

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

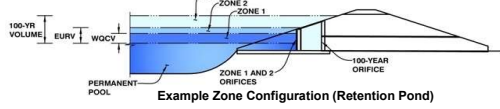
MHFD- Detention, Version 4.06 (July 2022)

Project: RETREAT AT TIMBERRIDGE FILING NO. 4

Basin ID: POND 4

Stormwater Facility Name: RETREAT AT TIMBERRIDGE FILING NO. 4 - POND 4

Facility Location & Jurisdiction: Approx. 1400' east of int. of Vollmer Road and Arroya Lane, El Paso County



Watershed Information

Table with Watershed Information parameters including Selected BMP Type (EDB), Watershed Area (48.50 acres), Watershed Length (2,200 ft), Watershed Length to Centroid (1,000 ft), Watershed Slope (0.050 ft/ft), Watershed Imperviousness (7.10% 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), Target WQCV Drain Time (40.0 hours), and 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.

Table with Water Quality Capture Volume (WQCV) = 0.201 acre-feet, Excess Urban Runoff Volume (EURV) = 0.315 acre-feet, 2-yr Runoff Volume (P1 = 1.19 in.) = 0.541 acre-feet, 5-yr Runoff Volume (P1 = 1.5 in.) = 1.291 acre-feet, 10-yr Runoff Volume (P1 = 1.75 in.) = 2.054 acre-feet, 25-yr Runoff Volume (P1 = 2 in.) = 3.459 acre-feet, 50-yr Runoff Volume (P1 = 2.25 in.) = 4.396 acre-feet, 100-yr Runoff Volume (P1 = 2.52 in.) = 5.766 acre-feet, 500-yr Runoff Volume (P1 = 3.85 in.) = 11.146 acre-feet, and Approximate 2-yr to 100-yr Detention Volumes ranging from 0.194 to 1.531 acre-feet.

Optional User Overrides table with columns for Stage (ft), Length (ft), Width (ft), Area (ft^2), and Volume (ac-ft) with values 1.19, 1.50, 1.75, 2.00, 2.25, 2.52, and 3.85 inches.

Define Zones and Basin Geometry

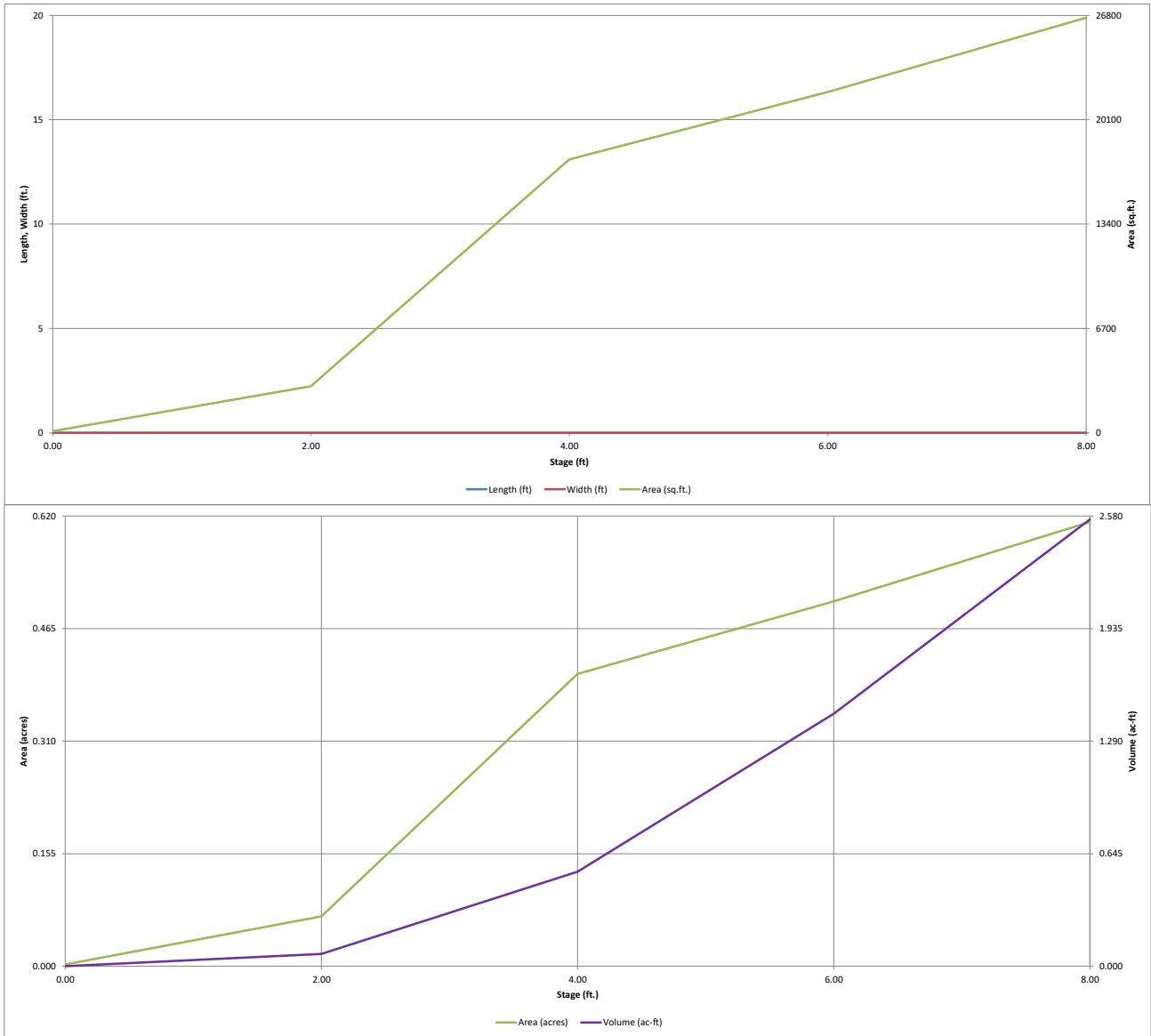
Table with Define Zones and Basin Geometry parameters including Zone 1 Volume (WQCV) = 0.201 acre-feet, Zone 2 Volume (EURV - Zone 1) = 0.114 acre-feet, Zone 3 Volume (100-year - Zones 1 & 2) = 1.216 acre-feet, Total Detention Basin Volume = 1.531 acre-feet, Initial Surcharge Volume (ISV) = user ft^3, Initial Surcharge Depth (ISD) = user ft, Total Available Detention Depth (Htotal) = user ft, Depth of Trickle Channel (Htr) = user ft, Slope of Trickle Channel (Str) = user ft/ft, Slopes of Main Basin Sides (Smain) = user H:V, and Basin Length-to-Width Ratio (RLW) = user.

