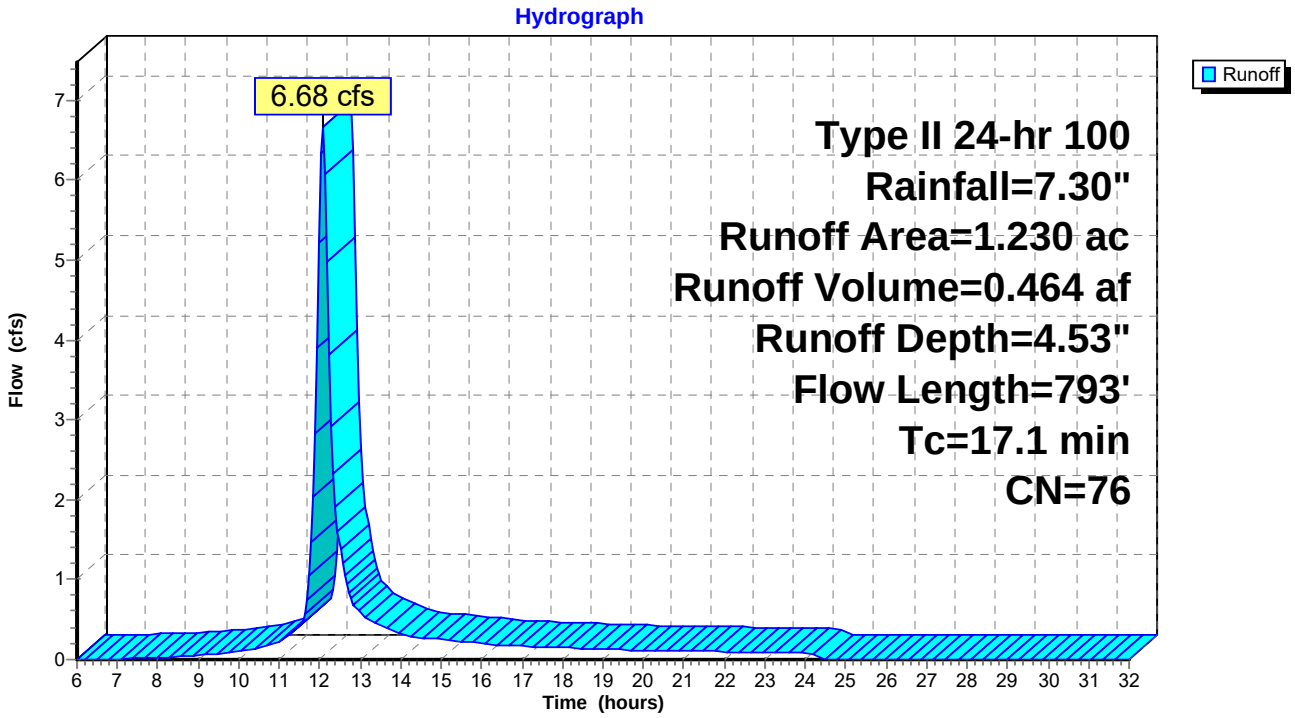
Runoff = 6.68 cfs @ 12.09 hrs, Volume= 0.464 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
1.230	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	77	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
13.8	716	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
17.1	793	Total			

Subcatchment 103:



Subcatchment 104:

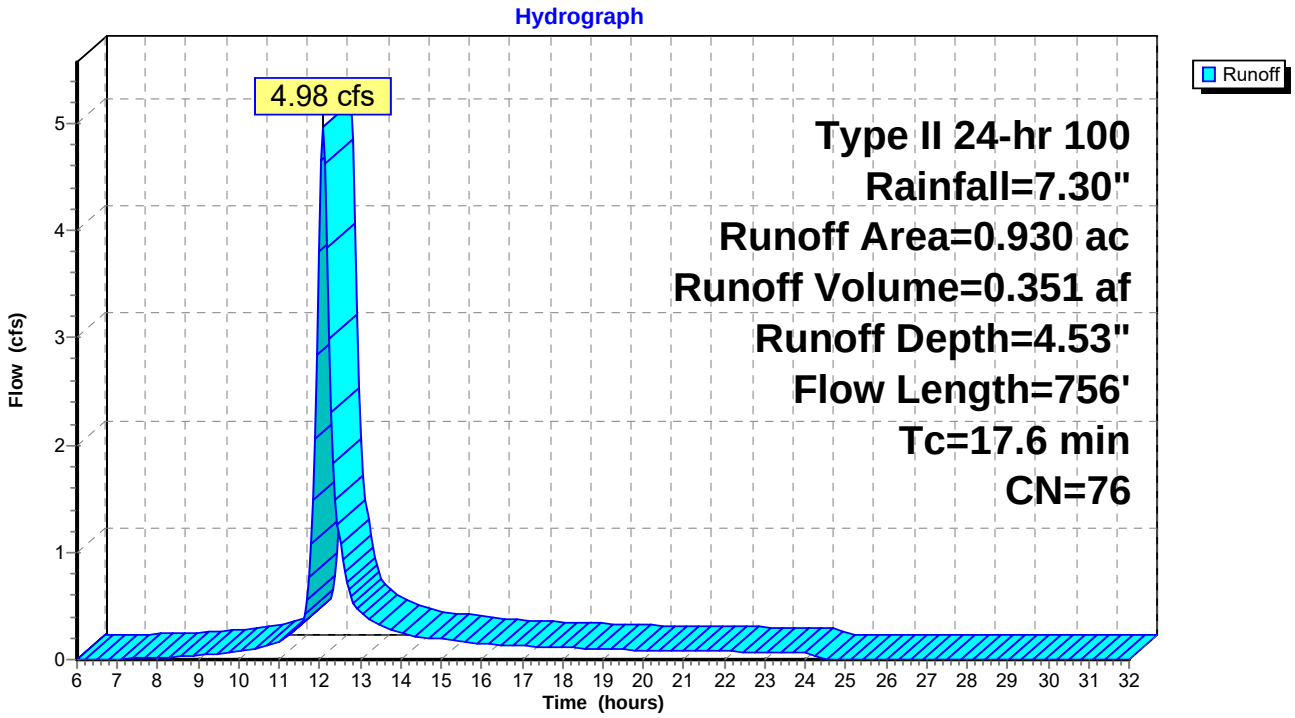
Runoff = 4.98 cfs @ 12.10 hrs, Volume= 0.351 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.930	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1900	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
12.6	656	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
17.6	756	Total			

Subcatchment 104:



Subcatchment 105:

[49] Hint: Tc<2dt may require smaller dt

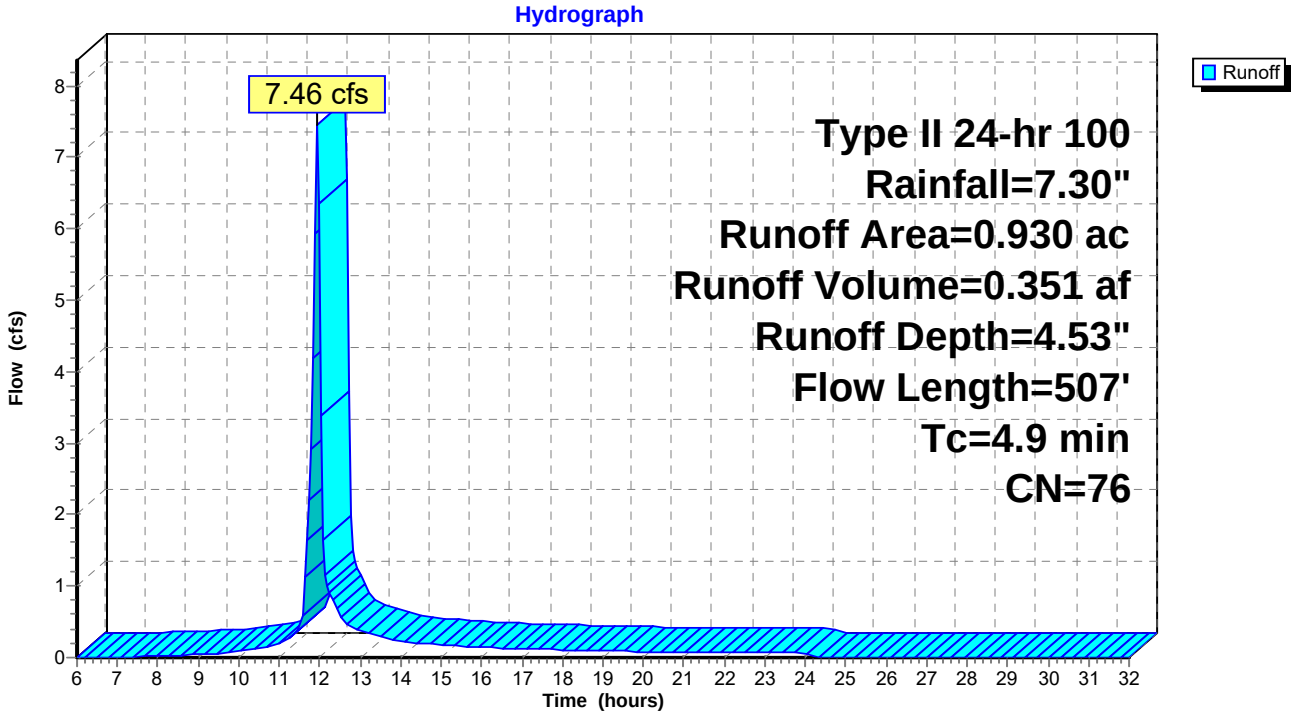
Runoff = 7.46 cfs @ 11.95 hrs, Volume= 0.351 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.930	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.9	407	0.0050	7.2	48.34	**Trap/Vee/Rect Channel Flow, PERIMETRAL CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.9	507	Total			

Subcatchment 105:



Subcatchment 106:

[49] Hint: Tc<2dt may require smaller dt

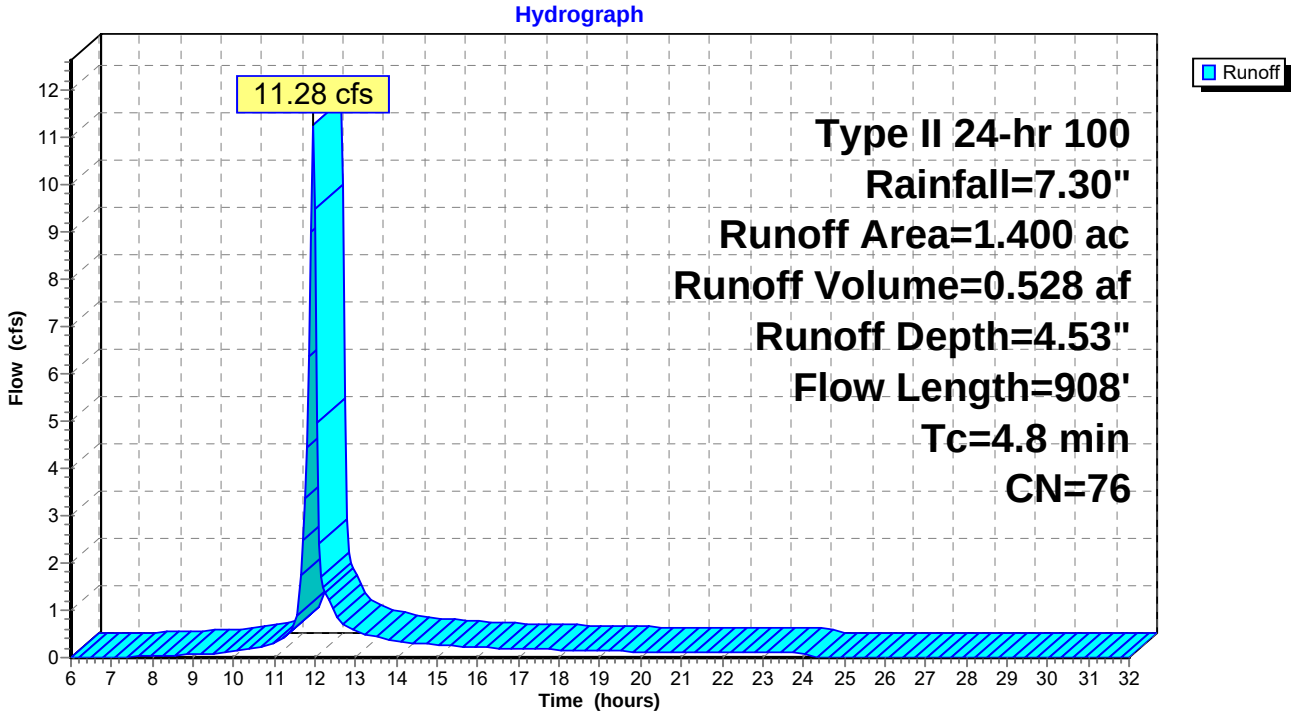
Runoff = 11.28 cfs @ 11.95 hrs, Volume= 0.528 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
1.400	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	74	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
1.6	834	0.0070	8.5	57.19	**Trap/Vee/Rect Channel Flow, PERIMETRAL CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.8	908	Total			

Subcatchment 106:



Subcatchment 107:

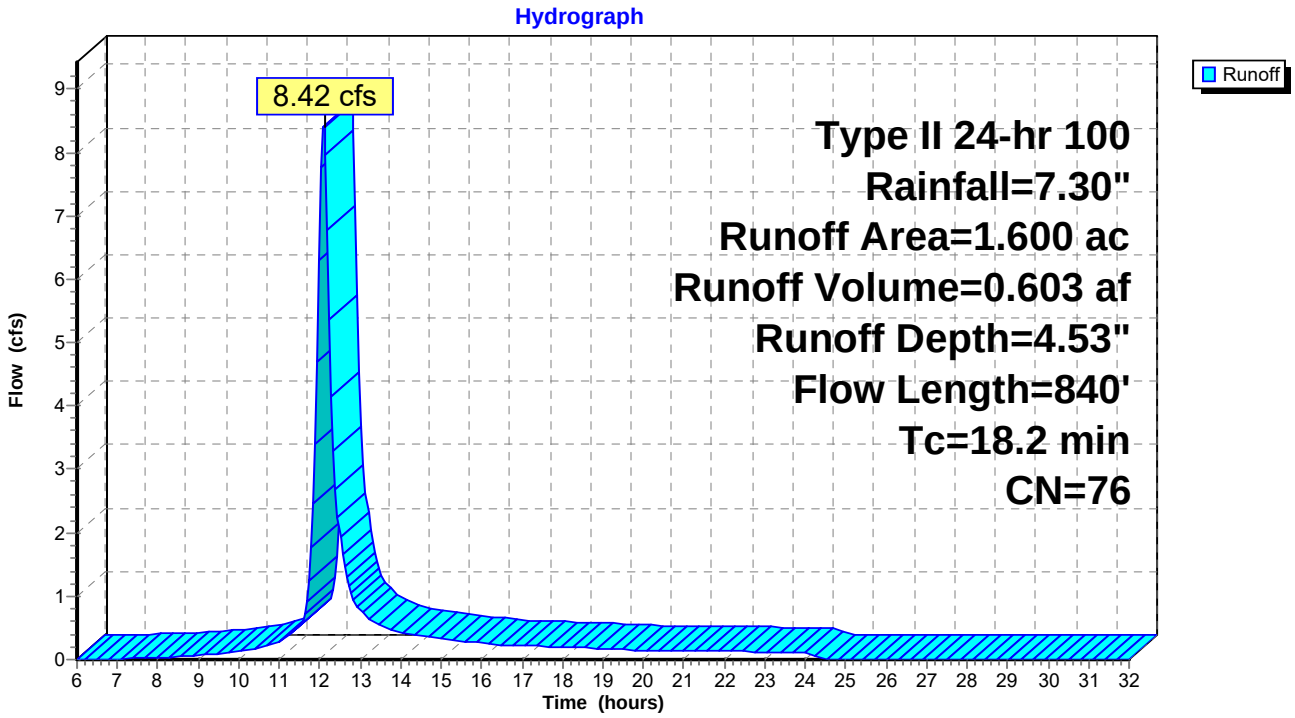
Runoff = 8.42 cfs @ 12.10 hrs, Volume= 0.603 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
1.600	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	94	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
14.4	746	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
18.2	840	Total			

Subcatchment 107:



Subcatchment 108:

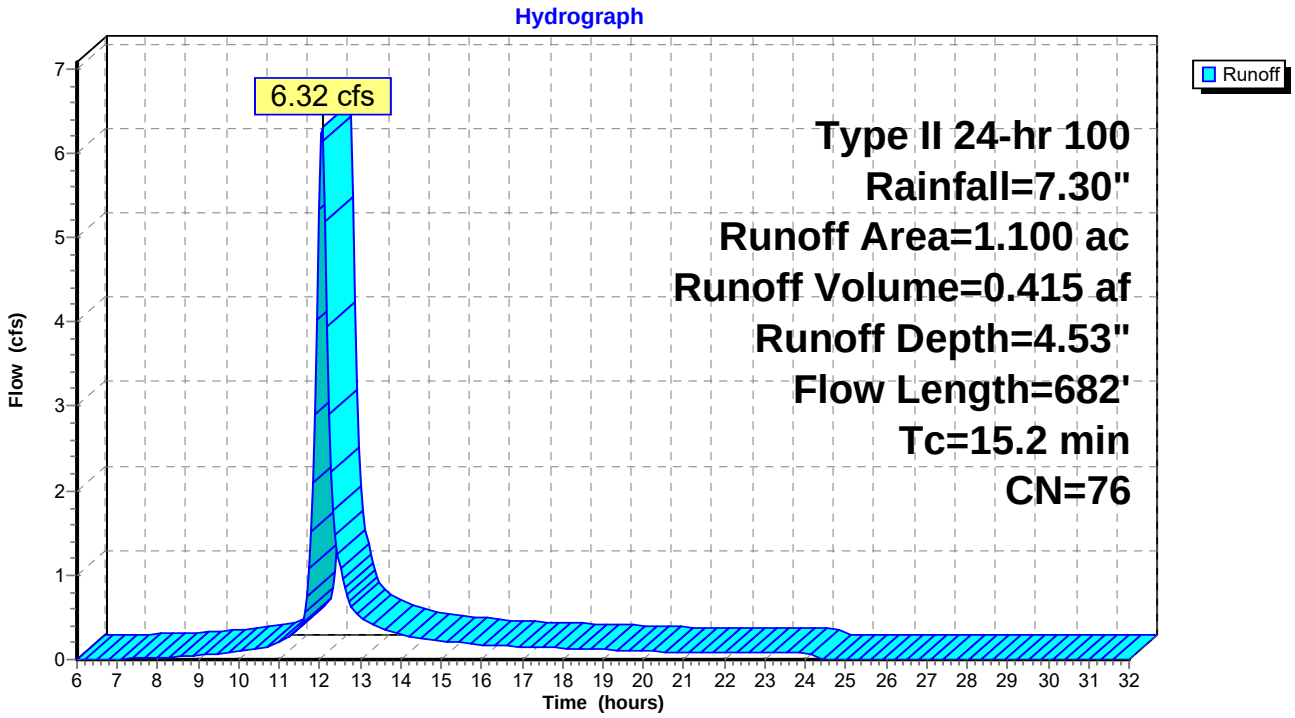
Runoff = 6.32 cfs @ 12.07 hrs, Volume= 0.415 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
1.100	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
11.2	582	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
15.2	682	Total			

Subcatchment 108:



Subcatchment 109:

[49] Hint: Tc<2dt may require smaller dt

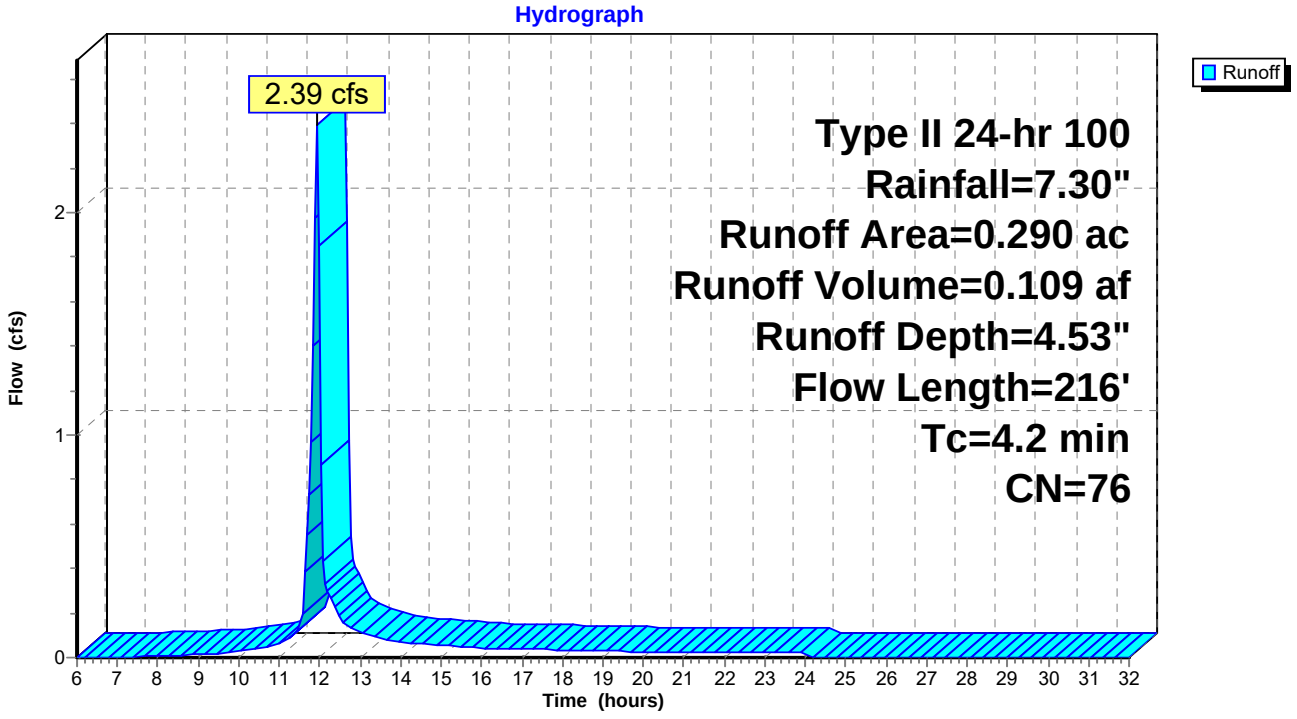
Runoff = 2.39 cfs @ 11.95 hrs, Volume= 0.109 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.290	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	94	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.4	122	0.0030	5.5	37.44	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.2	216	Total			

Subcatchment 109:



Subcatchment 110:

[49] Hint: Tc<2dt may require smaller dt

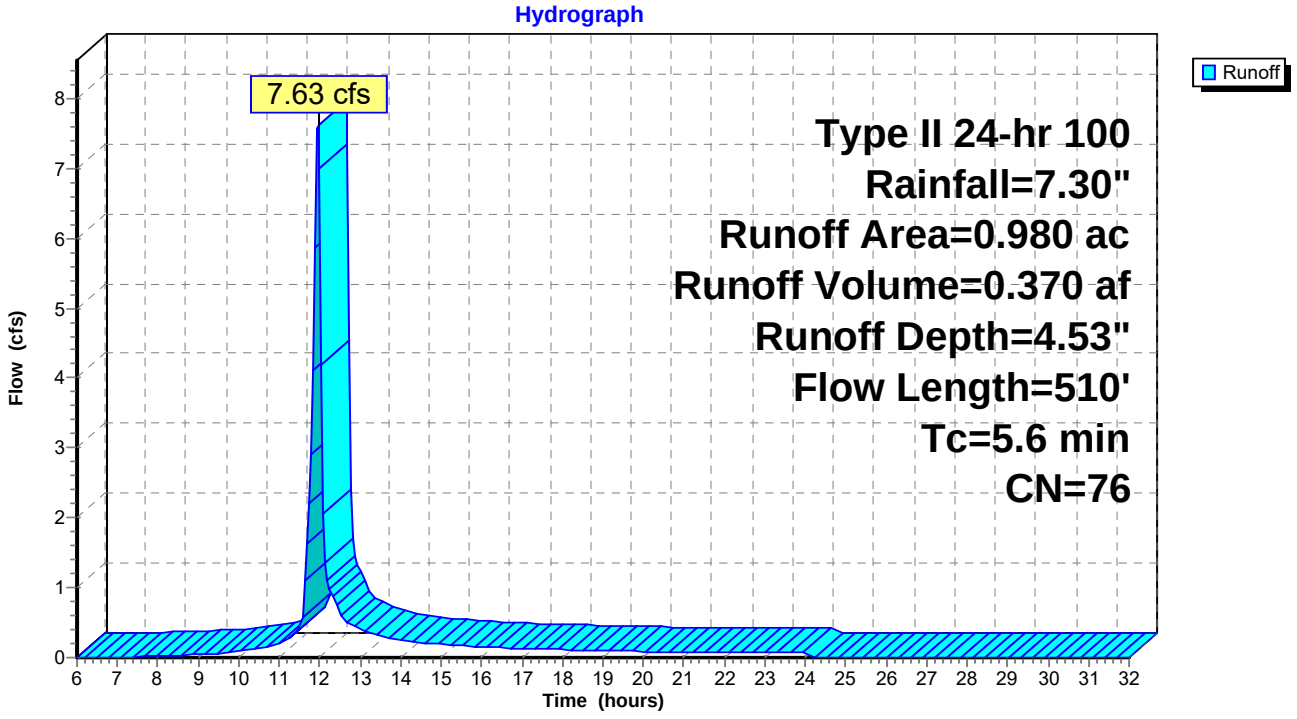
Runoff = 7.63 cfs @ 11.96 hrs, Volume= 0.370 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.980	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	84	0.2000	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
1.3	426	0.0030	5.5	37.44	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
5.6	510	Total			

Subcatchment 110:



Subcatchment 111:

[49] Hint: Tc<2dt may require smaller dt

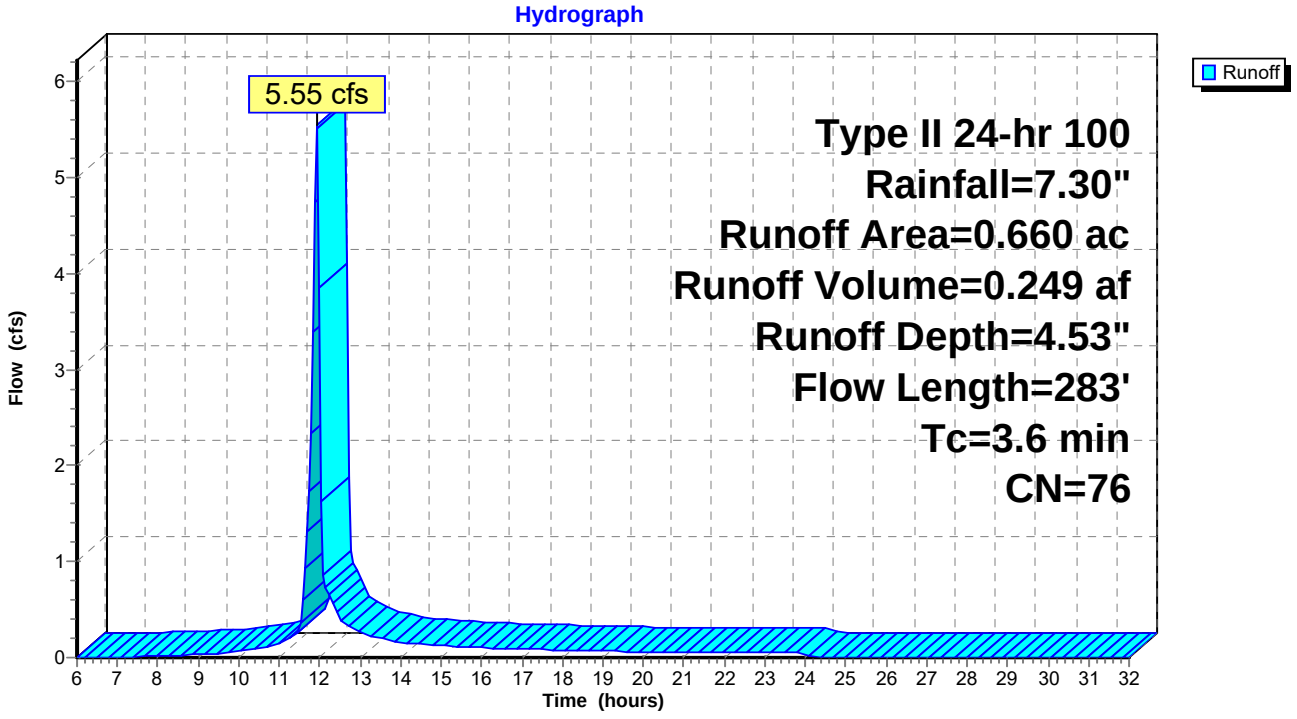
Runoff = 5.55 cfs @ 11.94 hrs, Volume= 0.249 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.660	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	67	0.2200	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.2	216	0.0310	20.3	259.13	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL W** Bot.W=7.00' D=1.50' Z= 1.0 '/' Top.W=10.00' n= 0.014
3.6	283	Total			

Subcatchment 111:



Subcatchment 112:

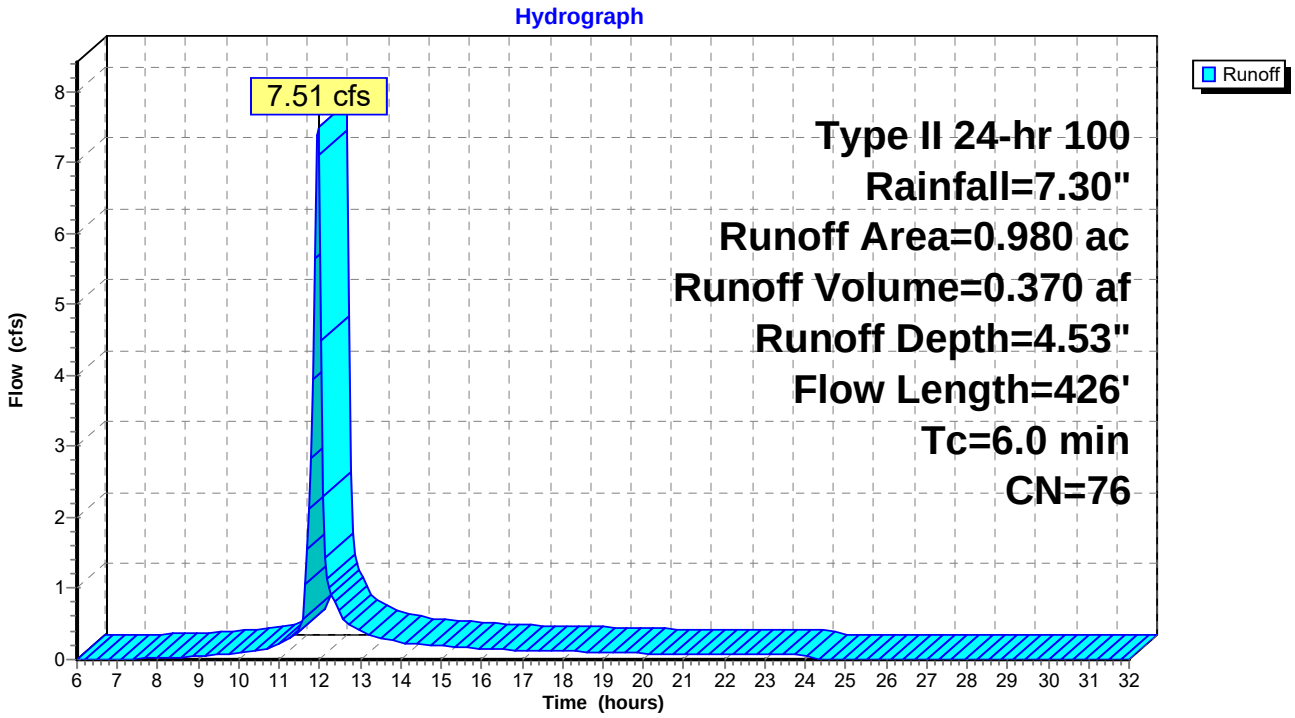
Runoff = 7.51 cfs @ 11.97 hrs, Volume= 0.370 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.980	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.1300	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.2	326	0.1060	30.8	161.65	**Trap/Vee/Rect Channel Flow, ACCES ROAD CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
6.0	426	Total			

Subcatchment 112:



Subcatchment 113:

[49] Hint: Tc<2dt may require smaller dt

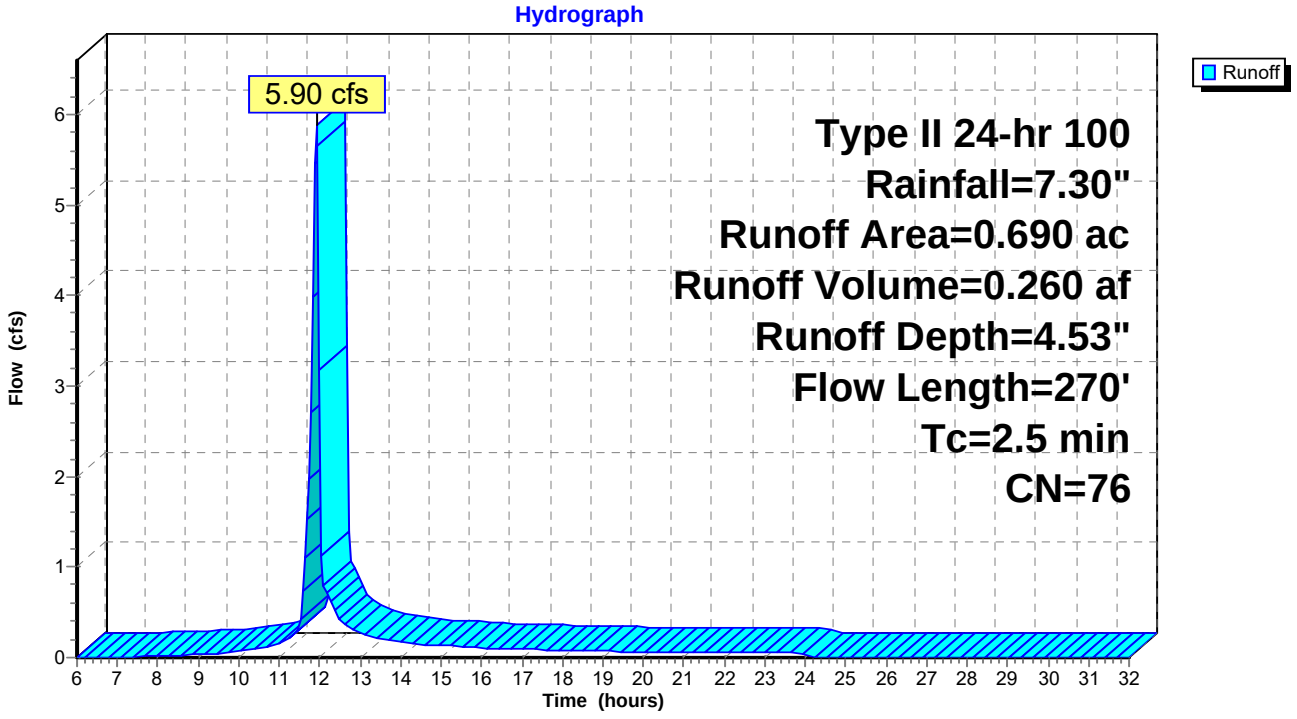
Runoff = 5.90 cfs @ 11.93 hrs, Volume= 0.260 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.690	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	52	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.1	218	0.0950	29.1	153.03	**Trap/Vee/Rect Channel Flow, ACCESS ROAD CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
2.5	270	Total			

Subcatchment 113:



Subcatchment 114:

[49] Hint: Tc<2dt may require smaller dt

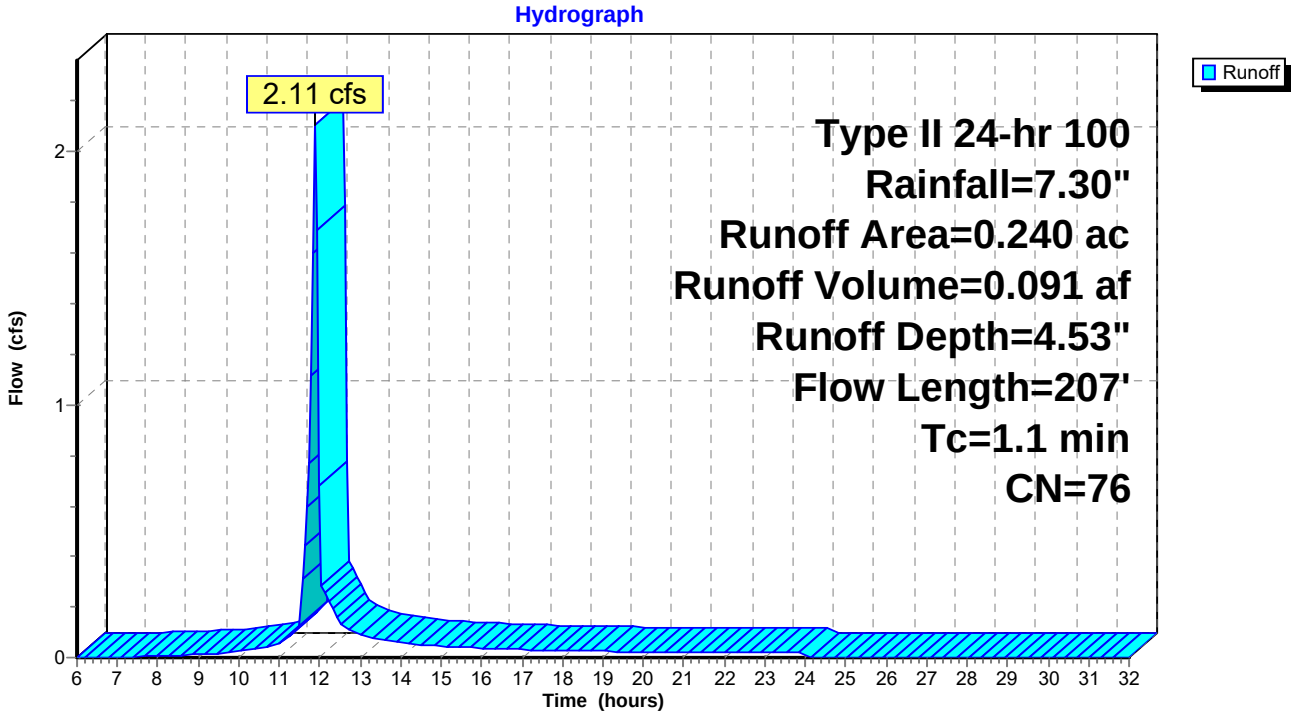
Runoff = 2.11 cfs @ 11.90 hrs, Volume= 0.091 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.240	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	17	0.3300	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.1	190	0.1050	30.6	160.88	**Trap/Vee/Rect Channel Flow, ACCESS ROAD CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
1.1	207	Total			

