Run-on And Run-off Control System Plan
Lawrence Energy Center
Industrial Landfill #0847

Prepared for:
Westar Energy Company
Lawrence Energy Center
Lawrence, Kansas

Prepared by:
Aptim Environmental & Infrastructure, Inc.

March 2018

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APTIM

LIST OF FIGURES AND APPENDICES

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APPENDICES

APTIM

Plan Review/Amendment Log §257.81(c)(2)

Date of Review	Reviewer Name	Sections Amended and Reason	Version
3-20-18	APTIM	Report amended due to redesign	Original

CCR Regulatory Requirements

USEPA CCR Rule Criteria 40 CFR 257.81	Lawrence Energy Center (LEC) Run-on and Run-off Control System Plan
§257.81(a)(1) stipulates: *(a) The owner or operator of an existing or new CCR landfill or any lateral expansion of a CCR landfill must design, construct, operate, and maintain:* *(1) A run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm;*	Sections 4.3.1
§257.81(a)(2) stipulates: *(a) The owner or operator of an existing or new CCR landfill or any lateral expansion of a CCR landfill must design, construct, operate, and maintain: …* *(2) A run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm.*	Sections 4.3.1
§257.81(b) stipulates: *(b) Run-off from the active portion of the CCR unit must be handled in accordance with the surface water requirements under §257.3-3.*	Sections 3.3

USEPA CCR Rule Criteria 40 CFR 257.81	Lawrence Energy Center (LEC) Run-on and Run-off Control System Plan
§257.81(c)(1) stipulates: *(c) Run-on and run-off control system plan—* *(1) Content of the plan. The owner or operator must prepare initial and periodic run-on and run-off control system plans for the CCR unit according to the timeframes specified in paragraphs (c)(3) and (4) of this section. These plans must document how the run-on and run-off control systems have been designed and constructed to meet the applicable requirements of this section. Each plan must be supported by appropriate engineering calculations. The owner or operator has completed the initial run-on and run-off control system plan when the plan has been placed in the facility's operating record as required by §257.105(g)(3).*	Section 5.1
§257.81(c)(2) stipulates: *(2) Amendment of the plan. The owner or operator may amend the written run-on and run-off control system plan at any time provided the revised plan is placed in the facility's operating record as required by §257.105(g)(3). The owner or operator must amend the written run-on and run-off control system plan whenever there is a change in conditions that would substantially affect the written plan in effect.*	Sections 2.0 & 5.3

USEPA CCR Rule Criteria 40 CFR 257.81	Lawrence Energy Center (LEC) Run-on and Run-off Control System Plan
§257.81(c)(3) stipulates: *(3) Timeframes for preparing the initial plan—(i) Existing CCR landfills. The owner or operator of the CCR unit must prepare the initial run-on and run-off control system plan no later than October 17, 2016.*	Section 1.0
§257.81(c)(4) stipulates: *(4) Frequency for revising the plan. The owner or operator of the CCR unit must prepare periodic run-on and run-off control system plans required by paragraph (c)(1) of this section every five years. The date of completing the initial plan is the basis for establishing the deadline to complete the first subsequent plan. The owner or operator may complete any required plan prior to the required deadline provided the owner or operator places the completed plan into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing a subsequent plan is based on the date of completing the previous plan. For purposes of this paragraph (c)(4), the owner or operator has completed a periodic run-on and run-off control system plan when the plan has been placed in the facility's operating record as required by §257.105(g)(3).*	Section 5.3
§257.81(c)(5) stipulates: *(5) The owner or operator must obtain a certification from a qualified professional engineer stating that the initial and periodic run-on and run-off control system plans meet the requirements of this section.*	Section 6.0

USEPA CCR Rule Criteria 40 CFR 257.81	Lawrence Energy Center (LEC) Run-on and Run-off Control System Plan
§257.81(d) stipulates: *(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in §257.105(g), the notification requirements specified in §257.106(g), and the internet requirements specified in §257.107(g).*	Sections 5.1 & 5.2

1.0 INTRODUCTION

Aptim Environmental and Infrastructure, Inc. (APTIM) formerly named CB&I Environmental and Infrastructure, Inc. has prepared the following Run-On and Run-Off Control System Plan (Plan) at the request of Westar Energy (Westar) for the Industrial Landfill No. 0847 (Landfill) located at the Lawrence Energy Center (LEC) in Lawrence, Kansas. LEC is a coal-fired power plant that was initially commissioned in 1938. The Landfill has been deemed to be a regulated coal combustion residual (CCR) unit by the United States Environmental Protection Agency (USEPA), through the Disposal of Coal Combustion Residuals from Electric Utilities Final Rule (CCR Rule) 40 CFR 257 and §261.

Design modifications for the Landfill were necessary to conform to new design requirements promulgated under the CCR Rule. A report entitled *Lawrence Energy Center Comprehensive Design Modification Report – Industrial Landfill #0847* was submitted to the Kansas Department of Health and Environment (KDHE) Bureau of Waste Management (BWM) at the beginning of 2018. This Plan reflects the design modifications provided in the aforementioned design modification report.

CCR regulations set forth within Title 40 Code of Federal Regulations (CFR) Part 257.81, provide guidelines for stormwater management controls (run-on and run-off controls) to ensure that regulated CCR units are designed to safely manage storm events up to the 25-year, 24-hour storm. Specifically, §257.81 stipulates:

> §257.81: "(*a) The owner or operator of an existing or new CCR landfill or any lateral expansion of a CCR landfill must design, construct, operate, and maintain: (1) A run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm; and (2) A run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm."*

As demonstrated in this Plan, the stormwater run-on and run-off controls have been designed for the 25-year, 24-hour storm and are in compliance with 40 CFR Part §257.81. This document provides discussion of APTIM's professional judgement/opinion regarding specific aspects of the Rule as they pertain to the Landfill, which has been deemed as a regulated CCR unit at Westar's Lawrence Energy Center.

2.0 REGULATORY OVERVIEW OF RUN-ON AND RUN-OFF CONTROL REQUIREMENTS

On April 17, 2015, the USEPA published the CCR Rule under Subtitle D of the Resource Conservation and Recovery Act (RCRA) as 40 CFR Parts §257 and §261. The purpose of the CCR Rule is to regulate the management of coal combustion residuals in regulated units for landfill and surface impoundments. The Landfill has been deemed to be a regulated CCR unit at LEC.

This Plan marks the first revision of the facility run-on and run-off control features based on the permitted facility conditions. Construction activities may occur at the facility that will subsequently modify the current conditions as described within this Plan. This Plan will be amended in accordance with §257.81(c)(2), which stipulates:

> §257.81(c)(2) : *"(c)(2)The owner or operator may amend the written run-on and run-off control system plan at any time provided the revised plan is placed in the facility's operating record as required by §257.105(g)(3). The owner or operator must amend the written run-on and run-off control system plan whenever there is a change in conditions that would substantially affect the written plan in effect."*

This Plan will be amended to accurately analyze the run-on and run-off control features associated with the permitted facility conditions. Amendments to this Plan will be documented within the Plan Review/Amendment Log immediately following the Table of Contents.

This Plan also details Westar's compliance with the recordkeeping requirements specified in Section 5.0.

3.0 LEC LANDFILL OVERVIEW

3.1 Site Location and Topography

Westar owns and operates an industrial landfill at LEC in Douglas County, Kansas. LEC resides in Section 14, Township 12 South, Range 19 East. The Landfill is located on the east side of LEC. The Landfill is surrounded by the Kansas River to the north, the Burlington Northern and Santa Fe railway along the north and east, prairies and industrial buildings to the south, and the LEC power plant to the west. The location of the Landfill is depicted in **Figure 1.**

The Landfill is located in Lawrence, Kansas, within Sections 13 and 14, Township 12 South, Range 19 East in Douglass County. The Landfill is located within LEC, on the east side of property. It is surrounded by the Kansas River to the north, the Burlington Northern and Santa Fe Railway along the north and east, industrial buildings to the west, and prairies, industrial buildings, and residential housing to the south, as detailed in **Figure 1**.

The Landfill has eight permitted Cells which are being filled in numerical order. Cell 1 shares the northwestern border with the closed 333 Landfill at LEC, which is permitted under KDHE-BWM Permit Number 0333. In total, the completed Landfill will cover approximately 58.9 acres. Once CCR material disposal and final cover installation/closure is complete, final cover slopes will be 3.25H:1V in Cells 1 through 3 and 4H:1V in Cells 4 through 8 with transition areas occurring between changes in slope grades. The final cover plateau of the Landfill will have a 5.0% slope with a peak elevation of approximately 992 ft. MSL. Existing and proposed site topography is depicted in **Figure 2** and **Figure 3**, respectively.

3.2 Existing Regulatory Permits and Consents

Westar has been granted an Industrial Landfill Permit at LEC by the Kansas Department of Health and Environment – Bureau of Waste Management (KDHE-BWM) Permit No. 0847, in accordance with Kansas Statutes Annotated (K.S.A.) 65-3407. The KDHE modified the solid waste permit, per K.A.R. 28-29-6a, in response to the CCR Rule to include CCR waste management units as disposal areas to be covered by the existing solid waste permit. This Permit enables the Site to continue safe disposal of the CCR generated on-site at LEC to be properly disposed of within the Industrial Landfill Permit boundary, including the Landfill.

Westar has also been granted a Kansas Water Pollution Control Permit and Authorization to Discharge under the National Pollutant Discharge Elimination System (NPDES) Permit No. I-KS31-PO09 from the KDHE. The NPDES Permit covers various outfall locations at LEC and allows the discharge of non-contact stormwater into the Kansas River and surrounding streams in accordance with effluent limitations and monitoring requirements.

3.3 Stormwater Management System Overview

The existing stormwater management system at the Landfill includes landfill side slopes and perimeter berm structures bounding active landfilling operations to minimize the flow of stormwater onto these active landfilling areas. Stormwater run-off from vegetated portions of the facility flow to outfall locations along the perimeter of the Landfill boundary. Direct precipitation that falls onto active portions of the Landfill is directed to wick drain structures installed in each cell. The wick drains direct contact water to the Contact Water Pond (pond) to be managed properly prior to discharge. The locations of the existing stormwater features are shown on **Figure 4.**

As landfilling operations continue, terrace berms and letdown structures will be constructed to manage stormwater run-off. Once disposal and final cover installation/closure is complete, all non-contact stormwater run-off will flow into existing outfall locations along the perimeter of the landfill boundary.

3.3.1 Landfill Run-On

All active portions of the Landfill are bound with perimeter berm structures that maintain an appropriate height above the CCR material.

Stormwater run-off from the landfill adjacent to Cell 1 is designed to flow into the Landfill waste boundary. The connection between the two landfills are capped and closed with a vegetated final cover. Stormwater along this connection flows away from the active portions of the operational Landfill, towards outfall locations along the Landfill perimeter.

3.3.2 Landfill Stormwater Management Controls

Stormwater at the Landfill has historically been managed by gentle landfill side slopes, perimeter berms, and the contact water (leachate) management system.

Perimeter berms are constructed to prevent the flow of stormwater onto the active portions; however, direct precipitation falling onto these areas has been historically managed by a contact water drainage system that is constructed prior to CCR disposal. Direct precipitation that falls onto active portions of the landfill is called contact water. All contact water is directed to wick drains within each landfill cell. Wick drains are vertical columns of stone aggregate that collect and transport stormwater to the drainage layer underneath each landfill cell. A drainage piping network within the drainage layer transports stormwater to the contact water basin. The contact water basin is lined with a 60-mil High Density Polyethylene (HDPE) liner to prevent infiltration into the groundwater system. Contact water is properly treated and managed in accordance with current permits and procedures. The contact water drainage system has been designed to properly manage stormwater associated with the 25-year, 24-hour storm event according to Landfill Operations Plan Addendum approved by the KDHE in 2014. Wick drains structures will be capped over as part of the final closure of each Landfill cell.

Stormwater run-off is currently managed by vegetated landfill slopes promoting positive drainage to outfall locations along the perimeter of the Landfill along the north and east perimeter. Northern outfall locations are pipes that convey stormwater underneath the railway bordering the Landfill. These outfall culverts are denoted Outfall 006, 011, 012, 013, and 014. These outfall culverts convey stormwater to the Kansas River. Stormwater run-off from the southern portion of the Landfill is directed towards outfall culverts located along the southern border of the Landfill. These outfall culverts are denoted Outfall 016, 017, and 018. Stormwater run-off that flows toward the south is conveyed to a small stream that flows to the Kansas River. All outfall locations are monitored to ensure they are free of silt and sediment, discoloration, or floating debris and non-aqueous substances.

Permanent stormwater management features are constructed contemporaneously with the Landfill. Perimeter drainage channels, terrace berms, and letdown pipes will be utilized to convey stormwater from the Landfill, towards the outfall culverts located in the north and south.

3.3.3 Stormwater Run-Off Location

The Landfill maintains positive drainage towards all outfall culverts throughout phased construction. The outfall culverts convey stormwater that eventually flows into the Kansas River. All outfall locations are routinely monitored to ensure that the stormwater flowing offsite is free of silt and sediment, discoloration, or floating debris or non-aqueous substances in order to meet the standards set by the NPDES Permit No. I-KS31-PO09 and 40 CFR Part §257.81(b). All outfall locations are depicted in **Figure 5.**

3.4 Stormwater Management Operations and Maintenance

3.4.1 Routine Operations and Maintenance

Prior to the placement of CCR material, a perimeter berm is constructed to properly convey stormwater run-on away from operational areas of the Landfill. Wick drains are installed to convey contact water into the contact water basin. CCR material is placed in a controlled manner, compacted, and graded within each operational cell. All cells will be completed to permitted final grades. The final cover will be placed contemporaneously with the completion of each cell.

3.4.2 Previous Inspection Review of Run-on/ Run-off controls

Routine and annual inspections occur at the Landfill in line with inspection requirements outlined in 40 CFR §257.84. Weekly inspection results are reviewed and will be summarized in the annual reports. Documentation of any required remedial action is placed in the Facility Operating Record.

4.0 HYDROLOGIC ANALYSES

4.1 Methodology Overview

In order to determine compliance with 40 CFR Part §257.81 regarding the management of stormwater run-on and run-off at the Landfill, existing site topography, permitted final build-out topography, and stormwater drainage features were modeled using the computer model software HydroCAD. The HydroCAD model conservatively utilizes the permitted final landform of the Landfill to determine the largest discharge rates and volumes. This conservative approach is utilized to ensure that the proposed stormwater management features are sized appropriately for the largest landfill area. This computer model is used to develop discharge rates and volumes for the 25-year, 24-hour storm event for each storm feature utilizes at the Landfill to manage stormwater run-on and run-off.

4.1.1 Run-on and Run-off Analysis

The purpose of the run-on and run-off analysis is to demonstrate that the run-on control system will safely convey stormwater around the permitted Landfill boundary and that the run-off control system is designed to collect and control stormwater run-off from the 25-year, 24-hour storm event. The run-on and run-off analysis will determine stormwater peak discharge rates and volumes associated with the 25-year, 24-hour storm event for both run-on and run-off. The run-on and run-off analysis will demonstrate that all stormwater conveyance features such as the perimeter drainage channel, terrace berms, and letdown pipes will not overtop or back up. The run-on and run-off subcatchments for the Landfill analysis are depicted in **Figure 5.**

4.2 Model Input Parameters

To ensure that all stormwater run-on and run-off control features comply with 40 CFR Part §257.81, all elements were computer modeled with numerous conservative assumptions. AutoCAD was utilized to delineate key features and the computer model HydroCAD was used to develop the largest discharge rates and volumes associated with the proposed final landform for the 25-year, 24-hour storm event to evaluate regulatory compliance with 40 CFR Part §257.81. HydroCAD is a computer aided design program used to model hydrology and hydraulics of stormwater using either TR-20 or TR-55 procedures developed by the Soil Conservation Services (now the Natural Resource Conservation Service). Both TR-20 and TR-55 provide similar results; the main differentiation in methodology is based on the use of chart-based solutions vs. computer modeling. TR-55, frequently called the “tabular method” was developed prior to the widespread use or computer modeling. As such it was developed to utilize chart based solutions to use the SCS runoff equation. TR-20 is a computer based modeling approach that is more complex and generally considered more accurate than TR-55. This conservative approach is utilized to ensure that the proposed stormwater management features are sized appropriately for the largest landfill area.

The stormwater modeling methodology used the following analysis methods:

Runoff Calculation Method:	SCS TR-20
Reach Routing Method:	Storage Indication Method (Modified-Puls)
Pond Routing Method:	Storage Indication Method (Modified-Puls)
Storm Distribution:	SCS Type II 24-hour storm
Unit Hydrograph:	SCS
Antecedent Moisture Condition:	2

4.2.1 Rainfall Totals and Distributions

Rainfall intensities and distribution patterns were determined using *Rainfall Intensity Tables for Kansas Counties - 1997,* developed for the Kansas Department of Transportation and authored by University of Kansas professor Bruce M. McEnroe. Rainfall depths for the modeled scenario was selected from this report and entered into HydroCAD. It is noted that TR-55 outlines that an NRCS Type II 24-hour storm distribution is appropriate within this region of Kansas. These distribution patterns may be selected from a drop-down list in HydroCAD. The rainfall totals and distributions table utilized for the model can be found in **Appendix A**.

4.2.2 Subcatchment Boundaries

Subcatchment areas (also known as watersheds) were delineated using AutoCAD based on topographic breaks within the areas to be analyzed. The watershed boundaries were delineated using the modified final grades of the Landfill. The Landfill is currently permitted to connect with the closed landfill to the west. Subcatchments have been delineated within the conjoined areas in order to accurately portray the permitted conditions at the site. All subcatchment boundaries are delineated and imported into HydroCAD. Subcatchment boundaries are depicted in **Figure 5**.

4.2.3 Run-off Coefficient Variables

Curve numbers are used to identify the runoff characteristics of an area. Curve numbers consider both the land cover that will be encountered by surface water (such as grass, road, standing water, etc.) as well as the type of soil that underlies the land cover. The underlying soil is important because soil matrix has a large impact on whether water infiltrates the soil or is shed.

The SCS technical resource TR-55 provides lookup tables of curve numbers for combinations of various land covers and the underlying surficial soils. As further described below, APTIM developed assumptions of surficial soil types and delineated various land covers to develop a weighted average for each modeled subcatchment area using values specified in TR-55.

Surficial Soil Types

Local surficial soils that influence the current rate of runoff within the Landfill area were defined by a project-specific soil survey prepared by the Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture (USDA). All areas within the Landfill boundary are comprised of Soil Group C. The soil surrounding the landfill will also be used as the final cover soils. A map of the soil boundaries and a copy of the NRCS soil survey is provided in **Appendix C.**

Land Covers

For the proposed conditions, the land cover was determined to be pasture/grassland/range in good condition. The TR-55 manual designates good grass cover as grassland with greater than 75% vegetative density. This conclusion was based on the proposed final cover design and review of aerial photography of all areas that will not be disturbed or modified as part of the proposed final cover design.

4.2.4 Time of Concentration

The time of concentration, defined as the longest amount of time a water drop would take to travel from the headwater of a subcatchment area to its downstream edge (i.e. prior to being managed by a downstream element) was delineated in AutoCAD and manually entered in HydroCAD.

For the model, the following assumptions were made in the calculations:

- For each subcatchment the time of concentration, T_c, is the sum of the travel times, T_t, of various consecutive flow segments. There are three types of flow: sheet flow, shallow concentrated flow, and open channel flow.

- Sheet flow is assumed to become shallow concentrated flow at 100 feet, which is conservative in comparison to 300 feet, which is designated in the TR-55 Manual.

- The Manning's coefficient "n" for sheet flow was assumed to be 0.15, indicative of short-grass prairie vegetative cover. This number is appropriate for the grass that anticipated to grow on the landform after final closure.

- An average flow velocity of 7 ft/sec was assumed in shallow concentrated flow calculations for the subcatchments, which is the HydroCAD default for "short grass pasture" and is considered most indicative of the grass type that exists in this area.

The time of concentration flow paths are depicted in **Figure 6**.

4.2.5 Terrace Berms and Letdown Structures

The Landfill is designed to convey stormwater from the landfill side slopes to terrace berm structures. Terrace berms are designed to direct the surface water flow, slow the discharge of stormwater and provide additional storage as it moves through the stormwater management system. A Manning's coefficient (a unit-less coefficient of a surface's hydraulic roughness) of 0.035 was modeled in HydroCAD to represent rip-rap lined terrace berms for Cells 1-3, and a coefficient of 0.030 was modeled to represent grass-lined terrace berms for the proposed terrace berms for Cells 4-8. The Manning's coefficients were selected from HydroCAD's lookup tables for each material type.

All terrace berms convey stormwater to letdown structures that transport stormwater to the perimeter drainage channels. The letdown pipes have pipe diameters of both 18-inches and 4-inches. The pipes run perpendicular to the 3.25H:1V sideslopes (permitted slopes for Cells 1-3) and the 4H:1V sideslopes (proposed for Cells 4-8. All letdown structures have been modeled utilizing a Manning's coefficient of 0.025, indicative of corrugated metal pipe.

During storm events, these features will decrease the peak discharge rates for each subcatchment on the landfill face. Any stormwater feature that results in a flow velocity exceeding 5 ft/sec for the 25-year, 24-hour storm will include riprap to prevent scouring. All stormwater conveyance features are depicted on **Figure 7**.

4.2.6 Basin Elements

The Contact Water Pond (pond) has been incorporated into the stormwater model, as it is currently constructed and permitted. The pond has been designed to manage contact water at the Landfill while also collecting small portions of stormwater run-off. The Contact Water Pond is currently sized to contain 5 days of contact water (leachate) from the entire Landfill, plus the contact stormwater from two active cells associated with the 25-year, 24-hour storm event. The pond allows for a freeboard of 5-feet, more than doubling the capacity.

The revised landfill final cover design does not propose to modify the pond, moreover, proposes to divert stormwater flows away from the pond using an interceptor terrace berm. By diverting stormwater flows away from the pond, the existing pond design is acceptable and compatible with the revised landfill final cover design. Additionally, contact water collected in the pond is will continue to meet the requirements set forth in the NPDES Permit No. I-KS31-PO09 and 40 CFR Part §257.81(b) prior to discharge.

4.2.7 Outfall Structures

Eight existing perimeter culverts are located along the BNSF Railway to the north and east as well as along the southern border of the landfill. All stormwater falling within the Industrial Landfill footprint is conveyed to perimeter culverts flowing to outfall locations. The culverts discharge stormwater to the Kansas River or a tributary that flows to the Kansas River. Existing perimeter culverts range in size from 18-inch diameter pipes up to 48-inch diameter pipes and vary in pipe material. The perimeter culverts that are proposed for Cells 4-8 will generally convey stormwater flows in a similar manner as the previously permitted final cover design. For pipes made of reinforced concrete, a Manning's coefficient of 0.012 was modeled in HydroCAD. For pipes made of corrugated metal, a Manning's coefficient of 0.025 was modeled in HydroCAD.

Based on the HydroCAD model results, it was determined that the perimeter culverts are appropriately sized to convey stormwater associate with the 25-year, 24-hour storm event. Discharge velocities from the outfall culverts that exceed 5 ft/sec for the 25-yar, 24-hour storm event will be equipped with a rip-rap apron or other approved erosion control measure at the outlet of the outfall pipe. This will prevent scour. HydroCAD model output files are provided in **Appendix C.**

4.3 Model Findings

All stormwater is directed away from the Landfill by these stormwater management features. These features demonstrate that the run-on control system that is currently in place and will be utilized through the landfilling operations is in compliance with 40 CFR Part §257.81(a)(1).

Results of the stormwater management model indicate that stormwater features that collect and convey stormwater on the Landfill area appropriately sized to manage stormwater flow volumes and peak discharge rates associated with the 25-year, 24-hour storm event per 40 CFR Part §257.81 of the CCR Rule. It was determined that all features are not anticipated to overtop or back up during the 25-year, 24-hour storm event. Additionally, all stormwater features are designed with the appropriate lining material based on the anticipated flow velocities within each stormwater feature.

Key findings associated with the Landfill's conveyance features are as follows:

1) All stormwater conveyance features will convey the stormwater volumes and peak flow rates associated with the 25-year, 24-hour storm event without overtopping, including:
    a. Terrace Berms
    b. Letdown Pipes
    c. Perimeter Ditches

2) All stormwater conveyance features will convey the stormwater volumes and peak flow rates associated with the 25-year 24-hour storm event without overtopping.

3) Flow velocities for the 25-year, 24-hour storm exceed 5 feet per second (ft/sec) in perimeter ditch D-18-1. A significant amount of stormwater flows to Outfall 018, therefore, perimeter ditch D-18-1 as well as the bounding berm structure at Outfall 018 will be lined with erosion control materials such as rip-rap or revetment matting.

4) Stormwater flow velocities exiting letdown pipes are anticipated to exceed 5 ft/sec. The outlet of the letdown structure will be lined with a rip-rap apron or other suitable erosion control material to dissipate stormwater flow velocities as it enters the perimeter ditch or overland flows to outfall culverts.

5) All outfall culverts will convey the stormwater associated with the 25-year, 24-hour storm event.

6) Discharge velocities from outfall culverts that exceed 5 ft/sec for the 25-year, 24-hour storm event have been equipped with a rip-rap apron or other approved erosion control measure at the outlet of the outfall pipe. Therefore, erosion or scour is not anticipated.

4.4 Engineering Evaluation of Findings

4.4.1 Design Appropriateness Based on Model Findings

The existing run-on control system is appropriately designed to prevent the flow of stormwater resulting from the 25-year, 24-hour storm event utilizing perimeter berms that provides the appropriate variance between the top of berm and the CCR material. In addition to the perimeter berms, the natural topography promotes positive drainage away from the active landfilling locations towards the Kansas River.

Based on the Landfill run-on and run-off model findings, it was determined that the run-off control system is designed to collect and control the water volume resulting from the 25-year, 24-hour storm event at the Lawrence Energy Center.

4.4.2 Operations and Maintenance Considerations

Routine and annual inspections of the landfill and stormwater conveyance structures are undertaken to ensure the structures will be clear from debris, identify repairs required for erosion, and monitor any erosion controls.

5.0 RECORDS RETENTION AND MAINTENANCE

5.1 Incorporation of Plan into Operating Record

§257.105(g) of 40 CFR Part §257 provides record keeping requirements to ensure that this Plan will be placed in the facility's operating record. Specifically, §257.105(g) stipulates:

> §257.105(g)*: (g) Operating criteria. The owner or operator of a CCR unit subject to this subpart must place the following information, as it becomes available, in the facility's operating record: (3) The initial and periodic run-on and run-off control system plans as required by §257.81(c).*

This Report will be placed within the Facility Operating Record upon Westar's review and approval.

5.2 Notification Requirements (§257.81(d))

§257.106(g) of 40 CFR Part §257 provides guidelines for the notification of the availability of the initial and periodic plan. Specifically, §257.106(g) stipulates:

> §257.106(g): *(g) Operating criteria. The owner or operator of a CCR unit subject to this subpart must notify the State Director and/or appropriate Tribal authority when information has been placed in the operating record and on the owner or operator's publicly accessible internet site. The owner or operator must: (3) Provide notification of the availability of the initial and periodic run-on and run-off control system plans specified under §257.105(g)(3).*

The State Director and appropriate Tribal Authority will be notified upon placement of this Plan in the Facility Operating Record.

§257.107(g) of 40 CFR Part §257 provides publicly accessible Internet site requirements to ensure that this Plan is accessible through the Westar Energy webpage. Specifically, §257.107(g) stipulates:

> §257.107(g): *(g) Operating criteria. The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site: (3) The initial and periodic run-on and run-off control system plans specified under §257.105(g)(3).*

This Plan will be uploaded to Westar Energy's CCR Compliance reporting Web site upon Westar's review and approval.

5.3 Plan Amendments (§257.81(c)(3)) & §257.81(c)(4))

This Plan has been completed in accordance with §257.81(c)(3) to provide an initial analysis of the run-on and run-off control systems. This Plan will continue to undergo review as the Landfill continues phased construction activities.

This Run-on and Run-off Control System Plan will continue to undergo review as the Landfill continues phased construction activities. Westar Energy is required to prepare periodic run-on and run-off control system plans every five (5) years, as required by §257.81(c)(4) of the Rule. The amended Plan will be reviewed and recertified by a registered professional engineer and will be placed in LEC's facility operating record as required per §257.105(g)(3). The amended Plan will supersede and replace any prior versions. Availability of the amended Plan will be noticed to the State Director per §257.106(g)(3) and posted to the publicly accessible internet site per §257.107(g)(3).

A record of Plan reviews/assessments is provided on the first page of this document, immediately following the Table of Contents.

6.0 PROFESSIONAL ENGINEER CERTIFICATION (§257.81(c)(5))

The undersigned registered professional engineer is familiar with the requirements of the CCR Rule and has visited and examined the Lawrence Energy Center or has supervised examination of the Lawrence Energy Center by appropriately qualified personnel. The undersigned registered professional engineer attests that this CCR Run-on and Run-off Control System Plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and meets the requirements of §257.81, and that this Plan is adequate for the LEC facility. This certification was prepared as required by §257.81(c)(5)

Name of Professional Engineer: Richard Southorn

Company: APTIM

Signature:

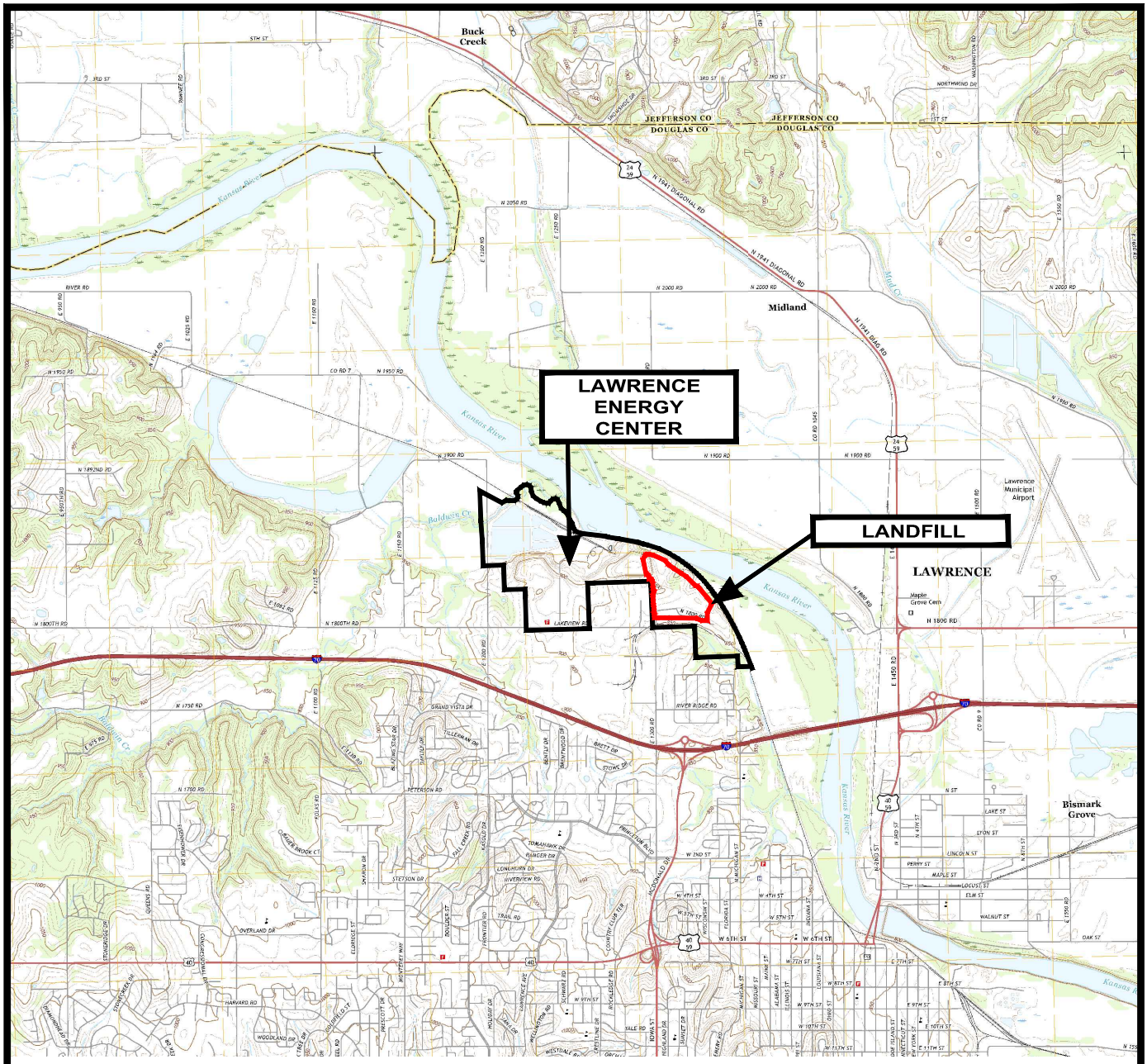
Date: 3/20/18

PE Registration State: Kansas

PE Registration Number: PE25201

Professional Engineer Seal:

FIGURES



LEGEND

LAWRENCE ENERGY CENTER FACILITY BOUNDARY

CCR UNIT BOUNDARY

0 5000'

GRAPHIC SCALE

NOTES

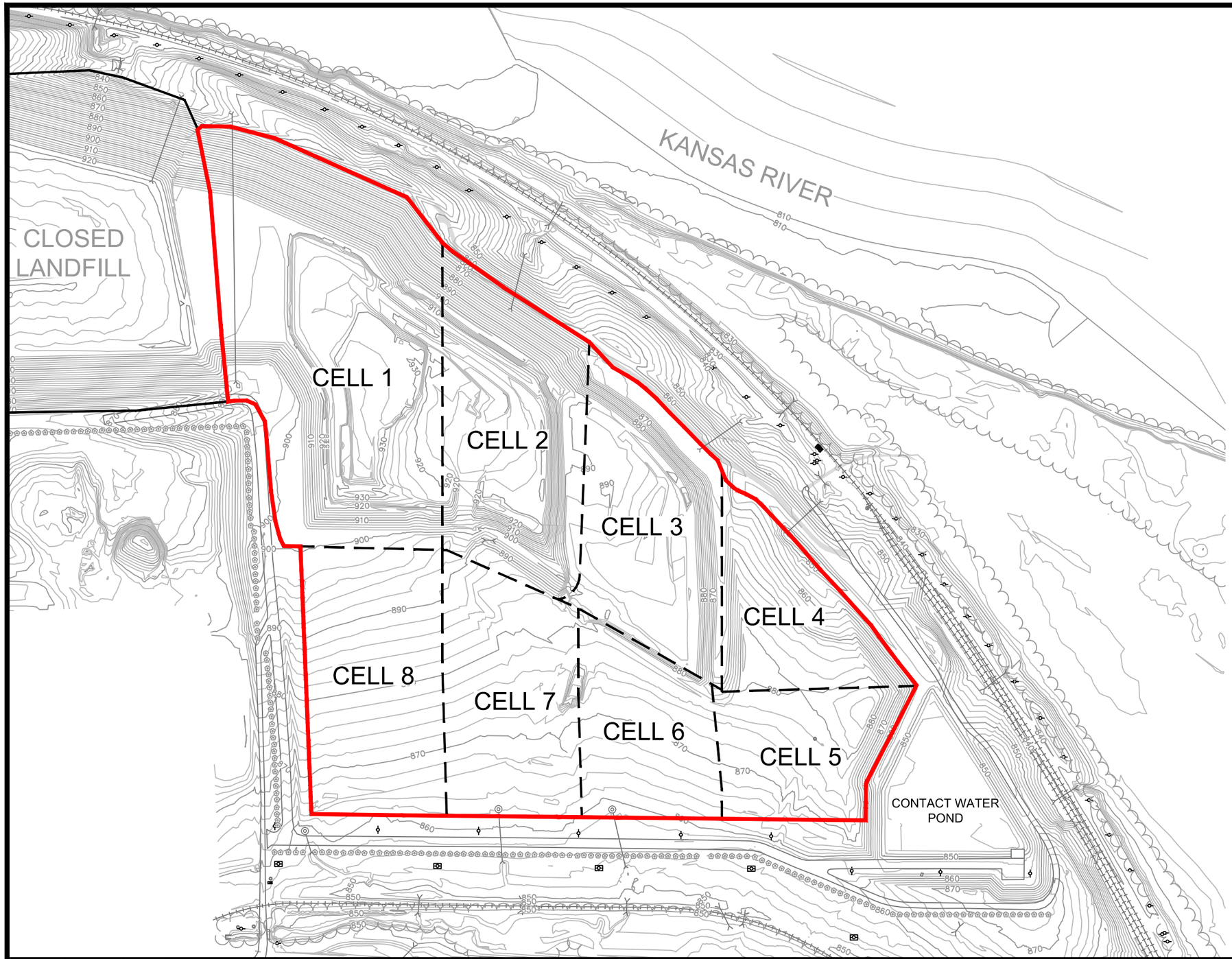
1. AERIAL TOPO OBTAINED FROM USGS 7.5-MINUTE SERIES, LAWRENCE EAST, LAWRENCE WEST, MIDLAND AND WILLIAMSTOWN QUADRANGLE, KANSAS, 2014.
2. ALL BOUNDARIES ARE APPROXIMATE.

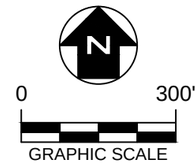
APTIM Environmental & Infrastructure, Inc.

LAWRENCE ENERGY CENTER
1250 N. 1800 RD., LAWRENCE, KS.

FIGURE 1
LAWRENCE LANDFILL
SITE LOCATION PLAN

APPROVED BY: RDS	PROJ. NO.: 631214397	DATE: FEBRUARY 2018





LEGEND

- APPROXIMATE CCR UNIT BOUNDARY
- APPROXIMATE LANDFILL CELL BOUNDARY

NOTES

1. EXISTING CONTOURS DEVELOPED FROM SITE AERIAL TOPOGRAPHIC SURVEY BY PROFESSIONAL ENGINEERING CONSULTANTS IN JUNE 2016. CONTOURS WERE SUBSEQUENTLY MODIFIED BY APTIM TO REFLECT A RIP-RAP AND SOIL STOCKPILE REMOVAL. EXISTING CONTOURS MAY DIFFER FROM SHOWN.
2. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
3. PROPOSED CCR UNIT BOUNDARY IS APPROX. 53.5 ACRES.
4. ALL BOUNDARIES ARE APPROXIMATE.

REV. NO.	DATE	DESCRIPTION

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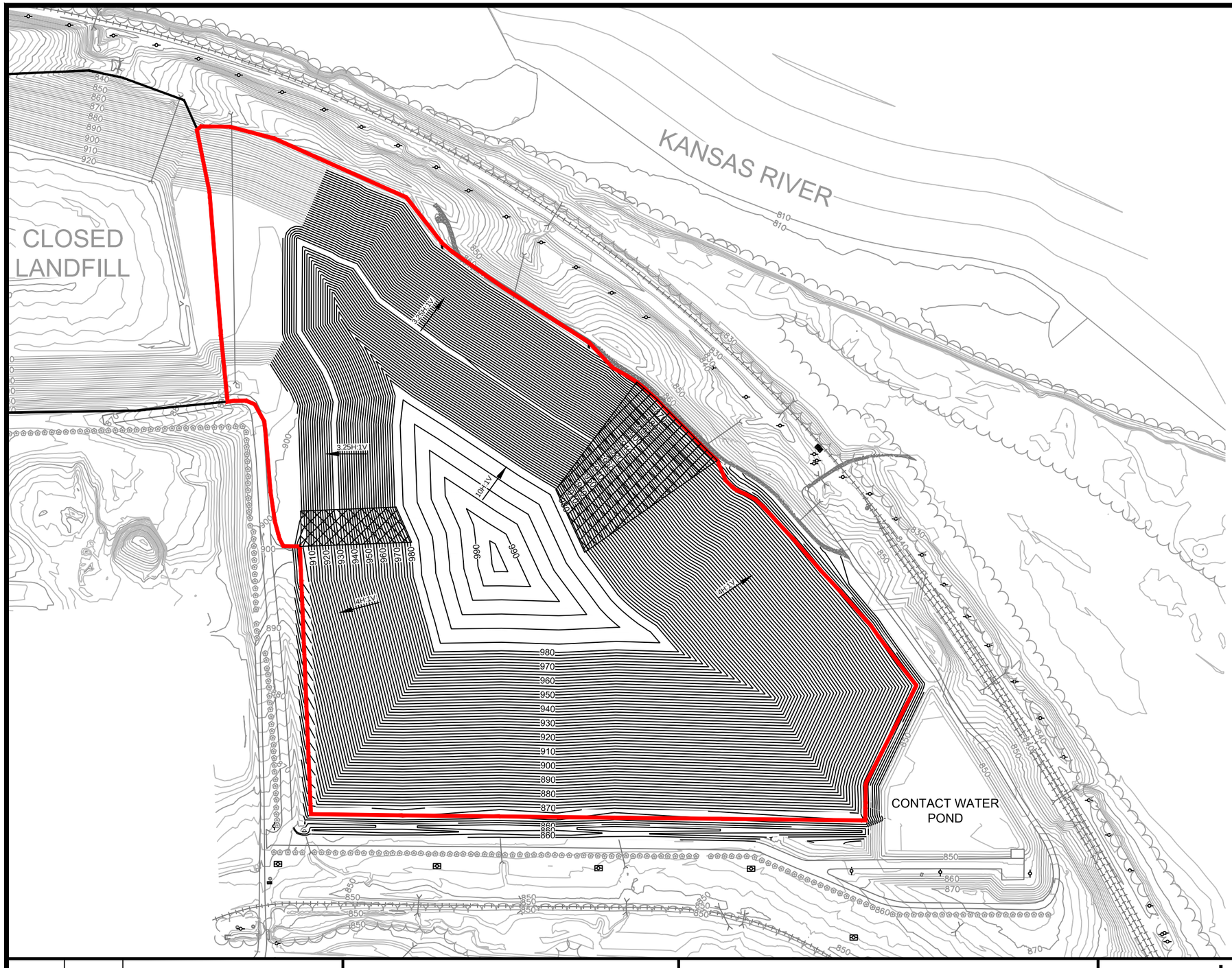
LAWRENCE ENERGY CENTER
1250 N 1800 RD., LAWRENCE, KANSAS

FIGURE 2
LAWRENCE LANDFILL
EXISTING SITE TOPOGRAPHY

DRAWN BY:	ORC	APPROVED BY:	RDS	PROJ. NO.:	631214397	DATE:	MARCH 2018

T:\AutoCAD\Projects\Westar Energy\Lawrence\Compliance Reports\Run-on and Run-off\Figure 2 - Existing Conditions.dwg



N

0 300'

GRAPHIC SCALE

LEGEND

APPROXIMATE CCR UNIT BOUNDARY

APPROXIMATE FINAL COVER DESIGN TRANSITION ZONE

NOTES

1. EXISTING CONTOURS DEVELOPED FROM SITE AERIAL TOPOGRAPHIC SURVEY BY PROFESSIONAL ENGINEERING CONSULTANTS IN JUNE 2016. CONTOURS WERE SUBSEQUENTLY MODIFIED BY APTIM TO REFLECT A RIP-RAP AND SOIL STOCKPILE REMOVAL. EXISTING CONTOURS MAY DIFFER FROM SHOWN.
2. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
3. PROPOSED CCR UNIT BOUNDARY IS APPROX. 53.5 ACRES.
4. ALL BOUNDARIES ARE APPROXIMATE.
5. PERMITTED SLOPE OF FINAL COVER PLATEAU AREA HAS BEEN MODIFIED TO PROVIDE AN INCREASED 20H:1V SLOPE IN ORDER TO PROMOTE DRAINAGE AND ACCOMMODATE DIFFERENTIAL SETTLEMENT.
6. FINAL COVER IN DEVELOPMENT AREAS UTILIZING GEOSYNTHETICS HAVE BEEN MODIFIED TO HAVE A SLOPE OF 4H:1V TO ENSURE LANDFILL STABILITY.

REV. NO.	DATE	DESCRIPTION

Westar Energy®

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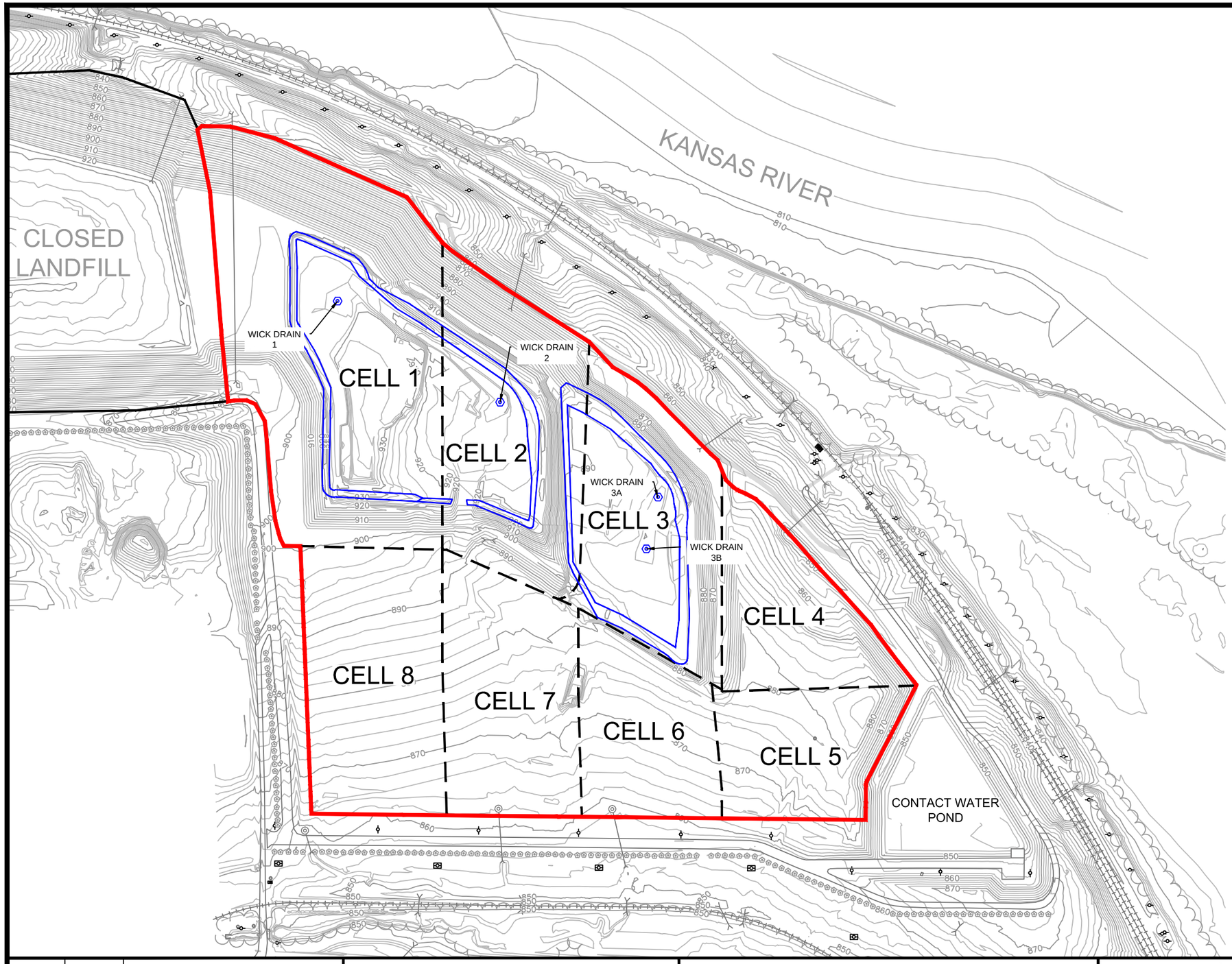
LAWRENCE ENERGY CENTER
1250 N 1800 RD., LAWRENCE, KANSAS

FIGURE 3
LAWRENCE LANDFILL
PROPOSED FINAL LANDFORM

DRAWN BY:	SJL	APPROVED BY:	RDS	PROJ. NO.:	631214397	DATE:	MARCH 2018

T:\AutoCAD\Projects\Westar Energy\Lawrence\Compliance Reports\Run-on and Run-off\Figure 3 - Proposed Conditions.dwg



N

0 300'

GRAPHIC SCALE

LEGEND

- APPROXIMATE CCR UNIT BOUNDARY
- APPROXIMATE LANDFILL CELL BOUNDARY
- EXISTING STORMWATER RUN-ON BERM/FEATURE
- APPROXIMATE WICK DRAIN LOCATION

NOTES

1. EXISTING CONTOURS DEVELOPED FROM SITE AERIAL TOPOGRAPHIC SURVEY BY PROFESSIONAL ENGINEERING CONSULTANTS IN JUNE 2016. CONTOURS WERE SUBSEQUENTLY MODIFIED BY APTIM TO REFLECT A RIP-RAP AND SOIL STOCKPILE REMOVAL. EXISTING CONTOURS MAY DIFFER FROM SHOWN.
2. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
3. ALL BOUNDARIES ARE APPROXIMATE.

REV. NO.	DATE	DESCRIPTION

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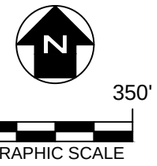
LAWRENCE ENERGY CENTER
1250 N 1800 RD., LAWRENCE, KANSAS

FIGURE 4
LAWRENCE LANDFILL
EXISTING STORMWATER MANAGEMENT SYSTEM

DRAWN BY:	SJL	APPROVED BY:	RDS	PROJ. NO.:	631214397	DATE:	MARCH 2018



LEGEND

- EXISTING CONTOUR
- PROPOSED SUBBASE GRADE CONTOUR
- SUBCATCHMENT MODEL NUMBER
- SUBCATCHMENT TO OUTFALL 006
- SUBCATCHMENT TO OUTFALL 011
- SUBCATCHMENT TO OUTFALL 012
- SUBCATCHMENT TO OUTFALL 013
- SUBCATCHMENT TO OUTFALL 014
- SUBCATCHMENT TO OUTFALL 016
- SUBCATCHMENT TO OUTFALL 017
- SUBCATCHMENT TO OUTFALL 018
- SUBCATCHMENT TO CONTACT WATER BASIN
- RUN-ON SUBCATCHMENT
- PROPOSED CULVERT FLOWING TO OUTFALL
- OUTFALL LOCATION

NOTES

1. EXISTING CONTOURS DEVELOPED FROM SITE AERIAL TOPOGRAPHIC SURVEY BY PROFESSIONAL ENGINEERING CONSULTANTS IN JUNE 2016. CONTOURS WERE SUBSEQUENTLY MODIFIED BY APTIM TO REFLECT A RIP-RAP AND SOIL STOCKPILE REMOVAL. EXISTING CONTOURS MAY DIFFER FROM SHOWN.
2. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
3. CURRENT TOPOGRAPHY MAY DIFFER FROM THAT SHOWN.
4. THE NEED FOR FLEXIBILITY TO ACCOMMODATE ADJUSTMENTS AND MODIFICATIONS IS ANTICIPATED CONSIDERING THE SIZE, COMPLEXITY, AND LIFE OF THE PROJECT.

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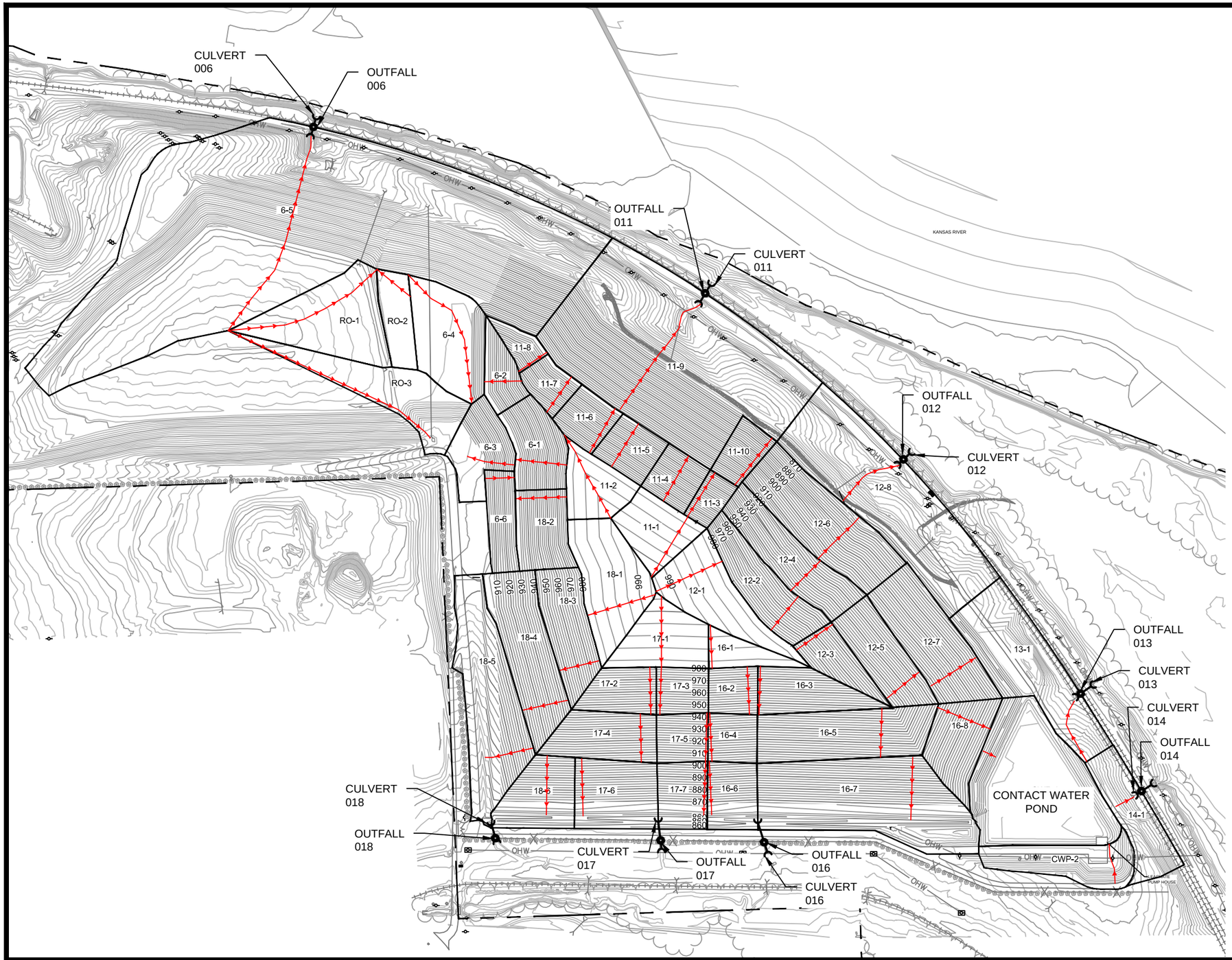
LAWRENCE ENERGY CENTER
1250 N 1800 RD., LAWRENCE, KANSAS

FIGURE 5
LAWRENCE LANDFILL
SUBCATCHMENT DELINEATION

DRAWN BY:	ORC	APPROVED BY:	RDS	PROJ. NO.:	631214397	DATE:	FEBRUARY 2018



N

0 350'

GRAPHIC SCALE

LEGEND

- 860 — EXISTING CONTOUR
- 860 — PROPOSED SUBBASE GRADE CONTOUR
- 6-1 — SUBCATCHMENT MODEL NUMBER
- TIME OF CONCENTRATION FLOWPATH
- PROPOSED CULVERT FLOWING TO OUTFALL
- OUTFALL LOCATION

NOTES

1. EXISTING CONTOURS DEVELOPED FROM SITE AERIAL TOPOGRAPHIC SURVEY BY PROFESSIONAL ENGINEERING CONSULTANTS IN JUNE 2016. CONTOURS WERE SUBSEQUENTLY MODIFIED BY APTIM TO REFLECT A RIP-RAP AND SOIL STOCKPILE REMOVAL. EXISTING CONTOURS MAY DIFFER FROM SHOWN.
2. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
3. CURRENT TOPOGRAPHY MAY DIFFER FROM THAT SHOWN.
4. THE NEED FOR FLEXIBILITY TO ACCOMMODATE ADJUSTMENTS AND MODIFICATIONS IS ANTICIPATED CONSIDERING THE SIZE, COMPLEXITY, AND LIFE OF THE PROJECT.

REV. NO.	DATE	DESCRIPTION

Westar Energy®

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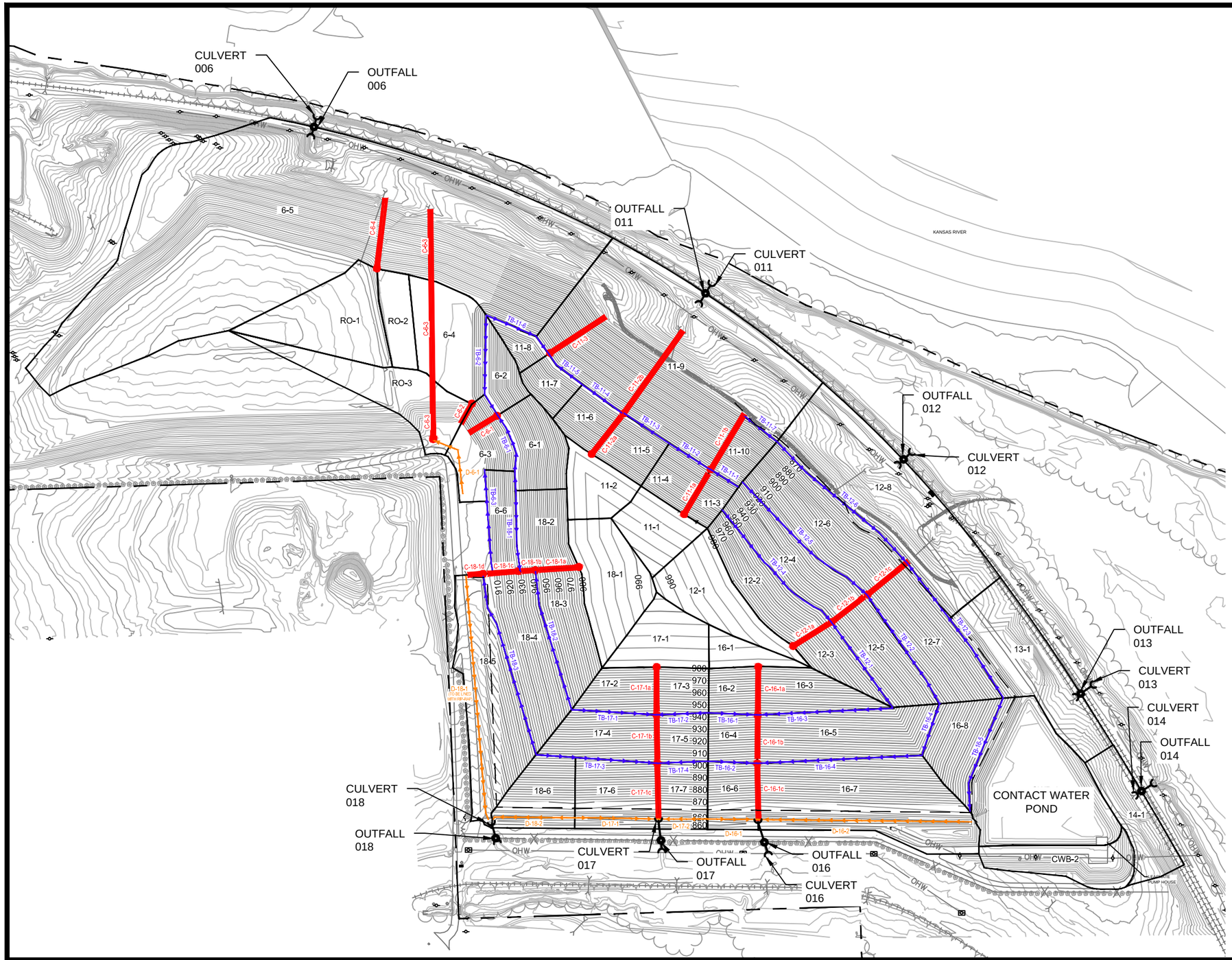
LAWRENCE ENERGY CENTER
1250 N 1800 RD., LAWRENCE, KANSAS

FIGURE 6
LAWRENCE LANDFILL
TIME OF CONCENTRATION FLOW PATHS

DRAWN BY:	ORC	APPROVED BY:	RDS	PROJ. NO.:	631214397	DATE:	FEBRUARY 2018



N

0 350'

GRAPHIC SCALE

LEGEND

- EXISTING CONTOUR
- PROPOSED SUBBASE GRADE CONTOUR
- SUBCATCHMENT MODEL NUMBER
- TERRACE BERM/BENCH
- DRAINAGE DITCH
- LETDOWN PIPE
- PROPOSED CULVERT FLOWING TO OUTFALL
- OUTFALL LOCATION

NOTES

1. EXISTING CONTOURS DEVELOPED FROM SITE AERIAL TOPOGRAPHIC SURVEY BY PROFESSIONAL ENGINEERING CONSULTANTS IN JUNE 2016. CONTOURS WERE SUBSEQUENTLY MODIFIED BY APTIM TO REFLECT A RIP-RAP AND SOIL STOCKPILE REMOVAL. EXISTING CONTOURS MAY DIFFER FROM SHOWN.
2. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
3. CURRENT TOPOGRAPHY MAY DIFFER FROM THAT SHOWN.
4. THE NEED FOR FLEXIBILITY TO ACCOMMODATE ADJUSTMENTS AND MODIFICATIONS IS ANTICIPATED CONSIDERING THE SIZE, COMPLEXITY, AND LIFE OF THE PROJECT.
5. ALL TERRACE BERMS/BENCHES AND DRAINAGE DITCHES TO BE LINED WITH VEGETATION.
6. DRAINAGE DITCH D-6-1 AND D-18-1 ARE TO BE LINED WITH RIP-RAP OR OTHER APPROVED EROSION CONTROL MATERIALS.

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LAWRENCE ENERGY CENTER
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FIGURE 7
LAWRENCE LANDFILL
STORMWATER CONVEYANCE FEATURES

DRAWN BY:	ORC	APPROVED BY:	RDS	PROJ. NO.:	631214397	DATE:	FEBRUARY 2018

APPENDICES

APPENDIX A

Rainfall Totals and Distributions

RAINFALL INTENSITY TABLES

FOR KANSAS COUNTIES

Developed for

Kansas Department of Transportation

by

Bruce M. McEnroe

Department of Civil and Environmental Engineering
University of Kansas
Lawrence, Kansas

June, 1997

RAINFALL INTENSITY TABLE

DOUGLAS COUNTY
KANSAS

THIS TABLE CONTAINS AVERAGE RAINFALL INTENSITIES
IN INCHES PER HOUR.

DURATION, HR:MIN	RETURN PERIOD 1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
0:05	4.63	5.40	6.48	7.26	8.41	9.31	10.20
0:06	4.44	5.19	6.23	6.99	8.10	8.97	9.84
0:07	4.28	5.00	6.02	6.75	7.83	8.68	9.52
0:08	4.12	4.83	5.82	6.53	7.58	8.40	9.22
0:09	3.98	4.66	5.62	6.32	7.34	8.13	8.93
0:10	3.84	4.50	5.43	6.11	7.10	7.87	8.64
0:11	3.70	4.34	5.25	5.91	6.87	7.61	8.36
0:12	3.57	4.19	5.08	5.71	6.64	7.37	8.09
0:13	3.45	4.05	4.91	5.53	6.43	7.14	7.84
0:14	3.33	3.92	4.76	5.36	6.24	6.93	7.61
0:15	3.22	3.80	4.62	5.21	6.06	6.73	7.40
0:16	3.12	3.69	4.49	5.06	5.90	6.56	7.21
0:17	3.03	3.58	4.37	4.93	5.75	6.39	7.03
0:18	2.94	3.48	4.26	4.81	5.61	6.24	6.86
0:19	2.86	3.39	4.15	4.69	5.48	6.10	6.71
0:20	2.78	3.30	4.05	4.59	5.36	5.97	6.57
0:21	2.71	3.22	3.96	4.48	5.25	5.84	6.43
0:22	2.64	3.14	3.87	4.39	5.14	5.72	6.30
0:23	2.57	3.07	3.79	4.30	5.03	5.61	6.18
0:24	2.51	3.00	3.71	4.21	4.94	5.50	6.06
0:25	2.45	2.93	3.63	4.13	4.84	5.40	5.95
0:26	2.39	2.87	3.56	4.05	4.75	5.30	5.85
0:27	2.34	2.81	3.49	3.97	4.67	5.21	5.74
0:28	2.29	2.75	3.42	3.90	4.58	5.12	5.65
0:29	2.24	2.69	3.36	3.83	4.50	5.03	5.55
0:30	2.19	2.64	3.30	3.76	4.43	4.94	5.46
0:31	2.14	2.59	3.24	3.70	4.35	4.86	5.37
0:32	2.10	2.54	3.18	3.63	4.28	4.78	5.29
0:33	2.06	2.49	3.13	3.57	4.21	4.71	5.20
0:34	2.02	2.45	3.07	3.51	4.14	4.64	5.12
0:35	1.98	2.40	3.02	3.46	4.08	4.56	5.05
0:36	1.94	2.36	2.97	3.40	4.02	4.50	4.97
0:37	1.91	2.32	2.93	3.35	3.96	4.43	4.90
0:38	1.88	2.28	2.88	3.30	3.90	4.36	4.83
0:39	1.84	2.24	2.84	3.25	3.84	4.30	4.76
0:40	1.81	2.21	2.79	3.20	3.78	4.24	4.69
0:41	1.78	2.17	2.75	3.16	3.73	4.18	4.62
0:42	1.75	2.14	2.71	3.11	3.68	4.12	4.56
0:43	1.73	2.11	2.67	3.07	3.63	4.07	4.50
0:44	1.70	2.08	2.63	3.02	3.58	4.01	4.44
0:45	1.67	2.05	2.60	2.98	3.53	3.96	4.38

RAINFALL INTENSITY TABLE

DOUGLAS COUNTY
KANSAS

THIS TABLE CONTAINS AVERAGE RAINFALL INTENSITIES
IN INCHES PER HOUR.

