Note that EPC has not completed a PA walk of this pond yet, as one has yet to be requested by the developer/contractor. We have reached out to them to see if they want to get one scheduled. Regardless, EPC Stormwater will at least schedule a walk for ourselves to check out this pond so we can see what punchlist items there are. And depending on those findings, I may have more comments on these as-builts and calcs. But in the meantime, I have provided some prelim/general comments on what you submitted. Thanks for getting these submitted nice and early, very helpful.

November 11, 2024

Thomas Hopper
The Garrett Company
401 Pennsylvania Parkway, Suite 300
Indianapolis, IN 46280

Re: ***Citizen on Constitution Filing No. 1 - Detention Pond Certification Letter***
El Paso County, Colorado

Dear Mr. Hopper:

Maybe just sympantics, but to me, this comes off as you just stating what a Pond Cert letter should state. But you aren't actually stating it about this particular site. Please revise to not just quote the ECM, but to actually make the statement about the pond in question.

This letter serves as the certification for the Detention Pond at Citizen on Constitution Filing No. 1, El Paso County, CO consistent with El Paso County Engineering Manual ("ECM") Section 5.10.B, which states that Engineering Record Drawings shall be accompanied by a certification letter from the Engineer of Record which shall state that the site and adjacent properties (as affected by work performed under the County permit) are stable and that the improvements (public improvements, common development improvements, site grading and paving) meet or exceed the minimum design requirements.

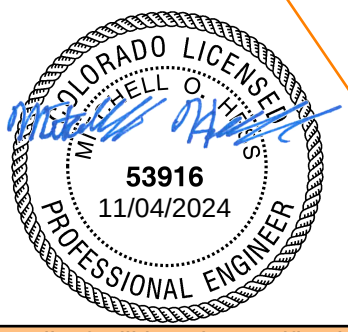
Based upon this information and information gathered during periodic site visits to the site during significant/key phases of the infrastructure installation, Kimley-Horn is of the opinion that the detention pond work performed under the County Permit, per Section 5.10.B of the ECM, have been constructed in general compliance with the approved Construction Plans as filed with the County dated November 21, 2022.

Attached to this letter are Record Drawings which certify that the public improvements meet or exceed the minimum design requirements, except as noted on the Record Drawings, and do not adversely affect the adjacent properties.

Statement Of Engineer In Responsible Charge:
I, Mitchell O. Hess, 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 documentation, it is my professional opinion that the required infrastructure improvements have been installed and are in general compliance with the approved Construction Plans as filed with El Paso County.

Revise statement to:
"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."

Mitchell O. Hess, P.E.
Colorado No. 53916



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

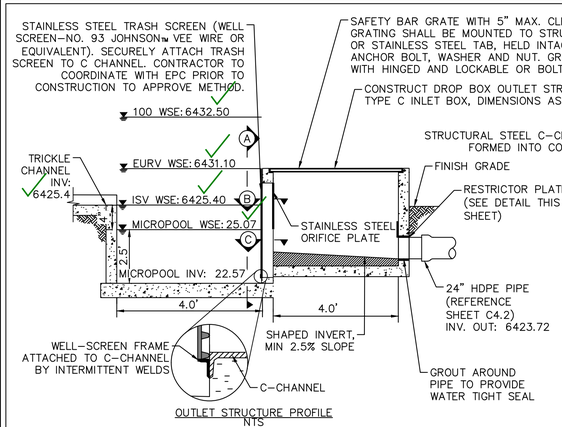
So reference that the updated MHFD calcs have been attached to this letter and why they were needed (ie: some of the inputs changed due to as-built conditions)

You can remove the as-built sheet from the Pond Cert Letter file since there is a separate slot on EDARP for As-Built CDs. That way this sheet isn't duplicated on EDARP.

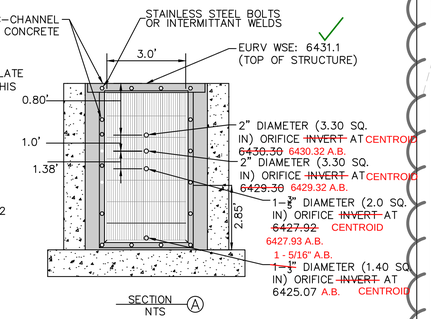
STAINLESS STEEL TRASH SCREEN (WELL SCREEN–NO. 93 JOHNSON▭ VEE WIRE OR EQUIVALENT). SECURELY ATTACH TRASH SCREEN TO C CHANNEL. CONTRACTOR TO COORDINATE WITH EPC PRIOR TO CONSTRUCTION TO APPROVE METHOD.

SAFETY BAR GRATE WITH 5" MAX. CLEAR BETWEEN BARS. BAR GRATING SHALL BE MOUNTED TO STRUCTURE WITH GALVANIZED OR STAINLESS STEEL TAB, HELD INTACT WITH STAINLESS STEEL ANCHOR BOLT, WASHER AND NUT. GRATE SHALL BE PROVIDED WITH HINGED AND LOCKABLE OR BOLTABLE ACCESS PANELS.

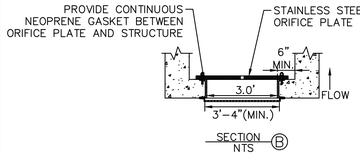
CONSTRUCT DROP BOX OUTLET STRUCTURE PER CDOT TYPE C INLET BOX, DIMENSIONS AS NOTED ON PLAN.



