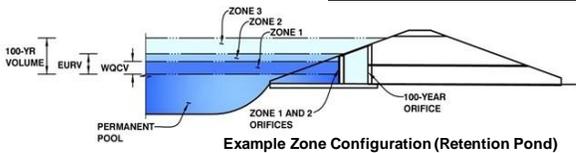


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Winsome Filling No. 3- WQ Pond A- Post Construction

Basin I.D.:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WOCV)	2.34	0.047	Orifice Plate
Zone 2 (EURV)	3.36	0.091	Weir&Pipe (Restrict)
Zone 3 (100-year)	#VALUE!	1.607	Not Utilized
Total (all zones)		1.745	

✔ Satisfies criteria

✘ Needs to be addressed

User Input: Orifice at Underdrain Outlet (typically used to drain WOCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft ²
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WOCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =	✔ 0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	✔ 3.36	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	sq. inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft ²
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft ²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	✔ 0.00	✔ 1.02	✔ 1.99					
Orifice Area (sq. inches)	✔ 0.16	✔ 0.16	✔ 0.16					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft ²
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Gate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 2 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	✘ 3.22	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	✔ 3.00	N/A	feet
Overflow Weir Gate Slope =	✔ 10.00	N/A	H:V
Horiz. Length of Weir Sides =	✔ 3.00	N/A	feet
Overflow Gate Type =	Type C Gate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Not Selected	
Height of Gate Upper Edge, Hi =	3.52	N/A	feet
Overflow Weir Slope Length =	3.01	N/A	feet
Gate Open Area / 100-yr Orifice Area =	3.56	N/A	
Overflow Gate Open Area w/o Debris =	6.30	N/A	ft ²
Overflow Gate Open Area w/ Debris =	3.15	N/A	ft ²

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 2 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.95	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	✔ 18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	✔ 18.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 2 Restrictor	Not Selected	
Outlet Orifice Area =	1.77	N/A	ft ²
Outlet Orifice Centroid =	0.75	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	✔ 3.79	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	✔ 47.00	feet
Spillway End Slopes =	✔ 4.00	H:V
Freeboard above Max Water Surface =	✔ 1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =	0.99	feet
Stage at Top of Freeboard =	5.78	feet
Basin Area at Top of Freeboard =	0.21	acres
Basin Volume at Top of Freeboard =	0.42	acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WOCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
One-Hour Rainfall Depth (in)									
CUHP Runoff Volume (acre-ft)	0.047	0.138	1.393	3.212	4.950	7.434	9.361	12.096	17.035
Inflow Hydrograph Volume (acre-ft)	N/A	N/A	1.393	3.212	4.950	7.434	9.361	12.096	17.035
CUHP Predevelopment Peak Q (cfs)	N/A	N/A	22.1	45.3	62.3	97.1	119.4	148.8	204.5
OPTIONAL Override Predevelopment Peak Q (cfs)	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre)	N/A	N/A	0.23	0.48	0.66	1.03	1.26	1.57	2.16
Peak Inflow Q (cfs)	N/A	N/A	22.1	45.3	62.3	97.1	119.4	148.8	204.5
Peak Outflow Q (cfs)	0.0	0.3	22.2	53.3	70.5	96.2	124.7	154.9	209.5
Ratio Peak Outflow to Predevelopment Q	N/A	N/A	N/A	1.2	1.1	1.0	1.0	1.0	1.0
Structure Controlling Flow	Plate	Overflow Weir 1	Spillway						
Max Velocity through Gate 1 (fps)	N/A	0.05	1.14	1.7	2.0	2.4	2.8	3.0	3.1
Max Velocity through Gate 2 (fps)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours)	44	86	53	19	3	2	1	1	1
Time to Drain 99% of Inflow Volume (hours)	45	90	78	61	48	32	21	7	3
Maximum Ponding Depth (ft)	2.34	3.36	4.01	4.23	4.33	4.46	4.59	4.73	4.95
Area at Maximum Ponding Depth (acres)	0.07	0.12	0.17	0.18	0.18	0.19	0.19	0.20	0.21
Maximum Volume Stored (acre-ft)	0.047	0.138	0.232	0.270	0.287	0.313	0.338	0.363	0.411

Q5 is higher than design conditions. Suggest adding a restrictor plate to reduce peak outflow.

Given that the spillway is the structure controlling flow at the 5 year, a restrictor plate won't help