DURATION, HR:MIN	RETURN PERIOD 1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
0:46	1.65	2.02	2.56	2.94	3.48	3.90	4.32
0:47	1.63	1.99	2.53	2.90	3.44	3.85	4.27
0:48	1.60	1.96	2.50	2.87	3.39	3.80	4.21
0:49	1.58	1.94	2.46	2.83	3.35	3.76	4.16
0:50	1.56	1.91	2.43	2.79	3.31	3.71	4.11
0:51	1.54	1.89	2.40	2.76	3.27	3.66	4.06
0:52	1.52	1.86	2.37	2.72	3.23	3.62	4.01
0:53	1.50	1.84	2.34	2.69	3.19	3.58	3.96
0:54	1.48	1.82	2.31	2.66	3.15	3.53	3.91
0:55	1.47	1.80	2.29	2.63	3.11	3.49	3.87
0:56	1.45	1.78	2.26	2.60	3.08	3.45	3.82
0:57	1.43	1.76	2.23	2.57	3.04	3.41	3.78
0:58	1.42	1.74	2.21	2.54	3.01	3.37	3.73
0:59	1.40	1.72	2.18	2.51	2.97	3.33	3.69
1:00	1.39	1.70	2.16	2.48	2.94	3.30	3.65
1:05	1.32	1.62	2.05	2.35	2.78	3.12	3.46
1:10	1.26	1.54	1.95	2.24	2.65	2.96	3.28
1:15	1.21	1.47	1.86	2.13	2.52	2.82	3.12
1:20	1.16	1.41	1.78	2.04	2.41	2.69	2.98
1:25	1.12	1.36	1.71	1.95	2.30	2.57	2.85
1:30	1.08	1.30	1.64	1.87	2.21	2.47	2.73
1:35	1.04	1.26	1.57	1.80	2.12	2.37	2.62
1:40	1.00	1.21	1.52	1.73	2.04	2.28	2.52
1:45	0.97	1.17	1.46	1.67	1.97	2.20	2.43
1:50	0.93	1.13	1.41	1.61	1.90	2.12	2.35
1:55	0.90	1.09	1.36	1.56	1.84	2.05	2.27
2:00	0.87	1.05	1.32	1.51	1.78	1.99	2.20
2:05	0.84	1.01	1.28	1.46	1.73	1.93	2.13
2:10	0.81	0.98	1.24	1.42	1.67	1.87	2.07
2:15	0.78	0.95	1.20	1.38	1.63	1.82	2.02
2:20	0.75	0.92	1.16	1.34	1.58	1.77	1.96
2:25	0.73	0.89	1.13	1.30	1.54	1.73	1.91
2:30	0.70	0.86	1.10	1.27	1.50	1.69	1.87
2:35	0.68	0.84	1.07	1.23	1.47	1.64	1.82
2:40	0.66	0.81	1.04	1.20	1.43	1.61	1.78
2:45	0.64	0.79	1.02	1.17	1.40	1.57	1.74
2:50	0.62	0.77	0.99	1.15	1.37	1.54	1.70
2:55	0.60	0.75	0.97	1.12	1.34	1.50	1.67
3:00	0.59	0.73	0.95	1.10	1.31	1.47	1.63

RAINFALL INTENSITY TABLE

DOUGLAS COUNTY
KANSAS

THIS TABLE CONTAINS AVERAGE RAINFALL INTENSITIES
IN INCHES PER HOUR.

DURATION, HR:MIN	RETURN PERIOD 1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
3:15	0.55	0.69	0.89	1.03	1.23	1.38	1.54
3:30	0.52	0.65	0.84	0.97	1.16	1.31	1.46
3:45	0.49	0.61	0.80	0.92	1.10	1.24	1.38
4:00	0.46	0.58	0.76	0.88	1.05	1.18	1.32
4:15	0.44	0.56	0.72	0.84	1.00	1.13	1.26
4:30	0.43	0.53	0.69	0.80	0.96	1.08	1.20
4:45	0.41	0.51	0.67	0.77	0.92	1.04	1.15
5:00	0.40	0.49	0.64	0.74	0.89	1.00	1.11
5:15	0.38	0.48	0.62	0.72	0.86	0.96	1.07
5:30	0.37	0.46	0.60	0.69	0.83	0.93	1.03
5:45	0.36	0.45	0.58	0.67	0.80	0.90	1.00
6:00	0.35	0.43	0.56	0.65	0.77	0.87	0.97
6:30	0.33	0.41	0.53	0.61	0.73	0.82	0.91
7:00	0.31	0.39	0.50	0.58	0.69	0.78	0.86
7:30	0.30	0.37	0.48	0.55	0.66	0.74	0.82
8:00	0.28	0.35	0.45	0.52	0.62	0.70	0.78
8:30	0.27	0.34	0.43	0.50	0.60	0.67	0.75
9:00	0.26	0.32	0.42	0.48	0.57	0.64	0.71
9:30	0.25	0.31	0.40	0.46	0.55	0.62	0.69
10:00	0.24	0.30	0.38	0.44	0.53	0.60	0.66
10:30	0.23	0.29	0.37	0.43	0.51	0.57	0.64
11:00	0.22	0.28	0.36	0.41	0.49	0.55	0.61
11:30	0.21	0.27	0.35	0.40	0.48	0.54	0.59
12:00	0.21	0.26	0.33	0.39	0.46	0.52	0.57
13:00	0.20	0.24	0.31	0.36	0.43	0.49	0.54
14:00	0.18	0.23	0.30	0.34	0.41	0.46	0.51
15:00	0.17	0.22	0.28	0.32	0.39	0.43	0.48
16:00	0.17	0.21	0.27	0.31	0.37	0.41	0.46
17:00	0.16	0.20	0.25	0.29	0.35	0.39	0.44
18:00	0.15	0.19	0.24	0.28	0.33	0.38	0.42
19:00	0.15	0.18	0.23	0.27	0.32	0.36	0.40
20:00	0.14	0.17	0.22	0.26	0.31	0.34	0.38
21:00	0.13	0.17	0.21	0.25	0.29	0.33	0.37
22:00	0.13	0.16	0.21	0.24	0.28	0.32	0.35
23:00	0.13	0.16	0.20	0.23	0.27	0.31	0.34
24:00	0.12	0.15	0.19	0.22	0.26	0.30	0.33

APPENDIX B

NRCS Soil Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Douglas County, Kansas

Westar Energy - Lawrence Energy Center

June 15, 2016

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

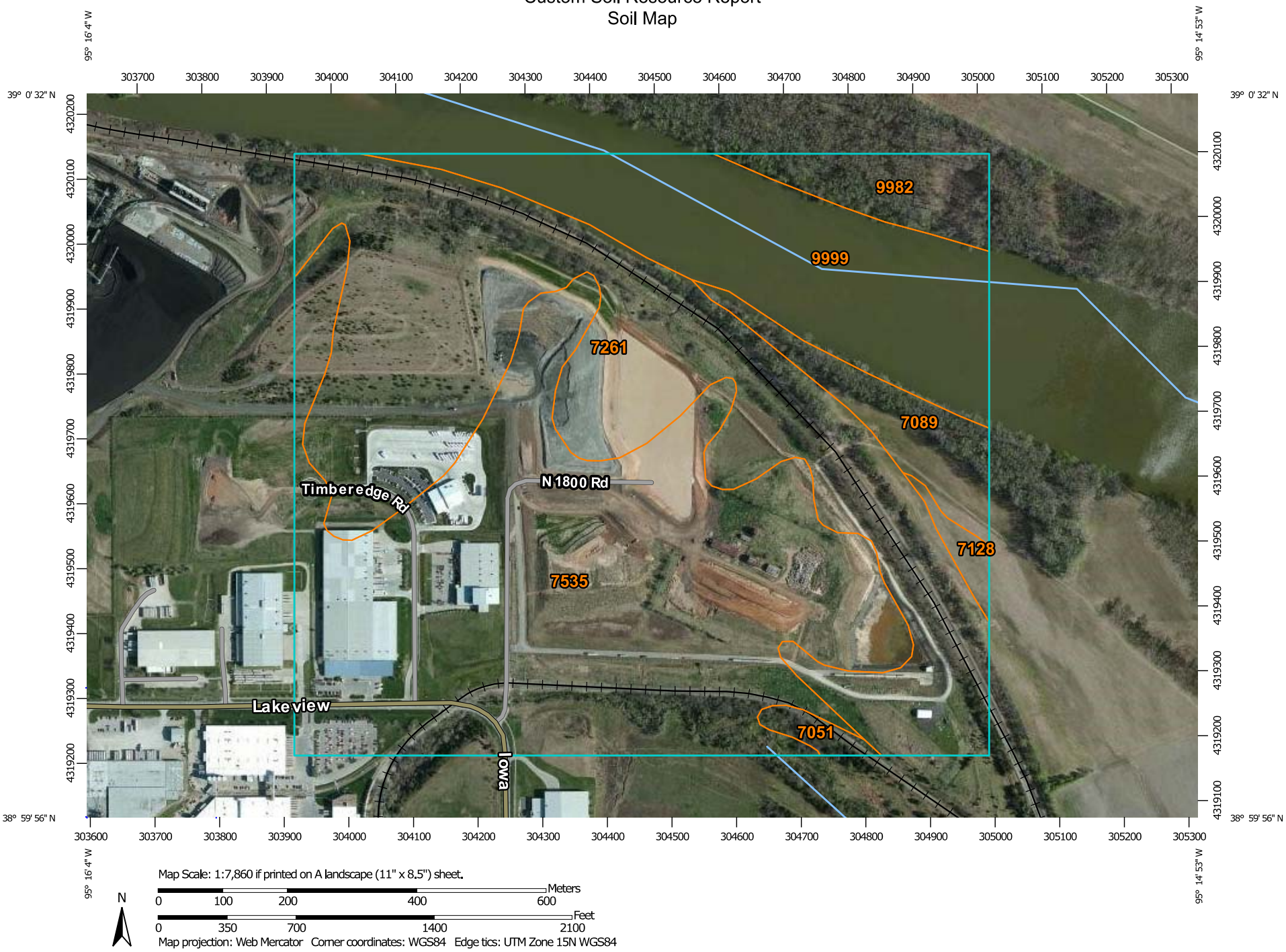
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Douglas County, Kansas
Survey Area Data: Version 12, Sep 14, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 5, 2011—Apr 12, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Douglas County, Kansas (KS045)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
7051	Kennebec silt loam, frequently flooded	1.8	0.7%
7089	Stonehouse-Eudora fine sandy loams, overwash, occasionally flooded	9.5	3.8%
7128	Eudora-Kimo complex, rarely flooded	1.8	0.7%
7261	Gymer silt loam, 3 to 7 percent slopes	83.5	33.8%
7535	Sharpsburg silt loam, 4 to 8 percent slopes	105.1	42.5%
9982	Fluvents, frequently flooded	8.7	3.5%
9999	Water	36.9	14.9%
Totals for Area of Interest		**247.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been

observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Douglas County, Kansas

7051—Kennebec silt loam, frequently flooded

Map Unit Setting

National map unit symbol: 1l9f4
Elevation: 400 to 2,000 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 175 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Kennebec and similar soils: 88 percent
Minor components: 12 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kennebec

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium

Typical profile

A1 - 0 to 10 inches: silt loam
A2 - 10 to 22 inches: silty clay loam
AC - 22 to 38 inches: silty clay loam
C - 38 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 40 to 44 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Very high (about 12.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B
Ecological site: Loamy Lowland (PE 30-37) (R106XY013KS)

Minor Components

Sogn

Percent of map unit: 3 percent
Landform: Hillslopes
Ecological site: Shallow Limy (Draft) (PE 35-42) (R112XY028KS)

Wabash

Percent of map unit: 3 percent
Landform: Flood plains
Other vegetative classification: CLAY LOWLAND (PE30-37) (106XY004KS_1)

Martin

Percent of map unit: 3 percent
Landform: Hillslopes
Ecological site: Loamy Upland (Draft) (PE 35-42) (R112XY015KS)

Vinland

Percent of map unit: 3 percent
Landform: Hillslopes
Ecological site: Loamy Upland (Draft) (PE 35-42) (R112XY015KS)

Aquolls, ponded

Percent of map unit: 0 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave

Aquolls

Percent of map unit: 0 percent
Landform: Depressions, drainageways, hillslopes
Down-slope shape: Concave
Across-slope shape: Concave

7089—Stonehouse-Eudora fine sandy loams, overwash, occasionally flooded

Map Unit Setting

National map unit symbol: 1n89d
Elevation: 750 to 980 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 55 degrees F
Frost-free period: 175 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Stonehouse and similar soils: 50 percent
Eudora and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stonehouse

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Sandy alluvium

Typical profile

Ap - 0 to 9 inches: fine sandy loam
C1 - 9 to 23 inches: loamy fine sand
C2 - 23 to 31 inches: stratified loamy sand
C3 - 31 to 45 inches: stratified fine sand
C4 - 45 to 71 inches: stratified sandy loam
C5 - 71 to 80 inches: stratified loamy fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: Sandy Lowland (PE 30-37) (R106XY023KS)

Description of Eudora

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-silty alluvium

Typical profile

Ap - 0 to 7 inches: fine sandy loam
A - 7 to 14 inches: silt loam
C1 - 14 to 40 inches: silt loam
C2 - 40 to 48 inches: silt loam
C3 - 48 to 80 inches: very fine sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Ecological site: Loamy Lowland (PE 30-37) (R106XY013KS)

Minor Components

Kimo

Percent of map unit: 10 percent
Landform: Meander scars on flood-plain steps
Other vegetative classification: CLAY LOWLAND (PE30-37) (106XY004KS_1)

Bourbonais

Percent of map unit: 5 percent
Landform: Flood-plain steps
Other vegetative classification: CLAY LOWLAND (PE30-37) (106XY004KS_1)

Bismarckgrove

Percent of map unit: 5 percent
Landform: Flood-plain steps
Ecological site: Loamy Lowland (PE 30-37) (R106XY013KS)

Aquolls

Percent of map unit: 0 percent
Landform: Drainageways, depressions
Down-slope shape: Concave
Across-slope shape: Concave

7128—Eudora-Kimo complex, rarely flooded

Map Unit Setting

National map unit symbol: 1l9fd
Elevation: 450 to 1,200 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 175 to 215 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Eudora and similar soils: 65 percent
Kimo and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Eudora

Setting

Landform: Flood plains
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Coarse-silty alluvium

Typical profile

A - 0 to 12 inches: fine sandy loam
C - 12 to 72 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water storage in profile: High (about 11.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: Loamy Lowland (PE 30-37) (R106XY013KS)

Description of Kimo

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty and clayey alluvium

Typical profile

A1 - 0 to 15 inches: fine sandy loam
A2 - 15 to 28 inches: silty clay
2C - 28 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 22 to 26 inches
Frequency of flooding: Rare
Frequency of ponding: Occasional
Available water storage in profile: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Ecological site: Loamy Lowland (PE 30-37) (R106XY013KS)

Minor Components

Sarpy

Percent of map unit: 10 percent
Ecological site: Sandy Lowland (PE 30-37) (R106XY023KS)

7261—Gymer silt loam, 3 to 7 percent slopes

Map Unit Setting

National map unit symbol: 1l9fm
Elevation: 700 to 2,000 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 175 to 215 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Gymer and similar soils: 88 percent
Minor components: 12 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gymer

Setting

Landform: Terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-silty alluvium

Typical profile

Ap - 0 to 6 inches: silt loam
AB - 6 to 15 inches: silt loam
Bt - 15 to 30 inches: silty clay loam
BC - 30 to 80 inches: silty clay loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Loamy Upland (PE 30-37) (R106XY015KS)

Minor Components

Morrill

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Ecological site: Loamy Upland (PE 30-37) (R106XY015KS)

Martin

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Ecological site: Loamy Upland (Draft) (PE 35-42) (R112XY015KS)

Thurman

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Ecological site: Savannah (PE 30-37) (R106XY025KS)

Sharpsburg

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Nose slope
Ecological site: Loamy Upland (PE 30-37) (R106XY015KS)

7535—Sharpsburg silt loam, 4 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2scy5
Elevation: 980 to 1,660 feet
Mean annual precipitation: 28 to 39 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 158 to 203 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sharpsburg and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sharpsburg

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loess

Typical profile

Ap - 0 to 6 inches: silt loam
A - 6 to 11 inches: silty clay loam
Bt1 - 11 to 18 inches: silty clay loam
Bt2 - 18 to 46 inches: silty clay loam
BC - 46 to 58 inches: silty clay loam
C - 58 to 79 inches: silty clay loam

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 45 to 50 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.0 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Loamy Upland (PE 30-37) (R106XY015KS)
Other vegetative classification: Loam (G106XY100NE)

Minor Components

Martin

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Upland (PE 30-37) (R106XY015KS)
Other vegetative classification: Loam (G106XY100NE)

Pawnee

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope

Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey Upland (R106XY074NE)
Other vegetative classification: Clayey Subsoil (G106XY210NE)

Morrill

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Upland (PE 30-37) (R106XY015KS)
Other vegetative classification: Loam (G106XY100NE)

9982—Fluvents, frequently flooded

Map Unit Setting

National map unit symbol: 1n89p
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 175 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Fluvents and similar soils: 100 percent
Minor components: 0 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fluvents

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-silty alluvium

Typical profile

A - 0 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 33 to 38 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: C

Minor Components

Aquolls

Percent of map unit: 0 percent
Landform: Drainageways, depressions
Down-slope shape: Concave
Across-slope shape: Concave

9999—Water

Map Unit Setting

National map unit symbol: 1l9hj
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 175 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

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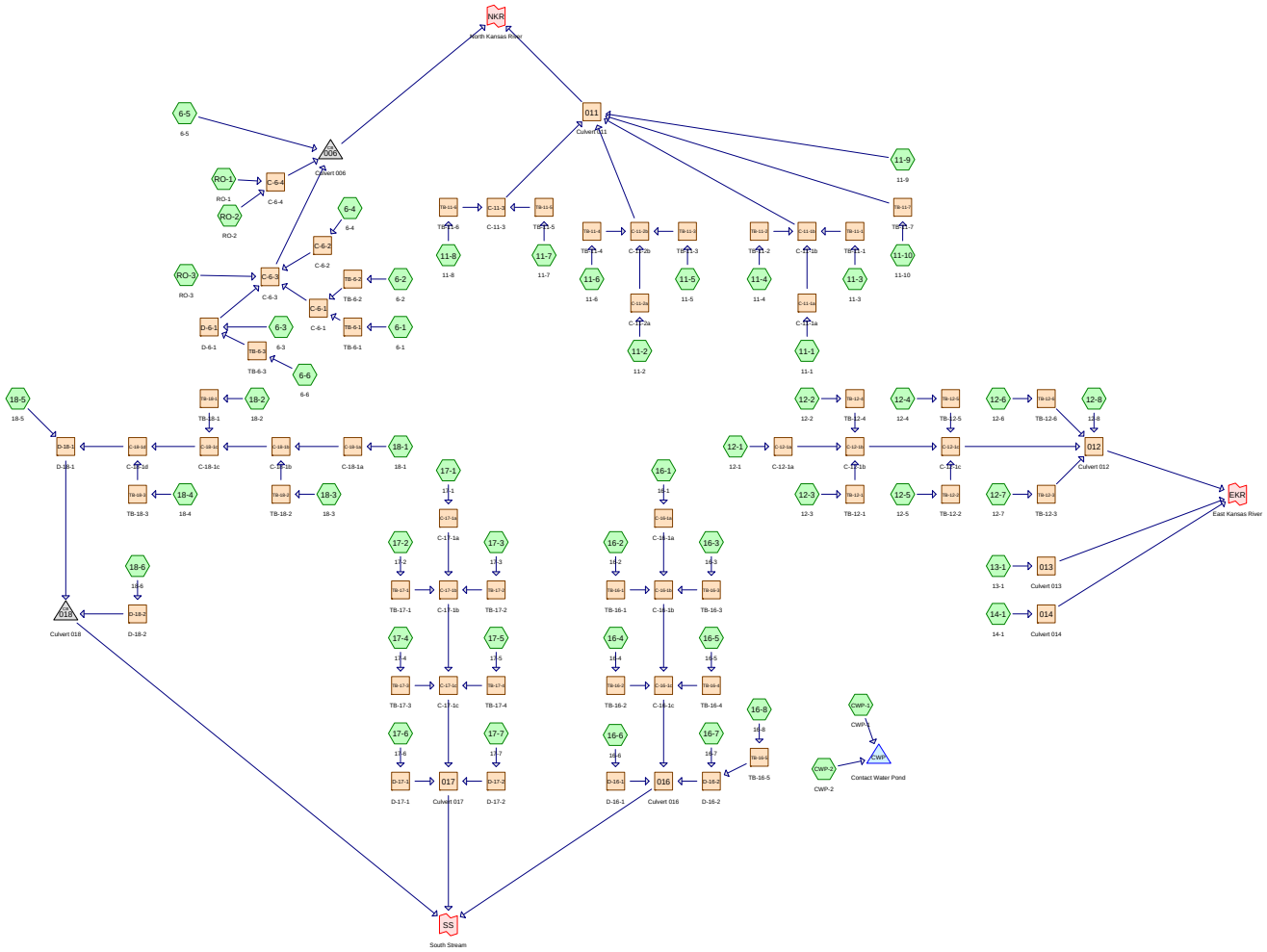
APPENDIX C

HydroCAD Output Files



Subcat Reach Pond Link

Routing Diagram for LEC Run-on and Run-off Control Plan - Feb. 2018

Prepared by Chicago Bridge and Iron Company, Printed 2/26/2018

Summary for Subcatchment 6-1: 6-1

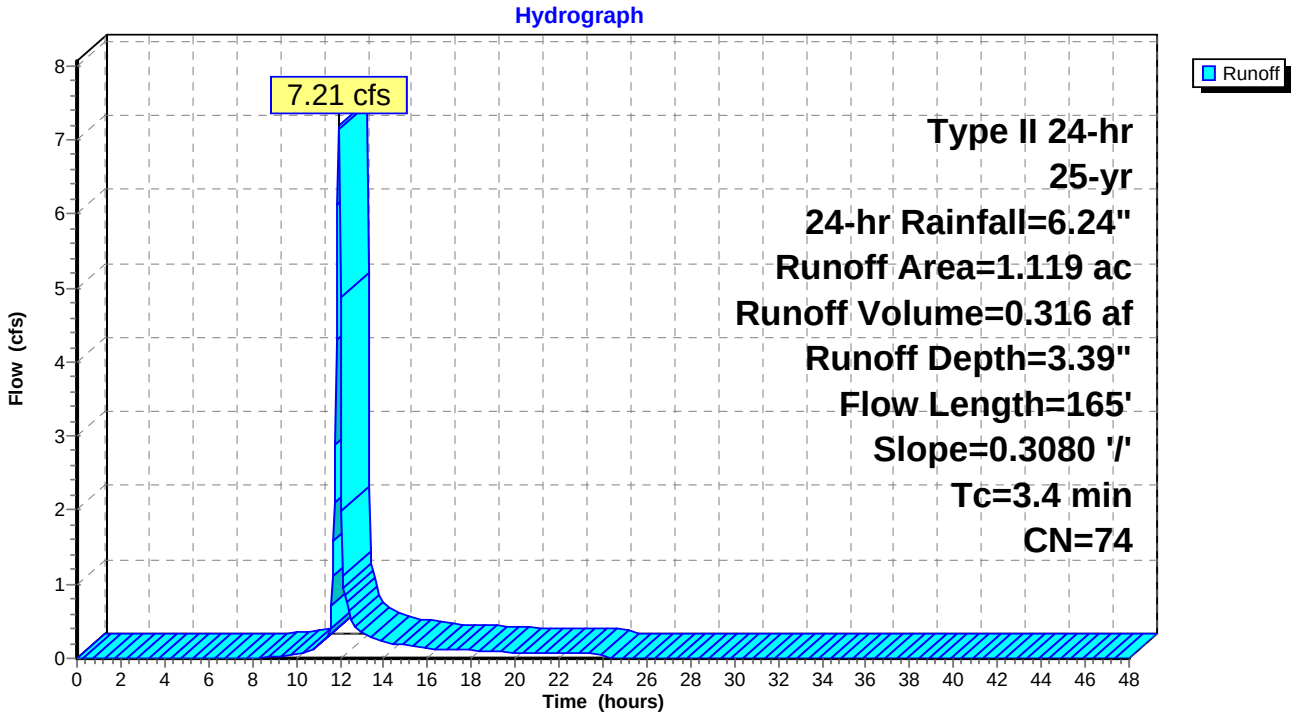
Runoff = 7.21 cfs @ 11.94 hrs, Volume= 0.316 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.119	74	>Pasture/grassland/range, Good, HSG C
1.119		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	100	0.3080	0.54		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.3	65	0.3080	3.88		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.4	165	Total			

Subcatchment 6-1: 6-1



Summary for Subcatchment 6-2: 6-2

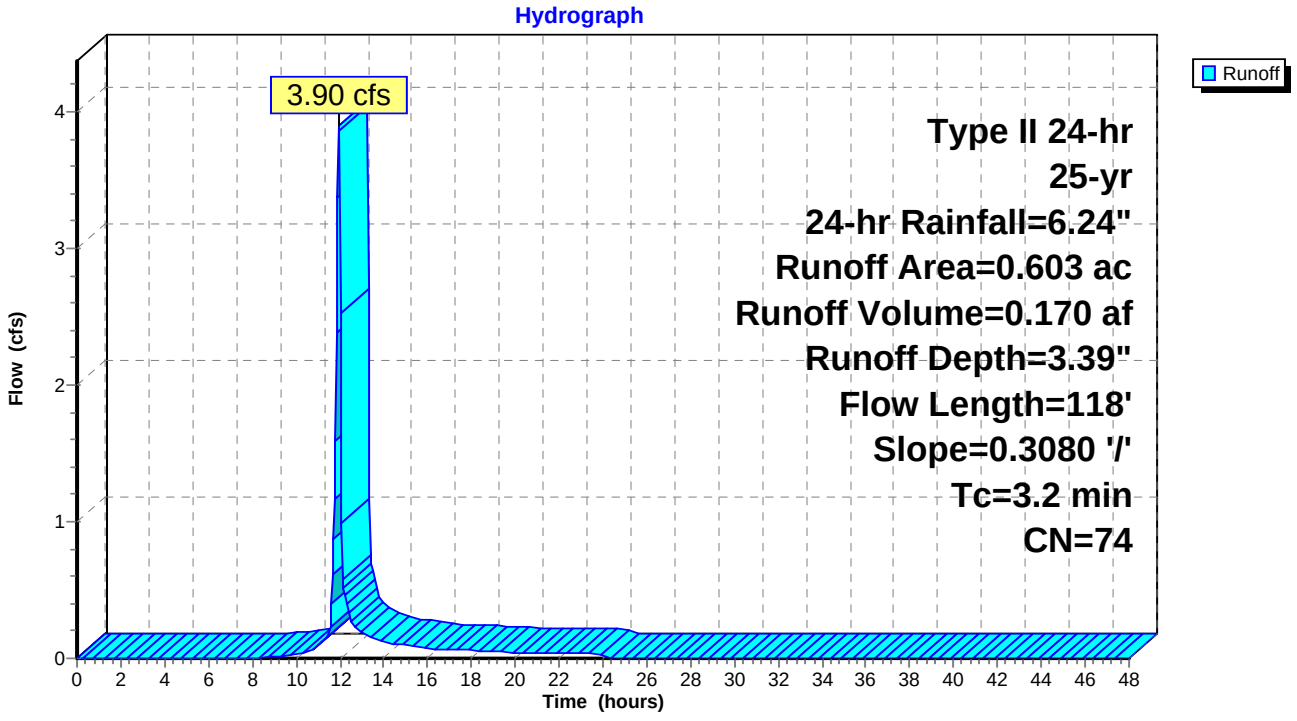
Runoff = 3.90 cfs @ 11.94 hrs, Volume= 0.170 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.603	74	>Pasture/grassland/range, Good, HSG C
0.603		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	100	0.3080	0.54		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.1	18	0.3080	3.88		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.2	118	Total			

Subcatchment 6-2: 6-2



Summary for Subcatchment 6-3: 6-3

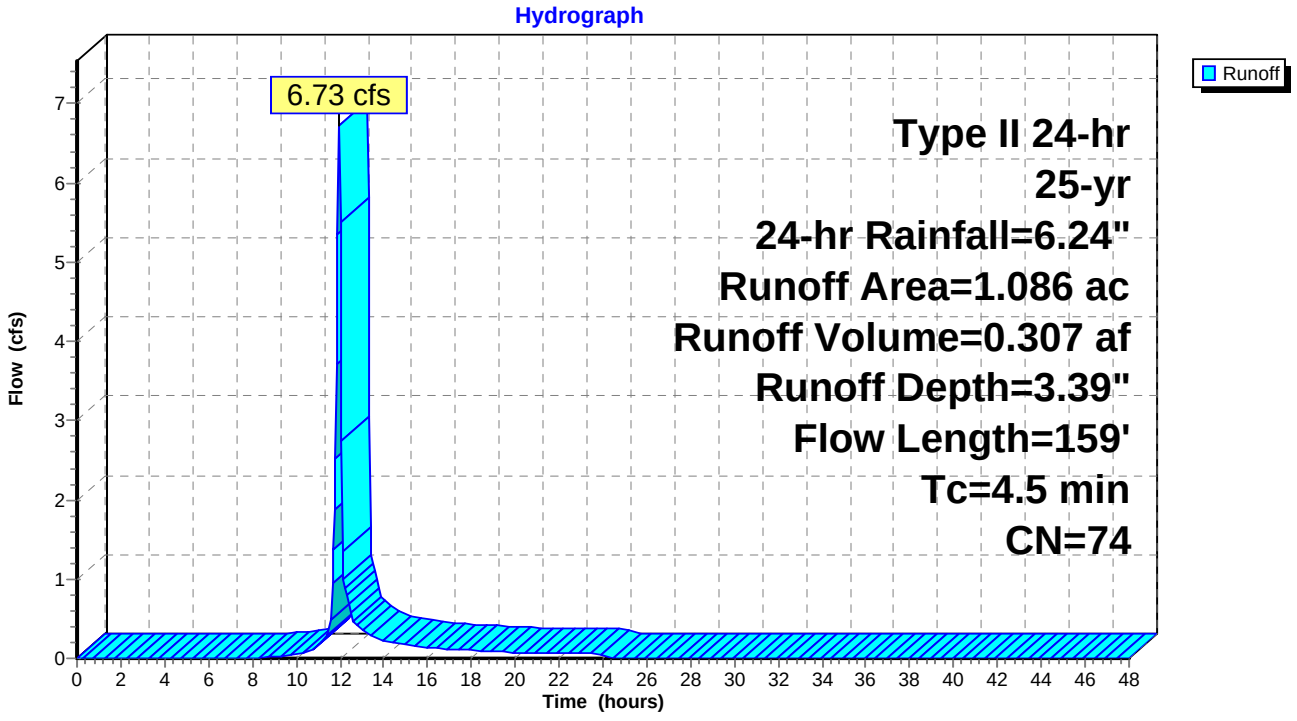
Runoff = 6.73 cfs @ 11.95 hrs, Volume= 0.307 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.086	74	>Pasture/grassland/range, Good, HSG C
1.086		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	100	0.3080	0.54		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.4	59	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.5	159	Total			

Subcatchment 6-3: 6-3



Summary for Subcatchment 6-4: 6-4

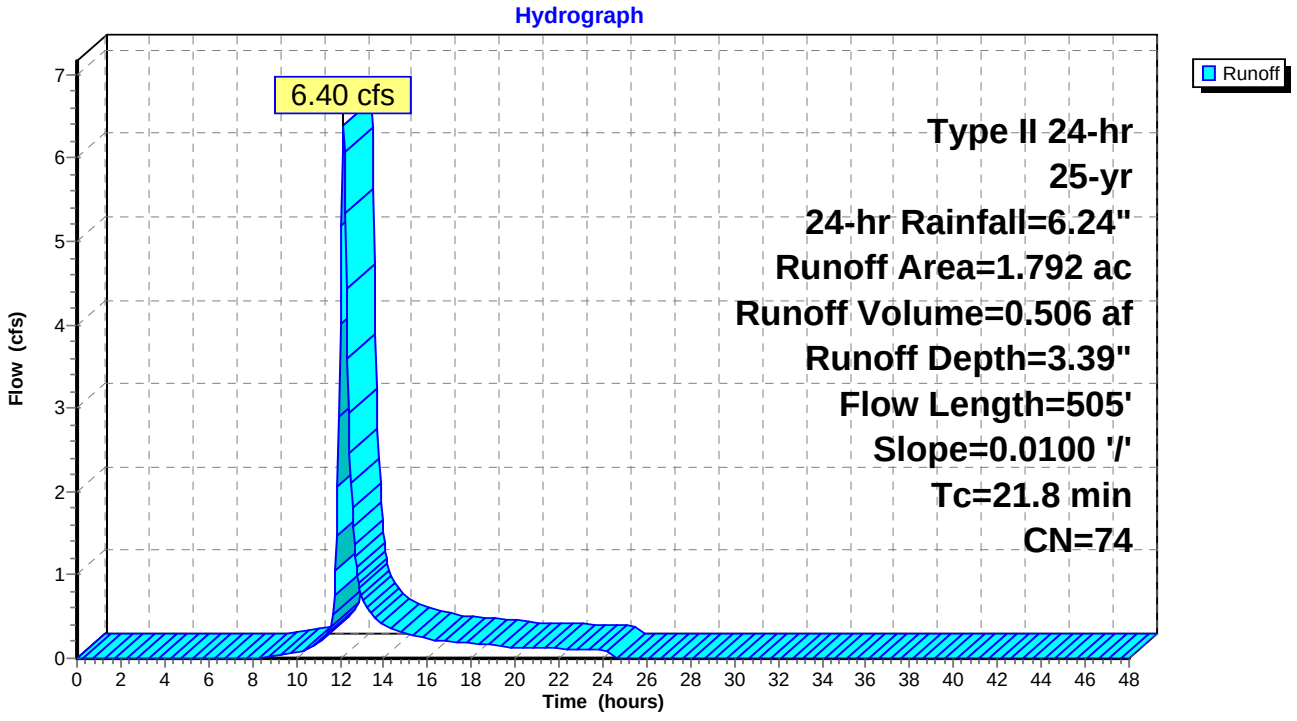
Runoff = 6.40 cfs @ 12.15 hrs, Volume= 0.506 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.792	74	>Pasture/grassland/range, Good, HSG C
1.792		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	100	0.0100	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
9.6	405	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
21.8	505	Total			

Subcatchment 6-4: 6-4



Summary for Subcatchment 6-5: 6-5

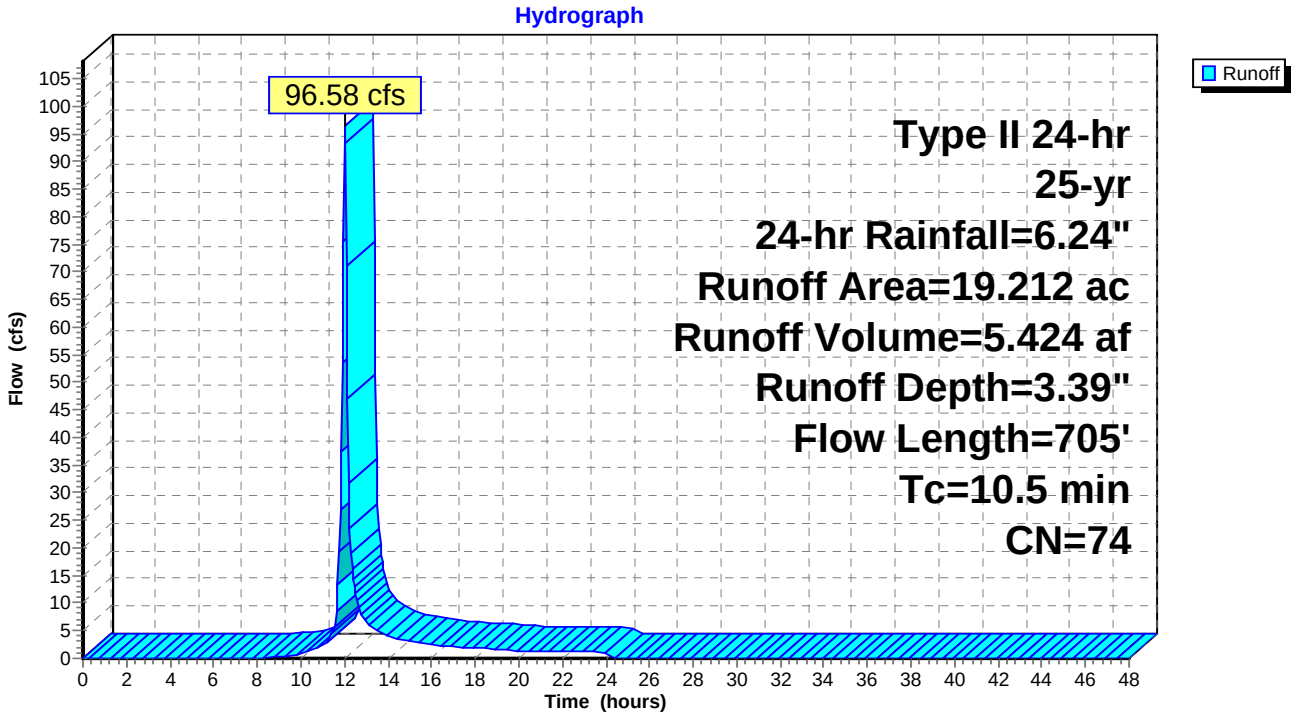
Runoff = 96.58 cfs @ 12.02 hrs, Volume= 5.424 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
19.212	74	>Pasture/grassland/range, Good, HSG C
19.212		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0500	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
2.6	244	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	361	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.5	705	Total			

Subcatchment 6-5: 6-5



Summary for Subcatchment 6-6: 6-6

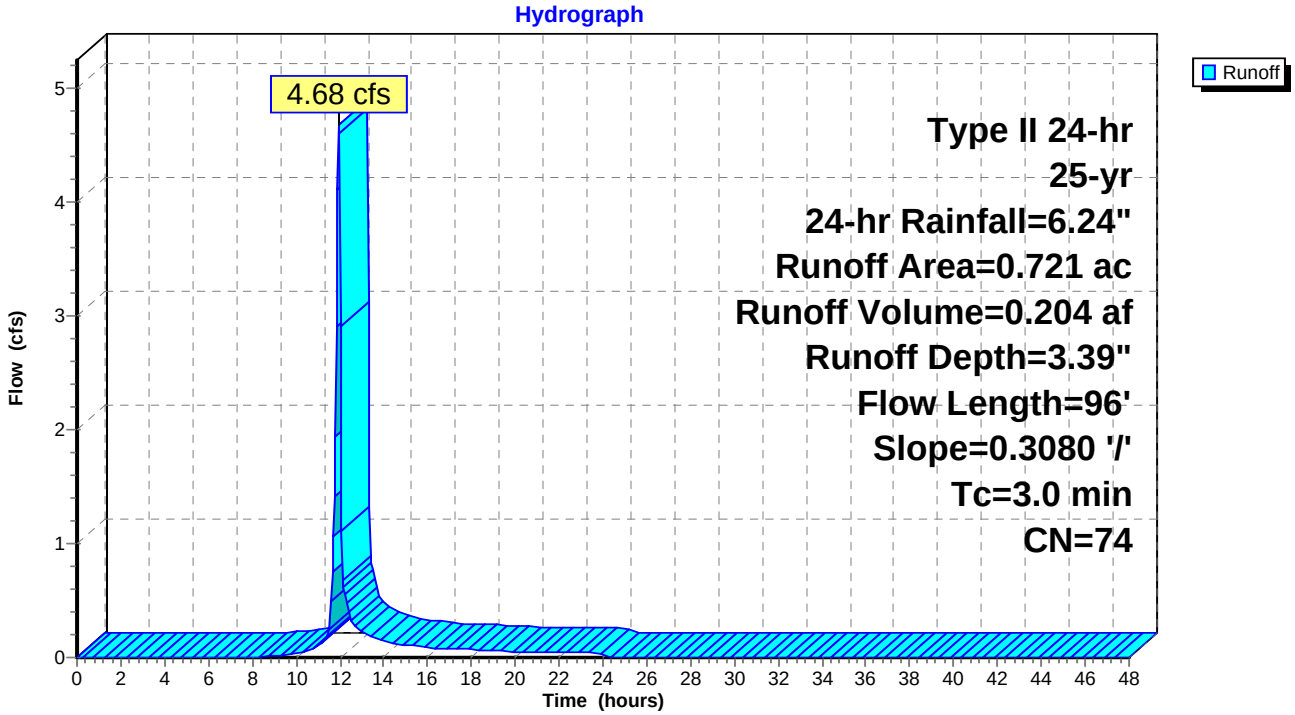
Runoff = 4.68 cfs @ 11.94 hrs, Volume= 0.204 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.721	74	>Pasture/grassland/range, Good, HSG C
0.721		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	96	0.3080	0.53		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"

Subcatchment 6-6: 6-6



Summary for Subcatchment 11-1: 11-1

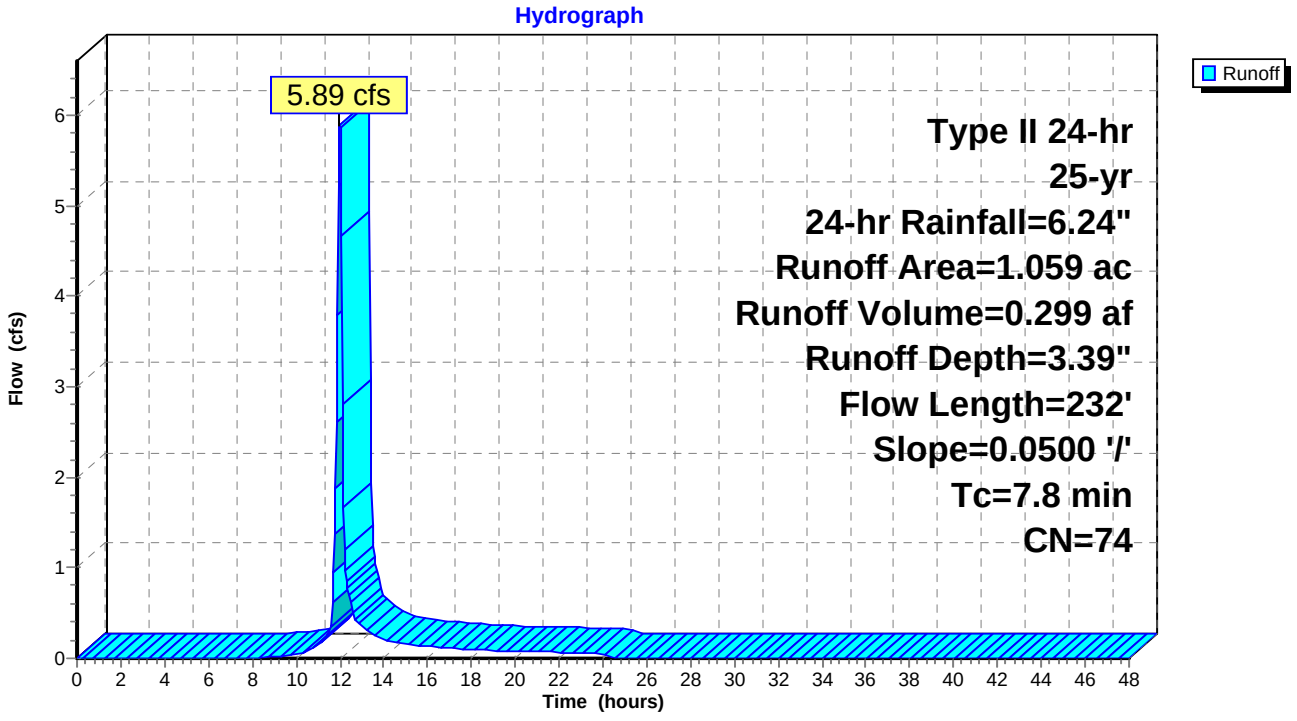
Runoff = 5.89 cfs @ 11.99 hrs, Volume= 0.299 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.059	74	>Pasture/grassland/range, Good, HSG C
1.059		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0500	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.4	132	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.8	232	Total			

Subcatchment 11-1: 11-1



Summary for Subcatchment 11-10: 11-10

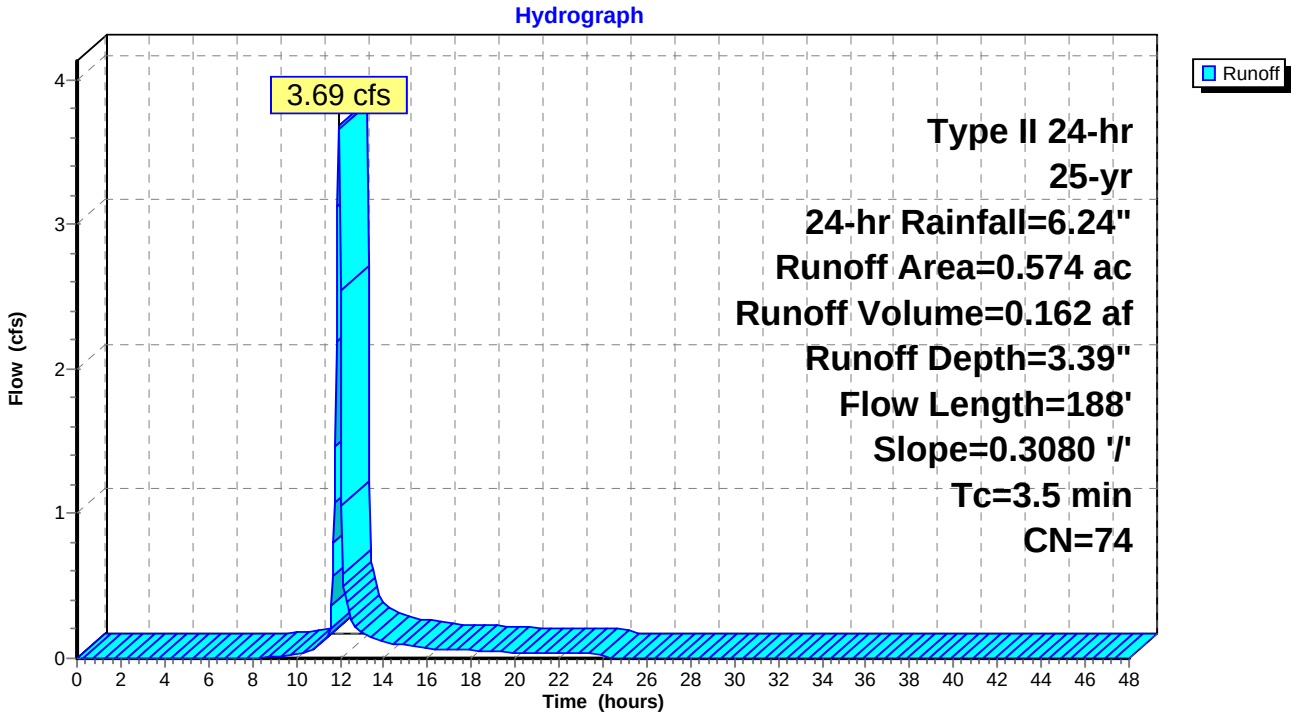
Runoff = 3.69 cfs @ 11.94 hrs, Volume= 0.162 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.574	74	>Pasture/grassland/range, Good, HSG C
0.574		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	100	0.3080	0.54		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.4	88	0.3080	3.88		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.5	188	Total			

Subcatchment 11-10: 11-10



Summary for Subcatchment 11-2: 11-2

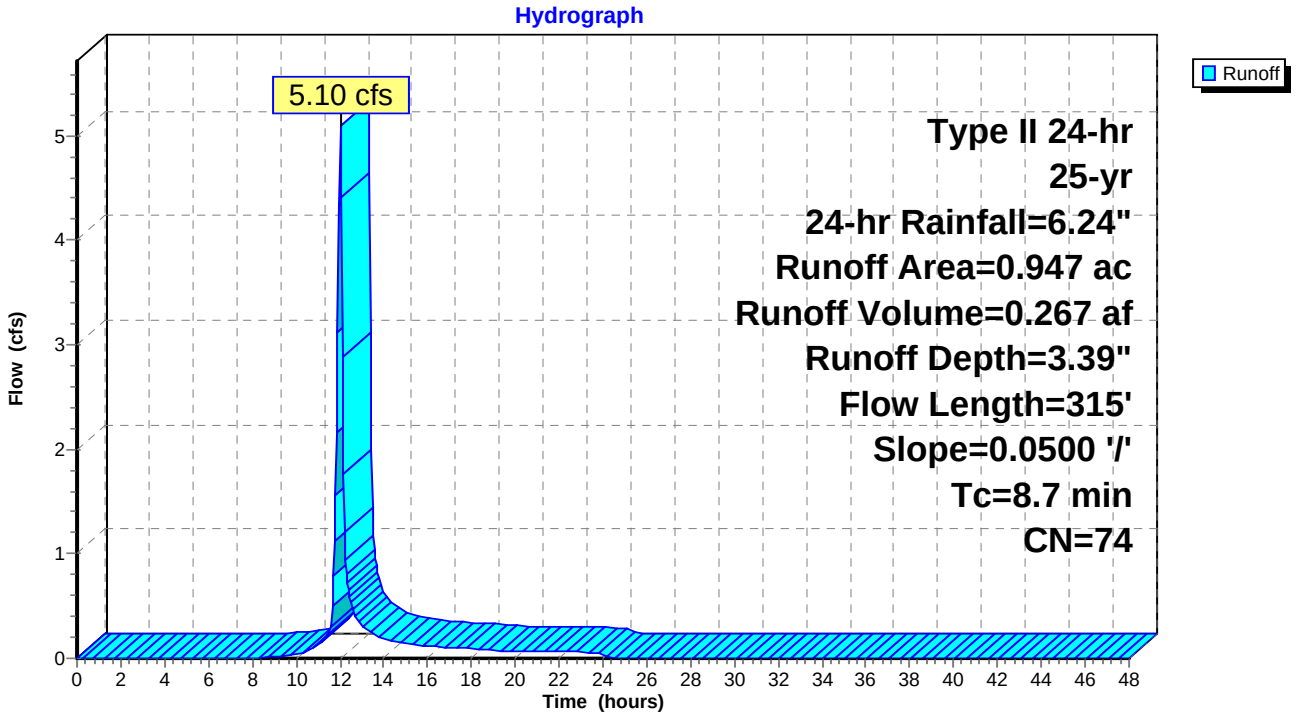
Runoff = 5.10 cfs @ 12.00 hrs, Volume= 0.267 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.947	74	>Pasture/grassland/range, Good, HSG C
0.947		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0500	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
2.3	215	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.7	315	Total			

Subcatchment 11-2: 11-2



Summary for Subcatchment 11-3: 11-3

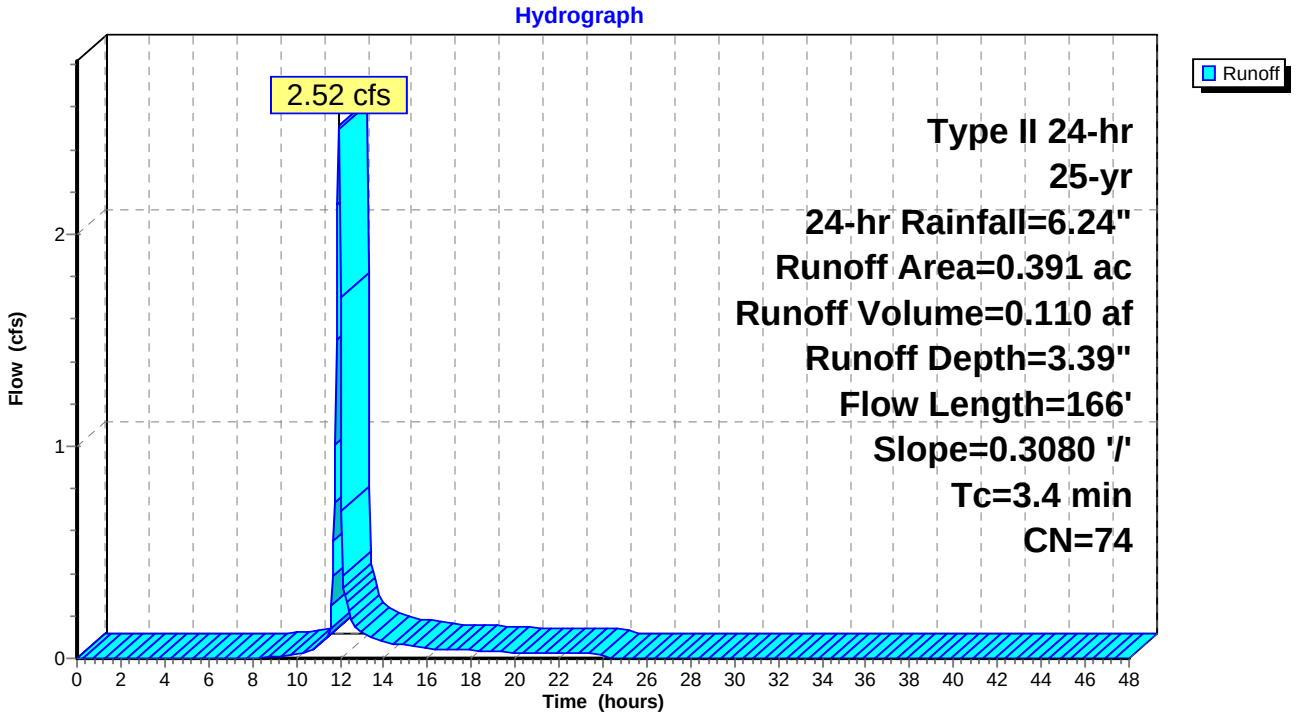
Runoff = 2.52 cfs @ 11.94 hrs, Volume= 0.110 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.391	74	>Pasture/grassland/range, Good, HSG C
0.391		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	100	0.3080	0.54		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.3	66	0.3080	3.88		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.4	166	Total			

Subcatchment 11-3: 11-3



Summary for Subcatchment 11-4: 11-4

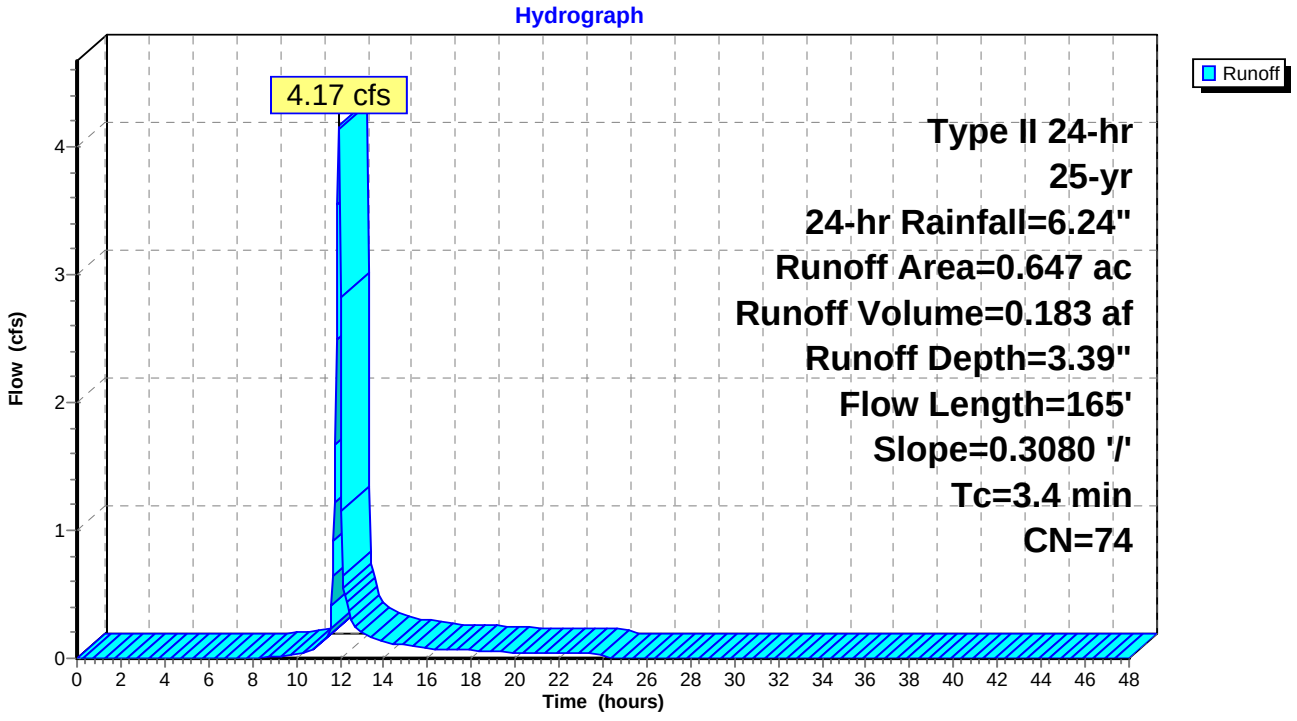
Runoff = 4.17 cfs @ 11.94 hrs, Volume= 0.183 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.647	74	>Pasture/grassland/range, Good, HSG C
0.647		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	100	0.3080	0.54		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.3	65	0.3080	3.88		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.4	165	Total			

Subcatchment 11-4: 11-4



Summary for Subcatchment 11-5: 11-5

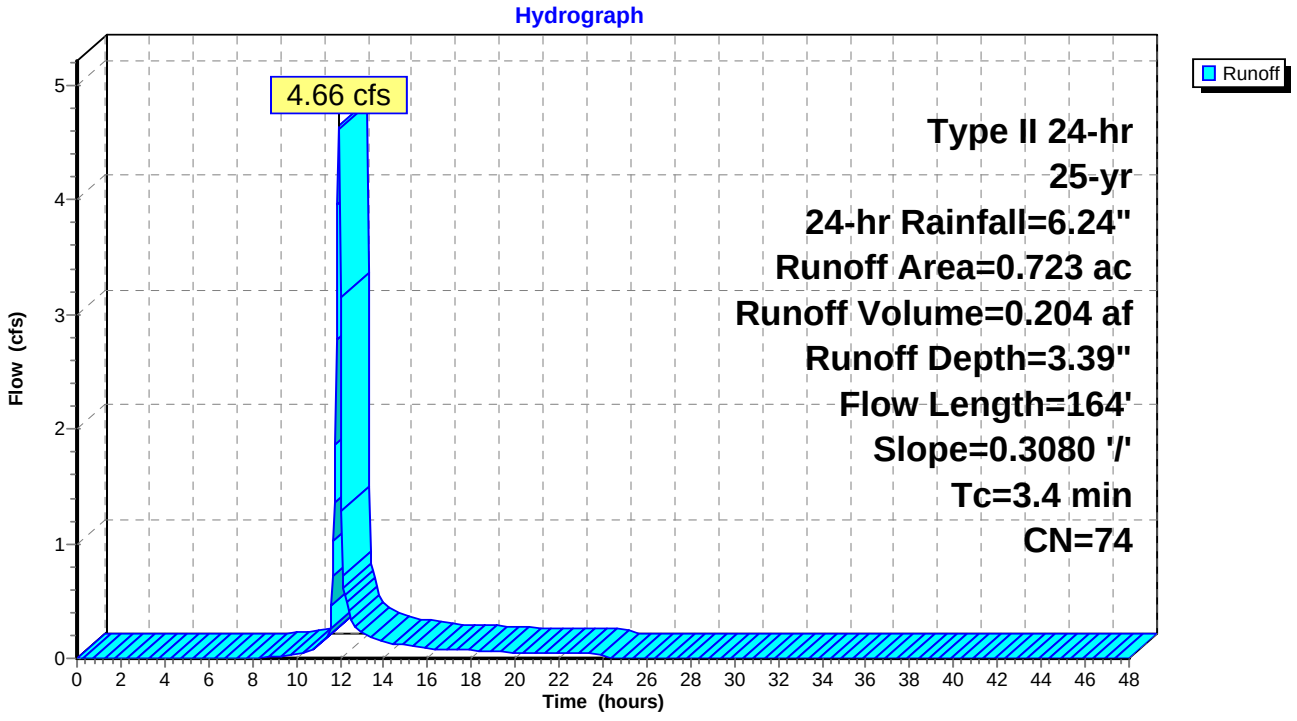
Runoff = 4.66 cfs @ 11.94 hrs, Volume= 0.204 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.723	74	>Pasture/grassland/range, Good, HSG C
0.723		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	100	0.3080	0.54		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.3	64	0.3080	3.88		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.4	164	Total			

Subcatchment 11-5: 11-5



Summary for Subcatchment 11-6: 11-6

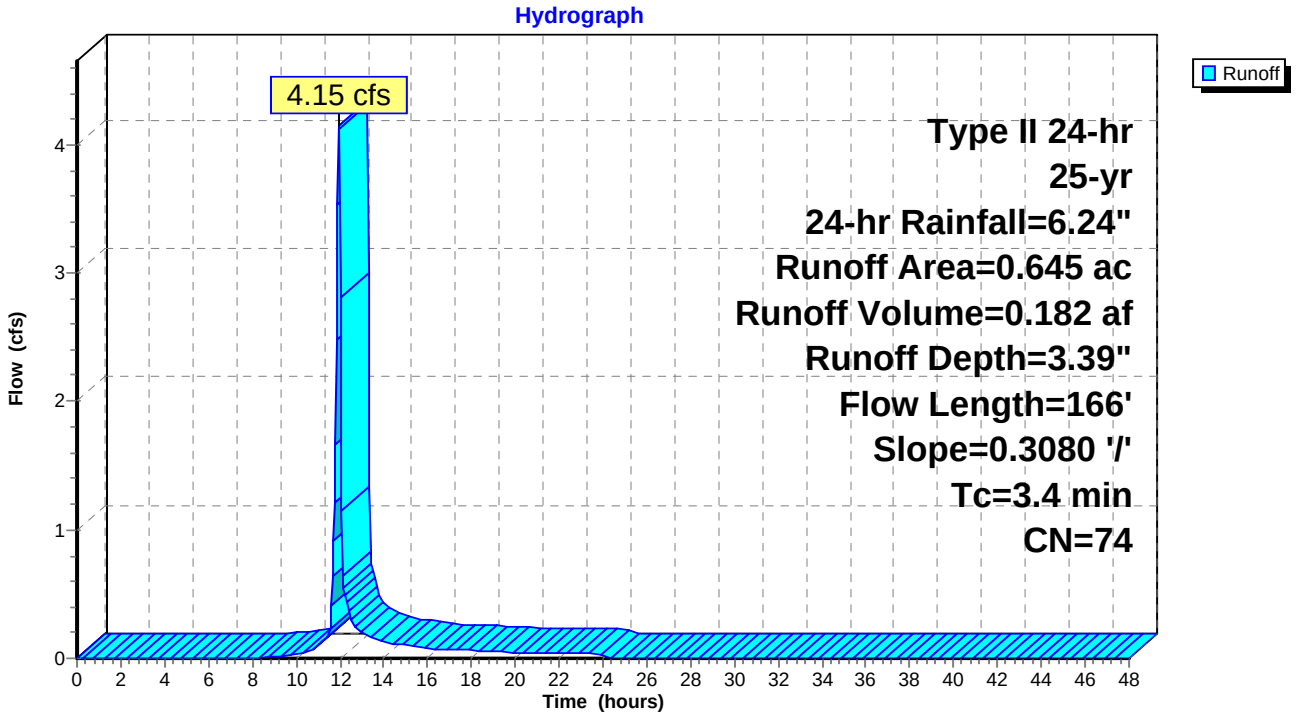
Runoff = 4.15 cfs @ 11.94 hrs, Volume= 0.182 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.645	74	>Pasture/grassland/range, Good, HSG C
0.645		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	100	0.3080	0.54		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.3	66	0.3080	3.88		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.4	166	Total			

Subcatchment 11-6: 11-6



Summary for Subcatchment 11-7: 11-7

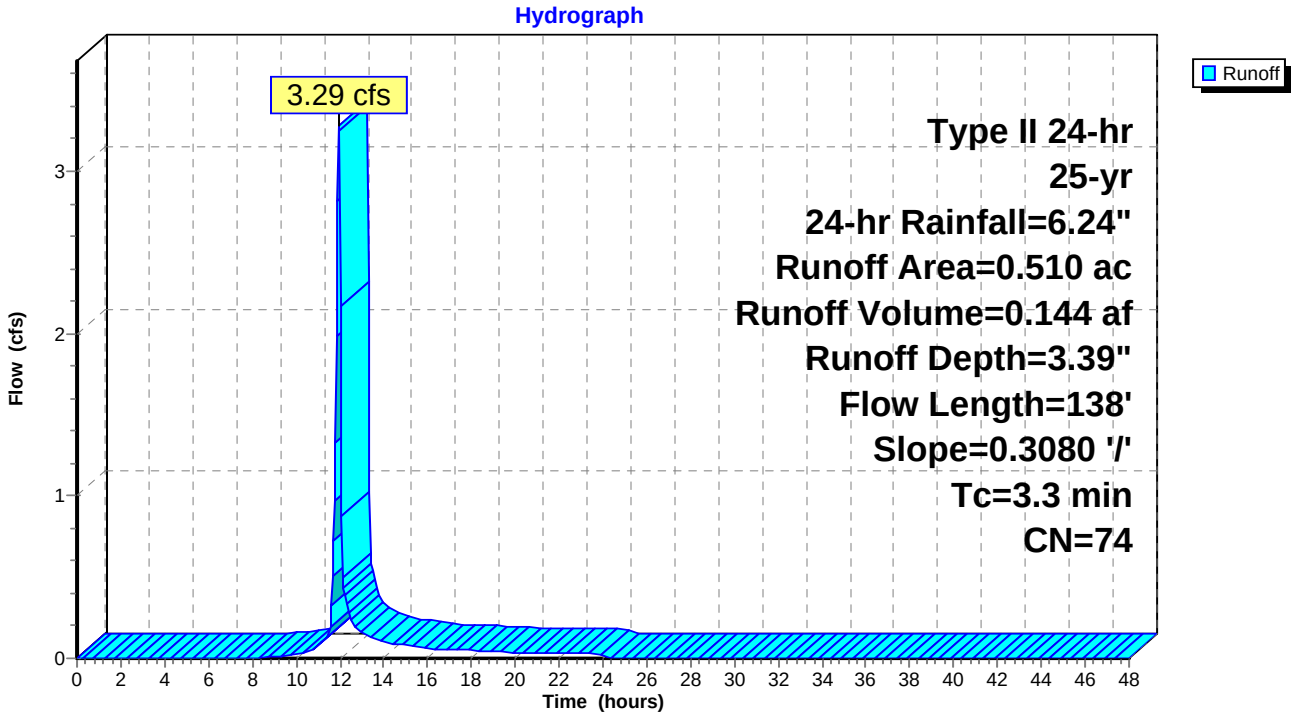
Runoff = 3.29 cfs @ 11.94 hrs, Volume= 0.144 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.510	74	>Pasture/grassland/range, Good, HSG C
0.510		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	100	0.3080	0.54		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.2	38	0.3080	3.88		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.3	138	Total			

