

July 1, 2025

Gilbert LaForce, PE  
El Paso County  
2880 International Circle, Suite 110  
Colorado Springs, CO 80910

Re: ***Barbarick Waste Transfer Station PCM Modification Certification Letter  
El Paso County, Colorado***

Dear Mr. LaForce:

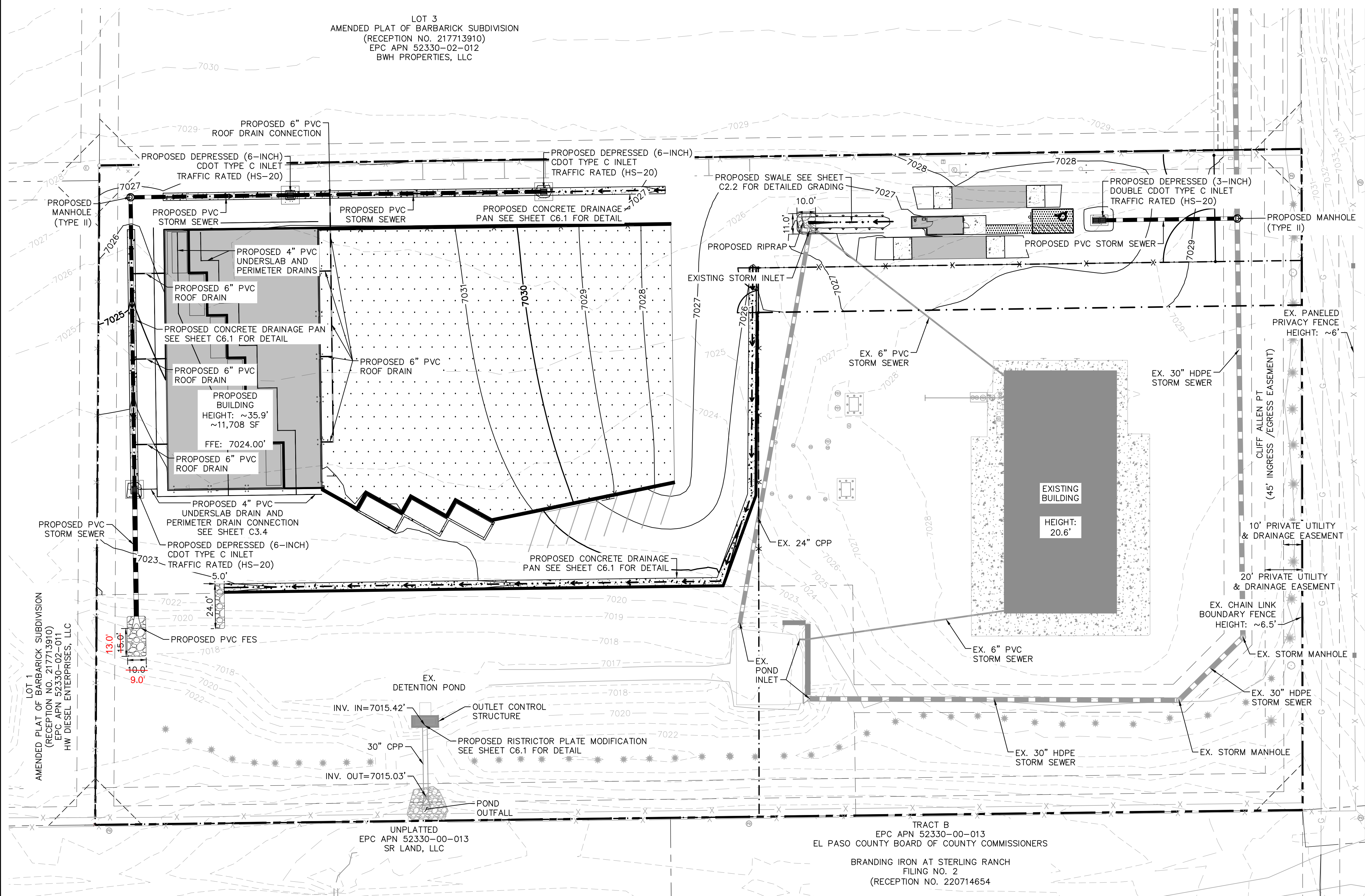
This letter serves as the certification for modifications to the existing PCM located at Lot 4 of the Barbarick Subdivision, El Paso County, CO consistent with El Paso County Engineering Manual ("ECM") Section 5.10.6.B, which states that Engineering Record Drawings shall be accompanied by a certification letter from the Engineer of Record which shall state that facilities constructed provide the required storage volume, meet the required release rates, the stage areas, elevations and outlet dimensions. Based upon this information and information gathered during periodic site visits to the site during significant/key phases of the infrastructure installation, *Kimley-Horn & Associates, Inc.* is of the opinion that the work performed under the County Permit, per Section 5.10.6.B of the ECM, have been constructed in general compliance with the approved Construction Plans as filed with the County dated April 28, 2023 and approved by El Paso County on May 28, 2024.

**Statement Of Engineer In Responsible Charge:**

I, Eric J. Gunderson, 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.



