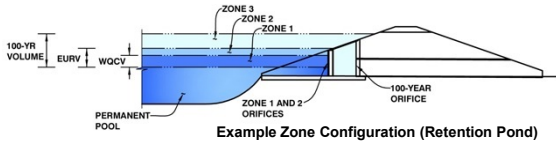


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: DWIRE Storage Yard
Basin ID: FSD Pond 1



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.98	0.453	Orifice Plate
Zone 2 (EURV)	4.84	1.065	Orifice Plate
Zone 3 (100-year)	6.04	0.884	Weir&Pipe (Restrict)
Total (all zones)		2.402	

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

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

Calculated Parameters for Underdrain
 Underdrain Orifice Area = ft²
 Underdrain Orifice Centroid = feet

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

Invert of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = 4.84 ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = 19.40 inches
 Orifice Plate: Orifice Area per Row = 1.91 sq. inches (diameter = 1-9/16 inches)

Calculated Parameters for Plate
 WQ Orifice Area per Row = 1.326E-02 ft²
 Elliptical Half-Width = N/A feet
 Elliptical Slot Centroid = N/A feet
 Elliptical Slot Area = N/A ft²

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	1.61	3.23					
Orifice Area (sq. inches)	1.91	1.91	1.91					
	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)

Invert of Vertical Orifice = Not Selected Not Selected 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
 Vertical Orifice Area = Not Selected Not Selected ft²
 Vertical Orifice Centroid = N/A N/A feet

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

	Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, H _o	4.85	N/A
Overflow Weir Front Edge Length	8.00	N/A
Overflow Weir Grate Slope	0.00	N/A
Horiz. Length of Weir Sides	3.50	N/A
Overflow Grate Open Area %	70%	N/A
Debris Clogging %	50%	N/A

Calculated Parameters for Overflow Weir
 Height of Grate Upper Edge, H_u = 4.85 N/A feet
 Overflow Weir Slope Length = 3.50 N/A feet
 Grate Open Area / 100-yr Orifice Area = 12.82 N/A
 Overflow Grate Open Area w/o Debris = 19.60 N/A ft²
 Overflow Grate Open Area w/ Debris = 9.80 N/A ft²

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

	Zone 3 Restrictor	Not Selected
Depth to Invert of Outlet Pipe	0.25	N/A
Outlet Pipe Diameter	24.00	N/A
Restrictor Plate Height Above Pipe Invert	11.75	

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
 Outlet Orifice Area = 1.53 N/A ft²
 Outlet Orifice Centroid = 0.56 N/A feet
 Half-Central Angle of Restrictor Plate on Pipe = 1.55 N/A radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 6.00 ft (relative to basin bottom at Stage = 0 ft)
 Spillway Crest Length = 25.00 feet
 Spillway End Slopes = 4.00 H:V
 Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway
 Spillway Design Flow Depth = 0.78 feet
 Stage at Top of Freeboard = 7.78 feet
 Basin Area at Top of Freeboard = 1.01 acres
 Basin Volume at Top of Freeboard = 3.99 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).

	WQCV	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)	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft)	0.453	1.518	1.391	1.867	2.267	2.732	3.149	3.640	4.697
Inflow Hydrograph Volume (acre-ft)	N/A	N/A	1.391	1.867	2.267	2.732	3.149	3.640	4.697
CUHP Predevelopment Peak Q (cfs)	N/A	N/A	1.8	5.1	7.8	14.1	17.7	22.6	31.6
OPTIONAL Override Predevelopment Peak Q (cfs)	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre)	N/A	N/A	0.10	0.27	0.40	0.73	0.91	1.17	1.63
Peak Inflow Q (cfs)	N/A	N/A	22.9	30.6	36.1	44.8	51.6	60.4	77.4
Peak Outflow Q (cfs)	0.2	0.3	0.3	3.7	7.8	15.9	16.8	17.5	36.4
Ratio Peak Outflow to Predevelopment Q	N/A	N/A	N/A	0.7	1.0	1.1	1.0	0.8	1.2
Structure Controlling Flow	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps)	N/A	N/A	N/A	0.2	0.4	0.8	0.8	0.9	0.9
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)	38	82	78	84	82	81	80	78	76
Time to Drain 99% of Inflow Volume (hours)	40	87	83	90	89	88	88	87	86
Maximum Ponding Depth (ft)	2.98	4.84	4.56	5.02	5.13	5.31	5.54	5.98	6.38
Area at Maximum Ponding Depth (acres)	0.47	0.67	0.64	0.69	0.71	0.73	0.75	0.80	0.85
Maximum Volume Stored (acre-ft)	0.453	1.519	1.335	1.635	1.719	1.848	2.011	2.352	2.682

see email dated
3/2/21

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected

Worksheet Protected

Stormwater Facility Name: Dwire Storage Yard

Facility Location & Jurisdiction: 38.88423 Latitude, -104.67879 Longitude, El Paso County

User Input: Watershed Characteristics

Watershed Slope =	0.021	ft/ft
Watershed Length =	1535	ft
Watershed Area =	19.36	acres
Watershed Imperviousness =	72.2%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent

Location for 1-hr Rainfall Depths (use dropdown):

User Input ▼

WQCV Treatment Method = Extended Detention ▼

User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	102	0.00	0.00
0.33	102	0.33	0.01
0.50	220	0.50	0.02
0.83	550	0.83	0.03
1.00	1,682	1.00	0.04
1.40	3,841	1.40	0.05
1.83	6,231	1.83	0.06
2.00	9,035	2.00	0.07
2.40	14,248	2.40	0.08
2.83	19,968	2.83	0.09
3.00	21,616	3.00	0.10
3.35	23,672	3.35	0.12
3.83	24,562	3.83	0.50
4.00	26,058	4.00	1.00
4.30	27,609	4.30	3.00
4.83	29,200	4.83	7.00
5.83	34,177	5.83	18.00
6.83	39,216	6.83	40.00

These values need to be based on the FSD worksheet results

After completing and printing this worksheet to a pdf, go to: <https://maperture.digitaldataservices.com/gvh/?viewer=cswdif>
 create a new stormwater facility, and
 attach the pdf of this worksheet to that record.

Routed Hydrograph Results

	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
Design Storm Return Period =							
One-Hour Rainfall Depth =	0.53	1.19	1.50	1.75	2.25	2.52	in
Calculated Runoff Volume =	0.460	1.287	1.706	2.151	3.092	3.621	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	0.460	1.286	1.705	2.150	3.092	3.620	acre-ft
Time to Drain 97% of Inflow Volume =	72.5	103.5	101.3	98.9	93.4	90.7	hours
Time to Drain 99% of Inflow Volume =	75.4	110.1	109.7	108.8	106.9	105.8	hours
Maximum Ponding Depth =	2.95	4.17	4.55	4.91	5.54	5.86	ft
Maximum Ponded Area =	0.48	0.62	0.65	0.68	0.75	0.79	acres
Maximum Volume Stored =	0.441	1.117	1.354	1.593	2.047	2.294	acre-ft

see email dated 3/2/21