HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

5 June 2020
File No. 129638-007

SUBJECT: Run-on and Run-off Control Plan – Revision 1
Associated Electric Cooperative, Inc.
New Madrid Power Plant – Utility Waste Landfill
New Madrid, MO

Haley & Aldrich, Inc. (Haley & Aldrich) was retained by Associated Electric Cooperative, Inc. (AECI) to develop this Run-on and Run-off Control Plan for the coal combustion residuals (CCR) Utility Waste Landfill (UWL) at the New Madrid Power Plant (NMPP) to comply with the requirements of the U.S. Environmental Protection Agency (USEPA) 40 CFR Parts 257 and 261 "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities" (CCR Rule) section §257.81. The existing conditions of the UWL active portion (Phase I and Phase III) run-on and run-off control system has been reviewed and associated stormwater modeling and analysis performed to meet the requirements of the Run-on and Run-off Control System Plan (Plan) requirement of CCR Rule Section §257.81 as described in the sections below. Once additional phases become active, this Plan will be updated accordingly.

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

§257.81(a)(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.

The UWL is located approximately 1.7 miles southwest of the New Madrid Power Plant, in New Madrid County, Missouri. Phase I and Phase III of the Landfill are currently active, as of the date of this Plan. The UWL was constructed with a perimeter berm around each side above existing grades. The perimeter berm, which also serves as an access road, is roughly 6 feet in height when measured to the existing topography outside of the UWL and prevents run-on to the active portion of the UWL. It is not feasible for the 24-hour, 25-year storm (6.62 inches) to flow over the berm and into the active portion of the UWL.

§257.81(a)(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.

Stormwater run-off from the UWL is managed by the perimeter berms. Phase I stormwater is conveyed in ditches that drain from a high point in the northeast corner of the UWL phase towards the low point in the southwest corner of the phase. Stormwater is then conveyed via a 24-inch CMP to the southeast corner of Phase III. A low area within the Phase I perimeter ditch (at the upstream end of the 24-inch CMP) exists to allow stormwater to be conveyed downstream without overtopping the ditch.

Similarly, Phase III stormwater is conveyed to the southwest corner of the phase. As the phase is filled with CCR, a perimeter ditch will be developed to convey stormwater, similar to Phase I existing conditions. Stormwater is collected in the southwest corner of the Phase III footprint, in accordance with the intended design, and passes through the landfill berm and into a clay-lined ditch via a 24-inch HDPE pipe. The ditch drains to the east and empties into a clay-lined sedimentation pond via a 24-inch HDPE pipe. Once the water enters the sedimentation pond, it can equilibrate via three (3) 24-inch HDPE pipes with another equally sized sedimentation pond. AECI maintains a water level in the ponds at approximately El. 281 by periodically pumping water to the existing CCR impoundments. AECI also pumps water to the existing CCR impoundments throughout large storm events to limit peak water surface elevations.

Haley & Aldrich analyzed the existing stormwater run-on and run-off for the UWL for the 24-hour, 25-year storm event in HydroCAD 10.00-15. The rainfall data for the analysis was obtained from NOAA Atlas 14 for the site. The rainfall for the 24-hour 25-year storm event was 6.62 inches. The Soil Conservation Service Type-II rainfall distribution pattern was used to distribute the total rainfall over a 24-hour period. Appendix A includes rainfall data used in the hydrologic model. The existing conditions and drainage areas for the unit are shown in Figure 1.

The results of the HydroCAD model are included in Appendix B. The results of the model indicate that the stormwater conveyance system for the UWL adequately handles the volume of the 24-hour, 25-year storm event. The pipe from the UWL footprint to the conveyance ditch and the pipe from the ditch to the sedimentation pond convey stormwater without causing a peak water surface elevation above the landfill and ditch berm elevations. Additionally, the sedimentation pond collects and controls the water volume resulting from the 24-hour, 25-year storm event below berm elevations.

§257.81(b): Run-off from the active portion of the CCR unit must be handled in accordance with the surface water requirement under §257.3-3.

§257.3-3(a): For purposes of section 4004(a) of the Act, a facility shall not cause a discharge of waters of the United States that is in violation of the requirements of the National Pollutant Discharge Elimination System (NPDES) under section 402 of the Clean Water Act, as amended.

§257.3-3(b): For purposes of section 4004(a) of the Act, a facility shall not cause a discharge of dredged material or fill material to waters of the United States that is in violation of the requirements under section 404 of the Clean Water Act, as amended.

§257.3-3(c): A facility or practice shall not cause non-point source pollution of waters of the United States that violates applicable legal requirements implementing an areawide or Statewide water quality management plan that has been approved by the Administrator under section 208 of the Clean Water Act, as amended.

Stormwater from the UWL is managed on-site for the 24-hour, 25-year storm event, and the only discharge from the sedimentation pond is pumped to existing CCR impoundments. Those impoundments either discharge via evaporation or through permitted NPDES outfalls.

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

This document and all attachments serve as an update to the initial Run-on and Run-off Control Plan and will be placed in the facility's operating record. Periodic Run-on and Run-off Control Plans will be prepared at 5-year increments or whenever determined necessary if there is a change in conditions that would affect the Plan.

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

The Run-on and Run-off Control Plan will be amended if conditions change that substantially affect the written plan in effect. Any amendments to the Plan will include written certification from a qualified professional engineer that any amendments to the Plan meet the requirements of the CCR Rule.

A record of amendments to the Plan will be tracked below. The latest version of the Run-on and Run-off Control Plan will be noted on the first page of the Plan.

Revision	Date	Description of Changes Made
0	16 October 2016	Initial Submittal
1	5 June 2020	Revision to account for Phase III filling activities

§257.81(c)(3): Timeframes for preparing the initial plan.

(i) Existing CCR landfills. The owner or operator of the CCR unit must prepare an initial run-on and run-off control system plan no later than October 17, 2016.

The initial Run-on and Run-off Control Plan was prepared within the specified time.

(ii) New CCR landfills and any lateral expansion of a CCR landfill. The owner or operator must prepare the initial run-on and run-off control system plan no later than the date of initial receipt of CCR in the CCR unit.

This Plan serves as an updated plan as Phase III of the landfill is actively receiving CCRs.

§257.81(c)(4): Frequency of revising the plan. The owner or operator of a CCR unit must prepare periodic run-on and run-off control system plans required by paragraph (c)(1) of this section every five years. The date of completing the initial plan is the basis for establishing the deadline to complete the first subsequent plan. The owner or operator may complete any required plan prior to the required deadline provided the owner or operator places the completed plan into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing a subsequent plan is based on the date of completing the previous plan. For purposes of this paragraph (c)(4), the owner or operator has completed a periodic run-on and run-off control system plan when the plan has been placed in the facility's operating record as required by §257.105(g)(3).

The Run-on and Run-off Control System Plan, or any subsequent Plan, will be assessed and amended whenever there is a change in operation of the CCR landfill that would substantially affect the Run-on and Run-off Control System Plan or when unanticipated events necessitate a revision of the Plan.

Professional Engineer Certification

§257.81(c)(5): The owner or operator must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is permitting authority stating that the initial and periodic run-on and run-off control system plans meet the requirements of this section.

