JPS ENGINEERING
19 E. Willamette Avenue
Colorado Springs, CO 80903
(719)-477-9429
www.jpsengr.com

WALDEN PRESERVE 2 - FILING NO. 1
FINAL DRAINAGE REPORT – ADDENDUM NO. 1

August 10, 2019

This Final Drainage Report Addendum has been prepared in response to El Paso County's request to upgrade the outlet structure of Walden Preserve Pond B to current full-spectrum detention design standards.

Background

JPS Engineering previously prepared the "Master Development Drainage Plan and Preliminary Drainage Report for Walden Preserve 2 PUD" dated September 17, 2014 and the "Final Drainage Report for Walden Preserve 2 - Filings No. 1 and 2" dated November 13, 2014. Walden Preserve Pond B is an existing Retention Pond which serves as an aesthetic amenity for the Walden community while also providing significant stormwater detention volume above the "active" storage volume in the pond. The historic stock pond was originally upgraded with a new outlet structure during construction of Walden Preserve Filing No. 1. Plans for Walden Preserve 2 Filing No. 1 included further upgrades to the Pond B outlet structure to incorporate a new water quality control orifice plate, though these improvements have not yet been constructed. El Paso County has now requested improvements to the outlet structure to meet current full-spectrum detention design standards.

Detention Pond Calculations

As detailed in the previous MDDP and Final Drainage Reports, off-site flows from the southeast combine with flows from the southern part of Walden Preserve (Basins A and B) in a main tributary channel of West Cherry Creek which flows northwesterly through the Walden property. The combined flows entering Pond B at Design Point #2 comprise a tributary drainage area of approximately 500 acres. Historic peak flows at Design Point #2 have been calculated as Q_5 = 65.8 cfs and Q_{100} = 287.9 cfs (SCS Method) in the previously approved drainage reports.

The pond outlet structure for Pond B has been designed to release detained flows below historic flows at Design Point #2, resulting in a net release at or below historic flows at Design Point #4 downstream (crossing Walker Road), discharging to the existing downstream channel. The pond outlet structure has been designed to maintain the calculated pond discharge below the target outflow, while holding the 100-year water surface elevation below the allowable maximum level.

In accordance with current County drainage criteria, Retention Pond B has been evaluated based on "Full-Spectrum" detention pond design guidance provided by the Denver Urban Drainage and Flood Control District (UDFCD). Design calculations have been performed for upgrade of the pond outlet structure to current full-spectrum detention standards, utilizing the UDFCD "UD-Detention_v3.07" and "UD-BMP_v3.06" software packages (see calculations in Appendix A).

For consistency with the previously accepted major basin hydrology, the "UD-Detention" model has been calibrated by adjusting the percentage of hydrologic soils group A and B soils so that the calculated predevelopment 100-year peak flow in the UD-Detention model matches the 100-year flow of 287.9 cfs calculated in the HEC-HMS model.

The existing Pond B outlet structure consists of a 6'x6.3' concrete catch basin with a lower 16"x16" orifice entering the west face of the box and an upper 36"x36" orifice entering the south face of the box. An existing 48" RCP discharge pipe extends north from the outlet structure to a riprap energy dissipation structure flowing into the downstream channel.

Based on the enclosed detention calculations, we recommend upgrading the existing pond outlet structure to current full-spectrum design standards by closing the west orifice, installing a new trash rack at the south face of the box and constructing a new interior wall and chamber within the outlet structure, providing a trash screen and orifice plate to meter flows through the structure. The proposed internal orifice plate will have a lower slot opening and two higher orifice openings sized based on the UD-Detention model. Additionally, a steel restrictor plate will be installed on the inside face of the box at the 48" discharge pipe opening.

As detailed in the enclosed calculations, the proposed outlet structure improvements result in calculated peak outflows below predevelopment flows for the full spectrum of storm events. The calculated 100-year discharge is 155.8 cfs, providing a significant reduction in comparison to predevelopment flows.

Summary

Retention Pond B provides stormwater detention and water quality enhancement to mitigate developed flow impacts from a large part of the Walden Preserve development. The proposed Pond B outlet structure improvements will improve the metering of discharge flows and upgrade the pond to current full-spectrum detention design standards.

APPENDIX A

DETENTION POND CALCULATIONS – POND B

HISTORIC FLOWS

BASIN	DESIGN POINT	AREA (AC)	AREA (SM)	CURVE No. (CN)	S	Ia	PERCENT IMPERVIOUS (%)	Time of Concentration Tc[1] (MIN)	Total Lag Time Tl[2] (MIN)	Peak Flow SCS Q5[3] (CFS)	Peak Flow SCS Q100[3] (CFS)
OA1		232.0	0.3625	61	6.39	1.28	2	34.80	20.88		
A		105.1	0.1642	61	6.39	1.28	2	18.80	11.28		
OA1,A	1	337.1	0.5267	61	6.39	1.28	2	53.60	32.16	33.1	213.4
OB1		35.4	0.0553	70	4.29	0.86	25	8.20	4.92		
B		118.0	0.1844	61	6.39	1.28	2	13.70	8.22		
OA1-OAB,A-B	2	490.5	0.7664	61	6.39	1.28	2	67.30	40.38	65.8	287.9
OC1		187.6	0.2931	70	4.29	0.86	25	14.40	8.64		
C		190.2	0.2972	61	6.39	1.28	2	47.10	28.26		
OD1		24.1	0.0377	61	6.39	1.28	2	30.30	18.18		
D		10.27	0.0160	61	6.39	1.28	2	4.50	2.70		
OA1-OC1,A-D	4	902.7	1.4104	61	6.39	1.28	2	114.40	68.64	222.5	582.9