Subcatchment 11-7: 11-7



Summary for Subcatchment 11-8: 11-8

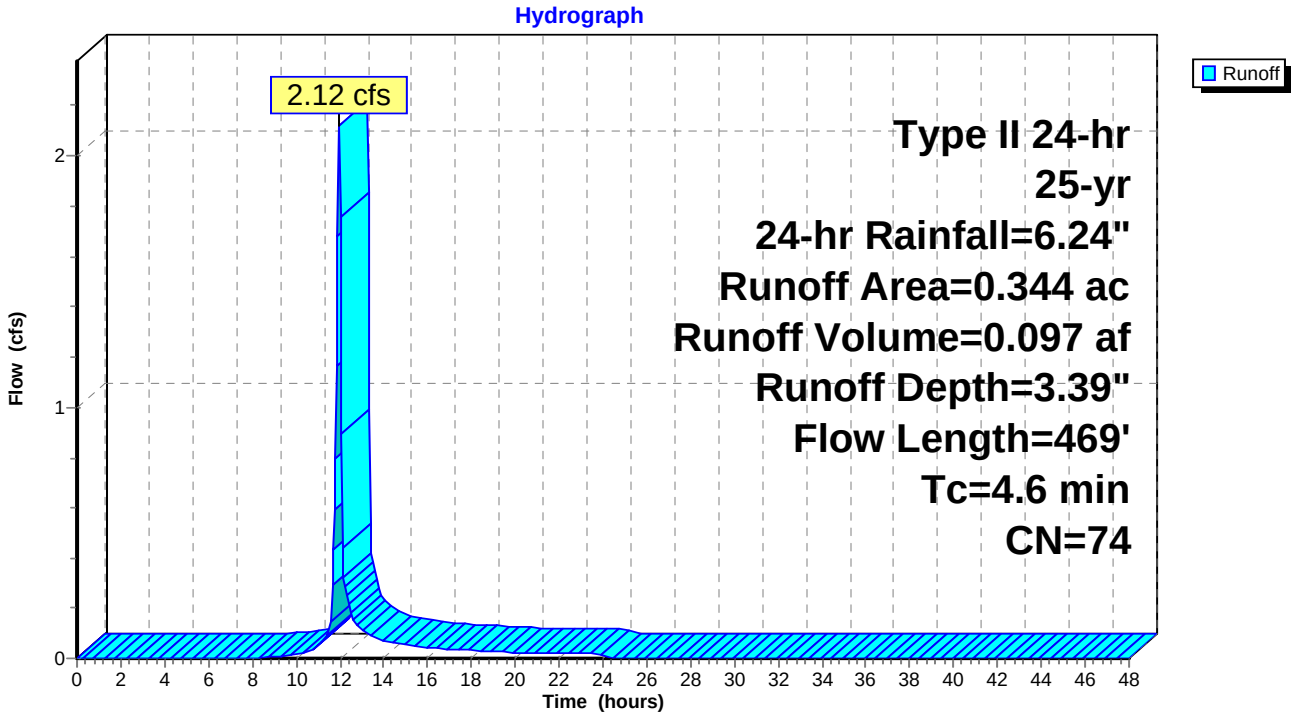
Runoff = 2.12 cfs @ 11.95 hrs, Volume= 0.097 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.344	74	>Pasture/grassland/range, Good, HSG C
0.344		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	100	0.3080	0.54		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.0	8	0.3080	3.88		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	361	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.6	469	Total			

Subcatchment 11-8: 11-8



Summary for Subcatchment 11-9: 11-9

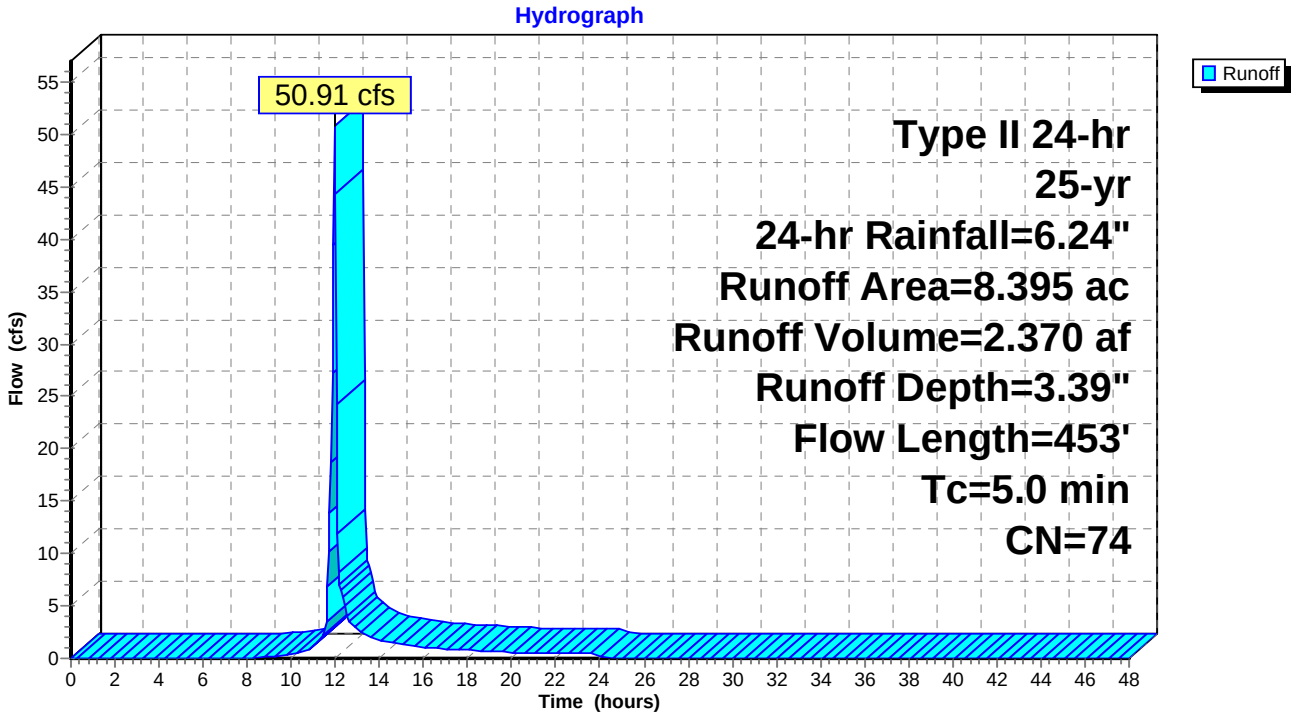
Runoff = 50.91 cfs @ 11.96 hrs, Volume= 2.370 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
8.395	74	>Pasture/grassland/range, Good, HSG C
8.395		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.6	119	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.0	234	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.0	453	Total			

Subcatchment 11-9: 11-9



Summary for Subcatchment 12-1: 12-1

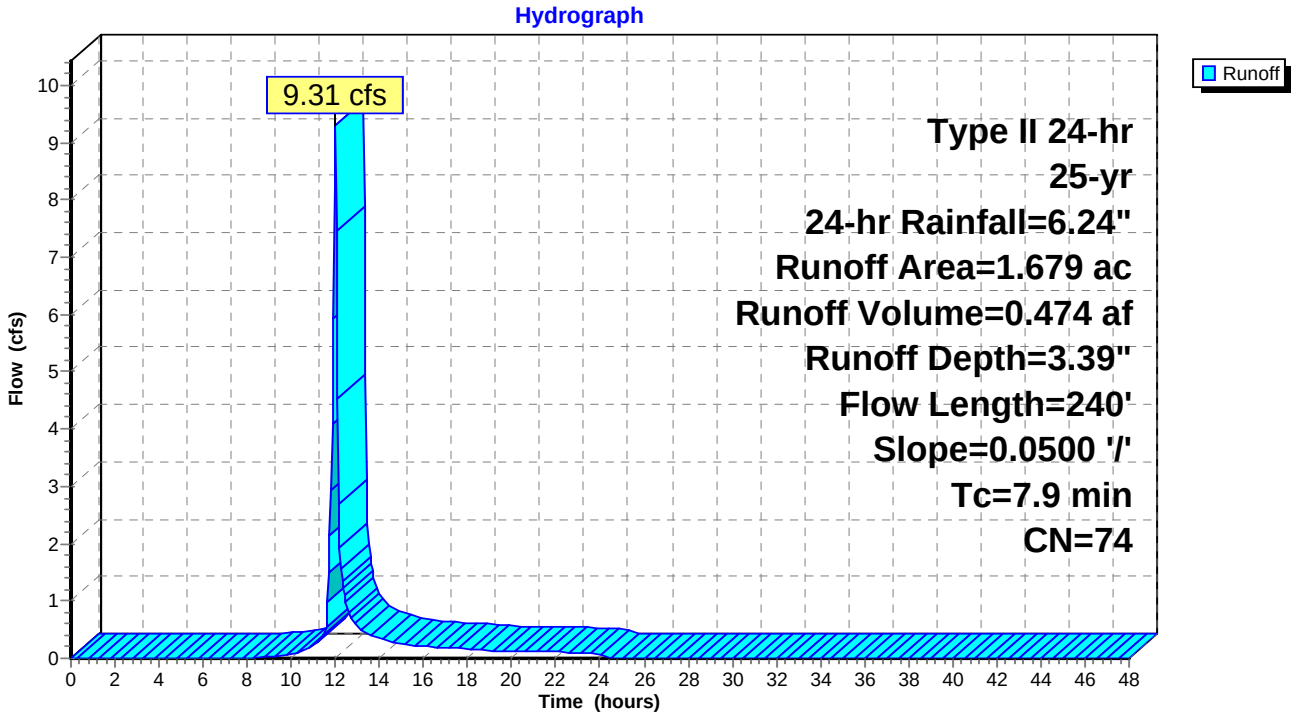
Runoff = 9.31 cfs @ 11.99 hrs, Volume= 0.474 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.679	74	>Pasture/grassland/range, Good, HSG C
1.679		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0500	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.5	140	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.9	240	Total			

Subcatchment 12-1: 12-1



Summary for Subcatchment 12-2: 12-2

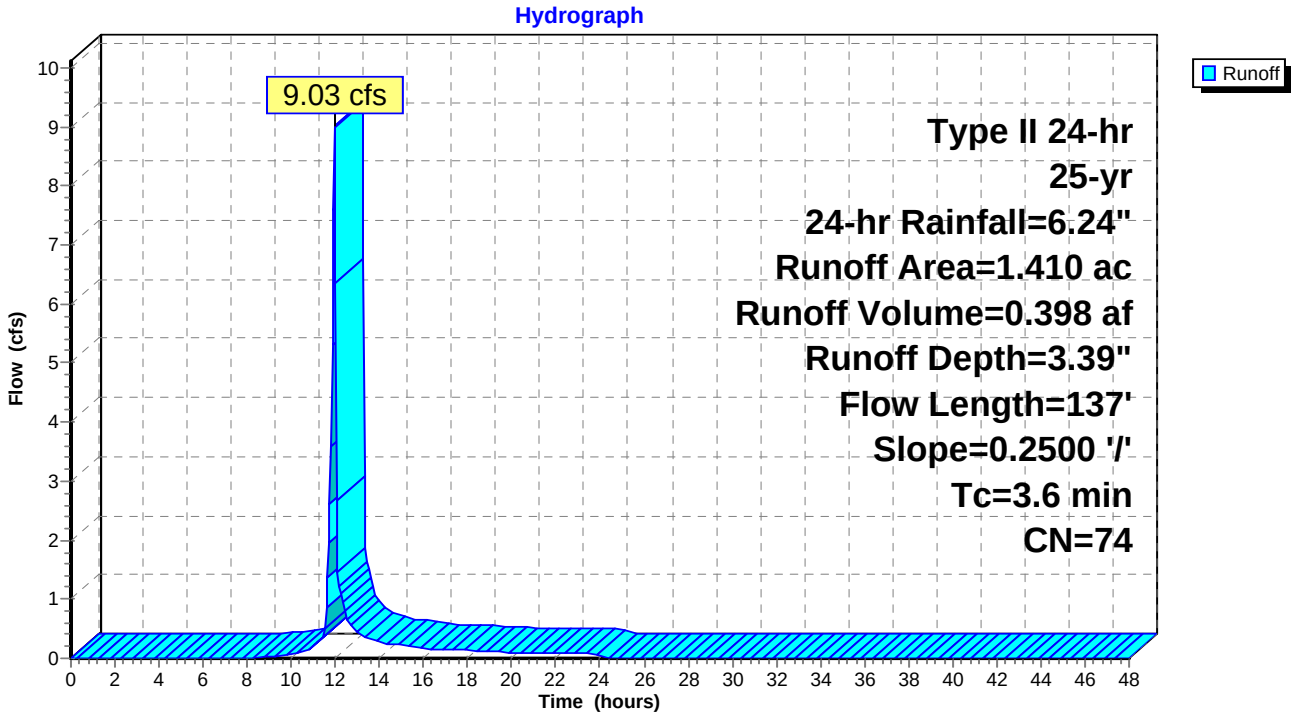
Runoff = 9.03 cfs @ 11.94 hrs, Volume= 0.398 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.410	74	>Pasture/grassland/range, Good, HSG C
1.410		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.2	37	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	137	Total			

Subcatchment 12-2: 12-2



Summary for Subcatchment 12-3: 12-3

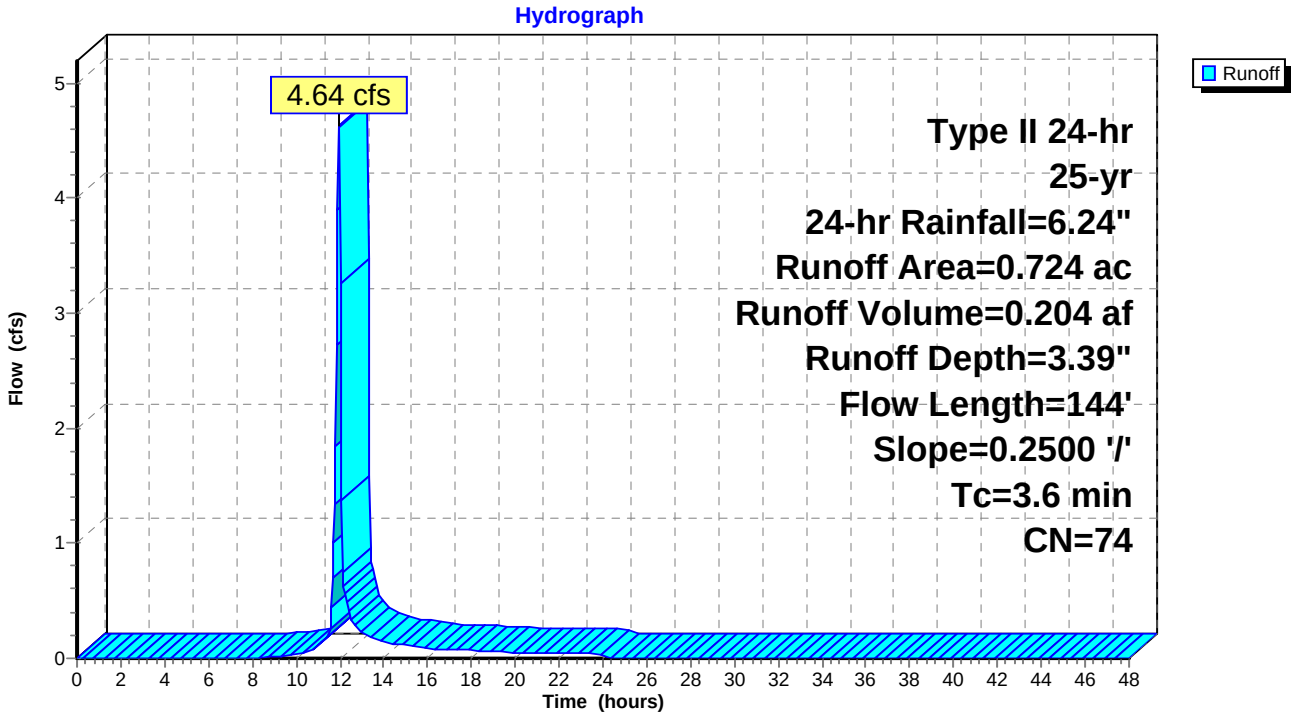
Runoff = 4.64 cfs @ 11.94 hrs, Volume= 0.204 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.724	74	>Pasture/grassland/range, Good, HSG C
0.724		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.2	44	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	144	Total			

Subcatchment 12-3: 12-3



Summary for Subcatchment 12-4: 12-4

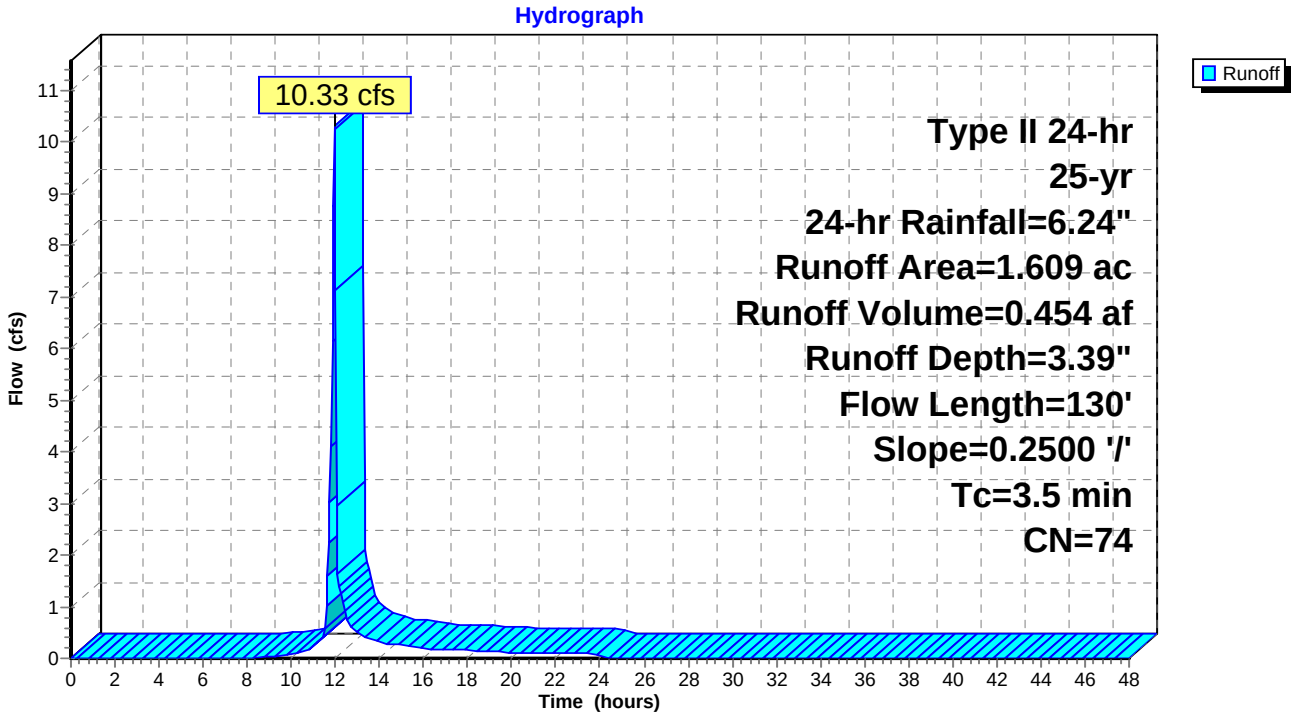
Runoff = 10.33 cfs @ 11.94 hrs, Volume= 0.454 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.609	74	>Pasture/grassland/range, Good, HSG C
1.609		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.1	30	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.5	130	Total			

Subcatchment 12-4: 12-4



Summary for Subcatchment 12-5: 12-5

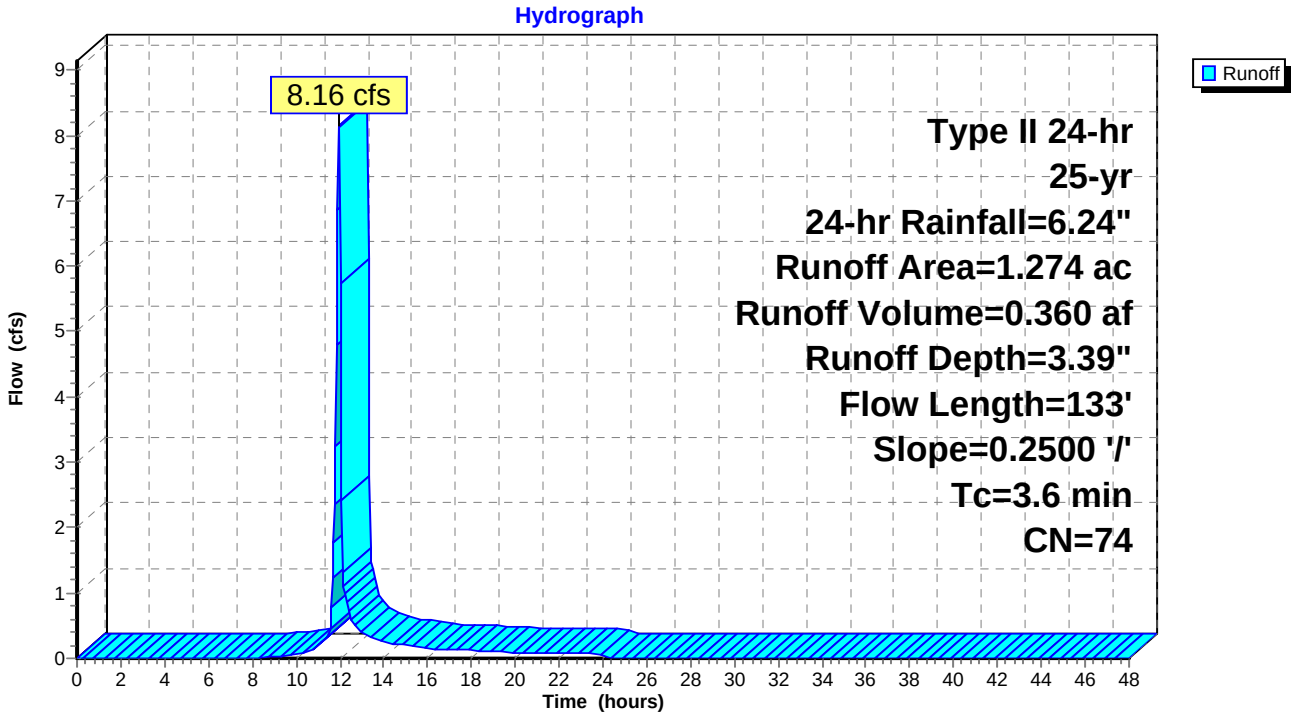
Runoff = 8.16 cfs @ 11.94 hrs, Volume= 0.360 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.274	74	>Pasture/grassland/range, Good, HSG C
1.274		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.2	33	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	133	Total			

Subcatchment 12-5: 12-5



Summary for Subcatchment 12-6: 12-6

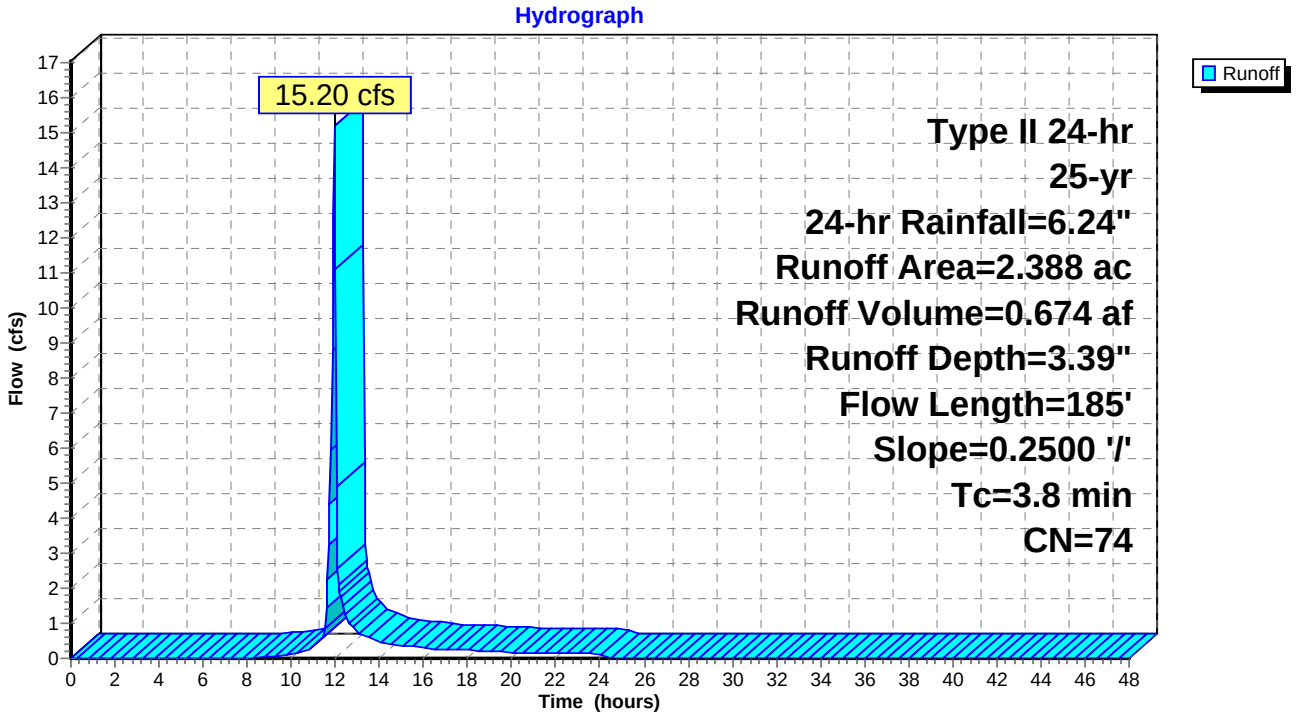
Runoff = 15.20 cfs @ 11.94 hrs, Volume= 0.674 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
2.388	74	>Pasture/grassland/range, Good, HSG C
2.388		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.4	85	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.8	185	Total			

Subcatchment 12-6: 12-6



Summary for Subcatchment 12-7: 12-7

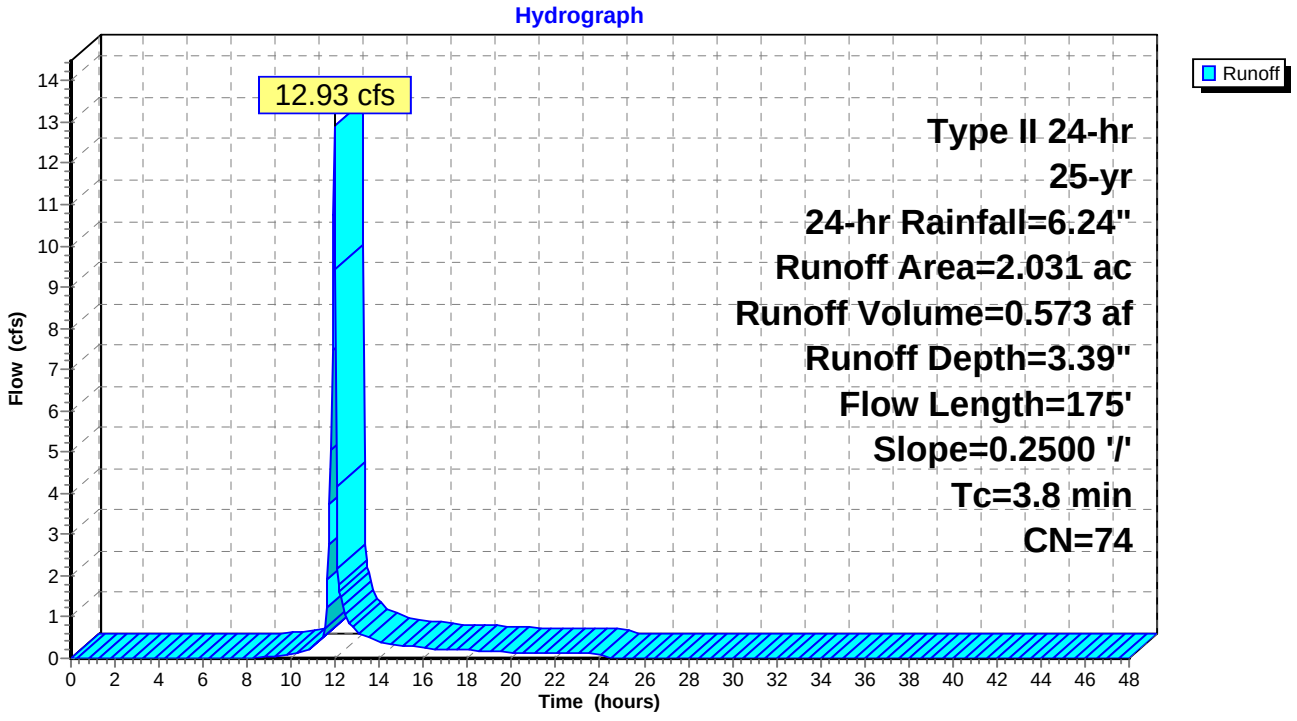
Runoff = 12.93 cfs @ 11.94 hrs, Volume= 0.573 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
2.031	74	>Pasture/grassland/range, Good, HSG C
2.031		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.4	75	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.8	175	Total			

Subcatchment 12-7: 12-7



Summary for Subcatchment 12-8: 12-8

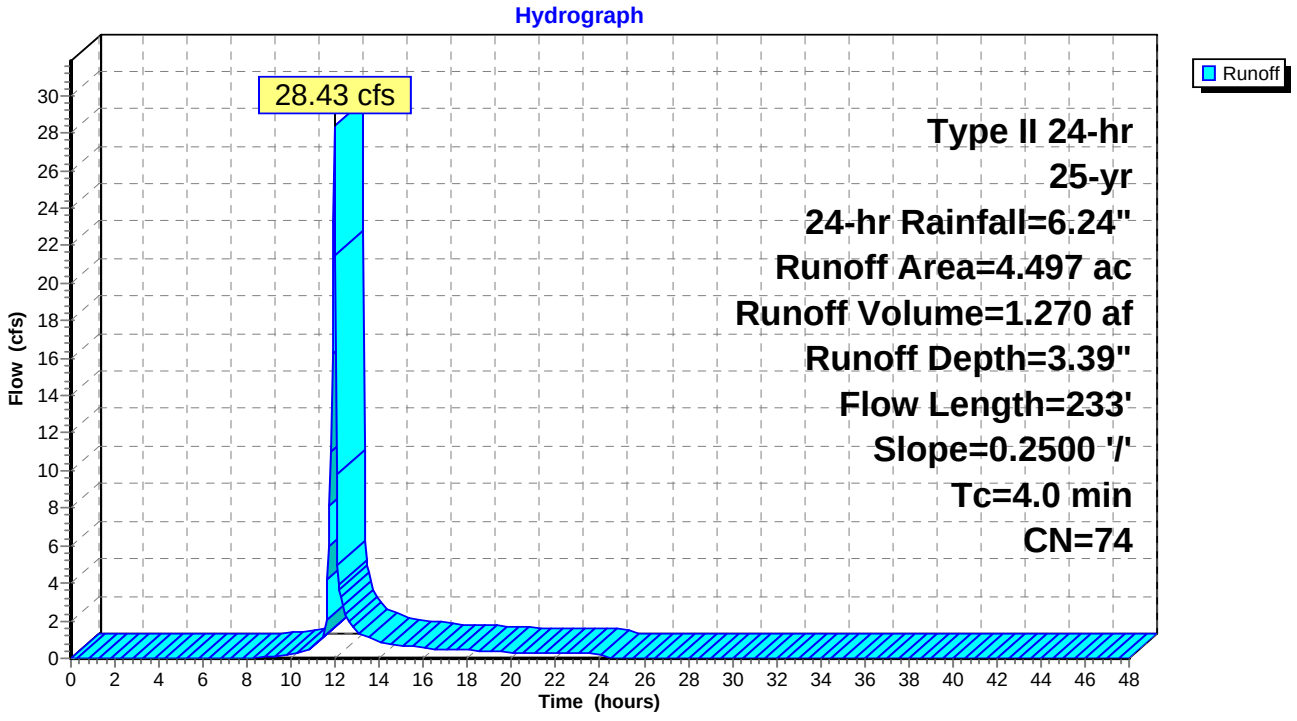
Runoff = 28.43 cfs @ 11.95 hrs, Volume= 1.270 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
4.497	74	>Pasture/grassland/range, Good, HSG C
4.497		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.6	133	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.0	233	Total			

Subcatchment 12-8: 12-8



Summary for Subcatchment 13-1: 13-1

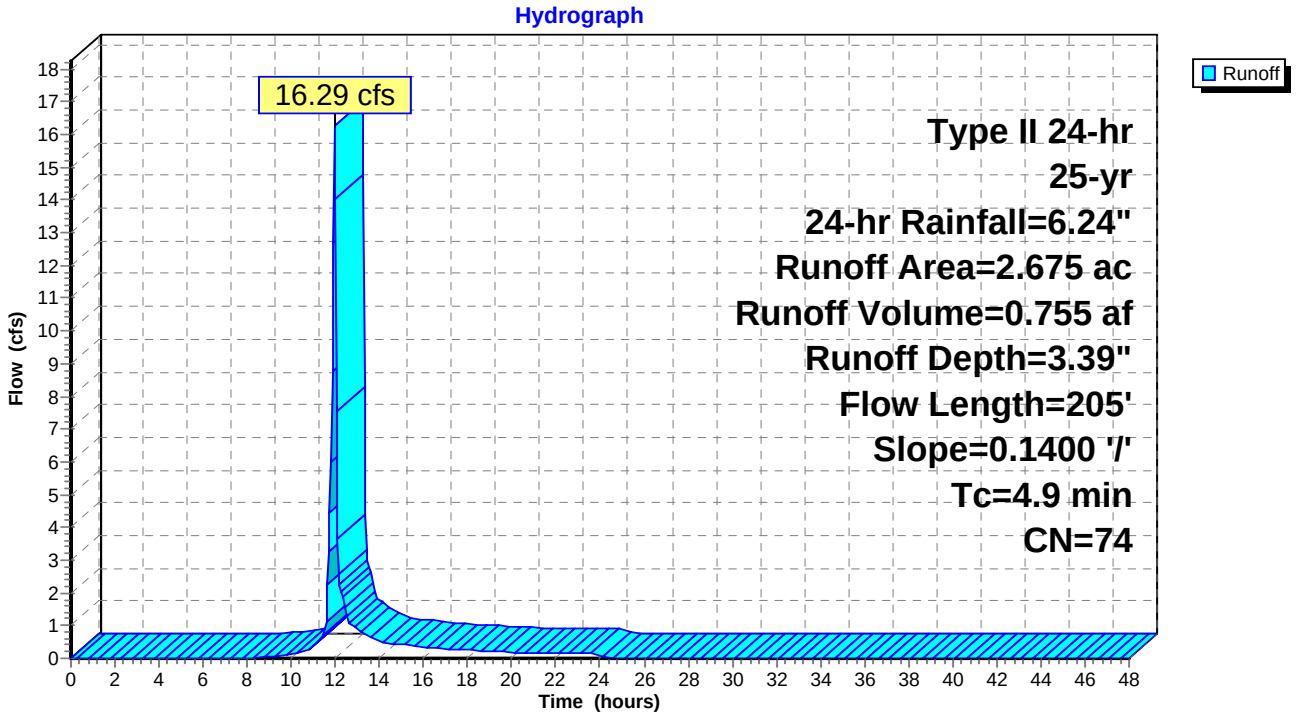
Runoff = 16.29 cfs @ 11.96 hrs, Volume= 0.755 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
2.675	74	>Pasture/grassland/range, Good, HSG C
2.675		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	100	0.1400	0.39		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.7	105	0.1400	2.62		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.9	205	Total			

Subcatchment 13-1: 13-1



Summary for Subcatchment 14-1: 14-1

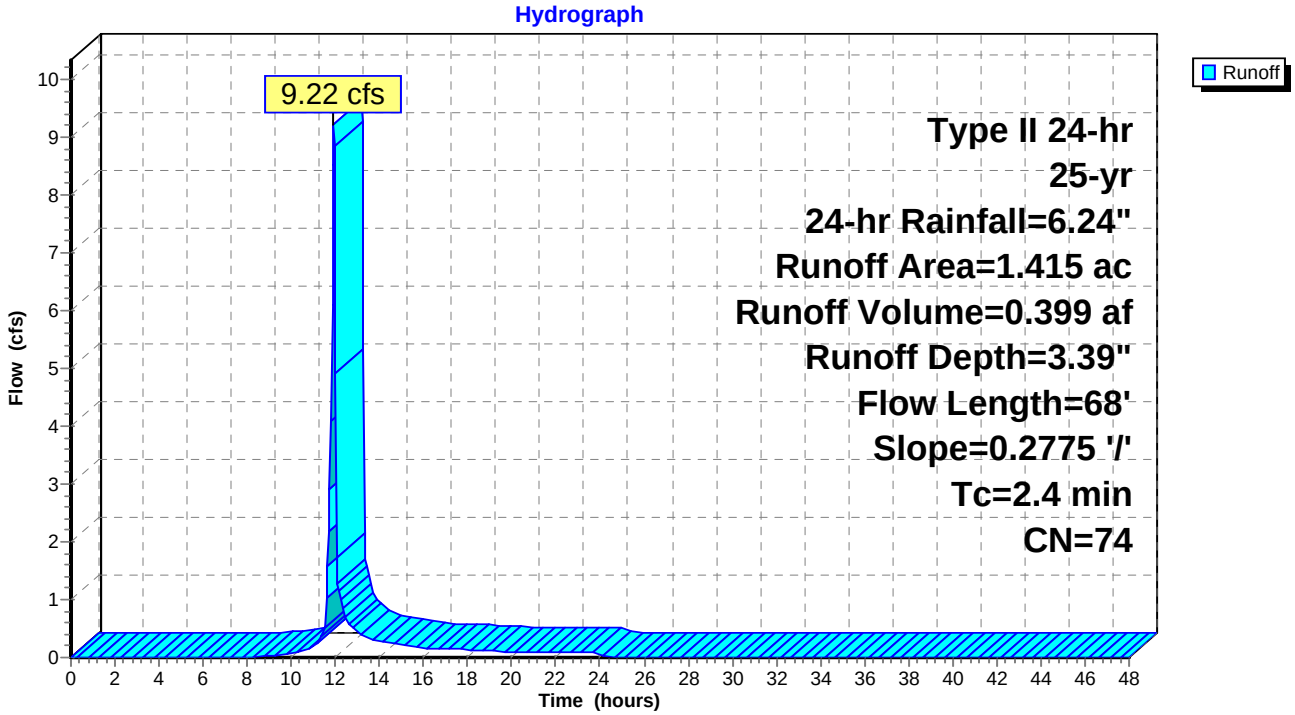
Runoff = 9.22 cfs @ 11.93 hrs, Volume= 0.399 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.415	74	>Pasture/grassland/range, Good, HSG C
1.415		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	68	0.2775	0.48		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"

Subcatchment 14-1: 14-1



Summary for Subcatchment 16-1: 16-1

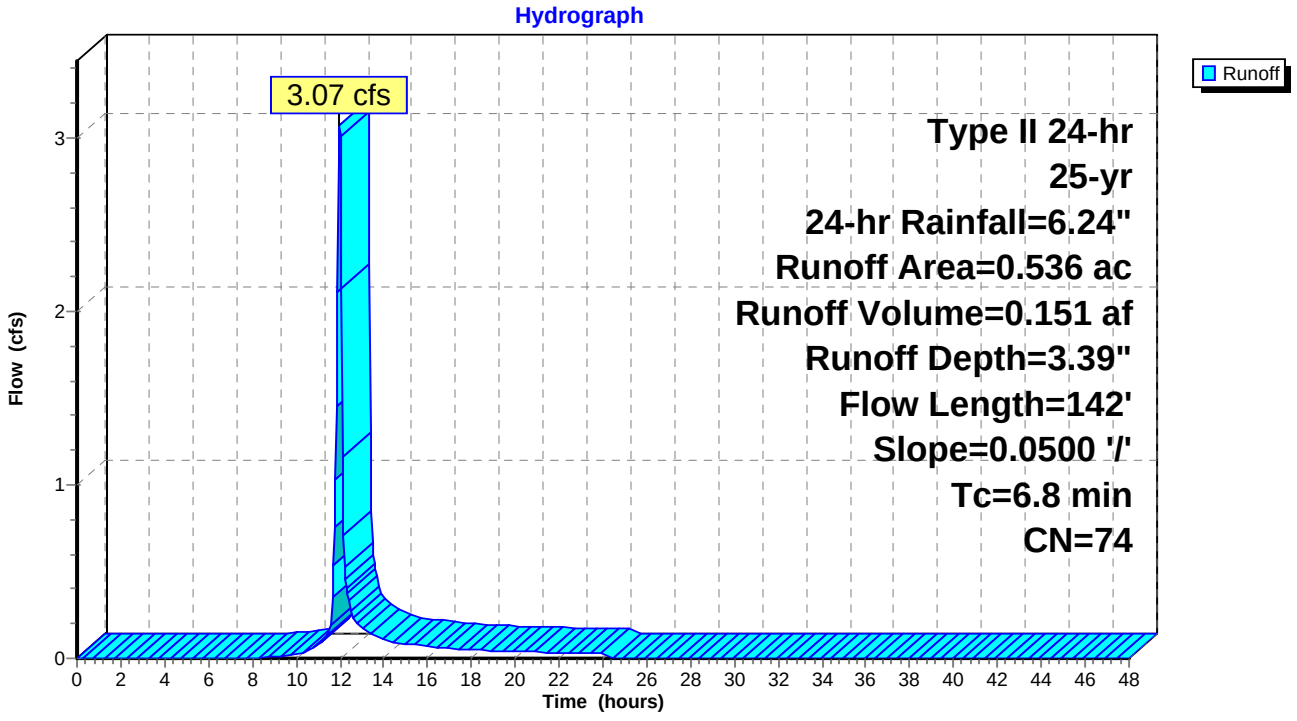
Runoff = 3.07 cfs @ 11.98 hrs, Volume= 0.151 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.536	74	>Pasture/grassland/range, Good, HSG C
0.536		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0500	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.4	42	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.8	142	Total			

Subcatchment 16-1: 16-1



Summary for Subcatchment 16-2: 16-2

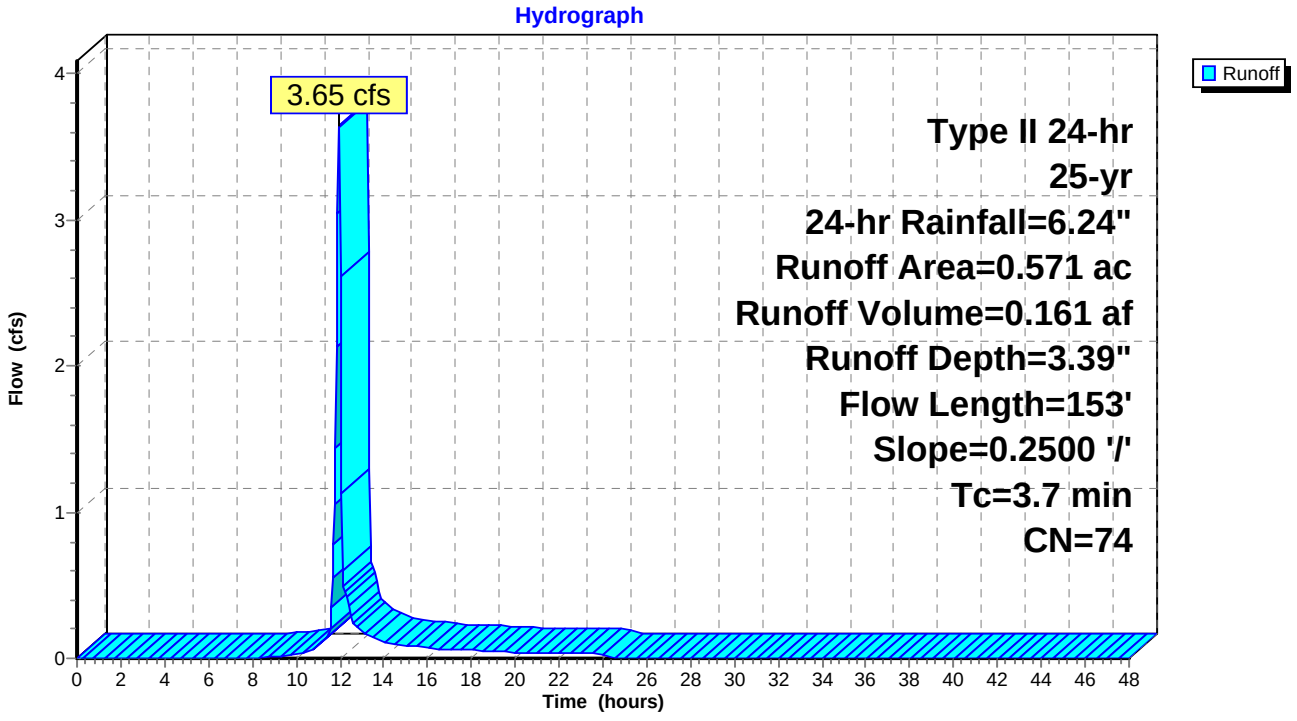
Runoff = 3.65 cfs @ 11.94 hrs, Volume= 0.161 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.571	74	>Pasture/grassland/range, Good, HSG C
0.571		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.3	53	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.7	153	Total			

Subcatchment 16-2: 16-2



Summary for Subcatchment 16-3: 16-3

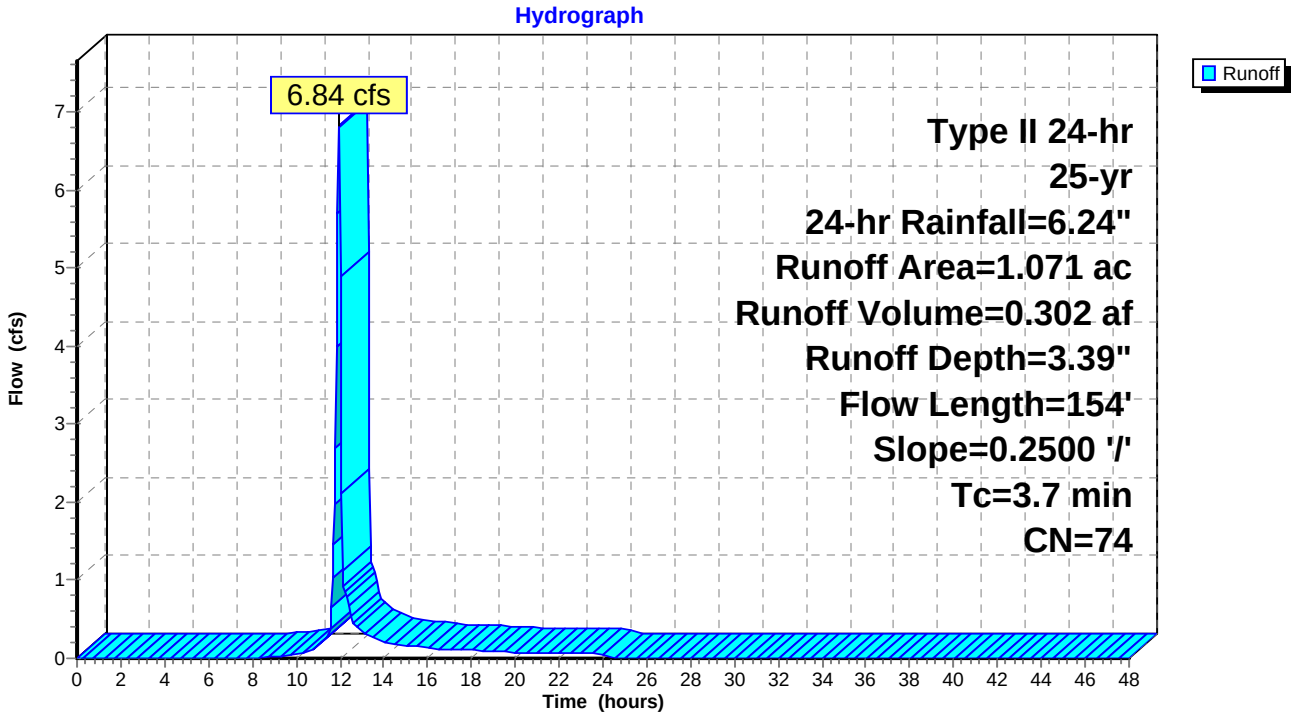
Runoff = 6.84 cfs @ 11.94 hrs, Volume= 0.302 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.071	74	>Pasture/grassland/range, Good, HSG C
1.071		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.3	54	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.7	154	Total			

Subcatchment 16-3: 16-3



Summary for Subcatchment 16-4: 16-4

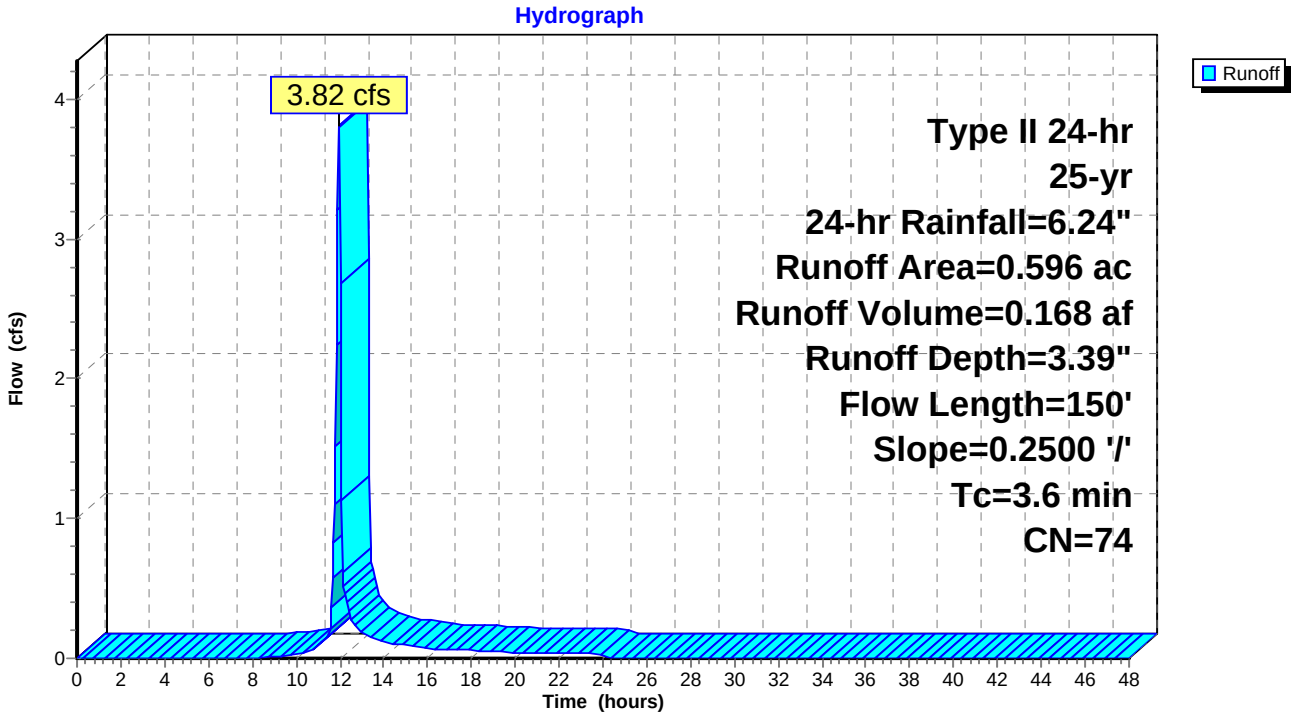
Runoff = 3.82 cfs @ 11.94 hrs, Volume= 0.168 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.596	74	>Pasture/grassland/range, Good, HSG C
0.596		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.2	50	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	150	Total			

Subcatchment 16-4: 16-4



Summary for Subcatchment 16-5: 16-5

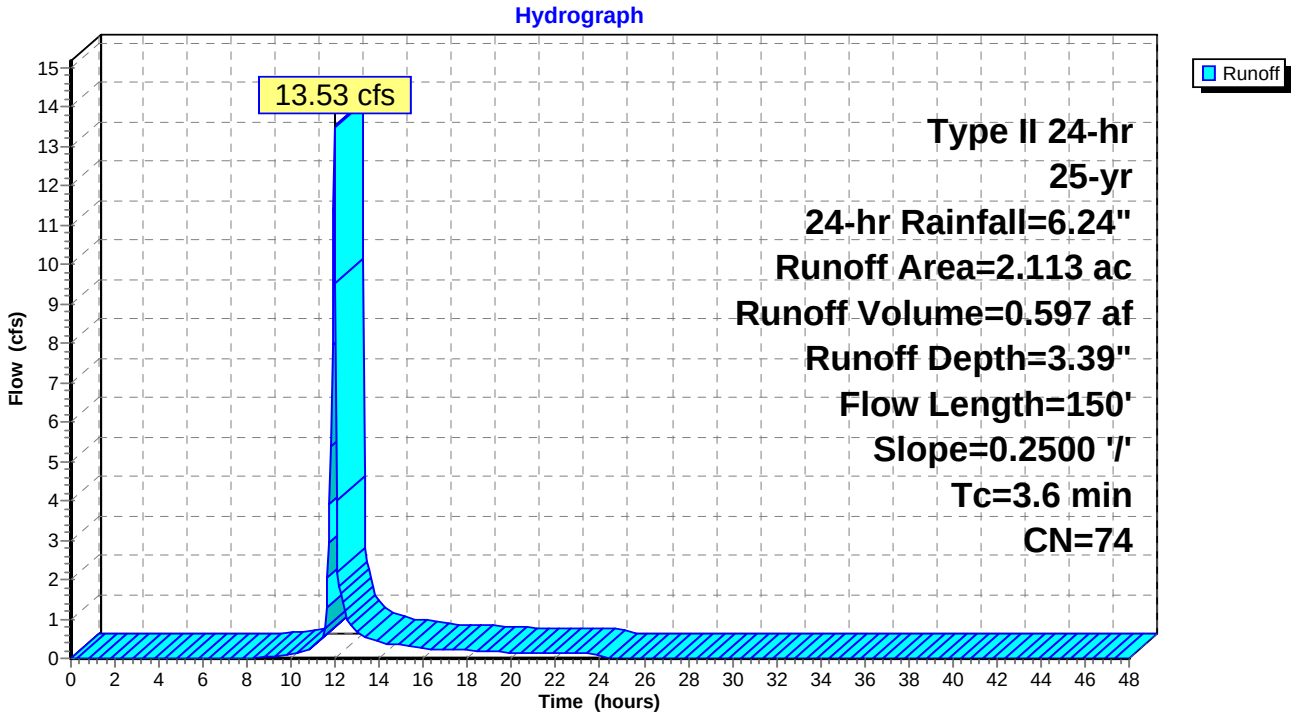
Runoff = 13.53 cfs @ 11.94 hrs, Volume= 0.597 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
2.113	74	>Pasture/grassland/range, Good, HSG C
2.113		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.2	50	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	150	Total			

Subcatchment 16-5: 16-5



Summary for Subcatchment 16-6: 16-6

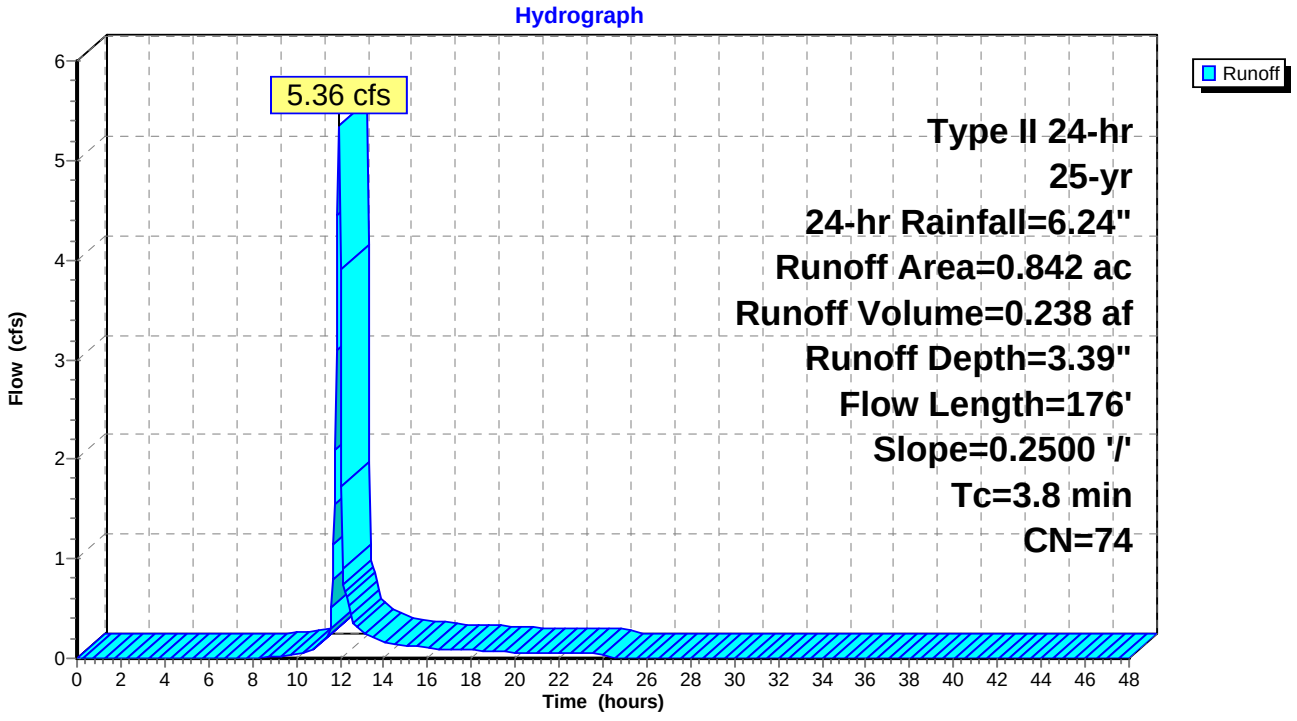
Runoff = 5.36 cfs @ 11.94 hrs, Volume= 0.238 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.842	74	>Pasture/grassland/range, Good, HSG C
0.842		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.4	76	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.8	176	Total			

Subcatchment 16-6: 16-6



Summary for Subcatchment 16-7: 16-7

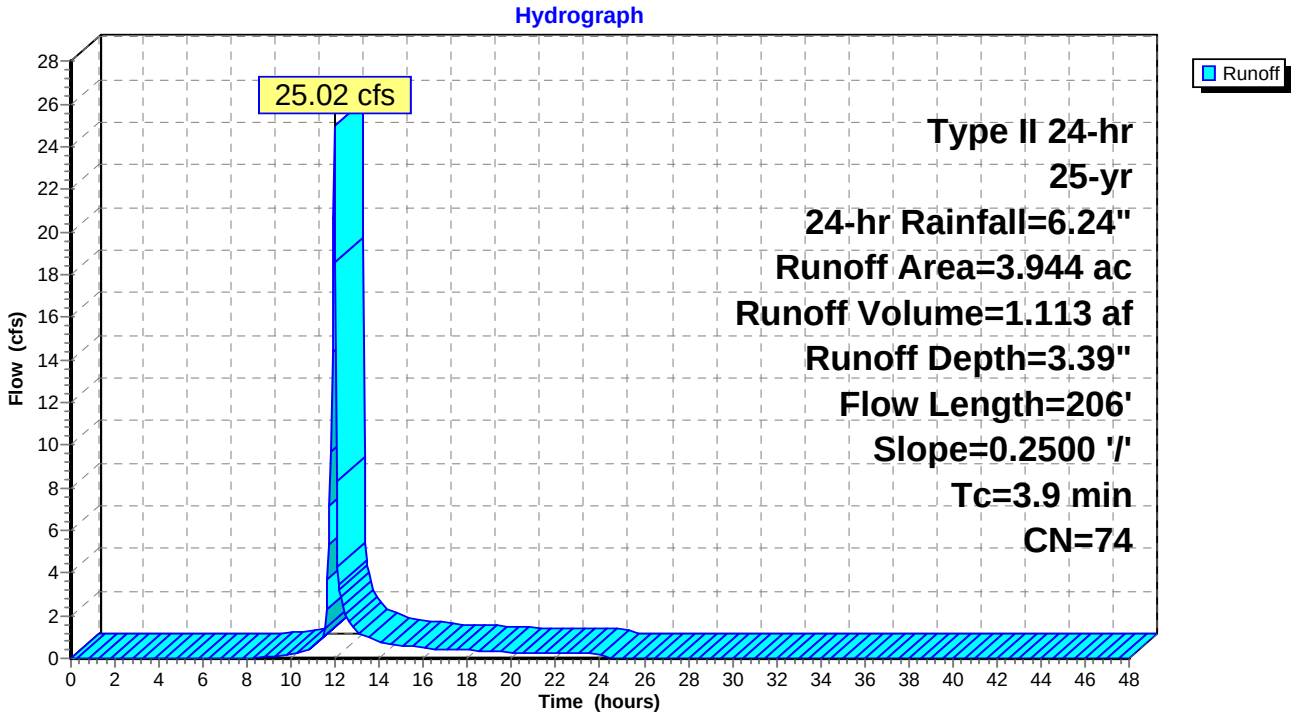
Runoff = 25.02 cfs @ 11.95 hrs, Volume= 1.113 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
3.944	74	>Pasture/grassland/range, Good, HSG C
3.944		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.5	106	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.9	206	Total			

Subcatchment 16-7: 16-7



Summary for Subcatchment 16-8: 16-8

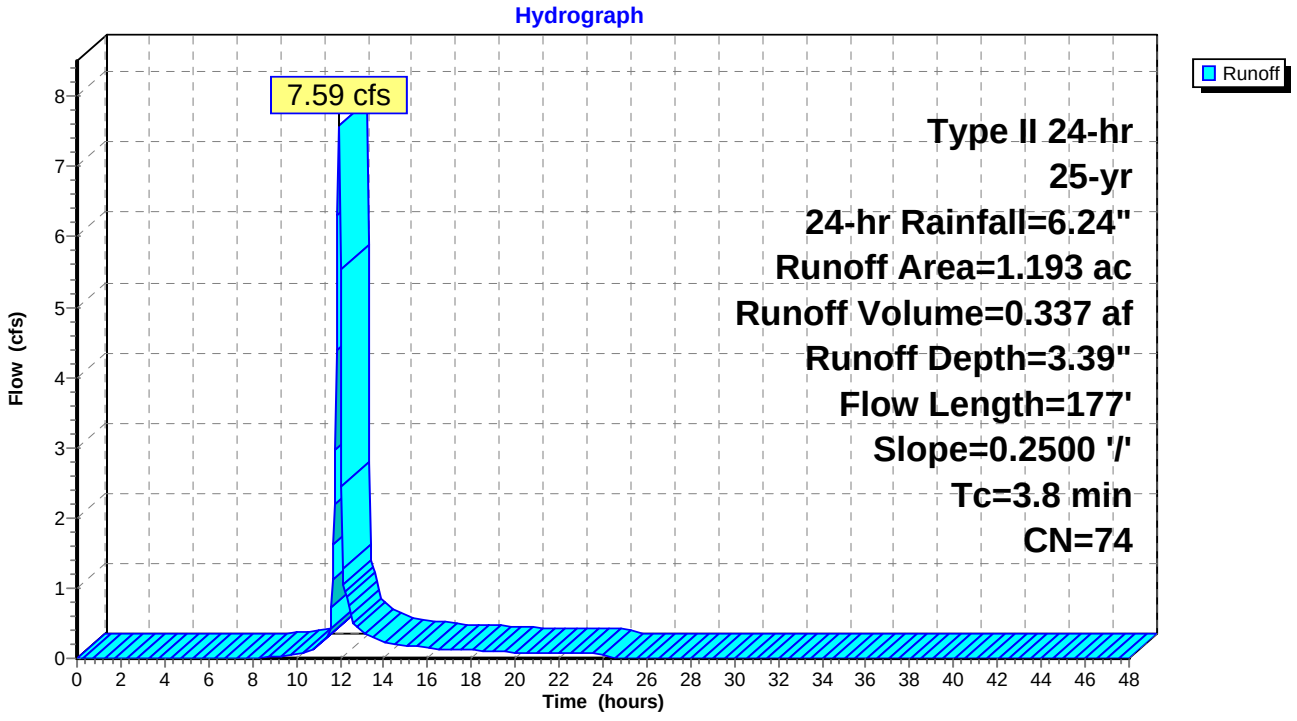
Runoff = 7.59 cfs @ 11.94 hrs, Volume= 0.337 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.193	74	>Pasture/grassland/range, Good, HSG C
1.193		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.4	77	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.8	177	Total			