Subcatchment 114:



Subcatchment 115:

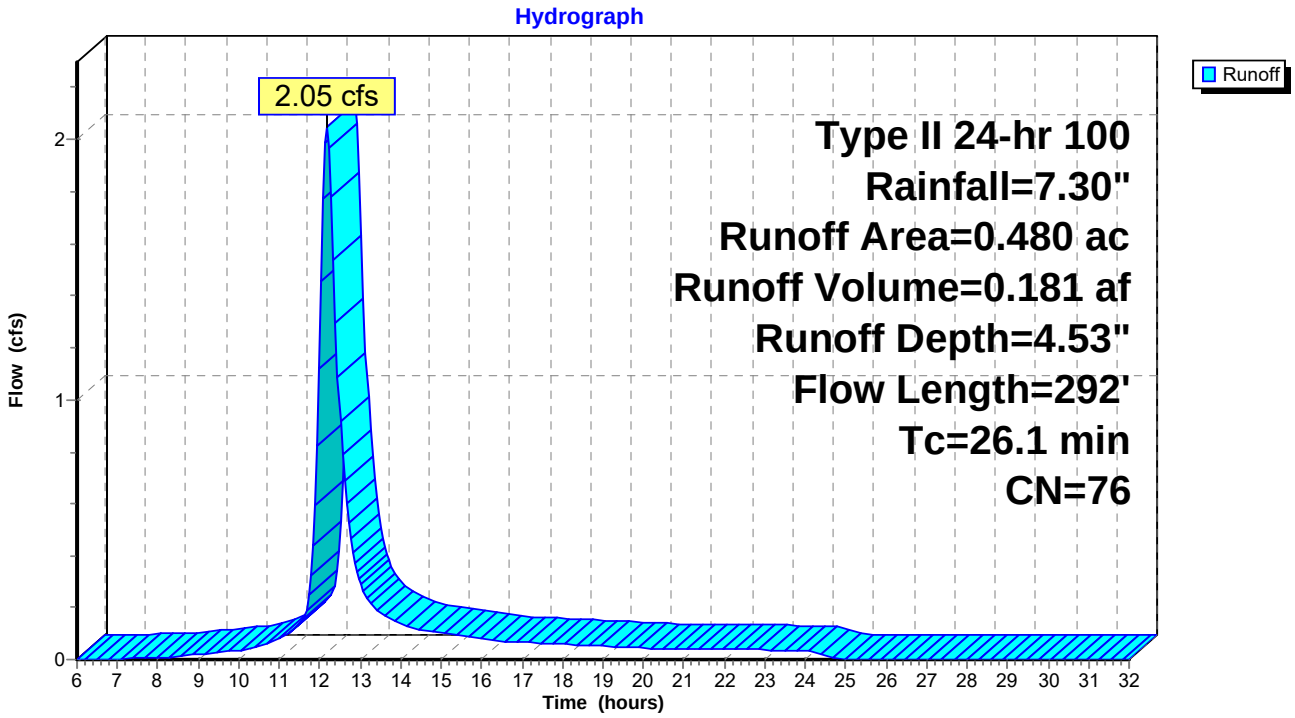
Runoff = 2.05 cfs @ 12.20 hrs, Volume= 0.181 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.480	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	74	0.0100	0.1		**Sheet Flow,** n= 0.200 P2= 3.20"
13.3	218	0.0030	0.3		**Shallow Concentrated Flow, DIVERSION BERM FLOW** Kv= 5.0 fps
26.1	292	Total			

Subcatchment 115:



Subcatchment 116:

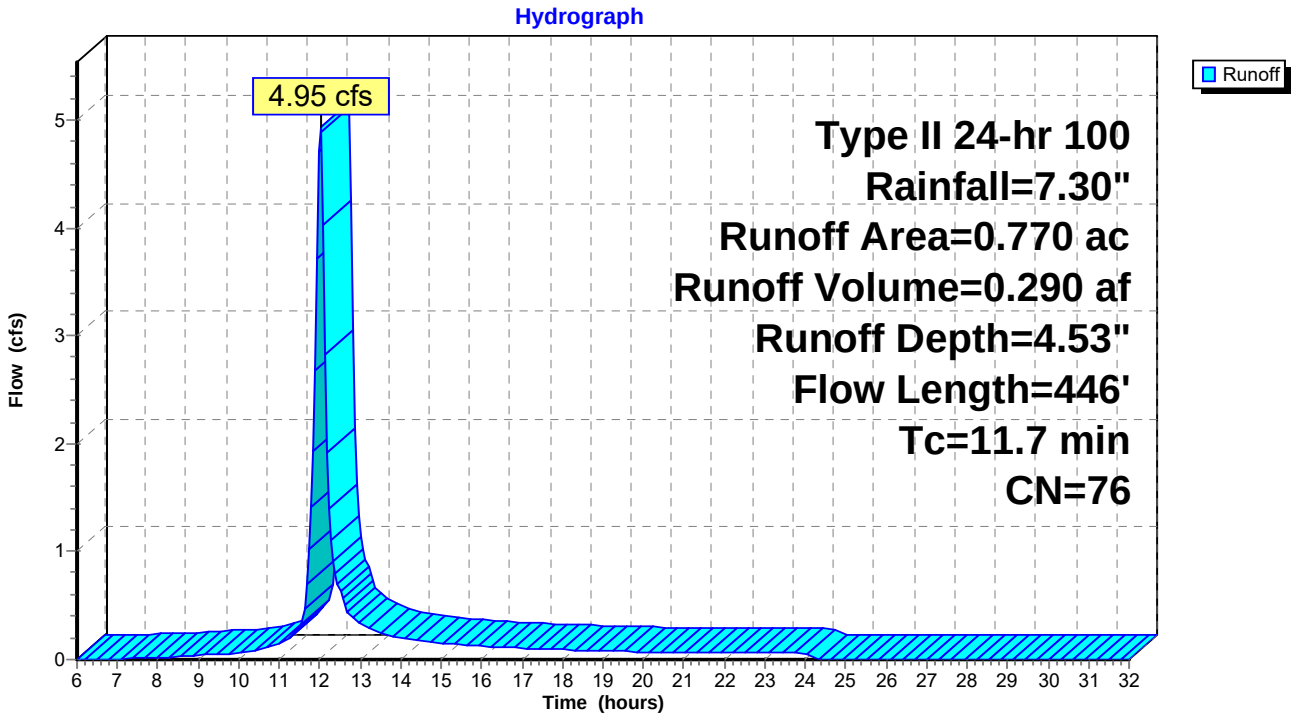
Runoff = 4.95 cfs @ 12.03 hrs, Volume= 0.290 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.770	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1600	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
6.3	346	0.0330	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
11.7	446	Total			

Subcatchment 116:



Subcatchment 117:

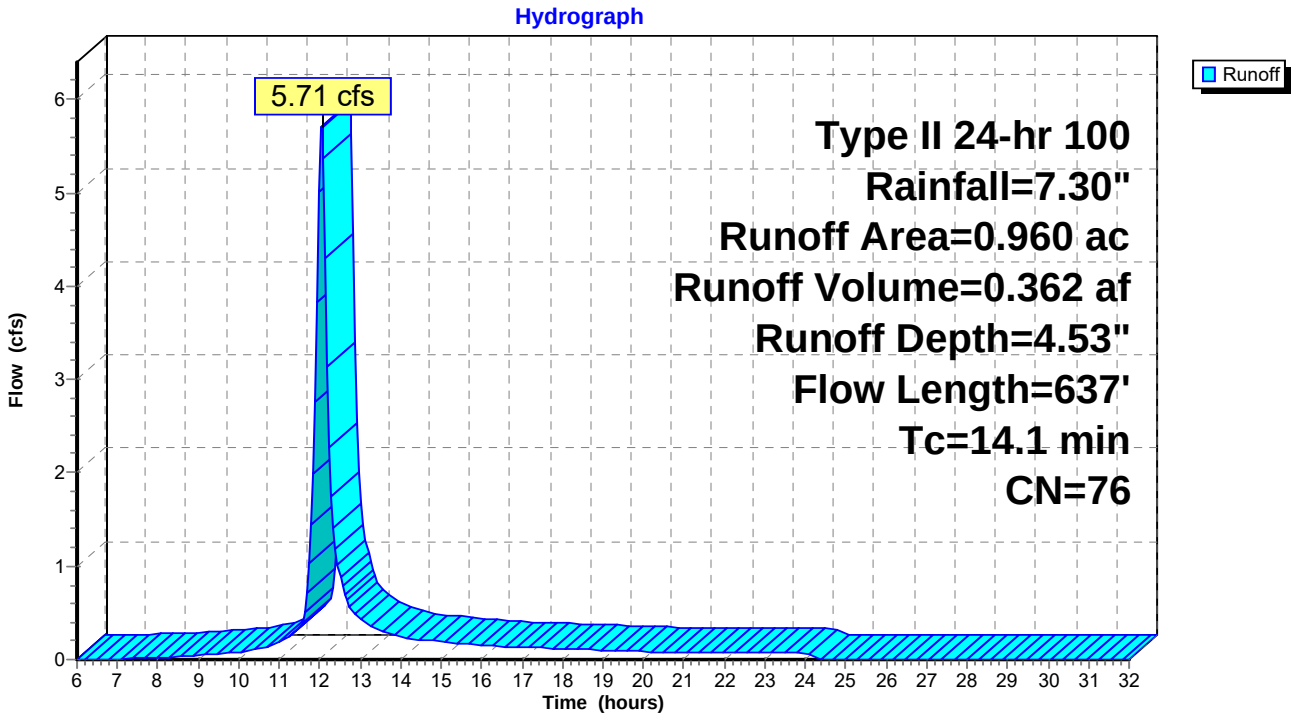
Runoff = 5.71 cfs @ 12.06 hrs, Volume= 0.362 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.960	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	82	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
10.7	555	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
14.1	637	Total			

Subcatchment 117:



Subcatchment 118:

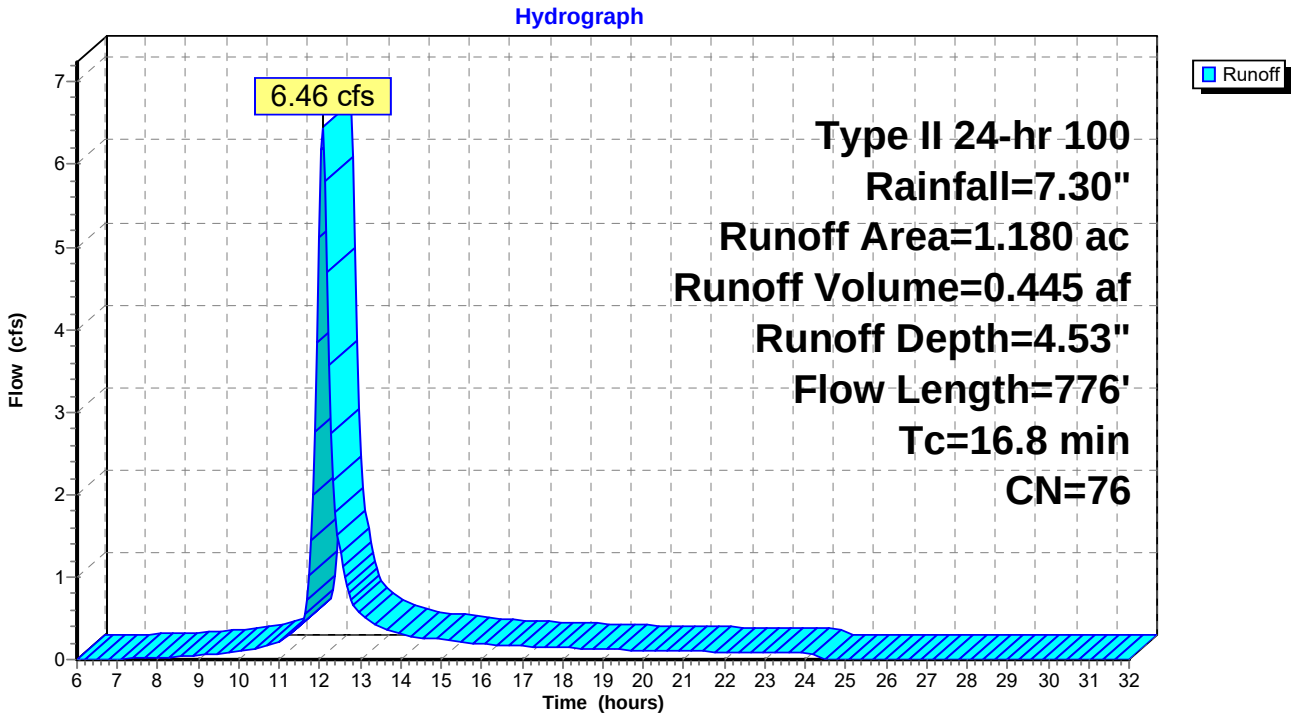
Runoff = 6.46 cfs @ 12.09 hrs, Volume= 0.445 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
1.180	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	80	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
13.4	696	0.0300	0.9		**Shallow Concentrated Flow,** Kv= 5.0 fps
16.8	776	Total			

Subcatchment 118:



Subcatchment 119:

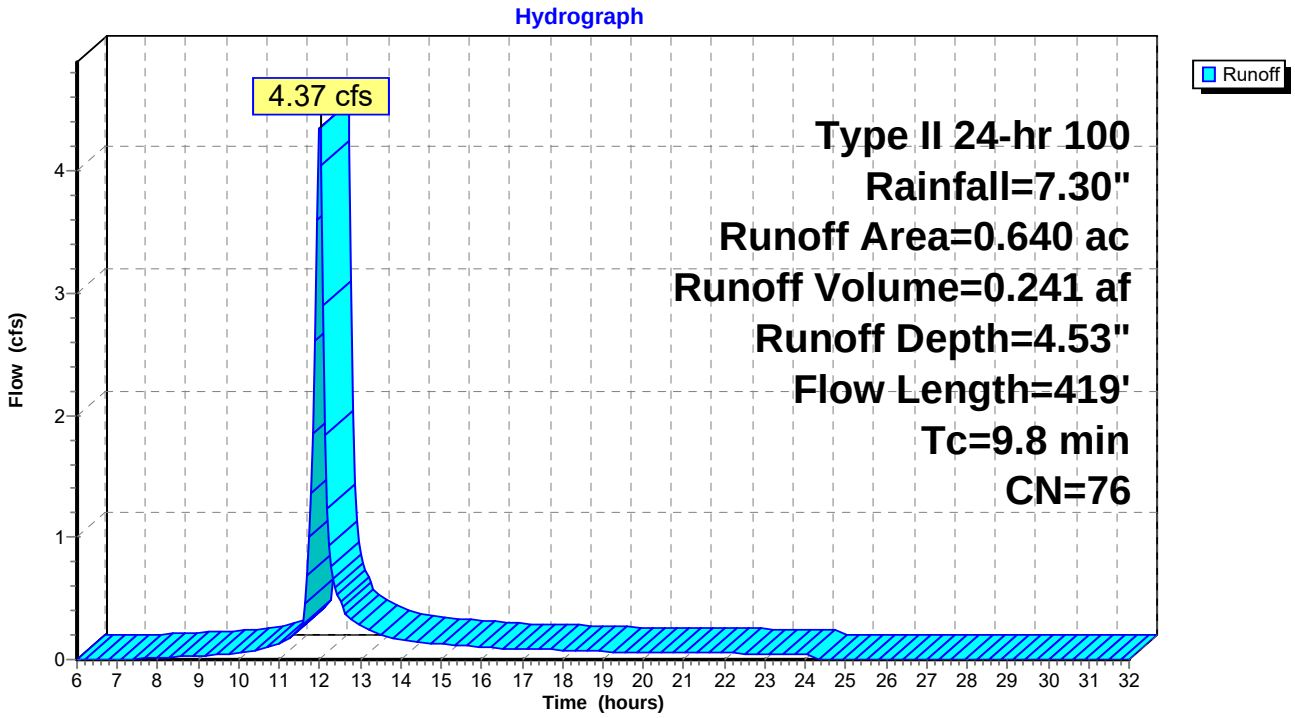
Runoff = 4.37 cfs @ 12.01 hrs, Volume= 0.241 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.640	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	79	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
6.5	340	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.8	419	Total			

Subcatchment 119:



Subcatchment 120:

[49] Hint: Tc<2dt may require smaller dt

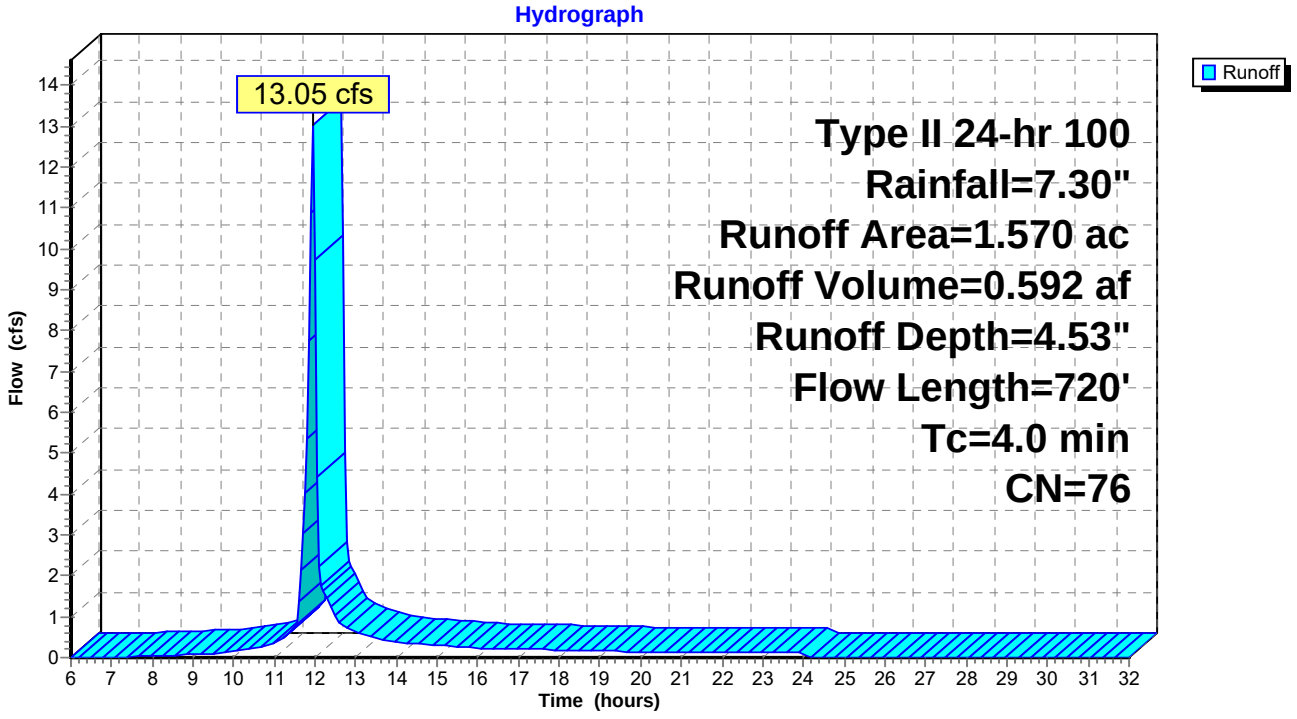
Runoff = 13.05 cfs @ 11.94 hrs, Volume= 0.592 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
1.570	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	83	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.5	637	0.0500	22.6	152.86	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.0	720	Total			

Subcatchment 120:



Subcatchment 121:

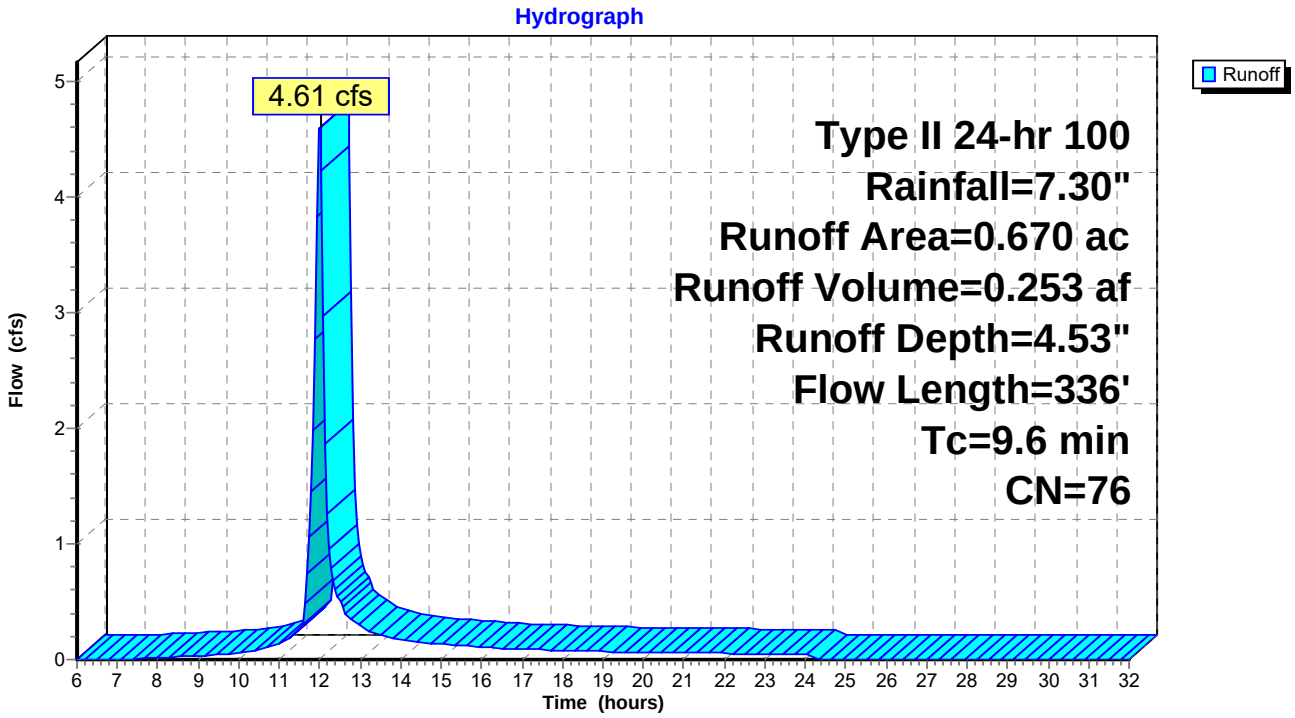
Runoff = 4.61 cfs @ 12.01 hrs, Volume= 0.253 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.670	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1600	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
4.2	236	0.0350	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.6	336	Total			

Subcatchment 121:



Subcatchment 122:

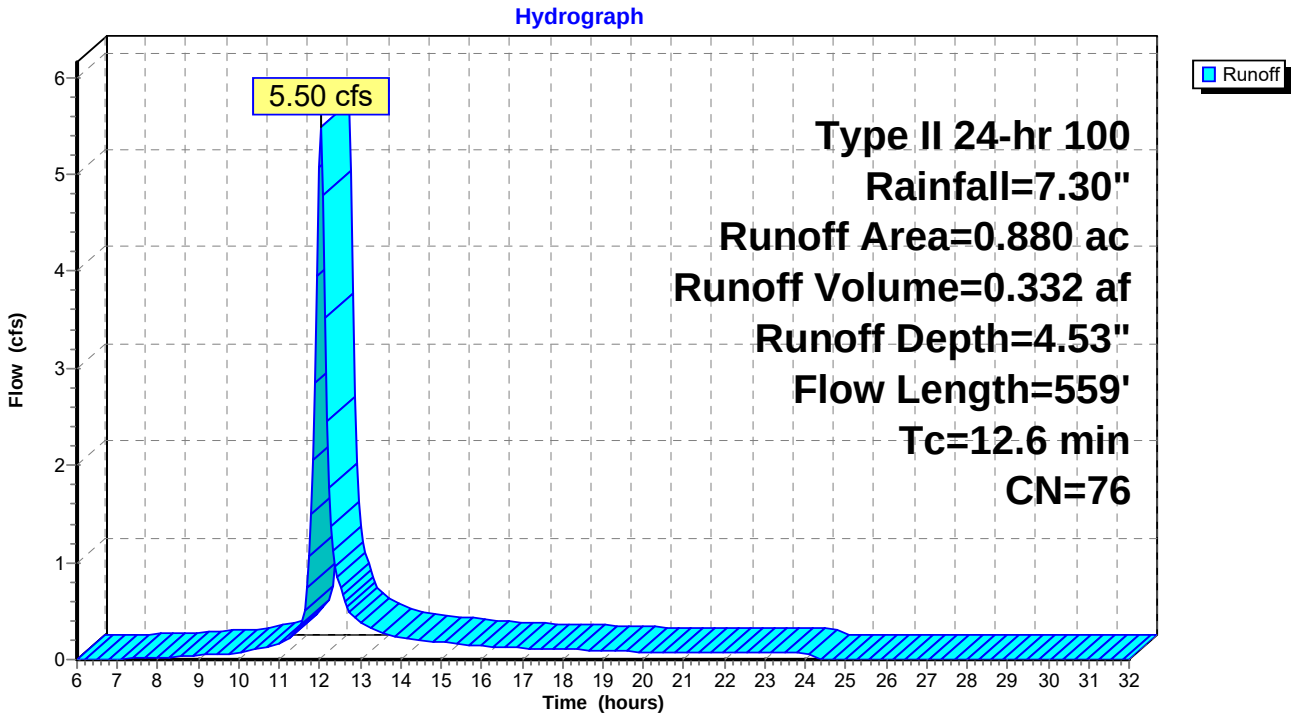
Runoff = 5.50 cfs @ 12.04 hrs, Volume= 0.332 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.880	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	84	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
9.1	475	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
12.6	559	Total			

Subcatchment 122:



Subcatchment 123:

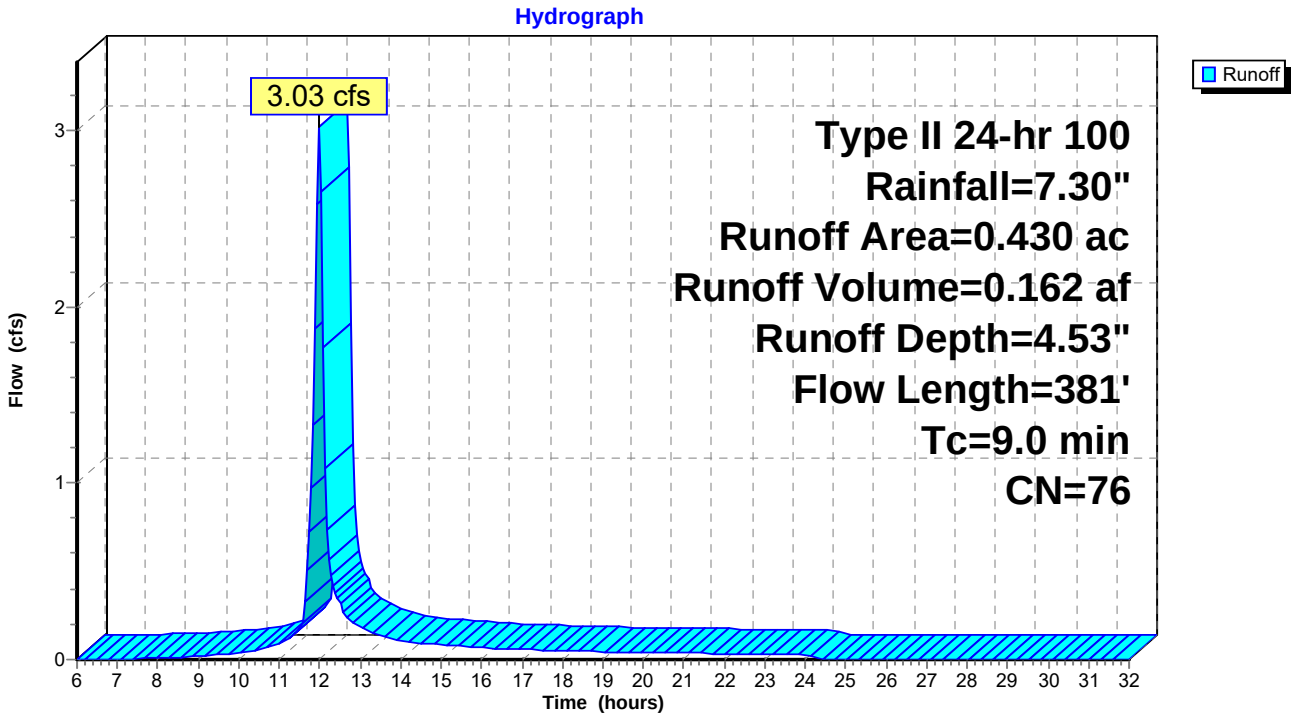
Runoff = 3.03 cfs @ 12.00 hrs, Volume= 0.162 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.430	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	72	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
5.9	309	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.0	381	Total			

Subcatchment 123:



Subcatchment 124:

[49] Hint: Tc<2dt may require smaller dt

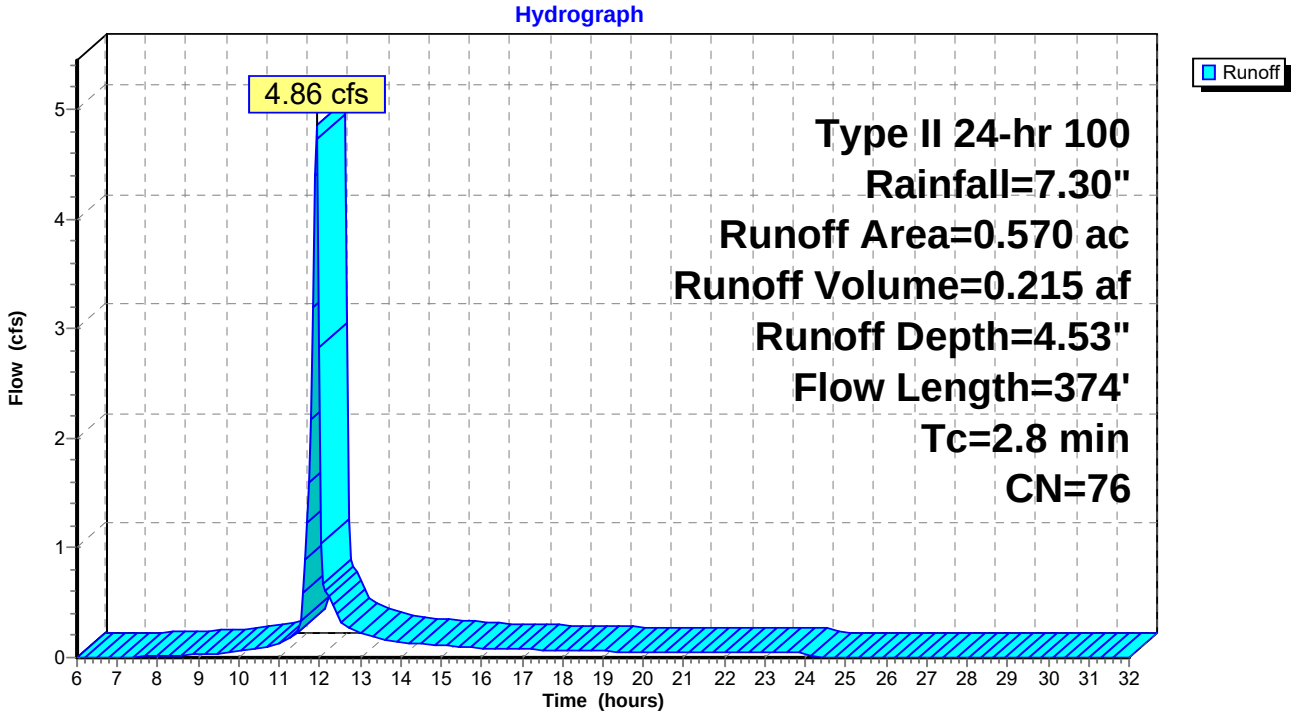
Runoff = 4.86 cfs @ 11.93 hrs, Volume= 0.215 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.570	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	58	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.2	316	0.0800	26.7	140.43	**Trap/Vee/Rect Channel Flow, MSE CHANNEL** Bot.W=2.00' D=1.50' Z= 1.0 '/' Top.W=5.00' n= 0.014
2.8	374	Total			

Subcatchment 124:



Subcatchment 125:

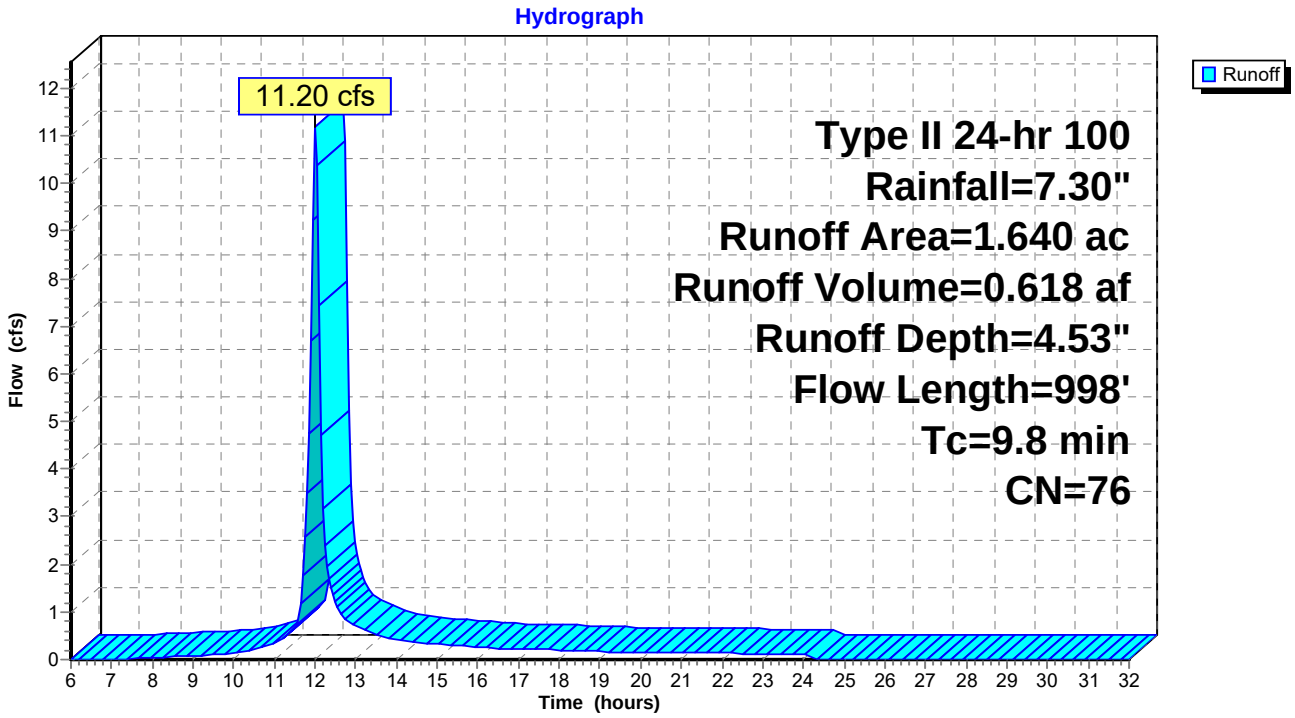
Runoff = 11.20 cfs @ 12.01 hrs, Volume= 0.618 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
1.640	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	62	0.0200	0.1		**Sheet Flow,** n= 0.200 P2= 3.20"
1.4	936	0.0800	11.5	80.16	**Trap/Vee/Rect Channel Flow, EXTERIOR CHANNEL** Bot.W=5.00' D=1.00' Z= 2.0 '/' Top.W=9.00' n= 0.030
9.8	998	Total			

Subcatchment 125:



Subcatchment 126:

[49] Hint: Tc<2dt may require smaller dt

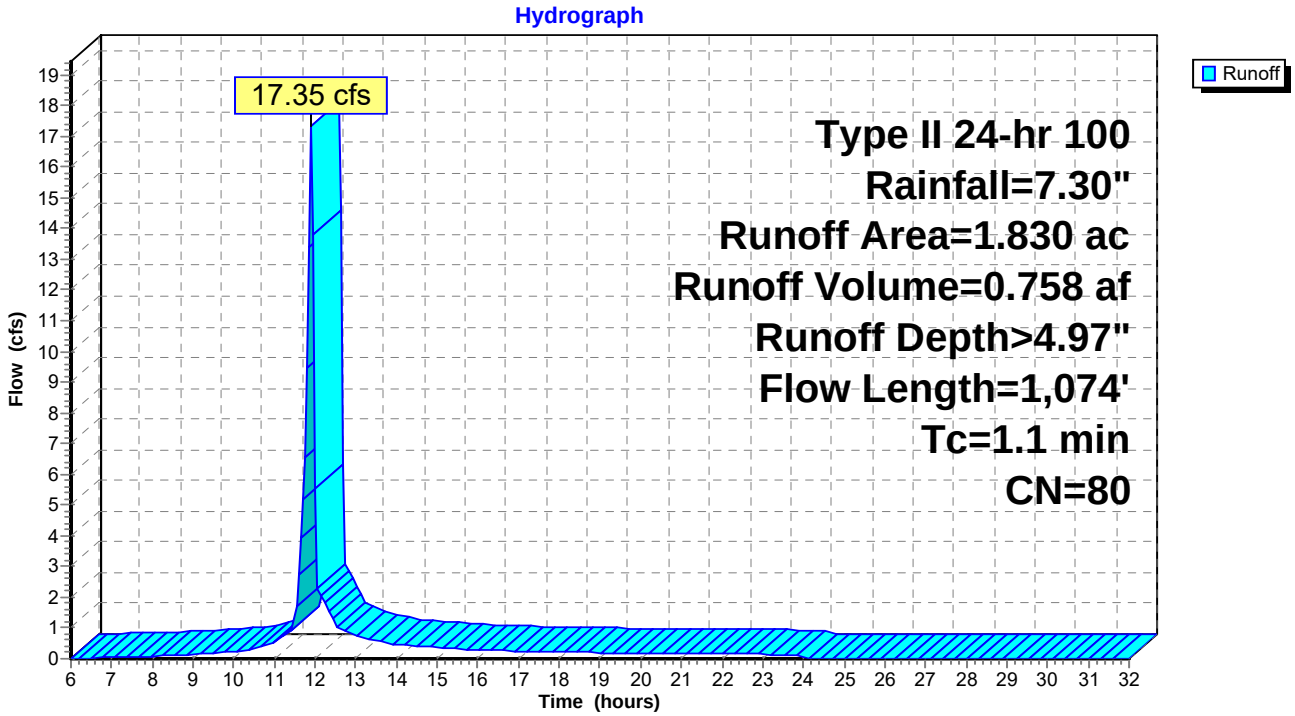
Runoff = 17.35 cfs @ 11.90 hrs, Volume= 0.758 af, Depth> 4.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
1.830	80	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	1,074	0.0600	16.4	51.46	**Circular Channel (pipe), PIPE** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.014