DEVELOPED FLOWS

BASIN	DESIGN POINT	AREA (AC)	AREA (SM)	CURVE No. (CN)	S	Ia	PERCENT IMPERVIOUS (%)	Time of Concentration Tc[1] (HR)	Total Lag Time Tl[2] (HR)	Peak Flow SCS Q5[3] (CFS)	Peak Flow SCS Q100[3] (CFS)
OA1		232.0	0.3625	61	6.39	1.28	2	36.80	22.08		
A9 (A1-A9)		110.0	0.1719	68	4.71	0.94	20	19.00	11.40		
OA1,A1-A9	1	342.0	0.5344					55.80	33.48	92.1	261.3
OB1		35.4	0.0553	70	4.29	0.86	25	20.60	12.36		
B4 (B1-B4)		55.5	0.0867	70	4.29	0.86	25	21.10	12.66		
B10 (B5-B10)		71.8	0.1122	68	4.71	0.94	20	28.70	17.22		
Tt DP1 to DP2								13.70	8.22		
OA1-OB1,A-B	2	504.7	0.7886					69.50	41.70	208.0	551.4
OC1		129	0.2016	69.5	4.39	0.88	23.6	14.40	8.64		
C4 (C1-C4)		40.3	0.0630	68	4.71	0.94	20	21.70	13.02		
C8 (C5-C8)		59.3	0.0927	68	4.71	0.94	20	35.00	21.00		
C9		4.5	0.0070	61	6.39	1.28	2	2.10	1.26		
Tt DP2 to DP3								22.10	13.26		
OA1-OC1,A,B,C1-C8	3	737.8	1.1528					91.60	54.96	280.7	734.2
OC2		81.7	0.1277	67.9	4.73	0.95	19.1	14.40	8.64		
C12 (C10-C12)		26.4	0.0413	68	4.71	0.94	20	19.10	11.46		
C13		22.4	0.0350	61	6.39	1.28	2	15.30	9.18		
OD1		24.1	0.0377	61	6.39	1.28	2	30.30	18.18		
D		10.3	0.0160	70	4.29	0.86	25	4.50	2.70		
Tt DP3 to DP4								25.40	15.24		
OA1-OC2,A-D	4	902.7	1.4104					117.00	70.20	298.7	785.0

1) Tc = Tco + Tt (from Rational Method Calculation Spreadsheet)
2) SCS LAG TIME, Tl = 0.6 * Tt
3) PEAK FLOWS CALCULATED BY HEC-HMS 3.5; 5-YR RAINFALL DEPTH = 2.6 IN; 100-YR RAINFALL DEPTH = 4.4 IN

WALDEN PRESERVE

IMPERVIOUS AREA CALCULATIONS

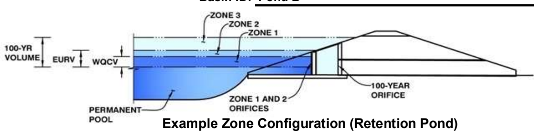
BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	% IMP.	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	% IMP.	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	% IMP.	WEIGHTED PERCENT IMPERVIOUS
OA1.1	83.8	83.8	PASTURE	0.00							0.00
OA1.2	108.2	108.2	PASTURE	0.00							0.00
A1	28.25	28.25	2.5-AC. LOTS	11.00							11.00
OA1.3	14.8	14.8	PASTURE	0.00							0.00
A2	2.34	2.34	2.5-AC. LOTS	11.00							11.00
OA1.3,A2	17.14										1.50
OA1,A1,A2	237.39										1.42
OA1.4	25.2	25.2	PASTURE	0.00							0.00
A3	11.22	11.22	2.5-AC. LOTS	11.00							11.00
A4	1.58	1.58	2.5-AC. LOTS	11.00							11.00
OA1.4,A3,A4	38.0										3.71
A5	15.14	15.14	2.5-AC. LOTS	11.00							11.00
A6	1.98	1.98	2.5-AC. LOTS	11.00							11.00
A5,A6	17.12										11.00
A7	27.55	27.55	1-AC. LOTS	20.00							20.00
A8	4.12	4.12	1-AC. LOTS	20.00							20.00
A9	17.78	17.78	1-AC. LOTS	20.00							20.00
OA1.4,A3,A4,A9	55.78										8.90
OA1,A1-A9	341.96										4.84
OB1,B1-B4	90.90										25.00
B5	4.78	4.78	2.5-AC. LOTS	11.0							11.00
B6	7.91	7.91	2.5-AC. LOTS	11.0							11.00
B5,B6	12.69										11.00
B7	3.24	3.24	1-AC LOTS	20.0							20.00
B8	28.74	28.74	1-AC LOTS	20.0							20.00
B5-B8	44.67										17.44
B9	10.23	10.23	1-AC LOTS	20.0							20.00
B10	16.90	71.17	1-AC LOTS	20.0							20.00
B5-B10	71.80										18.41
OB1,B1-B10	162.70										22.09
OA1,OB1,A,B	**504.66**										**10.40**