Subcatchment 16-8: 16-8



Summary for Subcatchment 17-1: 17-1

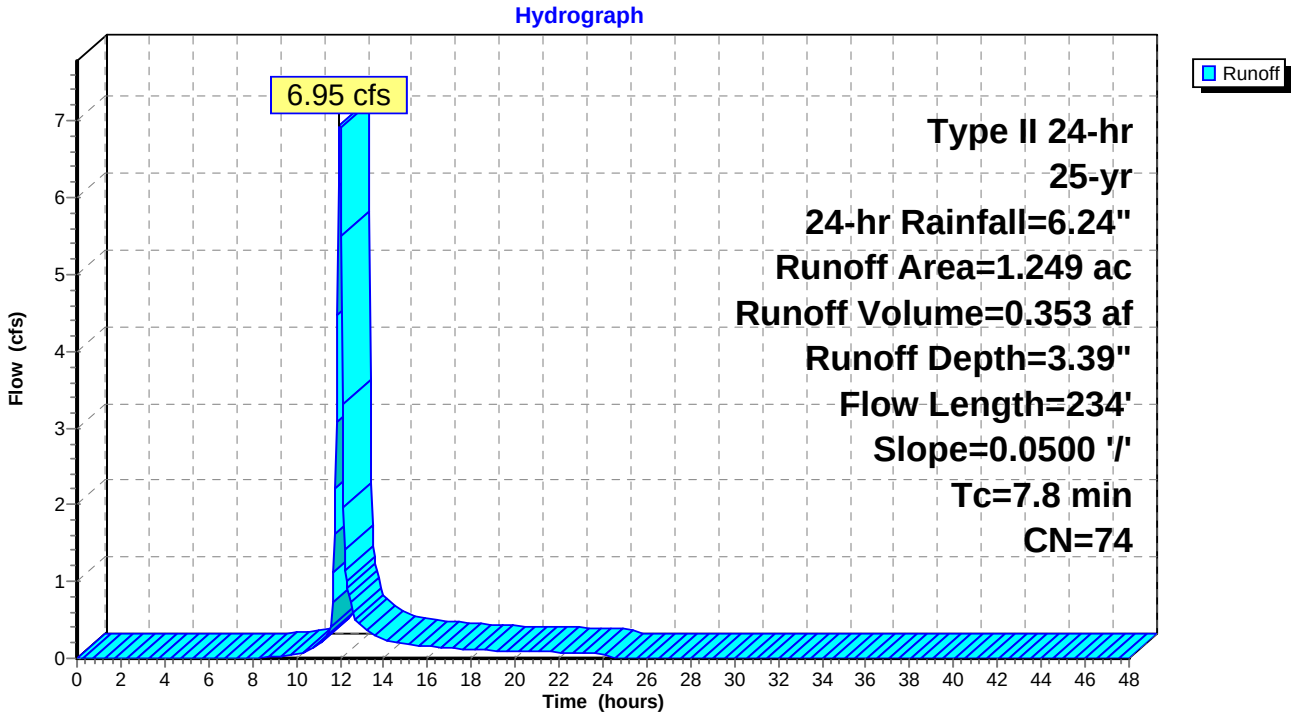
Runoff = 6.95 cfs @ 11.99 hrs, Volume= 0.353 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.249	74	Pasture/grassland/range, Good, HSG C
1.249		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0500	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.4	134	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.8	234	Total			

Subcatchment 17-1: 17-1



Summary for Subcatchment 17-2: 17-2

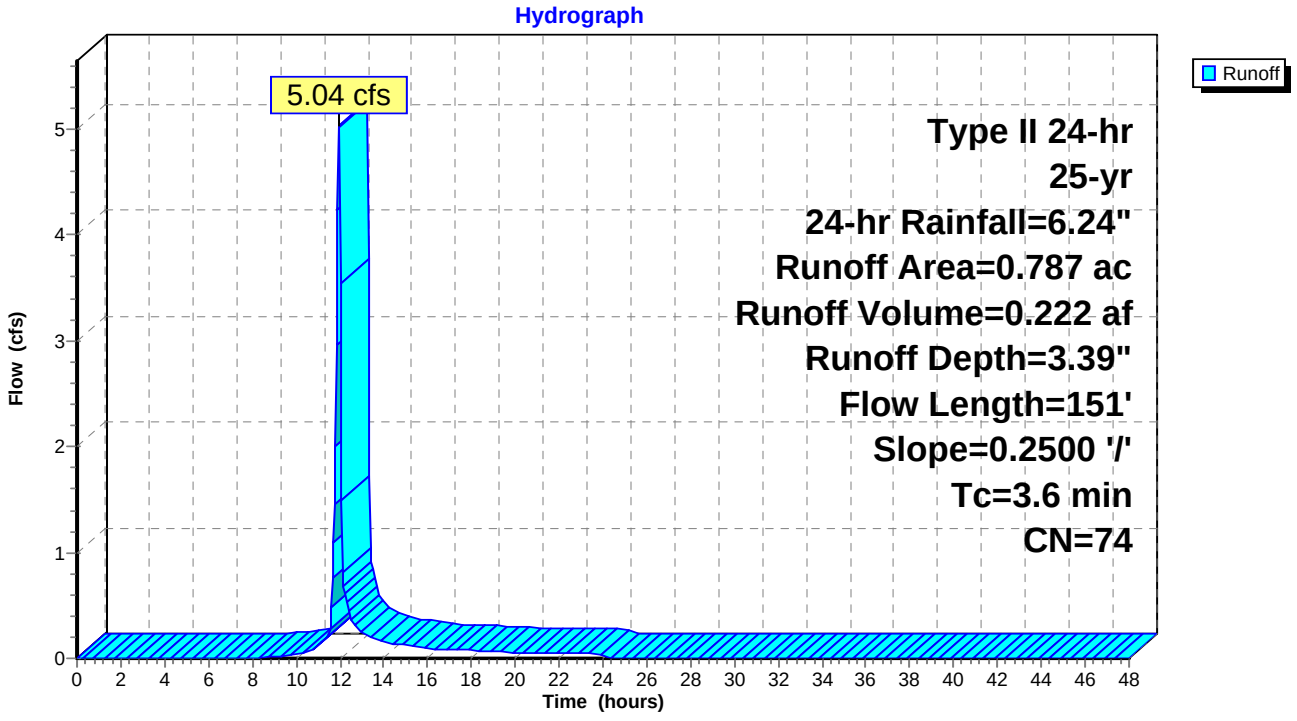
Runoff = 5.04 cfs @ 11.94 hrs, Volume= 0.222 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.787	74	>Pasture/grassland/range, Good, HSG C
0.787		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.2	51	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	151	Total			

Subcatchment 17-2: 17-2



Summary for Subcatchment 17-3: 17-3

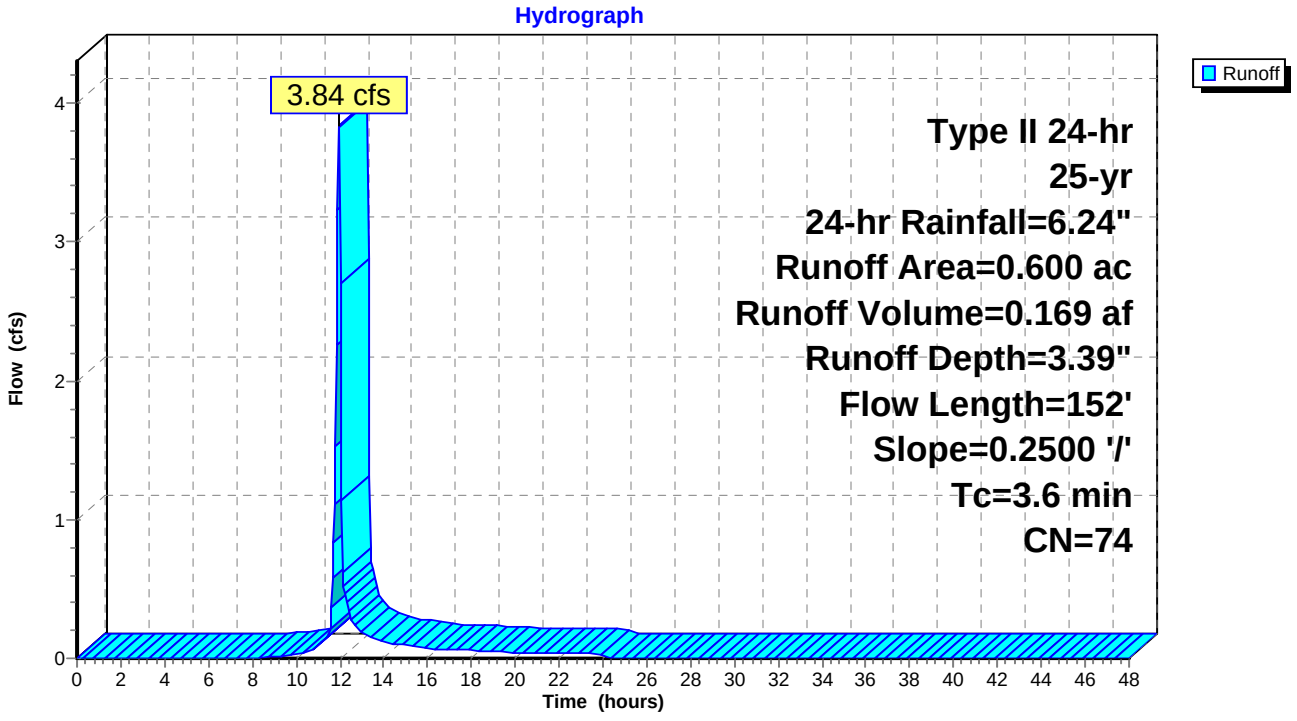
Runoff = 3.84 cfs @ 11.94 hrs, Volume= 0.169 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.600	74	>Pasture/grassland/range, Good, HSG C
0.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.2	52	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	152	Total			

Subcatchment 17-3: 17-3



Summary for Subcatchment 17-4: 17-4

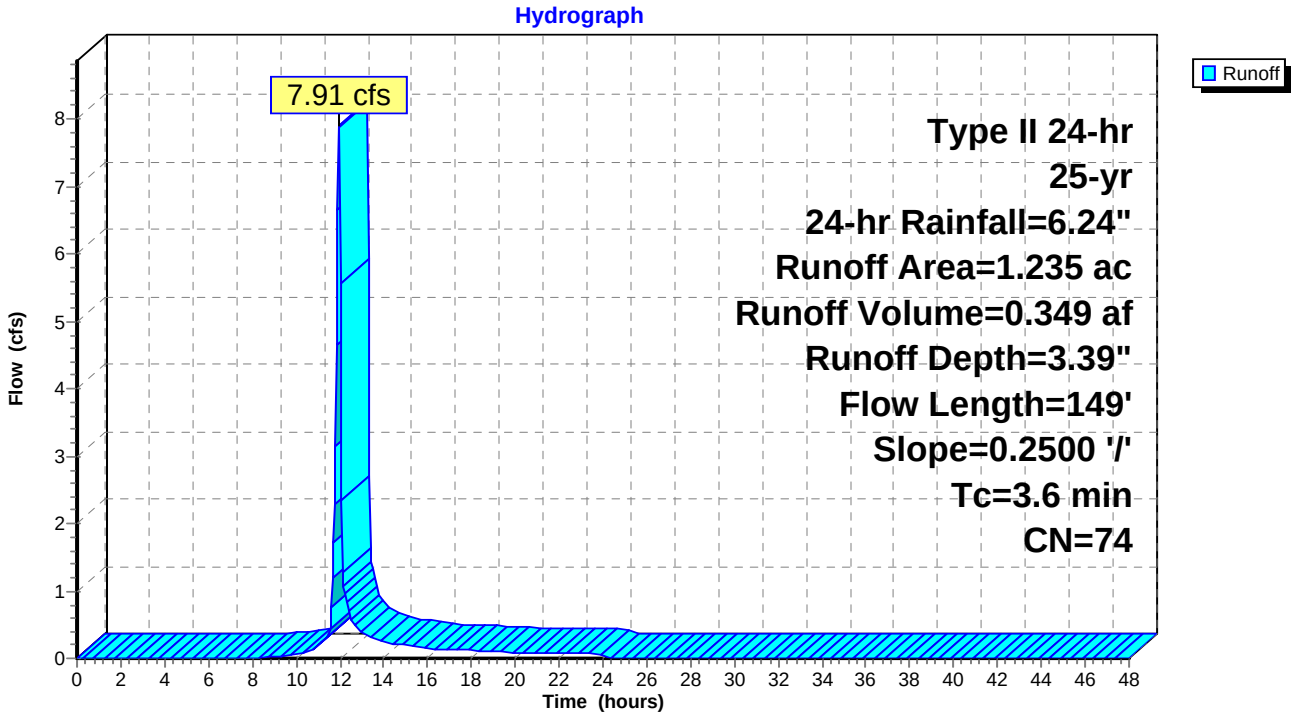
Runoff = 7.91 cfs @ 11.94 hrs, Volume= 0.349 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.235	74	>Pasture/grassland/range, Good, HSG C
1.235		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.2	49	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	149	Total			

Subcatchment 17-4: 17-4



Summary for Subcatchment 17-5: 17-5

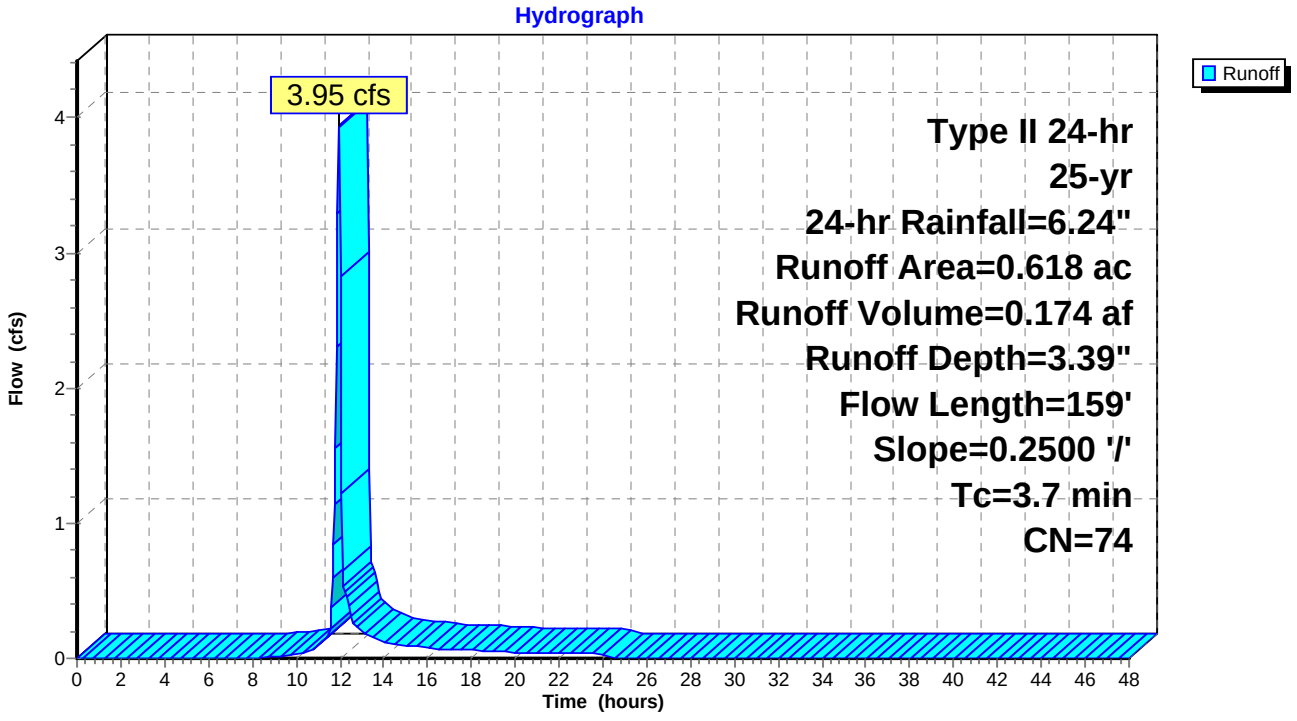
Runoff = 3.95 cfs @ 11.94 hrs, Volume= 0.174 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.618	74	>Pasture/grassland/range, Good, HSG C
0.618		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.3	59	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.7	159	Total			

Subcatchment 17-5: 17-5



Summary for Subcatchment 17-6: 17-6

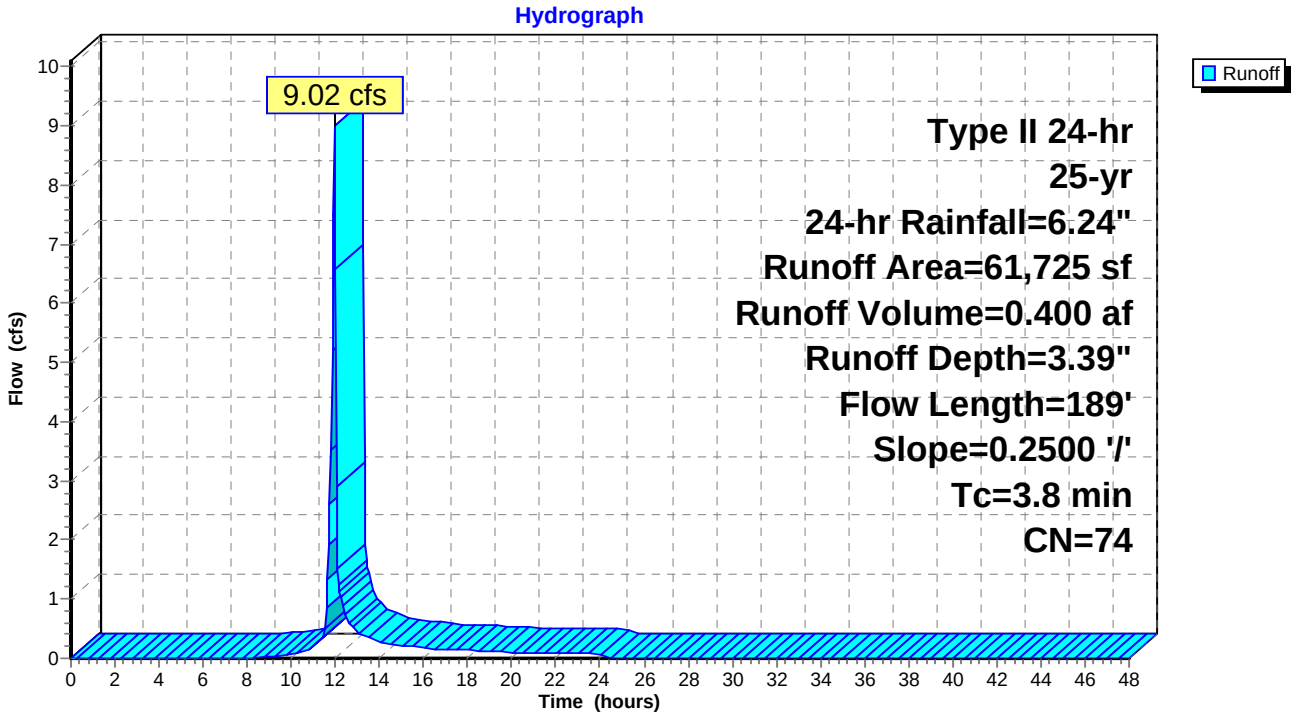
Runoff = 9.02 cfs @ 11.94 hrs, Volume= 0.400 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (sf)	CN	Description
61,725	74	>Pasture/grassland/range, Good, HSG C
61,725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.4	89	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.8	189	Total			

Subcatchment 17-6: 17-6



Summary for Subcatchment 17-7: 17-7

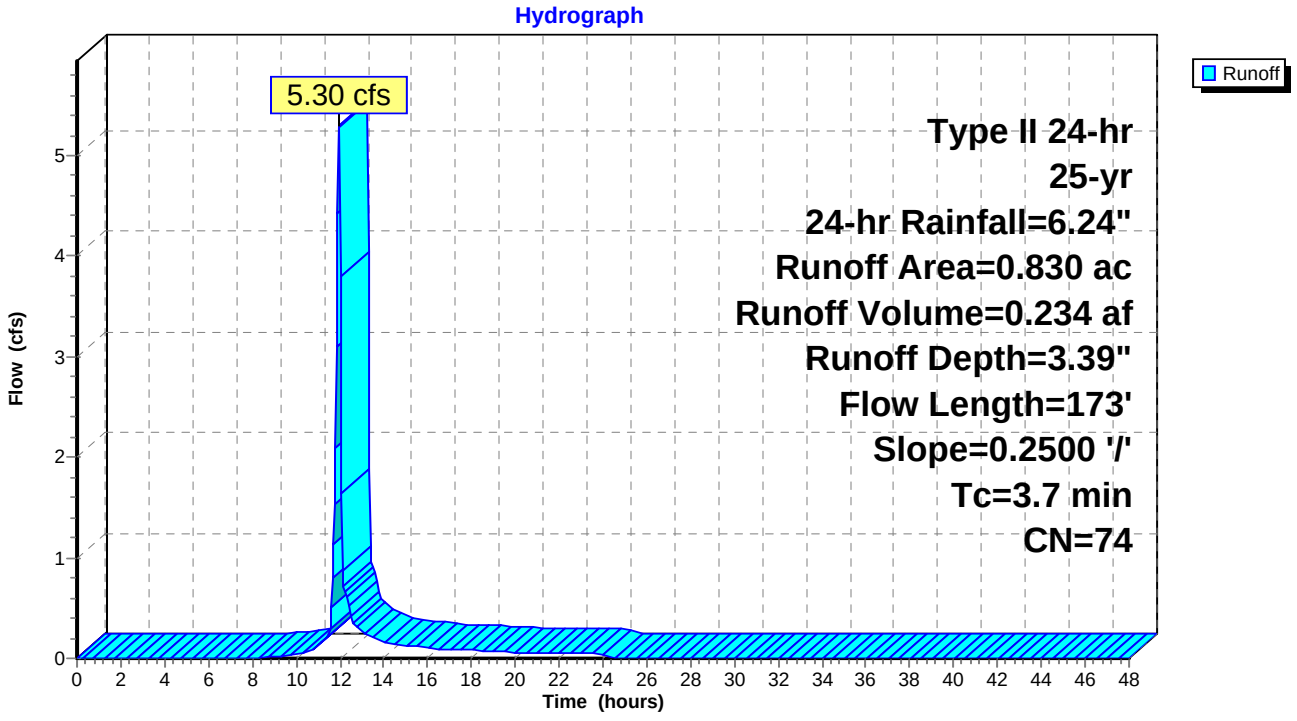
Runoff = 5.30 cfs @ 11.94 hrs, Volume= 0.234 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.830	74	>Pasture/grassland/range, Good, HSG C
0.830		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.3	73	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.7	173	Total			

Subcatchment 17-7: 17-7



Summary for Subcatchment 18-1: 18-1

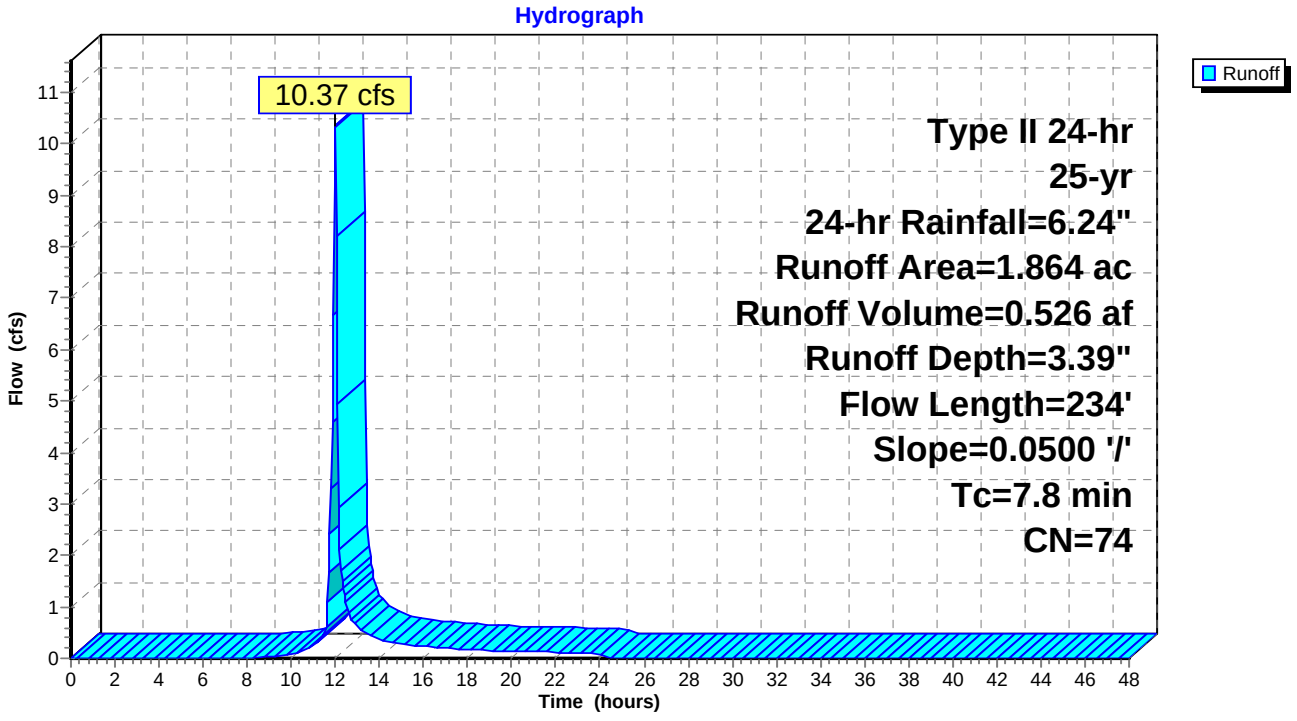
Runoff = 10.37 cfs @ 11.99 hrs, Volume= 0.526 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.864	74	>Pasture/grassland/range, Good, HSG C
1.864		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0500	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.4	134	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.8	234	Total			

Subcatchment 18-1: 18-1



Summary for Subcatchment 18-2: 18-2

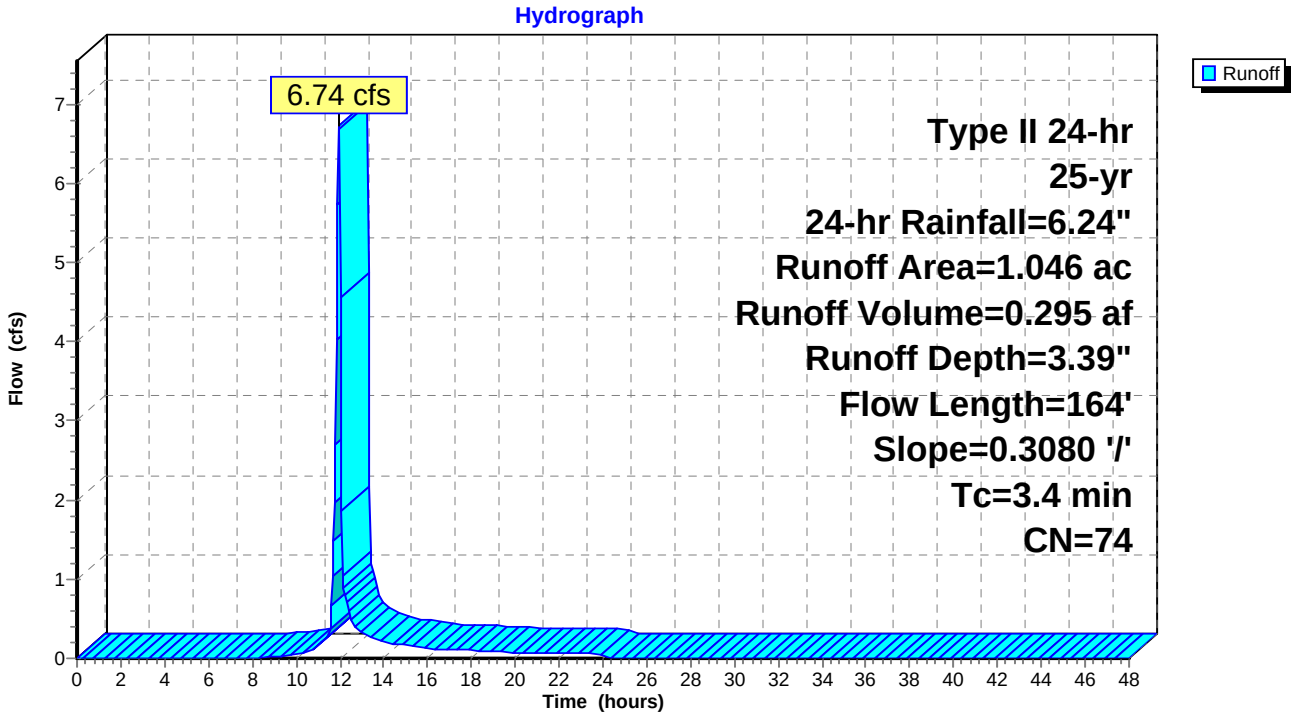
Runoff = 6.74 cfs @ 11.94 hrs, Volume= 0.295 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.046	74	>Pasture/grassland/range, Good, HSG C
1.046		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	100	0.3080	0.54		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.3	64	0.3080	3.88		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.4	164	Total			

Subcatchment 18-2: 18-2



Summary for Subcatchment 18-3: 18-3

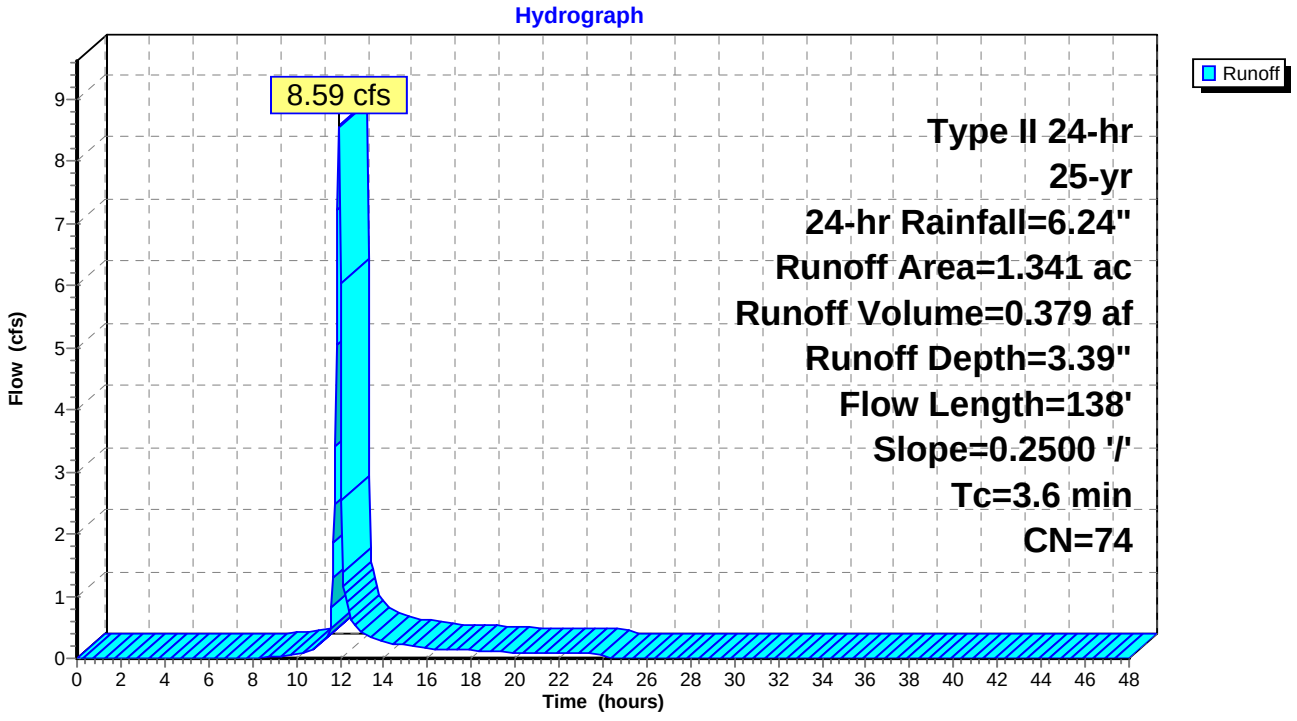
Runoff = 8.59 cfs @ 11.94 hrs, Volume= 0.379 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.341	74	>Pasture/grassland/range, Good, HSG C
1.341		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.2	38	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	138	Total			

Subcatchment 18-3: 18-3



Summary for Subcatchment 18-4: 18-4

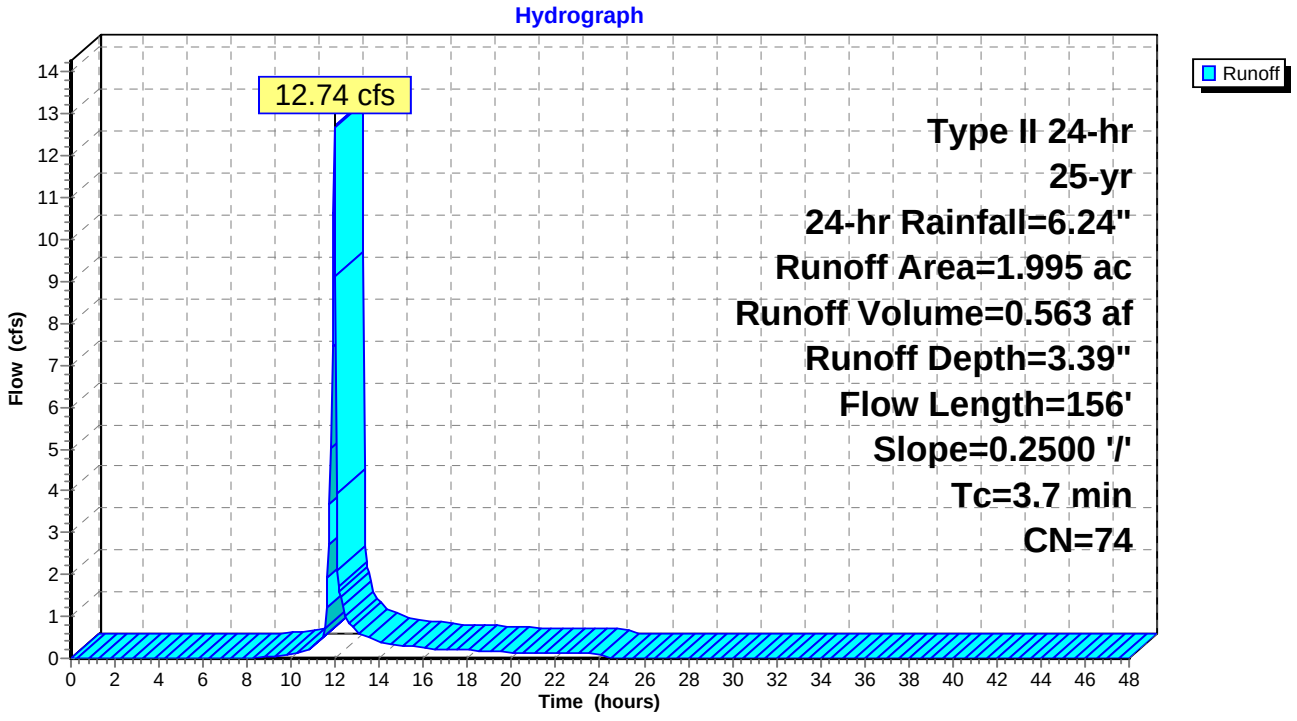
Runoff = 12.74 cfs @ 11.94 hrs, Volume= 0.563 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.995	74	>Pasture/grassland/range, Good, HSG C
1.995		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.3	56	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.7	156	Total			

Subcatchment 18-4: 18-4



Summary for Subcatchment 18-5: 18-5

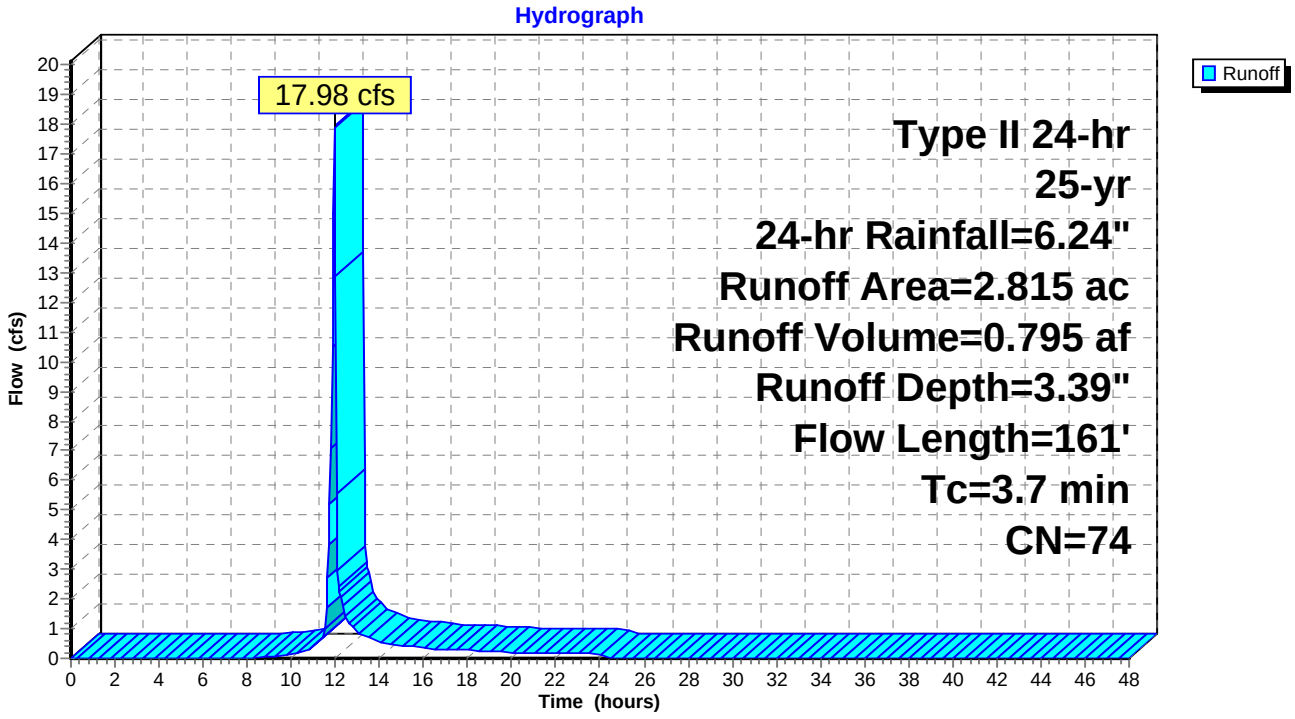
Runoff = 17.98 cfs @ 11.94 hrs, Volume= 0.795 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
2.815	74	>Pasture/grassland/range, Good, HSG C
2.815		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.2	36	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	25	0.3300	4.02		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.7	161	Total			

Subcatchment 18-5: 18-5



Summary for Subcatchment 18-6: 18-6

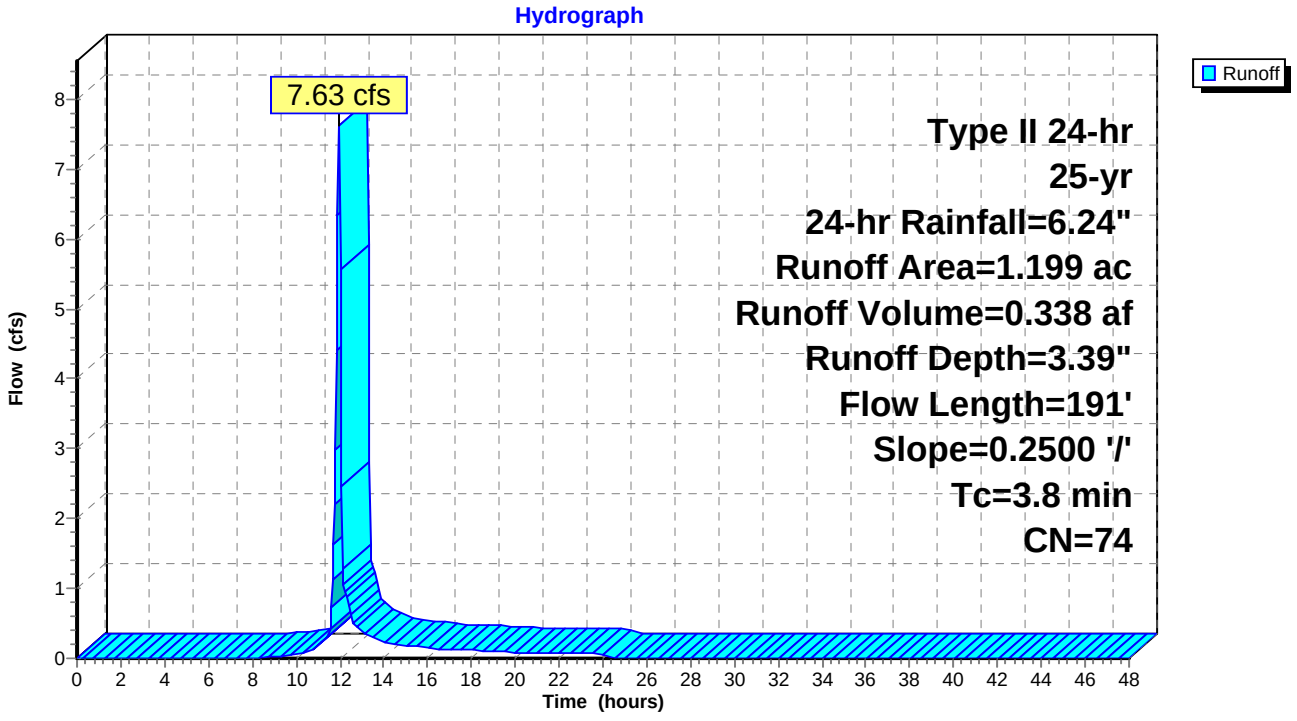
Runoff = 7.63 cfs @ 11.94 hrs, Volume= 0.338 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.199	74	>Pasture/grassland/range, Good, HSG C
1.199		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	100	0.2500	0.50		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.4	91	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.8	191	Total			

Subcatchment 18-6: 18-6



Summary for Subcatchment CWP-1: CWP-1

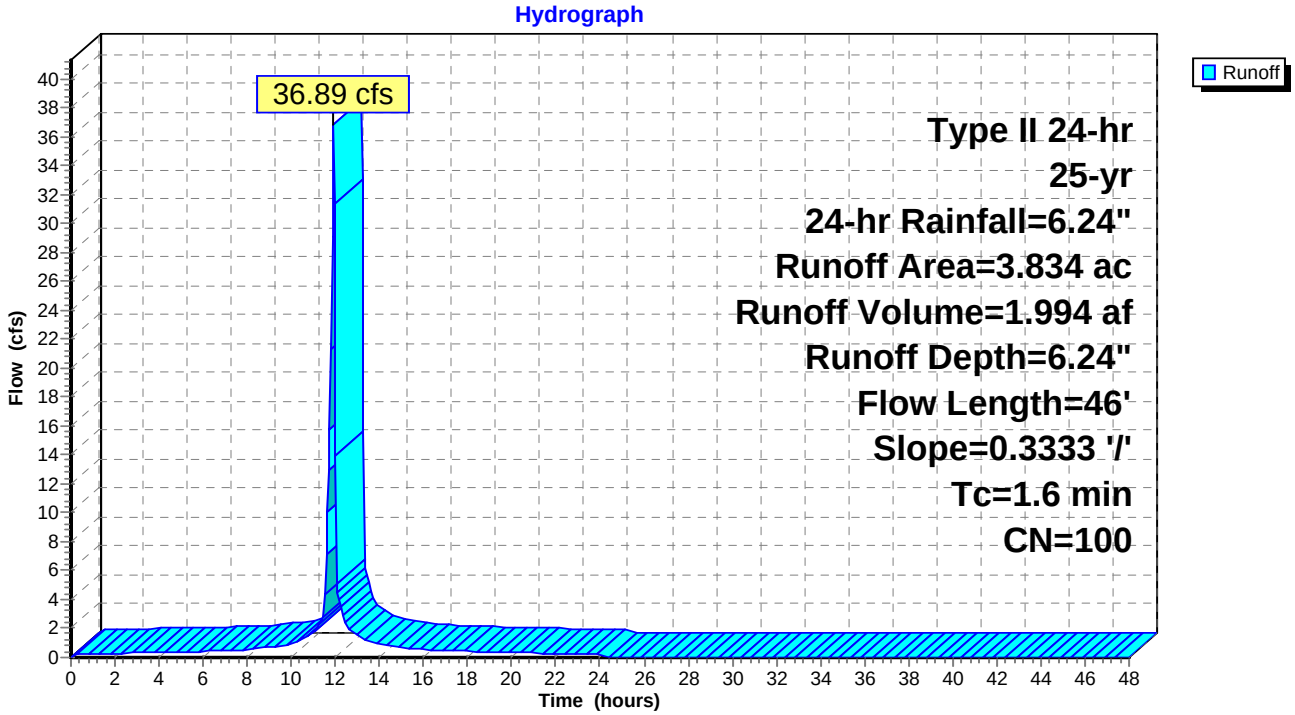
Runoff = 36.89 cfs @ 11.90 hrs, Volume= 1.994 af, Depth= 6.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

	Area (ac)	CN	Description
*	3.834	100	Water Surface, 0% imp, HSG C
	3.834		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	46	0.3333	0.48		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"

Subcatchment CWP-1: CWP-1



Summary for Subcatchment CWP-2: CWP-2

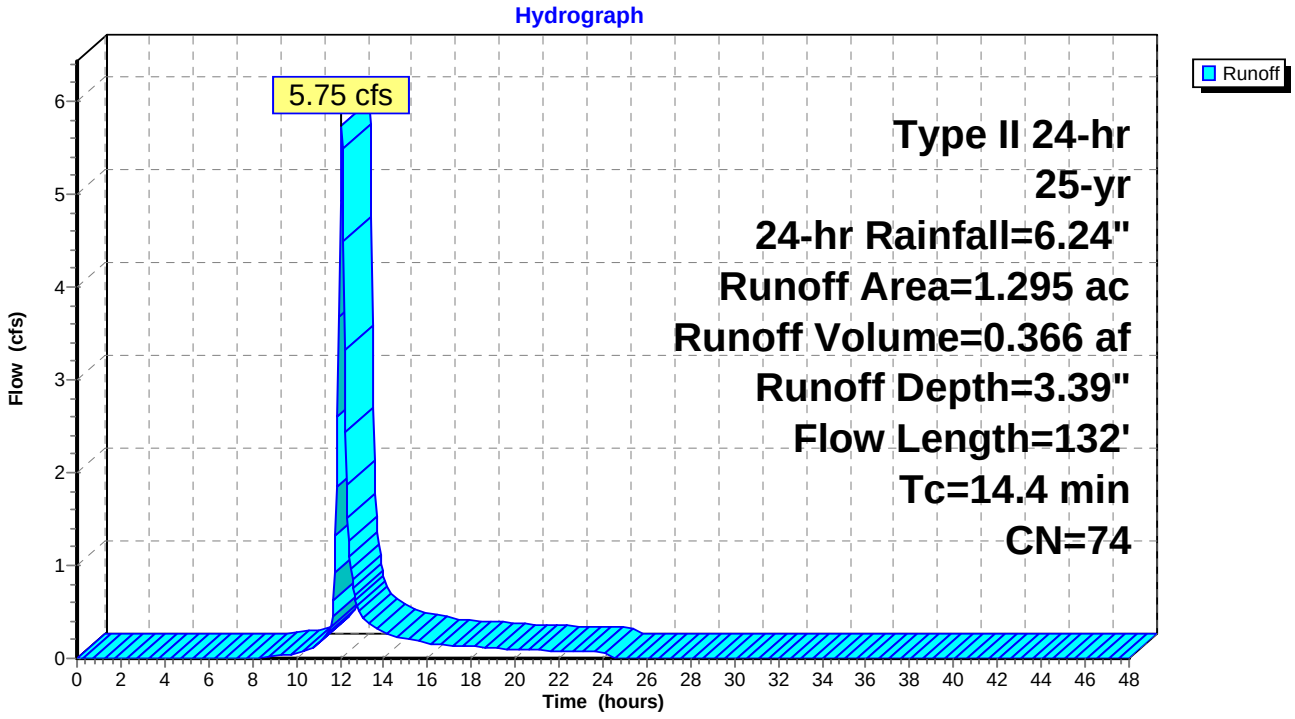
Runoff = 5.75 cfs @ 12.06 hrs, Volume= 0.366 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.295	74	>Pasture/grassland/range, Good, HSG C
1.295		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	49	0.3400	0.49		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
12.4	51	0.0025	0.07		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
0.3	32	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
14.4	132	Total			

Subcatchment CWP-2: CWP-2



Summary for Subcatchment RO-1: RO-1

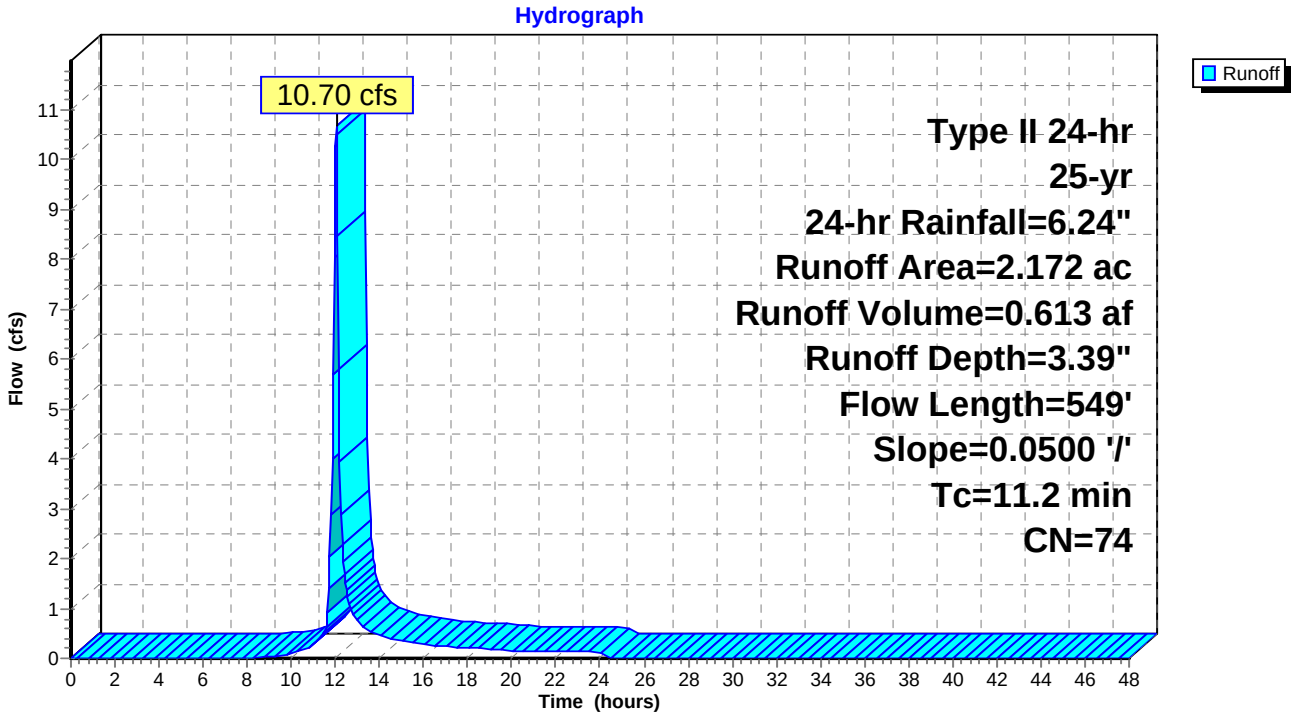
Runoff = 10.70 cfs @ 12.03 hrs, Volume= 0.613 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
2.172	74	>Pasture/grassland/range, Good, HSG C
2.172		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0500	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
4.8	449	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
11.2	549	Total			

Subcatchment RO-1: RO-1



Summary for Subcatchment RO-2: RO-2

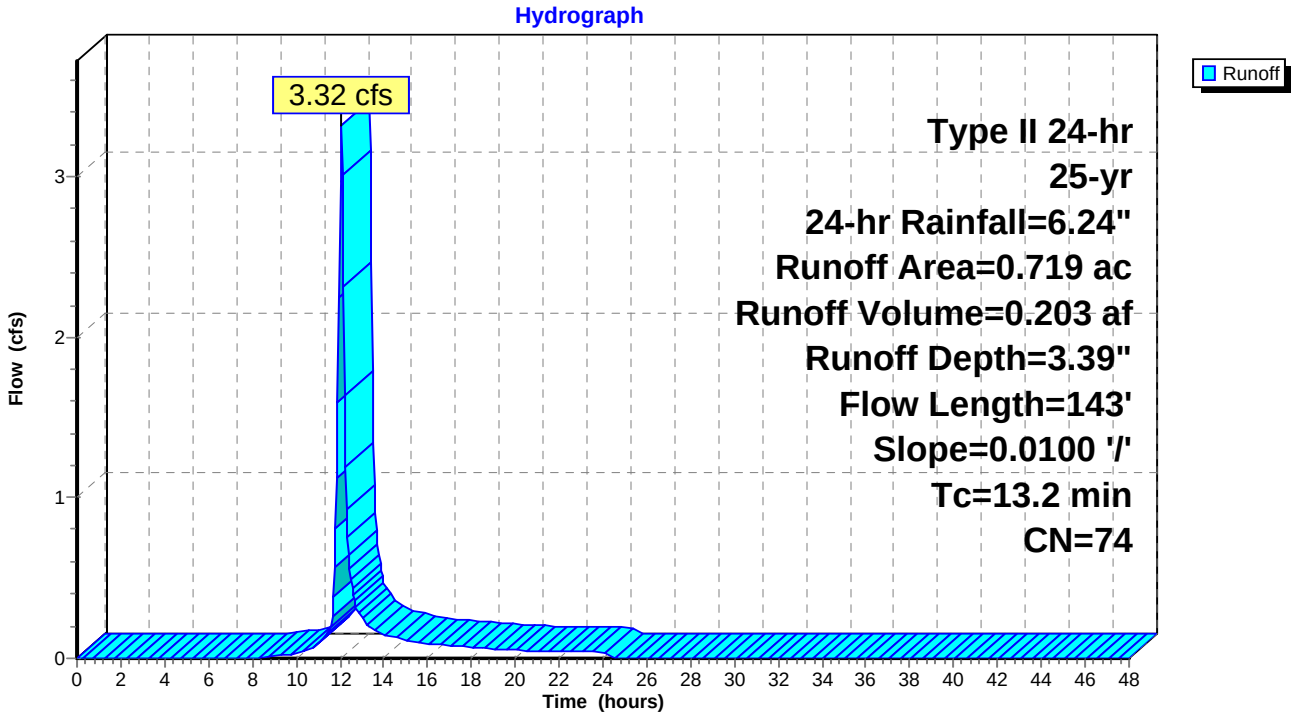
Runoff = 3.32 cfs @ 12.05 hrs, Volume= 0.203 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
0.719	74	>Pasture/grassland/range, Good, HSG C
0.719		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	100	0.0100	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.0	43	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.2	143	Total			

Subcatchment RO-2: RO-2



Summary for Subcatchment RO-3: RO-3

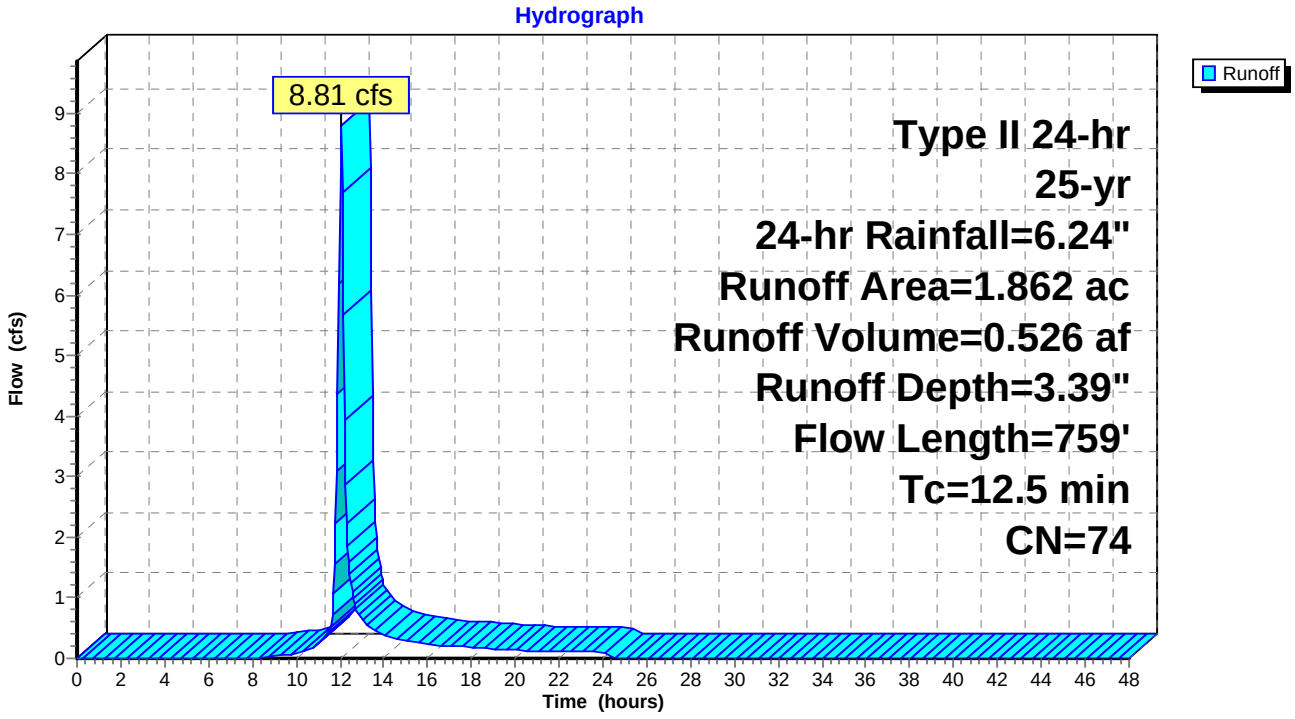
Runoff = 8.81 cfs @ 12.04 hrs, Volume= 0.526 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=6.24"

Area (ac)	CN	Description
1.862	74	>Pasture/grassland/range, Good, HSG C
1.862		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0500	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
5.5	520	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	139	0.3333	4.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.5	759	Total			

Subcatchment RO-3: RO-3



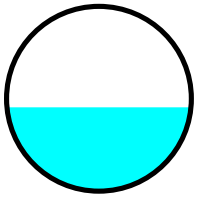
Summary for Reach 011: Culvert 011

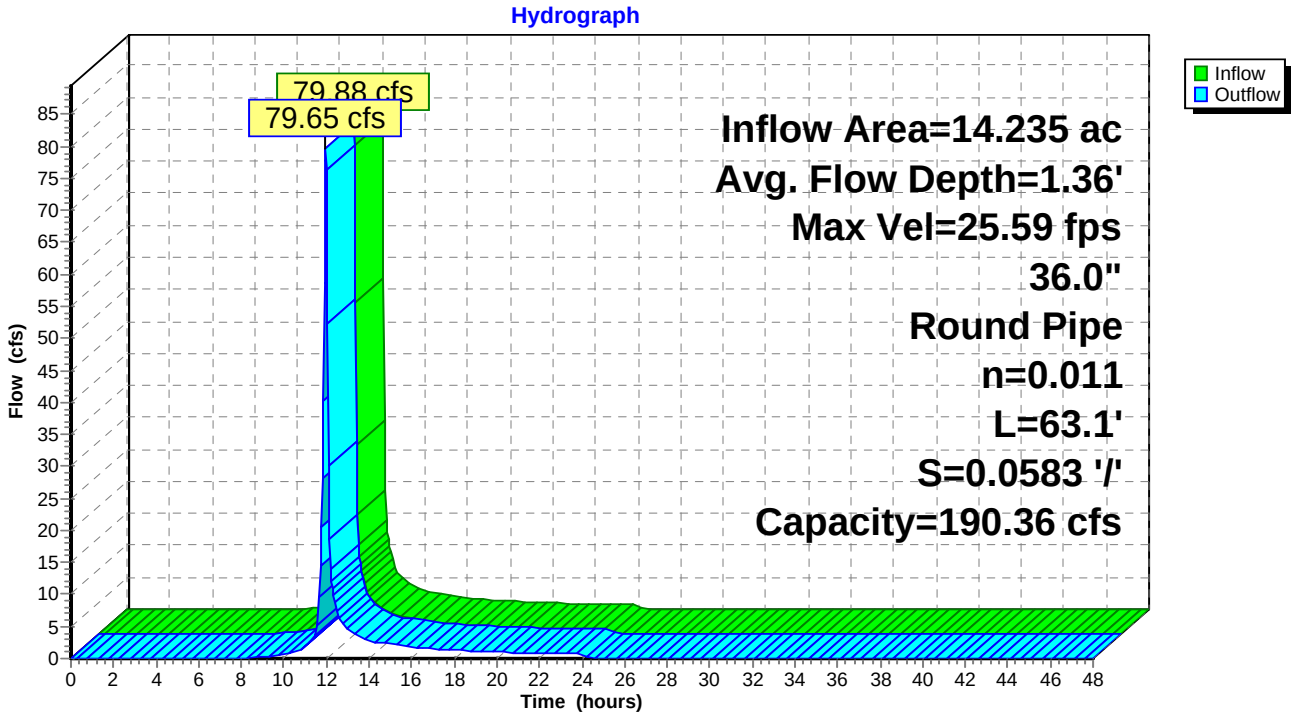
Inflow Area = 14.235 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 79.88 cfs @ 11.97 hrs, Volume= 4.019 af
Outflow = 79.65 cfs @ 11.97 hrs, Volume= 4.019 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 25.59 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 7.67 fps, Avg. Travel Time= 0.1 min

Peak Storage= 196 cf @ 11.97 hrs
Average Depth at Peak Storage= 1.36'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 190.36 cfs

36.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 63.1' Slope= 0.0583 '/'
Inlet Invert= 822.27', Outlet Invert= 818.59'





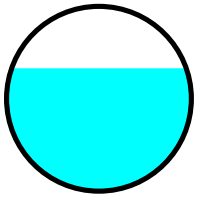
Summary for Reach 012: Culvert 012

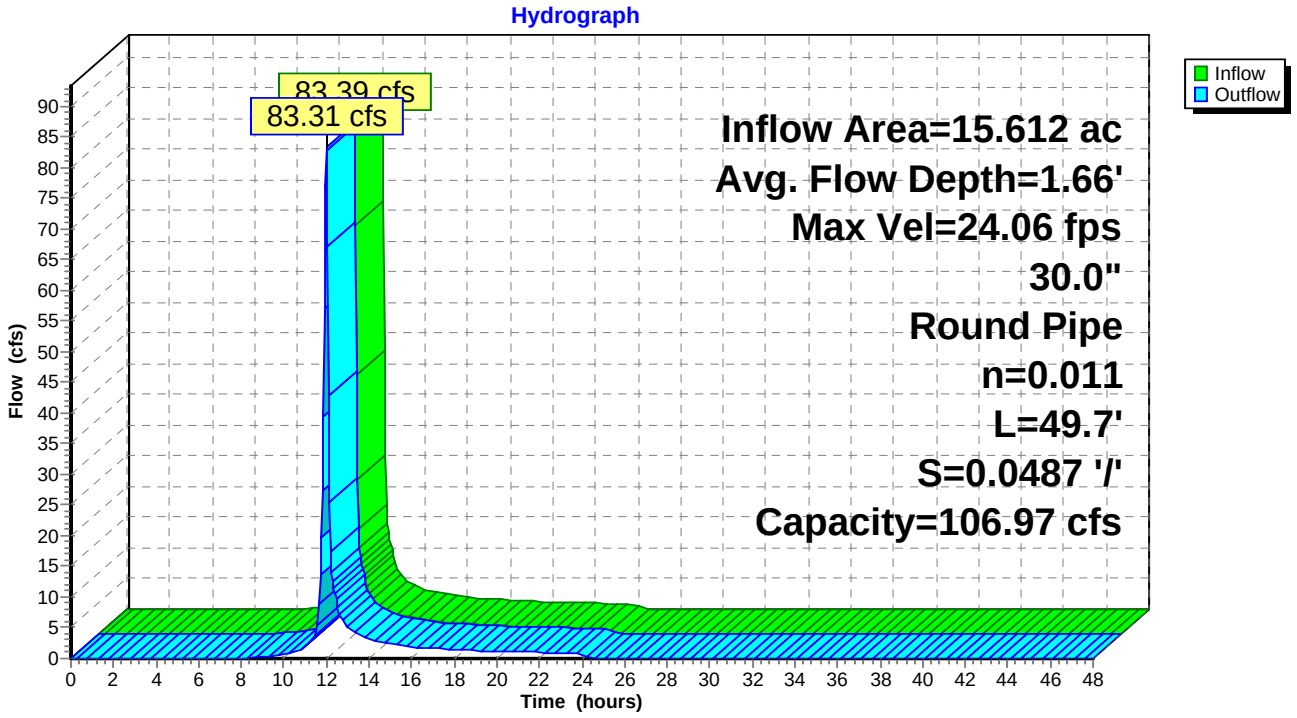
Inflow Area = 15.612 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 83.39 cfs @ 11.99 hrs, Volume= 4.407 af
Outflow = 83.31 cfs @ 11.99 hrs, Volume= 4.407 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 24.06 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 7.26 fps, Avg. Travel Time= 0.1 min

Peak Storage= 172 cf @ 11.99 hrs
Average Depth at Peak Storage= 1.66'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 106.97 cfs

30.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 49.7' Slope= 0.0487 '/'
Inlet Invert= 825.92', Outlet Invert= 823.50'





