LOT 1, STERLING RECYLCING SUBDIVISION

DRAINAGE LETTER

PCD FILE NO: PPR2524

ALL TERRAIN ENGINEERING PROJECT NO: 25005

SEPTEMBER 2025

PREPARED FOR:

RHETORIC, LLC

CONTACT: ERIC HOWARD

20 BOULDER CRESCENT STREET, SUITE 200

COLORADO SPRINGS, CO 80903

PREPARED BY:

ALL TERRAIN ENGINEERING LLC

CONTACT: NICHOLAS Q. JOKERST

NJOKERST@ALLTERRAINENG.COM

(530) 391-7635

ENGINEER'S STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Nicholas Jokerst

Digitally signed by Nicholas Jokerst
DN: C=US, E=njokerst@allterraineng.com, O=All Terrain Engineering LLC, OU=Co/Owner, CN=Nicholas Jokerst
Date: 2025.09.11 11:25:10-06'00'

COLORADO LICENSED NICHOLAS QUINN JOKERST PE0059273 PROFESSIONAL ENGINEER

09/11/2025

Nicholas Q. Jokerst, PE Date

State of Colorado No. 59273

For and on behalf of All Terrain Engineering LLC

DEVELOPER'S STATEMENT

I, the owner/developer have read and will comply with all of the requirements specified in this drainage report and plan.

09/11/2025

Eric Howard Date

Rhetoric, LLC

20 Boulder Crescent Street, Suite 200, Colorado Springs, CO 80903

EL PASO COUNTY ONLY

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

Charlene Durham, P.E.

Digitally signed by Charlene Durham, P.E.
Reason: Authorized signatory as County Engineer designee
Date: 2025.11.12 11:10:08-07'00'

Joshua Palmer, P.E. Date
County Engineer/ECM Administrator

Conditions:

Table of Contents

Appendices

I. General Purpose, Location & Description

a. Purpose

The purpose of this Drainage Letter for LOT 1, STERLING RECYLCING SUBDIVISION is to demonstrate conformance with the approved *Final Drainage Report for Sterling Ranch Recycling Facility* (PCD File No: PPR2341 & SF2325). The *Final Drainage Report for Sterling Ranch Recycling Facility (FDRSRRF)* was completed with the final plat for the Sterling Recycling Subdivision and it described the site's onsite and offsite drainage patterns, existing and proposed storm infrastructure, and methods to safely route developed stormwater to adequate outfalls.

b. Location

LOT 1, STERLING RECYLCING SUBDIVISION, referred to as 'the site' herein, is in the northwest quarter of the northwest quarter of Section 4 and the north half of Section 5, Township 13 South, Range 65 West of the 6th P.M., El Paso County, Colorado. The site was plated in El Paso County as Lot 1 of Sterling Recycling Subdivision on October 14, 2024. The site is bound by Marksheffel Road to the east and north, Lot 2 Sterling Recycling Subdivision to the west and unplatted parcels to the south. A vicinity map is presented in Appendix A.

c. Description of Property

The site is approximately 4.74 acres of undeveloped land. The site is currently used as an asphalt and concrete recycling facility. The site has sparse vegetation around its perimeter but otherwise is compacted dirt and gravel. The approximate disturbed area is 9.15 acres. The additional disturbance beyond the site acreage is for improvements to Sterling Ranch Road, Marksheffel Road and the construction of Pond A, located in Tract A. In general, the site slopes southerly towards an existing 8' berm along the site's southern boundary. Onsite elevations range from 6,977' – 6,987' with slopes ranging 1 – 50%. Per a NRCS soil survey, the site is made up of Type A Blakeland loamy sand and Type A Columbine gravelly sandy loam. The NRCS soil survey is presented in Appendix A.

There are no major drainageways or irrigation facilities that traverse the site nor does the site fall within the Streamside Overlay Zone. The ultimate receiving waters for the site are Sand Creek. Existing, on-site utilities are limited to an 8" water line located within Sterling Ranch Road. An existing, off-site storm sewer system parallels the site's northern boundary along Marksheffel Road.

d. Floodplain Statement

Based on FEMA Firm map 08041C0533G dated December 7, 2018, the site is Zone X. Zone X is defined as area outside the Special Flood Hazard Zone (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood.

II. Drainage Basins

a. Major Basin Description

The site is located within the upper Sand Creek Drainage Basin per the "Sand Creek Drainage Basin Planning Study" completed by Kiowa Engineering Corporation in January 1993, revised March 1996.

b. Existing Subbasin Description

The site's existing drainage patterns are unchanged from those identified in the *FDRSRRF*. The site is contained within Basin EXE and Basin EXF. Basins EXE and EXF are captured at DP7.1 and DP9.1, respectively. Both basins concentrate offsite to the east in an existing natural stream section and discharge to Sand Creek. The existing drainage map is presented in Appendix F. The existing basin descriptions are presented in Appendix E.

c. Proposed Subbasin Description

The *FDRSRRF* analyzed the site for an interim and ultimate condition. In the interim condition, the site was analyzed as a recycling facility. In the ultimate condition, the site was analyzed as heavy industrial (90%) impervious. The interim condition was used to size swales and inlets. However, the ultimate condition was used for the sizing of Pond A and the outfall infrastructure. Therefore, the outlet structure orifice plate will be sized & installed for the ultimate condition. The basin descriptions below will verify the sizing of swales and inlets per the revised ultimate condition of the site. Additionally, the basin descriptions will verify that the revised hydrologic parameters are in conformance the original Pond A design from *FDRSRRF*. The site's proposed grading and proposed drainage patterns are unchanged from those identified in the *FDRSRRF*. The site is contained within Basin E and Basin D.

Basin D is 2.16 acres of asphalt, self-storage units and landscaping. Basin D has a composite percent impervious of 73%, which is less than the assumed 90% from *FDRSRRF*. Therefore, Basin D is in conformance with the design of Pond A and will receive the required full spectrum water quality and detention therein. Runoff from this basin sheet flows overland southeast to a proposed swale that directs flow to DP5 (Q_5 = 5.8 cfs Q_{100} = 11.5 cfs). Runoff from DP5 is combined at the proposed Type C sump inlet at DP7.1 (Q_5 = 7.8 cfs Q_{100} = 18.3 cfs). Compared to the *FDRSRRF*, Basin D flow has increased (Original: Q_5 = 0.5 cfs Q_{100} = 3.7 cfs, Revised: Q_5 = 5.8 cfs Q_{100} = 11.5 cfs). The increase in flow can be attributed to the interim v. ultimate conditions analysis. The original hydrologic calculations were performed on the interim condition. The hydrologic analysis present in this report reflects the ultimate condition. For this reason, swale and inlet capacity calculations are provided in Appendix C to demonstrate the increased flow can be conveyed & captured by the swale and Type C inlet proposed by *FDRSRRF*. The DP5 swale conveys Basin D flow at 2.85 ft/s, a subcritical Froude number of 0.47 and with 0.84' of freeboard. The inlet capacity of the DP7.1 Type C inlet is Q_5 = 15.7 cfs and Q_{100} = 18.4, cfs which exceeds the site's design flow at DP7.1.

Basin E is 3.10 acres of asphalt roadway, gravel, self-storage units and landscaping. Basin E has a composite percent impervious of 32%, which is less than the assumed 90% from *FDRSRRF*. Therefore, Basin E is in conformance with the design of Pond A and will receive the required full spectrum water quality and detention therein. Runoff from this basin sheet flows overland southeast to a proposed swale that directs flow to DP6 (Q_5 = 3.1 cfs Q_{100} = 8.6 cfs). Runoff from DP6 is combined at the proposed Type C sump inlet at DP7.1 (Q_5 = 7.8 cfs Q_{100} = 18.3 cfs). Compared to the *FDRSRRF*, Basin E flow has increased (Original: Q_5 = 2.2 cfs Q_{100} = 7.1 cfs, Revised: Q_5 = 3.1 cfs Q_{100} = 8.6 cfs). The increase in flow can be attributed to the interim v. ultimate conditions analysis. The original hydrologic calculations were performed on the interim condition. The hydrologic analysis present in this report reflects the ultimate condition. For this reason, swale and inlet capacity calculations are provided in Appendix C to demonstrate the increased flow can be conveyed &

captured by the swale and Type C inlet proposed by *FDRSRRF*. The DP6 swale conveys Basin D flow at 2.60 ft/s, a subcritical Froude number of 0.45 and with 0.95' of freeboard. The inlet capacity of the DP7.1 Type C inlet is Q_5 = 15.7 cfs and Q_{100} = 18.4, cfs which exceeds the site's design flow at DP7.1.

Basin OS2 is 0.36 acres of offsite, undeveloped area. Basin OS2 is unchanged from the FDRSRRF and is shown to accurately quantify the flow at DP7.1. Basin OS2 stormwater (Q_5 = 0.1 cfs Q_{100} = 0.8 cfs) flows to DP7.1 and is captured by the Type C sump inlet.

In the event of inlet failure, the Type C sump inlet at DP7.1 would overtop the Pond A berm and overland flow directly into Pond A.

III. Drainage Design Criteria

a. Development Criteria Reference

The drainage analysis follows the criteria from the "Drainage Criteria Manual County of El Paso, Colorado" Volumes 1 and 2," as amended.

b. Hydrologic Criteria

Hydrologic data was obtained from the "City of Colorado Springs Drainage Criteria Manual – Chapter 6 Hydrology" adopted by El Paso County.

d. Hydraulic Criteria

Hydraulic criteria for open channel analysis are obtained from EPCDCM Chapter 9 – Culvert Design & Chapter 10 - Open Channels and Structures.

IV. Drainage Facility Design

a. General Concept

Onsite stormwater will be conveyed via grass lined swales to a Type C sump inlet. Captured stormwater will be piped to and detained in Pond A; a private, full spectrum water quality and detention pond. The ultimate receiving waters for the site are Sand Creek.

b. Water Quality & Detention

Water quality and detention for Basins D, E & OS2 are provided in Pond A. The approved design of Pond A accounted for Basin D and E at 90% impervious and Basin OS2 at 2% composite impervious. Based upon the proposed site plan for the Rhetoric Self Storage site, Basin D, E and OS2 have composite impervious values of 58.3%, 29.8% and 2%,respectively. Therefore, Basin D, E and OS2 are in conformance with the approved Pond A design. The approved, ultimate condition pond design calculations from *FDRSRRF* are presented in Appendix D.

c. Operations & Maintenance

The Stormwater Management Facility Operation and Maintenance Plan was approved with the Sterling Recycling Subdivision final plat and can be accessed under PCD File No: PPR2341 & SF2325.

d. Grading & Erosion Control Plan

The Sterling Recycling Facility Grading and Erosion Control Plan was approved on May 3, 2024, and includes all disturbed area associated with this Drainage Letter. Proposed grading and drainage patterns are unchanged from the approved Sterling Recycling Facility Grading and Erosion Control Plan.

e. Drainage Basin & Bridge Fees

Drainage and bridge fees were paid with the plat recordation of Sterling Recycling Subdivision.

f. Engineer's Opinion of Probable Cost

An engineer's opinion of probable cost was approved with the *Final Drainage Report for Sterling Ranch Recycling Facility* (PCD File No: PPR2341 & SF2325. There are no proposed changes to the approved OPC.

V. Summary

LOT 1, STERLING RECYLCING SUBDIVISION remains consistent with pre-development drainage conditions with the construction of the recommended drainage improvements. The proposed development will not adversely affect downstream stormwater infrastructure or surrounding developments. This report meets the latest El Paso County Drainage criteria and is in conformance with the *Final Drainage Report for Sterling Ranch Recycling Facility* (PCD File No: PPR2341 & SF2325.

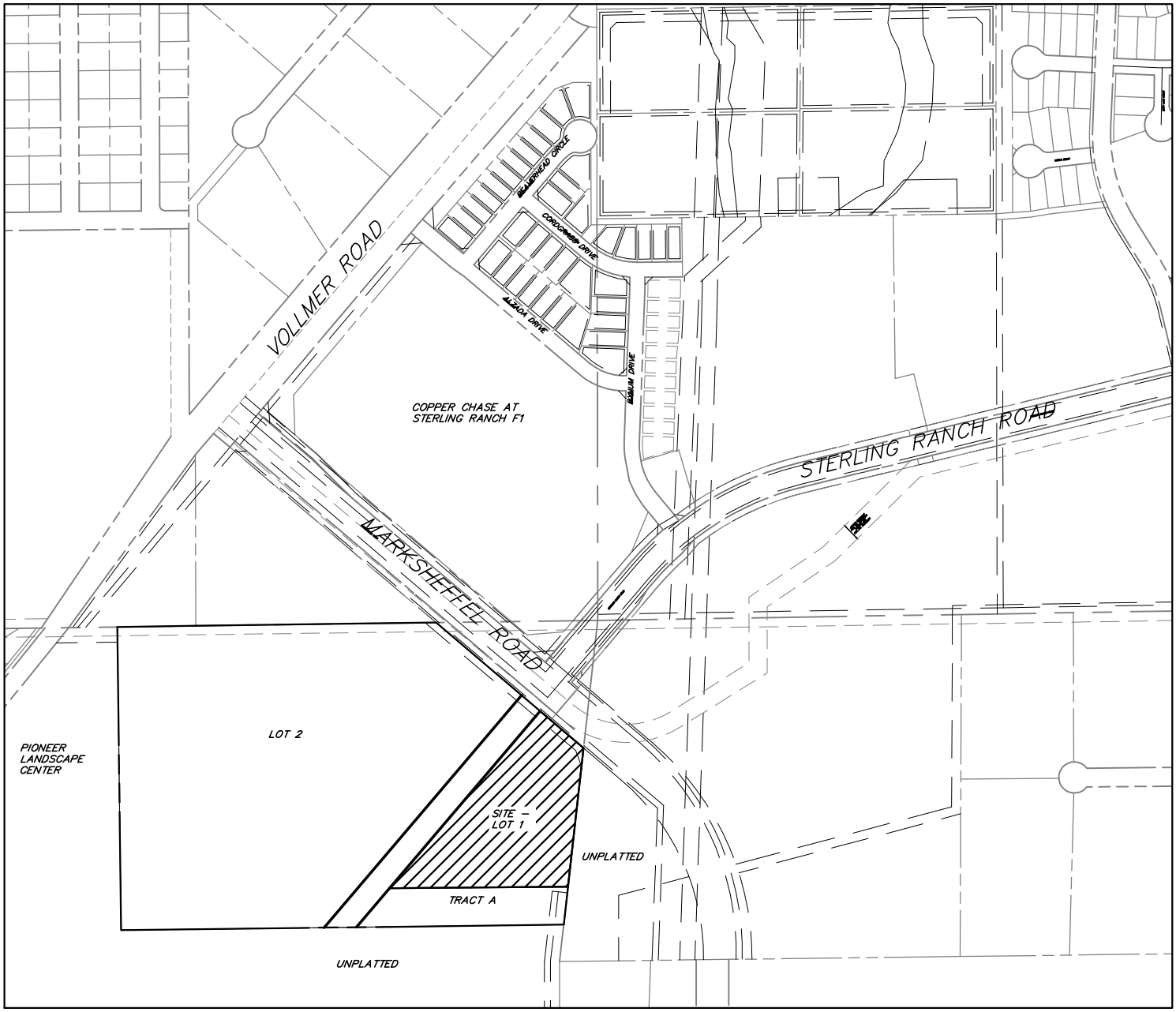
VI. References

1. Drainage Criteria Manual of El Paso County, Revised October 2018.
2. Urban Storm Drainage Criteria Manual, Urban Drainage Flood Control District, January 2018.
3. Final Drainage Report for Sterling Ranch Recycling Facility, July 2014, JR Engineering, LLC.
4. Web Soil Survey, Natural Resources Conservation Service - https://websoilsurvey.nrcs.usda.gov/app/

APPENDIX A – VICINITY MAP & NRCS WEB SOIL SURVEY

LOT 1, STERLING RECYCLING SUBDIVSION

VICINITY MAP



N

30 15 0 30 60

ORIGINAL SCALE: 1" = 30'

VICINITY MAP	
LOT 1, STERLING RECYCLING SUBDIVSION	
JOB NO. 25005	
LOCATION: EPC	SHEET
07/15/2025	
SHEET: 1	

ALL TERRAIN ENGINEERING
1004 WEST VAN BUREN STREET
COLORADO SPRINGS, CO 80907

Hydrologic Soil Group—El Paso County Area, Colorado

Map Scale: 1:4,680 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	46.2	51.5%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	43.6	48.5%
Totals for Area of Interest			**89.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

APPENDIX B – HYDROLOGIC CALCULATIONS

Subdivision:	Rhetoric Self Storage
Location:	El Paso County
Project Name:	Rhetoric Self Storage
Project Number:	25005
Calculated By:	NQJ
Checked By:	REB
Date:	7/21/2025

PROPOSED CALCS - BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
D	2.16	73%	0.68	0.79	10.9	5.8	11.5
E	3.10	32%	0.32	0.53	19.4	3.1	8.6
OS2	0.36	2%	0.09	0.36	15.1	0.1	0.8

DESIGN POINT SUMMARY TABLE

DP#	$Q_{5\text{-YR}}$	$Q_{100\text{-YR}}$
5	5.8	11.5
6	3.1	8.6
7	0.1	0.8
7.1	7.8	18.3

COMPOSITE % IMPERVIOUS CALCULATIONS - PROPOSED CONDITIONS

Subdivision: Rhetoric Self Storage
Location: El Paso County

Project Name: Rhetoric Self Storage
Project No.: 25005.00
Calculated By: NQJ
Checked By: REB
Date: 7/21/25

		Gravel Drives				Paved				Roofs				Landscaped				Weighted C_5 & C_{100}		Basins Total Weighted % Imp.
Basin ID	Total Area (ac)	C_5	C_{100}	Area (ac)	% Imp.	C_5	C_{100}	Area (ac)	% Imp.	C_5	C_{100}	Area (ac)	% Imp.	C_5	C_{100}	Area (ac)	% Imp.	C_5	C_{100}	
D	2.16	0.59	0.70	0.00	80.0%	0.90	0.96	1.56	100.0%	0.73	0.81	0.00	90.0%	0.09	0.36	0.60	2.0%	0.68	0.79	72.8%
E	3.10	0.59	0.70	0.31	80.0%	0.90	0.96	0.69	100.0%	0.73	0.81	0.00	90.0%	0.09	0.36	2.10	2.0%	0.32	0.53	31.6%
OS2	0.36	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.73	0.81	0.00	90.0%	0.09	0.36	0.36	2.0%	0.09	0.36	2.0%
Total	**5.62**																			**45.5%**

STANDARD FORM SF-2 - PROPOSED CONDITIONS
TIME OF CONCENTRATION

Subdivision: Rhetoric Self Storage
Location: El Paso County

Project Name: Rhetoric Self Storage
Project No.: 25005.00
Calculated By: NQJ
Checked By: REB
Date: 7/21/25

SUB-BASIN DATA					INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Weighted C_5	Impervious (%)	*L* (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	*K*	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
D	2.16	A	0.68	72.8%	215	3.0%	7.8	400	1.2%	20.0	2.1	3.1	10.9	615.0	16.9	10.9
E	3.10	A	0.32	31.6%	100	1.2%	13.3	910	1.5%	20.0	2.4	6.2	19.4	1010.0	29.8	19.4
OS2	0.36	A	0.09	2.0%	115	3.0%	13.6	300	3.0%	20.0	3.5	1.4	15.1	415.0	28.8	15.1

NOTES:

$$t_c = t_i + t_t$$

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

Eq $$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$ Equation 6-3

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

Equation 6-4 $26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$ Equation 6-5

e:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

STANDARD FORM SF-3 - PROPOSED CONDITIONS

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Rhetoric Self Storage
Location: El Paso County
Design Storm: 5-Year

Project Name: Rhetoric Self Storage
Project No.: 25005.00
Calculated By: NQJ
Checked By: REB
Date: 7/21/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	5	D	2.16	0.68	10.9	1.46	3.99	5.8															BASIN D FLOW CAPTURED IN DP5 SWALE, CAPTURED BY TYPE C INLET @ DP7.1, PIPE TO FULL SPECTRUM POND A
	6	E	3.10	0.32	19.4	0.99	3.13	3.1															BASIN E FLOW CAPTURED IN DP6 SWALE, CAPTURED BY TYPE C INLET @ DP7.1, PIPE TO FULL SPECTRUM POND A
	7	OS2	0.36	0.09	15.1	0.03	3.52	0.1															BASIN E FLOW CAPTURED IN DP6 SWALE, CAPTURED BY TYPE C INLET @ DP7.1, PIPE TO FULL SPECTRUM POND A
	7.1								19.4	2.48	3.13	7.8											TOTAL FLOW FROM BASIN D, E & OS2, PIPE TO FULL SPECTRUM POND A

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_5 = -1.50 \ln(D) + 7.583$

$I_2 = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

STANDARD FORM SF-3 - PROPOSED CONDITIONS

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Rhetoric Self Storage
Location: El Paso County
Design Storm: 100-Year

Project Name: Rhetoric Self Storage
Project No.: 25005.00
Calculated By: NQJ
Checked By: REB
Date: 7/21/25

		DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			
STREET	Design Point	Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	5	D	2.16	0.79	10.9	1.71	6.71	11.5															BASIN D FLOW CAPTURED IN DP5 SWALE, CAPTURED BY TYPE C INLET @ DP7.1, PIPE TO FULL SPECTRUM POND A
	6	E	3.10	0.53	19.4	1.64	5.26	8.6															BASIN E FLOW CAPTURED IN DP6 SWALE, CAPTURED BY TYPE C INLET @ DP7.1, PIPE TO FULL SPECTRUM POND A
	7	OS2	0.36	0.36	15.1	0.13	5.90	0.8															BASIN E FLOW CAPTURED IN DP6 SWALE, CAPTURED BY TYPE C INLET @ DP7.1, PIPE TO FULL SPECTRUM POND A
	7.1								19.4	3.48	5.26	18.3											TOTAL FLOW FROM BASIN D, E & OS2, PIPE TO FULL SPECTRUM POND A

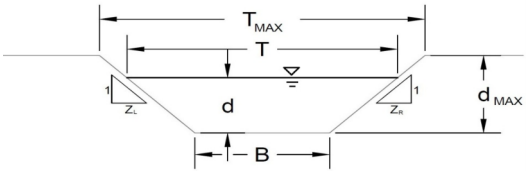
Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

APPENDIX C – HYDRAULIC CALCULATIONS

AREA INLET IN A SWALE

Rhetoric Self Storage

DP7.1



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0100	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Sloe	Z2 =	3.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- (•) Non-Cohesive
- ( ) Cohesive
- ( ) Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**9.00**	**12.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.50**	**2.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**26.7**	**57.5**	**cfs**
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	**1.50**	**2.00**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**7.8**	**18.3**	**cfs**
Water Depth	d =	**0.95**	**1.30**	**ft**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

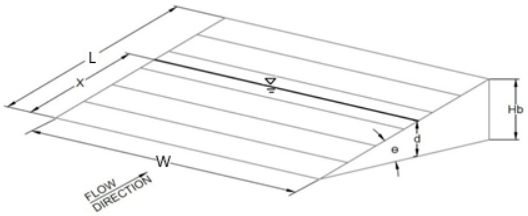
AREA INLET IN A SWALE

Rhetoric Self Storage

DP7.1

Inlet Design Information (Input)

Type of Inlet	CDOT Type C	Inlet Type =	CDOT Type C	
Angle of Inclined Grade (must be <= 30 degrees)		θ =	0.00	degrees
Width of Grate		W =	3.00	ft
Length of Grate		L =	3.00	ft
Open Area Ratio		A_{RATIO} =	0.70	
Height of Inclined Grade		H_B =	0.00	ft
Clogging Factor		C_f =	0.50	
Grate Discharge Coefficient		C_d =	0.96	
Orifice Coefficient		C_o =	0.64	
Weir Coefficient		C_w =	2.05	



		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.95	1.30	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**15.7**	**18.4**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**100**	**%**

Warning 04: Froude No. exceeds USDCM Volume I recommendation.