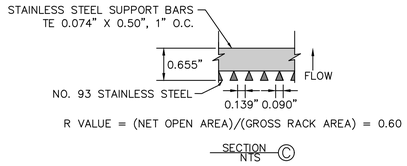
OUTLET STRUCTURE PROFILE
NTS



SECTION A
NTS

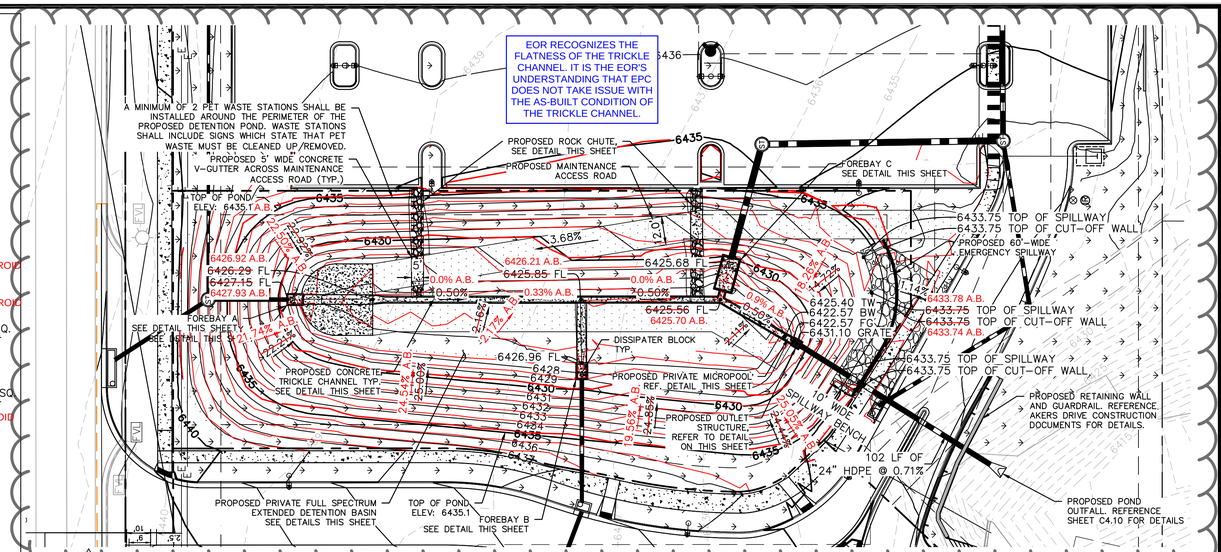


SECTION B
NTS



R VALUE = (NET OPEN AREA)/(GROSS RACK AREA) = 0.60

SECTION C
NTS



DETENTION POND PLAN VIEW
SCALE: 1" = 30'

GRAPHIC SCALE IN FEET
0 15 30 60

NORTH

NO.	REVISION	BY	DATE	APPR.
1	IFC SET	MOH	12/16/22	MOH
2	STORM SEWER AND GRADING REVISIONS	JWM	1/24/24	

Kimley»Horn
© 2023 KIMLEY–HORN AND ASSOCIATES, INC.
2 North Nevada Avenue, Suite 900
Colorado Springs, CO 80903 (303) 228–2300

DESIGNED BY: MOH
DRAWN BY: JWM
CHECKED BY: DLS
DATE: 9/21/2023

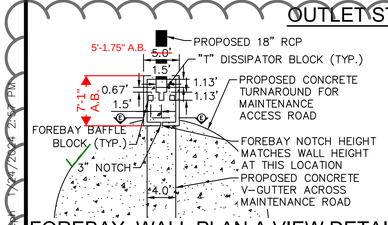
THE CITIZEN ON CONSTITUTION
EL PASO COUNTY, COLORADO
UTILITY AND WATER SERVICE PLANS
DETENTION POND PLAN AND DETAILS

COLORADO LICENSED
RECORD OF PROFESSIONAL ENGINEER
53916
1/24/2024

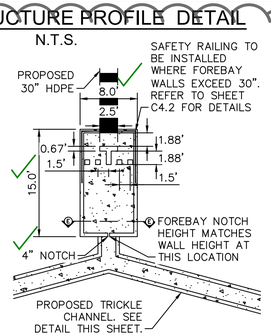
PROJECT NO.
096481004

SHEET
C4.11

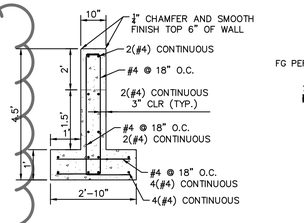
OUTLET STRUCTURE PROFILE DETAIL
N.T.S.



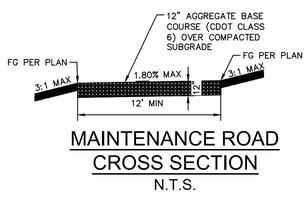
FOREBAY WALL PLAN A VIEW DETAIL
N.T.S.



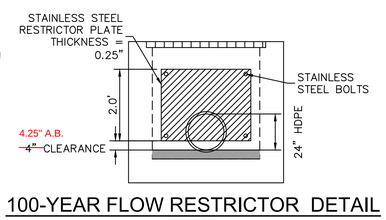
FOREBAY WALL PLAN C VIEW DETAIL
N.T.S.



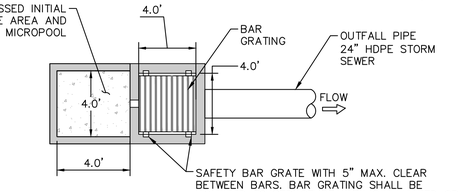
EMERGENCY OVERFLOW CUT-OFF WALL SECTION D
N.T.S.