Eric J. Gunderson, P.E.  
Colorado No. 49487



### LEGEND

- |  |                                      |
|--|--------------------------------------|
|  | PROPERTY LINE                        |
|  | LEASED PARCEL BOUNDARY               |
|  | EXISTING UTILITY & DRAINAGE EASEMENT |
|  | EXISTING FENCE                       |
|  | EXISTING STORM SEWER                 |
|  | EXISTING GAS MAIN                    |
|  | EXISTING VEGETATION                  |
|  | EXISTING TRANSFORMER                 |
|  | PROPOSED FLOW LINE                   |
|  | PROPOSED STORM SEWER                 |
|  | PROPOSED PERIMETER/UNDERSLAB DRAIN   |
|  | PROPOSED STORM INLET                 |
|  | PROPOSED ASPHALT                     |
|  | PROPOSED CONCRETE                    |

## NOTES

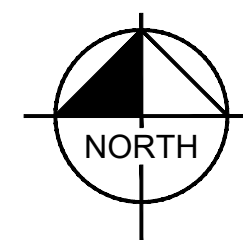
1. SEE SHEETS C3.1 — C3.3 FOR DETAILED STORM PLAN AND PROFILES
2. SEE SHEET C3.4 FOR DETAILED DRAIN PLAN
3. SEE SHEET C6.0 FOR INLET AND MANHOLE DETAILS
4. SEE SHEET C6.1 FOR CONCRETE DRAINAGE PAN DETAIL
5. ALL PROPOSED STORMWATER INFRASTRUCTURE DEPICTED ON THESE PLANS IS TO BE PRIVATELY OWNED AND MAINTAINED UNLESS OTHERWISE NOTED

### CAUTION NOTE

1. CONTRACTOR SHALL MAINTAIN 1.5' OF VERTICAL SEPARATION AT ALL WET UTILITY CROSSINGS.
2. CONTRACTOR SHALL MAINTAIN 1.0' OF VERTICAL SEPARATION AT ALL DRY UTILITY CROSSINGS.

RECORD DRAWING

THESE RECORD DRAWINGS HAVE BEEN PREPARED BY KIMLEY-HORN AND ASSOCIATES, INC. BASED ON FIELD OBSERVATION AND MEASUREMENT. THESE RECORD DRAWINGS ARE NOT GUARANTEED TO BE "AS-BUILT", BUT RATHER BASED ON CONFIRMING THE MODIFICATIONS TO THE EXISTING PCM TO BE IN COMPLIANCE WITH DESIGN DOCUMENTS.



GRAPHIC SCALE IN FEET

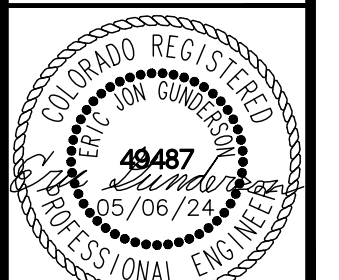
PCD FILE NO. COM2346



Know what's **below**.  
Call before you dig.



**CALL UTILITY NOTIFICATION  
CENTER OF COLORADO  
1-800-922-1987**  
CALL 2-BUSINESS DAYS IN ADVANCE  
BEFORE YOU DIG, GRADE, OR EXCAVATE  
FOR THE MARKING OF UNDERGROUND  
MEMBER UTILITIES



PROJECT NO.  
196489000

SHEET

## C3.0

**Kimley»Horn**  
2024 KIMLEY-HORN AND ASSOCIATES, INC.

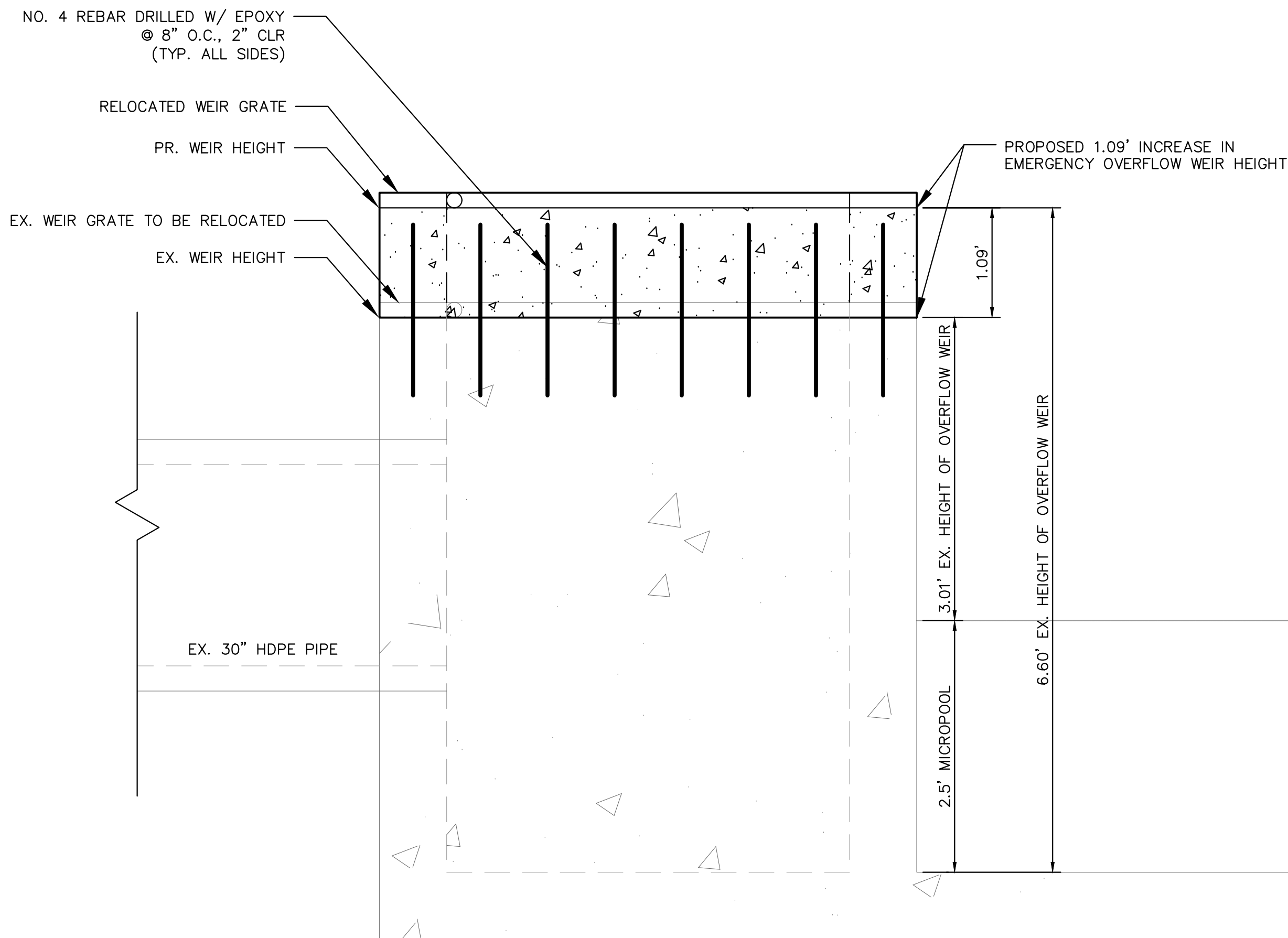
2024 NIMBLE-TURN AND ASSOCIATES, INC.  
2 North Nevada Avenue Suite 900  
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: EJC  
DRAWN BY: RES  
CHECKED BY: EJC  
DATE: 5/6/2024