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jul 22 2025

Swale DP5 (Q100 = Basin D = 11.5 cfs)

Triangular

Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.035

Calculations

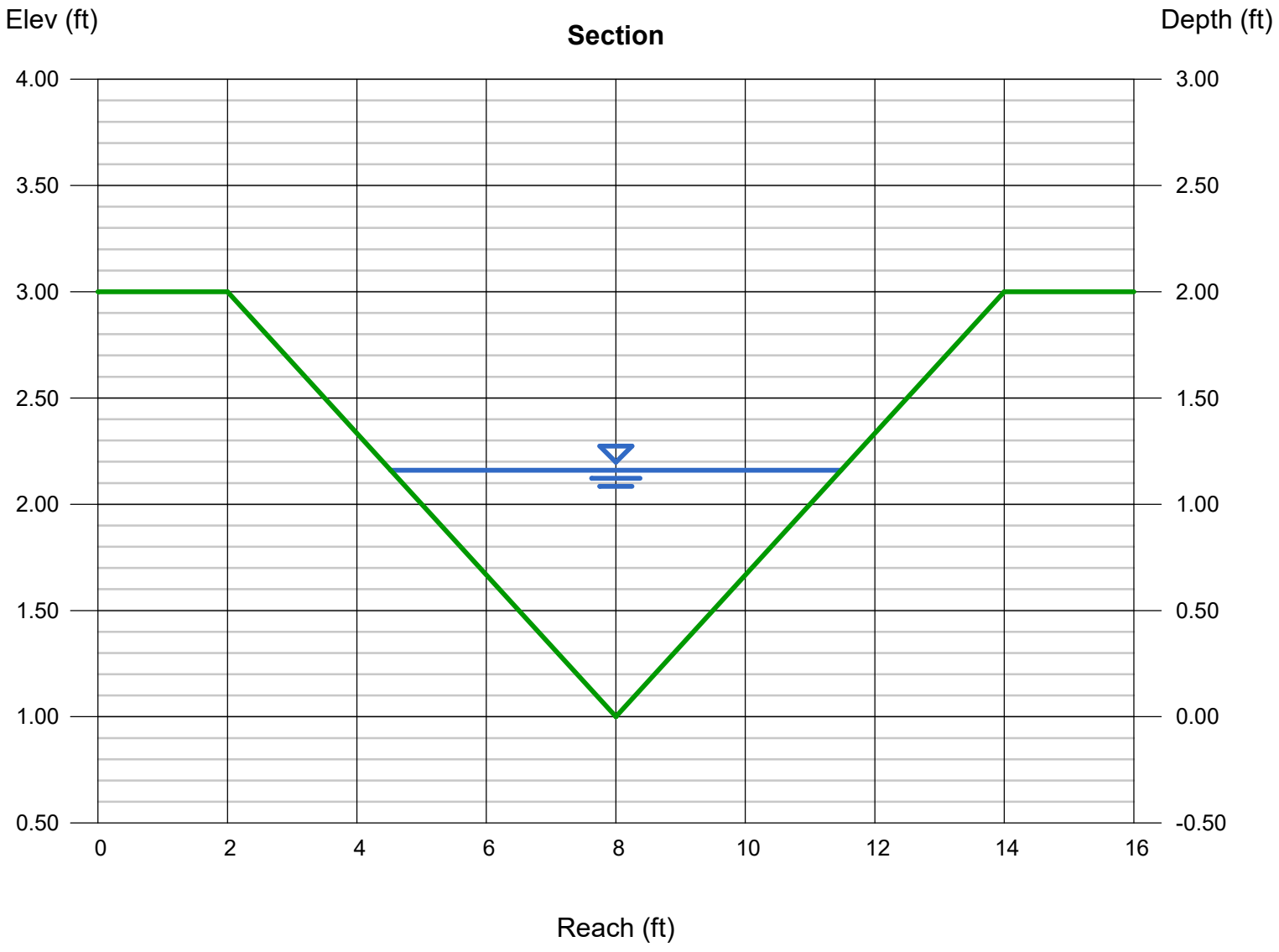
Compute by:	Known Q
Known Q (cfs)	= 11.50

Highlighted

Depth (ft)	= 1.16
Q (cfs)	= 11.50
Area (sqft)	= 4.04
Velocity (ft/s)	= 2.85
Wetted Perim (ft)	= 7.34
Crit Depth, Yc (ft)	= 0.99
Top Width (ft)	= 6.96
EGL (ft)	= 1.29

Froude = v / sqrt(g*d)

= 2.85/sqrt(32.2*1.16) = 0.47 ->subcritical



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jul 22 2025

Swale DP6 (Q100 = Basin E = 8.6 cfs)

Triangular

Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.035

Calculations

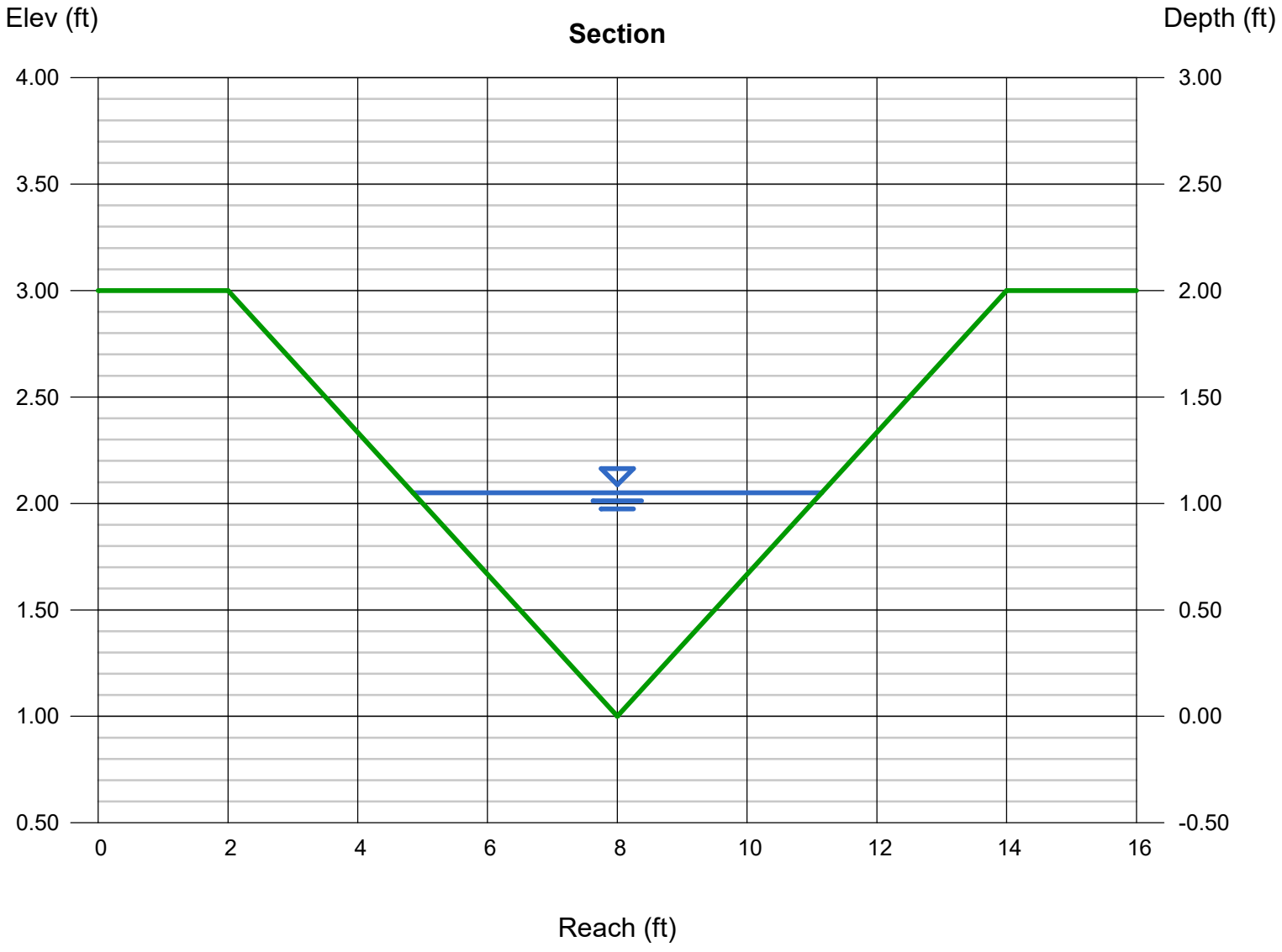
Compute by:	Known Q
Known Q (cfs)	= 8.60

Highlighted

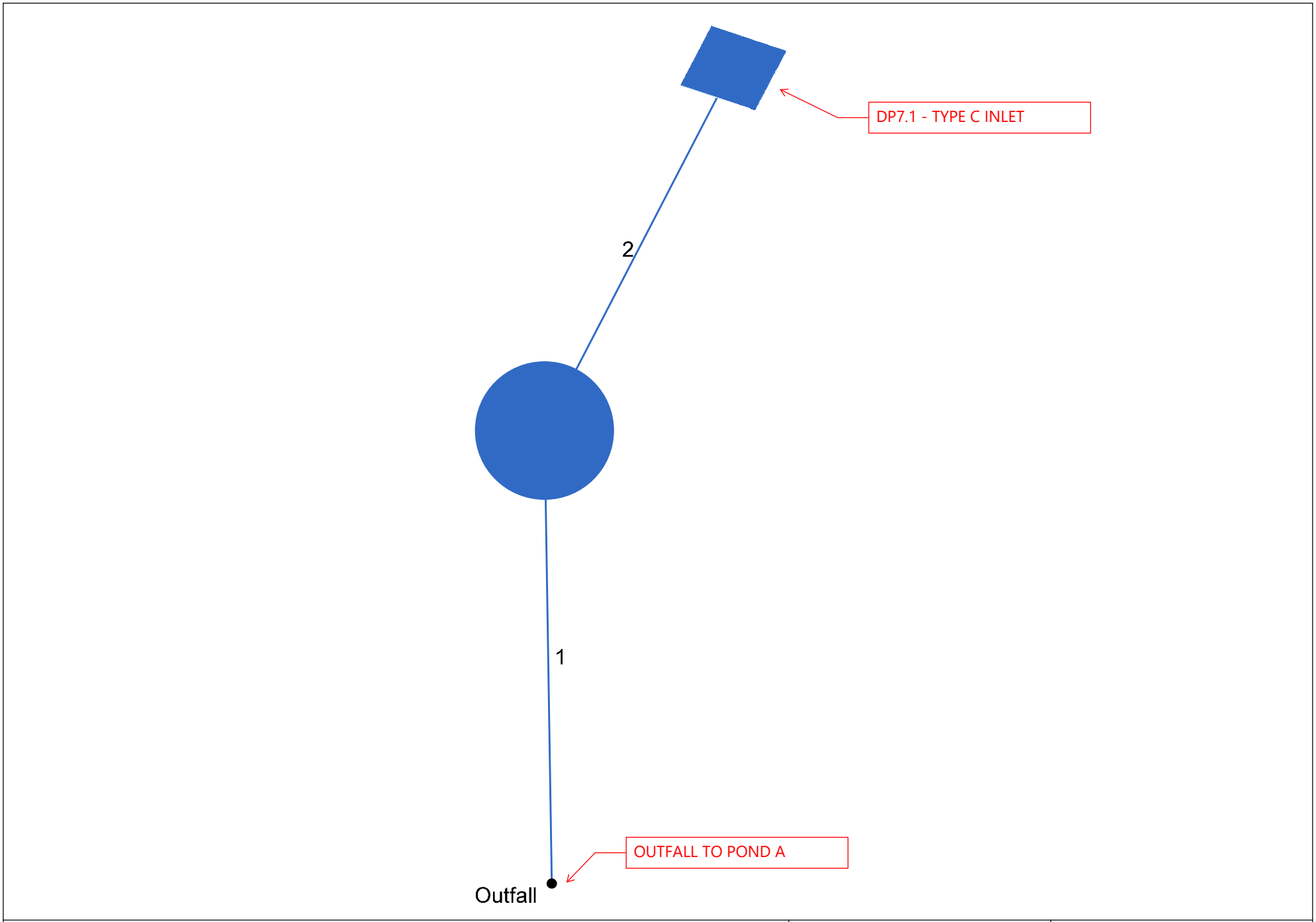
Depth (ft)	= 1.05
Q (cfs)	= 8.600
Area (sqft)	= 3.31
Velocity (ft/s)	= 2.60
Wetted Perim (ft)	= 6.64
Crit Depth, Yc (ft)	= 0.88
Top Width (ft)	= 6.30
EGL (ft)	= 1.16

Froude = v / sqrt(g*d)

= 2.60/sqrt(32.2*1.05) = 0.45 ->subcritical



Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: New.stm	Number of lines: 2	Date: 7/22/2025

5-yr

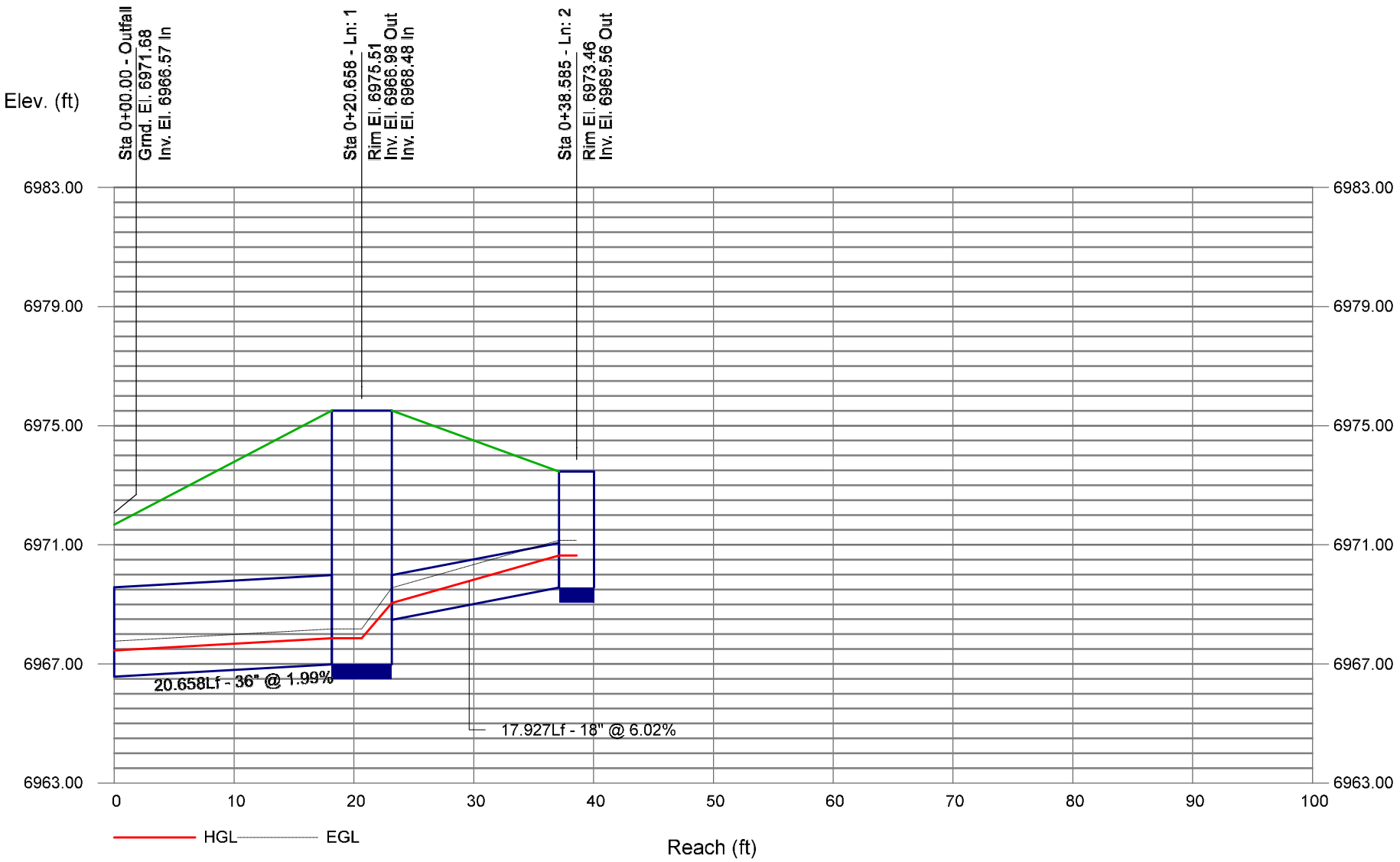
Line No.	Vel Ave (ft/s)	Flow Rate (cfs)	Line Size (in)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Line Slope (%)	HGL Up (ft)	HGL Dn (ft)	n-val Pipe	J-Loss Coeff	
1	4.52	7.80	36	20.658	6966.98	6966.57	1.99	6967.86	6967.45	0.013	0.45 z	
2	9.25	7.80	18	17.927	6969.56	6968.48	6.02	6970.64	6969.05	0.013	1.00 z	

Project File: New.stm | Number of lines: 2 | Date: 7/22/2025

NOTES: ** Critical depth

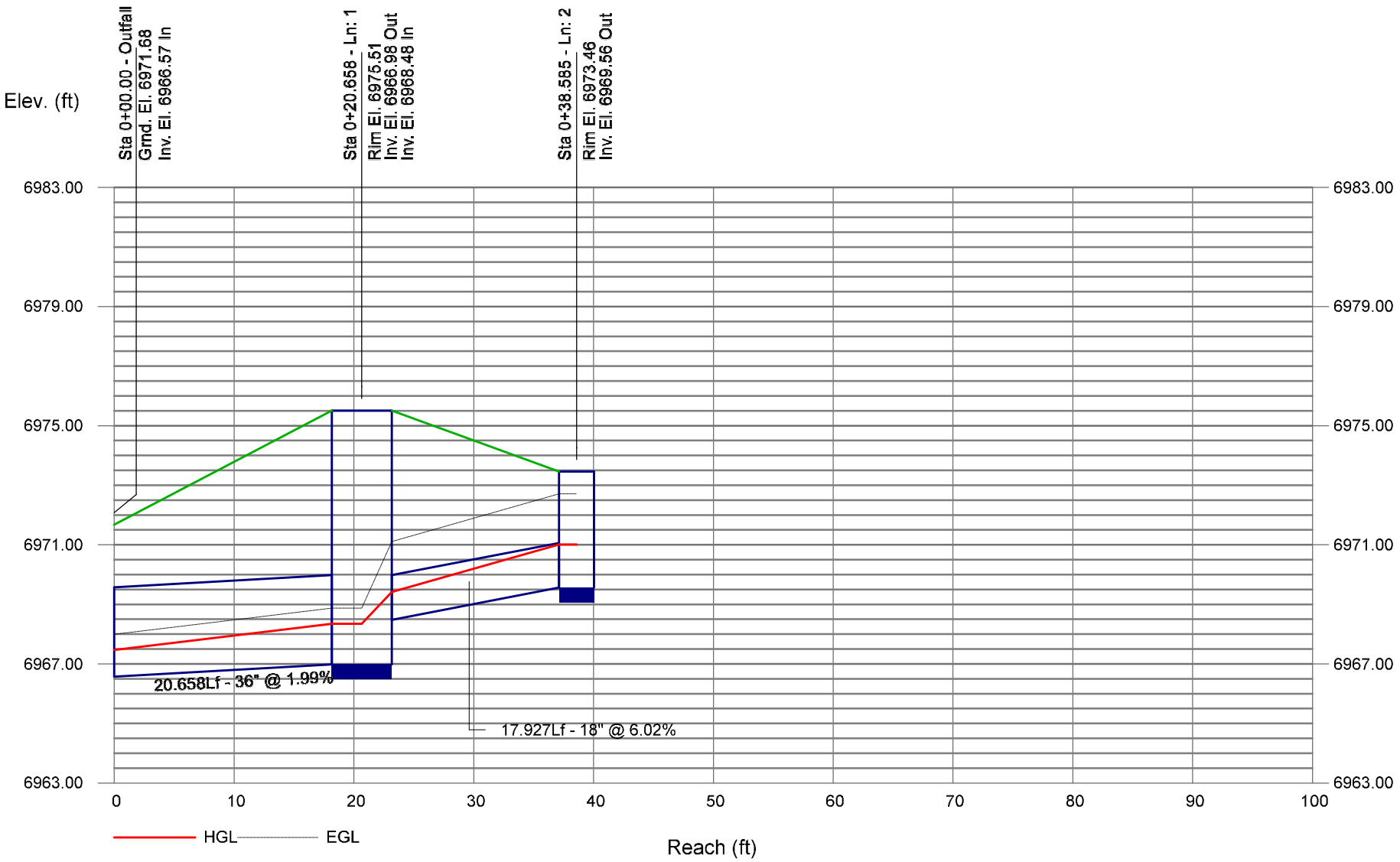
Storm Sewer Profile

Proj. file: New.stm



Storm Sewer Profile

Proj. file: New.stm



100-yr

Line No.	Vel Ave (ft/s)	Flow Rate (cfs)	Line Size (in)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Line Slope (%)	HGL Up (ft)	HGL Dn (ft)	n-val Pipe	J-Loss Coeff	
1	8.06	18.30	36	20.658	6966.98	6966.57	1.99	6968.35	6967.47	0.013	0.45 z	
2	13.13	18.30	18	17.927	6969.56	6968.48	6.02	6971.01	6969.41	0.013	1.00 z	