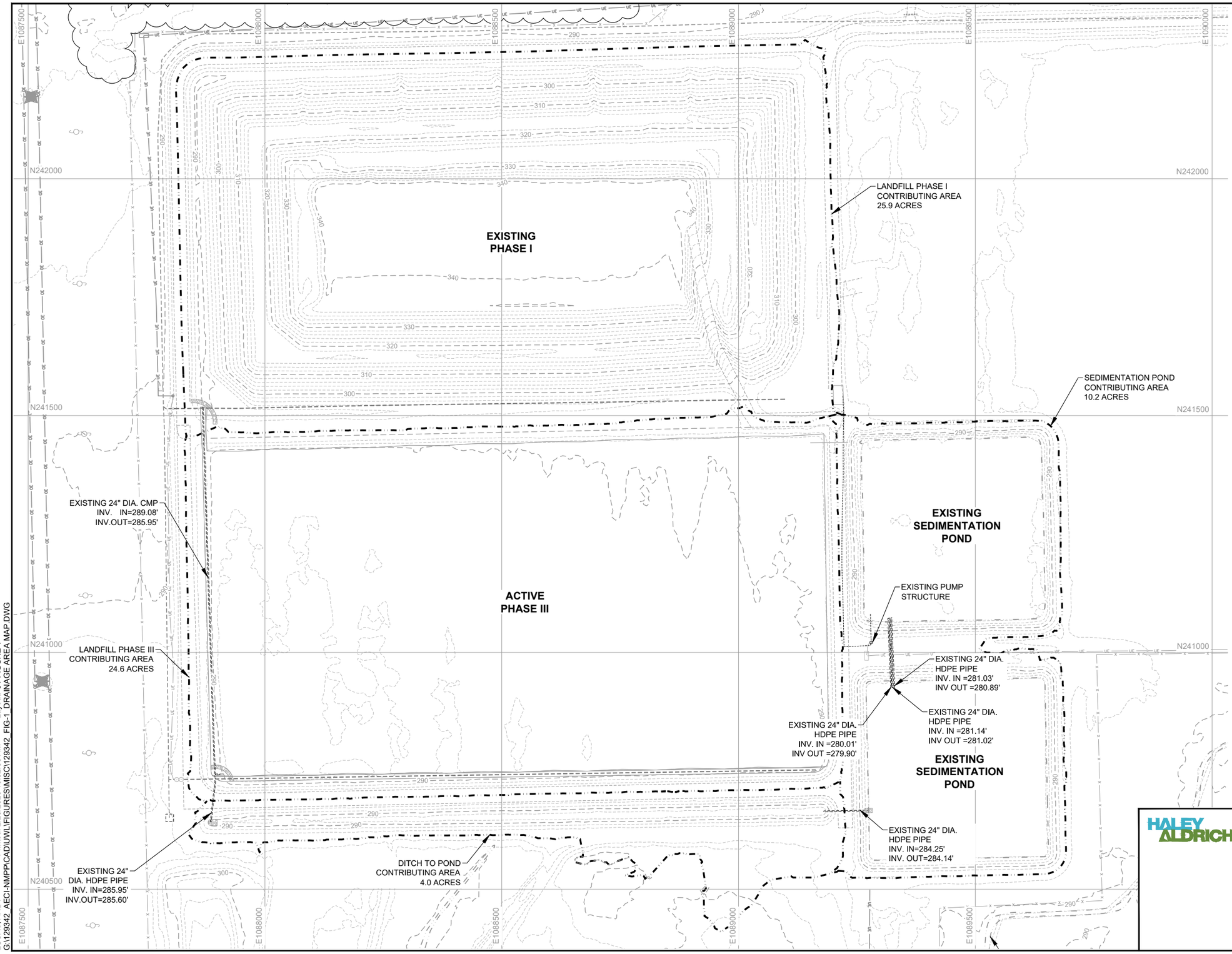
I certify that the above-referenced Run-on and Run-off Control System Plan for AECI's Utility Waste Landfill at the New Madrid Power Plant (NMPP) meets the USEPA's CCR Rule requirements of §257.81.

Signed:_____
Certifying Engineer

Print Name: Steven F. Putrich
Missouri License No.: 2014035813
Title: Project Principal
Company: Haley & Aldrich, Inc.

Professional Engineer's Seal:

Cc: Jenny Jones-AECI



LEGEND

- EXISTING GRAVEL ROAD
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- FINAL COVER MAJOR CONTOUR
- FINAL COVER MINOR CONTOUR
- EXISTING DRAINAGE DITCH
- EXISTING NORMAL WATER ELEVATION
- FENCE
- EXISTING UNDERGROUND ELECTRIC CABLES
- EXISTING LEACHATE PIPES
- EXISTING DRAINAGE PIPES
- DRAINAGE AREA BOUNDARY

NOTES

1. EXISTING TOPOGRAPHY PROVIDED BY HAMPTON, LENZINI, AND RENWICK AND PERFORMED JUNE 2019.
2. EXISTING CULVERT INFORMATION FROM "UTILITY WASTE LANDFILL PHASE III (CELL 2) RECORD PLAN" BY KOEHLER ENGINEERING AND LAND SURVEYING, INC., DATED 15 AUGUST 2017.

N

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SCALE IN FEET

HALEY ALDRICH

ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
UTILITY WASTE LANDFILL
NEW MADRID, MISSOURI

DRAINAGE AREA MAP

SCALE: AS SHOWN
FEBRUARY 2020

FIGURE 1

LUCAS, ANDY Printed: 2/26/2020 10:02:56 AM Layout: 01 FIGURE 1
G:\129342_AECI-NMPP\CAD\UWL\FIGURES\MISC\129342_FIG-1_DRAINAGE AREA MAP.DWG

Appendix A

NOAA Rainfall Data

NOAA Atlas 14, Volume 8, Version 2
Location name: Portageville, Missouri, US*
Latitude: 36.4945°, Longitude: -89.5877°
Elevation: 312 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.412 (0.329-0.515)	0.476 (0.379-0.596)	0.582 (0.462-0.729)	0.670 (0.530-0.842)	0.792 (0.609-1.02)	0.888 (0.668-1.15)	0.984 (0.719-1.29)	1.08 (0.762-1.45)	1.21 (0.825-1.66)	1.31 (0.873-1.81)
10-min	0.603 (0.481-0.754)	0.697 (0.556-0.872)	0.851 (0.677-1.07)	0.981 (0.776-1.23)	1.16 (0.891-1.49)	1.30 (0.978-1.68)	1.44 (1.05-1.90)	1.58 (1.12-2.12)	1.77 (1.21-2.42)	1.92 (1.28-2.65)
15-min	0.735 (0.587-0.920)	0.850 (0.678-1.06)	1.04 (0.826-1.30)	1.20 (0.946-1.50)	1.42 (1.09-1.82)	1.58 (1.19-2.05)	1.76 (1.28-2.31)	1.93 (1.36-2.59)	2.17 (1.47-2.96)	2.34 (1.56-3.23)
30-min	1.05 (0.840-1.32)	1.22 (0.974-1.53)	1.50 (1.19-1.88)	1.73 (1.37-2.17)	2.04 (1.57-2.62)	2.29 (1.72-2.97)	2.54 (1.85-3.34)	2.79 (1.96-3.74)	3.12 (2.13-4.26)	3.38 (2.25-4.66)
60-min	1.39 (1.11-1.74)	1.60 (1.28-2.00)	1.96 (1.56-2.46)	2.26 (1.79-2.84)	2.69 (2.07-3.46)	3.03 (2.28-3.93)	3.37 (2.47-4.45)	3.73 (2.63-5.01)	4.22 (2.88-5.77)	4.60 (3.06-6.35)
2-hr	1.73 (1.39-2.13)	1.98 (1.60-2.45)	2.42 (1.95-3.00)	2.79 (2.24-3.47)	3.33 (2.60-4.25)	3.76 (2.87-4.84)	4.21 (3.12-5.50)	4.68 (3.34-6.22)	5.32 (3.67-7.21)	5.82 (3.92-7.96)
3-hr	1.95 (1.59-2.39)	2.23 (1.81-2.74)	2.71 (2.20-3.34)	3.14 (2.53-3.87)	3.75 (2.95-4.76)	4.25 (3.27-5.44)	4.78 (3.57-6.21)	5.33 (3.84-7.07)	6.11 (4.24-8.24)	6.72 (4.55-9.13)
6-hr	2.38 (1.96-2.88)	2.71 (2.23-3.29)	3.29 (2.70-4.00)	3.81 (3.11-4.64)	4.56 (3.64-5.74)	5.19 (4.05-6.57)	5.85 (4.42-7.53)	6.55 (4.77-8.60)	7.54 (5.30-10.1)	8.32 (5.70-11.2)
12-hr	2.87 (2.39-3.43)	3.28 (2.73-3.93)	3.99 (3.31-4.78)	4.61 (3.81-5.55)	5.52 (4.46-6.85)	6.27 (4.95-7.84)	7.05 (5.39-8.97)	7.88 (5.81-10.2)	9.04 (6.43-12.0)	9.96 (6.90-13.3)
24-hr	3.40 (2.87-4.02)	3.92 (3.31-4.63)	4.79 (4.03-5.67)	5.54 (4.64-6.59)	6.62 (5.39-8.09)	7.48 (5.96-9.22)	8.37 (6.47-10.5)	9.30 (6.92-11.9)	10.6 (7.60-13.8)	11.6 (8.11-15.3)
2-day	3.98 (3.40-4.64)	4.61 (3.94-5.38)	5.67 (4.83-6.63)	6.56 (5.56-7.69)	7.80 (6.42-9.39)	8.78 (7.08-10.7)	9.78 (7.63-12.1)	10.8 (8.12-13.6)	12.2 (8.83-15.7)	13.2 (9.37-17.3)
3-day	4.37 (3.77-5.06)	5.06 (4.36-5.86)	6.20 (5.32-7.19)	7.16 (6.12-8.34)	8.51 (7.05-10.2)	9.56 (7.76-11.5)	10.6 (8.36-13.1)	11.7 (8.89-14.7)	13.2 (9.66-16.9)	14.4 (10.2-18.6)
4-day	4.68 (4.05-5.38)	5.40 (4.67-6.22)	6.60 (5.70-7.62)	7.62 (6.54-8.82)	9.04 (7.54-10.7)	10.2 (8.30-12.2)	11.3 (8.95-13.8)	12.5 (9.52-15.6)	14.1 (10.4-18.0)	15.3 (11.0-19.8)
7-day	5.40 (4.73-6.15)	6.19 (5.42-7.06)	7.53 (6.57-8.60)	8.68 (7.53-9.94)	10.3 (8.70-12.1)	11.6 (9.58-13.8)	12.9 (10.3-15.7)	14.3 (11.0-17.8)	16.2 (12.0-20.5)	17.7 (12.8-22.6)
10-day	6.07 (5.35-6.86)	6.92 (6.09-7.83)	8.35 (7.33-9.46)	9.57 (8.37-10.9)	11.3 (9.62-13.3)	12.7 (10.6-15.0)	14.2 (11.4-17.1)	15.7 (12.1-19.3)	17.7 (13.2-22.3)	19.3 (14.1-24.6)
20-day	8.17 (7.30-9.11)	9.15 (8.17-10.2)	10.8 (9.59-12.1)	12.1 (10.8-13.6)	14.1 (12.1-16.2)	15.6 (13.1-18.1)	17.1 (13.9-20.3)	18.6 (14.6-22.6)	20.7 (15.7-25.8)	22.4 (16.5-28.1)
30-day	9.98 (8.99-11.0)	11.1 (10.0-12.3)	12.9 (11.6-14.3)	14.4 (12.9-16.1)	16.5 (14.2-18.8)	18.0 (15.3-20.8)	19.6 (16.1-23.0)	21.1 (16.7-25.4)	23.2 (17.6-28.6)	24.7 (18.4-30.9)
45-day	12.3 (11.2-13.5)	13.6 (12.4-15.0)	15.8 (14.3-17.4)	17.5 (15.8-19.4)	19.8 (17.2-22.3)	21.5 (18.3-24.5)	23.1 (19.0-26.9)	24.7 (19.6-29.4)	26.6 (20.4-32.5)	28.1 (21.0-34.9)
60-day	14.2 (13.0-15.6)	15.8 (14.5-17.3)	18.3 (16.7-20.1)	20.3 (18.4-22.3)	22.8 (19.9-25.5)	24.6 (21.1-27.9)	26.3 (21.8-30.4)	28.0 (22.3-33.1)	29.9 (23.0-36.3)	31.3 (23.5-38.7)