Table with Basin Geometry parameters including Initial Surcharge Area (AISV) = user ft^2, Surcharge Volume Length (LISV) = user ft, Surcharge Volume Width (WISV) = user ft, Depth of Basin Floor (HFLOOR) = user ft, Length of Basin Floor (LFLOOR) = user ft, Width of Basin Floor (WFLOOR) = user ft, Area of Basin Floor (AFLOOR) = user ft^2, Volume of Basin Floor (VFLOOR) = user ft^3, Depth of Main Basin (HMAIN) = user ft, Length of Main Basin (LMAIN) = user ft, Width of Main Basin (WMAIN) = user ft, Area of Main Basin (AMAIN) = user ft^2, Volume of Main Basin (VMAIN) = user ft^3, and Calculated Total Basin Volume (Vtotal) = user acre-feet.

Main Stage-Storage Table with columns: 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), and Volume (ac-ft). Rows include Top of Micropool and stages 7250, 7252, 7254, 7256.

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

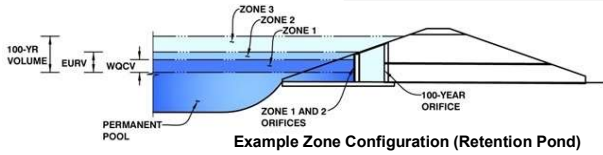


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

**Project:** RETREAT AT TIMBERIDGE FILING NO. 4

**Basin ID:** POND 4



**Example Zone Configuration (Retention Pond)**

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.91	0.201	Orifice Plate
Zone 2 (EURV)	3.35	0.114	Orifice Plate
Zone 3 (100-year)	6.17	1.216	Weir&Pipe (Restrict)
<b>Total (all zones)</b>		<b>1.531</b>	

**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 Diameter =	N/A	inches

**Calculated Parameters for Underdrain**

Underdrain Orifice Area =	N/A	ft <sup>2</sup>
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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.50	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	14.00	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 (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	1.20	2.40					
Orifice Area (sq. inches)	0.79	0.89	0.89					

	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 <sup>2</sup>
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, Ho =	3.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	9.00	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Type =	Close Mesh Grate	N/A	
Debris Clogging % =	50%	N/A	%

