Final Stormwater Management Plan

prepared for

Lakewood Business Park – Lot 35
4101 NE Port Drive
Lee's Summit, MO 64064

February 19, 2021
Rev. August 13, 2021

prepared by

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Schlagel & Associates Project 18-222

for

Lakewood Self-Storage, LLC
1220 Washington, Suite 300
Kansas City, Missouri

Executive Summary

August 13, 2021

Gene Williams, P.E.
220 SE Green Street
Lee's Summit, MO 64063

RE: Lakewood Business Park – Lot 35
4101 NE Port Drive
Lee's Summit, MO 64064

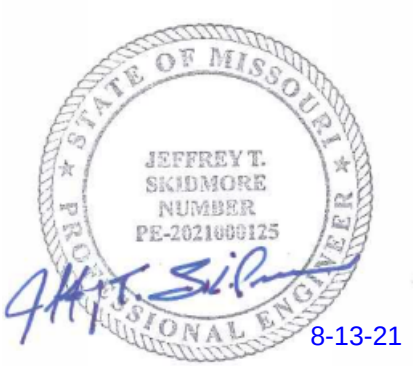
Dear Gene Williams,

We are submitting the enclosed stormwater management study in support of the preliminary development plan/special use permit application for Lakewood Business Park. This report has been prepared to address permitting requirements and provides preliminary design calculations for the required storm water detention and BMP facilities. We have modeled the existing site conditions as they existed at the time this report was prepared.

The proposed site is a 2.93 acres commercial/industrial proposed parcel located in Lee's Summit, MO east of I-470 and north of Northeast Lakewood Way. The proposed development has been analyzed and designed to meet the APWA Comprehensive Control Strategy, which entails limiting post-development peak discharge rates from the site for the 2-Year, 10-Year, and 100-Year design storm events. An Extended Dry Detention Basin (EDDB) along with a Proprietary Media Filtration Device has been designed to detain the mentioned events as well as provided 40-hour detention of runoff from the local 90% mean annual event. All elements of the enclosed drainage system will be designed and constructed in accordance with all City of Lee's Summit. Missouri. requirements.

Sincerely,

Schlagel & Associates, P.A.



Ryan P. McGinnis, P.E.
Design Engineer

Jeff T. Skidmore, P.E.
Project Engineer

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1.0 GENERAL INFORMATION

Lakewood Self-Storage, LLC is proposing to develop the 2.93 acres of land located in the West half of Section 9, Township 48 North, Range 31 West, Jackson County, Missouri. The property is located in commercial/industrial vacant land and is bounded on the North by similar industrial development and on the East by agricultural/residential land. The property is bounded on the West by Northeast Port Drive and on the South the property is bounded by Northeast Lakewood Way and the North 2.5 Million Gallon Water Tank. The proposed development includes a single commercial, climate controlled self-storage, warehouse building with associated infrastructure.

1.1 OBJECTIVE

The intent of this report is to provide information pertaining to the existing and proposed watersheds, identifying and addressing any downstream drainage issues, determine and address any detention requirements, provide 40-hour extended detention of runoff from the local 90% mean annual event, and address permitting requirements. This study provides the preliminary design calculations for the development of the facility and associated infrastructure. Detailed designs will be required and provided with permit documents.

1.2 METHODOLOGY

The following were utilized in the assessment, preparation and analysis of watersheds in this design concept plan: *Section 5600, 2011, Storm Drainage Systems & Facilities* of the Standard Specifications & Design Criteria of the Kansas City Metropolitan Chapter of the American Public Works Association; *City of Lee's Summit, Missouri Design Criteria (2011 Revision), Storm Drainage Systems & Facilities,* prepared by the City of Lee's Summit, Missouri, Public Works Department.

Watersheds for the site were defined according to soil cover and type, tributary area, and runoff times of concentration. Soil cover was determined from inspection of the site and aerial photography. A soil survey for the project area was obtained from the United

States Department of Agriculture, Natural Resources Conservation Service (NRCS), website and was utilized in determining soil type. The entire NRCS Soil Resource Report can be found in Appendix B. Watershed size was determined from both aerial topography and topographical survey, and by the proposed grading plan.

Times of concentration were compiled according to *NRCS TR-55 Urban Hydrology for Small Watersheds (1986)* methodology for sheet flow, shallow concentrated flow, and channel flow. Travel times for channel flows were determined using the length and velocity of the open channel. *HydroCAD-10* was utilized to model the runoff. All storm events were modeled using *SCS 24-hour Type II* distributions and were modeled for 2-Year, 10-Year, and 100-Year storm events.

* * * * *

2.0 EXISTING CONDITIONS ANALYSIS

The site lies within the Little Blue River Watershed. The existing site contains one watershed which has a release point located on the southwest portion of the site. Offsite stormwater comes into the site from the southeast and drains to the same release point previously mentioned.

2.1 TRIBUTARY AREAS

The existing drainage tributary is provided in Appendix A, Figure A.2. The site release point has been identified as Release Point 1(RP-1). The area has been delineated according to the existing topography and an annotation callout of, EX. DA-A, Ex. Off DA-B, and Ex. Off DA-C, on Figure A.2, has been provided for the watershed that drains to the release point, RP-1.

2.2 CURVE NUMBER AND TIME OF CONCENTRATION

The existing curve numbers and time of concentrations for each area have been established based on the procedures outlined in *NRCS TR-55 Urban Hydrology for Small Watersheds (1986)*. Existing curve numbers were based upon aerial photography, site inspection, and the soil types present on site.

The NRCS Soil Resource Report indicated that a Hydrologic Soil Group (HSG) of D was present on site. Hydrologically poor conditions indicate a state of land use that will provide higher runoff compared to good conditions. Therefore, group D was utilized to model the existing runoff conditions. A current aerial photograph can be found in Appendix A, Figure A.1; it depicts the existing cover conditions. Table 2-1 found in section 2.3 Existing Flow Rates summarizes the curve numbers for each of the watershed areas.

Cover types for existing conditions were considered to be a “pasture, grassland, or range” in fair condition and a small section of “unconnected pavement”. Procedures

outlined in *NRCS TR-55 Urban Hydrology for Small Watersheds* recommends utilizing curve numbers 89 and 98 for HSG D, for the respective cover types mentioned.

Time of concentration flow paths were based upon sheet flow and shallow concentrated flow for the existing conditions. Sheet flow lengths were limited to where a grade break occurred. Flow was then considered shallow concentrated flow until a channel was visible either from the USGS topographic map or the aerial photograph, and then from that point was considered channel flow determined by the length of the channel and the velocity of flow.

2.3 EXISTING FLOW RATES

Existing flow rates were determined for the 2-Year, 10-Year, and 100-Year design storms. Offsite runoff is included in the calculations for Table 2-1 and Table 2-2 below for Ex. Drainage Area A, Ex. DA-A. Appropriate runoff coefficient curve numbers were based upon aerial photography, site inspection, and the soil types present on site. Detailed calculations with composite curve numbers and time of concentration can be found in the HydroCAD Model Output in Appendix B.

Table 2-1 - Existing Flow Rates

Drainage Sub-Basin	Runoff Coeff. (CN)	Time of Concentration (minutes)	Area (acres)	2-Year Peak Flow (cfs)	10-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)
Ex. DA-A	84	9.8	2.93	8.64	15.53	24.83
Ex. Off DA-B	89	5.4	0.64	2.50	4.12	6.30
Ex. Off DA-C	89	6.6	0.12	0.45	0.75	1.15

Table 2-2 below reflects the total existing runoff for the sites stormwater at the release point identified in Figure A.2 found in Appendix A.

Table 2-2 - Existing Runoff Evaluation

Drainage Sub-Basin Release Points	2-Year Peak Flow (cfs)	10-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)
RP 1	11.43	20.21	31.99

2.4 DOWNSTREAM DRAINAGE ISSUES

The existing downstream drainage system has been reviewed with this development plan. FEMA flood maps have been checked and currently no immediate downstream issues appear to be present. A FEMA FIRMette is included in Appendix A, Figure A.6 and Figure A.7. The project lies outside of the identified FEMA floodplain per map number 29095C0430G.

2.5 AGENCY REVIEW

Permitting requirements of the following agencies were reviewed as part of the existing conditions analysis. These sections provide a discussion of the federal and state stormwater permitting that may be required for the proposed development. Supporting maps are located in Appendix A.

2.5.1 Corps of Engineers Review

The National Wetlands Inventory (NWI) map was reviewed for the site and there are no identified wetlands located within the project site. The NWI map can be found in Appendix A, Figure A.5. We do not anticipate any Corps of Engineers requirements associated with this project at this time.

2.5.2 FEMA Requirements

No FEMA identified floodplain is located on the proposed property per Flood Insurance Rate Map Panel No. 29095C0430G. There is currently no work proposed in the regulated floodplain. Please see the attached FEMA FIRMette in Appendix A, Figure A.4.

2.5.3 Missouri Department of Natural Resources

All land disturbance activities will be permitted in accordance with the City of Lee's Summit, MO specifications as well as the Missouri Department of Water Pollution Control general permit under the National Pollution Discharge Elimination System (NPDES) and an authorized Notice of Intent (NOI) application form. The disturbance of the site is greater than one acre; therefore, NPDES and NOI applications are required with the future permitting of the site in compliance with local, state and federal guidelines.

* * * * *

3.0 PROPOSED CONDITIONS ANALYSIS

With the proposed development, the site watershed will be divided into sub-basins for analysis. Stormwater runoff will be conveyed through the site via open sheet flow, shallow concentrated flow and a detention pond. An Extended Dry Detention Basin will collect the 2-Year, 10-Year, and 100-Year storm events for On-site Drainage Area-1, Off-site Drainage Area-1, and Off-site Drainage Area-2. On-Site Drainage Area-3 will be un-detained and allowed to run off the site as sheet flow.

All components of the overland and enclosed storm sewer systems will meet or exceed the specifications provided in *Section 5600 – Storm Drainage Systems & Facilities* of the *Standard Specifications and Design Criteria* compiled by the Kansas City Metropolitan Chapter of the American Public Works Association.

3.1 TRIBUTARY AREAS

Existing Drainage Area A, will be divided into sub-catchments, On-site Drainage Area-1, Off-Site Drainage Area-1, and Off-Site Drainage Area-2 will collect into the extended dry detention basin. On-Site Drainage Area-3 will bypass the storage areas and the extended dry detention basin. The parcel's release point designation remains the same for the proposed conditions. These tributary areas and their release point can be located in Appendix A, Figure A.3.

3.2 CURVE NUMBER AND TIME OF CONCENTRATION

Curve numbers for the proposed development were developed in a similar manner as the existing conditions. Hydrologic Soil Group (HSG) of D was utilized for post-development conditions. Cover types for the proposed conditions were considered to be heavily grassed in good condition with impervious areas, such as roofs and pavement.

Time of concentration was established in a similar manner as the existing conditions. Shallow concentrated flow lengths were shortened and considered paved. Detailed calculations with composite curve numbers and time of concentration can be found in

the HydroCAD Model Output in Appendix B. Appendix A, Figure A.3 depicts the proposed drainage conditions.

3.3 PROPOSED FLOW RATES

Proposed flow rates were determined for the 2-Year, 10-Year, and 100-Year design storms. Detailed calculations can be found in the HydroCAD Model Output Report in Appendix B.

Table 3-1 – HydroCAD Runoff Conditions

Drainage Sub-Basin	Ruoff Coeff. (CN)	Time of Concentration (minutes)	Area (acres)	2-Year Peak Flow (cfs)	10-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)
DA-1	93	24.1	2.43	6.41	10.28	15.37
OFF DA-1	84	13.0	0.12	0.32	0.58	0.92
OFF DA-2	80	10.7	0.64	1.55	2.96	4.92
DA-3	82	14.8	0.50	1.15	2.15	3.51

3.4 DETENTION ANALYSIS

The runoff hydrographs utilized to determine the peak flow volumes for each tributary area were determined using *TR-55* methodology and *HydroCAD-10*. For the 2-Year, 10-Year, and 100-Year storm events, the complete hydrograph routing and model output can be found in the HydroCAD Model Output Report in Appendix B.

The site will need to provide detention that meets the requirement under the Comprehensive Control release rates under Section 5608.4C1a and 5608.4C1b of the APWA. This entails limiting post-development peak discharge rates from the site for the 2-Year, 10-Year, and 100-Year design storm events, as well as providing 40-Hour extended detention of runoff from the local 90% mean annual event. The post-development peak discharge rates from the site shall not exceed the following:

- 50% storm peak rate less than or equal to 0.5 cfs per site acre
- 10% storm peak rate less than or equal to 2.0 cfs per site acre

- 1% storm peak rate less than or equal to 3.0 cfs per site acre

Based on the proposed drainage area of 2.93 acres, the required peak discharge with additional allowable offsite drainage peak discharge rates from Table 3-1 – HydroCAD Runoff Conditions are shown in Table 3-2 - Required & Proposed Runoff Comparison. The proposed post-development peak discharge rates are shown next to the maximum allowable peak discharge rates for comparison.

Table 3-2 - Required & Proposed Runoff Comparison

Site Release Information (cubic feet per second) (w/ EDDB)				
	Required Peak Discharge (A)	Allowable Offsite Discharge (B)	Required + Offsite Discharge (A+B)	Proposed Discharge
2-Year (50%)	1.47	2.95	4.42	4.29
10-Year (10%)	5.86	4.87	10.73	6.24
100-Year (1%)	8.79	7.45	16.24	15.03

Please note: Site release rates are not a direct addition of sub-basin runoff due to differences in the time peak as well as storage effects within the basins.

Stormwater runoff for DA-1, OFF DA-1, and OFF DA-2 is mitigated and detained by Extended Dry Detention Basin on the southwest corner of the property. Stormwater runoff for DA-3 will run freely through the site and ultimately detained by near-by existing street inlets. Proposed stormwater drainage structures have been aptly located throughout the site to capture and convey not only offsite but proposed stormwater runoff to the EDDB. The Water Quality volume above at the EDDB will be released over 40 hours.

Table 3-3 summarizes the exiting flow and velocity for the EDDB for the 2-Year, 10-Year, and 100-Year storm events. EDDB Water Quality Design calculations can be found in Appendix A.

Table 3-3 - Exit Flow & Velocity For EDDB

	2-Year Event	10-Year Event	100-Year Event
Q (cfs)	3.89	5.22	13.77
V (fps)	9.42	10.19	12.34

* * * * *

4.0 SUMMARY AND RECOMMENDATIONS

The proposed drainage site is a 2.93 acres commercial/industrial parcel of land located in Lee's Summit, MO east of I-470 and north of Northeast Lakewood Way. The proposed development has been analyzed and designed to meet the APWA Comprehensive Control Strategy, which entails limiting post-development peak discharge rates from the site for the 2-Year, 10-Year, and 100-Year design storm events. An EDDB has been designed to detain the mentioned events as well as provided 40-hour detention of runoff from the local 90% mean annual event. Should this outlet structure orifice's fail the 100-year storm event will be routed through the top of the structure. All elements of the enclosed drainage system will be designed and constructed in accordance with all City of Lee's Summit, Missouri, requirements.

* * * *

APPENDIX A

-Existing Site Aerial Photograph

-Existing Drainage Map

-Proposed Drainage Map

-EDDB Water Quality Design

-FEMA FIRMette

-National Wetlands Inventory

Jackson County MO Map

Jackson County, MO
GIS Department
303 W Walnut
Independence, MO 64050
816-881-4567
gis@jacksongov.org

Legend

Address

Tax Parcels

Tax Parcel

Condo

Township Range

Sections

Quarter Section Lines

N

1 inch = 94 feet

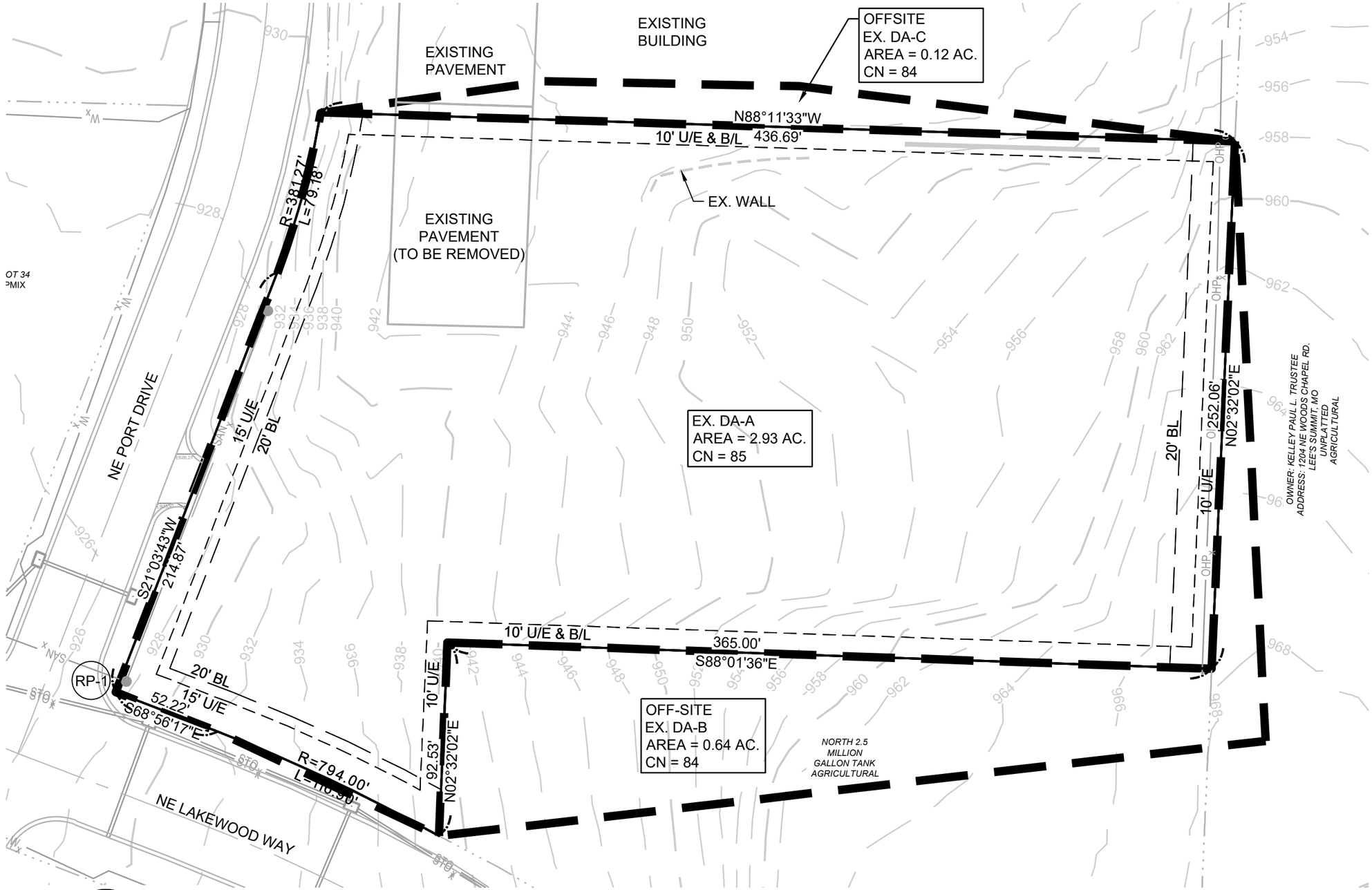
0 25 50 100

DISCLAIMER: These maps are NOT SURVEY ACCURATE.

DISCLAIMER: Requestor knowingly accepts the data and Information "as-is" and the County expressly disclaims any representation as to the completeness or accuracy of the data or information. Further, the County expressly disclaims any representation as to the suitability of the data or information for any specific use intended by requestor. Maps are intended to show as accurately as possible the relationship of data, but are not survey accurate.

RELEASE: Requestor expressly releases and agrees to hold the County, its officials, and its employees, harmless from any and all claims or damages arising out of the use of the data or information. Requestor expressly agrees to assume all risk for use and reliance on the data and information.

Date: 1/4/2019



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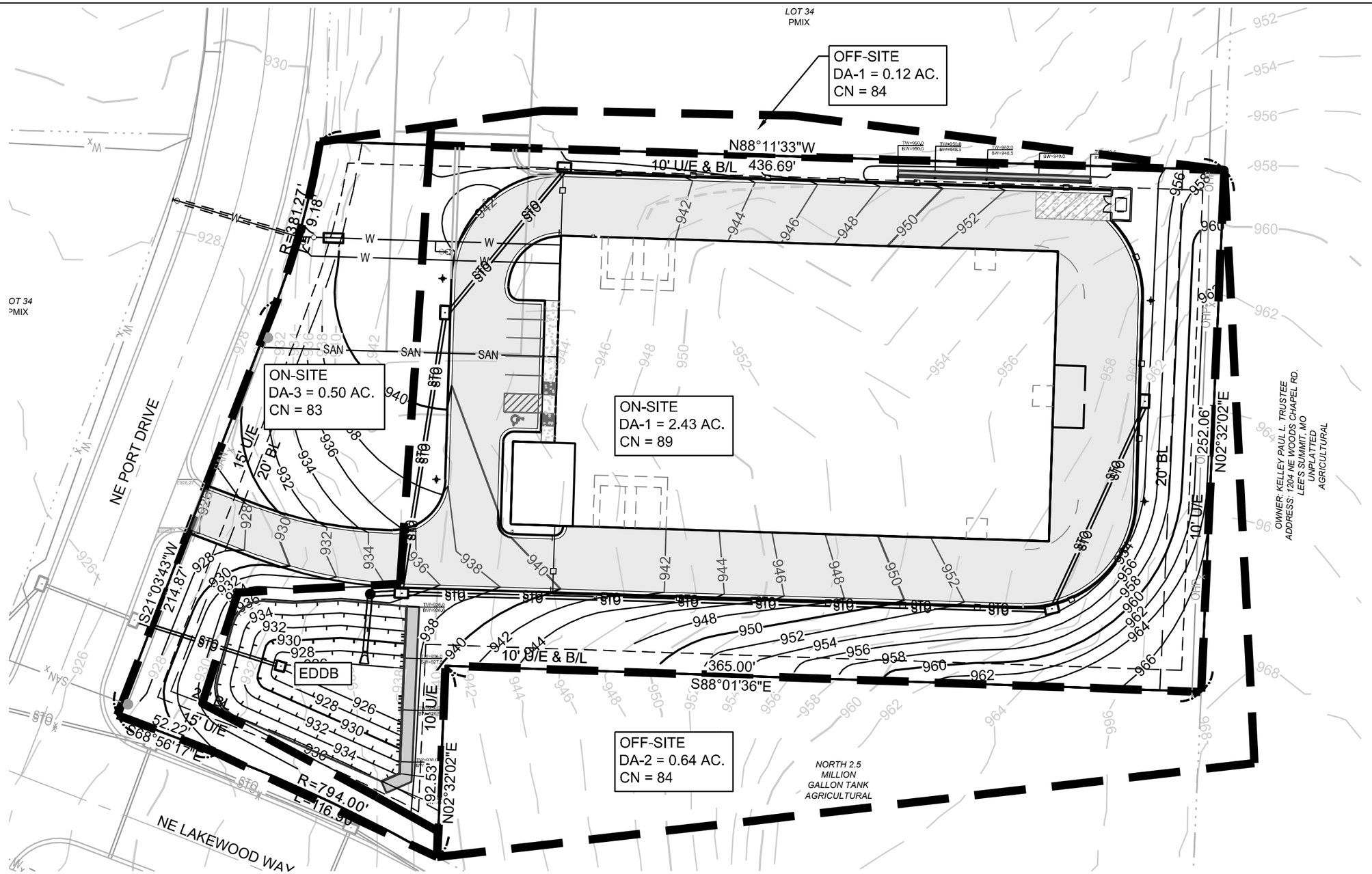
LAKEWOOD BUSINESS PARK
LOT 35
EXISTING DRAINAGE MAP

4101 NE PORT DRIVE
LEE'S SUMMIT, MISSOURI 64064

DRAWN BY:	DATE PREPARED:	PROJ. NUMBER:
RPM	02/18/2021	20-261

EXISTING DRAINAGE MAP

SHEET
A.2



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LAKEWOOD BUSINESS PARK
LOT 35
PROPOSED DRAINAGE MAP

4101 NE PORT DRIVE
LEE'S SUMMIT, MISSOURI 64064

DRAWN BY:	DATE PREPARED:	PROJ. NUMBER:
RPM	02/18/2021	20-261

PROPOSED
DRAINAGE MAP

SHEET
A.3

Basin Volume - EDDB-1

Project Name: LAKEWOOD BUSINESS PARK - LOT 35
Project #: 18-222
Time: 2/14/2019 14:16
Work By: R. McGinnis

Volume computed using Conic Method For Reservoir Volumes

Volume = (1/3) * (EL2-EL1)*(Area1 + Area2 + (Area1*Area2)$^{0.5}$)

Elevation (ft)	Area (ft^2)	Area (AC)	Δ Volume (ft^3)	Total Volume (ft^3)	Total Volume (ac-ft)
926	863	0.020	0	0	0.000
928	1,656	0.038	2,476	2,476	0.057
930	2,578	0.059	4,200	6,676	0.153
932	3,630	0.083	6,177	12,853	0.295
934	4,810	0.110	8,412	21,265	0.488
936	6,089	0.140	10,873	32,138	0.738

Water Quality Volume Calculation- EDDB-1

WQV = P * Weighted RV

WQV - Water Quality Volume (watershed-inches)
P - Rainfall Event (1.37 inches in Kansas City)
RV - Volumetric Runoff Coefficient

RV = 0.05 + 0.009(I)

I - Percent Site Imperviousness (%)

I. Determine Weighted RV & Weighted Rational C Coefficient Total Drainage Area

Cover Type	% Impervious	Area (Ac.)	Total Impervious Area (Ac.)	Rational Runoff Coefficient	RV	C * Area	RV * Area
Impervious (Building and Parking)	95	1.27	1.21	0.87	0.91	1.10	1.15
Open Space	0	1.32	0.00	0.30	0.05	0.40	0.07
Total	**47**	**2.59**	**1.21**			**1.50**	**1.22**

Rv = Sum(Rv*A)/Total Area = 1.215 / 2.59 = 0.469

C = Sum(C*A)/Total Area = 1.501 / 2.59 = 0.579

II. Determine Water Quality Volume

WQV = P * Rv = 1.37 * 0.4692 = **0.643 in**

III. Determine Total Water Quality Volume

Total Watershed Area (AT) = 2.59 acres
WQV = 0.643 in

WQV = (2.59 * 0.642)/12 = **0.14 ac-ft** 6044.057085 c.f.