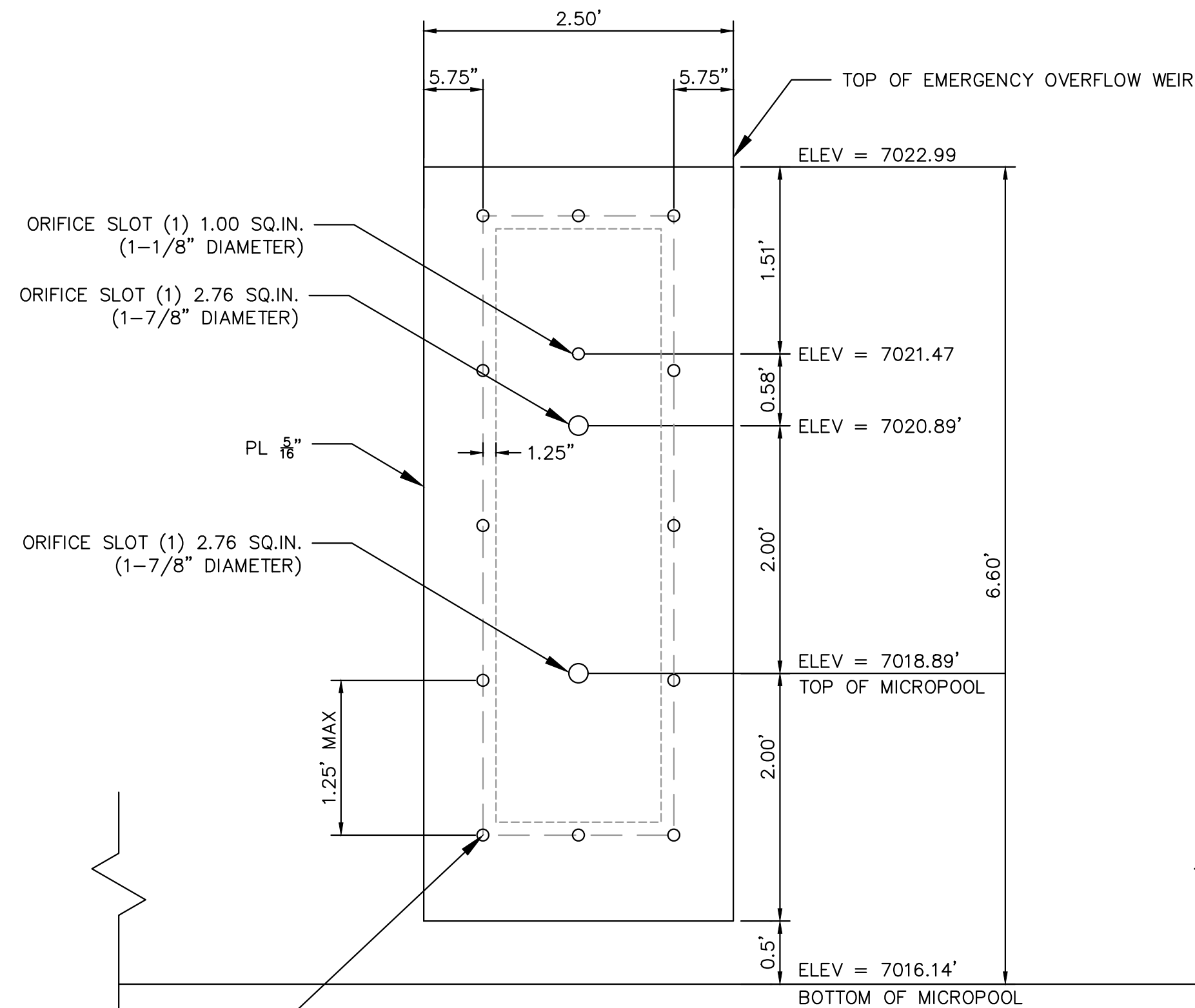
**RICK WASTE TRANSFER STATION  
EL PASO COUNTY, COLORADO  
CONSTRUCTION DOCUMENTS  
OVERALL STORM PLAN**