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Walden Preserve**

Basin ID: **Pond B**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**RP**	
Watershed Area =	504.70	acres
Watershed Length =	6,870	ft
Watershed Slope =	0.029	ft/ft
Watershed Imperviousness =	10.40%	percent
Percentage Hydrologic Soil Group A =	91.0%	percent
Percentage Hydrologic Soil Group B =	9.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	

			Optional User Override 1-hr Precipitation	
Water Quality Capture Volume (WQCV) =	2.331	acre-feet		
Excess Urban Runoff Volume (EURV) =	3.994	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	2.613	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.634	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	5.233	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	8.926	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	14.939	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	26.083	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	52.161	acre-feet	3.14	inches
Approximate 2-yr Detention Volume =	2.415	acre-feet		
Approximate 5-yr Detention Volume =	3.366	acre-feet		
Approximate 10-yr Detention Volume =	4.747	acre-feet		
Approximate 25-yr Detention Volume =	6.445	acre-feet		
Approximate 50-yr Detention Volume =	8.245	acre-feet		
Approximate 100-yr Detention Volume =	12.813	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	2.331	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.663	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	8.820	acre-feet
Total Detention Basin Volume =	12.813	acre-feet

Depth Increement = 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)
Permanent Pool	--	0.00	--	--	--	76,766	1.762		
EL=7448.0	--	1.00	--	--	--	84,736	1.945	79,904	1.834
	--	3.00	--	--	--	91,954	2.111	257,441	5.910
	--	5.00	--	--	--	116,593	2.677	465,988	10.698
Spillway=7453.0	--	6.00	--	--	--	134,165	3.080	591,367	13.576
	--	7.00	--	--	--	151,736	3.483	734,317	16.858
Top EL=7456.0	--	9.00	--	--	--	199,982	4.591	1,086,035	24.932
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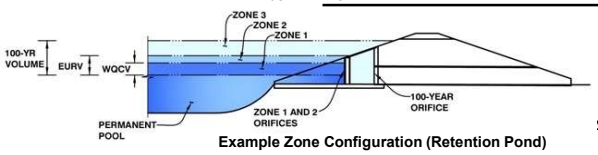
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: WALDEN PRESERVE

Basin ID: POND B



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.25	2.331	Orifice Plate
Zone 2 (EURV)	2.08	1.663	Orifice Plate
Zone 3 (100-year)	5.75	8.820	Weir&Pipe (Restrict)
		12.813	Total

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 =	2.08	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	8.30	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	0.69	1.39					
Orifice Area (sq. inches)	81.00	0.12	0.12					

	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) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.08	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	2.08	N/A	feet
Overflow Weir Front Edge Length =	6.00	N/A	feet	Over Flow Weir Slope Length =	0.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	0.00	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	0.00	N/A	feet	Overflow Grate Open Area w/o Debris =	0.00	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	0.00	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 =	4.17	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	10.11	N/A	ft^2
Outlet Pipe Diameter =	48.00	N/A	inches	Outlet Orifice Centroid =	1.66	N/A	feet
Restrictor Plate Height Above Pipe Invert =	36.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.09	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	3.73	feet
Spillway Crest Length =	10.00	feet	Stage at Top of Freeboard =	11.73	feet
Spillway End Slopes =	3.00	H:V	Basin Area at Top of Freeboard =	4.59	acres
Freeboard above Max Water Surface =	2.00	feet			