IV. Peak rate of runoff for WQv

Q = K*C*i*A
K = 1 for WQv
C = 0.3 + 0.6 I
I = Percent impervious
i = Rainfall Intensity from Table 9 in BMP manual

C = 0.3+0.6*I = 0.58
K = 1.00
i = 1.90
Q (cfs) = **2.85**

Design Procedure Form: Extended Dry Detention Basin (EDDB)
Main Worksheet

Project #:	18-222
Designer:	RPM
Checked by:	JPB
Company:	Schlagel
Date:	2/14/2019
Project:	LAKEWOOD BUSINESS PARK - LOT 35
Location:	

EDDB

I. Basin Water Quality Storage Volume:

Step 1) Tributary Area to EDDB, A_T (ac.)	A_T (ac.) =	2.59
Step 2) Calculate WQv using method in Section 6.1	WQv (ac-ft) =	0.14
Step 3) Add 20 percent to account for silt and sand sediment deposition in the basin	V_{design} (ac-ft) =	0.17

IIa. Water Quality Outlet Type

Step 1) Set Water Quality Outlet Type Type 1 = Single Orifice Type 2 = Perforated riser or plate Type 3 = v-notch weir	Outlet Type =	2
Step 2) Proceed to step 2b, 2c, or 2d based on water quality outlet type		

IIb. Water Quality Outlet, Single Orifice

Step 1) Depth of water quality volume at outlet, Z_{WQ} (ft.)	Z_{WQ} (ft.) =	2.50
Step 2) Average head of Water Quality volume over invert of orifice, H_{WQ} (ft) $H_{WQ} = 0.5 * Z_{WQ}$	H_{WQ} (ft.) =	1.25
Step 3) Average water quality outflow rate, Q_{WQ} (cfs) $Q_{WQ} = (WQv * 43{,}560)/(40 * 3600)$	Q_{WQ} (cfs) =	0.050
Step 4) Set value of orifice discharge coefficient, C_O $C_O = 0.66$ when thickness of riser/weir plate is = or < orifice diameter $C_O = 0.80$ when thickness of riser/weir plate is > orifice diameter	C_O =	0.66
Step 5) Water quality outlet orifice diameter (4.0-in, min.), D_O (in) $D_O = 12 * 2 * (Q_{WQ}/C_O * \pi * (2 * g * H)^{0.5}))^{0.5}$	D_O (in) =	1.25
Step 6) To size outlet orifice for EDDB with an irregular stage-volume relationship, use Single Outlet Worksheet		

IIc. Water Quality Outlet, Perforated Riser

Step 1) Depth at outlet above lowest perforation, Z_{WQ} (ft.)	Z_{WQ} (ft.) =	2.50
Step 2) Recommended maximum outlet area per row, A_O (in^2) $A_O = (WQv)/(0.013 * Z_{WQ}^2 + 0.22 * Z_{WQ} - 0.10)$	A_O (in^2) =	0.31
Step 3) Circular perforation diameter per row assuming a single column, D_1 (in)	D_1 (in) =	0.63
Step 4) Number of Columns, n_c	n_c =	1.00
Step 5) Design circular perforation diameter (should be between 1 and 2 inches), D_{perf} (in)	D_{perf} (in) =	1.00
Step 6) Horizontal perforation column spacing when $n_c > 1$, center to center, S_c If D_{perf} >/= 1.0 in, S_c =4	S_c (in)=	N/A
Step 7) Number of rows (4" vertical spacing between perforations, center to center), n_r	n_r =	7.00

IIb. Water Quality Outlet, V-notch Weir

Step 1) Depth of water quality volume above permanent pool, Z_{WQ} (ft.)	Z_{WQ} (ft.) =	2.50
Step 2) Average head of Water Quality volume over invert of V-notch, H_{WQ} (ft) $H_{WQ} = 0.5 * Z_{WQ}$	H_{WQ} (ft.) =	1.25
Step 3) Average water quality outflow rate, Q_{WQ} (cfs) $Q_{WQ} = (WQv * 43{,}560)/(40 * 3600)$	Q_{WQ} (cfs) =	0.05
Step 4) V-notch weir coefficient, C_V	C_V =	2.50
Step 5) V-notch weir angle, θ (deg) $\theta = 2 * \arctan(Q_{WQ} / C_V * H_{WQ}^{5/2}))$ V-notch angle should be at least 20 degeres. Set to 20 degrees if calculated angle is smaller.	θ (deg) =	1.13
Step 6) Top width of V-notch weir $W_V = 2 * Z_{WQ} * TAN(\theta/2)$	W_V =	0.05

Step 7) To calculate v-notch angle for EDDB with and irregular stage-volume relationship, use the V-notch Weir Worksheet

III. Flood Control

Refer to APWA Specifications Section 5608

IV. Trash Racks

Step 1) Total outlet area, A_{ot} (in^2)	A_{ot} (in^2) =	0.06
Step 2) Required trash rack open area, A_t (in^2) $A_t = A_{ot} * 77 * e^{(-0.124 * D)}$ for single orifice outlet $A_t = (A_{ot}/2) * 77 * e^{(-0.124 * D)}$ for orifice plate outlet $At = 4 * A_{ot}$ for v-notch weir outlet	A_t (in^2) =	0.25

V. Basin Shape

V - IX not c

Step 1) Length to width ratio should be 3:1 (L:W) wherever practical	L:W =	3.00
Step 2) Low flow channel side lining	Concrete:	
	Soil/ riprap:	x
	No low flow channel:	
Step 3) Top stage floor drainage slope (toward low flow channel), S_{ts} (%)	S_{ts} (%) =	1.00
Top stage depth, D_{ts} (ft)	D_{ts} (ft) =	1.25
Step 4) Bottom stage volume, V_{bs} (ac-ft)	V_{bs} (% of WQv) =	34.14
	V_{bs} (ac-ft) =	0.057

VI. Forebay (Optional)

Step 1) Volume should be greater than 10% of WQv	Min. Vol_{FB} (ac-ft) =	0.01
Step 2) Forebay depth, Z_{FB} (ft)	$Z_{(FB)}$ (ft) =	2.00
Step 3) Forebay surface area, A_{FB} (ac)	A_{FB} (ac) =	0.01
Step 4) Paved/hard bottom and sides?		0.00

VII. Basin side slopes

Basin side slopes shall be at least 4:1 (H:V)	Side Slope (H:V) =	3:01 (TRM used)

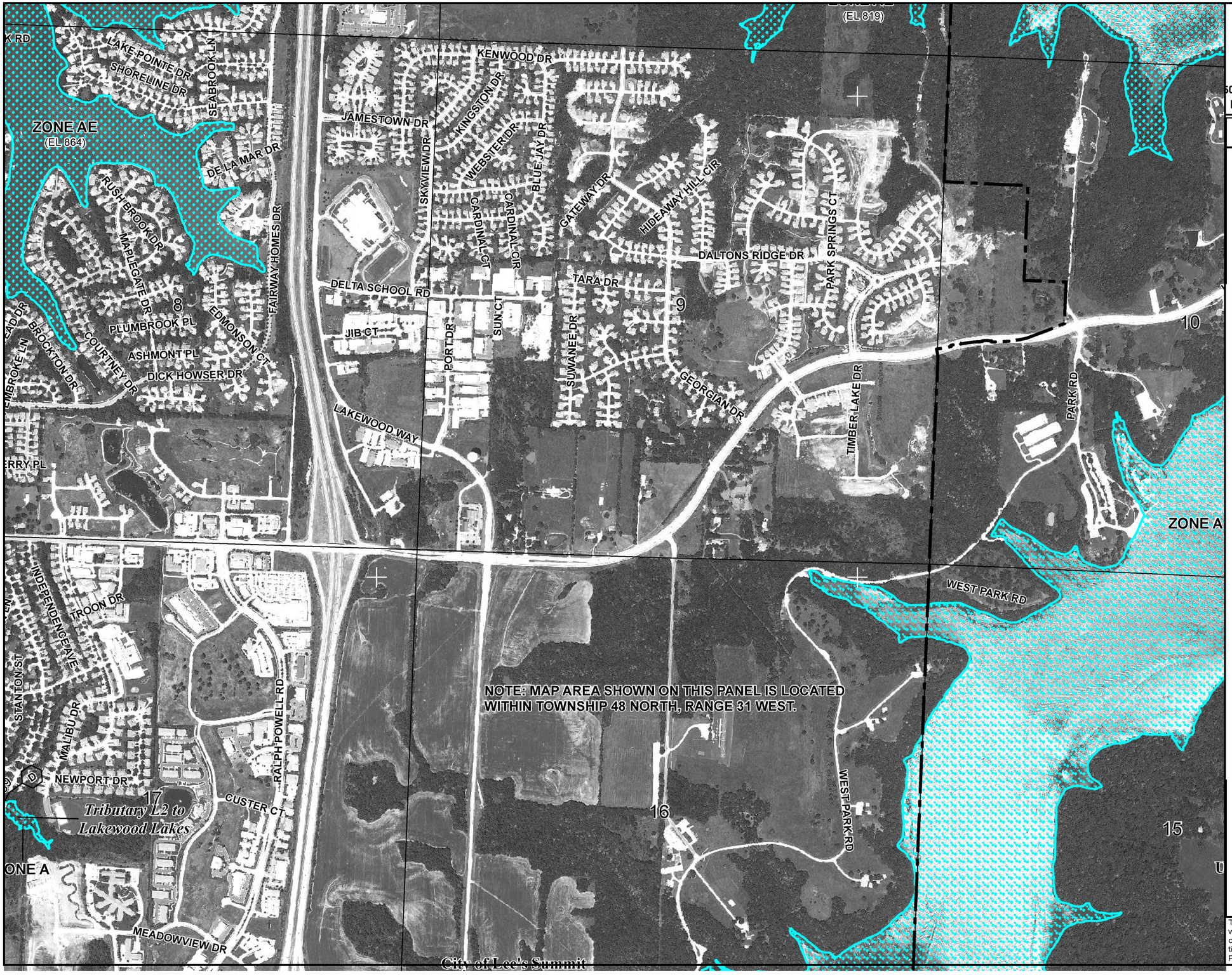
VIII. Dam Embankment side slopes

Dam embankment side slopes shouls be at least 3:1 (H:V)	Dam Embankment (H:V) =	3:01

IX. Vegetation

Check method of vegetation planted in the EDDB or descibe "other"

X Native Grass
___ Irrigated Turf Grass
___ Other: _____



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 48 NORTH, RANGE 31 WEST.

MAP SCALE 1" = 1000'

500 0 1000 2000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0430G

FIRM

FLOOD INSURANCE RATE MAP

JACKSON COUNTY, MISSOURI AND INCORPORATED AREAS

PANEL 430 OF 625

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
JACKSON COUNTY	290492	0430	G
LEE'S SUMMIT, CITY OF	290174	0430	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
29095C0430G

MAP REVISED
JANUARY 20, 2017

Federal Emergency Management Agency

U.S. Fish and Wildlife Service
National Wetlands Inventory

18-222-Lakewood Business Park

January 4, 2019

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

APPENDIX B

-NRCS Soil Resource Report

-HydroCAD Model Output 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 Jackson County, Missouri

January 4, 2019

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 (https://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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10143—Snead-Urban land complex, 9 to 30 percent slopes.....14
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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 Scale: 1:1,070 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

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:
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: Jackson County, Missouri
Survey Area Data: Version 19, Sep 13, 2018

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

Date(s) aerial images were photographed: Jun 11, 2017—Sep 22, 2017

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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10024	Greenton-Urban land complex, 5 to 9 percent slopes	3.0	82.4%
10143	Snead-Urban land complex, 9 to 30 percent slopes	0.6	17.6%
Totals for Area of Interest		**3.7**	**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.

Jackson County, Missouri

10024—Greenton-Urban land complex, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2qky4
Elevation: 800 to 1,100 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 177 to 220 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Greenton and similar soils: 60 percent
Urban land: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Greenton

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex, concave
Parent material: Loess over residuum weathered from limestone and shale

Typical profile

A - 0 to 16 inches: silty clay loam
Bt1 - 16 to 26 inches: silty clay loam
2Bt2 - 26 to 80 inches: silty clay

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: About 16 inches to abrupt textural change
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
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 12 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: Loess Upland Prairie (R109XY002MO)
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Across-slope shape: Convex, concave

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

10143—Snead-Urban land complex, 9 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2ql0r
Elevation: 700 to 900 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 177 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Snead and similar soils: 65 percent
Urban land: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Snead

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from calcareous shale

Typical profile

A - 0 to 12 inches: flaggy silty clay loam
Bw - 12 to 40 inches: silty clay
Cr - 40 to 80 inches: bedrock

Properties and qualities

Slope: 9 to 30 percent
Depth to restrictive feature: 39 to 50 inches to paralithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 24 to 36 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: Interbedded Sedimentary Backslope Savanna (R109XY012MO)
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Hills
Landform position (two-dimensional): Backslope

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

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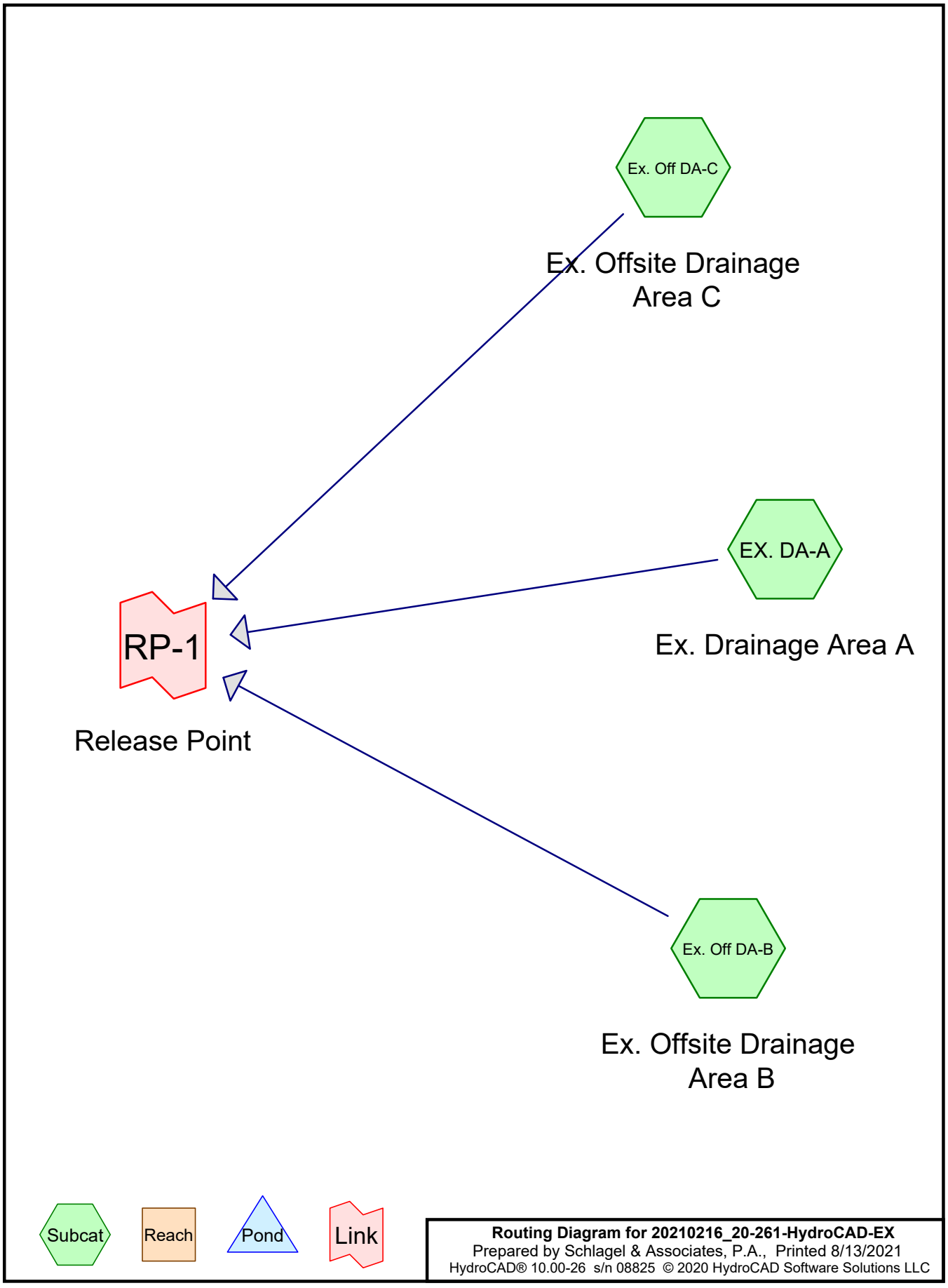


Routing Diagram for 20210216_20-261-HydroCAD-EX
Prepared by Schlagel & Associates, P.A., Printed 8/13/2021

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

Subcatchment EX. DA-A: Ex. Drainage Area Runoff Area=2.930 ac 5.12% Impervious Runoff Depth>1.79"
Flow Length=674' Slope=0.0600 '/' Tc=9.8 min UI Adjusted CN=84 Runoff=8.64 cfs 0.437 af

Subcatchment Ex. Off DA-B: Ex. Offsite Runoff Area=0.640 ac 0.00% Impervious Runoff Depth>2.20"
Flow Length=396' Slope=0.0750 '/' Tc=6.6 min CN=89 Runoff=2.50 cfs 0.117 af

Subcatchment Ex. Off DA-C: Ex. Offsite Runoff Area=0.120 ac 0.00% Impervious Runoff Depth>2.20"
Flow Length=369' Slope=0.0450 '/' Tc=8.0 min CN=89 Runoff=0.45 cfs 0.022 af

Link RP-1: Release Point Inflow=11.43 cfs 0.576 af
Primary=11.43 cfs 0.576 af

Total Runoff Area = 3.690 ac Runoff Volume = 0.576 af Average Runoff Depth = 1.87"
95.93% Pervious = 3.540 ac 4.07% Impervious = 0.150 ac

Summary for Subcatchment EX. DA-A: Ex. Drainage Area A

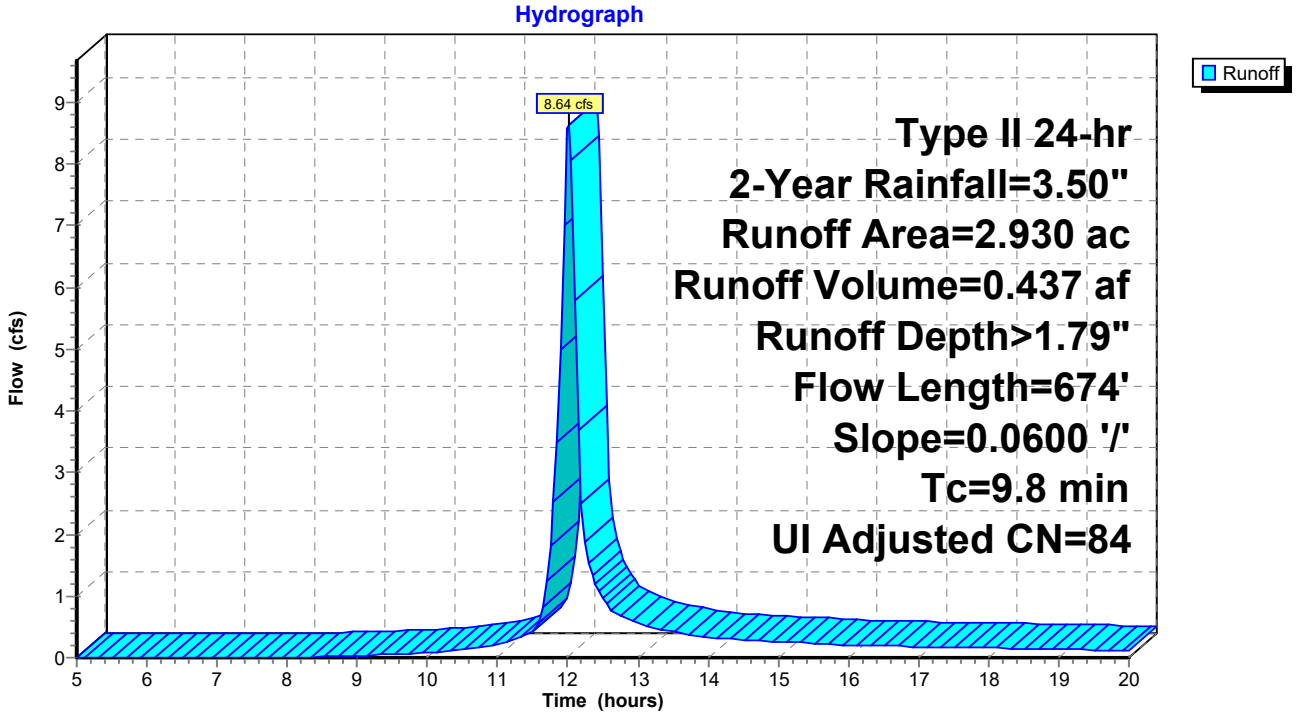
Runoff = 8.64 cfs @ 12.01 hrs, Volume= 0.437 af, Depth> 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Adj	Description
2.780	84		50-75% Grass cover, Fair, HSG D
0.150	98		Unconnected pavement, HSG D
2.930	85	84	Weighted Average, UI Adjusted
2.780			94.88% Pervious Area
0.150			5.12% Impervious Area
0.150			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	100	0.0600	0.28		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.71"
3.9	574	0.0600	2.45		**Shallow Concentrated Flow, Shallow** Nearly Bare & Untilled Kv= 10.0 fps
9.8	674	Total			

Subcatchment EX. DA-A: Ex. Drainage Area A



Summary for Subcatchment Ex. Off DA-B: Ex. Offsite Drainage Area B

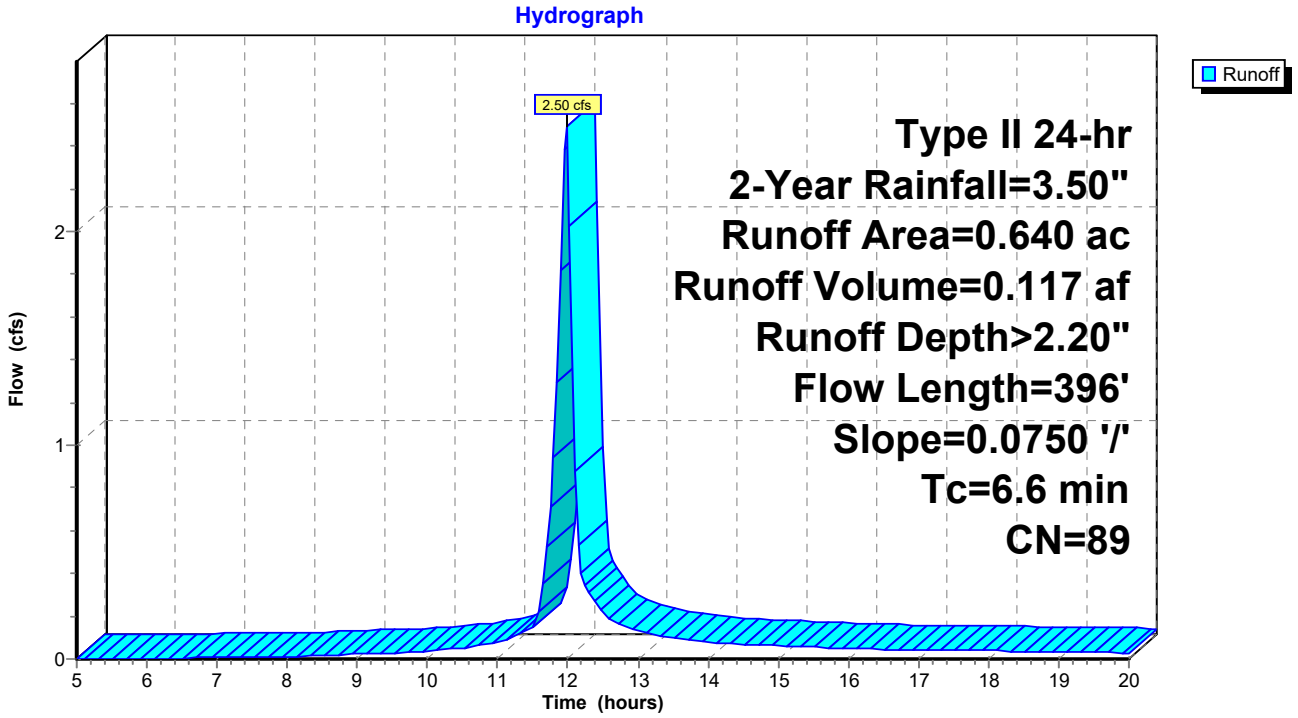
Runoff = 2.50 cfs @ 11.98 hrs, Volume= 0.117 af, Depth> 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
0.640	89	<50% Grass cover, Poor, HSG D
0.640		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.0750	0.31		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.71"
1.2	296	0.0750	4.11		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
6.6	396	Total			