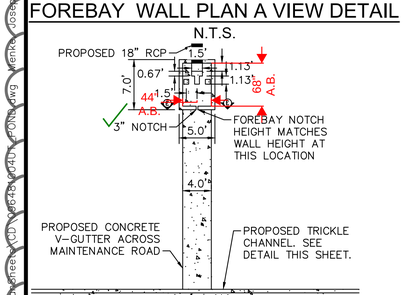


MAINTENANCE ROAD CROSS SECTION
N.T.S.



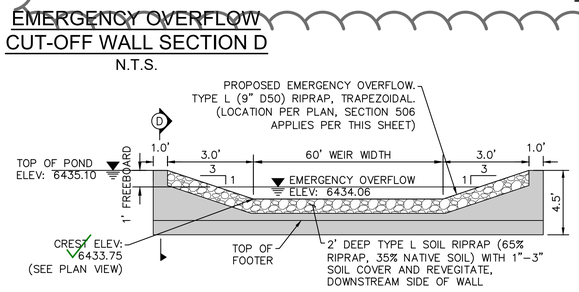
100-YEAR FLOW RESTRICTOR DETAIL
N.T.S.



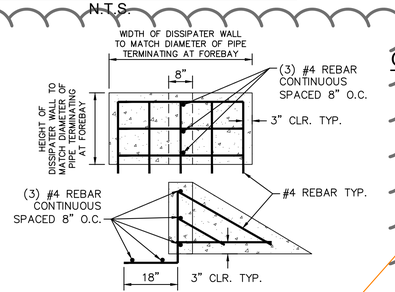


FOREBAY WALL PLAN B VIEW DETAIL
N.T.S.

FOREBAY NOTES:
1. FOREBAY BAFFLE BLOCKS SHALL BE 8" WIDE BY 8" DEEP AND SHALL BE ½ THE HEIGHT OF THE PIPE THAT DISCHARGES INTO THE FOREBAY.
2. FOREBAY BAFFLE BLOCKS SHALL HAVE ¾" CHAMFERS ON ALL CORNERS.
3. REFER TO "T" DISSIPATOR BLOCK ON THIS SHEET FOR ADDITIONAL DETAILS



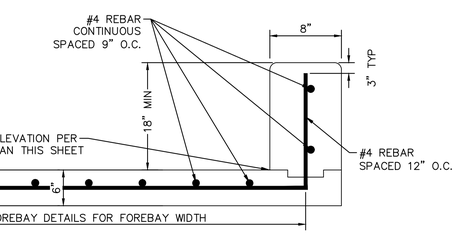
EMERGENCY OVERFLOW CUT-OFF WALL PROFILE
N.T.S.



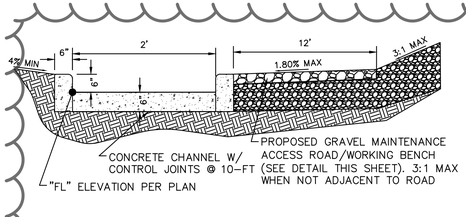
FOREBAY "T" DISSIPATER DETAIL
N.T.S.

OUTLET STRUCTURE PLAN VIEW DETAIL
N.T.S.

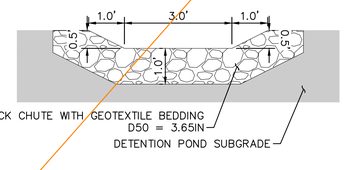
THESE RECORD DRAWINGS HAVE BEEN PREPARED BY KIMLEY-HORN AND ASSOCIATES, INC. BASED ON SURVEY INFORMATION PROVIDED BY MS CIVIL AS WELL AS MEASUREMENTS PROVIDED BY THE GENERAL CONTRACTOR (THE GARRETT COMPANIES). THESE RECORD DRAWINGS ARE NOT GUARANTEED TO BE "AS-BUILT", BUT RATHER BASED ON THE INFORMATION MADE AVAILABLE.



FOREBAY TYPICAL WALL SECTION
N.T.S.



TRICKLE CHANNEL- CROSS SECTION DETAIL
N.T.S.



ROCK CHUTE- CROSS SECTION DETAIL
N.T.S.

Pay Item	Stone Size d50[1] (Inches)	Percent of Material Smaller Than Typical Stone[2]	Typical Stone Dimensions[3] (Inches)	Typical Stone Weight[4] (Pounds)
Riprap	6	70-100	12	85
		50-70	9	35
		35-50	6	10
		2-10	2	0.4
Riprap	9	70-100	15	160
		50-70	12	85
		35-50	9	35
		2-10	3	1.3
Riprap	12	70-100	21	440
		50-70	18	275
		35-50	12	85
		2-10	4	3
Riprap	18	100	30	1280
		50-70	24	650
		35-50	18	275
		2-10	6	10
Riprap	24	100	42	3500
		50-70	33	1700
		35-50	24	650
		2-10	9	35

[1]d50 = nominal stone size
[2]based on typical rock mass
[3]equivalent spherical diameter
[4]based on a specific gravity = 2.5

Nominal stone size and total thickness of the riprap shall be as shown on the plans.

Include As-built condition stamp and EOR signature. Per ECM 5.10.6 Engineering Record Drawings: The record drawings shall be designated as "Engineering Record Drawings" and signed and dated by the engineer of record.