Subcatchment 126:



Subcatchment 127:

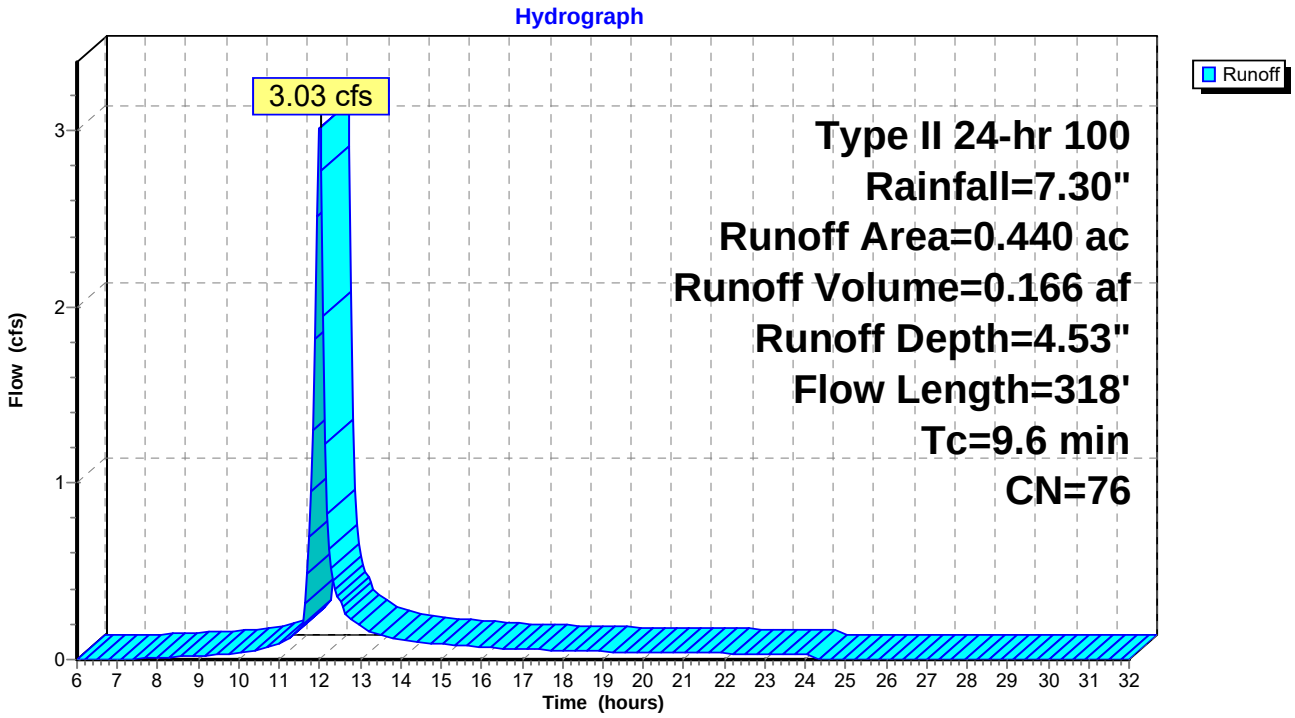
Runoff = 3.03 cfs @ 12.01 hrs, Volume= 0.166 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.440	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	98	0.1500	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
4.2	220	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
9.6	318	Total			

Subcatchment 127:



Subcatchment 128:

[49] Hint: Tc<2dt may require smaller dt

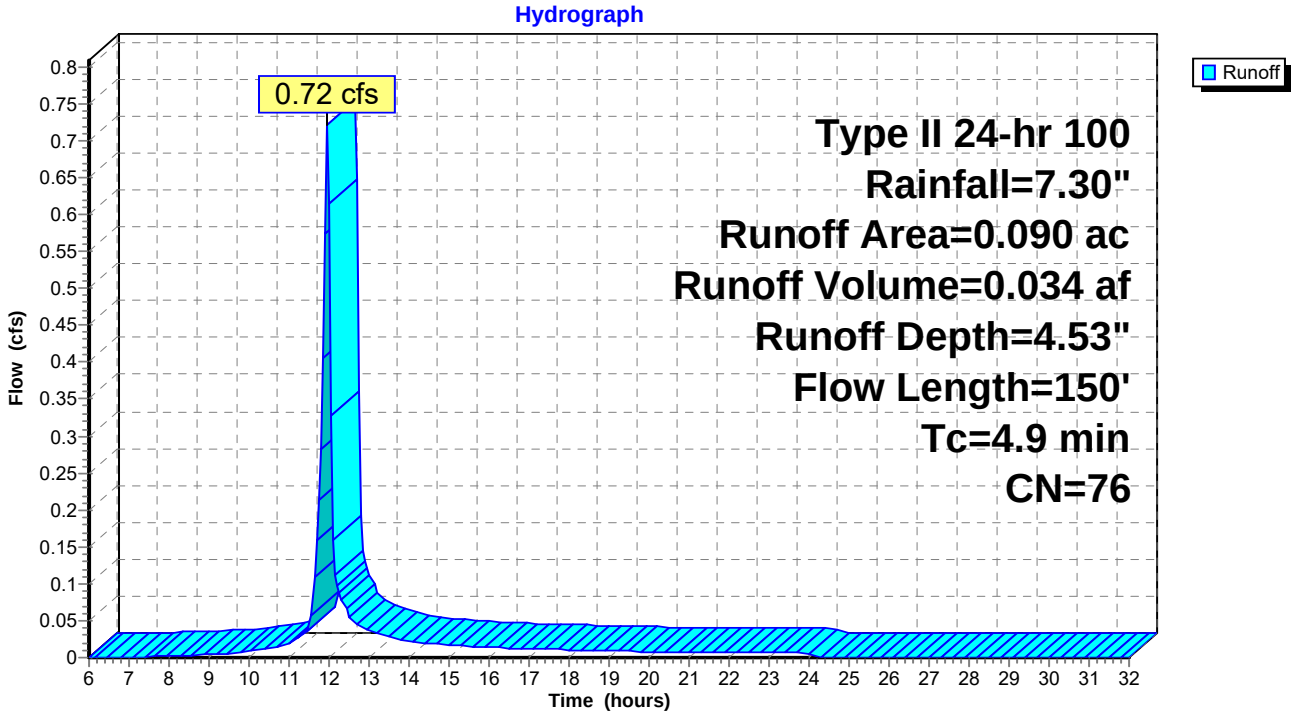
Runoff = 0.72 cfs @ 11.95 hrs, Volume= 0.034 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.090	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	93	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
1.1	57	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
4.9	150	Total			

Subcatchment 128:



Subcatchment 129:

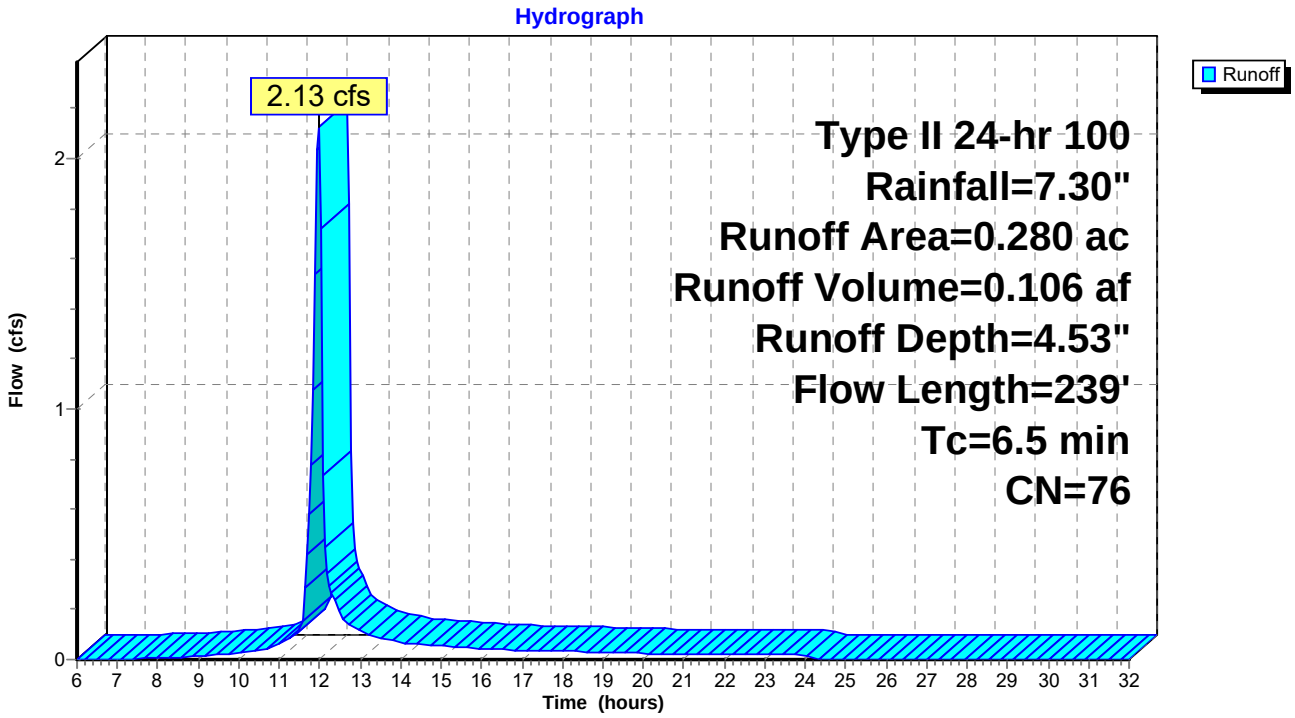
Runoff = 2.13 cfs @ 11.98 hrs, Volume= 0.106 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.280	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	91	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
2.8	148	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
6.5	239	Total			

Subcatchment 129:



Subcatchment 130:

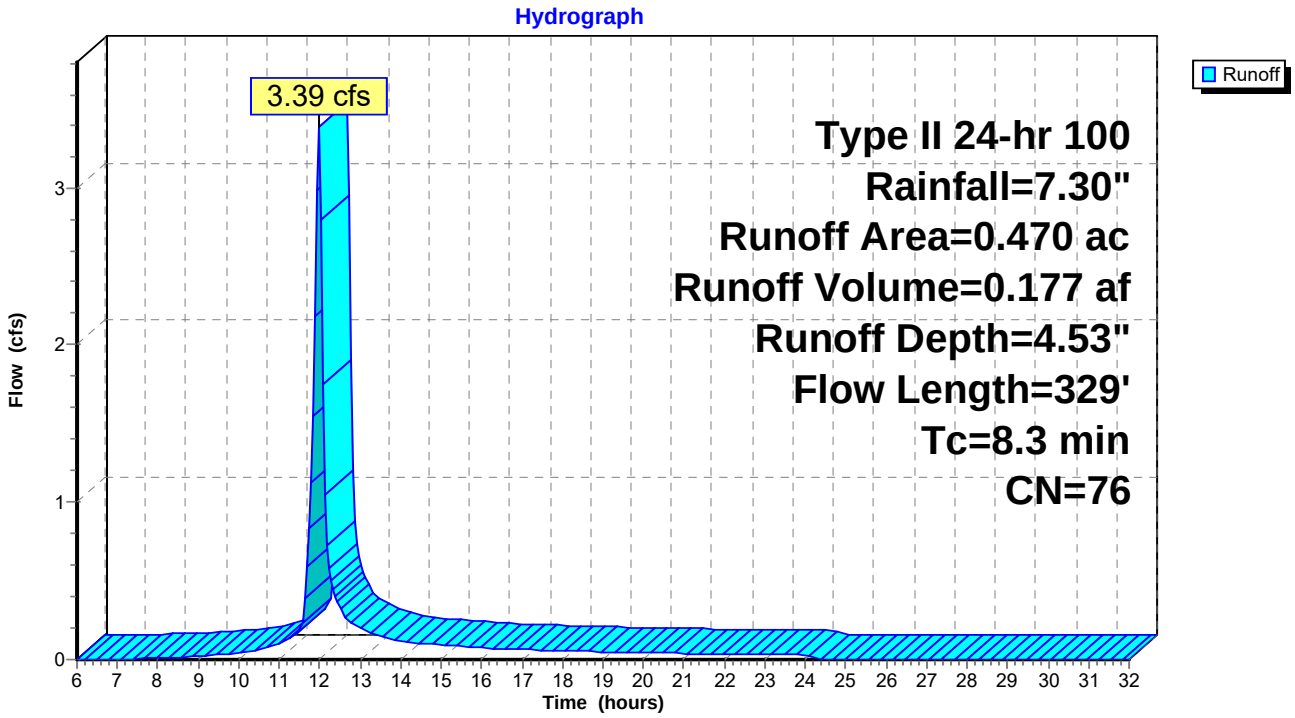
Runoff = 3.39 cfs @ 12.00 hrs, Volume= 0.177 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.470	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	94	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
4.5	235	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
8.3	329	Total			

Subcatchment 130:



Subcatchment 131:

[49] Hint: Tc<2dt may require smaller dt

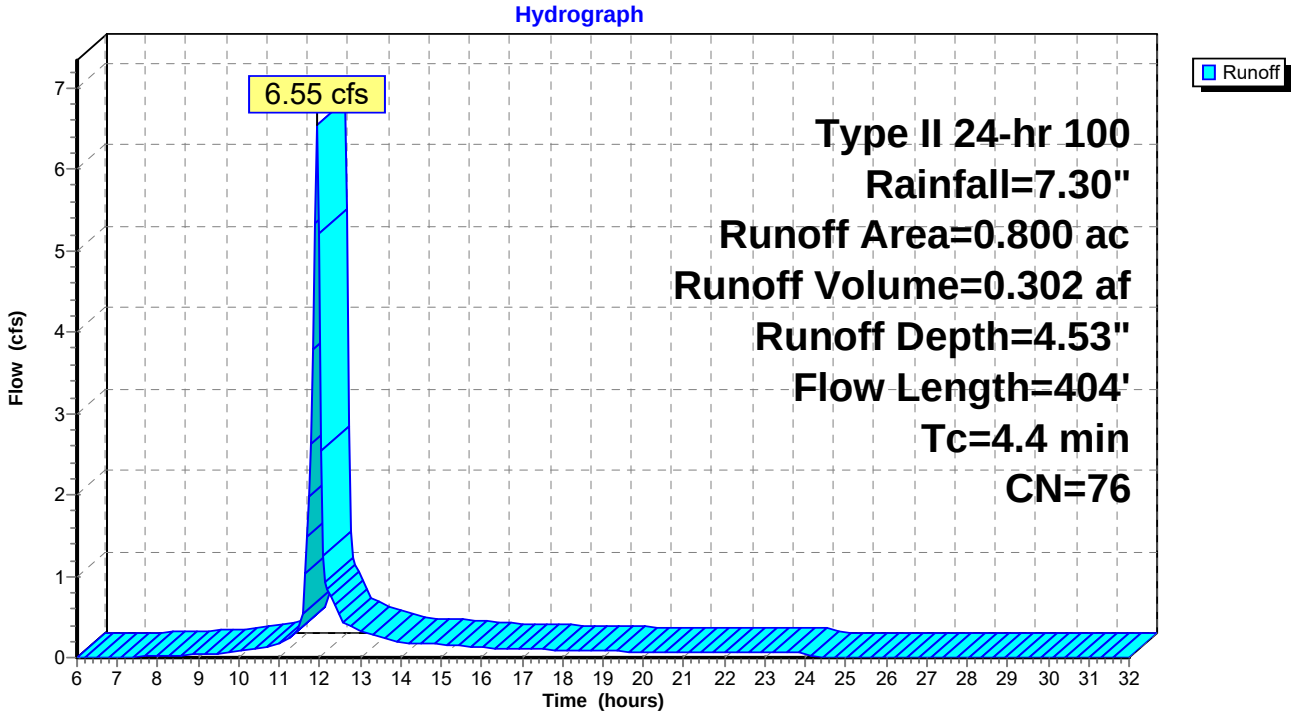
Runoff = 6.55 cfs @ 11.95 hrs, Volume= 0.302 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.800	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	97	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
0.5	307	0.0090	9.6	64.85	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.4	404	Total			

Subcatchment 131:



Subcatchment 132:

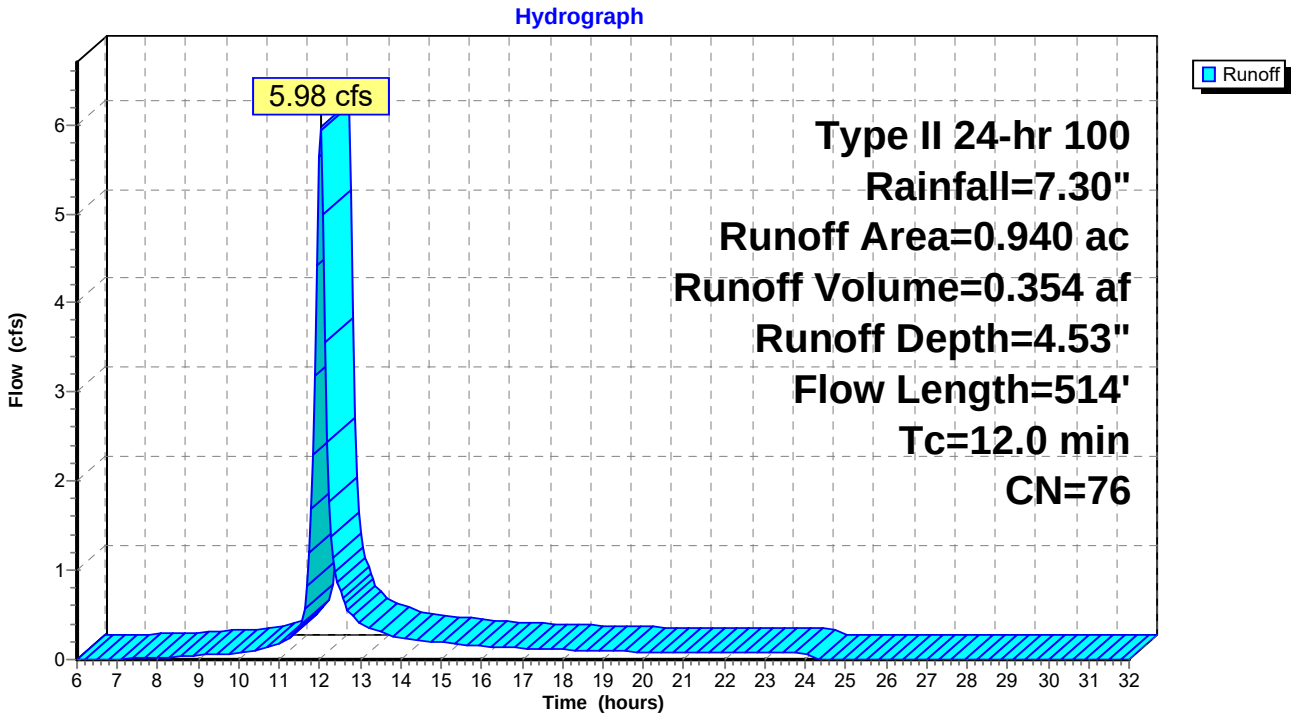
Runoff = 5.98 cfs @ 12.04 hrs, Volume= 0.354 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
0.940	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
8.0	414	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
12.0	514	Total			

Subcatchment 132:



Subcatchment 133:

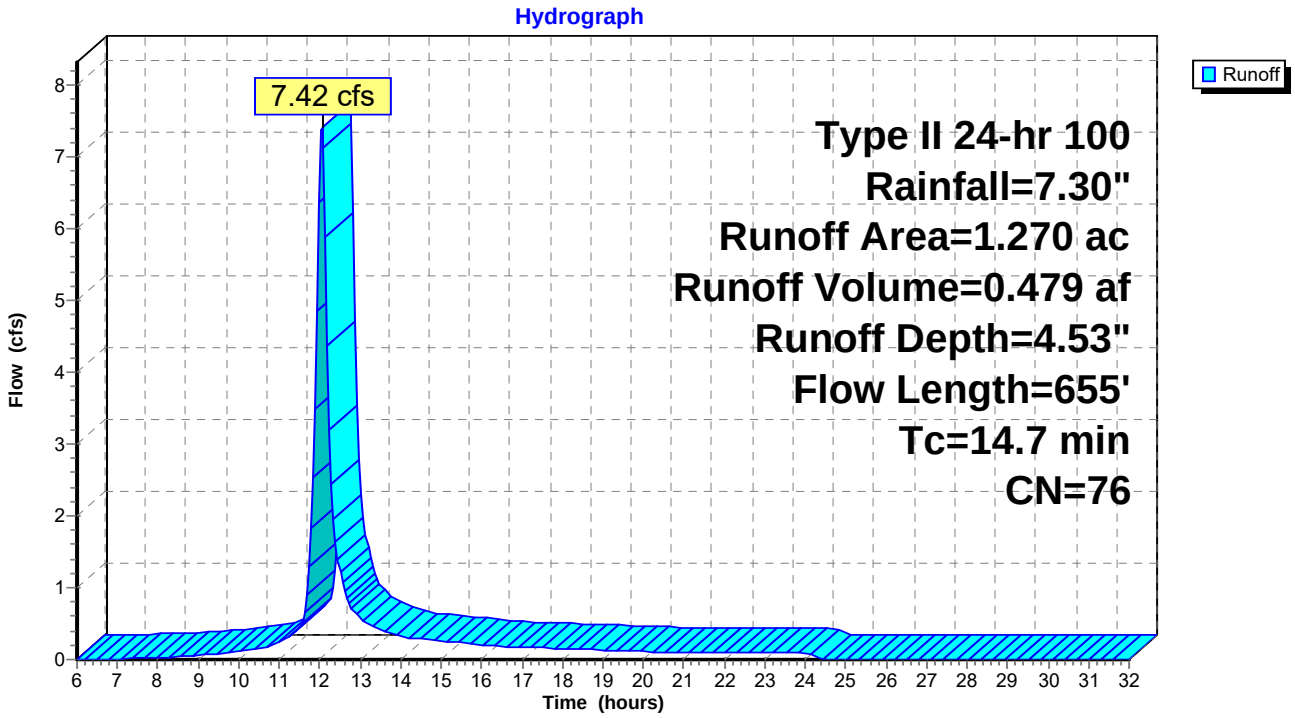
Runoff = 7.42 cfs @ 12.07 hrs, Volume= 0.479 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
1.270	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
10.7	555	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
14.7	655	Total			

Subcatchment 133:



Subcatchment 134:

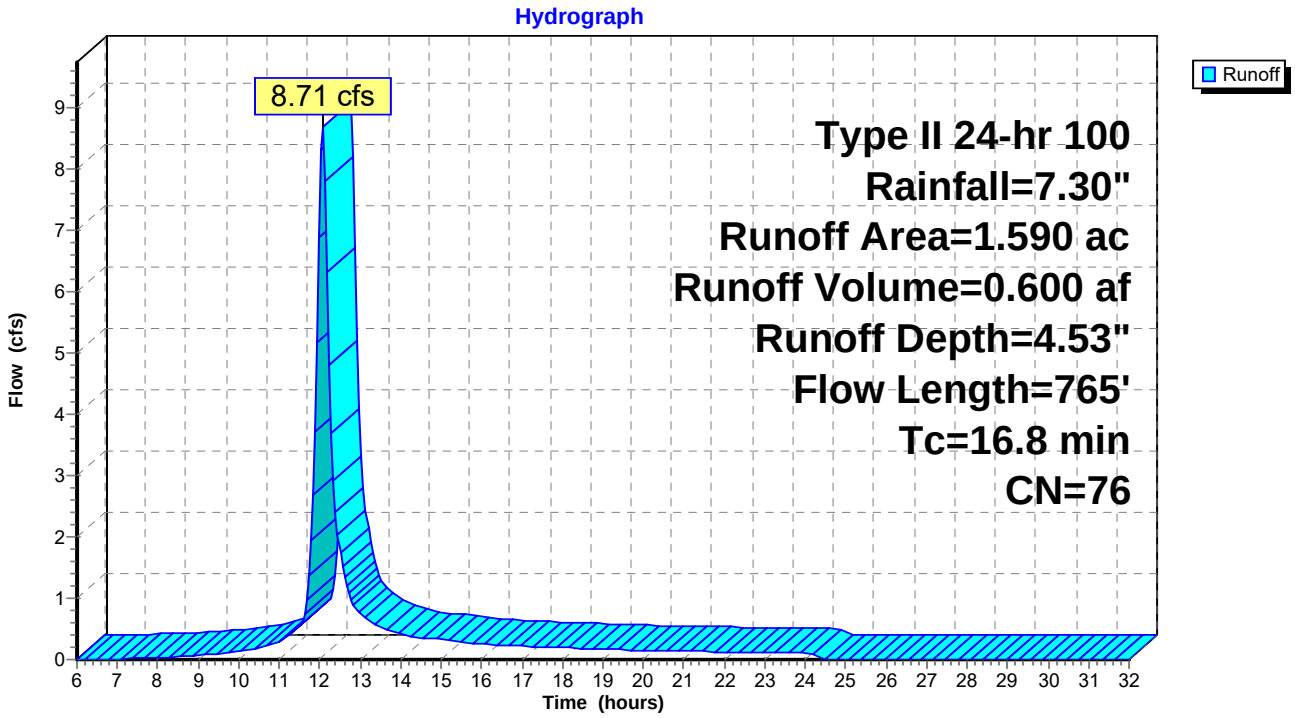
Runoff = 8.71 cfs @ 12.09 hrs, Volume= 0.600 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
1.590	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
12.8	665	0.0300	0.9		**Shallow Concentrated Flow, BENCHE** Kv= 5.0 fps
16.8	765	Total			

Subcatchment 134:



Subcatchment 135:

[49] Hint: Tc<2dt may require smaller dt

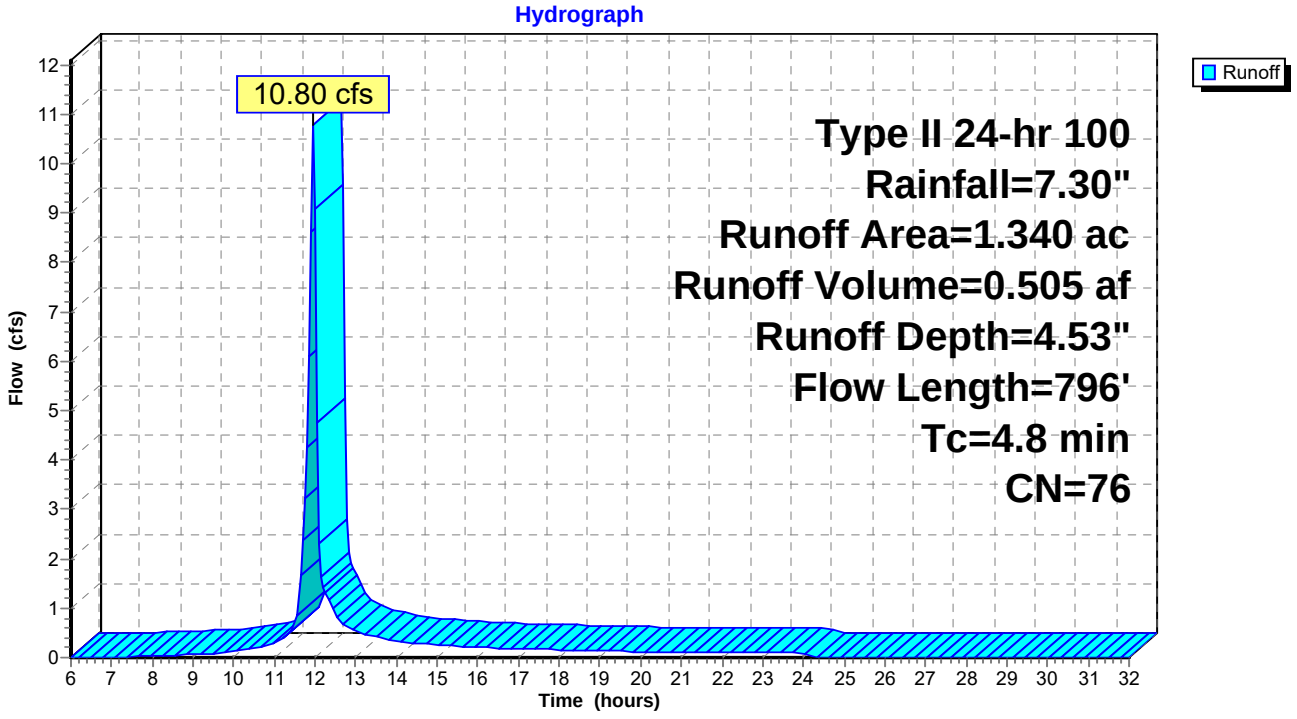
Runoff = 10.80 cfs @ 11.95 hrs, Volume= 0.505 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
1.340	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	82	0.3300	0.4		**Sheet Flow,** n= 0.200 P2= 3.20"
1.4	714	0.0070	8.5	57.19	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
4.8	796	Total			

Subcatchment 135:



Subcatchment 136:

[49] Hint: Tc<2dt may require smaller dt

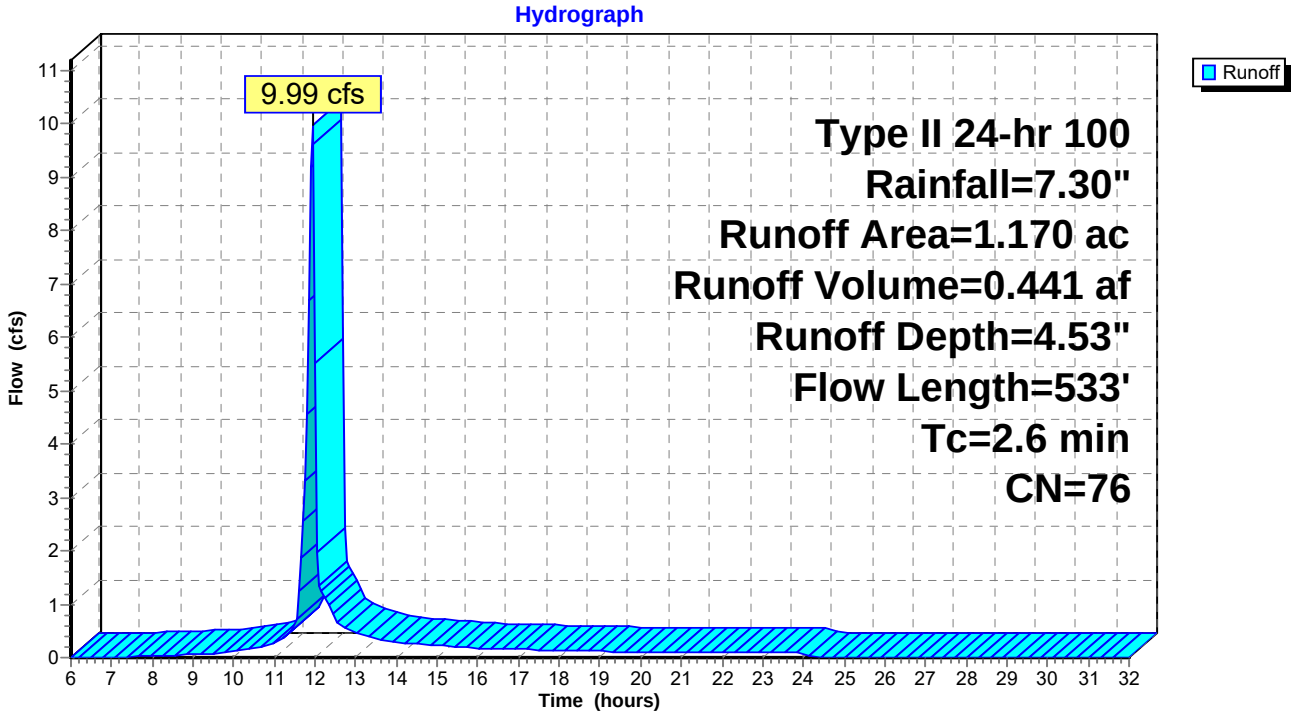
Runoff = 9.99 cfs @ 11.93 hrs, Volume= 0.441 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
1.170	76	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	36	0.3300	0.3		**Sheet Flow,** n= 0.200 P2= 3.20"
0.8	497	0.0100	10.1	68.36	**Trap/Vee/Rect Channel Flow, PERIMETER CHANNEL** Bot.W=3.00' D=1.50' Z= 1.0 '/' Top.W=6.00' n= 0.014
2.6	533	Total			

Subcatchment 136:



Subcatchment PWL-1:

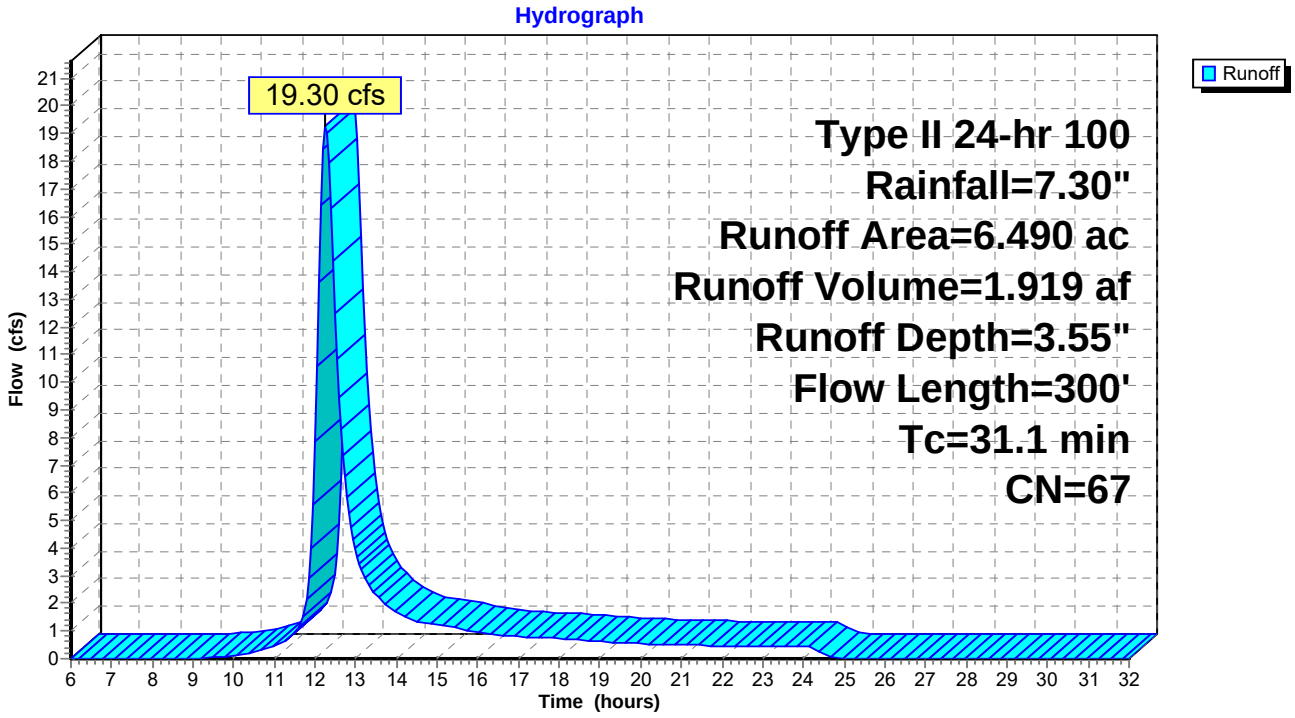
Runoff = 19.30 cfs @ 12.26 hrs, Volume= 1.919 af, Depth= 3.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
6.490	67	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	300	0.0100	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PWL-1:



Subcatchment PWL-2:

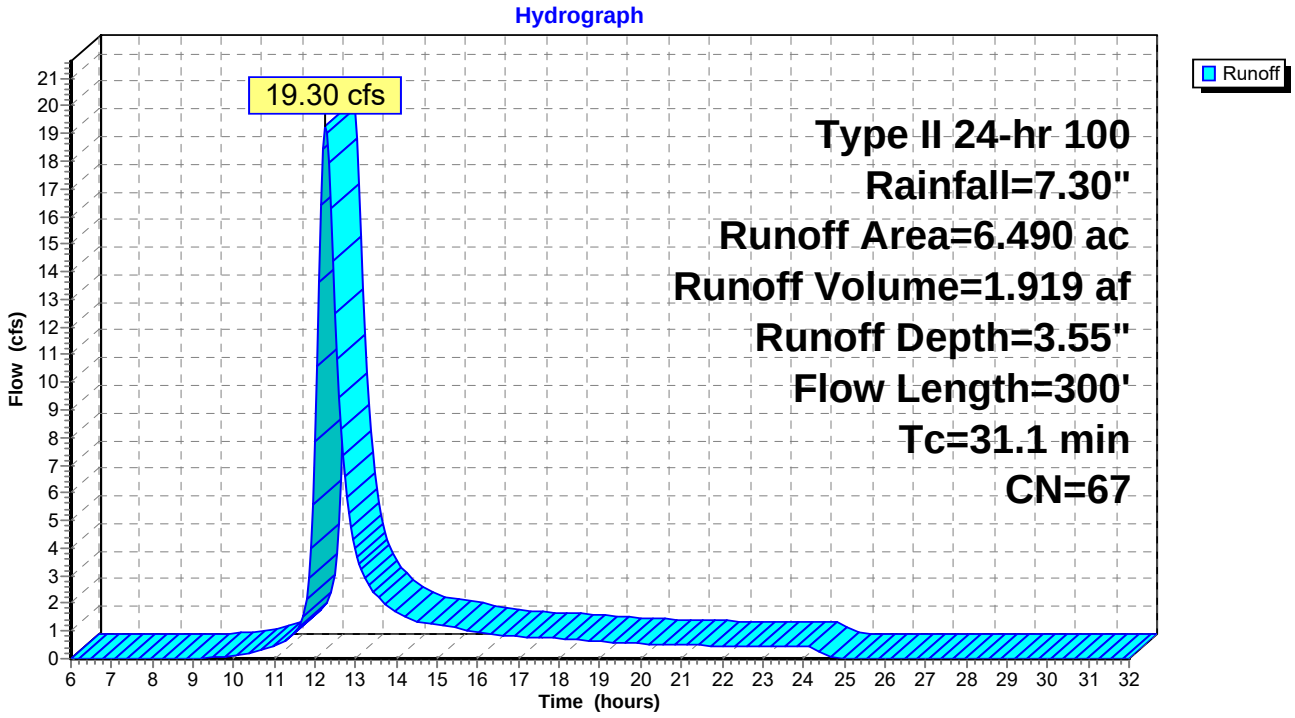
Runoff = 19.30 cfs @ 12.26 hrs, Volume= 1.919 af, Depth= 3.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
6.490	67	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	300	0.0100	0.2		**Sheet Flow,** n= 0.150 P2= 3.20"