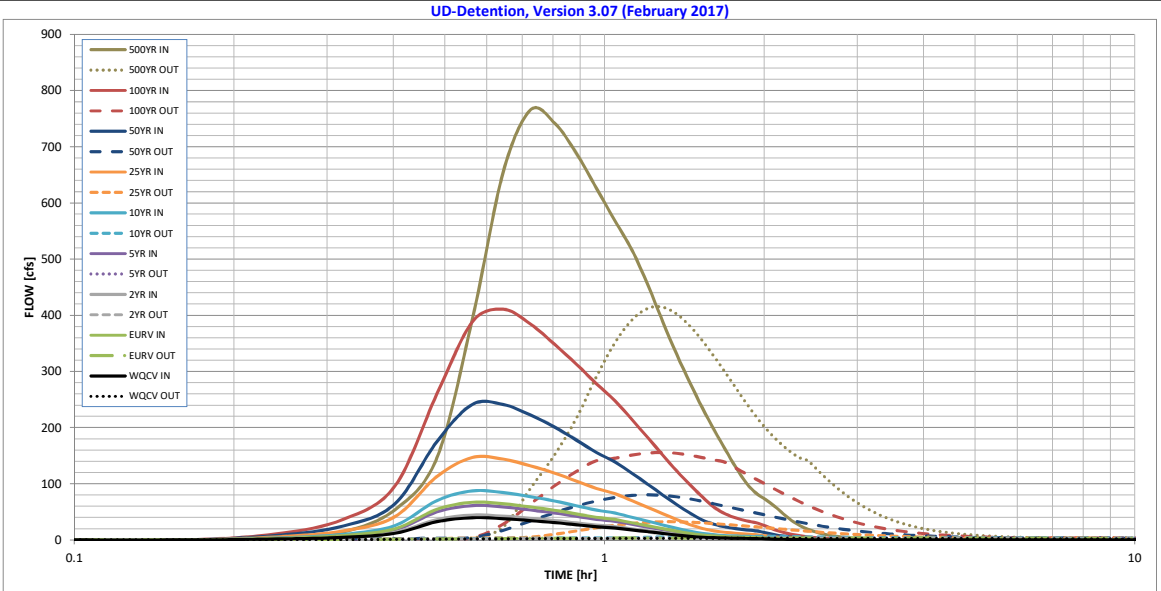
Calculated Parameters for Spillway

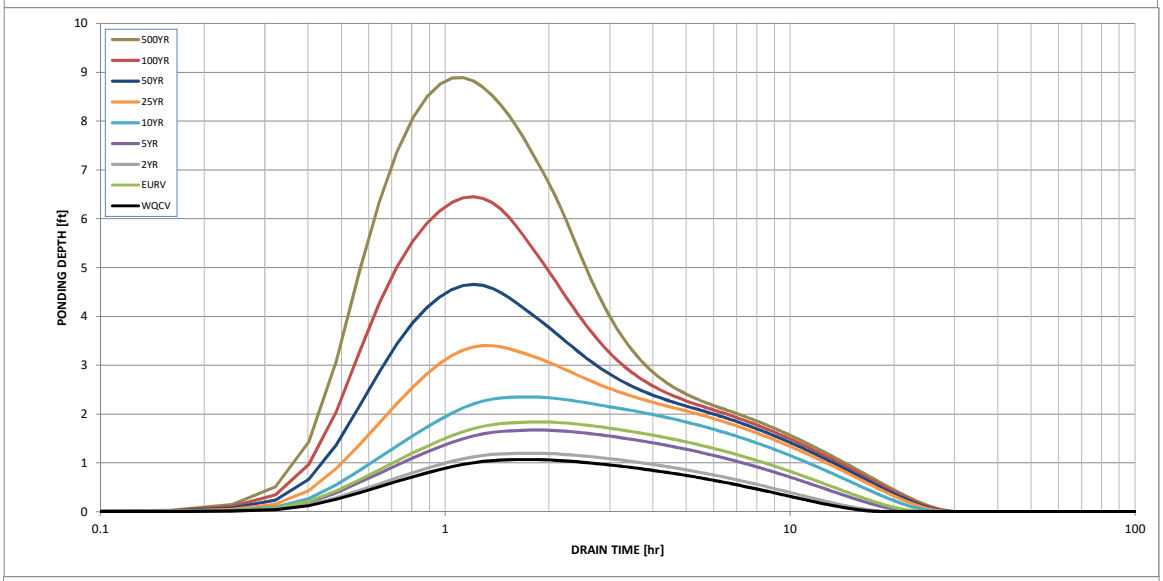
Routed Hydrograph Results

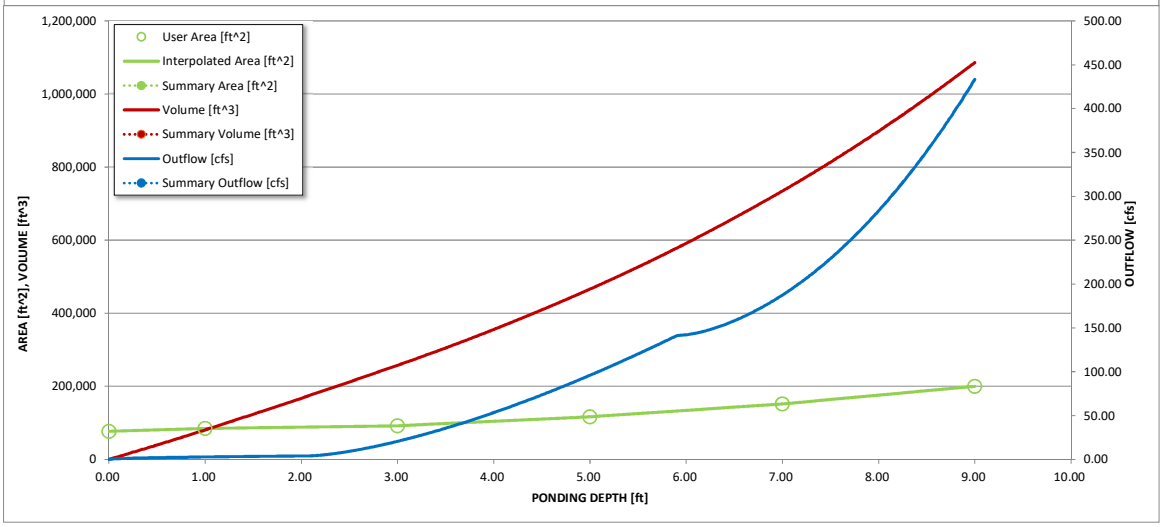
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.14
Calculated Runoff Volume (acre-ft) =	2.331	3.994	2.613	3.634	5.233	8.926	14.939	26.083	52.161
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	2.329	3.992	2.612	3.633	5.230	8.923	14.930	26.071	52.140
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.01	0.03	0.09	0.27	0.57	1.19
Predevelopment Peak Q (cfs) =	0.0	0.0	0.9	3.4	15.3	44.4	138.1	287.6	602.4
Peak Inflow Q (cfs) =	39.4	67.0	44.1	61.1	87.3	146.9	241.3	410.7	765.3
Peak Outflow Q (cfs) =	2.8	3.7	3.0	3.5	6.7	32.4	80.3	155.8	414.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.4	0.7	0.6	0.5	0.7
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Spillway	Spillway
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) =	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) =	16	21	17	20	23	23	22	20	16
Time to Drain 99% of Inflow Volume (hours) =	**17**	22	18	21	25	26	25	24	22
Maximum Ponding Depth (ft) =	1.07	1.84	1.20	1.67	2.35	3.40	4.66	6.45	8.89
Area at Maximum Ponding Depth (acres) =	1.95	2.01	1.96	2.00	2.06	2.22	2.58	3.26	4.53
Maximum Volume Stored (acre-ft) =	1.971	3.497	2.225	3.176	4.555	6.777	9.778	15.003	24.430