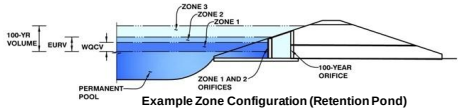
PCD PROJECT NUMBER: PPR-2229 & SF-226

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Citizen On Constitution (El Paso)

Basin ID: Extended Detention Basin



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	11.25	acres
Watershed Length =	1,200	ft
Watershed Length to Centroid =	600	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	71.00%	percent
Percentage Hydrologic Soil Group A =	66.5%	percent
Percentage Hydrologic Soil Group B =	33.5%	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) =	0.262	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.970	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.746	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.52 in.) =	0.986	acre-feet	1.52	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.177	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.437	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.663	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.55 in.) =	1.974	acre-feet	2.55	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	2.537	acre-feet		inches
Approximate 2-yr Detention Volume =	0.671	acre-feet		
Approximate 5-yr Detention Volume =	0.894	acre-feet		
Approximate 10-yr Detention Volume =	1.077	acre-feet		
Approximate 25-yr Detention Volume =	1.241	acre-feet		
Approximate 50-yr Detention Volume =	1.339	acre-feet		
Approximate 100-yr Detention Volume =	1.466	acre-feet		

Define Zones and Basin Geometry

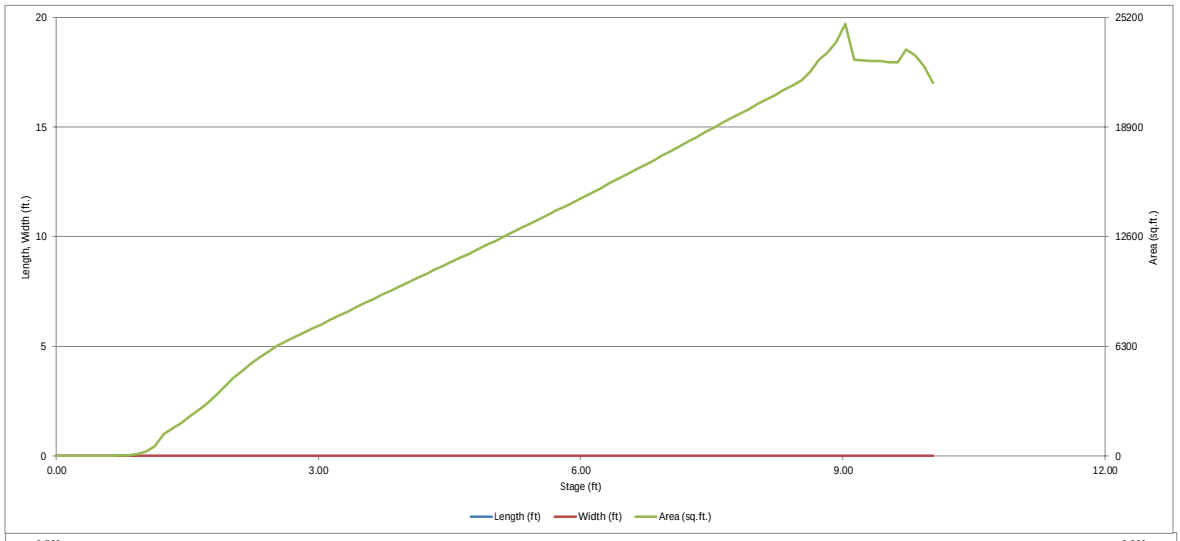
Zone 1 Volume (WQCV) =	0.262	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.708	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.496	acre-feet
Total Detention Basin Volume =	1.466	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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_{LW}) =	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