Subcatchment PWL-2:



Subcatchment PWL-3:

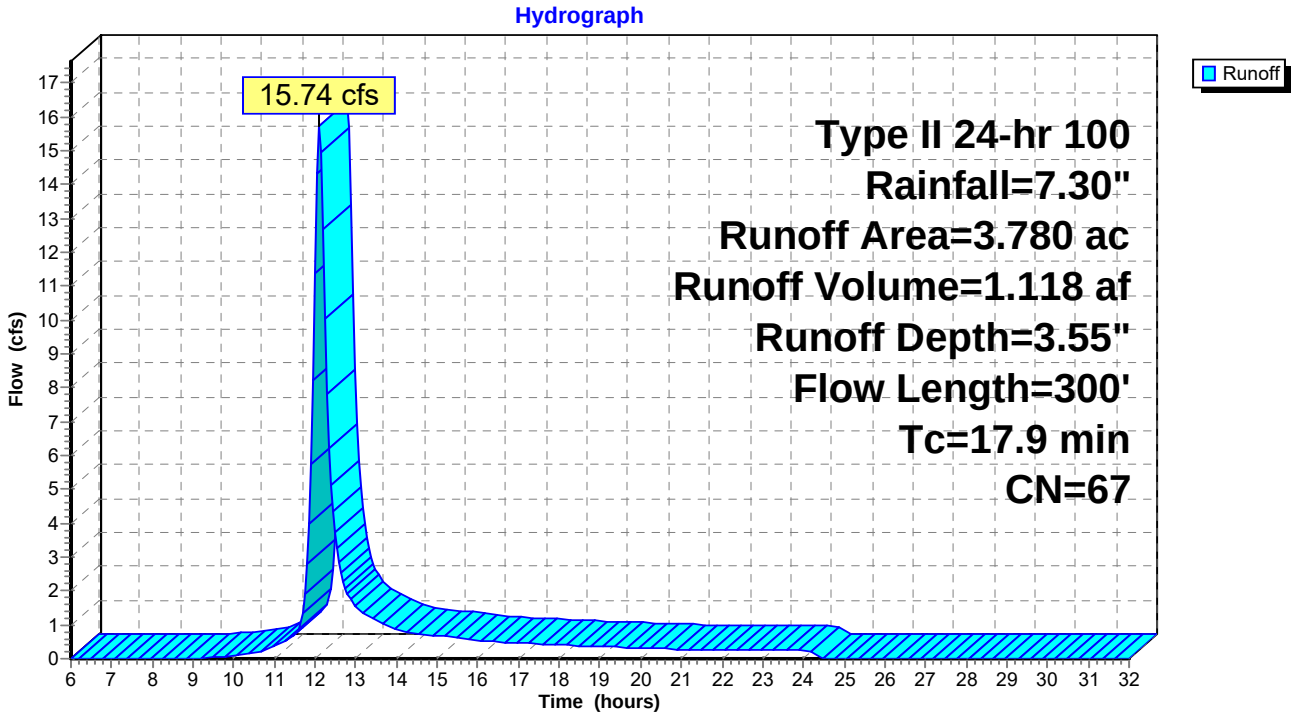
Runoff = 15.74 cfs @ 12.11 hrs, Volume= 1.118 af, Depth= 3.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Rainfall=7.30"

Area (ac)	CN	Description
3.780	67	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	300	0.0400	0.3		**Sheet Flow,** n= 0.150 P2= 3.20"

Subcatchment PWL-3:



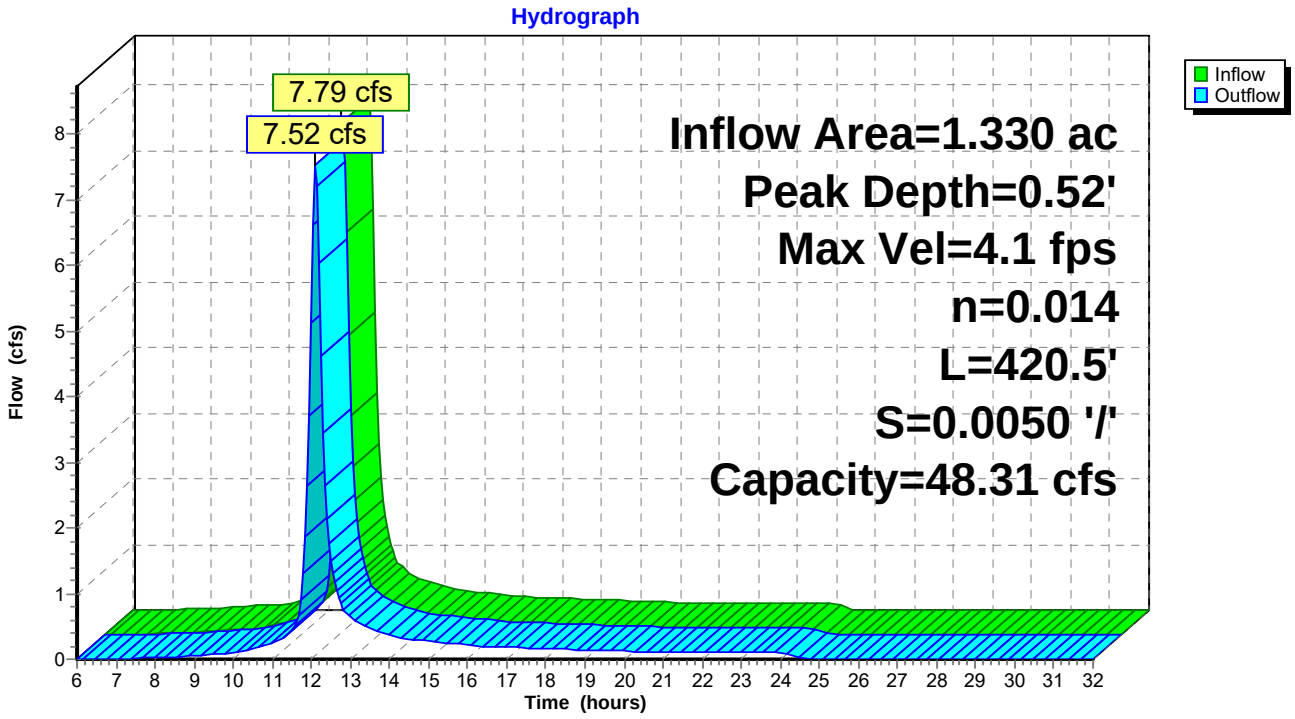
Reach 01-05: PERIMETER CHANNEL

Inflow Area = 1.330 ac, Inflow Depth = 4.53" for 100 event
Inflow = 7.79 cfs @ 12.06 hrs, Volume= 0.502 af
Outflow = 7.52 cfs @ 12.11 hrs, Volume= 0.502 af, Atten= 3%, Lag= 2.9 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.1 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 6.8 min

Peak Depth= 0.52' @ 12.09 hrs
Capacity at bank full= 48.31 cfs
Inlet Invert= 110.00', Outlet Invert= 107.90'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 420.5' Slope= 0.0050 '/'

Reach 01-05: PERIMETER CHANNEL



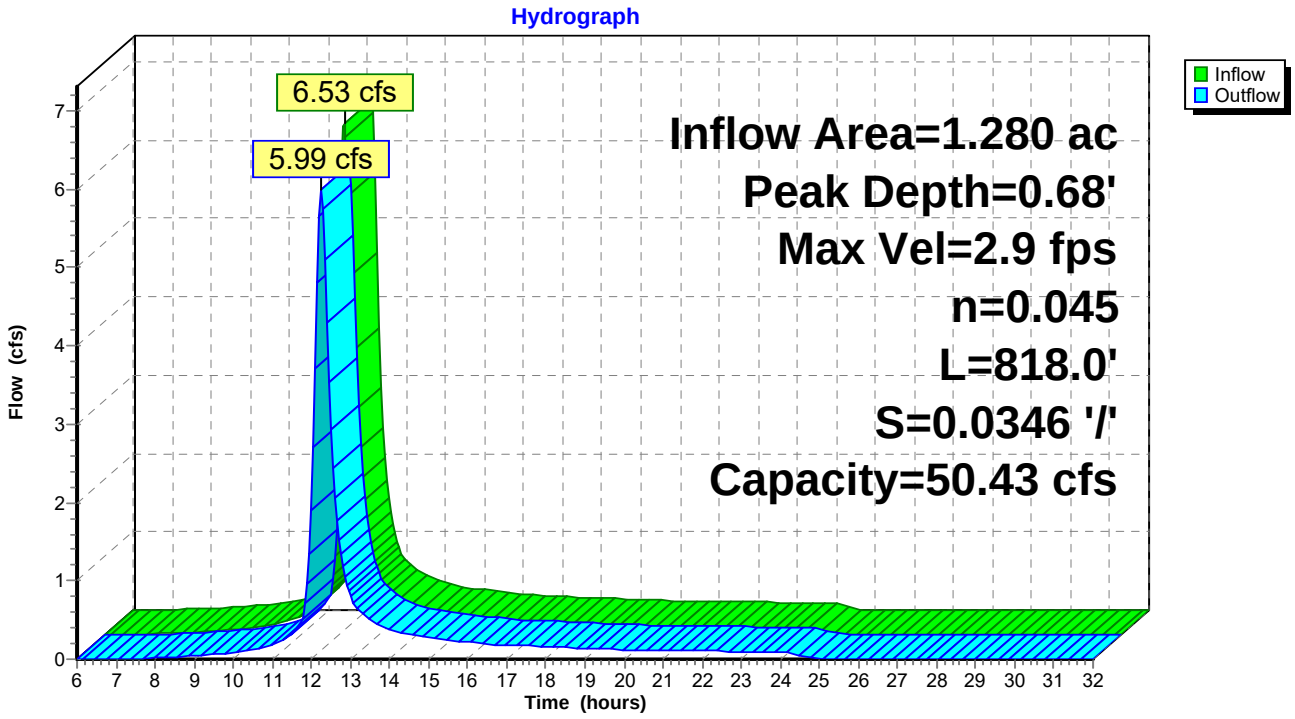
Reach 02-06: BENCH

Inflow Area = 1.280 ac, Inflow Depth = 4.53" for 100 event
Inflow = 6.53 cfs @ 12.12 hrs, Volume= 0.483 af
Outflow = 5.99 cfs @ 12.25 hrs, Volume= 0.483 af, Atten= 8%, Lag= 8.2 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.9 fps, Min. Travel Time= 4.7 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 13.4 min

Peak Depth= 0.68' @ 12.17 hrs
Capacity at bank full= 50.43 cfs
Inlet Invert= 130.00', Outlet Invert= 101.70'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 818.0' Slope= 0.0346 '/'

Reach 02-06: BENCH



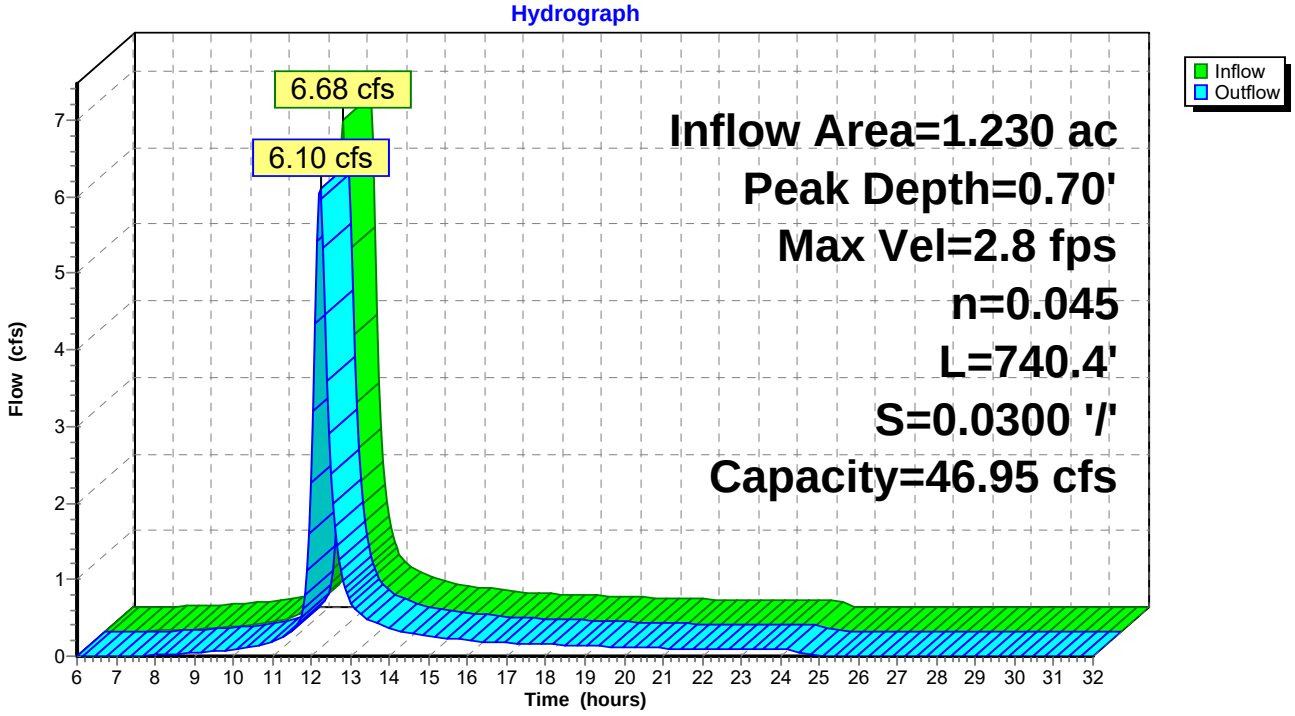
Reach 03-09: BENCH

Inflow Area = 1.230 ac, Inflow Depth = 4.53" for 100 event
Inflow = 6.68 cfs @ 12.09 hrs, Volume= 0.464 af
Outflow = 6.10 cfs @ 12.22 hrs, Volume= 0.464 af, Atten= 9%, Lag= 7.6 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.8 fps, Min. Travel Time= 4.4 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 12.9 min

Peak Depth= 0.70' @ 12.15 hrs
Capacity at bank full= 46.95 cfs
Inlet Invert= 152.21', Outlet Invert= 130.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 740.4' Slope= 0.0300 '/'

Reach 03-09: BENCH



Reach 04-08: ACCESS ROAD CHANNEL

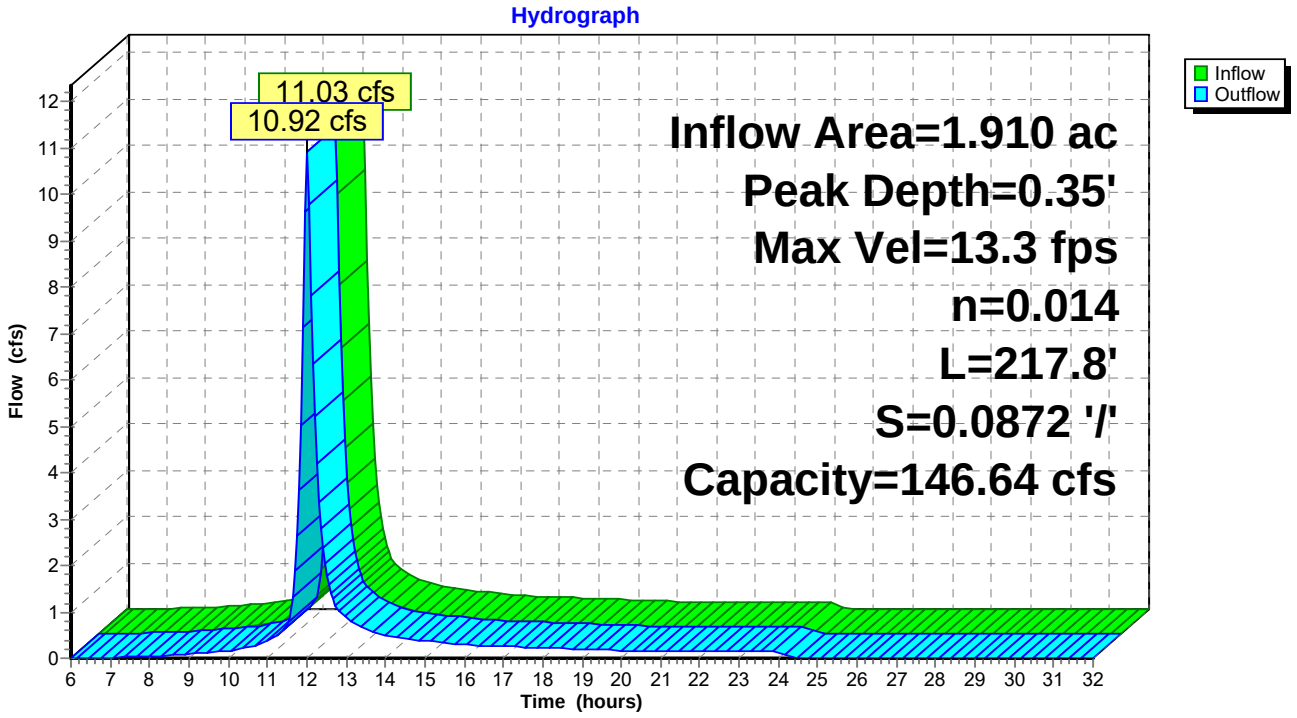
[61] Hint: Submerged 2% of Reach 07-04 bottom

Inflow Area = 1.910 ac, Inflow Depth = 4.53" for 100 event
Inflow = 11.03 cfs @ 11.99 hrs, Volume= 0.720 af
Outflow = 10.92 cfs @ 12.00 hrs, Volume= 0.720 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 13.3 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.5 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.35' @ 12.00 hrs
Capacity at bank full= 146.64 cfs
Inlet Invert= 174.80', Outlet Invert= 155.80'
2.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 5.00'
Length= 217.8' Slope= 0.0872 '/'

Reach 04-08: ACCESS ROAD CHANNEL



Reach 05-06: PERIMETER CHANNEL

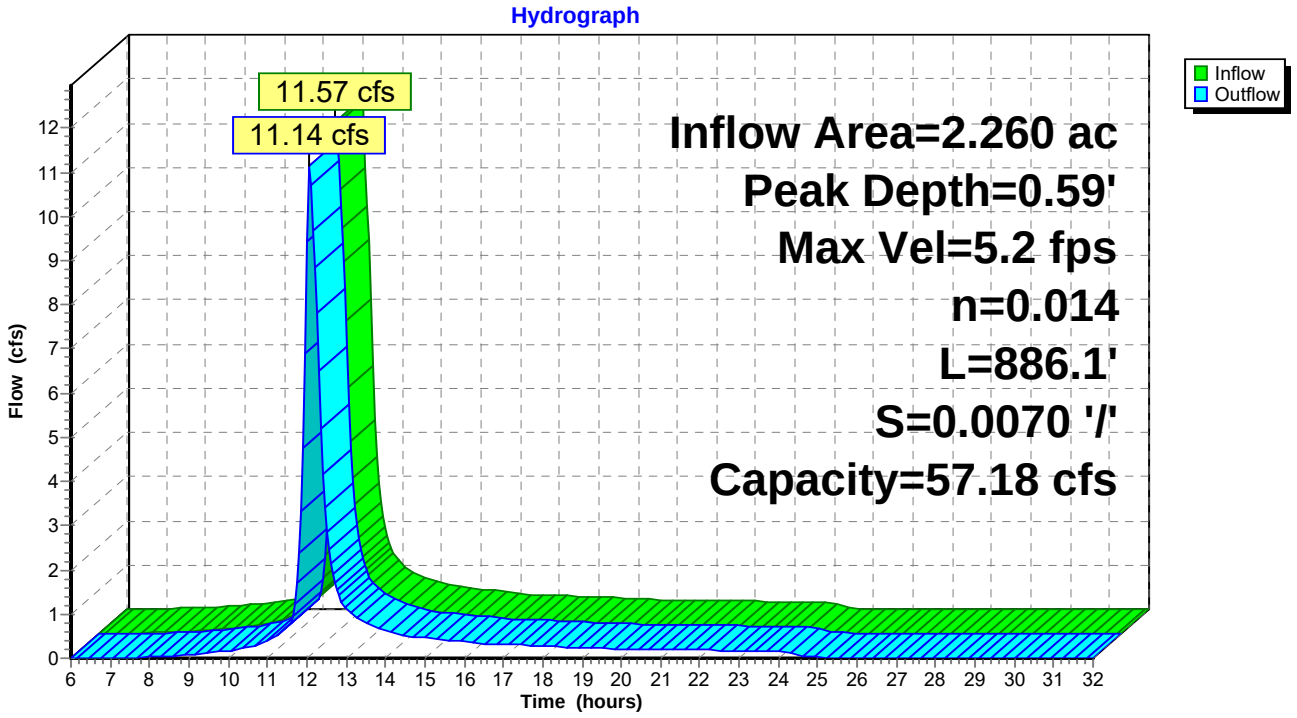
[61] Hint: Submerged 28% of Reach 01-05 bottom

Inflow Area = 2.260 ac, Inflow Depth = 4.53" for 100 event
Inflow = 11.57 cfs @ 11.98 hrs, Volume= 0.852 af
Outflow = 11.14 cfs @ 12.07 hrs, Volume= 0.852 af, Atten= 4%, Lag= 5.0 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.2 fps, Min. Travel Time= 2.8 min
Avg. Velocity = 1.3 fps, Avg. Travel Time= 11.2 min

Peak Depth= 0.59' @ 12.02 hrs
Capacity at bank full= 57.18 cfs
Inlet Invert= 107.90', Outlet Invert= 101.70'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 886.1' Slope= 0.0070 '/'

Reach 05-06: PERIMETER CHANNEL



Reach 06-10: PERIMETER CHANNEL

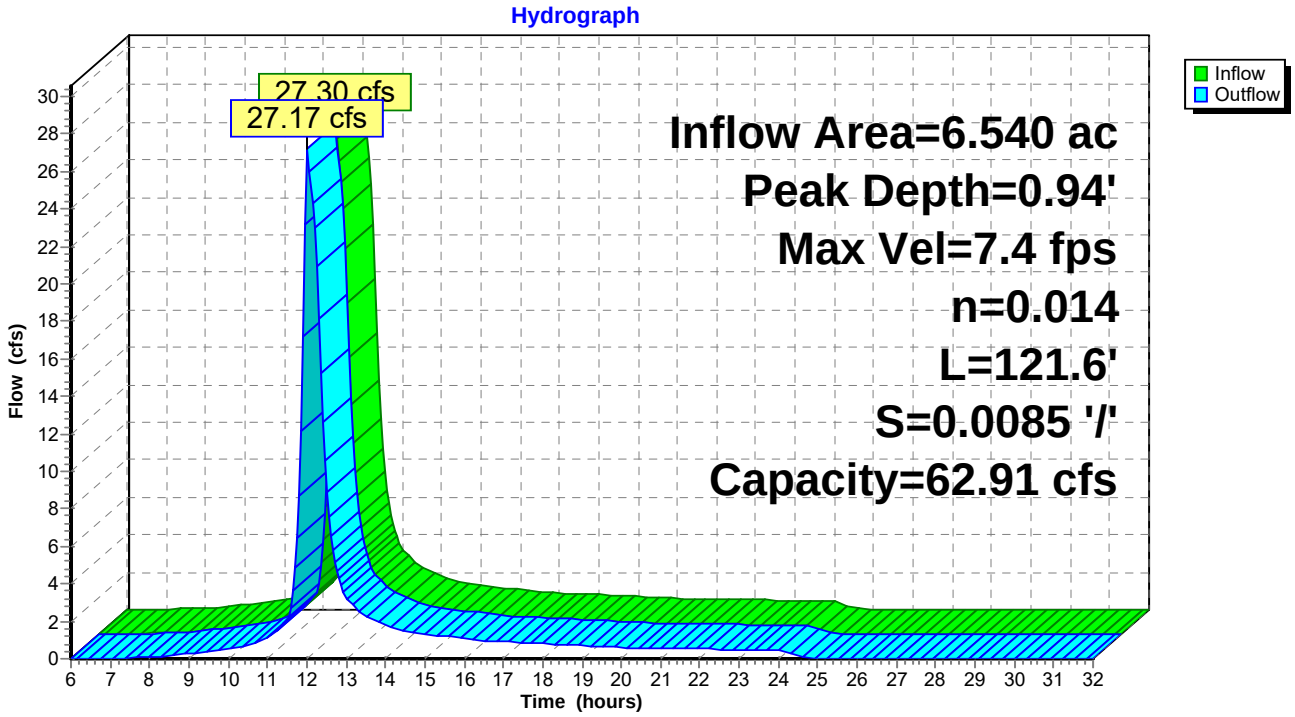
[61] Hint: Submerged 3% of Reach 02-06 bottom
[61] Hint: Submerged 15% of Reach 05-06 bottom

Inflow Area = 6.540 ac, Inflow Depth = 4.53" for 100 event
Inflow = 27.30 cfs @ 12.02 hrs, Volume= 2.466 af
Outflow = 27.17 cfs @ 12.02 hrs, Volume= 2.466 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.4 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.0 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.94' @ 12.02 hrs
Capacity at bank full= 62.91 cfs
Inlet Invert= 101.70', Outlet Invert= 100.67'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 121.6' Slope= 0.0085 '/'

Reach 06-10: PERIMETER CHANNEL



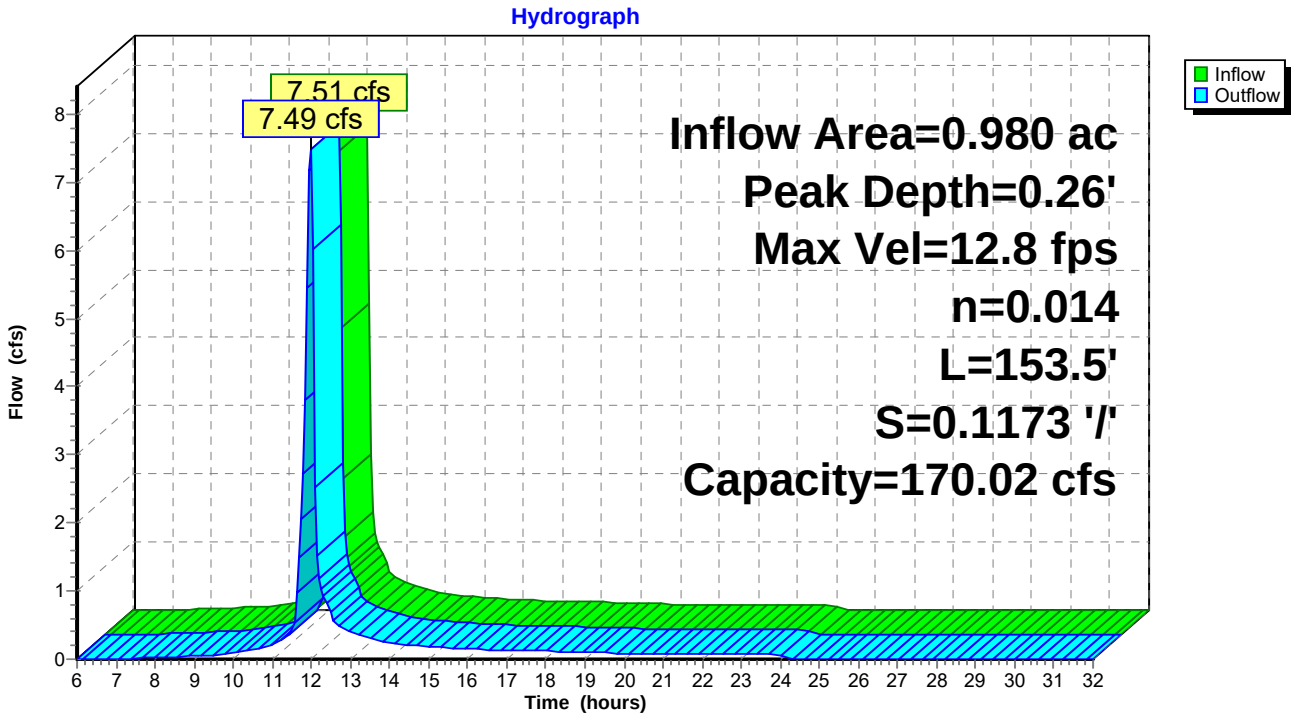
Reach 07-04: ACCESS ROAD CHANNEL

Inflow Area = 0.980 ac, Inflow Depth = 4.53" for 100 event
Inflow = 7.51 cfs @ 11.97 hrs, Volume= 0.370 af
Outflow = 7.49 cfs @ 11.98 hrs, Volume= 0.370 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 12.8 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.1 fps, Avg. Travel Time= 0.8 min

Peak Depth= 0.26' @ 11.97 hrs
Capacity at bank full= 170.02 cfs
Inlet Invert= 192.80', Outlet Invert= 174.80'
2.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 5.00'
Length= 153.5' Slope= 0.1173 '/'

Reach 07-04: ACCESS ROAD CHANNEL



Reach 08-08`: ACCESS ROAD CHANNEL

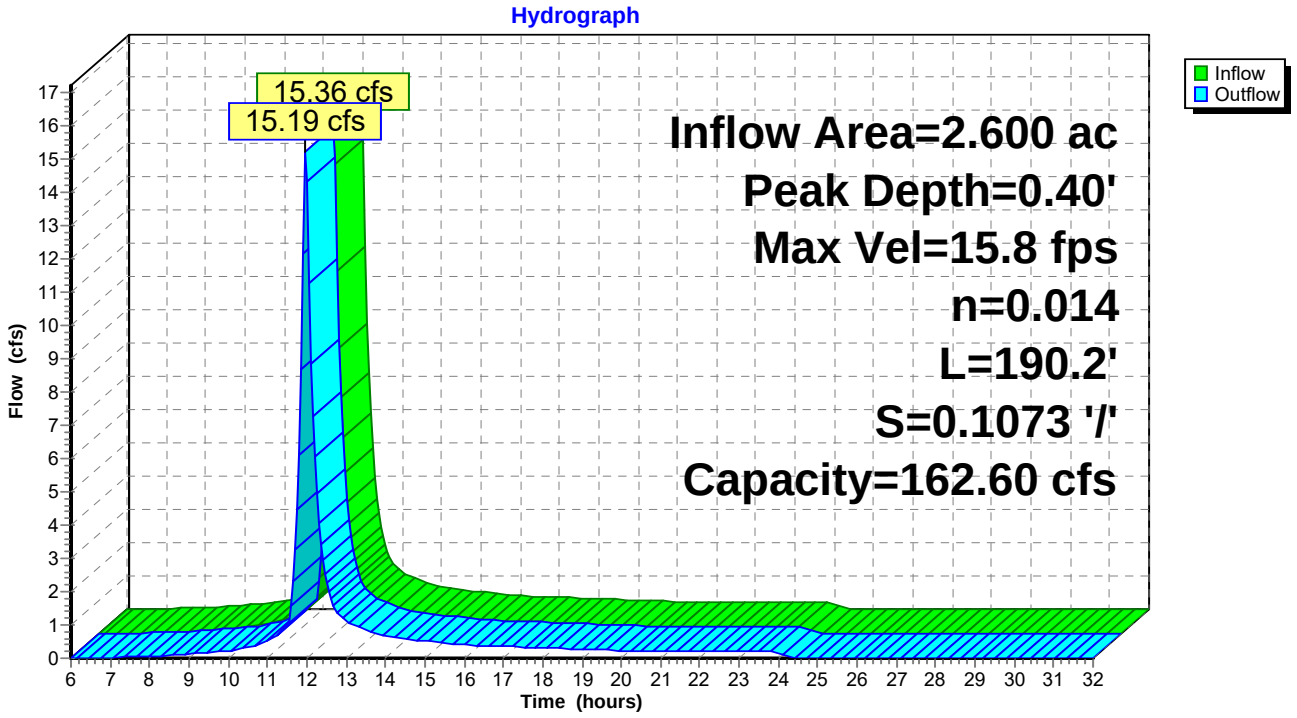
[61] Hint: Submerged 2% of Reach 04-08 bottom

Inflow Area = 2.600 ac, Inflow Depth = 4.53" for 100 event
Inflow = 15.36 cfs @ 11.96 hrs, Volume= 0.980 af
Outflow = 15.19 cfs @ 11.97 hrs, Volume= 0.980 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 15.8 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.1 fps, Avg. Travel Time= 0.8 min

Peak Depth= 0.40' @ 11.96 hrs
Capacity at bank full= 162.60 cfs
Inlet Invert= 155.80', Outlet Invert= 135.40'
2.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 5.00'
Length= 190.2' Slope= 0.1073 '/'

Reach 08-08`: ACCESS ROAD CHANNEL



Reach 09-10: PIPE DOWNCHUTE

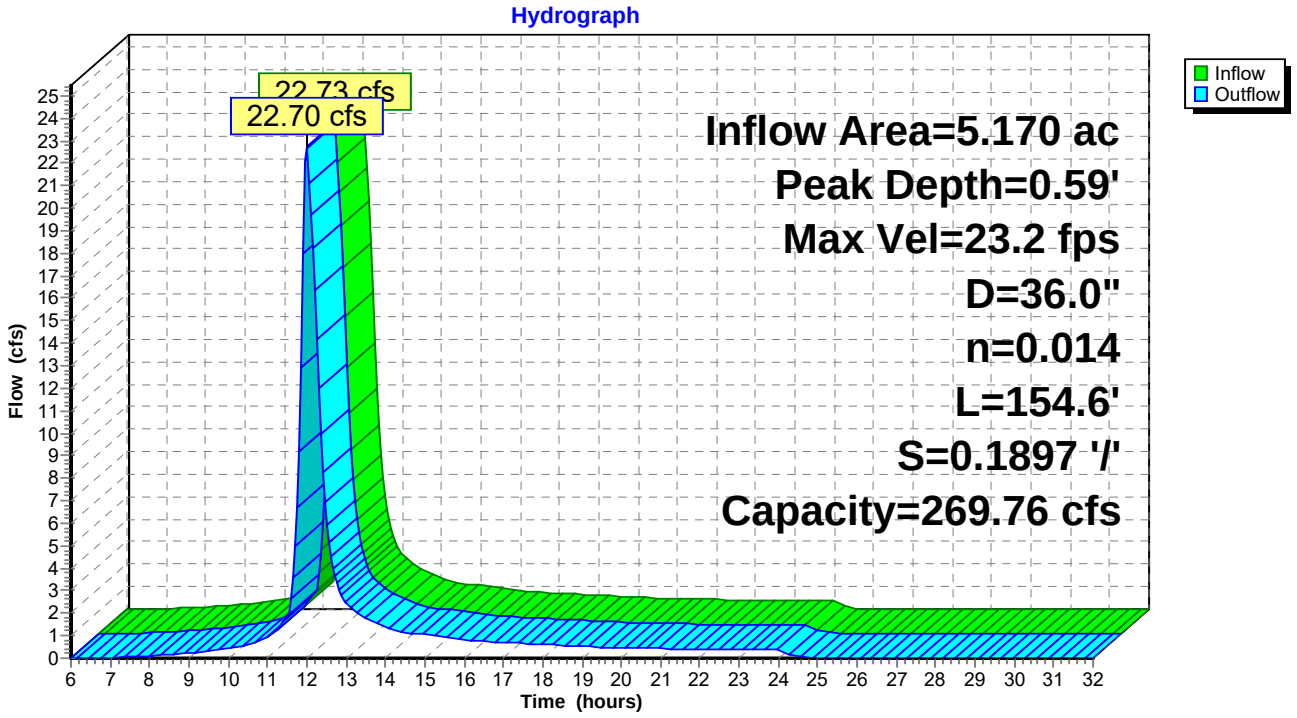
[52] Hint: Inlet conditions not evaluated
[61] Hint: Submerged 3% of Reach 03-09 bottom

Inflow Area = 5.170 ac, Inflow Depth = 4.53" for 100 event
Inflow = 22.73 cfs @ 11.98 hrs, Volume= 1.950 af
Outflow = 22.70 cfs @ 11.99 hrs, Volume= 1.950 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 23.2 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 7.7 fps, Avg. Travel Time= 0.3 min

Peak Depth= 0.59' @ 11.98 hrs
Capacity at bank full= 269.76 cfs
Inlet Invert= 130.00', Outlet Invert= 100.67'
36.0" Diameter Pipe, n= 0.014
Length= 154.6' Slope= 0.1897 '/'

