

Technical Memorandum (Our Lady of the Presentation Parking Lot Expansion)

To: City of Lee's Summit

Attn: _____

From: HG Consult (Matthew Castor)

Date: June 16, 2023

Re: Detention Pond Calculations

Introduction

The purpose of the study was to analyze the hydrology/hydraulics of the Our Lady of the Presentation Parking Lot Expansion and determine detention pond sizes in accordance with APWA 5600 (Stormwater Detention and Retention) and City of Lee's Summit requirements.

The subject property is a platted parcel located on the west side of Murray Road approximately 650' south of NW O'Brien Road (130 NW Murray Road). The parcel is developed and is currently zoned RP-4 per the city's zoning map. The existing parking lot is unable to accommodate the needs of the church and therefore they would like to add 56 additional parking spaces and 21,350.78 SF of pavement. Detention is being proposed via a dry detention pond located on the west side of the proposed parking lot to capture the runoff from the proposed improvements and the undeveloped area to the west. The allowable discharge is calculated by adding the pass-through flow from the undeveloped area to the west plus the allowable APWA values for the parking lot improvements. A storm structure with a baffle wall will be installed in the location of the existing inlet. The parking lot and drainage basin will be piped to the storm structure. An SCS curve number of 98 was applied to the proposed parking area. The comprehensive control release rates as shown in APWA 5608.4 were applied to the calculations. The pond will release the WQ event (1.37" of rainfall) over a 40-hour duration for the proposed improvements. An SCS 24-hour hydrograph with a Type II distribution was used for all calculations. The analysis was completed with PondPack Connect Edition utilizing SCS Hydrograph methodology. Time of concentration was assumed at 5 minutes for calculations. The subsequent 100-Year event with the primary outlet clogged will be routed overland across the parking lot.

Findings

Table I – Methodology and Rainfall Data

Methods and Rainfall Data	
Pond Routing	Pondpack using SCS Method
Existing CN	74
T _c	5 minutes
Water Quality, type II, 24-hr	1.4 inch
2-yr rainfall, type II, 24-hr	3.5 inch
10-yr rainfall, type II, 24-hr	5.3 inch
100-yr rainfall, type II, 24-hr	7.7 inch

Existing Drainage Areas and CN Values

Area ID	Area (SF)	CN Value (Existing)
Proposed Parking	21,351	74



6/27/23

Proposed Drainage Areas and CN Values

Area ID	Area (SF)	CN Value (Proposed)
Proposed Parking	21,351	98

Allowable Discharge

	2-Year	10-Year	100-Year
A. Existing Discharge EX1 (cfs)	4.80	10.32	18.41
B. Existing Discharge (EX1 - Proposed Parking Area) (cfs)	3.86	8.32	14.83
C. Allowable Discharge for Proposed Parking Area (cfs)*	0.25	0.98	1.47
D. Total Allowable Discharge (B + C) (cfs)	4.11	9.30	16.30

*Comprehensive values utilizing 0.5 cfs (2-Year), 2 cfs (10-Year), and 3 cfs (100-Year) per site acre applied

Proposed Flow Values and Pond Results

	2-Year	10-Year	100-Year	100-Year*
A. Detention Pond Discharge (cfs)	3.67	8.02	10.39	15.82
B. P4 Fringe Discharge (cfs)	0.68	1.03	1.51	1.51
C. Total Discharge	4.05	8.70	11.42	16.97
D. Pond Water Surface Elevation	993.27	993.59	993.98	994.88
E. Top of Pond	996.00	996.00	996.00	996.00
Freeboard	2.73	2.41	2.02	1.12

*Assumes zero flow through primary outlet with subsequent 1% storm event

Detention Pond Input Data/Outlet Structure Design

	ELEV
1" Orifice	990.30
V- Notched Weir (6' Long, Sides = 993.08, Middle = 992.75)	992.75
Top of Proposed Inlets	994.50
Top of Pond	996.00

*Assumes zero flow through primary outlet with subsequent 1% storm event

Water Quality

Water Quality is being achieved via an orifice located within the dry detention basin. An orifice size of 1" was selected due to the trash guard opening size. See Chapter 4 of the MARC/APWA BMP Manual and Water Quality Out-put in the appendix for additional information.

$$WQ_v = P \cdot R_v$$

P = Rainfall event in inches (1.37")

R_v = Volumetric runoff coefficient for project

$$R_v = 0.05 + 0.009(I)$$

I = % Impervious Area

$$R_v = 0.05 + 0.009(100\%)$$

$$R_v = 0.95$$

$$WQ_v = (1.37 \text{ in})(0.95) = 1.30 \text{ watershed inches}$$

$$WQ_v = (1.30 \text{ in})(1 \text{ ft} / 12 \text{ in})(21,351) = 2,316 \text{ CF}$$

$$WQ_v = 2,316 \text{ CF} + 20\% = 2,779 \text{ CF}$$

Detention Pond Volume Table

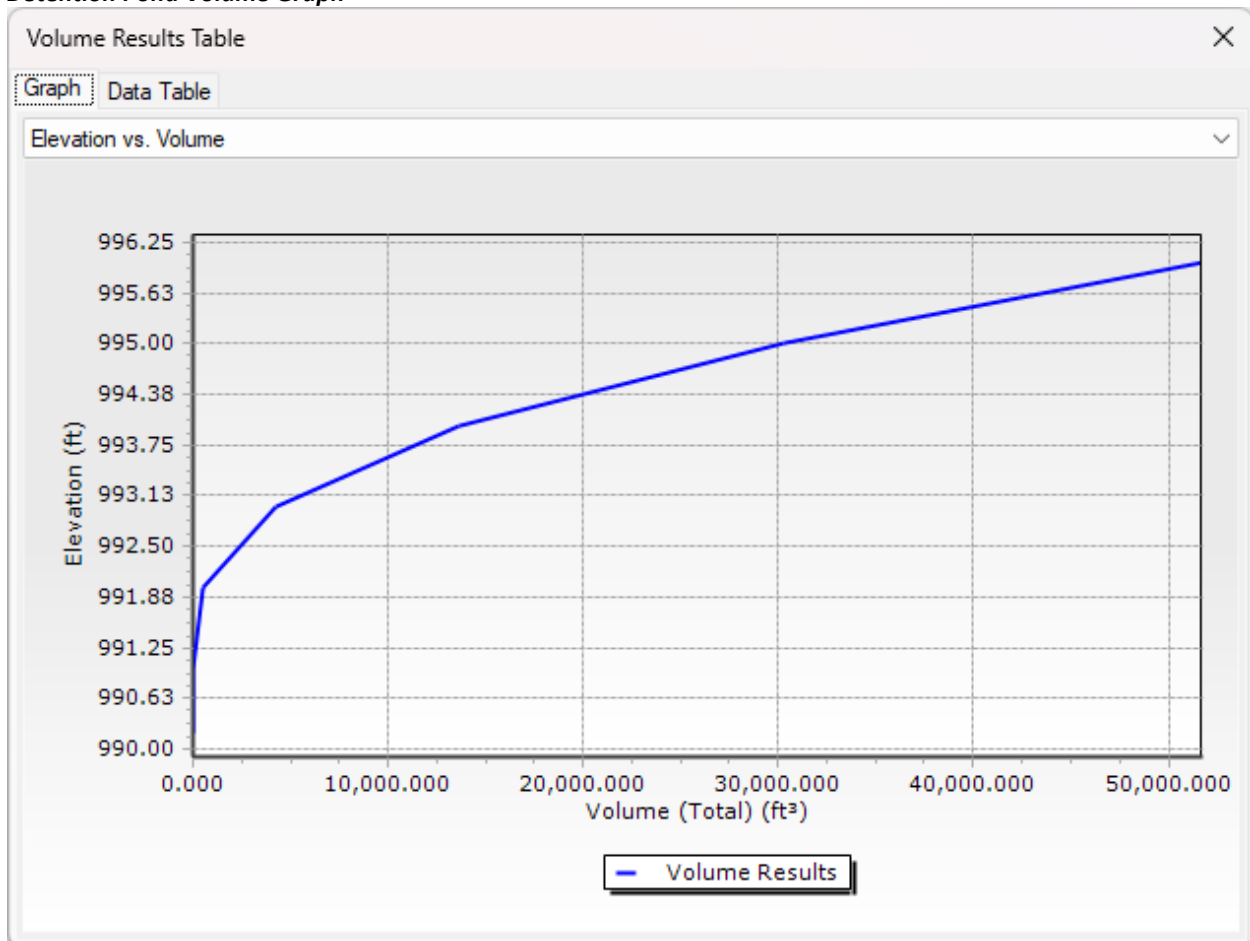
Volume Results Table

Graph

Data Table

	Elevation (ft)	Planimeter (ft ²)	Area (ft ²)	A1+A2+sqr (A1*A2) (ft ²)	Volume (ft ³)	Volume (Total) (ft ³)
1	990.20	0.0	0.000	0.000	0.000	0.000
2	991.00	0.0	3.330	3.330	1.000	1.000
3	992.00	0.0	1,555.570	1,630.873	544.000	545.000
4	993.00	0.0	6,273.390	10,952.851	3,651.000	4,195.000
5	994.00	0.0	12,935.700	28,217.458	9,406.000	13,601.000
6	995.00	0.0	20,756.850	50,078.653	16,693.000	30,294.000
7	996.00	0.0	22,176.520	64,388.316	21,463.000	51,757.000

Detention Pond Volume Graph



Conclusion

The proposed development will provide comprehensive control for all developed areas via a dry detention pond located on the west side of the proposed improvements. The existing storm structure will be replaced with a new storm structure with a water quality orifice and weir. The subsequent 100-Year will surcharge out of the proposed inlets and discharge overland across the existing parking lot. The water quality event will discharge through a 1" orifice protected with a trash rack.