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
	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]
4.83 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:04:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:09:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:14:29	1.69	2.79	1.88	2.56	3.54	5.51	8.10	10.97	14.27
1.035	0:19:19	4.62	7.74	5.16	7.08	9.95	16.08	24.98	36.70	53.80
	0:24:09	11.86	19.88	13.24	18.18	25.54	41.30	64.26	95.86	146.00
	0:28:59	32.54	54.50	36.34	49.86	70.00	112.94	175.18	259.88	393.03
	0:33:49	39.42	67.01	44.13	61.08	87.28	146.86	241.27	388.32	654.58
	0:38:38	37.77	64.44	42.30	58.67	84.31	143.83	241.02	410.71	765.26
	0:43:28	34.38	58.68	38.50	53.40	76.93	131.92	222.54	384.62	742.25
	0:48:18	30.89	52.85	34.61	48.09	69.33	119.02	200.99	348.55	688.21
	0:53:08	26.89	46.22	30.16	42.02	60.75	104.71	177.55	312.64	626.08
	0:57:58	23.39	40.35	26.26	36.66	53.09	91.68	155.62	278.05	568.30
	1:02:47	21.19	36.43	23.77	33.12	47.84	82.23	138.83	247.70	516.02
	1:07:37	17.69	30.52	19.85	27.73	40.20	69.65	118.73	214.43	453.67
	1:12:27	14.60	25.29	16.40	22.96	33.35	57.93	98.94	181.80	388.59
	1:17:17	11.47	20.02	12.91	18.15	26.52	46.45	80.01	151.00	330.40
	1:22:07	8.77	15.46	9.89	13.99	20.55	36.23	62.75	122.78	279.94
	1:26:56	6.48	11.54	7.32	10.43	15.41	27.40	47.87	98.31	235.19
	1:31:46	4.90	8.66	5.53	7.84	11.52	20.29	35.43	76.53	196.23
	1:36:36	3.98	6.97	4.48	6.31	9.23	16.12	27.82	58.16	160.68
	1:41:26	3.36	5.86	3.78	5.32	7.76	13.51	23.18	46.31	128.56
	1:46:16	2.93	5.10	3.30	4.63	6.74	11.69	19.97	38.98	101.28
	1:51:05	2.63	4.56	2.95	4.14	6.02	10.42	17.73	34.03	83.19
	1:55:55	2.41	4.18	2.71	3.80	5.51	9.51	16.14	30.50	71.90
	2:00:45	1.78	3.11	2.00	2.82	4.13	7.28	12.65	24.79	60.01
	2:05:35	1.30	2.25	1.46	2.04	2.99	5.24	9.12	18.31	46.54
	2:10:25	0.95	1.67	1.07	1.51	2.21	3.89	6.76	13.31	34.59
	2:15:14	0.71	1.24	0.80	1.12	1.64	2.89	5.02	9.91	25.74
	2:20:04	0.51	0.91	0.58	0.82	1.21	2.13	3.72	7.47	19.13
	2:24:54	0.37	0.65	0.41	0.59	0.87	1.54	2.70	5.57	14.52
	2:29:44	0.27	0.47	0.30	0.43	0.63	1.12	1.95	4.11	11.00
	2:34:34	0.18	0.33	0.21	0.30	0.44	0.79	1.40	3.06	8.35
	2:39:23	0.12	0.21	0.13	0.19	0.29	0.52	0.94	2.22	6.40
	2:44:13	0.06	0.12	0.07	0.11	0.17	0.31	0.57	1.51	4.85
	2:49:03	0.03	0.05	0.03	0.05	0.08	0.15	0.29	0.94	3.52
	2:53:53	0.01	0.01	0.01	0.01	0.02	0.05	0.11	0.50	2.41
	2:58:43	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.20	1.50
	3:03:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.81
	3:08:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32
	3:13:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
	3:18:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:22:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:27:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:32:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:37:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:42:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:47:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:51:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:56:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:01:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:06:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:11:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:44:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:49:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:54:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:59:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:04:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:09:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:13:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:18:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:23:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:28:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:33:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:38:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:42:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:47:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Design Procedure Form: Retention Pond (RP)