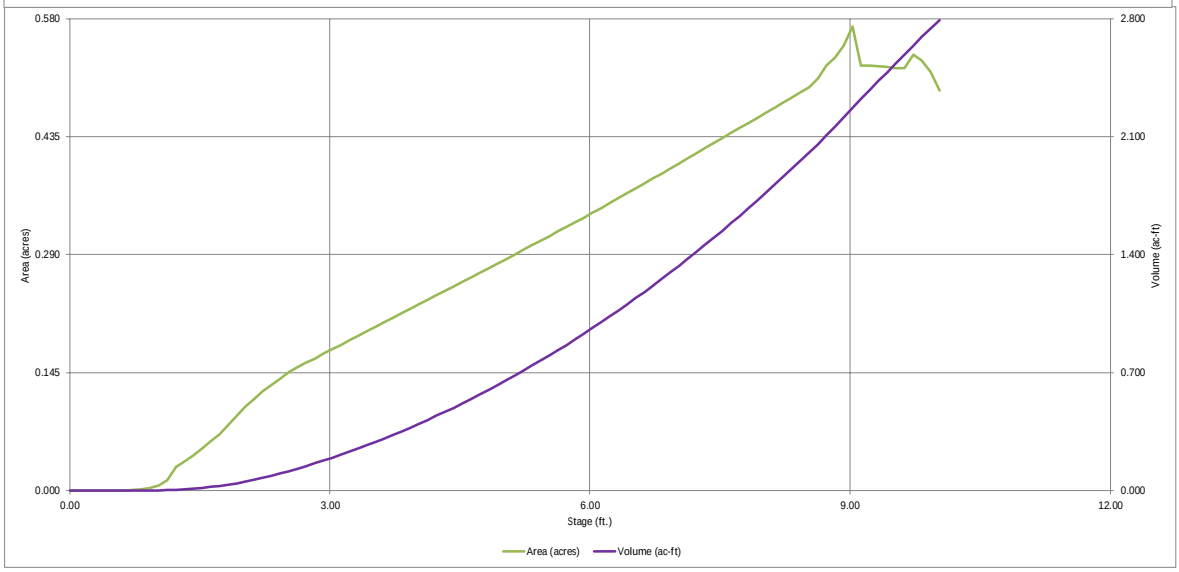
Depth Increment = ft

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	--	--	--	10	0.000		
6425.4	--	0.33	--	--	--	10	0.000	3	0.000
6425.5	--	0.43	--	--	--	10	0.000	4	0.000
6425.6	--	0.53	--	--	--	10	0.000	5	0.000
6425.7	--	0.63	--	--	--	10	0.000	6	0.000
6425.8	--	0.73	--	--	--	23	0.001	8	0.000
6425.9	--	0.83	--	--	--	51	0.001	11	0.000
6426	--	0.93	--	--	--	121	0.003	19	0.000
6426.1	--	1.03	--	--	--	258	0.006	37	0.001
6426.2	--	1.13	--	--	--	546	0.013	74	0.002
6426.3	--	1.23	--	--	--	1,259	0.029	157	0.004
6426.4	--	1.33	--	--	--	1,575	0.036	296	0.007
6426.5	--	1.43	--	--	--	1,884	0.043	466	0.011
6426.6	--	1.53	--	--	--	2,274	0.052	670	0.015
6426.7	--	1.63	--	--	--	2,632	0.060	911	0.021
6426.8	--	1.73	--	--	--	3,021	0.069	1,190	0.027
6426.9	--	1.83	--	--	--	3,493	0.080	1,511	0.035
6427	--	1.93	--	--	--	4,018	0.092	1,881	0.043
6427.1	--	2.03	--	--	--	4,487	0.103	2,302	0.053
6427.2	--	2.13	--	--	--	4,909	0.113	2,767	0.064
6427.3	--	2.23	--	--	--	5,306	0.122	3,274	0.075
6427.4	--	2.33	--	--	--	5,663	0.130	3,819	0.088
6427.5	--	2.43	--	--	--	6,008	0.138	4,399	0.101
6427.6	--	2.53	--	--	--	6,328	0.145	5,013	0.115
6427.7	--	2.63	--	--	--	6,597	0.151	5,656	0.130
6427.8	--	2.73	--	--	--	6,841	0.157	6,326	0.145
6427.9	--	2.83	--	--	--	7,069	0.162	7,019	0.161
6428	--	2.93	--	--	--	7,333	0.168	7,737	0.178
6428.1	--	3.03	--	--	--	7,557	0.173	8,479	0.195
6428.2	--	3.13	--	--	--	7,788	0.179	9,244	0.212
6428.3	--	3.23	--	--	--	8,040	0.185	10,033	0.230
6428.4	--	3.33	--	--	--	8,289	0.190	10,847	0.249
6428.5	--	3.43	--	--	--	8,537	0.196	11,685	0.268
6428.6	--	3.53	--	--	--	8,782	0.202	12,549	0.288
6428.7	--	3.63	--	--	--	9,022	0.207	13,437	0.308
6428.8	--	3.73	--	--	--	9,259	0.213	14,348	0.329
6428.9	--	3.83	--	--	--	9,496	0.218	15,284	0.351
6429	--	3.93	--	--	--	9,733	0.223	16,243	0.373
6429.1	--	4.03	--	--	--	9,971	0.229	17,226	0.395
6429.2	--	4.13	--	--	--	10,210	0.234	18,232	0.419
6429.3	--	4.23	--	--	--	10,449	0.240	19,263	0.442
6429.4	--	4.33	--	--	--	10,688	0.245	20,317	0.466
6429.5	--	4.43	--	--	--	10,927	0.251	21,396	0.491
6429.6	--	4.53	--	--	--	11,166	0.256	22,498	0.516
6429.7	--	4.63	--	--	--	11,404	0.262	23,624	0.542
6429.8	--	4.73	--	--	--	11,642	0.267	24,774	0.569
6429.9	--	4.83	--	--	--	11,882	0.273	25,948	0.596
6430	--	4.93	--	--	--	12,124	0.278	27,146	0.623
6430.1	--	5.03	--	--	--	12,369	0.284	28,368	0.651
6430.2	--	5.13	--	--	--	12,617	0.290	29,615	0.680
6430.3	--	5.23	--	--	--	12,868	0.295	30,886	0.709
6430.4	--	5.33	--	--	--	13,118	0.301	32,183	0.739
6430.5	--	5.43	--	--	--	13,368	0.307	33,505	0.769
6430.6	--	5.53	--	--	--	13,616	0.313	34,852	0.800
6430.7	--	5.63	--	--	--	13,863	0.318	36,223	0.832
6430.8	--	5.73	--	--	--	14,109	0.324	37,619	0.864
6430.9	--	5.83	--	--	--	14,357	0.330	39,040	0.896
6431	--	5.93	--	--	--	14,609	0.335	40,486	0.929
6431.1 (EURV)	--	6.03	--	--	--	14,866	0.341	41,957	0.963
6431.2	--	6.13	--	--	--	15,126	0.347	43,454	0.998
6431.3	--	6.23	--	--	--	15,390	0.353	44,977	1.033
6431.4	--	6.33	--	--	--	15,657	0.359	46,527	1.068
6431.5	--	6.43	--	--	--	15,921	0.366	48,103	1.104
6431.6	--	6.53	--	--	--	16,184	0.372	49,706	1.141
6431.7	--	6.63	--	--	--	16,444	0.378	51,335	1.178
6431.8	--	6.73	--	--	--	16,705	0.383	52,990	1.216
6431.9	--	6.83	--	--	--	16,969	0.390	54,671	1.255
6432	--	6.93	--	--	--	17,235	0.396	56,378	1.294
6432.1	--	7.03	--	--	--	17,510	0.402	58,113	1.334
6432.2	--	7.13	--	--	--	17,784	0.408	59,875	1.375
6432.3	--	7.23	--	--	--	18,057	0.415	61,664	1.416
6432.4	--	7.33	--	--	--	18,331	0.421	63,481	1.457
6432.5 (100-YR)	--	7.43	--	--	--	18,604	0.427	65,325	1.500
6432.6	--	7.53	--	--	--	18,875	0.433	67,196	1.543
6432.7	--	7.63	--	--	--	19,146	0.440	69,094	1.586
6432.8	--	7.73	--	--	--	19,415	0.446	71,020	1.630
6432.9	--	7.83	--	--	--	19,684	0.452	72,972	1.675
6433	--	7.93	--	--	--	19,951	0.458	74,951	1.721
6433.1	--	8.03	--	--	--	20,218	0.464	76,957	1.767
6433.2	--	8.13	--	--	--	20,487	0.470	78,989	1.813
6433.3	--	8.23	--	--	--	20,759	0.477	81,049	1.861
6433.4	--	8.33	--	--	--	21,033	0.483	83,136	1.909
6433.5	--	8.43	--	--	--	21,309	0.489	85,250	1.957
6433.6	--	8.53	--	--	--	21,588	0.496	87,392	2.006
6433.7	--	8.63	--	--	--	22,082	0.507	89,571	2.056
6433.8	--	8.73	--	--	--	22,759	0.522	91,806	2.108
6433.9	--	8.83	--	--	--	23,201	0.533	94,099	2.160
6434	--	8.93	--	--	--	23,801	0.546	96,444	2.214
6434.1	--	9.03	--	--	--	24,854	0.571	98,866	2.270
6434.2	--	9.13	--	--	--	22,771	0.523	101,266	2.325
6434.3	--	9.23	--	--	--	22,738	0.522	103,543	2.377
6434.4	--	9.33	--	--	--	22,712	0.521	105,816	2.429
6434.5	--	9.43	--	--	--	22,686	0.521	108,086	2.481
6434.6	--	9.53	--	--	--	22,630	0.520	110,353	2.533
6434.7	--	9.63	--	--	--	22,621	0.519	112,615	2.585
6434.8	--	9.73	--	--	--	23,348	0.536	114,907	2.638
6434.9	--	9.83	--	--	--	23,027	0.529	117,228	2.691
6435	--	9.93	--	--	--	22,410	0.514	119,506	2.743
6435.1	--	10.03	--	--	--	21,426	0.492	121,707	2.794

