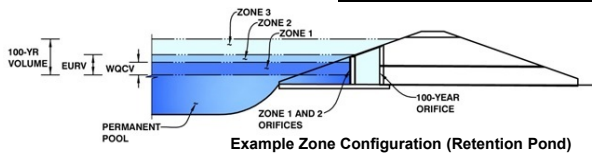


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-*Detention*, Version 4.03 (May 2020)

Project: Watermark at Akers

Basin ID: South Pond



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.76	0.333	Orifice Plate
Zone 2 (EURV)	3.55	0.779	Orifice Plate
Zone 3 (100-year)	4.67	0.700	Weir&Pipe (Restrict)
Total (all zones)		1.812	

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

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

Calculated Parameters for Underdrain
 Underdrain Orifice Area = ft²
 Underdrain Orifice Centroid = 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)

Invert of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = inches
 Orifice Plate: Orifice Area per Row = inches

Calculated Parameters for Plate
 WQ Orifice Area per Row = ft²
 Elliptical Half-Width = feet
 Elliptical Slot Centroid = feet
 Elliptical Slot Area = 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	0.60	1.60	2.40	3.20			
Orifice Area (sq. inches)	1.77	3.14	3.98	12.57	12.57			

	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 ²
Vertical Orifice Centroid =	N/A	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, H _o =	3.90	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Gate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.92	N/A	feet
Overflow Gate Open Area % =	70%	N/A	%, gate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Gate Upper Edge, H _t =	3.90	N/A	feet
Overflow Weir Slope Length =	2.92	N/A	feet
Gate Open Area / 100-yr Orifice Area =	5.21	N/A	
Overflow Gate Open Area w/o Debris =	8.18	N/A	ft ²
Overflow Gate Open Area w/ Debris =	4.09	N/A	ft ²

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 =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	12.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.57	N/A	ft ²
Outlet Orifice Centroid =	0.58	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.57	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	5.60	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	13.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =	0.87	feet
Stage at Top of Freeboard =	7.47	feet
Basin Area at Top of Freeboard =	1.10	acres
Basin Volume at Top of Freeboard =	3.86	acre-ft