K:\cos\_civil\196489000\_barbarick waste transfer\CADD\plansheets\CDs\CD\_DT-196489000.dwg    Schnelbach, Ryan    5/1/2025 10:33 AM

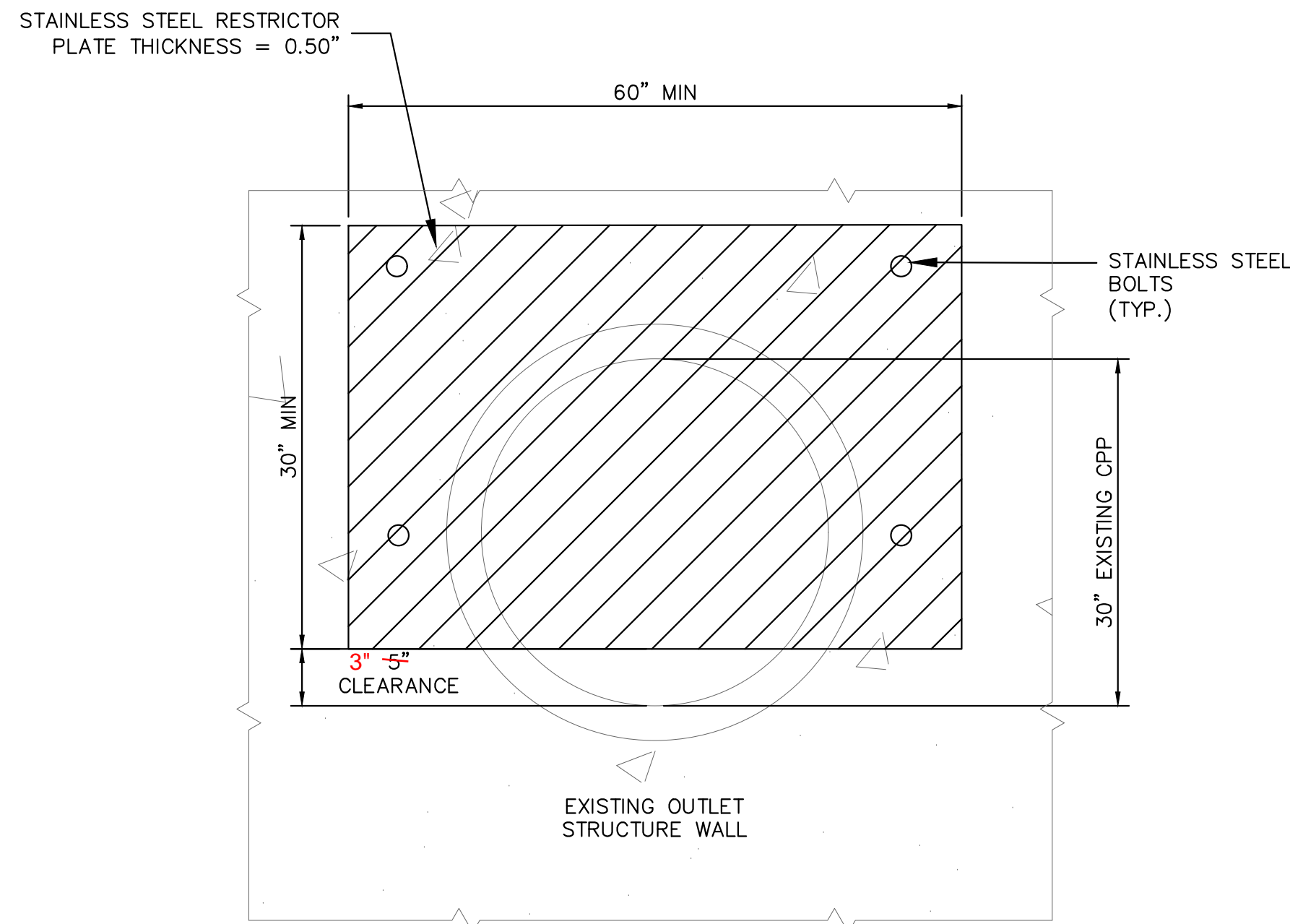


EXISTING OUTLET STRUCTURE MODIFICATION  
1" = 1'



ORIFICE PLATE MODIFICATION  
1" = 1'

- ORIFICE PLATE SHALL BE 0.50" IN THICKNESS
- CONTRACTOR SHALL INSTALL WATER TIGHT RUBBER GASKET OR EQUIVALENT SEALANT BETWEEN CONCRETE AND STEEL PLATE



RESTRICTOR PLATE MODIFICATION  
1" = 1'

RECORD DRAWING

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**Kimley»Horn**

2024 KIMLEY-HORN AND ASSOCIATES, INC.  
2 North Nevada Avenue Suite 900  
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: E.J.G.  
DRAWN BY: RES  
CHECKED BY: E.J.G.  
DATE: 05/01/2025

