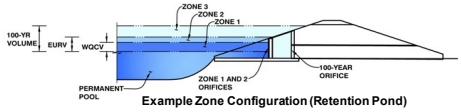
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Falcon Field Filing 1

Basin ID: Pond B



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	14.77	acres
Watershed Length =	915	ft
Watershed Length to Centroid =	450	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	89.40%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

		Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.488 acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.792 acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.212 acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.562 acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.844 acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.153 acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.455 acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.795 acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.49 in.) =	3.992 acre-feet	3.49	inches
Approximate 2-yr Detention Volume =	1.182 acre-feet		
Approximate 5-yr Detention Volume =	1.532 acre-feet		
Approximate 10-yr Detention Volume =	1.820 acre-feet		
Approximate 25-yr Detention Volume =	2.146 acre-feet		
Approximate 50-yr Detention Volume =	2.336 acre-feet		
Approximate 100-yr Detention Volume =	2.501 acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.488	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.304	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.709	acre-feet
Total Detention Basin Volume =	2.501	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	40	0.001		
6827	--	1.50	--	--	--	6,362	0.146	4,801	0.110
6828	--	2.50	--	--	--	25,828	0.593	20,896	0.480
6832	--	6.50	--	--	--	37,351	0.857	147,254	3.380

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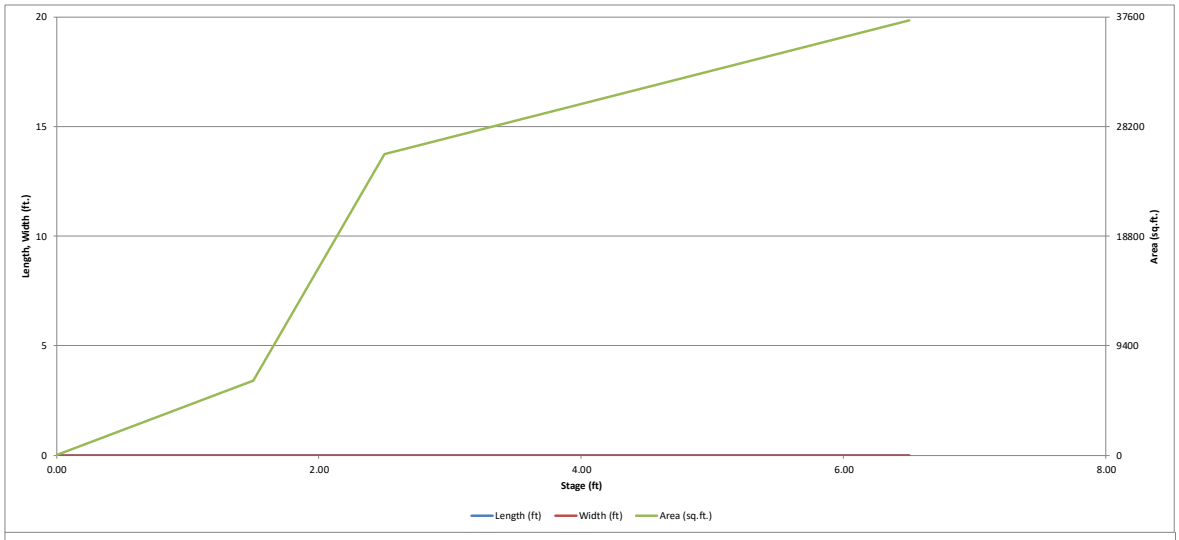
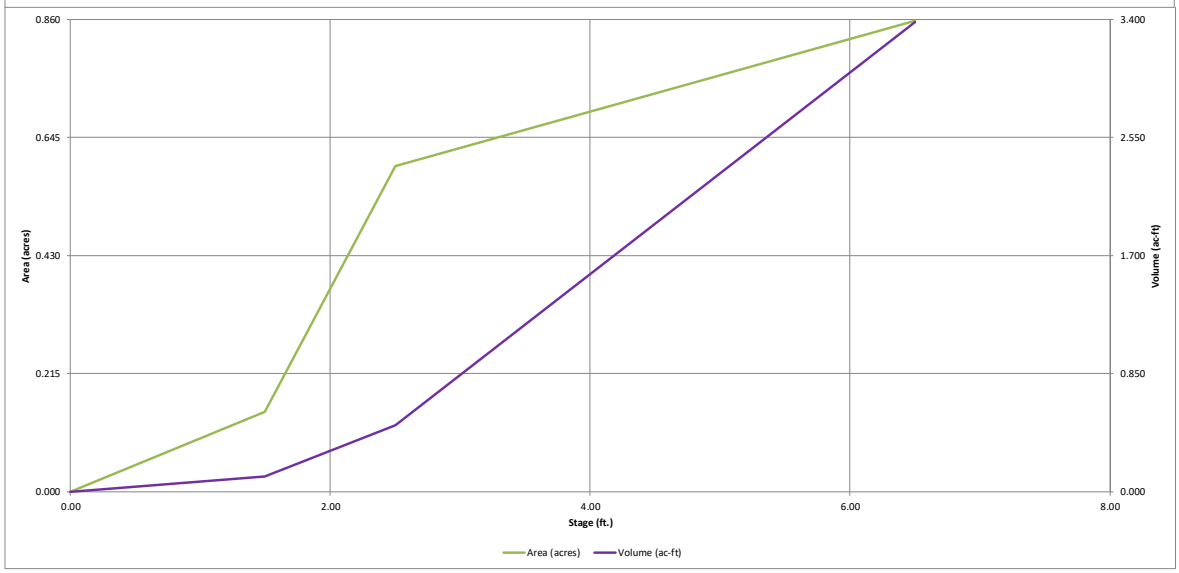


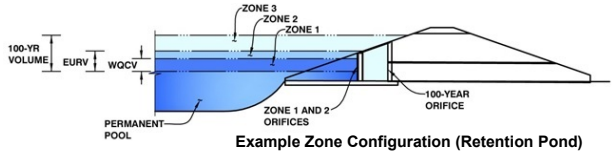


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Falcon Field Filing 1

Basin ID: Pond B



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.52	0.488	Orifice Plate
Zone 2 (EURV)	4.50	1.304	Orifice Plate
Zone 3 (100-year)	5.43	0.709	Weir&Pipe (Circular)
Total (all zones)		2.501	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.50	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	15.10	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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	1.50	3.00					
Orifice Area (sq. inches)	2.57	2.50	12.00					

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

Calculated Parameters for Vertical Orifi

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			Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, Ho =	4.55	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.55	N/A
Overflow Weir Front Edge Length =	6.50	N/A	feet	Overflow Weir Slope Length =	6.50	N/A
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	16.64	N/A
Horiz. Length of Weir Sides =	6.50	N/A	feet	Overflow Grate Open Area w/o Debris =	29.41	N/A
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	14.70	N/A
Debris Clogging % =	50%	N/A	%			

Calculated Parameters for Overflow We

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

	Zone 3 Circular	Not Selected			Zone 3 Circular	Not Selected
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.77	N/A
Circular Orifice Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.75	N/A
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.97	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.53	feet
Spillway Crest Length =	50.00	feet	Stage at Top of Freeboard =	6.50	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.86	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.38	acre-ft

Calculated Parameters for Spillway

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).

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	0.488	1.792	1.212	1.562	1.844	2.153	2.455	2.795
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.212	1.562	1.844	2.153	2.455	2.795
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.3	0.4	3.5	7.0	11.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.24	0.47	0.77
Peak Inflow Q (cfs) =	N/A	N/A	26.2	33.8	39.8	47.3	54.0	59.9
Peak Outflow Q (cfs) =	0.2	0.8	0.6	0.7	0.8	3.2	5.9	11.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.5	2.0	0.9	0.8	1.0
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.1	0.2	0.4
Max Velocity through Grate 2 (fps) =	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	68	62	66	69	70	69	68
Time to Drain 99% of Inflow Volume (hours) =	**40**	74	66	71	75	76	76	76
Maximum Ponding Depth (ft) =	2.52	4.50	3.55	4.04	4.42	4.70	4.79	4.96
Area at Maximum Ponding Depth (acres) =	0.59	0.73	0.66	0.69	0.72	0.74	0.74	0.75
Maximum Volume Stored (acre-ft) =	0.492	1.798	1.139	1.464	1.733	1.937	2.011	2.131