See attached Pondpack calculations for additional information.

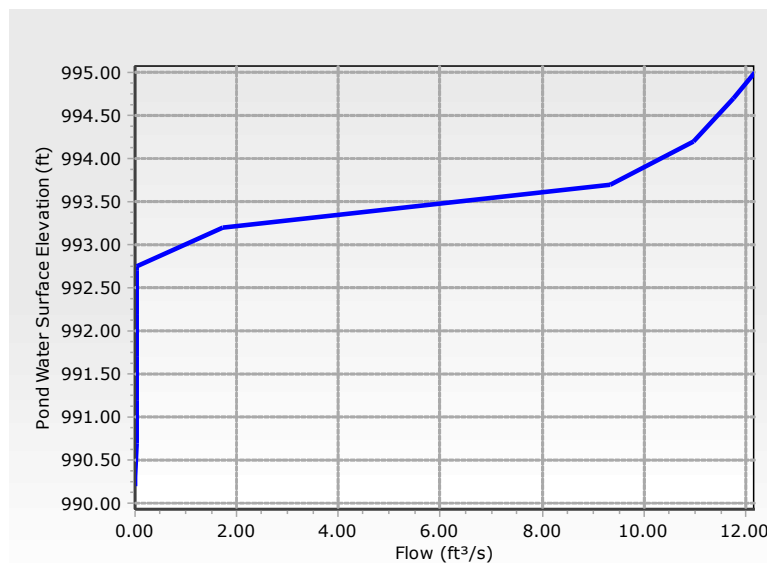
Composite Outlet Structure Detailed Report: Composite Outlet Structure

Element Details			
Label	Composite Outlet Structure	Notes	
Headwater Range			
Headwater Type	Use Pond for Headwater Range	Maximum (Headwater)	995.00 ft
Pond	Detention Pond	Increment (Headwater)	0.50 ft
Minimum (Headwater)	990.20 ft		
SpotElevation (ft)			
Tailwater Setup			
Tailwater Type	Free Outfall		
Tailwater Tolerances			
Maximum Iterations	30	Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft	Flow Tolerance (Minimum)	0.001 ft³/s
Headwater Tolerance (Maximum)	0.50 ft	Flow Tolerance (Maximum)	10.000 ft³/s
Tailwater Tolerance (Minimum)	0.01 ft		
Outlet Structure			
Outlet Structure Type	Culvert	Culvert Type	Circular
Outlet Structure (IDs and Direction)			
Outlet ID	Culvert	Downstream ID	Tailwater
Flow Direction	Forward Flow Only	Notes	
Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft
Culvert Data			
Number of Barrels	1	Downstream Invert	989.10 ft
Length	65.50 ft	Diameter	15.0 in
Upstream Invert	990.20 ft		
Unsubmerged->Submerged			
Specify Transitions	False	Compute Inlet Control Only	False

Composite Outlet Structure Detailed Report: Composite Outlet Structure

Culvert Coefficients			
Inlet Description	CMP - Headwall	C	0.0379
Chart	Chart 2	Y	0.6900
Nomograph	Nomograph 2	Manning's n	0.013
Equation Form	Form 1	Ke	0.500
K	0.0078	Kr	0.000
M	2.0000	Slope Correction Factor	-0.500

Culvert (Advanced)			
Convergence Tolerance	0.00 ft	Specify Number of Backwater Sections	False



RATING TABLE FOR ONE OUTLET TYPE Structure ID = Culvert (Culvert-Circular)

Mannings open channel maximum capacity: 9.00 ft³/s
Upstream ID = Weir - 1, Riser - 1, Orifice - 1
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
990.20	0.00	0.00	0.00	Free Outfall

Composite Outlet Structure Detailed Report: Composite Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Culvert (Culvert-Circular)

Mannings open channel maximum capacity: 9.00 ft³/s

Upstream ID = Weir - 1, Riser - 1, Orifice - 1

Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Device Flow (ft ³ /s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
990.30	0.00	0.00	0.00	Free Outfall
990.70	0.02	990.27	Free Outfall	Free Outfall
991.20	0.02	990.29	Free Outfall	Free Outfall
991.70	0.03	990.30	Free Outfall	Free Outfall
992.20	0.04	990.31	Free Outfall	Free Outfall
992.70	0.04	990.31	Free Outfall	Free Outfall
992.75	0.04	990.31	Free Outfall	Free Outfall
993.20	1.71	991.01	Free Outfall	Free Outfall
993.70	9.34	993.25	Free Outfall	Free Outfall
994.20	10.96	994.08	Free Outfall	Free Outfall
994.70	11.76	994.65	Free Outfall	Free Outfall
995.00	12.18	994.97	Free Outfall	Free Outfall
Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft ³ /s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.01	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.01	(N/A)	0.00	

Message

WS below an invert; no flow.
 WS below an invert; no flow.
 FLOW PRECEDENCE SET TO
 UPSTREAM CONTROLLING
 STRUCTURE
 CRIT.DEPTH CONTROL Vh= .020ft
 Dcr= .059ft CRIT.DEPTH Hev= .00ft
 CRIT.DEPTH CONTROL Vh= .022ft
 Dcr= .066ft CRIT.DEPTH Hev= .00ft

Composite Outlet Structure Detailed Report: Composite Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Culvert (Culvert-Circular)

Mannings open channel maximum capacity: 9.00 ft³/s

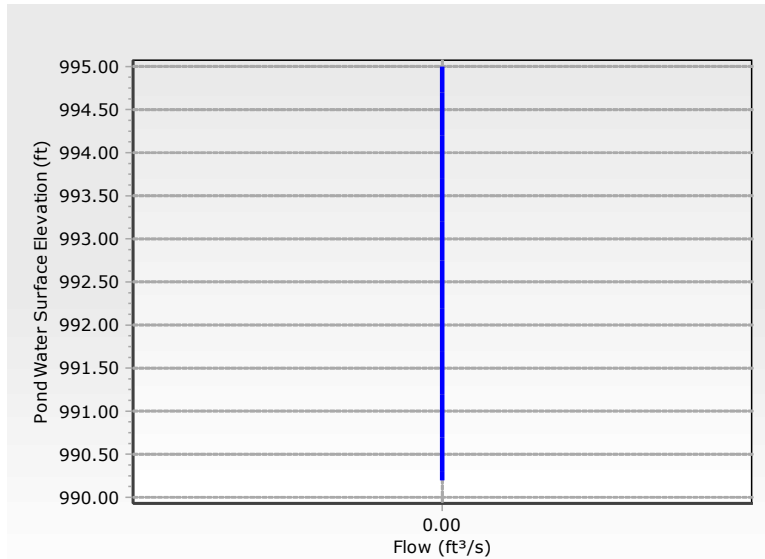
Upstream ID = Weir - 1, Riser - 1, Orifice - 1

Downstream ID = Tailwater (Pond Outfall)

Message			
CRIT.DEPTH CONTROL Vh= .025ft Dcr= .073ft CRIT.DEPTH Hev= .00ft CRIT.DEPTH CONTROL Vh= .026ft Dcr= .076ft CRIT.DEPTH Hev= .00ft CRIT.DEPTH CONTROL Vh= .026ft Dcr= .076ft CRIT.DEPTH Hev= .00ft CRIT.DEPTH CONTROL Vh= .196ft Dcr= .519ft CRIT.DEPTH Hev= .00ft INLET CONTROL... Submerged: HW =3.05 FULL FLOW...Lfull=64.22ft Vh=1.240ft HL=3.710ft Hev= .00ft FULL FLOW...Lfull=64.63ft Vh=1.427ft HL=4.284ft Hev= .00ft FULL FLOW...Lfull=64.86ft Vh=1.532ft HL=4.605ft Hev= .00ft			
Outlet Structure			
Outlet Structure Type		Riser	
Outlet Structure (IDs and Direction)			
Outlet ID	Riser - 1	Downstream ID	Culvert
Flow Direction	Forward and Reverse Flow	Notes	
Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft
Outlet Structure (Riser)			
Riser	Stand Pipe	Transition Elevation	0.00 ft
Diameter	48.0 in	Transition Height	0.00 ft
Weir Coefficient	3.00 (ft^0.5)/s	K Reverse	1.000
Orifice Coefficient	0.600		
Outlet Structure (Common)			
Elevation	995.00 ft		
Outlet Structure (Riser, Advanced)			
Use Orifice Depth to Crest?	True	Use Submerged Weir Equation?	False