BARBARICK WASTE TRANSFER STATION  
EL PASO COUNTY, COLORADO  
CONSTRUCTION DOCUMENTS  
POND DETAILS



PROJECT NO.  
196489000

SHEET

C6.2

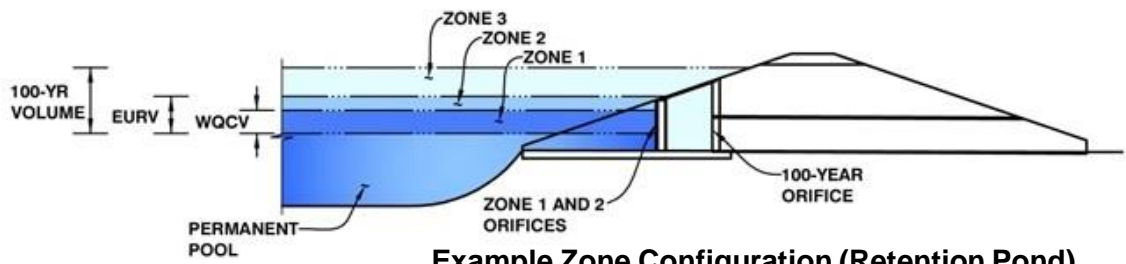
PCD FILE NO. COM2346

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Barbarick Transfer Station

Basin ID: EDB Modification - Proposed Condition - 05/01/2025



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.07	0.344	Orifice Plate
Zone 2 (EURV)	4.08	0.903	Orifice Plate
Zone 3 (100-year)	4.94	0.511	Weir&Pipe (Restrict)
Total (all zones)		1.758	

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 =	4.10	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 (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	2.00	2.58					
Orifice Area (sq. inches)	2.76	2.76	1.00					

	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 Orif	
	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, H <sub>o</sub> =	4.10	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	12.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Inlet Pipe)		Calculated Parameters for Overflow Weir	
		Zone 3 Weir	Not Selected
0 ft)	Height of Grate Upper Edge, $H_t$ =	4.10	N/A
	Overflow Weir Slope Length =	4.00	N/A
	Grate Open Area / 100-yr Orifice Area =	62.12	N/A
	Overflow Grate Open Area w/o Debris =	33.41	N/A
	Overflow Grate Open Area w/ Debris =	16.70	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 =	1.08	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	5.00		inches

Pond Restrictor Plate is installed so that ~ 3" of space is provided above the invert. See updated design spreadsheet.

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate		
	Zone 3 Restrictor	Not Selected
at Stage = 0 ft)		
Outlet Orifice Area =	0.54	N/A
Outlet Orifice Centroid =	0.25	N/A
Half-Central Angle of Restrictor Plate on Pipe =	0.84	N/A

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	4.53	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	33.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Spillway Design Flow Depth=	0.53	feet
Stage at Top of Freeboard =	6.06	feet
Basin Area at Top of Freeboard =	0.76	acres
Basin Volume at Top of Freeboard =	2.52	acre-ft

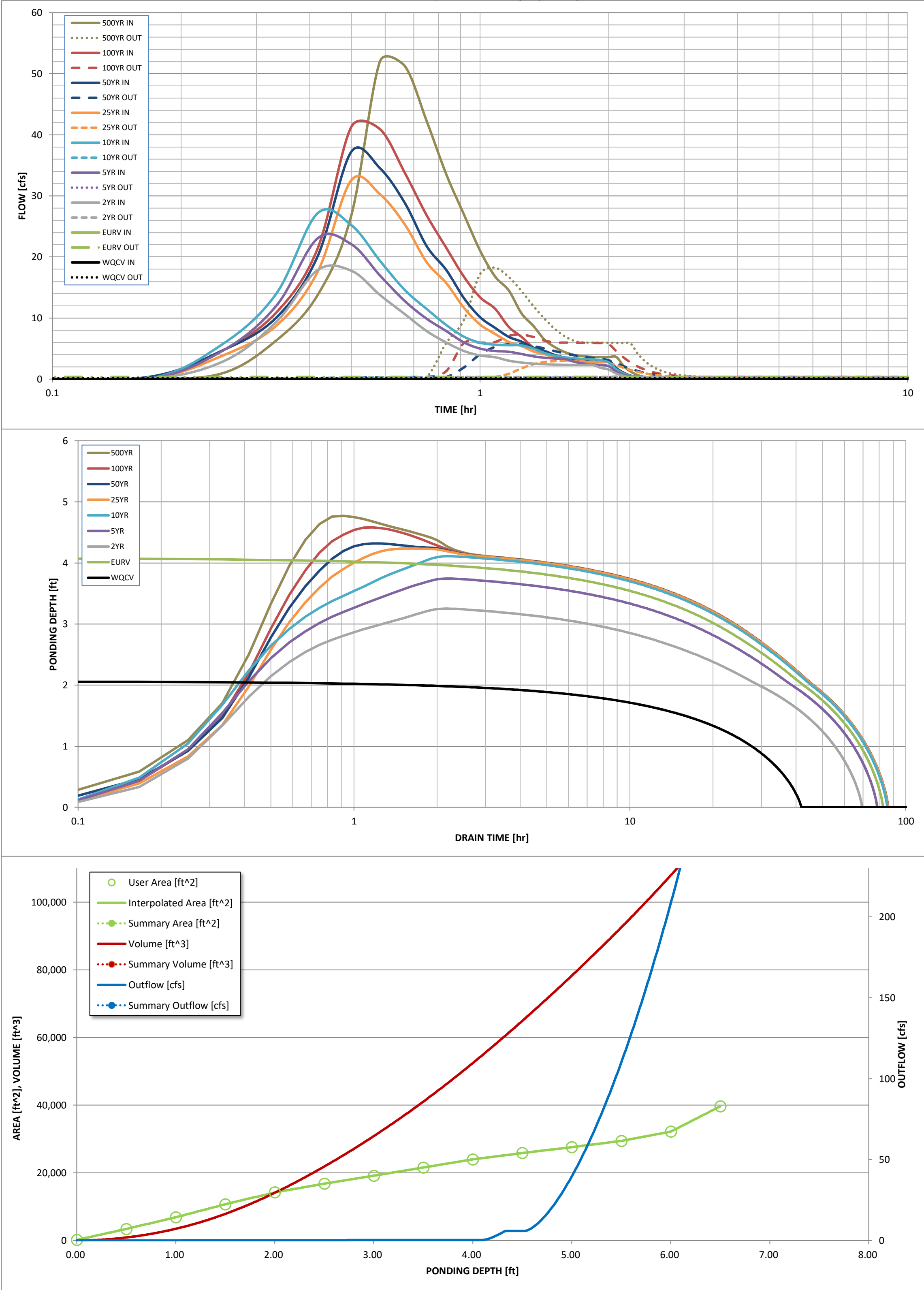
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
One-Hour Rainfall Depth (in) =	0.344	1.247	0.865	1.116	1.320	1.551	1.770	2.018
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.865	1.116	1.320	1.551	1.770	2.018
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.1	0.2	0.3	4.0	6.4	9.5
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	0.01	0.02	0.03	0.38	0.60	0.89
Peak Inflow Q (cfs) =	N/A	N/A	17.8	23.0	27.1	32.6	37.2	41.3
Peak Outflow Q (cfs) =	0.2	0.4	0.3	0.3	0.4	3.0	5.7	7.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.5	1.4	0.7	0.9	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.1	0.2	0.2
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) =	39	75	63	71	77	77	76	75
Time to Drain 99% of Inflow Volume (hours) =	40	79	67	75	82	82	82	81
Maximum Ponding Depth (ft) =	2.07	4.08	3.25	3.74	4.11	4.24	4.32	4.58
Area at Maximum Ponding Depth (acres) =	0.33	0.56	0.47	0.52	0.56	0.57	0.58	0.60
Maximum Volume Stored (acre-ft) =	0.347	1.248	0.822	1.064	1.265	1.333	1.384	1.538