Subcatchment Ex. Off DA-B: Ex. Offsite Drainage Area B



Summary for Subcatchment Ex. Off DA-C: Ex. Offsite Drainage Area C

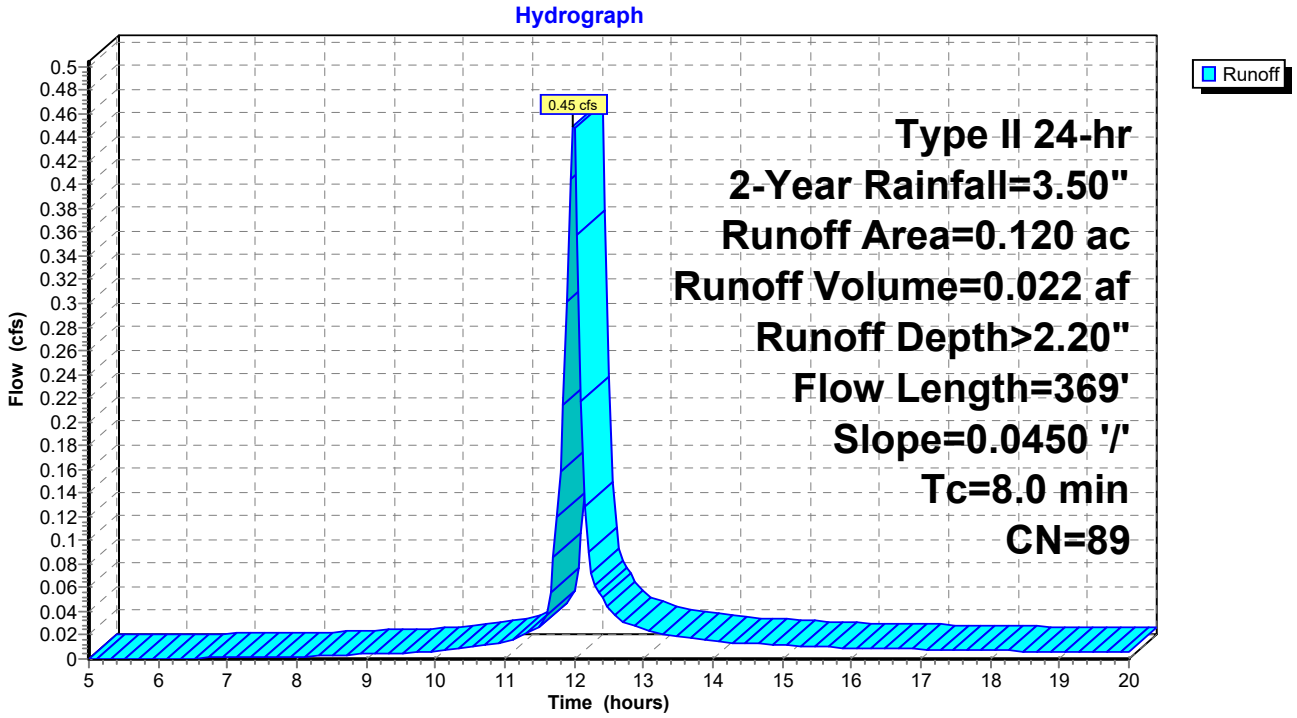
Runoff = 0.45 cfs @ 11.99 hrs, Volume= 0.022 af, Depth> 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
0.120	89	<50% Grass cover, Poor, HSG D
0.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	100	0.0450	0.25		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.71"
1.4	269	0.0450	3.18		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.0	369	Total			

Subcatchment Ex. Off DA-C: Ex. Offsite Drainage Area C

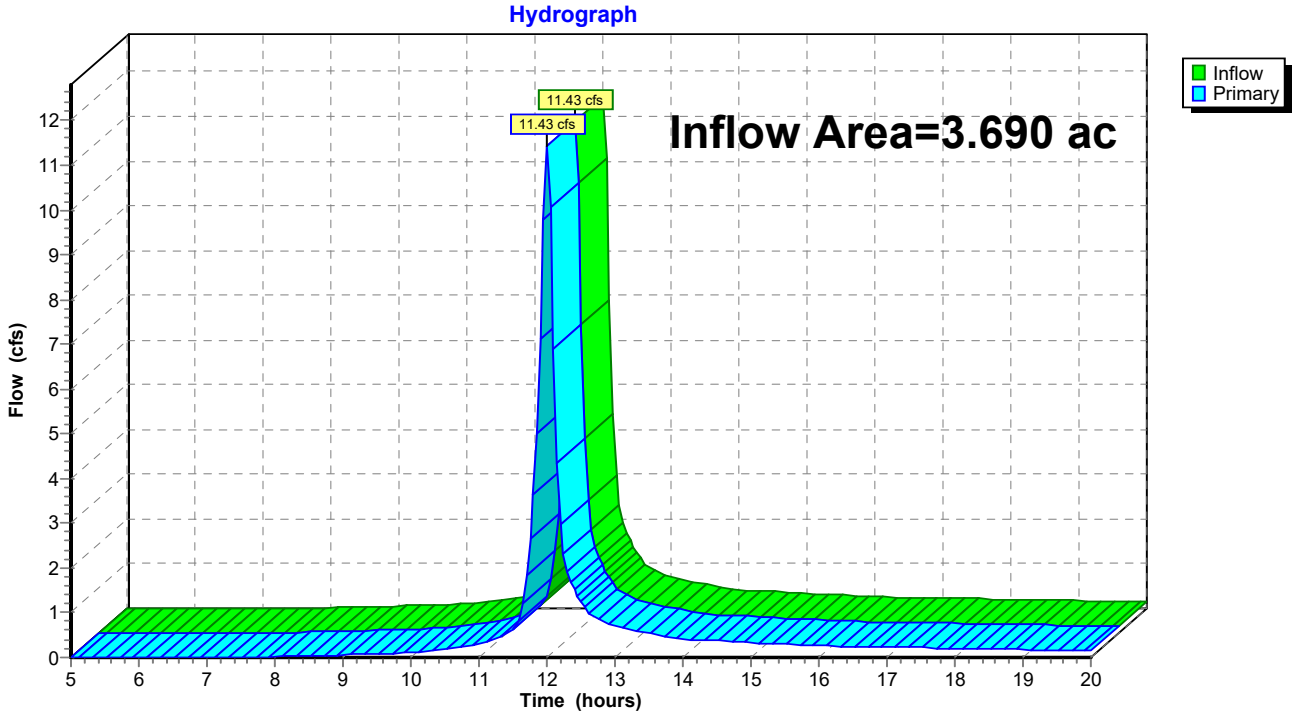


Summary for Link RP-1: Release Point

Inflow Area = 3.690 ac, 4.07% Impervious, Inflow Depth > 1.87" for 2-Year event
Inflow = 11.43 cfs @ 12.00 hrs, Volume= 0.576 af
Primary = 11.43 cfs @ 12.00 hrs, Volume= 0.576 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link RP-1: Release Point



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

Subcatchment EX. DA-A: Ex. Drainage Area Runoff Area=2.930 ac 5.12% Impervious Runoff Depth>3.30"
Flow Length=674' Slope=0.0600 '/' Tc=9.8 min UI Adjusted CN=84 Runoff=15.53 cfs 0.807 af

Subcatchment Ex. Off DA-B: Ex. Offsite Runoff Area=0.640 ac 0.00% Impervious Runoff Depth>3.81"
Flow Length=396' Slope=0.0750 '/' Tc=6.6 min CN=89 Runoff=4.12 cfs 0.203 af

Subcatchment Ex. Off DA-C: Ex. Offsite Runoff Area=0.120 ac 0.00% Impervious Runoff Depth>3.80"
Flow Length=369' Slope=0.0450 '/' Tc=8.0 min CN=89 Runoff=0.75 cfs 0.038 af

Link RP-1: Release Point Inflow=20.21 cfs 1.048 af
Primary=20.21 cfs 1.048 af

Total Runoff Area = 3.690 ac Runoff Volume = 1.048 af Average Runoff Depth = 3.41"
95.93% Pervious = 3.540 ac 4.07% Impervious = 0.150 ac

Summary for Subcatchment EX. DA-A: Ex. Drainage Area A

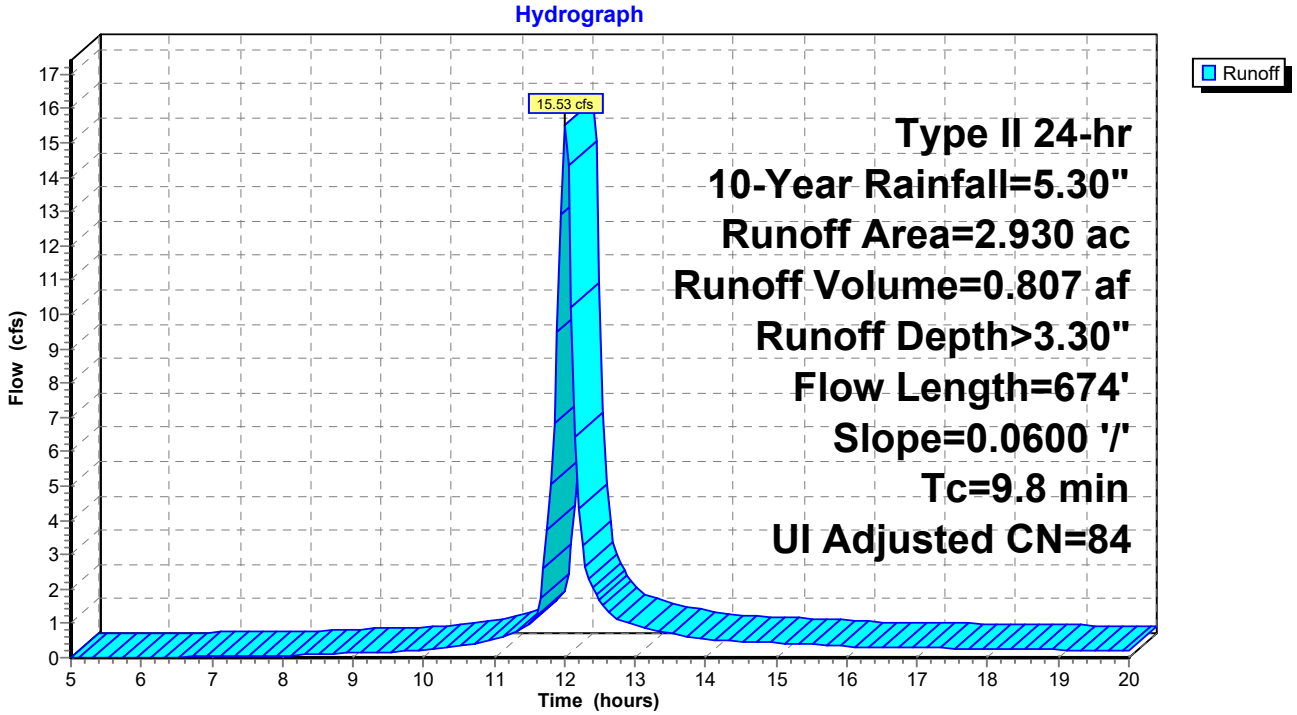
Runoff = 15.53 cfs @ 12.01 hrs, Volume= 0.807 af, Depth> 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Adj	Description
2.780	84		50-75% Grass cover, Fair, HSG D
0.150	98		Unconnected pavement, HSG D
2.930	85	84	Weighted Average, UI Adjusted
2.780			94.88% Pervious Area
0.150			5.12% Impervious Area
0.150			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	100	0.0600	0.28		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.71"
3.9	574	0.0600	2.45		**Shallow Concentrated Flow, Shallow** Nearly Bare & Untilled Kv= 10.0 fps
9.8	674	Total			

Subcatchment EX. DA-A: Ex. Drainage Area A



Summary for Subcatchment Ex. Off DA-B: Ex. Offsite Drainage Area B

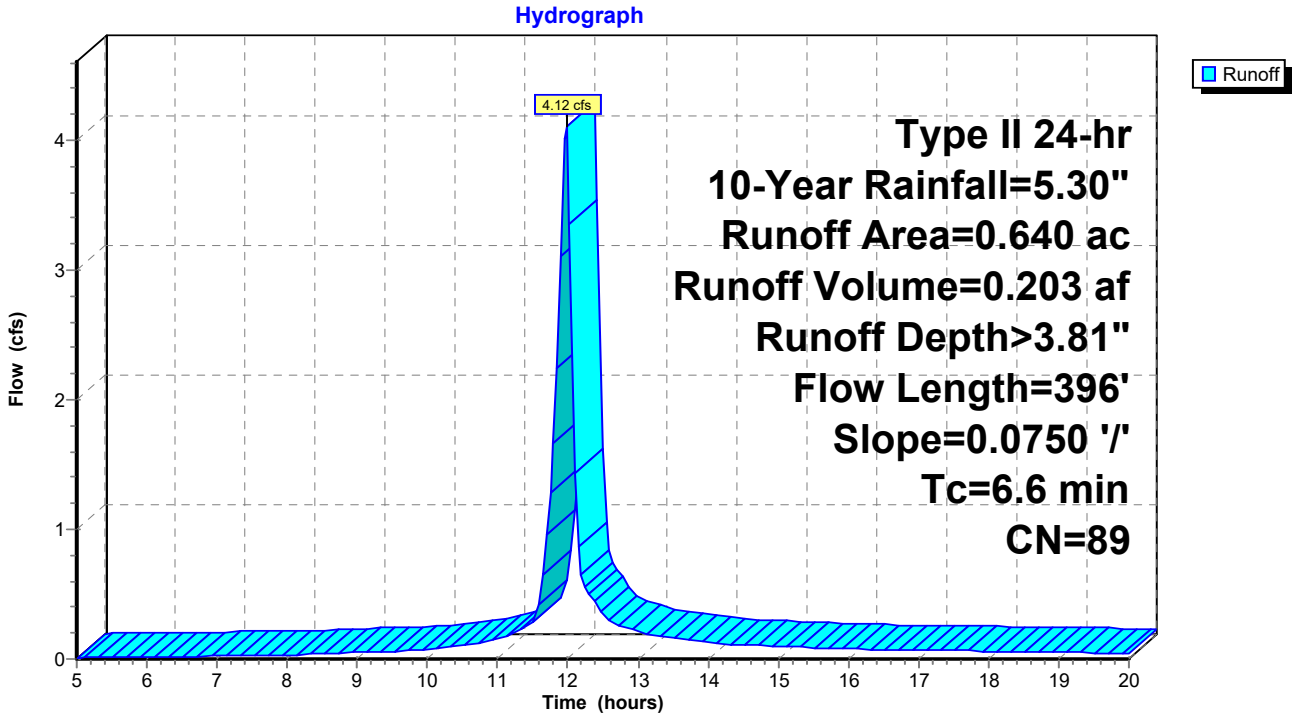
Runoff = 4.12 cfs @ 11.97 hrs, Volume= 0.203 af, Depth> 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
0.640	89	<50% Grass cover, Poor, HSG D
0.640		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.0750	0.31		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.71"
1.2	296	0.0750	4.11		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
6.6	396	Total			

Subcatchment Ex. Off DA-B: Ex. Offsite Drainage Area B



Summary for Subcatchment Ex. Off DA-C: Ex. Offsite Drainage Area C

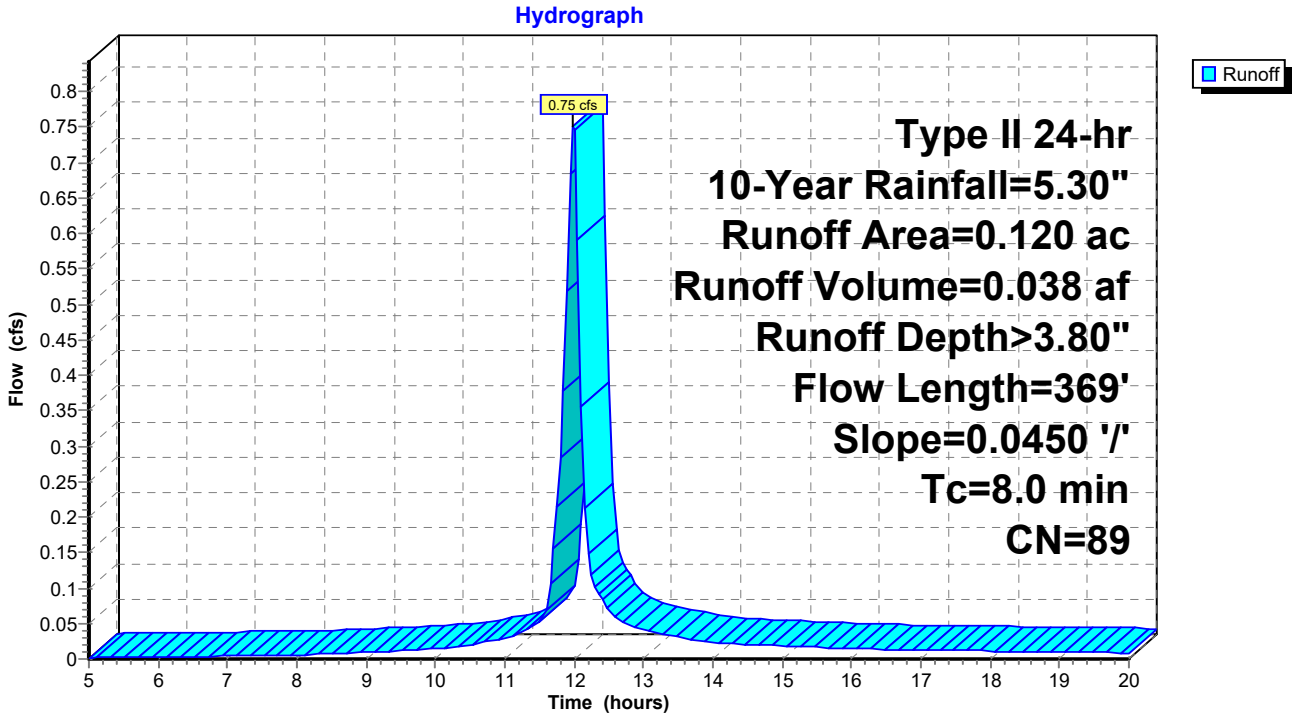
Runoff = 0.75 cfs @ 11.99 hrs, Volume= 0.038 af, Depth> 3.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
0.120	89	<50% Grass cover, Poor, HSG D
0.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	100	0.0450	0.25		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.71"
1.4	269	0.0450	3.18		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.0	369	Total			

Subcatchment Ex. Off DA-C: Ex. Offsite Drainage Area C

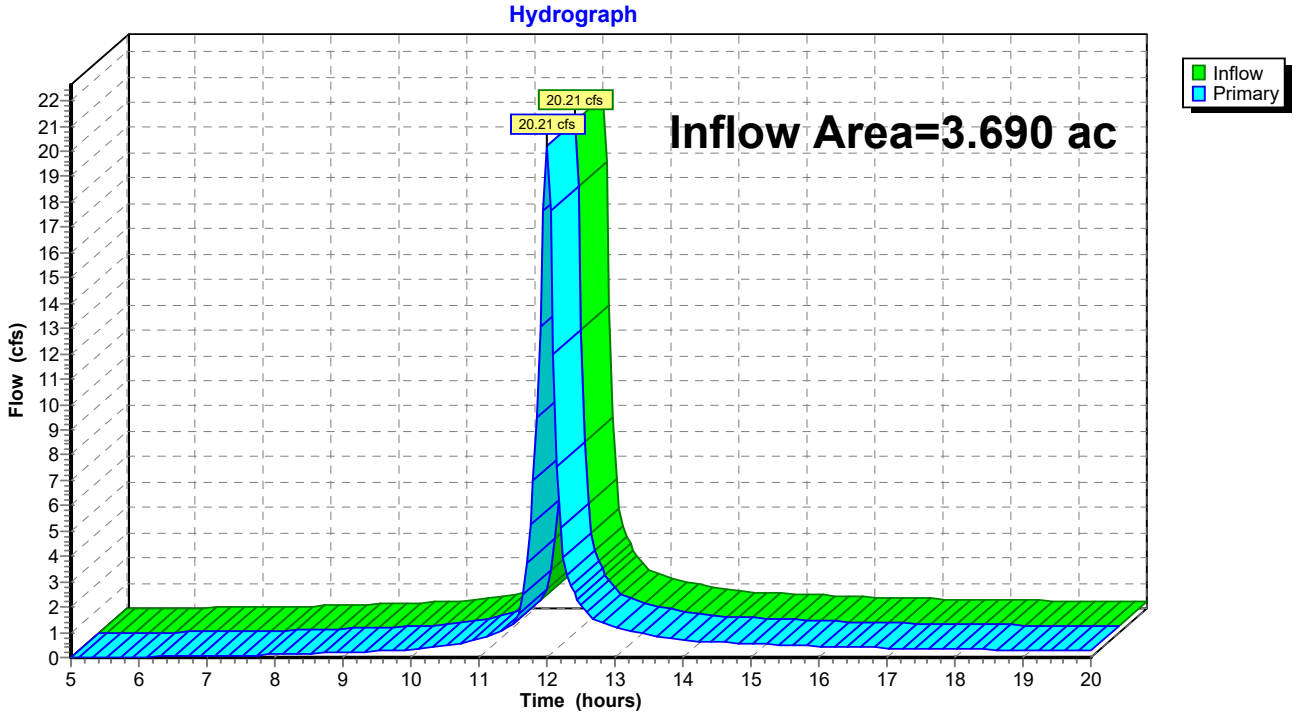


Summary for Link RP-1: Release Point

Inflow Area = 3.690 ac, 4.07% Impervious, Inflow Depth > 3.41" for 10-Year event
Inflow = 20.21 cfs @ 12.00 hrs, Volume= 1.048 af
Primary = 20.21 cfs @ 12.00 hrs, Volume= 1.048 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link RP-1: Release Point



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

Subcatchment EX. DA-A: Ex. Drainage Area Runoff Area=2.930 ac 5.12% Impervious Runoff Depth>5.44"
Flow Length=674' Slope=0.0600 '/' Tc=9.8 min UI Adjusted CN=84 Runoff=24.83 cfs 1.328 af

Subcatchment Ex. Off DA-B: Ex. Offsite Runoff Area=0.640 ac 0.00% Impervious Runoff Depth>5.99"
Flow Length=396' Slope=0.0750 '/' Tc=6.6 min CN=89 Runoff=6.30 cfs 0.319 af

Subcatchment Ex. Off DA-C: Ex. Offsite Runoff Area=0.120 ac 0.00% Impervious Runoff Depth>5.99"
Flow Length=369' Slope=0.0450 '/' Tc=8.0 min CN=89 Runoff=1.15 cfs 0.060 af

Link RP-1: Release Point Inflow=31.99 cfs 1.707 af
Primary=31.99 cfs 1.707 af

Total Runoff Area = 3.690 ac Runoff Volume = 1.707 af Average Runoff Depth = 5.55"
95.93% Pervious = 3.540 ac 4.07% Impervious = 0.150 ac

Summary for Subcatchment EX. DA-A: Ex. Drainage Area A

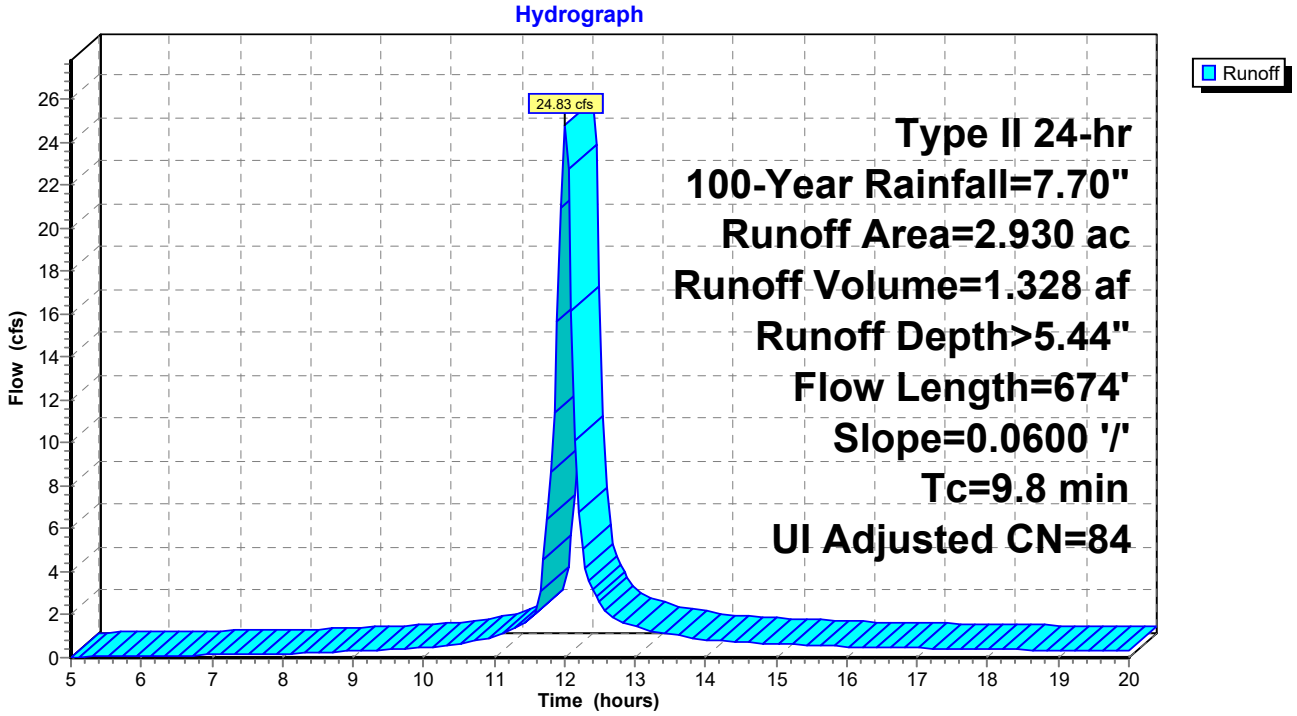
Runoff = 24.83 cfs @ 12.01 hrs, Volume= 1.328 af, Depth> 5.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Adj	Description
2.780	84		50-75% Grass cover, Fair, HSG D
0.150	98		Unconnected pavement, HSG D
2.930	85	84	Weighted Average, UI Adjusted
2.780			94.88% Pervious Area
0.150			5.12% Impervious Area
0.150			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	100	0.0600	0.28		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.71"
3.9	574	0.0600	2.45		**Shallow Concentrated Flow, Shallow** Nearly Bare & Untilled Kv= 10.0 fps
9.8	674	Total			