Composite Outlet Structure Detailed Report: Composite Outlet Structure

Outlet Structure (Riser, Advanced)



RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Riser - 1 (Stand Pipe)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
990.20	0.00	0.00	0.00	0.00
990.30	0.00	0.00	0.00	0.00
990.70	0.00	0.00	0.00	990.27
991.20	0.00	0.00	0.00	990.29
991.70	0.00	0.00	0.00	990.30
992.20	0.00	0.00	0.00	990.31
992.70	0.00	0.00	0.00	990.31
992.75	0.00	0.00	0.00	990.31
993.20	0.00	0.00	0.00	991.01
993.70	0.00	0.00	0.00	993.25
994.20	0.00	0.00	0.00	994.08
994.70	0.00	0.00	0.00	994.65
995.00	0.00	0.00	0.00	994.97

Composite Outlet Structure Detailed Report: Composite Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Riser - 1 (Stand Pipe)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert (Culvert-Circular)

Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft ³ /s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00

Message

WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.

Outlet Structure

Outlet Structure Type	Orifice
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Outlet Structure (IDs and Direction)

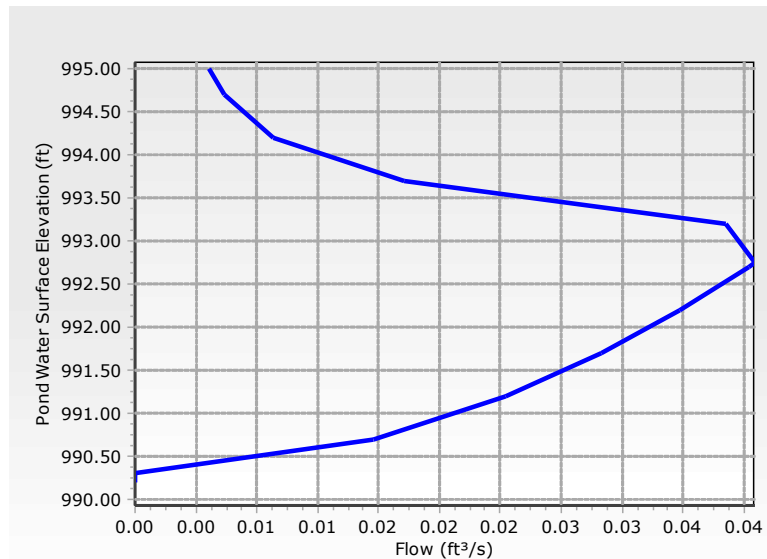
Outlet ID	Orifice - 1	Downstream ID	Culvert
Flow Direction	Forward and Reverse Flow	Notes	

Outlet Structure (Advanced)

Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft
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Composite Outlet Structure Detailed Report: Composite Outlet Structure

Outlet Structure (Orifice)			
Orifice	Circular Orifice	Orifice Coefficient	0.600
Number of Openings	1	Orifice Diameter	1.0 in
Outlet Structure (Common)			
Elevation	990.30 ft		



RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Orifice - 1 (Orifice-Circular)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
990.20	0.00	0.00	0.00	0.00
990.30	0.00	0.00	0.00	0.00
990.70	0.02	990.70	Free Outfall	990.27
991.20	0.02	991.20	Free Outfall	990.29
991.70	0.03	991.70	Free Outfall	990.30
992.20	0.04	992.20	990.31	990.31
992.70	0.04	992.70	990.31	990.31

Composite Outlet Structure Detailed Report: Composite Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Orifice - 1 (Orifice-Circular)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft ³ /s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
992.75	0.04	992.75	990.31	990.31
993.20	0.04	993.20	991.01	991.01
993.70	0.02	993.70	993.25	993.25
994.20	0.01	994.20	994.08	994.08
994.70	0.01	994.70	994.65	994.65
995.00	0.00	995.00	994.97	994.97
Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft ³ /s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	

Message

WS below an invert; no flow.
 WS below an invert; no flow.
 H =.36
 H =.86
 H =1.36
 H =1.86
 H =2.36
 H =2.41
 H =2.19
 H =.45
 H =.12
 H =.05
 H =.03

Outlet Structure

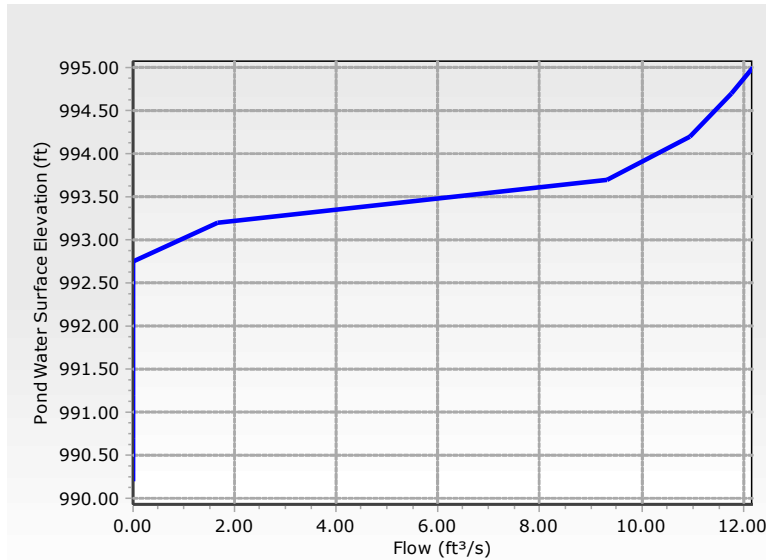
Outlet Structure Type

Weir

Composite Outlet Structure Detailed Report: Composite Outlet Structure

Outlet Structure (IDs and Direction)			
Outlet ID	Weir - 1	Downstream ID	Culvert
Flow Direction	Forward and Reverse Flow	Notes	
Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft
Outlet Structure (Weir)			
Weir	Irregular Weir	Weir Coefficient	3.00 (ft ^{0.5})/s
Vary Coefficient with Depth	False		
Irregular Weir Cross-section			
Station (ft)	Elevation (ft)		
0.00	995.00		
0.10	993.08		
3.00	992.75		
5.90	993.08		
6.00	995.00		
Outlet Structure (Common)			
Elevation	0.00 ft		
Outlet Structure (Weir, Advanced)			
User Defined Table	False		

Composite Outlet Structure Detailed Report: Composite Outlet Structure



RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Weir - 1 (Irregular Weir)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
990.20	0.00	0.00	0.00	0.00
990.30	0.00	0.00	0.00	0.00
990.70	0.00	0.00	0.00	990.27
991.20	0.00	0.00	0.00	990.29
991.70	0.00	0.00	0.00	990.30
992.20	0.00	0.00	0.00	990.31
992.70	0.00	0.00	0.00	990.31
992.75	0.00	0.00	0.00	990.31
993.20	1.67	993.20	991.01	991.01
993.70	9.32	993.70	993.25	993.25
994.20	10.96	994.20	994.08	994.08
994.70	11.76	994.70	994.65	994.65
995.00	12.19	995.00	994.97	994.97
Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft³/s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)	

Composite Outlet Structure Detailed Report: Composite Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Weir - 1 (Irregular Weir)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert (Culvert-Circular)

Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft ³ /s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00

Message

WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 Max.H=.45; Max.Htw=-1.74;; W(ft)
 =5.22
 Max.H=.95; Max.Htw=.50;; W(ft)=5.85
 Max.H=1.45; Max.Htw=1.33;; W(ft)
 =5.91
 Max.H=1.95; Max.Htw=1.90;; W(ft)
 =5.97
 Max.H=2.25; Max.Htw=2.22;; W(ft)
 =6.00

