Lawrence Energy Center
847 Landfill
Run-On and Run-Off Control System Plan

Lawrence Energy Center
1250 N 1800 Road
Lawrence, Kansas

Prepared for:

Evergy Kansas Central, Inc.

SCS ENGINEERS

25221145.00 | October 2021

40 Shuman Blvd, Ste 216
Naperville, IL 60563

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PLAN REVIEW/AMENDMENT LOG

Date of Review	Reviewer Name	Amendment Required (YES/NO)	Sections Amended and Reason
October 2016 (Revision 0)	CB&I Environmental & Infrastructure, Inc.	N/A	Initial Plan
October 2021 (Revision 1)	SCS Engineers	YES	All sections revised / updated as part of the 5-year periodic review process.

PROFESSIONAL ENGINEER CERTIFICATION

I, Richard D. Southorn, hereby certify that this Run-On and Run-Off Control System Plan meets the requirements of 40 CFR §257.81, was prepared by me or under my direct supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Kansas.

This plan has been prepared as a periodic update to the initial Run-On and Run-Off Control System Plan that was certified on October 17, 2016.

Richard D. Southorn, PE

License No. PE 25201

Expires 4/30/2023

1.0 INTRODUCTION

The 847 Landfill (Landfill) is an existing coal combustion residual (CCR) landfill located at Evergy's Lawrence Energy Center in Lawrence, Kansas. This Run-on and Run-off Control System Plan (RORO Plan) documents that the Landfill's run-on and run-off control systems have been designed and constructed to meet the applicable requirements of Title 40 Code of Federal Regulations (CFR) §257.81[1] of the CCR Rule.

2.0 REGULATORY REQUIREMENTS

40 CFR §257.81 Run-on and run-off controls for CCR landfills.

(a) The owner or operator of an existing or new CCR landfill or any lateral expansion of a CCR landfill must design, construct, operate, and maintain:

(1) A run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm; and

(2) A run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm.

(b) Run-off from the active portion of the CCR unit must be handled in accordance with the surface water requirements under 40 CFR §257.3-3[1].

(c) Run-on and run-off control system plan

(1) Content of the plan. The owner or operator must prepare initial and periodic run-on and run-off control system plans for the CCR unit according to the timeframes specified in paragraphs (c)(3) and (4) of this section. These plans must document how the run-on and run-off control systems have been designed and constructed to meet the applicable requirements of this section. Each plan must be supported by appropriate engineering calculations. The owner or operator has completed the initial run-on and run-off control system plan when the plan has been placed in the facility's operating record as required by 40 CFR §257.105(g)(3).

With reference to 40 CFR §257.81(c) above, the initial RORO Plan was required to be developed no later than October 17, 2016 for existing landfills (40 CFR §257.81(c)(3)(i))[1]. Updates to the RORO Plan are required whenever there is a change in conditions that would substantially affect the written plan in effect (40 CFR §257.81(2))[1], or within five years of the previous plan (40 CFR §257.81(c)(4))[1].

The owner or operator must obtain a certification from a qualified professional engineer or approval from the Participating State Director or EPA, where EPA is the permitting authority, stating that the initial and periodic RORO Plans meet the requirements of 40 CFR §257.81[1].

3.0 2021 RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

This document has been prepared as a periodic update to the 2018 RORO Plan updated. This plan has been developed to reflect run-on and run-off controls that are being used at the facility at the time of this report. As such, this plan replaces the previous RORO Plan and 2018 update. The current run-on and run-off control systems at the Landfill have been reviewed as part of this 2021 Periodic RORO Plan update and have been found to meet the requirements of 40 CFR §257.81(a)[1], as outlined in Section 2.0.

Conveyance features that comprise the run-on and run-off control systems at the Landfill are depicted in **Figure 1**. Storm water calculations supporting the below discussion are included in **Appendices A and B.**

3.1 RUN-ON CONTROL SYSTEM

The current landfill geometry directs all storm water away from the active area of the Landfill. Inactive areas with final cover are not included in this evaluation. Inactive areas with final cover at the Landfill included Cell 1, the northern and southern slopes in Cell 2, and the northern and southern slopes in Cell 3. The active area of Cells 2 and 3 are above grade and extend to the closed side-slopes of the Landfill. Storm water that falls on Cells 2 and 3 outside of the active area flow by gravity away from the active area through constructed final cover storm water controls.

An approximate 1.4-acre area south of Cell 4 drains toward Cell 4. Storm water that lands in this area is prevented from flowing into Cell 4 by a containment berm that is approximate 10-ft tall berm. The water drains to the east to a 24-inch drain pipe and discharges into the leachate pond. The run-on control system is depicted in **Figure 1**.

3.2 RUN-OFF CONTROL SYSTEM

The active portion of Cells 2, 3, and 4 of the Landfill are surrounded by a perimeter berm system that varies in height between 2-ft. to 6-ft. above surrounding grade and is designed to contain run-off. The active portion of the Landfill is graded to the east, such that contact water flows from Cell 2, then to Cell 3 and finally into Cell 4. Run-off control ditches have also been constructed along the inside toe of the containment berms in Cells 2 and 3 to direct water into Cell 4. Contact water that collects in Cell 4 ultimately drains into the leachate collection system and discharges into the leachate pond.

3.3 HYDROLOGIC AND HYDRAULIC ANALYSIS

Engineering calculations to evaluate the run-on and run-off control system at the Landfill consist of a hydrologic and hydraulic storm water model prepared using HydroCAD storm water modeling software. The run-on and run-off control system model for the Landfill is provided in **Appendix B**. Information used to prepare the HydroCAD storm water model are summarized below.

3.3.1 Rainfall Data

Rainfall amounts for the 25-year, 24-hour storm were obtained from the Rainfall Intensity Tables for Counties in Kansas (2014) prepared by Kansas Department of Transportation. This document provides rainfall intensities for various durations and recurrence intervals, displayed in rainfall intensity tables for each county in Kansas. The rainfall intensity table applicable to the Landfill is the

table prepared for Douglas County (**Appendix A**). The 25-year, 24-hour rainfall amount for the Landfill was determined to be 6.24-inches, based on a rainfall rate of 0.26 inches/hour for 24 hours.

The Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service (SCS), Technical Release 55 (TR-55) was consulted to determine the appropriate storm water distribution pattern to model the rainfall depth in HydroCAD. According to TR-55[2], the Type-II 24-hour storm distribution is appropriate for all counties located in Kansas.

3.3.2 Model Input Parameters

Subcatchment areas (also known as watersheds) were delineated using AutoCAD Civil3D 2020 (AutoCAD) based on topographic divides. For the Landfill run-on and run-off control system model, all areas flowing toward the Landfill and the active portion of the Landfill are delineated and modeled in HydroCAD. These areas are depicted in **Figure 1**.

Runoff from each subcatchment area was calculated using the NRCS-SCS Technical Release 20 (TR-20) method that utilizes soil types, land covers, and flow length parameters to calculate storm water run-off. The Curve number (CN) is a parameter used to determine the amount of runoff that will occur from a surface. High CN values indicate that the majority of rainfall will run off with minimal losses. Lower values correspond to an increased ability of rainfall to infiltrate the ground surface, leading to lower run off rates.

For the run-on area, the curve number was selected based on the prevailing soil type and grass cover. According to the NRCS Web Soil Survey for Douglas County, the predominant soil type within the area of the landfill is Hydrologic Soil Group C (HSG-C). The associated curve number for grassed HSG-C soils is 74. The CN for the comingled CCR placed in the Landfill has been previously determined to be 63.4, based on a review of the Hydrologic Evaluation of Landfill Performance (HELP) model completed as part of the 2006 Solid Waste Permit Application.

The time of concentration, defined as the longest amount of time a waterdrop would take to travel from the headwater of a subcatchment area to its downstream edge, was delineated in AutoCAD and entered for each subcatchment in HydroCAD.

3.3.3 Conveyance Features

Key attributes used in the HydroCAD model for each conveyance feature are summarized below:

- Run-On Discharge Pipe (HydroCAD Node – ROD-1)
  - Modeled as a 24-inch smooth interior HDPE pipe at 0.5% slope.
- Run-Off Ditch 1 (HydroCAD Node – RD-1)
  - Modeled as a 2-ft. deep channel with 10-ft. bottom width and 3H:1V sideslopes.
  - Ditch lining designated as CCR Material.
- Run-Off Ditch 2 (HydroCAD Node – RD-2)
  - Modeled as a 3-ft. deep channel with 10-ft. bottom width and 3H:1V sideslopes.
  - Ditch lining designated as CCR Material.
- Run-Off Ditch 3 (HydroCAD Node – RD-3)
  - Modeled as a 2-ft. deep channel with 10-ft. bottom width and 2H:1V sideslopes.
  - Ditch lining designated as CCR Material.
- Temporary Downchute (HydroCAD Node – DC-2)
  - Modeled as a 3-ft. deep channel with 6-ft. bottom width and 2H:1V sideslopes..
  - Ditch lining designated as 1-ft. diameter riprap.