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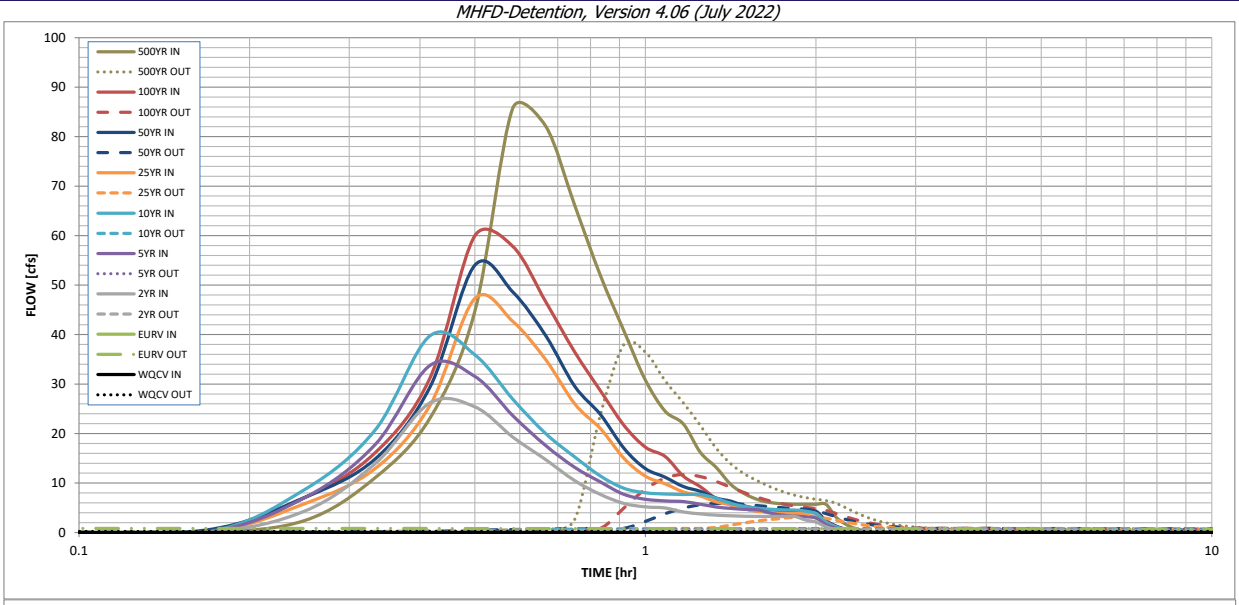
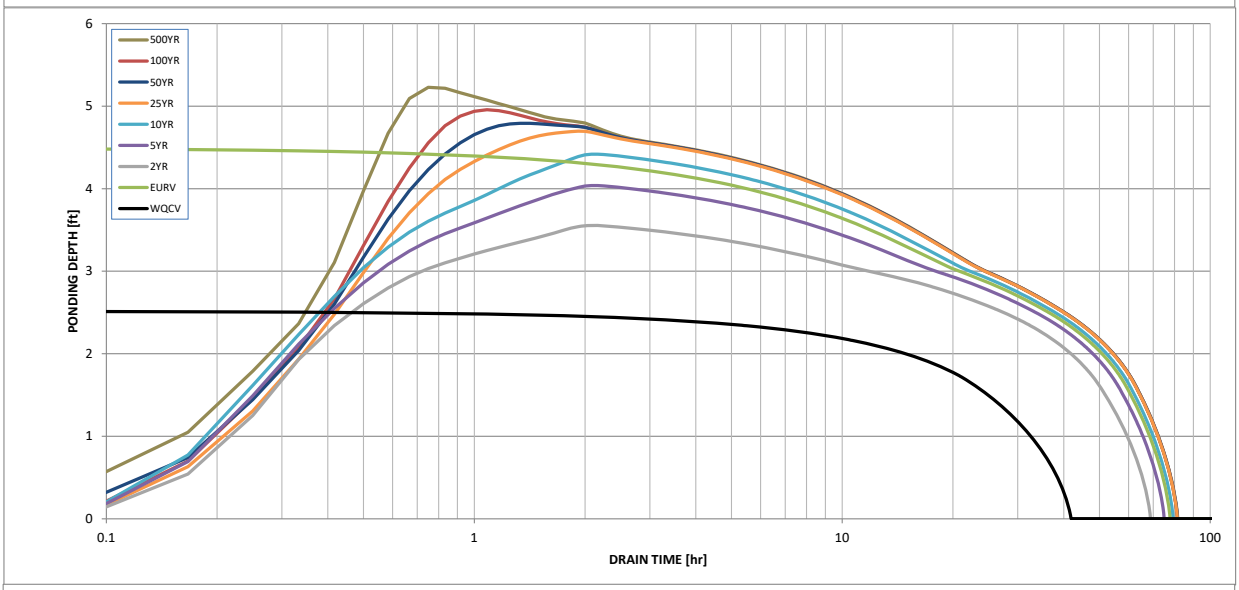
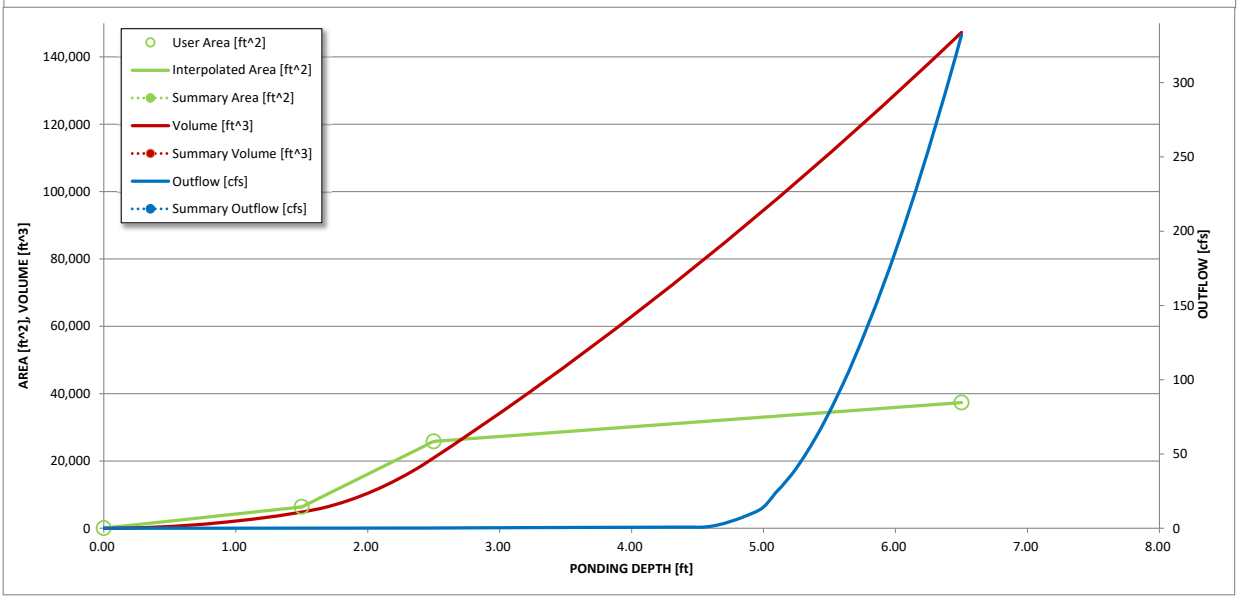






S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.05	2.40
	0:15:00	0.00	0.00	4.31	7.01	8.66	5.81	7.08	7.04	11.06
	0:20:00	0.00	0.00	13.90	17.77	20.69	12.91	14.85	16.12	23.14
	0:25:00	0.00	0.00	26.20	33.76	39.76	25.71	29.40	31.26	44.71
	0:30:00	0.00	0.00	25.39	31.54	35.92	47.27	54.00	59.95	85.72
	0:35:00	0.00	0.00	19.28	23.63	26.93	42.66	48.62	57.84	82.10
	0:40:00	0.00	0.00	14.72	17.58	20.00	34.93	39.79	46.64	66.13
	0:45:00	0.00	0.00	10.48	13.17	15.28	26.00	29.57	36.50	51.85
	0:50:00	0.00	0.00	7.68	10.19	11.40	20.96	23.81	28.60	40.72
	0:55:00	0.00	0.00	5.88	7.70	8.93	14.98	17.01	21.66	30.79
	1:00:00	0.00	0.00	5.18	6.72	8.05	11.39	12.93	17.24	24.53
	1:05:00	0.00	0.00	4.95	6.38	7.79	9.85	11.18	15.39	21.95
	1:10:00	0.00	0.00	4.16	6.24	7.69	8.21	9.29	11.39	16.21
	1:15:00	0.00	0.00	3.76	5.72	7.67	7.38	8.34	9.26	13.16
	1:20:00	0.00	0.00	3.51	5.17	6.92	6.19	6.98	6.84	9.64
	1:25:00	0.00	0.00	3.38	4.86	5.87	5.60	6.31	5.55	7.78
	1:30:00	0.00	0.00	3.29	4.68	5.26	4.75	5.34	4.74	6.61
	1:35:00	0.00	0.00	3.25	4.58	4.90	4.29	4.83	4.34	6.03
	1:40:00	0.00	0.00	3.25	3.89	4.69	4.04	4.54	4.19	5.81
	1:45:00	0.00	0.00	3.25	3.52	4.58	3.91	4.40	4.13	5.72
	1:50:00	0.00	0.00	3.25	3.30	4.54	3.85	4.33	4.13	5.72
	1:55:00	0.00	0.00	2.53	3.18	4.33	3.82	4.30	4.13	5.72
	2:00:00	0.00	0.00	2.13	2.93	3.79	3.82	4.30	4.13	5.72
	2:05:00	0.00	0.00	1.17	1.61	2.11	2.13	2.40	2.30	3.18
	2:10:00	0.00	0.00	0.63	0.89	1.15	1.19	1.33	1.28	1.77
	2:15:00	0.00	0.00	0.30	0.46	0.58	0.61	0.68	0.66	0.91
	2:20:00	0.00	0.00	0.13	0.22	0.26	0.29	0.33	0.32	0.44
	2:25:00	0.00	0.00	0.04	0.06	0.07	0.09	0.10	0.10	0.13
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pond B