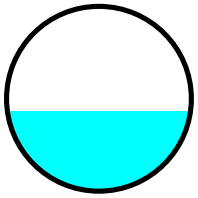
Summary for Reach 013: Culvert 013

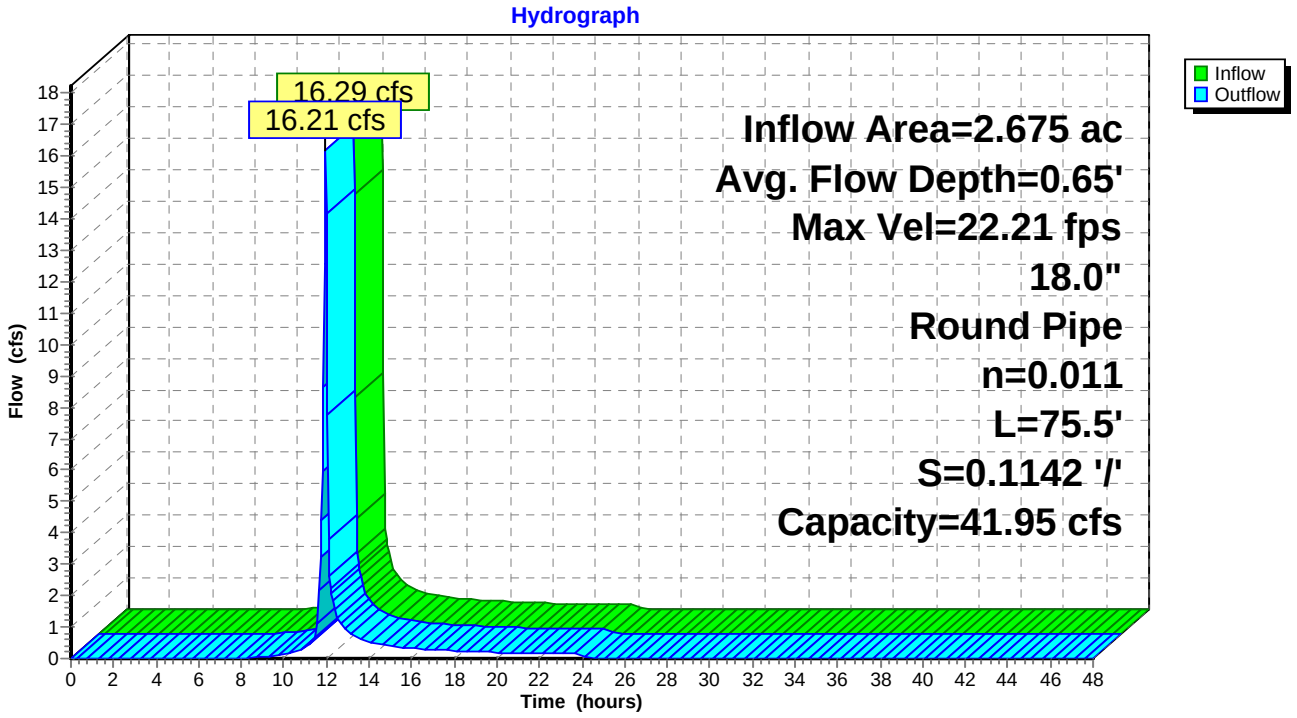
Inflow Area = 2.675 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 16.29 cfs @ 11.96 hrs, Volume= 0.755 af
Outflow = 16.21 cfs @ 11.96 hrs, Volume= 0.755 af, Atten= 1%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 22.21 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 6.83 fps, Avg. Travel Time= 0.2 min

Peak Storage= 55 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 41.95 cfs

18.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 75.5' Slope= 0.1142 '/'
Inlet Invert= 837.42', Outlet Invert= 828.80'





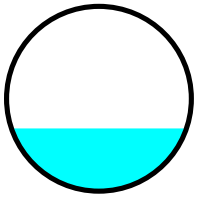
Summary for Reach 014: Culvert 014

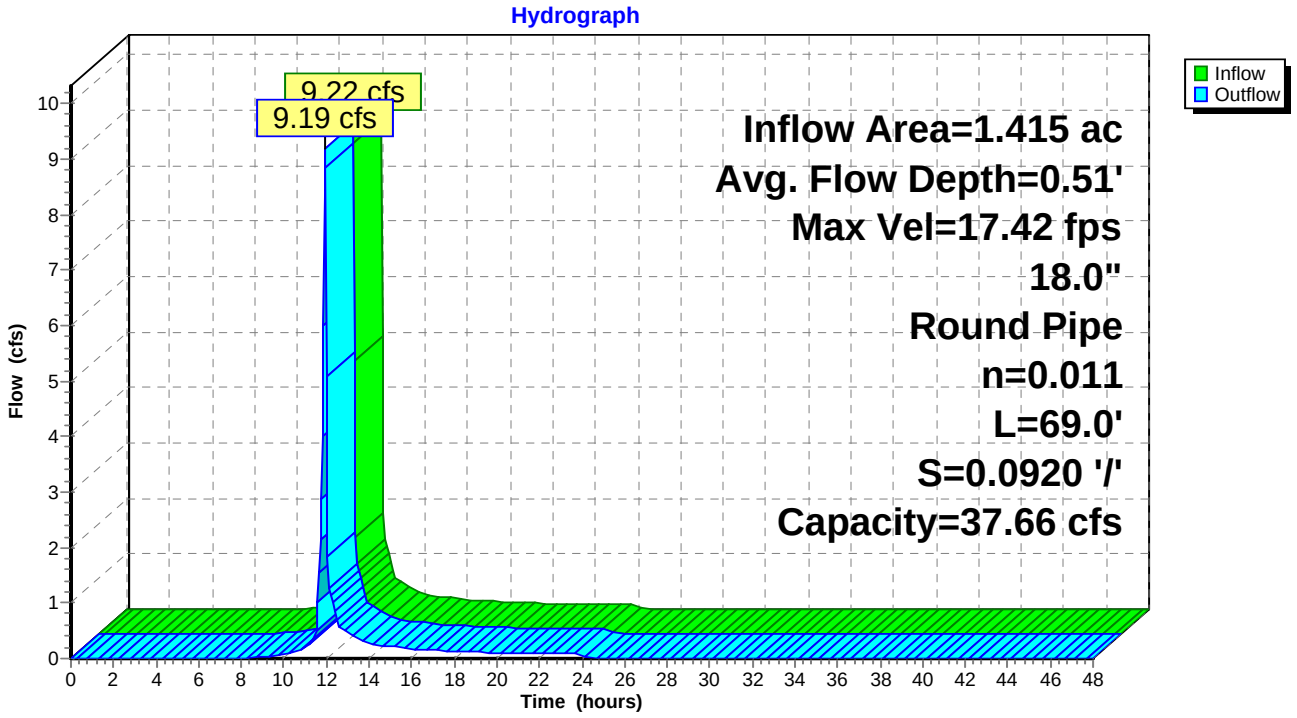
Inflow Area = 1.415 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 9.22 cfs @ 11.93 hrs, Volume= 0.399 af
Outflow = 9.19 cfs @ 11.93 hrs, Volume= 0.399 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 17.42 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 5.25 fps, Avg. Travel Time= 0.2 min

Peak Storage= 36 cf @ 11.93 hrs
Average Depth at Peak Storage= 0.51'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 37.66 cfs

18.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 69.0' Slope= 0.0920 '/'
Inlet Invert= 837.74', Outlet Invert= 831.39'





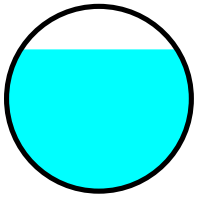
Summary for Reach 016: Culvert 016

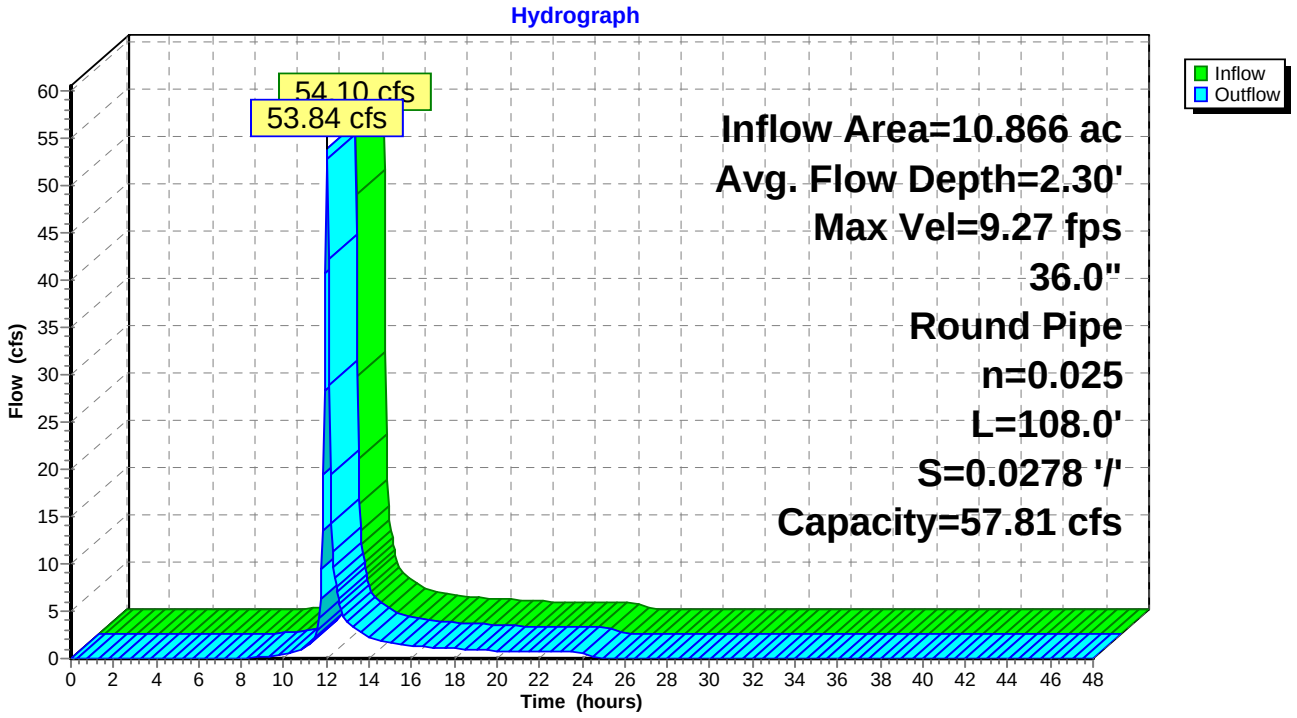
Inflow Area = 10.866 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 54.10 cfs @ 12.02 hrs, Volume= 3.068 af
Outflow = 53.84 cfs @ 12.03 hrs, Volume= 3.068 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.27 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.66 fps, Avg. Travel Time= 0.7 min

Peak Storage= 629 cf @ 12.03 hrs
Average Depth at Peak Storage= 2.30'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 57.81 cfs

36.0" Round Pipe
n= 0.025 Corrugated metal
Length= 108.0' Slope= 0.0278 '/'
Inlet Invert= 854.00', Outlet Invert= 851.00'





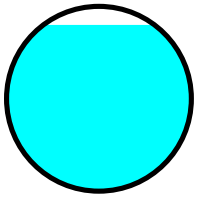
Summary for Reach 017: Culvert 017

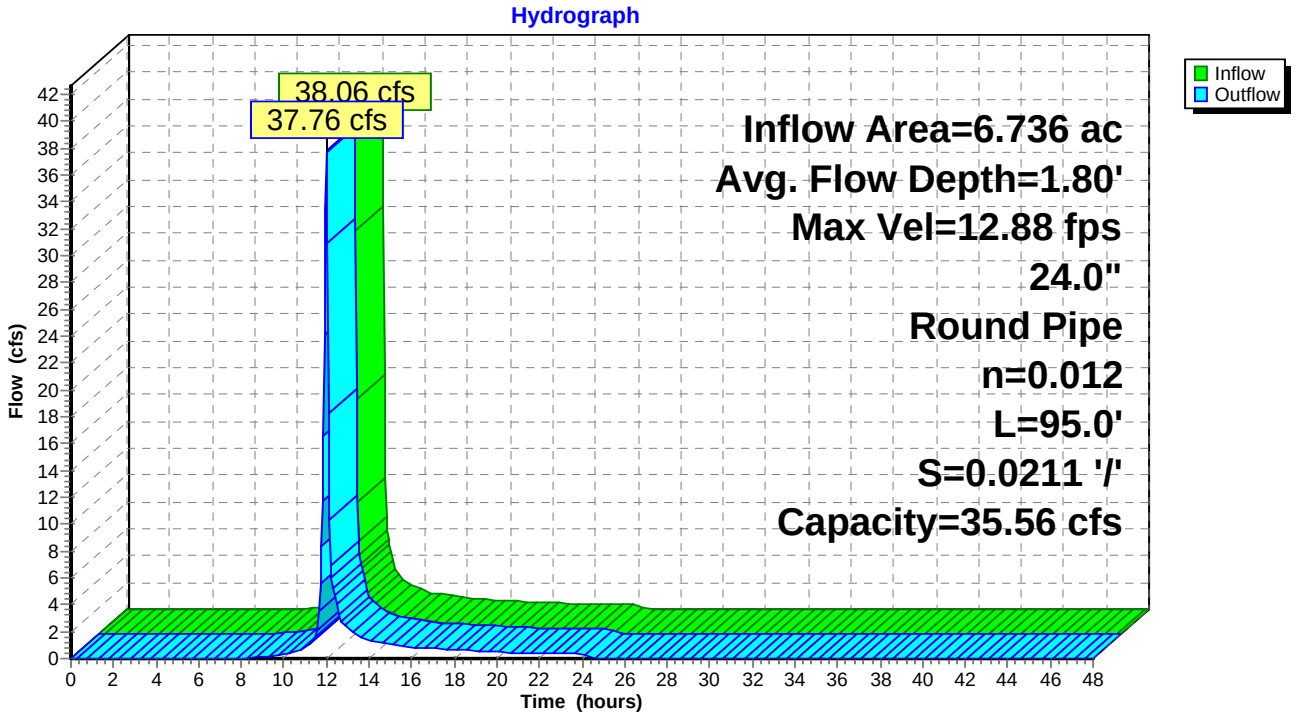
Inflow Area = 6.736 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 38.06 cfs @ 11.99 hrs, Volume= 1.902 af
Outflow = 37.76 cfs @ 11.99 hrs, Volume= 1.902 af, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 12.88 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.22 fps, Avg. Travel Time= 0.4 min

Peak Storage= 283 cf @ 11.99 hrs
Average Depth at Peak Storage= 1.80'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 35.56 cfs

24.0" Round Pipe
n= 0.012 Concrete pipe, finished
Length= 95.0' Slope= 0.0211 '/'
Inlet Invert= 855.00', Outlet Invert= 853.00'





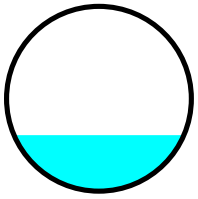
Summary for Reach C-11-1a: C-11-1a

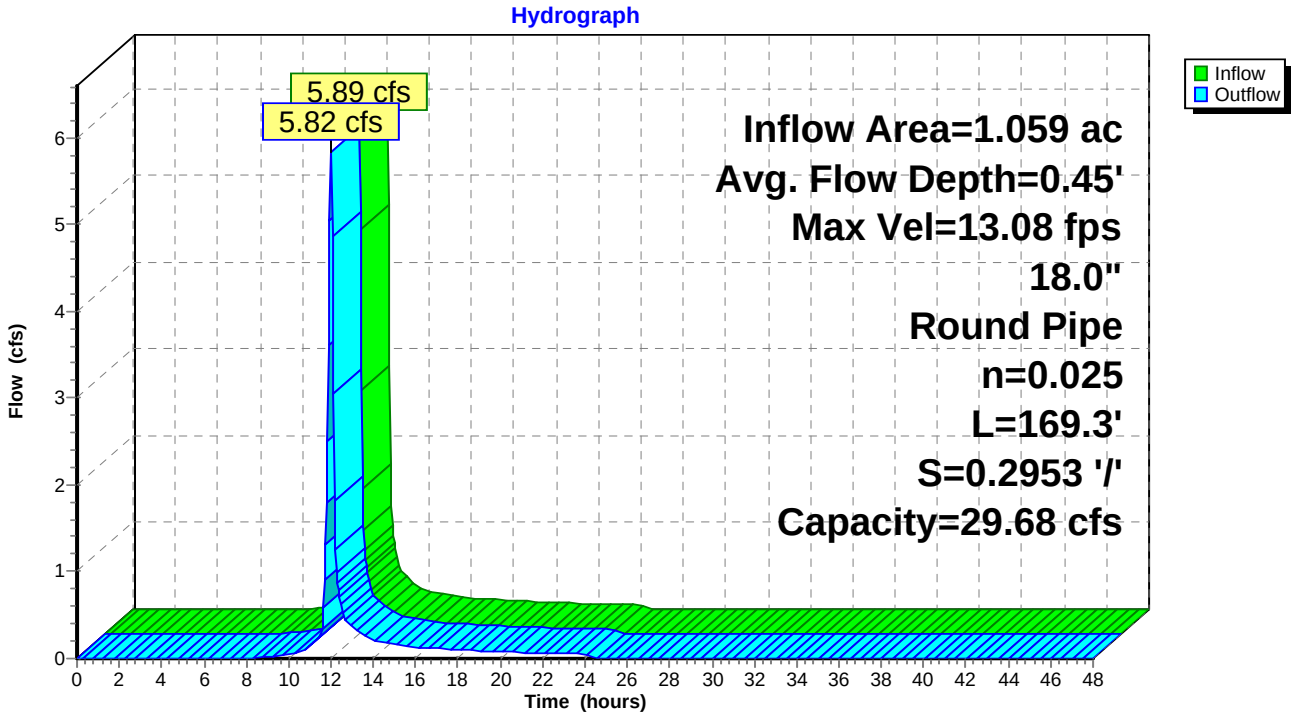
Inflow Area = 1.059 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 5.89 cfs @ 11.99 hrs, Volume= 0.299 af
Outflow = 5.82 cfs @ 12.00 hrs, Volume= 0.299 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 13.08 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.05 fps, Avg. Travel Time= 0.7 min

Peak Storage= 76 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 29.68 cfs

18.0" Round Pipe
n= 0.025 Corrugated metal
Length= 169.3' Slope= 0.2953 '/'
Inlet Invert= 980.00', Outlet Invert= 930.00'





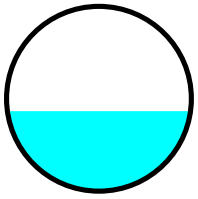
Summary for Reach C-11-1b: C-11-1b

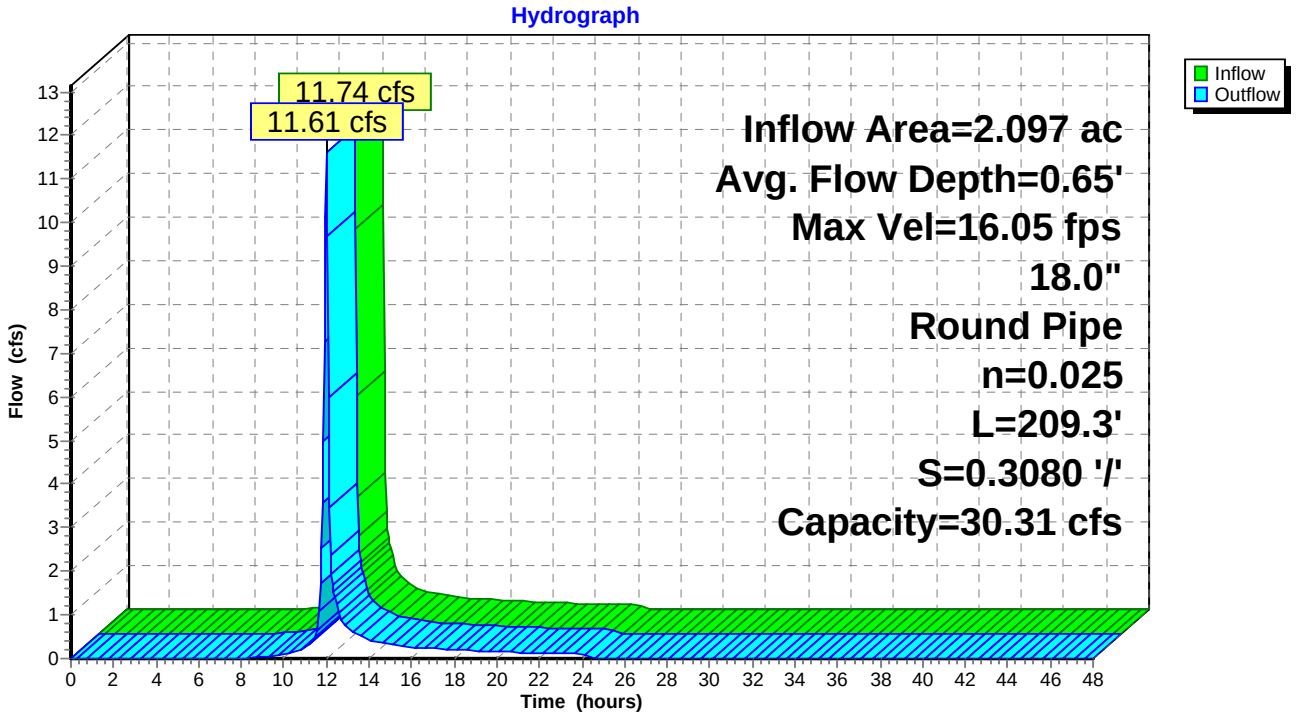
Inflow Area = 2.097 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 11.74 cfs @ 11.99 hrs, Volume= 0.592 af
Outflow = 11.61 cfs @ 12.00 hrs, Volume= 0.592 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 16.05 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.90 fps, Avg. Travel Time= 0.7 min

Peak Storage= 153 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 30.31 cfs

18.0" Round Pipe
n= 0.025 Corrugated metal
Length= 209.3' Slope= 0.3080 '/'
Inlet Invert= 930.00', Outlet Invert= 865.54'





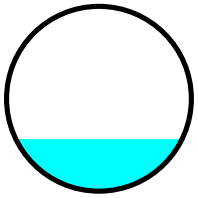
Summary for Reach C-11-2a: C-11-2a

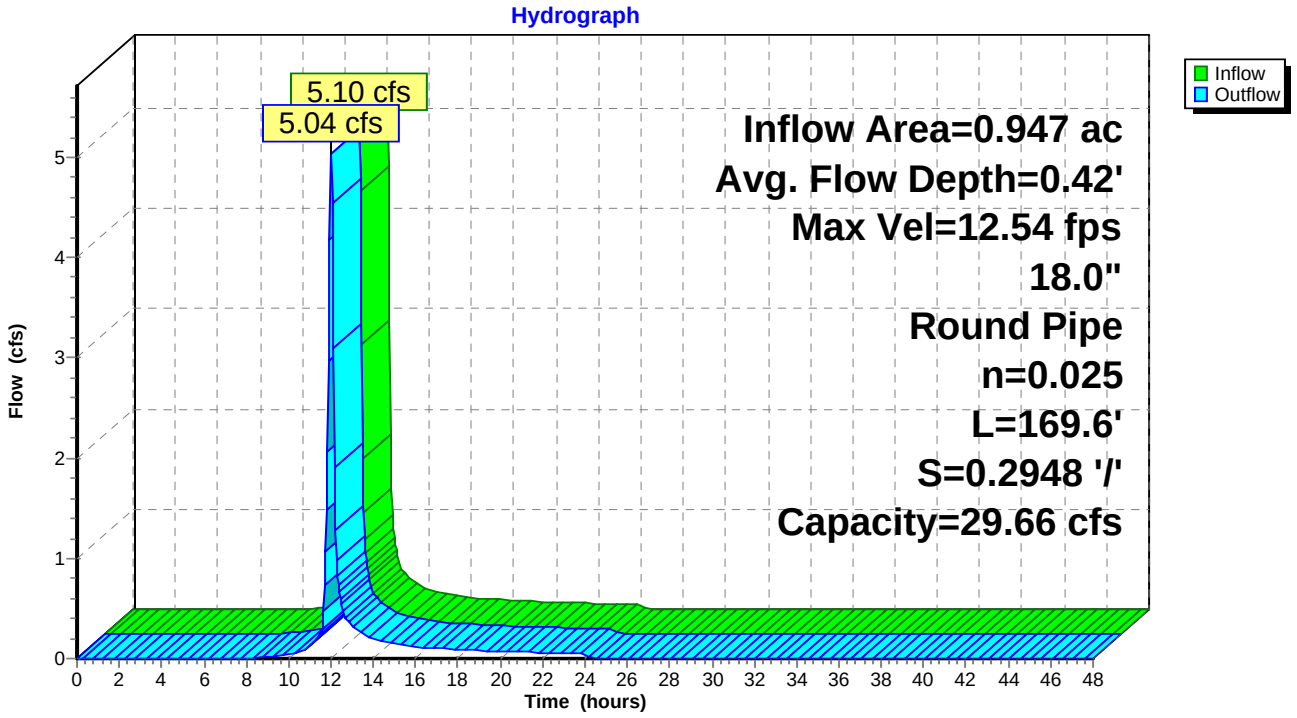
Inflow Area = 0.947 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 5.10 cfs @ 12.00 hrs, Volume= 0.267 af
Outflow = 5.04 cfs @ 12.01 hrs, Volume= 0.267 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 12.54 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.91 fps, Avg. Travel Time= 0.7 min

Peak Storage= 69 cf @ 12.00 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 29.66 cfs

18.0" Round Pipe
n= 0.025 Corrugated metal
Length= 169.6' Slope= 0.2948 '/'
Inlet Invert= 980.00', Outlet Invert= 930.00'





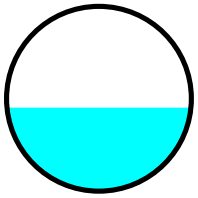
Summary for Reach C-11-2b: C-11-2b

Inflow Area = 2.315 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 12.87 cfs @ 12.00 hrs, Volume= 0.654 af
Outflow = 12.62 cfs @ 12.01 hrs, Volume= 0.654 af, Atten= 2%, Lag= 0.5 min

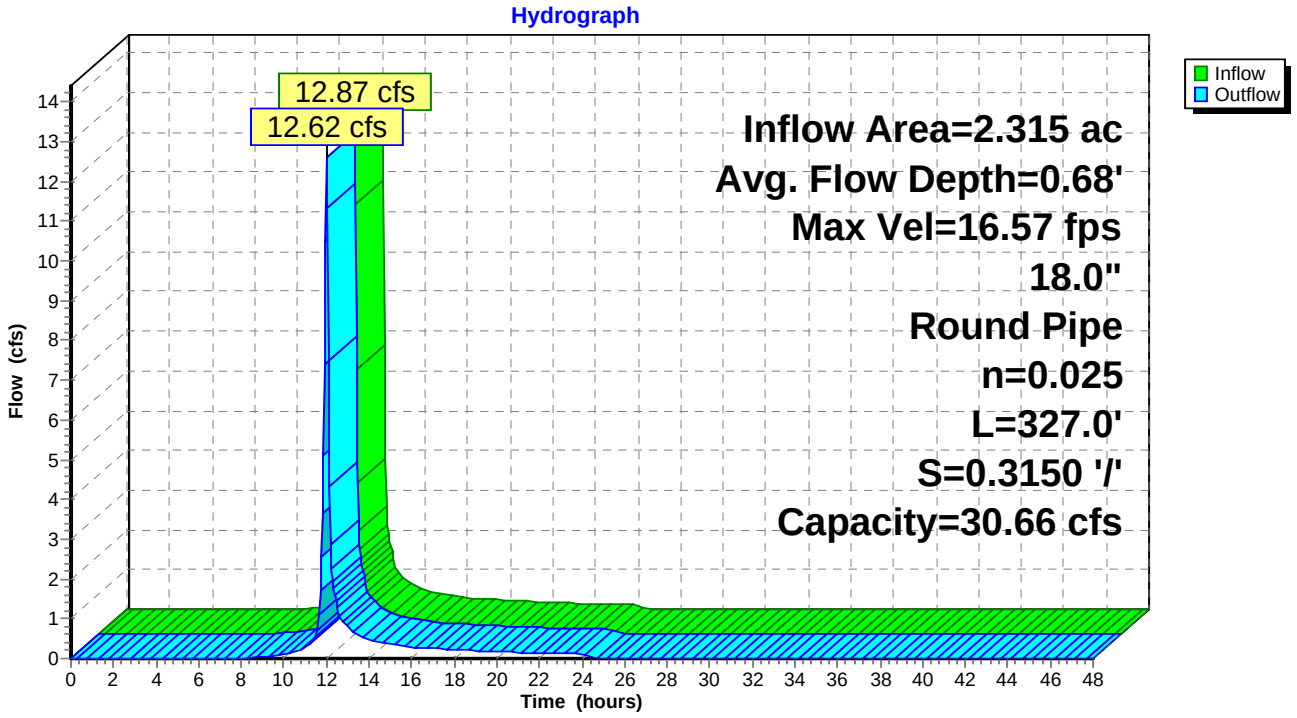
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 16.57 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 5.05 fps, Avg. Travel Time= 1.1 min

Peak Storage= 253 cf @ 12.00 hrs
Average Depth at Peak Storage= 0.68'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 30.66 cfs

18.0" Round Pipe
n= 0.025 Corrugated metal
Length= 327.0' Slope= 0.3150 '/'
Inlet Invert= 930.00', Outlet Invert= 827.00'



Reach C-11-2b: C-11-2b



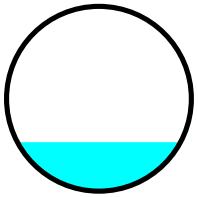
Summary for Reach C-11-3: C-11-3

Inflow Area = 0.854 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 4.60 cfs @ 12.01 hrs, Volume= 0.241 af
Outflow = 4.52 cfs @ 12.02 hrs, Volume= 0.241 af, Atten= 2%, Lag= 0.5 min

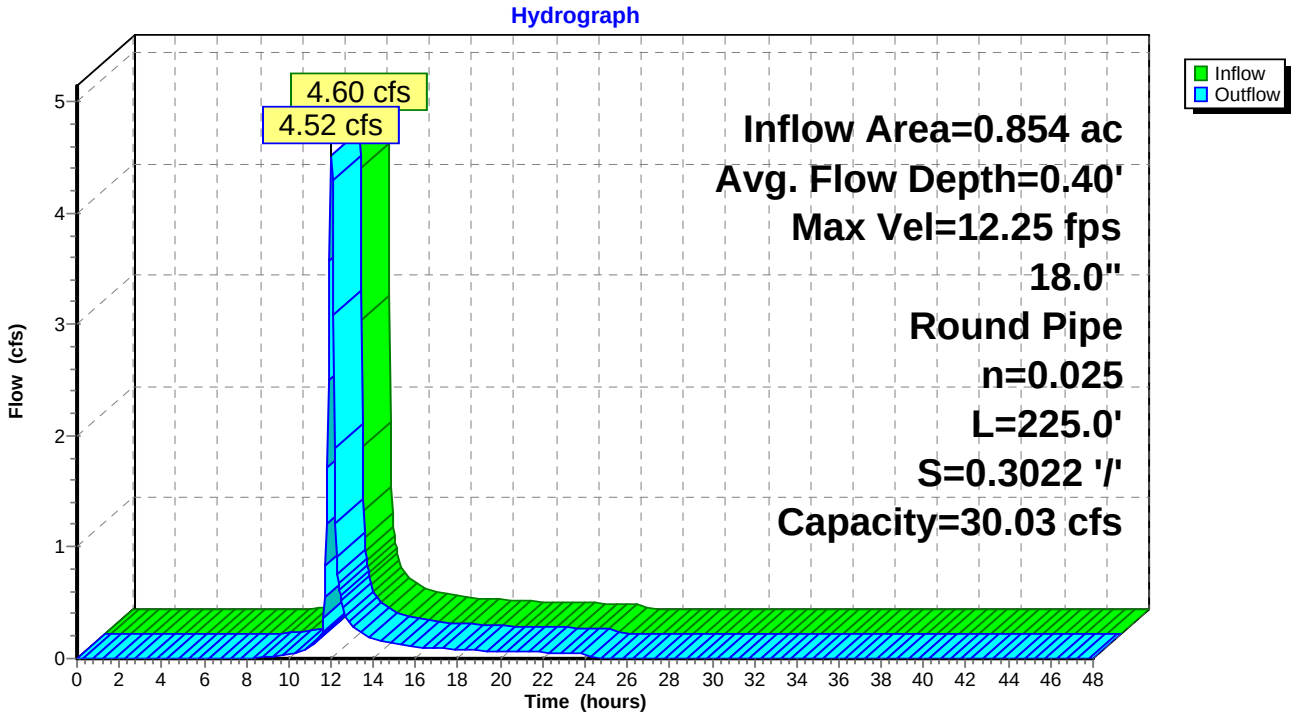
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 12.25 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.71 fps, Avg. Travel Time= 1.0 min

Peak Storage= 84 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 30.03 cfs

18.0" Round Pipe
n= 0.025 Corrugated metal
Length= 225.0' Slope= 0.3022 '/'
Inlet Invert= 930.00', Outlet Invert= 862.00'



Reach C-11-3: C-11-3



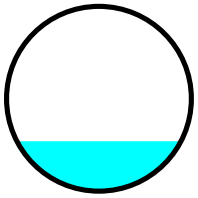
Summary for Reach C-12-1a: C-12-1a

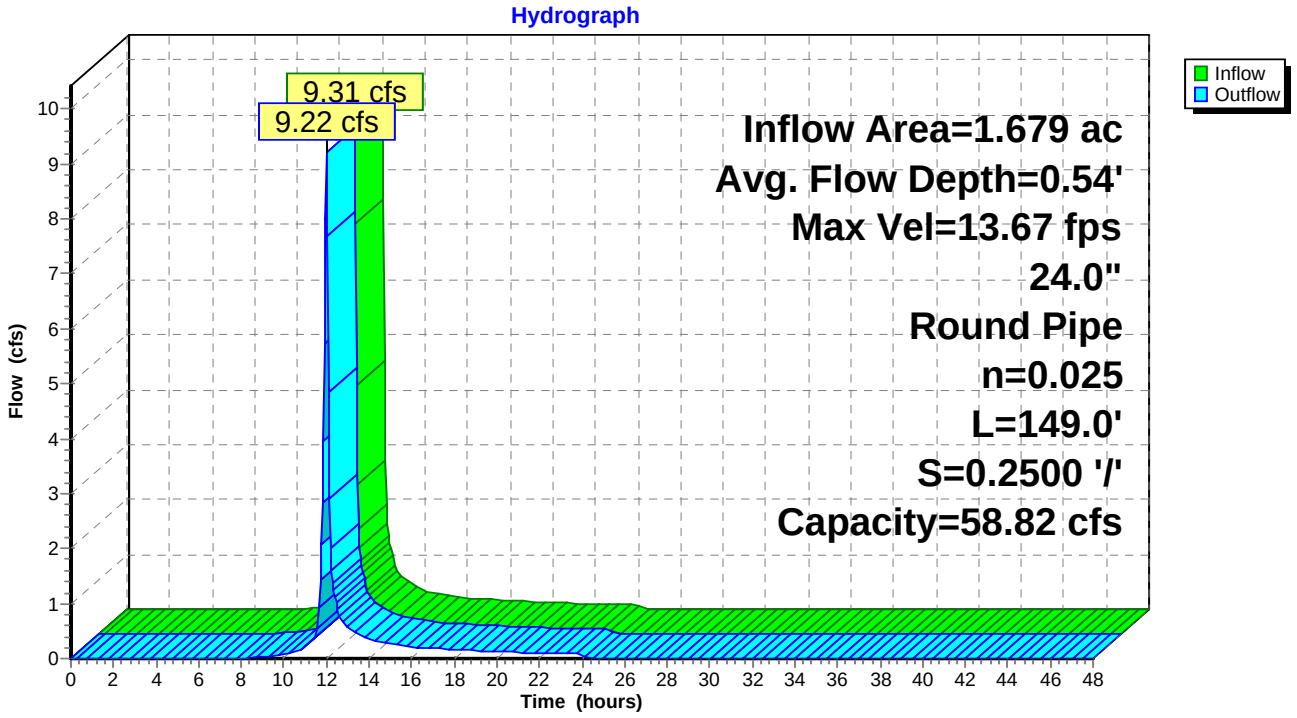
Inflow Area = 1.679 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 9.31 cfs @ 11.99 hrs, Volume= 0.474 af
Outflow = 9.22 cfs @ 12.00 hrs, Volume= 0.474 af, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 13.67 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.23 fps, Avg. Travel Time= 0.6 min

Peak Storage= 101 cf @ 12.00 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 58.82 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 149.0' Slope= 0.2500 '/'
Inlet Invert= 980.25', Outlet Invert= 943.00'





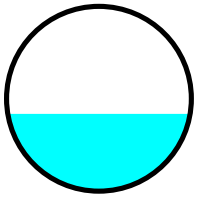
Summary for Reach C-12-1b: C-12-1b

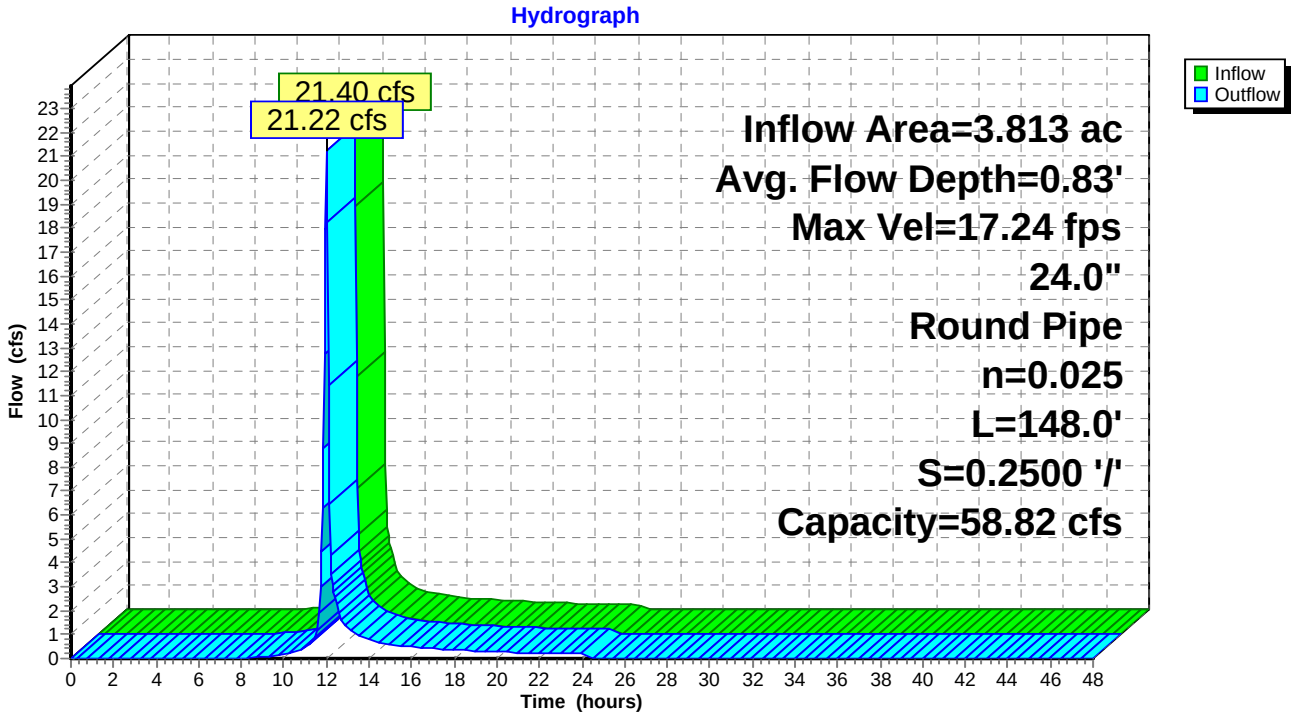
Inflow Area = 3.813 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 21.40 cfs @ 12.00 hrs, Volume= 1.076 af
Outflow = 21.22 cfs @ 12.00 hrs, Volume= 1.076 af, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 17.24 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 5.16 fps, Avg. Travel Time= 0.5 min

Peak Storage= 183 cf @ 12.00 hrs
Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 58.82 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 148.0' Slope= 0.2500 '/'
Inlet Invert= 943.00', Outlet Invert= 906.00'





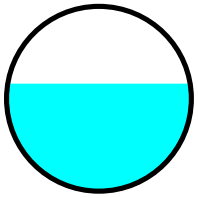
Summary for Reach C-12-1c: C-12-1c

Inflow Area = 6.696 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 37.70 cfs @ 12.00 hrs, Volume= 1.890 af
Outflow = 37.38 cfs @ 12.00 hrs, Volume= 1.890 af, Atten= 1%, Lag= 0.2 min

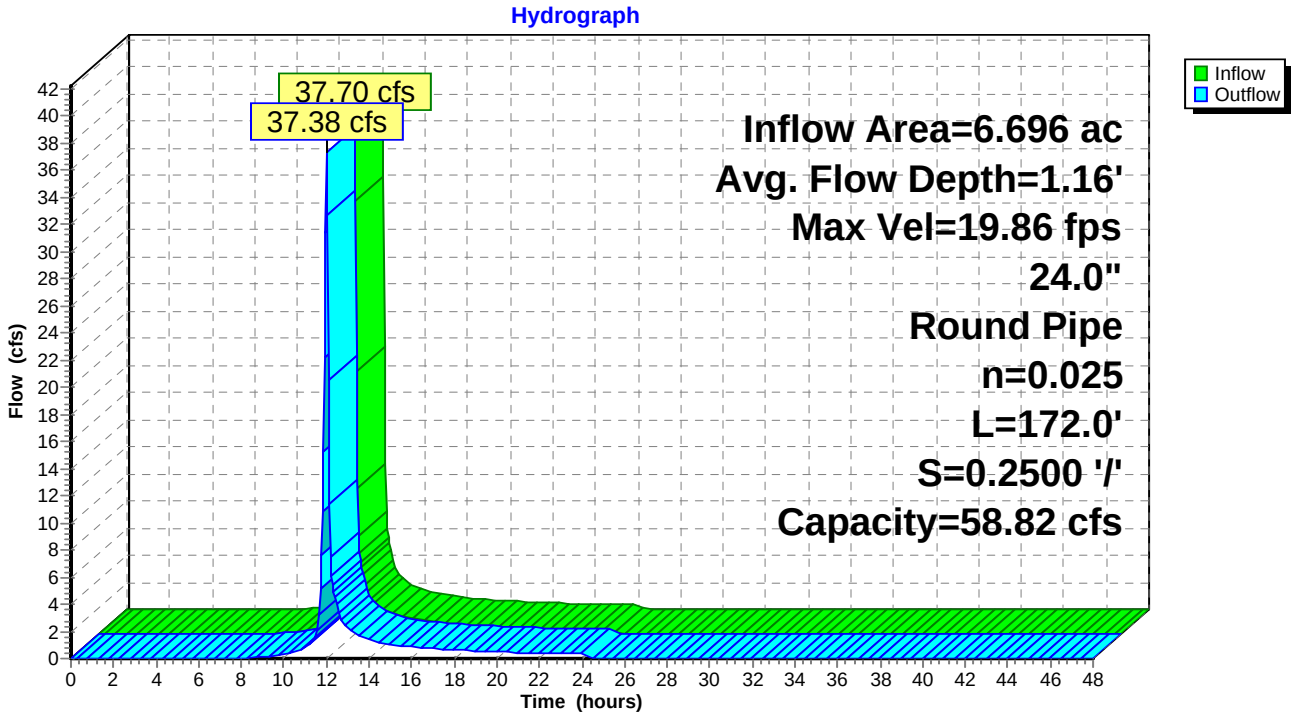
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 19.86 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 5.98 fps, Avg. Travel Time= 0.5 min

Peak Storage= 326 cf @ 12.00 hrs
Average Depth at Peak Storage= 1.16'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 58.82 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 172.0' Slope= 0.2500 '/'
Inlet Invert= 906.00', Outlet Invert= 863.00'



Reach C-12-1c: C-12-1c



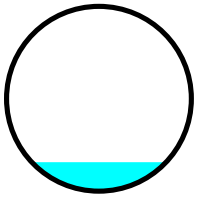
Summary for Reach C-16-1a: C-16-1a

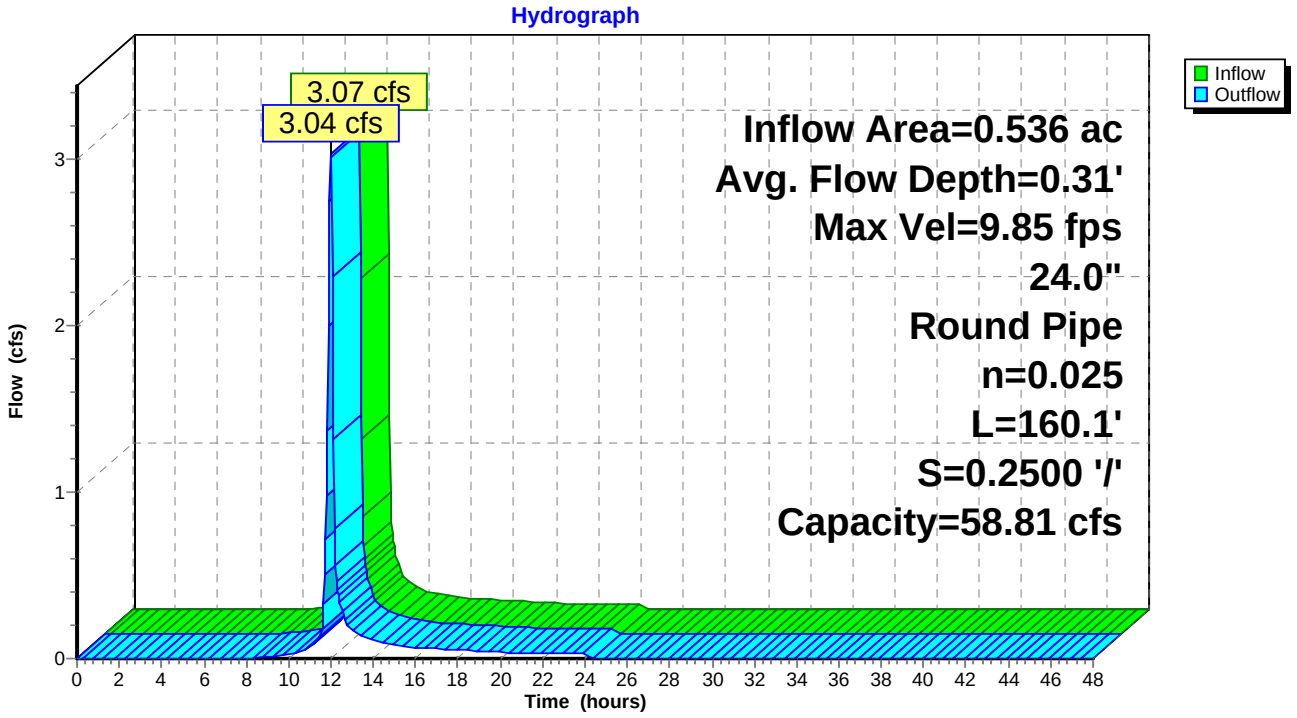
Inflow Area = 0.536 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 3.07 cfs @ 11.98 hrs, Volume= 0.151 af
Outflow = 3.04 cfs @ 11.99 hrs, Volume= 0.151 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.85 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.05 fps, Avg. Travel Time= 0.9 min

Peak Storage= 50 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 58.81 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 160.1' Slope= 0.2500 '/'
Inlet Invert= 980.02', Outlet Invert= 940.00'





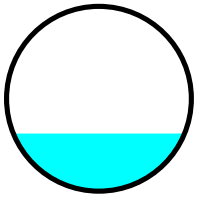
Summary for Reach C-16-1b: C-16-1b

Inflow Area = 2.178 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 12.33 cfs @ 11.99 hrs, Volume= 0.615 af
Outflow = 12.22 cfs @ 11.99 hrs, Volume= 0.615 af, Atten= 1%, Lag= 0.3 min

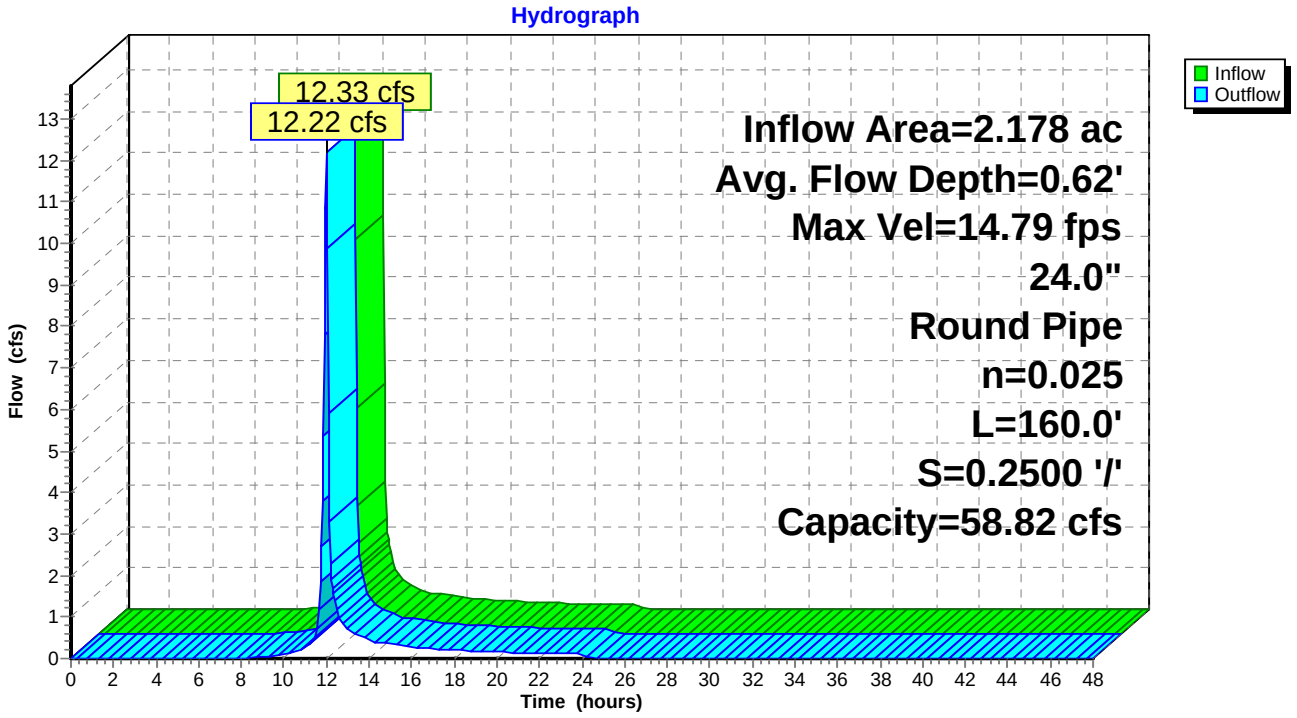
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 14.79 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.42 fps, Avg. Travel Time= 0.6 min

Peak Storage= 133 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.62'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 58.82 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 160.0' Slope= 0.2500 '/'
Inlet Invert= 940.00', Outlet Invert= 900.00'



Reach C-16-1b: C-16-1b



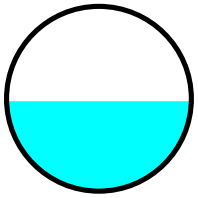
Summary for Reach C-16-1c: C-16-1c

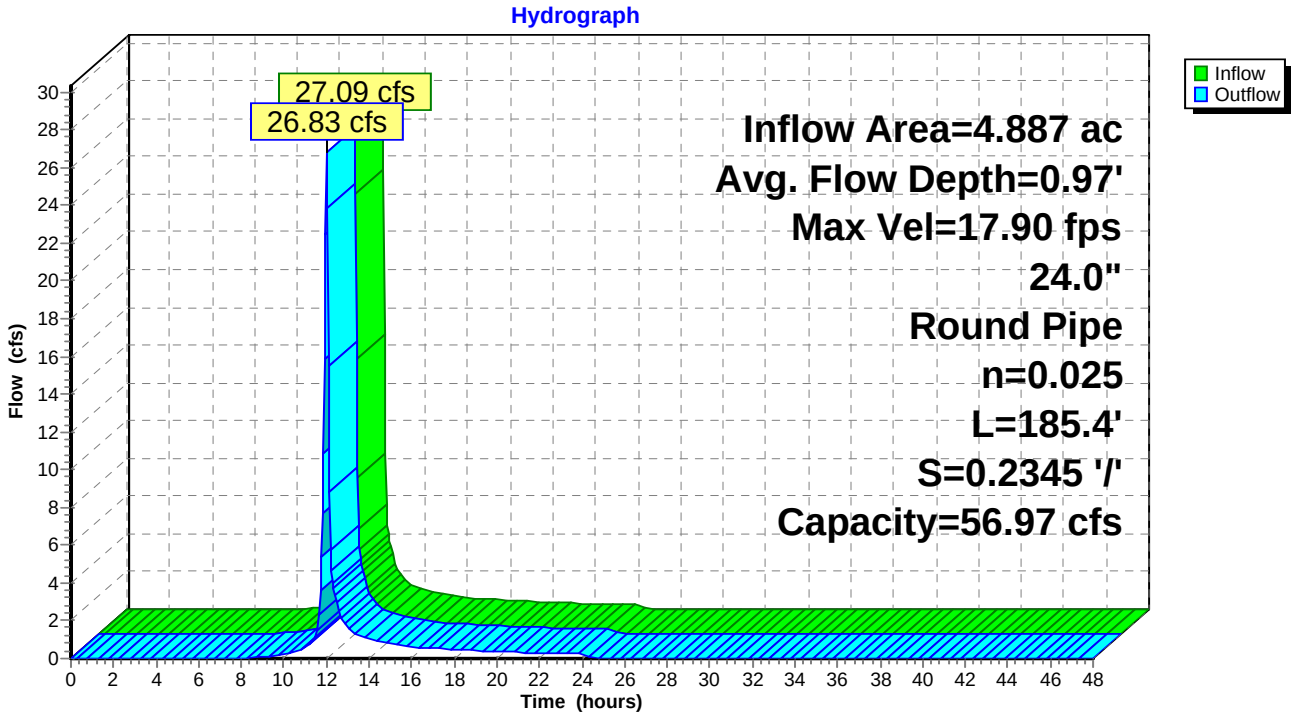
Inflow Area = 4.887 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 27.09 cfs @ 12.00 hrs, Volume= 1.380 af
Outflow = 26.83 cfs @ 12.00 hrs, Volume= 1.380 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 17.90 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 5.30 fps, Avg. Travel Time= 0.6 min

Peak Storage= 280 cf @ 12.00 hrs
Average Depth at Peak Storage= 0.97'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 56.97 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 185.4' Slope= 0.2345 '/'
Inlet Invert= 900.00', Outlet Invert= 856.52'





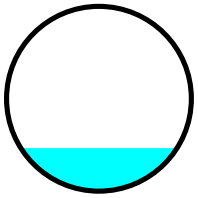
Summary for Reach C-17-1a: C-17-1a

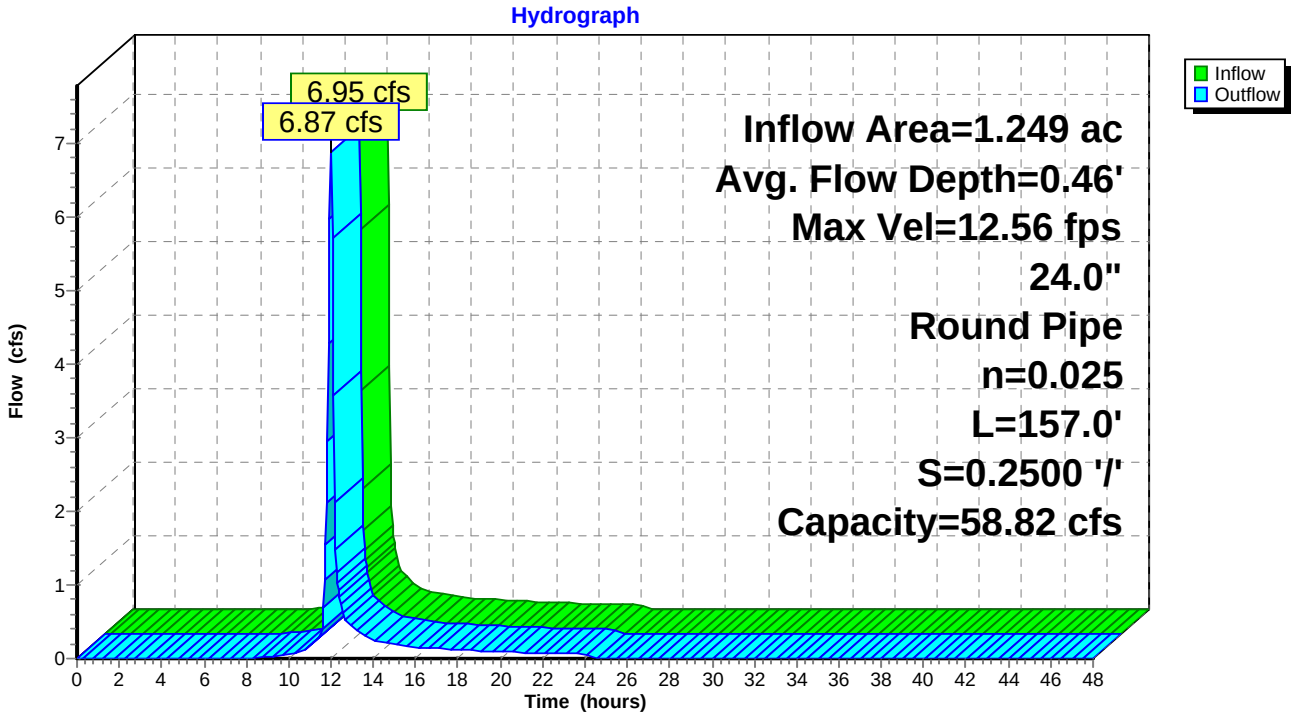
Inflow Area = 1.249 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 6.95 cfs @ 11.99 hrs, Volume= 0.353 af
Outflow = 6.87 cfs @ 12.00 hrs, Volume= 0.353 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 12.56 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.88 fps, Avg. Travel Time= 0.7 min

Peak Storage= 87 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.46'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 58.82 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 157.0' Slope= 0.2500 '/'
Inlet Invert= 980.17', Outlet Invert= 940.92'





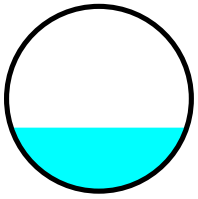
Summary for Reach C-17-1b: C-17-1b

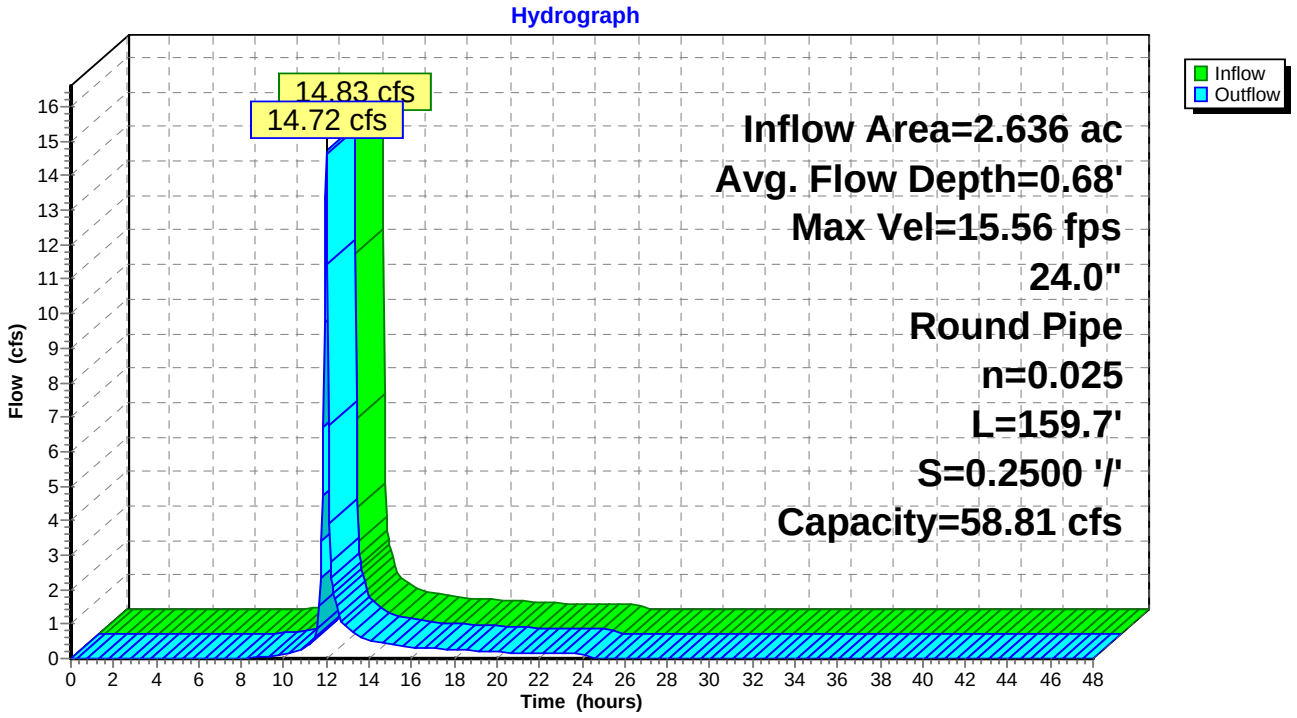
Inflow Area = 2.636 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 14.83 cfs @ 11.99 hrs, Volume= 0.744 af
Outflow = 14.72 cfs @ 11.99 hrs, Volume= 0.744 af, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 15.56 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.74 fps, Avg. Travel Time= 0.6 min

Peak Storage= 152 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.68'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 58.81 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 159.7' Slope= 0.2500 '/'
Inlet Invert= 940.92', Outlet Invert= 901.00'





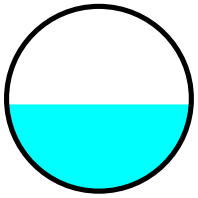
Summary for Reach C-17-1c: C-17-1c

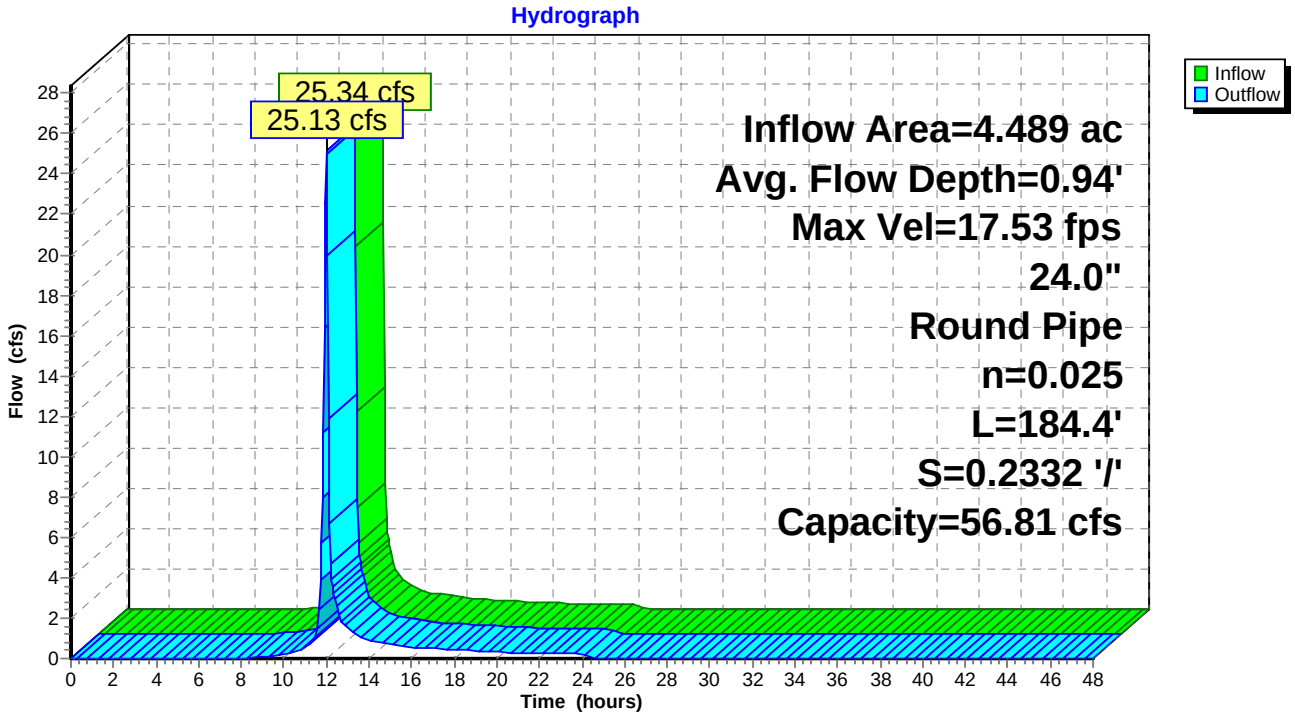
Inflow Area = 4.489 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 25.34 cfs @ 11.99 hrs, Volume= 1.267 af
Outflow = 25.13 cfs @ 11.99 hrs, Volume= 1.267 af, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 17.53 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 5.33 fps, Avg. Travel Time= 0.6 min

Peak Storage= 266 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.94'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 56.81 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 184.4' Slope= 0.2332 '/'
Inlet Invert= 901.00', Outlet Invert= 858.00'