- Cell 4 (HydroCAD Node – C4)
    - Although Cell 4 is a disposal area, it has been modeled as a detention basin due to the fact that water is temporarily collected in this location prior to discharging to the leachate pond. Cell 4 has been modeled with incremental detention volume defined by its containment berm using 0.5 ft contour intervals from elevation 866 ft MSL (current lowest floor base elevation) and elevation 869.5 ft MSL (lowest elevation of containment berm, located at Cell 4 access road).
- Cell 4 Leachate Trench Discharge Pipe (HydroCAD Node – C4)
    - Modeled as a 6-in. diameter, high-density polyethylene (HDPE) pipe from Cell 4 to the leachate pond.

These conveyance features are modeled in HydroCAD to demonstrate the run-on and run-off control systems are appropriately sized to accommodate the 25-year, 24-hour storm event.

3.4 RESULTS AND CONCLUSIONS

Landfill Run-On Control System

The 1.4-acres that drains toward the active area are routed along a 10-foot berm to a 24-inch diameter pipe. The berm was constructed to prevent flow from entering the active area of the landfill. The pipe reaches a maximum flow depth of approximately 10-inches (0.84 feet) during the 25-year, 24-hour storm, indicating that run-on does not back up and will not enter the active area. Therefore, the run-on controls meet the regulatory requirements of 40 CFR §257.81(a)(1).

Landfill Run-Off Control System

Based on the results of the HydroCAD storm water model, the Landfill run-off control system was determined to accommodate the 25-year, 24-hour storm event without overtopping. The peak depth and freeboard remaining within each conveyance feature is summarized below:

Table 2 – Conveyance Feature Sizing

Conveyance Feature Designation	Peak Depth (feet)	Freeboard (feet)
Run-Off Ditch 1	0.08	1.92
Run-Off Ditch 2	0.36	2.64
Run-Off Ditch 3	0.15	1.85
Temporary Downchute	0.51	2.49

Model results indicate that the run-off that collects in Cell 4 reaches a peak elevation of 867.88 ft MSL, which is 1.62 ft below the lowest elevation of the containment berm.

Based on the results from the HydroCAD model, the run-off control system is designed to prevent run-on to the active portion of the Landfill during the peak discharge from the 25-year, 24-hour storm event and meets the requirements of 40 CFR §257.81(a)(1)[1]. In addition, the run-off control system is designed to accommodate the water volume from the 25-year, 24-hour storm event without overtopping and meets the requirements of 40 CFR §257.81(a)(2)[1].

4.0 CERTIFICATIONS

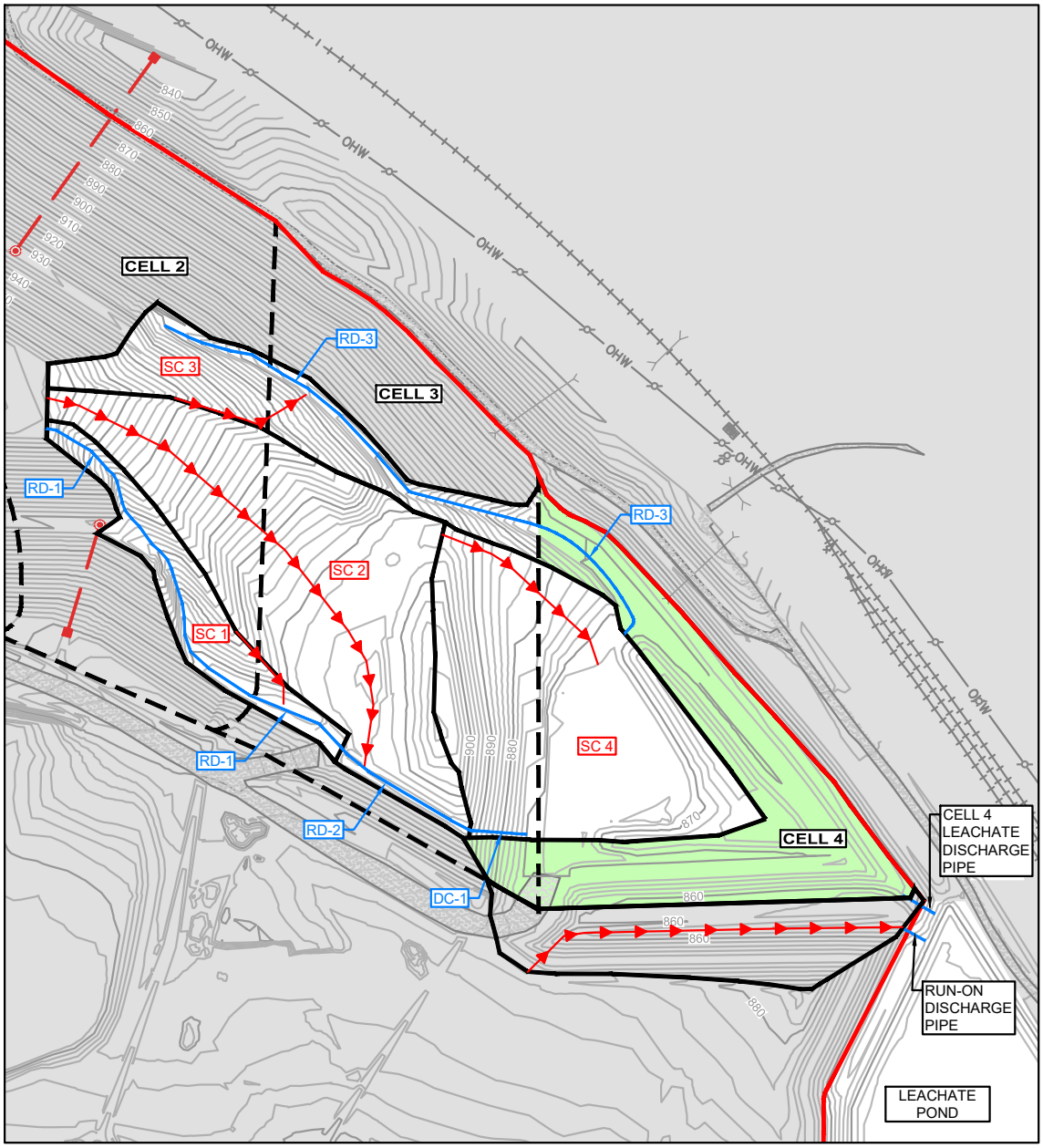
Richard D. Southorn, a licensed Professional Engineer in the State of Kansas, has overseen the preparation of this Run-On and Run-Off Control System Plan. A certification statement in accordance with 40 CFR §257.81(c)(5)[1] is provided on **Page iii** of this plan.

5.0 REFERENCES

1. U.S. Environmental Protection Agency, Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments, Title 40 Code of Federal Regulations Part §257. Federal Register 80, Subpart D, dated April 17, 2015, as revised.
2. USDA Natural Resources Conservation Service, Technical Release 55, dated June 1986.
3. USDA Natural Resources Conservation Service, Web Soil Survey for Douglas County https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm, dated 2021.

Figures

Figure 1. 847 Landfill Run-On and Run-Off Control System



EXISTING SITE TOPOGRAPHY DEVELOPED BY PROFESSIONAL ENGINEERING CONSULTANTS (PEC) IN DECEMBER 2020

LEGEND

- CCR LANDFILL BOUNDARY
- APPROXIMATE CELL BOUNDARY
- SUBCATCHMENT BOUNDARY
- WATER CONVEYANCE FEATURE LOCATION
- TIME OF CONCENTRATION FLOW PATH
- CONTAINMENT BERM

250 0 250

SCALE: 1" = 250'

CLIENT	evergy	SITE	LAWRENCE ENERGY CENTER LAWRENCE, KS	RUN–ON RUN–OFF PLAN SUBCATCHMENT DELINEATION	
PROJECT NO.	25221145	DRAWN BY:	NV	ENGINEER	FIGURE
DRAWN:	08/26/2021	CHECKED BY:	SJL	SCS ENGINEERS 2830 DAIRY DRIVE MADISON, WI 53718–6751 PHONE: (608) 224–2830	1 OF 1
REVISED:	09/22/2021	APPROVED BY:	RDS		

I:\25221145.00\Drawings\RunOn RunOff\Site Layout-HydroCAD.dwg, 9/24/2021 9:04:26 AM

Appendices

Appendix A Rainfall Intensity Table for Kansas Counties

Appendix B 847 Landfill Run-On and Run-Off Control System – HydroCAD Output Files

Appendix A Rainfall Intensity Table for Kansas Counties

MEMO

Kansas
Department of Transportation
Bureau of Road Design

ROAD MEMORANDUM NO. 16-03

DATE: September 2, 2016

SUBJECT: *Rainfall Intensity Tables*

The publication, *Rainfall Intensity Tables for Counties in Kansas*, dated June 1997, has recently be updated and replaced by *Rainfall Intensity Tables for Counties in Kansas (2014)*.