UD-BMP (Version 3.06, November 2016)

Designer: JPS
Company: JPS
Date: August 10, 2019
Project: Walden Preserve
Location: Pond B

1. Baseflow A) Is the permanent pool established by groundwater?	Choose One ○ YES ◉ NO THE NET INFLUX OF WATER MUST BE AVAILABLE THROUGH A PERENNIAL BASEFLOW AND MUST EXCEED THE LOSSES.
2. Surcharge Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 10.4 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.104
C) Contributing Watershed Area	Area = 504.660 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = in
E) Design Concept (Select EURV when also designing for flood control)	Choose One ○ Water Quality Capture Volume (WQCV) ◉ Excess Urban Runoff Volume (EURV)
F) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time ($V_{WQCV} = (0.8 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$	V_{WQCV}= 2.331 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) ($V_{WQCV\ OTHER} = (d_6 * (V_{WQCV}/0.43))$	$V_{WQCV\ OTHER}$= ac-ft
H) User Input of Water Quality Capture Volume (WQCV) (Only if a different WQCV Design Volume is desired)	$V_{WQCV\ USER}$= ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One ◉ A ○ B ○ C / D
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	EURV = 3.899 ac-f t
3. Basin Shape (It is recommended to have a basin length-to-width ratio between 2:1 and 3:1)	L : W = 2.0 : 1
4. Permanent Pool A) Minimum Permanent Pool Volume	V_{POOL} = 2.331 ac-ft
B) Depth of the Safety Wetland Bench (Depth between 6 to 12 inches recommended)	D_{LZ} = 6 in
C) Depth of the Open Water Zone (Maximum depth of 12 feet)	D_{OWZ} = 7.0 ft
5. Side Slopes	
A) Maximum Side Slopes Above the Safety Wetland Bench (Horiz. dist. per unit vertical, should be no steeper than 4:1)	Z_{PP} = 4.00 ft / ft
B) Maximum Side Slopes Below the Safety Wetland Bench (Horiz. dist. per unit vertical, should be no steeper than 3:1)	Z_{OWZ} = 3.00 ft / ft

Design Procedure Form: Retention Pond (RP)

Designer:	**JPS**
Company:	**JPS**
Date:	**August 10, 2019**
Project:	**Walden Preserve**
Location:	**Pond B**

6. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations: Riprap Aprons

7. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) V_{FMIN} = 0.070 ac-ft

B) Actual Forebay Volume V_F = _____ ac-ft

8. Outlet

A) Outlet Type: Choose One; (●) Orifice Plate; ( ) Other (Describe):

C) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) $D_{orifice}$ = 0.375 inches

D) Total Outlet Area (A_{ot}) A_{ot} = 81.240 square inches

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = Aot * 38.5*(e^{-0.095D})$ A_t = 3018 square inches

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) *Other (Please describe below)*

Amico Klemp SR Series Aluminum Bar Grate; 3/16" Width Bars on 1-3/16" Centers Cross Rods on 4" Centers

Other (Y/N): Y

C) Ratio of Total Open Area to Total Area (only for type 'Other') User Ratio = 0.77

D) Total Water Quality Screen Area (based on screen type) A_{total} = 3920 square inches

E) Inundated Depth of Water Quality Screen below Permanent Pool $D_{inundated}$ = 4.0 ft

F) Depth of Design Volume (EURV or WQCV) Based on the Design Concept Chosen Under 1.E H= 2.1 ft

G) Height of Water Quality Screen (H_{TR}) H_{TR}= 72.96 inches

H) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended) $W_{opening}$ = 53.7 inches

Design Procedure Form: Retention Pond (RP)

Designer: JPS
Company: JPS
Date: August 10, 2019
Project: Walden Preserve
Location: Pond B

10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping: Riprap Spillway

B) Maximum Embankment Side Slopes
(Horiz. dist. per unit vertical, should be no steeper than 4:1) 0.08 TOO STEEP (< 4)

11. Maintenance Considerations

A) Describe Means of Draining the Pond: Pumping to drain water below active level into pond outlet pipe