**Calculated Parameters for Overflow Weir**

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H <sub>u</sub> =	4.50	N/A	feet
Overflow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	6.86	N/A	
Overflow Grate Open Area w/o Debris =	29.35	N/A	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	14.68	N/A	ft <sup>2</sup>

**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 =	3.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	36.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	21.00		inches

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

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	4.28	N/A	ft <sup>2</sup>
Outlet Orifice Centroid =	1.00	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.74	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 =	3.00	H:V
Freeboard above Max Water Surface =	1.00	feet

**Calculated Parameters for Spillway**

Spillway Design Flow Depth =	0.93	feet
Stage at Top of Freeboard =	7.93	feet
Basin Area at Top of Freeboard =	0.61	acres
Basin Volume at Top of Freeboard =	2.52	acre-ft

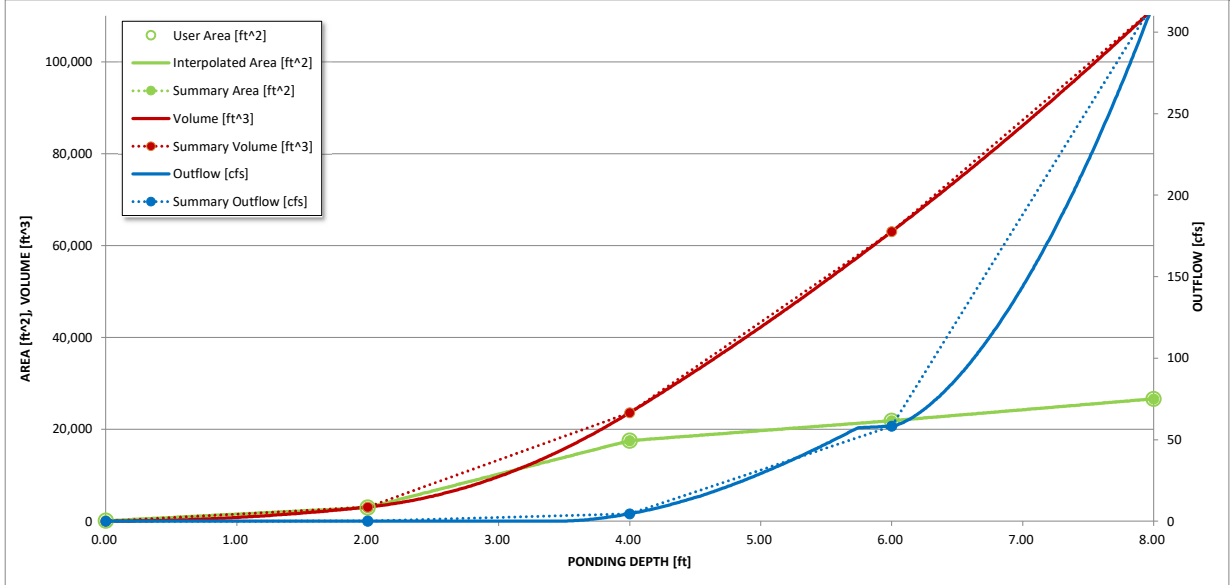
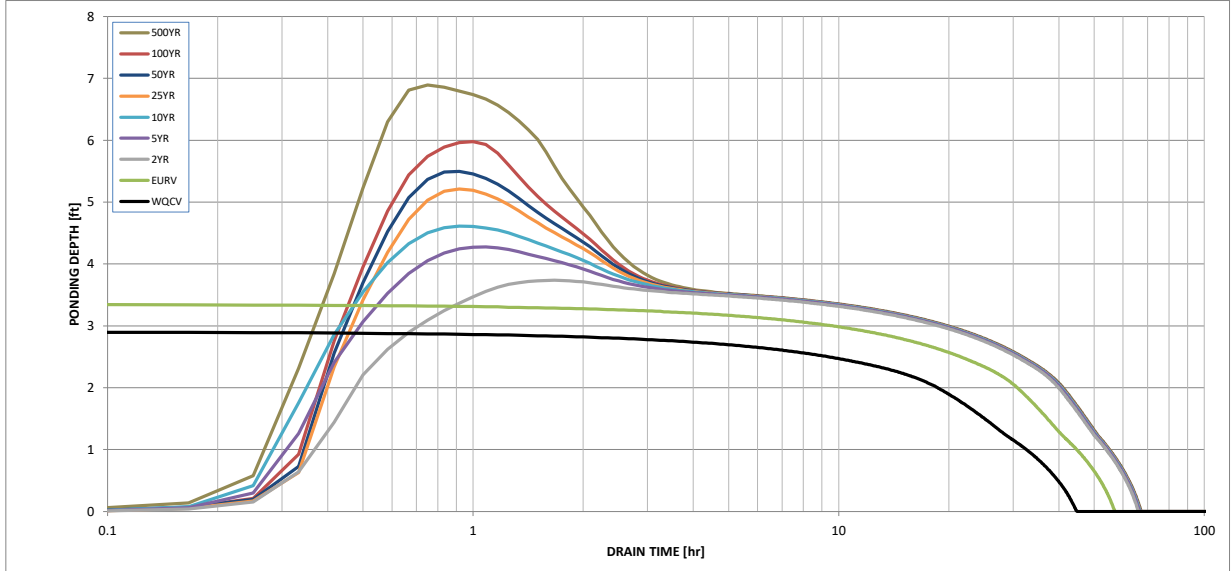
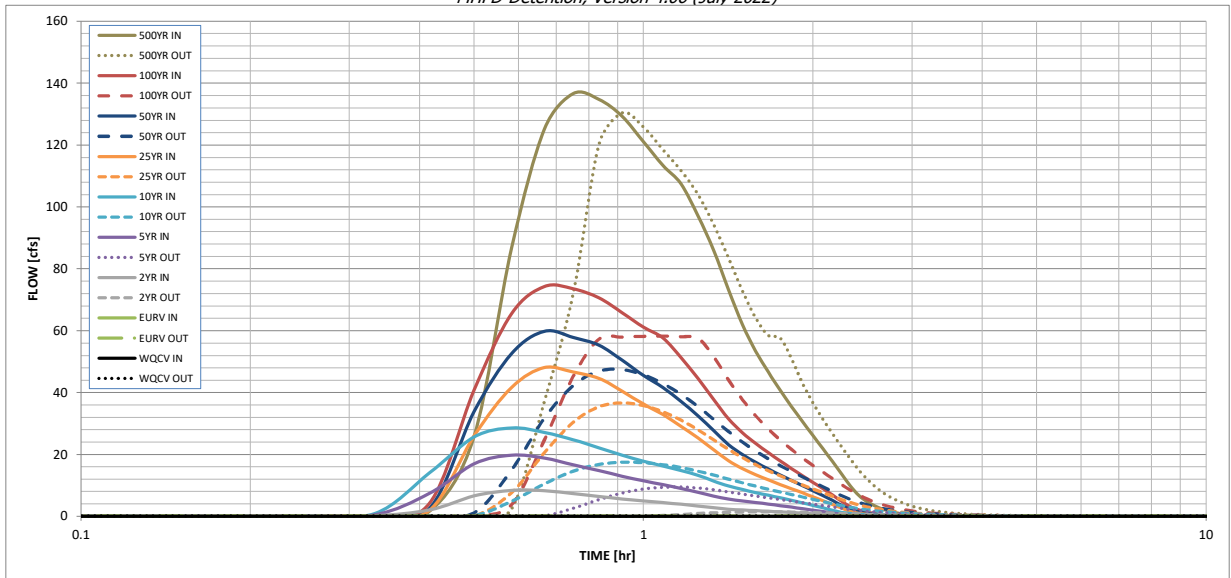
**Routed Hydrograph Results**