Reach 09-10: PIPE DOWNCHUTE



Reach 10-11: PERIMETER CHANNEL

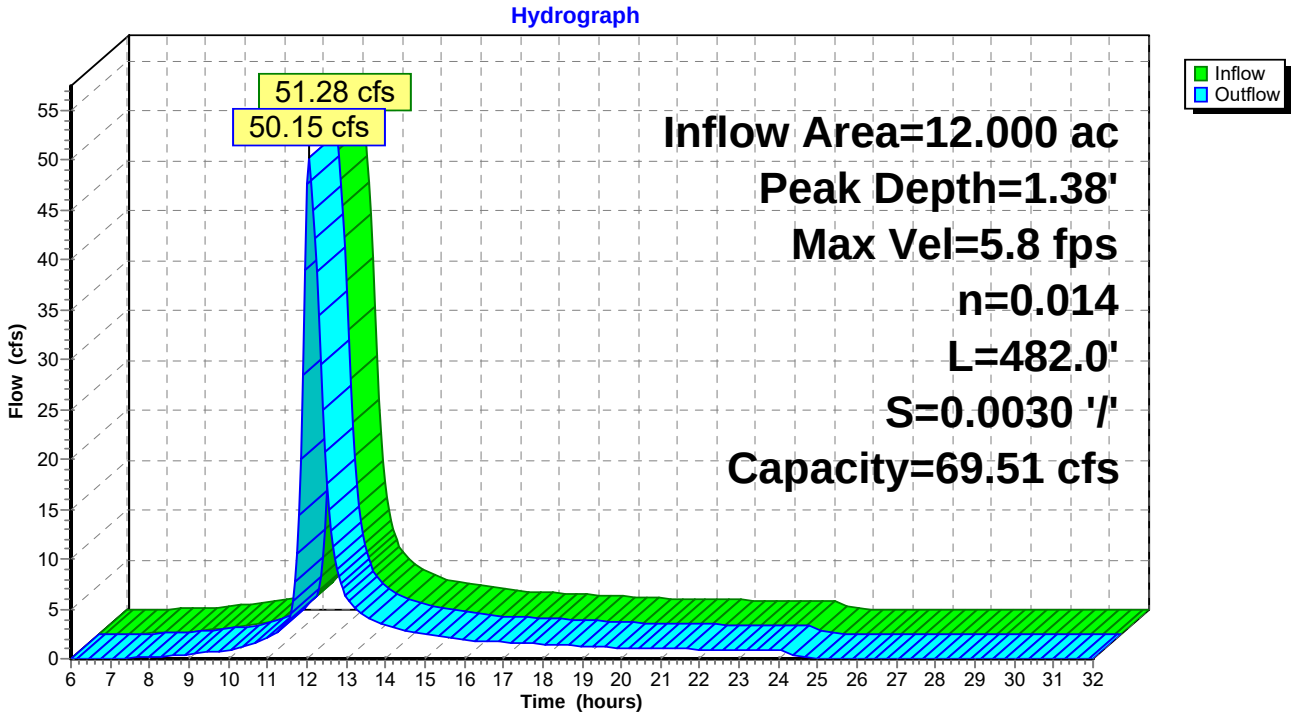
[62] Warning: Submerged 23% of Reach 06-10 inlet
[61] Hint: Submerged 5% of Reach 09-10 bottom

Inflow Area = 12.000 ac, Inflow Depth = 4.53" for 100 event
Inflow = 51.28 cfs @ 12.00 hrs, Volume= 4.525 af
Outflow = 50.15 cfs @ 12.05 hrs, Volume= 4.525 af, Atten= 2%, Lag= 2.9 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.8 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 1.5 fps, Avg. Travel Time= 5.5 min

Peak Depth= 1.38' @ 12.02 hrs
Capacity at bank full= 69.51 cfs
Inlet Invert= 100.67', Outlet Invert= 99.22'
5.00' x 1.65' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 8.30'
Length= 482.0' Slope= 0.0030 '/'

Reach 10-11: PERIMETER CHANNEL



Reach 11-19: PERIMETER CHANNEL

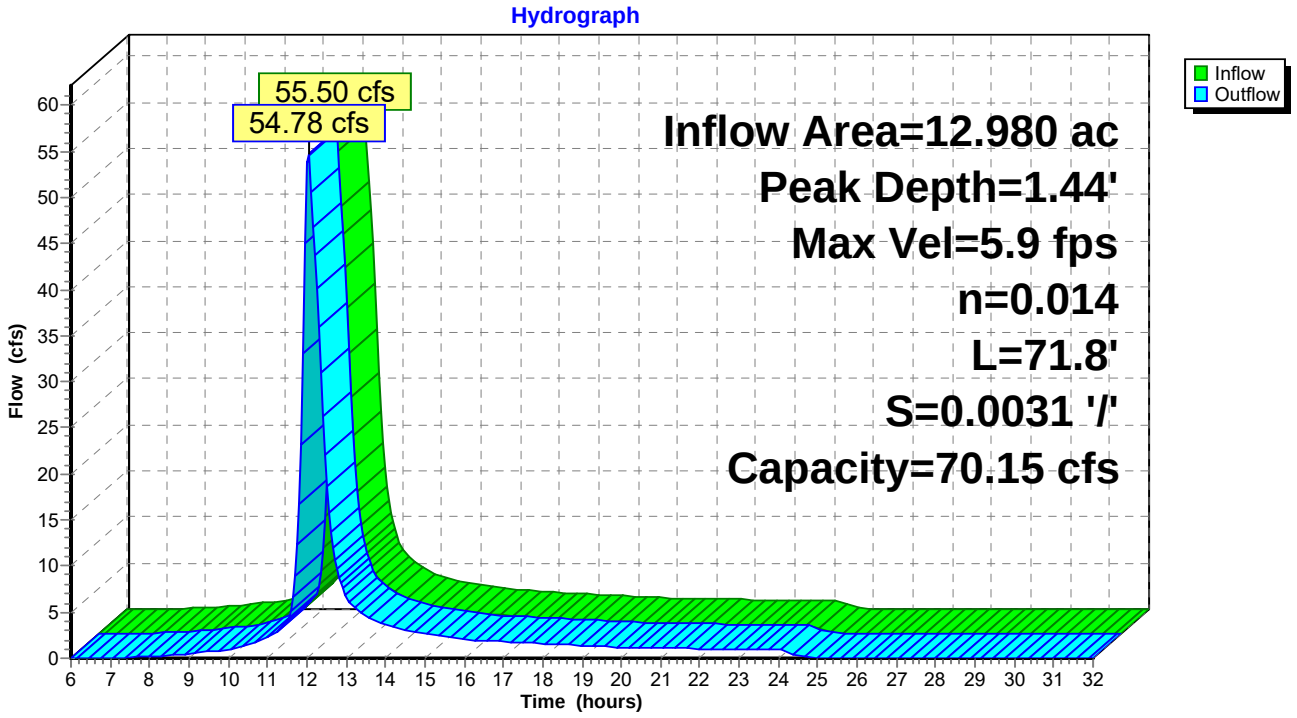
[61] Hint: Submerged 99% of Reach 10-11 bottom

Inflow Area = 12.980 ac, Inflow Depth = 4.53" for 100 event
Inflow = 55.50 cfs @ 12.02 hrs, Volume= 4.895 af
Outflow = 54.78 cfs @ 12.03 hrs, Volume= 4.895 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.9 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.5 fps, Avg. Travel Time= 0.8 min

Peak Depth= 1.44' @ 12.03 hrs
Capacity at bank full= 70.15 cfs
Inlet Invert= 99.22', Outlet Invert= 99.00'
5.00' x 1.65' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 8.30'
Length= 71.8' Slope= 0.0031 '/'

Reach 11-19: PERIMETER CHANNEL



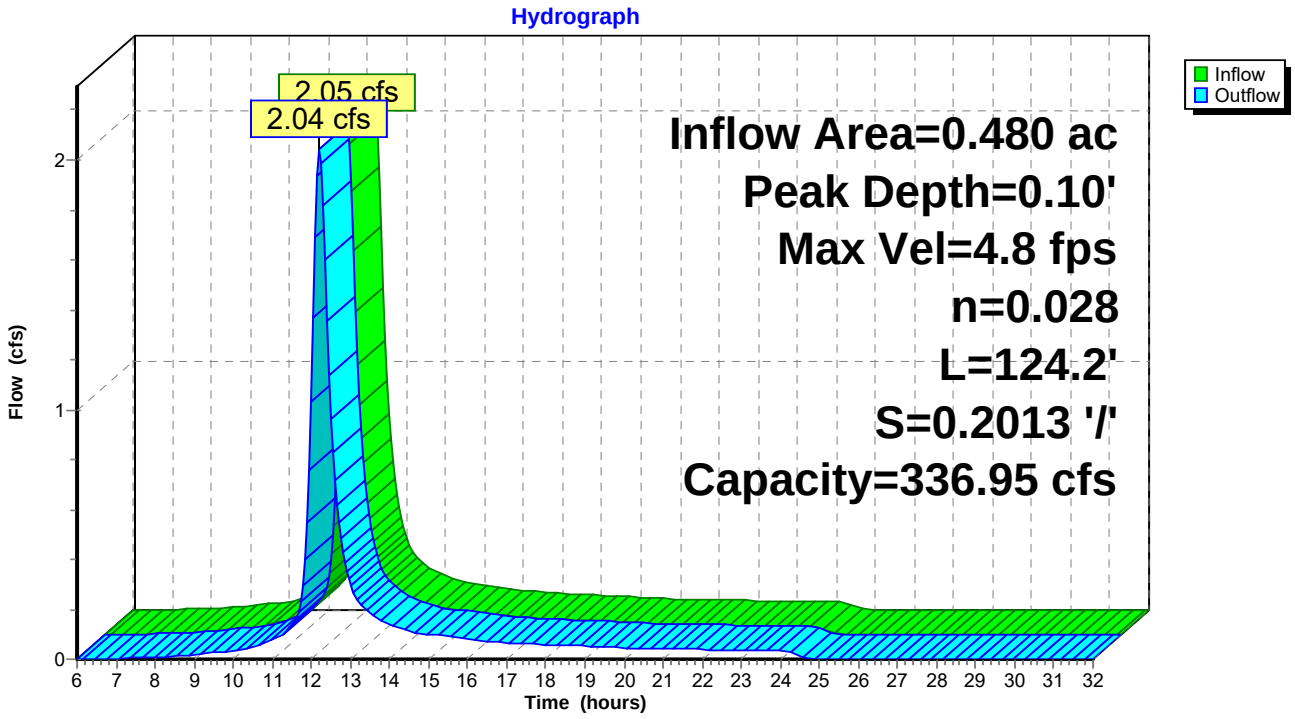
Reach 12-13: DOWNCHUTE

Inflow Area = 0.480 ac, Inflow Depth = 4.53" for 100 event
Inflow = 2.05 cfs @ 12.20 hrs, Volume= 0.181 af
Outflow = 2.04 cfs @ 12.21 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.8 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.6 fps, Avg. Travel Time= 1.3 min

Peak Depth= 0.10' @ 12.20 hrs
Capacity at bank full= 336.95 cfs
Inlet Invert= 235.00', Outlet Invert= 210.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 124.2' Slope= 0.2013 '/'

Reach 12-13: DOWNCHUTE



Reach 13-14: DOWNCHUTE

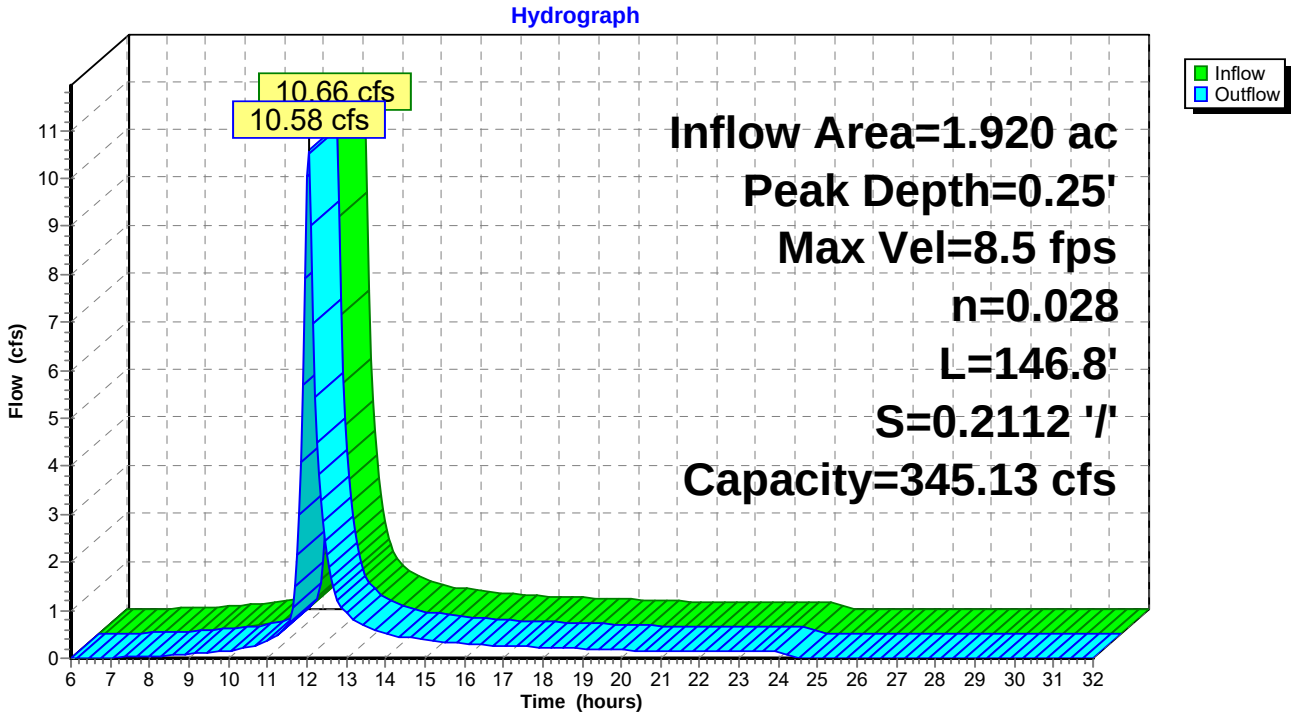
[61] Hint: Submerged 1% of Reach 12-13 bottom

Inflow Area = 1.920 ac, Inflow Depth = 4.53" for 100 event
Inflow = 10.66 cfs @ 12.03 hrs, Volume= 0.724 af
Outflow = 10.58 cfs @ 12.04 hrs, Volume= 0.724 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.5 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.3 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.25' @ 12.03 hrs
Capacity at bank full= 345.13 cfs
Inlet Invert= 210.00', Outlet Invert= 179.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 146.8' Slope= 0.2112 '/'

Reach 13-14: DOWNCHUTE



Reach 14-15: DOWNCHUTE

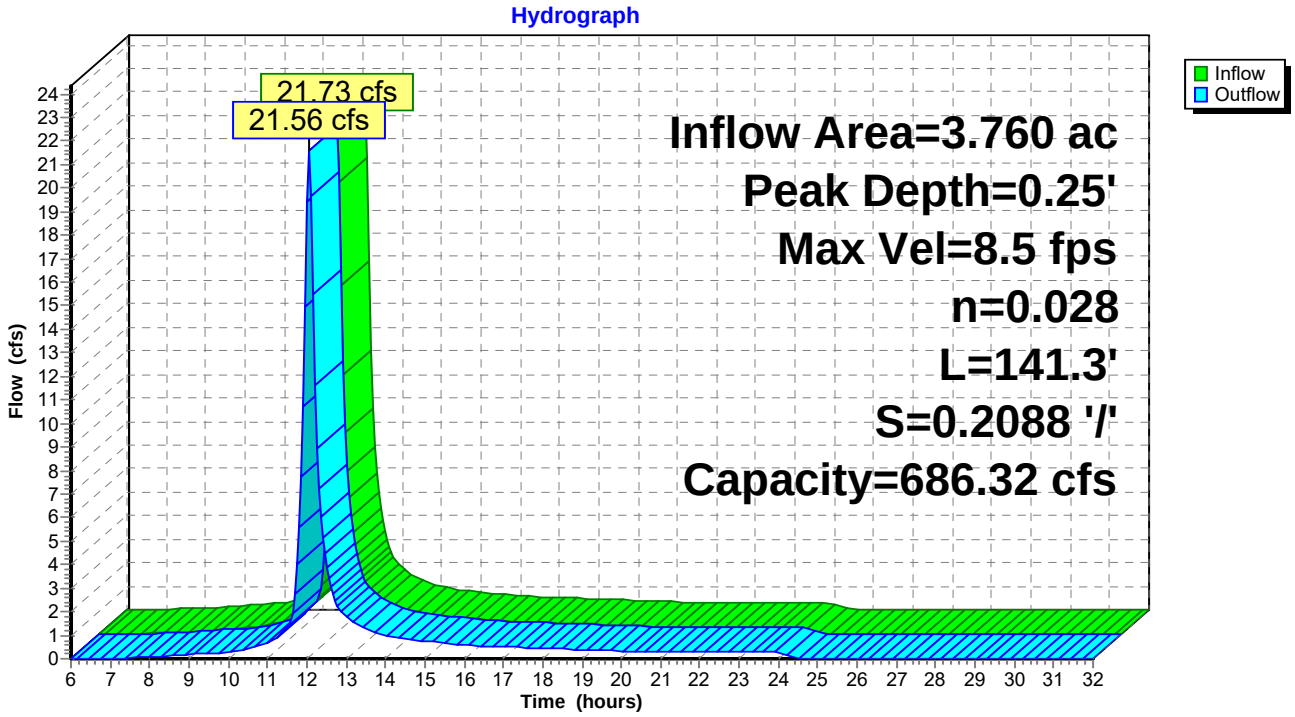
[61] Hint: Submerged 1% of Reach 13-14 bottom

Inflow Area = 3.760 ac, Inflow Depth = 4.53" for 100 event
Inflow = 21.73 cfs @ 12.04 hrs, Volume= 1.418 af
Outflow = 21.56 cfs @ 12.05 hrs, Volume= 1.418 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.5 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.3 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.25' @ 12.05 hrs
Capacity at bank full= 686.32 cfs
Inlet Invert= 179.00', Outlet Invert= 149.50'
A factor of 2.00 has been applied to the supplied storage and discharge data
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 141.3' Slope= 0.2088 '/'

Reach 14-15: DOWNCHUTE



Reach 15-17: DOWNCHUTE

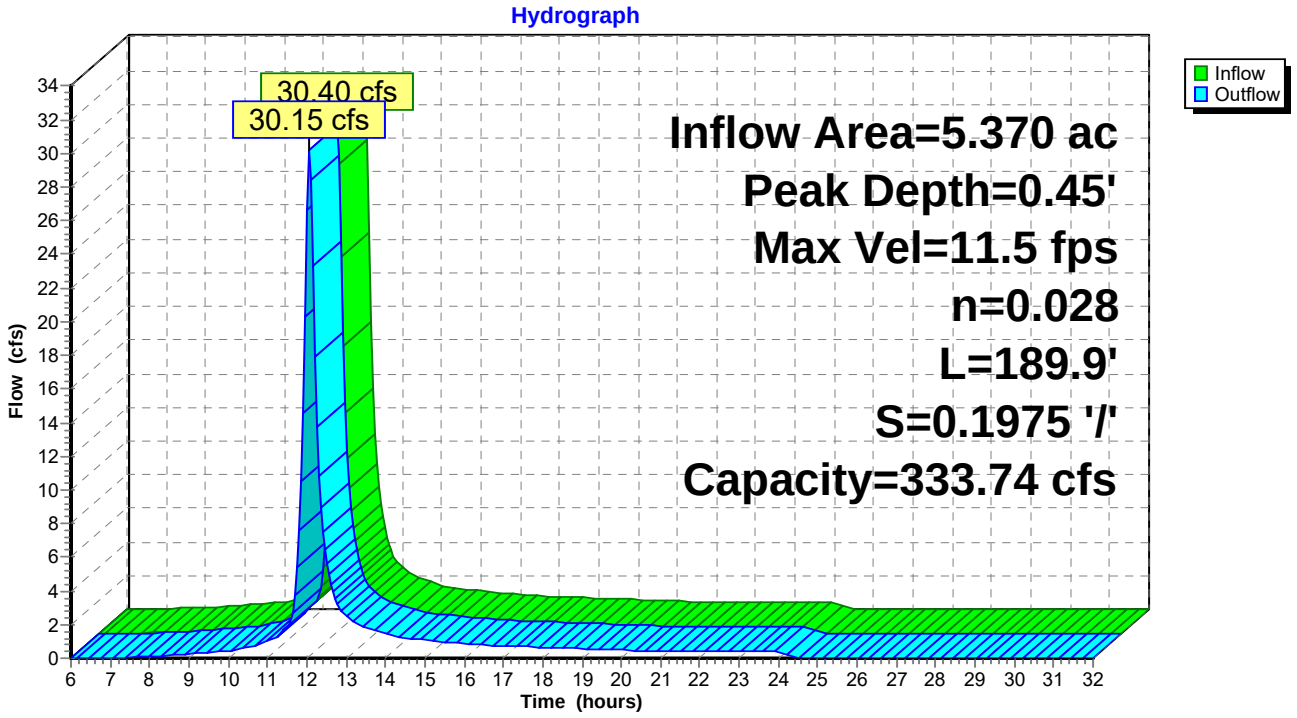
[61] Hint: Submerged 2% of Reach 14-15 bottom

Inflow Area = 5.370 ac, Inflow Depth = 4.53" for 100 event
Inflow = 30.40 cfs @ 12.05 hrs, Volume= 2.025 af
Outflow = 30.15 cfs @ 12.06 hrs, Volume= 2.025 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.5 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.2 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.45' @ 12.05 hrs
Capacity at bank full= 333.74 cfs
Inlet Invert= 149.50', Outlet Invert= 112.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 189.9' Slope= 0.1975 '/'

Reach 15-17: DOWNCHUTE



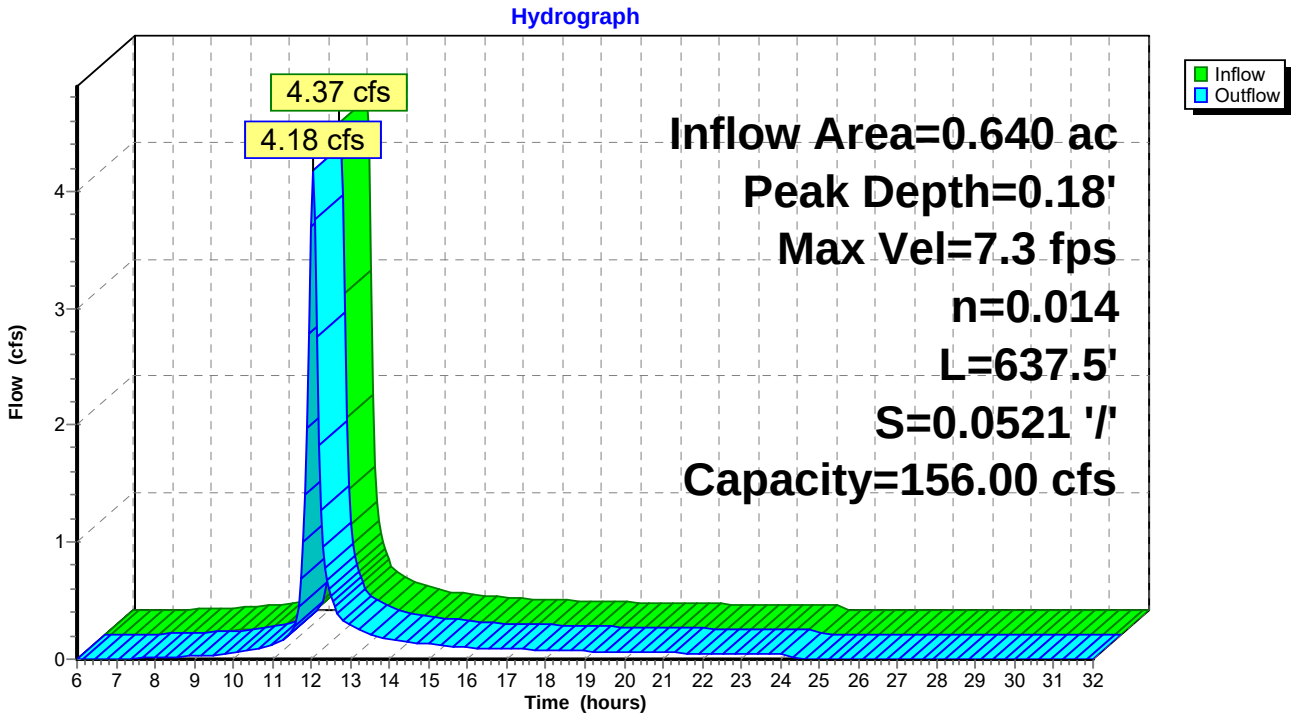
Reach 16-18: PERIMETER CHANNEL

Inflow Area = 0.640 ac, Inflow Depth = 4.53" for 100 event
Inflow = 4.37 cfs @ 12.01 hrs, Volume= 0.241 af
Outflow = 4.18 cfs @ 12.05 hrs, Volume= 0.241 af, Atten= 4%, Lag= 2.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.3 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 5.8 min

Peak Depth= 0.18' @ 12.03 hrs
Capacity at bank full= 156.00 cfs
Inlet Invert= 135.70', Outlet Invert= 102.50'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 637.5' Slope= 0.0521 '/'

Reach 16-18: PERIMETER CHANNEL



Reach 17-18: PIPE DOWNCHUTE

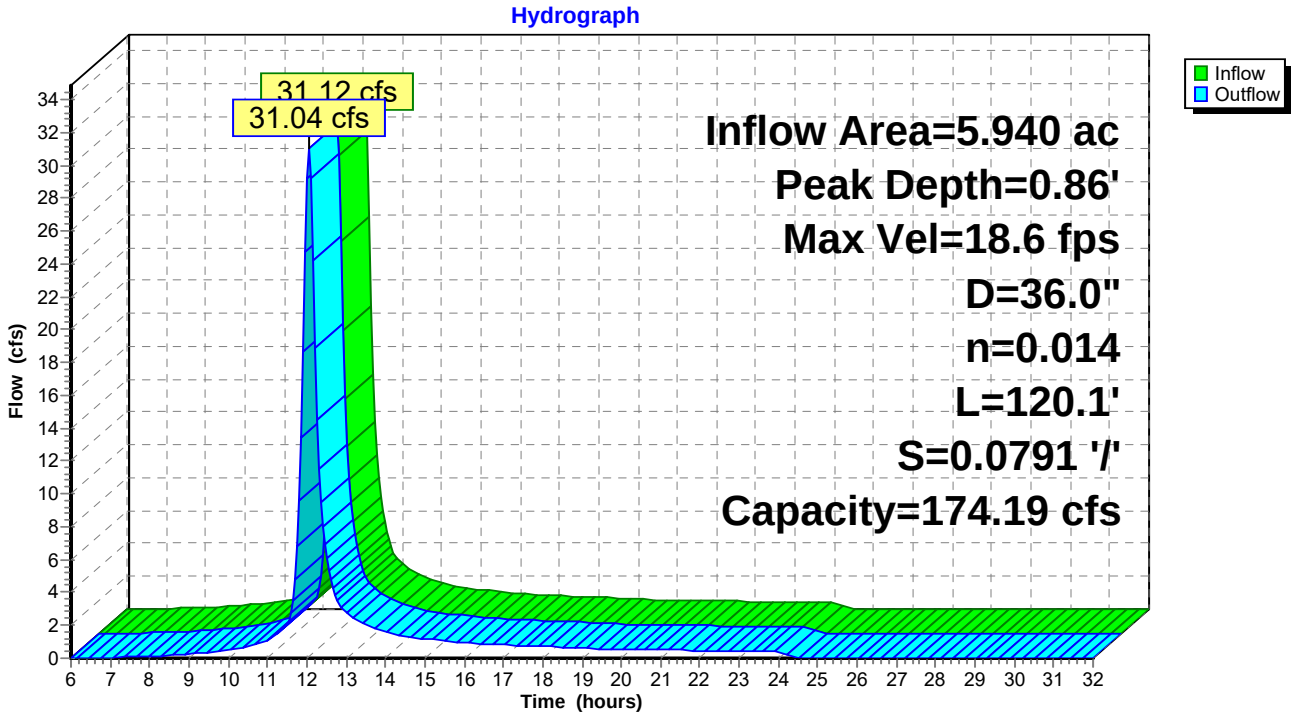
[52] Hint: Inlet conditions not evaluated
[61] Hint: Submerged 2% of Reach 15-17 bottom

Inflow Area = 5.940 ac, Inflow Depth = 4.53" for 100 event
Inflow = 31.12 cfs @ 12.05 hrs, Volume= 2.240 af
Outflow = 31.04 cfs @ 12.05 hrs, Volume= 2.240 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 18.6 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 6.0 fps, Avg. Travel Time= 0.3 min

Peak Depth= 0.86' @ 12.05 hrs
Capacity at bank full= 174.19 cfs
Inlet Invert= 112.00', Outlet Invert= 102.50'
36.0" Diameter Pipe, n= 0.014
Length= 120.1' Slope= 0.0791 '/'

Reach 17-18: PIPE DOWNCHUTE



Reach 18-19: PERIMETER CHANNEL W

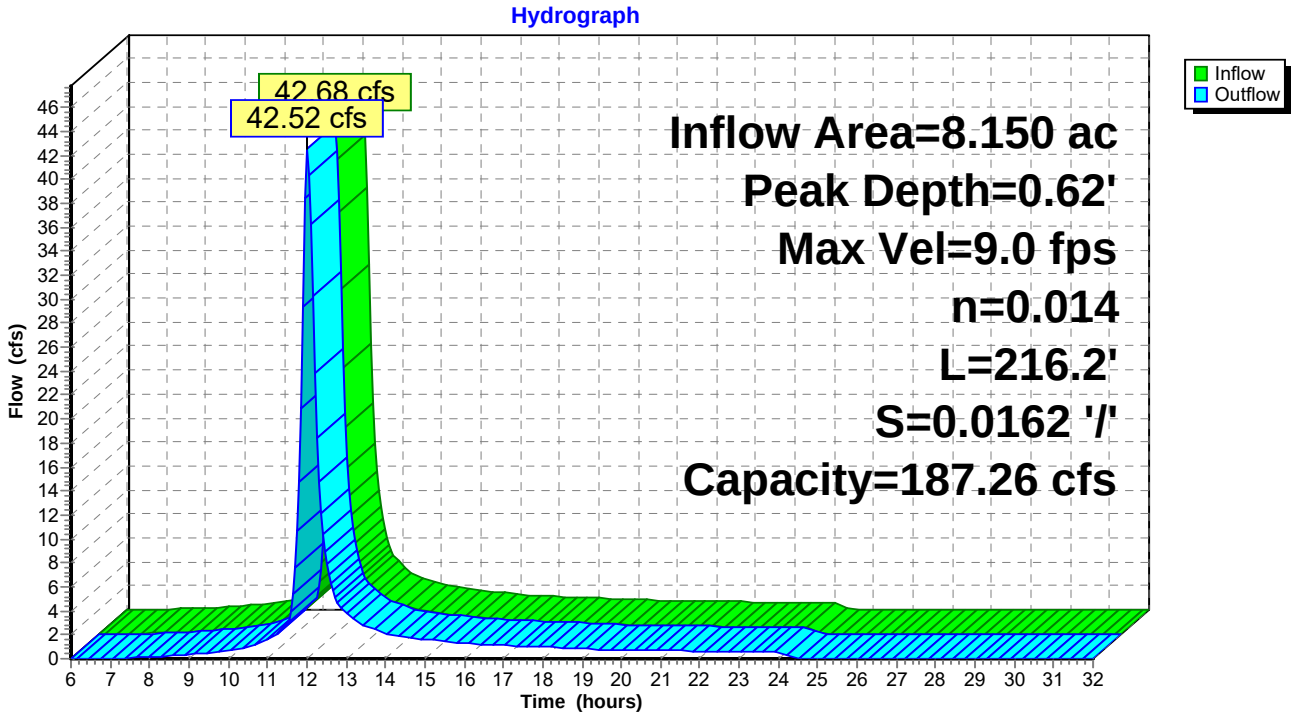
[61] Hint: Submerged 2% of Reach 16-18 bottom
[61] Hint: Submerged 7% of Reach 17-18 bottom

Inflow Area = 8.150 ac, Inflow Depth = 4.53" for 100 event
Inflow = 42.68 cfs @ 12.00 hrs, Volume= 3.073 af
Outflow = 42.52 cfs @ 12.01 hrs, Volume= 3.073 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.0 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.2 fps, Avg. Travel Time= 1.6 min

Peak Depth= 0.62' @ 12.00 hrs
Capacity at bank full= 187.26 cfs
Inlet Invert= 102.50', Outlet Invert= 99.00'
7.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 10.00'
Length= 216.2' Slope= 0.0162 '/'

Reach 18-19: PERIMETER CHANNEL W



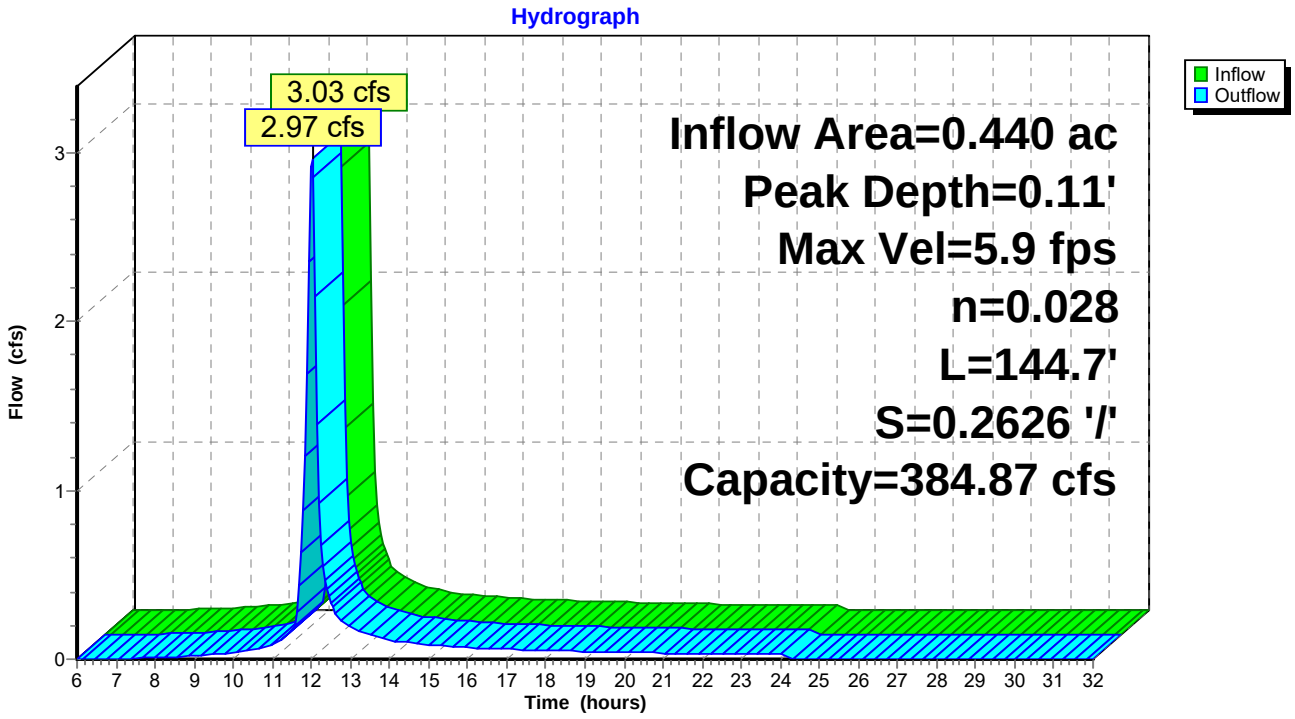
Reach 21-23: DOWNCHUTE

Inflow Area = 0.440 ac, Inflow Depth = 4.53" for 100 event
Inflow = 3.03 cfs @ 12.01 hrs, Volume= 0.166 af
Outflow = 2.97 cfs @ 12.02 hrs, Volume= 0.166 af, Atten= 2%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.9 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 1.3 min

Peak Depth= 0.11' @ 12.01 hrs
Capacity at bank full= 384.87 cfs
Inlet Invert= 219.00', Outlet Invert= 181.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 144.7' Slope= 0.2626 '/'

Reach 21-23: DOWNCHUTE



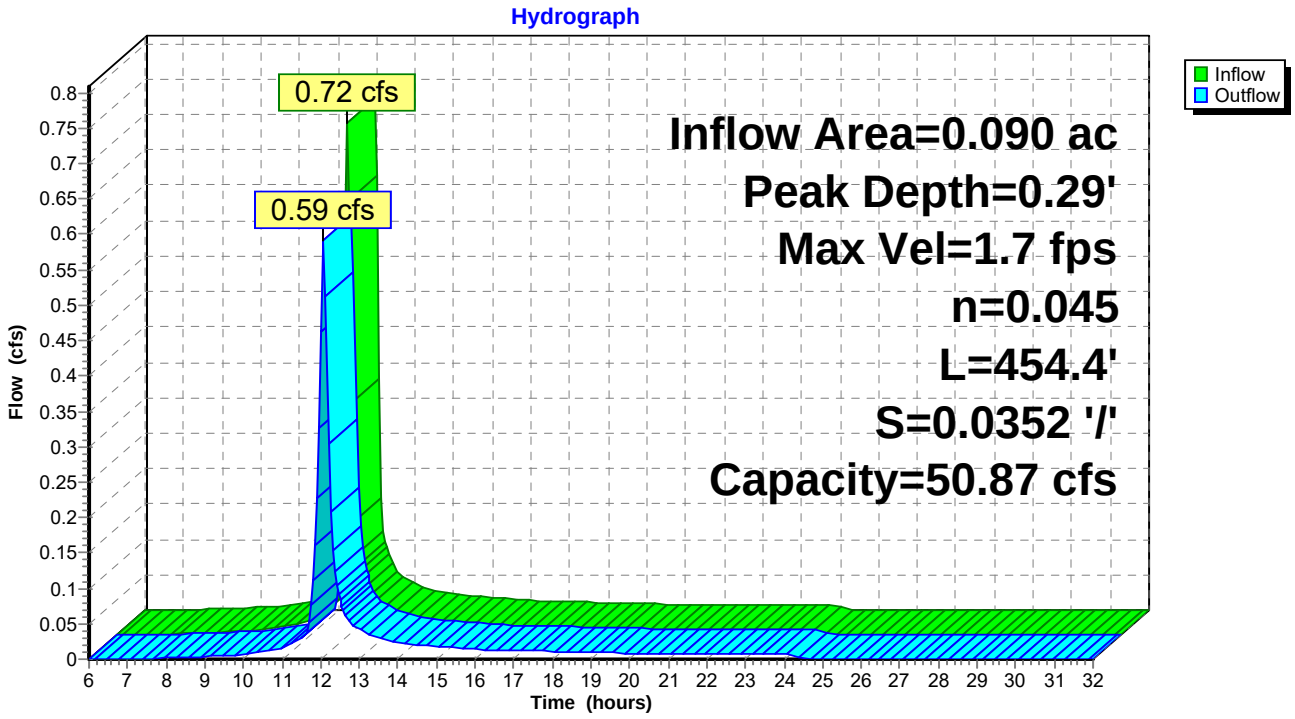
Reach 22-23: BENCH

Inflow Area = 0.090 ac, Inflow Depth = 4.53" for 100 event
Inflow = 0.72 cfs @ 11.95 hrs, Volume= 0.034 af
Outflow = 0.59 cfs @ 12.07 hrs, Volume= 0.034 af, Atten= 18%, Lag= 7.2 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.7 fps, Min. Travel Time= 4.5 min
Avg. Velocity = 0.6 fps, Avg. Travel Time= 12.9 min