Composite Outlet Structure Detailed Report: Composite Outlet Structure

Composite Rating Table

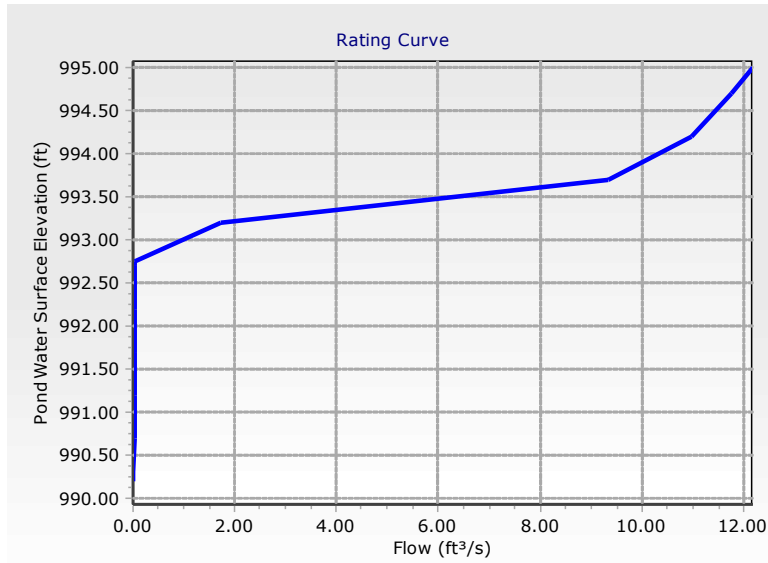
Tailwater Elevation = Free Outfall (Composite Outlet Structure)

Water Surface Elevation (ft)	Flow (ft ³ /s)	Tailwater Elevation (ft)	Convergence Error (ft)
990.20	0.00	(N/A)	0.00
990.30	0.00	(N/A)	0.00
990.70	0.02	(N/A)	0.00
991.20	0.02	(N/A)	0.00
991.70	0.03	(N/A)	0.00
992.20	0.04	(N/A)	0.00
992.70	0.04	(N/A)	0.00
992.75	0.04	(N/A)	0.00
993.20	1.71	(N/A)	0.00
993.70	9.34	(N/A)	0.00
994.20	10.96	(N/A)	0.00
994.70	11.76	(N/A)	0.00
995.00	12.18	(N/A)	0.00

Contributing Structures

(no Q: Weir - 1,Riser - 1,Orifice - 1,Culvert)
 (no Q: Weir - 1,Riser - 1,Orifice - 1,Culvert)
 Orifice - 1,Culvert (no Q: Weir - 1,Riser - 1)
 Orifice - 1,Culvert (no Q: Weir - 1,Riser - 1)
 Orifice - 1,Culvert (no Q: Weir - 1,Riser - 1)
 Orifice - 1,Culvert (no Q: Weir - 1,Riser - 1)
 Orifice - 1,Culvert (no Q: Weir - 1,Riser - 1)
 Orifice - 1,Culvert (no Q: Weir - 1,Riser - 1)
 Weir - 1,Orifice - 1,Culvert (no Q: Riser - 1)
 Weir - 1,Orifice - 1,Culvert (no Q: Riser - 1)
 Weir - 1,Orifice - 1,Culvert (no Q: Riser - 1)
 Weir - 1,Orifice - 1,Culvert (no Q: Riser - 1)
 Weir - 1,Orifice - 1,Culvert (no Q: Riser - 1)
 Weir - 1,Orifice - 1,Culvert (no Q: Riser - 1)

Composite Outlet Structure Detailed Report: Composite Outlet Structure



Minimum Drain Time Detailed Report: Water Quality Output

Element Details			
ID	117	End	40.000 hours
Label	Water Quality Output	Pond Node	Detention Pond
Start	0.000 hours	Outlet Structure	Composite Outlet Structure
Increment	0.500 hours		
Notes			

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: User Notifications

Scenario: Post-Development 100 year

Label: Water Quality Output

User Notifications

Message Id	15
Scenario	Post-Development 100 year
Element Type	Composite Outlet Structure
Element Id	64
Label	Composite Outlet Structure
Time	(N/A)
Message	Kr (reverse flow entrance loss coefficient) was not specified. Kr was set to same value as Ke= 0.500 .
Source	Warning
Message Id	67
Scenario	Post-Development 100 year
Element Type	Composite Outlet Structure
Element Id	64
Label	Composite Outlet Structure
Time	(N/A)
Message	Flow direction set to reverse for one ore more structures in composite outlet structure Composite Outlet Structure. To eliminate this warning, edit outlet data and select forward only. If reverse flow analysis is required, then the tailwater conditions must be set to interconnected pond.
Source	Warning

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Time vs. Elevation

Label: Water Quality Output (OUT)

Time vs. Elevation (ft)

Output Time increment = 0.500 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	992.75	992.73	992.72	992.70	992.68
2.500	992.66	992.64	992.62	992.60	992.58
5.000	992.56	992.53	992.51	992.49	992.47
7.500	992.45	992.43	992.41	992.39	992.37
10.000	992.35	992.33	992.31	992.29	992.27
12.500	992.25	992.23	992.21	992.18	992.13
15.000	992.09	992.05	992.00	991.96	991.92
17.500	991.88	991.84	991.80	991.76	991.73
20.000	991.66	991.53	991.40	991.28	990.53
22.500	990.20	990.20	990.20	990.20	990.20
25.000	990.20	990.20	990.20	990.20	990.20
27.500	990.20	990.20	990.20	990.20	990.20
30.000	990.20	990.20	990.20	990.20	990.20
32.500	990.20	990.20	990.20	990.20	990.20
35.000	990.20	990.20	990.20	990.20	990.20
37.500	990.20	990.20	990.20	990.20	990.20
40.000	990.20	(N/A)	(N/A)	(N/A)	(N/A)

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Time vs. Volume

Label: Water Quality Output (OUT)

Time vs. Volume (ft³)

Output Time increment = 0.500 hours

Time on left represents time for first value in each row.

Time (hours)	Volume (ft ³)	Volume (ft ³)	Volume (ft ³)	Volume (ft ³)	Volume (ft ³)
0.000	2,815.000	2,742.000	2,670.000	2,599.000	2,508.000
2.500	2,414.000	2,322.000	2,234.000	2,147.000	2,064.000
5.000	1,983.000	1,904.000	1,828.000	1,754.000	1,683.000
7.500	1,614.000	1,547.000	1,482.000	1,420.000	1,359.000
10.000	1,301.000	1,244.000	1,190.000	1,137.000	1,086.000
12.500	1,037.000	990.000	944.000	872.000	779.000
15.000	696.000	620.000	551.000	488.000	431.000
17.500	380.000	333.000	292.000	254.000	220.000
20.000	168.000	90.000	43.000	17.000	0.000
22.500	0.000	0.000	0.000	0.000	0.000
25.000	0.000	0.000	0.000	0.000	0.000
27.500	0.000	0.000	0.000	0.000	0.000
30.000	0.000	0.000	0.000	0.000	0.000
32.500	0.000	0.000	0.000	0.000	0.000
35.000	0.000	0.000	0.000	0.000	0.000
37.500	0.000	0.000	0.000	0.000	0.000
40.000	0.000	(N/A)	(N/A)	(N/A)	(N/A)

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Elevation-Area Volume Curve

Label: Detention Pond

Elevation (ft)	Planimeter (ft ²)	Area (ft ²)	A1+A2+sqr (A1*A2) (ft ²)	Volume (ft ³)	Volume (Total) (ft ³)
990.20	0.0	0.000	0.000	0.000	0.000
991.00	0.0	3.330	3.330	1.000	1.000
992.00	0.0	1,555.570	1,630.873	544.000	545.000
993.00	0.0	6,273.390	10,952.851	3,651.000	4,195.000
994.00	0.0	12,935.700	28,217.458	9,406.000	13,601.000
995.00	0.0	20,756.850	50,078.653	16,693.000	30,294.000

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Outlet Input Data

Label: Composite Outlet Structure

Requested Pond Water Surface Elevations

Minimum (Headwater)	990.20 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	995.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Irregular Weir	Weir - 1	Forward	Culvert	992.75	995.00
Stand Pipe	Riser - 1	Forward	Culvert	995.00	995.00
Orifice-Circular	Orifice - 1	Forward	Culvert	990.30	995.00
Culvert-Circular	Culvert	Forward	TW	990.20	995.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Outlet Input Data

Label: Composite Outlet Structure

Structure ID: Culvert	
Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	15.0 in
Length	65.50 ft
Length (Computed Barrel)	65.51 ft
Slope (Computed)	0.017 ft/ft
Outlet Control Data	
Manning's n	0.013
Ke	0.500
Kb	0.023
Kr	0.000
Convergence Tolerance	0.00 ft
Inlet Control Data	
Equation Form	Form 1
K	0.0078
M	2.0000
C	0.0379
Y	0.6900
T1 ratio (HW/D)	1.127
T2 ratio (HW/D)	1.288
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control, interpolate between flows at T1 & T2...