The new tables were developed from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 Volume 8 (Perica et al. 2013) which was recently released by the National Weather Service (NWS) Hydro Meteorological Design Studies Center. The new tables provide rainfall intensities for durations from 5 minutes to 24 hours and various recurrence intervals from 1-500 years.

The *Rainfall Intensity Tables for Counties in Kansas (2014)* supersede the previous rainfall tables based on TP-40 and HYDRO-35 (McEnroe 1997). The new rainfall tables are available on the Kansas Department of Transportation's (KDOT) website at http://kart.ksdot.org.

If you have any questions, please contact John Hobelman at (785) 368-8791.

Scott W. King, P.E., Chief
Bureau of Road Design

SWK:js
By e-mail: American Council of Engineering Companies
Federal Highway Administration
Kansas Contractors Association (kca@ink.org)
Active Consultants
Director of Engineering & Design
Director of Operations
District Engineers
Area Engineers
Chief, Bureau of Local Projects
Chief, Bureau of Right of Way
Chief, Bureau of Transportation Safety & Technology
Chief, Bureau of Construction & Materials
Chief, Bureau of Maintenance
Chief, Bureau of Structures and Geotechnical Services
Road Design/Squad Leaders
Coordinating Section

Rainfall Intensity Tables for Counties in Kansas

(December, 2014 Edition)

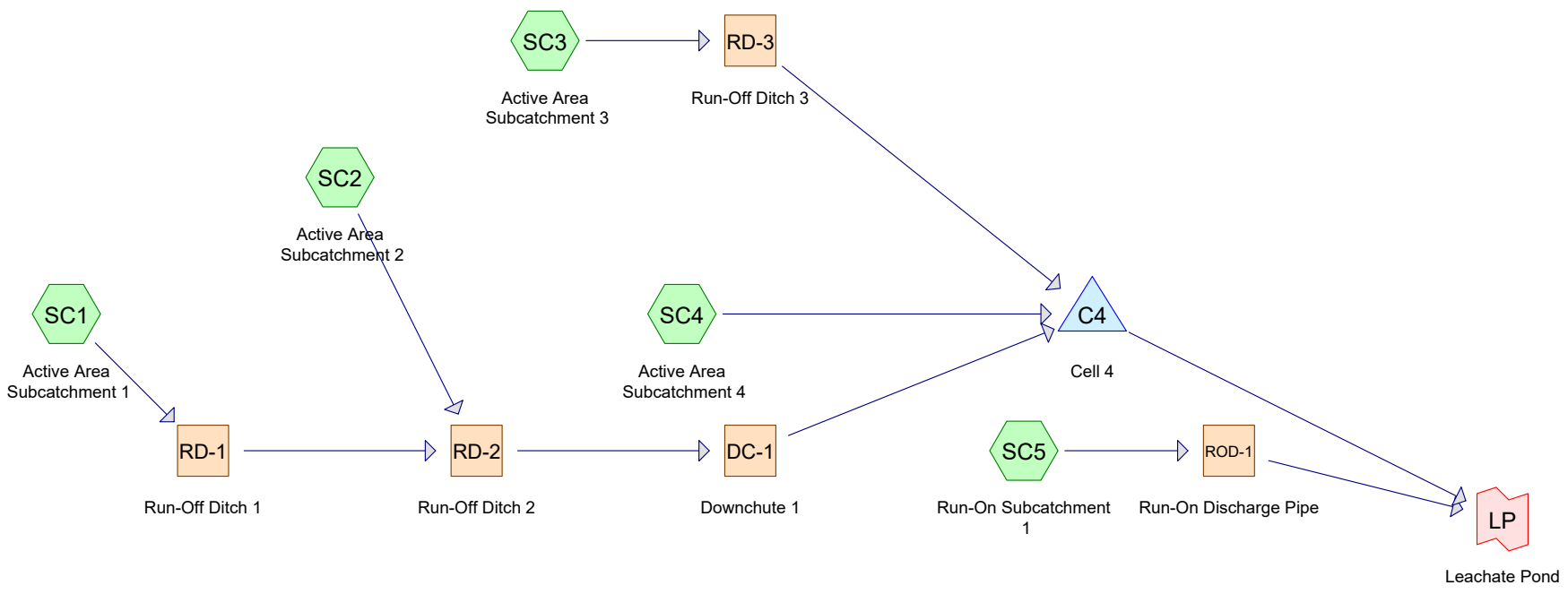
RAINFALL INTENSITY TABLE

DOUGLAS COUNTY, KANSAS

This table contains average rainfall intensities in inches per hour.

DURATION	AVERAGE RECURRENCE INTERVAL								
(H:M)	1 yr	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr	200 yr	500 yr
3:15	0.59	0.70	0.89	1.05	1.28	1.46	1.64	1.83	2.10
3:30	0.56	0.66	0.84	0.99	1.21	1.38	1.56	1.74	1.99
3:45	0.53	0.63	0.80	0.94	1.15	1.31	1.48	1.66	1.90
4:00	0.50	0.60	0.76	0.90	1.10	1.25	1.41	1.58	1.82
4:15	0.48	0.57	0.73	0.86	1.05	1.20	1.35	1.52	1.74
4:30	0.46	0.55	0.70	0.82	1.00	1.15	1.30	1.45	1.67
4:45	0.44	0.53	0.67	0.79	0.96	1.10	1.25	1.40	1.60
5:00	0.43	0.51	0.64	0.76	0.93	1.06	1.20	1.34	1.54
5:15	0.41	0.49	0.62	0.73	0.89	1.02	1.15	1.29	1.49
5:30	0.40	0.47	0.60	0.70	0.86	0.98	1.11	1.25	1.43
5:45	0.38	0.45	0.58	0.68	0.83	0.95	1.08	1.21	1.39
6:00	0.37	0.44	0.56	0.66	0.80	0.92	1.04	1.17	1.34
6:30	0.35	0.41	0.52	0.62	0.76	0.87	0.98	1.10	1.26
7:00	0.33	0.39	0.49	0.59	0.71	0.82	0.93	1.04	1.20
7:30	0.31	0.37	0.47	0.55	0.68	0.78	0.88	0.99	1.13
8:00	0.30	0.35	0.45	0.53	0.64	0.74	0.84	0.94	1.08
8:30	0.28	0.34	0.43	0.50	0.61	0.70	0.80	0.89	1.03
9:00	0.27	0.32	0.41	0.48	0.59	0.67	0.76	0.85	0.98
9:30	0.26	0.31	0.39	0.46	0.56	0.64	0.73	0.82	0.94
10:00	0.25	0.30	0.37	0.44	0.54	0.62	0.70	0.78	0.90
10:30	0.24	0.28	0.36	0.43	0.52	0.59	0.67	0.75	0.87
11:00	0.23	0.27	0.35	0.41	0.50	0.57	0.65	0.73	0.83
11:30	0.22	0.26	0.33	0.39	0.48	0.55	0.62	0.70	0.80
12:00	0.22	0.26	0.32	0.38	0.47	0.53	0.60	0.67	0.77
13:00	0.20	0.24	0.30	0.36	0.44	0.50	0.56	0.63	0.73
14:00	0.19	0.23	0.29	0.34	0.41	0.47	0.53	0.59	0.68
15:00	0.18	0.21	0.27	0.32	0.39	0.44	0.50	0.56	0.64
16:00	0.17	0.20	0.26	0.30	0.37	0.42	0.47	0.53	0.61
17:00	0.16	0.19	0.24	0.29	0.35	0.40	0.45	0.50	0.58
18:00	0.16	0.19	0.23	0.27	0.33	0.38	0.43	0.48	0.55
19:00	0.15	0.18	0.22	0.26	0.32	0.36	0.41	0.46	0.53
20:00	0.14	0.17	0.21	0.25	0.30	0.35	0.39	0.44	0.50
21:00	0.14	0.16	0.21	0.24	0.29	0.33	0.38	0.42	0.48
22:00	0.13	0.16	0.20	0.23	0.28	0.32	0.36	0.40	0.46
23:00	0.13	0.15	0.19	0.22	0.27	0.31	0.35	0.39	0.45
24:00	0.13	0.15	0.18	0.22	0.26	0.30	0.34	0.38	0.43

Appendix B 847 Landfill Run-On and Run-Off Control System – HydroCAD Output Files