Project File: New.stm	Number of lines: 2	Date: 7/22/2025

NOTES: ** Critical depth

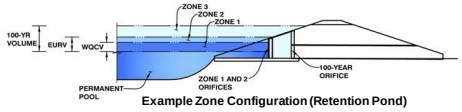
APPENDIX D – WATER QUALITY & DETENTION

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Sterling Ranch Recycling Facility

Basin ID: Pond A-Ultimate



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	43.77	acres
Watershed Length =	2,265	ft
Watershed Length to Centroid =	1,455	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	72.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	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) =	1.037	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	4.024	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.942	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.836	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	4.555	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	5.444	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	6.314	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	7.348	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	9.622	acre-feet	inches
Approximate 2-yr Detention Volume =	2.630	acre-feet	
Approximate 5-yr Detention Volume =	3.429	acre-feet	
Approximate 10-yr Detention Volume =	4.114	acre-feet	
Approximate 25-yr Detention Volume =	4.918	acre-feet	
Approximate 50-yr Detention Volume =	5.395	acre-feet	
Approximate 100-yr Detention Volume =	5.864	acre-feet	

Define Zones and Basin Geometry

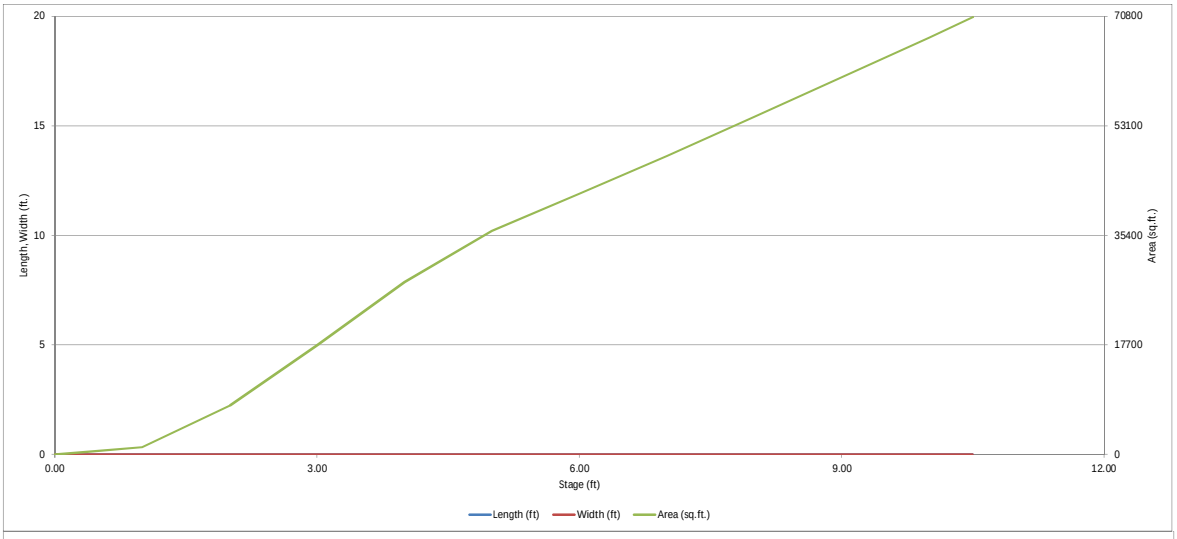
Zone 1 Volume (WQCV) =	1.037	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.987	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.839	acre-feet
Total Detention Basin Volume =	5.864	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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

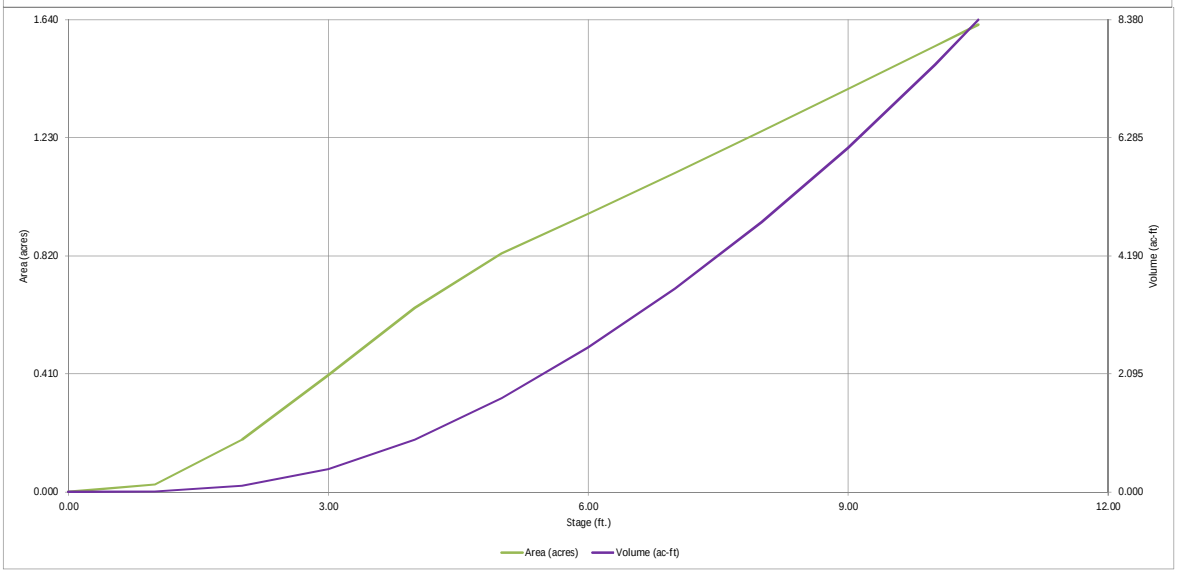
Depth Increment = ft

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		
6966	--	1.00	--	--	--	1,164	0.027	587	0.013
6967	--	2.00	--	--	--	7,912	0.182	5,125	0.118
6968	--	3.00	--	--	--	17,659	0.405	17,910	0.411
6969	--	4.00	--	--	--	27,893	0.640	40,686	0.934
6970	--	5.00	--	--	--	36,100	0.829	72,683	1.669
6971	--	6.00	--	--	--	42,123	0.967	111,794	2.566
6972	--	7.00	--	--	--	48,273	1.108	156,992	3.604
6973	--	8.00	--	--	--	54,548	1.252	208,403	4.784
6974 (Crest)	--	9.00	--	--	--	60,948	1.399	266,151	6.110
6975	--	10.00	--	--	--	67,404	1.547	330,327	7.583
6975.5	--	10.50	--	--	--	70,671	1.622	364,846	8.376

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)





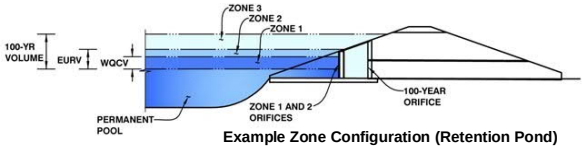
Ultimate Condition Pond A Design from Final Drainage Report for Sterling Ranch Recycling Facility (PCD File No: PPR2341 & SF2325)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Sterling Ranch Recycling Facility

Basin ID: Pond A-Ultimate



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.16	1.037	Orifice Plate
Zone 2 (EURV)	7.38	2.987	Circular Orifice
Zone 3 (100-year)	8.83	1.839	Weir&Pipe (Restrict)
Total (all zones)		5.864	

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)

Centroid 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 =	4.16	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	sq. 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	1.35	2.77					
Orifice Area (sq. inches)	2.80	2.80	2.80					

	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)

	Zone 2 Circular	Not Selected			Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	4.16	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.10	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	7.38	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.18	N/A	feet
Vertical Orifice Diameter =	4.30	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 =	7.90	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	7.90	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 =	9.01	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	12.66	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	6.33	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 =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.40	N/A	ft^2
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.53	N/A	feet
Restrictor Plate Height Above Pipe Invert =	11.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.49	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.48	feet
Spillway Crest Length =	120.00	feet	Stage at Top of Freeboard =	10.48	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.62	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	8.34	acre-ft

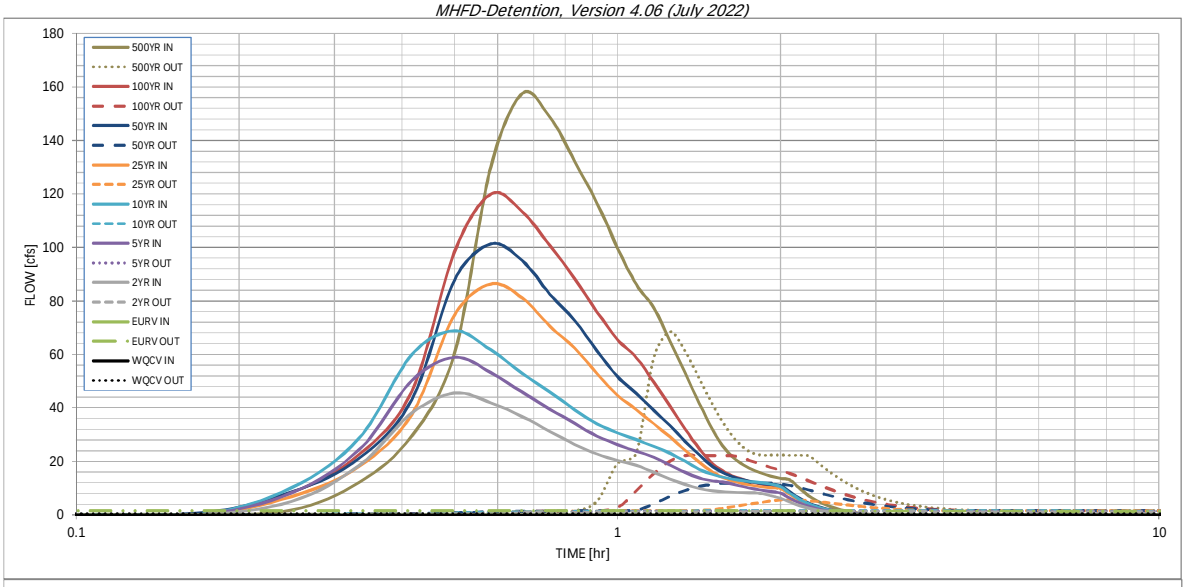
Calculated Parameters for Spillway

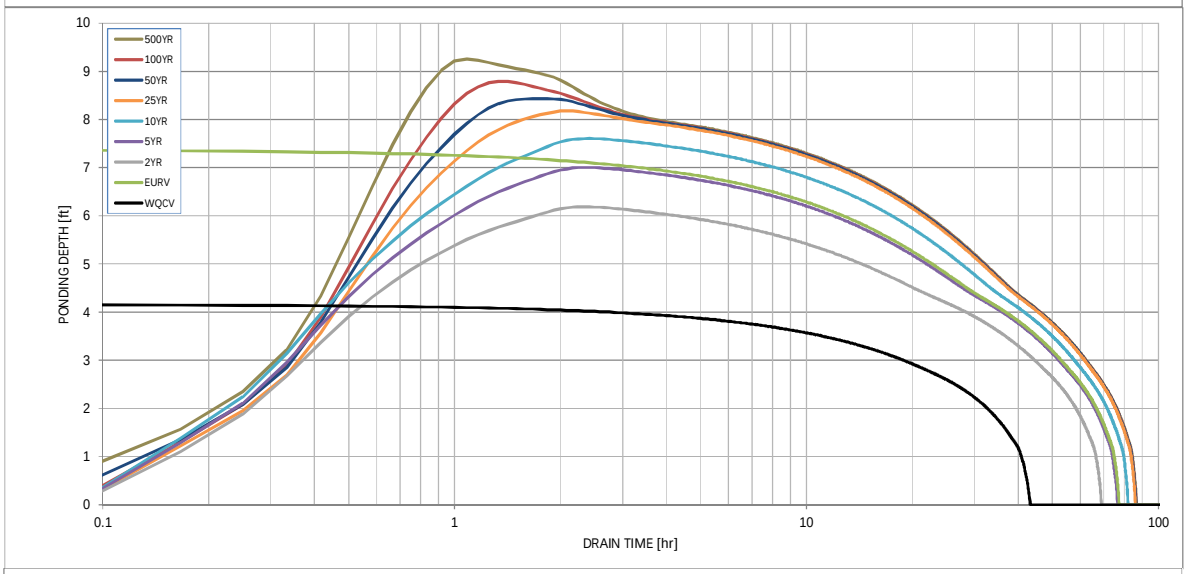
Routed Hydrograph Results *The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

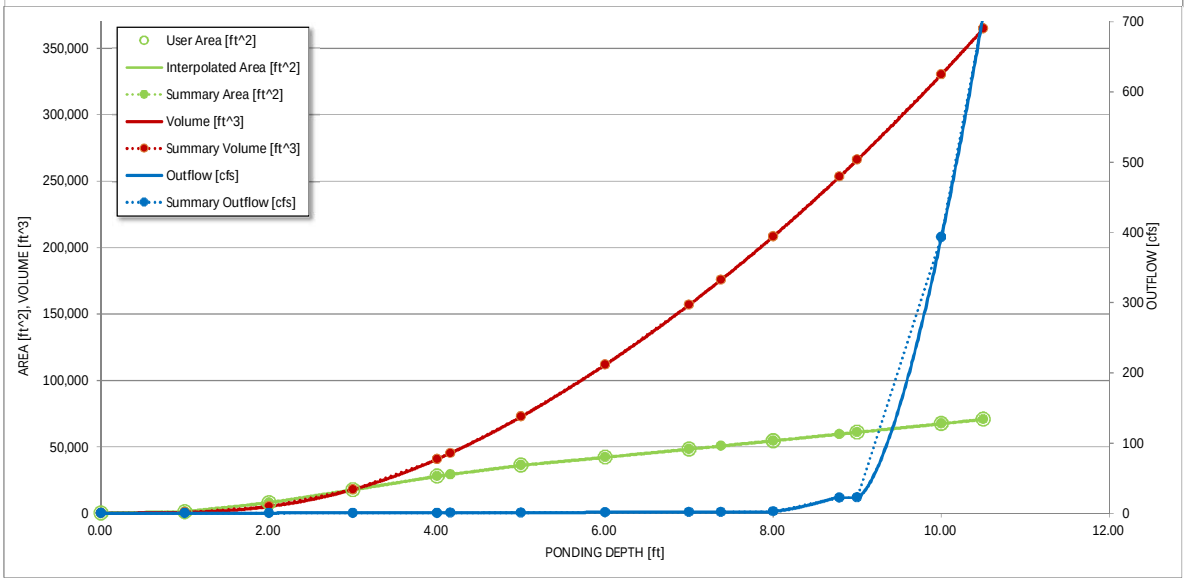
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	1.037	4.024	2.942	3.836	4.555	5.444	6.314	7.348	9.622
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.942	3.836	4.555	5.444	6.314	7.348	9.622
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.3	0.5	0.7	6.7	13.4	22.5	40.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.15	0.31	0.51	0.93
Peak Inflow Q (cfs) =	N/A	N/A	45.5	58.9	68.8	86.3	101.3	120.0	157.6
Peak Outflow Q (cfs) =	0.5	1.5	1.3	1.5	1.6	5.6	12.1	22.2	68.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.7	2.1	0.8	0.9	1.0	1.7
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 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	N/A	0.3	0.8	1.6	1.6
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	67	60	66	71	73	72	71	68
Time to Drain 99% of Inflow Volume (hours) =	41	72	65	71	76	80	79	79	78
Maximum Ponding Depth (ft) =	4.16	7.38	6.19	7.00	7.61	8.18	8.43	8.79	9.25
Area at Maximum Ponding Depth (acres) =	0.67	1.16	0.99	1.11	1.19	1.28	1.32	1.37	1.44
Maximum Volume Stored (acre-ft) =	1.039	4.036	2.743	3.604	4.295	5.012	5.336	5.819	6.464

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	0.57	0.06	1.83
	0:15:00	0.00	0.00	5.05	8.22	10.18	6.84	8.59	8.34	12.16
	0:20:00	0.00	0.00	18.49	24.39	28.72	18.15	21.18	22.63	29.51
	0:25:00	0.00	0.00	38.05	50.12	59.86	37.51	43.02	46.17	60.49
	0:30:00	0.00	0.00	45.54	58.87	68.83	74.78	87.92	98.38	130.15
	0:35:00	0.00	0.00	41.90	53.26	61.67	86.30	101.33	119.99	157.58
	0:40:00	0.00	0.00	36.74	45.86	52.97	81.13	95.11	113.39	148.64
	0:45:00	0.00	0.00	31.21	39.50	45.91	70.58	82.55	100.68	132.31
	0:50:00	0.00	0.00	26.39	34.22	39.33	62.32	72.70	88.45	116.56
	0:55:00	0.00	0.00	22.70	29.43	33.99	52.82	61.36	75.91	99.84
	1:00:00	0.00	0.00	20.32	26.23	30.69	44.70	51.70	65.52	86.12
	1:05:00	0.00	0.00	18.51	23.80	28.11	39.37	45.45	58.85	77.48
	1:10:00	0.00	0.00	15.95	21.50	25.59	34.05	39.18	49.59	64.99
	1:15:00	0.00	0.00	13.45	18.71	23.09	29.16	33.43	40.80	53.16
	1:20:00	0.00	0.00	11.32	15.89	20.06	24.06	27.48	32.11	41.61
	1:25:00	0.00	0.00	9.80	13.80	16.95	19.69	22.38	24.67	31.79
	1:30:00	0.00	0.00	8.99	12.73	15.05	15.90	17.99	19.07	24.43
	1:35:00	0.00	0.00	8.58	12.15	13.89	13.59	15.33	15.79	20.11
	1:40:00	0.00	0.00	8.35	11.01	13.06	12.15	13.69	13.82	17.52
	1:45:00	0.00	0.00	8.20	10.02	12.46	11.21	12.62	12.47	15.72
	1:50:00	0.00	0.00	8.08	9.31	12.04	10.55	11.88	11.56	14.50
	1:55:00	0.00	0.00	7.16	8.78	11.48	10.11	11.38	10.90	13.63
	2:00:00	0.00	0.00	6.26	8.16	10.49	9.80	11.03	10.45	13.03
	2:05:00	0.00	0.00	4.79	6.27	8.01	7.59	8.53	8.03	10.00
	2:10:00	0.00	0.00	3.51	4.55	5.79	5.49	6.17	5.81	7.23
	2:15:00	0.00	0.00	2.55	3.31	4.20	3.98	4.47	4.23	5.27
	2:20:00	0.00	0.00	1.84	2.38	3.04	2.89	3.25	3.10	3.85
	2:25:00	0.00	0.00	1.31	1.66	2.15	2.04	2.29	2.19	2.72
	2:30:00	0.00	0.00	0.90	1.13	1.50	1.43	1.60	1.53	1.90
	2:35:00	0.00	0.00	0.60	0.78	1.04	1.01	1.13	1.08	1.34
	2:40:00	0.00	0.00	0.37	0.51	0.66	0.66	0.74	0.70	0.87
	2:45:00	0.00	0.00	0.19	0.30	0.37	0.39	0.43	0.41	0.50
	2:50:00	0.00	0.00	0.08	0.14	0.17	0.18	0.20	0.19	0.24
	2:55:00	0.00	0.00	0.03	0.04	0.05	0.06	0.06	0.06	0.07
	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 4.06 (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.

Stage - Storage Description	Stage [ft]	Area [ft²]	Area [acres]	Volume [ft³]	Volume [ac-ft]	Total Outflow [cfs]
6965-Top of Micropool	0.00	10	0.000	0	0.000	0.00
6966	1.00	1,164	0.027	587	0.013	0.09
6967	2.00	7,912	0.182	5,125	0.118	0.21
6968	3.00	17,659	0.405	17,910	0.411	0.33
6969	4.00	27,893	0.640	40,686	0.934	0.44
6969.16-WQCV WSEL	4.16	29,206	0.670	45,254	1.039	0.46
6970	5.00	36,100	0.829	72,683	1.669	0.92
6971	6.00	42,123	0.967	111,794	2.566	1.23
6972	7.00	48,273	1.108	156,992	3.604	1.45
6972.38-EURV WSEL	7.38	50,657	1.163	175,789	4.036	1.53
6973	8.00	54,548	1.252	208,403	4.784	2.49
6973.79-100 yr WSEL	8.79	59,604	1.368	253,493	5.819	22.18
6974-Spillway Crest	9.00	60,948	1.399	266,151	6.110	22.40
6975	10.00	67,404	1.547	330,327	7.583	392.99
6975.50-Top of Pond	10.50	70,671	1.622	364,846	8.376	711.69

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).

APPENDIX E – REFERENCE MATERIAL

STERLING RECYCLING SUBDIVISION

LOCATED IN THE NW1/4 OF THE NW1/4 OF SECTION 4 & THE N1/2 OF SECTION 5, BOTH IN TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH PRINCIPAL MERIDIAN COUNTY OF EL PASO, STATE OF COLORADO

15466

BE IT KNOWN BY THESE PRESENTS:

THAT RHETORIC REAL ESTATE LLC, BEING THE OWNER OF THE FOLLOWING DESCRIBED TRACT OF LAND TO WIT:

LEGAL DESCRIPTION:

A PARCEL OF LAND LOCATED IN THE NORTH HALF OF SECTION 5, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF EL PASO, STATE OF COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BASIS OF BEARINGS: THE NORTH LINE OF THE NORTHWEST QUARTER OF THE NORTHEAST QUARTER OF SECTION 5, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH PRINCIPAL MERIDIAN, BEING MONUMENTED AT THE NORTHEAST CORNER OF THE NORTHWEST QUARTER OF THE NORTHEAST QUARTER OF SECTION 5 BY A 3-1/4" ALUMINUM CAP STAMPED "LS 10376" AND AT THE NORTH QUARTER CORNER BY A 3-1/4" ALUMINUM CAP STAMPED "LS 4842 1996", BEARING S89°14'13"W.