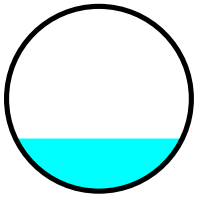
Summary for Reach C-18-1a: C-18-1a

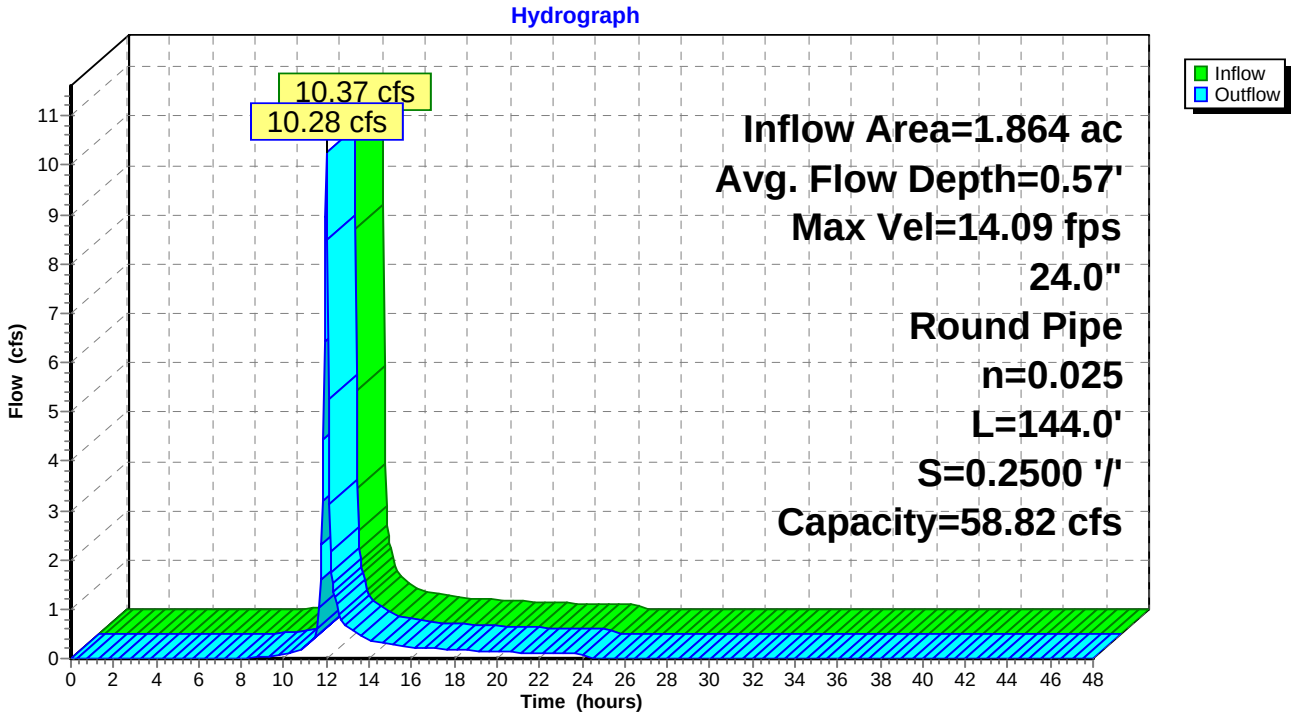
Inflow Area = 1.864 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 10.37 cfs @ 11.99 hrs, Volume= 0.526 af
Outflow = 10.28 cfs @ 12.00 hrs, Volume= 0.526 af, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 14.09 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.36 fps, Avg. Travel Time= 0.6 min

Peak Storage= 106 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.57'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 58.82 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 144.0' Slope= 0.2500 '/'
Inlet Invert= 980.00', Outlet Invert= 944.00'





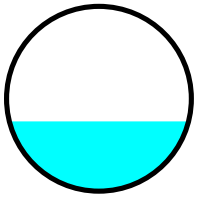
Summary for Reach C-18-1b: C-18-1b

Inflow Area = 3.205 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 17.73 cfs @ 12.00 hrs, Volume= 0.905 af
Outflow = 17.67 cfs @ 12.01 hrs, Volume= 0.905 af, Atten= 0%, Lag= 0.1 min

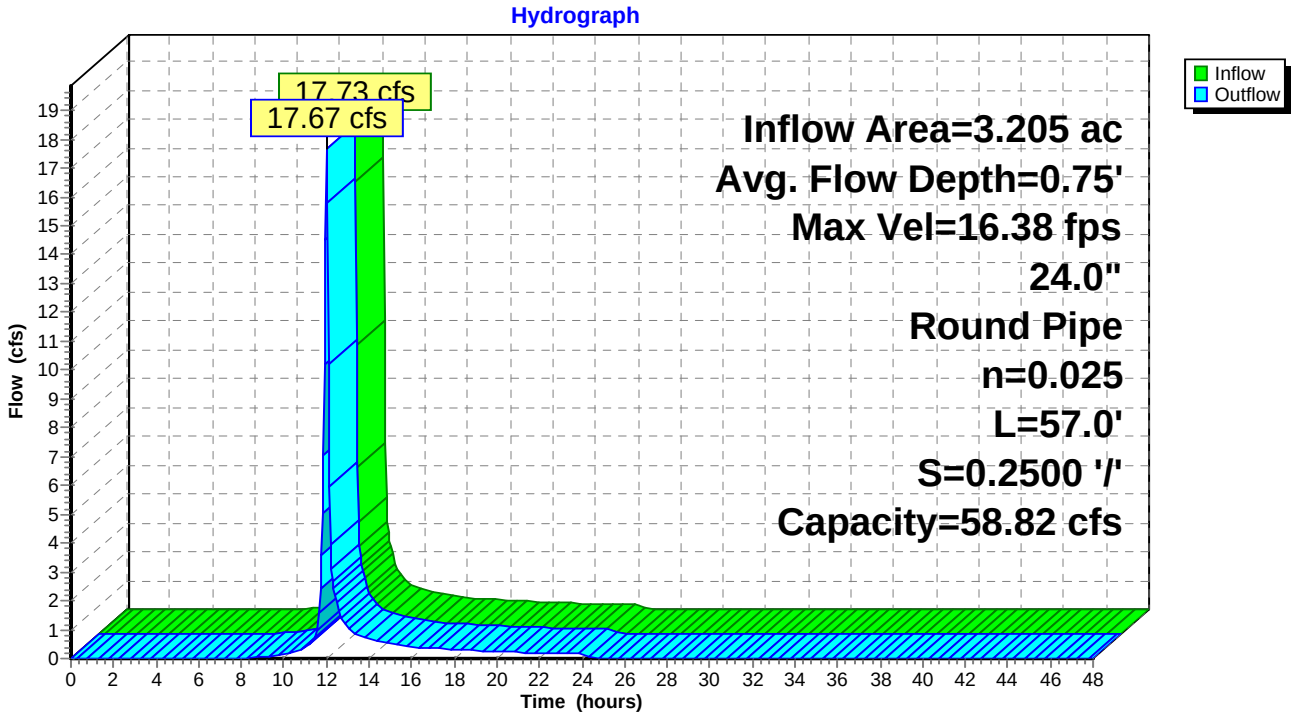
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 16.38 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.88 fps, Avg. Travel Time= 0.2 min

Peak Storage= 62 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.75'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 58.82 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 57.0' Slope= 0.2500 '/'
Inlet Invert= 944.00', Outlet Invert= 929.75'



Reach C-18-1b: C-18-1b



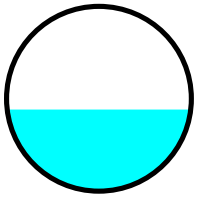
Summary for Reach C-18-1c: C-18-1c

Inflow Area = 4.251 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 23.59 cfs @ 12.01 hrs, Volume= 1.200 af
Outflow = 23.42 cfs @ 12.01 hrs, Volume= 1.200 af, Atten= 1%, Lag= 0.2 min

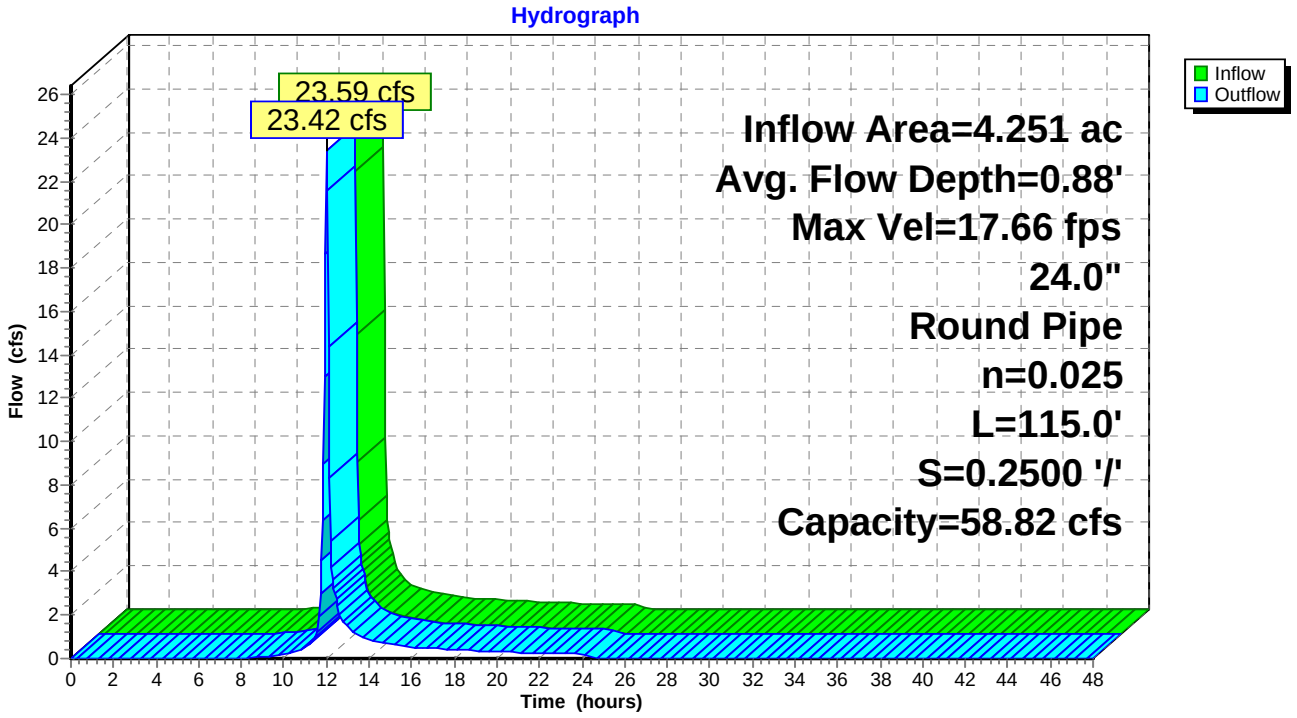
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 17.66 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 5.22 fps, Avg. Travel Time= 0.4 min

Peak Storage= 153 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.88'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 58.82 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 115.0' Slope= 0.2500 '/'
Inlet Invert= 929.75', Outlet Invert= 901.00'



Reach C-18-1c: C-18-1c



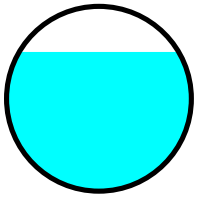
Summary for Reach C-18-1d: C-18-1d

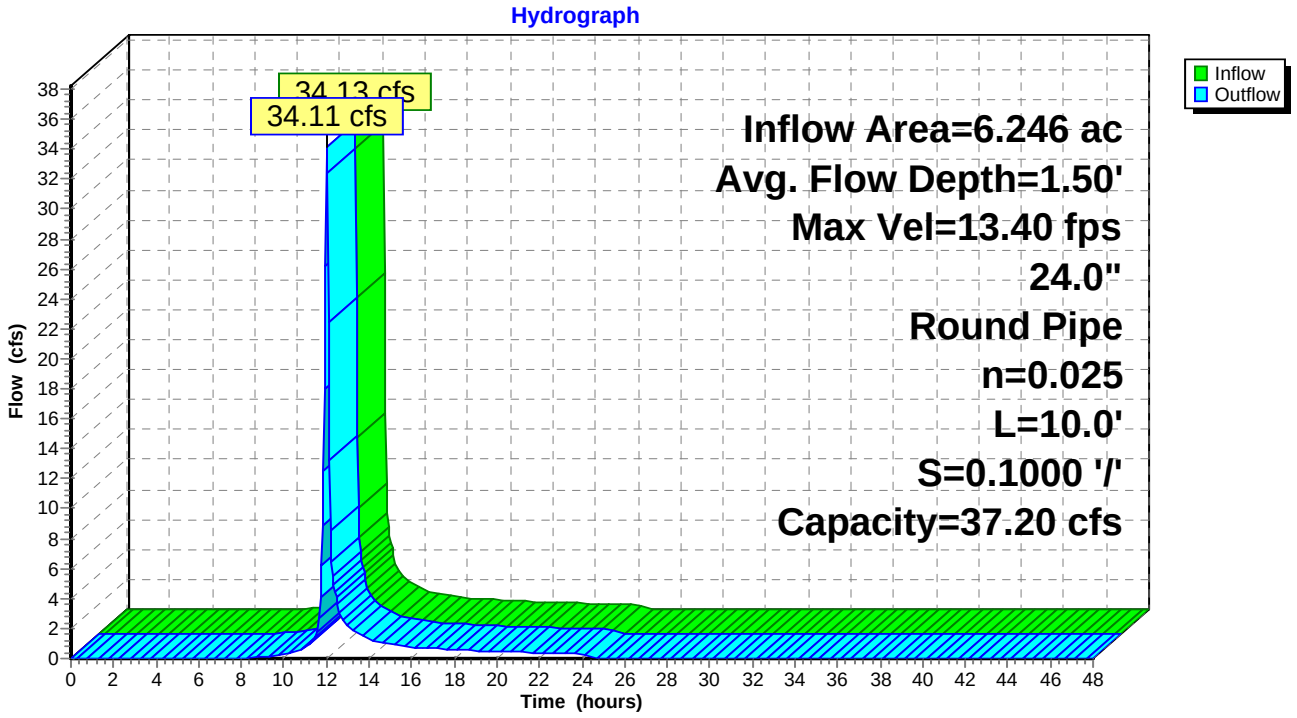
Inflow Area = 6.246 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 34.13 cfs @ 12.02 hrs, Volume= 1.763 af
Outflow = 34.11 cfs @ 12.02 hrs, Volume= 1.763 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 13.40 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.06 fps, Avg. Travel Time= 0.0 min

Peak Storage= 25 cf @ 12.02 hrs
Average Depth at Peak Storage= 1.50'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 37.20 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 10.0' Slope= 0.1000 '/'
Inlet Invert= 901.00', Outlet Invert= 900.00'





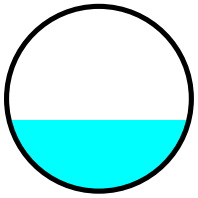
Summary for Reach C-6-1: C-6-1

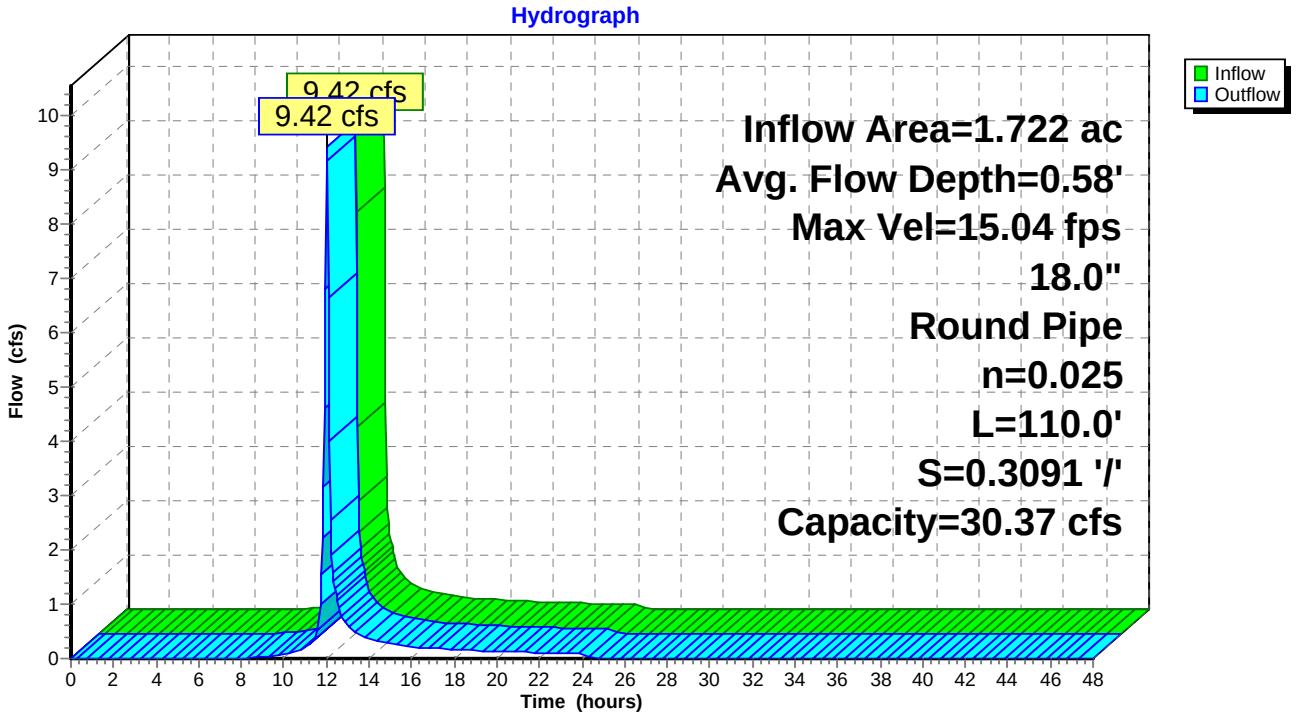
Inflow Area = 1.722 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 9.42 cfs @ 12.02 hrs, Volume= 0.486 af
Outflow = 9.42 cfs @ 12.03 hrs, Volume= 0.486 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 15.04 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.45 fps, Avg. Travel Time= 0.4 min

Peak Storage= 69 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.58'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 30.37 cfs

18.0" Round Pipe
n= 0.025 Corrugated metal
Length= 110.0' Slope= 0.3091 '/'
Inlet Invert= 930.00', Outlet Invert= 896.00'





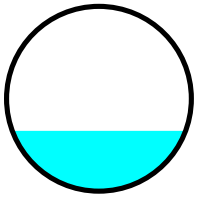
Summary for Reach C-6-2: C-6-2

Inflow Area = 1.792 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 6.40 cfs @ 12.15 hrs, Volume= 0.506 af
Outflow = 6.39 cfs @ 12.15 hrs, Volume= 0.506 af, Atten= 0%, Lag= 0.2 min

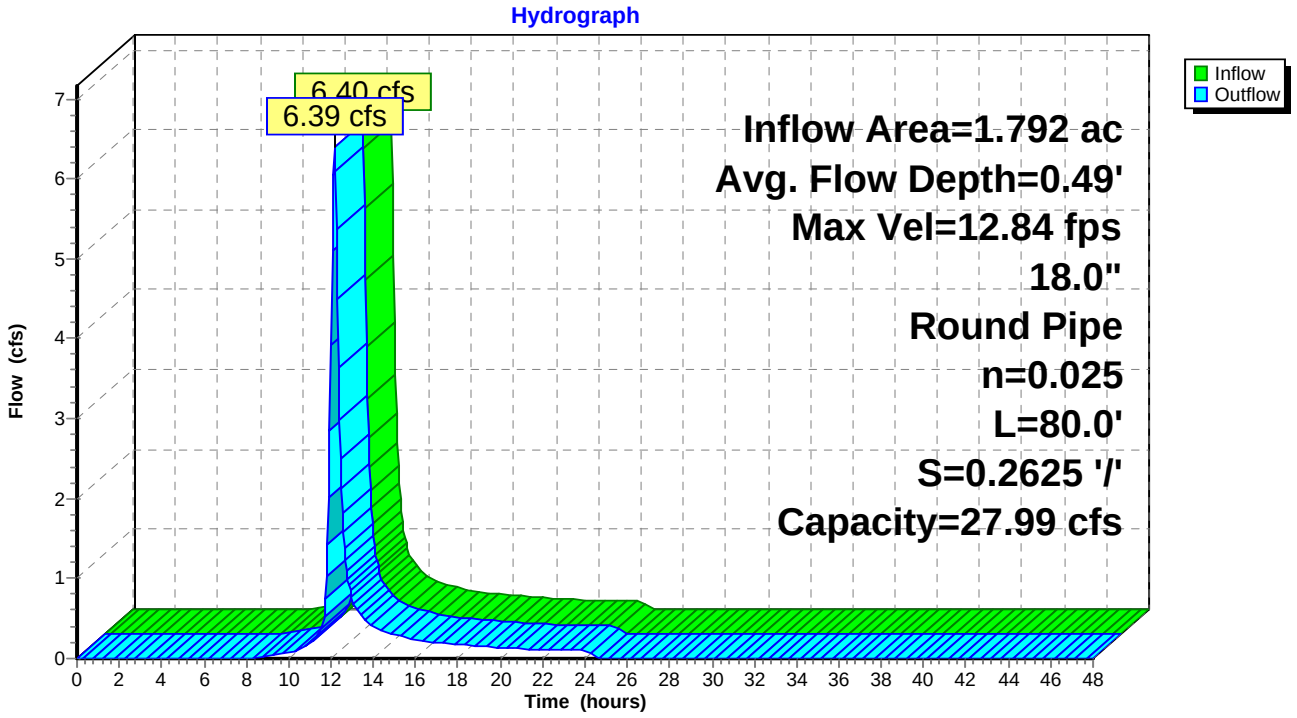
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 12.84 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.47 fps, Avg. Travel Time= 0.3 min

Peak Storage= 40 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 27.99 cfs

18.0" Round Pipe
n= 0.025 Corrugated metal
Length= 80.0' Slope= 0.2625 '/'
Inlet Invert= 916.00', Outlet Invert= 895.00'



Reach C-6-2: C-6-2



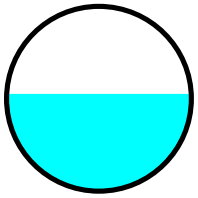
Summary for Reach C-6-3: C-6-3

Inflow Area = 7.183 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 31.39 cfs @ 12.03 hrs, Volume= 2.028 af
Outflow = 30.84 cfs @ 12.05 hrs, Volume= 2.028 af, Atten= 2%, Lag= 1.2 min

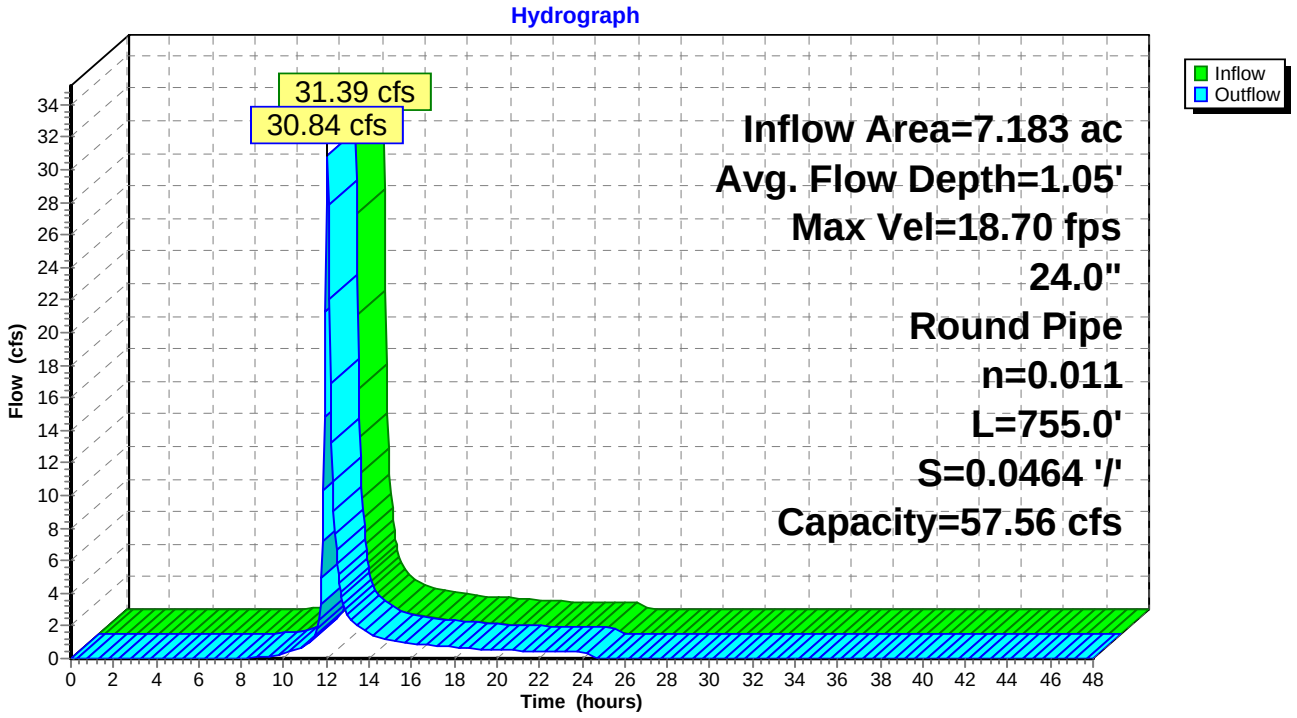
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 18.70 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 5.88 fps, Avg. Travel Time= 2.1 min

Peak Storage= 1,266 cf @ 12.04 hrs
Average Depth at Peak Storage= 1.05'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 57.56 cfs

24.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 755.0' Slope= 0.0464 '/'
Inlet Invert= 893.00', Outlet Invert= 858.00'



Reach C-6-3: C-6-3



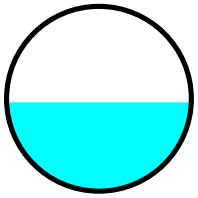
Summary for Reach C-6-4: C-6-4

Inflow Area = 2.891 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 13.97 cfs @ 12.04 hrs, Volume= 0.816 af
Outflow = 13.88 cfs @ 12.04 hrs, Volume= 0.816 af, Atten= 1%, Lag= 0.4 min

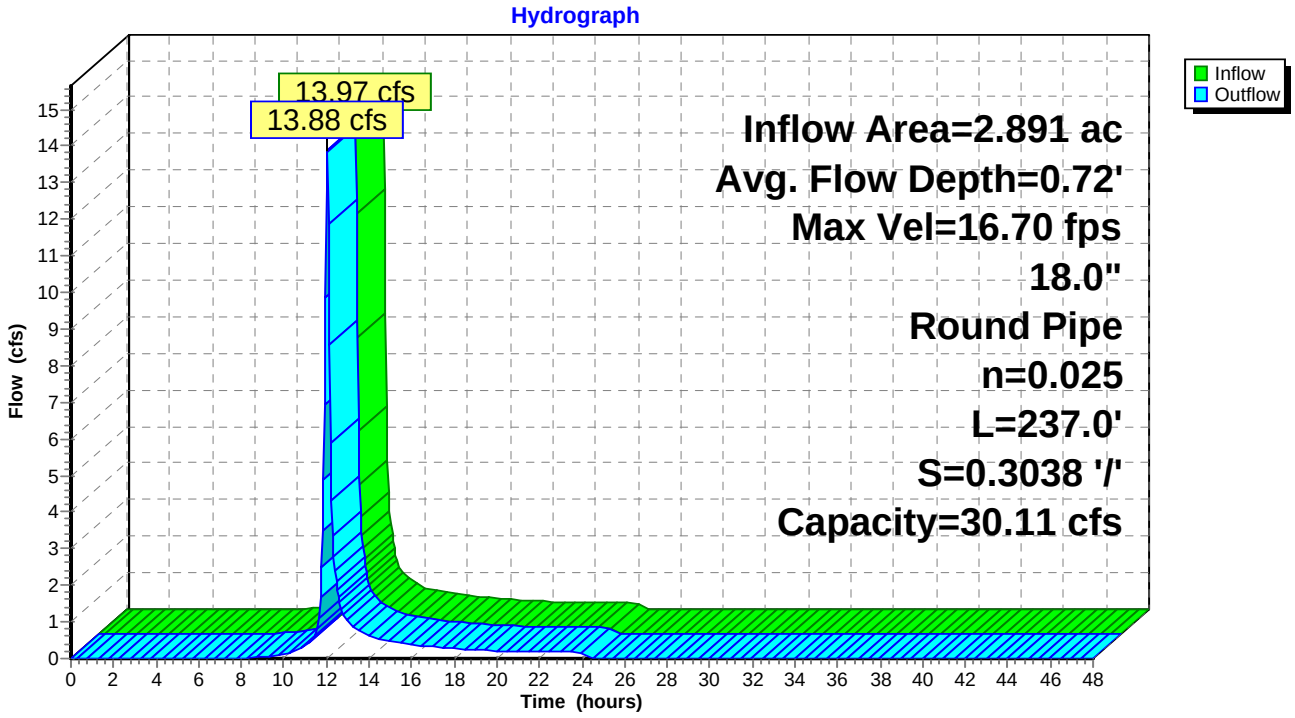
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 16.70 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 5.47 fps, Avg. Travel Time= 0.7 min

Peak Storage= 198 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.72'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 30.11 cfs

18.0" Round Pipe
n= 0.025 Corrugated metal
Length= 237.0' Slope= 0.3038 '/'
Inlet Invert= 922.00', Outlet Invert= 850.00'



Reach C-6-4: C-6-4



Summary for Reach D-16-1: D-16-1

Inflow Area = 0.842 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 5.36 cfs @ 11.94 hrs, Volume= 0.238 af
Outflow = 4.89 cfs @ 11.97 hrs, Volume= 0.238 af, Atten= 9%, Lag= 1.7 min

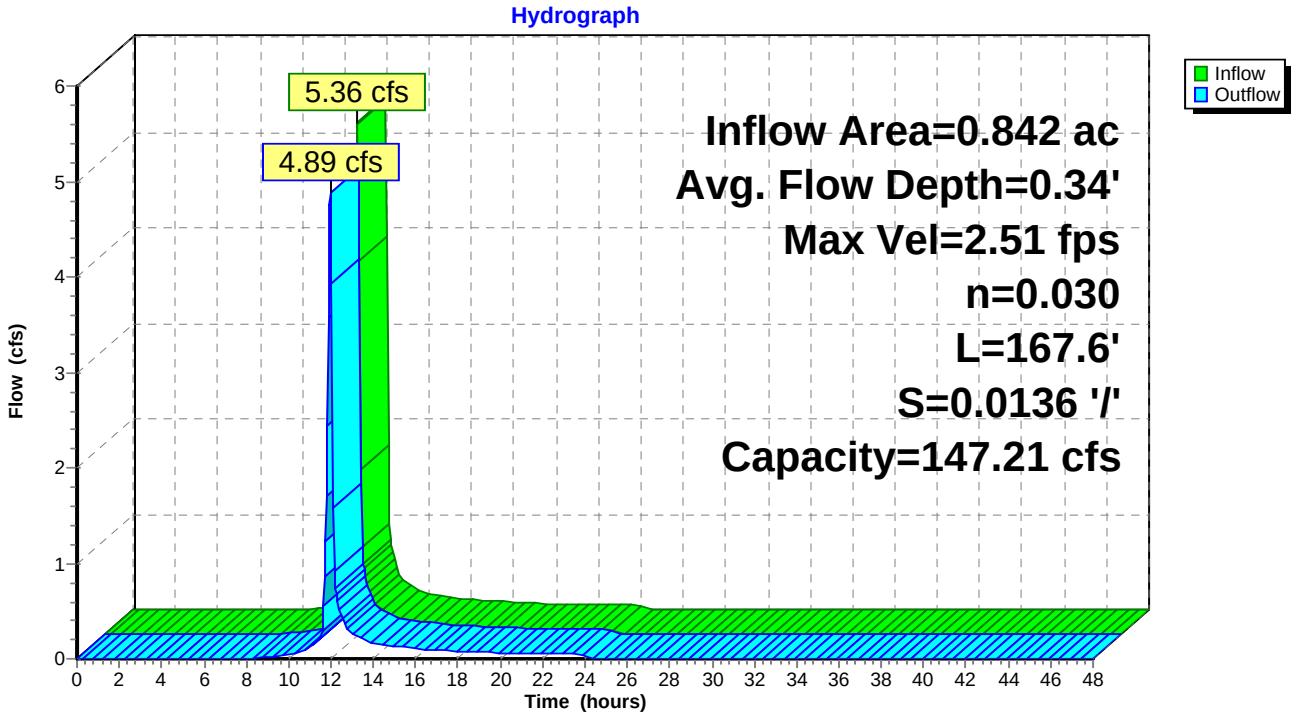
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.51 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.61 fps, Avg. Travel Time= 4.6 min

Peak Storage= 345 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 2.00' Flow Area= 22.0 sf, Capacity= 147.21 cfs

5.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 3.0 '/' Top Width= 17.00'
Length= 167.6' Slope= 0.0136 '/'
Inlet Invert= 858.80', Outlet Invert= 856.52'

‡

Reach D-16-1: D-16-1



Summary for Reach D-16-2: D-16-2

Inflow Area = 5.137 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 30.35 cfs @ 11.95 hrs, Volume= 1.450 af
Outflow = 25.62 cfs @ 12.06 hrs, Volume= 1.450 af, Atten= 16%, Lag= 6.4 min

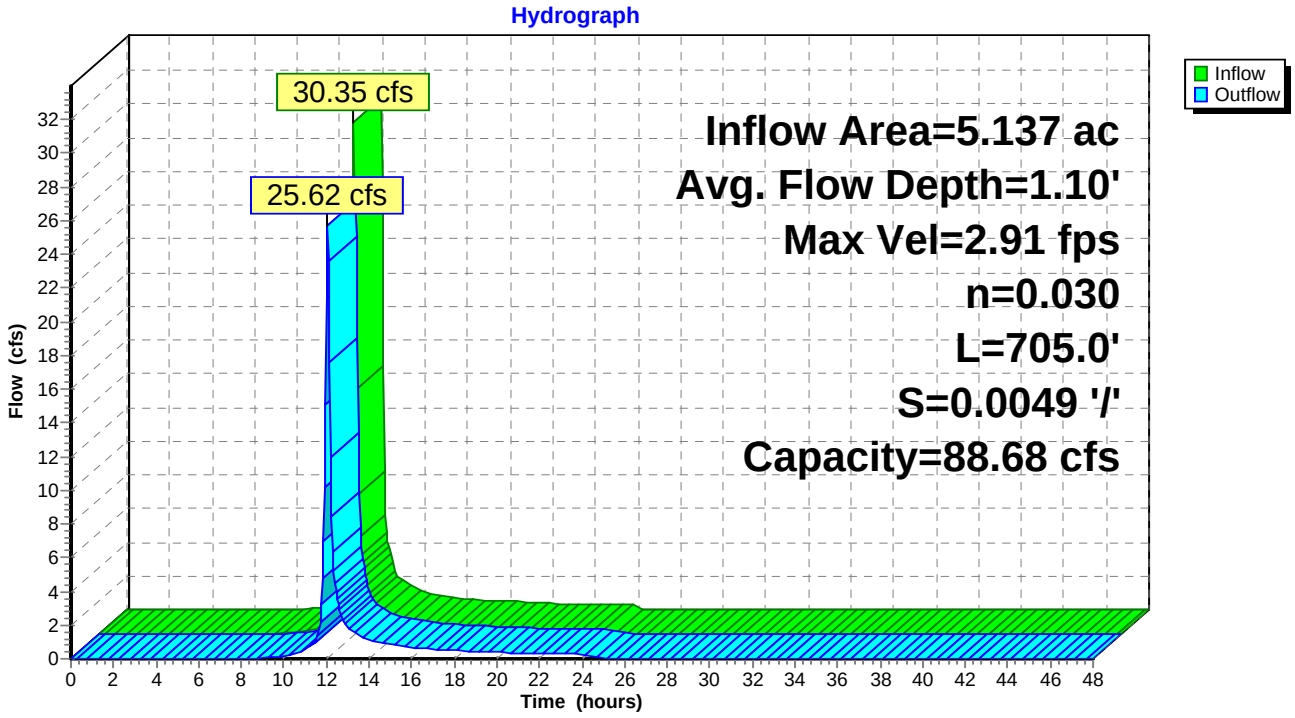
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.91 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 0.68 fps, Avg. Travel Time= 17.2 min

Peak Storage= 6,434 cf @ 11.99 hrs
Average Depth at Peak Storage= 1.10'
Bank-Full Depth= 2.00' Flow Area= 22.0 sf, Capacity= 88.68 cfs

5.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 3.0 '/' Top Width= 17.00'
Length= 705.0' Slope= 0.0049 '/'
Inlet Invert= 860.00', Outlet Invert= 856.52'

‡

Reach D-16-2: D-16-2



Summary for Reach D-17-1: D-17-1

Inflow Area = 1.417 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 9.02 cfs @ 11.94 hrs, Volume= 0.400 af
Outflow = 8.14 cfs @ 11.99 hrs, Volume= 0.400 af, Atten= 10%, Lag= 3.0 min

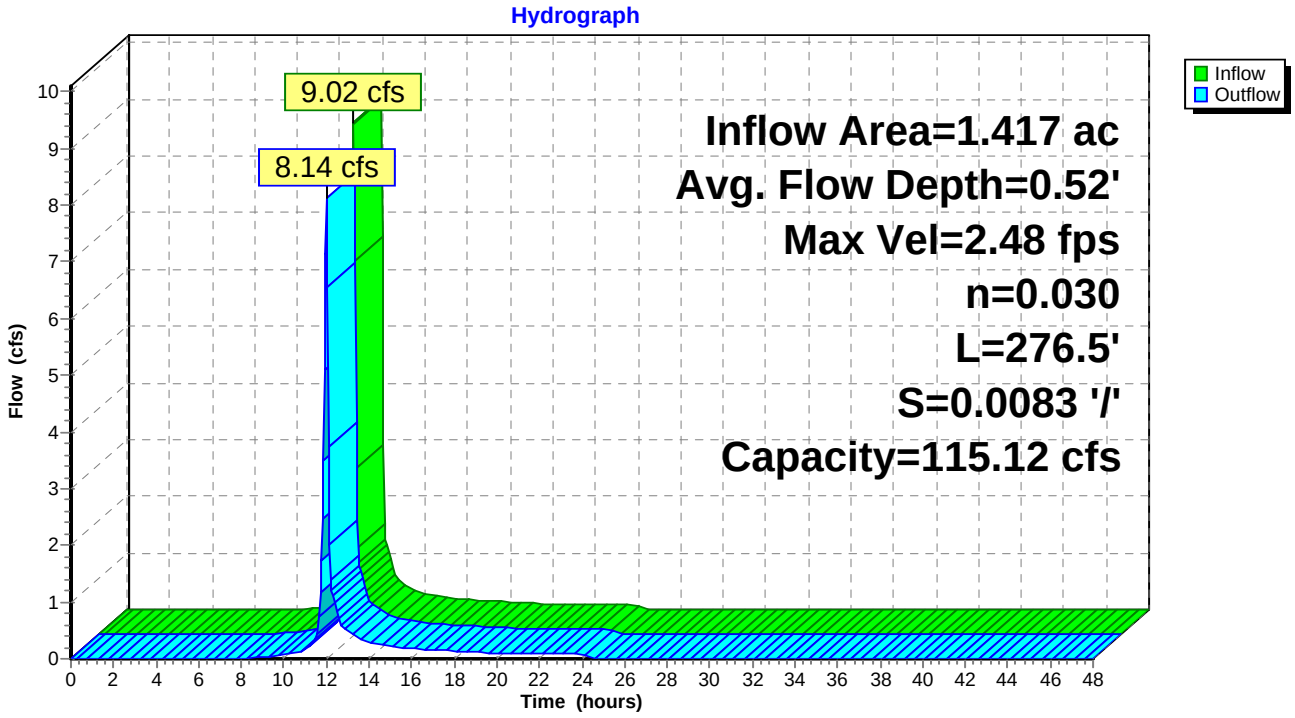
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.48 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 0.60 fps, Avg. Travel Time= 7.7 min

Peak Storage= 937 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 2.00' Flow Area= 22.0 sf, Capacity= 115.12 cfs

5.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 3.0 '/' Top Width= 17.00'
Length= 276.5' Slope= 0.0083 '/'
Inlet Invert= 860.30', Outlet Invert= 858.00'

‡

Reach D-17-1: D-17-1



Summary for Reach D-17-2: D-17-2

Inflow Area = 0.830 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 5.30 cfs @ 11.94 hrs, Volume= 0.234 af
Outflow = 4.81 cfs @ 11.98 hrs, Volume= 0.234 af, Atten= 9%, Lag= 2.5 min

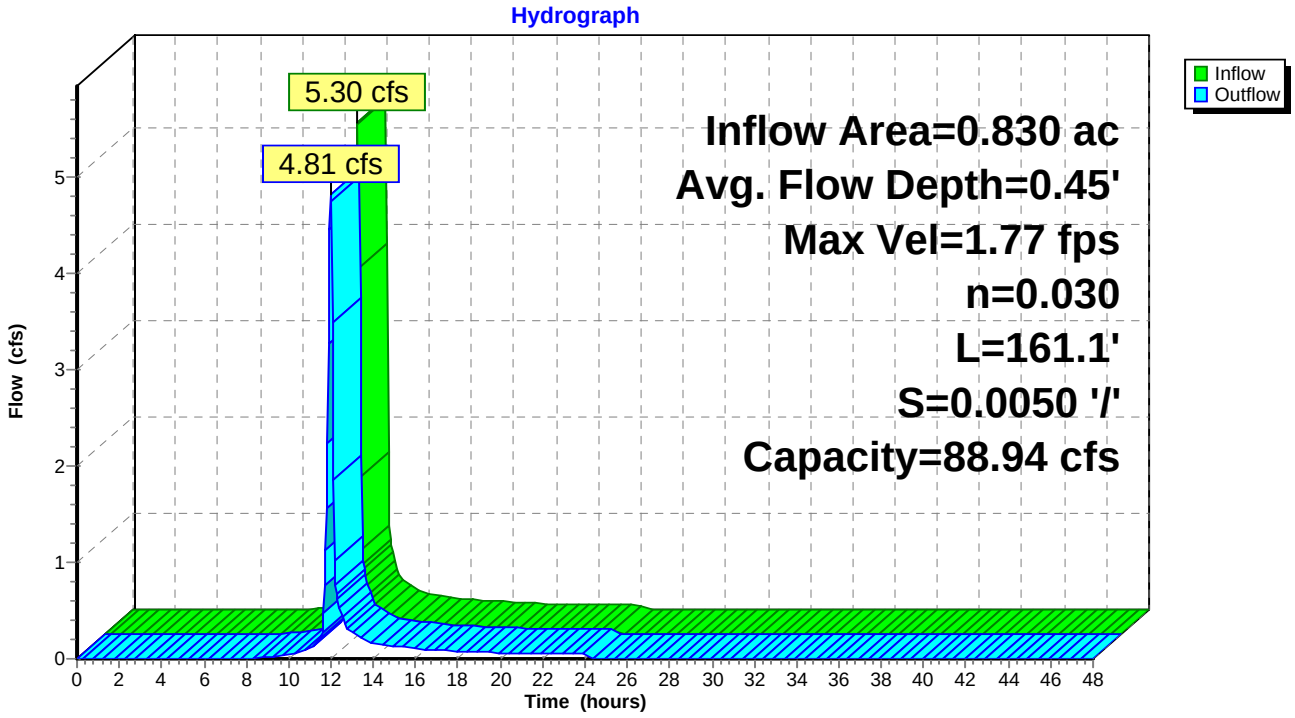
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.77 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.43 fps, Avg. Travel Time= 6.3 min

Peak Storage= 457 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 2.00' Flow Area= 22.0 sf, Capacity= 88.94 cfs

5.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 3.0 '/' Top Width= 17.00'
Length= 161.1' Slope= 0.0050 '/'
Inlet Invert= 858.80', Outlet Invert= 858.00'

‡

Reach D-17-2: D-17-2



Summary for Reach D-18-1: D-18-1

Inflow Area = 9.061 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 46.83 cfs @ 11.99 hrs, Volume= 2.558 af
Outflow = 44.36 cfs @ 12.04 hrs, Volume= 2.558 af, Atten= 5%, Lag= 3.3 min

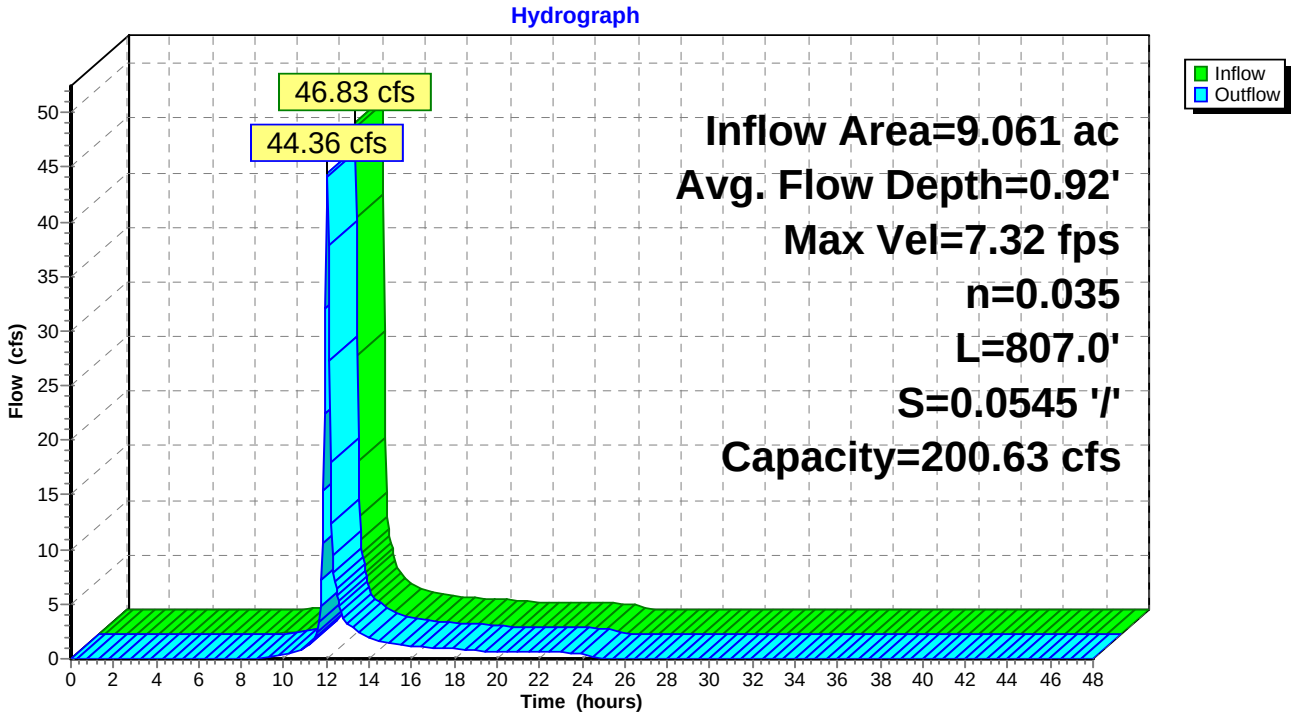
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.32 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 1.88 fps, Avg. Travel Time= 7.1 min

Peak Storage= 5,037 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.92'
Bank-Full Depth= 1.90' Flow Area= 18.4 sf, Capacity= 200.63 cfs

4.00' x 1.90' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 15.40'
Length= 807.0' Slope= 0.0545 '/'
Inlet Invert= 900.00', Outlet Invert= 856.00'

‡

Reach D-18-1: D-18-1



Summary for Reach D-18-2: D-18-2

Inflow Area = 1.199 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 7.63 cfs @ 11.94 hrs, Volume= 0.338 af
Outflow = 6.80 cfs @ 12.01 hrs, Volume= 0.338 af, Atten= 11%, Lag= 4.2 min

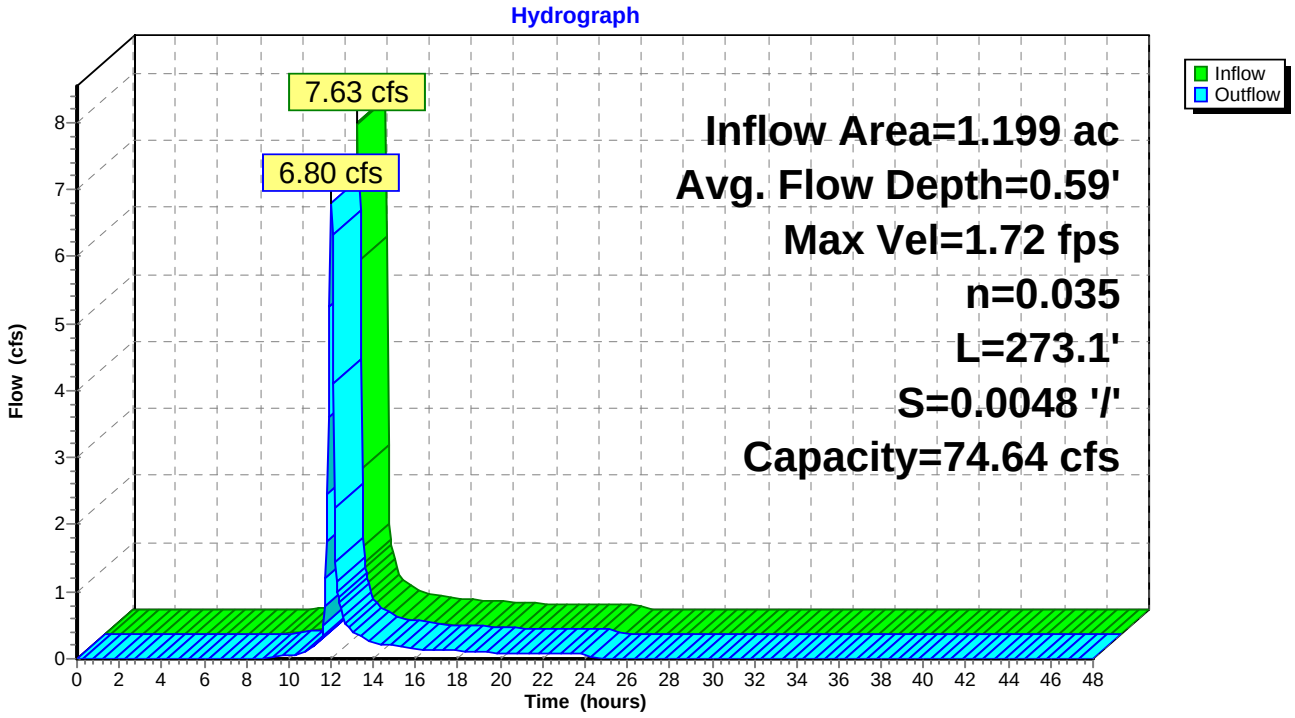
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.72 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 0.41 fps, Avg. Travel Time= 11.0 min

Peak Storage= 1,088 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.59'
Bank-Full Depth= 2.00' Flow Area= 22.0 sf, Capacity= 74.64 cfs

5.00' x 2.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '/' Top Width= 17.00'
Length= 273.1' Slope= 0.0048 '/'
Inlet Invert= 860.30', Outlet Invert= 859.00'

‡

Reach D-18-2: D-18-2



Summary for Reach D-6-1: D-6-1

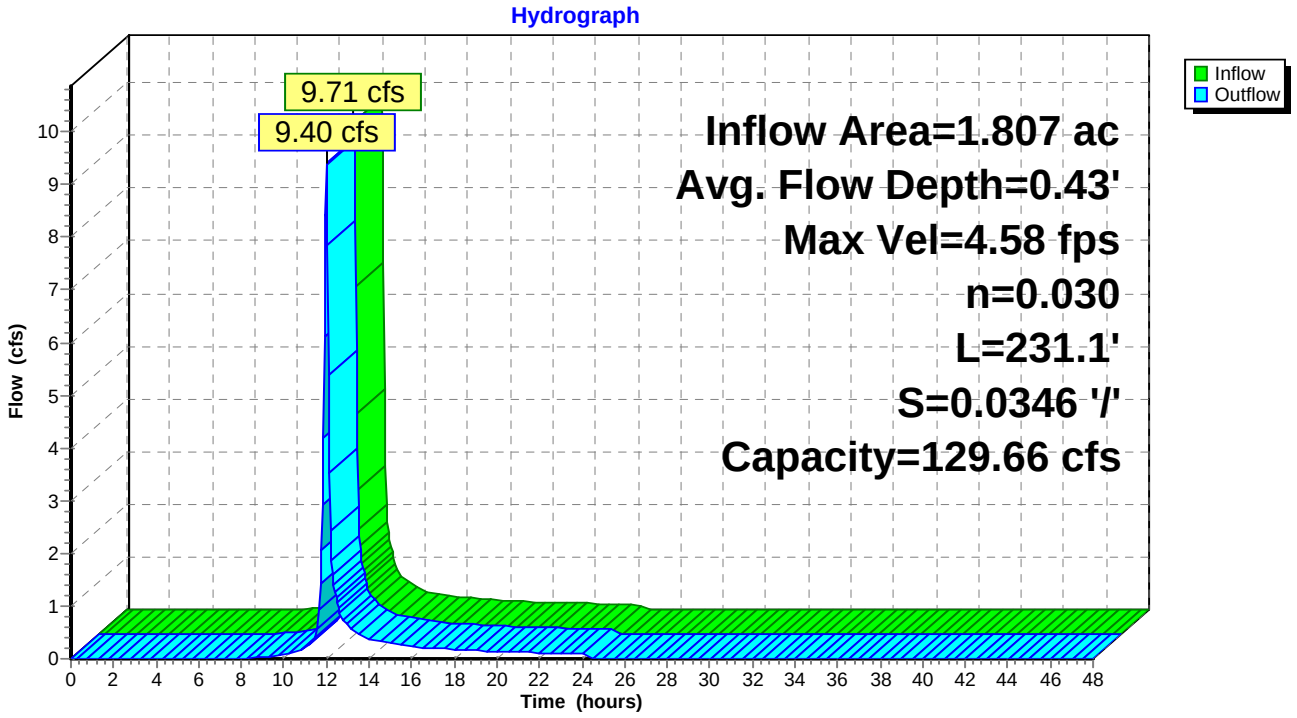
Inflow Area = 1.807 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 9.71 cfs @ 11.97 hrs, Volume= 0.510 af
Outflow = 9.40 cfs @ 11.99 hrs, Volume= 0.510 af, Atten= 3%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.58 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.10 fps, Avg. Travel Time= 3.5 min

Peak Storage= 485 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.75' Flow Area= 13.1 sf, Capacity= 129.66 cfs

4.00' x 1.75' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 11.00'
Length= 231.1' Slope= 0.0346 '/'
Inlet Invert= 899.00', Outlet Invert= 891.00'

Reach D-6-1: D-6-1



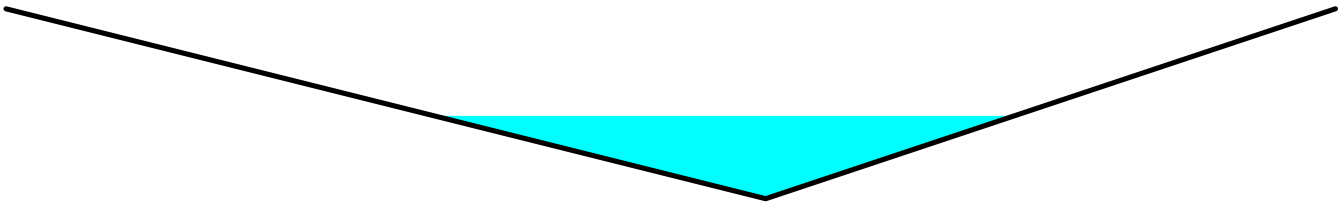
Summary for Reach TB-11-1: TB-11-1

Inflow Area = 0.391 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 2.52 cfs @ 11.94 hrs, Volume= 0.110 af
Outflow = 2.29 cfs @ 11.97 hrs, Volume= 0.110 af, Atten= 9%, Lag= 1.6 min

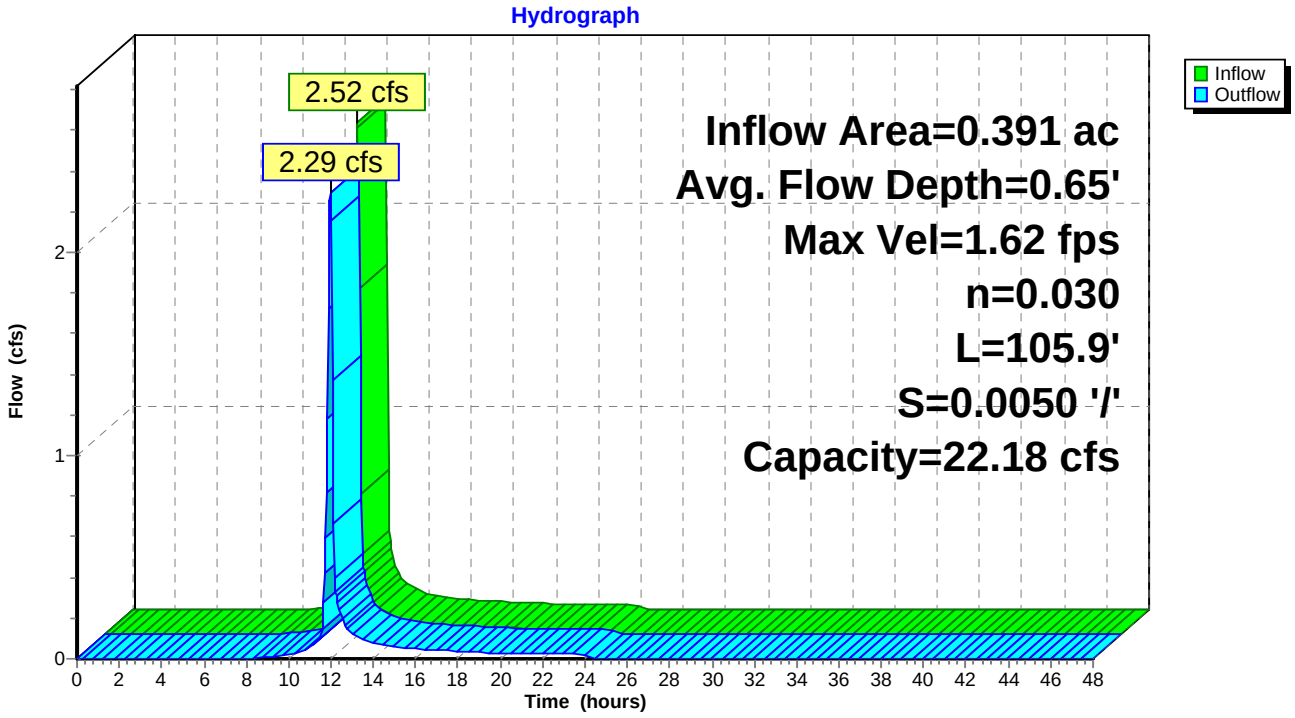
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.62 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 3.1 min

Peak Storage= 159 cf @ 11.95 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 22.18 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 105.9' Slope= 0.0050 '/'
Inlet Invert= 0.00', Outlet Invert= -0.53'



Reach TB-11-1: TB-11-1



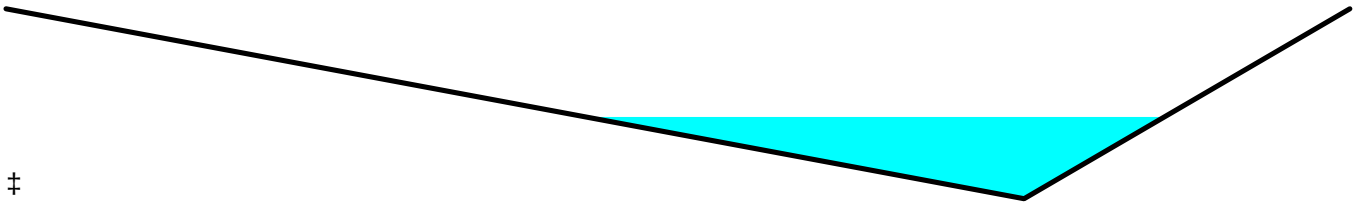
Summary for Reach TB-11-2: TB-11-2

Inflow Area = 0.647 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 4.17 cfs @ 11.94 hrs, Volume= 0.183 af
Outflow = 3.71 cfs @ 12.00 hrs, Volume= 0.183 af, Atten= 11%, Lag= 3.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.39 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 0.47 fps, Avg. Travel Time= 6.3 min

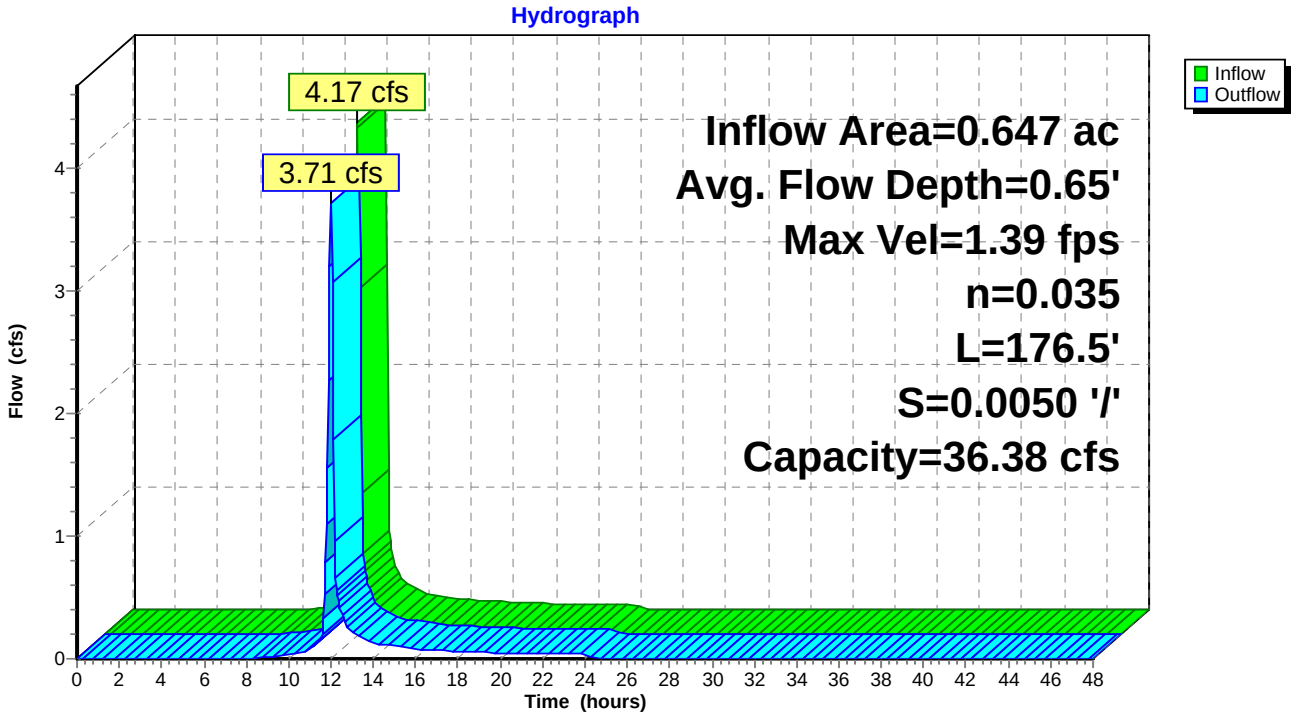
Peak Storage= 485 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 1.50' Flow Area= 14.9 sf, Capacity= 36.38 cfs

0.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 10.0 3.2 '/' Top Width= 19.80'
Length= 176.5' Slope= 0.0050 '/'
Inlet Invert= 0.00', Outlet Invert= -0.88'



‡

Reach TB-11-2: TB-11-2



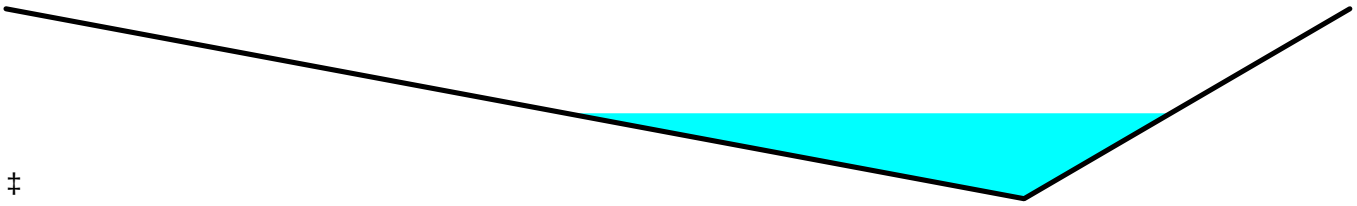
Summary for Reach TB-11-3: TB-11-3

Inflow Area = 0.723 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 4.66 cfs @ 11.94 hrs, Volume= 0.204 af
Outflow = 4.16 cfs @ 11.99 hrs, Volume= 0.204 af, Atten= 11%, Lag= 3.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.43 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 0.48 fps, Avg. Travel Time= 5.7 min

Peak Storage= 502 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.68'
Bank-Full Depth= 1.50' Flow Area= 14.9 sf, Capacity= 36.32 cfs

0.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 10.0 3.2 '/' Top Width= 19.80'
Length= 167.0' Slope= 0.0050 '/'
Inlet Invert= 0.00', Outlet Invert= -0.83'



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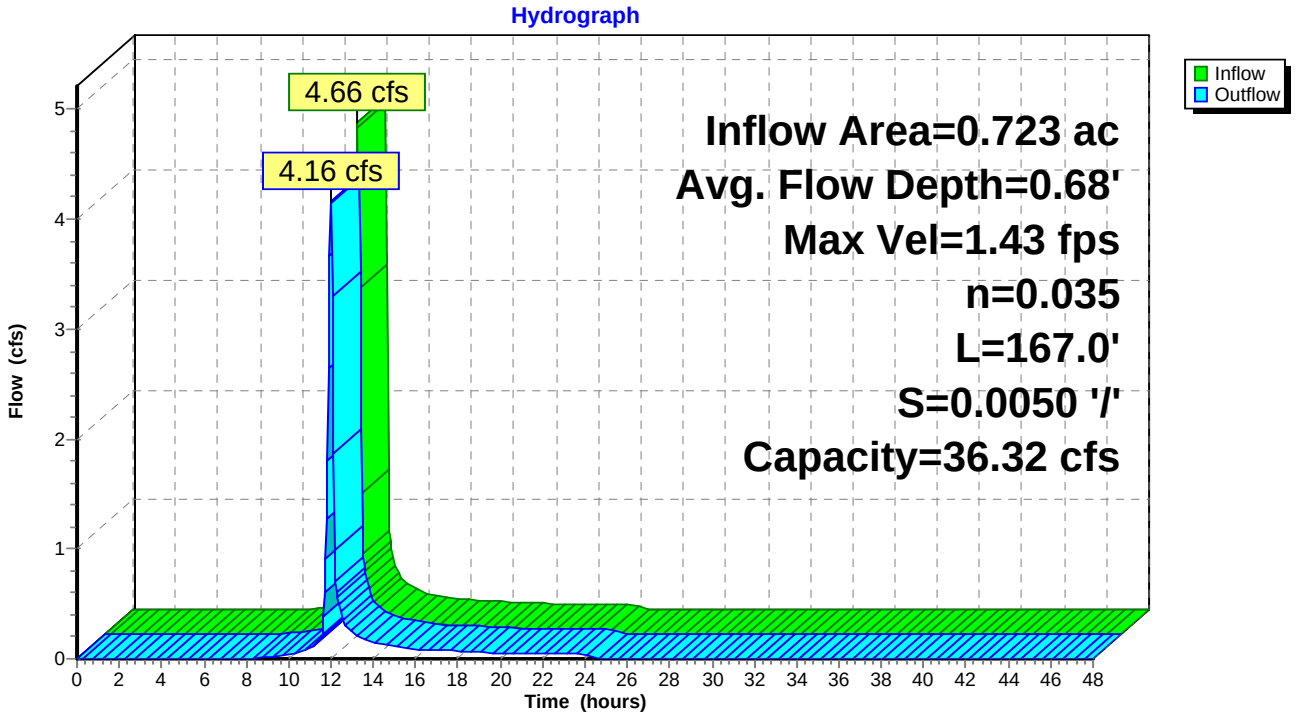
Reach TB-11-3: TB-11-3