Subcat Reach Pond Link

Routing Diagram for 847 Landfill

Prepared by SCS Engineers, Printed 9/22/2021

Summary for Subcatchment SC1: Active Area Subcatchment 1

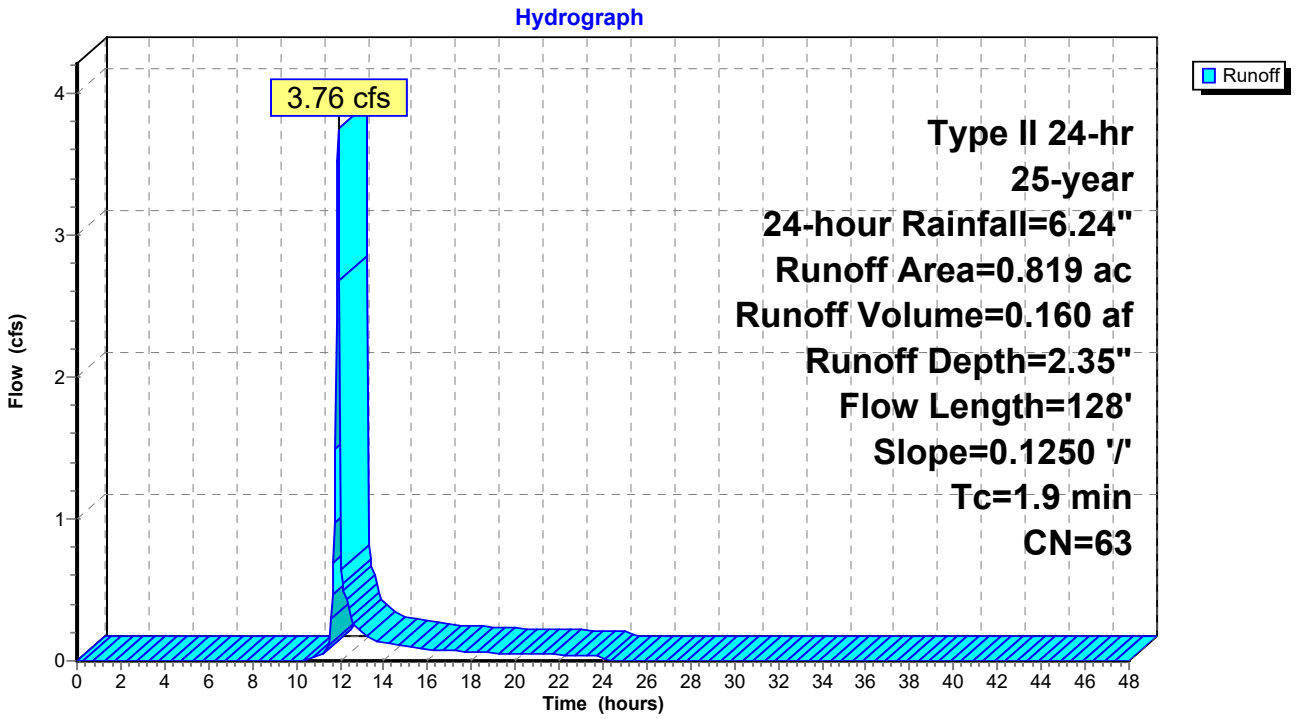
Runoff = 3.76 cfs @ 11.93 hrs, Volume= 0.160 af, Depth= 2.35"
Routed to Reach RD-1 : Run-Off Ditch 1

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

	Area (ac)	CN	Description
*	0.819	63	CCR Material, HSG C
	0.819		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	100	0.1250	0.90		**Sheet Flow,** Fallow n= 0.050 P2= 3.60"
0.1	28	0.1250	3.54		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
1.9	128	Total			

Subcatchment SC1: Active Area Subcatchment 1



Summary for Subcatchment SC2: Active Area Subcatchment 2

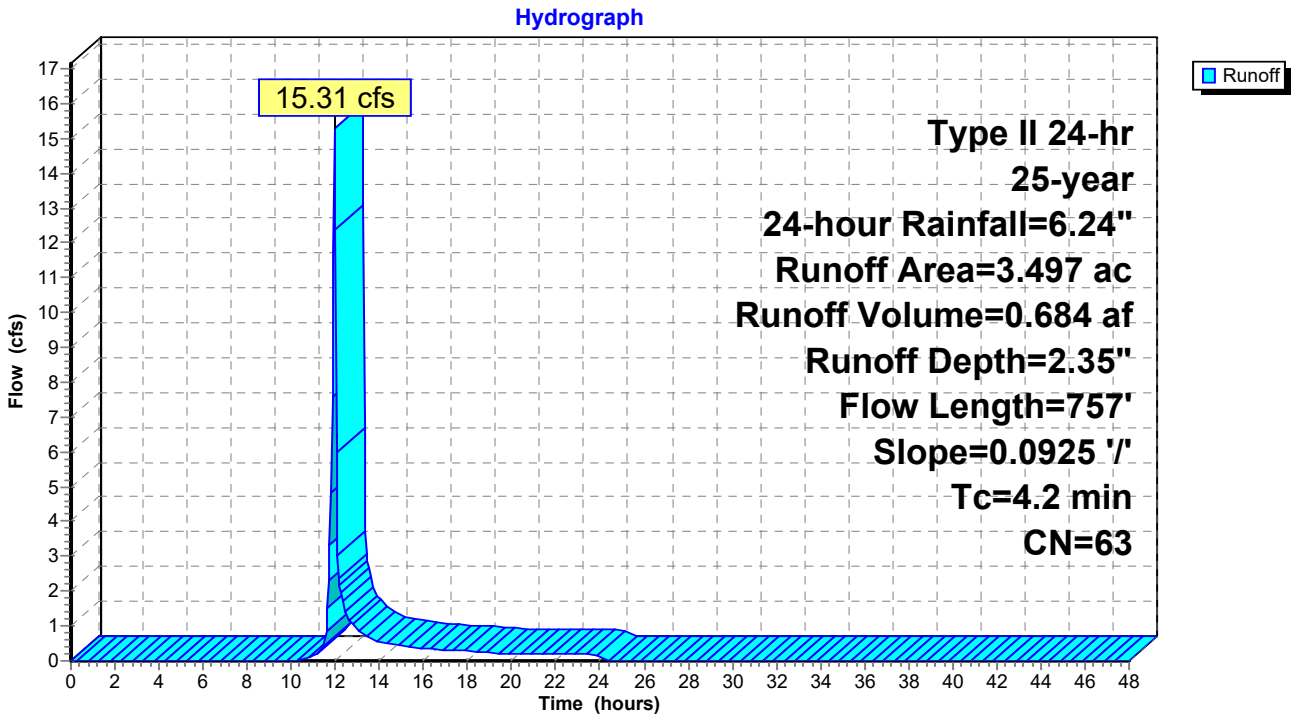
Runoff = 15.31 cfs @ 11.95 hrs, Volume= 0.684 af, Depth= 2.35"
Routed to Reach RD-2 : Run-Off Ditch 2

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

	Area (ac)	CN	Description
*	3.497	63	CCR Material, HSG C
	3.497		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	100	0.0925	2.69		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
3.6	657	0.0925	3.04		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
4.2	757	Total			