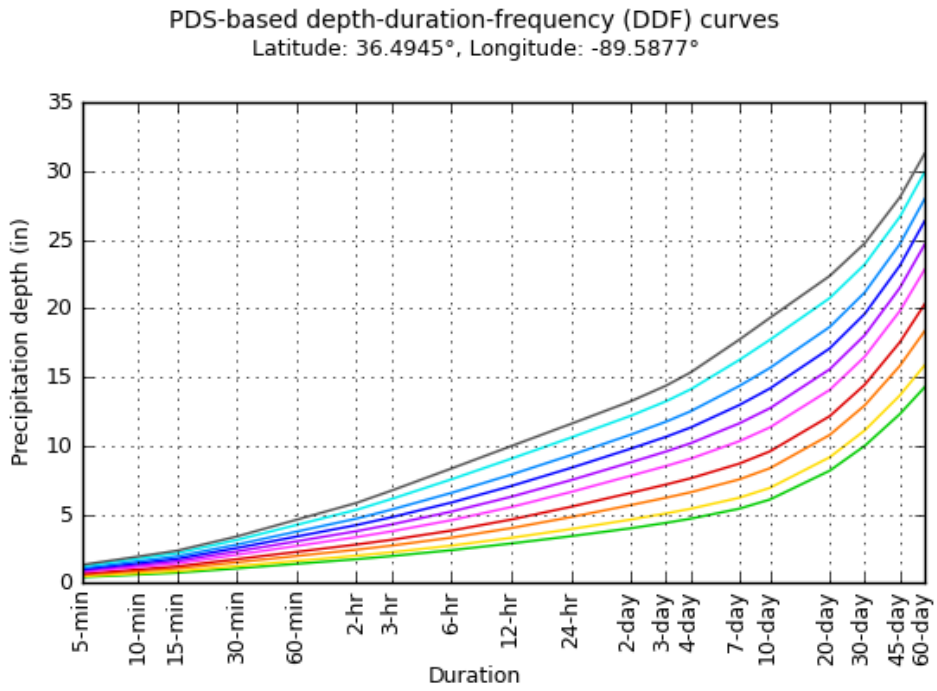
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

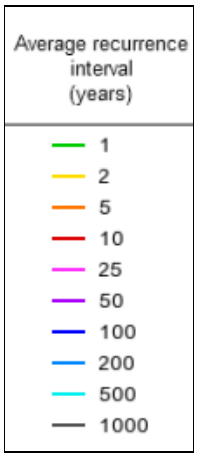
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

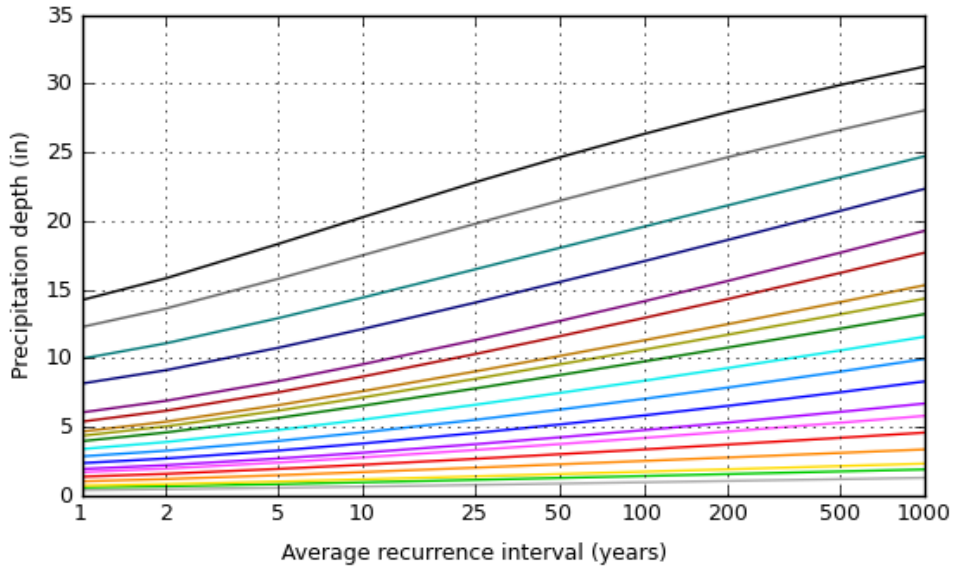
Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical







