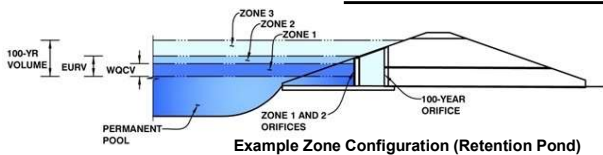




# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

**Project:** New Breed Ranch Filing Three  
**Basin ID:** Rain Garden 1-9.1



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.92	0.045	Filtration Media
Zone 2 (User)	0.92	0.000	Weir&Pipe (Restrict)
Zone 3			
<b>Total (all zones)</b>		<b>0.045</b>	

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

Underdrain Orifice Invert Depth =	2.00	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	1.05	inches

**Calculated Parameters for Underdrain**

Underdrain Orifice Area =	0.0	ft <sup>2</sup>
Underdrain Orifice Centroid =	0.04	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 =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	N/A	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 <sup>2</sup>
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft <sup>2</sup>

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

	Row 1 (optional)	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**User Input:** Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	2.00		ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.00		ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	18.00		inches

**Calculated Parameters for Vertical Orifice**

	Not Selected	Not Selected	
Vertical Orifice Area =	1.77		ft <sup>2</sup>
Vertical Orifice Centroid =	0.75		feet

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

	Zone 2 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.00		ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00		feet
Overflow Weir Grate Slope =	0.00		H:V
Horiz. Length of Weir Sides =	2.50		feet
Overflow Grate Type =	Type C Grate		
Debris Clogging % =	50%		%

**Calculated Parameters for Overflow Weir**

	Zone 2 Weir	Not Selected	
Height of Grate Upper Edge, H <sub>u</sub> =	1.00		feet
Overflow Weir Slope Length =	2.50		feet
Grate Open Area / 100-yr Orifice Area =	23.80		
Overflow Grate Open Area w/o Debris =	6.96		ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	3.48		ft <sup>2</sup>

**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 =	2.00		ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00		inches
Restrictor Plate Height Above Pipe Invert =	4.00		inches

**Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate**

	Zone 2 Restrictor	Not Selected	
Outlet Orifice Area =	0.29		ft <sup>2</sup>
Outlet Orifice Centroid =	0.20		feet
Half-Central Angle of Restrictor Plate on Pipe =	0.98	N/A	radians

**User Input:** Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	1.10	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	5.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	0.00	feet

**Calculated Parameters for Spillway**

Spillway Design Flow Depth =	0.86	feet
Stage at Top of Freeboard =	1.96	feet
Basin Area at Top of Freeboard =	0.08	acres
Basin Volume at Top of Freeboard =	0.12	acre-ft