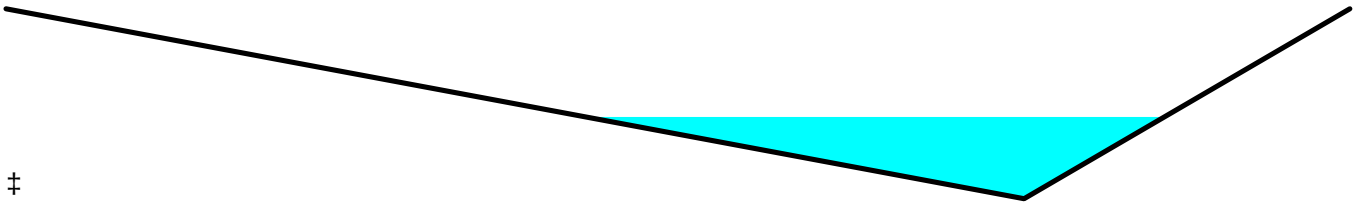
Summary for Reach TB-11-4: TB-11-4

Inflow Area = 0.645 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 4.15 cfs @ 11.94 hrs, Volume= 0.182 af
Outflow = 3.71 cfs @ 11.99 hrs, Volume= 0.182 af, Atten= 11%, Lag= 3.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.40 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 0.47 fps, Avg. Travel Time= 5.9 min

Peak Storage= 457 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 1.50' Flow Area= 14.9 sf, Capacity= 36.43 cfs

0.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 10.0 3.2 '/' Top Width= 19.80'
Length= 166.0' Slope= 0.0050 '/'
Inlet Invert= 0.00', Outlet Invert= -0.83'



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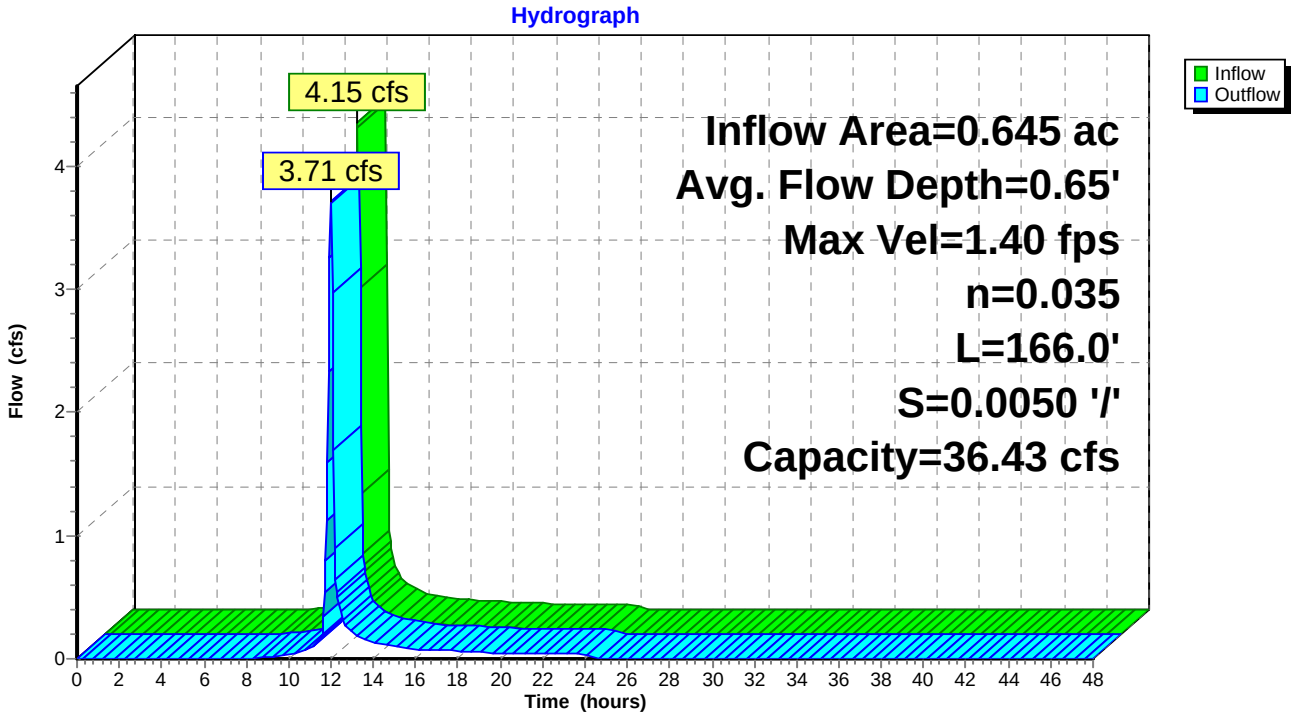
Reach TB-11-4: TB-11-4



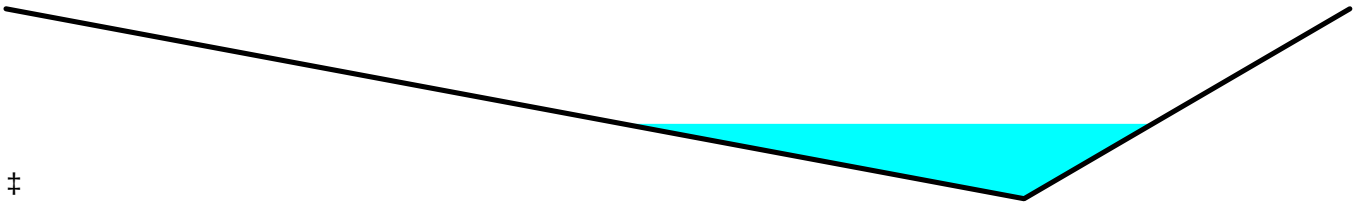
Summary for Reach TB-11-5: TB-11-5

Inflow Area = 0.510 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 3.29 cfs @ 11.94 hrs, Volume= 0.144 af
Outflow = 2.94 cfs @ 11.99 hrs, Volume= 0.144 af, Atten= 11%, Lag= 3.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.32 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 0.45 fps, Avg. Travel Time= 5.8 min

Peak Storage= 361 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.59'
Bank-Full Depth= 1.50' Flow Area= 14.9 sf, Capacity= 36.43 cfs

0.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 10.0 3.2 '/' Top Width= 19.80'
Length= 156.0' Slope= 0.0050 '/'
Inlet Invert= 0.00', Outlet Invert= -0.78'



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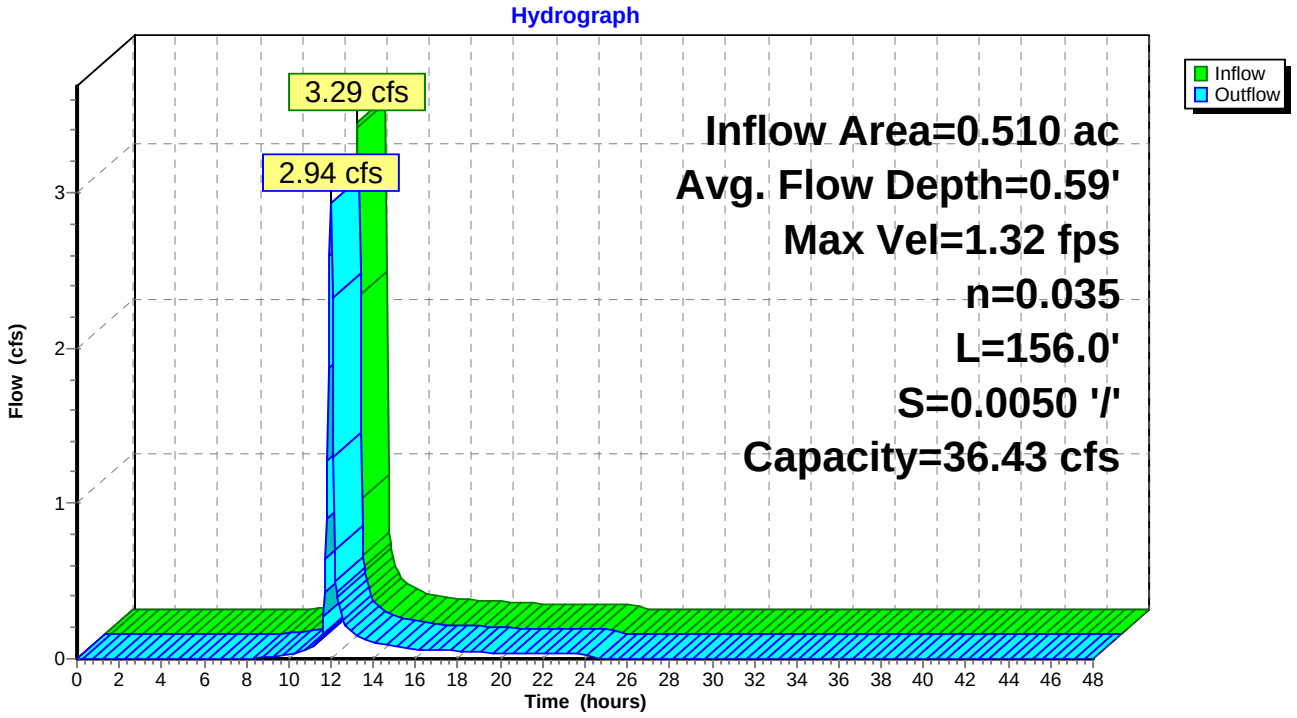
Reach TB-11-5: TB-11-5



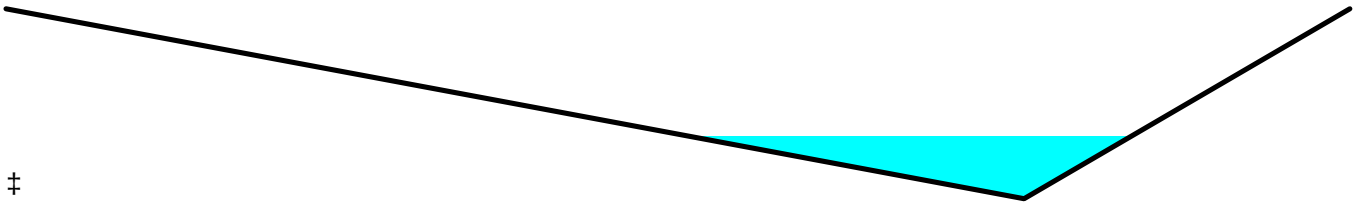
Summary for Reach TB-11-6: TB-11-6

Inflow Area = 0.344 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 2.12 cfs @ 11.95 hrs, Volume= 0.097 af
Outflow = 1.86 cfs @ 12.04 hrs, Volume= 0.097 af, Atten= 12%, Lag= 5.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.17 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 0.40 fps, Avg. Travel Time= 9.9 min

Peak Storage= 381 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 1.50' Flow Area= 14.9 sf, Capacity= 36.43 cfs

0.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 10.0 3.2 '/' Top Width= 19.80'
Length= 236.0' Slope= 0.0050 '/'
Inlet Invert= 0.00', Outlet Invert= -1.18'



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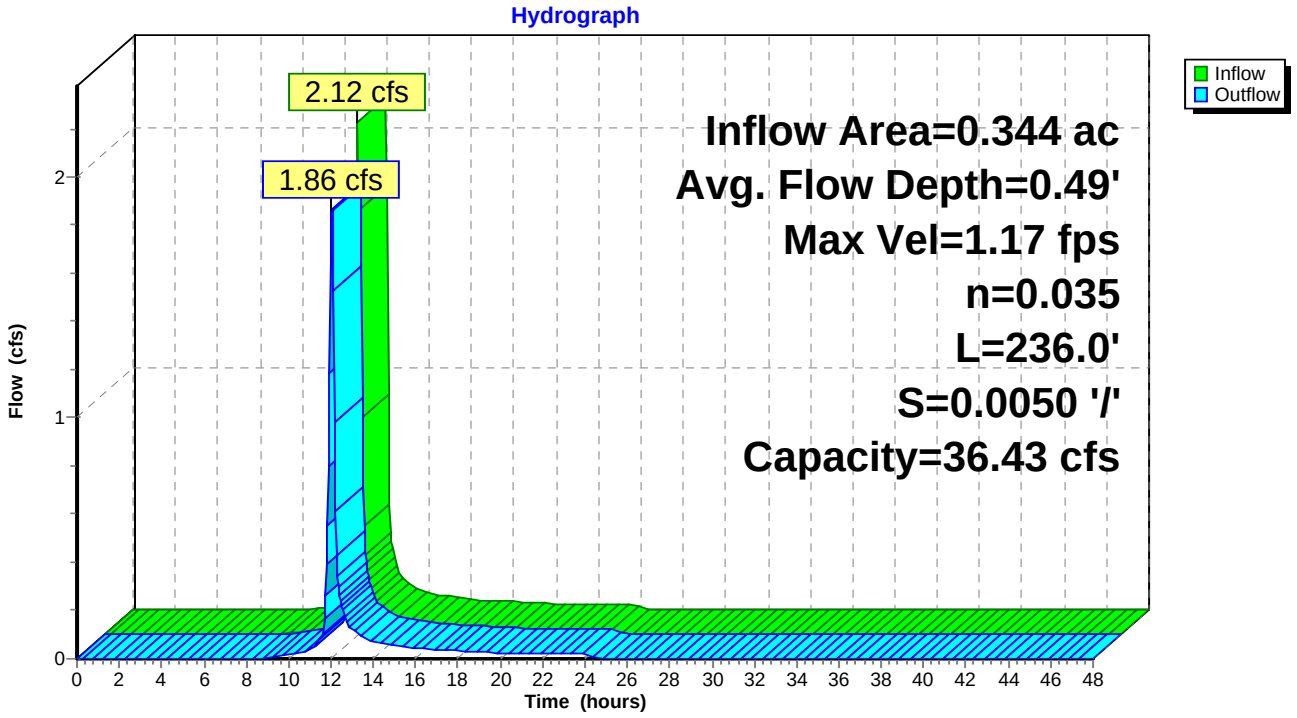
Reach TB-11-6: TB-11-6



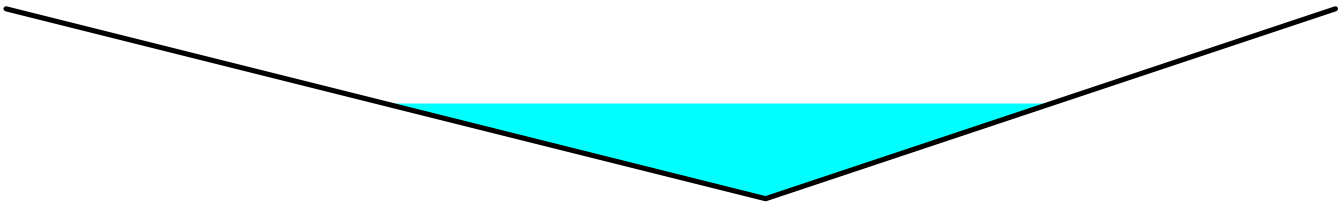
Summary for Reach TB-11-7: TB-11-7

Inflow Area = 0.574 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 3.69 cfs @ 11.94 hrs, Volume= 0.162 af
Outflow = 3.35 cfs @ 11.98 hrs, Volume= 0.162 af, Atten= 9%, Lag= 2.1 min

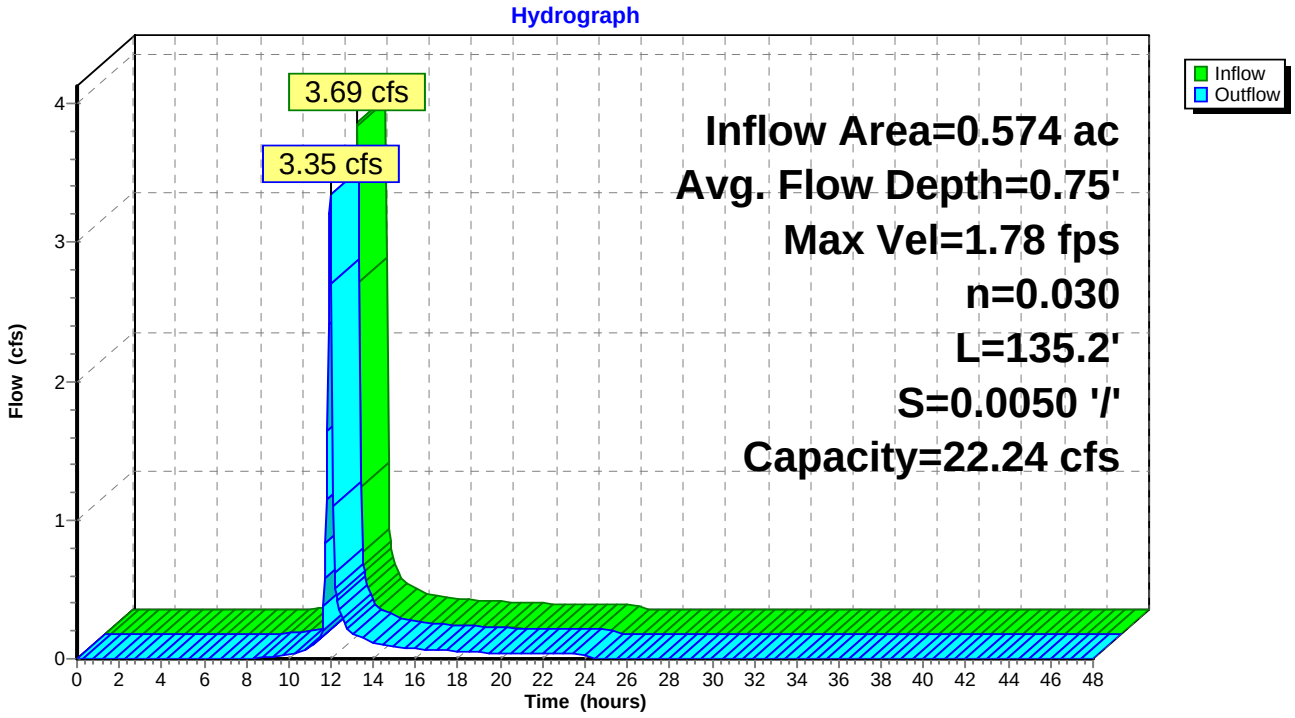
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.78 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 0.61 fps, Avg. Travel Time= 3.7 min

Peak Storage= 267 cf @ 11.95 hrs
Average Depth at Peak Storage= 0.75'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 22.24 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 135.2' Slope= 0.0050 '/'
Inlet Invert= 0.00', Outlet Invert= -0.68'



Reach TB-11-7: TB-11-7



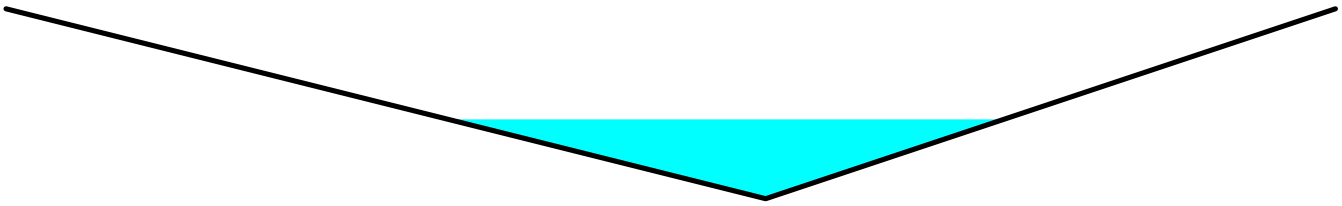
Summary for Reach TB-12-1: TB-12-1

Inflow Area = 0.724 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 4.64 cfs @ 11.94 hrs, Volume= 0.204 af
Outflow = 4.16 cfs @ 11.99 hrs, Volume= 0.204 af, Atten= 10%, Lag= 3.0 min

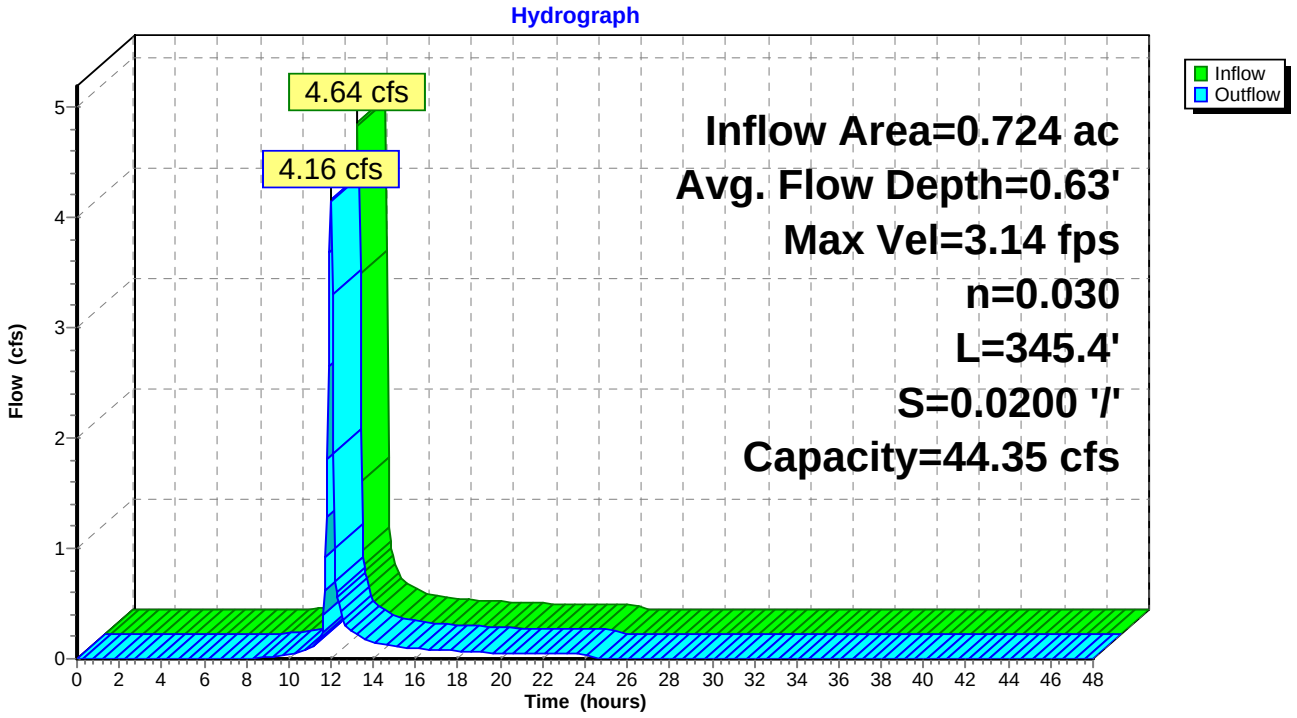
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.14 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 1.09 fps, Avg. Travel Time= 5.3 min

Peak Storage= 474 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.63'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 44.35 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 345.4' Slope= 0.0200 '/'
Inlet Invert= 0.00', Outlet Invert= -6.91'



Reach TB-12-1: TB-12-1



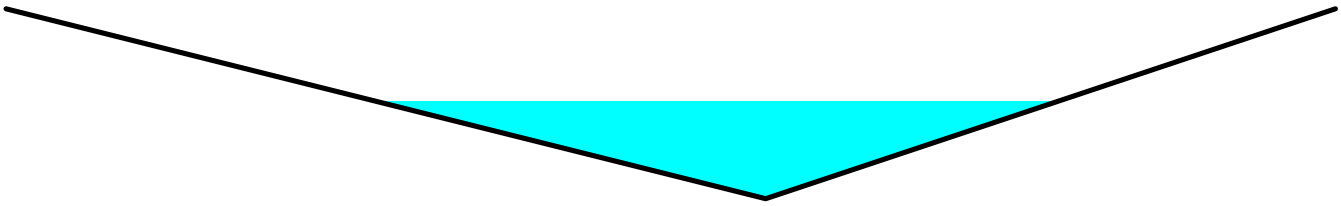
Summary for Reach TB-12-2: TB-12-2

Inflow Area = 1.274 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 8.16 cfs @ 11.94 hrs, Volume= 0.360 af
Outflow = 7.29 cfs @ 12.00 hrs, Volume= 0.360 af, Atten= 11%, Lag= 3.3 min

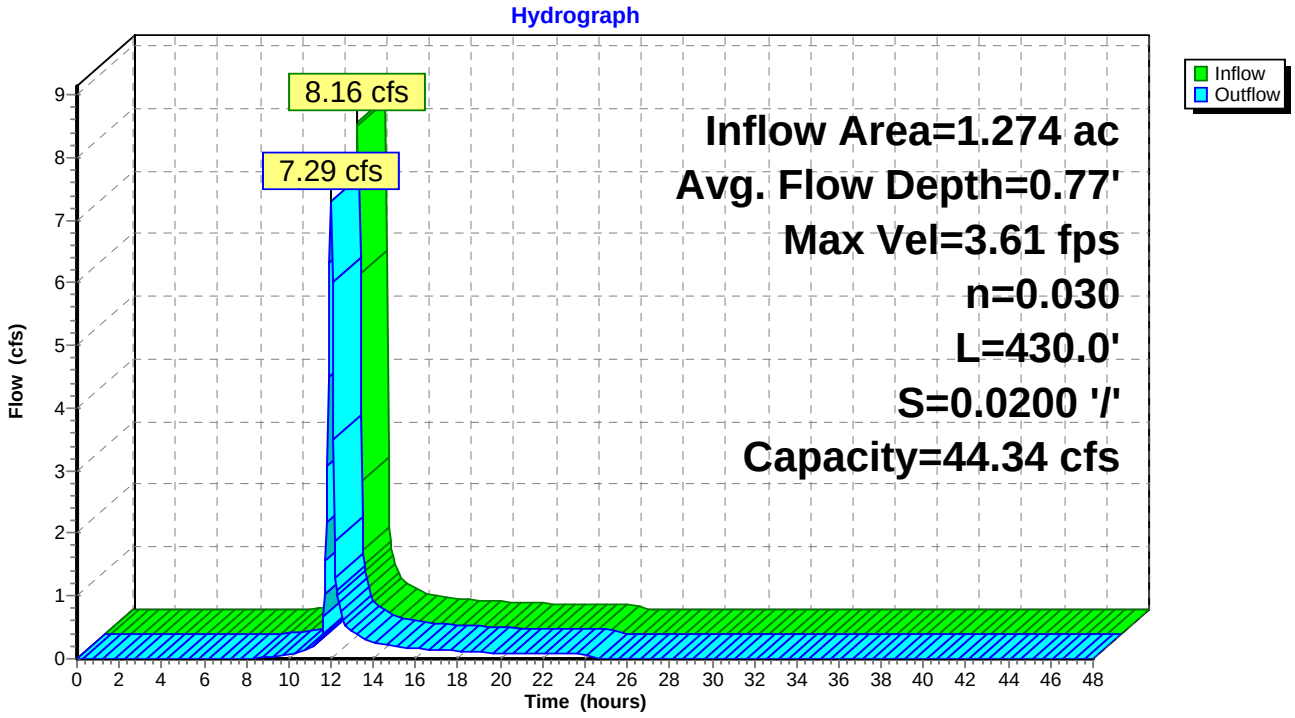
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.61 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 1.22 fps, Avg. Travel Time= 5.9 min

Peak Storage= 897 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.77'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 44.34 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 430.0' Slope= 0.0200 '/'
Inlet Invert= 0.00', Outlet Invert= -8.60'



Reach TB-12-2: TB-12-2



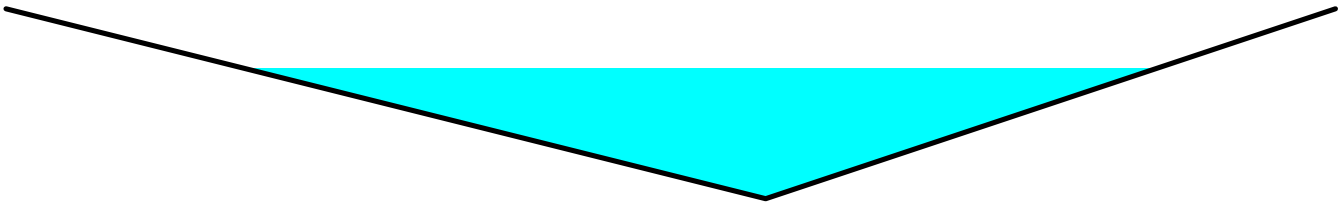
Summary for Reach TB-12-3: TB-12-3

Inflow Area = 2.031 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 12.93 cfs @ 11.94 hrs, Volume= 0.573 af
Outflow = 11.50 cfs @ 12.03 hrs, Volume= 0.573 af, Atten= 11%, Lag= 4.9 min

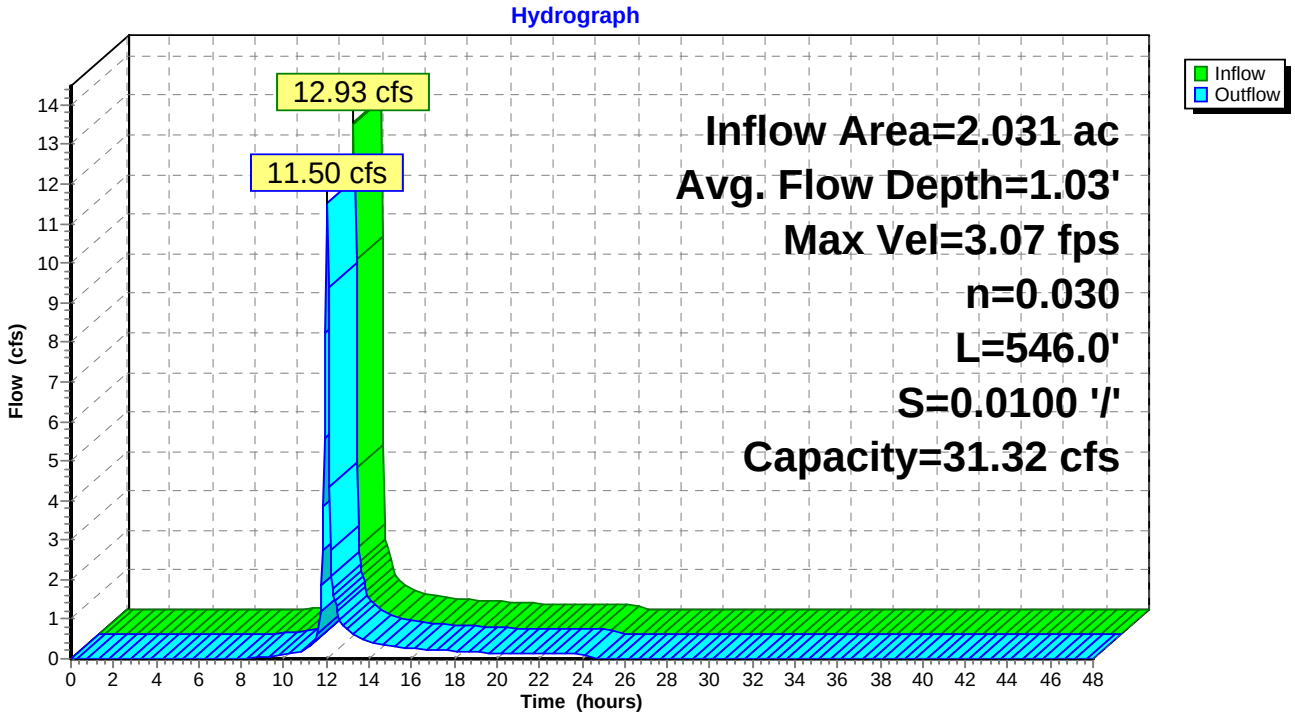
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.07 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 0.99 fps, Avg. Travel Time= 9.2 min

Peak Storage= 2,035 cf @ 11.98 hrs
Average Depth at Peak Storage= 1.03'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 31.32 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 546.0' Slope= 0.0100 '/'
Inlet Invert= 0.00', Outlet Invert= -5.45'



Reach TB-12-3: TB-12-3



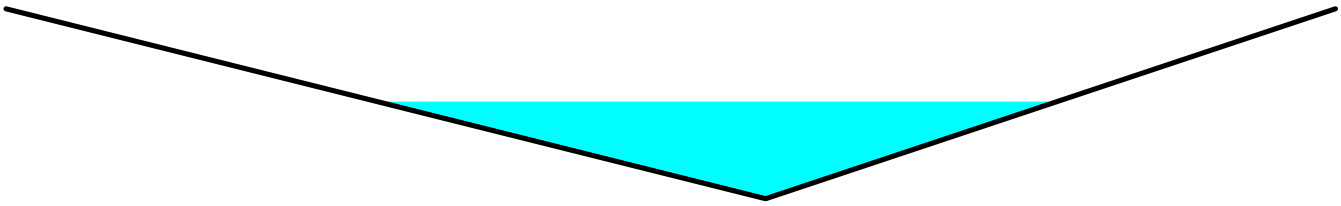
Summary for Reach TB-12-4: TB-12-4

Inflow Area = 1.410 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 9.03 cfs @ 11.94 hrs, Volume= 0.398 af
Outflow = 8.04 cfs @ 12.00 hrs, Volume= 0.398 af, Atten= 11%, Lag= 3.5 min

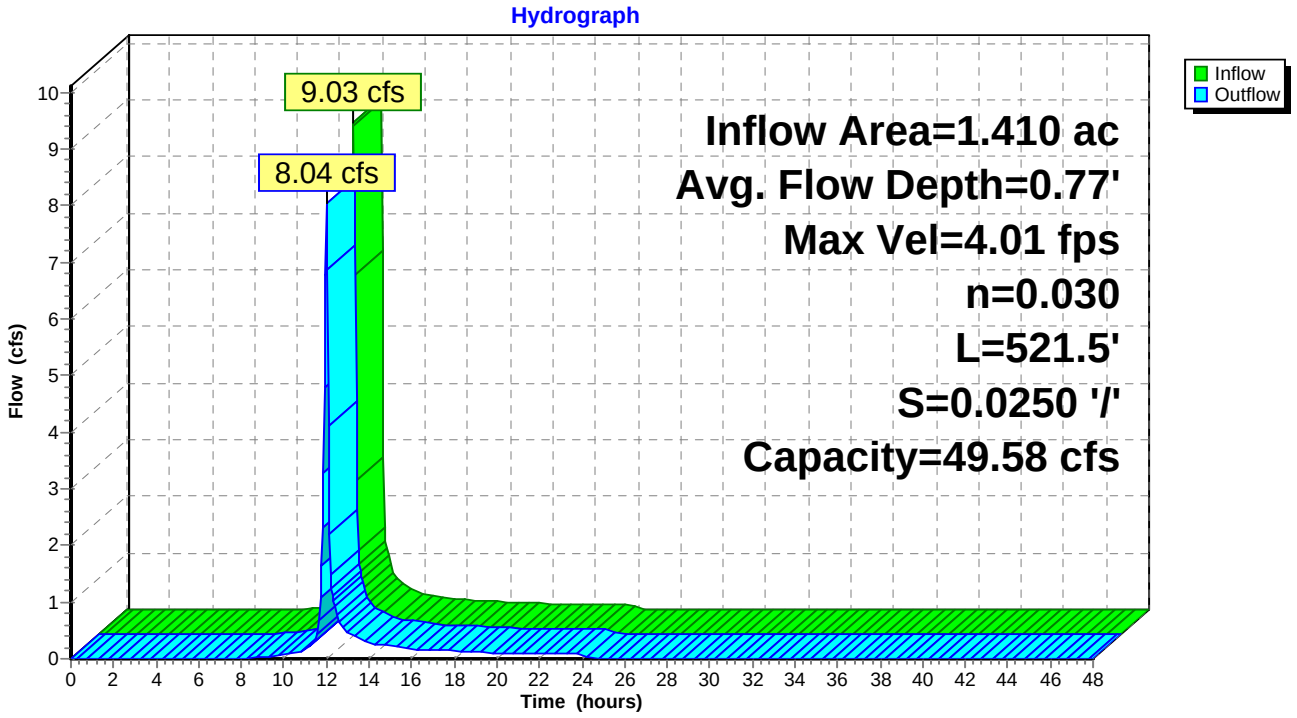
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.01 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 1.35 fps, Avg. Travel Time= 6.4 min

Peak Storage= 1,073 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.77'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 49.58 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 521.5' Slope= 0.0250 '/'
Inlet Invert= 0.00', Outlet Invert= -13.04'



Reach TB-12-4: TB-12-4



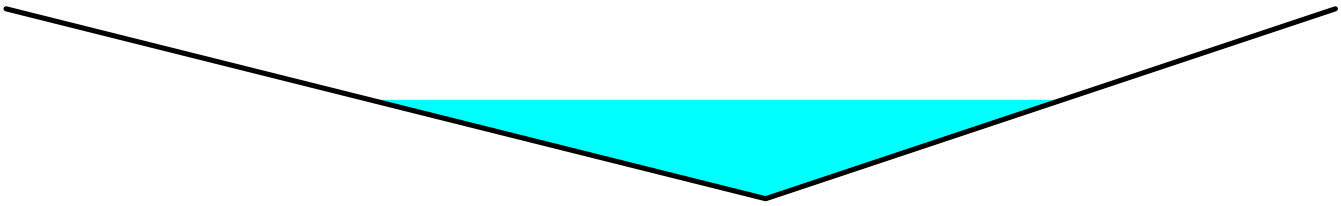
Summary for Reach TB-12-5: TB-12-5

Inflow Area = 1.609 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 10.33 cfs @ 11.94 hrs, Volume= 0.454 af
Outflow = 9.21 cfs @ 12.00 hrs, Volume= 0.454 af, Atten= 11%, Lag= 3.4 min

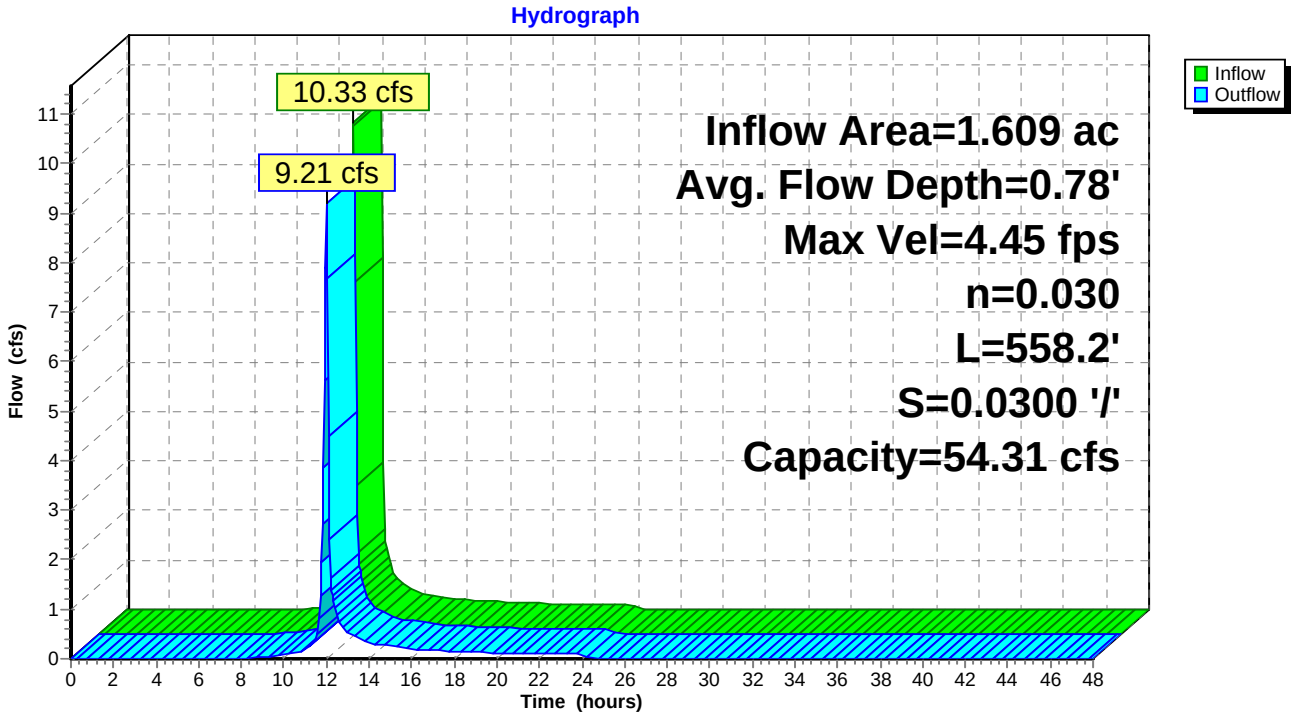
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.45 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 1.50 fps, Avg. Travel Time= 6.2 min

Peak Storage= 1,190 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.78'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 54.31 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 558.2' Slope= 0.0300 '/'
Inlet Invert= 0.00', Outlet Invert= -16.75'



Reach TB-12-5: TB-12-5



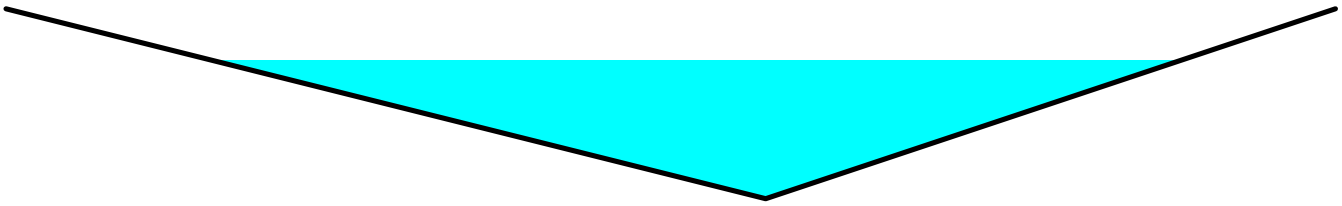
Summary for Reach TB-12-6: TB-12-6

Inflow Area = 2.388 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 15.20 cfs @ 11.94 hrs, Volume= 0.674 af
Outflow = 13.46 cfs @ 12.03 hrs, Volume= 0.674 af, Atten= 11%, Lag= 5.0 min

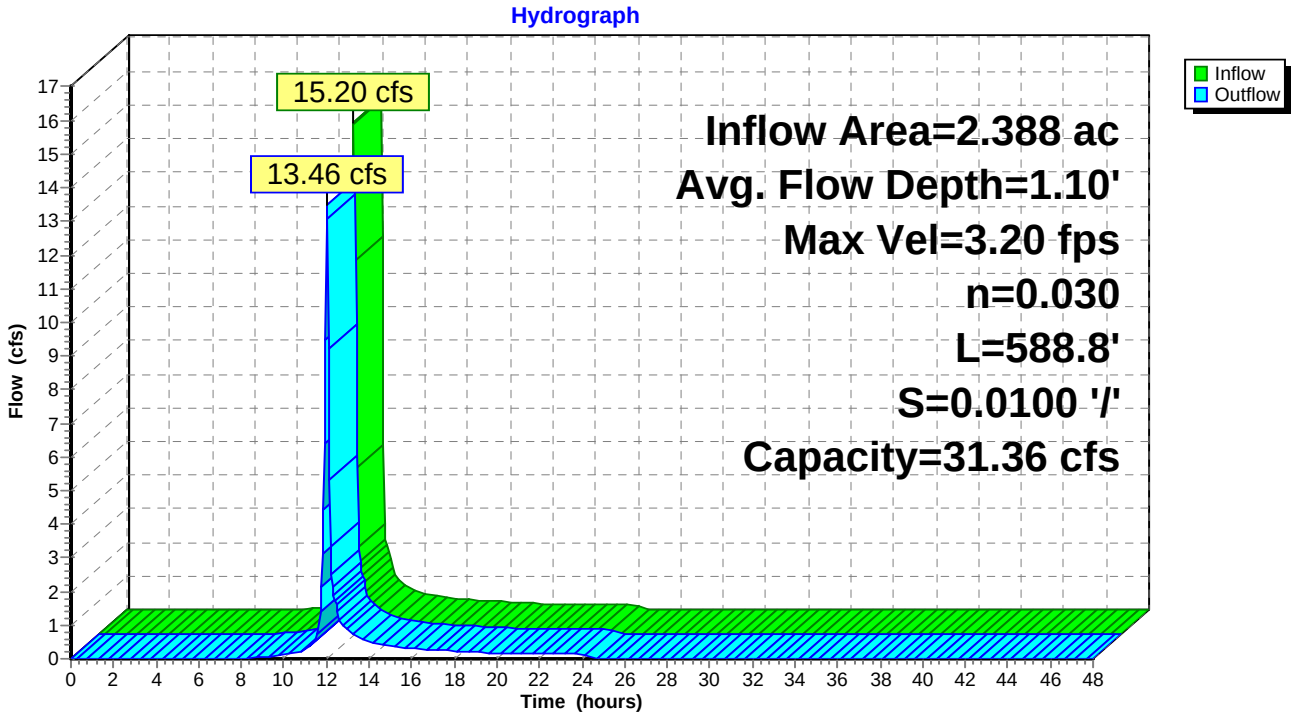
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.20 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 1.02 fps, Avg. Travel Time= 9.6 min

Peak Storage= 2,467 cf @ 11.98 hrs
Average Depth at Peak Storage= 1.10'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 31.36 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 588.8' Slope= 0.0100 '/'
Inlet Invert= 0.00', Outlet Invert= -5.89'



Reach TB-12-6: TB-12-6



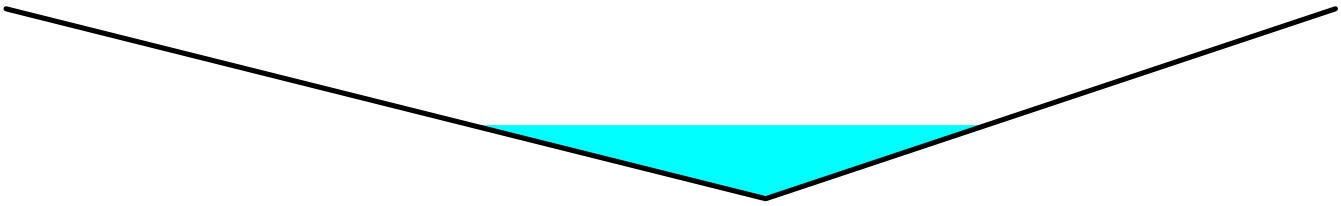
Summary for Reach TB-16-1: TB-16-1

Inflow Area = 0.571 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 3.65 cfs @ 11.94 hrs, Volume= 0.161 af
Outflow = 3.36 cfs @ 11.97 hrs, Volume= 0.161 af, Atten= 8%, Lag= 1.4 min

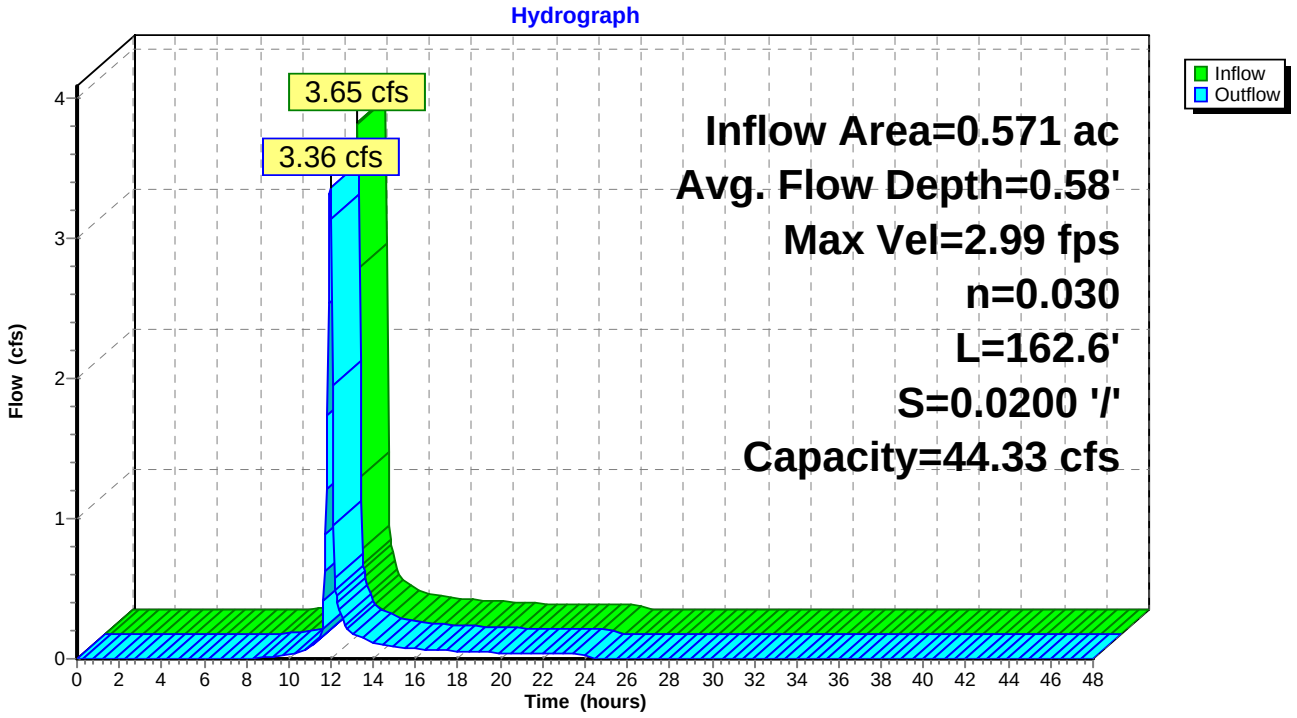
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.99 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.05 fps, Avg. Travel Time= 2.6 min

Peak Storage= 192 cf @ 11.95 hrs
Average Depth at Peak Storage= 0.58'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 44.33 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 162.6' Slope= 0.0200 '/'
Inlet Invert= 0.00', Outlet Invert= -3.25'



Reach TB-16-1: TB-16-1



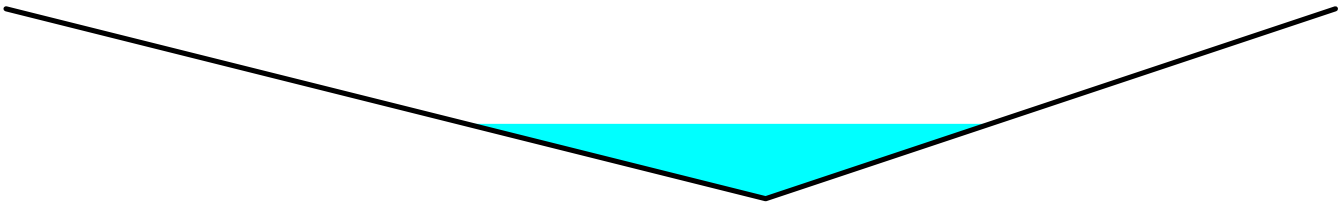
Summary for Reach TB-16-2: TB-16-2

Inflow Area = 0.596 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 3.82 cfs @ 11.94 hrs, Volume= 0.168 af
Outflow = 3.52 cfs @ 11.96 hrs, Volume= 0.168 af, Atten= 8%, Lag= 1.3 min

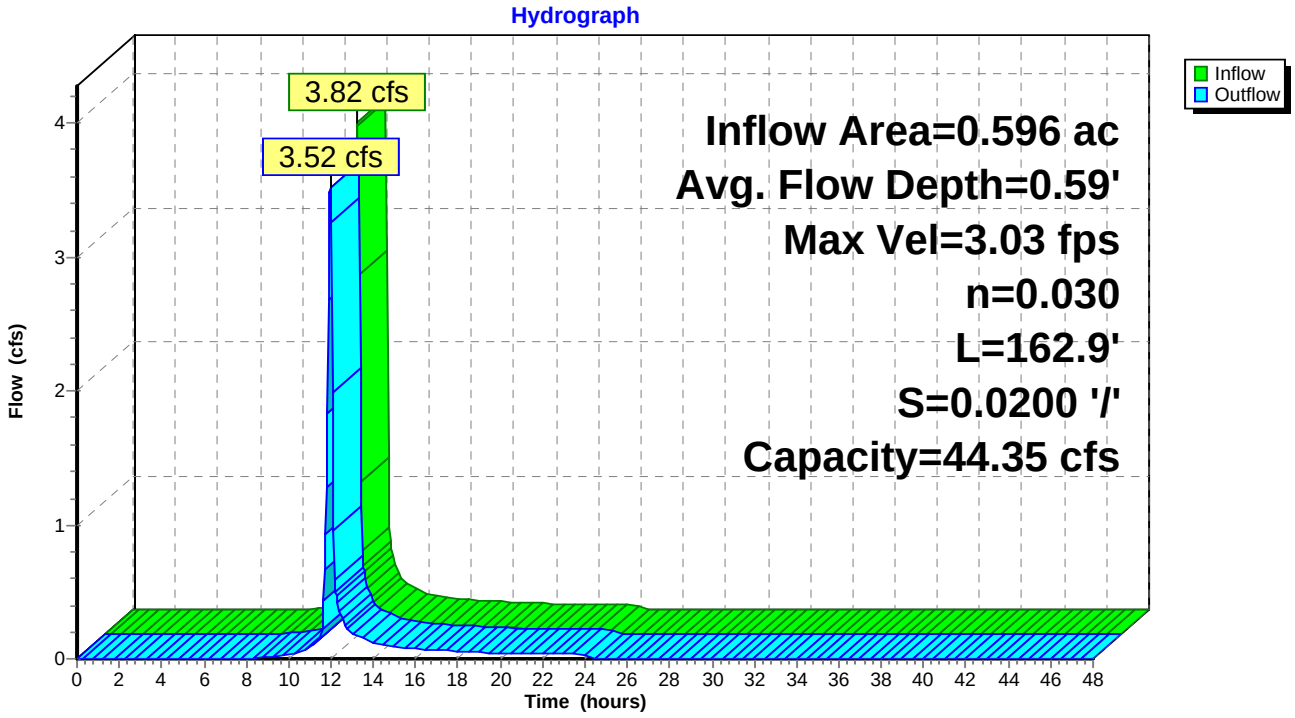
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.03 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.07 fps, Avg. Travel Time= 2.5 min

Peak Storage= 199 cf @ 11.95 hrs
Average Depth at Peak Storage= 0.59'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 44.35 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 162.9' Slope= 0.0200 '/'
Inlet Invert= 0.00', Outlet Invert= -3.26'



Reach TB-16-2: TB-16-2



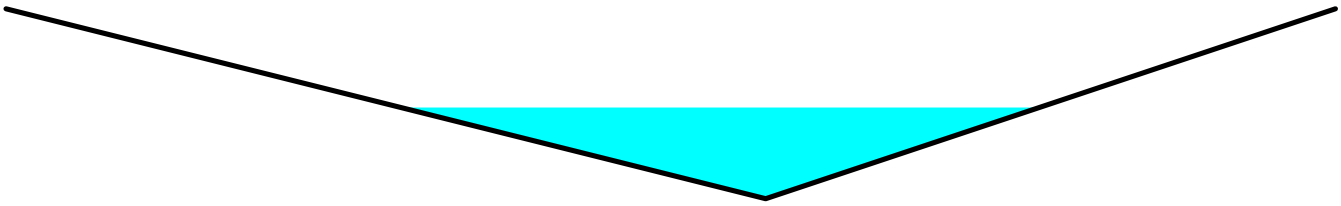
Summary for Reach TB-16-3: TB-16-3

Inflow Area = 1.071 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 6.84 cfs @ 11.94 hrs, Volume= 0.302 af
Outflow = 6.09 cfs @ 12.00 hrs, Volume= 0.302 af, Atten= 11%, Lag= 3.5 min

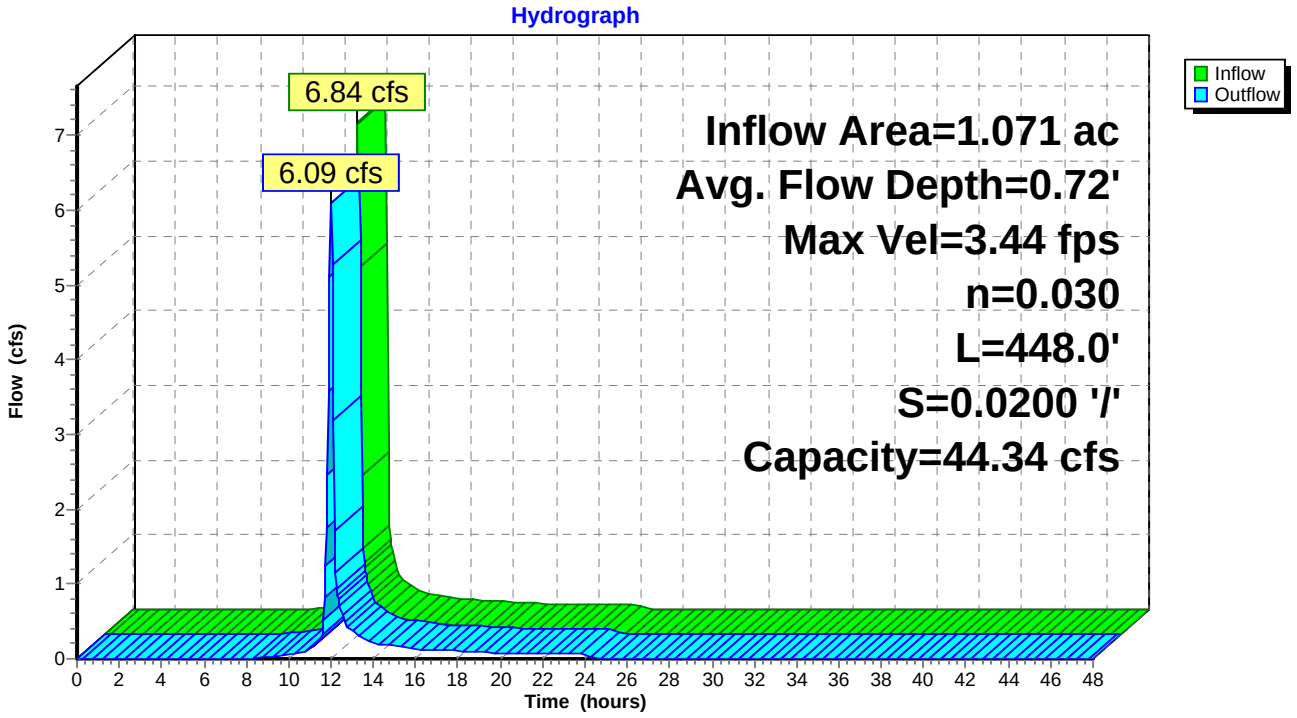
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.44 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 1.17 fps, Avg. Travel Time= 6.4 min

Peak Storage= 814 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.72'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 44.34 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 448.0' Slope= 0.0200 '/'
Inlet Invert= 0.00', Outlet Invert= -8.96'



Reach TB-16-3: TB-16-3



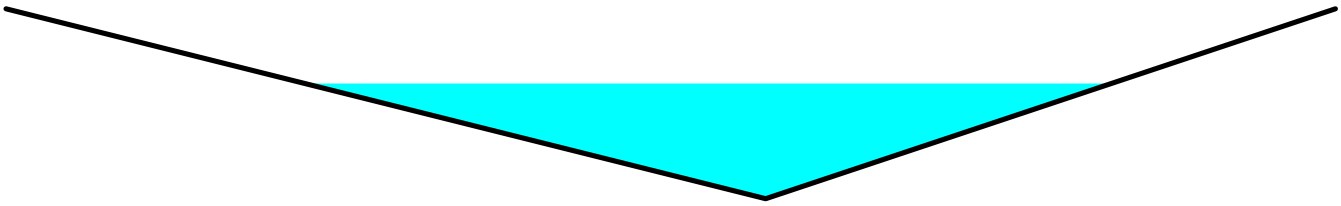
Summary for Reach TB-16-4: TB-16-4

Inflow Area = 2.113 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 13.53 cfs @ 11.94 hrs, Volume= 0.597 af
Outflow = 11.94 cfs @ 12.02 hrs, Volume= 0.597 af, Atten= 12%, Lag= 4.8 min

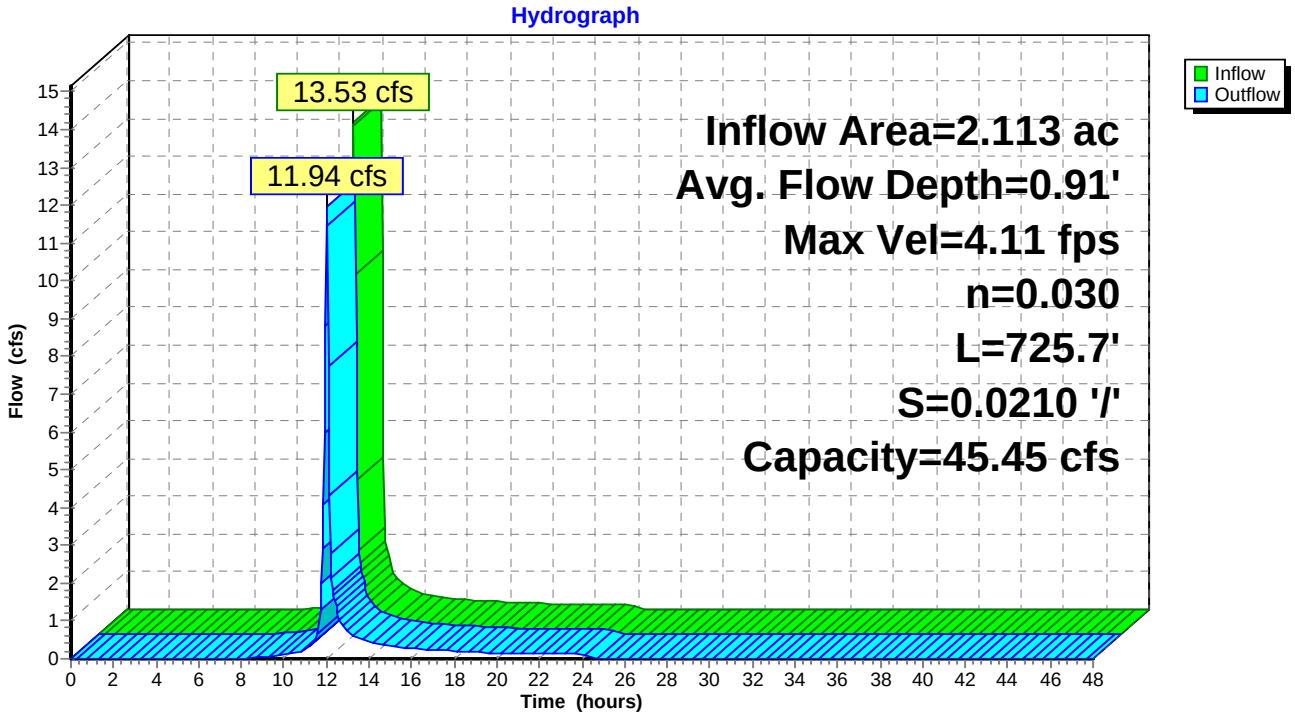
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.11 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 1.34 fps, Avg. Travel Time= 9.0 min

Peak Storage= 2,103 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.91'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 45.45 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 725.7' Slope= 0.0210 '/'
Inlet Invert= 0.00', Outlet Invert= -15.25'



Reach TB-16-4: TB-16-4



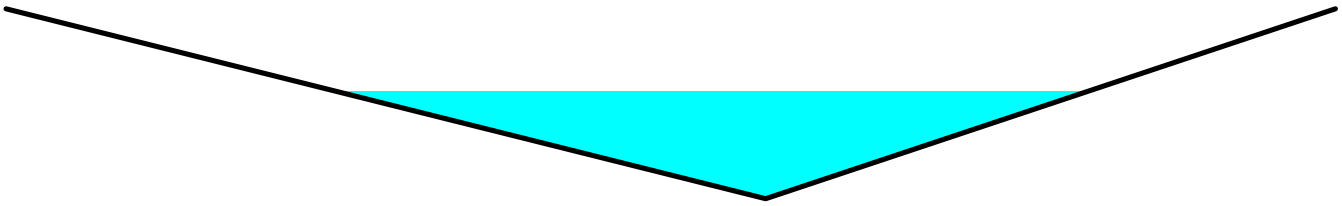
Summary for Reach TB-16-5: TB-16-5

Inflow Area = 1.193 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 7.59 cfs @ 11.94 hrs, Volume= 0.337 af
Outflow = 6.73 cfs @ 12.01 hrs, Volume= 0.337 af, Atten= 11%, Lag= 4.0 min