NOAA Atlas 14, Volume 8, Version 2

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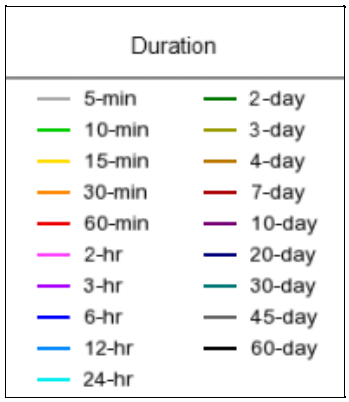
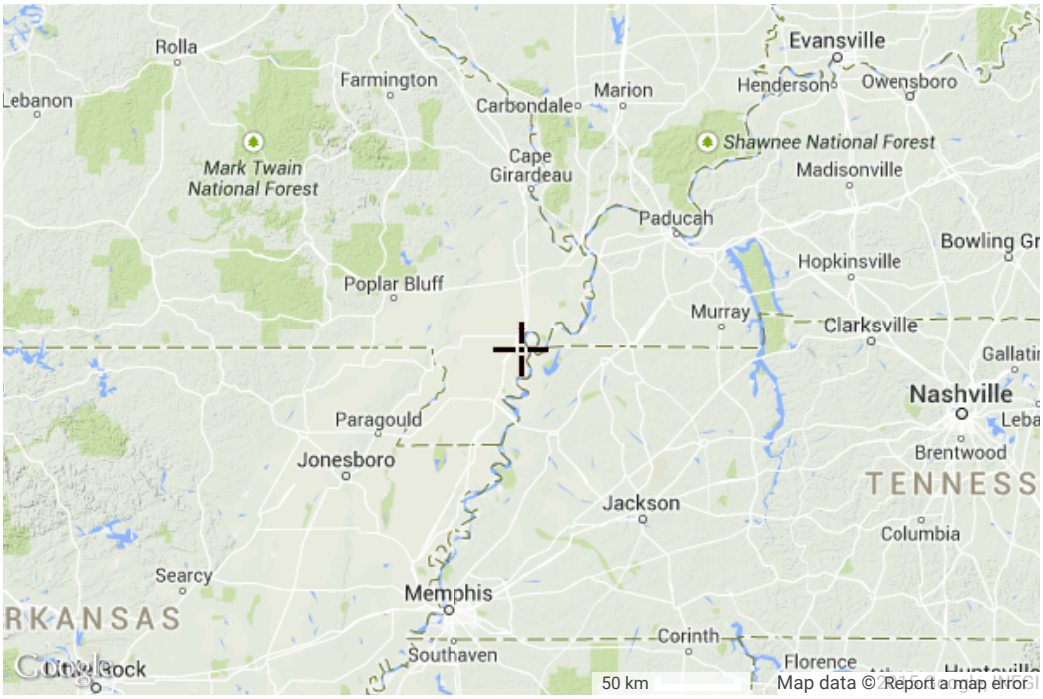


Back to Top

Maps & aerials

Small scale terrain



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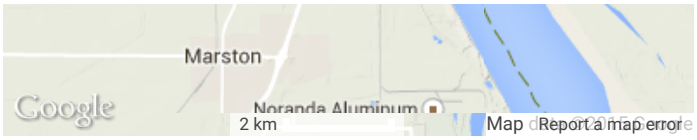


Large scale map

Large scale aerial

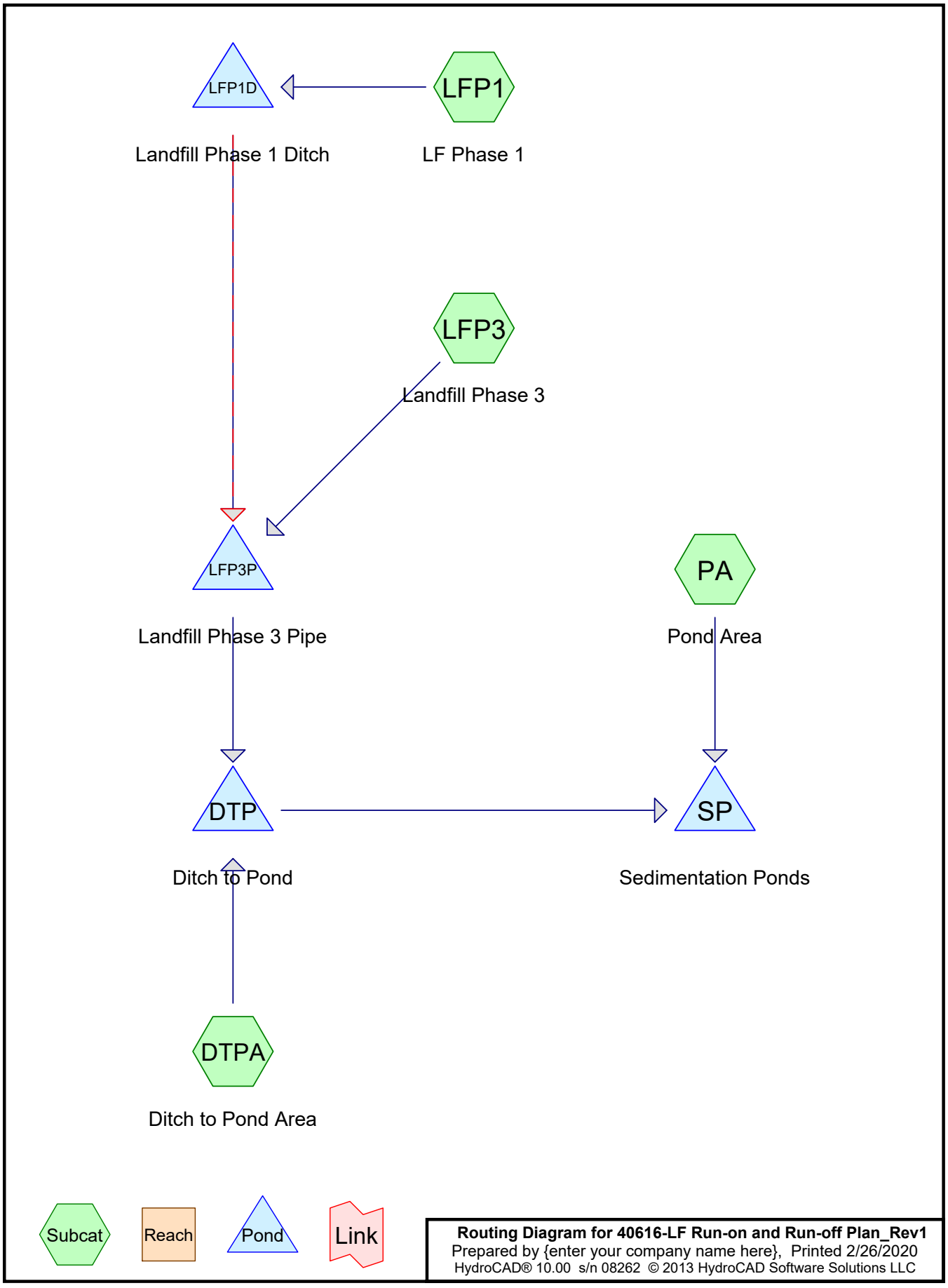
Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Appendix B

HydroCAD Results



Routing Diagram for 40616-LF Run-on and Run-off Plan_Rev1
Prepared by {enter your company name here}, Printed 2/26/2020

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
14.231	80	>75% Grass cover, Good, HSG D (DTPA, LFP1)
39.336	89	Open Landfill (LFP1, LFP3)
10.161	98	Water Surface, HSG A (PA)
63.728	**88**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
10.161	HSG A	PA
0.000	HSG B	
0.000	HSG C	
14.231	HSG D	DTPA, LFP1
39.336	Other	LFP1, LFP3
63.728		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	14.231	0.000	14.231	>75% Grass cover, Good	DTPA, LFP1
0.000	0.000	0.000	0.000	39.336	39.336	Open Landfill	LFP1, LFP3
10.161	0.000	0.000	0.000	0.000	10.161	Water Surface	PA
10.161	**0.000**	**0.000**	**14.231**	**39.336**	**63.728**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	DTP	284.25	284.14	91.9	0.0012	0.013	24.0	0.0	0.0
2	LFP1D	289.08	285.95	780.6	0.0040	0.025	24.0	0.0	0.0
3	LFP3P	285.95	285.60	92.9	0.0038	0.013	24.0	0.0	0.0

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DTPA: Ditch to Pond Area Runoff Area=173,692 sf 0.00% Impervious Runoff Depth=4.35"
Flow Length=52' Slope=0.0963 '/' Tc=2.8 min CN=80 Runoff=33.53 cfs 1.444 af