Subcatchment SC2: Active Area Subcatchment 2



Summary for Subcatchment SC3: Active Area Subcatchment 3

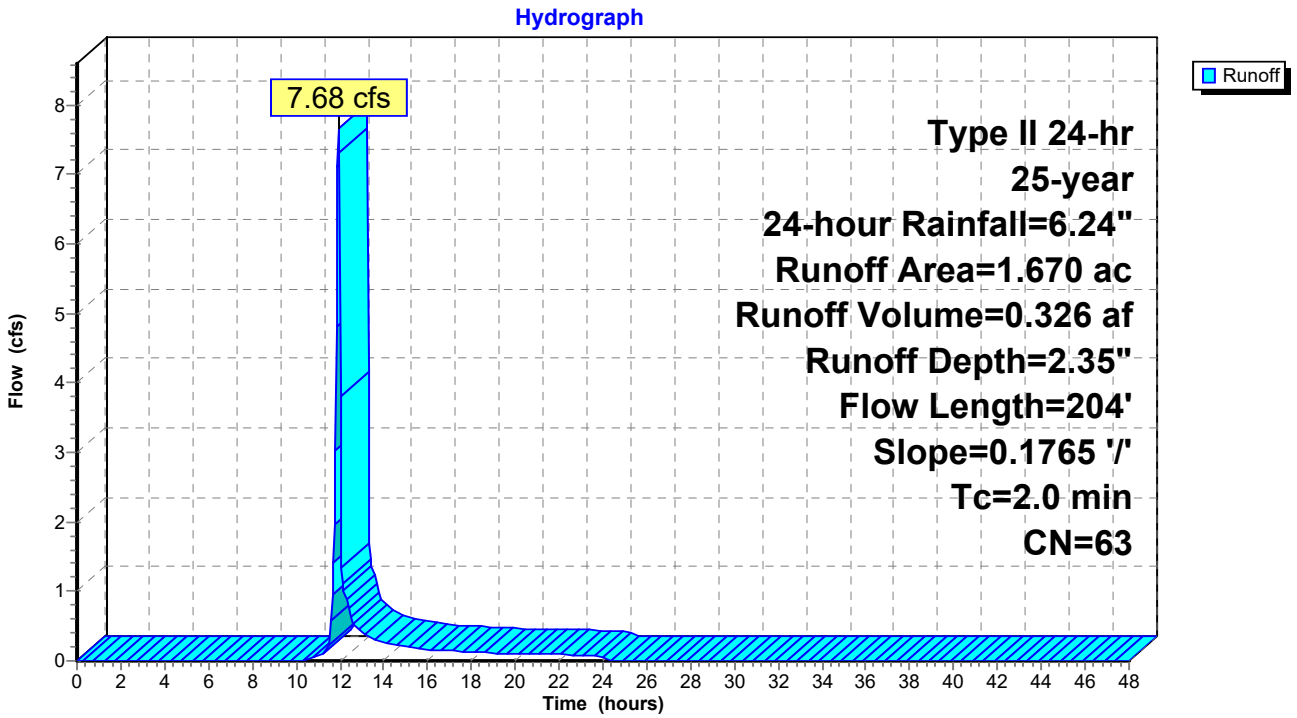
Runoff = 7.68 cfs @ 11.93 hrs, Volume= 0.326 af, Depth= 2.35"
Routed to Reach RD-3 : Run-Off Ditch 3

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

	Area (ac)	CN	Description
*	1.670	63	CCR Material, HSG C
	1.670		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.1765	1.04		**Sheet Flow,** Fallow n= 0.050 P2= 3.60"
0.4	104	0.1765	4.20		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
2.0	204	Total			

Subcatchment SC3: Active Area Subcatchment 3



Summary for Subcatchment SC4: Active Area Subcatchment 4

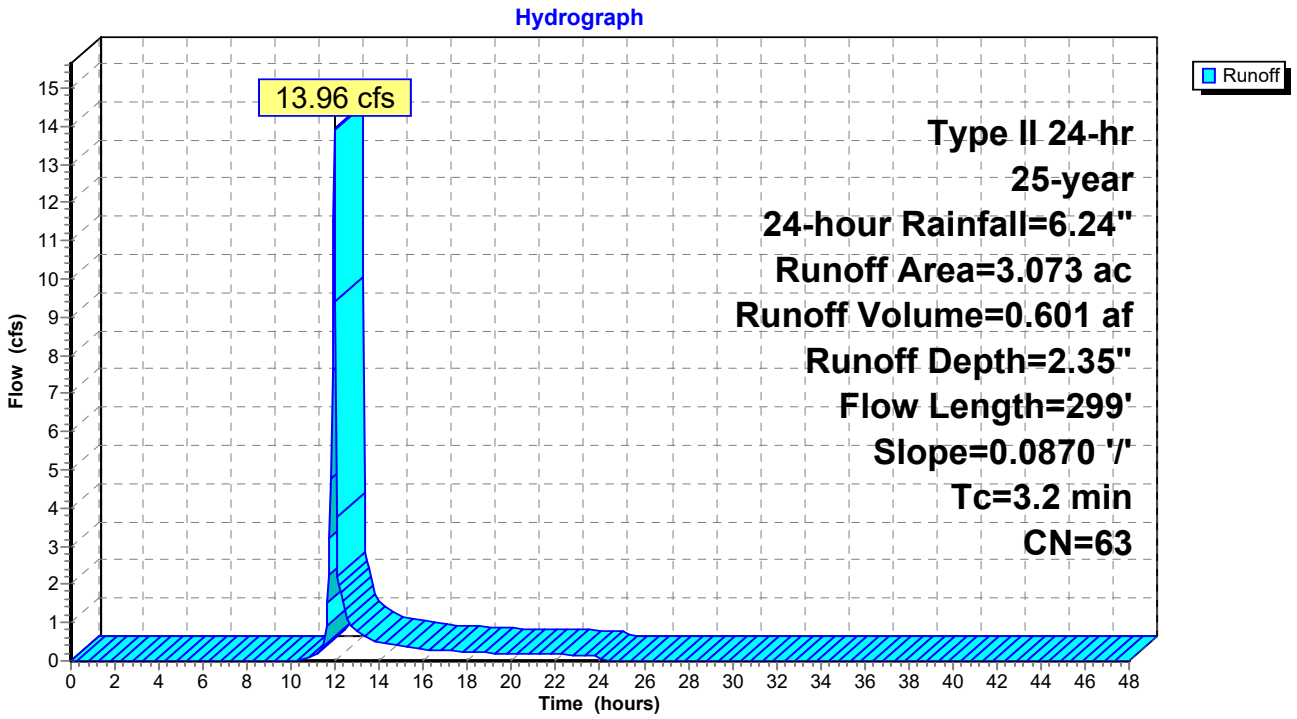
Runoff = 13.96 cfs @ 11.94 hrs, Volume= 0.601 af, Depth= 2.35"
Routed to Pond C4 : Cell 4

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

	Area (ac)	CN	Description
*	3.073	63	CCR Material, HSG C
	3.073		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	100	0.0870	0.78		**Sheet Flow,** Fallow n= 0.050 P2= 3.60"
1.1	199	0.0870	2.95		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
3.2	299	Total			

Subcatchment SC4: Active Area Subcatchment 4



Summary for Subcatchment SC5: Run-On Subcatchment 1

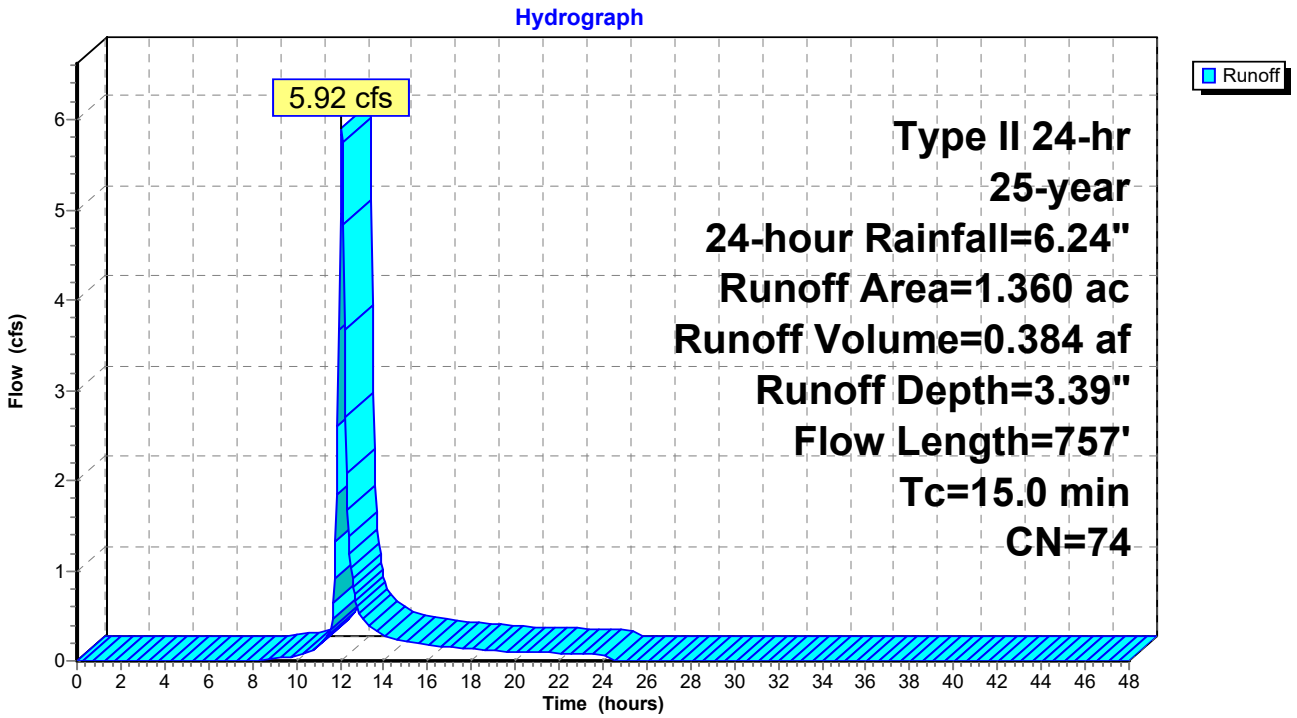
Runoff = 5.92 cfs @ 12.07 hrs, Volume= 0.384 af, Depth= 3.39"
Routed to Reach ROD-1 : Run-On Discharge Pipe