T1 Elevation	991.61 ft	T1 Flow	4.80 ft ³ /s
T2 Elevation	991.81 ft	T2 Flow	5.49 ft ³ /s

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Outlet Input Data

Label: Composite Outlet Structure

Structure ID: Riser - 1
Structure Type: Stand Pipe

Number of Openings	1
Elevation	995.00 ft
Diameter	48.0 in
Orifice Area	12.6 ft ²
Orifice Coefficient	0.600
Weir Length	12.57 ft
Weir Coefficient	3.00 (ft ^{0.5})/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: Orifice - 1
Structure Type: Orifice-Circular

Number of Openings	1
Elevation	990.30 ft
Orifice Diameter	1.0 in
Orifice Coefficient	0.600

Structure ID: Weir - 1 Structure Type: Irregular Weir

Station (ft)	Elevation (ft)
0.00	995.00
0.10	993.08
3.00	992.75
5.90	993.08
6.00	995.00

Lowest Elevation	992.75 ft
Weir Coefficient	3.00 (ft ^{0.5})/s

Structure ID: TW
Structure Type: TW Setup, DS Channel

Tailwater Type	Free Outfall
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Convergence Tolerances

Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Outlet Input Data

Label: Composite Outlet Structure

Convergence Tolerances	
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft ³ /s
Flow Tolerance (Maximum)	10.000 ft ³ /s

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Individual Outlet Curves

Label: Composite Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Culvert (Culvert-Circular)

Mannings open channel maximum capacity: 9.00 ft³/s

Upstream ID = Weir - 1, Riser - 1, Orifice - 1

Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Device Flow (ft ³ /s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)	Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft ³ /s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
990.20	0.00	0.00	0.00	Free Outfall	0.00	0.00	(N/A)	0.00
990.30	0.00	0.00	0.00	Free Outfall	0.00	0.00	(N/A)	0.00
990.70	0.02	990.27	Free Outfall	Free Outfall	0.00	0.00	(N/A)	0.00
991.20	0.02	990.29	Free Outfall	Free Outfall	0.00	0.00	(N/A)	0.00
991.70	0.03	990.30	Free Outfall	Free Outfall	0.00	0.00	(N/A)	0.00
992.20	0.04	990.31	Free Outfall	Free Outfall	0.00	0.00	(N/A)	0.00
992.70	0.04	990.31	Free Outfall	Free Outfall	0.00	0.00	(N/A)	0.00
992.75	0.04	990.31	Free Outfall	Free Outfall	0.00	0.00	(N/A)	0.00
993.20	2.68	991.25	Free Outfall	Free Outfall	0.00	0.00	(N/A)	0.00
993.70	9.61	993.38	Free Outfall	Free Outfall	0.00	0.00	(N/A)	0.00
994.20	10.99	994.10	Free Outfall	Free Outfall	0.00	0.01	(N/A)	0.00
994.70	11.77	994.66	Free Outfall	Free Outfall	0.00	0.15	(N/A)	0.00
995.00	12.19	994.97	Free Outfall	Free Outfall	0.00	0.01	(N/A)	0.00

Message

WS below an invert; no flow.
 WS below an invert; no flow.
 FLOW PRECEDENCE SET TO UPSTREAM CONTROLLING STRUCTURE
 CRIT.DEPTH CONTROL
 Vh= .020ft Dcr= .059ft
 CRIT.DEPTH Hev= .00ft
 CRIT.DEPTH CONTROL
 Vh= .022ft Dcr= .066ft
 CRIT.DEPTH Hev= .00ft
 CRIT.DEPTH CONTROL
 Vh= .025ft Dcr= .073ft
 CRIT.DEPTH Hev= .00ft
 CRIT.DEPTH CONTROL
 Vh= .026ft Dcr= .076ft
 CRIT.DEPTH Hev= .00ft

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Individual Outlet Curves

Label: Composite Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Culvert (Culvert-Circular)

Mannings open channel maximum capacity: 9.00 ft³/s

Upstream ID = Weir - 1, Riser - 1, Orifice - 1

Downstream ID = Tailwater (Pond Outfall)

Message
CRIT.DEPTH CONTROL
Vh= .026ft Dcr= .076ft
CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL
Vh= .262ft Dcr= .657ft
CRIT.DEPTH Hev= .00ft
INLET CONTROL...
Submerged: HW =3.18
FULL
FLOW...Lfull=64.23ft
Vh=1.247ft HL=3.731ft
Hev= .00ft
FULL
FLOW...Lfull=64.64ft
Vh=1.430ft HL=4.290ft
Hev= .00ft
FULL
FLOW...Lfull=64.87ft
Vh=1.533ft HL=4.609ft
Hev= .00ft

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Individual Outlet Curves

Label: Composite Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Riser - 1 (Stand Pipe)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft ³ /s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)	Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft ³ /s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
990.20	0.00	0.00	0.00	0.00	0.00	0.00	(N/A)	0.00
990.30	0.00	0.00	0.00	0.00	0.00	0.00	(N/A)	0.00
990.70	0.00	0.00	0.00	990.27	0.00	0.00	(N/A)	0.00
991.20	0.00	0.00	0.00	990.29	0.00	0.00	(N/A)	0.00
991.70	0.00	0.00	0.00	990.30	0.00	0.00	(N/A)	0.00
992.20	0.00	0.00	0.00	990.31	0.00	0.00	(N/A)	0.00
992.70	0.00	0.00	0.00	990.31	0.00	0.00	(N/A)	0.00
992.75	0.00	0.00	0.00	990.31	0.00	0.00	(N/A)	0.00
993.20	0.00	0.00	0.00	991.25	0.00	0.00	(N/A)	0.00
993.70	0.00	0.00	0.00	993.38	0.00	0.00	(N/A)	0.00
994.20	0.00	0.00	0.00	994.10	0.00	0.00	(N/A)	0.00
994.70	0.00	0.00	0.00	994.66	0.00	0.00	(N/A)	0.00
995.00	0.00	0.00	0.00	994.97	0.00	0.00	(N/A)	0.00

Message

WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Individual Outlet Curves

Label: Composite Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Riser - 1 (Stand Pipe)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert (Culvert-Circular)

Message
WS below an invert; no flow.
WS below an invert; no flow.

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Individual Outlet Curves

Label: Composite Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Orifice - 1 (Orifice-Circular)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft ³ /s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)	Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft ³ /s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
990.20	0.00	0.00	0.00	0.00	0.00	0.00	(N/A)	0.00
990.30	0.00	0.00	0.00	0.00	0.00	0.00	(N/A)	0.00
990.70	0.02	990.70	Free Outfall	990.27	0.00	0.00	(N/A)	0.00
991.20	0.02	991.20	Free Outfall	990.29	0.00	0.00	(N/A)	0.00
991.70	0.03	991.70	Free Outfall	990.30	0.00	0.00	(N/A)	0.00
992.20	0.04	992.20	990.31	990.31	0.00	0.00	(N/A)	0.00
992.70	0.04	992.70	990.31	990.31	0.00	0.00	(N/A)	0.00
992.75	0.04	992.75	990.31	990.31	0.00	0.00	(N/A)	0.00
993.20	0.04	993.20	991.25	991.25	0.00	0.00	(N/A)	0.00
993.70	0.01	993.70	993.38	993.38	0.00	0.00	(N/A)	0.00
994.20	0.01	994.20	994.10	994.10	0.00	0.00	(N/A)	0.00
994.70	0.01	994.70	994.65	994.66	0.00	0.00	(N/A)	0.00
995.00	0.00	995.00	994.97	994.97	0.00	0.00	(N/A)	0.00

Message

WS below an invert; no flow.

WS below an invert; no flow.

H =.36

H =.86

H =1.36

H =1.86

H =2.36

H =2.41

H =1.95

H =.32

H =.10

H =.05

H =.03

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Individual Outlet Curves

Label: Composite Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Weir - 1 (Irregular Weir)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft ³ /s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)	Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft ³ /s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
990.20	0.00	0.00	0.00	0.00	0.00	0.00	(N/A)	0.00
990.30	0.00	0.00	0.00	0.00	0.00	0.00	(N/A)	0.00
990.70	0.00	0.00	0.00	990.27	0.00	0.00	(N/A)	0.00
991.20	0.00	0.00	0.00	990.29	0.00	0.00	(N/A)	0.00
991.70	0.00	0.00	0.00	990.30	0.00	0.00	(N/A)	0.00
992.20	0.00	0.00	0.00	990.31	0.00	0.00	(N/A)	0.00
992.70	0.00	0.00	0.00	990.31	0.00	0.00	(N/A)	0.00
992.75	0.00	0.00	0.00	990.31	0.00	0.00	(N/A)	0.00
993.20	2.65	993.20	991.25	991.25	0.00	0.00	(N/A)	0.00
993.70	9.59	993.70	993.38	993.38	0.00	0.00	(N/A)	0.00
994.20	10.98	994.20	994.10	994.10	0.00	0.00	(N/A)	0.00
994.70	11.82	994.70	994.66	994.66	0.00	0.00	(N/A)	0.00
995.00	12.18	995.00	994.97	994.97	0.00	0.00	(N/A)	0.00

Message

WS below an invert; no flow.

WS below an invert; no flow.

WS below an invert; no flow.

WS below an invert; no flow.