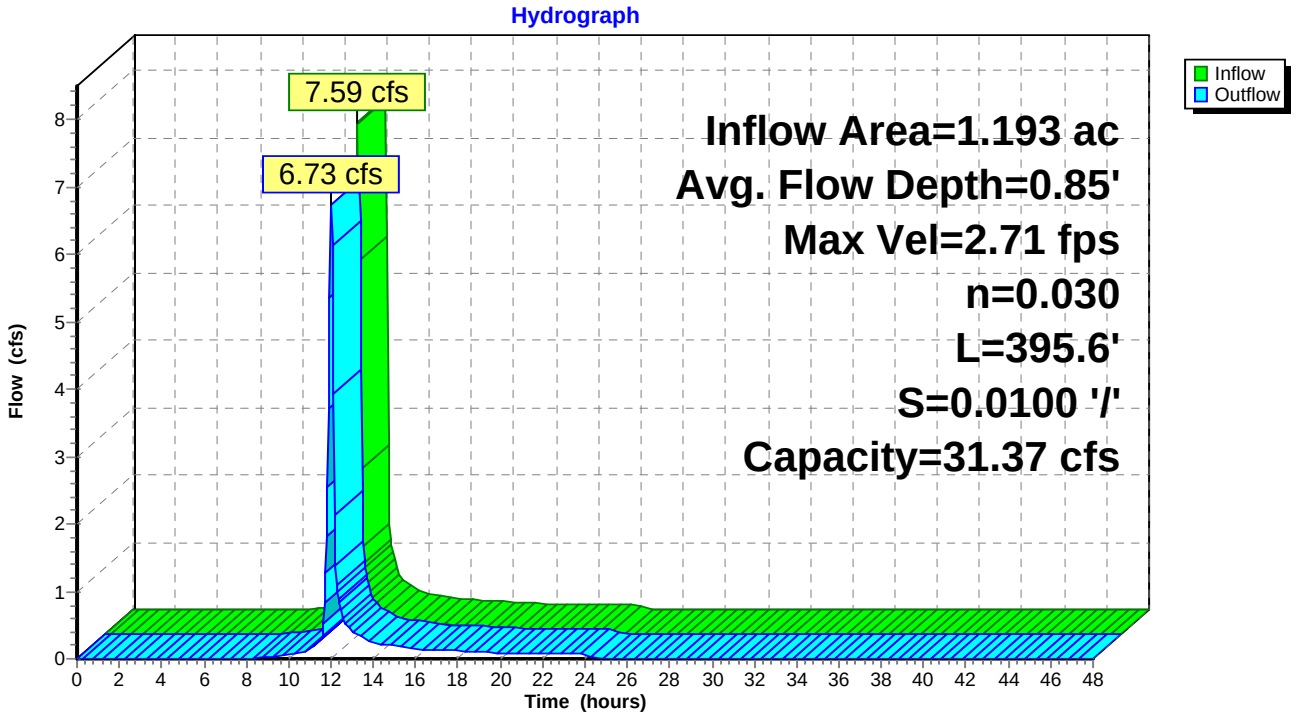
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.71 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 0.90 fps, Avg. Travel Time= 7.3 min

Peak Storage= 999 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.85'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 31.37 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 395.6' Slope= 0.0100 '/'
Inlet Invert= 0.00', Outlet Invert= -3.96'



Reach TB-16-5: TB-16-5



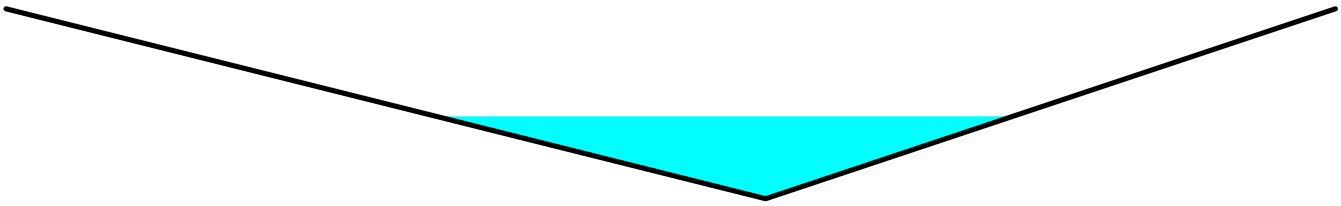
Summary for Reach TB-17-1: TB-17-1

Inflow Area = 0.787 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 5.04 cfs @ 11.94 hrs, Volume= 0.222 af
Outflow = 4.56 cfs @ 11.98 hrs, Volume= 0.222 af, Atten= 10%, Lag= 2.4 min

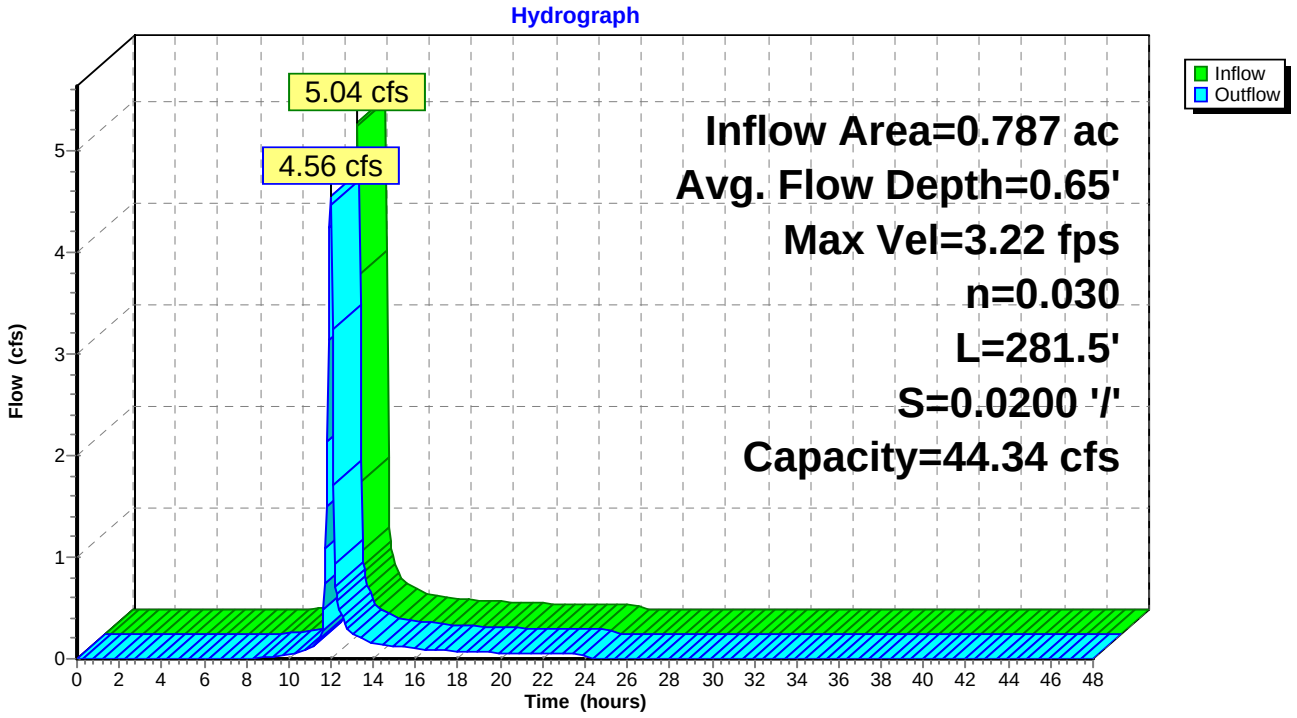
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.22 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 1.12 fps, Avg. Travel Time= 4.2 min

Peak Storage= 417 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 44.34 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 281.5' Slope= 0.0200 '/'
Inlet Invert= 0.00', Outlet Invert= -5.63'



Reach TB-17-1: TB-17-1



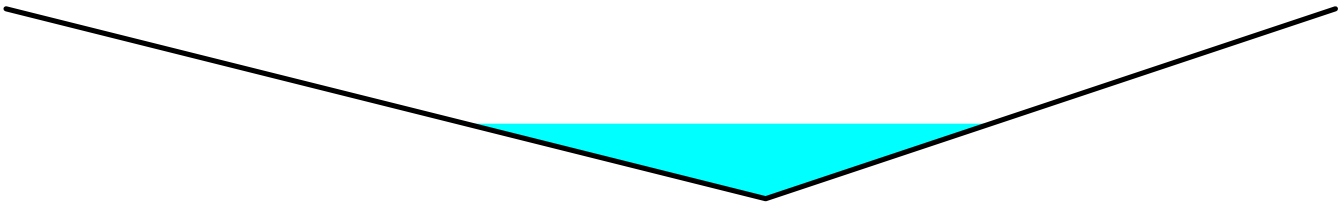
Summary for Reach TB-17-2: TB-17-2

Inflow Area = 0.600 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 3.84 cfs @ 11.94 hrs, Volume= 0.169 af
Outflow = 3.53 cfs @ 11.97 hrs, Volume= 0.169 af, Atten= 8%, Lag= 1.4 min

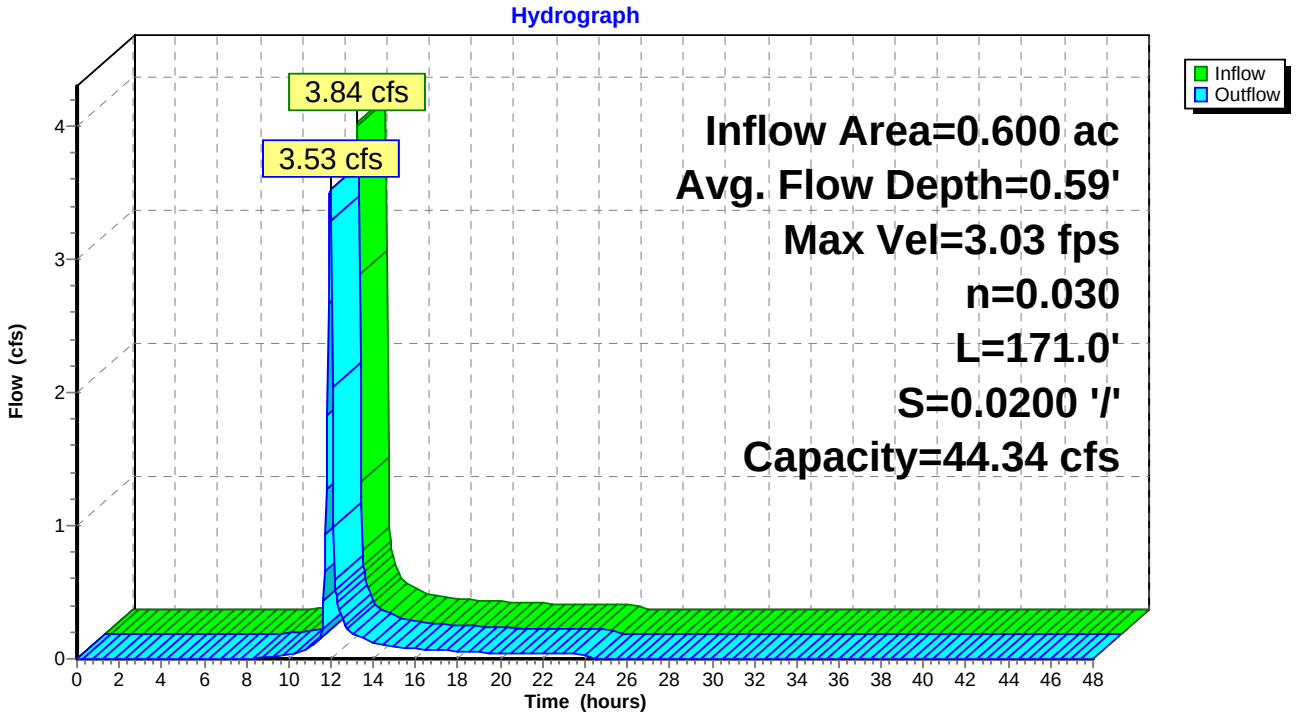
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.03 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.07 fps, Avg. Travel Time= 2.7 min

Peak Storage= 210 cf @ 11.95 hrs
Average Depth at Peak Storage= 0.59'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 44.34 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 171.0' Slope= 0.0200 '/'
Inlet Invert= 0.00', Outlet Invert= -3.42'



Reach TB-17-2: TB-17-2



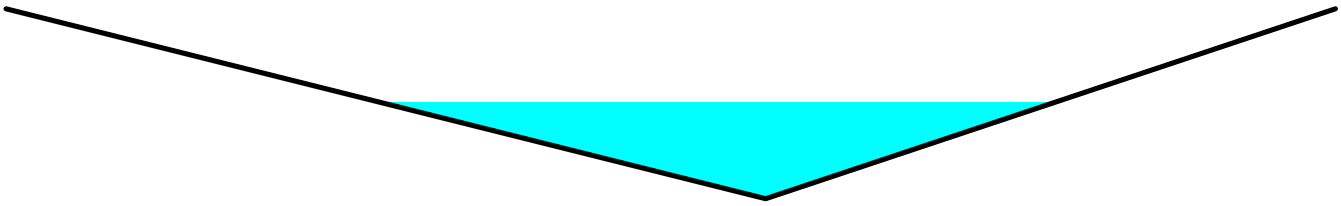
Summary for Reach TB-17-3: TB-17-3

Inflow Area = 1.235 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 7.91 cfs @ 11.94 hrs, Volume= 0.349 af
Outflow = 7.08 cfs @ 11.99 hrs, Volume= 0.349 af, Atten= 10%, Lag= 3.1 min

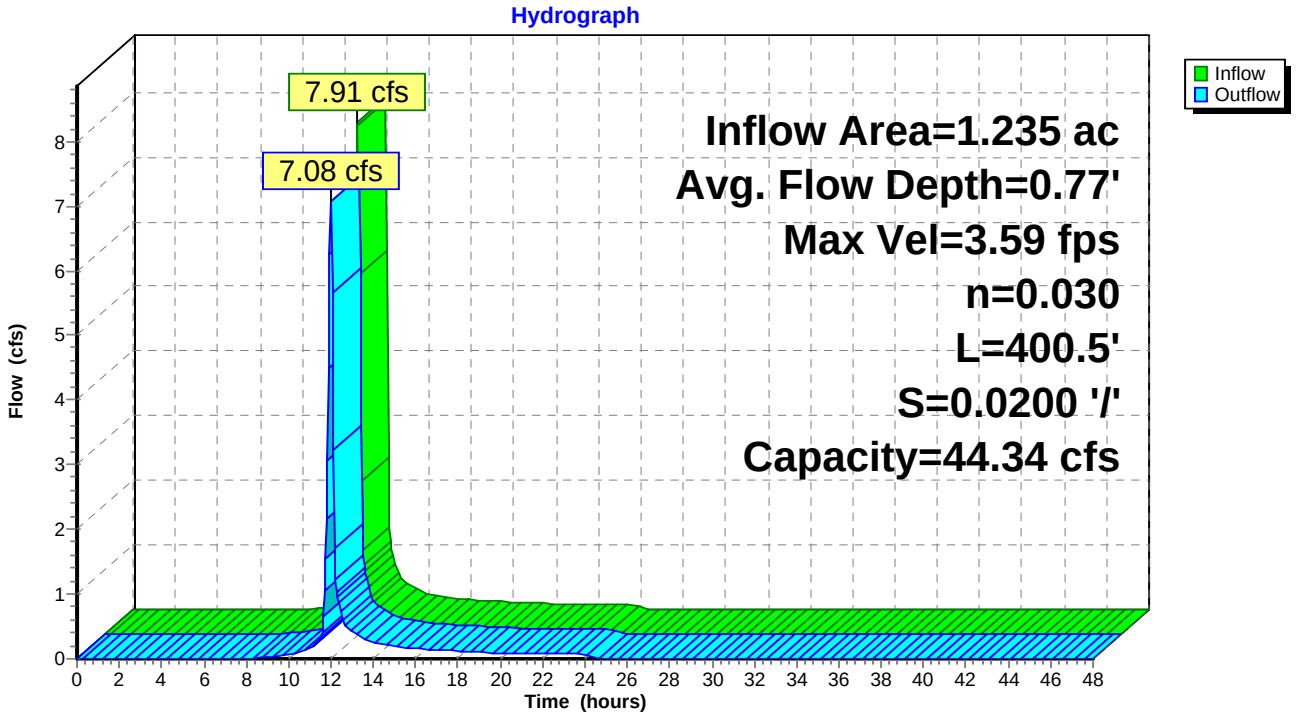
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.59 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 1.22 fps, Avg. Travel Time= 5.5 min

Peak Storage= 820 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.77'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 44.34 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 400.5' Slope= 0.0200 '/'
Inlet Invert= 0.00', Outlet Invert= -8.01'



Reach TB-17-3: TB-17-3



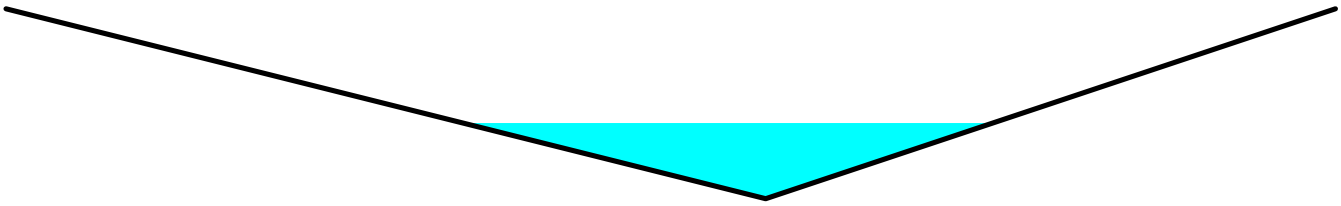
Summary for Reach TB-17-4: TB-17-4

Inflow Area = 0.618 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 3.95 cfs @ 11.94 hrs, Volume= 0.174 af
Outflow = 3.63 cfs @ 11.97 hrs, Volume= 0.174 af, Atten= 8%, Lag= 1.4 min

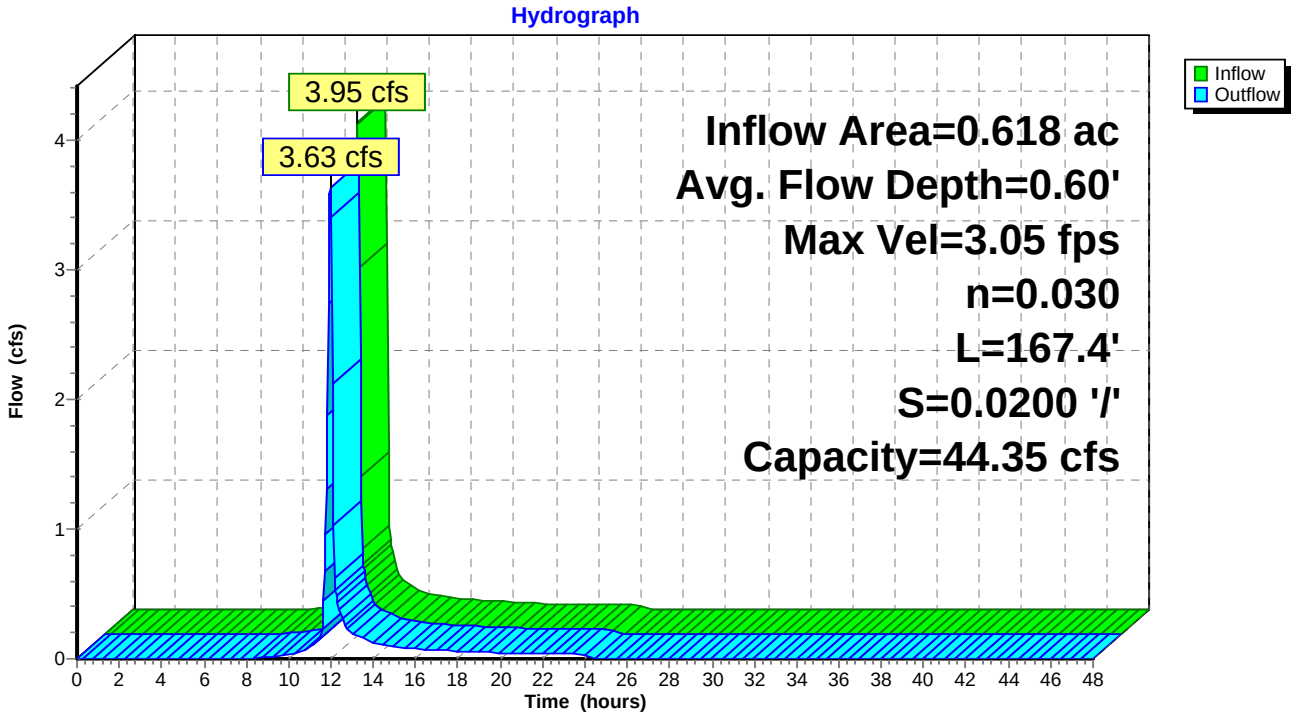
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.05 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.08 fps, Avg. Travel Time= 2.6 min

Peak Storage= 210 cf @ 11.95 hrs
Average Depth at Peak Storage= 0.60'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 44.35 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 167.4' Slope= 0.0200 '/'
Inlet Invert= 0.00', Outlet Invert= -3.35'



Reach TB-17-4: TB-17-4



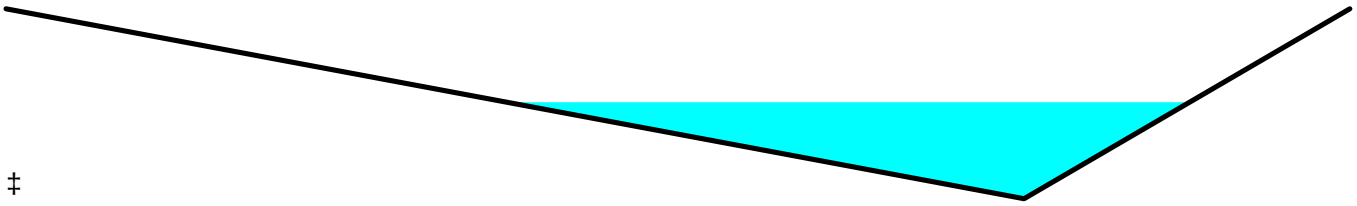
Summary for Reach TB-18-1: TB-18-1

Inflow Area = 1.046 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 6.74 cfs @ 11.94 hrs, Volume= 0.295 af
Outflow = 5.94 cfs @ 12.02 hrs, Volume= 0.295 af, Atten= 12%, Lag= 4.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.55 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 0.51 fps, Avg. Travel Time= 8.7 min

Peak Storage= 1,020 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.76'
Bank-Full Depth= 1.50' Flow Area= 14.9 sf, Capacity= 36.43 cfs

0.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 10.0 3.2 '/' Top Width= 19.80'
Length= 266.0' Slope= 0.0050 '/'
Inlet Invert= 0.00', Outlet Invert= -1.33'



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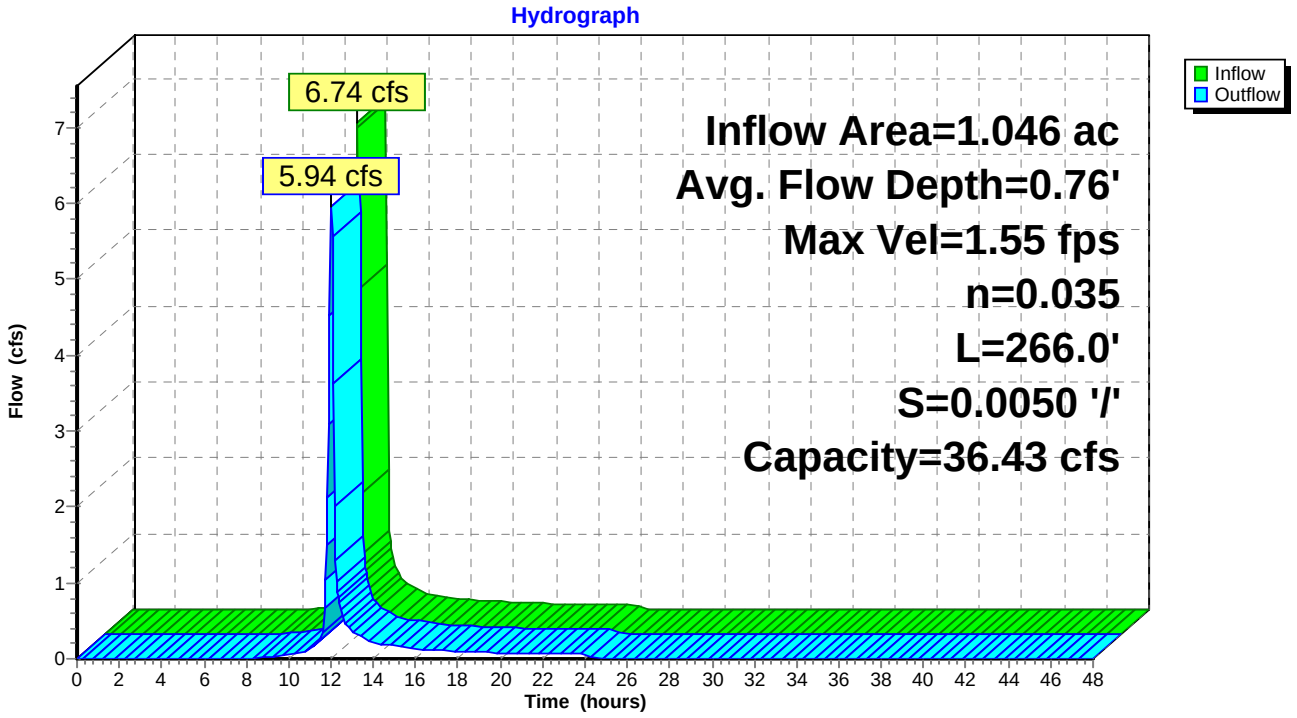
Reach TB-18-1: TB-18-1



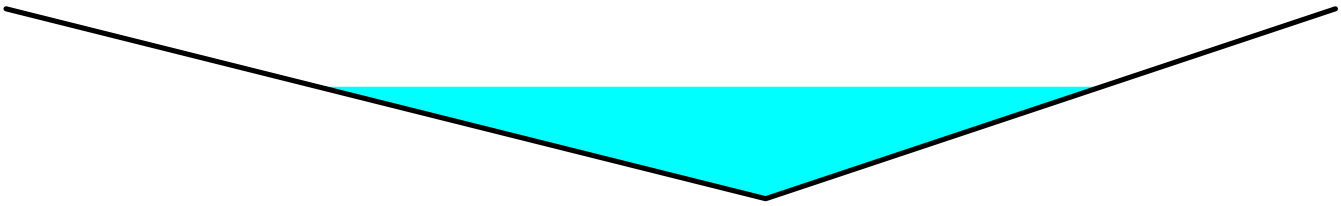
Summary for Reach TB-18-2: TB-18-2

Inflow Area = 1.341 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 8.59 cfs @ 11.94 hrs, Volume= 0.379 af
Outflow = 7.58 cfs @ 12.02 hrs, Volume= 0.379 af, Atten= 12%, Lag= 4.6 min

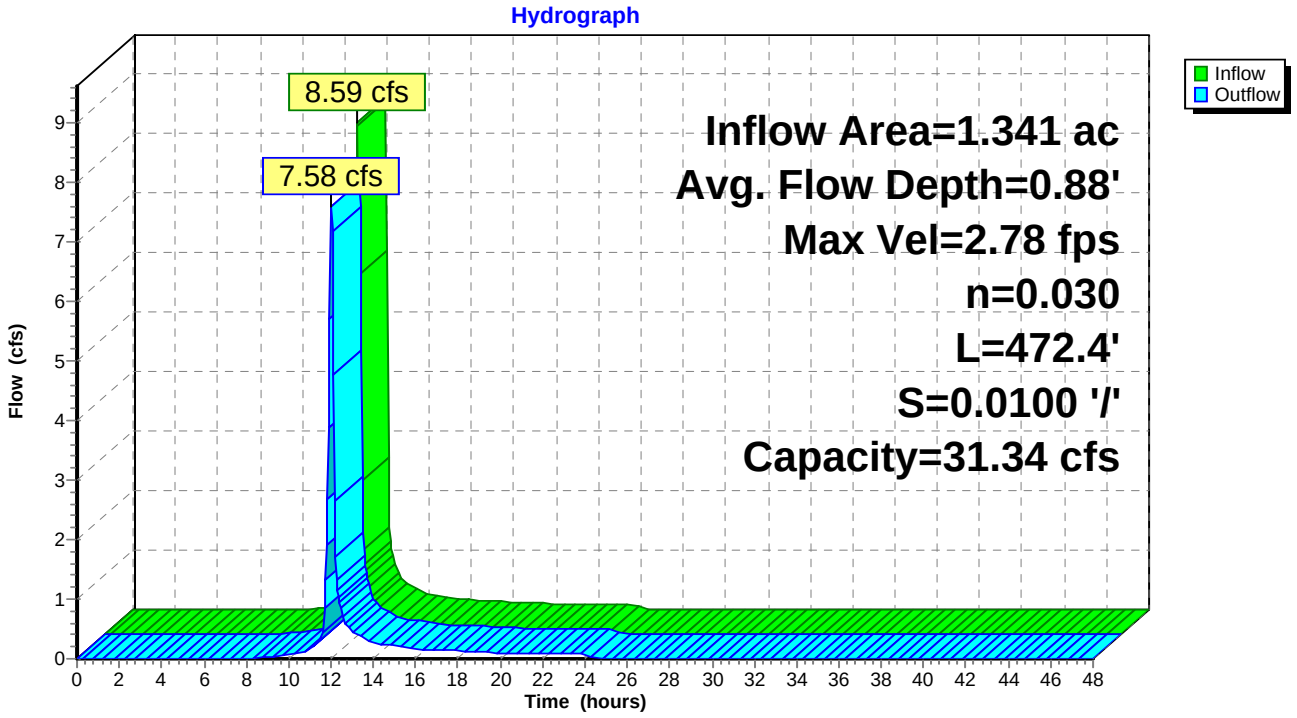
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.78 fps, Min. Travel Time= 2.8 min
Avg. Velocity = 0.91 fps, Avg. Travel Time= 8.6 min

Peak Storage= 1,291 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.88'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 31.34 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 472.4' Slope= 0.0100 '/'
Inlet Invert= 0.00', Outlet Invert= -4.72'



Reach TB-18-2: TB-18-2



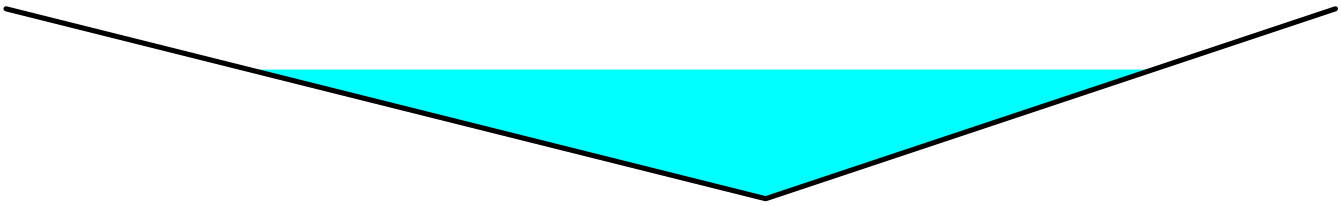
Summary for Reach TB-18-3: TB-18-3

Inflow Area = 1.995 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 12.74 cfs @ 11.94 hrs, Volume= 0.563 af
Outflow = 11.02 cfs @ 12.03 hrs, Volume= 0.563 af, Atten= 14%, Lag= 5.4 min

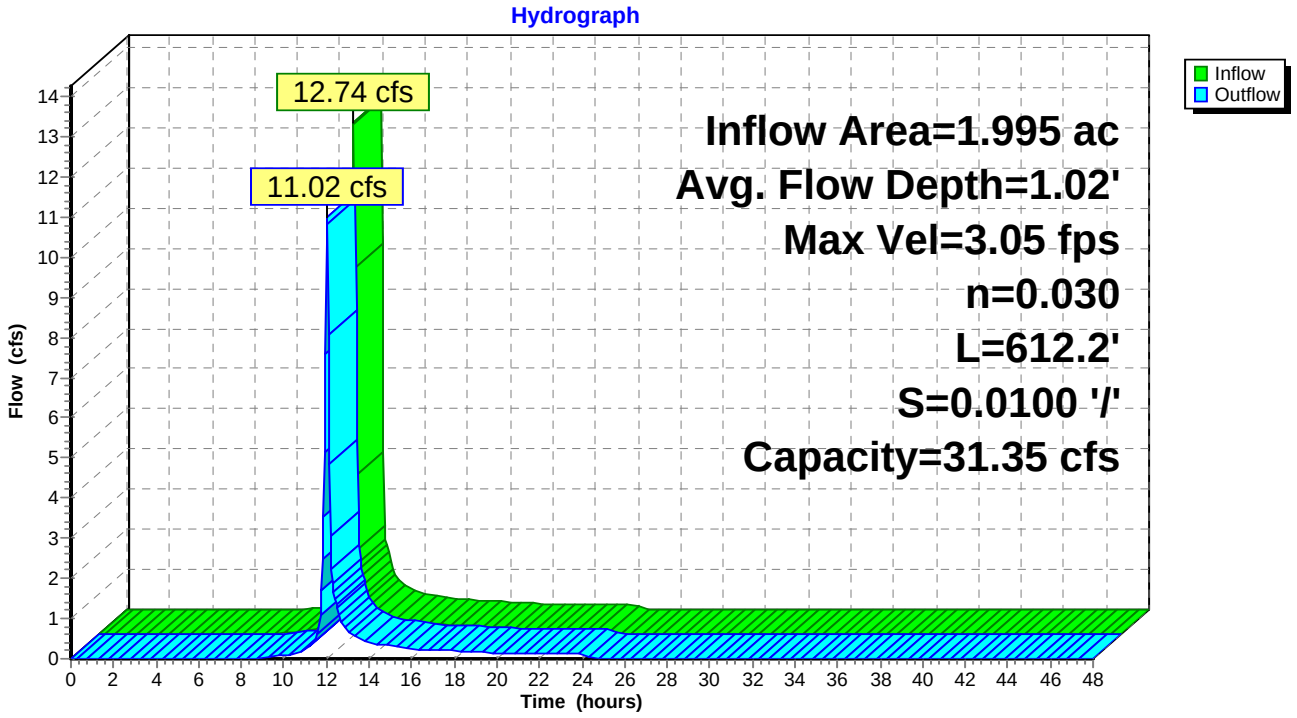
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.05 fps, Min. Travel Time= 3.3 min
Avg. Velocity = 0.97 fps, Avg. Travel Time= 10.5 min

Peak Storage= 2,225 cf @ 11.98 hrs
Average Depth at Peak Storage= 1.02'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 31.35 cfs

0.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 3.0 '/' Top Width= 10.50'
Length= 612.2' Slope= 0.0100 '/'
Inlet Invert= 0.00', Outlet Invert= -6.12'



Reach TB-18-3: TB-18-3



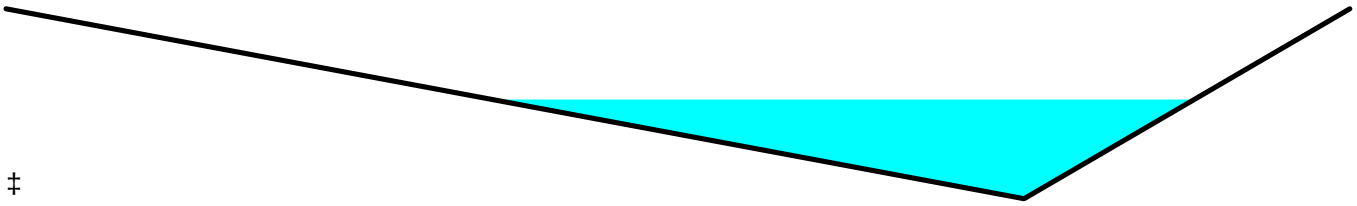
Summary for Reach TB-6-1: TB-6-1

Inflow Area = 1.119 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 7.21 cfs @ 11.94 hrs, Volume= 0.316 af
Outflow = 6.36 cfs @ 12.01 hrs, Volume= 0.316 af, Atten= 12%, Lag= 4.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.58 fps, Min. Travel Time= 2.8 min
Avg. Velocity = 0.51 fps, Avg. Travel Time= 8.6 min

Peak Storage= 1,079 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.78'
Bank-Full Depth= 1.50' Flow Area= 14.9 sf, Capacity= 36.36 cfs

0.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 10.0 3.2 '/' Top Width= 19.80'
Length= 267.0' Slope= 0.0050 '/'
Inlet Invert= 0.00', Outlet Invert= -1.33'



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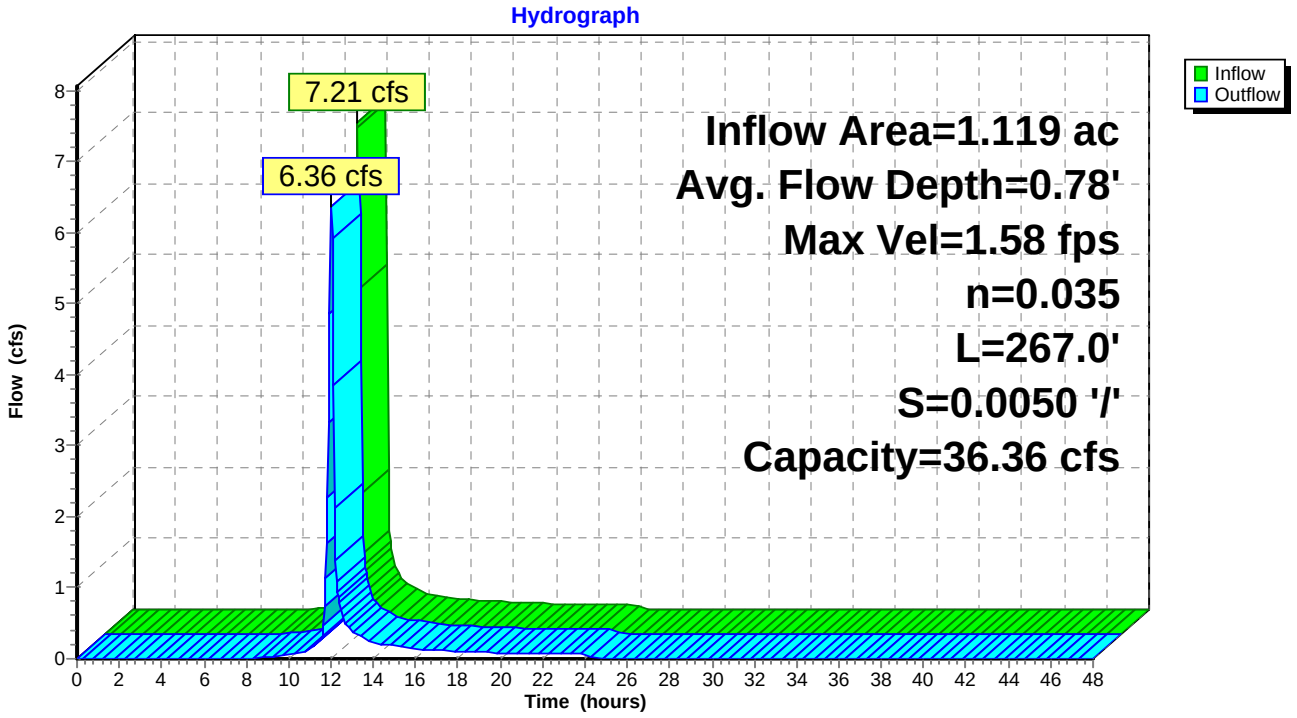
Reach TB-6-1: TB-6-1



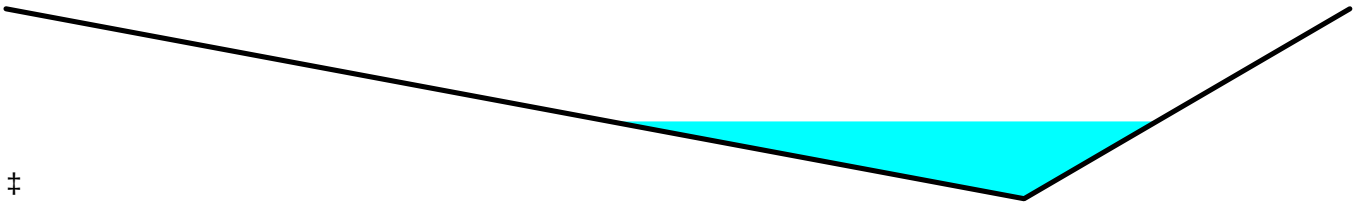
Summary for Reach TB-6-2: TB-6-2

Inflow Area = 0.603 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 3.90 cfs @ 11.94 hrs, Volume= 0.170 af
Outflow = 3.19 cfs @ 12.04 hrs, Volume= 0.170 af, Atten= 18%, Lag= 6.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.33 fps, Min. Travel Time= 4.1 min
Avg. Velocity = 0.44 fps, Avg. Travel Time= 12.4 min

Peak Storage= 798 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 1.50' Flow Area= 14.9 sf, Capacity= 36.43 cfs

0.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 10.0 3.2 '/' Top Width= 19.80'
Length= 326.0' Slope= 0.0050 '/'
Inlet Invert= 0.00', Outlet Invert= -1.63'



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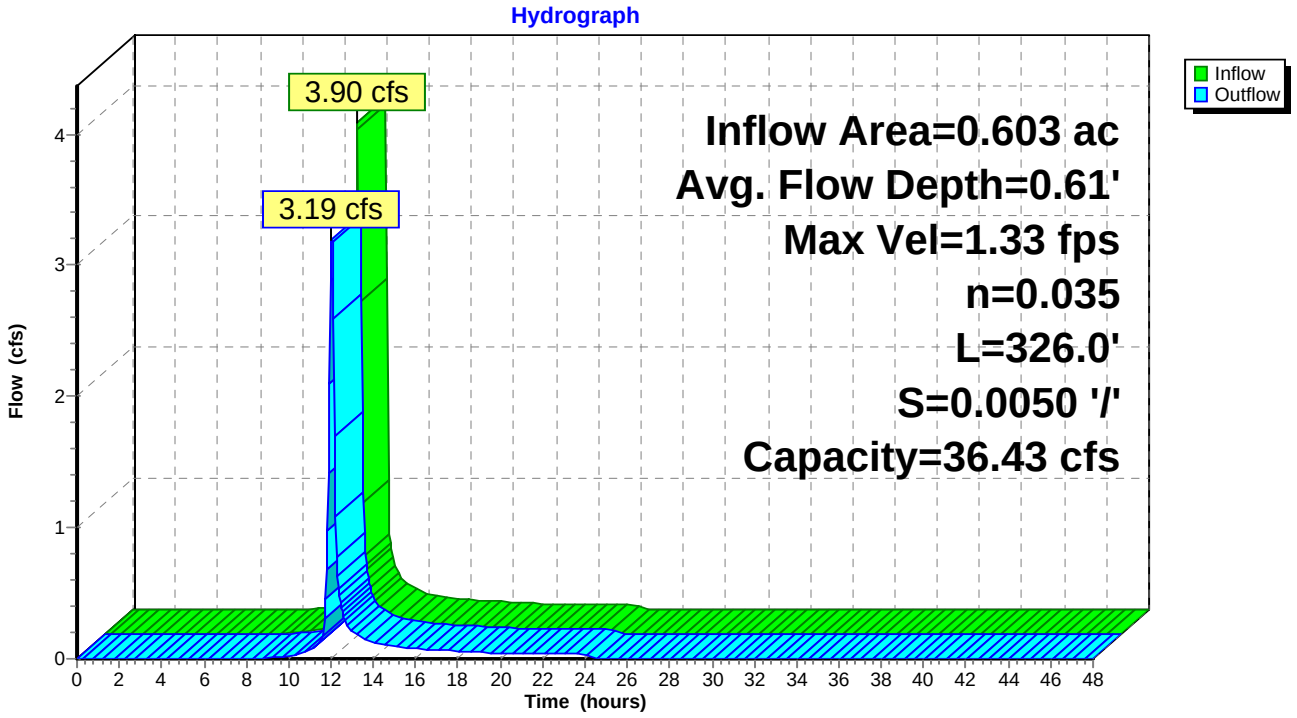
Reach TB-6-2: TB-6-2



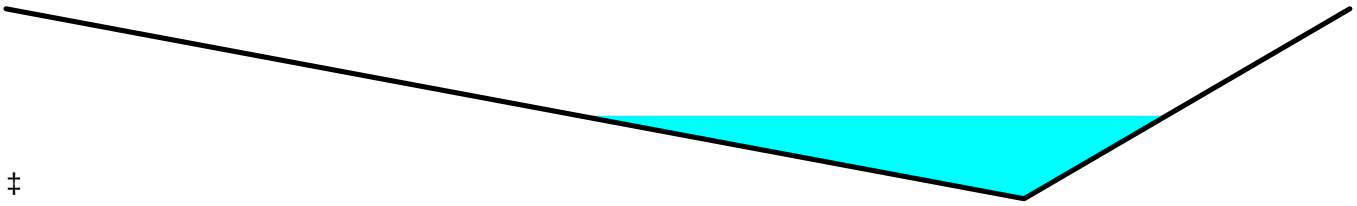
Summary for Reach TB-6-3: TB-6-3

Inflow Area = 0.721 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 4.68 cfs @ 11.94 hrs, Volume= 0.204 af
Outflow = 3.92 cfs @ 12.03 hrs, Volume= 0.204 af, Atten= 16%, Lag= 5.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.41 fps, Min. Travel Time= 3.7 min
Avg. Velocity = 0.46 fps, Avg. Travel Time= 11.2 min

Peak Storage= 875 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.66'
Bank-Full Depth= 1.50' Flow Area= 14.9 sf, Capacity= 36.42 cfs

0.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 10.0 3.2 '/' Top Width= 19.80'
Length= 308.2' Slope= 0.0050 '/'
Inlet Invert= 0.00', Outlet Invert= -1.54'



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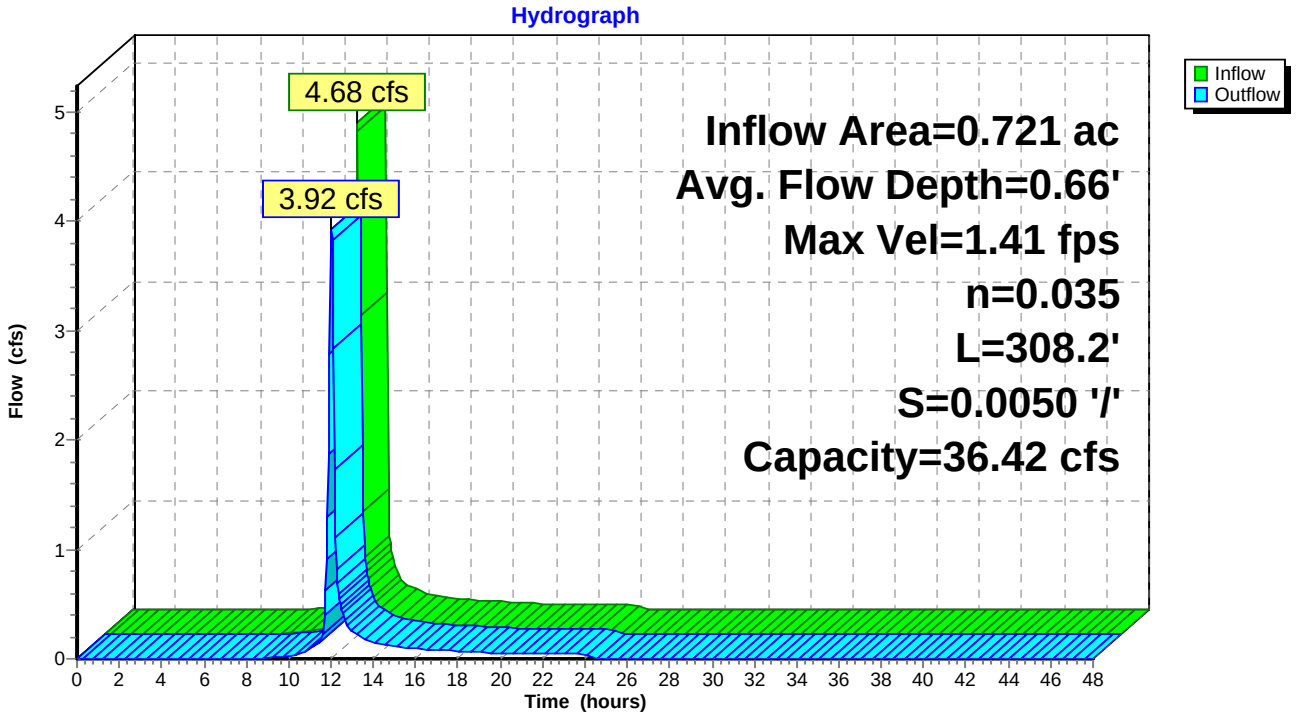
Reach TB-6-3: TB-6-3



Summary for Pond 006: Culvert 006

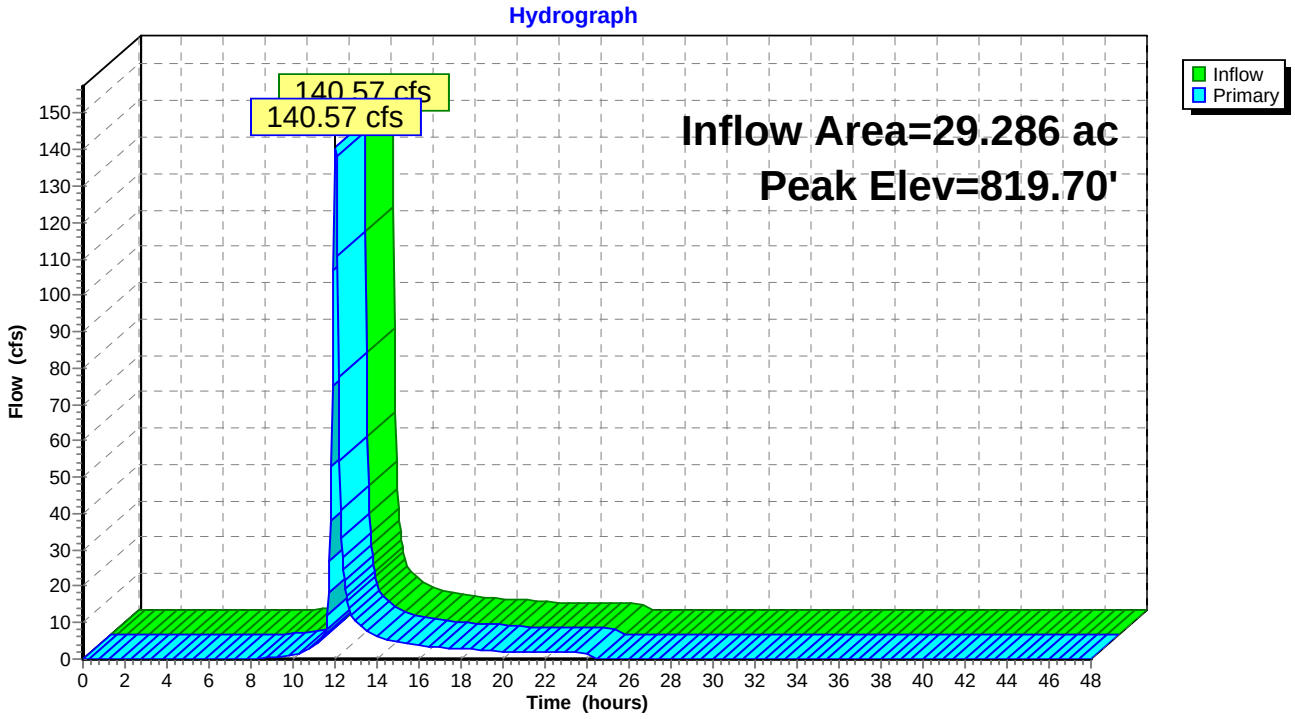
Inflow Area = 29.286 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 140.57 cfs @ 12.03 hrs, Volume= 8.268 af
Outflow = 140.57 cfs @ 12.03 hrs, Volume= 8.268 af, Atten= 0%, Lag= 0.0 min
Primary = 140.57 cfs @ 12.03 hrs, Volume= 8.268 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 819.70' @ 12.03 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	816.04'	**48.0" Round Culvert** L= 44.7' Ke= 0.500 Inlet / Outlet Invert= 816.04' / 815.42' S= 0.0139 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 12.57 sf
#2	Primary	816.06'	**48.0" Round Culvert** L= 44.5' Ke= 0.500 Inlet / Outlet Invert= 816.06' / 814.41' S= 0.0371 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 12.57 sf

Primary OutFlow Max=136.97 cfs @ 12.03 hrs HW=819.64' (Free Discharge)
1=Culvert (Barrel Controls 60.63 cfs @ 6.72 fps)
2=Culvert (Inlet Controls 76.34 cfs @ 6.44 fps)

Pond 006: Culvert 006



Summary for Pond 018: Culvert 018

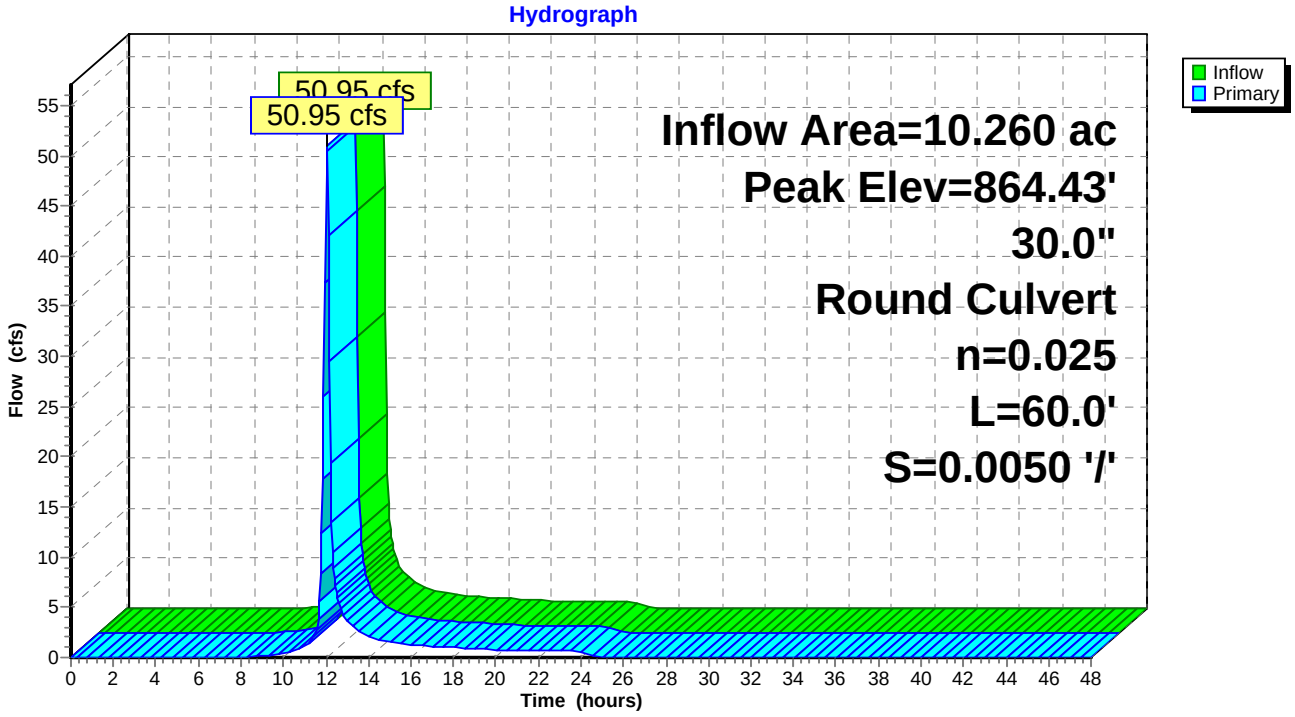
Inflow Area = 10.260 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 50.95 cfs @ 12.04 hrs, Volume= 2.897 af
Outflow = 50.95 cfs @ 12.04 hrs, Volume= 2.897 af, Atten= 0%, Lag= 0.0 min
Primary = 50.95 cfs @ 12.04 hrs, Volume= 2.897 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 864.43' @ 12.04 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	856.30'	**30.0" Round CMP_Round 30"** L= 60.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 856.30' / 856.00' S= 0.0050 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 4.91 sf

Primary OutFlow Max=49.86 cfs @ 12.04 hrs HW=864.19' (Free Discharge)
1=CMP_Round 30" (Barrel Controls 49.86 cfs @ 10.16 fps)

Pond 018: Culvert 018



Summary for Pond CWP: Contact Water Pond

Inflow Area = 5.129 ac, 0.00% Impervious, Inflow Depth = 5.52" for 25-yr, 24-hr event
Inflow = 39.61 cfs @ 11.91 hrs, Volume= 2.359 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

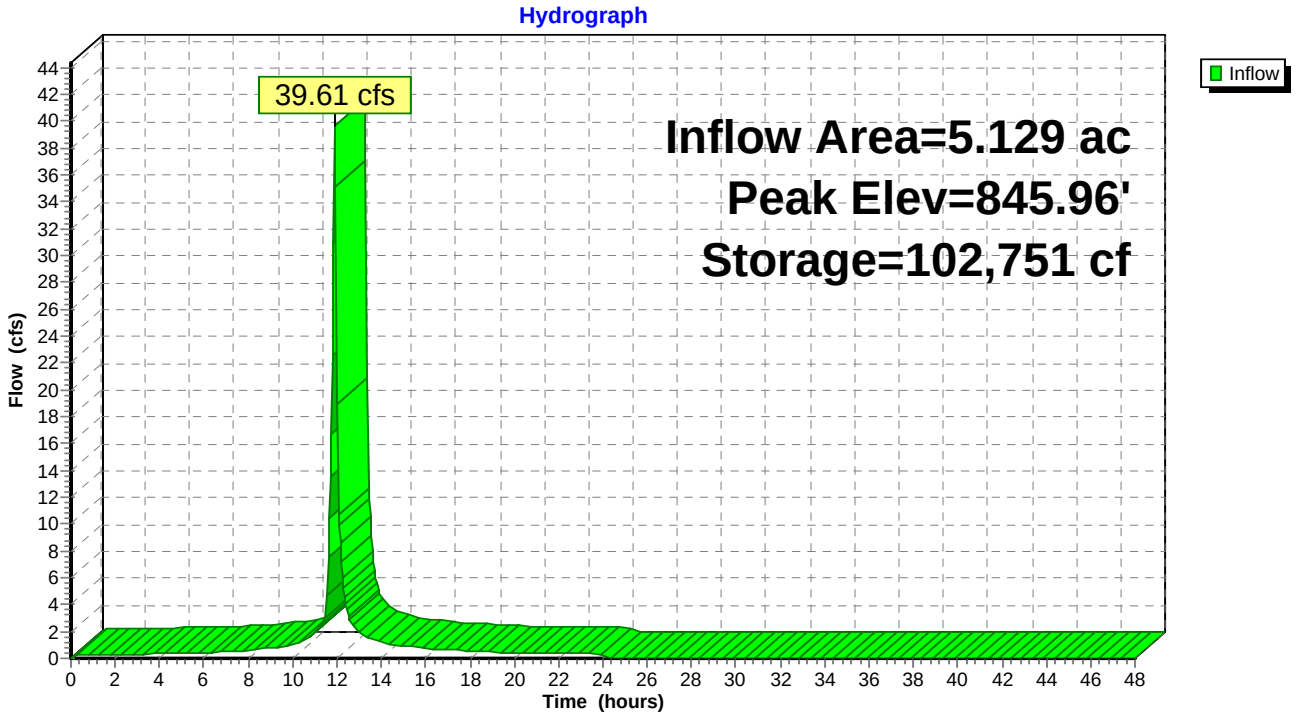
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 845.96' @ 24.85 hrs Surf.Area= 95,945 sf Storage= 102,751 cf

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	844.00'	546,654 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
844.00	9,005	0	0
846.00	97,805	106,810	106,810
848.00	110,558	208,363	315,173
850.00	120,923	231,481	546,654

Pond CWP: Contact Water Pond

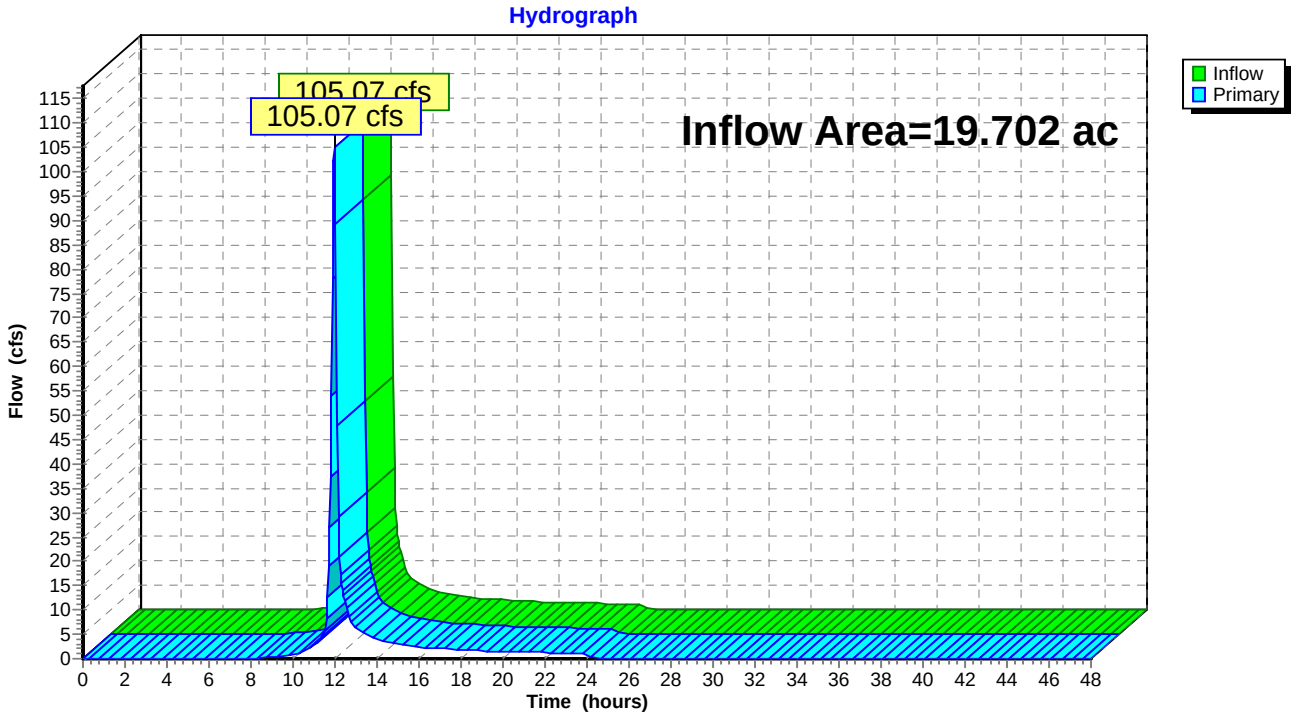


Summary for Link EKR: East Kansas River

Inflow Area = 19.702 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 105.07 cfs @ 11.97 hrs, Volume= 5.562 af
Primary = 105.07 cfs @ 11.97 hrs, Volume= 5.562 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link EKR: East Kansas River

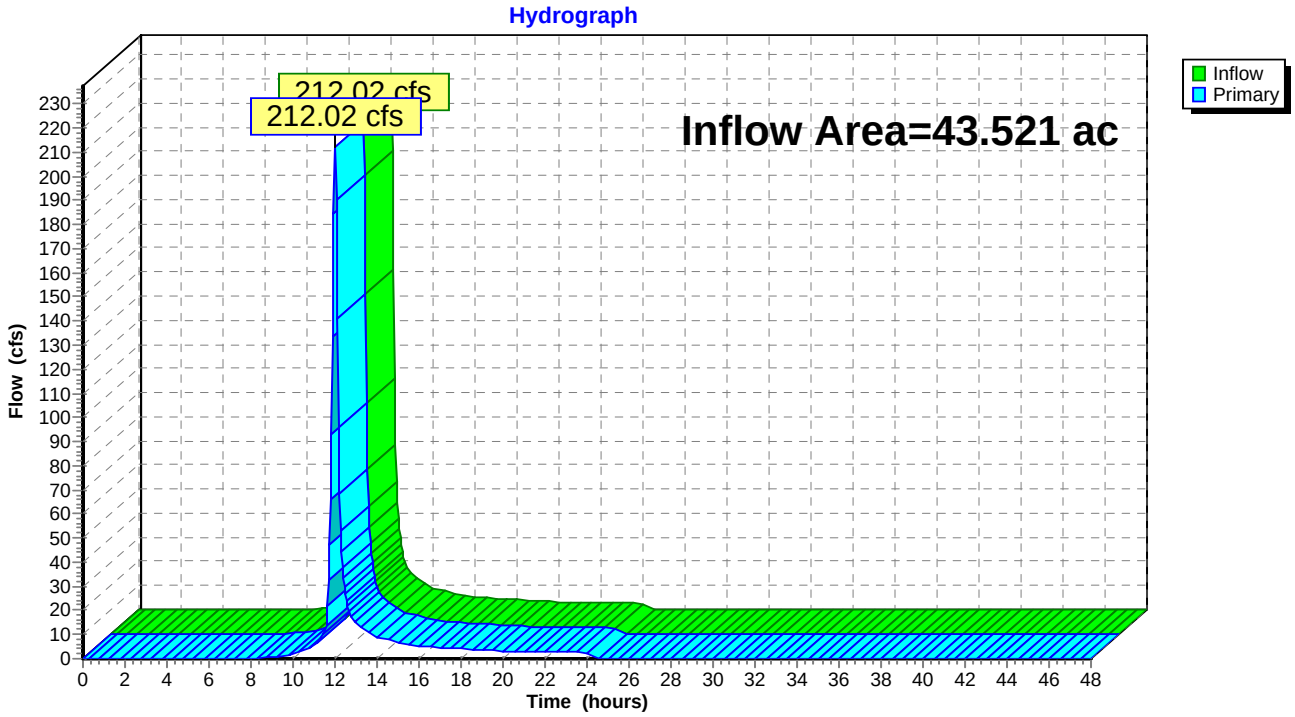


Summary for Link NKR: North Kansas River

Inflow Area = 43.521 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 212.02 cfs @ 12.00 hrs, Volume= 12.286 af
Primary = 212.02 cfs @ 12.00 hrs, Volume= 12.286 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link NKR: North Kansas River



Summary for Link SS: South Stream

Inflow Area = 27.862 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-yr, 24-hr event
Inflow = 139.81 cfs @ 12.02 hrs, Volume= 7.866 af
Primary = 139.81 cfs @ 12.02 hrs, Volume= 7.866 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link SS: South Stream