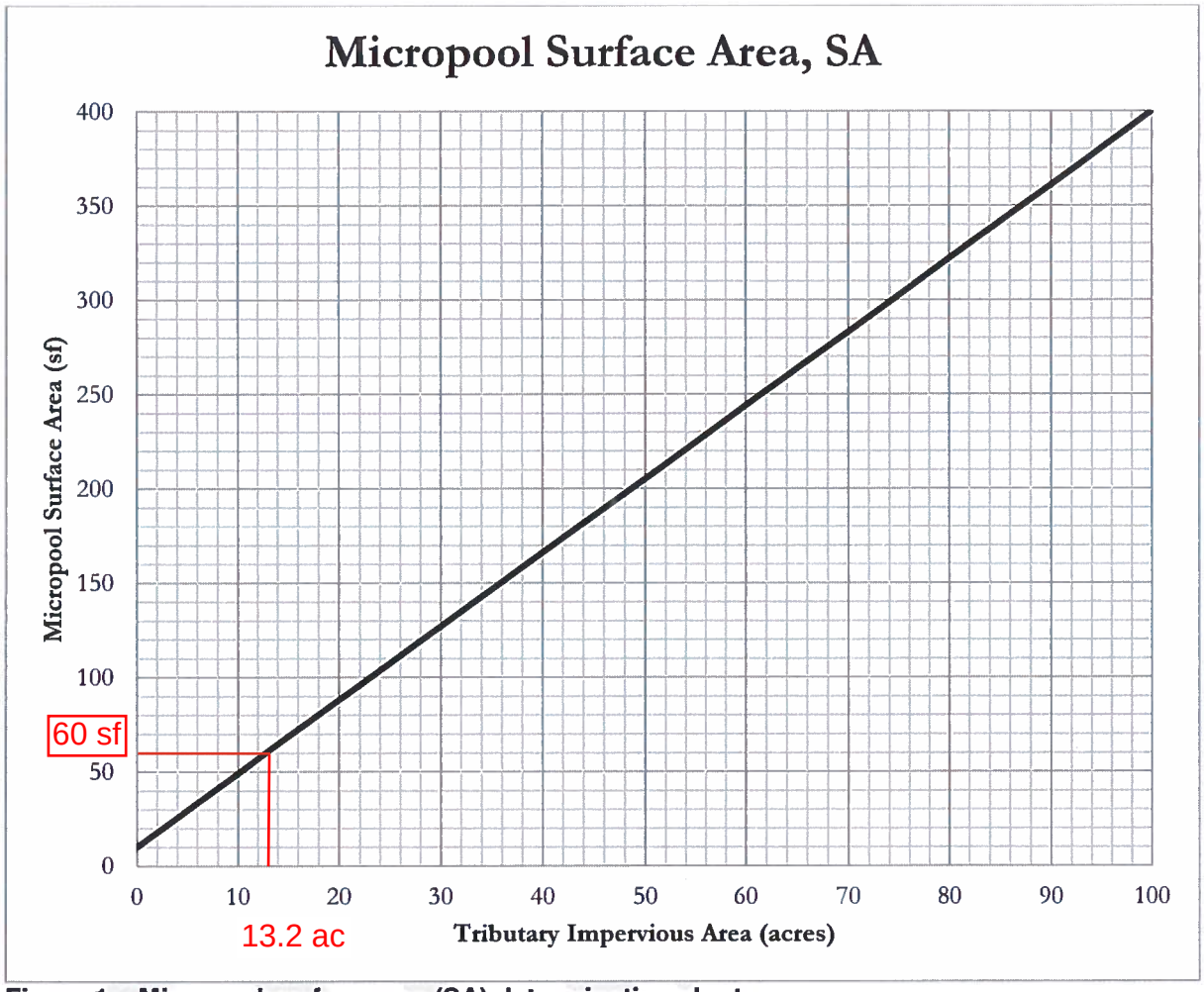


Figure 1 – Micropool surface area (SA) determination chart

The tributary impervious area is the effective number of impervious acres that will be treated by the extended detention basin (EDB). It is calculated by multiplying the tributary area to be treated by the impervious fraction of that area.

$$TIA = I \times A$$ = (89.4/100) x 14.8 ac = 13.2 ac

TIA = Tributary impervious area (acres)
I = Imperviousness (fraction)
A = Tributary catchment area upstream (acres)

For EDBs with tributary impervious areas greater than 100 acres, the micropool surface area is 400 sf. The initial surcharge depth (ISD) is defined as the depth of the initial surcharge volume (ISV). The surface area determined using Figure 1 assumes an ISD of 4 inches. The initial surcharge volume is thus calculated by multiplying the micropool surface area by 4 inches.

$$ISV = SA \times 4\ inches$$

ISV = Initial surcharge volume (cf)
SA = Surface area (from Figure 1, sf)

Pond B

Figure 13-12c. Emergency Spillway Protection

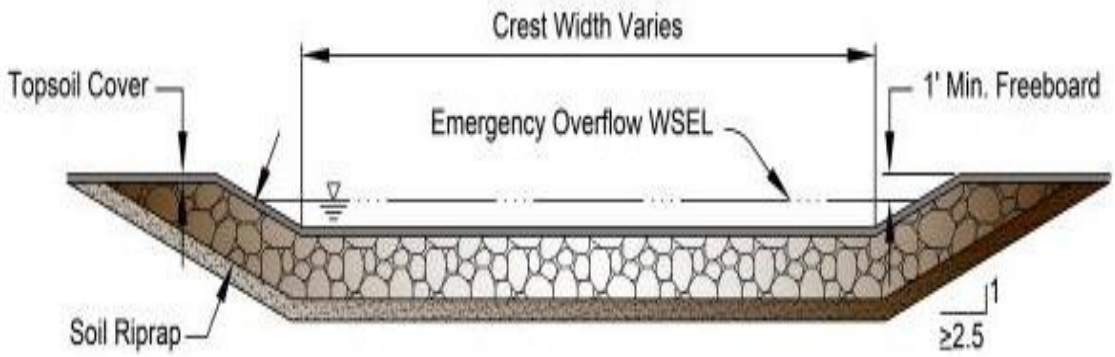
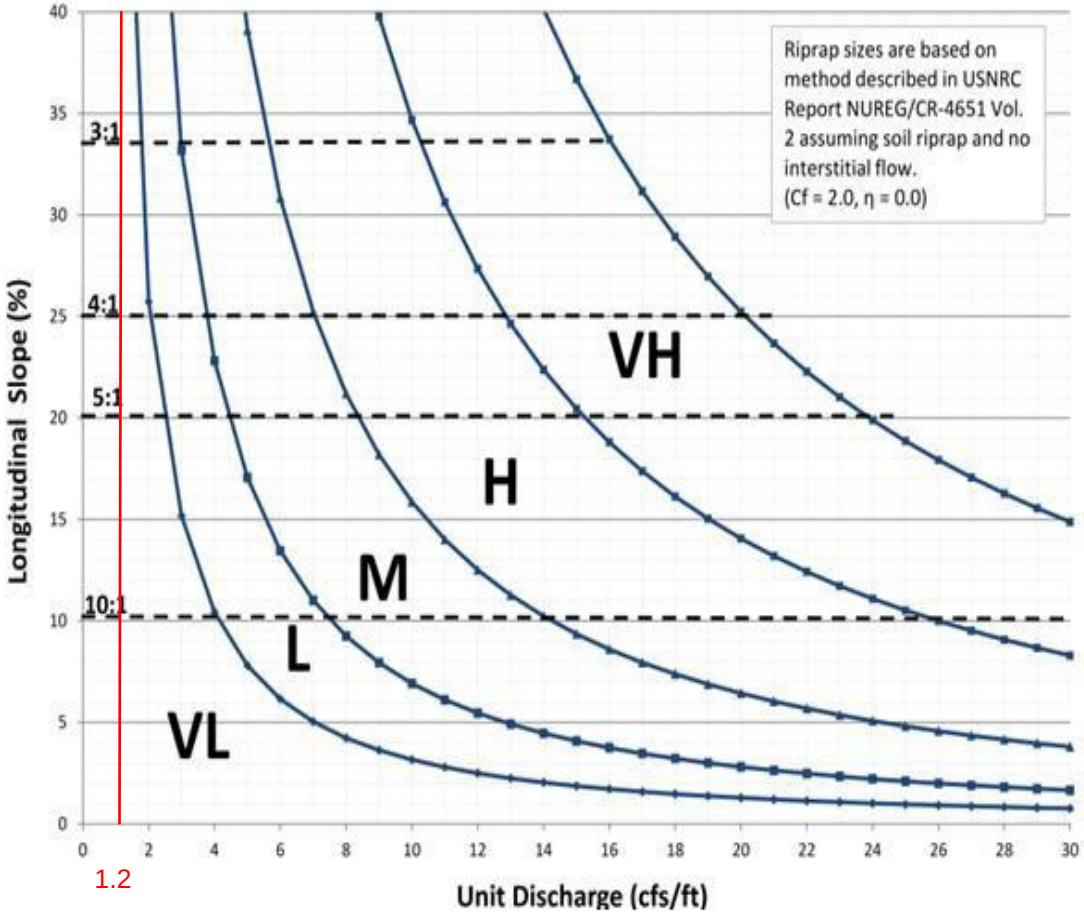


Figure 13-12d. Riprap Types for Emergency Spillway Protection



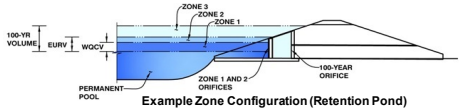
Q100=59.9 cfs
Spillway length=50 ft
59.9 cfs/50 ft = 1.2 cfs/ft

