



## **Civil Engineer**

# Stormwater Best Management Practice (permanent) Certification Letter

May 16, 2023

El Paso County Planning and Community Development 2880 International Circle, Suite 110 Colorado Springs, CO 80910

Attn.: Brad Walters, Inspections Supervisor

RE: Retreat at TimberRidge Filing No. 2

Please include the following statements in the Pond Volume Certification Letter:

From ECM 5.10.6 Engineering Record Drawings:

Engineering Record Drawings shall be accompanied by a certification letter from the Engineer of Record which shall <u>state</u> that the site and adjacent properties (as affected by work performed under the County permit) are stable with respect to settlement and subsidence, sloughing of cut and fill slopes, revegetation or other ground cover, and that the improvements (public improvements, common development improvements, site grading and paving) meet or exceed the minimum design requirements.

For sites including detention and/or water quality facilities, the certification letter shall include a <u>statement</u> that the facilities provide the required storage volume and will meet the required release rates, as documented by an attached UDFCD design form submitted with the original application, the stage areas, elevations and outlet dimensions.

The permanent stormwater Best Management Practices (BMPs) for the **Retreat at TimberRidge** Filing No. 2 consists of a Private Full Spectrum Extended Detention Basin. This facility is described by the following:

Pond 3 within Tract A

Based upon this information and information gathered during periodic site visits to the project during significant/key phases of the stormwater BMP installation, Classic Consulting Engineers & Surveyors, LLC is of the opinion that the stormwater BMPs have been constructed in general compliance with the approved Construction Plans, and Specifications as filed with El Paso County.

## **Statement Of Engineer In Responsible Charge:**

I, Marc A. Whorton, a registered Professional Engineer in the State of Colorado, in accordance with Sections 5.2 and 5.3 of the Bylaws and Rules of the State Board of Registration for Professional Engineers and Professional Land Surveyors, do hereby certify that I or a person under my responsible charge periodically observed the construction of the above mentioned project. Based on the on-site

field observations and review of pertinent as-built documentation, it is my professional opinion that the required permanent BMPs have been installed and are in general compliance with the approved Construction Plans, and Specifications as filed with El Paso County. For BMPs with a Water Quality Capture Volume (WQCV), I have attached the post-construction As-Built drawings and calculations. The As-Built drawings accurately depict the final installation of the stormwater BMPs.

Marc A. Whorton, P.E. Colorado No. 37155

llation of the stormwater BMPs.

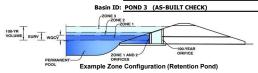
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## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

### Project: REETREAT AT TIMBERRIDGE FILING NO. 2



### Watershed Information

Selected BMP Type =	EDB					
Watershed Area =	58.30	acres				
Watershed Length =	3,400	ft				
Watershed Length to Centroid =	1,500	ft				
Watershed Slope =	0.050	ft/ft				
Watershed Imperviousness =	12.60%	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				
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.

the embedded Colorado Urban Hydrograph Procedure.								
Water Quality Capture Volume (WQCV) =	0.395	acre-feet						
Excess Urban Runoff Volume (EURV) =	0.703	acre-feet						
2-yr Runoff Volume (P1 = 1.19 in.) =	0.904	acre-feet						
5-yr Runoff Volume (P1 = 1.5 in.) =	1.876	acre-feet						
10-yr Runoff Volume (P1 = 1.75 in.) =	2.832	acre-feet						
25-yr Runoff Volume (P1 = 2 in.) =	4.494	acre-feet						
50-yr Runoff Volume (P1 = 2.25 in.) =	5.642	acre-feet						
100-yr Runoff Volume (P1 = 2.52 in.) =	7.279	acre-feet						
500-yr Runoff Volume (P1 = 3.85 in.) =	13.819	acre-feet						
Approximate 2-yr Detention Volume =	0.460	acre-feet						
Approximate 5-yr Detention Volume =	0.708	acre-feet						
Approximate 10-yr Detention Volume =	1.336	acre-feet						
Approximate 25-yr Detention Volume =	1.794	acre-feet						
Approximate 50-yr Detention Volume =	1.887	acre-feet						
Approximate 100-yr Detention Volume =	2.404	acre-feet						
		-						