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			



AS DESIGNED

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	0.32	0.03	0.96
	0:15:00	0.00	0.00	2.85	4.64	5.73	3.84	4.70	4.66	6.29
	0:20:00	0.00	0.00	9.31	11.94	13.92	8.70	10.02	10.86	13.71
	0:25:00	0.00	0.00	17.84	23.02	27.14	17.50	20.03	21.31	26.80
	0:30:00	0.00	0.00	17.74	22.08	25.20	32.56	37.23	41.30	52.01
	0:35:00	0.00	0.00	13.77	16.97	19.37	30.28	34.53	40.93	51.27
	0:40:00	0.00	0.00	10.65	12.79	14.59	25.32	28.86	33.79	42.28
	0:45:00	0.00	0.00	7.87	9.89	11.49	19.15	21.78	26.83	33.57
	0:50:00	0.00	0.00	5.99	7.88	8.86	15.73	17.89	21.52	26.97
	0:55:00	0.00	0.00	4.60	6.00	6.94	11.68	13.27	16.77	21.04
	1:00:00	0.00	0.00	3.87	5.00	5.95	8.94	10.15	13.39	16.83
	1:05:00	0.00	0.00	3.59	4.61	5.64	7.41	8.40	11.55	14.53
	1:10:00	0.00	0.00	3.02	4.47	5.54	6.09	6.92	8.56	10.77
	1:15:00	0.00	0.00	2.71	4.11	5.52	5.40	6.14	6.92	8.69
	1:20:00	0.00	0.00	2.53	3.72	4.99	4.53	5.13	5.13	6.41
	1:25:00	0.00	0.00	2.43	3.49	4.26	4.07	4.60	4.17	5.18
	1:30:00	0.00	0.00	2.36	3.36	3.82	3.47	3.91	3.54	4.38
	1:35:00	0.00	0.00	2.32	3.28	3.55	3.12	3.52	3.19	3.94
	1:40:00	0.00	0.00	2.31	2.81	3.39	2.92	3.28	3.02	3.72
	1:45:00	0.00	0.00	2.31	2.54	3.29	2.81	3.16	2.96	3.64
	1:50:00	0.00	0.00	2.31	2.38	3.24	2.76	3.10	2.94	3.62
	1:55:00	0.00	0.00	1.84	2.29	3.09	2.73	3.07	2.94	3.62
	2:00:00	0.00	0.00	1.55	2.11	2.73	2.72	3.06	2.94	3.62
	2:05:00	0.00	0.00	0.90	1.23	1.60	1.60	1.80	1.73	2.12
	2:10:00	0.00	0.00	0.52	0.70	0.92	0.93	1.05	1.01	1.24
	2:15:00	0.00	0.00	0.27	0.38	0.50	0.51	0.57	0.55	0.67
	2:20:00	0.00	0.00	0.13	0.21	0.26	0.28	0.31	0.30	0.37
	2:25:00	0.00	0.00	0.05	0.09	0.10	0.12	0.13	0.13	0.15
	2:30:00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.03	0.03
	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

AS DESIGNED

## DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.06 (July 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.