Subcatchment EX. DA-A: Ex. Drainage Area A



Summary for Subcatchment Ex. Off DA-B: Ex. Offsite Drainage Area B

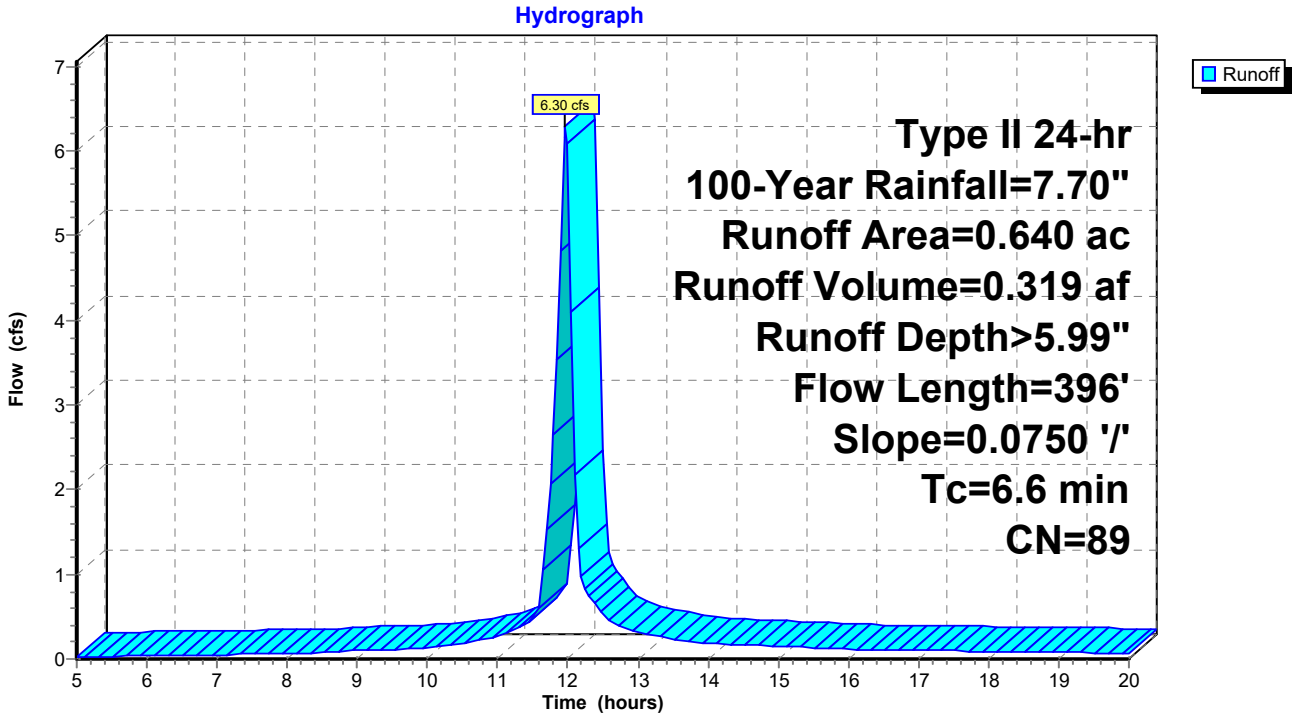
Runoff = 6.30 cfs @ 11.97 hrs, Volume= 0.319 af, Depth> 5.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
0.640	89	<50% Grass cover, Poor, HSG D
0.640		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.0750	0.31		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.71"
1.2	296	0.0750	4.11		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
6.6	396	Total			

Subcatchment Ex. Off DA-B: Ex. Offsite Drainage Area B



Summary for Subcatchment Ex. Off DA-C: Ex. Offsite Drainage Area C

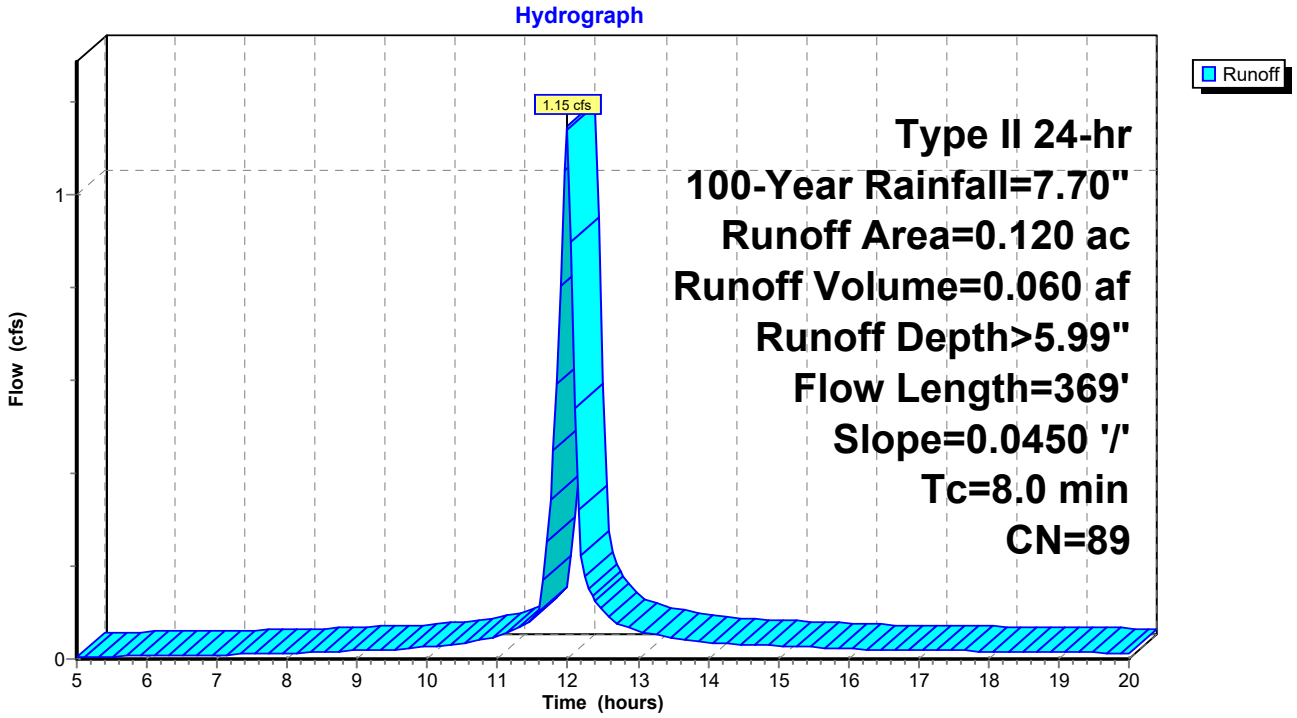
Runoff = 1.15 cfs @ 11.99 hrs, Volume= 0.060 af, Depth> 5.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
0.120	89	<50% Grass cover, Poor, HSG D
0.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	100	0.0450	0.25		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.71"
1.4	269	0.0450	3.18		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.0	369	Total			

Subcatchment Ex. Off DA-C: Ex. Offsite Drainage Area C

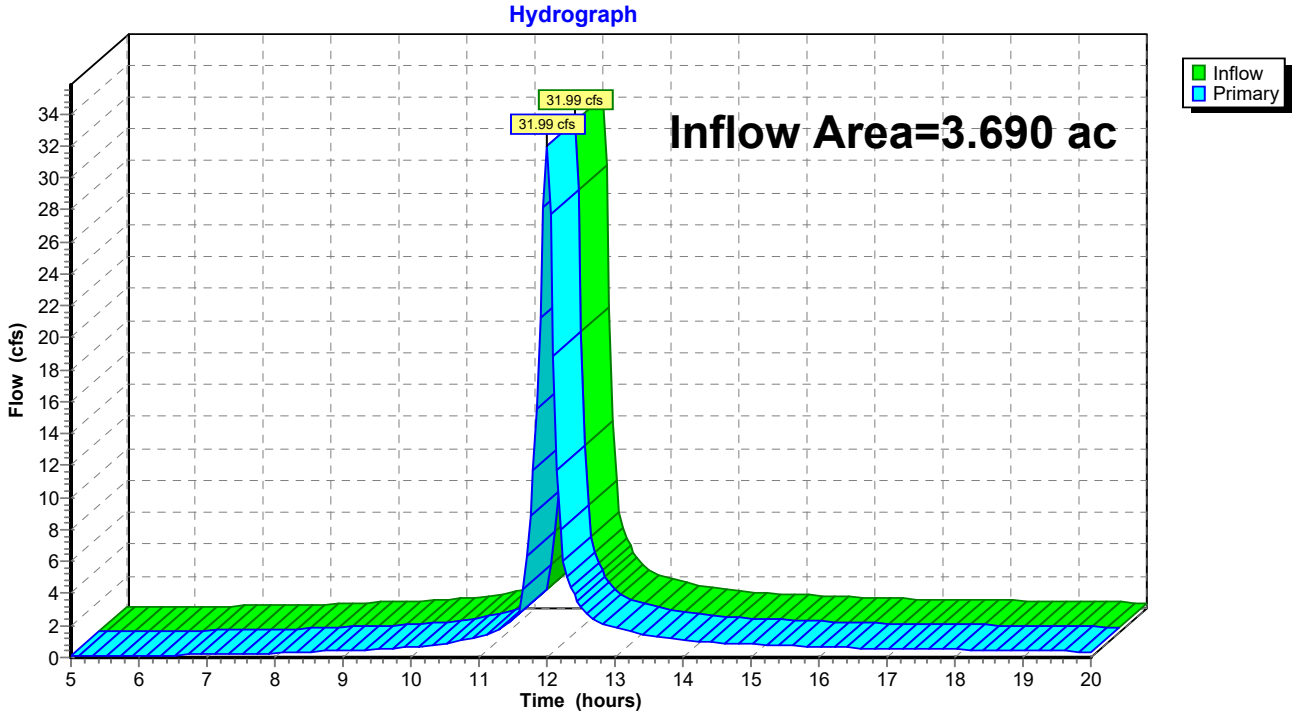


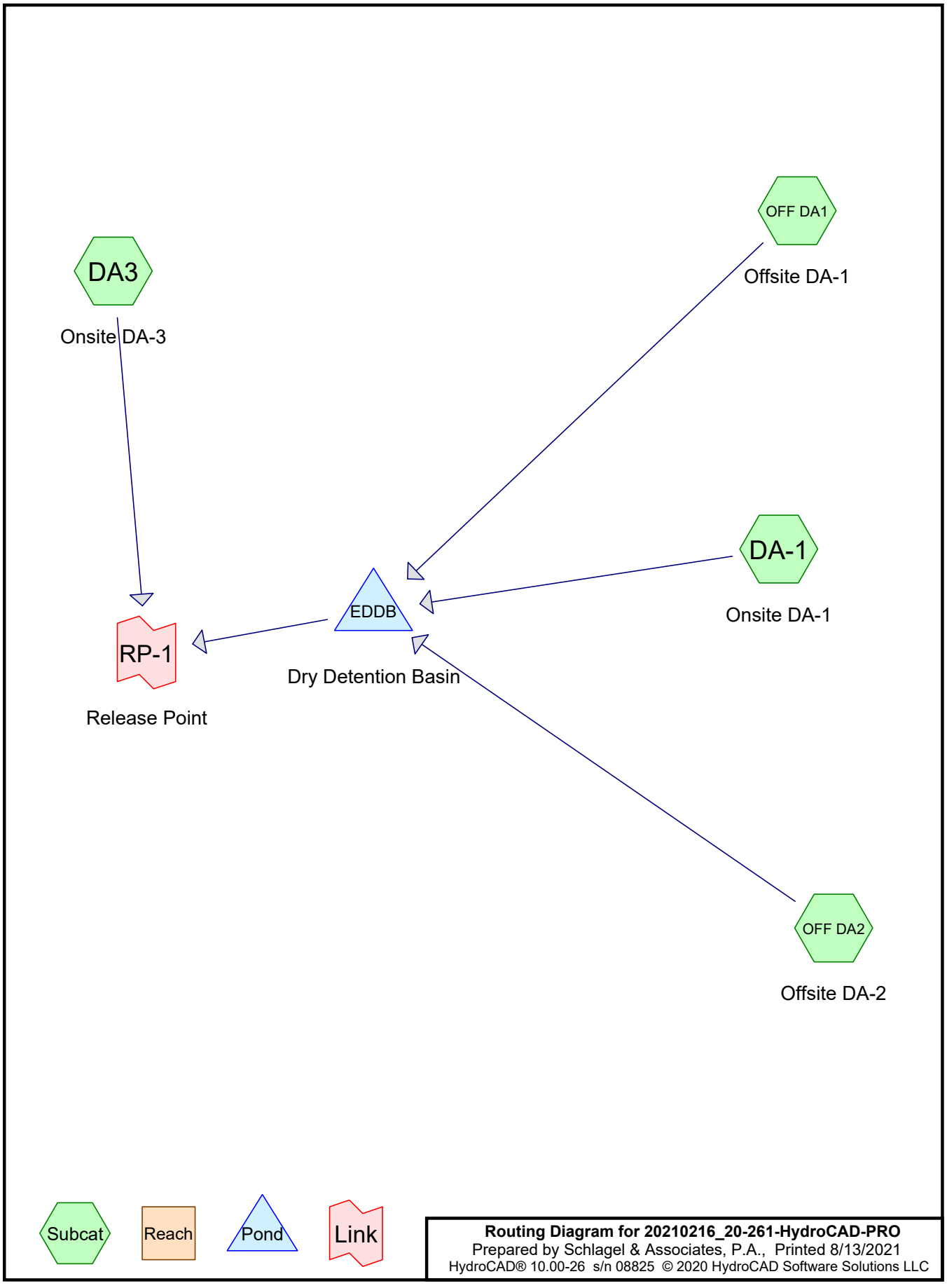
Summary for Link RP-1: Release Point

Inflow Area = 3.690 ac, 4.07% Impervious, Inflow Depth > 5.55" for 100-Year event
Inflow = 31.99 cfs @ 12.00 hrs, Volume= 1.707 af
Primary = 31.99 cfs @ 12.00 hrs, Volume= 1.707 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link RP-1: Release Point





Routing Diagram for 20210216_20-261-HydroCAD-PRO
Prepared by Schlagel & Associates, P.A., Printed 8/13/2021

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA-1: Onsite DA-1 Runoff Area=2.430 ac 70.37% Impervious Runoff Depth>2.72"
Flow Length=244' Slope=0.0150 '/' Tc=24.1 min CN=93 Runoff=6.41 cfs 0.551 af

Subcatchment DA3: Onsite DA-3 Runoff Area=0.500 ac 12.00% Impervious Runoff Depth>1.78"
Flow Length=292' Slope=0.0200 '/' Tc=14.8 min CN=82 Runoff=1.15 cfs 0.074 af

Subcatchment OFF DA1: Offsite DA-1 Runoff Area=0.120 ac 0.00% Impervious Runoff Depth>1.93"
Flow Length=369' Slope=0.0300 '/' Tc=13.0 min CN=84 Runoff=0.32 cfs 0.019 af

Subcatchment OFF DA2: Offsite DA-2 Runoff Area=0.640 ac 0.00% Impervious Runoff Depth>1.63"
Flow Length=396' Slope=0.0500 '/' Tc=10.7 min CN=80 Runoff=1.55 cfs 0.087 af

Pond EDDB: Dry Detention Basin Peak Elev=930.74' Storage=9,062 cf Inflow=7.47 cfs 0.658 af
Outflow=3.89 cfs 0.603 af

Link RP-1: Release Point Inflow=4.29 cfs 0.677 af
Primary=4.29 cfs 0.677 af

Total Runoff Area = 3.690 ac Runoff Volume = 0.732 af Average Runoff Depth = 2.38"
52.03% Pervious = 1.920 ac 47.97% Impervious = 1.770 ac

Summary for Subcatchment DA-1: Onsite DA-1

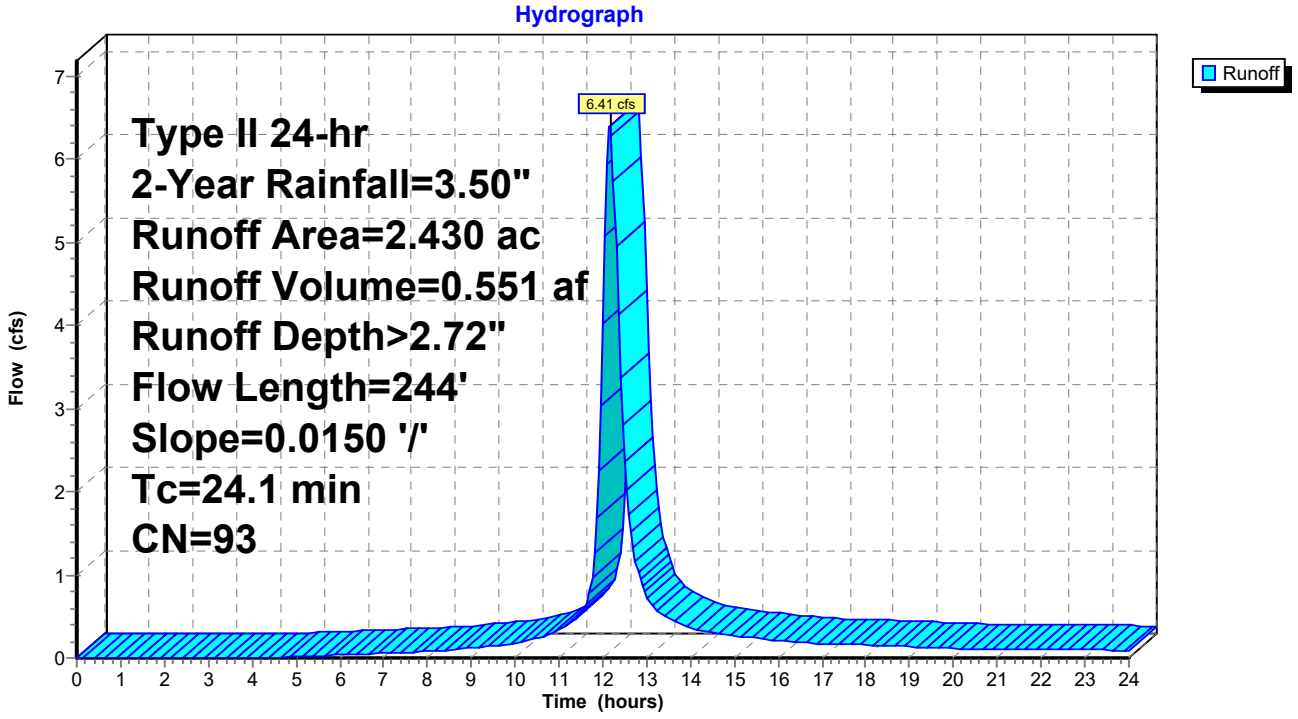
Runoff = 6.41 cfs @ 12.17 hrs, Volume= 0.551 af, Depth> 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
0.790	98	Unconnected roofs, HSG D
0.920	98	Paved parking, HSG D
0.720	80	>75% Grass cover, Good, HSG D
2.430	93	Weighted Average
0.720		29.63% Pervious Area
1.710		70.37% Impervious Area
0.790		46.20% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.8	100	0.0150	0.07		**Sheet Flow, Sheet** Grass: Bermuda n= 0.410 P2= 3.71"
1.3	144	0.0150	1.84		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
24.1	244	Total			

Subcatchment DA-1: Onsite DA-1



Summary for Subcatchment DA3: Onsite DA-3

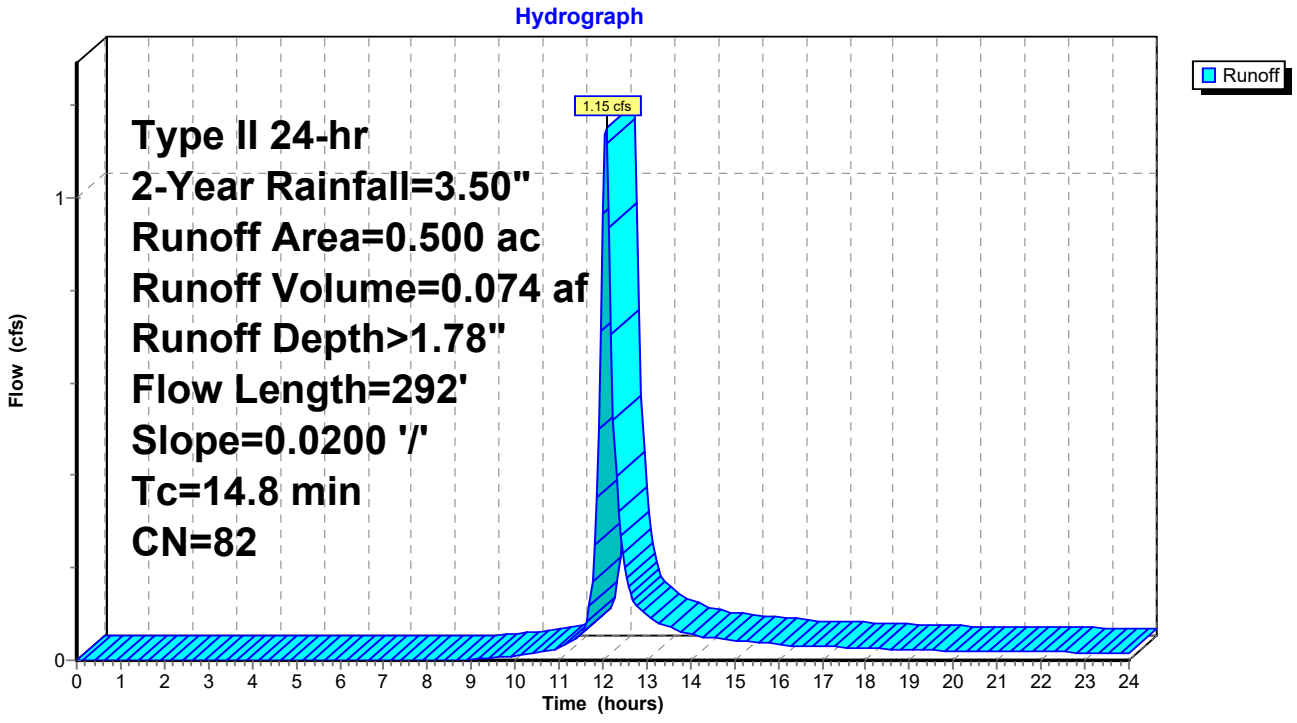
Runoff = 1.15 cfs @ 12.07 hrs, Volume= 0.074 af, Depth> 1.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
0.440	80	>75% Grass cover, Good, HSG D
0.060	98	Paved parking, HSG D
0.500	82	Weighted Average
0.440		88.00% Pervious Area
0.060		12.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	100	0.0200	0.13		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.71"
1.5	192	0.0200	2.12		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
14.8	292	Total			

Subcatchment DA3: Onsite DA-3



Summary for Subcatchment OFF DA1: Offsite DA-1

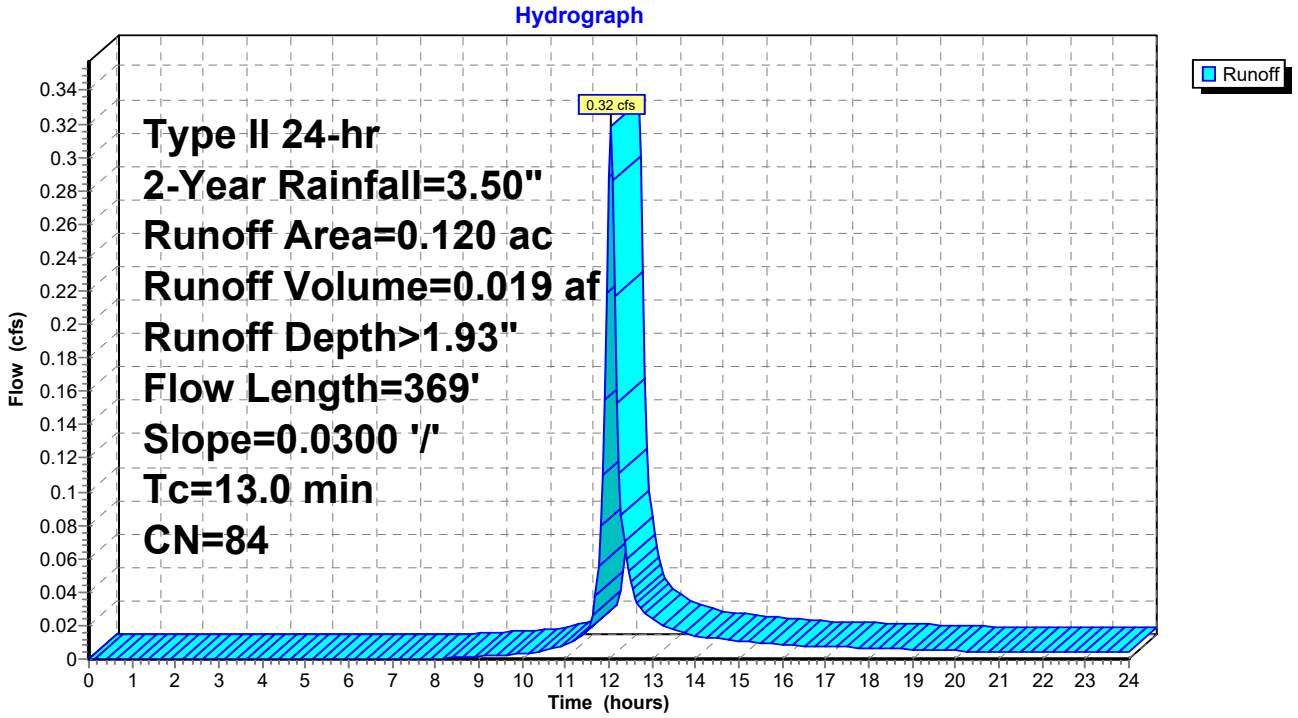
Runoff = 0.32 cfs @ 12.05 hrs, Volume= 0.019 af, Depth> 1.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
0.120	84	50-75% Grass cover, Fair, HSG D
0.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.3	100	0.0300	0.15		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.71"
1.7	269	0.0300	2.60		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
13.0	369	Total			