BEGINNING AT THE NORTHEAST CORNER OF THE NORTHWEST QUARTER OF THE NORTHEAST QUARTER OF SECTION 5, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH PRINCIPAL MERIDIAN;

THENCE ON THE NORTH LINE OF THE NORTHEAST 1/4 OF THE NORTHEAST 1/4 OF SAID SECTION 5, N89°12'38"E A DISTANCE OF 792.39 FEET;

THENCE S49°38'29"E A DISTANCE OF 638.55 FEET, TO A POINT ON THE EAST LINE OF THE NORTHEAST 1/4 OF THE NORTHEAST 1/4 OF SAID SECTION 5;

THENCE ON SAID EAST LINE, S06°22'37"W A DISTANCE OF 586.31 FEET;

THENCE S89°16'22"W A DISTANCE OF 1460.40 FEET;

THENCE N00°43'38"W A DISTANCE OF 1000.44 FEET, TO A POINT ON THE NORTH LINE OF THE NORTHWEST 1/4 OF THE NORTHEAST 1/4 OF SAID SECTION 5;

THENCE ON SAID NORTH LINE, N89°14'13"E A DISTANCE OF 259.23 FEET, TO THE POINT OF BEGINNING.

CONTAINING A CALCULATED AREA OF 1,412,489 SQUARE FEET OR 32.4263 ACRES.

OWNERS CERTIFICATE/ DEDICATION STATEMENT:

THE UNDERSIGNED, BEING ALL THE OWNERS, MORTGAGEES, BENEFICIARIES OF DEEDS OF TRUST AND HOLDERS OF OTHER INTERESTS IN THE LAND DESCRIBED HEREIN, HAVE LAID OUT, SUBDIVIDED, AND PLATTED SAID LANDS INTO LOTS, TRACTS, STREETS, AND EASEMENTS AS SHOWN HEREON UNDER THE NAME AND SUBDIVISION OF STERLING RECYCLING SUBDIVISION. ALL PUBLIC IMPROVEMENTS SO PLATTED ARE HEREBY DEDICATED TO PUBLIC USE AND SAID OWNER DOES HEREBY COVENANT AND AGREE THAT THE PUBLIC IMPROVEMENTS WILL BE CONSTRUCTED TO EL PASO COUNTY STANDARDS AND THAT PROPER DRAINAGE AND EROSION CONTROL FOR SAME WILL BE PROVIDED AT SAID OWNER'S EXPENSE, ALL TO THE SATISFACTION OF THE BOARD OF COUNTY COMMISSIONERS OF EL PASO COUNTY, COLORADO. UPON ACCEPTANCE BY RESOLUTION, ALL PUBLIC IMPROVEMENTS SO DEDICATED WILL BECOME MATTERS OF MAINTENANCE BY EL PASO COUNTY, COLORADO. THE UTILITY EASEMENTS SHOWN HEREON ARE HEREBY DEDICATED FOR PUBLIC UTILITIES AND COMMUNICATION SYSTEMS AND OTHER PURPOSES AS SHOWN HEREON. THE ENTITIES RESPONSIBLE FOR PROVIDING THE SERVICES FOR WHICH THE EASEMENTS ARE ESTABLISHED ARE HEREBY GRANTED THE PERPETUAL RIGHT OF INGRESS AND EGRESS FROM AND TO ADJACENT PROPERTIES FOR INSTALLATION, MAINTENANCE, AND REPLACEMENT OF UTILITY LINE AND RELATED FACILITIES.

RHETORIC REAL ESTATE
OWNER/MORTGAGEE

BY: _____

TITLE: MANAGAER

STATE OF COLORADO)
) SS
COUNTY OF EL PASO)

SIGNED BEFORE ME ON October 18th, 2024

BY CHARLES R. COLLINS, AS MANAGER OF RHETORIC REAL ESTATE, LLC, A COLORADO LIMITED LIABILITY COMPANY.

_____
NOTARY

CLOE GOMEZ
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20234001584
MY COMMISSION EXPIRES JANUARY 12, 2027

January 12, 2027
COMMISSION EXPIRATION

ACCEPTANCE CERTIFICATE FOR TRACTS:

THE DEDICATION OF TRACT A IS FOR DRAINAGE PURPOSES AND IS HEREBY ACCEPTED FOR OWNERSHIP AND MAINTENANCE BY RHETORIC REAL ESTATE, LLC.

BY: _____

AS: MANAGER OF RHETORIC REAL ESTATE, LLC

STATE OF COLORADO)
) SS
COUNTY OF EL PASO)

THE FOREGOING INSTRUMENT WAS ACKNOWLEDGED BEFORE ME THIS 18th DAY OF October, 2024, A.D.

BY: CHARLES R. COLLINS

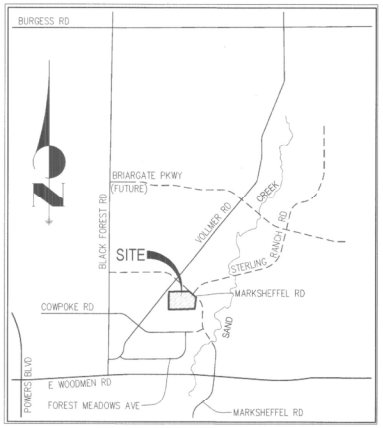
AS: MANAGER OF RHETORIC REAL ESTATE, LLC

WITNESS MY HAND AND OFFICIAL SEAL:

MY COMMISSION EXPIRES January 12, 2027

NOTARY PUBLIC: _____

CLOE GOMEZ
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20234001584
MY COMMISSION EXPIRES JANUARY 12, 2027



VICINITY MAP
N.T.S.

BOARD OF COUNTY COMMISSIONERS CERTIFICATE:

THIS PLAT FOR STERLING RECYCLING SUBDIVISION WAS APPROVED FOR FILING BY THE EL PASO COUNTY, COLORADO BOARD OF COUNTY COMMISSIONERS ON THE 10th DAY OF October, 2024, SUBJECT TO ANY NOTES SPECIFIED HEREON AND ANY CONDITIONS INCLUDED IN THE RESOLUTION OF APPROVAL. THE DEDICATIONS OF LAND TO THE PUBLIC, STREETS, ARE ACCEPTED, BUT PUBLIC IMPROVEMENTS THEREON WILL NOT BECOME THE MAINTENANCE RESPONSIBILITY OF EL PASO COUNTY UNTIL PRELIMINARY ACCEPTANCE OF THE PUBLIC IMPROVEMENTS IN ACCORDANCE WITH THE REQUIREMENTS OF THE LAND DEVELOPMENT CODE AND ENGINEERING CRITERIA MANUAL, AND THE SUBDIVISION IMPROVEMENTS AGREEMENT.

_____ 12/17/24
CHAIR, BOARD OF COUNTY COMMISSIONERS DATE

_____ 11/25/24
PLANNING DIRECTOR DATE

SUMMARY:

2 LOTS	28.7988 ACRES	88.81%
1 TRACT	1.8448 ACRES	5.69%
RIGHTS-OF-WAY	1.7827 ACRES	5.50%
TOTAL	32.4263 ACRES	100.00%

FEES:

SAND CREEK DRAINAGE FEE: $517,494.34 (CREDITS) CD

BRIDGE FEE: $211,659.77 (CREDITS) CD

ACADEMY SCHOOL DISTRICT #20 FEE: Ø

PARK FEE: Ø

SURVEYOR'S CERTIFICATE:

THE UNDERSIGNED REGISTERED PROFESSIONAL LAND SURVEYOR LICENSED IN THE STATE OF COLORADO, HEREBY STATES AND DECLARES THAT THE ACCOMPANYING PLAT WAS SURVEYED AND DRAWN UNDER HIS RESPONSIBLE CHARGE AND ACCURATELY SHOWS THE DESCRIBED TRACT OF LAND, AND SUBDIVISION THEREOF, AND THAT THE REQUIREMENTS OF TITLE 38 OF THE COLORADO REVISED STATUTES, 1973, AS AMENDED, HAVE BEEN MET TO THE BEST OF HIS KNOWLEDGE AND BELIEF.

JARROD ADAMS, PROFESSIONAL LAND SURVEYOR
COLORADO NO. 38252
FOR AND ON BEHALF OF JR ENGINEERING, LLC

NOTICE:

ACCORDING TO COLORADO LAW, YOU MUST COMMENCE ANY LEGAL ACTION BASED UPON ANY DEFECT IN THIS SURVEY WITHIN THREE YEARS AFTER YOU FIRST DISCOVER SUCH DEFECT. IN NO EVENT, MAY ANY ACTION BASED UPON ANY DEFECT IN THIS SURVEY BE COMMENCED MORE THAN TEN YEARS FROM THE DATE OF THE CERTIFICATION SHOWN HEREON.

CLERK AND RECORDER

STATE OF COLORADO
COUNTY OF EL PASO

I HEREBY CERTIFY THAT THIS INSTRUMENT WAS FILED IN MY OFFICE ON THIS 23 DAY OF DECEMBER, 2024, AND WAS RECORDED AT RECEPTION NO. 224715416 OF THE RECORDS OF EL PASO COUNTY.

_____
STEVE SCHLEIKER

OWNER OF RECORD

NAMES: RHETORIC REAL ESTATE, LLC

ADDRESS: 20 BOULDER CRESCENT, SUITE 100, COLORADO SPRINGS, CO 80903

TELEPHONE NUMBER: 719-491-8717

JOB NO. 25188.14
OCTOBER 11, 2024
SHEET 1 OF 3

FILE NO. SF-2325

J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

STERLING RECYCLING SUBDIVISION

LOCATED IN THE NW1/4 OF THE NW1/4 OF SECTION 4 & THE N1/2 OF SECTION 5, BOTH IN TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH PRINCIPAL MERIDIAN COUNTY OF EL PASO, STATE OF COLORADO

15466

PLAT NOTES:

1. BASIS OF BEARINGS:
BEARINGS ARE BASED ON THE NORTH LINE OF THE NORTHWEST QUARTER OF THE NORTHEAST QUARTER OF SECTION 5, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH PRINCIPAL MERIDIAN, BEING MONUMENTED AT THE WEST END BY A 3.25" ALUMINUM CAP STAMPED "LS 4842 1996" AND AT THE EAST END BY A 3.25" ALUMINUM CAP STAMPED "LS 10376 2006", SAID LINE BEARS N89°14'13"E.

2. ALL STRUCTURAL FOUNDATIONS SHALL BE LOCATED AND DESIGNED BY A PROFESSIONAL ENGINEER, CURRENTLY LICENSED IN THE STATE OF COLORADO.

3. THE FOLLOWING REPORTS HAVE BEEN SUBMITTED IN ASSOCIATION WITH THE FINAL PLAT FOR THIS SUBDIVISION AND ARE ON FILE AT THE COUNTY PLANNING AND COMMUNITY DEVELOPMENT DEPARTMENT: TRANSPORTATION IMPACT STUDY; DRAINAGE REPORT; WATER RESOURCES REPORT; WASTEWATER DISPOSAL REPORT; NATURAL HAZARDS REPORT; GEOLOGY AND SOILS REPORT; WETLAND STUDY/ 404 PERMIT.

4. ALL PROPERTY OWNERS ARE RESPONSIBLE FOR MAINTAINING PROPER STORM WATER DRAINAGE IN AND THROUGH THEIR PROPERTY. PUBLIC DRAINAGE EASEMENTS AS SPECIFICALLY NOTED ON THE PLAT SHALL BE MAINTAINED BY THE INDIVIDUAL LOT OWNERS UNLESS OTHERWISE INDICATED. STRUCTURES, FENCES, MATERIALS OR LANDSCAPING THAT COULD IMPEDE THE FLOW OF RUNOFF SHALL NOT BE PLACED IN DRAINAGE EASEMENTS.

5. UNLESS OTHERWISE INDICATED, ALL SIDE, FRONT, AND REAR LOT LINES ARE HEREBY PLATTED ON EITHER SIDE WITH A 10 FOOT PUBLIC UTILITY AND DRAINAGE EASEMENT UNLESS OTHERWISE INDICATED. ALL EXTERIOR SUBDIVISION BOUNDARIES ARE HEREBY PLATTED WITH A 20 FOOT PUBLIC UTILITY AND DRAINAGE EASEMENT. THE SOLE RESPONSIBILITY FOR MAINTENANCE OF THESE EASEMENTS IS HEREBY VESTED WITH THE INDIVIDUAL PROPERTY OWNERS..

6. DEVELOPER SHALL COMPLY WITH FEDERAL AND STATE LAWS, REGULATIONS, ORDINANCES, REVIEW AND PERMIT REQUIREMENTS, AND OTHER AGENCY REQUIREMENTS, IF ANY, OF APPLICABLE AGENCIES INCLUDING, BUT NOT LIMITED TO, THE COLORADO PARKS AND WILDLIFE, COLORADO DEPARTMENT OF TRANSPORTATION, U.S. ARMY CORP OF ENGINEERS AND THE U.S. FISH AND WILDLIFE SERVICE REGARDING THE ENDANGERED SPECIES ACT, PARTICULARLY AS IT RELATES TO THE LISTED SPECIES.

7. THE ADDRESS EXHIBITED ON THIS PLAT ARE FOR INFORMATIONAL PURPOSES ONLY. THEY ARE NOT THE LEGAL DESCRIPTION AND ARE SUBJECT TO CHANGE.

8. NO LOT OR INTEREST THEREIN, SHALL BE SOLD, CONVEYED, OR TRANSFERRED WHETHER BY DEED OR BY CONTRACT, NOR SHALL BUILDING PERMITS BE ISSUED, UNTIL AND UNLESS EITHER THE REQUIRED PUBLIC AND COMMON DEVELOPMENT IMPROVEMENTS HAVE BEEN CONSTRUCTED AND COMPLETED AND PRELIMINARILY ACCEPTED IN ACCORDANCE WITH THE SUBDIVISION IMPROVEMENTS AGREEMENT BETWEEN THE APPLICANT/ OWNER AND EL PASO COUNTY AS RECORDED UNDER RECEPTION NUMBER 224102052 IN THE OFFICE OF THE CLERK AND RECORDER OF EL PASO COUNTY, COLORADO OR, IN THE ALTERNATIVE, OTHER COLLATERAL IS PROVIDED TO MAKE PROVISION FOR THE COMPLETION OF SAID IMPROVEMENTS IN ACCORDANCE WITH THE EL PASO COUNTY LAND DEVELOPMENT CODE AND ENGINEERING CRITERIA MANUAL. ANY SUCH ALTERNATIVE COLLATERAL MUST BE APPROVED BY THE BOARD OF COUNTY COMMISSIONERS OR, IF PERMITTED BY THE SUBDIVISION IMPROVEMENTS AGREEMENT, BY THE PLANNING AND COMMUNITY DEVELOPMENT CHAIR AND MEET THE POLICY AND PROCEDURE REQUIREMENTS OF EL PASO COUNTY PRIOR TO THE RELEASE BY THE COUNTY OF ANY LOTS FOR SALE, CONVEYANCE OR TRANSFER.

   THIS PLAT RESTRICTION MAY BE REMOVED OR RESCINDED BY THE BOARD OF COUNTY COMMISSIONERS OR, IF PERMITTED BY THE SUBDIVISION IMPROVEMENTS AGREEMENT, BY THE PLANNING AND COMMUNITY DEVELOPMENT CHAIR UPON EITHER APPROVAL OF AN ALTERNATIVE FORM OF COLLATERAL OR COMPLETION AND PRELIMINARY ACCEPTANCE BY THE EL PASO BOARD OF COUNTY COMMISSIONERS OF ALL IMPROVEMENTS REQUIRED TO BE CONSTRUCTED AND COMPLETED IN ACCORDANCE WITH SAID SUBDIVISION IMPROVEMENTS AGREEMENT. THE PARTIAL RELEASE OF LOTS FOR SALE, CONVEYANCE OR TRANSFER MAY ONLY BE GRANTED IN ACCORDANCE WITH ANY PLANNED PARTIAL RELEASE OF LOTS AUTHORIZED BY THE SUBDIVISION IMPROVEMENTS AGREEMENT.

9. TEMPORARY TURNAROUND EASEMENTS AS SHOWN ON THIS PLAT SHALL BE RELINQUISHED UPON THE CONSTRUCTION COMPLETION OF THE EXTENSION OF STERLING RANCH ROAD BY OTHERS.

10. THE FOLLOWING LOTS HAVE BEEN FOUND TO BE IMPACTED BY GEOLOGIC HAZARDS. MITIGATION MEASURES AND A MAP OF THE HAZARD AREA CAN BE FOUND IN REPORT PRELIMINARY SUBSURFACE SOILS INVESTIGATION BY ENTECH ENGINEERING, INC., DATED AUGUST 17, 2023 IN FILE SF23-25 AVAILABLE AT THE EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT DEPARTMENT.
    - POTENTIALLY SEASONALLY HIGH GROUNDWATER: LOTS 1 & 2 – DUE TO HIGH GROUNDWATER IN AREA, NO BASEMENTS SHALL BE ALLOWED.
    - OTHER HAZARD: ARTIFICIAL FILL–LOTS 1 & 2

11. THE NON–REVOCABLE PUBLIC IMPROVEMENT EASEMENT AS SHOWN AT THE END OF STERLING RANCH ROAD CUL–DE–SAC IS INTENDED FOR TURN AROUND AND EMERGENCY RESPONSE PURPOSES. AT SUCH TIME THAT STERLING RANCH ROAD IS EXTENDED BY THE ADJACENT PROPERTY OWNER/DEVELOPER AND ACCEPTED BY THE COUNTY, THE NON–REVOCABLE PUBLIC IMPROVEMENT EASEMENT FOR THE CUL–DE–SAC WILL BE VACATED, LEAVING A STANDARD STREET ROW AND THE CUL–DE–SAC IMPROVEMENTS WILL BE REMOVED AND REPLACED WITH A STANDARD STREET SECTION. THE EASEMENT VACATION, CUL–DE–SAC REMOVAL AND STANDARD STREET SECTION CONSTRUCTION AND SITE RESTORATION IS THE RESPONSIBILITY OF THE OWNER/DEVELOPER EXTENDING STERLING RANCH ROAD.

12. NOTICE OF POTENTIAL AIRCRAFT OVERFLIGHT AND NOISE IMPACT ASSOCIATED WITH AIRPORT: THIS SERVES AS A NOTICE OF POTENTIAL AIRCRAFT OVERFLIGHT AND NOISE IMPACTS ON THIS PROPERTY DUE TO ITS CLOSE PROXIMITY TO AN AIRPORT, WHICH IS BEING DISCLOSED TO ALL PROSPECTIVE PURCHASERS CONSIDERING THE USE OF THIS PROPERTY FOR RESIDENTIAL AND OTHER PURPOSES. THIS PROPERTY IS SUBJECT TO THE OVERFLIGHT AND ASSOCIATED NOISE OF ARRIVING AND DEPARTING AIRCRAFT DURING THE COURSE OF NORMAL OPERATIONS.

   ALL PROPERTY WITHIN THIS SUBDIVISION IS SUBJECT TO AN AVIGATION EASEMENT AS RECORDED AT RECEPTION NO. 224059859 OF THE RECORDS OF THE EL PASO COUNTY CLERK AND RECORDER. THIS SITE IS LOCATED WITHIN PART 77.

13. THIS SITE IS NOT WITHIN A DESIGNATED F.E.M.A. FLOODPLAIN, AS DETERMINED BY THE FLOOD INSURANCE RATE MAP FOR EL PASO, COLORADO, PANEL NUMBER 08041C0533G, EFFECTIVE DATE DECEMBER 7, 2018.

14. ANY PERSON WHO KNOWINGLY REMOVES, ALTERS OR DEFACES ANY PUBLIC LAND SURVEY MONUMENT OR LAND BOUNDARY MONUMENT OR ACCESSORY, COMMITS A CLASS TWO (2) MISDEMEANOR PURSUANT TO CRS 18–4–508.

15. RHETORIC, LLC WILL BE RESPONSIBLE FOR MAINTENANCE OF THE ROADS AND DRAINAGE FACILITIES UNTIL PRELIMINARY ACCEPTANCE OF THE PUBLIC IMPROVEMENTS IN ACCORDANCE WITH THE REQUIREMENTS OF THE LAND DEVELOPMENT CODE, THE ENGINEERING CRITERIA MANUAL, AND THE SUBDIVISION IMPROVEMENTS AGREEMENT.

16. SPECIAL DISTRICT DISCLOSURE: A TITLE 32 SPECIAL DISTRICT ANNUAL REPORT AND DISCLOSURE FORM SATISFACTORY TO THE DEVELOPMENT SERVICES DEPARTMENT SHALL BE RECORDED WITH EACH PLAT.

17. MAIL BOXES SHALL BE INSTALLED IN ACCORDANCE WITH ALL EL PASO COUNTY AND UNITED STATES POSTAL SERVICE REGULATION.

18. THE SUBDIVIDER(S) AGREES ON BEHALF OF HIM/HERSELF AND ANY DEVELOPER OR BUILDER SUCCESSORS AND ASSIGNEES THAT SUBDIVIDER AND/OR SAID SUCCESSORS AND ASSIGNS SHALL BE REQUIRED TO PAY TRAFFIC IMPACT FEES IN ACCORDANCE WITH THE EL PASO COUNTY ROAD IMPACT FEE PROGRAM RESOLUTION (RESOLUTION NO. 19–471), OR ANY AMENDMENTS THERETO, AT OR PRIOR TO THE TIME OF BUILDING PERMIT SUBMITTALS. THE FEE OBLIGATION, IF NOT PAID AT FINAL PLAT RECORDING, SHALL BE DOCUMENTED ON ALL SALES DOCUMENTS AND ON PLAT NOTES TO ENSURE THAT A TITLE SEARCH WOULD FIND THE FEE OBLIGATION BEFORE SALE OF THE PROPERTY. TRANSPORTATION IMPACT FEES ARE TO BE PAID AT BUILDING PERMIT.