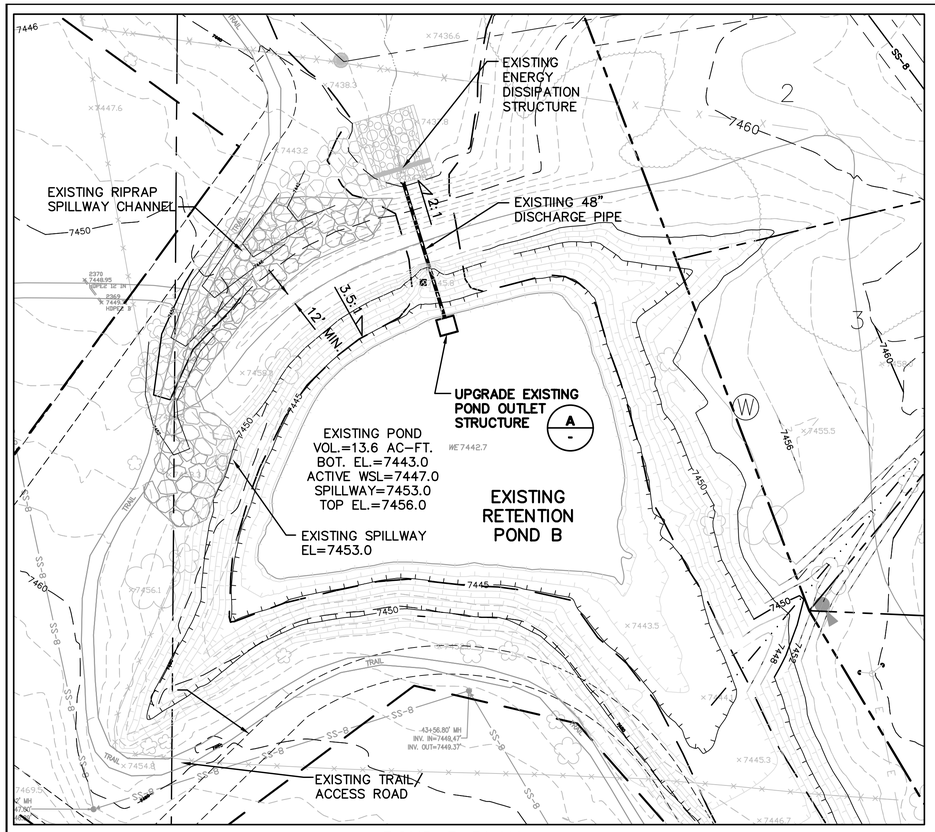
12. Vegetation

Choose One
○ Irrigated
◉ Not Irrigated

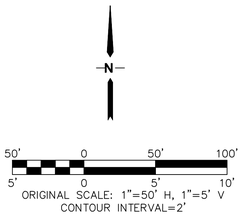
13. Access

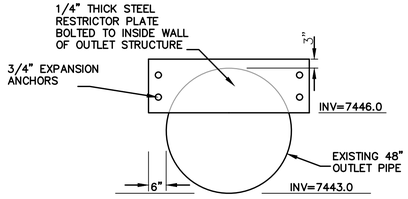
A) Describe Sediment Removal Procedures: Periodic inspection and sediment removal as needed; Draining / pumping as needed to lower pond level for excavation / hauling off sediment

Notes:

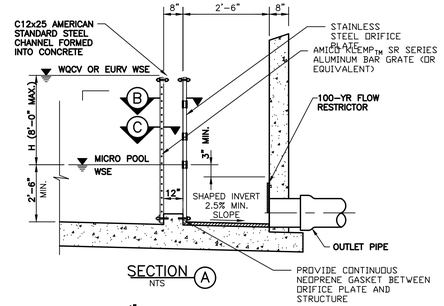


POND B PLAN

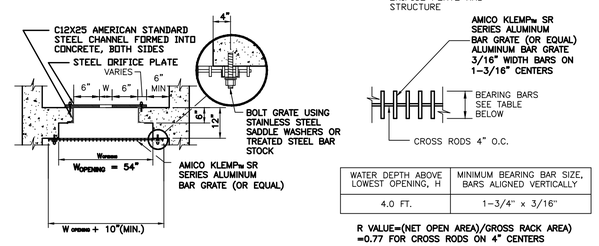




RESTRICTOR PLATE DETAIL (B)
NTS



SECTION (A)
NTS



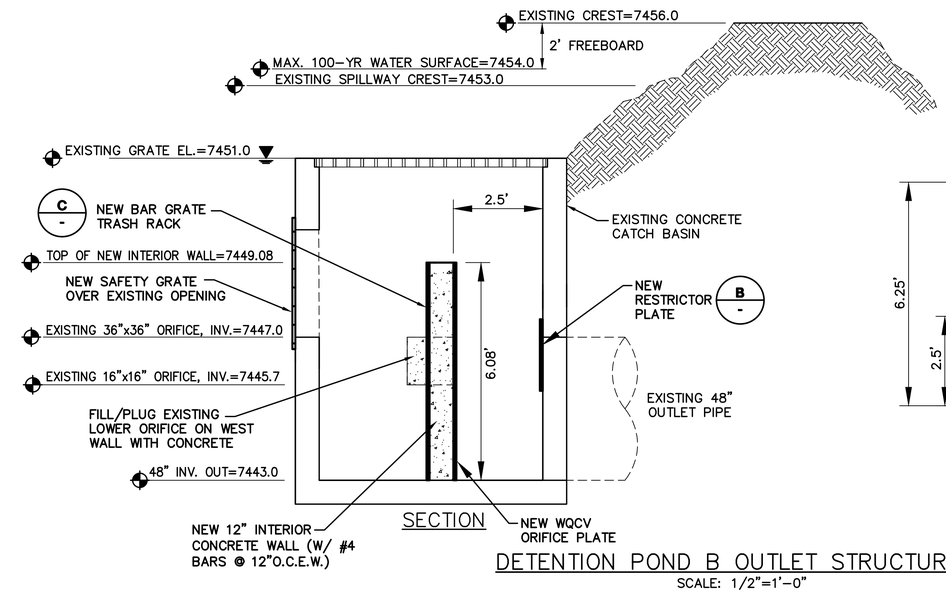
WATER DEPTH ABOVE LOWEST OPENING, H	MINIMUM BEARING BAR SIZE, BARS ALIGNED VERTICALLY
4.0 FT.	1-3/4" x 3/16"

