

To: Lisa Gish
Engineering I
El Paso County

From: Eric Gunderson, P.E.,
Kimley-Horn and Associates, Inc.

Date: April 6, 2023

Subject: Widefield Parks and Recreation – Recreation Center – Pond Outlet Structure

Based upon an email received by Kimley-Horn from Lisa Gish dated April 4, 2023 4:09PM, it is understood the proposed outlet structure in the extended detention basin at the subject site has been constructed differently than the approved plans dated 2/28/23. The approved plans call for a 5'x5' Type C CDOT structure with 4:1 sideslope/grate. Based upon the referenced email from the County, it is understood the structure was installed at 4'x4' and was installed with a flat top instead of the 4:1 sloping grate.

Attached is a markup of the approved pond plans showing the as constructed condition based upon the information above. Kimley-Horn redesigned the outlet structure using this information and the MHFD analysis has been included in this memo, following the plan markup.

Kimley-Horn proposes lowering the restrictor plate on the outlet pipe 6" for a total of 12" of clearance as noted. This will maintain the appropriate pre-development vs. post development flow ratios and drain times to be in compliance with the approved final drainage report for the project.

Final as-built drawings will be required to be provided to Kimley-Horn to perform the final pond certification following construction. The pond certification will then be submitted to El Paso County for their records.

Based upon the information above and analysis performed herein and the adjustment to the restrictor plate, the change in size and slope of the outlet structure is acceptable to the engineer of record.

Thank You,

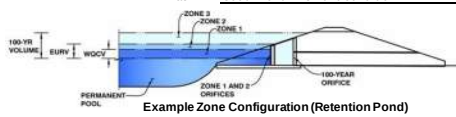
Eric Gunderson, PE

Again, this is what I am asking for. You even acknowledged yourself that one is necessary.



MHFD-Detention, Version 4.06 (July 2022)

Basin ID: South Pond - As Built Condition



Watershed Information

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

Define Zones and Basin Geometry

Initial Surcharge Area (A_{SIV})	=	user	ft ²
Surcharge Volume Length (L_{SIV})	=	user	ft
Surcharge Volume Width (W_{SIV})	=	user	ft
Depth of Basin Floor (H_{LFLOOR})	=	user	ft
Length of Basin Floor (L_{LFLOOR})	=	user	ft
Width of Basin Floor (W_{LFLOOR})	=	user	ft
Area of Basin Floor (A_{LFLOOR})	=	user	ft ²
Volume of Basin Floor (V_{LFLOOR})	=	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

[illegible]

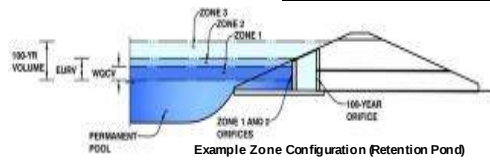
- ✓ = calcs match details in plans
✗ = calcs do not match details in plans

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD- Detention, Version 4.06 (July 2022)

Project: Widenfield Rec Center

Basin ID: South Pond - As Built Condition



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.71	0.212	Orifice Plate
Zone 2 (EURV)	3.47	0.181	Circular Orifice
Zone 3 (100-year)	5.06	0.483	Weir&Pipe (Restrict)
Total (all zones)		0.876	

CHANGES FROM APPROVED FDR AMENDMENT NO. 1 DATED 3/1/23 NOTED IN RED

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 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 = 0.00 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = 2.71 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = 12.00 inches
Orifice Plate: Orifice Area per Row = 0.67 sq. inches (diameter = 15/16 inch)

Calculated Parameters for Plate
WQ Orifice Area per Row = 4.653E-03 ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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	1.00	2.00					
Orifice Area (sq. inches)	0.67	0.67	0.67					

	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)

✗ Invert of Vertical Orifice = 2.71 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = 3.47 ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = 1.87 inches

no vertical orifice even shown on plans.

Calculated Parameters for Vertical Orifice
Zone 2 Circular Not Selected
Vertical Orifice Area = 0.02 ft²
Vertical Orifice Centroid = 0.08 feet

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

Overflow Weir Front Edge Height, H_o = 3.47 ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = 4.00 feet
Overflow Weir Grate Slope = 0.00 H:V
Horiz. Length of Weir Sides = 4.00 feet
Overflow Grate Type = Type C Grate
Debris Clogging % = 50%

I will need to check this on the plans once the plans are updated to label the elev at this location

I will need to check these on the plans once the plans are updated to show these dimensions

Calculated Parameters for Overflow Weir
Zone 3 Weir Not Selected
H_o, H_i = 3.47 feet
Length = 4.00 feet
Area = 7.09 ft²
Debris = 11.14 ft²
Debris = 5.57 ft²

5' PER FDR
4' PER FDR
5' PER FDR

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

✓ Depth to Invert of Outlet Pipe = 0.08 ft (distance below basin bottom at Stage = 0 ft)
✓ Outlet Pipe Diameter = 24.00 inches
Restrictor Plate Height Above Pipe Invert = 12.00 inches

18 PER FDR

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Zone 3 Restrictor Not Selected
Outlet Orifice Area = 1.57 ft²
Outlet Orifice Centroid = 0.58 feet
Half-Central Angle of Restrictor Plate on Pipe = 1.57 radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

✗ Spillway Invert Stage = 5.18 ft (relative to basin bottom at Stage = 0 ft)
✓ Spillway Crest Length = 21.00 feet
✓ Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway
Spillway Design Flow Depth = 0.50 feet
Stage at Top of Freeboard = 6.68 feet
Basin Area at Top of Freeboard = 0.43 acres
Basin Volume at Top of Freeboard = 1.50 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	2.55	3.14
One-Hour Rainfall Depth (in) =	0.212	0.393	0.248	0.358	0.460	0.797	1.118	1.599	2.515
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.248	0.358	0.460	0.797	1.118	1.599	2.515
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.2	0.4	0.5	4.9	9.8	16.6	28.6
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	0.02	0.22	0.44	0.76	1.30
Peak Inflow Q (cfs) =	N/A	N/A	3.4	5.0	6.3	11.7	16.9	24.1	36.8
Peak Outflow Q (cfs) =	0.1	0.2	0.1	0.2	0.6	5.3	9.9	14.8	23.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	1.2	1.1	1.0	0.9	0.8
Structure Controlling Flow =	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	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	0.5	0.9	1.3	1.5
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) =	46	59	51	58	61	57	54	50	43
Time to Drain 99% of Inflow Volume (hours) =	49	64	54	62	67	64	63	60	57
Maximum Ponding Depth (ft) =	2.71	3.47	2.79	3.23	3.54	3.81	3.99	4.31	5.39
Area at Maximum Ponding Depth (acres) =	0.21	0.26	0.22	0.25	0.27	0.28	0.29	0.31	0.36
Maximum Volume Stored (acre-ft) =	0.213	0.393	0.231	0.330	0.409	0.483	0.535	0.633	0.993

Please QC these as-built calcs against your as-built CDs. Based on how many discrepancies I found, no QC was performed. Please QC thoroughly before resubmitting.