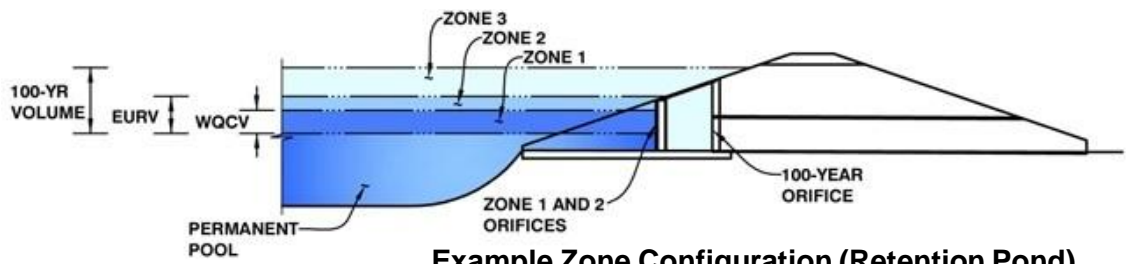
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DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **Barbarick Transfer Station**

Basin ID: **EDB Modification - Proposed Condition**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.07	0.344	Orifice Plate
Zone 2 (EURV)	4.08	0.903	Orifice Plate
Zone 3 (100-year)	4.94	0.511	Weir&Pipe (Restrict)
Total (all zones)		1.758	

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 =	4.10	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 (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	2.00	2.58					
Orifice Area (sq. inches)	2.76	2.76	1.00					

	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 Orif	
Vertical Orifice Area =	Not Selected
Vertical Orifice Centroid =	Not Selected

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, H <sub>o</sub> =	4.10	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	12.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

<u>Inlet Pipe)</u>		<u>Calculated Parameters for Overflow Weir</u>	
		Zone 3 Weir	Not Selected
0 ft)	Height of Grate Upper Edge, $H_t$ =	4.10	N/A
	Overflow Weir Slope Length =	4.00	N/A
	Grate Open Area / 100-yr Orifice Area =	130.77	N/A
	Overflow Grate Open Area w/o Debris =	33.41	N/A
	Overflow Grate Open Area w/ Debris =	16.70	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 =	1.08	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	3.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate		
	Zone 3 Restrictor	Not Selected
at Stage = 0 ft)		
Outlet Orifice Area =	0.26	N/A
Outlet Orifice Centroid =	0.15	N/A
Half-Central Angle of Restrictor Plate on Pipe =	0.64	N/A

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	4.53	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	33.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway		
Spillway Design Flow Depth=	0.53	feet
Stage at Top of Freeboard =	6.06	feet
Basin Area at Top of Freeboard =	0.76	acres
Basin Volume at Top of Freeboard =	2.52	acre-ft

Routed Hydrograph Results

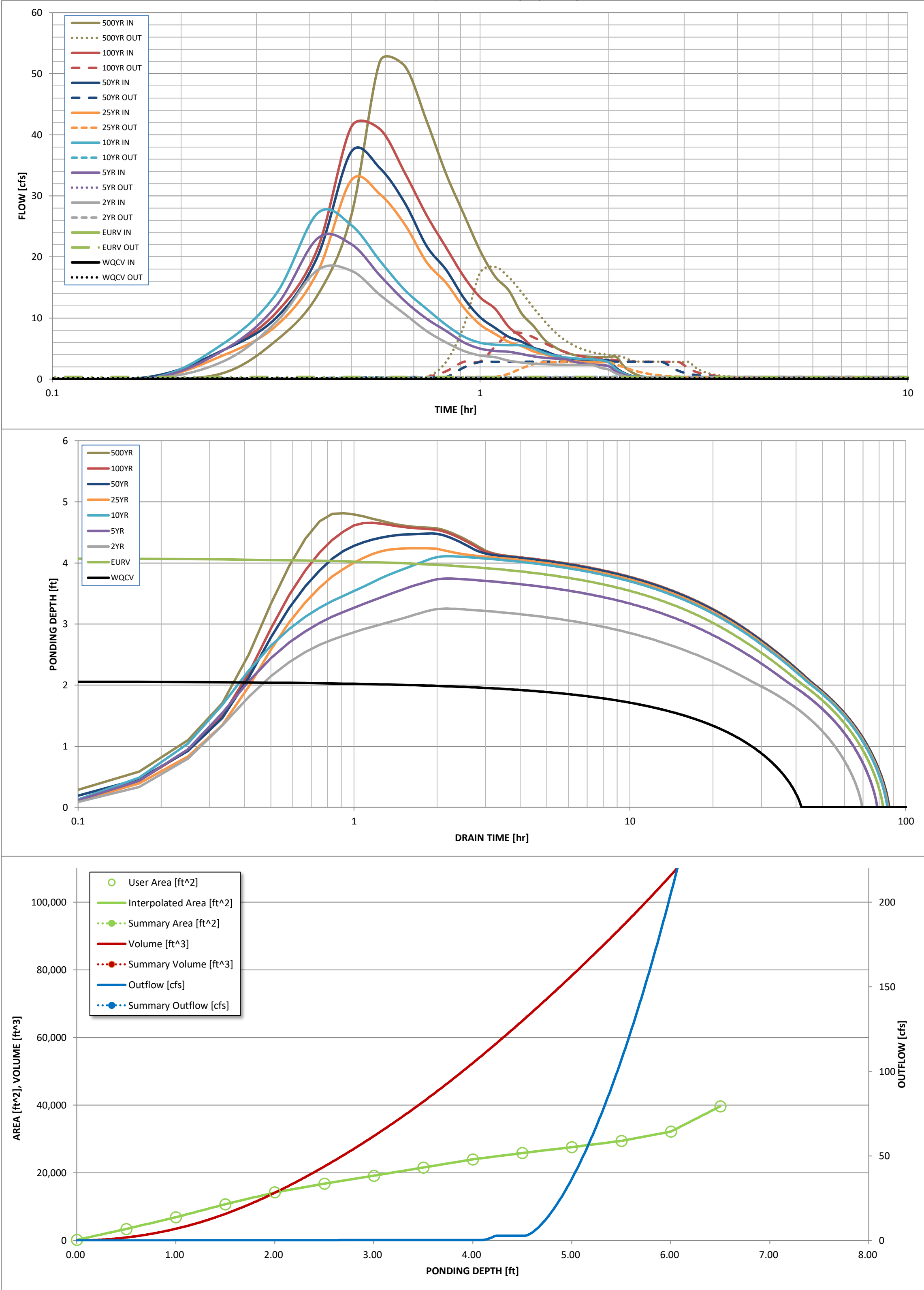
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through A)