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Falcon Field Filing 1

Basin ID: Pond C - INTERIM CONDITION



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	23.89	acres
Watershed Length =	1,200	ft
Watershed Length to Centroid =	650	ft
Watershed Slope =	0.050	ft/ft
Watershed Imperviousness =	31.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.308	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.747	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.520	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.713	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.875	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.271	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.642	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.138	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.49 in.) =	3.868	acre-feet	3.49	inches
Approximate 2-yr Detention Volume =	0.470	acre-feet		
Approximate 5-yr Detention Volume =	0.627	acre-feet		
Approximate 10-yr Detention Volume =	0.782	acre-feet		
Approximate 25-yr Detention Volume =	0.986	acre-feet		
Approximate 50-yr Detention Volume =	1.137	acre-feet		
Approximate 100-yr Detention Volume =	1.377	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.308	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.439	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.630	acre-feet
Total Detention Basin Volume =	1.377	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

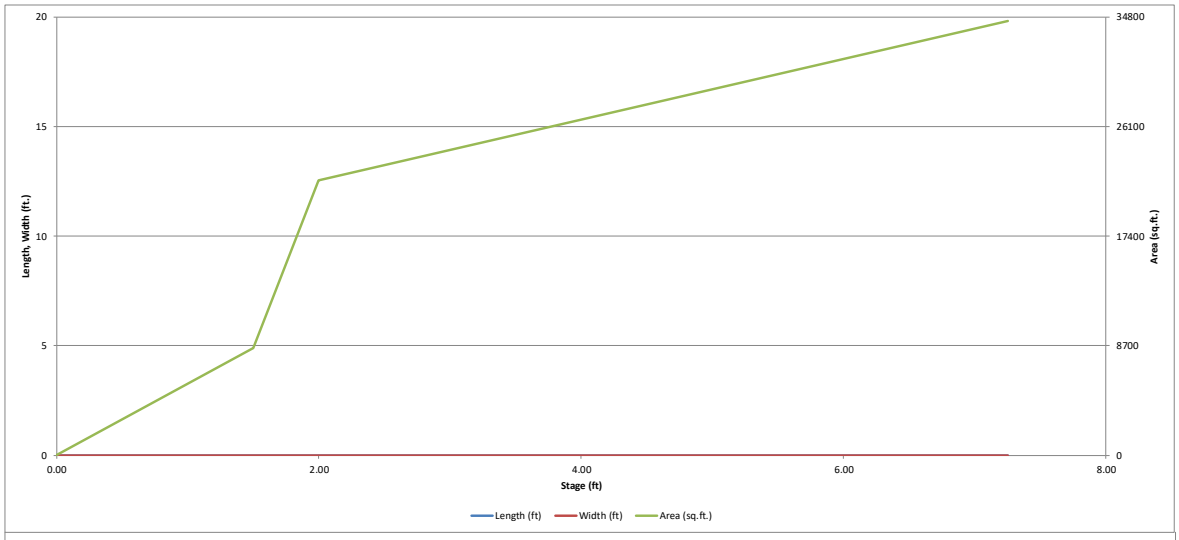
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

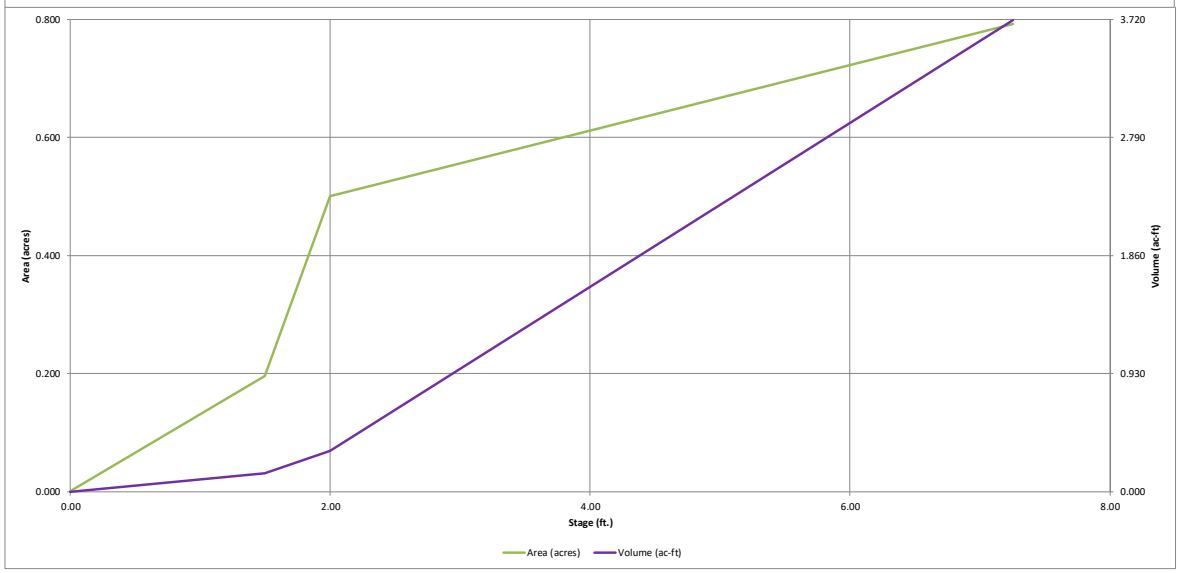
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	40	0.001		
6805	--	1.50	--	--	--	8,527	0.196	6,425	0.148
6805.5	--	2.00	--	--	--	21,821	0.501	14,012	0.322
6810.75	--	7.25	--	--	--	34,523	0.793	161,915	3.717

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



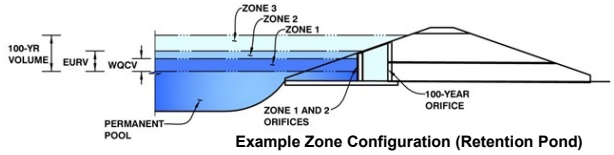


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Falcon Field Filing 1

Basin ID: Pond C - INTERIM CONDITION



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.98	0.308	Orifice Plate
Zone 2 (EURV)	2.82	0.439	Orifice Plate
Zone 3 (100-year)	3.91	0.630	Weir&Pipe (Restrict)
Total (all zones)		1.377	

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

Calculated Parameters for Underdrain

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	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)

Calculated Parameters for Plate

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =	3.91	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	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	1.30	2.61	3.73				
Orifice Area (sq. inches)	2.05	2.05	10.00	96.00				

	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)

Calculated Parameters for Vertical Orifi

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

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

Calculated Parameters for Overflow We

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, Ho =	4.85	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.85	N/A
Overflow Weir Front Edge Length =	3.92	N/A	feet	Overflow Weir Slope Length =	3.92	N/A
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.81	N/A
Horiz. Length of Weir Sides =	3.92	N/A	feet	Overflow Grate Open Area w/o Debris =	10.70	N/A
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	5.35	N/A
Debris Clogging % =	50%	N/A	%			

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected
Depth to Invert of Outlet Pipe =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.57	N/A
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.58	N/A
Restrictor Plate Height Above Pipe Invert =	12.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.57	N/A

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage=	5.69	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.55	feet
Spillway Crest Length =	58.00	feet	Stage at Top of Freeboard =	7.24	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.79	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.71	acre-ft