Subcatchment LFP1: LF Phase 1 Runoff Area=1,086,418 sf 0.00% Impervious Runoff Depth=4.89"
Flow Length=2,008' Tc=10.9 min CN=85 Runoff=174.92 cfs 10.164 af

Subcatchment LFP3: Landfill Phase 3 Runoff Area=1,073,287 sf 0.00% Impervious Runoff Depth=5.34"
Flow Length=1,953' Tc=69.8 min CN=89 Runoff=61.59 cfs 10.960 af

Subcatchment PA: Pond Area Runoff Area=442,603 sf 100.00% Impervious Runoff Depth=6.38"
Tc=0.0 min CN=98 Runoff=114.11 cfs 5.403 af

Pond DTP: Ditch to Pond Peak Elev=289.51' Storage=98,767 cf Inflow=48.06 cfs 22.567 af
24.0" Round Culvert n=0.013 L=91.9' S=0.0012 '/' Outflow=24.66 cfs 22.556 af

Pond LFP1D: Landfill Phase 1 Ditch Peak Elev=294.07' Storage=180,215 cf Inflow=174.92 cfs 10.164 af
Primary=8.50 cfs 5.054 af Secondary=72.26 cfs 5.110 af Outflow=78.49 cfs 10.164 af

Pond LFP3P: Landfill Phase 3 Pipe Peak Elev=294.26' Storage=205,830 cf Inflow=102.33 cfs 21.123 af
24.0" Round Culvert n=0.013 L=92.9' S=0.0038 '/' Outflow=27.66 cfs 21.123 af

Pond SP: Sedimentation Ponds Peak Elev=285.03' Storage=1,415,589 cf Inflow=129.58 cfs 27.959 af
Outflow=0.98 cfs 5.199 af

Total Runoff Area = 63.728 ac Runoff Volume = 27.970 af Average Runoff Depth = 5.27"
84.06% Pervious = 53.567 ac 15.94% Impervious = 10.161 ac

Summary for Subcatchment DTPA: Ditch to Pond Area

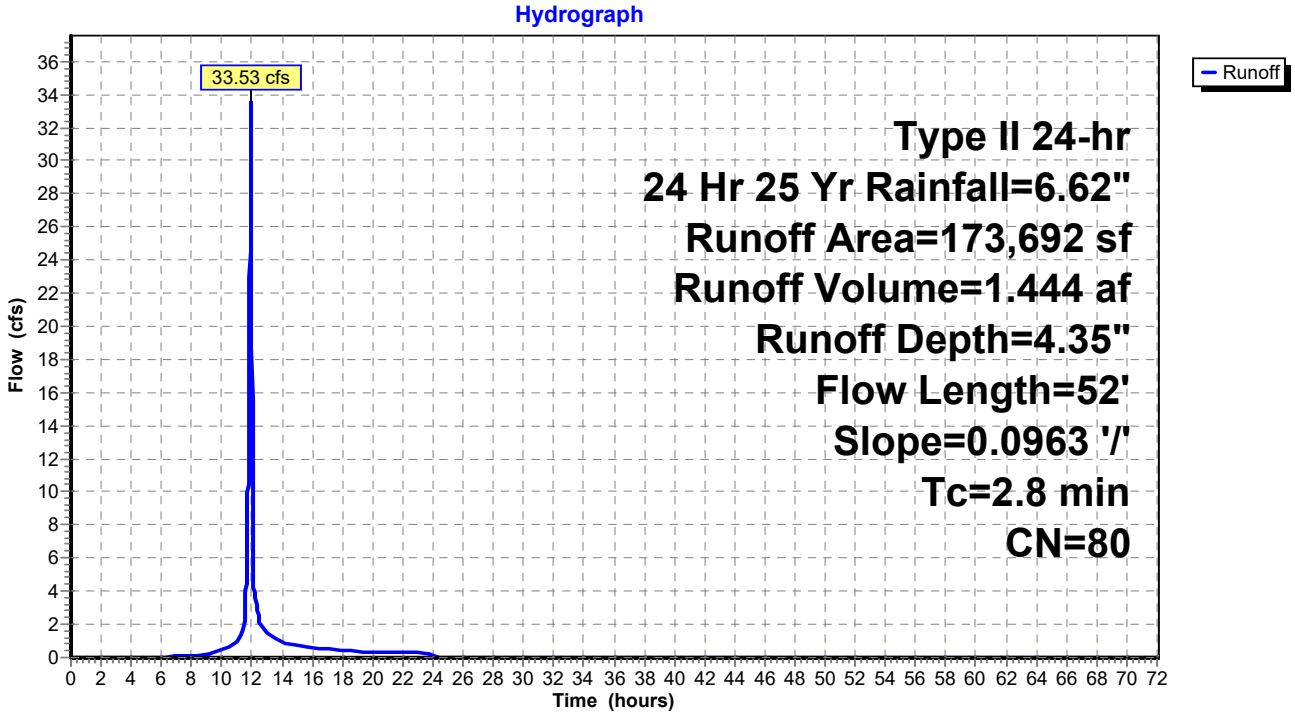
Runoff = 33.53 cfs @ 11.93 hrs, Volume= 1.444 af, Depth= 4.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 24 Hr 25 Yr Rainfall=6.62"

Area (sf)	CN	Description
173,692	80	>75% Grass cover, Good, HSG D
173,692		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	52	0.0963	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.92"

Subcatchment DTPA: Ditch to Pond Area



Summary for Subcatchment LFP1: LF Phase 1

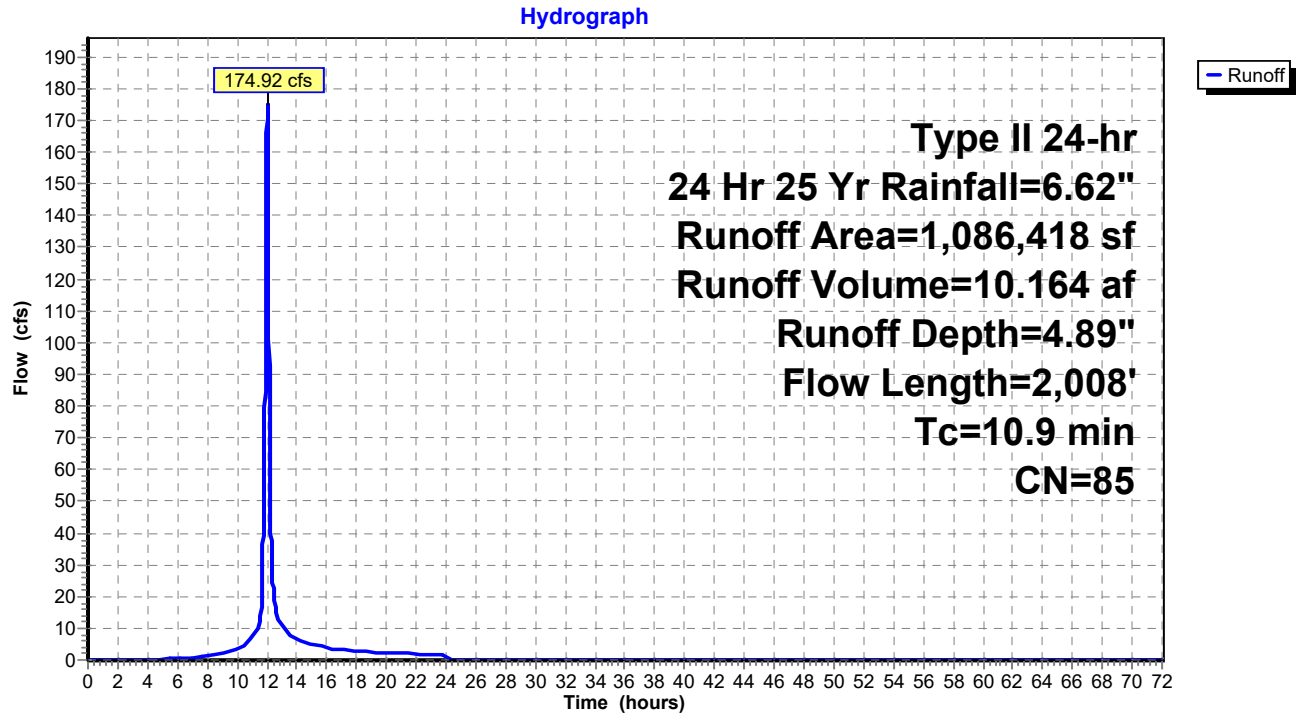
Runoff = 174.92 cfs @ 12.02 hrs, Volume= 10.164 af, Depth= 4.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 24 Hr 25 Yr Rainfall=6.62"