Optional User Overrides					
	acre-feet				
	acre-feet				
1.19	inches				
1.50	inches				
1.75	inches				
2.00	inches				
2.25	inches				
2.52	inches				
3.85	inches				

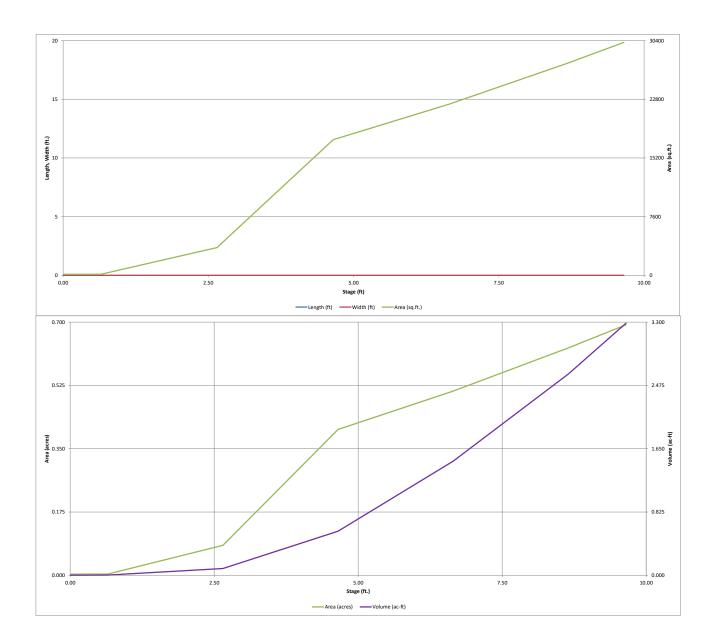
## <u>Define Zones and Basin Geo</u>metrv

Jefine Zones and Basin Geometry		
Zone 1 Volume (WQCV) =	0.395	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.309	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.700	acre-feet
Total Detention Basin Volume =	2.404	acre-feet
Initial Surcharge Volume (ISV) =	user	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H <sub>total</sub> ) =	user	ft
Depth of Trickle Channel $(H_{TC}) =$	user	ft
Slope of Trickle Channel $(S_{TC}) =$	user	ft/ft
Slopes of Main Basin Sides (Smain) =	user	H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	user	

Initial Surcharge Area (A <sub>ISV</sub> ) =	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 <sub>FLOOR</sub> ) =	user	ft
Area of Basin Floor $(A_{FLOOR}) =$	user	ft 2
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	user	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	user	ft
Length of Main Basin $(L_{MAIN}) =$	user	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	user	ft
Area of Main Basin $(A_{MAIN}) =$	user	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	user	ft <sup>3</sup>
Calculated Total Basin Volume ( $V_{total}$ ) =	user	acre-fe

		1.							
Depth Increment =	1.00	ft Optional			T	Optional		1	1
Stage - Storage	Stage	Override	Length	Width	Area	Override	Area	Volume	Volume
Description	(ft)	Stage (ft)	(ft)	(ft)	(ft²)	Area (ft 2)	(acre)	(ft 3)	(ac-ft)
Top of Micropool		0.00				135	0.003		
7200		0.65				135	0.003	88	0.002
7202		2.65				3,615	0.083	3,838	0.088
7204		4.65				17,570	0.403	25,023	0.574
7206		6.65				22,201	0.510	64,794	1.487
7208		8.65				27,398	0.629	114,393	2.626
7209		9.65				30,167	0.693	143,175	3.287
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5/17/2023, 3:23 PM MHFD-Detention\_v4-05 Pond 3 AS-BUILT, Basin

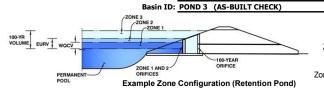


MHFD-Detention\_v4-05 Pond 3 AS-BUILT, Basin 5/17/2023, 3:23 PM

### DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: REETREAT AT TIMBERRIDGE FILING NO. 2



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
	Stage (It)	volume (ac-it)	Outlet Type
Zone 1 (WQCV)	4.16	0.395	Orifice Plate
Zone 2 (EURV)	4.97	0.309	Orifice Plate
ne 3 (100-year)	8.30	1.700	Weir&Pipe (Restrict)
	Total (all zones)	2.404	