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

Area (ac)	CN	Description
1.360	74	>75% Grass cover, Good, HSG C
1.360		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	100	0.0300	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.60"
3.6	657	0.0925	3.04		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
15.0	757	Total			

Subcatchment SC5: Run-On Subcatchment 1



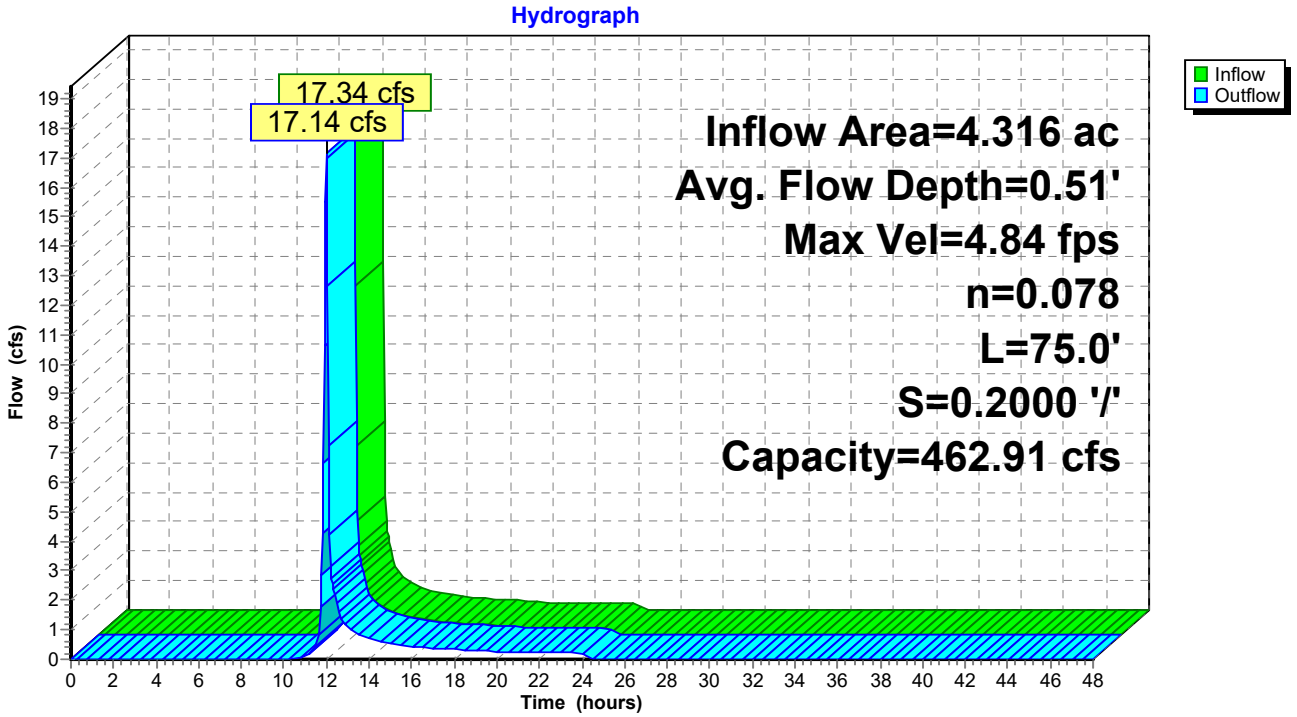
Summary for Reach DC-1: Downchute 1

Inflow Area = 4.316 ac, 0.00% Impervious, Inflow Depth = 2.35" for 25-year, 24-hour event
Inflow = 17.34 cfs @ 11.98 hrs, Volume= 0.844 af
Outflow = 17.14 cfs @ 11.99 hrs, Volume= 0.844 af, Atten= 1%, Lag= 0.4 min
Routed to Pond C4 : Cell 4

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.84 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.28 fps, Avg. Travel Time= 1.0 min

Peak Storage= 268 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.51' , Surface Width= 8.04'
Bank-Full Depth= 3.00' Flow Area= 36.0 sf, Capacity= 462.91 cfs

6.00' x 3.00' deep channel, n= 0.078 Riprap, 12-inch
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 75.0' Slope= 0.2000 '/'
Inlet Invert= 893.00', Outlet Invert= 878.00'



Summary for Reach RD-1: Run-Off Ditch 1

Inflow Area = 0.819 ac, 0.00% Impervious, Inflow Depth = 2.35" for 25-year, 24-hour event
Inflow = 3.76 cfs @ 11.93 hrs, Volume= 0.160 af
Outflow = 3.42 cfs @ 12.00 hrs, Volume= 0.160 af, Atten= 9%, Lag= 4.2 min
Routed to Reach RD-2 : Run-Off Ditch 2

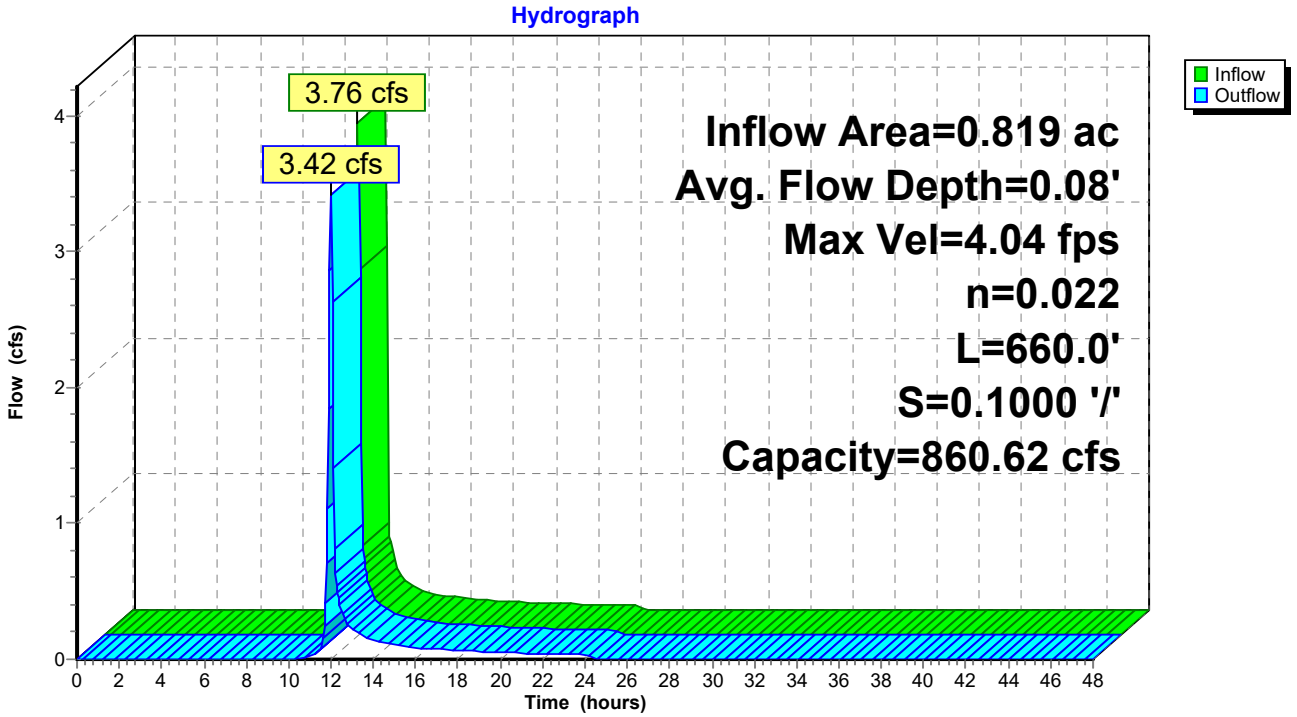
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.04 fps, Min. Travel Time= 2.7 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 6.8 min

Peak Storage= 568 cf @ 11.95 hrs
Average Depth at Peak Storage= 0.08' , Surface Width= 10.50'
Bank-Full Depth= 2.00' Flow Area= 32.0 sf, Capacity= 860.62 cfs

10.00' x 2.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 3.0 '/' Top Width= 22.00'
Length= 660.0' Slope= 0.1000 '/'
Inlet Invert= 964.00', Outlet Invert= 898.00'

‡

Reach RD-1: Run-Off Ditch 1



Summary for Reach RD-2: Run-Off Ditch 2

Inflow Area = 4.316 ac, 0.00% Impervious, Inflow Depth = 2.35" for 25-year, 24-hour event
Inflow = 18.25 cfs @ 11.96 hrs, Volume= 0.844 af
Outflow = 17.34 cfs @ 11.98 hrs, Volume= 0.844 af, Atten= 5%, Lag= 1.4 min
Routed to Reach DC-1 : Downchute 1