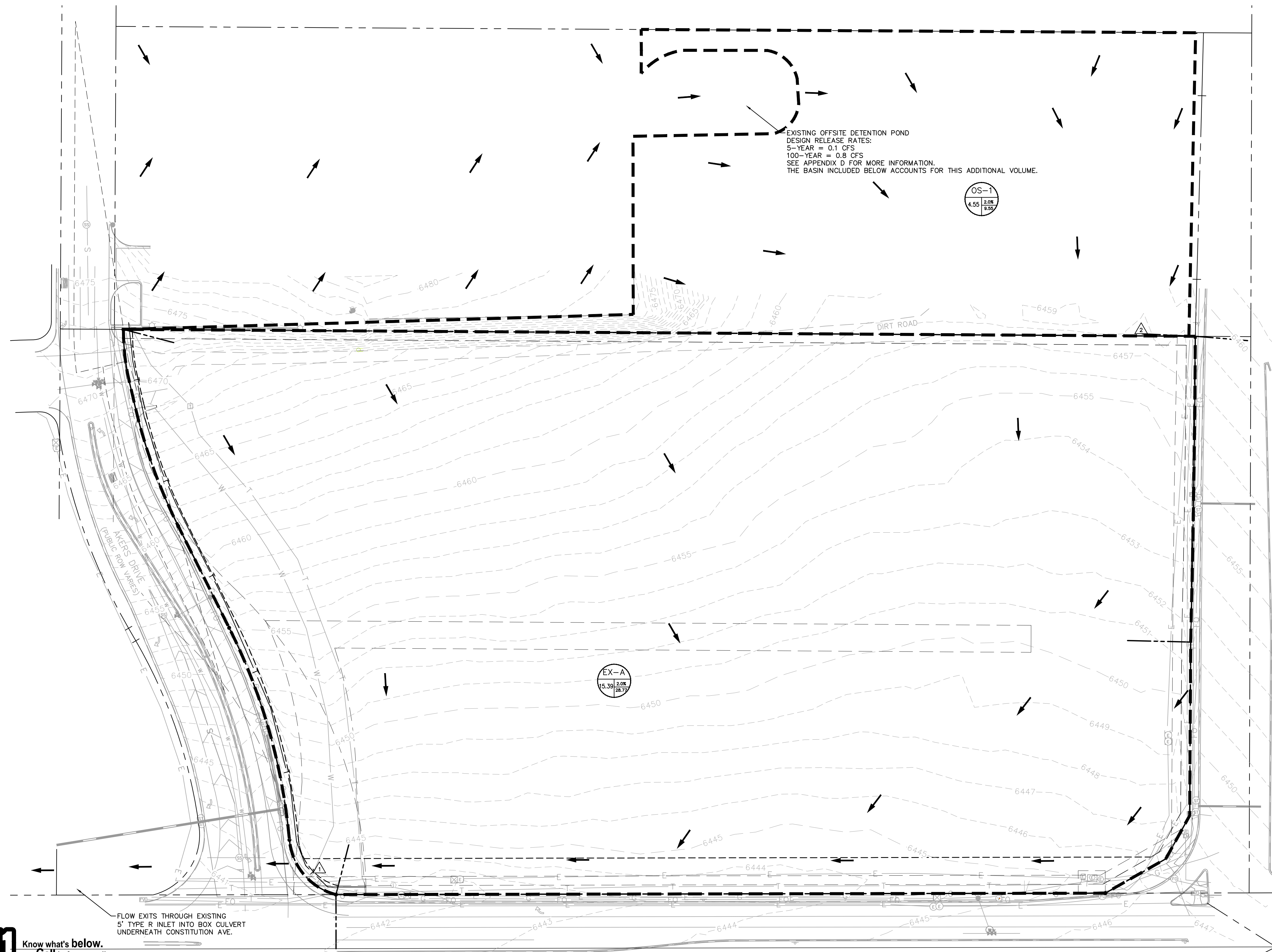
Routed Hydrograph Results

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	1.52	1.75	2.00	2.25	2.55	3.14
One-Hour Rainfall Depth (in) =	0.333	1.112	0.865	1.162	1.391	1.827	2.179	2.693	3.626
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.865	1.162	1.391	1.827	2.179	2.693	3.626
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.2	0.3	1.0	5.7	8.6	13.2	21.5
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.0	5.3	11.3	21.4	28.9	38.3	
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	0.05	0.28	0.59	1.12	1.61	2.01	1.12
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	11.3	15.3	18.3	25.8	31.1	38.5	52.0
Peak Inflow Q (cfs) =	0.2	1.2	0.7	1.1	1.3	5.0	9.2	15.1	16.4
Peak Outflow Q (cfs) =	N/A	N/A	N/A	0.2	0.1	0.2	0.3	0.4	0.8
Ratio Peak Outflow to Predevelopment Q =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Structure Controlling Flow =	N/A	N/A	N/A	N/A	N/A	0.4	0.9	1.6	1.8
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =	39	49	49	50	50	48	46	44	41
Time to Drain 97% of Inflow Volume (hours) =	43	57	56	59	60	59	58	56	53
Time to Drain 99% of Inflow Volume (hours) =	1.76	3.55	2.87	3.38	3.74	4.14	4.30	4.54	5.28
Maximum Ponding Depth (ft) =	0.32	0.55	0.47	0.53	0.57	0.63	0.66	0.70	0.77
Area at Maximum Ponding Depth (acres) =	0.335	1.116	0.771	1.024	1.216	1.460	1.563	1.720	2.258
Maximum Volume Stored (acre-ft) =									

The existing condition times of concentration and addition of flows do not appear to be correct. Verify the calculations with UD-Rational workbook or use the default UD-*Detention* values.

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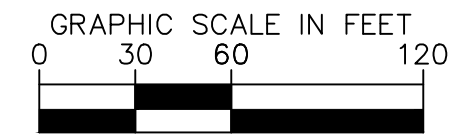
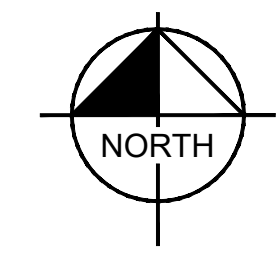
EXISTING OFFSITE DETENTION POND
 DESIGN RELEASE RATES:
 5-YEAR = 0.1 CFS
 100-YEAR = 0.8 CFS
 SEE APPENDIX D FOR MORE INFORMATION.
 THE BASIN INCLUDED BELOW ACCOUNTS FOR THIS ADDITIONAL VOLUME.

LEGEND

- A = BASIN DESIGNATION
 B = AREA (ACRES)
 C = 100-YR COMPOSITE RUNOFF COEFFICIENT
 D = 100-YR DESIGN STORM RUNOFF (CFS)
- DESIGN POINT
- FLOW DIRECTION
- EMERGENCY OVERFLOW PATH
- DRAINAGE BASIN BOUNDARY
- PROPERTY LINE
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MAJOR CONTOUR

NOTES

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 MEMBER UTILITIES

SUMMARY - EXISTING RUNOFF TABLE						
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
1	EX-A	15.39	3.92	28.77	5.31	38.33
2	OS-1	4.55	1.39	9.55	1.39	9.55

NO.	REVISION	DATE	BY	APPR.
1	FIRST SUBMITTAL	5/19	JAR	EJC

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DESIGNED BY: EJC
 DRAWN BY: JAR
 CHECKED BY: EJC
 DATE: 5/19/21

UPLAND FLATS BY WATERMARK
 EL PASO COUNTY, COLORADO
 CONSTRUCTION DRAWING PLANS
 EXISTING DRAINAGE MAP

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See comment on UD-Detention sheet