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	3.85
One-Hour Rainfall Depth (in) =	0.201	0.315	0.541	1.291	2.054	3.459	4.396	5.766	11.146
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.541	1.291	2.054	3.459	4.396	5.766	11.146
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	6.1	17.2	26.0	45.5	57.2	71.6	133.9
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.13	0.23	0.54	0.94	1.18	1.42	2.76
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	8.4	19.7	28.6	48.0	59.8	74.3	136.6
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	1.5	9.5	17.5	36.7	47.4	58.2	130.4
Peak Inflow Q (cfs) =	N/A	N/A	N/A	0.9	0.7	0.8	0.8	0.8	1.0
Peak Outflow Q (cfs) =	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	0.05	0.3	0.6	1.2	1.6	2.0	2.1
Structure Controlling Flow =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 1 (fps) =	39	50	55	47	43	35	31	26	8
Max Velocity through Grate 2 (fps) =	42	54	61	57	54	49	47	44	34
Time to Drain 97% of Inflow Volume (hours) =	2.91	3.35	3.74	4.28	4.61	5.21	5.50	5.98	6.89
Time to Drain 99% of Inflow Volume (hours) =	0.22	0.29	0.36	0.42	0.43	0.46	0.48	0.50	0.55
Maximum Ponding Depth (ft) =	0.203	0.316	0.440	0.653	0.797	1.066	1.198	1.433	1.916
Area at Maximum Ponding Depth (acres) =									
Maximum Volume Stored (acre-ft) =									