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

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

Calculated Parameters for Underdrain Underdrain Orifice Area N/A ft2 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 = ft (relative to basin bottom at Stage = 0 ft) 0.00 Depth at top of Zone using Orifice Plate = 5.03 ft (relative to basin bottom at Stage = 0 ft) Orifice Plate: Orifice Vertical Spacing = 20.00 inches

sq. inches

N/A

WO Orifice Area per Row = ft2 N/A Elliptical Half-Width = N/A feet Elliptical Slot Centroid = N/A feet Elliptical Slot Area = ft<sup>2</sup> N/A

Calculated Parameters for Plate

Calculated Parameters for Vertical Orifice

ft<sup>2</sup>

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

and Total Filed of Each of inco from (named ca from lovest 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	1.70	3.40							
Orifice Area (sq. inches)	1.23	1.29	1.29							

	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)

Orifice Plate: Orifice Area per Row =

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

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

in bottom at Stage = 0 ft) in bottom at Stage = 0 ft)

User Input: Overflow Weir (Dropbox with Flat o	Calculated Parameters for Overflow Weir					
	Zone 3 Weir	Not Selected		Zone 3 Weir	Not Selected	1
Overflow Weir Front Edge Height, Ho =	5.03	N/A	ft (relative to basin bottom at Stage = 0 ft) Height of Grate Upper Edge, $H_t$ =	6.03	N/A	feet
Overflow Weir Front Edge Length =	10.00	N/A	feet Overflow Weir Slope Length =	4.12	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V Grate Open Area / 100-yr Orifice Area =	6.64	N/A	1
Horiz. Length of Weir Sides =	4.00	N/A	feet Overflow Grate Open Area w/o Debris =	32.61	N/A	ft <sup>2</sup>
Overflow Grate Type =	Close Mesh Grate	N/A	Overflow Grate Open Area w/ Debris =	16.31	N/A	ft <sup>2</sup>
Debris Clogging % =	50%	N/A	<b>%</b>			

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
nvert of Outlet Pipe =	0.58	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	4.91	N/A	ft <sup>2</sup>
utlet Pipe Diameter =	30.00	N/A	inches	Outlet Orifice Centroid =	1.25	N/A	feet
t Above Pipe Invert =	30.00		inches Half-Central Angl	le of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

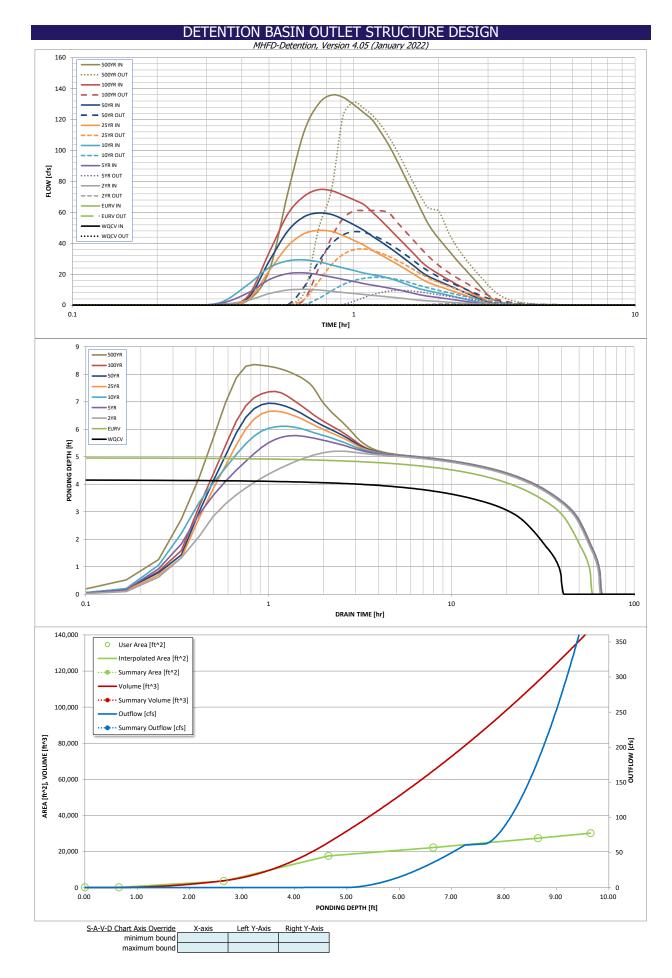
Depth to Inv Ou

Restrictor Plate Height

Spillway Invert Stage=	7.65	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	35.00	feet
Spillway End Slopes =	4.00	H:V
Freehoard above May Water Surface -	1.00	feet