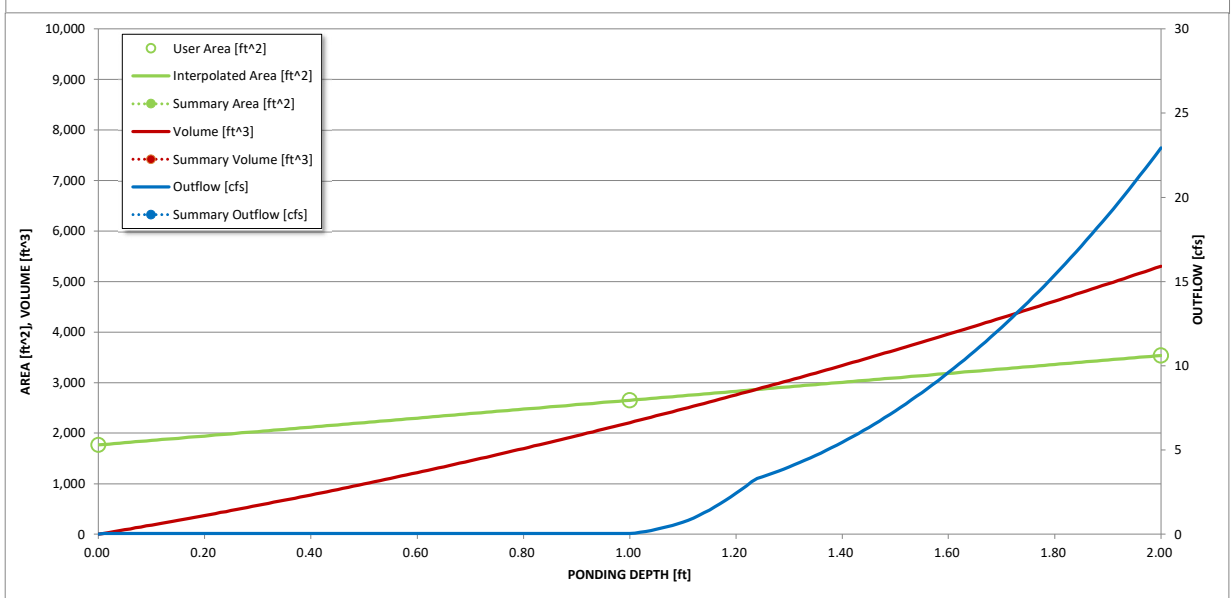
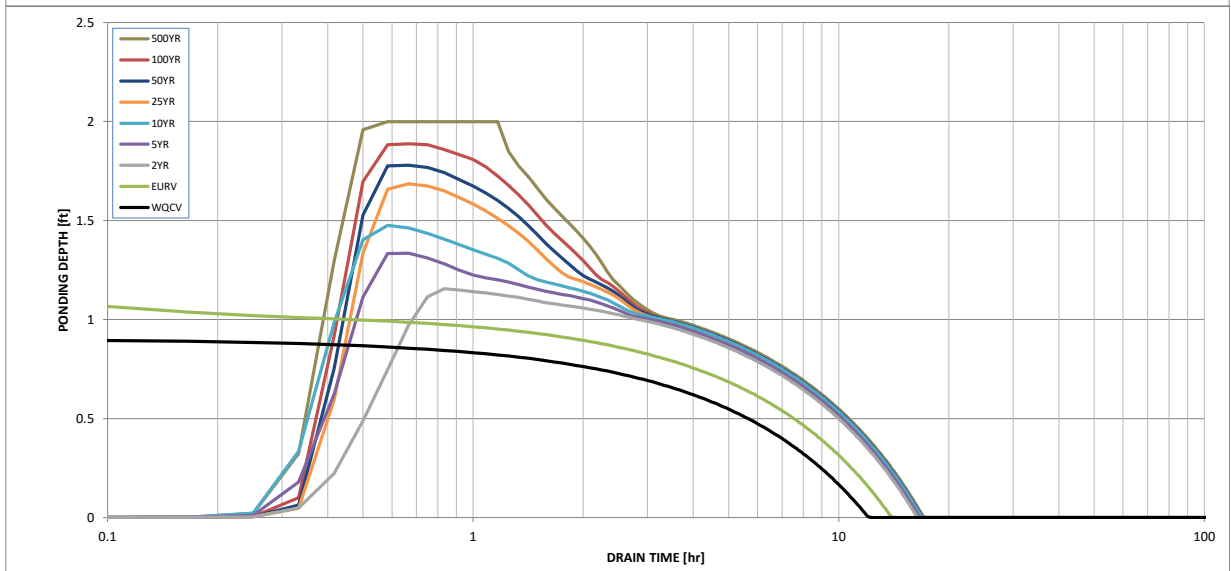
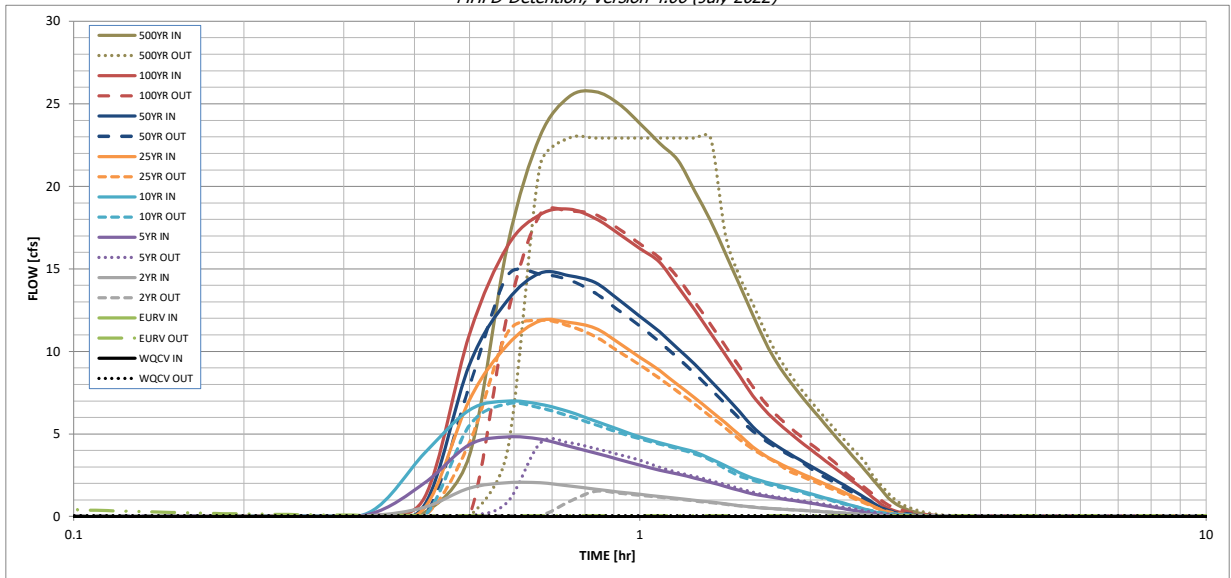
## Routed Hydrograph Results