19. PURSUANT TO RESOLUTION NO. 24–306, APPROVED BY THE BOARD OF DIRECTORS, EL PASO COUNTY PUBLIC IMPROVEMENT DISTRICT 2 AND RECORDED IN THE RECORDS OF THE EL PASO COUNTY CLERK AND RECORDER AT RECEPTION NO. 224061067, THE PARCELS WITHIN THE PLATTED BOUNDARIES OF STERLING RECYCLING SUBDIVISION ARE INCLUDED WITHIN THE BOUNDARIES OF THE EL PASO COUNTY PUBLIC IMPROVEMENT DISTRICT 2 AND AS SUCH IS SUBJECT TO APPLICABLE ROAD IMPACT FEES AND MILL LEVY.

20. WATER AND WASTEWATER SERVICE FOR THIS SUBDIVISION IS PROVIDED BY THE FALCON AREA WATER AND WASTEWATER AUTHORITY (FAWWA) SUBJECT TO THE PROVIDERS RULES, REGULATIONS AND SPECIFICATIONS.

21. GAS SERVICE FOR THIS SUBDIVISION IS PROVIDED BY COLORADO SPRINGS UTILITIES (CSU) SUBJECT TO PROVIDERS RULES, REGULATIONS AND SPECIFICATIONS.

22. ELECTRIC SERVICE FOR THIS SUBDIVISION IS PROVIDED BY MOUNTAIN VIEW ELECTRIC ASSOC. (MVEA) SUBJECT TO PROVIDERS RULES, REGULATIONS AND SPECIFICATIONS.

23. NO DRIVEWAY SHALL BE ESTABLISHED UNLESS AN ACCESS PERMIT HAS BEEN GRANTED BY EL PASO COUNTY.

24. TRACT A OF THIS PROPERTY IS SUBJECT TO A PRIVATE DETENTION BASIN/STORMWATER QUALITY BMP MAINTENANCE AGREEMENT AND EASEMENT AS RECORDED AT RECEPTION NO. _____ OF THE RECORDS OF EL PASO COUNTY. THE OWNER IS RESPONSIBLE FOR MAINTENANCE OF THE SUBJECT DRAINAGE FACILITIES.

JOB NO. 25188.14
OCTOBER 11, 2024
SHEET 2 OF 3

FILE NO. SF-2325

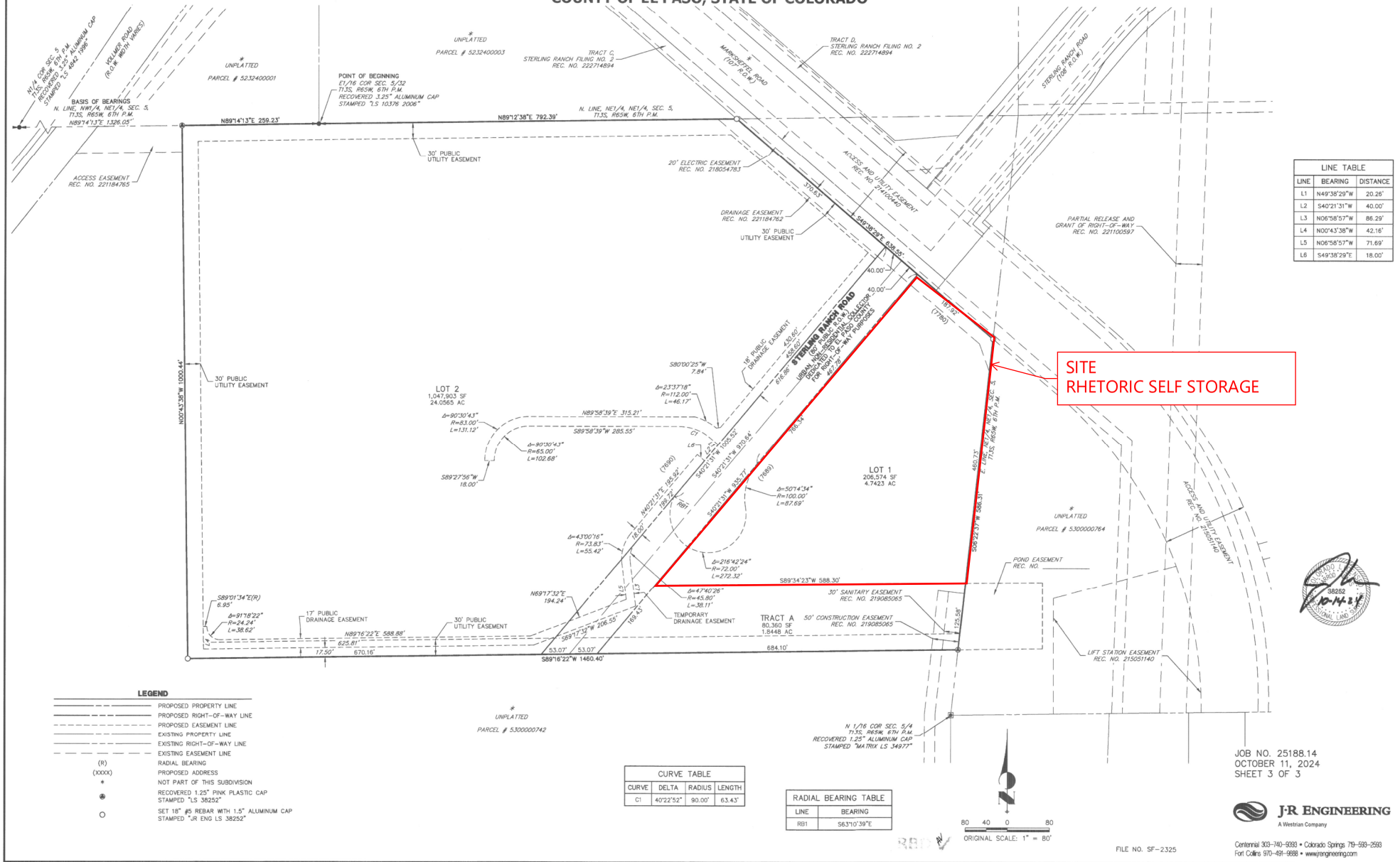
J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

STERLING RECYCLING SUBDIVISION

15466

LOCATED IN THE NW1/4 OF THE NW1/4 OF SECTION 4 & THE N1/2 OF SECTION 5,
BOTH IN TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH PRINCIPAL MERIDIAN
COUNTY OF EL PASO, STATE OF COLORADO



LINE TABLE		
LINE	BEARING	DISTANCE
L1	N49°38'29"W	20.26'
L2	S40°21'31"W	40.00'
L3	N06°58'57"W	86.29'
L4	N00°43'38"W	42.16'
L5	N06°58'57"W	71.69'
L6	S49°38'29"E	18.00'

CURVE TABLE			
CURVE	DELTA	RADIUS	LENGTH
C1	40°22'52"	90.00'	63.43'

RADIAL BEARING TABLE	
LINE	BEARING
RB1	S63°10'39"E

LEGEND

- PROPOSED PROPERTY LINE
- PROPOSED RIGHT-OF-WAY LINE
- PROPOSED EASEMENT LINE
- EXISTING PROPERTY LINE
- EXISTING RIGHT-OF-WAY LINE
- EXISTING EASEMENT LINE
- (R) RADIAL BEARING
- (XXXX) PROPOSED ADDRESS
- * NOT PART OF THIS SUBDIVISION
- ◉ RECOVERED 1.25" PINK PLASTIC CAP STAMPED "LS 38252"
- ○ SET 18" #5 REBAR WITH 1.5" ALUMINUM CAP STAMPED "JR ENG LS 38252"

80 40 0 80
ORIGINAL SCALE: 1" = 80'

JOB NO. 25188.14
OCTOBER 11, 2024
SHEET 3 OF 3

FILE NO. SF-2325

J·R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

FINAL DRAINAGE REPORT
FOR
STERLING RANCH RECYCLING FACILITY

Prepared For:

Colorado Concrete Crushing, LLC
20 Boulder Crescent, Suite 200
Colorado Springs, CO 80903
(719) 491-3024

July 2024
Project No. 25188.14
PCD Filing No: PPR2341 & SF2325

Prepared By:

JR Engineering, LLC
5475 Tech Center Drive, Suite 235
Colorado Springs, CO 80919
719-593-2593

ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage letter has been prepared according to the criteria established by El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

COLORADO REGISTERED BRYAN T. LAW 25043 9/9/24 PROFESSIONAL ENGINEER

Bryan T. Law, Colorado P.E. 25043
For and On Behalf of JR Engineering, LLC

DEVELOPER'S STATEMENT:

I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: Colorado Concrete Crushing, LLC

By:

Title: MANAGER

Address: 20 Boulder Crescent, Suite 200
Colorado Springs, CO 80903

El Paso County:

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual, Volumes 1 and 2 and Engineering Criteria Manual, as amended.

Gilbert LaForce, P.E. Digitally signed by Gilbert LaForce, P.E. Reason: Authorized signatory as County Engineer designee Date: 2024.11.07 09:20:04-07'00' 11/7/2024

County Engineer/ ECM Administrator

than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. Refer to the FIRM Map in Appendix A for additional information.

EXISTING DRAINAGE CONDITIONS

MAJOR BASIN DESCRIPTIONS

The site lies within the upper Sand Creek Drainage Basin based on the "Sand Creek Drainage Basin Planning Study" (DBPS) completed by Kiowa Engineering Corporation in January 1993, revised March 1996. The Sand Creek Drainage Basin covers approximately 54 square miles and is divided into 7 major sub-basins. The site is within the respective upper basin Sand Creek sub-basin as shown in Appendix D. Sand Creek ultimately enters Fountain Creek about two miles upstream of the Academy Boulevard bridge over Fountain Creek.

The site generally drains from north to southwest. Sand Creek is located to the east of the site and runs from north to south. This reach of drainage conveyance does not currently have any improvements. As of the date of this report, Kiowa is performing studies and plans to address Sand Creek stabilization adjacent to the site.

EXISTING SUB-BASIN DRAINAGE

The existing condition analyzes the parcel at the latest time of sale in 2021. The existing condition of the site was broken into nine sub-basins including six on-site basins and three off-site basins. The basin delineation is shown in the existing drainage map in Appendix E and is described as follows:

Basin EXA (Q_5=1.1 cfs, Q_{100}=5.4 cfs) is 2.68 acres with an 8 percent impervious and is located on the northwestern portion of the site. This basin is comprised of part of an existing paved access road, existing vegetation and undeveloped area. Runoff from this basin sheet flows southwest onto the adjacent property to the west at design point (DP) 1. Runoff follows historical drainage patterns off-site and outfalls to Sand Creek.

Basin EXB (Q_5=0.6 cfs, Q_{100}=4.3cfs) is 2.60 acres with a 2 percent impervious and is located on the western portion of the site. This basin is comprised of existing vegetation and undeveloped area. Runoff from this basin sheet flows southwest onto the adjacent property to the west at DP2. Runoff follows historical drainage patterns off-site and outfalls to Sand Creek.

Basin EXC (Q_5=1.0 cfs, Q_{100}=4.3 cfs) is 2.11 acres with a 14 percent impervious and is located on the southwest portion of the site. This basin is comprised of several existing gravel roads, existing vegetation and undeveloped area. Runoff from this basin sheet flows southwest to DP3 located along the existing 8' berm. Runoff from DP3 infiltrates the ground along the berm's toe of slope.

Basin EXD (Q_5=7.6 cfs, Q_{100}=28.1 cfs) is 13.44 acres with a 17 percent impervious and is located on the western central portion of the site. This basin is comprised of part of an existing paved access road, several existing gravel roads, existing vegetation and undeveloped area. Runoff from this basin sheet flows south to DP4 located along the existing 8' berm. Runoff from DP4 flows south across the existing berm via an existing 12" PVC pipe. Runoff follows historical drainage patterns off-site and outfalls to Sand Creek.

Basin OS1 (Q_5=1.4 cfs, Q_{100}=9.2 cfs) is 8.74 acres with a 2 percent impervious and is located to the north of the site. This basin is comprised of off-site undeveloped area tributary to the site. Runoff from this basin sheet flows south and then east along the existing off-site berm to DP5. Runoff from DP5 flows south entering into Basin EXE. Runoff follows historical drainage patterns within Basin EXE and combines at DP7.1.

Basin OS3 (Q_5=0.2 cfs, Q_{100}=0.9 cfs) is 0.29 acres with a 2 percent impervious and is located to the south of the site. This basin is comprised of off-site undeveloped area tributary to the proposed pond. Runoff from this basin sheet flows north to DP6 entering into Basin EXE. Runoff follows historical drainage patterns within Basin EXE and combines at DP7.1.

Basin EXE (Q_5=2.0 cfs, Q_{100}=13.4 cfs) is 8.51 acres with a 2 percent impervious and is located on the eastern central portion of the site. This basin is comprised of part of several existing dirt access roads, existing vegetation and undeveloped area. Runoff from this basin sheet flows south and then east to DP6 located along the existing 8' berm. Runoff from DP5, DP6, and DP7 combine at DP7.1 (Q_5=2.8 cfs, Q_{100}=18.3 cfs). Runoff from DP7.1 continues to flow southeast through the neighboring property to the south. Flow becomes concentrated off-site in a natural stream section that ultimately follows the historical drainage patterns into Sand Creek.

Basin OS2 (Q_5=0.2 cfs, Q_{100}=1.1 cfs) is 0.53 acres with a 2 percent impervious and is located to the east of the site. Runoff from this basin sheet flows west to DP8 entering into Basin EXF. Runoff follows historical drainage patterns within Basin EXE and combines at DP9.1.

Basin EXF (Q_5=0.8 cfs, Q_{100}=5.2 cfs) is 3.09 acres with a 2 percent impervious and is located on the eastern portion of the site. This basin is comprised of part of an existing dirt access road and undeveloped area. Runoff from this basin sheet flows southeast to DP9 located along the eastern side of the site. Runoff from DP8 and DP9 combine at DP9.1 (Q_5=0.9 cfs, Q_{100}=6.1 cfs). Runoff from DP9.1 continues to flow south through the neighboring sanitary lift station property to the east. Flow becomes concentrated off-site in a natural stream section that ultimately follows the historical drainage patterns into Sand Creek.

PROPOSED DRAINAGE CONDITIONS

PROPOSED CONVEYANCE

In general, developed flows are collected in proposed swales, which convey water to the proposed water quality and detention area. Proposed swale sections were designed to ensure they are stable and have required capacity to satisfy criteria. A swale is considered stable with a velocity of 5 ft/s of less. Where swale Froude numbers exceed 0.8, swales will be reinforced with the specified SC250 VMax TRM (turf reinforcement mat) product (or approved equivalent) shown in Appendix C. Specific locations where the TRM is required in swale sections is shown in the Grading and Erosion Control Construction Documents. To ensure capacity, swales will have a minimum of 1 ft. of freeboard over the water surface for flows anticipated in a 100-year storm event. In addition to the swales, a proposed culvert also conveys flows under the access roadway. The culvert was sized to not overtop the roadways with flows from a 100-year storm event. Detailed swale calculations, sections, and culvert calculations are located in Appendix C.

PROPOSED SUB-BASIN DRAINAGE

The proposed condition analyzes the parcel for the interim use of a recycling facility. The Rational Method produced flows that were used to design the proposed interim swales, culverts, storm sewer, and pond forebays. The proposed site was broken into eight basins including six on-site basins and two off-site basins. The proposed basin delineation is shown on the drainage basin map within Appendix E and is described as follows:

Basin A (Q_5=0.3 cfs, Q_{100}=1.6 cfs) is 0.50 acres with a 2% impervious and is located on the western and a portion of the southern property line of the site. This basin is comprised of proposed area to remain undeveloped and therefore follows the historic drainage pattern flowing off-site to the west and south undetained or treated. This is in accordance with Section I.7.1.B.7 of the ECM Stormwater Quality Policy and Procedure. Runoff from this basin sheet flows southwest to DP1 and then off-site to the adjacent property to the west. Runoff then follows historical drainage patterns sheet flowing off-site and outfalls to Sand Creek.

Basin B (Q_5=7.4 cfs, Q_{100}=25.1 cfs) is 14.03 acres with a 19 percent impervious and is located on the western central portion of the site. This basin is comprised of part of a paved roadway, raw concrete stockpile, raw concrete with rebar stockpile, asphalt stockpile, weighing station, mobile crusher, fence, part of temporary gravel road, swales and undeveloped land. Runoff from this basin sheet flows overland south to a proposed swale that directs flows east to DP2. Runoff from DP2 is combined at the proposed 54” FES at DP4.2. Runoff from this basin is captured and treated within proposed Pond A.

Basin OS1 (Q_5=1.4 cfs, Q_{100}=9.2 cfs) is 8.74 acres with a 2 percent impervious and is located to the north of the site. This basin is comprised of off-site undeveloped area tributary to the site. Runoff

from this basin sheet flows south and then east along the existing off-site berm to DP3. Runoff from DP3 flows south entering into Basin C. Runoff follows the drainage patterns within Basin C and combines at the proposed 24" RCP culvert at DP4.1.

Basin C (Q_5=3.4 cfs, Q_{100}=17.7 cfs) is 10.70 acres with a 6 percent impervious and is located on the eastern central portion of the site. This basin is comprised of a part of proposed Sterling Ranch Road, asphalt access roads, swales and undeveloped land. Runoff from this basin flows along proposed curb and gutter as well as sheet flows overland south to proposed swales that directs flows east to DP4. Runoff from DP4 is combined with flows from DP3 at the proposed 24" RCP culvert at DP4.1 (Q_5=3.7 cfs, Q_{100}=21.1 cfs). Runoff from DP4.1 enters the proposed culvert into Basin B and a proposed swale directs flows to the proposed 54" FES at DP4.2 (Q_5=9.3 cfs, Q_{100}=40.1 cfs). DP4.2 flows are piped to the west forebay within the pond and combine at DP9.1. Runoff from this basin is captured and treated within proposed Pond A.

Basin D (Q_5=0.5 cfs, Q_{100}=3.7 cfs) is 2.16 acres with a 2 percent impervious and is located on the eastern boundary of the site. This basin is comprised of undeveloped land. Runoff from this basin sheet flows overland southeast to a proposed swale that directs flows south to DP5. Runoff from DP5 is combined at the proposed Type C sump inlet at DP7.1 within Basin E. Runoff from this basin is captured and treated within proposed Pond A.

Basin E (Q_5=2.2 cfs, Q_{100}=7.1 cfs) is 3.10 acres with a 22 percent impervious and is located on the eastern portion of the site. This basin is comprised of a part of proposed Sterling Ranch Road, part of a temporary gravel road, asphalt access road, swale and undeveloped land. Runoff from this basin flows along proposed curb and gutter and then sheet flows overland southeast to a proposed swale that directs flows east to DP6. Runoff from DP6 is combined at the proposed Type C sump inlet at DP7.1. Runoff from this basin is captured and treated within proposed Pond A.

Basin OS2 (Q_5=0.1 cfs, Q_{100}=0.7 cfs) is 0.36 acres with a 2 percent impervious and is located to the east of the site. This basin is comprised of off-site undeveloped area tributary to the proposed pond. Runoff from this basin sheet flows west and then south along the property boundary to DP7. Runoff from DP7 is combined with DP5 and DP6 flows at the proposed Type C sump inlet at DP7.1 (Q_5=2.8 cfs, Q_{100}=11.2 cfs). DP7.1 flows are piped to the north forebay within the pond and combine at DP9.1.

Basin OS3 (Q_5=0.2 cfs, Q_{100}=1.0 cfs) is 0.30 acres with a 2 percent impervious and is located to the south of the site. This basin is comprised of off-site undeveloped area tributary to the proposed pond. Runoff from this basin sheet flows north to DP8. Runoff from DP8 combines with DP4.2, DP7.1, and DP6 flows at the proposed outlet structure at DP9.1.

Basin F (Q_5=0.6 cfs, Q_{100}=4.4 cfs) is 2.27 acres with a 2 percent impervious and is located on the southeast portion of the site. This basin is comprised of a proposed full-spectrum extended detention

adversely affect downstream infrastructure. See the ultimate section below for more information on the existing downstream infrastructure.

2. Flows from Basin G leave the site uncaptured and untreated at DP10 (Q_5=0.2 cfs, Q_{100}=0.4 cfs) and combine with OS4 flows at DP11 (Q_5=6.7 cfs, Q_{100}=12.8 cfs) at the existing 15' Type R on-grade inlet at DP11.1 (Q_5=6.9 cfs, Q_{100}=13.1 cfs). The existing inlet was constructed as part of Sterling Ranch Filing No. 2 (see applicable excerpts in Appendix D). The Filing 2 report Basin A10 (Basin OS4) has a total flow to the 15' Type R on-grade inlet of Q_5=9.2 cfs, Q_{100}=17.3 cfs. Compared to the existing flows, DP11.1 flows are less than historic and will not adversely affect downstream infrastructure.

ULTIMATE SUB-BASIN DRAINAGE

The ultimate condition analyzes the parcel and tributary properties for the future development based on the land use in order to design the ultimate full-spectrum EDB and spillway overflow path. The ultimate site was broken into five land uses. The land uses are shown on the proposed drainage map within Appendix E and is described as follows.

- Lot 1 is 4.74 acres and is zoned as Heavy Industrial Area (90% impervious)
- Urban Non-Residential Collector Roadway (80' R.O.W.) is 1.78 acres (100% impervious for roadway, curb & gutter, and sidewalk width, 2% impervious for other areas)
- Lot 2 is 24.05 acres and is zoned as Residential-1/8 Acre or Less (65% impervious)
- Tract A is 1.85 acres and is used as detention pond area (2% impervious)
- Off-site vacant land to the north is 8.74 acres and is zoned as Commercial Area (95% impervious)
- Off-site Tract/ Lift Station land to the east is 1.87 acres and is zoned as Heavy Industrial Area (90% impervious)
- Off-site land to the east is 0.44 acres and is used as detention pond area (2% impervious)
- Off-site land to the south is 0.30 acres and flows to detention pond area (2% impervious)
- Total Area = 43.77 acres with 71.6% impervious (used 72% for design)

The ultimate condition was used overall to size the full-spectrum EDB and ensure it will operate for future developments.

In the ultimate condition, there is one location where flows leave the site.