Subcatchment OFF DA1: Offsite DA-1



Summary for Subcatchment OFF DA2: Offsite DA-2

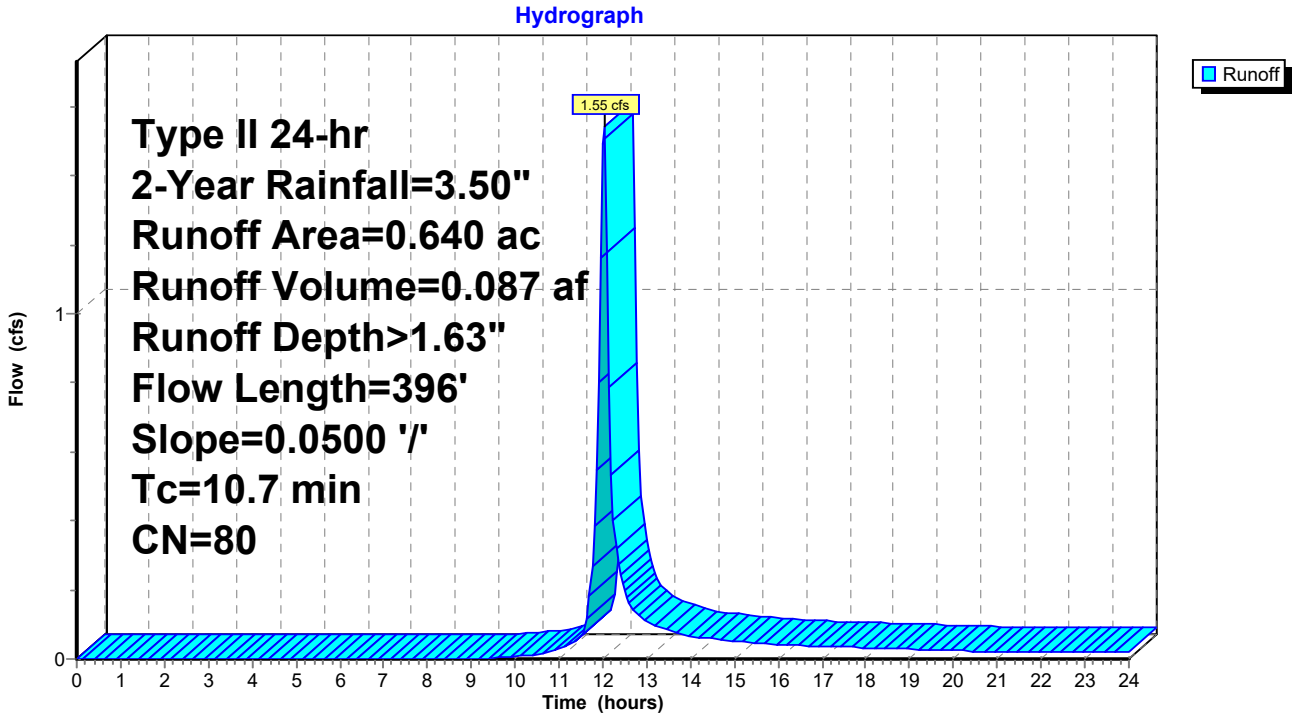
Runoff = 1.55 cfs @ 12.03 hrs, Volume= 0.087 af, Depth> 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
0.640	80	>75% Grass cover, Good, HSG D
0.640		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.0500	0.18		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.71"
1.5	296	0.0500	3.35		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
10.7	396	Total			

Subcatchment OFF DA2: Offsite DA-2



Summary for Pond EDDB: Dry Detention Basin

Inflow Area = 3.190 ac, 53.61% Impervious, Inflow Depth > 2.47" for 2-Year event
Inflow = 7.47 cfs @ 12.12 hrs, Volume= 0.658 af
Outflow = 3.89 cfs @ 12.39 hrs, Volume= 0.603 af, Atten= 48%, Lag= 15.9 min
Primary = 3.89 cfs @ 12.39 hrs, Volume= 0.603 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 930.74' @ 12.39 hrs Surf.Area= 2,969 sf Storage= 9,062 cf

Plug-Flow detention time= 96.1 min calculated for 0.601 af (91% of inflow)
Center-of-Mass det. time= 53.2 min (859.0 - 805.8)

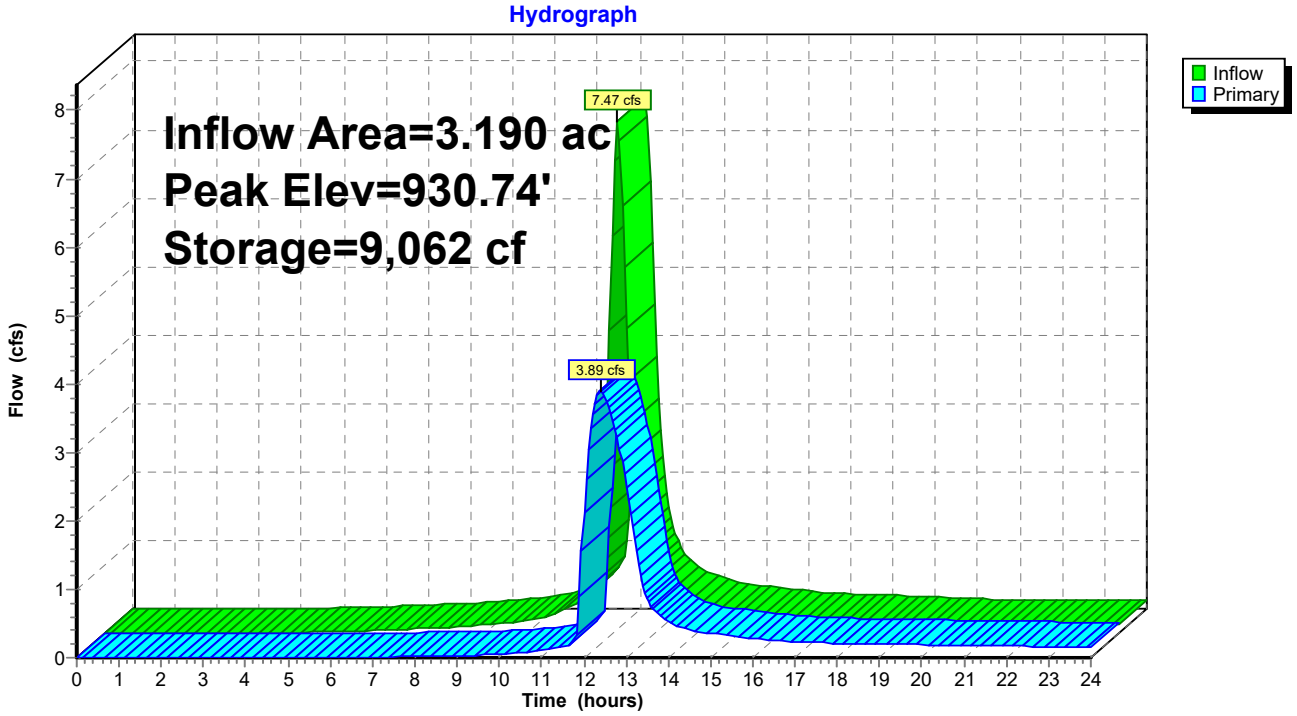
Volume	Invert	Avail.Storage	Storage Description
#1	926.00'	32,300 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
926.00	863	0	0
928.00	1,656	2,519	2,519
930.00	2,578	4,234	6,753
932.00	3,630	6,208	12,961
934.00	4,810	8,440	21,401
936.00	6,089	10,899	32,300

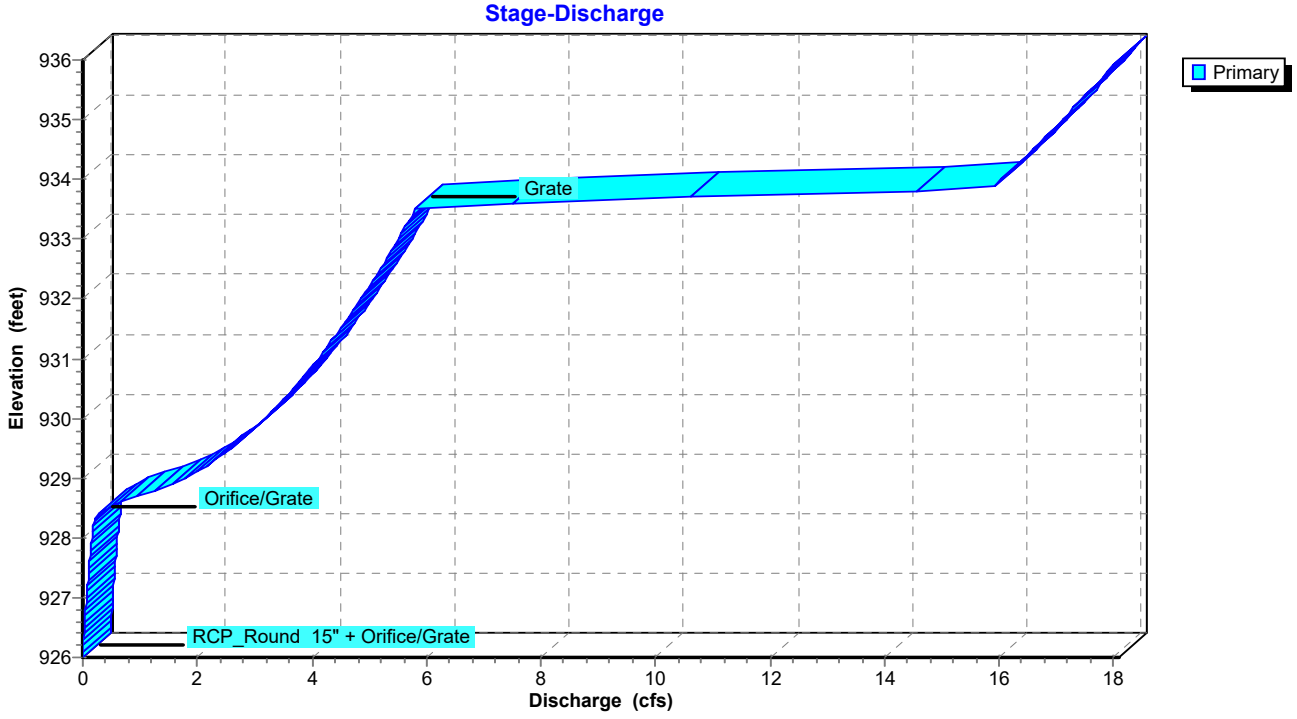
Device	Routing	Invert	Outlet Devices
#1	Primary	926.00'	**15.0" Round RCP_Round 15"** L= 71.5' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 926.00' / 922.77' S= 0.0452 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	926.00'	**1.0" Vert. Orifice/Grate** X 7 rows with 4.0" cc spacing C= 0.600
#3	Device 1	928.33'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	933.50'	**48.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.89 cfs @ 12.39 hrs HW=930.74' (Free Discharge)
└**1=RCP_Round 15"** (Passes 3.89 cfs of 11.99 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.35 cfs @ 9.22 fps)
  ├**3=Orifice/Grate** (Orifice Controls 3.54 cfs @ 7.07 fps)
  └**4=Grate** (Controls 0.00 cfs)

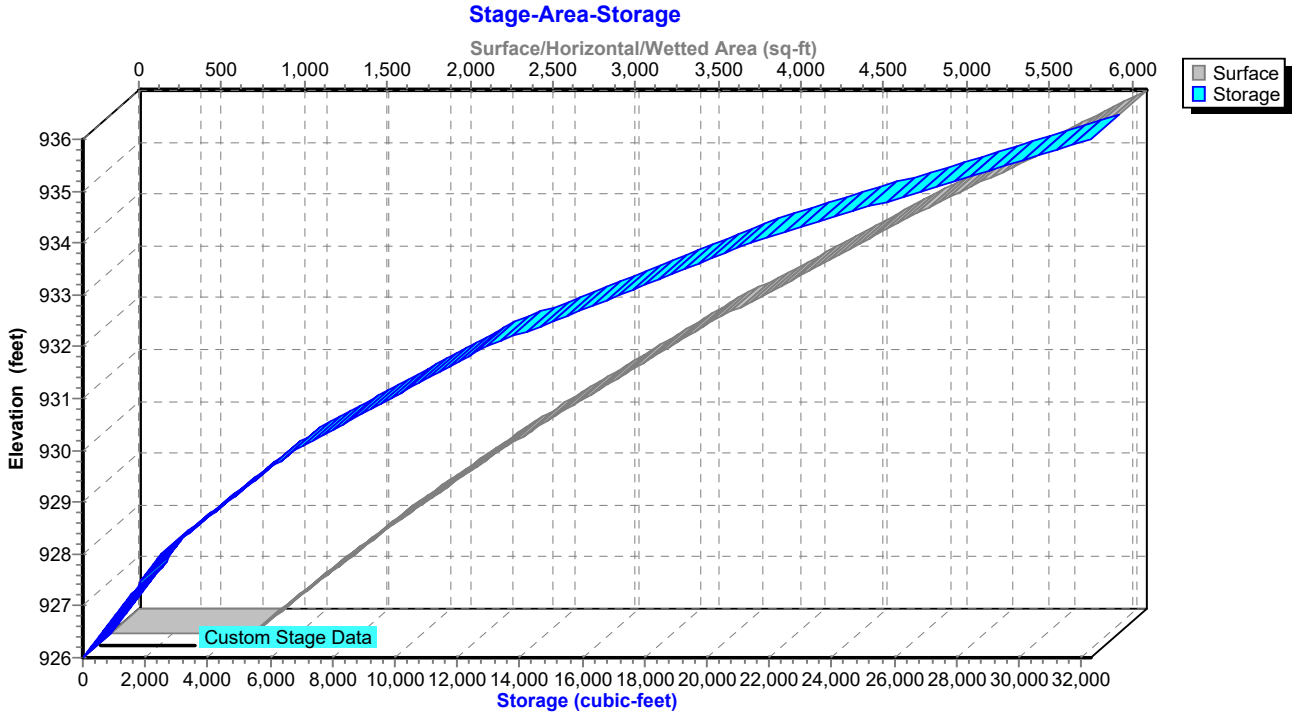
Pond EDDB: Dry Detention Basin



Pond EDDB: Dry Detention Basin



Pond EDDB: Dry Detention Basin

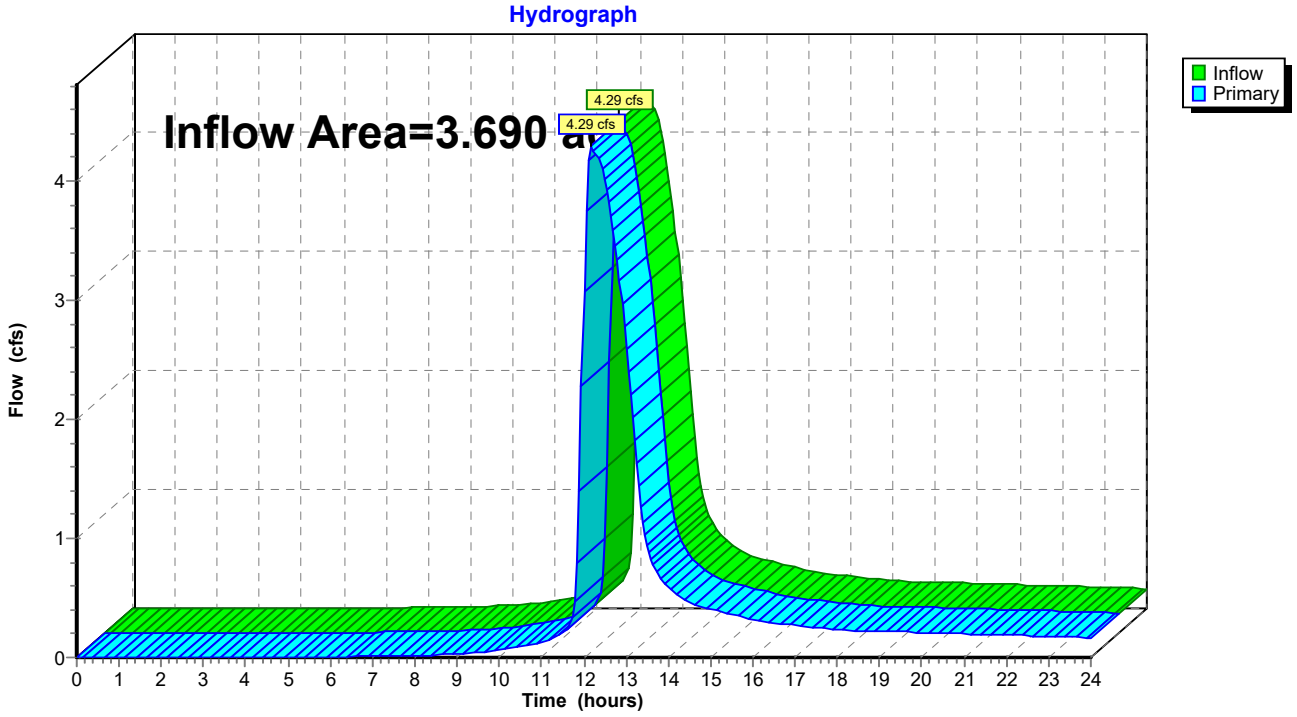


Summary for Link RP-1: Release Point

Inflow Area = 3.690 ac, 47.97% Impervious, Inflow Depth > 2.20" for 2-Year event
Inflow = 4.29 cfs @ 12.17 hrs, Volume= 0.677 af
Primary = 4.29 cfs @ 12.17 hrs, Volume= 0.677 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link RP-1: Release Point



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA-1: Onsite DA-1 Runoff Area=2.430 ac 70.37% Impervious Runoff Depth>4.47"
Flow Length=244' Slope=0.0150 '/' Tc=24.1 min CN=93 Runoff=10.28 cfs 0.906 af

Subcatchment DA3: Onsite DA-3 Runoff Area=0.500 ac 12.00% Impervious Runoff Depth>3.34"
Flow Length=292' Slope=0.0200 '/' Tc=14.8 min CN=82 Runoff=2.15 cfs 0.139 af

Subcatchment OFF DA1: Offsite DA-1 Runoff Area=0.120 ac 0.00% Impervious Runoff Depth>3.54"
Flow Length=369' Slope=0.0300 '/' Tc=13.0 min CN=84 Runoff=0.58 cfs 0.035 af

Subcatchment OFF DA2: Offsite DA-2 Runoff Area=0.640 ac 0.00% Impervious Runoff Depth>3.15"
Flow Length=396' Slope=0.0500 '/' Tc=10.7 min CN=80 Runoff=2.96 cfs 0.168 af

Pond EDDB: Dry Detention Basin Peak Elev=932.54' Storage=15,224 cf Inflow=12.34 cfs 1.109 af
Outflow=5.22 cfs 1.036 af

Link RP-1: Release Point Inflow=6.24 cfs 1.175 af
Primary=6.24 cfs 1.175 af

Total Runoff Area = 3.690 ac Runoff Volume = 1.248 af Average Runoff Depth = 4.06"
52.03% Pervious = 1.920 ac 47.97% Impervious = 1.770 ac

Summary for Subcatchment DA-1: Onsite DA-1

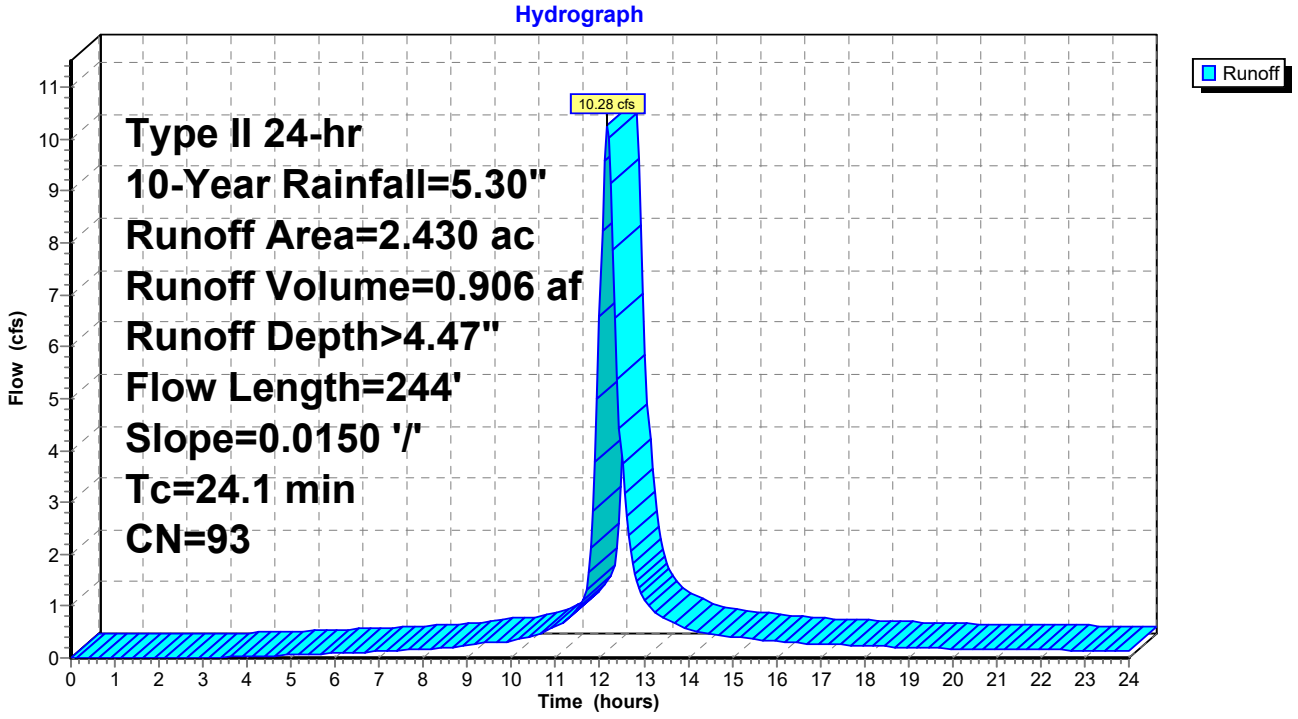
Runoff = 10.28 cfs @ 12.16 hrs, Volume= 0.906 af, Depth> 4.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
0.790	98	Unconnected roofs, HSG D
0.920	98	Paved parking, HSG D
0.720	80	>75% Grass cover, Good, HSG D
2.430	93	Weighted Average
0.720		29.63% Pervious Area
1.710		70.37% Impervious Area
0.790		46.20% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.8	100	0.0150	0.07		**Sheet Flow, Sheet** Grass: Bermuda n= 0.410 P2= 3.71"
1.3	144	0.0150	1.84		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
24.1	244	Total			

Subcatchment DA-1: Onsite DA-1



Summary for Subcatchment DA3: Onsite DA-3

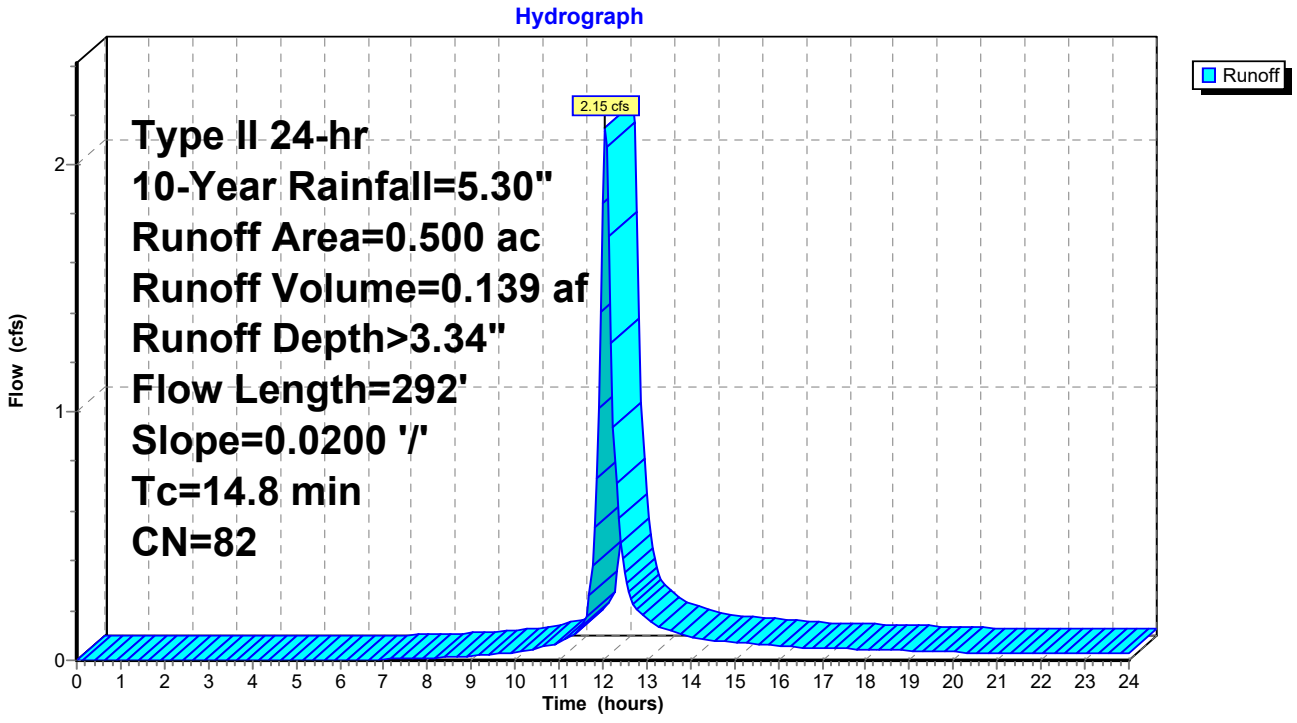
Runoff = 2.15 cfs @ 12.07 hrs, Volume= 0.139 af, Depth> 3.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
0.440	80	>75% Grass cover, Good, HSG D
0.060	98	Paved parking, HSG D
0.500	82	Weighted Average
0.440		88.00% Pervious Area
0.060		12.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	100	0.0200	0.13		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.71"
1.5	192	0.0200	2.12		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
14.8	292	Total			