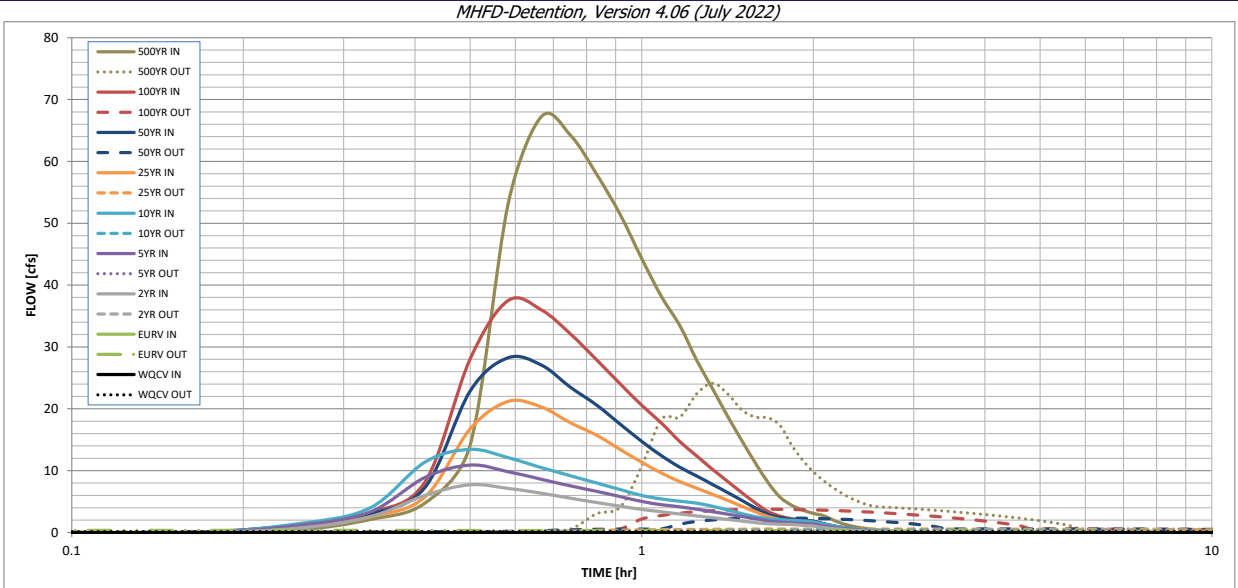
Routed Hydrograph Results

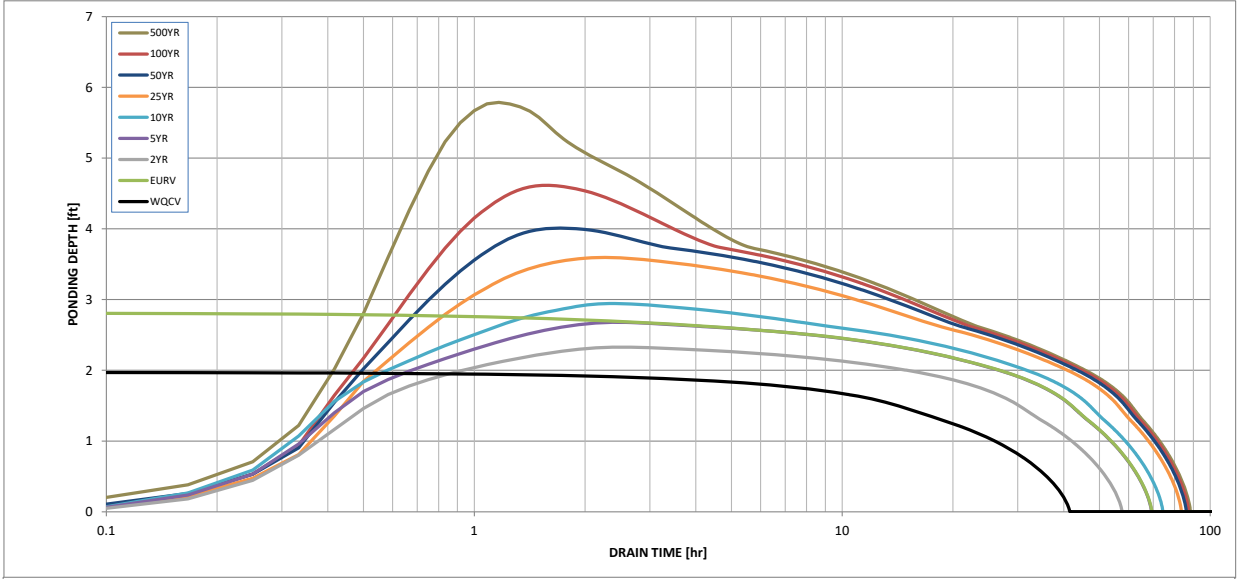
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

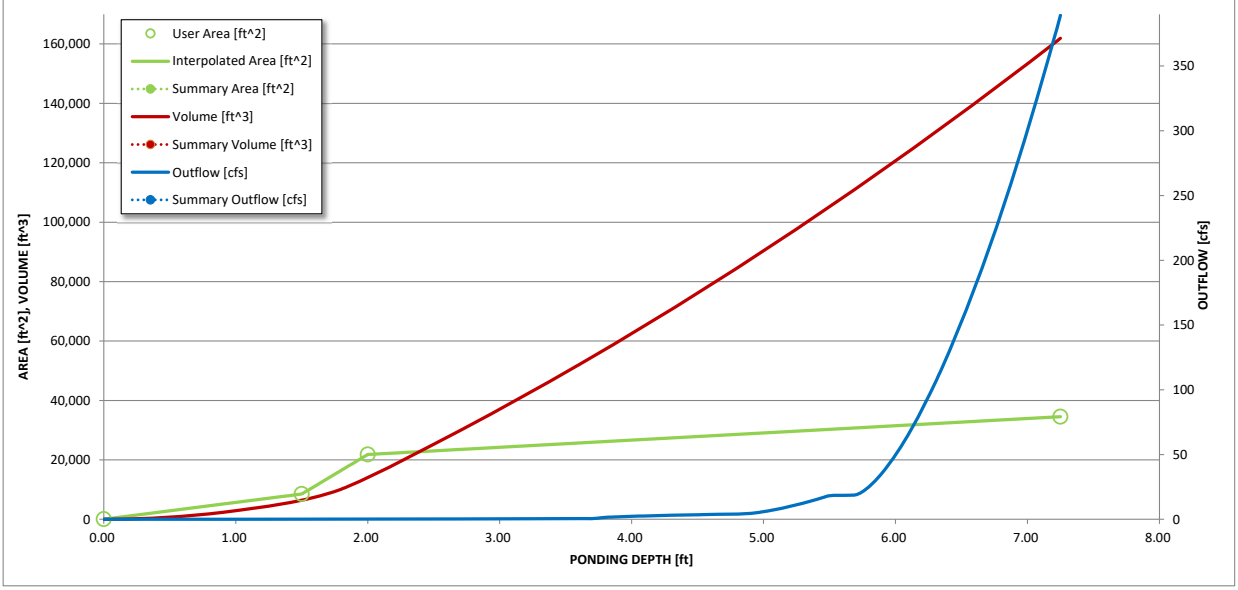
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	0.308	0.747	0.520	0.713	0.875	1.271	1.642	2.138
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.520	0.713	0.875	1.271	1.642	2.138
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.2	0.5	0.7	5.9	11.6	19.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.25	0.49	0.80
Peak Inflow Q (cfs) =	N/A	N/A	7.7	10.9	13.4	21.2	28.3	37.5
Peak Outflow Q (cfs) =	0.2	0.3	0.2	0.3	0.4	0.6	2.3	3.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.6	0.1	0.2	0.2
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Plate
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =	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	63	52	63	67	73	74	72
Time to Drain 99% of Inflow Volume (hours) =	**40**	66	55	66	71	79	81	81
Maximum Ponding Depth (ft) =	1.98	2.82	2.33	2.68	2.94	3.59	4.01	4.62
Area at Maximum Ponding Depth (acres) =	0.49	0.55	0.52	0.54	0.55	0.59	0.61	0.65
Maximum Volume Stored (acre-ft) =	0.312	0.751	0.485	0.670	0.817	1.188	1.435	1.818

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.01	0.42
	0:15:00	0.00	0.00	0.70	1.14	1.44	0.98	1.23	1.21	2.08
	0:20:00	0.00	0.00	2.52	3.30	3.94	2.51	2.96	3.18	4.78
	0:25:00	0.00	0.00	6.03	8.91	11.39	5.77	7.31	8.20	14.16
	0:30:00	0.00	0.00	7.72	10.90	13.44	16.74	22.89	28.08	53.25
	0:35:00	0.00	0.00	7.13	9.83	12.09	21.20	28.27	37.51	67.24
	0:40:00	0.00	0.00	6.36	8.60	10.50	20.28	27.07	35.99	64.22
	0:45:00	0.00	0.00	5.54	7.53	9.18	17.73	23.46	32.09	57.93
	0:50:00	0.00	0.00	4.85	6.66	8.00	15.73	20.61	27.92	51.38
	0:55:00	0.00	0.00	4.25	5.81	6.94	13.42	17.51	24.01	44.29
	1:00:00	0.00	0.00	3.73	5.03	6.00	11.36	14.74	20.58	38.13
	1:05:00	0.00	0.00	3.36	4.50	5.42	9.61	12.40	17.68	33.42
	1:10:00	0.00	0.00	2.99	4.15	5.06	8.22	10.54	14.68	27.78
	1:15:00	0.00	0.00	2.68	3.77	4.74	7.16	9.12	12.34	23.14
	1:20:00	0.00	0.00	2.39	3.36	4.23	6.14	7.73	10.16	18.69
	1:25:00	0.00	0.00	2.11	2.96	3.62	5.18	6.43	8.20	14.77
	1:30:00	0.00	0.00	1.84	2.58	3.05	4.23	5.16	6.42	11.22
	1:35:00	0.00	0.00	1.60	2.24	2.56	3.35	3.97	4.77	8.03
	1:40:00	0.00	0.00	1.42	1.88	2.24	2.58	2.95	3.39	5.67
	1:45:00	0.00	0.00	1.34	1.67	2.08	2.11	2.40	2.64	4.39
	1:50:00	0.00	0.00	1.30	1.55	1.98	1.86	2.12	2.25	3.61
	1:55:00	0.00	0.00	1.16	1.46	1.88	1.72	1.95	2.00	3.09
	2:00:00	0.00	0.00	1.04	1.36	1.73	1.62	1.84	1.83	2.72
	2:05:00	0.00	0.00	0.83	1.08	1.37	1.28	1.44	1.40	2.02
	2:10:00	0.00	0.00	0.64	0.84	1.06	0.98	1.09	1.03	1.45
	2:15:00	0.00	0.00	0.50	0.65	0.82	0.75	0.83	0.77	1.06
	2:20:00	0.00	0.00	0.39	0.50	0.63	0.57	0.63	0.59	0.79
	2:25:00	0.00	0.00	0.30	0.38	0.47	0.43	0.47	0.44	0.59
	2:30:00	0.00	0.00	0.23	0.29	0.35	0.32	0.35	0.33	0.44
	2:35:00	0.00	0.00	0.17	0.21	0.26	0.24	0.26	0.24	0.32
	2:40:00	0.00	0.00	0.13	0.16	0.20	0.18	0.19	0.18	0.24
	2:45:00	0.00	0.00	0.09	0.11	0.14	0.13	0.14	0.13	0.17
	2:50:00	0.00	0.00	0.06	0.08	0.10	0.09	0.09	0.09	0.11
	2:55:00	0.00	0.00	0.04	0.05	0.06	0.05	0.06	0.05	0.06
	3:00:00	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.03	0.03
	3:05:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pond C