Peak Depth= 0.29' @ 12.00 hrs
Capacity at bank full= 50.87 cfs
Inlet Invert= 197.00', Outlet Invert= 181.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 454.4' Slope= 0.0352 '/'

Reach 22-23: BENCH



Reach 23-25: DOWNCHUTE

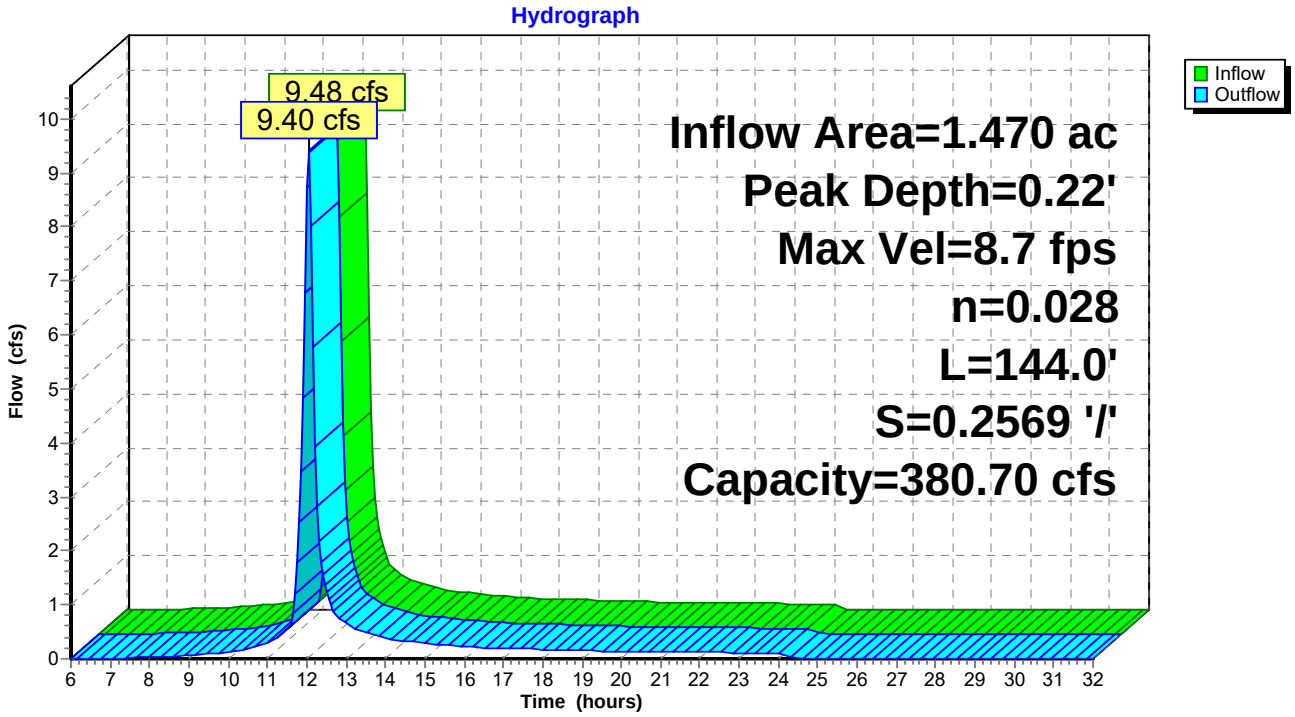
[61] Hint: Submerged 1% of Reach 21-23 bottom
[61] Hint: Submerged 1% of Reach 22-23 bottom

Inflow Area = 1.470 ac, Inflow Depth = 4.53" for 100 event
Inflow = 9.48 cfs @ 12.03 hrs, Volume= 0.554 af
Outflow = 9.40 cfs @ 12.04 hrs, Volume= 0.554 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.7 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.3 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.22' @ 12.04 hrs
Capacity at bank full= 380.70 cfs
Inlet Invert= 181.00', Outlet Invert= 144.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 144.0' Slope= 0.2569 '/'

Reach 23-25: DOWNCHUTE



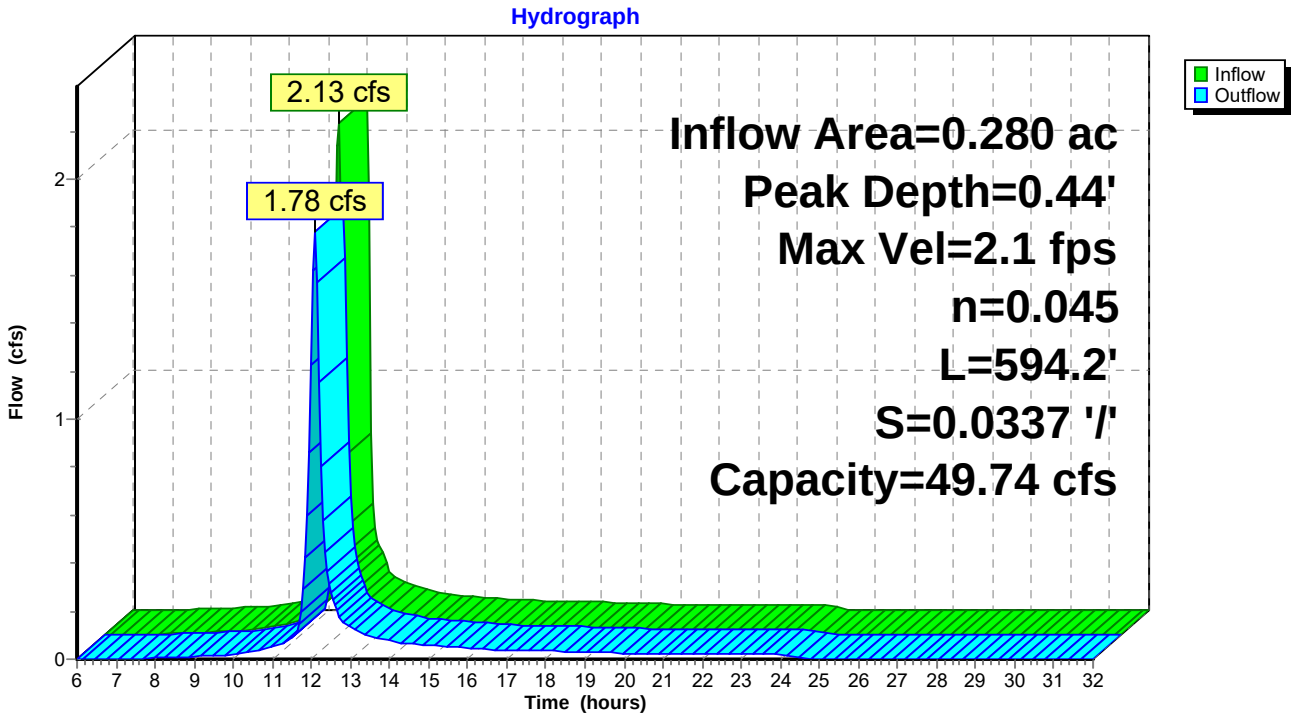
Reach 24-25: BENCH

Inflow Area = 0.280 ac, Inflow Depth = 4.53" for 100 event
Inflow = 2.13 cfs @ 11.98 hrs, Volume= 0.106 af
Outflow = 1.78 cfs @ 12.10 hrs, Volume= 0.106 af, Atten= 16%, Lag= 7.2 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.1 fps, Min. Travel Time= 4.6 min
Avg. Velocity = 0.7 fps, Avg. Travel Time= 13.6 min

Peak Depth= 0.44' @ 12.02 hrs
Capacity at bank full= 49.74 cfs
Inlet Invert= 164.00', Outlet Invert= 144.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 594.2' Slope= 0.0337 '/'

Reach 24-25: BENCH



Reach 25-27: DOWNCHUTE

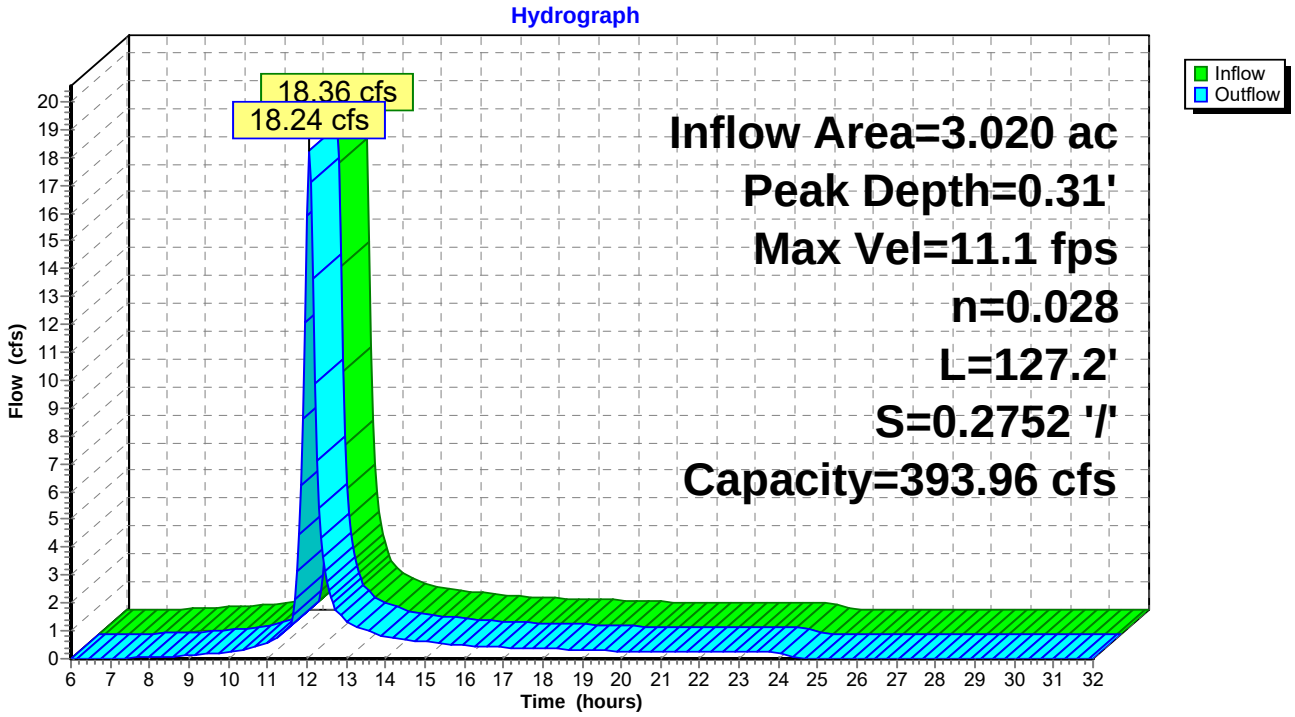
[61] Hint: Submerged 1% of Reach 23-25 bottom
[61] Hint: Submerged 2% of Reach 24-25 bottom

Inflow Area = 3.020 ac, Inflow Depth = 4.53" for 100 event
Inflow = 18.36 cfs @ 12.05 hrs, Volume= 1.139 af
Outflow = 18.24 cfs @ 12.06 hrs, Volume= 1.139 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.1 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.9 fps, Avg. Travel Time= 0.7 min

Peak Depth= 0.31' @ 12.06 hrs
Capacity at bank full= 393.96 cfs
Inlet Invert= 144.00', Outlet Invert= 109.00'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 127.2' Slope= 0.2752 '/'

Reach 25-27: DOWNCHUTE



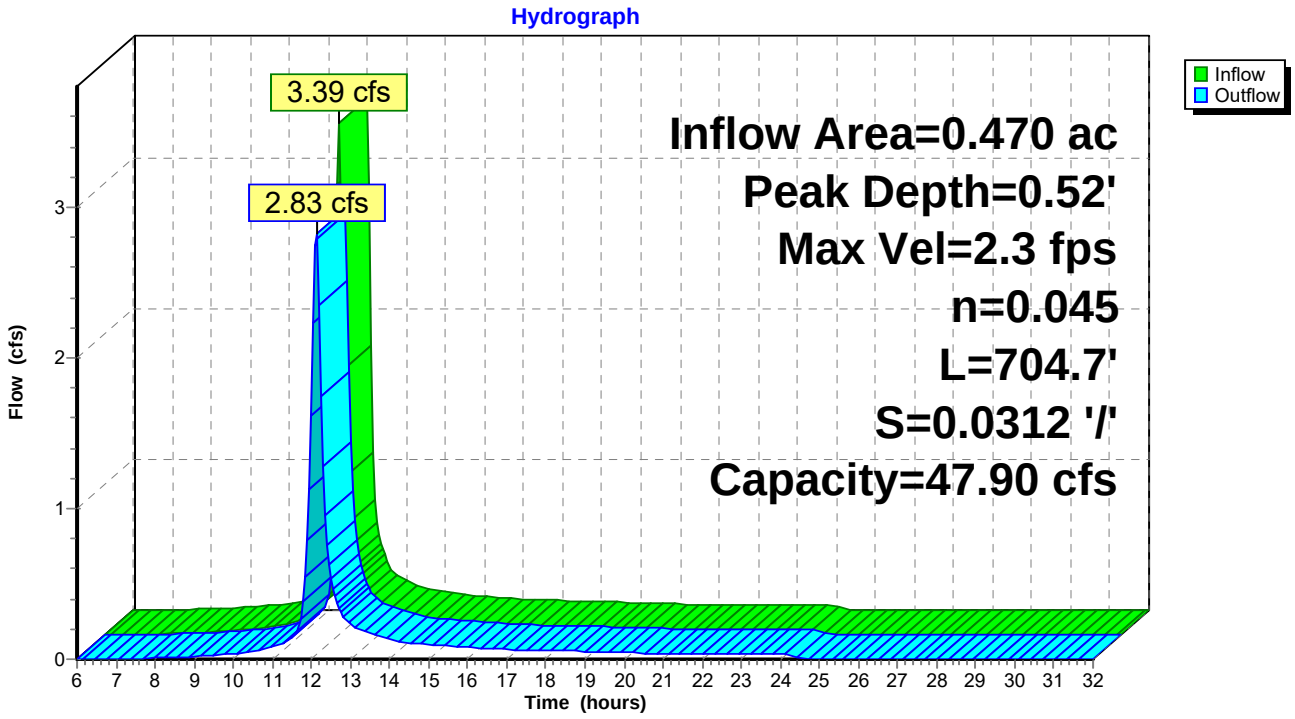
Reach 26-27: BENCH

Inflow Area = 0.470 ac, Inflow Depth = 4.53" for 100 event
Inflow = 3.39 cfs @ 12.00 hrs, Volume= 0.177 af
Outflow = 2.83 cfs @ 12.13 hrs, Volume= 0.177 af, Atten= 17%, Lag= 8.1 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.3 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 0.8 fps, Avg. Travel Time= 15.0 min

Peak Depth= 0.52' @ 12.05 hrs
Capacity at bank full= 47.90 cfs
Inlet Invert= 131.00', Outlet Invert= 109.00'
0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 3.0 6.0 '/' Top Width= 13.50'
Length= 704.7' Slope= 0.0312 '/'

Reach 26-27: BENCH



Reach 27-29: DOWNCHUTE

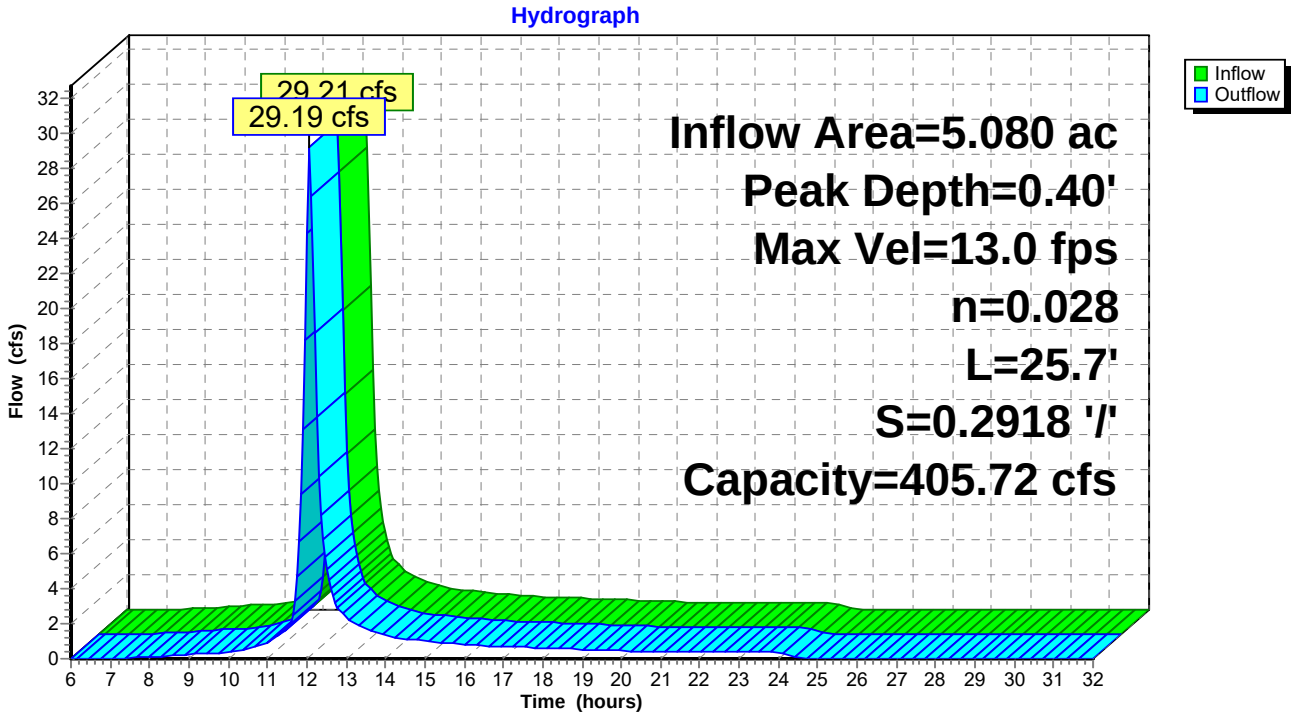
[61] Hint: Submerged 1% of Reach 25-27 bottom
[61] Hint: Submerged 2% of Reach 26-27 bottom

Inflow Area = 5.080 ac, Inflow Depth = 4.53" for 100 event
Inflow = 29.21 cfs @ 12.07 hrs, Volume= 1.916 af
Outflow = 29.19 cfs @ 12.07 hrs, Volume= 1.916 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 13.0 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.4 fps, Avg. Travel Time= 0.1 min

Peak Depth= 0.40' @ 12.07 hrs
Capacity at bank full= 405.72 cfs
Inlet Invert= 109.00', Outlet Invert= 101.50'
4.00' x 1.50' deep channel, n= 0.028
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 25.7' Slope= 0.2918 '/'

Reach 27-29: DOWNCHUTE



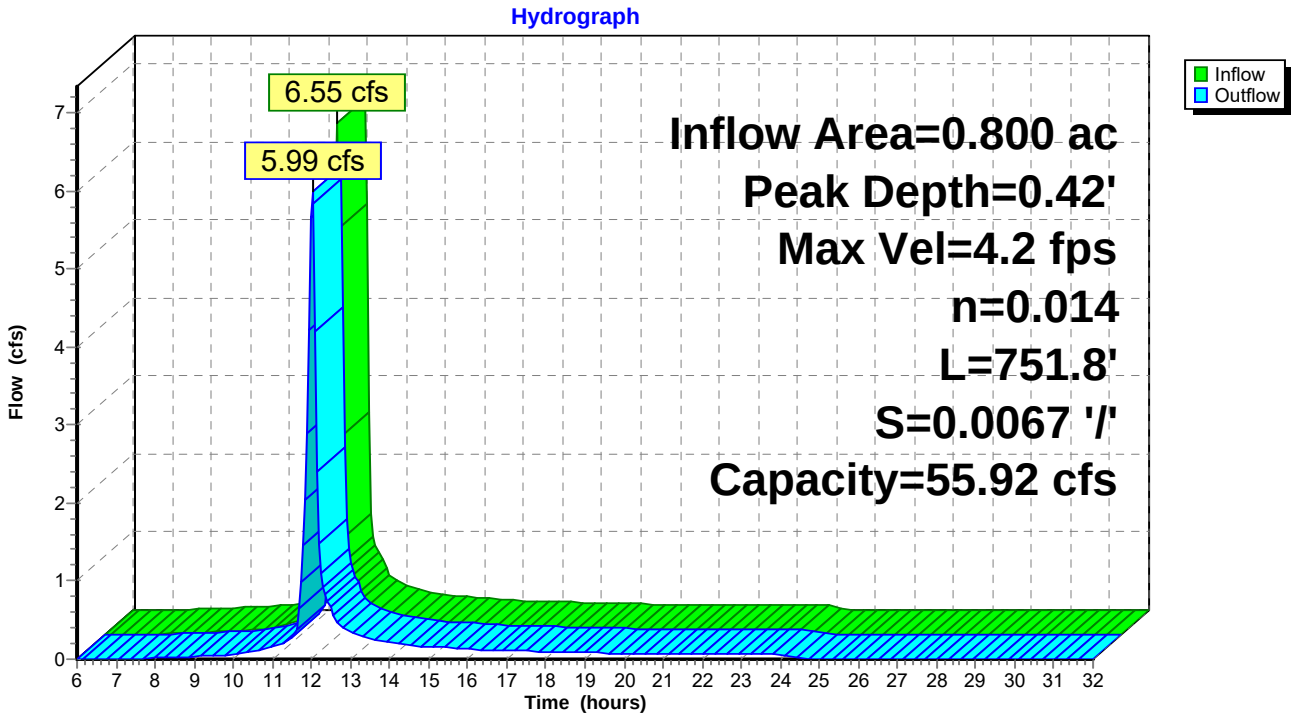
Reach 28-29: PERIMETER CHANNEL

Inflow Area = 0.800 ac, Inflow Depth = 4.53" for 100 event
Inflow = 6.55 cfs @ 11.95 hrs, Volume= 0.302 af
Outflow = 5.99 cfs @ 12.03 hrs, Volume= 0.302 af, Atten= 9%, Lag= 4.9 min

Routing by Stor-Ind+Trans method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.2 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 0.9 fps, Avg. Travel Time= 13.4 min

Peak Depth= 0.42' @ 11.98 hrs
Capacity at bank full= 55.92 cfs
Inlet Invert= 106.53', Outlet Invert= 101.50'
3.00' x 1.50' deep channel, n= 0.014
Side Slope Z-value= 1.0 '/' Top Width= 6.00'
Length= 751.8' Slope= 0.0067 '/'

Reach 28-29: PERIMETER CHANNEL



Pond POND Nº1:

Inflow Area = 23.430 ac, Inflow Depth = 4.53" for 100 event
Inflow = 111.77 cfs @ 12.01 hrs, Volume= 8.836 af
Outflow = 25.27 cfs @ 12.54 hrs, Volume= 8.545 af, Atten= 77%, Lag= 31.6 min
Primary = 25.27 cfs @ 12.54 hrs, Volume= 8.545 af

Routing by Stor-Ind method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 29.14' @ 12.54 hrs Surf.Area= 0.855 ac Storage= 3.888 af
Plug-Flow detention time= 125.3 min calculated for 8.545 af (97% of inflow)
Center-of-Mass det. time= 105.8 min (929.9 - 824.2)

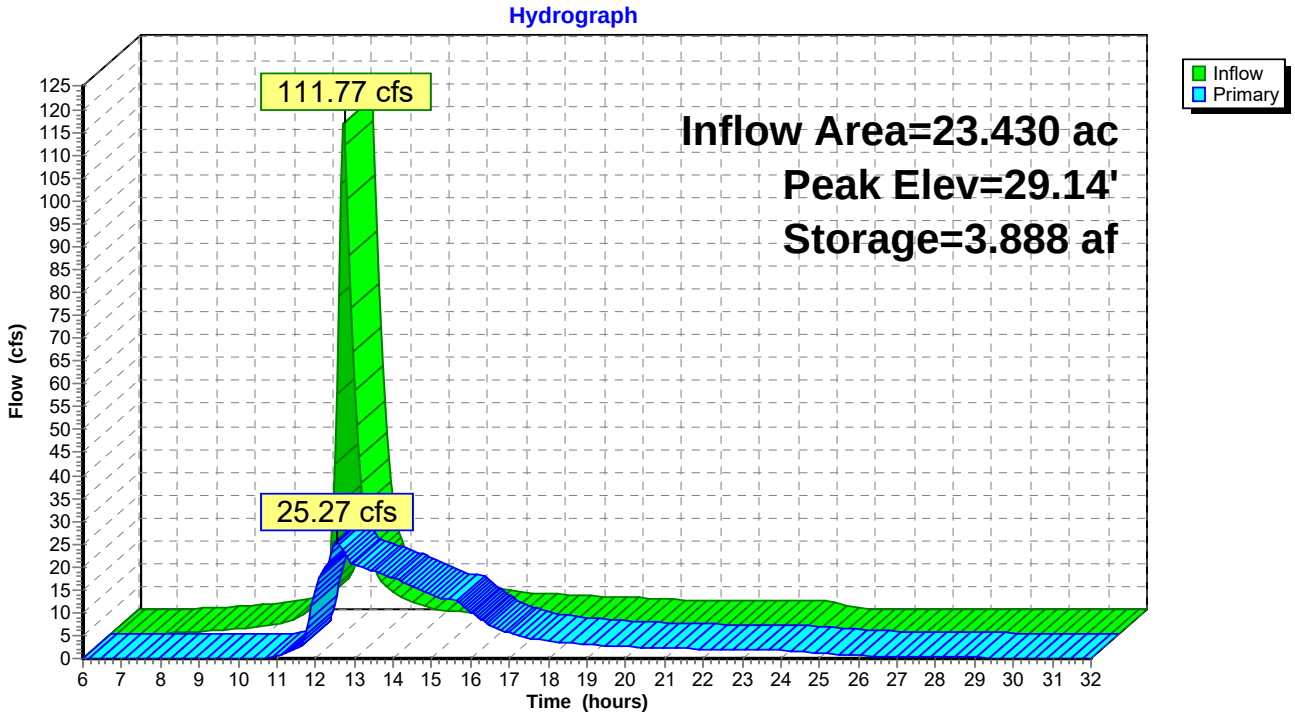
Volume	Invert	Avail.Storage	Storage Description
#1	24.00'	4.638 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
24.00	0.670	728.0	0.000	0.000	0.670
26.00	0.730	755.0	1.400	1.400	0.751
28.00	0.810	781.0	1.539	2.939	0.832
30.00	0.890	807.0	1.699	4.638	0.915

Device	Routing	Invert	Outlet Devices
#1	Primary	24.30'	**18.0" x 97.0' long Culvert X 2.00** Ke= 0.900 Outlet Invert= 23.23' S= 0.0110 '/' Cc= 0.900 n= 0.024
#2	Primary	28.90'	**13.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=25.21 cfs @ 12.54 hrs HW=29.14' (Free Discharge)
└**1=Culvert** (Barrel Controls 21.13 cfs @ 6.0 fps)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 4.08 cfs @ 1.3 fps)

Pond POND Nº1:



Pond POND Nº2:

Inflow Area = 8.390 ac, Inflow Depth = 4.53" for 100 event
Inflow = 44.64 cfs @ 11.99 hrs, Volume= 3.164 af
Outflow = 8.56 cfs @ 12.44 hrs, Volume= 2.574 af, Atten= 81%, Lag= 26.8 min
Primary = 8.56 cfs @ 12.44 hrs, Volume= 2.574 af

Routing by Stor-Ind method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 39.01' @ 12.44 hrs Surf.Area= 0.379 ac Storage= 1.529 af
Plug-Flow detention time= 175.7 min calculated for 2.569 af (81% of inflow)
Center-of-Mass det. time= 98.1 min (916.9 - 818.8)

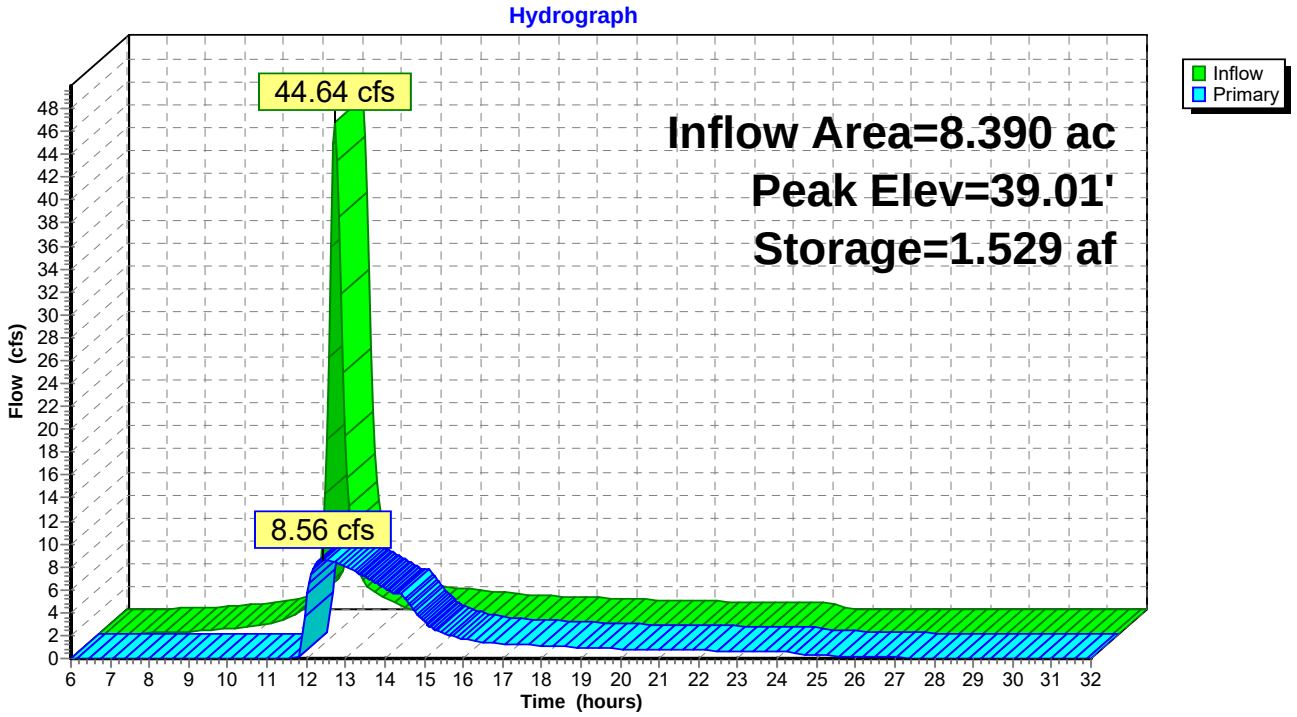
Volume	Invert	Avail.Storage	Storage Description
#1	33.00'	1.925 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
33.00	0.135	833.8	0.000	0.000	0.135
34.00	0.174	851.5	0.154	0.154	0.193
35.00	0.213	870.3	0.193	0.347	0.255
36.00	0.250	890.0	0.231	0.579	0.322
38.00	0.340	924.0	0.588	1.166	0.442
40.00	0.420	958.0	0.759	1.925	0.566

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	**12.0" x 45.0' long Culvert X 2.00** Ke= 0.500 Outlet Invert= 35.10' S= 0.0200 '/' Cc= 0.900 n= 0.024
#2	Primary	39.60'	**12.0' long x 6.0' 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 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=8.55 cfs @ 12.44 hrs HW=39.01' (Free Discharge)
└─**1=Culvert** (Barrel Controls 8.55 cfs @ 5.4 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond POND Nº2:



Pond WL-2:

Inflow Area = 6.490 ac, Inflow Depth = 3.55" for 100 event
Inflow = 19.30 cfs @ 12.26 hrs, Volume= 1.919 af
Outflow = 6.50 cfs @ 12.76 hrs, Volume= 1.126 af, Atten= 66%, Lag= 29.9 min
Primary = 6.50 cfs @ 12.76 hrs, Volume= 1.126 af

Routing by Stor-Ind method, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 37.07' @ 12.76 hrs Surf.Area= 1.691 ac Storage= 0.902 af
Plug-Flow detention time= 227.7 min calculated for 1.126 af (59% of inflow)
Center-of-Mass det. time= 109.3 min (964.8 - 855.5)

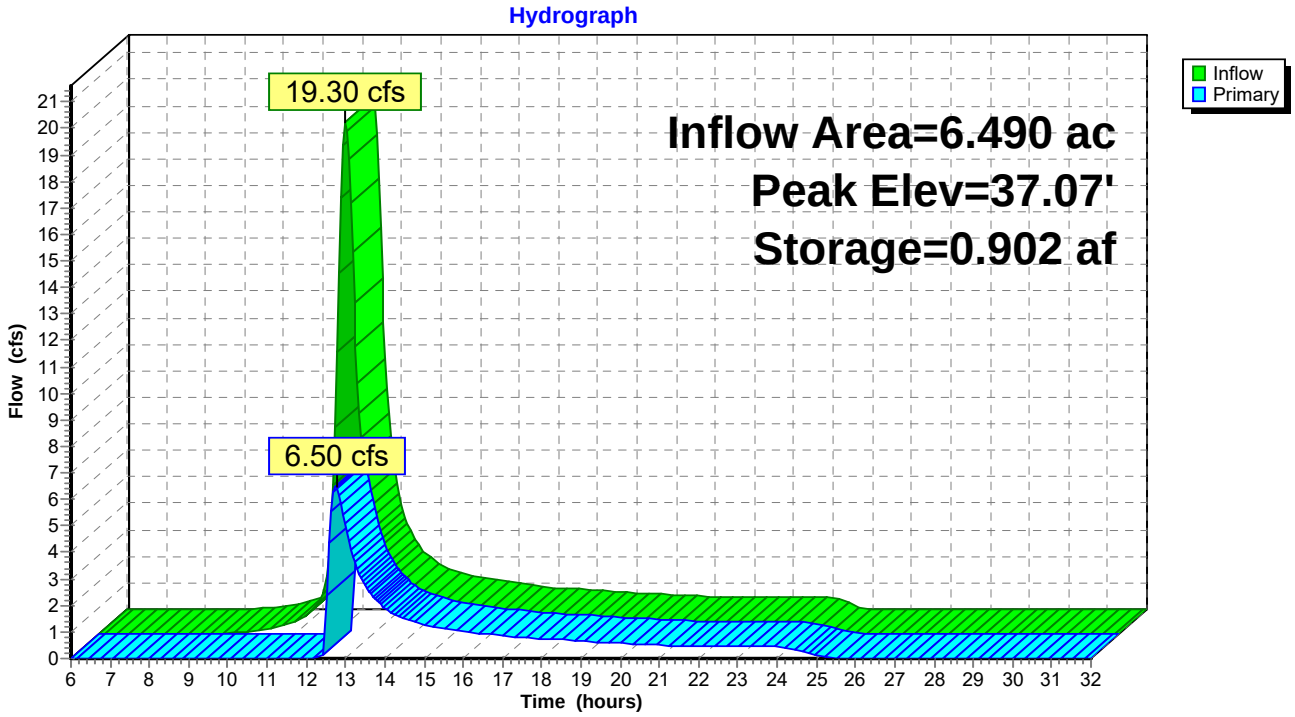
Volume	Invert	Avail.Storage	Storage Description
#1	36.00'	3.170 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
36.00	0.000	0.000	0.000
38.00	3.170	3.170	3.170

Device	Routing	Invert	Outlet Devices
#1	Primary	37.00'	**140.0' long x 30.0' 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=6.43 cfs @ 12.76 hrs HW=37.07' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 6.43 cfs @ 0.7 fps)

Pond WL-2:

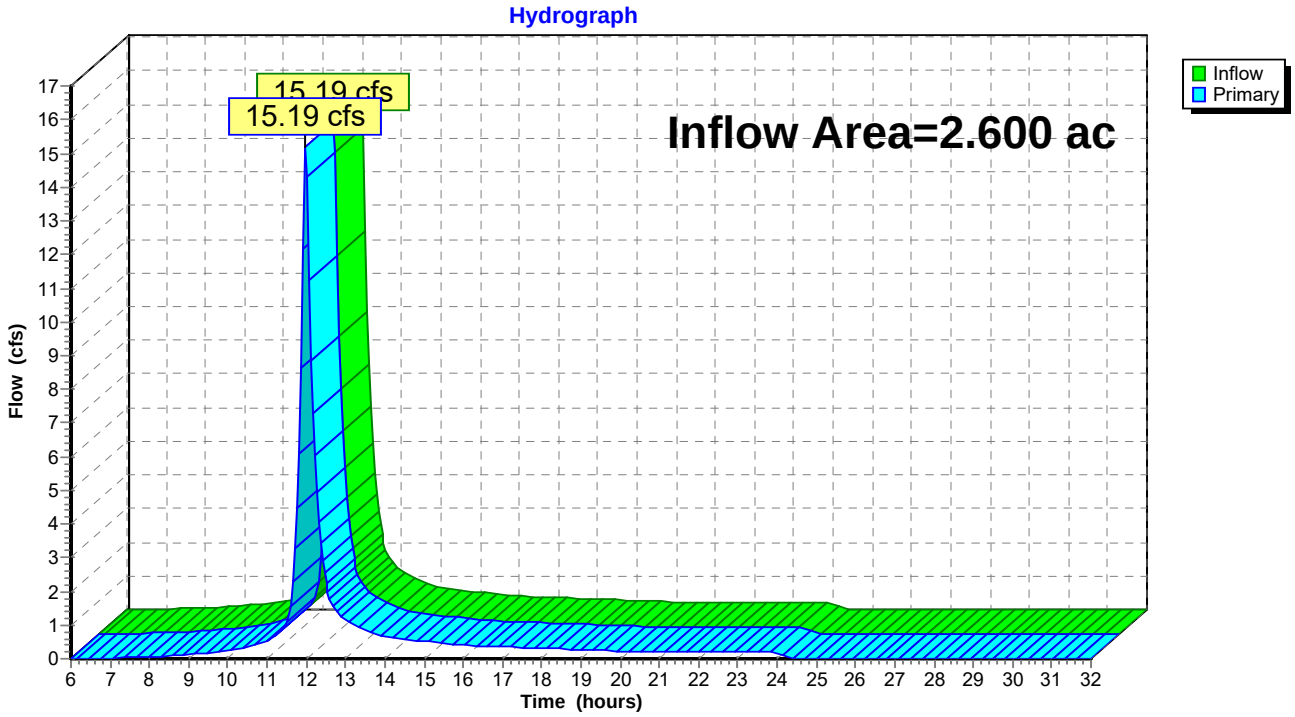

Hydrograph
19.30 cfs
6.50 cfs
Inflow Area=6.490 ac
Peak Elev=37.07'
Storage=0.902 af
Inflow
Primary
Flow (cfs)
Time (hours)