Subcatchment DA3: Onsite DA-3



Summary for Subcatchment OFF DA1: Offsite DA-1

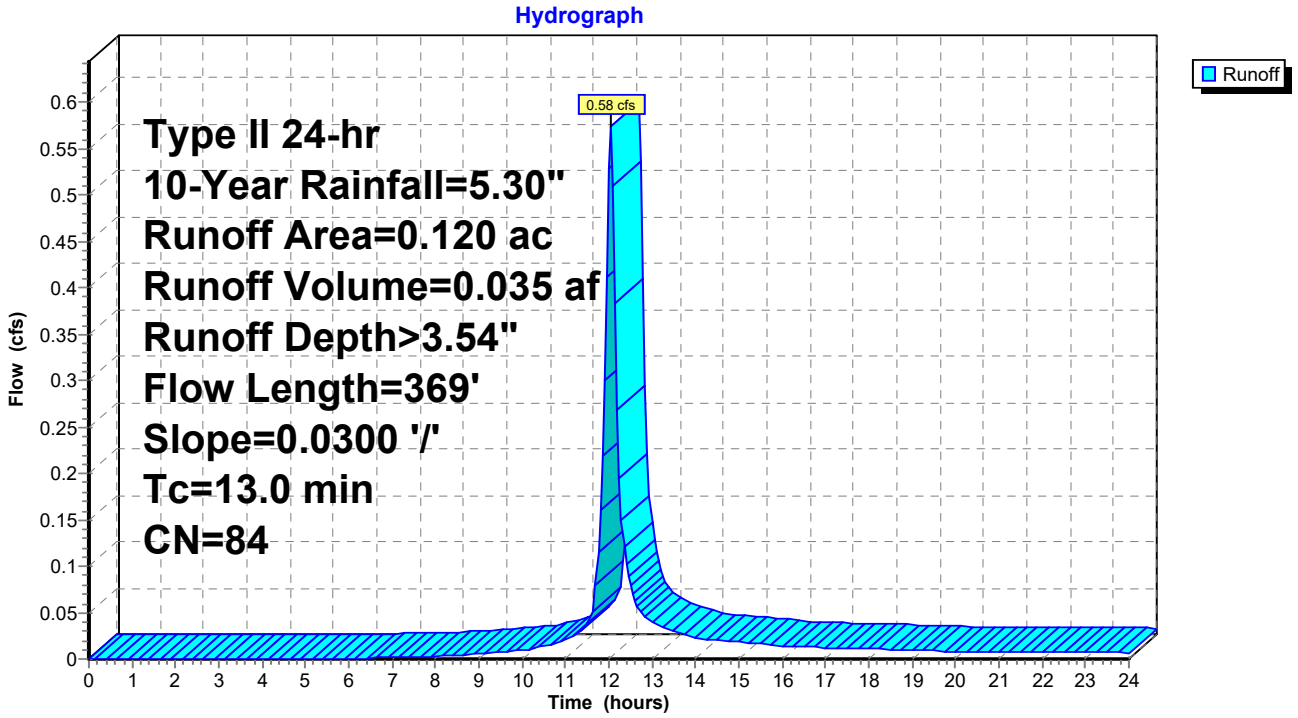
Runoff = 0.58 cfs @ 12.05 hrs, Volume= 0.035 af, Depth> 3.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
0.120	84	50-75% Grass cover, Fair, HSG D
0.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.3	100	0.0300	0.15		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.71"
1.7	269	0.0300	2.60		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
13.0	369	Total			

Subcatchment OFF DA1: Offsite DA-1



Summary for Subcatchment OFF DA2: Offsite DA-2

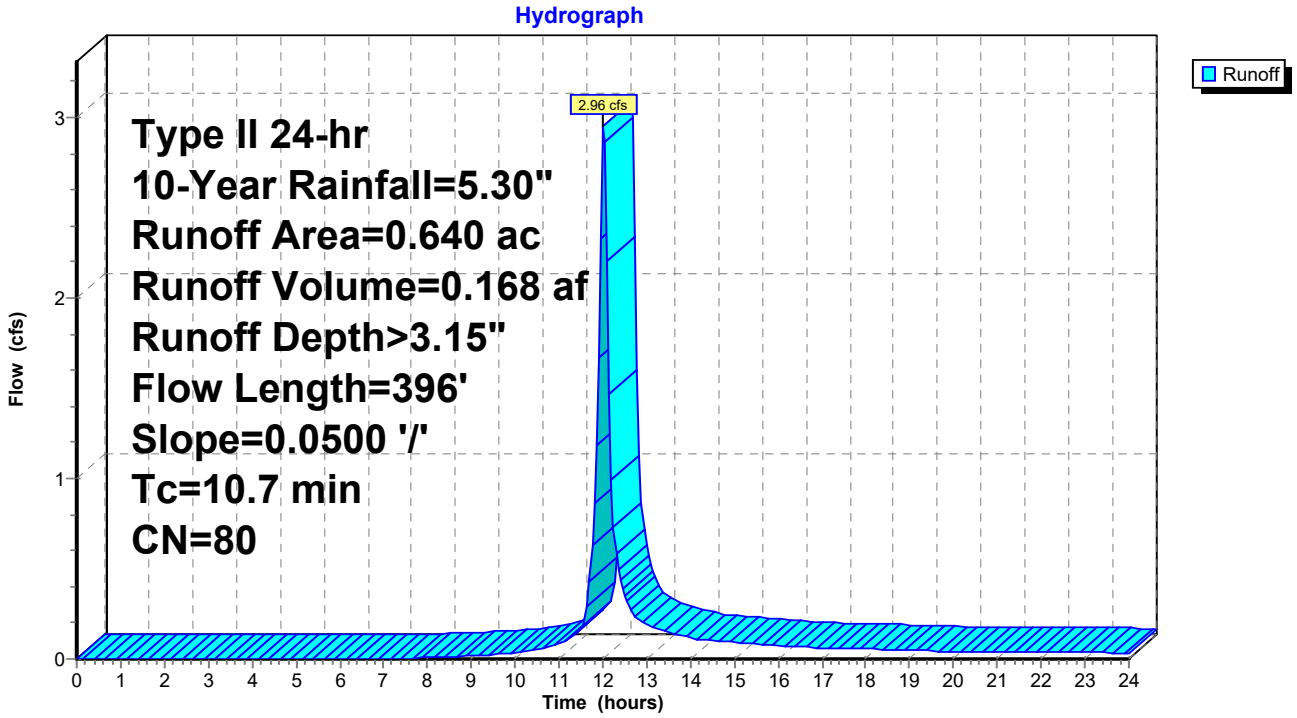
Runoff = 2.96 cfs @ 12.02 hrs, Volume= 0.168 af, Depth> 3.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
0.640	80	>75% Grass cover, Good, HSG D
0.640		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.0500	0.18		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.71"
1.5	296	0.0500	3.35		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
10.7	396	Total			

Subcatchment OFF DA2: Offsite DA-2



Summary for Pond EDDB: Dry Detention Basin

Inflow Area = 3.190 ac, 53.61% Impervious, Inflow Depth > 4.17" for 10-Year event
Inflow = 12.34 cfs @ 12.11 hrs, Volume= 1.109 af
Outflow = 5.22 cfs @ 12.44 hrs, Volume= 1.036 af, Atten= 58%, Lag= 19.4 min
Primary = 5.22 cfs @ 12.44 hrs, Volume= 1.036 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 932.54' @ 12.44 hrs Surf.Area= 3,946 sf Storage= 15,224 cf

Plug-Flow detention time= 78.5 min calculated for 1.036 af (93% of inflow)
Center-of-Mass det. time= 42.6 min (835.1 - 792.5)

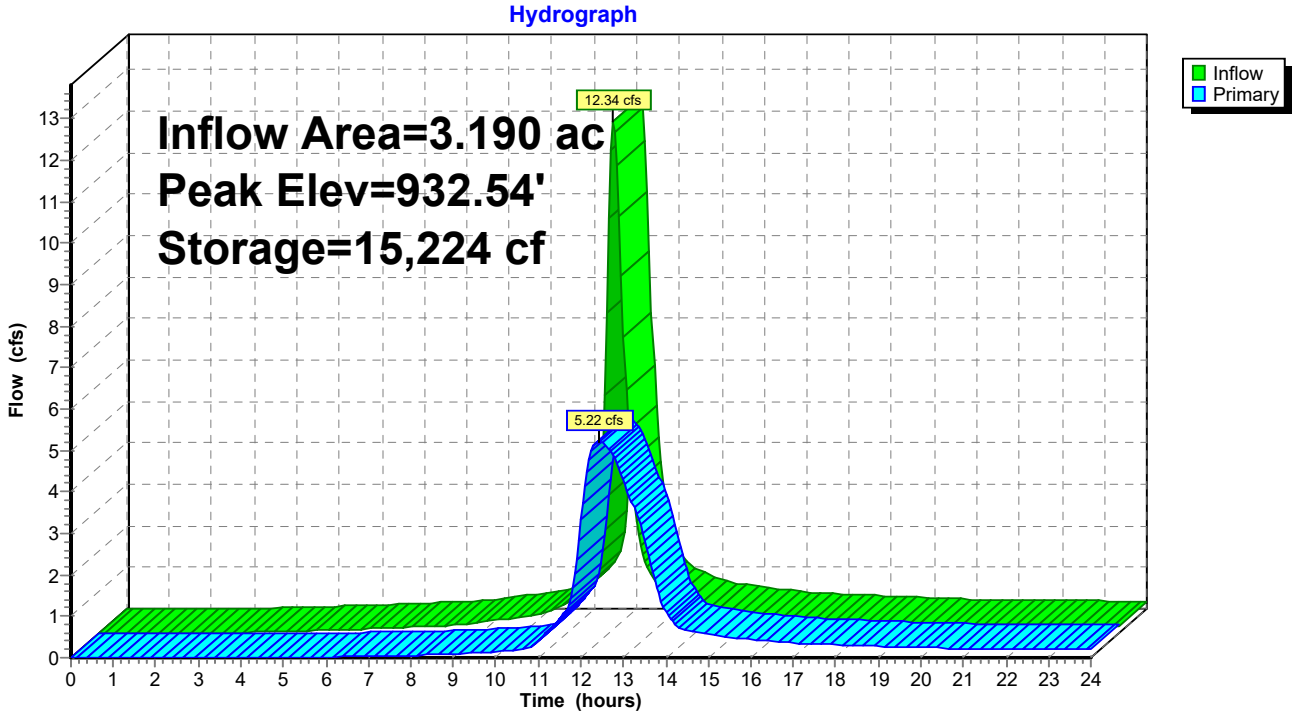
Volume	Invert	Avail.Storage	Storage Description
#1	926.00'	32,300 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
926.00	863	0	0
928.00	1,656	2,519	2,519
930.00	2,578	4,234	6,753
932.00	3,630	6,208	12,961
934.00	4,810	8,440	21,401
936.00	6,089	10,899	32,300

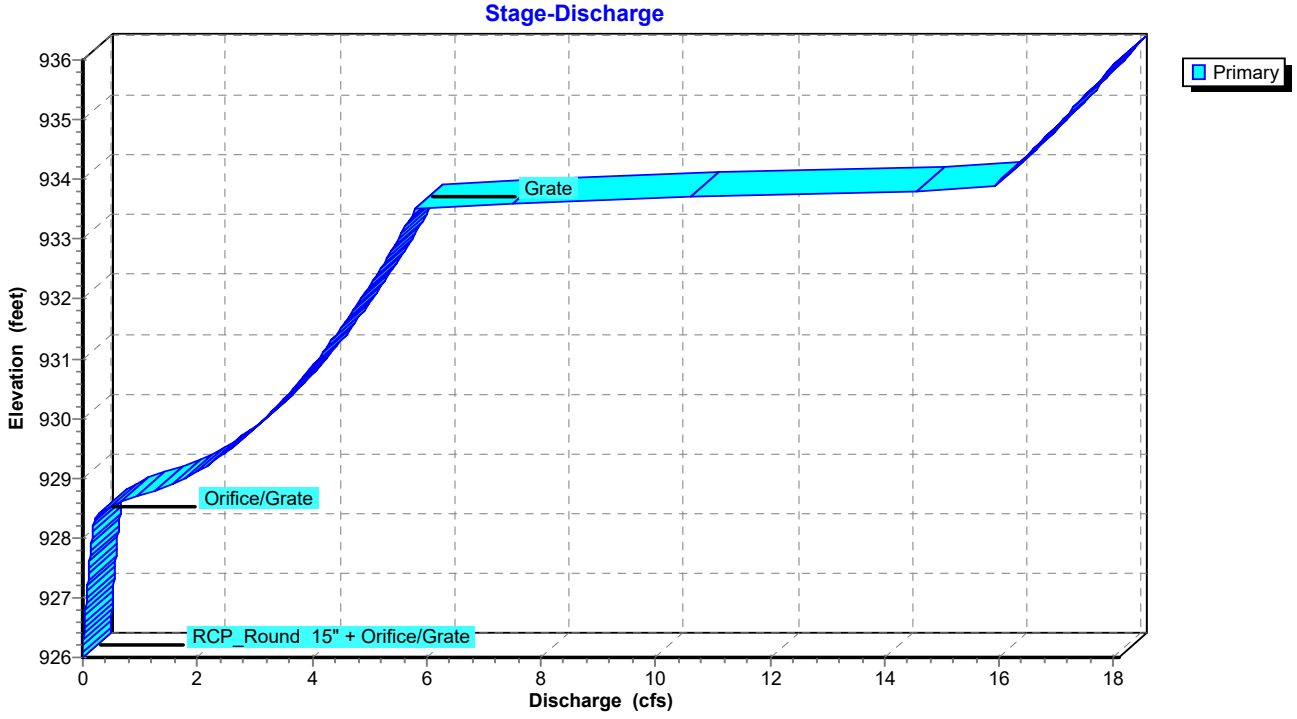
Device	Routing	Invert	Outlet Devices
#1	Primary	926.00'	**15.0" Round RCP_Round 15"** L= 71.5' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 926.00' / 922.77' S= 0.0452 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	926.00'	**1.0" Vert. Orifice/Grate** X 7 rows with 4.0" cc spacing C= 0.600
#3	Device 1	928.33'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	933.50'	**48.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=5.22 cfs @ 12.44 hrs HW=932.53' (Free Discharge)
└**1=RCP_Round 15"** (Passes 5.22 cfs of 14.36 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.43 cfs @ 11.26 fps)
  ├**3=Orifice/Grate** (Orifice Controls 4.79 cfs @ 9.57 fps)
  └**4=Grate** (Controls 0.00 cfs)

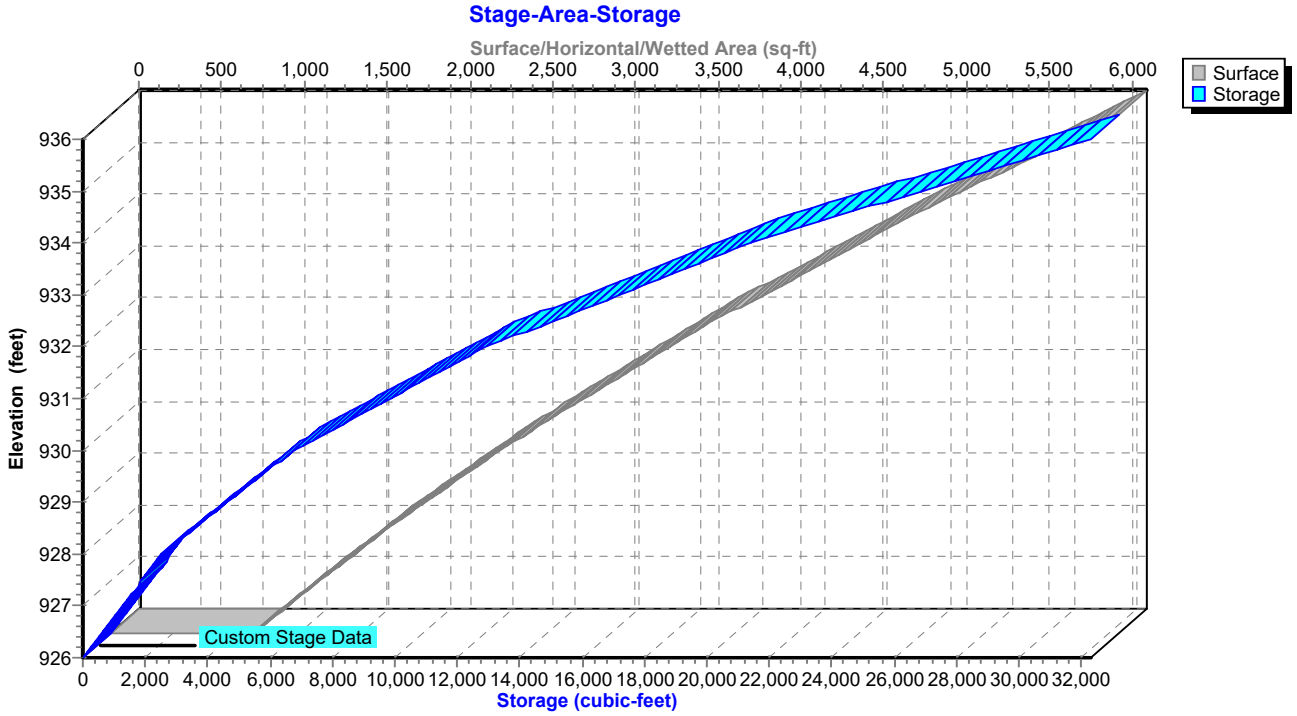
Pond EDDB: Dry Detention Basin



Pond EDDB: Dry Detention Basin



Pond EDDB: Dry Detention Basin

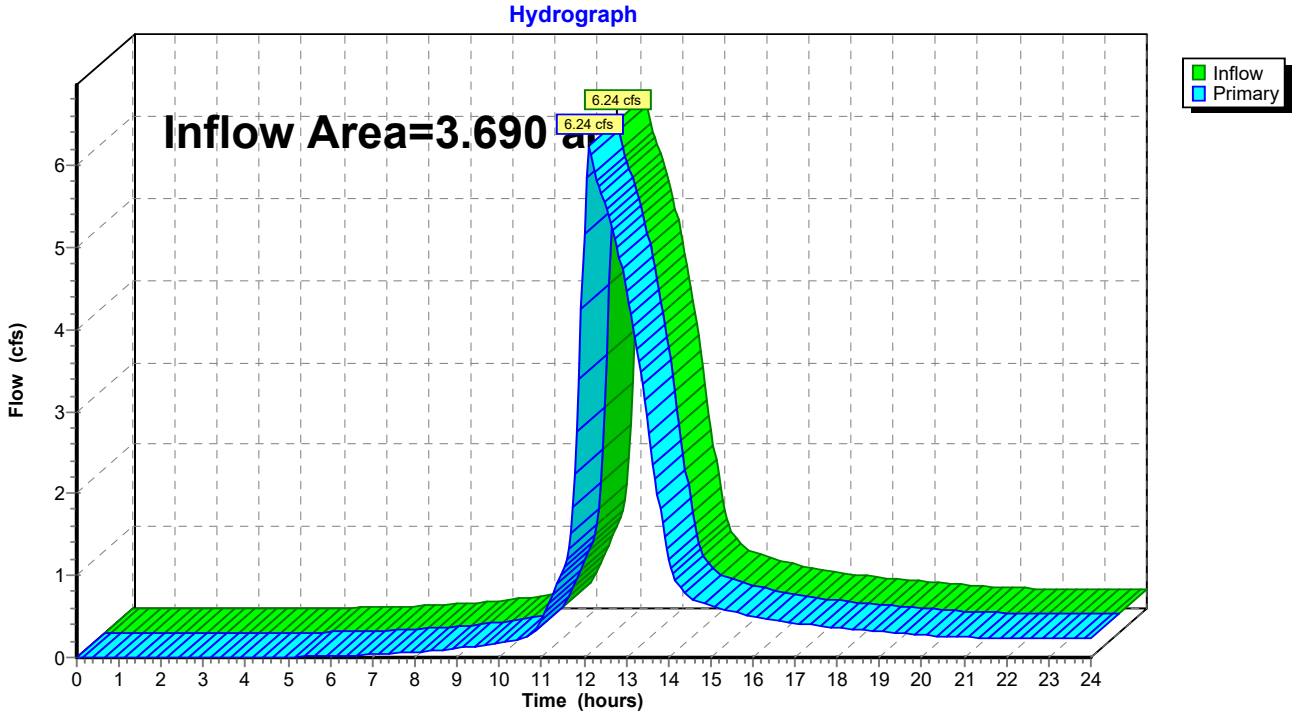


Summary for Link RP-1: Release Point

Inflow Area = 3.690 ac, 47.97% Impervious, Inflow Depth > 3.82" for 10-Year event
Inflow = 6.24 cfs @ 12.12 hrs, Volume= 1.175 af
Primary = 6.24 cfs @ 12.12 hrs, Volume= 1.175 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link RP-1: Release Point



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA-1: Onsite DA-1 Runoff Area=2.430 ac 70.37% Impervious Runoff Depth>6.84"
Flow Length=244' Slope=0.0150 '/' Tc=24.1 min CN=93 Runoff=15.37 cfs 1.384 af

Subcatchment DA3: Onsite DA-3 Runoff Area=0.500 ac 12.00% Impervious Runoff Depth>5.56"
Flow Length=292' Slope=0.0200 '/' Tc=14.8 min CN=82 Runoff=3.51 cfs 0.232 af

Subcatchment OFF DA1: Offsite DA-1 Runoff Area=0.120 ac 0.00% Impervious Runoff Depth>5.79"
Flow Length=369' Slope=0.0300 '/' Tc=13.0 min CN=84 Runoff=0.92 cfs 0.058 af

Subcatchment OFF DA2: Offsite DA-2 Runoff Area=0.640 ac 0.00% Impervious Runoff Depth>5.33"
Flow Length=396' Slope=0.0500 '/' Tc=10.7 min CN=80 Runoff=4.92 cfs 0.284 af

Pond EDDB: Dry Detention Basin Peak Elev=933.78' Storage=20,472 cf Inflow=18.82 cfs 1.727 af
Outflow=13.77 cfs 1.647 af

Link RP-1: Release Point Inflow=15.03 cfs 1.879 af
Primary=15.03 cfs 1.879 af

Total Runoff Area = 3.690 ac Runoff Volume = 1.958 af Average Runoff Depth = 6.37"
52.03% Pervious = 1.920 ac 47.97% Impervious = 1.770 ac

Summary for Subcatchment DA-1: Onsite DA-1

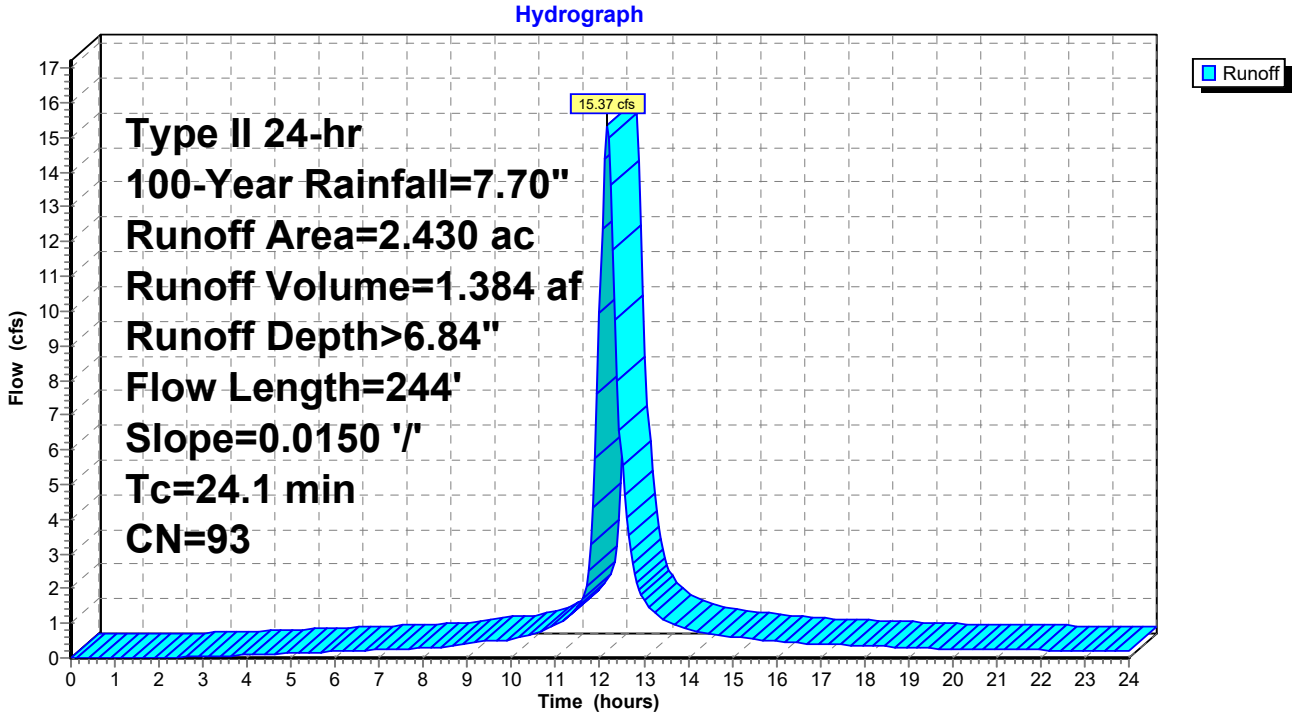
Runoff = 15.37 cfs @ 12.16 hrs, Volume= 1.384 af, Depth> 6.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
0.790	98	Unconnected roofs, HSG D
0.920	98	Paved parking, HSG D
0.720	80	>75% Grass cover, Good, HSG D
2.430	93	Weighted Average
0.720		29.63% Pervious Area
1.710		70.37% Impervious Area
0.790		46.20% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.8	100	0.0150	0.07		**Sheet Flow, Sheet** Grass: Bermuda n= 0.410 P2= 3.71"
1.3	144	0.0150	1.84		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
24.1	244	Total			