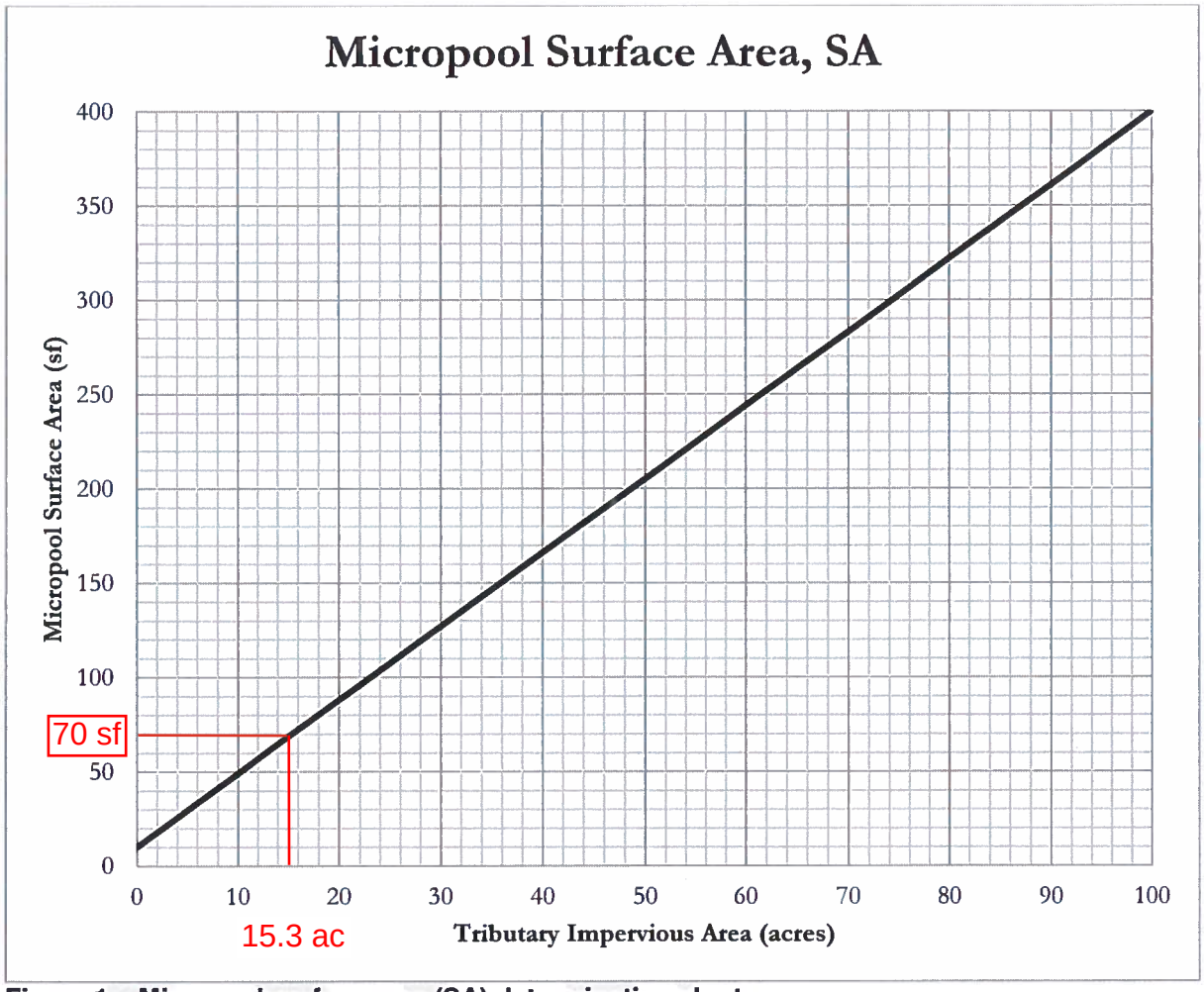


Figure 1 – Micropool surface area (SA) determination chart

The tributary impervious area is the effective number of impervious acres that will be treated by the extended detention basin (EDB). It is calculated by multiplying the tributary area to be treated by the impervious fraction of that area.

$$TIA = I \times A$$ = (64.0/100) x 23.9 ac = 15.3 ac

TIA = Tributary impervious area (acres)
I = Imperviousness (fraction)
A = Tributary catchment area upstream (acres)

For EDBs with tributary impervious areas greater than 100 acres, the micropool surface area is 400 sf. The initial surcharge depth (ISD) is defined as the depth of the initial surcharge volume (ISV). The surface area determined using Figure 1 assumes an ISD of 4 inches. The initial surcharge volume is thus calculated by multiplying the micropool surface area by 4 inches.

$$ISV = SA \times 4\ inches$$

ISV = Initial surcharge volume (cf)
SA = Surface area (from Figure 1, sf)

Pond C

Figure 13-12c. Emergency Spillway Protection

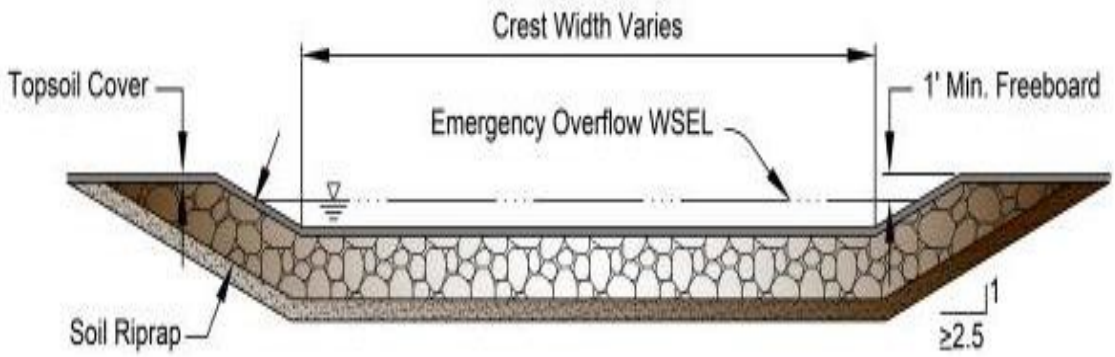
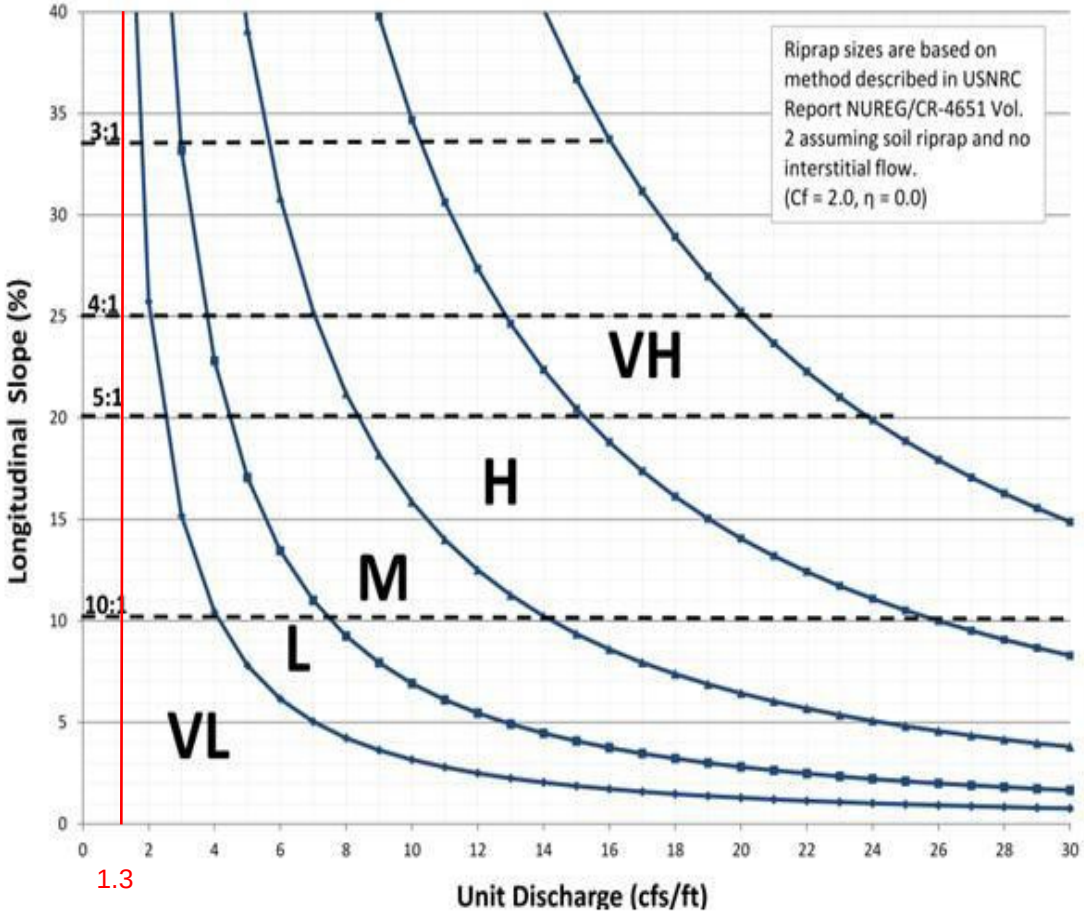


Figure 13-12d. Riprap Types for Emergency Spillway Protection



Q100=75.1 cfs
Spillway length=58 ft
75.1 cfs/58 ft = 1.3 cfs/ft

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

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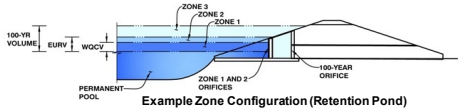
Project: Falcon Field Filing 1