Link 08`-09:

Inflow Area = 2.600 ac, Inflow Depth = 4.53" for 100 event
Inflow = 15.19 cfs @ 11.97 hrs, Volume= 0.980 af
Primary = 15.19 cfs @ 11.97 hrs, Volume= 0.980 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link 08`-09:

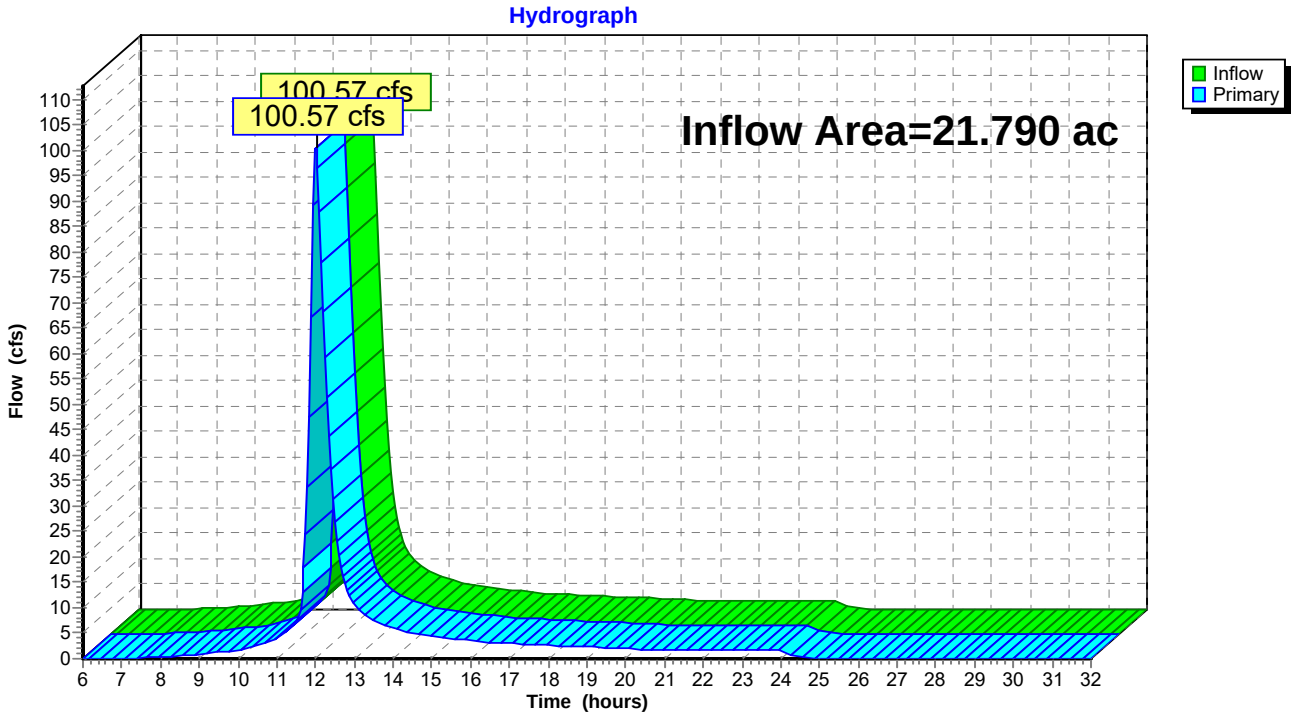


Link 19-20:

Inflow Area = 21.790 ac, Inflow Depth = 4.53" for 100 event
Inflow = 100.57 cfs @ 12.01 hrs, Volume= 8.217 af
Primary = 100.57 cfs @ 12.01 hrs, Volume= 8.217 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link 19-20:

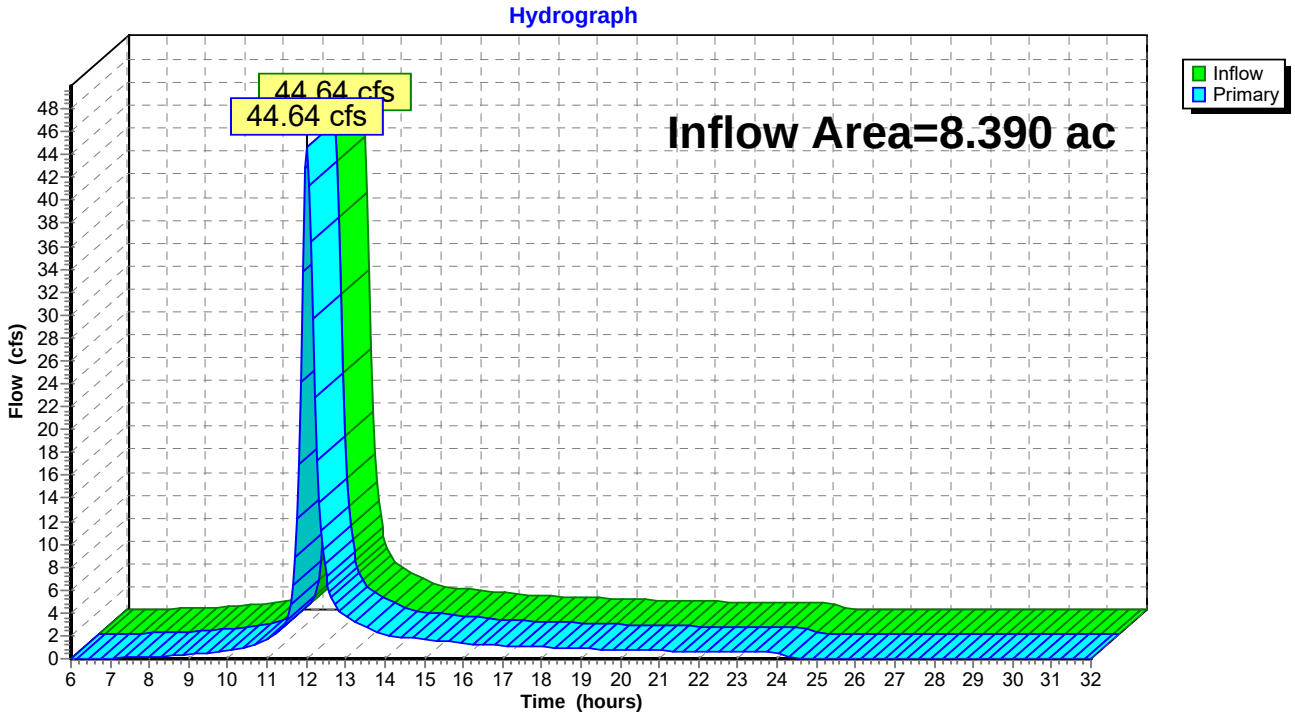


Link 29-30:

Inflow Area = 8.390 ac, Inflow Depth = 4.53" for 100 event
Inflow = 44.64 cfs @ 11.99 hrs, Volume= 3.164 af
Primary = 44.64 cfs @ 11.99 hrs, Volume= 3.164 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link 29-30:

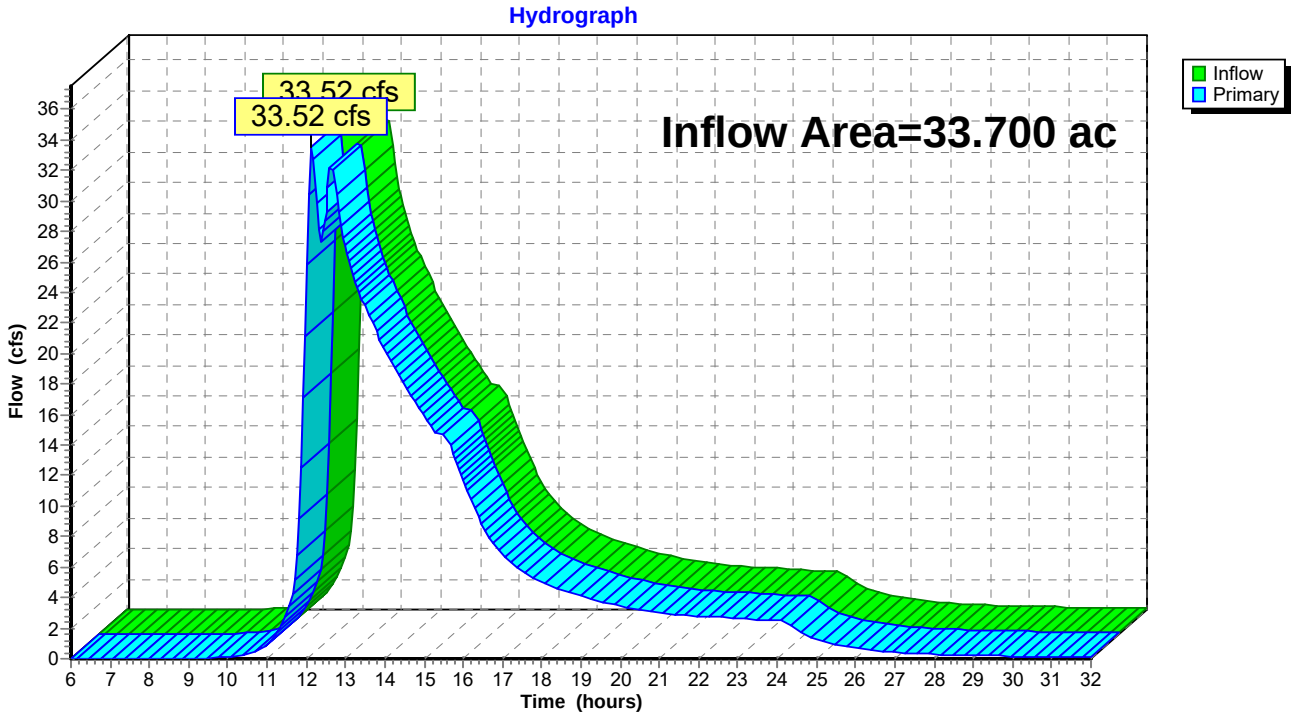


Link OUTLET 1:

Inflow Area = 33.700 ac, Inflow Depth > 3.84" for 100 event
Inflow = 33.52 cfs @ 12.13 hrs, Volume= 10.789 af
Primary = 33.52 cfs @ 12.13 hrs, Volume= 10.789 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link OUTLET 1:

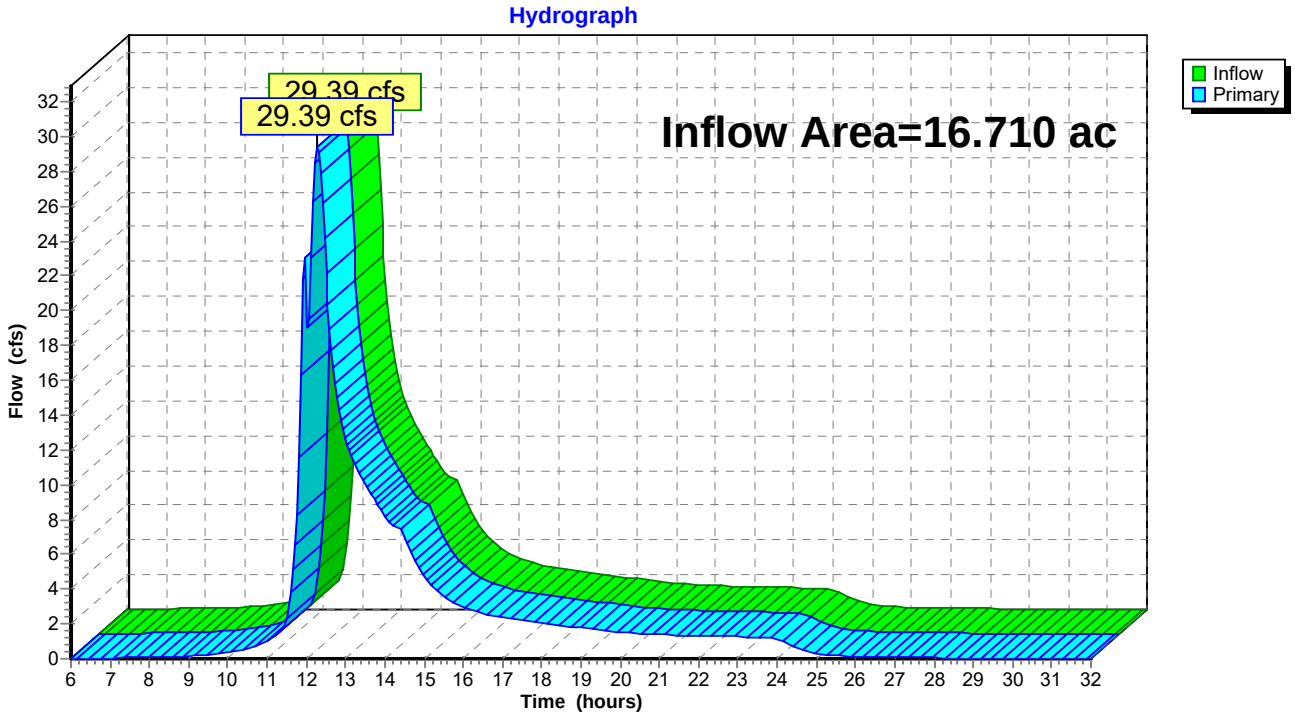


Link OUTLET2:

Inflow Area = 16.710 ac, Inflow Depth > 3.77" for 100 event
Inflow = 29.39 cfs @ 12.26 hrs, Volume= 5.250 af
Primary = 29.39 cfs @ 12.26 hrs, Volume= 5.250 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link OUTLET2:

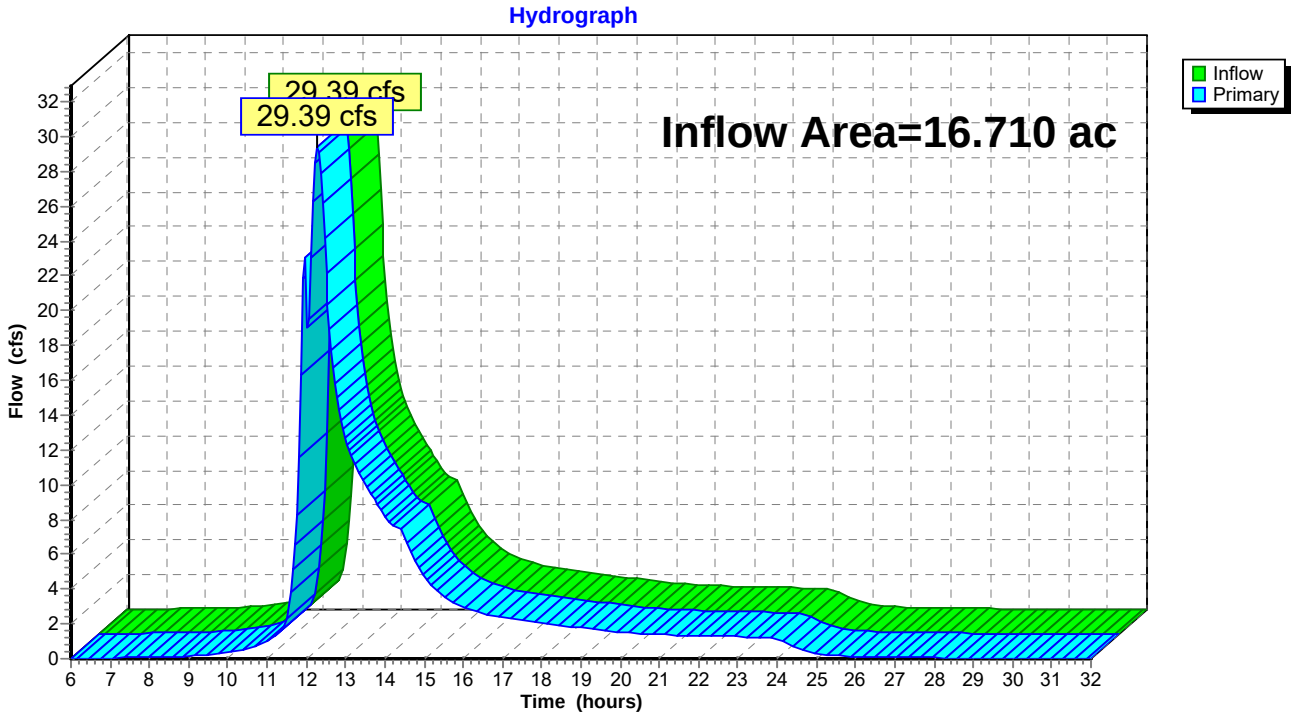


Link WL-1:

Inflow Area = 16.710 ac, Inflow Depth > 3.77" for 100 event
Inflow = 29.39 cfs @ 12.26 hrs, Volume= 5.250 af
Primary = 29.39 cfs @ 12.26 hrs, Volume= 5.250 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link WL-1:

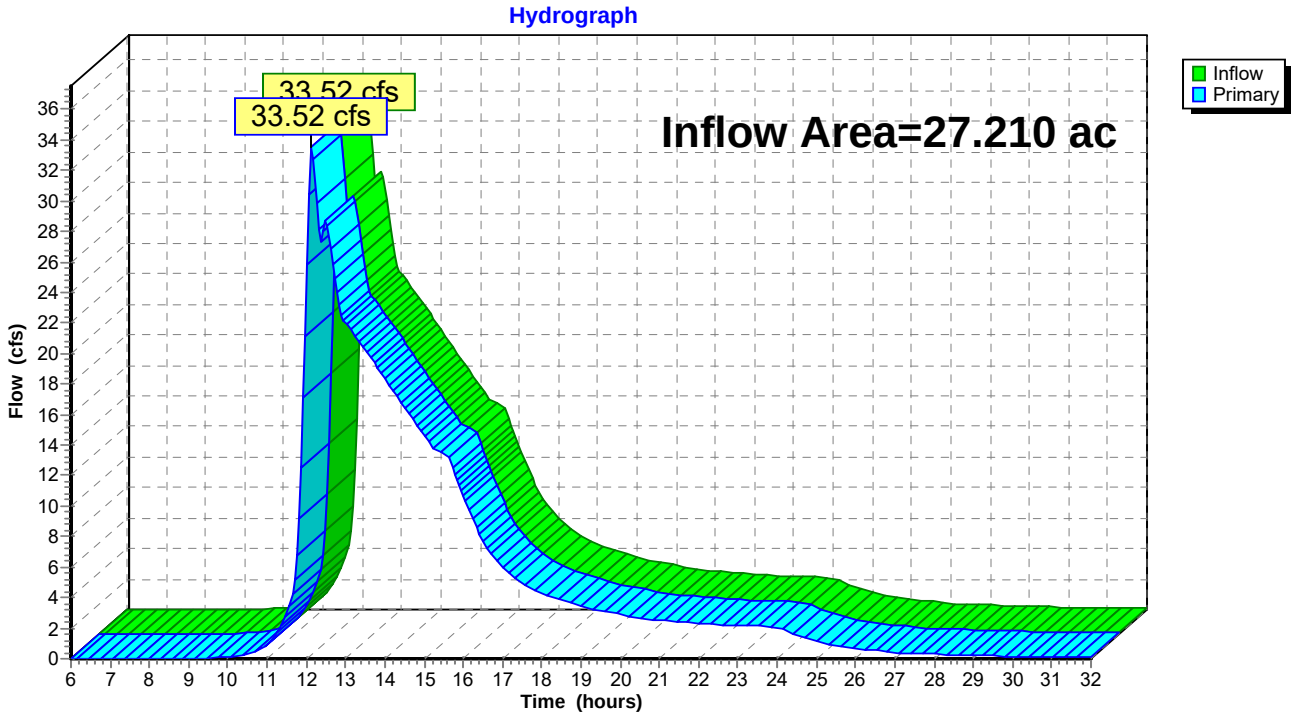


Link WL-3:

Inflow Area = 27.210 ac, Inflow Depth > 4.26" for 100 event
Inflow = 33.52 cfs @ 12.13 hrs, Volume= 9.663 af
Primary = 33.52 cfs @ 12.13 hrs, Volume= 9.663 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 6.00-32.00 hrs, dt= 0.05 hrs

Link WL-3:



Geosyntec consultants

COMPUTATION COVER SHEET

Client: Constellation Power Source **Project:** Lot 15 Landfill **Project #:** ME0668 **Task #:** 06

TITLE OF COMPUTATIONS CHANNEL DESIGN

COMPUTATIONS BY:
Signature _____ DATE _____
Printed Name and Title: Fabián Fulginiti, Senior Staff Engineer

ASSUMPTIONS AND PROCEDURES CHECKED BY:
(Peer Reviewer)
Signature _____ DATE _____
Printed Name and Title: Teresa María Reyna, Senior Project Engineer

COMPUTATIONS CHECKED BY:
Signature _____ DATE _____
Printed Name and Title: Teresa María Reyna, Senior Project Engineer

COMPUTATIONS BACKCHECKED BY:
(Originator)
Signature _____ DATE _____
Printed Name and Title: Fabián Fulginiti, Senior Staff Engineer

APPROVED BY:
(PM or Designate)
Signature _____ DATE _____
Printed Name and Title: R. David Espinoza, Associate

APPROVAL NOTES: _____

REVISIONS (Number and initial all revisions)

NO.	SHEET	DATE	BY	CHECKED BY	APPROVAL

SITE DRAINAGE

1. PURPOSE

The purpose of this calculation package is to design the geometry and the appropriate lining for cover terraces, downchutes and perimeter channels at Lot 15 Landfill in Baltimore City, Maryland. For each channel, the design takes into consideration the permissible flow velocity and stability of the chosen lining. Each channel is designed to convey the 100-year 24-hour storm without overtopping the channel. Also, as required by the Maryland Department of the Environment (MDE) Standards and Specifications for Soil Erosion and Sediment Control each channel is designed to convey the 10-year 24-hour at less than erosive velocities.

2. DESIGN CRITERIA

Regulations governing the permissible channel velocities are presented in the following table.

Regulation	Requirements
Maryland Department of the Environment (MDE). Sediment and Stormwater Administration	Velocities in stormwater structures shall be non-erosive for the 10-year storm event.

2. GOVERNING EQUATIONS

The conveyance system (i.e., channel, terraces, and downchutes) is sized using Manning's hydraulic equation developed for sheet flow:

$$Q = \frac{1.49}{n} A R_h^{2/3} S^{1/2} \qquad \text{Eq. (1)}$$

where:

- Q = flow rate obtained from HYDROCAD (cfs)
- R_h = hydraulic radius (ft) (wetted area/wetted perimeter)
- S = hydraulic gradient (ft/ft)
- A = cross-sectional flow area (ft^2)
- n = Manning's roughness coefficient (Typical values obtained from the Urban Hydrology for Small Watersheds, United States Department of Agriculture, TR-55are provided below)

Surface description	n [1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses [2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: [3]	
Light underbrush	0.40
Dense underbrush	0.80

1 The n values are a composite of information compiled by Engman (1986).
2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
3 When selecting n , consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

The Manning's roughness coefficient for riprap is given by [Maryland E&S, 1994]:

$$n = \frac{d^{1/6}}{21.6\log(d / D_{50}) + 14} \qquad \text{Eq. (2a)}$$

where:

d = flow depth (ft)
D_{50} = average particle diameter (ft)

For gabions or Reno mattress, the Mannings coefficient is given by [Macaferri, 1985]:

$$n = \frac{D_{90}^{1/6}}{26} \qquad \text{Eq. (2b)}$$

where D_{90} (expressed in meters) is the diameter of a sieve that will permit passage of 90% of the stone material. The factor of safety against riprap movement due to flow of water is calculated in accordance with the procedure presented in Hydraulic Engineering Circular 15 (HEC-15) [FHWA, 1988]. The factor of safety is defined as:

$$F_{riprap} = \frac{\cos\theta\tan\phi}{\eta'\tan\phi + \sin\theta\cos\beta} \qquad \text{Eq. (3)}$$

$$\beta = \tan^{-1}\left(\frac{\cos\alpha}{\frac{2\sin\theta}{\eta\tan\phi} + \sin\alpha}\right) \qquad \text{Eq. (4)}$$

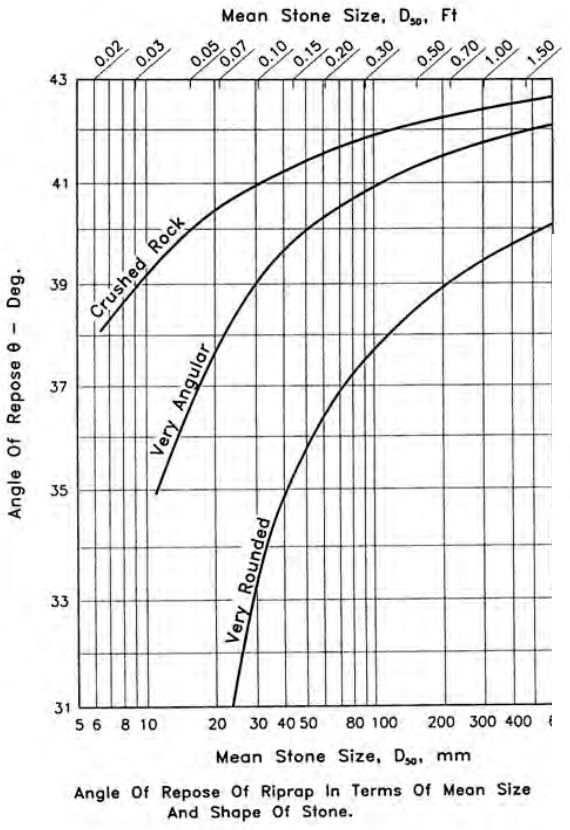
$$\eta = \frac{\tau_S}{f(\gamma_S - \gamma)D_{50}} \quad \text{Eq. (5)}$$

$$\eta' = \eta \frac{1 + \sin(\alpha + \beta)}{2} \quad \text{Eq. (6)}$$

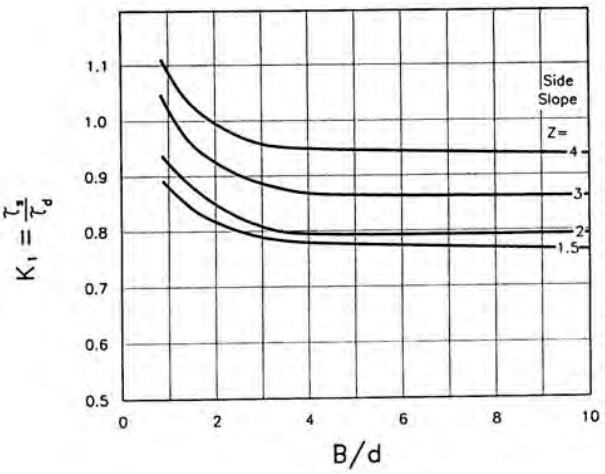
$$\tau_S = K_1 \tau_o \quad \text{Eq. (7)}$$

where:

τ_s = side slope shear stresses (lbs/ft^2)
τ_o = side slope shear stresses (lbs/ft^2)
θ = channel side slope (degrees)
ϕ = angle of repose (degrees, see Chart below obtained from www.fhwa.dot.gov)
α = longitudinal bed slope (degrees)
f = dimensionless critical shear stress (0.047 for flat channels; 0.15 for steep channels)
γ_s = specific weigh of the rock (lbs/ft^3)
γ = specific weigh of water (lbs/ft^3)
D_{50} = average diameter of the riprap (ft)
η = stability number
η' = side slope stability number
K_1 = channel side shear stress to bottom shear stress ratio (see Chart below obtained from www.fhwa.dot.gov)



Angle Of Repose Of Riprap In Terms Of Mean Size And Shape Of Stone.



Channel Side Shear Stress To Bottom Shear Stress Ratio, K_1.

3. PROCEDURE

Considering that several variables are interrelated, an iterative procedure was developed. The procedure consists of combining peak runoff and channel flow volumes calculated using the HYDROCAD micro-computer program with a flow and stability equations presented in series of spread sheets (Table 1 through Table 8). The process consisted of the following steps:

1. Select the HYDROCAD results (i.e., flows) included in Appendix G.1 for the 10-yr and the 100-yr, 24-hr storm events. Keep in mind that to perform a HYDROCAD analysis, the channel geometry and lining for each reach needed to be completely defined (the initial design assumes erosion mat for terrace and perimeter channel with n = 0.045 and riprap for downchutes with n=0.035). In this package, these values will be verified/adjusted.
2. Measure the longitudinal slope (S), base width (b), and a side slope channel (m:1) for each channel from the design drawings. The channel/terrace/downchute longitudinal slope is taken from the drawings. The sides slopes are assumed to vary from 2H: 1V to 6H: 1V.
3. Calculate the flow velocity for each channel and downchute using equation 1 (Table 1 and 2). Input parameters are based on: (i) the most economical channel lining (i.e. erosion mat, n=0.045), and the data collected in steps 1 and 2.
4. Compare the calculated velocity with permissible flow velocity for erosion mat (Table 1 and 2). Permissible flow velocity for erosion mat is 6 fps. Channels with non-erosive velocities, (i.e. less than 6 fps) are removed from the iterative procedure, and are designed with erosion mat lining.
5. The remaining channels are redesigned with various sized stone lining (i.e., riprap). Flow velocities and flow depths are recalculated for these channels in Table 3.
6. The flow depths are entered in Table 4 and the stability of riprap stone sizes selected in Table 1, 2, and 3 are evaluated by Equations (3) through (7).
7. The riprap stone is acceptable if the stone class size is Class I or less and the factor of safety is 1.5 or greater. If these requirements are not met the, the following options are considered: (i) increase the riprap size (i.e., select another class of stone); (ii) change the geometry of the channel to reduce the velocity (e.g., flattening bed slopes); or (iii) change the lining type (e.g., concrete lining). Repeat Steps 2 through 6 with the new geometry, stone size, or lining type. Channels with acceptable stability are removed from the iterative procedure. Channels with unacceptable stability or stone class can be redesigned with Reno Mattress or Gabion baskets.
8. Channels to be redesigned with Reno Mattress or Gabion Baskets are entered into Table 5. For redesign with Reno Mattress the channels geometry may be redesigned to match the basket size. Manning n values are recalculated using riprap fill stone size.

9. Permissible flow velocity for Reno Mattress is based on manufacturer provided information. Permissible flow velocities are based on the total basket thickness and riprap gradation. The channel lining is acceptable if the calculated velocity is less than the manufacturer's stated critical velocity (see table below from Maccaferri, "Flexible Lining in Reno Mattresses and Gabions For Canals and Canalized Water Courses", 1995).
10. The receiving channels below downchutes designed with Reno Mattress lining are analyzed to estimate the size and magnitude of the predicted hydraulic jump. This data is used to size the initial horizontal portion of the receiving channel. This calculation is presented on Table 5.
11. The flow depth is recalculated in Tables 6 and 7 for the 100-year 24-hour storm event. The flow depths in presented in theses tables are used to size the channel depths.
12. The final channel geometry and Manning's coefficient are re-entered into the HYDROCAD micro-computer model to verify that no significant variations in flow are obtained (in general, the quantity of flow is not very sensitive to the channel geometry and lining type).
13. Table 8 summarizes the final lining for every structure. The materials used for each structure were homogenized for constructive reasons.

	Unit	D_{50}	D_{100}	D_0	D_{90}	Critical Velocity (fps)
Reno 1	in.	3.3	3.9	2.8	3.8	11.5
	m	0.085	0.100	0.070	0.097	
Reno 2	in.	4.7	5.9	2.8	5.6	14.8
	m	0.120	0.150	0.070	0.142	
Reno 3	in.	4.9	5.9	3.9	5.7	16.4
	m	0.125	0.150	0.100	0.145	
Gabions	in.	5.9	7.9	3.9	7.5	19.0
	m	0.150	0.200	0.100	0.190	

4. RESULTS

The each SWM conveyance feature was designed on the basis of available capacity (i.e., flow depth) and peak velocity. Table 8 present a summary of the channels designs, including geometry, input parameters and chosen lining types. The main HydroCAD™ model summarized in Appendix G.1 (Attachment 2) was used for this evaluation. A description of the final design of each channel is presented below:

Drainage Terraces

A typical cross-section of a drainage terrace is presented in Detail 2 of Drawing 21. Cover terrace widths will vary based on the depth, terrace side slopes are constant for all terraces at 3H: 1V (against the landfill) and 6H: 1V (facing the landfill). Terrace depth and lining are summarized on Table 8. The slopes of the drainage terraces vary slightly from 3% to fit with

the cover system especially in the corners. The critical drainage terrace was chosen such that it serves the largest drainage area in the Landfill facility. As shown in Table 8, the peak flow depth in the critical drainage terrace is less than or equal to the depth of the drainage terrace (i.e., 1.0 ft). This indicates that the drainage terraces have adequate capacity to pass the 100-year storm. In addition, the peak calculated velocity (i.e., 3.1 ft/s) in the drainage terraces is less than 6 ft/s, which is the maximum permissible velocity for erosion-mat channels. Therefore, the 100-year stormwater runoff in the drainage terraces is considered to be non-erosive.

Access Road Channel

A typical cross-section of the access road channel is presented in Detail 1 of Drawing 21. As shown in Table 7 the peak flow depth in the critical access road channel (i.e., 0.45ft) is less than the depth of the cross-section (i.e., 1.5ft). Therefore, the access road channel has more than adequate capacity to pass the 100-year storm. In addition, the peak calculated velocity (i.e., 14 ft/s) in the access road channel is less than 14 ft/s, which is the maximum permissible velocity for concrete-lined channels (i.e., between 18 fps to 23 fps). Therefore, the 100-year stormwater runoff in the drainage terraces is considered to be non-erosive. Channel sizes are summarized on Table 8.

Perimeter Channel

The perimeter berm channel will be concrete-lined. Typical cross-sections of the perimeter channel are presented in Detail 1 of Drawing 22. As shown in Table 8, the peak flow depths in the perimeter channels vary from 0.2 ft to 1.5 ft. As a result, the design depths are 1.5 ft for almost the entire perimeter except between Downchute No. 3 and Drop inlet No. 1 where a depth of 1.65 ft is selected. This indicates that the perimeter channels have adequate capacity to pass the 100-year storm. In addition, the peak calculated velocity in the concrete channel (8.4 ft/s) is less than the permissive velocity for concrete lined channels. Perimeter channel will be concrete lined. Channel sizes are summarized on Table 8.

Downchutes

Downchutes will be Reno Mattress lined. Reno Mattress Gabion basket design is based on the standard specifications for Maccaferri Reno Mattress. That is, nominal dimensions, thickness 12 in., width 6 ft, and length 9 ft. Reno mattress stone fill material shall be riprap as defined by the Maryland Department of the Environment (1994), (i.e. stone diameter 2.5 in. to 6 in.; D_{50} = 4.9 in). Downchute geometry is as indicted on the Drawings. Downchute depths and linings are summarized on Table 8.

5. REFERENCE

US Army Corps of Engineers, "Practical Guidance for Estimating and Controlling Erosion at Culvert Outlets", Engineers Research Report H-72-5, Waterways Experiment Station, Vicksburg, Mississippi, 1972.

FHWA, "*Design of roadside channels with flexible linings*", Hydraulic Engineering Circular 15 (HEC-15), Federal Highway Administration, Washington, D.C., April 1988.

"*Maryland Standards and Specifications for Soil Erosion and Sediment control* (Maryland E&S)", Maryland Department of the Environment, 1994.

MACCAFERRI, "Flexible linings in Reno mattress and gabions for canals and canalized water courses", 1995.

TABLES

Table-1 Initial Design of Cover Terraces

Location: Millennium
Project: ME0668

Discussion:

Table 1 presents the initial design dimensions and estimated maximum runoff volume for cover terraces above stormwater basins. Runoff volume is based on analysis performed by the HydroCAD micro-computer program. The flow velocity and depth of water in each terrace is calculated for the 10 year storm using Mannings equation; Manning n values (n=0.045) are based on Erosion mat cover.

Channel ID	Bed Slope[1]	Drain Area ID (SC)	Manning n	Base Width (ft)	Side Slope m1:1	Side Slope m2:1	Area A (sq ft)	Perimeter P (ft)	Hydraulic Radius, R (ft)	HydroCad Q[2] (cfs)	Velocity V (fps)	Flow Depth (ft)	Estimated Q[3] (cfs)	Lining Type
Cover Terrace 02-06	3.00%	102 + 107	0.045	0	3	6	2.91	7.44	0.39	8.9	3.1	0.8	8.9	Erosion mat
Cover Terrace 03-09	3.00%	103 + 108	0.045	0	3	6	2.63	7.06	0.37	7.8	3.0	0.8	7.8	Erosion mat
Cover Terrace 22-23	3.00%	128 + 132	0.045	0	3	6	1.61	5.53	0.29	4.1	2.5	0.6	4.0	Erosion mat
Cover Terrace 24-25	3.00%	129 + 133	0.045	0	3	6	2.09	6.30	0.33	5.7	2.7	0.7	5.7	Erosion mat
Cover Terrace 26-27	3.00%	130 + 134	0.045	0	3	6	2.49	6.88	0.36	7.3	2.9	0.7	7.3	Erosion mat

Notes:
1. Bed slopes taken from the Drawings.
2. Flow values calculated by HydroCAD.
3. Calculate flow to compare with flow from Hydrocad
4. Channel ID's are related to subcatchment (SC) numbers used in the Hydrocad analysis.

Table-2 Initial Design of Downchutes and Channels (10yr 24hr-storm)

Location: Millennium
Project: ME0668

Discussion: Table 2 presents the initial design dimensions and estimated maximum runoff volume for downchutes and perimeter channels above stormwater basin. Runoff volume is based on analysis performed by the HydroCAD micro-computer program. The flow velocity and depth of water in each structure is calculated for the 10 year storm using Mannings equation; Manning n values (n=0.035) are based on Erosion Mat. Calculated flow velocities greater than 6 feet per second (fps) require additional channel lining protection (i.e. riprap). Channels with flow velocity equal to or less than 6.0 ft/sec are designed with erosion control mat protection (n=0.045) Channels requiring additional, stone, protection are shown in bold print.