WS below an invert; no flow.

WS below an invert; no flow.

WS below an invert; no flow.

WS below an invert; no flow.

Max.H=.45; Max.Htw=-1.50;; W(ft)=5.81

Max.H=.95;
Max.Htw=.63;; W(ft)=5.86

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Individual Outlet Curves

Label: Composite Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Weir - 1 (Irregular Weir)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert (Culvert-Circular)

Message
Max.H=1.45; Max.Htw=1.35;; W(ft) =5.92
Max.H=1.95; Max.Htw=1.91;; W(ft) =5.97
Max.H=2.25; Max.Htw=2.22;; W(ft) =6.00

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Composite Rating Curve

Label: Composite Outlet Structure

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft ³ /s)	Tailwater Elevation (ft)	Convergence Error (ft)
990.20	0.00	(N/A)	0.00
990.30	0.00	(N/A)	0.00
990.70	0.02	(N/A)	0.00
991.20	0.02	(N/A)	0.00
991.70	0.03	(N/A)	0.00
992.20	0.04	(N/A)	0.00
992.70	0.04	(N/A)	0.00
992.75	0.04	(N/A)	0.00
993.20	2.68	(N/A)	0.00
993.70	9.61	(N/A)	0.00
994.20	10.99	(N/A)	0.00
994.70	11.77	(N/A)	0.00
995.00	12.19	(N/A)	0.00

Contributing Structures

(no Q: Weir - 1,Riser - 1,Orifice - 1,Culvert)
 (no Q: Weir - 1,Riser - 1,Orifice - 1,Culvert)
 Orifice - 1,Culvert (no Q: Weir - 1,Riser - 1)
 Orifice - 1,Culvert (no Q: Weir - 1,Riser - 1)
 Orifice - 1,Culvert (no Q: Weir - 1,Riser - 1)
 Orifice - 1,Culvert (no Q: Weir - 1,Riser - 1)
 Orifice - 1,Culvert (no Q: Weir - 1,Riser - 1)
 Orifice - 1,Culvert (no Q: Weir - 1,Riser - 1)
 Weir - 1,Orifice - 1,Culvert (no Q: Riser - 1)
 Weir - 1,Orifice - 1,Culvert (no Q: Riser - 1)
 Weir - 1,Orifice - 1,Culvert (no Q: Riser - 1)
 Weir - 1,Orifice - 1,Culvert (no Q: Riser - 1)
 Weir - 1,Orifice - 1,Culvert (no Q: Riser - 1)

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Composite Rating Curve

Label: Composite Outlet Structure

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Elevation-Volume-Flow Table (Pond)

Label: Water Quality Output

Infiltration	
Infiltration Method (Computed)	No Infiltration
Initial Conditions	
Elevation (Water Surface, Initial)	992.75 ft
Volume (Initial)	2,815.244 ft ³
Flow (Initial Outlet)	0.04 ft ³ /s
Flow (Initial Infiltration)	0.00 ft ³ /s
Flow (Initial, Total)	0.04 ft ³ /s
Time Increment	0.500 hours

Elevation (ft)	Outflow (ft ³ /s)	Storage (ft ³)	Area (ft ²)	Infiltration (ft ³ /s)	Flow (Total) (ft ³ /s)	2S/t + O (ft ³ /s)
990.20	0.00	0.000	0.000	0.00	0.00	0.00
990.30	0.00	0.002	0.052	0.00	0.00	0.00
990.70	0.02	0.217	1.301	0.00	0.02	0.02
991.20	0.02	8.073	87.385	0.00	0.02	0.03
991.70	0.03	198.630	792.757	0.00	0.03	0.25
992.20	0.04	922.576	2,246.146	0.00	0.04	1.06
992.70	0.04	2,582.670	4,525.997	0.00	0.04	2.91
992.75	0.04	2,815.724	4,797.464	0.00	0.04	3.17
993.20	2.68	5,562.719	7,415.075	0.00	2.68	8.86
993.70	9.61	10,063.301	10,686.613	0.00	9.61	20.80
994.20	10.99	16,328.892	14,352.675	0.00	10.99	29.14
994.70	11.77	24,452.195	18,217.233	0.00	11.77	38.94
995.00	12.19	30,294.166	20,756.850	0.00	12.19	45.85

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Level Pool Pond Routing Summary

Label: Water Quality Output

Infiltration			
Infiltration Method (Computed)		No Infiltration	
Initial Conditions			
Elevation (Water Surface, Initial)	992.75 ft		
Volume (Initial)	2,815.244 ft³		
Flow (Initial Outlet)	0.04 ft³/s		
Flow (Initial Infiltration)	0.00 ft³/s		
Flow (Initial, Total)	0.04 ft³/s		
Time Increment	0.500 hours		
Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	0.00 ft³/s	Time to Peak (Flow, In)	0.000 hours
Flow (Peak Outlet)	0.04 ft³/s	Time to Peak (Flow, Outlet)	0.000 hours
Peak Conditions			
Elevation (Water Surface, Peak)	992.73 ft		
Volume (Peak)	2,741.871 ft³		
Mass Balance (ft³)			
Volume (Initial)	2,815.244 ft³		
Volume (Total Inflow)	0.000 ft³		
Volume (Total Infiltration)	0.000 ft³		
Volume (Total Outlet Outflow)	2,815.244 ft³		
Volume (Retained)	0.000 ft³		
Volume (Unrouted)	0.000 ft³		
Error (Mass Balance)	0.0 %		

Minimum Drain Time Detailed Report: Water Quality Output

Subsection: Pond Routed Hydrograph (total out)

Label: Water Quality Output

Peak Discharge	0.04 ft ³ /s
Time to Peak	1.000 hours
Hydrograph Volume	2,815.244 ft ³

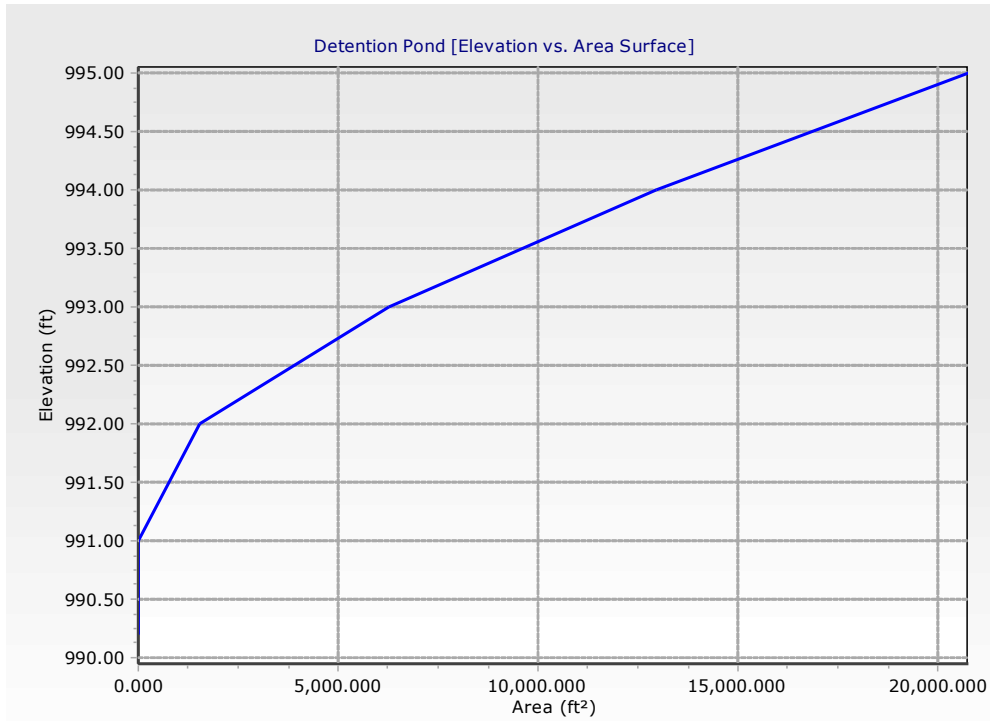
HYDROGRAPH ORDINATES (ft³/s)