*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	0.154	0.369	0.588	0.991	1.260	1.653	2.361
CUHP Runoff Volume (acre-ft) =	0.045	0.089	0.154	0.369	0.588	0.991	1.260	1.653	2.361
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.5	4.2	6.3	11.2	14.1	18.0	25.1
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.11	0.30	0.46	0.81	1.01	1.30	1.81
Peak Inflow Q (cfs) =	N/A	N/A	2.0	4.8	7.0	11.9	14.7	18.6	25.7
Peak Outflow Q (cfs) =	0.0	4.6	1.5	4.5	6.8	11.9	14.7	18.5	22.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.1	1.1	1.1	1.0	1.0	0.9
Structure Controlling Flow =	Filtration Media	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway	N/A
Max Velocity through Gate 1 (fps) =	N/A	0.36	0.17	0.4	0.4	0.4	0.4	0.4	0.4
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) =	12	13	15	14	12	9	7	4	2
Time to Drain 99% of Inflow Volume (hours) =	<b>12</b>	14	16	16	15	14	13	12	11
Maximum Ponding Depth (ft) =	0.91	1.58	1.15	1.34	1.47	1.69	1.78	1.89	2.00
Area at Maximum Ponding Depth (acres) =	0.06	0.07	0.06	0.07	0.07	0.07	0.08	0.08	0.08
Maximum Volume Stored (acre-ft) =	0.045	0.089	0.060	0.072	0.082	0.097	0.104	0.112	0.122

# 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.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	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	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	0:20:00	0.00	0.00	0.04	0.14	0.26	0.04	0.05	0.06	0.25
	0:25:00	0.00	0.00	0.56	2.03	3.83	0.52	0.69	1.14	3.70
	0:30:00	0.00	0.00	1.72	4.36	6.45	7.07	9.20	11.04	16.36
	0:35:00	0.00	0.00	2.04	4.81	6.98	10.38	13.07	16.35	23.06
	0:40:00	0.00	0.00	2.04	4.69	6.80	11.85	14.75	18.30	25.43
	0:45:00	0.00	0.00	1.85	4.25	6.34	11.75	14.60	18.61	25.74
	0:50:00	0.00	0.00	1.66	3.85	5.78	11.42	14.17	18.06	25.02
	0:55:00	0.00	0.00	1.49	3.46	5.27	10.53	13.15	17.15	23.82
	1:00:00	0.00	0.00	1.34	3.10	4.82	9.64	12.12	16.23	22.62
	1:05:00	0.00	0.00	1.22	2.81	4.47	8.84	11.19	15.41	21.58
	1:10:00	0.00	0.00	1.10	2.57	4.18	7.98	10.16	13.93	19.71
	1:15:00	0.00	0.00	0.98	2.33	3.90	7.19	9.22	12.52	17.92
	1:20:00	0.00	0.00	0.87	2.07	3.51	6.41	8.23	11.11	15.93
	1:25:00	0.00	0.00	0.76	1.82	3.08	5.67	7.28	9.79	14.03
	1:30:00	0.00	0.00	0.66	1.57	2.65	4.93	6.34	8.52	12.22
	1:35:00	0.00	0.00	0.56	1.37	2.32	4.22	5.43	7.32	10.55
	1:40:00	0.00	0.00	0.50	1.23	2.09	3.68	4.76	6.41	9.27
	1:45:00	0.00	0.00	0.46	1.11	1.90	3.28	4.25	5.71	8.28
	1:50:00	0.00	0.00	0.42	1.01	1.73	2.94	3.82	5.11	7.42
	1:55:00	0.00	0.00	0.38	0.91	1.56	2.64	3.43	4.57	6.64
	2:00:00	0.00	0.00	0.34	0.81	1.39	2.37	3.08	4.08	5.93
	2:05:00	0.00	0.00	0.30	0.71	1.22	2.10	2.73	3.61	5.24
	2:10:00	0.00	0.00	0.26	0.61	1.05	1.84	2.40	3.16	4.59
	2:15:00	0.00	0.00	0.22	0.52	0.89	1.60	2.07	2.75	3.98
	2:20:00	0.00	0.00	0.18	0.42	0.73	1.35	1.76	2.34	3.39
	2:25:00	0.00	0.00	0.14	0.33	0.59	1.11	1.45	1.94	2.80
	2:30:00	0.00	0.00	0.11	0.24	0.44	0.87	1.14	1.54	2.23
	2:35:00	0.00	0.00	0.07	0.15	0.30	0.63	0.83	1.14	1.65
	2:40:00	0.00	0.00	0.04	0.09	0.20	0.40	0.53	0.75	1.12
	2:45:00	0.00	0.00	0.02	0.05	0.14	0.24	0.34	0.49	0.76
	2:50:00	0.00	0.00	0.01	0.04	0.11	0.15	0.22	0.32	0.53
	2:55:00	0.00	0.00	0.01	0.03	0.09	0.09	0.15	0.21	0.36
	3:00:00	0.00	0.00	0.01	0.02	0.07	0.06	0.10	0.13	0.24
	3:05:00	0.00	0.00	0.01	0.02	0.05	0.04	0.07	0.08	0.15
	3:10:00	0.00	0.00	0.00	0.01	0.04	0.02	0.04	0.04	0.09
	3:15:00	0.00	0.00	0.00	0.01	0.03	0.01	0.03	0.02	0.05
	3:20:00	0.00	0.00	0.00	0.01	0.02	0.01	0.02	0.01	0.03
	3:25:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02
	3:30:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02
	3:35:00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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	