Subcatchment DA-1: Onsite DA-1



Summary for Subcatchment DA3: Onsite DA-3

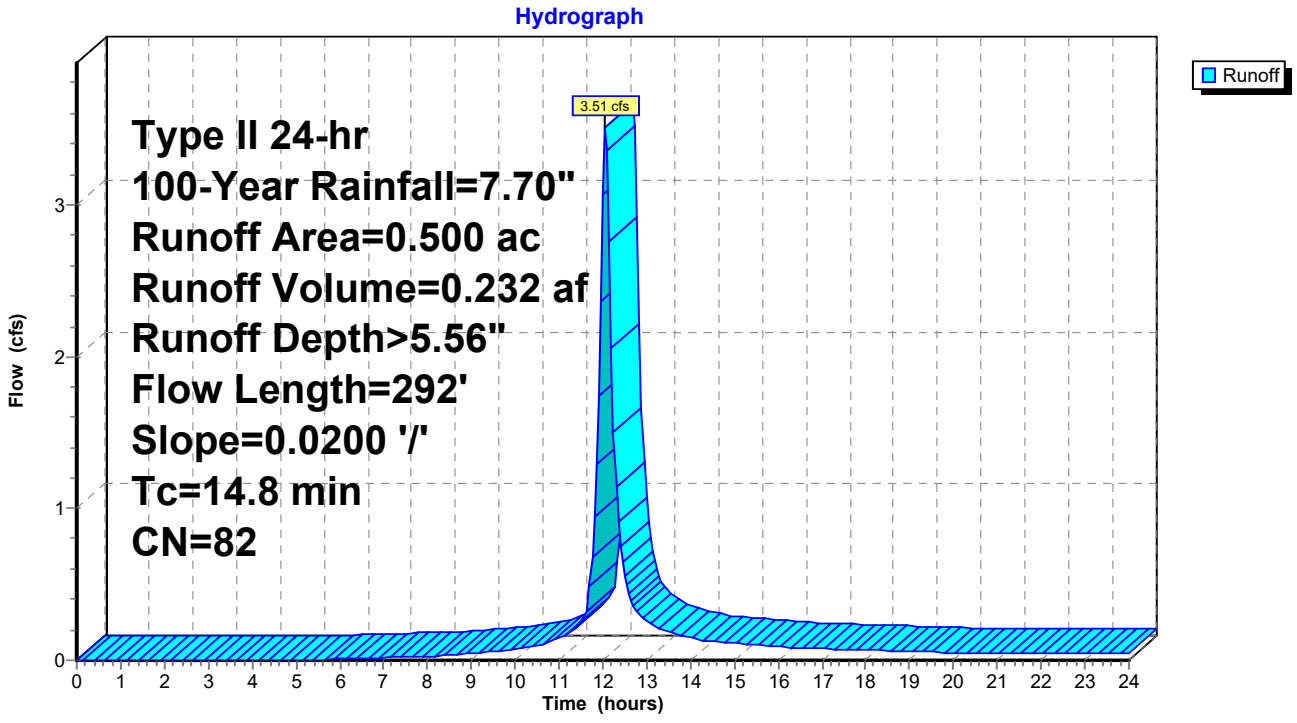
Runoff = 3.51 cfs @ 12.06 hrs, Volume= 0.232 af, Depth> 5.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
0.440	80	>75% Grass cover, Good, HSG D
0.060	98	Paved parking, HSG D
0.500	82	Weighted Average
0.440		88.00% Pervious Area
0.060		12.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	100	0.0200	0.13		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.71"
1.5	192	0.0200	2.12		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
14.8	292	Total			

Subcatchment DA3: Onsite DA-3



Summary for Subcatchment OFF DA1: Offsite DA-1

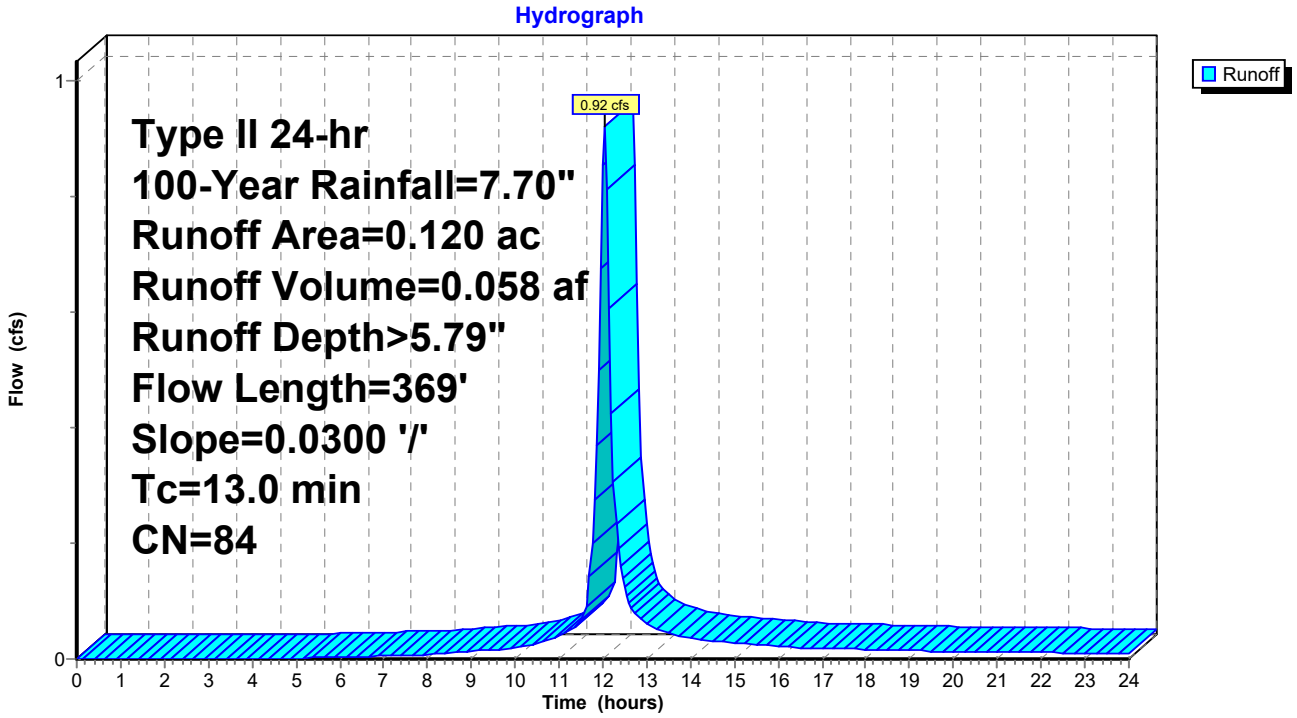
Runoff = 0.92 cfs @ 12.04 hrs, Volume= 0.058 af, Depth> 5.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
0.120	84	50-75% Grass cover, Fair, HSG D
0.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.3	100	0.0300	0.15		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.71"
1.7	269	0.0300	2.60		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
13.0	369	Total			

Subcatchment OFF DA1: Offsite DA-1



Summary for Subcatchment OFF DA2: Offsite DA-2

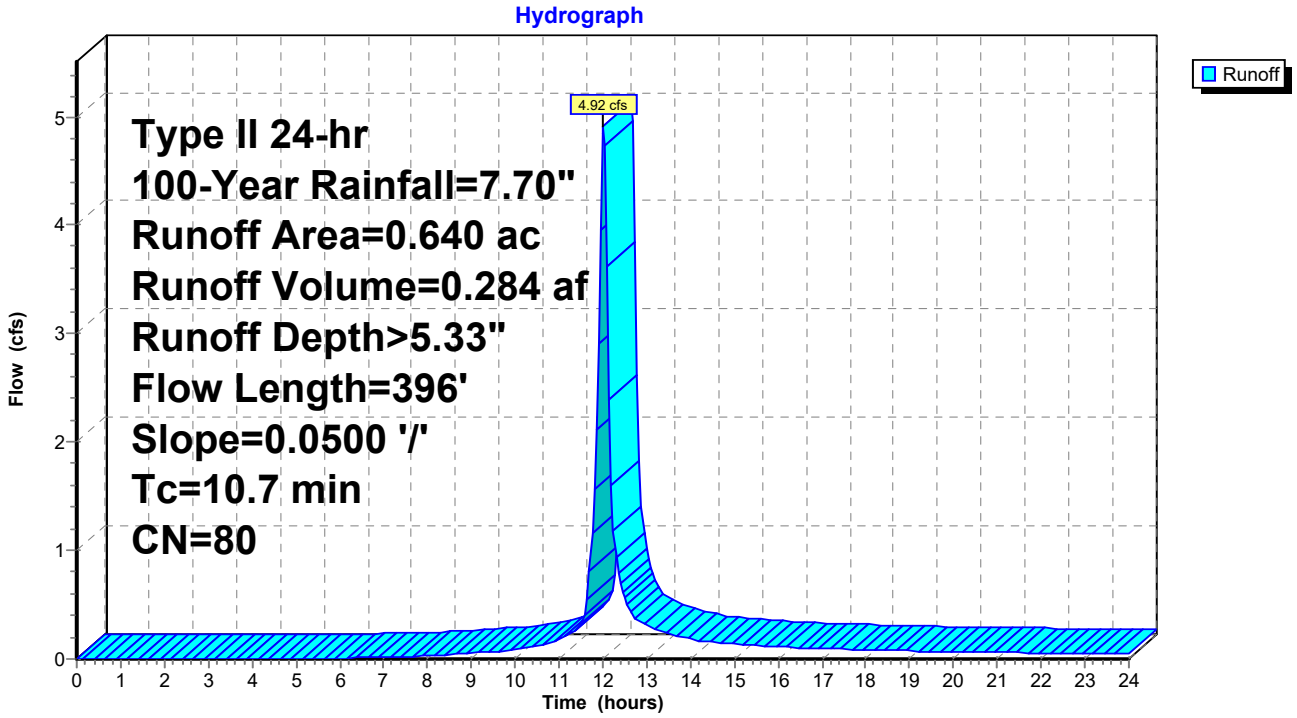
Runoff = 4.92 cfs @ 12.02 hrs, Volume= 0.284 af, Depth> 5.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
0.640	80	>75% Grass cover, Good, HSG D
0.640		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.0500	0.18		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.71"
1.5	296	0.0500	3.35		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
10.7	396	Total			

Subcatchment OFF DA2: Offsite DA-2



Summary for Pond EDDB: Dry Detention Basin

Inflow Area = 3.190 ac, 53.61% Impervious, Inflow Depth > 6.49" for 100-Year event
Inflow = 18.82 cfs @ 12.11 hrs, Volume= 1.727 af
Outflow = 13.77 cfs @ 12.29 hrs, Volume= 1.647 af, Atten= 27%, Lag= 10.8 min
Primary = 13.77 cfs @ 12.29 hrs, Volume= 1.647 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 933.78' @ 12.29 hrs Surf.Area= 4,680 sf Storage= 20,472 cf

Plug-Flow detention time= 66.1 min calculated for 1.644 af (95% of inflow)
Center-of-Mass det. time= 39.6 min (821.4 - 781.7)

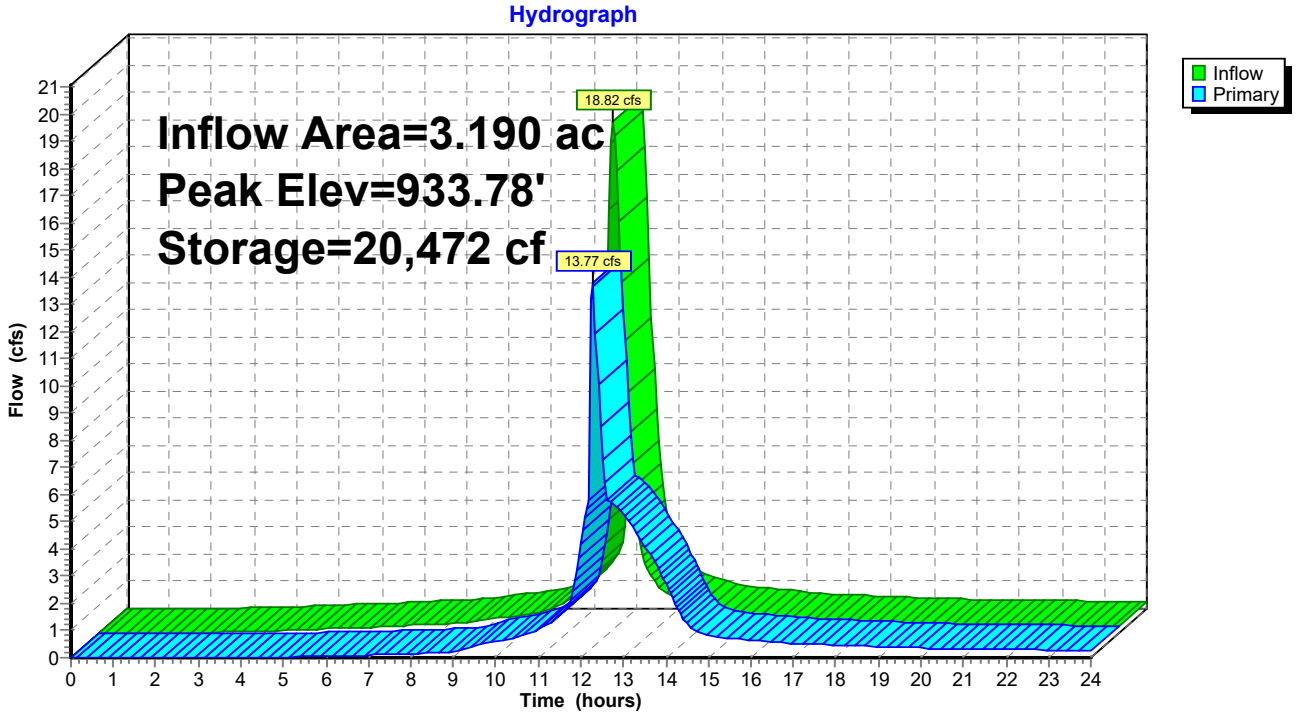
Volume	Invert	Avail.Storage	Storage Description
#1	926.00'	32,300 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
926.00	863	0	0
928.00	1,656	2,519	2,519
930.00	2,578	4,234	6,753
932.00	3,630	6,208	12,961
934.00	4,810	8,440	21,401
936.00	6,089	10,899	32,300

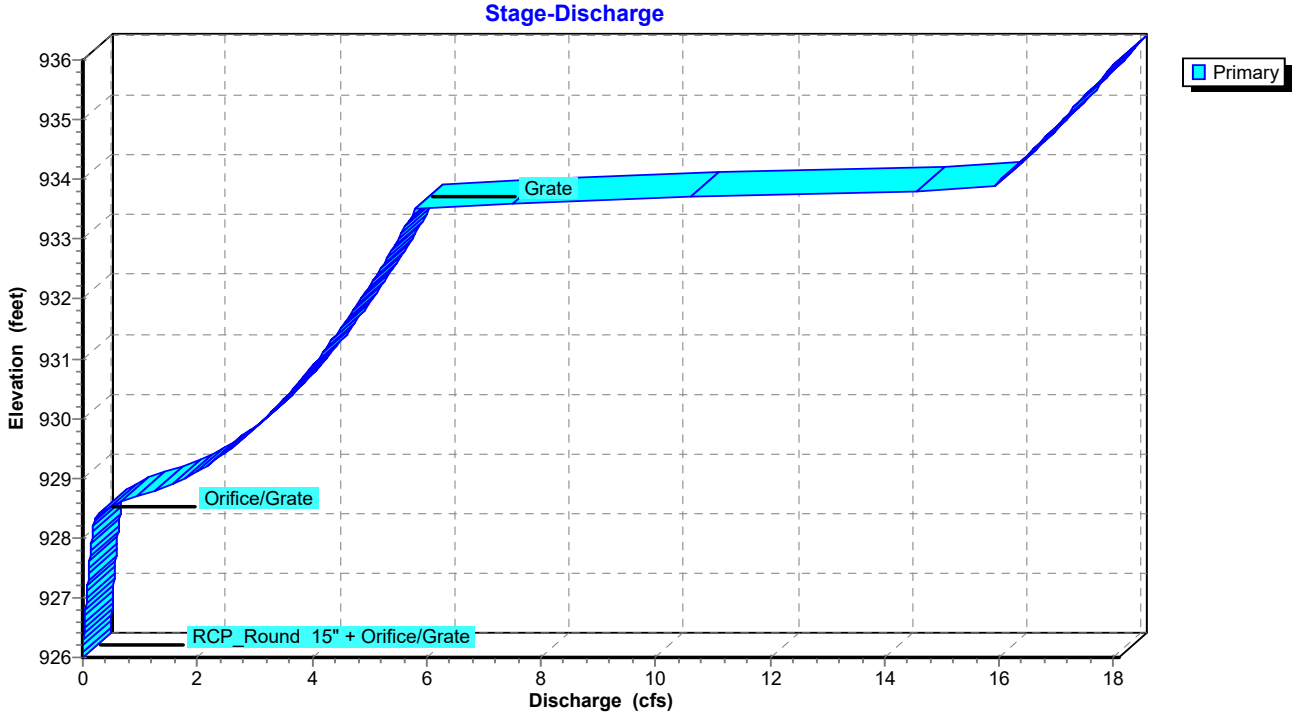
Device	Routing	Invert	Outlet Devices
#1	Primary	926.00'	**15.0" Round RCP_Round 15"** L= 71.5' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 926.00' / 922.77' S= 0.0452 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	926.00'	**1.0" Vert. Orifice/Grate** X 7 rows with 4.0" cc spacing C= 0.600
#3	Device 1	928.33'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	933.50'	**48.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=13.47 cfs @ 12.29 hrs HW=933.77' (Free Discharge)
└─**1=RCP_Round 15"** (Passes 13.47 cfs of 15.80 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.48 cfs @ 12.48 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 5.49 cfs @ 10.97 fps)
  └─**4=Grate** (Weir Controls 7.51 cfs @ 1.71 fps)

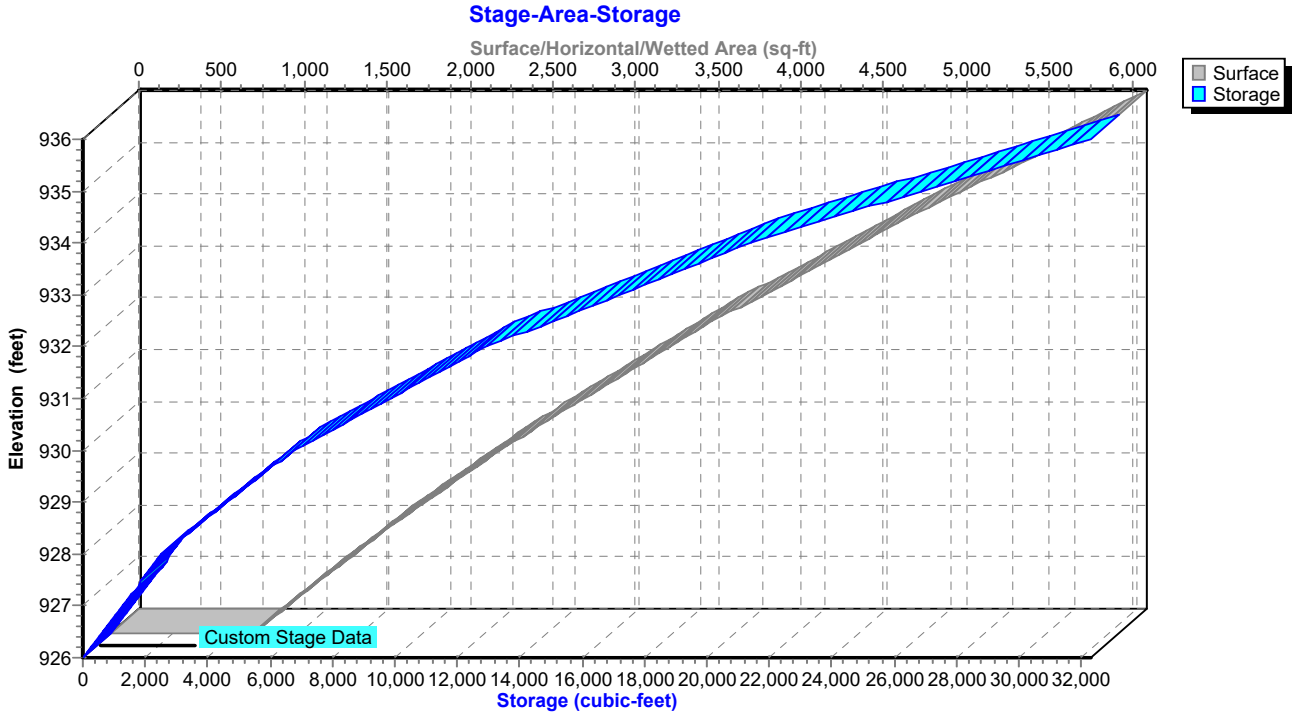
Pond EDDB: Dry Detention Basin



Pond EDDB: Dry Detention Basin



Pond EDDB: Dry Detention Basin

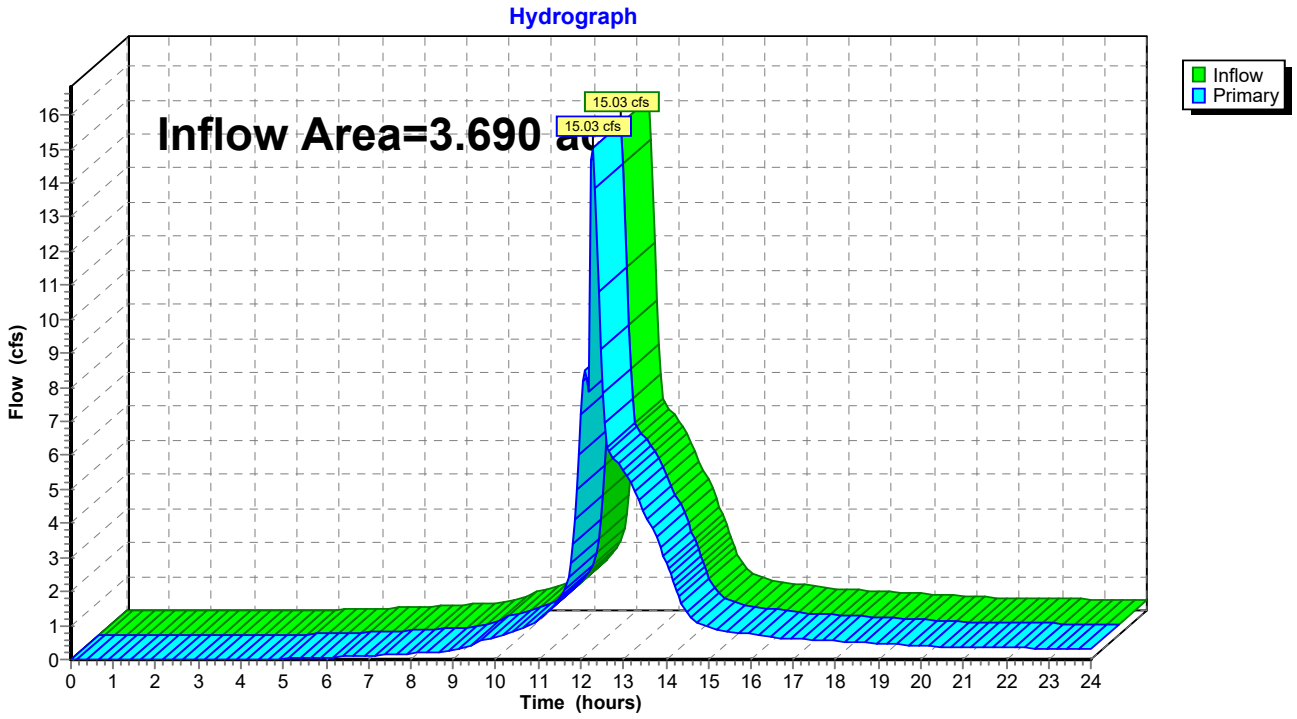


Summary for Link RP-1: Release Point

Inflow Area = 3.690 ac, 47.97% Impervious, Inflow Depth > 6.11" for 100-Year event
Inflow = 15.03 cfs @ 12.28 hrs, Volume= 1.879 af
Primary = 15.03 cfs @ 12.28 hrs, Volume= 1.879 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link RP-1: Release Point



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA-1: Onsite DA-1 Runoff Area=2.430 ac 70.37% Impervious Runoff Depth>0.75"
Flow Length=244' Slope=0.0150 '/' Tc=24.1 min CN=93 Runoff=1.82 cfs 0.152 af

Subcatchment DA3: Onsite DA-3 Runoff Area=0.500 ac 12.00% Impervious Runoff Depth>0.28"
Flow Length=292' Slope=0.0200 '/' Tc=14.8 min CN=82 Runoff=0.15 cfs 0.011 af

Subcatchment OFF DA1: Offsite DA-1 Runoff Area=0.120 ac 0.00% Impervious Runoff Depth>0.34"
Flow Length=369' Slope=0.0300 '/' Tc=13.0 min CN=84 Runoff=0.05 cfs 0.003 af