# 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	0.03
	0:15:00	0.00	0.00	0.04	0.07	0.09	0.06	0.07	0.07	0.15
	0:20:00	0.00	0.00	0.17	0.53	0.98	0.17	0.20	0.24	1.71
	0:25:00	0.00	0.00	2.06	7.44	14.04	1.94	2.56	4.22	25.79
	0:30:00	0.00	0.00	6.58	16.97	25.62	25.93	33.77	40.74	86.94
	0:35:00	0.00	0.00	8.37	19.75	28.59	41.71	52.67	65.59	125.12
	0:40:00	0.00	0.00	8.29	18.84	27.07	48.05	59.82	74.25	136.60
	0:45:00	0.00	0.00	7.31	16.64	24.77	46.61	57.77	73.56	134.74
	0:50:00	0.00	0.00	6.42	14.79	22.16	44.63	55.37	70.63	129.26
	0:55:00	0.00	0.00	5.61	12.95	19.72	40.44	50.43	65.81	121.03
	1:00:00	0.00	0.00	4.96	11.45	17.83	36.26	45.54	61.13	113.40
	1:05:00	0.00	0.00	4.45	10.21	16.28	32.85	41.60	57.59	107.42
	1:10:00	0.00	0.00	3.90	9.03	14.78	29.09	37.10	51.34	97.17
	1:15:00	0.00	0.00	3.34	7.81	13.29	25.30	32.53	44.54	85.98
	1:20:00	0.00	0.00	2.79	6.56	11.38	21.53	27.76	37.75	73.33
	1:25:00	0.00	0.00	2.32	5.59	9.83	17.98	23.21	31.53	61.97
	1:30:00	0.00	0.00	2.04	4.99	8.67	15.42	19.99	27.03	53.40
	1:35:00	0.00	0.00	1.82	4.49	7.68	13.43	17.44	23.54	46.62
	1:40:00	0.00	0.00	1.63	3.97	6.79	11.77	15.30	20.57	40.76
	1:45:00	0.00	0.00	1.43	3.46	5.96	10.27	13.37	17.91	35.51
	1:50:00	0.00	0.00	1.24	2.96	5.17	8.91	11.62	15.46	30.69
	1:55:00	0.00	0.00	1.05	2.48	4.37	7.61	9.94	13.16	26.16
	2:00:00	0.00	0.00	0.85	2.00	3.56	6.35	8.32	11.01	21.92
	2:05:00	0.00	0.00	0.66	1.52	2.75	5.11	6.72	8.96	17.78
	2:10:00	0.00	0.00	0.46	1.05	1.97	3.88	5.13	6.91	13.69
	2:15:00	0.00	0.00	0.28	0.62	1.29	2.66	3.56	4.90	9.83
	2:20:00	0.00	0.00	0.14	0.35	0.89	1.58	2.19	3.11	6.70
	2:25:00	0.00	0.00	0.09	0.25	0.68	0.98	1.43	2.05	4.71
	2:30:00	0.00	0.00	0.07	0.19	0.53	0.62	0.96	1.37	3.34
	2:35:00	0.00	0.00	0.05	0.15	0.41	0.40	0.64	0.89	2.32
	2:40:00	0.00	0.00	0.04	0.11	0.31	0.25	0.42	0.55	1.56
	2:45:00	0.00	0.00	0.03	0.09	0.23	0.16	0.28	0.32	1.00
	2:50:00	0.00	0.00	0.02	0.06	0.17	0.10	0.18	0.16	0.60
	2:55:00	0.00	0.00	0.02	0.05	0.12	0.06	0.12	0.08	0.35
	3:00:00	0.00	0.00	0.01	0.03	0.08	0.04	0.08	0.06	0.24
	3:05:00	0.00	0.00	0.01	0.02	0.05	0.03	0.06	0.04	0.17
	3:10:00	0.00	0.00	0.01	0.02	0.04	0.02	0.05	0.04	0.14
	3:15:00	0.00	0.00	0.01	0.01	0.03	0.02	0.03	0.03	0.11
	3:20:00	0.00	0.00	0.00	0.01	0.02	0.01	0.03	0.02	0.08
	3:25:00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.01	0.06
	3:30:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.04
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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	