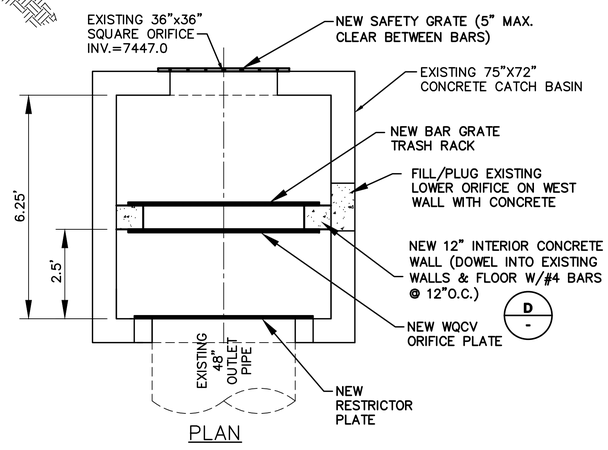
R VALUE=(NET OPEN AREA)/GROSS RACK AREA)
=0.77 FOR CROSS RODS ON 4" CENTERS

SECTION (B)
NTS

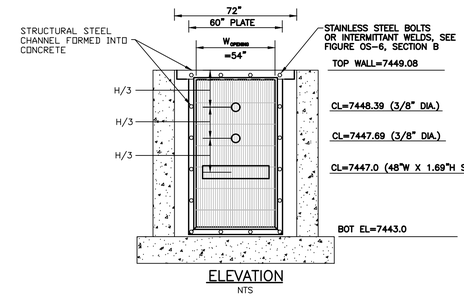
SECTION (C)
NTS

TRASH RACK & ORIFICE PLATE DETAIL (C)
(BASED ON UDFCD VOL. 3 FIGURE OS-6)





DETENTION POND B OUTLET STRUCTURE (A)
SCALE: 1/2"=1'-0"



ELEVATION
NTS

ORIFICE PLATE NOTES:

1. PROVIDE CONTINUOUS NEOPRENE GASKET MATERIAL BETWEEN THE ORIFICE PLATE AND CONCRETE.
2. BOLT PLATE TO CONCRETE 12" MAX. ON CENTER. SEE TABLE OS-2 FOR PLATE THICKNESS.

EURV AND WQCV TRASH RACKS:

1. WELL-SCREEN TRASH RACKS SHALL BE STAINLESS STEEL AND SHALL BE ATTACHED BY INTERMITTENT WELDS ALONG THE EDGE OF THE MOUNTING FRAME.
2. BAR GATE TRASH RACKS SHALL BE ALUMINUM AND SHALL BE BOLTED USING STAINLESS STEEL HARDWARE.
3. TRASH RACK OPEN AREAS ARE FOR SPECIFIED TRASH RACK MATERIALS. TOTAL TRASH RACK SIZE MAY NEED TO BE ADJUSTED FOR MATERIALS HAVING DIFFERENT OPEN AREA/GROSS AREA RATIO (R VALUE).
4. STRUCTURAL DESIGN OF TRASH RACKS SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF THE RACK.

OVERFLOW SAFETY GRATES:

1. ALL SAFETY GRATES SHALL BE MOUNTED USING STAINLESS STEEL HARDWARE AND PROVIDED WITH HINGED AND LOCKABLE OR BOLTABLE ACCESS PANELS.
2. SAFETY GRATES SHALL BE STAINLESS STEEL, ALUMINUM, OR STEEL. STEEL GRATES SHALL BE HOT DIP GALVANIZED AND MAY BE HOT POWDER COATED AFTER GALVANIZING.
3. SAFETY GRATES SHALL BE DESIGNED SUCH THAT THE DIAGONAL DIMENSION OF EACH OPENING IS SMALLER THAN THE DIAMETER OF THE OUTLET PIPE.
4. STRUCTURAL DESIGN OF SAFETY GRATES SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF THE RACK.

ORIFICE PLATE AND TRASH RACK DETAIL & NOTES (D)
(BASED ON UDFCD VOL. 3 FIGURE OS-4)

WALDEN PRESERVE 2 - FILING NO. 1

POND B - OUTLET STRUCTURE UPGRADE DETAILS

No.	REVISION	BY	DATE
A	FINAL PLAT SUBMITTAL	JPS	7/23/14
B	EPC COMMENTS	JPS	9/17/14
C	FSD OUTLET STRUCTURE UPGRADE	JPS	8/9/19

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

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.

HORZ. SCALE:	1"=50'
VERT. SCALE:	N/A
SURVEYED:	RAMPART
CREATED:	7/17/14
PROJECT NO:	040201
SHEET:	C5
DRAWN:	MJP
DESIGNED:	JPS
CHECKED:	JPS
LAST MODIFIED:	8/9/19
MODIFIED BY:	BJJ

Z:\040201.walden\dwg\civil\WALDEN PRESERVE 2\FLG-4\C5.dwg Aug 10, 2019 - 7:02pm