Subcatchment OFF DA2: Offsite DA-2 Runoff Area=0.640 ac 0.00% Impervious Runoff Depth>0.22"
Flow Length=396' Slope=0.0500 '/' Tc=10.7 min CN=80 Runoff=0.17 cfs 0.012 af

Pond EDDB: Dry Detention Basin Peak Elev=928.46' Storage=3,498 cf Inflow=1.95 cfs 0.167 af
Outflow=0.37 cfs 0.139 af

Link RP-1: Release Point Inflow=0.40 cfs 0.151 af
Primary=0.40 cfs 0.151 af

Total Runoff Area = 3.690 ac Runoff Volume = 0.179 af Average Runoff Depth = 0.58"
52.03% Pervious = 1.920 ac 47.97% Impervious = 1.770 ac

Summary for Subcatchment DA-1: Onsite DA-1

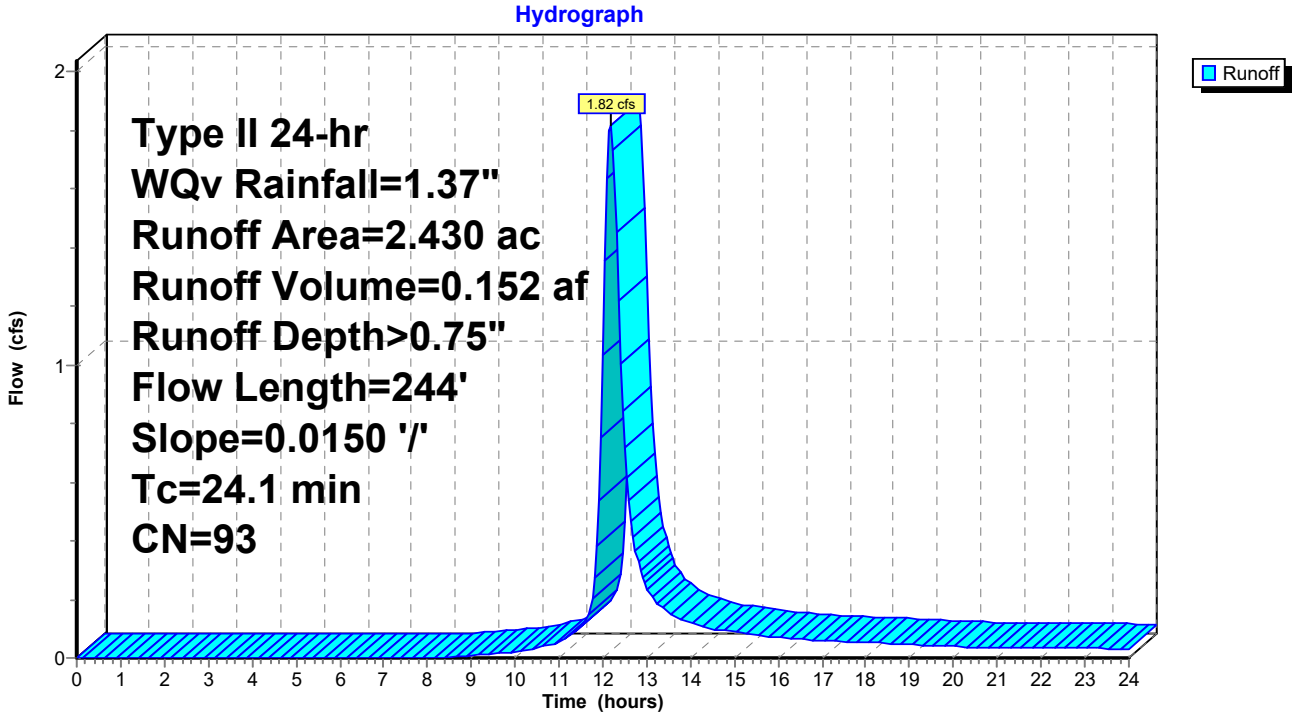
Runoff = 1.82 cfs @ 12.17 hrs, Volume= 0.152 af, Depth> 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr WQv Rainfall=1.37"

Area (ac)	CN	Description
0.790	98	Unconnected roofs, HSG D
0.920	98	Paved parking, HSG D
0.720	80	>75% Grass cover, Good, HSG D
2.430	93	Weighted Average
0.720		29.63% Pervious Area
1.710		70.37% Impervious Area
0.790		46.20% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.8	100	0.0150	0.07		**Sheet Flow, Sheet** Grass: Bermuda n= 0.410 P2= 3.71"
1.3	144	0.0150	1.84		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
24.1	244	Total			

Subcatchment DA-1: Onsite DA-1



Summary for Subcatchment DA3: Onsite DA-3

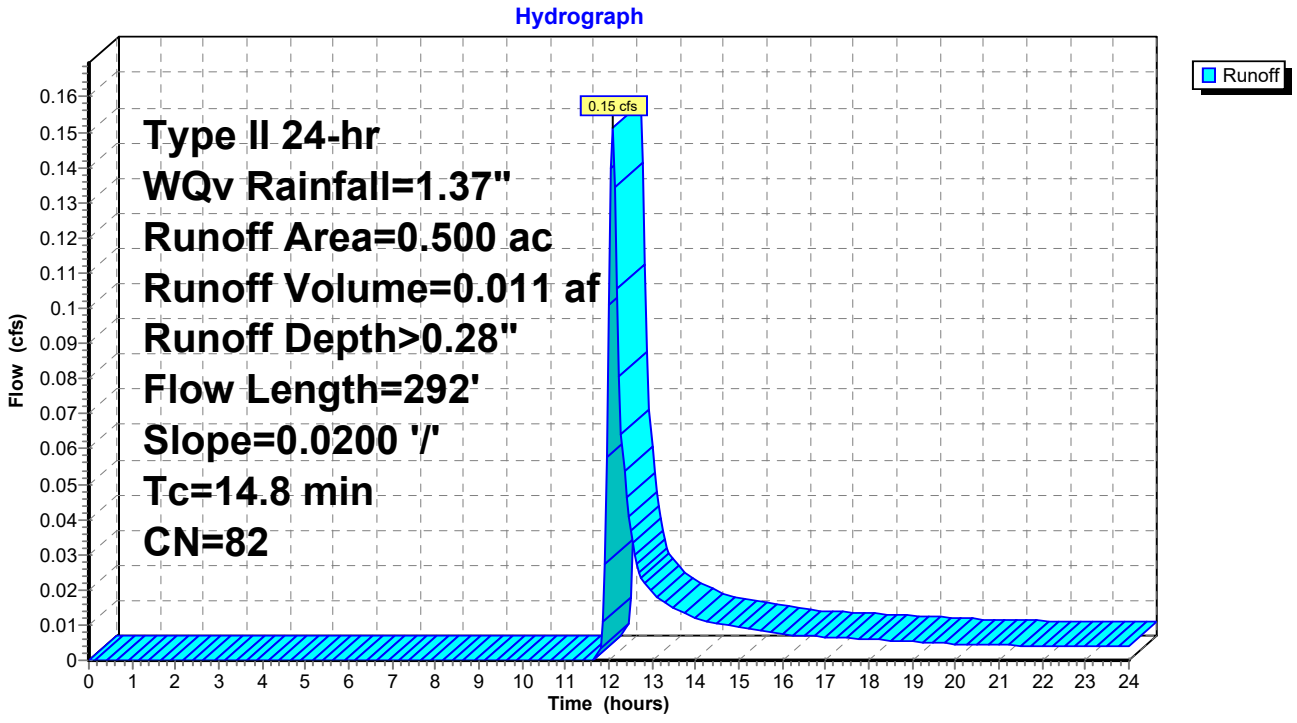
Runoff = 0.15 cfs @ 12.10 hrs, Volume= 0.011 af, Depth> 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr WQv Rainfall=1.37"

Area (ac)	CN	Description
0.440	80	>75% Grass cover, Good, HSG D
0.060	98	Paved parking, HSG D
0.500	82	Weighted Average
0.440		88.00% Pervious Area
0.060		12.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	100	0.0200	0.13		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.71"
1.5	192	0.0200	2.12		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
14.8	292	Total			

Subcatchment DA3: Onsite DA-3



Summary for Subcatchment OFF DA1: Offsite DA-1

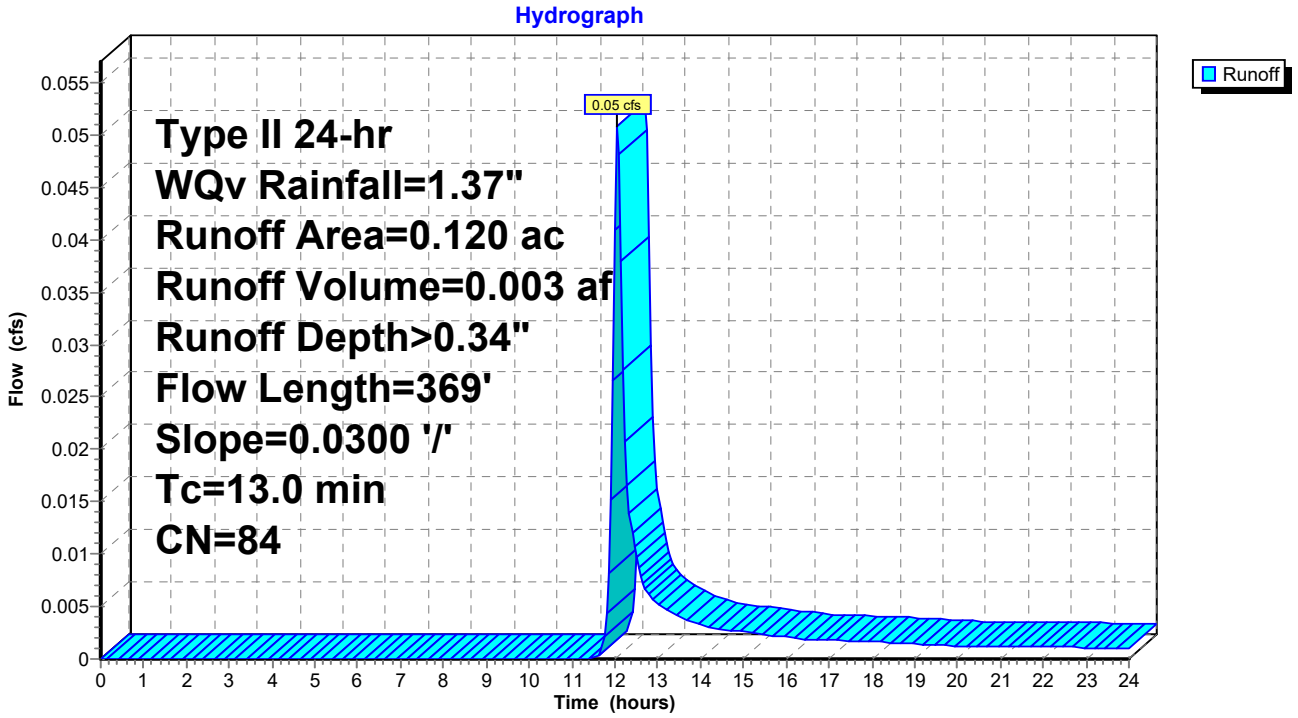
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 0.003 af, Depth> 0.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr WQv Rainfall=1.37"

Area (ac)	CN	Description
0.120	84	50-75% Grass cover, Fair, HSG D
0.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.3	100	0.0300	0.15		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.71"
1.7	269	0.0300	2.60		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
13.0	369	Total			

Subcatchment OFF DA1: Offsite DA-1



Summary for Subcatchment OFF DA2: Offsite DA-2

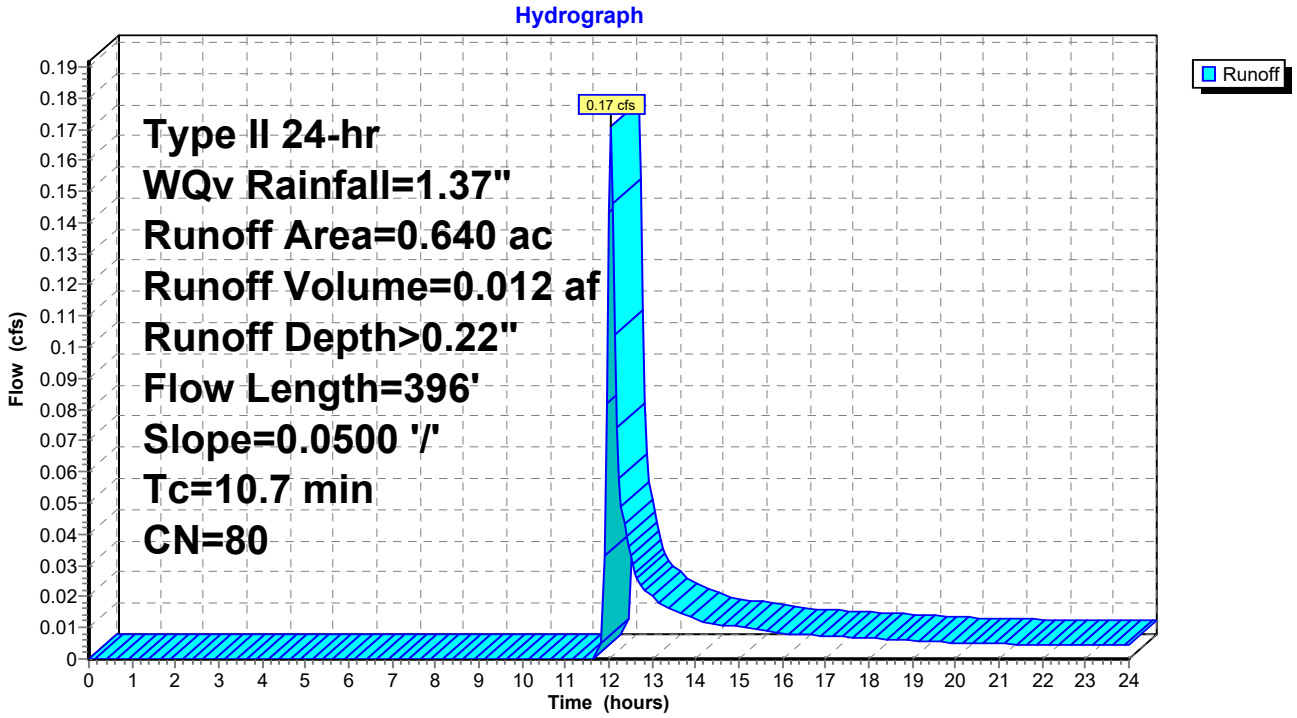
Runoff = 0.17 cfs @ 12.05 hrs, Volume= 0.012 af, Depth> 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr WQv Rainfall=1.37"

Area (ac)	CN	Description
0.640	80	>75% Grass cover, Good, HSG D
0.640		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.0500	0.18		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.71"
1.5	296	0.0500	3.35		**Shallow Concentrated Flow, Shallow** Grassed Waterway Kv= 15.0 fps
10.7	396	Total			

Subcatchment OFF DA2: Offsite DA-2



Summary for Pond EDDB: Dry Detention Basin

Inflow Area = 3.190 ac, 53.61% Impervious, Inflow Depth > 0.63" for WQv event
Inflow = 1.95 cfs @ 12.16 hrs, Volume= 0.167 af
Outflow = 0.37 cfs @ 12.78 hrs, Volume= 0.139 af, Atten= 81%, Lag= 37.1 min
Primary = 0.37 cfs @ 12.78 hrs, Volume= 0.139 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 928.46' @ 12.78 hrs Surf.Area= 1,869 sf Storage= 3,498 cf

Plug-Flow detention time= 216.2 min calculated for 0.139 af (83% of inflow)
Center-of-Mass det. time= 143.2 min (984.8 - 841.6)

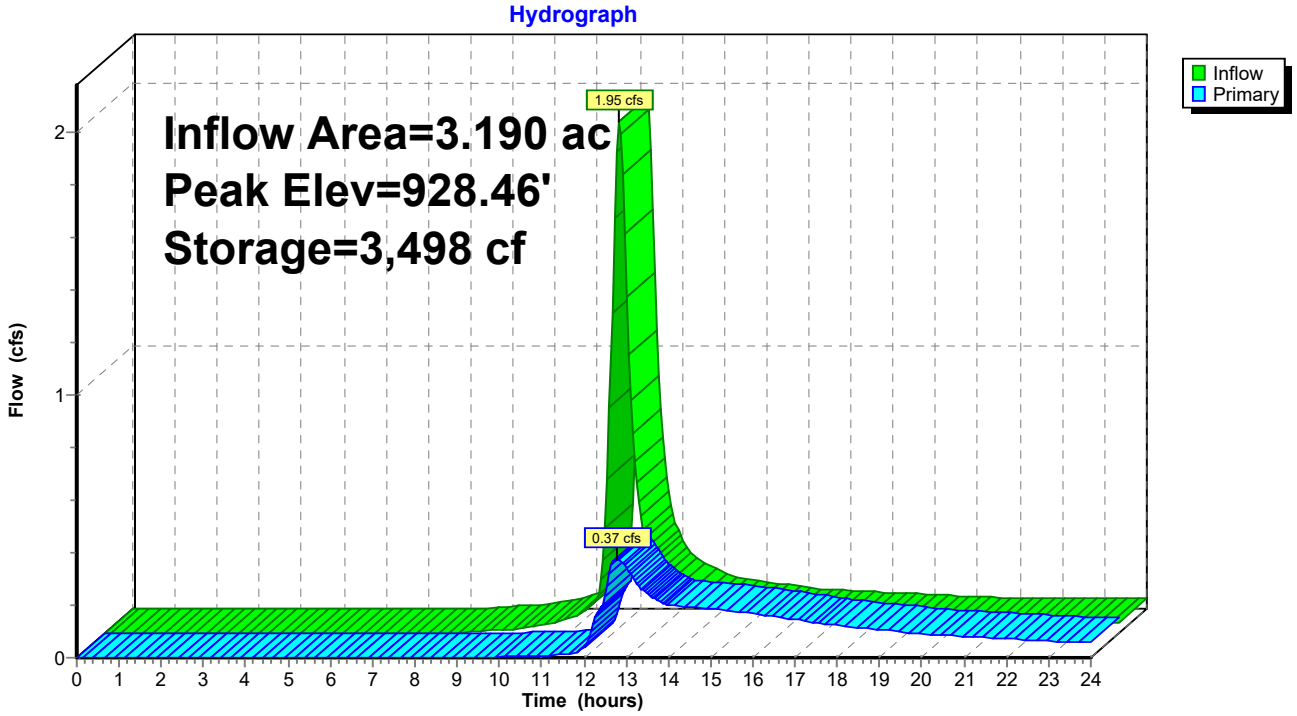
Volume	Invert	Avail.Storage	Storage Description
#1	926.00'	32,300 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
926.00	863	0	0
928.00	1,656	2,519	2,519
930.00	2,578	4,234	6,753
932.00	3,630	6,208	12,961
934.00	4,810	8,440	21,401
936.00	6,089	10,899	32,300

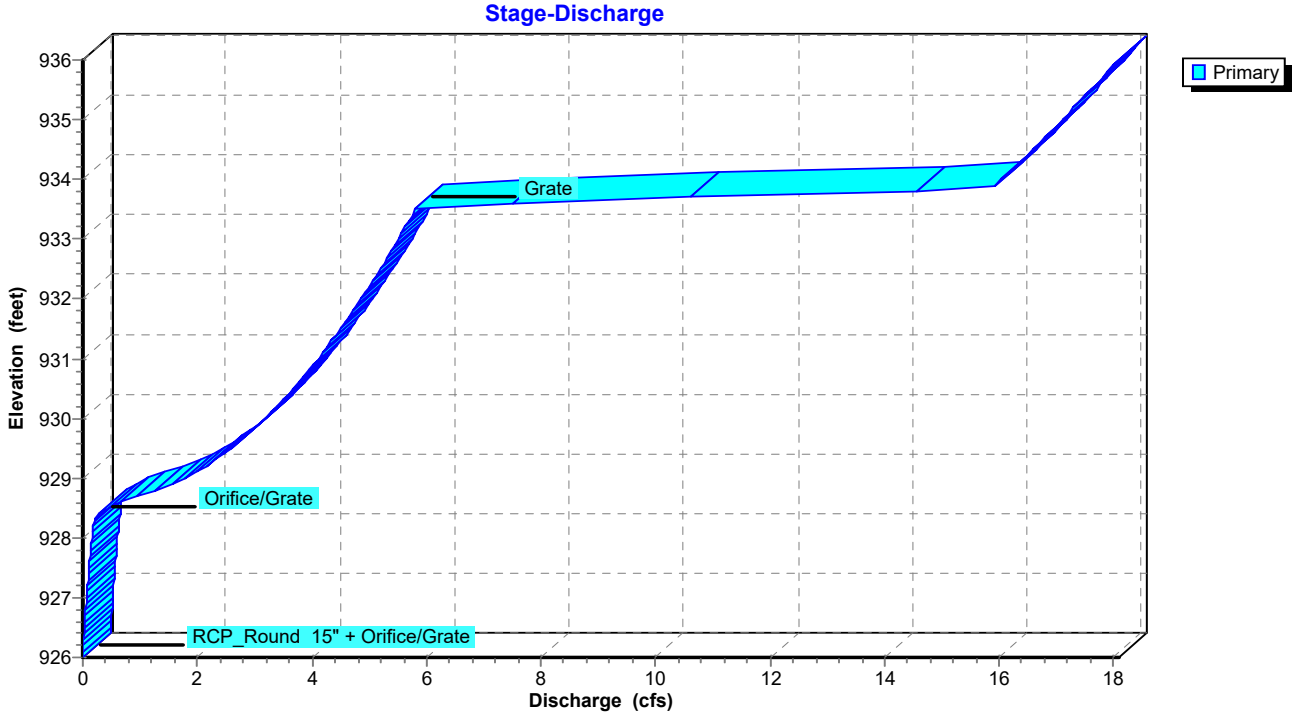
Device	Routing	Invert	Outlet Devices
#1	Primary	926.00'	**15.0" Round RCP_Round 15"** L= 71.5' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 926.00' / 922.77' S= 0.0452 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	926.00'	**1.0" Vert. Orifice/Grate** X 7 rows with 4.0" cc spacing C= 0.600
#3	Device 1	928.33'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	933.50'	**48.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.37 cfs @ 12.78 hrs HW=928.46' (Free Discharge)
└─**1=RCP_Round 15"** (Passes 0.37 cfs of 8.01 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.21 cfs @ 5.55 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.15 cfs @ 1.17 fps)
  └─**4=Grate** (Controls 0.00 cfs)

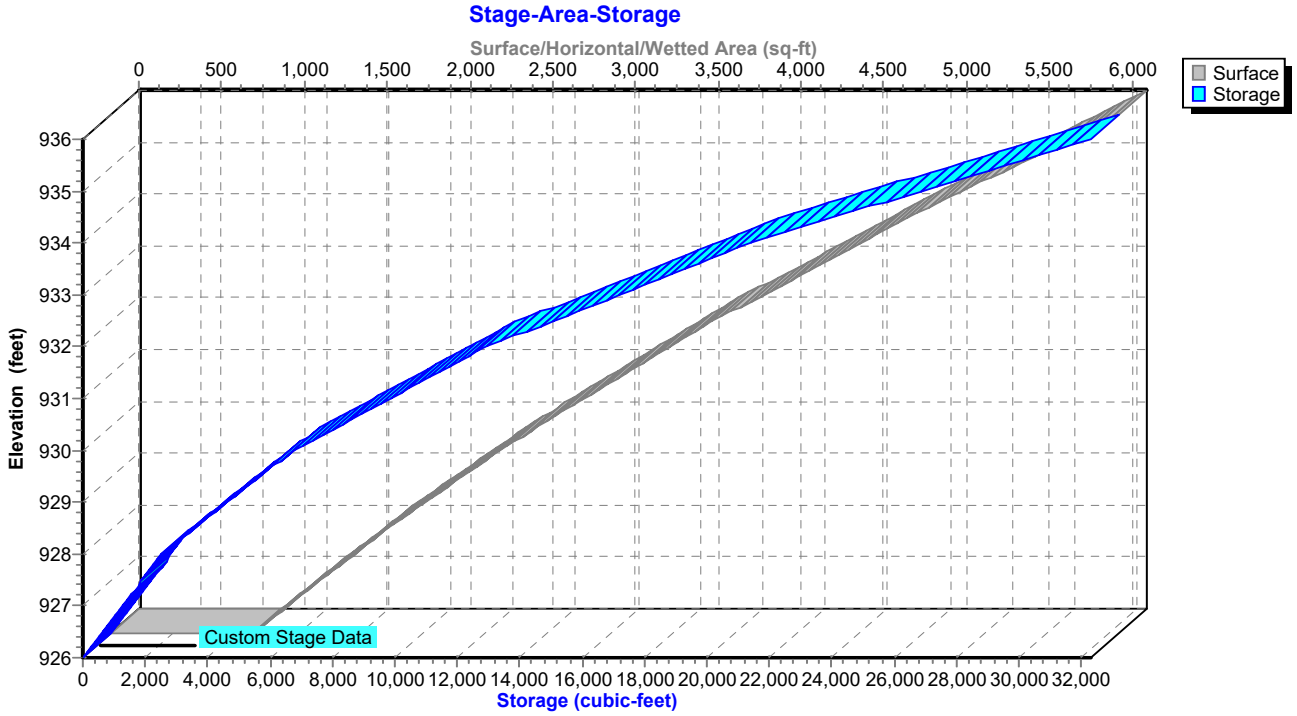
Pond EDDB: Dry Detention Basin



Pond EDDB: Dry Detention Basin



Pond EDDB: Dry Detention Basin



Summary for Link RP-1: Release Point

Inflow Area = 3.690 ac, 47.97% Impervious, Inflow Depth > 0.49" for WQv event
Inflow = 0.40 cfs @ 12.77 hrs, Volume= 0.151 af
Primary = 0.40 cfs @ 12.77 hrs, Volume= 0.151 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link RP-1: Release Point