	Area (sf)	CN	Description
*	640,187	89	Open Landfill
	446,231	80	>75% Grass cover, Good, HSG D
	1,086,418	85	Weighted Average
	1,086,418		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	100	0.0100	1.15		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.92"
1.7	284	0.1655	2.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.8	1,624	0.0012	3.46	259.54	**Channel Flow,** Area= 75.0 sf Perim= 41.7' r= 1.80' n= 0.022 Earth, clean & straight
10.9	2,008	Total			

Subcatchment LFP1: LF Phase 1



Summary for Subcatchment LFP3: Landfill Phase 3

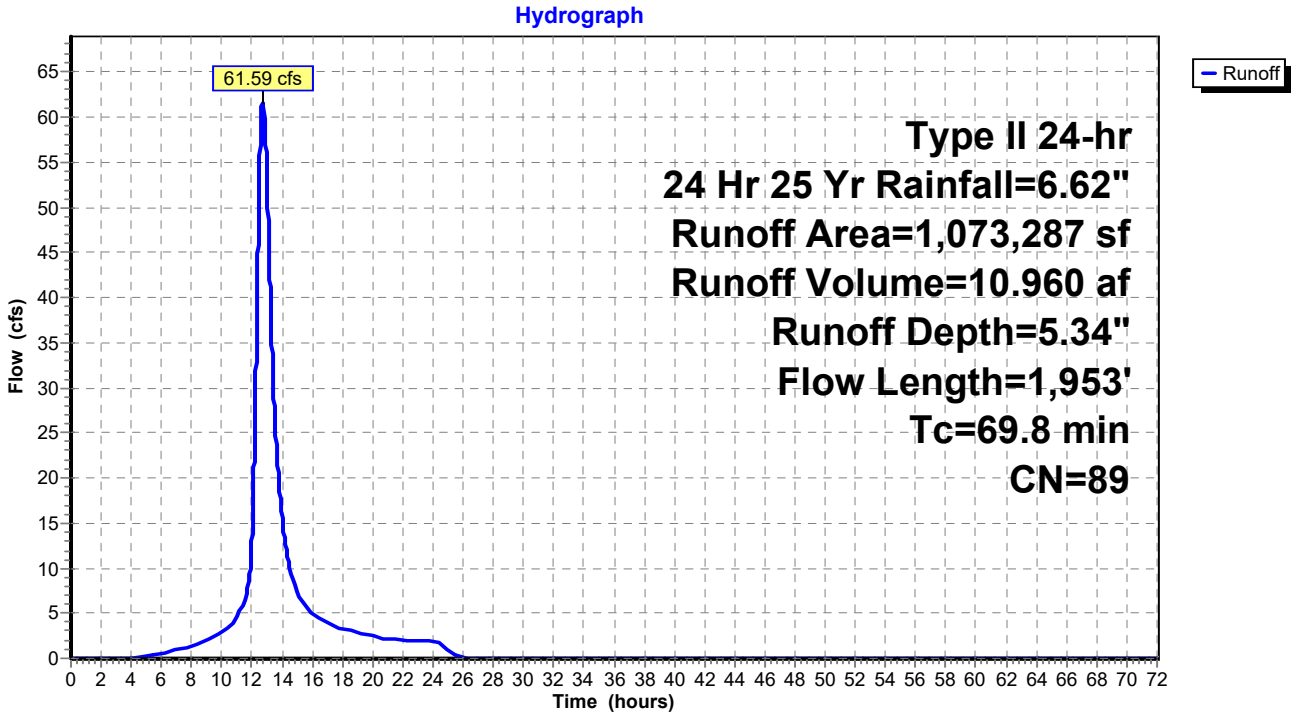
Runoff = 61.59 cfs @ 12.72 hrs, Volume= 10.960 af, Depth= 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 24 Hr 25 Yr Rainfall=6.62"

	Area (sf)	CN	Description
*	1,073,287	89	Open Landfill
	1,073,287		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	100	0.0530	2.25		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.92"
69.1	1,853	0.0020	0.45		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
69.8	1,953	Total			

Subcatchment LFP3: Landfill Phase 3



Summary for Subcatchment PA: Pond Area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

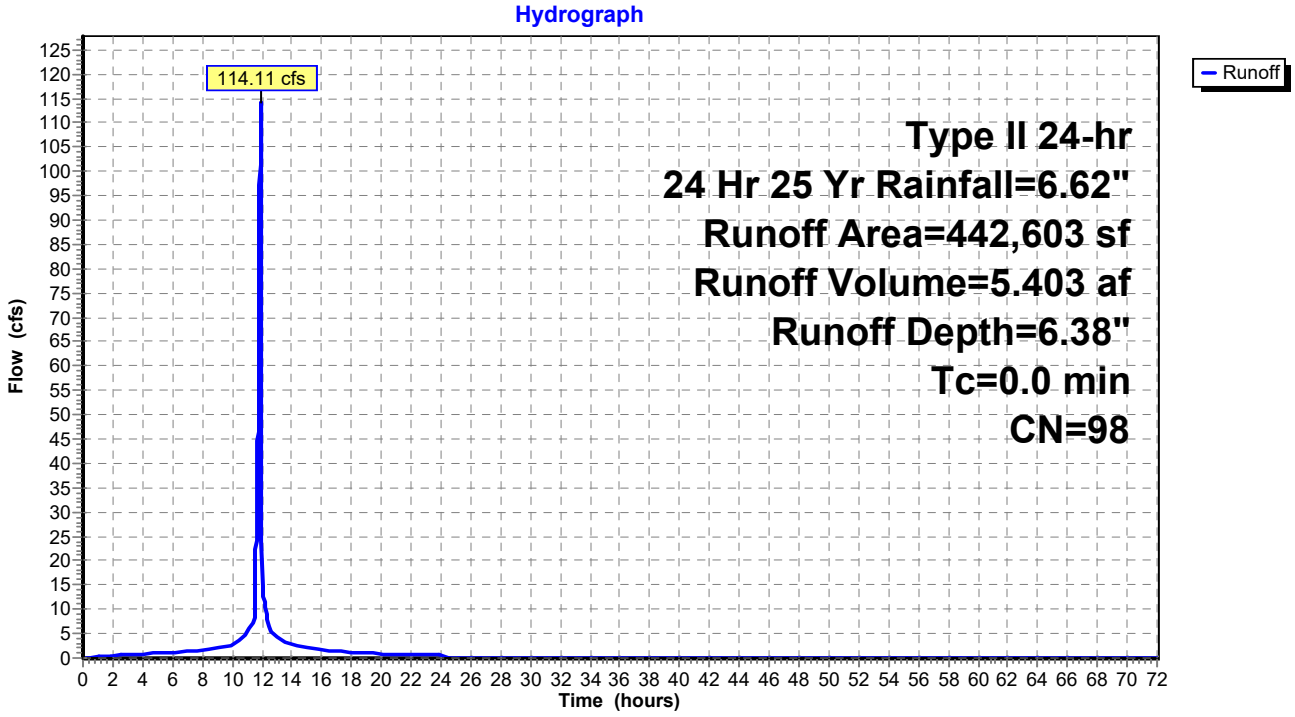
Runoff = 114.11 cfs @ 11.90 hrs, Volume= 5.403 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 24 Hr 25 Yr Rainfall=6.62"

Area (sf)	CN	Description
442,603	98	Water Surface, HSG A
442,603		100.00% Impervious Area

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

Subcatchment PA: Pond Area



Summary for Pond DTP: Ditch to Pond

Inflow Area = 53.567 ac, 0.00% Impervious, Inflow Depth = 5.06" for 24 Hr 25 Yr event
Inflow = 48.06 cfs @ 11.93 hrs, Volume= 22.567 af
Outflow = 24.66 cfs @ 15.96 hrs, Volume= 22.556 af, Atten= 49%, Lag= 241.7 min
Primary = 24.66 cfs @ 15.96 hrs, Volume= 22.556 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 289.51' @ 15.96 hrs Surf.Area= 39,368 sf Storage= 98,767 cf