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)





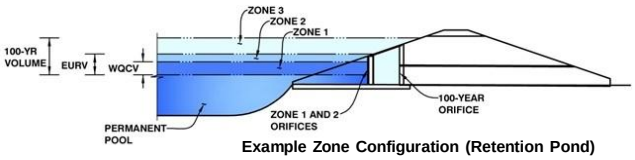
Please highlight/circle the inputs that were updated to show as-built conditions as I have done below.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Citizen On Constitution (El Paso)

Basin ID: Extended Detention Basin



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.39	0.262	Orifice Plate
Zone 2 (EURV)	6.04	0.708	Orifice Plate
Zone 3 (100-year)	7.35	0.496	Weir&Pipe (Restrict)
Total (all zones)		1.466	

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)

Invert 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 =	6.03	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	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	2.86	4.25	5.25				
Orifice Area (sq. inches)	1.35	2.00	3.30	3.30				

	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	ft^2
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	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

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 =	6.03	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 =	4.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	29.65	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	11.14	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	5.57	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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	
Depth to Invert of Outlet Pipe =	1.35	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.38	N/A	ft^2
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.21	N/A	feet
Restrictor Plate Height Above Pipe Invert =	4.25		inches	Half-Central Angle of Restrictor Plate on Pipe =	0.87	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.68	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.31	feet
Spillway Crest Length =	60.00	feet	Stage at Top of Freeboard =	9.99	feet
Spillway End Slopes =	3.00	H:V	Basin Area at Top of Freeboard =	0.50	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	2.78	acre-ft