2. Ultimate released flows from the pond outlet structure (Q_5=1.5 cfs, Q_{100}=22.2 cfs) are released into the existing storm infrastructure located adjacent to the site. Flows from existing design points DP7.1 and 9.1 flow off-site to the south for a total flow of Q_5=3.7 cfs, Q_{100}=24.4 cfs. The existing downstream 66" RCP that the outfall ties into was designed and approved as part of the Sterling Ranch Filing 2 development. The pipe shall be installed by June 2024 and for the purposes of this report, considered as existing. The existing 66" RCP was designed for Filing 2 DP4.7 flows (Q_5=58.4 cfs, Q_{100}=248.6 cfs) and the ultimate

condition flows (Q_5=32.2 cfs, Q_{100}=255.6 cfs) will result in an increase in flows in the major storm. The StormCAD analysis in Appendix C shows that the existing storm system was designed deep enough to have the capacity for the increase in flow. There are also no adverse affects from the increase in flow in the minor storm shown in the MHFD Detention spreadsheet as the existing storm system was designed to handle the peak 100-year flows which greatly surpass the 5-year flow rates. See Appendix C for the StormCAD analysis and calculations. The existing storm system the proposed site ties continues to travel east and south about 1,800 feet before ultimately releasing directly into Sand Creek.

DRAINAGE DESIGN CRITERIA

DEVELOPMENT CRITERIA REFERENCE

Storm drainage analysis and design criteria for this project were taken from the "*City of Colorado Springs/El Paso County Drainage Criteria Manual*" Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the "*Urban Storm Drainage Criteria Manual*" Volumes 1 to 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the "*Colorado Springs Drainage Criteria Manual*" (CSDCM), dated May 2014, as adopted by El Paso County.

HYDROLOGIC CRITERIA

All hydrologic data was obtained from the "*El Paso Drainage Criteria Manual*" Volumes 1 and 2, and the "*Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual*" Volumes 1, 2, and 3. On-site drainage improvements were designed based on the 5-year (minor) storm event and the 100-year (major) storm event. Runoff was calculated using the Rational Method, and rainfall intensities for the 5-year and the 100-year storm return frequencies were obtained from Table 6-2 of the CSDCM. One-hour point rainfall data for the storm events is identified in the chart below. Runoff coefficients were determined based on proposed land use and from data in Table 6-6 from the CSDCM. Time of concentrations were developed using equations from CSDCM. All runoff calculations and applicable charts and graphs are included in the Appendices.

Table 1: 1-hr Point Rainfall Data

Storm	Rainfall (in.)
5-year	1.50
100-year	2.52

COMPOSITE % IMPERVIOUS & COMPOSITE EXISTING RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Sterling Ranch Recycling Facility
Location: El Paso County

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: GAG
Checked By:
Date: 1/18/24

Basin ID	Total Area (ac)	Streets-Paved (100% Impervious)				Streets-Gravel (80% Impervious)				Historical Analysis (2% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
EXA	2.68	0.90	0.96	0.16	6.0%	0.59	0.70	0.00	0.0%	0.09	0.36	2.52	1.9%	0.14	0.40	7.9%
EXB	2.60	0.90	0.96	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	2.60	2.0%	0.09	0.36	2.0%
EXC	2.11	0.90	0.96	0.00	0.0%	0.59	0.70	0.33	12.5%	0.09	0.36	1.78	1.7%	0.17	0.41	14.2%
EXD	13.44	0.90	0.96	0.86	6.4%	0.59	0.70	1.48	8.8%	0.09	0.36	11.10	1.7%	0.20	0.44	16.9%
EXE	8.51	0.90	0.96	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	8.51	2.0%	0.09	0.36	2.0%
EXF	3.09	0.90	0.96	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	3.09	2.0%	0.09	0.36	2.0%
OS1	8.74	0.90	0.96	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	8.74	2.0%	0.09	0.36	2.0%
OS2	0.53	0.90	0.96	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.53	2.0%	0.09	0.36	2.0%
OS3	0.29	0.90	0.96	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.29	2.0%	0.09	0.36	2.0%
TOTAL	**41.99**															**7.7%**

EXISTING
STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Sterling Ranch Recycling Facility
Location: El Paso County

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: GAG
Checked By:
Date: 1/18/24

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
EXA	2.68	A	8%	0.14	0.40	300	4.0%	19.0	190	2.3%	10.0	1.5	2.1	21.1	490.0	26.7	21.1
EXB	2.60	A	2%	0.09	0.36	300	2.5%	23.3	240	2.5%	10.0	1.6	2.5	25.9	540.0	28.4	25.9
EXC	2.11	A	14%	0.17	0.41	300	2.6%	21.3	135	1.7%	15.0	2.0	1.2	22.4	435.0	25.2	22.4
EXD	13.44	A	17%	0.20	0.44	300	3.6%	18.5	810	3.4%	15.0	2.8	4.9	23.4	1110.0	29.6	23.4
EXE	8.51	A	2%	0.09	0.36	300	4.0%	20.0	800	3.0%	10.0	1.7	7.7	27.7	1100.0	34.0	27.7
EXF	3.09	A	2%	0.09	0.36	300	3.5%	20.9	400	4.3%	10.0	2.1	3.2	24.1	700.0	29.1	24.1
OS1	8.74	A	2%	0.09	0.36	150	2.0%	17.8	850	0.2%	10.0	0.4	31.7	49.4	1000.0	59.8	49.4
OS2	0.53	A	2%	0.09	0.36	155	3.0%	15.8	0	0.0%	10.0	0.0	0.0	15.8	155.0	25.7	15.8
OS3	0.29	A	2%	0.09	0.36	35	15.0%	4.4	0	0.0%	10.0	0.0	0.0	4.4	35.0	25.7	5.0

NOTES:

$$t_c = t_i + t_t$$ Equation 6-2

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$ Equation 6-3

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$ Equation 6-4

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$ Equation 6-5

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

STANDARD FORM SF-3 - EXISTING

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Sterling Ranch Recycling Facility
Location: El Paso County
Design Storm: 5-Year

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: GAG
Checked By:
Date: 1/18/24

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	1	EXA	2.68	0.14	21.1	0.37	3.01	1.1															Sheet flows overland to DP1 Flows off-site to the west
	2	EXB	2.60	0.09	25.9	0.23	2.70	0.6															Sheet flows overland to DP2 Flows off-site to the west
	3	EXC	2.11	0.17	22.4	0.35	2.92	1.0															Sheet flows overland and along berm to DP3 Flows off-site to the south
	4	EXD	13.44	0.20	23.4	2.65	2.85	7.6															Sheet flows overland and along berm to DP4 Flows off-site to the south
	5	OS1	8.74	0.09	49.4	0.79	1.73	1.4															Sheet flows overland and along berm to DP5 Flows on-site and combines at DP7.1
	6	OS3	0.29	0.09	5.0	0.03	5.17	0.2															Sheet flows overland to DP6 Flows on-site and combines at DP7.1
	7	EXE	8.51	0.09	27.7	0.77	2.60	2.0															Sheet flows overland and along berm to DP7 Combines flows at DP7.1
	7.1								49.4	1.59	1.73	2.8											~~Combines the flows from DP5, DP6, and DP7~~ Flows off-site to the south
	8	OS2	0.53	0.09	15.8	0.05	3.44	0.2															Sheet flows overland to DP8 Combines flows at DP9.1
	9	EXF	3.09	0.09	24.1	0.28	2.81	0.8															Sheet flows overland to DP9 Combines flows at DP9.1
	9.1								24.1	0.33	2.81	0.9											Combines the flows from DP8 and DP9 Flows off-site to the east

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

STANDARD FORM SF-3 - EXISTING

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Sterling Ranch Recycling Facility
Location: El Paso County
Design Storm: 100-Year

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: GAG
Checked By:
Date: 1/18/24

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
Description	Design Point	Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	1	EXA	2.68	0.40	21.1	1.06	5.05	5.4															Sheet flows overland to DP1 Flows off-site to the west
	2	EXB	2.60	0.36	25.9	0.94	4.54	4.3															Sheet flows overland to DP2 Flows off-site to the west
	3	EXC	2.11	0.41	22.4	0.87	4.90	4.3															Sheet flows overland and along berm to DP3 Flows off-site to the south
	4	EXD	13.44	0.44	23.4	5.86	4.79	28.1															Sheet flows overland and along berm to DP4 Flows off-site to the south
	5	OS1	8.74	0.36	49.4	3.15	2.90	9.2															Sheet flows overland and along berm to DP5 Flows on-site and combines at DP7.1
	6	OS3	0.29	0.36	5.0	0.10	8.68	0.9															Sheet flows overland to DP6 Flows on-site and combines at DP7.1
	7	EXE	8.51	0.36	27.7	3.06	4.37	13.4															Sheet flows overland and along berm to DP7 Combines flows at DP7.1
	7.1								49.4	6.31	2.90	18.3											Combines the flows from DP5, DP6, and DP7 Flows off-site to the south
	8	OS2	0.53	0.36	15.8	0.19	5.78	1.1															Sheet flows overland to DP8 Combines flows at DP9.1
	9	EXF	3.09	0.36	24.1	1.11	4.72	5.2															Sheet flows overland to DP9 Combines flows at DP9.1
	9.1								24.1	1.30	4.72	6.1											Combines the flows from DP8 and DP9 Flows off-site to the east

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

COMPOSITE % IMPERVIOUS & COMPOSITE PROPOSED RUNOFF COEFFICIENT CALCULATIONS

PROPOSED CONDITION ANALYSIS FOR SIZING OF SWALES & INLETS.

Subdivision: Sterling Ranch Recycling Facility
Location: El Paso County

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: GAG
Checked By:
Date: 1/24/24

Basin ID	Total Area (ac)	Streets-Paved (100% Impervious)				Streets-Gravel (80% Impervious)				Historical Analysis (2% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
A	0.50	0.90	0.96	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.50	2.0%	0.09	0.36	2.0%
B	14.03	0.90	0.96	2.45	17.5%	0.59	0.70	0.00	0.0%	0.09	0.36	11.58	1.7%	0.23	0.46	19.1%
C	10.70	0.90	0.96	0.47	4.4%	0.59	0.70	0.00	0.0%	0.09	0.36	10.23	1.9%	0.13	0.39	6.3%
D	2.16	0.90	0.96	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	2.16	2.0%	0.09	0.36	2.0%
E	3.10	0.90	0.96	0.40	12.9%	0.59	0.70	0.31	8.0%	0.09	0.36	2.39	1.5%	0.24	0.47	22.4%
F	2.27	0.90	0.96	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	2.27	2.0%	0.09	0.36	2.0%
G	0.06	0.90	0.96	0.04	66.7%	0.59	0.70	0.00	0.0%	0.09	0.36	0.02	0.7%	0.63	0.76	67.3%
OS1	8.74	0.90	0.96	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	8.74	2.0%	0.09	0.36	2.0%
OS2	0.36	0.90	0.96	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.36	2.0%	0.09	0.36	2.0%
OS3	0.30	0.90	0.96	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.30	2.0%	0.09	0.36	2.0%
OS4	2.08	0.90	0.96	1.70	81.7%	0.59	0.70	0.00	0.0%	0.09	0.36	0.38	0.4%	0.75	0.85	82.1%
Total W. Forebay (Basins B, C, OS1)	**33.47**															**10.5%**
Total N. Forebay (Basins D, E, OS2)	**5.62**															**13.3%**
Total Pond A (Basins B-F, OS1-3)	**41.66**															**10.4%**

PROPOSED
STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Sterling Ranch Recycling Facility
Location: El Paso County

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: GAG
Checked By:
Date: 1/24/24

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
A	0.50	A	2%	0.09	0.36	20	33.0%	2.6	0	0.0%	10.0	0.0	0.0	2.6	20.0	25.7	5.0
B	14.03	A	19%	0.23	0.46	300	2.7%	19.6	1600	1.5%	15.0	1.8	14.5	34.1	1900.0	41.4	34.1
C	10.70	A	6%	0.13	0.39	300	2.7%	22.0	735	1.5%	15.0	1.8	6.7	28.6	1035.0	35.0	28.6
D	2.16	A	2%	0.09	0.36	215	3.0%	18.6	400	1.5%	10.0	1.2	5.4	24.1	615.0	31.5	24.1
E	3.10	A	22%	0.24	0.47	100	1.2%	14.5	910	1.5%	15.0	1.8	8.3	22.8	1010.0	32.4	22.8
F	2.27	A	2%	0.09	0.36	40	25.0%	4.0	615	0.5%	10.0	0.7	14.5	18.5	655.0	41.3	18.5
G	0.06	A	67%	0.63	0.76	54	2.0%	5.0	35	1.0%	20.0	2.0	0.3	5.3	89.0	14.9	5.3
OS1	8.74	A	2%	0.09	0.36	150	2.0%	17.8	850	0.2%	10.0	0.4	31.7	49.4	1000.0	59.8	49.4
OS2	0.36	A	2%	0.09	0.36	115	3.0%	13.6	300	3.0%	10.0	1.7	2.9	16.5	415.0	28.8	16.5
OS3	0.30	A	2%	0.09	0.36	35	15.0%	4.4	0	0.0%	10.0	0.0	0.0	4.4	35.0	25.7	5.0
OS4	2.08	A	82%	0.75	0.85	15	2.0%	1.9	1335	2.5%	20.0	3.2	7.0	9.0	1350.0	18.9	9.0

NOTES:

$$t_c = t_i + t_t$$ Equation 6-2

Where:

t_c = computed time of concentration (minutes)
t_i = overland (initial) flow time (minutes)
t_t = channelized flow time (minutes).

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$ Equation 6-3

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$ Equation 6-4

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$ Equation 6-5

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

STANDARD FORM SF-3 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Sterling Ranch Recycling Facility
Location: El Paso County
Design Storm: 5-Year

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: GAG
Checked By:
Date: 1/24/24

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	A	0.50	0.09	5.0	0.05	5.17	0.3															Flows overland along the western site boundary to DP1 Flows off-site to the west
	2	B	14.03	0.23	34.1	3.25	2.29	7.4															Sheet flows overland to swale and then to DP2 Combines flow at FES at DP4.2
	3	OS1	8.74	0.09	49.4	0.79	1.73	1.4															Sheet flows overland and along berm to DP3 Flows on-site and combines at culvert at DP4.1
	4	C	10.70	0.13	28.6	1.34	2.55	3.4															Sheet flows overland to swale and then to DP4 Combines flow at culvert at DP4.1
	4.1								49.4	2.13	1.73	3.7											Combined flow of DP3 and DP4 within culvert Swale to FES at DP4.2
	4.2								49.4	5.38	1.73	9.3											Combined flow of DP2 and DP4.1 at sump inlet Piped to pond forebay, combines flow at DP9.1
	5	D	2.16	0.09	24.1	0.19	2.81	0.5															Sheet flows overland to swale and then to DP5 Combines flow at sump inlet at DP7.1
	6	E	3.10	0.24	22.8	0.76	2.89	2.2															Sheet flows overland to swale and then to DP6 Combines flow at sump inlet at DP7.1
	7	OS2	0.36	0.09	16.5	0.03	3.38	0.1															Sheet flows overland to DP7 Combines flow at sump inlet at DP7.1
	7.1								24.1	0.98	2.81	2.8											Combined flow of DP5, DP6, and DP7 at sump inlet Piped to pond forebay, combines flow at DP9.1
	8	OS3	0.30	0.09	5.0	0.03	5.17	0.2															Sheet flows overland to DP8 Combines flow at DP9.1
	9	F	2.27	0.09	18.5	0.20	3.21	0.6															Flows along trickle channel to DP9 at outlet structure Combines flow at DP9.1
	9.1								49.4	6.59	1.73	11.4											Combined flow of DP4.2, DP7.1, DP8 and DP9. Total interim pond inflow. Released though pond outlet structure at DP9.2
	9.2								-	-	-	0.1											Released flow through interim outlet structure from MHFD_Detention Piped to existing junction box and storm infrastructure
	10	G	0.06	0.63	5.3	0.04	5.09	0.2															Flows along prop. Sterling Ranch Rd. c&g to DP10 to Marksheffel Rd. Combines at existing Marksheffel Rd. existing 15' Type R inlet.
	11	OS4	2.08	0.75	9.0	1.56	4.29	6.7															Off-site work along existing Marksheffel Rd. c&g to ex. 15' Type R inlet. Combines at existing Marksheffel Rd. existing 15' Type R inlet.
	11.1								9.0	1.60	4.29	6.9											Combined flow of DP 10 and DP11 within existing 15' Type R inlet. Captured flow continues off-site southeast along Marksheffel Rd. storm

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

PROPOSED CONDITION ANALYSIS FOR SIZING OF SWALES & INLETS.

STANDARD FORM SF-3 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Sterling Ranch Recycling Facility
Location: El Paso County
Design Storm: 100-Year

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: GAG
Checked By:
Date: 1/24/24

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	A	0.50	0.36	5.0	0.18	8.68	1.6															Flows overland along the western site boundary to DP1 Flows off-site to the west
	2	B	14.03	0.46	34.1	6.52	3.84	25.1															Sheet flows overland to swale and then to DP2 Combines flow at FES at DP4.2
	3	OS1	8.74	0.36	49.4	3.15	2.90	9.2															Sheet flows overland and along berm to DP3 Flows on-site and combines at culvert at DP4.1
	4	C	10.70	0.39	28.6	4.13	4.28	17.7															Sheet flows overland to swale and then to DP4 Combines flow at culvert at DP4.1
	4.1								49.4	7.28	2.90	21.1											Combined flow of DP3 and DP4 within culvert Swale to FES at DP4.2
	4.2								49.4	13.80	2.90	40.1											Combined flow of DP2 and DP4.1 at sump inlet Piped to pond forebay, combines flow at DP9.1
	5	D	2.16	0.36	24.1	0.78	4.72	3.7															Sheet flows overland to swale and then to DP5 Combines flow at sump inlet at DP7.1
	6	E	3.10	0.47	22.8	1.46	4.86	7.1															Sheet flows overland to swale and then to DP6 Combines flow at sump inlet at DP7.1
	7	OS2	0.36	0.36	16.5	0.13	5.67	0.7															Sheet flows overland to DP7 Combines flow at sump inlet at DP7.1
	7.1								24.1	2.37	4.72	11.2											Combined flow of DP5, DP6, and DP7 at sump inlet Piped to pond forebay, combines flow at DP9.1
	8	OS3	0.30	0.36	5.0	0.11	8.68	1.0															Sheet flows overland to DP8 Combines flow at DP9.1
	9	F	2.27	0.36	18.5	0.82	5.38	4.4															Flows along trickle channel to DP9 at outlet structure Combines flow at DP9.1
	9.1								49.4	16.99	2.90	49.4											Combined flow of DP4.2, DP7.1, DP8 and DP9. Total interim pond inflow. Released though pond outlet structure at DP9.2
	9.2								-	-	-	8.3											Released flow through interim outlet structure from MHFD_Detention Piped to existing junction box and storm infrastructure
	10	G	0.06	0.76	5.3	0.05	8.56	0.4															Flows along prop. Sterling Ranch Rd. c&g to DP10 to Marksheffel Rd. Combines at existing Marksheffel Rd. existing 15' Type R inlet.
	11	OS4	2.08	0.85	9.0	1.77	7.21	12.8															Off-site work along existing Marksheffel Rd. c&g to ex. 15' Type R inlet. Combines at existing Marksheffel Rd. existing 15' Type R inlet.
	11.1								9.0	1.82	7.21	13.1											Combined flow of DP 10 and DP11 within existing 15' Type R inlet. Captured flow continues off-site southeast along Marksheffel Rd. storm

PROPOSED CONDITION ANALYSIS FOR SIZING OF SWALES & INLETS.