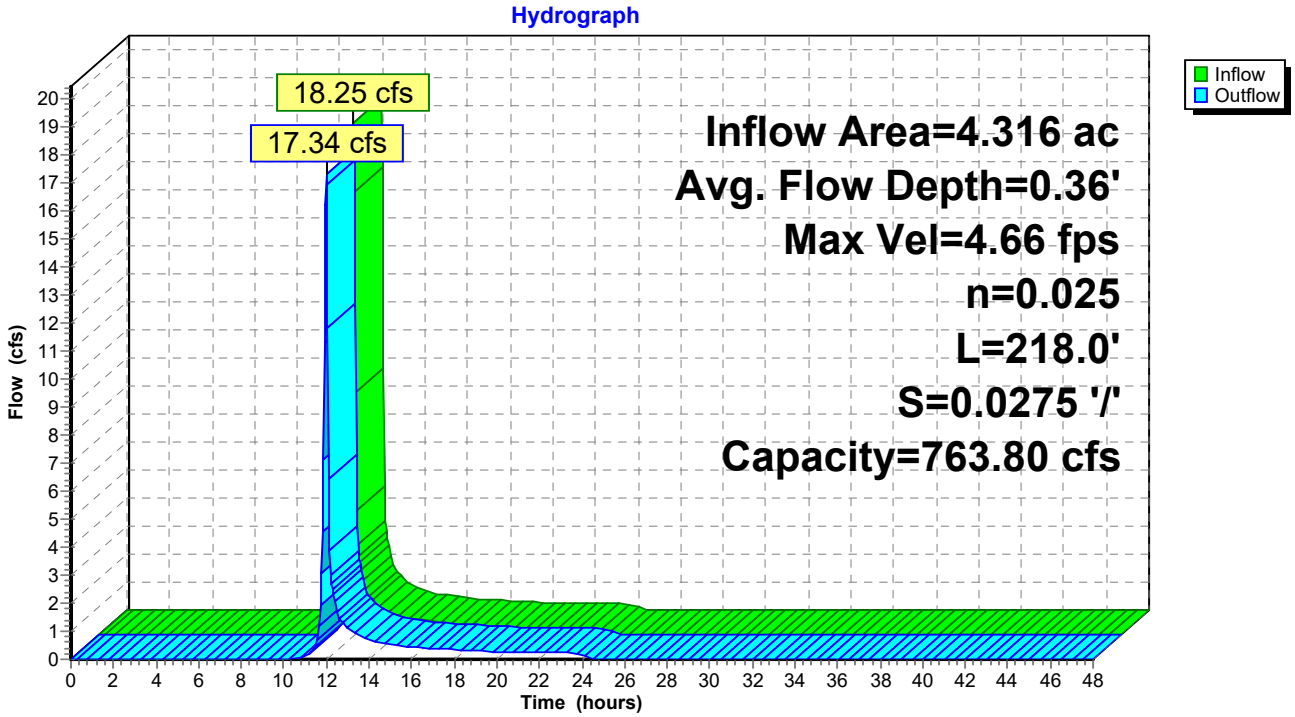
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.66 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.20 fps, Avg. Travel Time= 3.0 min

Peak Storage= 830 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.36' , Surface Width= 11.42'
Bank-Full Depth= 3.00' Flow Area= 48.0 sf, Capacity= 763.80 cfs

10.00' x 3.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 22.00'
Length= 218.0' Slope= 0.0275 '/'
Inlet Invert= 898.00', Outlet Invert= 892.00'

‡

Reach RD-2: Run-Off Ditch 2



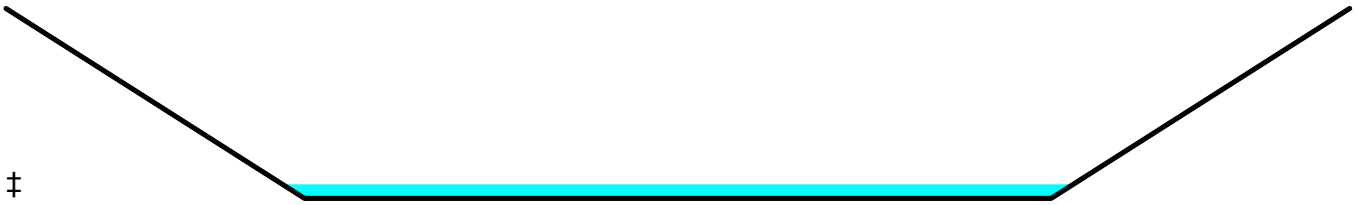
Summary for Reach RD-3: Run-Off Ditch 3

Inflow Area = 1.670 ac, 0.00% Impervious, Inflow Depth = 2.35" for 25-year, 24-hour event
Inflow = 7.68 cfs @ 11.93 hrs, Volume= 0.326 af
Outflow = 6.94 cfs @ 12.00 hrs, Volume= 0.326 af, Atten= 10%, Lag= 4.6 min
Routed to Pond C4 : Cell 4

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.59 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 1.35 fps, Avg. Travel Time= 10.4 min

Peak Storage= 1,283 cf @ 11.95 hrs
Average Depth at Peak Storage= 0.15' , Surface Width= 10.59'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 609.12 cfs

10.00' x 2.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 844.0' Slope= 0.0616 '/'
Inlet Invert= 920.00', Outlet Invert= 868.00'



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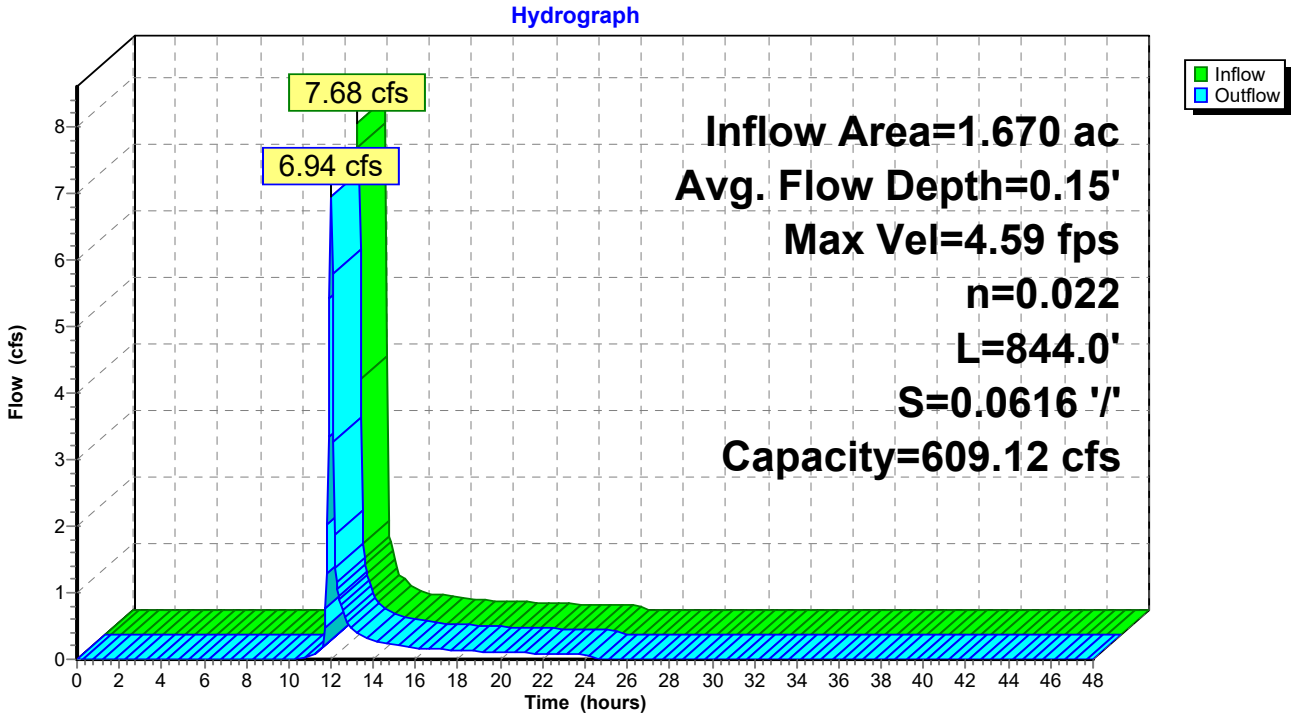
Reach RD-3: Run-Off Ditch 3