Plug-Flow detention time= 51.5 min calculated for 22.556 af (100% of inflow)
Center-of-Mass det. time= 51.2 min (1,003.7 - 952.5)

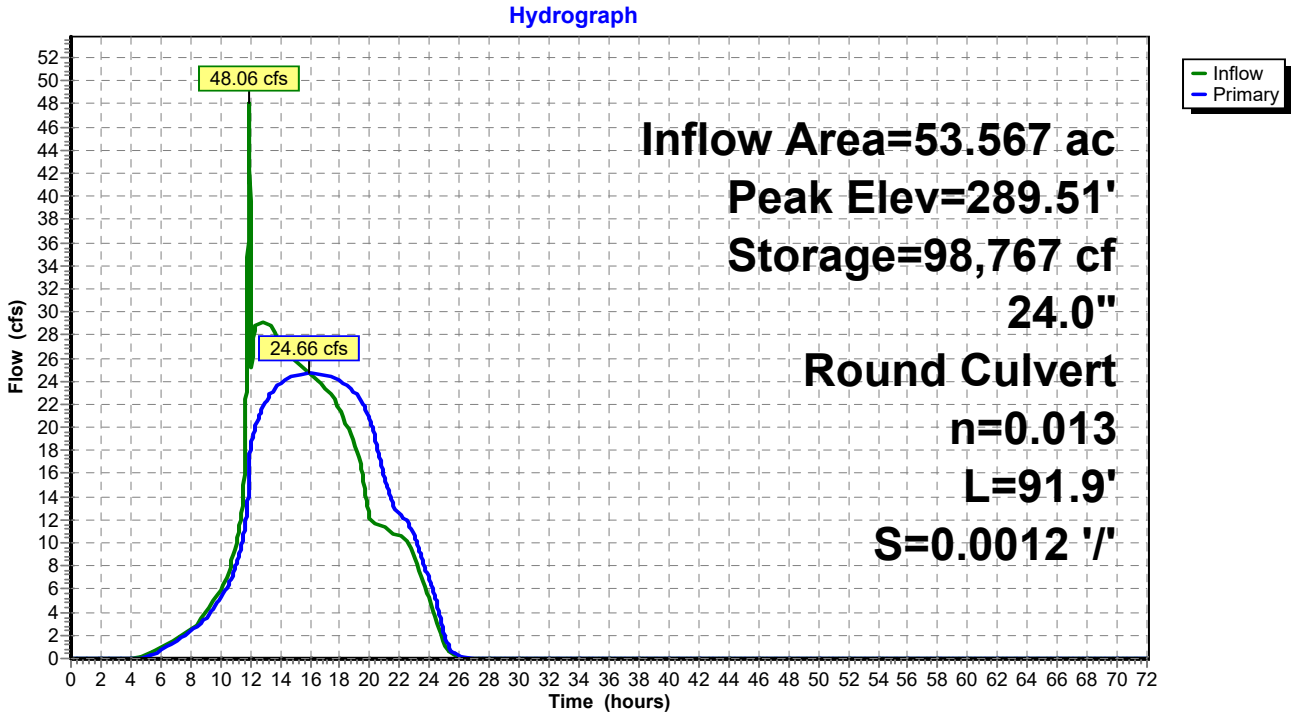
Volume	Invert	Avail.Storage	Storage Description
#1	284.00'	437,028 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
284.00	0	0	0
285.00	3,803	1,902	1,902
286.00	11,513	7,658	9,560
287.00	19,365	15,439	24,999
288.00	27,272	23,319	48,317
289.00	35,241	31,257	79,574
290.00	43,262	39,252	118,825
291.00	51,348	47,305	166,130
292.00	59,483	55,416	221,546
293.00	67,685	63,584	285,130
294.00	75,935	71,810	356,940
295.00	84,242	80,089	437,028

Device	Routing	Invert	Outlet Devices
#1	Primary	284.25'	**24.0" Round Culvert** L= 91.9' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 284.25' / 284.14' S= 0.0012 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=24.66 cfs @ 15.96 hrs HW=289.51' TW=283.18' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 24.66 cfs @ 7.85 fps)

Pond DTP: Ditch to Pond



Summary for Pond LFP1D: Landfill Phase 1 Ditch

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=4)

Inflow Area = 24.941 ac, 0.00% Impervious, Inflow Depth = 4.89" for 24 Hr 25 Yr event
Inflow = 174.92 cfs @ 12.02 hrs, Volume= 10.164 af
Outflow = 78.49 cfs @ 12.16 hrs, Volume= 10.164 af, Atten= 55%, Lag= 8.0 min
Primary = 8.50 cfs @ 22.09 hrs, Volume= 5.054 af
Secondary = 72.26 cfs @ 12.16 hrs, Volume= 5.110 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 294.07' @ 14.16 hrs Surf.Area= 93,285 sf Storage= 180,215 cf

Plug-Flow detention time= 165.8 min calculated for 10.162 af (100% of inflow)
Center-of-Mass det. time= 165.8 min (964.3 - 798.5)

Volume	Invert	Avail.Storage	Storage Description
#1	289.08'	223,814 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

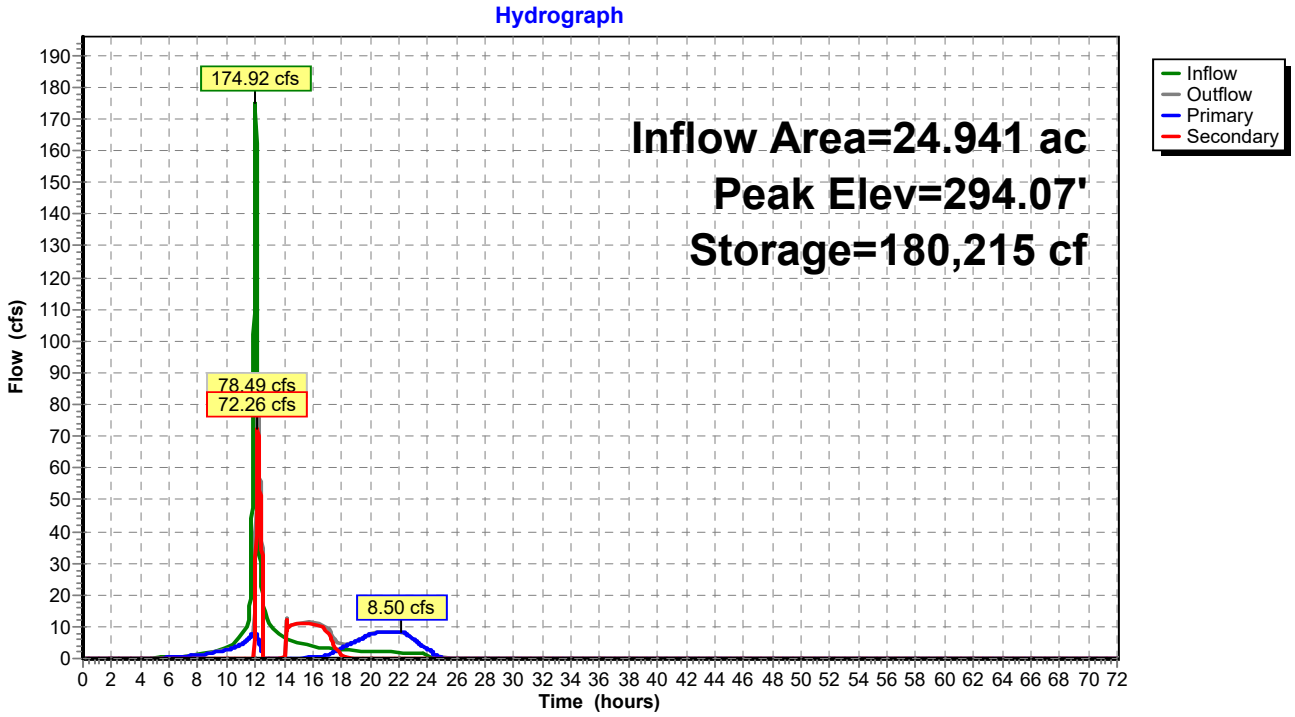
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
289.08	0	0	0
290.00	4,971	2,287	2,287
291.00	21,446	13,209	15,495
292.00	38,785	30,116	45,611
293.00	63,411	51,098	96,709
294.00	90,453	76,932	173,641
294.50	110,240	50,173	223,814

Device	Routing	Invert	Outlet Devices
#1	Primary	289.08'	**24.0" Round Culvert** L= 780.6' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 289.08' / 285.95' S= 0.0040 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf
#2	Secondary	293.00'	**40.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=8.50 cfs @ 22.09 hrs HW=291.62' TW=287.85' (Dynamic Tailwater)
1=Culvert (Barrel Controls 8.50 cfs @ 2.75 fps)

Secondary OutFlow Max=72.25 cfs @ 12.16 hrs HW=293.78' TW=291.57' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Weir Controls 72.25 cfs @ 2.33 fps)

Pond LFP1D: Landfill Phase 1 Ditch



Summary for Pond LFP3P: Landfill Phase 3 Pipe

Assumed least amount of stormwater storage in Phase III (as landfill cell is filled) will be equal to existing conditions in Phase I.