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

COMPOSITE % IMPERVIOUS & COMPOSITE ULTIMATE RUNOFF COEFFICIENT CALCULATIONS

ULTIMATE CONDITION FOR POND SIZING FOR LOT 1

Subdivision: Sterling Ranch Recycling Facility
Location: El Paso County

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: GAG
Checked By:
Date: 2/8/24

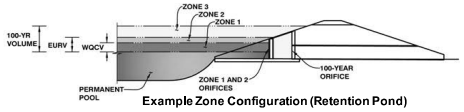
Basin ID	Total Area (ac)	Industrial-Heavy Areas (90% Impervious)				Business-Commercial Areas (95% Impervious)				Residential-1/8 Acre or Less (65% Impervious)				Streets-Paved (100% Impervious)				Historical Analysis (2% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
Lot 1 Heavy Industrial	4.74	0.73	0.81	4.74	90.0%	0.81	0.88	0.00	0.0%	0.45	0.59	0.00	0.0%	0.90	0.96	0.00	0.0%	0.09	0.36	0.00	0.0%	0.73	0.81	**90.0%**
Urban Non-Residential Collector Roadway (R.O.W.)	1.78	0.73	0.81	0.00	0.0%	0.81	0.88	0.00	0.0%	0.45	0.59	0.00	0.0%	0.90	0.96	1.40	78.7%	0.09	0.36	0.38	0.4%	0.73	0.83	**79.1%**
Lot 2 Residential-1/8 Acre or Less	24.05	0.73	0.81	0.00	0.0%	0.81	0.88	0.00	0.0%	0.45	0.59	24.05	65.0%	0.90	0.96	0.00	0.0%	0.09	0.36	0.00	0.0%	0.45	0.59	**65.0%**
Tract A Detention Pond	1.85	0.73	0.81	0.00	0.0%	0.81	0.88	0.00	0.0%	0.45	0.59	0.00	0.0%	0.90	0.96	0.00	0.0%	0.09	0.36	1.85	2.0%	0.09	0.36	**2.0%**
Future Commercial (Off-site to north)	8.74	0.73	0.81	0.00	0.0%	0.81	0.88	8.74	95.0%	0.45	0.59	0.00	0.0%	0.90	0.96	0.00	0.0%	0.09	0.36	0.00	0.0%	0.81	0.88	**95.0%**
Future Heavy Industrial (Off-site to east)	1.87	0.73	0.81	1.87	90.0%	0.81	0.88	0.00	0.0%	0.45	0.59	0.00	0.0%	0.90	0.96	0.00	0.0%	0.09	0.36	0.00	0.0%	0.73	0.81	**90.0%**
Detention Pond (Off-site to east)	0.44	0.73	0.81	0.00	0.0%	0.81	0.88	0.00	0.0%	0.45	0.59	0.00	0.0%	0.90	0.96	0.00	0.0%	0.09	0.36	0.44	2.0%	0.09	0.36	**2.0%**
Detention Pond (Off-site to south)	0.30	0.73	0.81	0.00	0.0%	0.81	0.88	0.00	0.0%	0.45	0.59	0.00	0.0%	0.90	0.96	0.00	0.0%	0.09	0.36	0.30	2.0%	0.09	0.36	**2.0%**
Total Pond A	**43.77**																							**71.6%**
Total W. Forebay (North Commercial, Lot 2, R.O.W.)	**34.57**																					**0.56**	**0.68**	**73.3%**
Total N. Forebay (Lot 1, East Heavy Industrial)	**6.61**																					**0.73**	**0.81**	**90.0%**

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Sterling Ranch Recycling Facility

Basin ID: Pond A-Ultimate



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	43.77	acres
Watershed Length =	2,265	ft
Watershed Length to Centroid =	1,455	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	72.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	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) =	1.037 acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	4.024 acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.942 acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.836 acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	4.555 acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	5.444 acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	6.314 acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	7.348 acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	9.622 acre-feet		inches
Approximate 2-yr Detention Volume =	2.630 acre-feet		
Approximate 5-yr Detention Volume =	3.429 acre-feet		
Approximate 10-yr Detention Volume =	4.114 acre-feet		
Approximate 25-yr Detention Volume =	4.918 acre-feet		
Approximate 50-yr Detention Volume =	5.395 acre-feet		
Approximate 100-yr Detention Volume =	5.864 acre-feet		

Define Zones and Basin Geometry

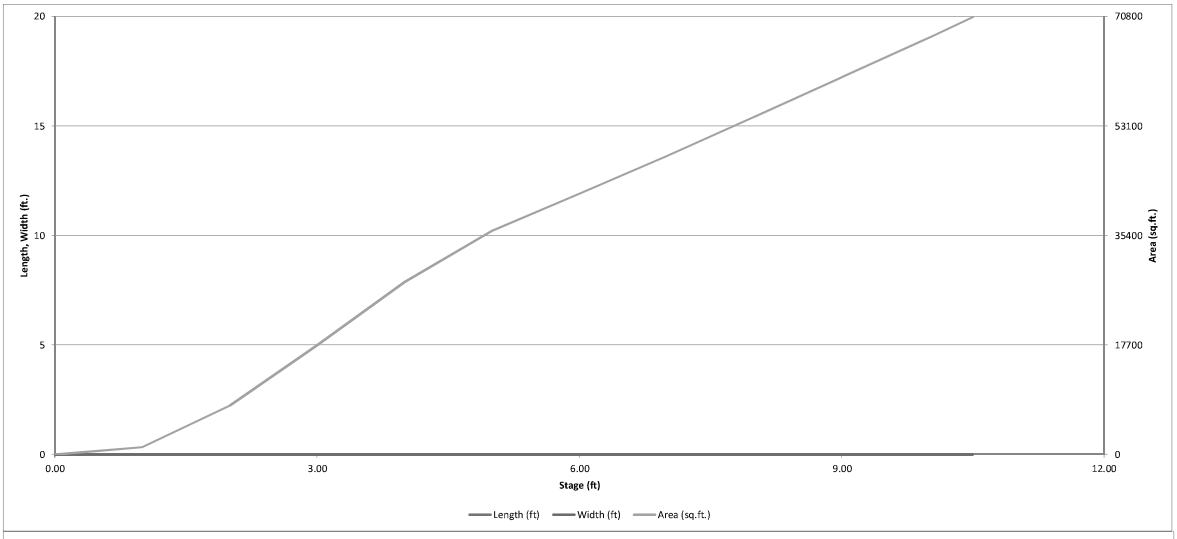
Zone 1 Volume (WQCV) =	1.037	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.987	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.839	acre-feet
Total Detention Basin Volume =	5.864	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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 ($R_{L/W}$) =	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

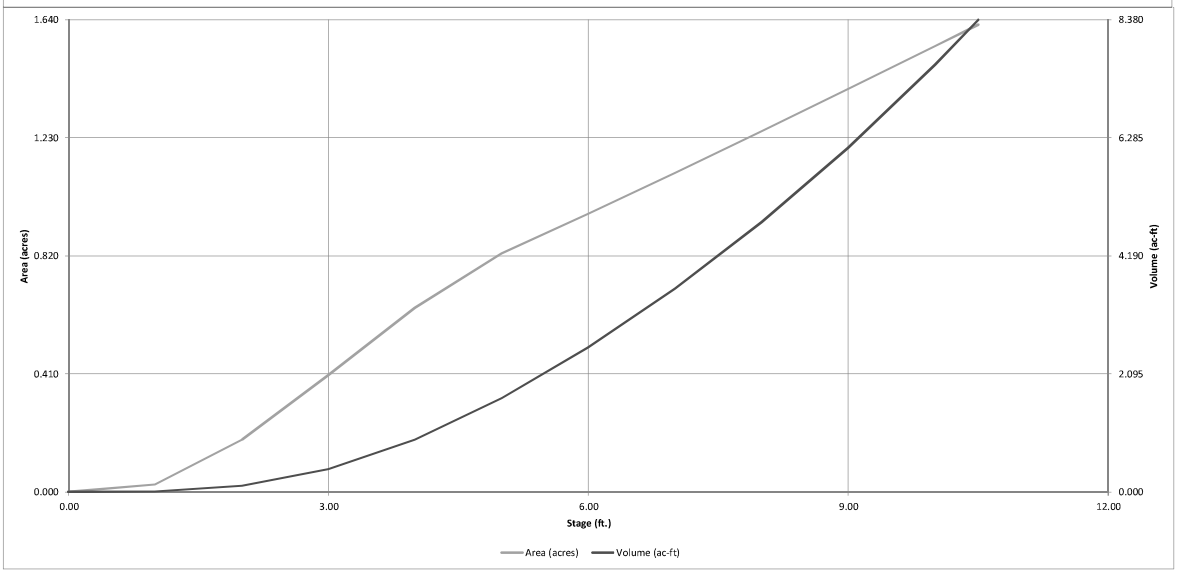
Depth Increment = ft

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		
6966	--	1.00	--	--	--	1,164	0.027	587	0.013
6967	--	2.00	--	--	--	7,912	0.182	5,125	0.118
6968	--	3.00	--	--	--	17,659	0.405	17,910	0.411
6969	--	4.00	--	--	--	27,893	0.640	40,686	0.934
6970	--	5.00	--	--	--	36,100	0.829	72,683	1.669
6971	--	6.00	--	--	--	42,123	0.967	111,794	2.566
6972	--	7.00	--	--	--	48,273	1.108	156,992	3.604
6973	--	8.00	--	--	--	54,548	1.252	208,403	4.784
6974 (Crest)	--	9.00	--	--	--	60,948	1.399	266,151	6.110
6975	--	10.00	--	--	--	67,404	1.547	330,327	7.583
6975.5	--	10.50	--	--	--	70,671	1.622	364,846	8.376

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



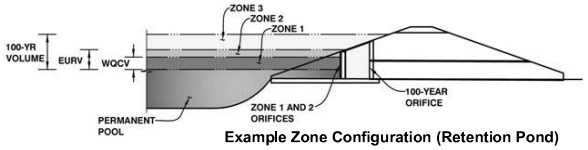


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Sterling Ranch Recycling Facility

Basin ID: Pond A-Ultimate



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.16	1.037	Orifice Plate
Zone 2 (EURV)	7.38	2.987	Circular Orifice
Zone 3 (100-year)	8.83	1.839	Weir&Pipe (Restrict)
Total (all zones)		5.864	

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	ft²
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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =	4.16	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	sq. inches	Elliptical Slot Area =	N/A	ft²

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	1.35	2.77					
Orifice Area (sq. inches)	2.80	2.80	2.80					

	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)

	Zone 2 Circular	Not Selected			Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	4.16	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.10	N/A	ft²
Depth at top of Zone using Vertical Orifice =	7.38	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.18	N/A	feet
Vertical Orifice Diameter =	4.30	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 =	7.90	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	7.90	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 =	9.01	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	12.66	N/A	ft²
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	6.33	N/A	ft²
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 =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.40	N/A	ft²
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.53	N/A	feet
Restrictor Plate Height Above Pipe Invert =	11.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.49	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.48	feet
Spillway Crest Length =	120.00	feet	Stage at Top of Freeboard =	10.48	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.62	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	8.34	acre-ft

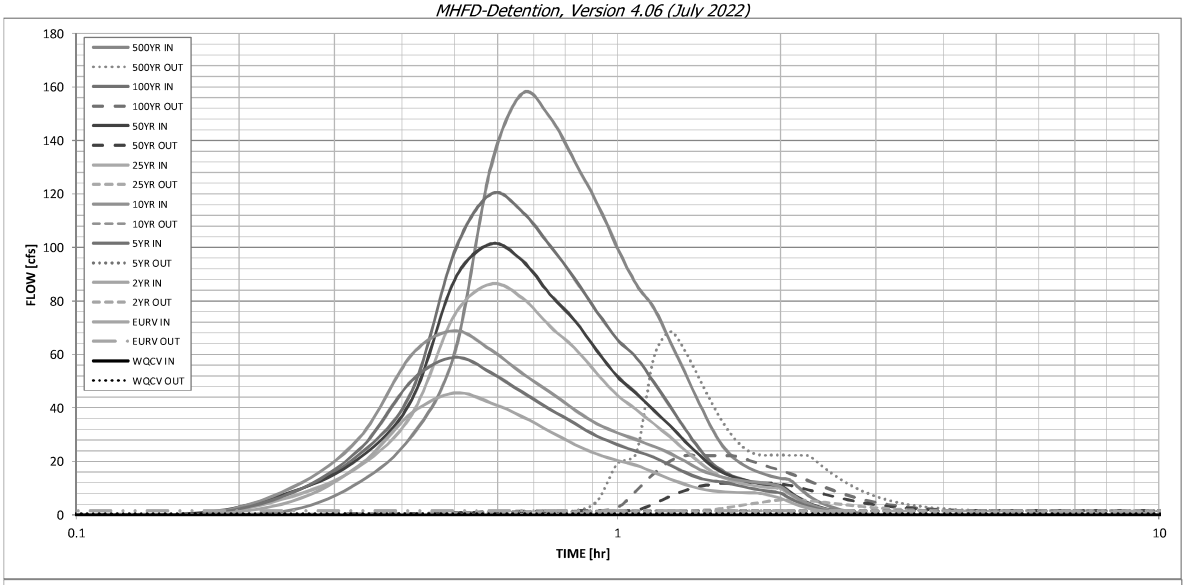
Calculated Parameters for Spillway

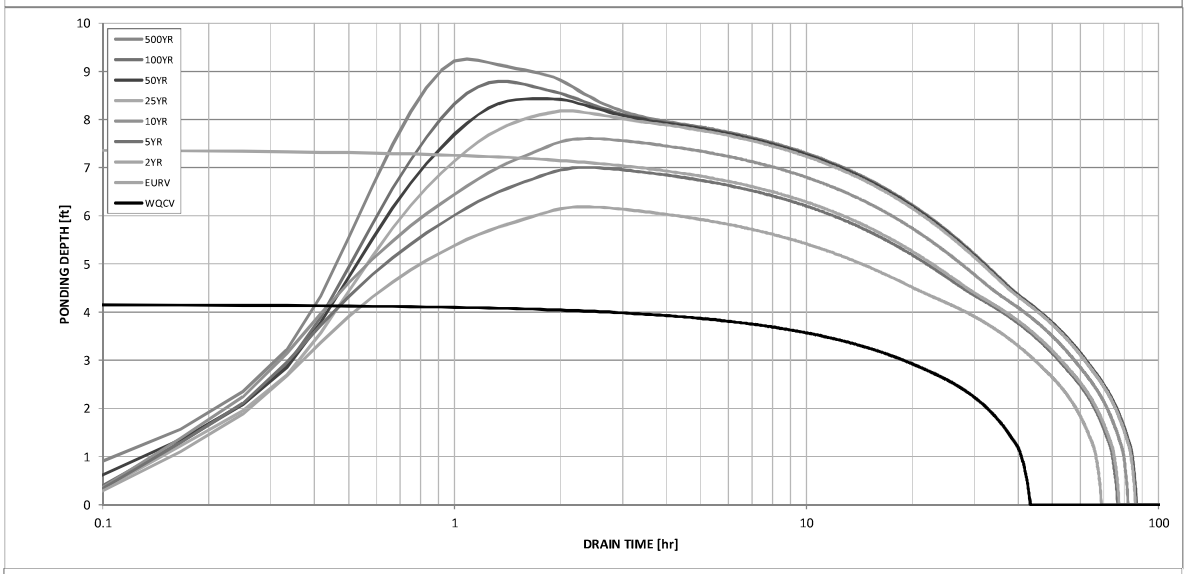
Routed Hydrograph Results *The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

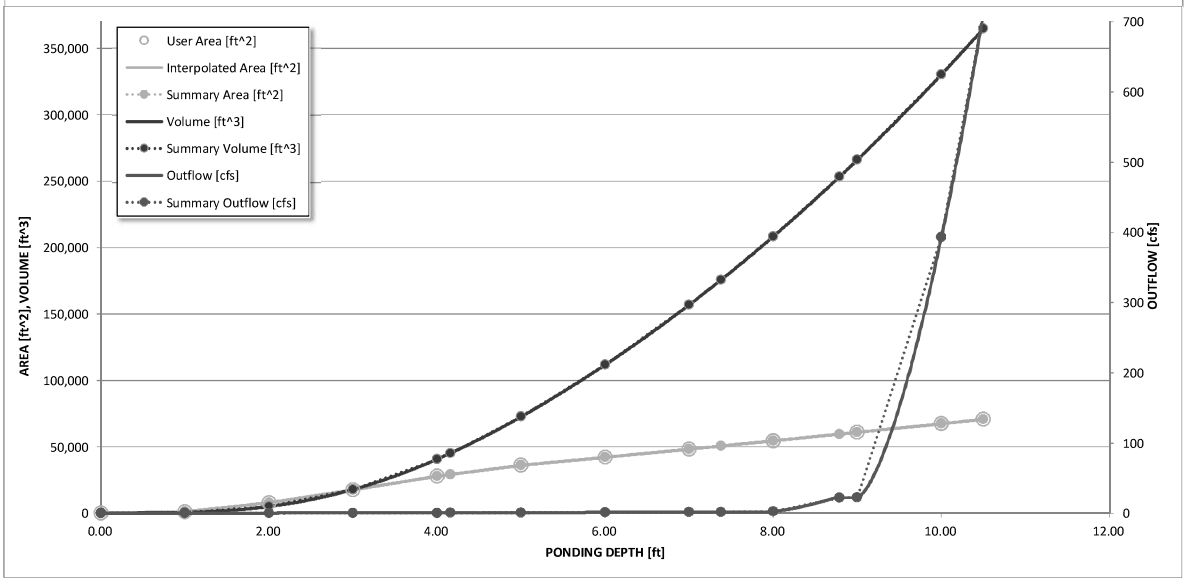
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	1.037	4.024	2.942	3.836	4.555	5.444	6.314	7.348	9.622
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.942	3.836	4.555	5.444	6.314	7.348	9.622
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.3	0.5	0.7	6.7	13.4	22.5	40.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.15	0.31	0.51	0.93
Peak Inflow Q (cfs) =	N/A	N/A	45.5	58.9	68.8	86.3	101.3	120.0	157.6
Peak Outflow Q (cfs) =	0.5	1.5	1.3	1.5	1.6	5.6	12.1	22.2	68.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.7	2.1	0.8	0.9	1.0	1.7
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 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	N/A	0.3	0.8	1.6	1.6
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	67	60	66	71	73	72	71	68
Time to Drain 99% of Inflow Volume (hours) =	**41**	72	65	71	76	80	79	79	78
Maximum Ponding Depth (ft) =	4.16	7.38	6.19	7.00	7.61	8.18	8.43	8.79	9.25
Area at Maximum Ponding Depth (acres) =	0.67	1.16	0.99	1.11	1.19	1.28	1.32	1.37	1.44
Maximum Volume Stored (acre-ft) =	1.039	4.036	2.743	3.604	4.295	5.012	5.336	5.819	6.464

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	0.57	0.06	1.83
	0:15:00	0.00	0.00	5.05	8.22	10.18	6.84	8.59	8.34	12.16
	0:20:00	0.00	0.00	18.49	24.39	28.72	18.15	21.18	22.63	29.51
	0:25:00	0.00	0.00	38.05	50.12	59.86	37.51	43.02	46.17	60.49
	0:30:00	0.00	0.00	45.54	58.87	68.83	74.78	87.92	98.38	130.15
	0:35:00	0.00	0.00	41.90	53.26	61.67	86.30	101.33	119.99	157.58
	0:40:00	0.00	0.00	36.74	45.86	52.97	81.13	95.11	113.39	148.64
	0:45:00	0.00	0.00	31.21	39.50	45.91	70.58	82.55	100.68	132.31
	0:50:00	0.00	0.00	26.39	34.22	39.33	62.32	72.70	88.45	116.56
	0:55:00	0.00	0.00	22.70	29.43	33.99	52.82	61.36	75.91	99.84
	1:00:00	0.00	0.00	20.32	26.23	30.69	44.70	51.70	65.52	86.12
	1:05:00	0.00	0.00	18.51	23.80	28.11	39.37	45.45	58.85	77.48
	1:10:00	0.00	0.00	15.95	21.50	25.59	34.05	39.18	49.59	64.99
	1:15:00	0.00	0.00	13.45	18.71	23.09	29.16	33.43	40.80	53.16
	1:20:00	0.00	0.00	11.32	15.89	20.06	24.06	27.48	32.11	41.61
	1:25:00	0.00	0.00	9.80	13.80	16.95	19.69	22.38	24.67	31.79
	1:30:00	0.00	0.00	8.99	12.73	15.05	15.90	17.99	19.07	24.43
	1:35:00	0.00	0.00	8.58	12.15	13.89	13.59	15.33	15.79	20.11
	1:40:00	0.00	0.00	8.35	11.01	13.06	12.15	13.69	13.82	17.52
	1:45:00	0.00	0.00	8.20	10.02	12.46	11.21	12.62	12.47	15.72
	1:50:00	0.00	0.00	8.08	9.31	12.04	10.55	11.88	11.56	14.50
	1:55:00	0.00	0.00	7.16	8.78	11.48	10.11	11.38	10.90	13.63
	2:00:00	0.00	0.00	6.26	8.16	10.49	9.80	11.03	10.45	13.03
	2:05:00	0.00	0.00	4.79	6.27	8.01	7.59	8.53	8.03	10.00
	2:10:00	0.00	0.00	3.51	4.55	5.79	5.49	6.17	5.81	7.23
	2:15:00	0.00	0.00	2.55	3.31	4.20	3.98	4.47	4.23	5.27
	2:20:00	0.00	0.00	1.84	2.38	3.04	2.89	3.25	3.10	3.85
	2:25:00	0.00	0.00	1.31	1.66	2.15	2.04	2.29	2.19	2.72
	2:30:00	0.00	0.00	0.90	1.13	1.50	1.43	1.60	1.53	1.90
	2:35:00	0.00	0.00	0.60	0.78	1.04	1.01	1.13	1.08	1.34
	2:40:00	0.00	0.00	0.37	0.51	0.66	0.66	0.74	0.70	0.87
	2:45:00	0.00	0.00	0.19	0.30	0.37	0.39	0.43	0.41	0.50
	2:50:00	0.00	0.00	0.08	0.14	0.17	0.18	0.20	0.19	0.24
	2:55:00	0.00	0.00	0.03	0.04	0.05	0.06	0.06	0.06	0.07
	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 4.06 (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.

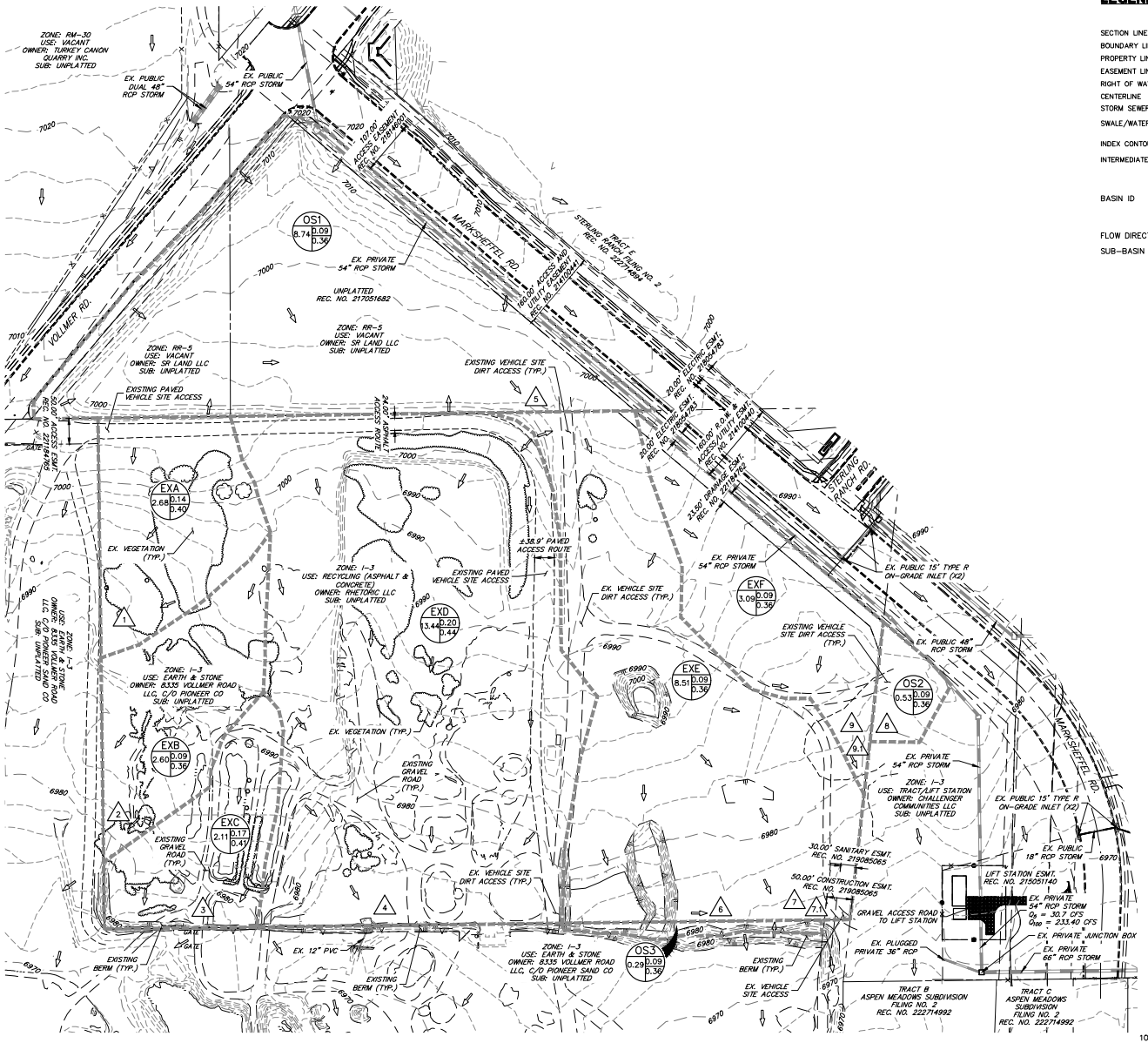
Stage - Storage Description	Stage [ft]	Area [ft²]	Area [acres]	Volume [ft³]	Volume [ac-ft]	Total Outflow [cfs]
6965-Top of Micropool	0.00	10	0.000	0	0.000	0.00
6966	1.00	1,164	0.027	587	0.013	0.09
6967	2.00	7,912	0.182	5,125	0.118	0.21
6968	3.00	17,659	0.405	17,910	0.411	0.33
6969	4.00	27,893	0.640	40,686	0.934	0.44
6969.16-WQCV WSEL	4.16	29,206	0.670	45,254	1.039	0.46
6970	5.00	36,100	0.829	72,683	1.669	0.92
6971	6.00	42,123	0.967	111,794	2.566	1.23
6972	7.00	48,273	1.108	156,992	3.604	1.45
6972.38-EURV WSEL	7.38	50,657	1.163	175,789	4.036	1.53
6973	8.00	54,548	1.252	208,403	4.784	2.49
6973.79-100 yr WSEL	8.79	59,604	1.368	253,493	5.819	22.18
6974-Spillway Crest	9.00	60,948	1.399	266,151	6.110	22.40
6975	10.00	67,404	1.547	330,327	7.583	392.99
6975.50-Top of Pond	10.50	70,671	1.622	364,846	8.376	711.69

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).