Basin ID: Pond C



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	23.89	acres
Watershed Length =	1,200	ft
Watershed Length to Centroid =	650	ft
Watershed Slope =	0.050	ft/ft
Watershed Imperviousness =	64.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.498	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	1.889	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.349	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.770	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.107	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	2.552	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.988	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.521	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.49 in.) =	5.372	acre-feet	3.49 inches
Approximate 2-yr Detention Volume =	1.228	acre-feet	
Approximate 5-yr Detention Volume =	1.606	acre-feet	
Approximate 10-yr Detention Volume =	1.938	acre-feet	
Approximate 25-yr Detention Volume =	2.334	acre-feet	
Approximate 50-yr Detention Volume =	2.573	acre-feet	
Approximate 100-yr Detention Volume =	2.825	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.498	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.391	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.936	acre-feet
Total Detention Basin Volume =	2.825	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	40	0.001		
6805	--	1.50	--	--	--	8,527	0.196	6,425	0.148
6805.5	--	2.00	--	--	--	21,821	0.501	14,012	0.322
6810.75	--	7.25	--	--	--	34,523	0.793	161,915	3

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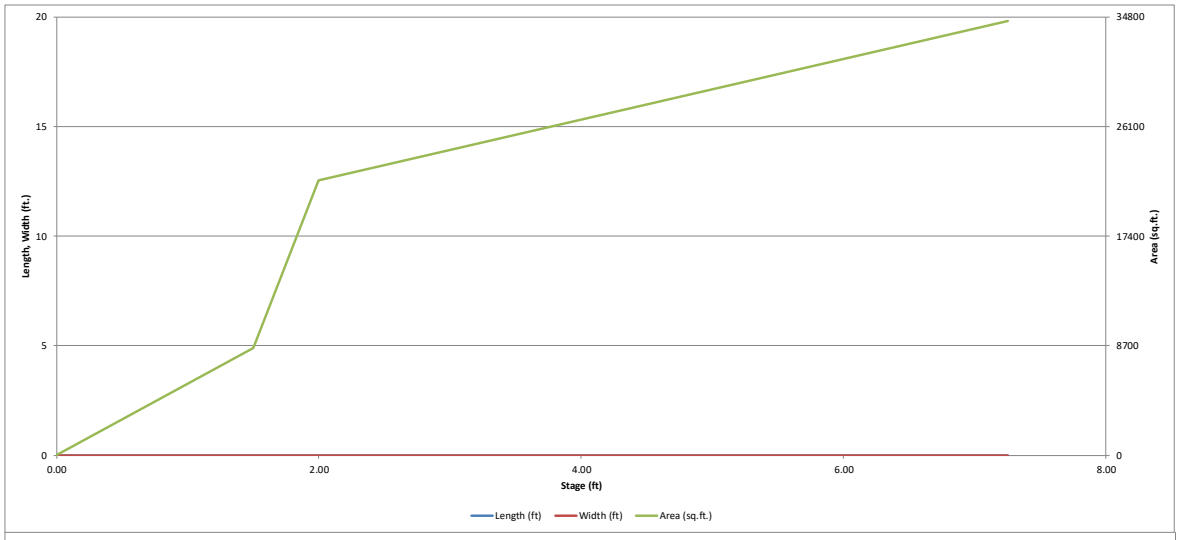

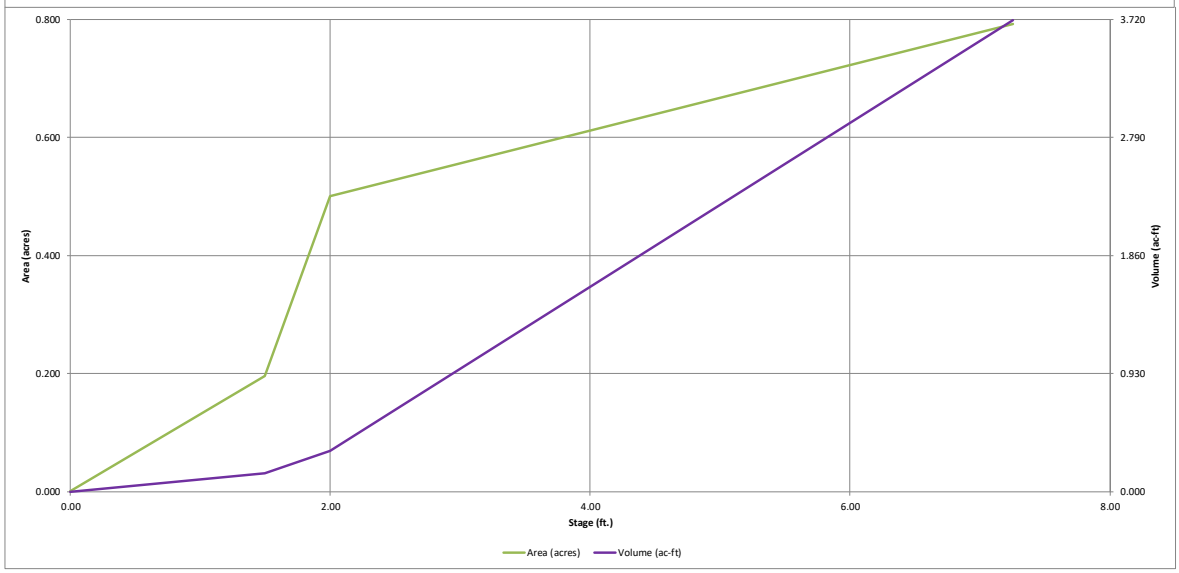

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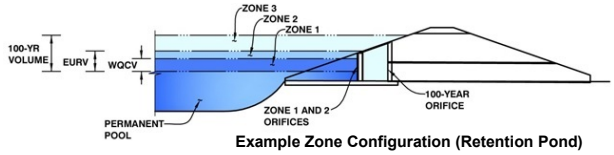
DETENTION BASIN OUTLET STRUCTURE DE

MHFD-Detention, Version 4.06 (July 2022)

Project: Falcon Field Filing 1

Basin ID: Pond C



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.35	0.498	Orifice Plate
Zone 2 (EURV)	4.72	1.391	Orifice Plate
Zone 3 (100-year)	6.08	0.936	Weir&Pipe (Restrict)
Total (all zones)		2.825	

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =	4.72	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	18.90	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highes 8

	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	1.57	3.15					
Orifice Area (sq. inches)	2.78	4.00	6.00					

	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 Orifi

	Not Selected	Not Selected
Vertical Orifice Area =	N/A	N/A
Vertical Orifice Centroid =	N/A	N/A

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, Ho =	4.85	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.92	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	3.92	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow We

	Zone 3 Weir	Not Selected
Height of Grate Upper Edge, H_t =	4.85	N/A
Overflow Weir Slope Length =	3.92	N/A
Grate Open Area / 100-yr Orifice Area =	6.81	N/A
Overflow Grate Open Area w/o Debris =	10.70	N/A
Overflow Grate Open Area w/ Debris =	5.35	N/A

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 =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	12.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

	Zone 3 Restrictor	Not Selected
Outlet Orifice Area =	1.57	N/A
Outlet Orifice Centroid =	0.58	N/A
Half-Central Angle of Restrictor Plate on Pipe =	1.57	N/A

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.69	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.54	feet
Spillway Crest Length =	58.00	feet	Stage at Top of Freeboard =	7.23	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.79	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.70	acre-ft

Calculated Parameters for Spillway

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)

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	0.498	1.889	1.349	1.770	2.107	2.552	2.988	3.521
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.349	1.770	2.107	2.552	2.988	3.521
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.2	0.5	0.7	5.9	11.6	19.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.25	0.49	0.80
Peak Inflow Q (cfs) =	N/A	N/A	26.4	34.4	41.4	51.8	62.4	75.1
Peak Outflow Q (cfs) =	0.3	0.7	0.5	0.6	0.9	4.8	9.6	18.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.3	1.4	0.8	0.8	1.0
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.4	0.8	1.7
Max Velocity through Grate 2 (fps) =	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	71	63	70	74	73	72	70
Time to Drain 99% of Inflow Volume (hours) =	**40**	76	68	75	80	80	80	79
Maximum Ponding Depth (ft) =	2.35	4.72	3.74	4.39	4.89	5.14	5.35	5.66
Area at Maximum Ponding Depth (acres) =	0.52	0.65	0.60	0.63	0.66	0.68	0.69	0.70
Maximum Volume Stored (acre-ft) =	0.500	1.890	1.277	1.678	2.001	2.168	2.305	2.527

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DETENTION BASIN OUTLET STRUCTURE DESIG