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[80] Warning: Exceeded Pond LFP1D by 0.41' @ 13.25 hrs (2.62 cfs 0.259 af)
[80] Warning: Exceeded Pond LFP1D by 0.41' @ 13.25 hrs (104.63 cfs 9.968 af)

Inflow Area = 49.580 ac, 0.00% Impervious, Inflow Depth = 5.11" for 24 Hr 25 Yr event
Inflow = 102.33 cfs @ 12.18 hrs, Volume= 21.123 af
Outflow = 27.66 cfs @ 13.11 hrs, Volume= 21.123 af, Atten= 73%, Lag= 55.4 min
Primary = 27.66 cfs @ 13.11 hrs, Volume= 21.123 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 294.26' @ 13.50 hrs Surf.Area= 100,567 sf Storage= 205,830 cf

Plug-Flow detention time= 62.4 min calculated for 21.120 af (100% of inflow)
Center-of-Mass det. time= 62.4 min (962.6 - 900.2)

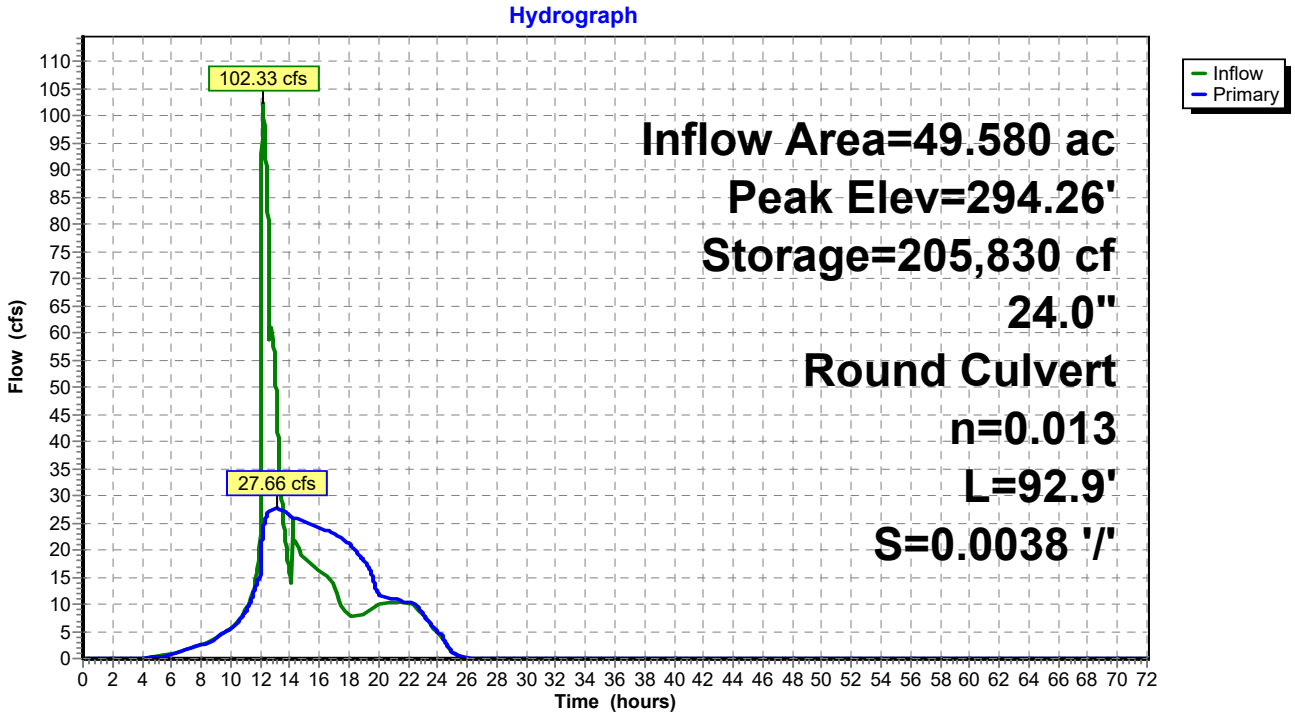
Volume	Invert	Avail.Storage	Storage Description
#1	285.95'	231,594 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
285.95	0	0	0
290.00	4,971	10,066	10,066
291.00	21,446	13,209	23,275
292.00	38,785	30,116	53,390
293.00	63,411	51,098	104,488
294.00	90,453	76,932	181,420
294.50	110,240	50,173	231,594

Device	Routing	Invert	Outlet Devices
#1	Primary	285.95'	**24.0" Round Culvert** L= 92.9' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 285.95' / 285.60' S= 0.0038 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=27.64 cfs @ 13.11 hrs HW=294.14' TW=288.78' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 27.64 cfs @ 8.80 fps)

Pond LFP3P: Landfill Phase 3 Pipe



Summary for Pond SP: Sedimentation Ponds

Phase I and Phase III Sedimentation Ponds connected by three 24-in. dia. equalization pipes.

Inflow Area = 63.728 ac, 15.94% Impervious, Inflow Depth = 5.26" for 24 Hr 25 Yr event
Inflow = 129.58 cfs @ 11.90 hrs, Volume= 27.959 af
Outflow = 0.98 cfs @ 25.32 hrs, Volume= 5.199 af, Atten= 99%, Lag= 805.4 min
Primary = 0.98 cfs @ 25.32 hrs, Volume= 5.199 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Starting Elev= 281.00' Surf.Area= 267,895 sf Storage= 263,008 cf
Peak Elev= 285.03' @ 25.32 hrs Surf.Area= 304,105 sf Storage= 1,415,589 cf (1,152,581 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 1,433.9 min (2,385.5 - 951.6)

Volume	Invert	Avail.Storage	Storage Description
#1	279.50'	4,526,674 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
279.50	127,449	0	0
280.00	129,597	64,262	64,262
281.00	267,895	198,746	263,008
282.00	276,705	272,300	535,308
283.00	285,626	281,166	816,473
284.00	294,661	290,144	1,106,617
285.00	303,808	299,235	1,405,851
286.00	313,069	308,439	1,714,290
287.00	322,441	317,755	2,032,045
288.00	331,928	327,185	2,359,229
289.00	341,525	336,727	2,695,956
290.00	351,239	346,382	3,042,338
291.00	361,061	356,150	3,398,488
292.00	371,001	366,031	3,764,519
293.00	381,048	376,025	4,140,543
294.00	391,214	386,131	4,526,674

Device	Routing	Invert	Outlet Devices
#1	Primary	281.10'	**Pump** Discharges@307.00' Turns Off@281.00' 6.0" Diam. x 8,413.0' Long Discharge, Hazen-Williams C= 140 Flow (gpm)= 100.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 Head (feet)= 156.00 154.00 150.00 144.00 137.00 122.00 105.00 72.00 -Loss (feet)= 7.65 27.62 58.52 99.70 150.72 211.25 281.04 359.88 =Lift (feet)= 148.35 126.38 91.48 44.30 -13.72 -89.25 -176.04 -287.88

Primary OutFlow Max=0.98 cfs @ 25.32 hrs HW=285.03' (Free Discharge)
└**1=Pump** (Pump Controls 0.98 cfs)

Pond SP: Sedimentation Ponds