STERLING RANCH RECYCLING FACILITY

EXISTING DRAINAGE MAP



LEGEND

	EXISTING	PROPOSED
SECTION LINE		
BOUNDARY LINE		
PROPERTY LINE		
EASEMENT LINE		
RIGHT OF WAY		
CENTERLINE		
STORM SEWER		
SWALE/WATERWAY FLOWLINE		
INDEX CONTOUR	6100	6100
INTERMEDIATE CONTOUR		

BASIN ID — ID / AC / C5 / C100

DESIGN POINT DESIGNATION — 1

FLOW DIRECTION

SUB-BASIN DRAINAGE AREA

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EXA	2.68	8%	0.14	0.40	21.1	1.1	5.4
EXB	2.60	2%	0.09	0.36	25.9	0.6	4.3
EXC	2.11	14%	0.17	0.41	22.4	1.0	4.3
EXD	13.44	17%	0.20	0.44	23.4	7.6	28.1
EXE	8.51	2%	0.09	0.36	27.7	2.0	13.4
EXF	3.09	2%	0.09	0.36	24.1	0.8	5.2
OS1	8.74	2%	0.09	0.36	49.4	1.4	9.2
OS2	0.53	2%	0.09	0.36	15.8	0.2	1.1
OS3	0.29	2%	0.09	0.36	5.0	0.2	0.9

DESIGN POINT

DP	C5 Total	Q100 Total
1	11	5.4
2	06	4.3
3	10	4.3
4	76	28.1
5	14	9.2
6	02	0.9
7	20	13.4
7.1	28	18.3
8	02	1.1
9	08	5.2
9.1	09	6.1

PCD FILE NO. PPR2341 & SF2325
STERLING RANCH RECYCLING FACILITY
EXISTING DRAINAGE MAP
JOB NO. 25188.14
01/19/2024
SHEET 1 OF 1

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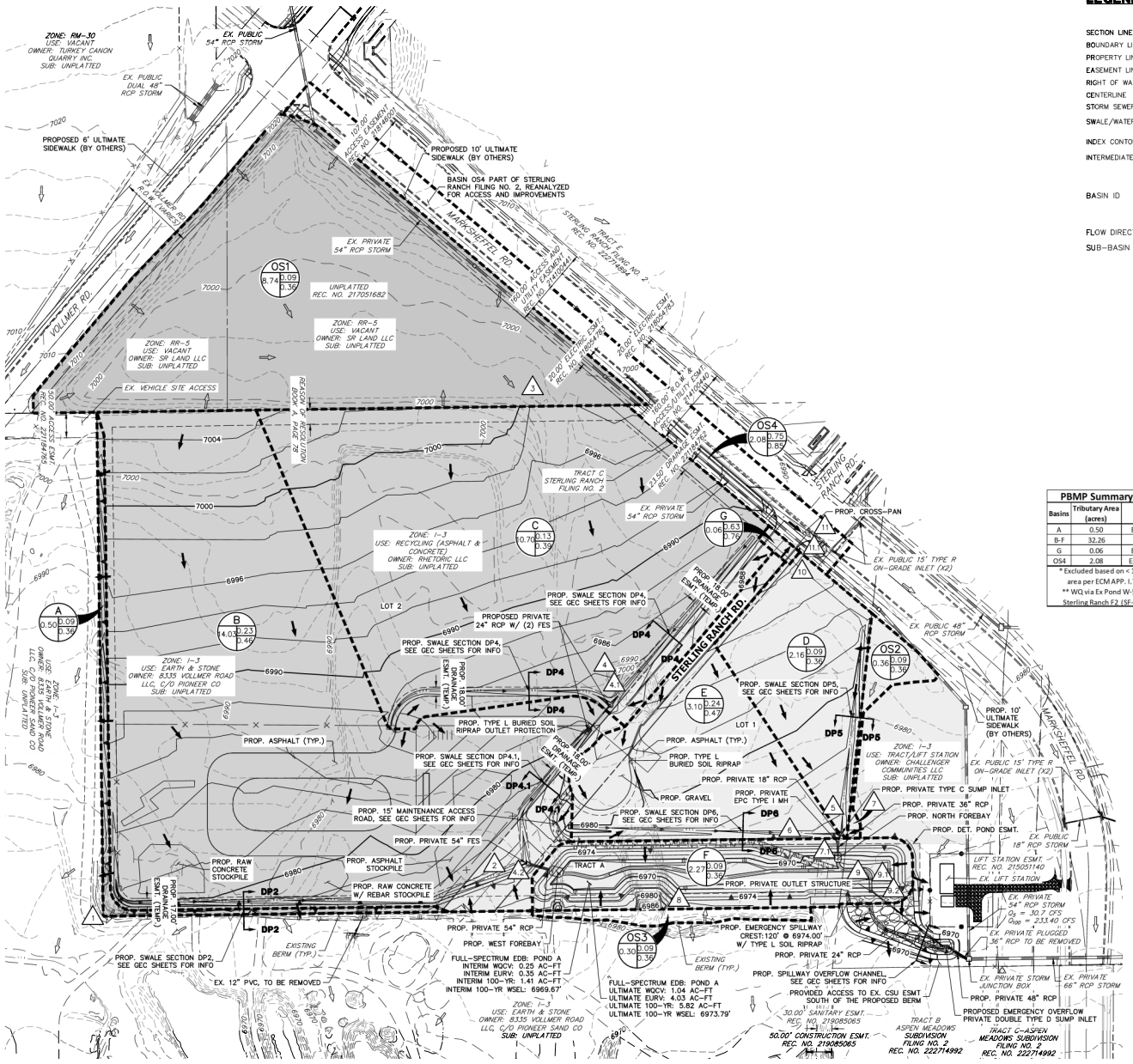
STERLING RANCH RECYCLING FACILITY

PROPOSED DRAINAGE MAP



LEGEND

	EXISTING	PROPOSED
SECTION LINE		
BOUNDARY LINE		
PROPERTY LINE		
EASEMENT LINE		
RIGHT OF WAY		
CENTERLINE		
STORM SEWER		
SWALE/WATERWAY FLOWLINE		
INDEX CONTOUR	6100	6100
INTERMEDIATE CONTOUR		

BASIN ID (ID / AC / C5 / C100)

DESIGN POINT DESIGNATION (1)

FLOW DIRECTION

SUB-BASIN DRAINAGE AREA

ULTIMATE LAND USE LEGEND

INDUSTRIAL-HEAVY AREAS (90% IMPERVIOUS)	
BUSINESS COMMERCIAL AREAS (85% IMPERVIOUS)	
RESIDENTIAL-1/8 ACRE OR LESS (65% IMPERVIOUS)	
NON-RESIDENTIAL COLLECTOR-80' R.O.W. (100% AND 2% IMPERVIOUS)	
HISTORICAL ANALYSIS (2% IMPERVIOUS)	

PBMP Summary Table

Basins	Tributary Area (acres)	PBMP
A	0.50	Excluded*
B-F	32.26	Pond A
G	0.06	Excluded*
OS4	2.08	Excluded**

* Excluded based on < 1 acres of area per ECM APP. I.7.C.1.a
** WQ via Ex Pond W-5 within Sterling Ranch F2 (SF-20-015)

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A	0.50	2%	0.09	0.36	5.0	0.3	1.6
B	14.03	19%	0.23	0.46	34.1	7.4	25.1
C	10.70	6%	0.13	0.39	28.6	3.4	17.7
D	2.16	2%	0.09	0.36	24.1	0.5	3.7
E	3.10	22%	0.24	0.47	22.8	2.2	7.1
F	2.27	2%	0.09	0.36	18.5	0.6	4.4
G	0.06	67%	0.63	0.76	5.3	0.2	0.4
OS1	8.74	2%	0.09	0.36	49.4	1.4	9.2
OS2	0.36	2%	0.09	0.36	16.5	0.1	0.7
OS3	0.30	2%	0.09	0.36	5.0	0.2	1.0
OS4	2.08	82%	0.75	0.85	9.0	6.7	12.8

DESIGN POINT

DP	Q_5 Total	Q_{100} Total
1	0.3	1.6
2	7.4	25.1
3	1.4	9.2
4	3.4	17.7
4.1	3.7	21.1
4.2	9.3	40.1
5	0.5	3.7
6	2.2	7.1
7	0.1	0.7
7.1	2.8	11.2
8	0.2	1.0
9	0.6	4.4
9.1	11.4	49.4
9.2	0.1	8.3
10	0.2	0.4
11	6.7	12.8
11.1	6.9	13.1

N

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

PCD FILE NO. PPR2341 & SF2325
STERLING RANCH RECYCLING FACILITY
PROPOSED DRAINAGE MAP
JOB NO. 25188.14
09/09/2024
SHEET 1 OF 1

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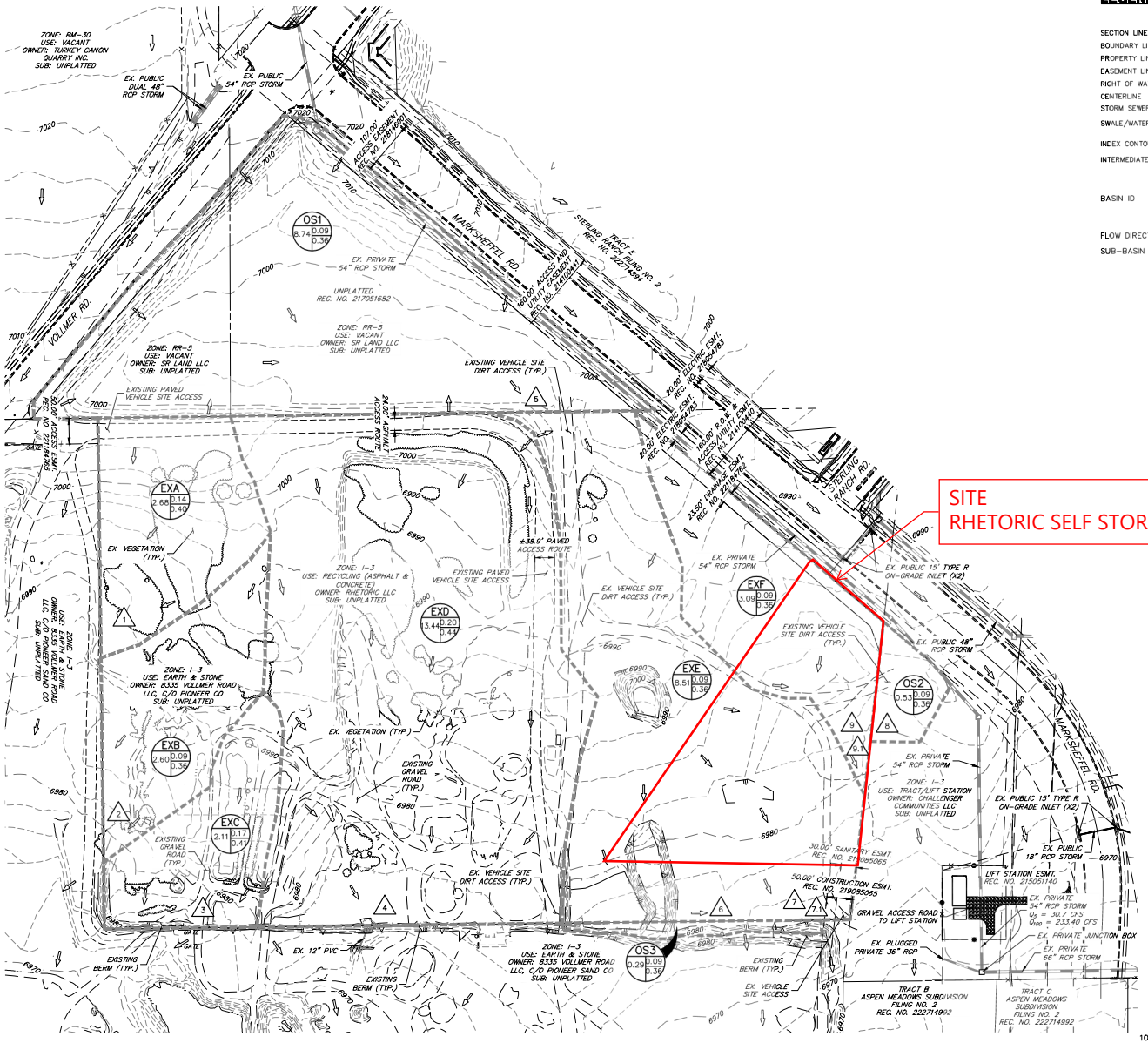
APPENDIX F – DRAINAGE MAPS

STERLING RANCH RECYCLING FACILITY

EXISTING DRAINAGE MAP



LEGEND

	EXISTING	PROPOSED
SECTION LINE		
BOUNDARY LINE		
PROPERTY LINE		
EASEMENT LINE		
RIGHT OF WAY		
CENTERLINE		
STORM SEWER		
SWALE/WATERWAY FLOWLINE		
INDEX CONTOUR	6100	6100
INTERMEDIATE CONTOUR		
BASIN ID	ID AC C5 C100	
DESIGN POINT DESIGNATION	1	
FLOW DIRECTION		
SUB-BASIN DRAINAGE AREA		

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EXA	2.68	8%	0.14	0.40	21.1	1.1	5.4
EXB	2.60	2%	0.09	0.36	25.9	0.6	4.3
EXC	2.11	14%	0.17	0.41	22.4	1.0	4.3
EXD	13.44	17%	0.20	0.44	23.4	7.6	28.1
EXE	8.51	2%	0.09	0.36	27.7	2.0	13.4
EXF	3.09	2%	0.09	0.36	24.1	0.8	5.2
OS1	8.74	2%	0.09	0.36	49.4	1.4	9.2
OS2	0.53	2%	0.09	0.36	15.8	0.2	1.1
OS3	0.29	2%	0.09	0.36	5.0	0.2	0.9

DESIGN POINT

DP	Q5 Total	Q100 Total
1	1.1	5.4
2	0.6	4.3
3	1.0	4.3
4	7.6	28.1
5	1.4	9.2
6	0.2	0.9
7	2.0	13.4
7.1	2.8	18.3
8	0.2	1.1
9	0.8	5.2
9.1	0.9	6.1

PCD FILE NO. PPR2341 & SF2325
STERLING RANCH RECYCLING FACILITY
EXISTING DRAINAGE MAP
JOB NO. 25188.14
01/19/2024
SHEET 1 OF 1

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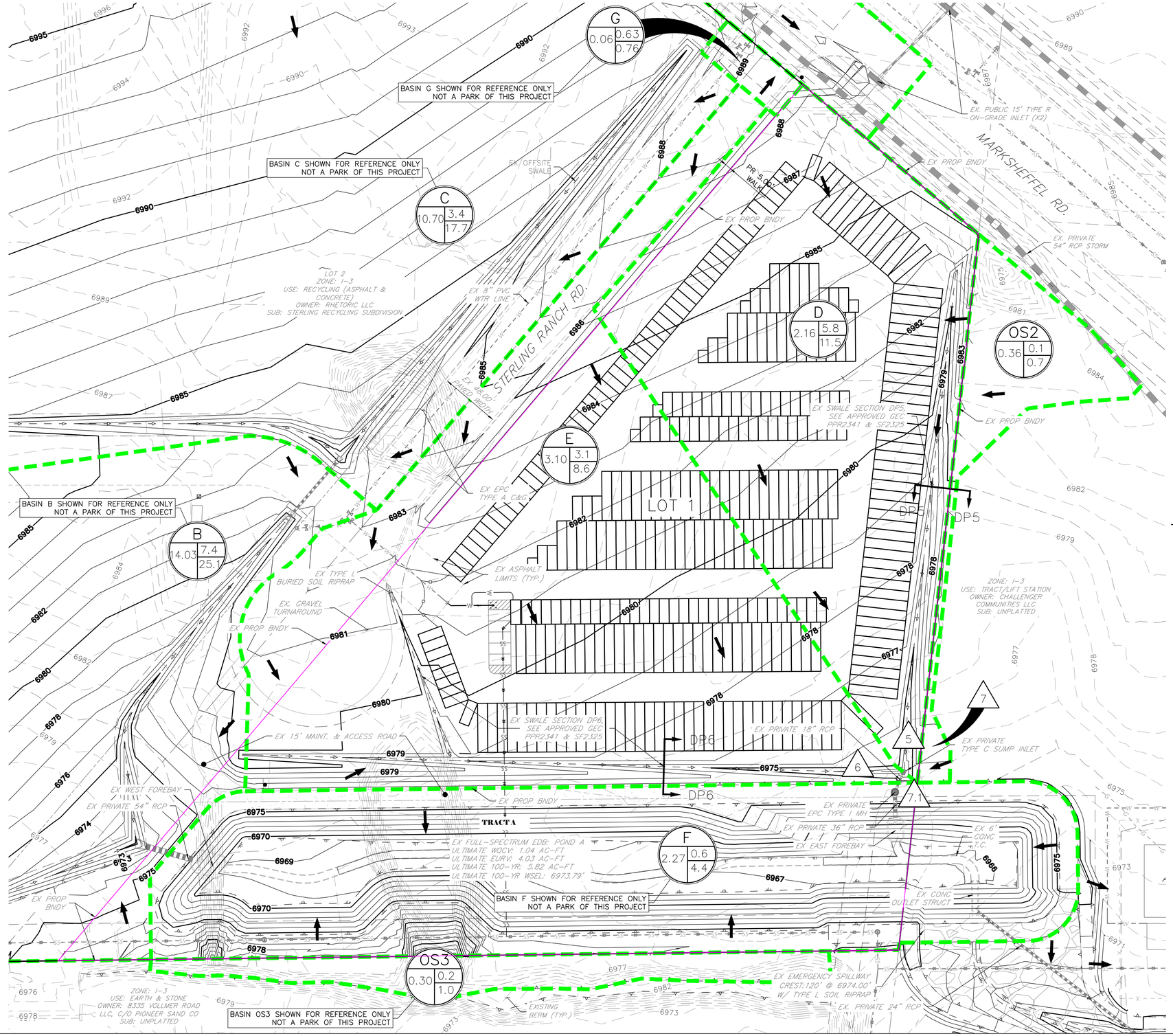
RHETORIC SELF STORAGE

PROPOSED DRAINAGE MAP



LEGEND

	EXISTING	PROPOSED
SECTION LINE		
BOUNDARY LINE		
LOT 1 BOUNDARY LINE		
PROPERTY LINE		
EASEMENT LINE		
RIGHT OF WAY		
CENTERLINE		
STORM SEWER		
SWALE/WATERWAY FLOWLINE		
INDEX CONTOUR	6100	6100
INTERMEDIATE CONTOUR		
100-YEAR FLOODPLAIN	100YR 100YR	
FLOW DIRECTION		

BASIN ID: ID / AC / Q5 / Q100

DESIGN POINT DESIGNATION: 1

SUB-BASIN DRAINAGE AREA

PROPOSED CALCS - BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
D	2.16	73%	0.68	0.79	10.9	5.8	11.5
E	3.10	32%	0.32	0.53	19.4	3.1	8.6
OS2	0.36	2%	0.09	0.36	15.1	0.1	0.8

DESIGN POINT SUMMARY TABLE

DP#	$Q_{5\text{-YR}}$	$Q_{100\text{-YR}}$
5	5.8	11.5
6	3.1	8.6
7	0.1	0.8
7.1	7.8	18.3

PROPOSED DRAINAGE MAP NOTES:

1. PROPOSED GRADING ON THIS DRAINAGE MAP WAS APPROVED WITH PCD FILE NO.: PPR2341 & SF2325. GRADING OPERATIONS HAVE ALREADY COMMENCED ON THE SITE & THE APPROVED GRADING IS SHOWN HERE FOR REFERENCE & IS UNCHANGED FROM THE ORIGINAL PROJECT.

N

40 20 0 40 80

ORIGINAL SCALE: 1" = 40'

PROPOSED DRAINAGE MAP	
RHETORIC SELF STORAGE	
JOB NO. 25005	SHEET 1
LOCATION: EPC	
07/21/2025	

ALL TERRAIN ENGINEERING