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
One-Hour Rainfall Depth (in) =	0.344	1.247	0.865	1.116	1.320	1.551	1.770	2.018
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.865	1.116	1.320	1.551	1.770	2.018
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.1	0.2	0.3	4.0	6.4	9.5
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	0.01	0.02	0.03	0.38	0.60	0.89
Peak Inflow Q (cfs) =	N/A	N/A	17.8	23.0	27.1	32.6	37.2	41.3
Peak Outflow Q (cfs) =	0.2	0.4	0.3	0.3	0.4	2.8	2.9	7.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.5	1.4	0.7	0.4	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.1	0.1	0.1
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) =	39	75	63	71	77	77	76	75
Time to Drain 99% of Inflow Volume (hours) =	40	79	67	75	82	82	82	82
Maximum Ponding Depth (ft) =	2.07	4.08	3.25	3.74	4.11	4.24	4.48	4.66
Area at Maximum Ponding Depth (acres) =	0.33	0.56	0.47	0.52	0.56	0.57	0.59	0.61
Maximum Volume Stored (acre-ft) =	0.347	1.248	0.822	1.064	1.265	1.338	1.478	1.580



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	0.32	0.03	0.96
	0:15:00	0.00	0.00	2.85	4.64	5.73	3.84	4.70	4.66	6.29
	0:20:00	0.00	0.00	9.31	11.94	13.92	8.70	10.02	10.86	13.71
	0:25:00	0.00	0.00	17.84	23.02	27.14	17.50	20.03	21.31	26.80
	0:30:00	0.00	0.00	17.74	22.08	25.20	32.56	37.23	41.30	52.01
	0:35:00	0.00	0.00	13.77	16.97	19.37	30.28	34.53	40.93	51.27
	0:40:00	0.00	0.00	10.65	12.79	14.59	25.32	28.86	33.79	42.28
	0:45:00	0.00	0.00	7.87	9.89	11.49	19.15	21.78	26.83	33.57
	0:50:00	0.00	0.00	5.99	7.88	8.86	15.73	17.89	21.52	26.97
	0:55:00	0.00	0.00	4.60	6.00	6.94	11.68	13.27	16.77	21.04
	1:00:00	0.00	0.00	3.87	5.00	5.95	8.94	10.15	13.39	16.83
	1:05:00	0.00	0.00	3.59	4.61	5.64	7.41	8.40	11.55	14.53
	1:10:00	0.00	0.00	3.02	4.47	5.54	6.09	6.92	8.56	10.77
	1:15:00	0.00	0.00	2.71	4.11	5.52	5.40	6.14	6.92	8.69
	1:20:00	0.00	0.00	2.53	3.72	4.99	4.53	5.13	5.13	6.41
	1:25:00	0.00	0.00	2.43	3.49	4.26	4.07	4.60	4.17	5.18
	1:30:00	0.00	0.00	2.36	3.36	3.82	3.47	3.91	3.54	4.38
	1:35:00	0.00	0.00	2.32	3.28	3.55	3.12	3.52	3.19	3.94
	1:40:00	0.00	0.00	2.31	2.81	3.39	2.92	3.28	3.02	3.72
	1:45:00	0.00	0.00	2.31	2.54	3.29	2.81	3.16	2.96	3.64
	1:50:00	0.00	0.00	2.31	2.38	3.24	2.76	3.10	2.94	3.62
	1:55:00	0.00	0.00	1.84	2.29	3.09	2.73	3.07	2.94	3.62
	2:00:00	0.00	0.00	1.55	2.11	2.73	2.72	3.06	2.94	3.62
	2:05:00	0.00	0.00	0.90	1.23	1.60	1.60	1.80	1.73	2.12
	2:10:00	0.00	0.00	0.52	0.70	0.92	0.93	1.05	1.01	1.24
	2:15:00	0.00	0.00	0.27	0.38	0.50	0.51	0.57	0.55	0.67
	2:20:00	0.00	0.00	0.13	0.21	0.26	0.28	0.31	0.30	0.37
	2:25:00	0.00	0.00	0.05	0.09	0.10	0.12	0.13	0.13	0.15
	2:30:00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.03	0.03
	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

AS  
CONSTRUCTED

## DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.06 (July 2022)*

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