Channel ID	Bed Slope[1]	Drain Area Subcatchment / branch	Manning n	Diameter (ft)	Theta (rad)	Base Width (ft)	Side Slope m1:1	Side Slope m2:1	Area A (sq ft)	Perimeter P (ft)	Hydraulic Radius, R (ft)	HydroCad Q[2] (cfs)	Velocity[4] V (fps)	Flow Depth (ft)	Estimated Q[3] (cfs)	Lining Type[6]	
Downchute 12-13	20.13%	115	0.035			4	4	4	0.36	4.68	0.08	1.2	3.4	0.08	1.2	Erosion Mat	
Downchute 13-14	**21.12%**	**12-13 + 116 + 121**	**0.045**			**4**	**4**	**4**	**1.21**	**6.01**	**0.20**	**6.4**	**5.2**	**0.24**	**6.4**	**Rip Rap**	
Downchute 14-15	**20.88%**	**13-14 + 117 + 122**	**0.045**			**4**	**4**	**4**	**1.99**	**7.00**	**0.28**	**13.0**	**6.5**	**0.36**	**13.0**	**Rip Rap**	
Downchute 15-17	**19.75%**	**14-15 + 118 + 123**	**0.045**			**4**	**4**	**4**	**2.55**	**7.65**	**0.33**	**18.1**	**7.1**	**0.44**	**18.1**	**Rip Rap**	
Pipe Downchute 17-18	7.91%	15-17 + 124	0.014	2	2.66	-	-	-	1.10	2.66	0.41	18.3	16.6	0.76	18.3	Concrete Pipe	(7)
Downchute 21-23	26.26%	127	0.035			4	4	4	0.42	4.79	0.09	1.8	4.3	0.10	1.8	Erosion Mat	
Downchute 23-25	**25.69%**	**21-23 + 128 + 132**	**0.045**			**4**	**4**	**4**	**1.06**	**5.79**	**0.18**	**5.7**	**5.4**	**0.22**	**5.7**	**Rip Rap**	
Downchute 25-27	**27.52%**	**23-25 + 129 + 135**	**0.045**			**4**	**4**	**4**	**1.62**	**6.55**	**0.25**	**11.1**	**6.8**	**0.31**	**11.1**	**Rip Rap**	
Downchute 27-29	**29.18%**	**25-27 + 130 + 134**	**0.045**			**4**	**4**	**4**	**2.19**	**7.24**	**0.30**	**17.7**	**8.1**	**0.39**	**17.7**	**Rip Rap**	
Perimeter Channel 01-05	0.50%	101 + 105	0.014			3	1	1	2.09	4.65	0.45	9.2	4.4	0.58	9.2	Concrete	
Perimeter Channel 05-06	0.70%	01-05 + 106	0.014			3	1	1	2.43	4.87	0.50	13.6	5.6	0.66	13.6	Concrete	
Perimeter Channel 06-10	0.85%	05-06 + 109	0.014			3	1	1	2.66	5.03	0.53	17.1	6.4	0.72	17.1	Concrete	
Perimeter Channel 10-11	0.30%	10-06 + 110	0.014			5	1	1	6.72	8.12	0.83	34.6	5.1	1.10	34.6	Concrete	
Perimeter Channel 11-19	0.30%	10-11	0.014			5	1	1	6.35	7.97	0.80	31.8	5.0	1.05	31.8	Concrete	
Perimeter Channel 16-18	5.21%	119 + 120	0.014			3	1	1	0.43	3.39	0.13	2.6	6.1	0.14	2.6	Concrete	
Perimeter Channel W 18-19	1.62%	17-18 + 16-18 + 120 + 111	0.014			7	1	1	4.22	8.58	0.49	35.7	8.4	0.56	35.7	Concrete	
Perimeter Channel 28-29	0.67%	131 + 135	0.014			3	1	1	2.07	4.64	0.45	10.5	5.1	0.58	10.5	Concrete	
Acces Road Channel 07-04	11.73%	112.00	0.014			2	1	1	0.42	2.54	0.16	4.6	10.9	0.19	4.5	Concrete	
Acces Road Channel 04-08	8.72%	07-04 + 113	0.014			2	1	1	0.79	2.95	0.27	10.2	13.0	0.34	10.2	Concrete	
Acces Road Channel 08-08`	10.70%	04-08 + 114	0.014			**2**	1	1	0.74	2.91	0.26	10.4	14.0	0.32	10.4	Concrete	
Pipe Downchute 09-10	18.97%	03-09 + 108 + 08-08` + 114	0.014	1.5	2.68	-	-	-	0.63	2.01	0.31	13.5	21.4	0.58	13.5	Concrete Pipe	(7)

Notes:
1. Bed slopes taken from the Drawings.
2. Flow values calculated by HydroCAD.
3. Calculate flow to compare with flow from Hydrocad
4. Maximum permissible velocity is 6fps for Erosion Mat lined channels; redesign channels that have a calculated erosive velocities that is, v>6 fps.
5. Channel ID's are related to Reach (R) numbers used in the Hydrocad analysis.
6. Stone lining refers to all riprap sizes and reno mattresses, actual lining is defined on the following tables.
7. Flow depth values were obtained by iteration

Table 3 - Design Using Stone Lining - Flow Depth Calculation

Location: Millennium
Project: ME0668

RIPRAP REFERENCE TABLE

Class	d50 (ft)	d50 (in)	Maximum, n[5]
Riprap	0.46	5.50	0.07
Class I	0.67	8.00	0.09
Class II	1.33	16.00	0.19
Class III	1.92	23.00	0.18

Discussion: Table 3 presents the recalculation of flow velocities and depths using various riprap stone sizes for channel protection. Flow velocities and depths are calculated using Mannings equation, Manning n values are based on stone size and flow depth. Design storm is 10 year. Calculated flow depths are used for stability calculations performed in Table 4.

Channel ID	Stone Type	Average Diameter (ft)	Bed Slope[1]	Manning n[4]	Base Width (ft)	Side Slope m:1	Area A (sq ft)	Perimeter P (ft)	Hydraulic Radius, R (ft)	HydroCad Q[2] (cfs)	Velocity[4] V (fps)	Flow Depth (ft)	Estimated Q[3] (cfs)	
Downchute 13-14	Riprap	0.460	21.12%	0.070	4	4				6.4		0.24		(6)
Downchute 14-15	Riprap	0.460	20.88%	0.064	4	4	2.55	7.64	0.33	13.0	5.1	0.44	13.0	
Downchute 15-17	Riprap	0.460	19.75%	0.060	4	4	3.11	8.24	0.38	18.1	5.8	0.51	18.1	
Downchute 23-25	Riprap	0.460	25.69%	0.070	4	4				5.7		0.22		(6)
Downchute 25-27	Riprap	0.460	27.52%	0.069	4	4	2.17	7.22	0.30	11.1	5.1	0.39	11.1	
Downchute 27-29	Riprap	0.460	29.18%	0.062	4	4	2.75	7.86	0.35	17.7	6.4	0.47	17.7	

Notes:
1. Bed slopes taken from Table 2.
2. Flow values calculated by HydroCAD.
3. Calculate flow to compare with flow from Hydrocad
4. n is based on riprap stone size and estimated flow depth: n = y^(1/6) / [21.6*log(y/d50)+14]
5. Maximum n values limited by minimum flow depth as follows: Riprap & Class I stone, min. depth .4 ft; Class II min.depth .5 ft; Class III min. depth 0.75 ft..
6. Due to the low flow depth, the n value exceeds the limit set for the rip rap. This is set in 0.07

Table 4 - Design Using Stone Lining - Stability Calculation

Location: Millennium
Project: ME0668

RIPRAP REFERENCE TABLE

Class	d50 (ft)	d50 (in)	ϕ
Riprap	0.458333	5.5	41.3
Class I	0.666667	8	41.5
Class II	1.333333	16	42.0
Class III	1.916667	23	42.1

Average Angle of Repose (ϕ) for riprap (From Chart 1): **41.5** °

Dimensionless critical shear stress factor (*f*): **0.15** For bed slope >10 percent 0.047 for bed slope < 10 percent

Specific weight of riprap: **165** pcf

Specific weight of water: **62.4** pcf

Conversion Factor from Radians to Degrees: 57.30

Discussion

Table 4 presents the stability evaluation of the riprap stone for each of the channels evaluated in Table 3. Design storm 10-yr. Channels that have a factor of safety less than 1.5 re-evaluated using reno mattress lining In Table 5. Channels to be redesigned are shown in bold.

Channel Id	Stone Class	Mean Stone Diameter (ft)	Bed Slope (%)	Bed Slope (degrees) α	Flow Depth (ft)	Channel Side Slope (m:1)	Factor K_1 (Chart 2)	Shear Stress τ_0	Side Slope Shear τ_s	Stability Number η	Angle Beta β	Stability Number Prime η '	Safety Factor
Downchute 13-14	Riprap	0.460	21.12%	11.9	0.24	4	0.85	3.2	2.7	0.39	31.0	0.324	1.73
Downchute 14-15	**Riprap**	**0.460**	**20.88%**	**11.8**	**0.44**	**4**	**0.85**	**5.8**	**4.9**	**0.69**	**44.4**	**0.632**	**1.17**
Downchute 15-17	**Riprap**	**0.460**	**19.75%**	**11.2**	**0.51**	**4**	**0.85**	**6.3**	**5.4**	**0.76**	**47.0**	**0.703**	**1.09**
Downchute 23-25	Riprap	0.460	25.69%	14.4	0.22	4	0.85	3.5	3.0	0.42	31.9	0.360	1.64
Downchute 25-27	**Riprap**	**0.460**	**27.52%**	**15.4**	**0.39**	**4**	**0.85**	**6.7**	**5.7**	**0.80**	**45.5**	**0.753**	**1.03**
Downchute 27-29	**Riprap**	**0.460**	**29.18%**	**16.3**	**0.47**	**4**	**0.85**	**8.5**	**7.2**	**1.02**	**49.6**	**0.979**	**0.84**

Notes:
1. Bed slopes taken from Table 2.
2. Flow depths are taken from Table 3.
3. Stability calculation, FHWA HEC-15.
4. Chart 2 is located in Appendix A

Table 5 - RE-Design Using Reno Mattress Stone Lining - Stability Calculation

Location: Millennium
Project: ME0668

Discussion: Table 5 presents the calculation of flow velocities and depths for channels not meeting the design criteria set forth in the previous tables. The Channels evaluated below, are redesigned using 9-inch thick Reno Mattress wire baskets. The stone fill size is based Riprap Stone (Stone Size D_{min} =4 in. D_{max} = 7 in., D_{50} = 5.5 in.) Flow velocities and depths are calculated using Mannings equation. Manning's n value is estimated based on the riprap stone size. Design is acceptable if the calculated flow velocity is less than the critical flow velocity of 16.4 cfs (Appendix A).

Channel ID	Stone Type	D_{90} (m)	Bed Slope[(1)]	Manning n	Base Width (ft)	Side Slope m:1	Area A (sq ft)	Perimeter P (ft)	Hydraulic Radius, R (ft)	Flow Q[(2)] (cfs)	Velocity (fps)	Flow Depth (ft)	Verify Q[(3)] (cfs)
Downchute 14-15	Reno Mattress 2	0.142	20.9%	0.028	4	4	1.43	6.30	0.23	13.0	9.1	0.3	13.0
Downchute 15-17	Reno Mattress 2	0.142	19.8%	0.028	4	4	1.82	6.81	0.27	18.1	9.9	0.3	18.1
Downchute 25-27	Reno Mattress 2	0.142	27.5%	0.028	4	4	1.17	5.94	0.20	11.1	9.5	0.2	11.1
Downchute 27-29	Reno Mattress 2	0.142	29.2%	0.028	4	4	1.57	6.49	0.24	17.7	11.2	0.3	17.7

Notes:
1. Bed slopes taken from Table 3.
2. Flow values calculated by HydroCAD.
3. Calculate flow to compare with flow from Hydrocad
4. n is based on riprap stone size : n = D_{90}^(1/6) / 26
5. D_{90} is estimated using the following equation: $D_{90} = (d_{max} - (D_{max}-D_{min}) \times 0.1)$

		D_{50}	D_{100}	D_0	D_{90}	Critical Velocity (fps)
Reno 1	inches	3.3	3.9	2.8	3.8	
	meters	0.085	0.100	0.070	0.097	11.5
Reno 2	inches	4.7	5.9	2.8	5.6	
	meters	0.120	0.150	0.070	0.142	14.8
Reno 3	inches	4.9	5.9	3.9	5.7	
	meters	0.125	0.150	0.100	0.145	16.4
Gabions	inches	5.9	7.9	3.9	7.5	
	meters	0.150	0.200	0.100	0.190	19

Table 6- 100-yr Storm Flow Depth Calculation For Terraces Above Stormwater Pond

Location: Millennium
Project: ME0668

Discussion: Table 6 presents recalculation of the flow depth in the channels for the 100-year 24-hour storm event. Channel design, and Manning's n values are taken from the previous Tables.

Channel ID	Bed Slope(1)	Drain Area ID (SC)	Manning n	Base Width (ft)	Side Slope m1:1	Side Slope m2:1	Area A (sq ft)	Perimeter P (ft)	Hydraulic Radius, R (ft)	HydroCad Q(2) (cfs)	Velocity (4 V (fps)	Flow Depth (ft)	Estimated Q(3) (cfs)	Lining Type
Cover Terrace 02-06	3.00%	102 + 107	0.045	0	3	6	4.28	9.02	0.47	15.0	3.5	1.0	14.9	Erosion mat
Cover Terrace 03-09	3.00%	103 + 108	0.045	0	3	6	3.86	8.56	0.45	13.0	3.4	0.9	13.0	Erosion mat
Cover Terrace 22-23	3.00%	128 + 132	0.045	0	3	6	2.34	6.67	0.35	6.7	2.9	0.7	6.7	Erosion mat
Cover Terrace 24-25	3.00%	129 + 133	0.045	0	3	6	3.06	7.62	0.40	9.6	3.1	0.8	9.5	Erosion mat
Cover Terrace 26-27	3.00%	130 + 134	0.045	0	3	6	3.65	8.33	0.44	12.1	3.3	0.9	12.1	Erosion mat

Notes:
1. Bed slopes taken from the Drawings.
2. Flow values calculated by HydroCAD.
3. Calculate flow to compare with flow from Hydrocad
4. Maximum permissible velocity is 4fps for grass lined channels and 6fps for Erosion mat lined channels.
5. Channel ID's are related to subcatchment (SC) numbers used in the Hydrocad analysis.

Table 7 - 100-yr Storm Flow Depth Calculation

Location: Millennium
Project: ME0668

Discussion: 100-YR

Table 7 presents recalculation of the flow depth in the channels for the 100-year 24-hour storm event. Channel design, and Manning's n values are taken from the previous Tables.

Channel ID	Bed Slope[1]	Drain Area Subcatchment / tramo	Manning n	Diameter (ft)	Theta (rad)	Base Width (ft)	Side Slope m1:1	Side Slope m2:1	Area A (sq ft)	Perimeter P (ft)	Hydraulic Radius, R (ft)	HydroCad Q[2] (cfs)	Velocity[4] V (fps)	Flow Depth (ft)	Estimated Q[3] (cfs)	Lining Type[6]	Froude Number	
Downchute 12-13	20.13%	115	0.028			4	4	4	0.43	4.81	0.09	2.1	4.8	0.1	2.0	Reno Mattress 2	1.9	
Downchute 13-14	21.12%	12-13 + 116 + 121	0.028			4	4	4	1.25	6.06	0.21	10.6	8.5	0.2	10.6	Reno Mattress 2	2.2	
Downchute 14-15	20.88%	13-14 + 117 + 122	0.028			4	4	4	2.04	7.07	0.29	21.7	10.6	0.4	21.7	Reno Mattress 2	2.2	
Downchute 15-17	19.75%	14-15 + 118 + 123	0.028			4	4	4	2.63	7.73	0.34	30.3	11.5	0.5	30.2	Reno Mattress 2	2.2	
Pipe Downchute 17-18	7.91%	15-17 + 124	0.014	2	3.19	-	-	-	1.62	3.19	0.51	30.8	19.0	1.02	30.8	Concrete Pipe	2.4	(9)
Downchute 21-23	26.26%	127	0.028			4	4	4	0.51	4.94	0.10	3.0	6.0	0.1	3.0	Reno Mattress 2	2.2	
Downchute 23-25	25.69%	21-23 + 128 + 132	0.028			4	4	4	1.08	5.83	0.19	9.5	8.8	0.2	9.5	Reno Mattress 2	2.4	
Downchute 25-27	27.52%	23-25 + 129 + 135	0.028			4	4	4	1.67	6.61	0.25	18.6	11.1	0.3	18.6	Reno Mattress 2	2.5	
Downchute 27-29	29.18%	25-27 + 130 + 134	0.028			4	4	4	2.26	7.32	0.31	29.7	13.1	0.4	29.7	Reno Mattress 2	2.6	
Perimeter Channel 01-05	0.50%	101 + 105	0.014			3	1	1	2.96	5.21	0.57	15.3	5.2	0.78	15.2	Concrete	0.7	
Perimeter Channel 05-06	0.70%	01-05 + 106	0.014			3	1	1	3.49	5.53	0.63	22.9	6.5	0.90	22.8	Concrete	0.9	
Perimeter Channel 06-10	0.85%	05-06 + 109	0.014			3	1	1	3.95	5.80	0.68	30.1	7.6	0.99	30.1	Concrete	1.0	
Perimeter Channel 10-11	0.30%	10-06 + 110	0.014			5	1	1	9.84	9.27	1.06	59.6	6.1	1.51	59.6	Concrete	0.6	
Perimeter Channel 11-19	0.30%	10-11	0.014			5	1	1	9.42	9.13	1.03	56.1	6.0	1.46	56.1	Concrete	0.6	
Perimeter Channel 16-18	5.21%	119 + 120	0.014			3	1	1	0.59	3.52	0.17	4.4	7.4	0.19	4.4	Concrete	2.2	
Perimeter Channel W 18-19	1.62%	17-18 + 16-18 + 120 + 111	0.014			7	1	1	5.94	9.16	0.65	60.2	10.1	0.76	60.2	Concrete	1.5	
Perimeter Channel 28-29	0.67%	131 + 135	0.014			3	1	1	2.92	5.19	0.56	17.4	5.9	0.77	17.3	Concrete	0.9	
Acces Road Channel 07-04	11.73%	112.00	0.014			2	1	1	0.58	2.73	0.21	7.5	13.0	0.26	7.5	Concrete	3.2	
Acces Road Channel 04-08	8.72%	07-04 + 113	0.014			2	1	1	1.11	3.28	0.34	16.9	15.3	0.45	16.9	Concrete	2.9	
Acces Road Channel 08-08`	10.70%	04-08 + 114	0.014			2	1	1	1.06	3.23	0.33	17.5	16.5	0.43	17.5	Concrete	3.2	
Pipe Downchute 09-10	18.97%	03-09 + 108 + 08-08` + 114	0.014	1.5	3.24	-	-	-	0.94	2.43	0.39	23.1	24.6	0.79	23.1	Concrete Pipe	3.5	(9)

Notes:
1. Bed slopes taken from the Drawings.
2. Flow values calculated by HydroCAD.
3. Calculate flow to compare with flow from Hydrocad
4. Maximum permissible velocity is 4fps for grass lined channels; redesign channels that have a calculated erosive velocities that is, v>4 fps.
5. Channel ID's are related to Reach (R) numbers used in the Hydrocad analysis.
6. Stone lining refers to all riprap sizes and reno mattresses, actual lining is defined on the following tables.
7. to simplify the construction the same lining type will be set along the whole structure
8. Froude number is estimated using the following equation: F=V/(g*d)^0,5, the same one is used in the design of the dissipation structures.
9. Flow depth values were obtained by iteration

Table 7 presents recalculation of the flow depth in the channels for the 100-year 24-hour storm event. Channel design, and

Table 8 - Channel Design Summary

Location: Millennium
Project: ME0668

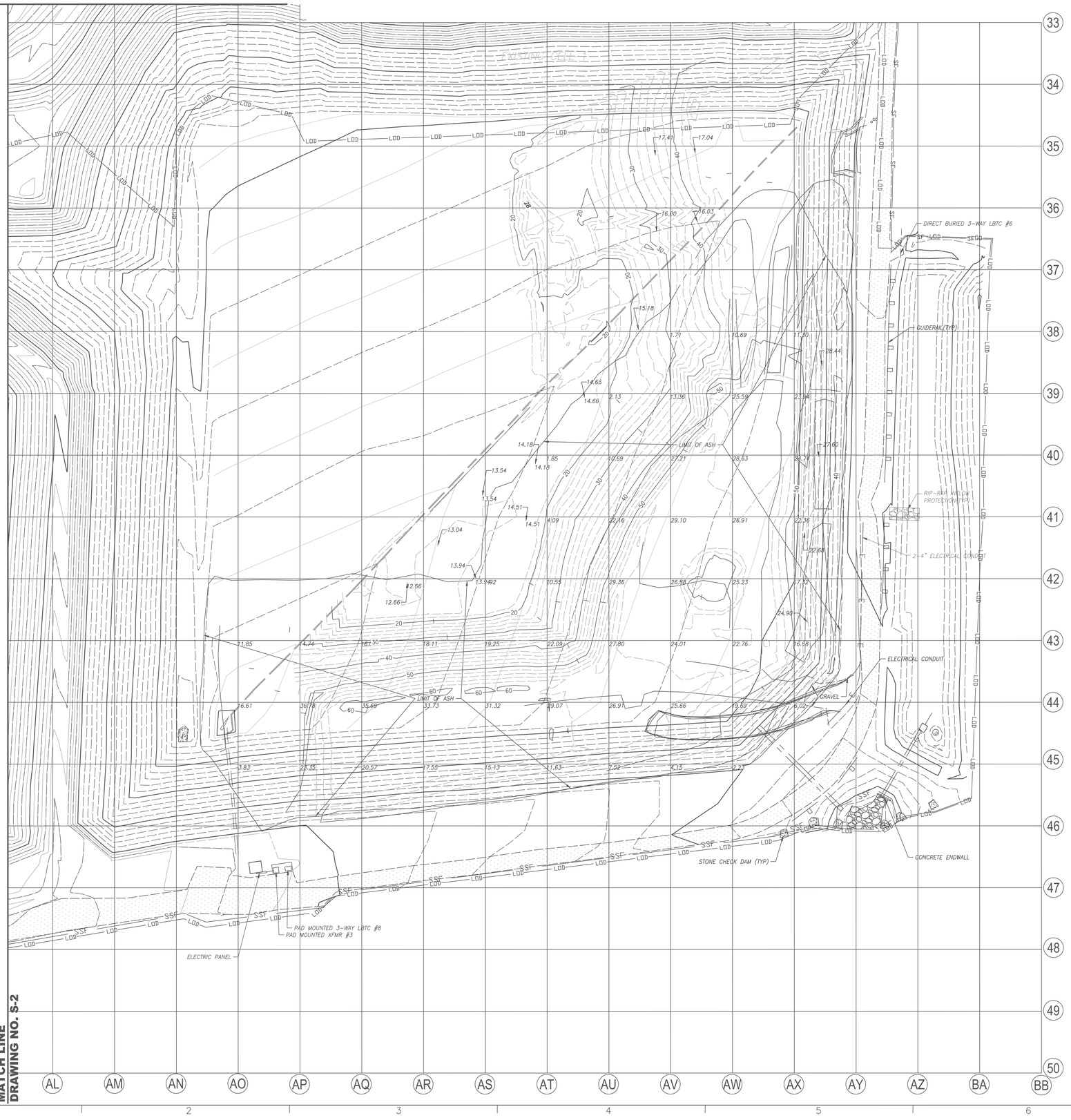
Channel ID	Lining Type	Lining Thickness[1] in.	Design Depth ft	Base Width ft	Side Slope m:1	Side Slope m:1	Peak Flow Depth 10-yr 24-hr Storm cfs	Peak Velocity 10-yr 24 hr Storm fps	Peak Flow Depth 100-yr 24-hr Storm ft
Cover Terrace 02-06	Erosion mat	NA	1.5	0	3	6	8.9	3.1	0.98
Cover Terrace 03-09	Erosion mat	NA	1.5	0	3	6	7.8	3.0	0.93
Cover Terrace 22-23	Erosion mat	NA	1.5	0	3	6	4.1	2.5	0.72
Cover Terrace 24-25	Erosion mat	NA	1.5	0	3	6	5.7	2.7	0.82
Cover Terrace 26-27	Erosion mat	NA	1.5	0	3	6	7.3	2.9	0.90
Downchute 12-13	Reno Mattress 2	9	1.5	4	4	4	0.1	3.4	0.10
Downchute 13-14	Reno Mattress 2	9	1.5	4	4	4	0.2	5.2	0.25
Downchute 14-15	Reno Mattress 2	9	1.5	4	4	4	0.4	6.5	0.37
Downchute 15-17	Reno Mattress 2	9	1.5	4	4	4	0.4	7.1	0.45
Pipe Downchute 17-18	Concrete Pipe	NA	2.0	-	-	-	0.8	16.6	1.02
Downchute 21-23	Reno Mattress 2	9	1.5	4	4	4	0.1	4.3	0.11
Downchute 23-25	Reno Mattress 2	9	1.5	4	4	4	0.2	5.4	0.22
Downchute 25-27	Reno Mattress 2	9	1.5	4	4	4	0.3	6.8	0.32
Downchute 27-29	Reno Mattress 2	9	1.5	4	4	4	0.4	8.1	0.40
Perimeter Channel 01-05	Concrete	NA	1.5	3	1	1	0.6	4.4	0.78
Perimeter Channel 05-06	Concrete	NA	1.5	3	1	1	0.7	5.6	0.90
Perimeter Channel 06-10	Concrete	NA	1.5	3	1	1	0.7	6.4	0.99
Perimeter Channel 10-11	Concrete	NA	1.65	5	1	1	1.1	5.1	1.51
Perimeter Channel 11-19	Concrete	NA	1.65	5	1	1	1.0	5.0	1.46
Perimeter Channel 16-18	Concrete	NA	1.5	3	1	1	0.1	6.1	0.19
Perimeter Channel W 18-19	Concrete	NA	1.5	7	1	1	0.6	8.4	0.76
Perimeter Channel 28-29	Concrete	NA	1.5	3	1	1	0.6	5.1	0.77
Acces Road Channel 07-04	Concrete	NA	1.5	2	1	1	0.2	10.9	0.26
Acces Road Channel 04-08	Concrete	NA	1.5	2	1	1	0.3	13.0	0.45
Acces Road Channel 08-08`	Concrete	NA	1.5	2	1	1	0.3	14.0	0.43
Pipe Downchute 09-10	Concrete Pipe	NA	1.5	-	-	-	0.6	21.4	0.79

Notes
1. Summary values are representative of worst case terrace
2. Summary values are representative of worst case terrace
3. Not Applicable (NA). Riprap thickness is based on 1.5 x max stone diameter, (Maryland Standards and Specifications for Soil Erosion and Sediment Control, 1994.
4. The 10-year peak flow velocities for Basin outlet is calculated at the culvert outlet. The 10-year Flow depths are calculated within the outfall apron.

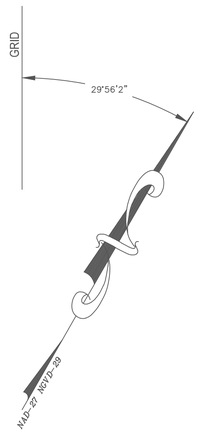
APPENDIX D

CELL 3 AS-BUILT DRAWINGS

MATCH LINE
DRAWING NO. S-1



MATCH LINE
DRAWING NO. S-2



LEGEND

- 70 — AS-BUILT MAJOR (10-FT) CONTOURS
- AS-BUILT MINOR (2-FT) CONTOURS
- PROPOSED MAJOR (10-FT) CONTOURS
- PROPOSED MINOR (2-FT) CONTOURS
- LIMIT OF LINER
- SSF — SUPER SILT FENCE
- SF — SILT FENCE
- LOD — LIMIT OF DISTURBANCE
- RIP-RAP
- AGGREGATE ROAD SURFACE

NOTES:

- GRID LAYOUT TAKEN FROM BASELINE SHOWN ON DRAWING 0635x006, BY GEOSYNTEC CONSULTANTS.
- CONTOUR INTERVAL IS 1' ON CELL BOTTOM.
- HORIZONTAL DATUM: NAD-27
- VERTICAL DATUM: NGVD-29
- STORMWATER BASIN AS-BUILT COMPLETED 07/02/2018.
- CELL 3 SUBGRADE AS-BUILT COMPLETED 12/10/2018.
- CELL 3 AS-BUILT COMPLETED 07/18/2019.
- CELL 3 AS-BUILT COMPLETED 01/10/2024.
- CELL 3 AS-BUILT COMPLETED 06/20/2024.
- CELL 3 AS-BUILT COMPLETED 04/09/2025
- CELL 3 AS-BUILT COMPLETED 07/14/2025
- CELL 3 AS-BUILT COMPLETED 10/21/2025
- CELL 3 AS-BUILT COMPLETED 01/06/2026

FILL VOLUMES COMPARED TO CELL LINER AS-BUILT SURVEY COMPLETED JULY 18, 2019. CALCULATED BY GRID METHOD.

DATE	NET VOLUME
6/11/2021	5890 CuYd FILL
9/24/2021	26756 CuYd FILL
12/30/2021	37401 CuYd FILL
12/06/2022	68389 CuYd FILL
04/03/2023	73410 CuYd FILL
01/10/2024	90246 CuYd FILL
06/20/2024	92132 CuYd FILL
12/23/2024	123027 CuYD FILL
04/09/2025	128226 CuYD FILL
07/14/2025	138155 CuYD FILL
10/21/2025	140300 CuYD FILL
01/06/2026	144055 CuYD FILL

SURVEYOR CERTIFICATION:

I HEREBY CERTIFY THAT TO THE BEST OF MY KNOWLEDGE, INFORMATION AND BELIEF THAT THE AS-BUILT INFORMATION AND QUANTITY INFORMATION SHOWN HEREON IS BASED ON THE SURVEY DATA AS DATED HEREON AND AS CONTRACT BY CHARAH SOLUTIONS INC

13-JAN-2026

CCJM DATE
Gary J. Thurman, LS
License Experies 9/17/2026

STATE OF MARYLAND
GARY JOSEPH THURMAN
No. 22
REGISTERED
PROPERTY LINE SURVEYOR

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

REV	DATE	DESCRIPTION	DRN	APP

CCJM C.C.Johnson & Malhotra, P.C. ENGINEERING INFRASTRUCTURE SOLUTIONS
ENGINEERS, SCIENTISTS & SURVEYORS
4660 E. Thistle Road, Suite 104
Camp Hill, PA 17011
Phone: (717) 730-4166

RAVEN LOT 15 LLC
600 HAMILTON STREET, SUITE 600
ALLENTOWN, PA 18101 USA

TITLE: CELL 3 ASH AS-BUILT AS OF JANUARY 6, 2026

PROJECT: CELL 3 CONSTRUCTION

SITE: LOT 15 LANDFILL – BALTIMORE, MARYLAND

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE
1/13/2026
DATE

EXPIRY 09-17-2026

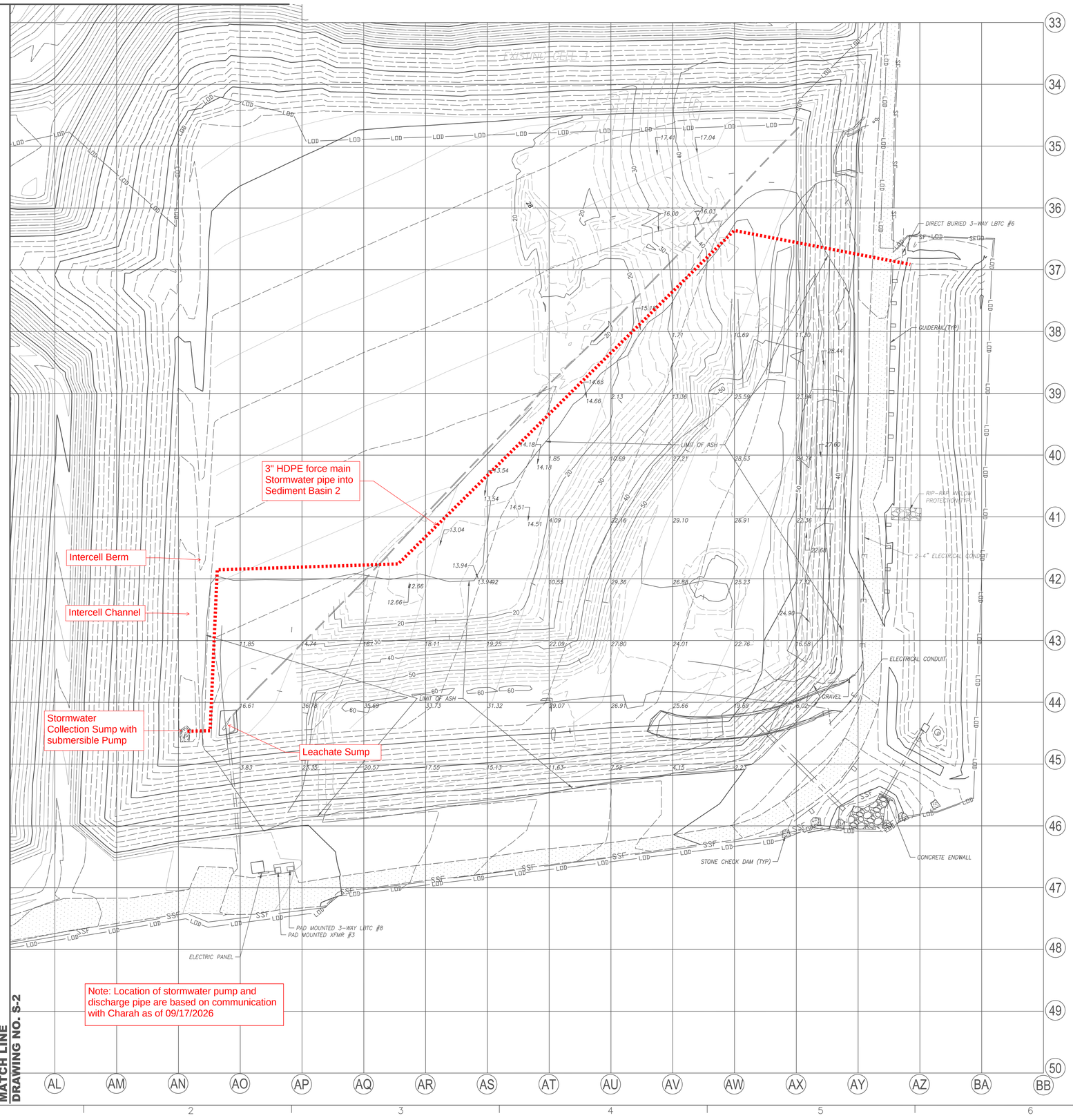
DESIGNED BY:	---	DATE:	1-13-2026
DRAWN BY:	JRG	PROJECT NO.:	1111014.001
CHECKED BY:	TKM	FILE:	2026-01-06 CELL 3 ASH AS-BUILT.DWG
REVIEWED BY:	---	DRAWING NO.:	
APPROVED BY:	GJT		1 OF 1

APPENDIX E

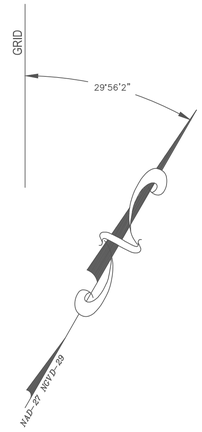
CELL 3 STORMWATER
RUN-ON AND RUN-OFF EXHIBIT

Cell 3 Stormwater Run-On and Run-Off Exhibit - 09/17/2026

MATCH LINE DRAWING NO. S-1



MATCH LINE DRAWING NO. S-2



LEGEND

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- AS-BUILT MINOR (2-FT) CONTOURS
- PROPOSED MAJOR (10-FT) CONTOURS
- PROPOSED MINOR (2-FT) CONTOURS
- LIMIT OF LINER
- SSF — SUPER SILT FENCE
- SF — SILT FENCE
- LOD — LIMIT OF DISTURBANCE
- RIP-RAP
- AGGREGATE ROAD SURFACE

NOTES:

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- CONTOUR INTERVAL IS 1' ON CELL BOTTOM.
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- VERTICAL DATUM: NGVD-29
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- CELL 3 AS-BUILT COMPLETED 01/10/2024.
- CELL 3 AS-BUILT COMPLETED 06/20/2024.
- CELL 3 AS-BUILT COMPLETED 04/09/2025
- CELL 3 AS-BUILT COMPLETED 07/14/2025
- CELL 3 AS-BUILT COMPLETED 10/21/2025
- CELL 3 AS-BUILT COMPLETED 01/06/2026

FILL VOLUMES COMPARED TO CELL LINER AS-BUILT SURVEY COMPLETED JULY 18, 2019. CALCULATED BY GRID METHOD.

DATE	NET VOLUME
6/11/2021	5890 CuYd FILL
9/24/2021	26756 CuYd FILL
12/30/2021	37401 CuYd FILL
12/06/2022	68389 CuYd FILL
04/03/2023	73410 CuYd FILL
01/10/2024	90246 CuYd FILL
06/20/2024	92132 CuYd FILL
12/23/2024	123027 CuYD FILL
04/09/2025	128226 CuYD FILL
07/14/2025	138155 CuYD FILL
10/21/2025	140300 CuYD FILL
01/06/2026	144055 CuYD FILL

SURVEYOR CERTIFICATION:

I HEREBY CERTIFY THAT TO THE BEST OF MY KNOWLEDGE, INFORMATION AND BELIEF THAT THE AS-BUILT INFORMATION AND QUANTITY INFORMATION SHOWN HEREON IS BASED ON THE SURVEY DATA AS DATED HEREON AND AS CONTRACT BY CHARAH SOLUTIONS INC

13-JAN-2026

CCJM DATE
Gary J. Thurman, LS
License Experies 9/17/2026

STATE OF MARYLAND — GARY JOSEPH THURMAN — No. 922 — REGISTERED PROPERTY LINE SURVEYOR

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

REV	DATE	DESCRIPTION	DRN	APP

CCJM C.C.Johnson & Malhotra, P.C. — ENGINEERING INFRASTRUCTURE SOLUTIONS
ENGINEERS, SCIENTISTS & SURVEYORS
4060 E. Trindle Road, Suite 104
Camp Hill, PA 17011
Phone: (717) 730-4166

RAVEN LOT 15 LLC
600 HAMILTON STREET, SUITE 600
ALLENTOWN, PA 18101 USA

TITLE: CELL 3 ASH AS-BUILT AS OF JANUARY 6, 2026

PROJECT: CELL 3 CONSTRUCTION

SITE: LOT 15 LANDFILL – BALTIMORE, MARYLAND

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE
1/13/2026
DATE

EXPIRY 09-17-2026

DESIGNED BY:	---	DATE:	1-13-2026
DRAWN BY:	JRG	PROJECT NO.:	1111014.001
CHECKED BY:	TKM	FILE:	2026-01-06 CELL 3 ASH AS-BUILT.DWG
REVIEWED BY:	---	DRAWING NO.:	
APPROVED BY:	GJT		1 OF 1