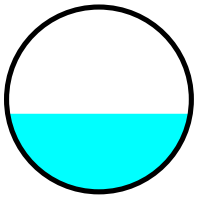
Summary for Reach ROD-1: Run-On Discharge Pipe

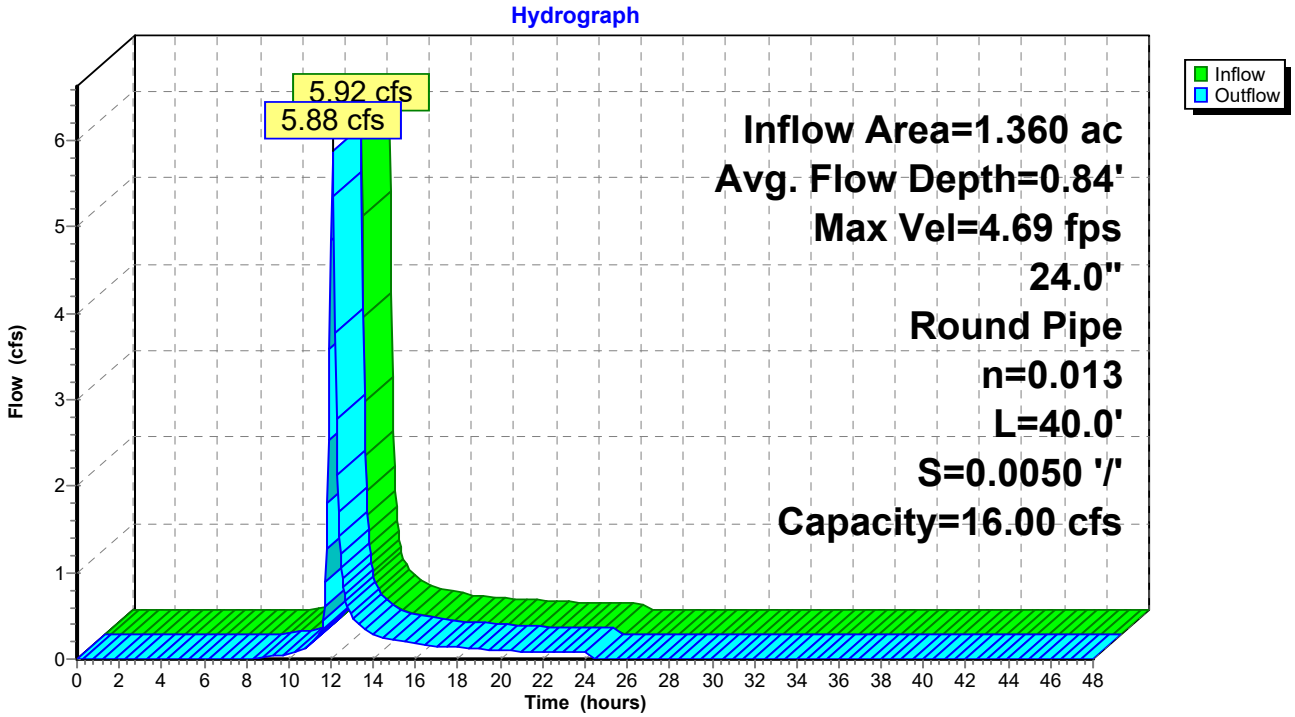
Inflow Area = 1.360 ac, 0.00% Impervious, Inflow Depth = 3.39" for 25-year, 24-hour event
Inflow = 5.92 cfs @ 12.07 hrs, Volume= 0.384 af
Outflow = 5.88 cfs @ 12.08 hrs, Volume= 0.384 af, Atten= 1%, Lag= 0.3 min
Routed to Link LP : Leachate Pond

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.69 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.57 fps, Avg. Travel Time= 0.4 min

Peak Storage= 50 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.84' , Surface Width= 1.97'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 16.00 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 40.0' Slope= 0.0050 '/'
Inlet Invert= 858.00', Outlet Invert= 857.80'





Summary for Pond C4: Cell 4

Inflow Area = 9.059 ac, 0.00% Impervious, Inflow Depth = 2.35" for 25-year, 24-hour event
Inflow = 35.49 cfs @ 11.97 hrs, Volume= 1.771 af
Outflow = 0.95 cfs @ 15.83 hrs, Volume= 1.770 af, Atten= 97%, Lag= 231.6 min
Primary = 0.95 cfs @ 15.83 hrs, Volume= 1.770 af
Routed to Link LP : Leachate Pond

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 867.88' @ 15.83 hrs Surf.Area= 44,301 sf Storage= 45,198 cf

Plug-Flow detention time= 573.9 min calculated for 1.770 af (100% of inflow)
Center-of-Mass det. time= 573.6 min (1,425.1 - 851.5)

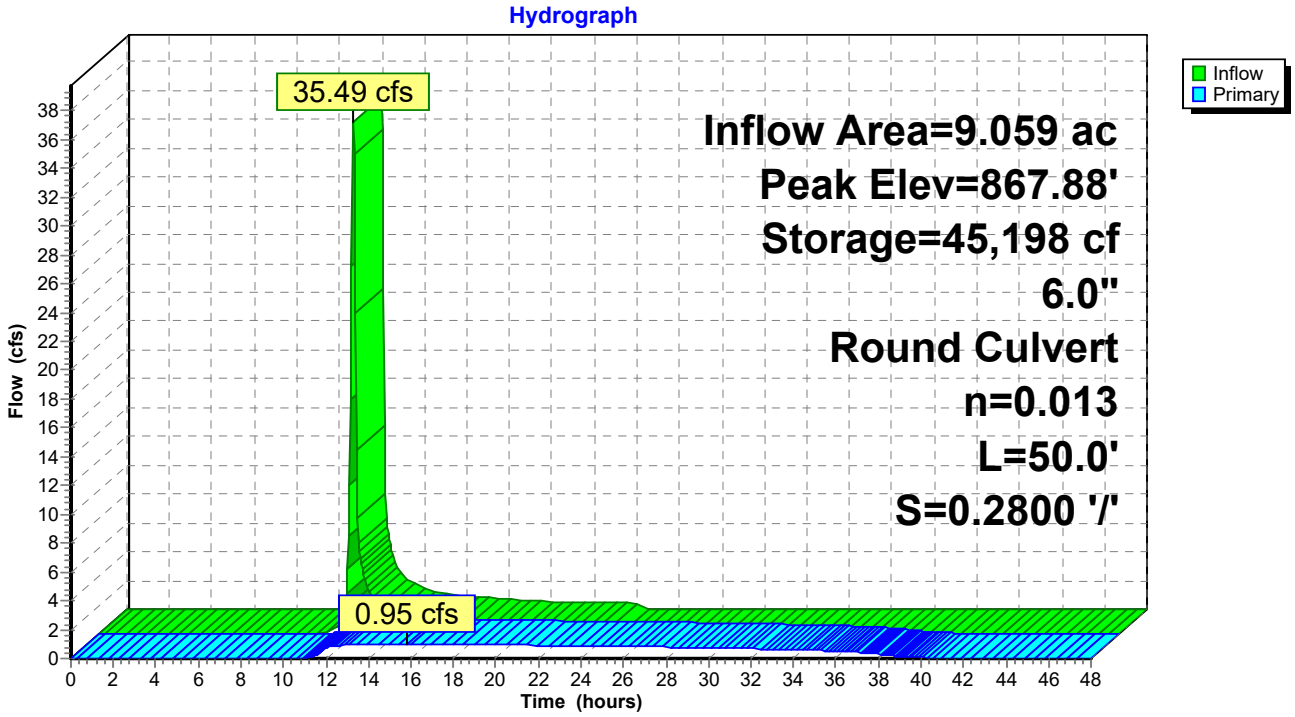
Volume	Invert	Avail.Storage	Storage Description
#1	866.00'	123,337 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
866.00	1,208	0	0
866.50	7,207	2,104	2,104
867.00	28,798	9,001	11,105
867.50	41,892	17,673	28,778
868.00	45,053	21,736	50,514
869.00	49,088	47,071	97,584
869.50	53,921	25,752	123,337

Device	Routing	Invert	Outlet Devices
#1	Primary	866.00'	**6.0" Round Cell 4 Pipe** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 866.00' / 852.00' S= 0.2800 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.95 cfs @ 15.83 hrs HW=867.88' (Free Discharge)
1=Cell 4 Pipe (Inlet Controls 0.95 cfs @ 4.85 fps)

Pond C4: Cell 4



Summary for Link LP: Leachate Pond

Inflow Area = 10.419 ac, 0.00% Impervious, Inflow Depth > 2.48" for 25-year, 24-hour event
Inflow = 6.72 cfs @ 12.08 hrs, Volume= 2.154 af
Primary = 6.72 cfs @ 12.08 hrs, Volume= 2.154 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link LP: Leachate Pond