Output Time Increment = 0.500 hours

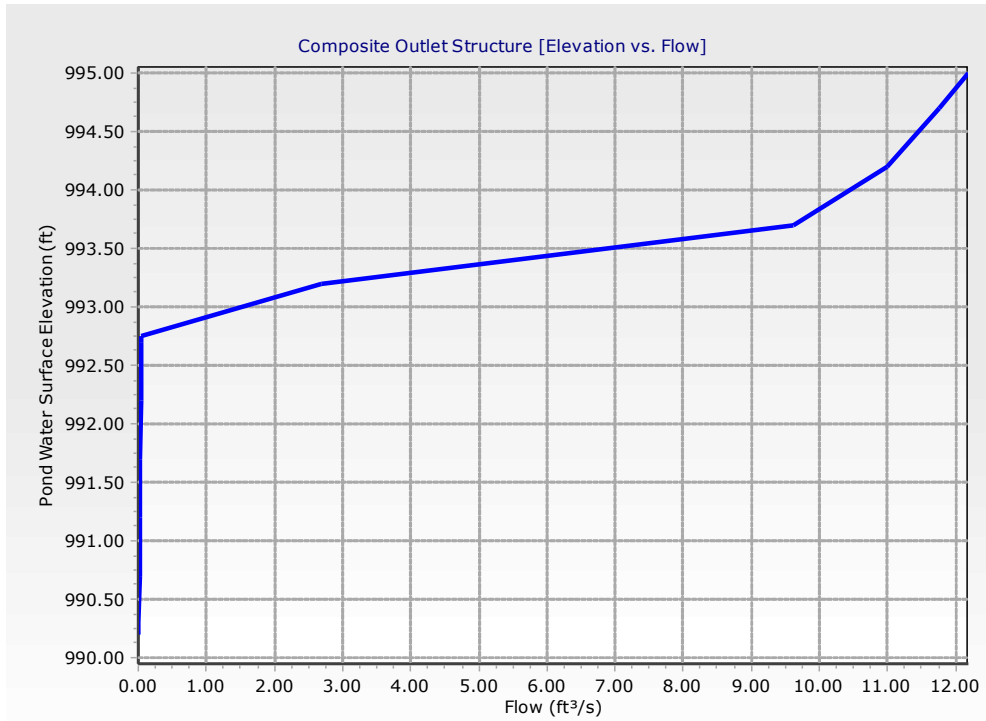
Time on left represents time for first value in each row.

Time (hours)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)
0.000	0.04	0.04	0.04	0.04	0.04
2.500	0.04	0.04	0.04	0.04	0.04
5.000	0.04	0.04	0.04	0.04	0.04
7.500	0.04	0.04	0.04	0.04	0.04
10.000	0.04	0.04	0.04	0.04	0.04
12.500	0.04	0.04	0.04	0.04	0.04
15.000	0.03	0.03	0.03	0.03	0.03
17.500	0.03	0.03	0.03	0.03	0.03
20.000	0.03	0.03	0.03	0.02	0.01
22.500	0.00	(N/A)	(N/A)	(N/A)	(N/A)

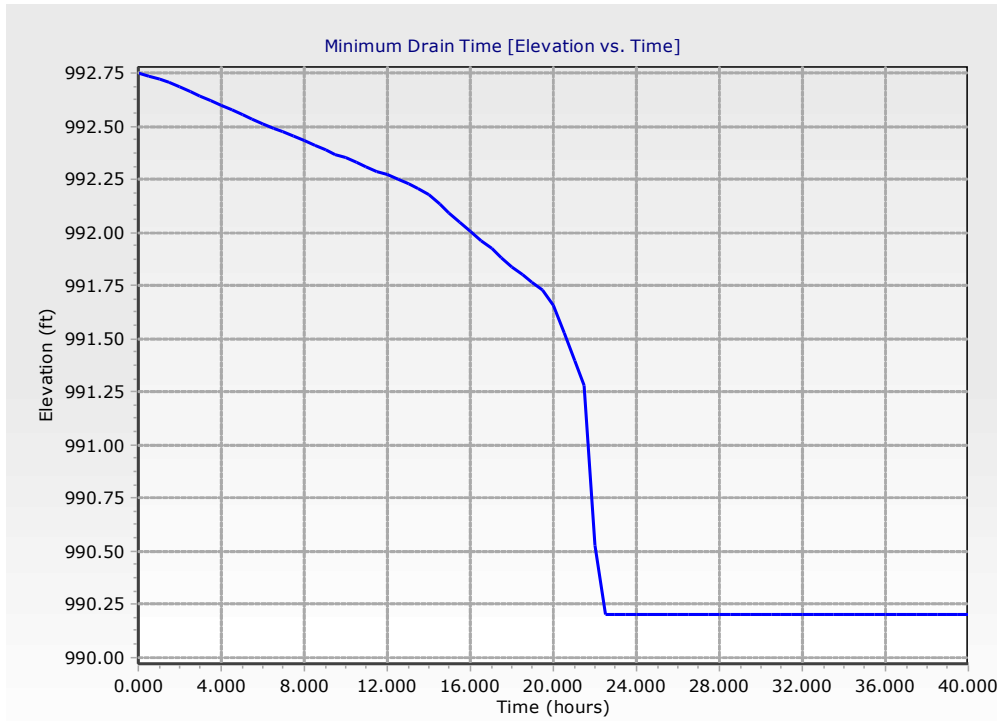
Minimum Drain Time Detailed Report: Water Quality Output



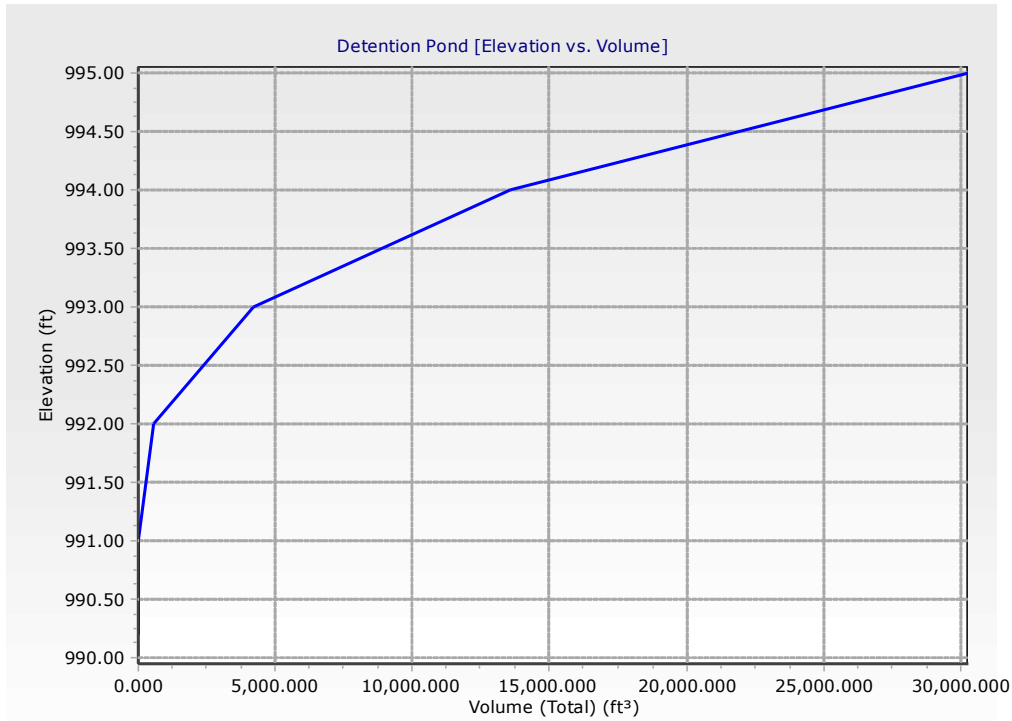
Minimum Drain Time Detailed Report: Water Quality Output



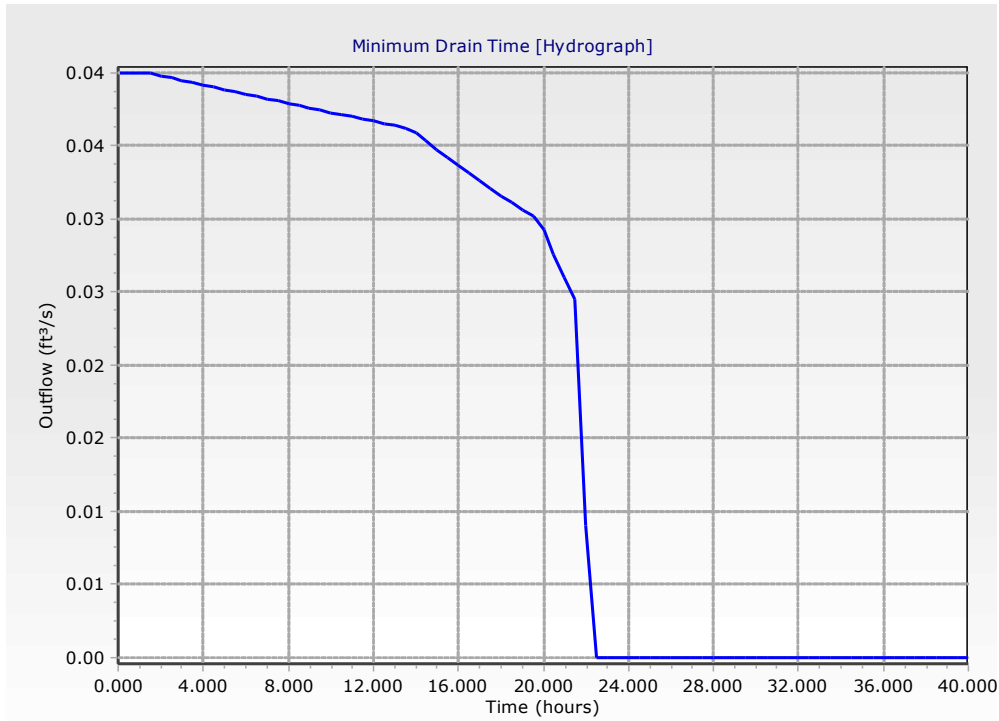
Minimum Drain Time Detailed Report: Water Quality Output