Calculated Parameters for Spillway

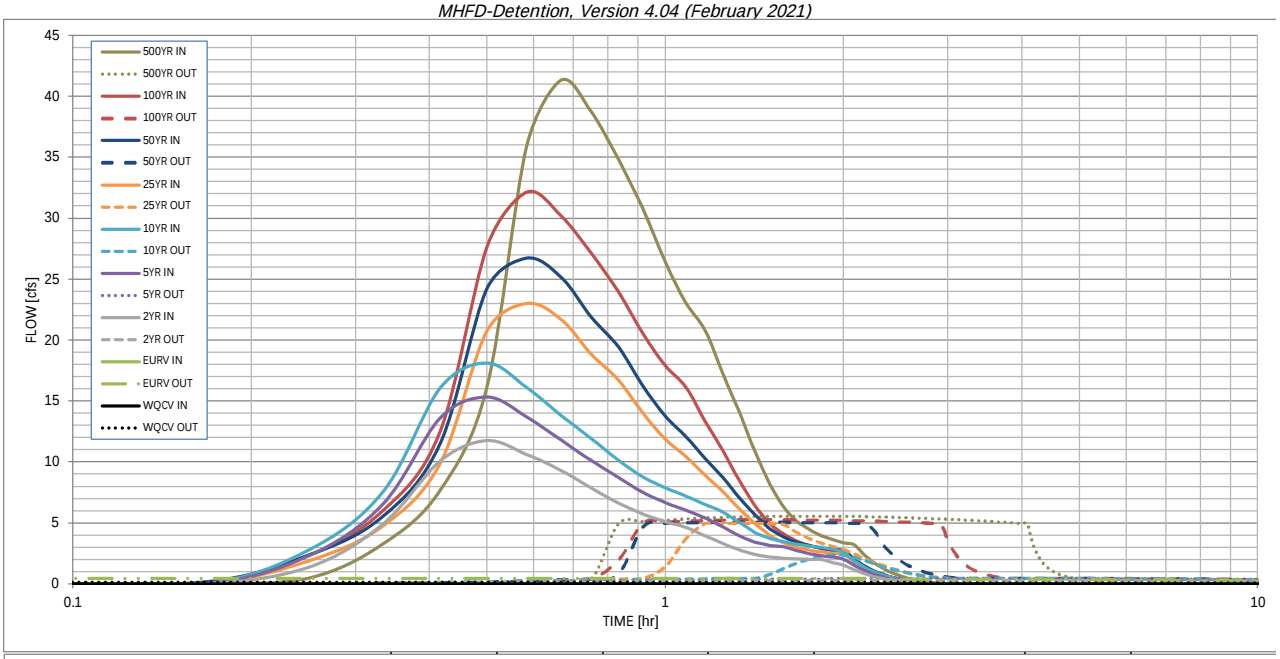
Routed Hydrograph Results

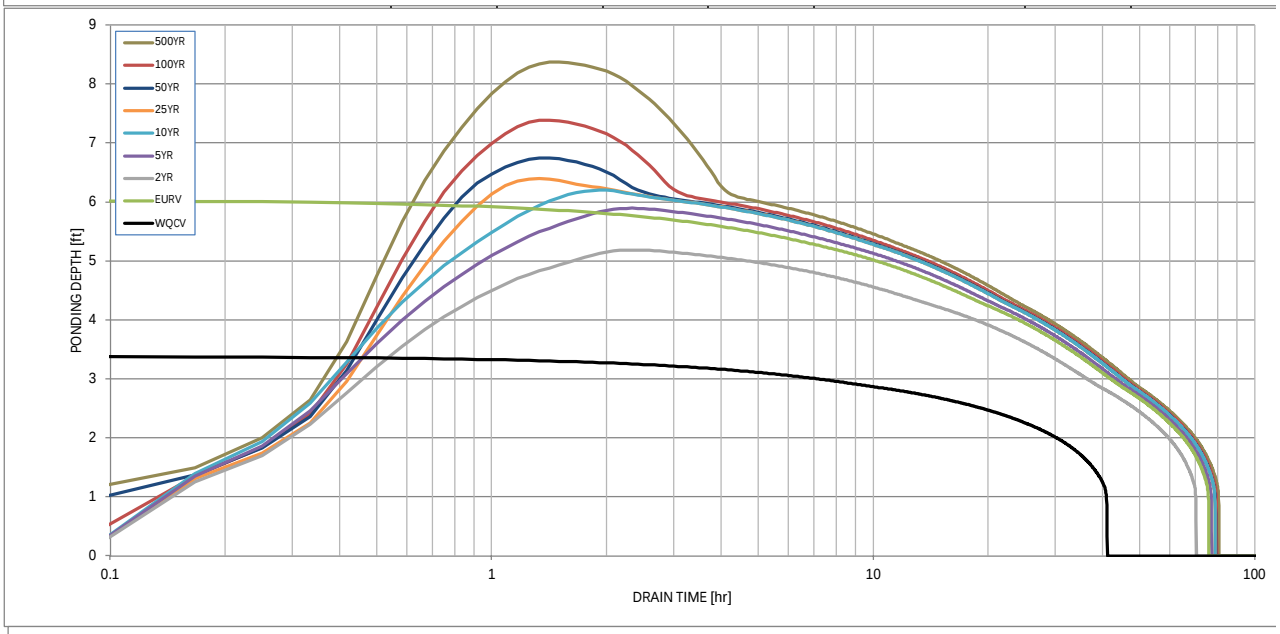
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

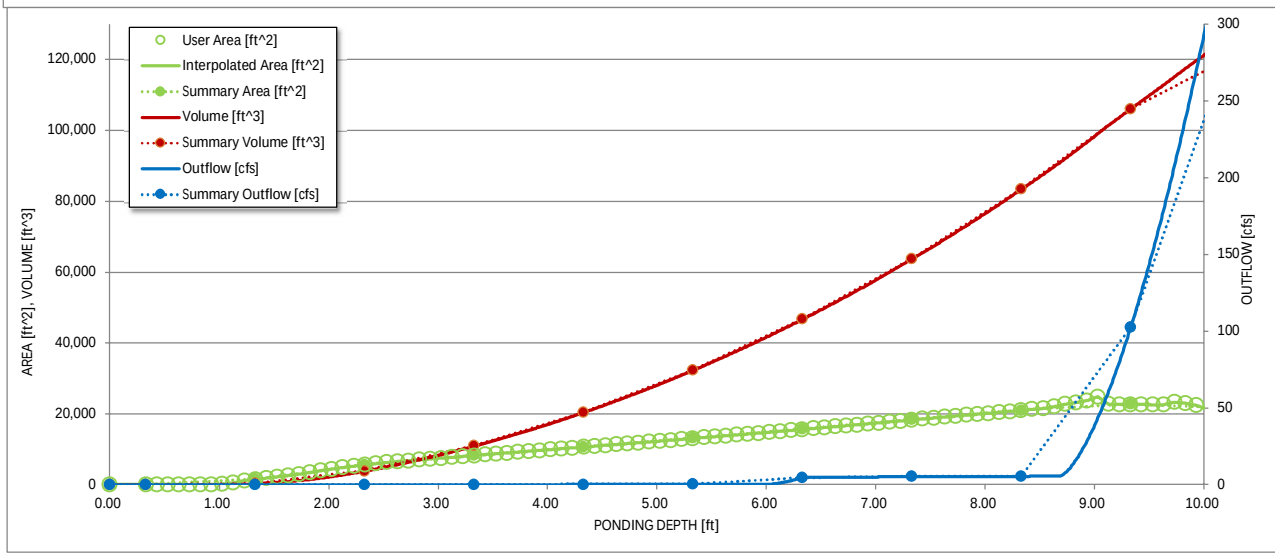
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.52	1.75	2.00	2.25	2.55	3.14
CUHP Runoff Volume (acre-ft) =	0.262	0.970	0.746	0.986	1.177	1.437	1.663	1.974	2.537
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.746	0.986	1.177	1.437	1.663	1.974	2.537
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	1.4	4.4	6.2	9.3	14.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		5.4	7.8			16.9	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.48	0.69	0.39	0.55	1.50	1.27
Peak Inflow Q (cfs) =	N/A	N/A	11.8	15.3	18.1	23.0	26.7	32.2	41.4
Peak Outflow Q (cfs) =	0.1	0.5	0.3	0.5	2.4	5.0	5.1	5.3	5.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.3	1.1	0.8	0.3	0.4
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	0.00	N/A	N/A	0.2	0.4	0.4	0.4	0.4
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) =	39	69	65	71	71	70	68	67	65
Time to Drain 99% of Inflow Volume (hours) =	40	73	68	75	76	75	75	75	75
Maximum Ponding Depth (ft) =	3.39	6.04	5.19	5.90	6.21	6.40	6.75	7.40	8.38
Area at Maximum Ponding Depth (acres) =	0.19	0.34	0.29	0.33	0.35	0.36	0.38	0.42	0.49
Maximum Volume Stored (acre-ft) =	0.262	0.970	0.700	0.919	1.025	1.097	1.228	1.487	1.933