	Calculated Parame	ters for Spillway
Spillway Design Flow Depth=	0.76	feet
Stage at Top of Freeboard =	9.41	feet
Basin Area at Top of Freeboard =	0.68	acres
Basin Volume at Top of Freeboard =	3.12	acre-ft

Routed Hydrograph Results **EURV** Design Storm Return Period = WQCV 2 Year 5 Year 10 Year 25 Year 50 Year 100 Year 500 Year One-Hour Rainfall Depth (in) = N/A 1.50 N/A 1.19 1.75 2.00 3.85 13.819 0.904 7.279 CUHP Runoff Volume (acre-ft) 0.395 0.703 1.876 2.832 4.494 5.642 Inflow Hydrograph Volume (acre-ft) = N/A N/A 0.904 1.876 2.832 13.819 CUHP Predevelopment Peak Q (cfs) = N/A N/A 15.8 24.0 43.0 54.0 69.2 129.0 5.6 OPTIONAL Override Predevelopment Peak Q (cfs) = N/A N/A Predevelopment Unit Peak Flow, q (cfs/acre) = 0.41 0.74 0.93 N/A N/A 0.10 0.27 1.19 2.21 Peak Inflow Q (cfs) : 20.8 29.3 48.3 59.6 74.7 135.8 10.3 N/A N/A Peak Outflow Q (cfs) = 47.5 0.2 0.2 18.0 36.4 61.2 131.1 Ratio Peak Outflow to Predevelopment Q = N/A N/A N/A 0.6 0.7 0.8 0.9 0.9 1.0 Structure Controlling Flow : Plate Plate Overflow Weir 1 erflow Weir 1 Overflow Weir 1 Overflow Weir 1 Overflow Weir 1 Outlet Plate Spillway Max Velocity through Grate 1 (fps) = N/A N/A 0.03 0.3 0.5 1.1 2.0 Max Velocity through Grate 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) = Time to Drain 99% of Inflow Volume (hours) = 40 60 58 54 45 56 62 56 52 6.11 6.95 Maximum Ponding Depth (ft) = 4.16 4.97 5.20 6.66 8.35 0.51 1.493 0.61 2.440 Area at Maximum Ponding Depth (acres) 0.32 0.42 0.43 0.46 0.48 0.53 0.706 0.804 1.215 Maximum Volume Stored (acre-ft) = 1.055 1.638 1.870