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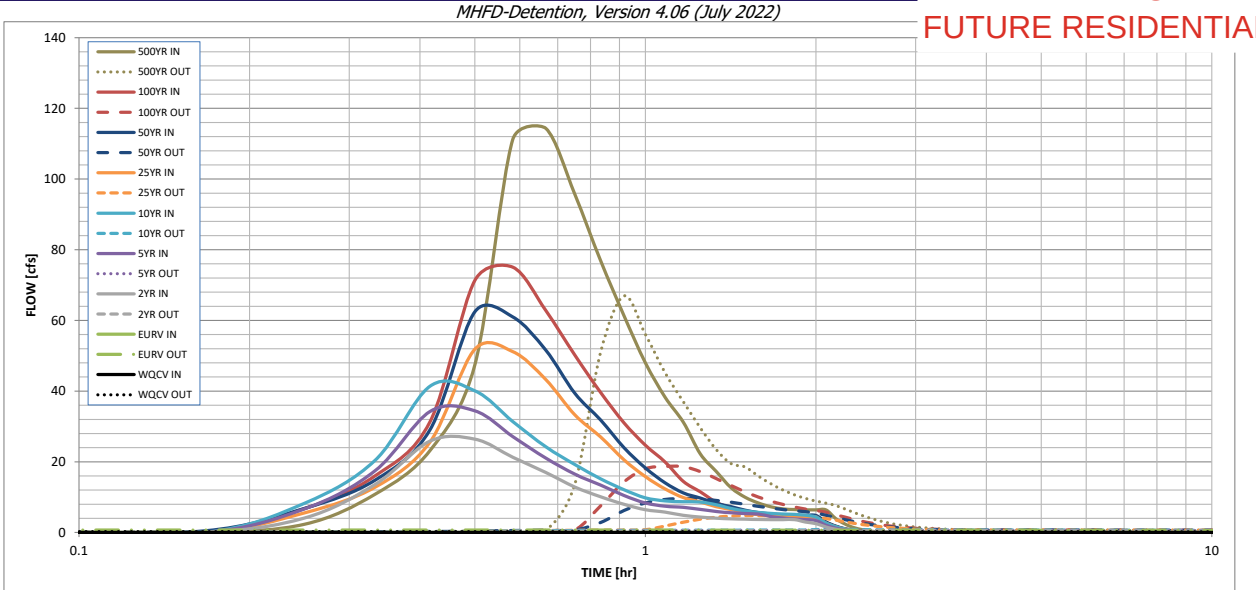

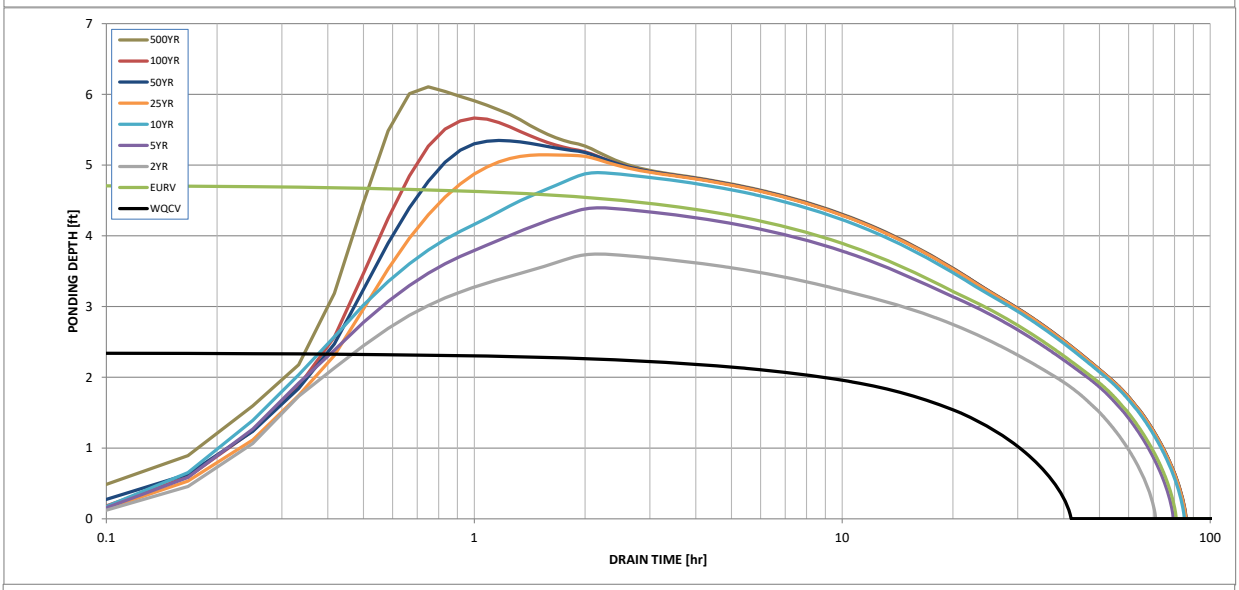

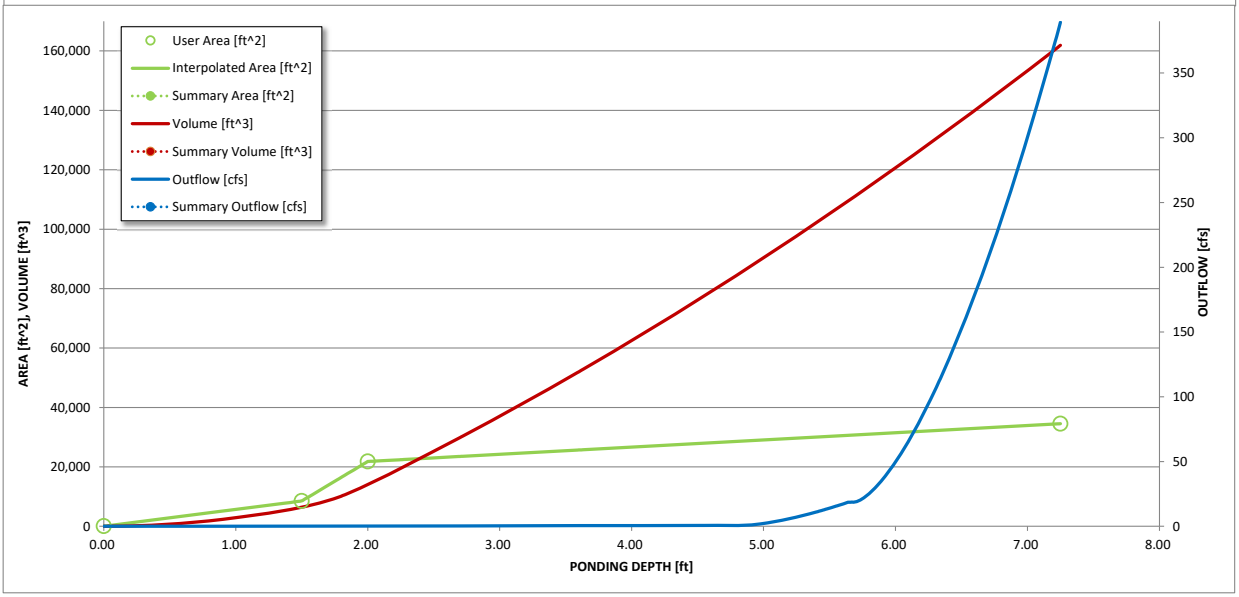

S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

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DETENTION BASIN OUTLET STRUCTURE DESIG

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.05	2.31
	0:15:00	0.00	0.00	4.10	6.67	8.27	5.56	6.82	6.77	10.84
	0:20:00	0.00	0.00	13.59	17.49	20.45	12.82	14.80	16.03	23.20
	0:25:00	0.00	0.00	25.87	34.22	41.37	25.61	29.08	31.34	47.43
	0:30:00	0.00	0.00	26.43	34.42	40.10	51.85	62.44	71.30	111.17
	0:35:00	0.00	0.00	21.28	27.12	31.38	51.18	60.99	75.06	114.37
	0:40:00	0.00	0.00	16.98	21.07	24.26	43.30	51.62	62.83	95.79
	0:45:00	0.00	0.00	12.89	16.52	19.26	33.32	39.42	50.25	76.93
	0:50:00	0.00	0.00	10.11	13.41	15.20	27.06	31.83	39.65	61.35
	0:55:00	0.00	0.00	7.96	10.47	12.09	20.55	23.99	31.01	48.00
	1:00:00	0.00	0.00	6.45	8.36	9.81	15.79	18.25	24.68	38.26
	1:05:00	0.00	0.00	5.78	7.42	8.95	12.32	14.04	19.95	31.20
	1:10:00	0.00	0.00	4.87	7.11	8.70	9.88	11.20	14.45	22.23
	1:15:00	0.00	0.00	4.34	6.55	8.60	8.65	9.77	11.49	17.32
	1:20:00	0.00	0.00	4.05	5.95	7.86	7.32	8.24	8.58	12.66
	1:25:00	0.00	0.00	3.87	5.57	6.80	6.51	7.32	6.89	9.97
	1:30:00	0.00	0.00	3.76	5.35	6.11	5.60	6.30	5.85	8.33
	1:35:00	0.00	0.00	3.68	5.21	5.68	5.03	5.65	5.19	7.27
	1:40:00	0.00	0.00	3.64	4.52	5.41	4.67	5.24	4.81	6.67
	1:45:00	0.00	0.00	3.64	4.07	5.23	4.47	5.03	4.68	6.49
	1:50:00	0.00	0.00	3.64	3.80	5.12	4.36	4.90	4.62	6.40
	1:55:00	0.00	0.00	2.96	3.65	4.88	4.31	4.84	4.62	6.40
	2:00:00	0.00	0.00	2.52	3.37	4.35	4.28	4.81	4.62	6.40
	2:05:00	0.00	0.00	1.55	2.08	2.69	2.66	2.99	2.86	3.96
	2:10:00	0.00	0.00	0.93	1.25	1.63	1.62	1.82	1.74	2.40
	2:15:00	0.00	0.00	0.53	0.73	0.94	0.95	1.06	1.01	1.39
	2:20:00	0.00	0.00	0.28	0.41	0.52	0.54	0.60	0.57	0.79
	2:25:00	0.00	0.00	0.12	0.21	0.25	0.27	0.30	0.29	0.39
	2:30:00	0.00	0.00	0.04	0.07	0.08	0.09	0.10	0.09	0.13
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00