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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	0.16	0.04	0.51
	0:15:00	0.00	0.00	1.40	2.34	2.83	1.90	2.36	2.36	3.29
	0:20:00	0.00	0.00	4.91	6.54	7.55	4.75	5.52	6.01	7.69
	0:25:00	0.00	0.00	10.11	13.61	16.08	9.90	11.52	12.51	16.16
	0:30:00	0.00	0.00	11.77	15.33	18.15	20.78	24.25	27.63	35.91
	0:35:00	0.00	0.00	10.64	13.70	16.11	23.01	26.72	32.15	41.35
	0:40:00	0.00	0.00	9.33	11.82	13.85	21.72	25.19	30.22	38.75
	0:45:00	0.00	0.00	7.87	10.13	11.95	18.88	21.92	27.14	34.81
	0:50:00	0.00	0.00	6.65	8.75	10.16	16.73	19.45	23.97	30.77
	0:55:00	0.00	0.00	5.73	7.52	8.79	14.02	16.27	20.55	26.42
	1:00:00	0.00	0.00	5.13	6.70	7.91	11.89	13.78	17.90	23.05
	1:05:00	0.00	0.00	4.65	6.04	7.22	10.46	12.09	16.16	20.83
	1:10:00	0.00	0.00	3.97	5.42	6.54	8.92	10.31	13.37	17.22
	1:15:00	0.00	0.00	3.33	4.67	5.89	7.57	8.74	10.93	14.07
	1:20:00	0.00	0.00	2.80	3.95	5.05	6.15	7.08	8.48	10.87
	1:25:00	0.00	0.00	2.42	3.45	4.24	4.98	5.70	6.45	8.21
	1:30:00	0.00	0.00	2.22	3.19	3.77	3.99	4.55	4.97	6.31
	1:35:00	0.00	0.00	2.13	3.05	3.47	3.40	3.87	4.10	5.18
	1:40:00	0.00	0.00	2.07	2.74	3.26	3.03	3.44	3.56	4.47
	1:45:00	0.00	0.00	2.04	2.51	3.11	2.79	3.15	3.18	3.98
	1:50:00	0.00	0.00	2.01	2.33	3.00	2.62	2.96	2.93	3.64
	1:55:00	0.00	0.00	1.75	2.20	2.85	2.51	2.83	2.74	3.40
	2:00:00	0.00	0.00	1.54	2.04	2.59	2.43	2.74	2.62	3.24
	2:05:00	0.00	0.00	1.16	1.53	1.93	1.82	2.05	1.95	2.41
	2:10:00	0.00	0.00	0.85	1.12	1.40	1.33	1.49	1.42	1.75
	2:15:00	0.00	0.00	0.62	0.81	1.02	0.97	1.09	1.04	1.28
	2:20:00	0.00	0.00	0.45	0.58	0.73	0.70	0.78	0.76	0.93
	2:25:00	0.00	0.00	0.32	0.40	0.52	0.49	0.55	0.54	0.66
	2:30:00	0.00	0.00	0.22	0.28	0.36	0.35	0.39	0.38	0.46
	2:35:00	0.00	0.00	0.14	0.19	0.25	0.24	0.27	0.26	0.32
	2:40:00	0.00	0.00	0.09	0.12	0.15	0.16	0.17	0.17	0.21
	2:45:00	0.00	0.00	0.04	0.07	0.08	0.09	0.10	0.10	0.12
	2:50:00	0.00	0.00	0.02	0.03	0.04	0.04	0.04	0.04	0.05
	2:55:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	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

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

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 [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
	0.00	10	0.000	0	0.000	0.00
	0.33	10	0.000	3	0.000	0.03
	1.33	1,575	0.036	311	0.007	0.05
	2.33	5,663	0.130	3,876	0.089	0.07
	3.33	8,289	0.190	10,929	0.251	0.13
	4.33	10,688	0.245	20,424	0.469	0.21
	5.33	13,118	0.301	32,314	0.742	0.36
	6.33	15,657	0.359	46,684	1.072	4.75
	7.33	18,331	0.421	63,664	1.462	5.26
	8.33	21,033	0.483	83,346	1.913	5.57
	9.33	22,712	0.521	106,043	2.434	102.63
	10.33	21,426	0.492	121,922	2.799	303.63

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 all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).