# 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.

								l in a separate pr		CUIUD
Time Interval	SOURCE	CUHP WOOV Fefel	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]		25 Year [cfs]	50 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	0.01	0.00	0.08
	0:15:00 0:20:00	0.00	0.00	0.10	0.17	0.21	0.14	0.18	0.17	0.37
	0:20:00	0.00	0.00	0.41 2.95	1.01 7.51	1.58 12.72	0.43 2.84	0.50 3.62	0.67 4.99	2.55 21.98
	0:30:00	0.00	0.00	7.42	16.44	24.17	22.06	28.28	33.86	72.66
	0:35:00	0.00	0.00	9.78	20.38	28.68	38.31	48.01	58.97	112.34
	0:40:00	0.00	0.00	10.28	20.85	29.25	46.22	57.17	70.48	130.16
	0:45:00	0.00	0.00	9.81	19.73	28.04	48.33	59.58	74.66	135.85
	0:50:00	0.00	0.00	8.97	18.17	26.01	47.63	58.62	74.00	134.31
	0:55:00	0.00	0.00	8.21	16.68	24.13	44.98	55.52	71.13	129.59
	1:00:00	0.00	0.00	7.56	15.30	22.42	41.90	51.98	68.13	124.56
	1:05:00	0.00	0.00	6.95	14.00	20.83	38.93	48.54	65.17	119.60
	1:10:00	0.00	0.00	6.35	12.93	19.65	35.47	44.47	60.02	111.61
	1:15:00 1:20:00	0.00	0.00	5.82	12.02	18.70	32.44	40.91	54.77	103.41
	1:25:00	0.00	0.00	5.32 4.83	11.08 10.12	17.43 15.90	29.61 26.90	37.42 34.01	49.70 44.80	94.43 85.24
	1:30:00	0.00	0.00	4.35	9.17	14.33	24.23	30.65	40.22	76.53
	1:35:00	0.00	0.00	3.88	8.23	12.76	21.63	27.37	35.86	68.18
	1:40:00	0.00	0.00	3.42	7.24	11.26	19.07	24.16	31.62	60.17
	1:45:00	0.00	0.00	3.04	6.41	10.14	16.62	21.10	27.63	53.05
	1:50:00	0.00	0.00	2.79	5.83	9.33	14.81	18.88	24.65	47.66
	1:55:00	0.00	0.00	2.57	5.36	8.62	13.41	17.14	22.30	43.29
	2:00:00	0.00	0.00	2.38	4.92	7.90	12.24	15.67	20.27	39.46
	2:05:00	0.00	0.00	2.17	4.48	7.18	11.13	14.24	18.36	35.73
	2:10:00	0.00	0.00	1.96	4.04	6.46	10.09	12.89	16.56	32.17
	2:15:00	0.00	0.00	1.75	3.62	5.76	9.09	11.60	14.88	28.81
	2:20:00 2:25:00	0.00	0.00	1.56 1.37	3.20 2.80	5.09 4.46	8.13 7.21	10.36 9.19	13.29 11.83	25.66 22.74
	2:30:00	0.00	0.00	1.18	2.41	3.84	6.31	8.04	10.39	19.91
	2:35:00	0.00	0.00	1.00	2.03	3.26	5.42	6.92	8.96	17.16
	2:40:00	0.00	0.00	0.82	1.66	2.69	4.54	5.81	7.55	14.42
	2:45:00	0.00	0.00	0.64	1.29	2.13	3.67	4.71	6.14	11.71
	2:50:00	0.00	0.00	0.47	0.93	1.58	2.81	3.61	4.74	9.03
	2:55:00	0.00	0.00	0.30	0.60	1.09	1.96	2.54	3.36	6.50
	3:00:00	0.00	0.00	0.19	0.40	0.80	1.23	1.63	2.20	4.51
	3:05:00	0.00	0.00	0.14	0.30	0.63	0.81	1.12	1.49	3.23
	3:10:00	0.00	0.00	0.11	0.24	0.51	0.55	0.78	1.03	2.34
	3:15:00	0.00	0.00	0.09	0.20	0.41	0.38	0.56	0.69	1.67
	3:20:00 3:25:00	0.00	0.00	0.07	0.16 0.12	0.33 0.26	0.26	0.40 0.29	0.46	1.17 0.80
	3:30:00	0.00	0.00	0.06 0.04	0.12	0.20	0.19 0.13	0.29	0.29	0.53
	3:35:00	0.00	0.00	0.04	0.07	0.15	0.10	0.15	0.11	0.36
	3:40:00	0.00	0.00	0.03	0.06	0.11	0.07	0.11	0.09	0.26
	3:45:00	0.00	0.00	0.02	0.04	0.08	0.05	0.08	0.07	0.20
	3:50:00	0.00	0.00	0.02	0.03	0.06	0.04	0.07	0.05	0.16
	3:55:00	0.00	0.00	0.01	0.02	0.04	0.03	0.05	0.04	0.12
	4:00:00	0.00	0.00	0.01	0.01	0.03	0.02	0.04	0.03	0.09
	4:05:00 4:10:00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.02	0.06
	4:10:00 4:15:00	0.00	0.00	0.00	0.01	0.01 0.01	0.01 0.01	0.02 0.01	0.01 0.01	0.04 0.02
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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 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 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 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 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			

## DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically. The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft²]	Area [acres]	Volume [ft <sup>3</sup> ]	Volume [ac-ft]	Total Outflow [cfs]	
							For best results, include the
							stages of all grade slope
							changes (e.g. ISV and Floor from the S-A-V table on
							Sheet 'Basin'.
							_
							Also include the inverts of al
							outlets (e.g. vertical orifice,
							overflow grate, and spillway where applicable).
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