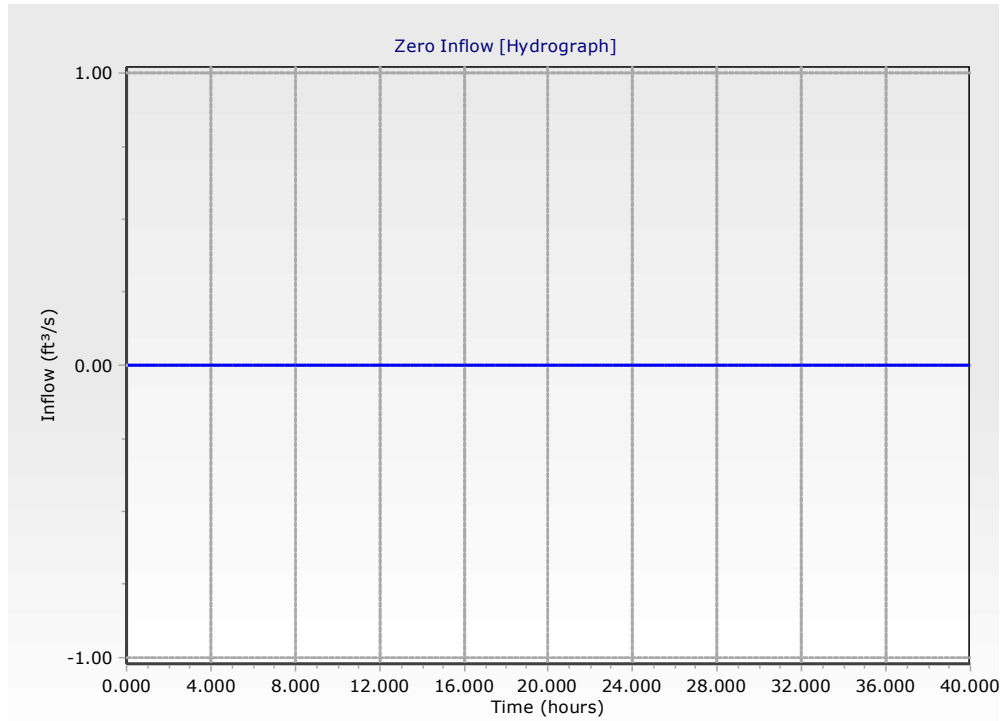
Minimum Drain Time Detailed Report: Water Quality Output



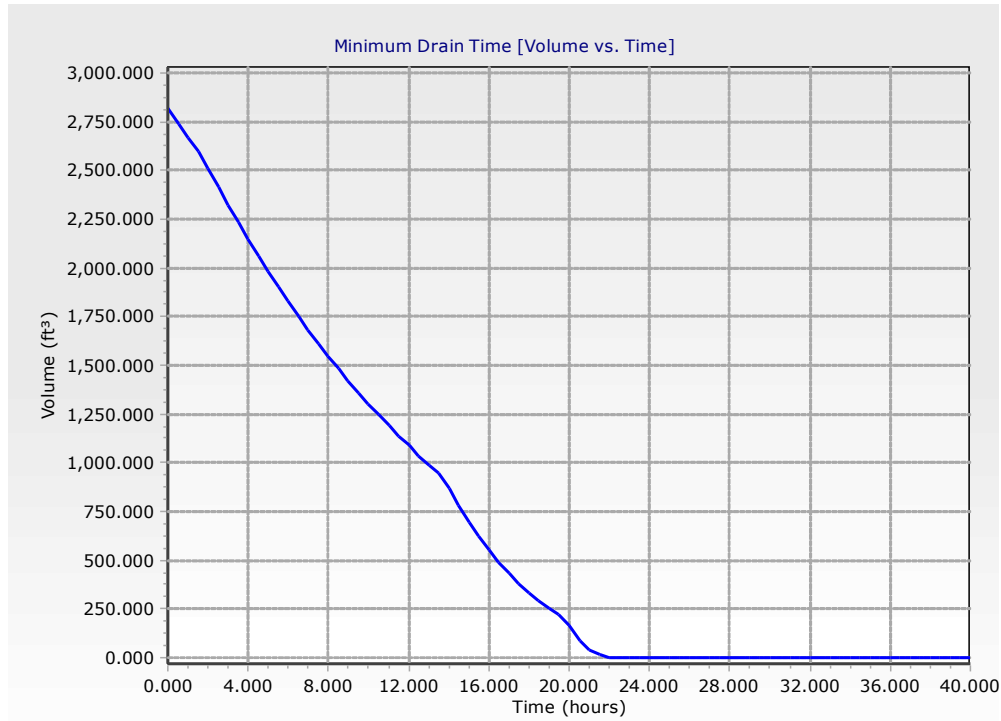
Minimum Drain Time Detailed Report: Water Quality Output



Minimum Drain Time Detailed Report: Water Quality Output



Minimum Drain Time Detailed Report: Water Quality Output



Our Lady of the Presentation Parking Lot Expansion

Project Summary

Title	Our Lady of the Presentation Parking Lot Expansion (2, 10, & 100-Yr)
Engineer	Matthew Castor
Company	Hg Consult, Inc
Date	6/19/2023

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Master Network Summary

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Our Lady of the Presentation Parking Lot Expansion

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft ³)	Time to Peak (hours)	Peak Flow (ft ³ /s)
P1, P2, and P3	Post-Development 2 year	2	15,271.000	11.920	6.62
P1, P2, and P3	Post-Development 10 year	10	28,688.000	11.920	12.35
P1, P2, and P3	Post-Development 100 year	100	47,764.000	11.920	20.17
P4	Post-Development 2 year	2	1,779.000	11.920	0.68
P4	Post-Development 10 year	10	2,757.000	11.920	1.03
P4	Post-Development 100 year	100	4,062.000	11.920	1.51

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft ³)	Time to Peak (hours)	Peak Flow (ft ³ /s)
Outfall	Post-Development 2 year	2	19,866.000	12.040	4.05
Outfall	Post-Development 10 year	10	34,261.000	12.030	8.70
Outfall	Post-Development 100 year	100	54,642.000	12.010	11.42

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft ³)	Time to Peak (hours)	Peak Flow (ft ³ /s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft ³)
Detention Pond (IN)	Post-Development 2 year	2	15,271.000	11.920	6.62	(N/A)	(N/A)
Detention Pond (OUT)	Post-Development 2 year	2	18,087.000	12.050	3.67	993.27	6,105.000
Detention Pond (IN)	Post-Development 10 year	10	28,688.000	11.920	12.35	(N/A)	(N/A)
Detention Pond (OUT)	Post-Development 10 year	10	31,504.000	12.040	8.02	993.59	8,884.000

Our Lady of the Presentation Parking Lot Expansion

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft ³)	Time to Peak (hours)	Peak Flow (ft ³ /s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft ³)
Detention Pond (IN)	Post-Development 100 year	100	47,764.000	11.920	20.17	(N/A)	(N/A)
Detention Pond (OUT)	Post-Development 100 year	100	50,580.000	12.050	10.39	993.98	13,364.000

Our Lady of the Presentation Parking Lot Expansion

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Our Lady of the Presentation Parking Lot Expansion

Project Summary

Title	Our Lady of the Presentation Parking Lot Expansion (Subsequent 100- Yr)
Engineer	Matthew Castor
Company	Hg Consult, Inc
Date	6/19/2023

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Master Network Summary

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Our Lady of the Presentation Parking Lot Expansion

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft ³)	Time to Peak (hours)	Peak Flow (ft ³ /s)
P1, P2, and P3	Post-Development 100 year	100	47,764.000	11.920	20.17
P4	Post-Development 100 year	100	4,062.000	11.920	1.51

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft ³)	Time to Peak (hours)	Peak Flow (ft ³ /s)
Outfall	Post-Development 100 year	100	44,200.000	12.010	16.97

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft ³)	Time to Peak (hours)	Peak Flow (ft ³ /s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft ³)
Detention Pond (IN)	Post-Development 100 year	100	47,764.000	11.920	20.17	(N/A)	(N/A)
Detention Pond (OUT)	Post-Development 100 year	100	40,138.000	12.010	15.82	994.88	27,778.000

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