

**PRELIMINARY DRAINAGE REPORT  
FOR  
STERLING RANCH FILING NO. 5**

**Prepared For:**

**Classic SRJ Land, LLC  
2138 Flying Horse Club Drive  
Colorado Springs, CO 80921  
(719) 785-3270**

**November 2023  
Project No. 25188.16**

**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 report 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.



Ryan Burns, Colorado P.E. 0054412  
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: Classic SRJ Land, LLC

By:



Title:

VICE PRESIDENT

Address:

2138 Flying Horse Club Drive  
Colorado Springs, CO 80921

**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.

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

**By: Gilbert LaForce, P.E.**  
**Engineering Manager**  
**On behalf of the**  
**ECM Administrator**  
**Date: 01/18/2024 9:20:19 AM**  
El Paso County Department of Public Works



Conditions:





## Table of Contents

Purpose.....	1
General Site Description .....	1
General Location .....	1
Description of Property .....	1
Floodplain Statement.....	1
Existing Drainage Conditions.....	2
Major Basin Descriptions .....	2
Existing Sub-basin Drainage .....	2
Proposed Drainage Conditions .....	4
Proposed Sub-basin Drainage.....	4
Drainage Design Criteria .....	7
Development Criteria Reference .....	7
Hydrologic Criteria.....	7
Hydraulic Criteria.....	7
Drainage Facility Design .....	9
General Concept .....	9
Four Step Process to Minimize Adverse Impacts of Urbanization .....	9
Water Quality .....	10
Erosion Control Plan .....	10
Operation & Maintenance .....	10
Drainage and Bridge Fees .....	10
Summary.....	11
References.....	12

### APPENDIX

- Appendix A – Vicinity Map, Soil Descriptions, FEMA Floodplain Map
- Appendix B – Hydrologic Calcs
- Appendix C – Reference Material
- Appendix D – Drainage Maps



## **PURPOSE**

---

This document is the Preliminary Drainage Report for Sterling Ranch Filing Number 5. The purpose of this report is to identify on-site and off-site drainage patterns, storm sewer, culvert, inlet locations, areas tributary to the site, and to safely route developed storm water to adequate outfall facilities.

## **GENERAL SITE DESCRIPTION**

---

### **GENERAL LOCATION**

Sterling Ranch Filing Number 5 (hereby referred to as the “site”) is a proposed development within the Sterling Ranch master planned community with a total area of approximately 11.6 acres. The site is currently being designed to accommodate approximately 72 urban lots.

The site is located in a portion of the Southeast Quarter (SE ¼) Of Section 33, Township 12 South, Range 65 West of the 6th Principal Meridian County Of El Paso, State Of Colorado. The site is surrounded by Barbarick Subdivision and Branding Iron at Sterling Ranch Filing No. 1 to the north, Sterling Ranch Filing No. 4 to the west, Sterling Ranch Road to the south, and Dines Boulevard to the east.

### **DESCRIPTION OF PROPERTY**

The property will be primarily single-family residential development (approximately 11.6 acres), open space and drainage tracts. The site is comprised of variable sloping grasslands that generally slope(s) downward to the southwest at 1 to 3% towards Sterling Ranch Road and Hazlett Dr.

Soil characteristics are comprised of Type A and B hydrologic soil groups. Refer to the soil survey map in Appendix A for additional information.

There are no major drainage ways running through the site, Sand Creek lies to the east of the site. Currently, JR Engineering, LLC is performing studies and plans to address Sand Creek stabilization. There are no known irrigation facilities located on the project site.

### **FLOODPLAIN STATEMENT**

Based on the FEMA FIRM Maps number 08041C0533G, dated December 7, 2018, the proposed development lies within Zone X. Zone X is defined as area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. FIRM Map is presented in Appendix A.



## EXISTING DRAINAGE CONDITIONS

---

### MAJOR BASIN DESCRIPTIONS

The site lies within the 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 major sub-basins. The site is within the Upper Sand Creek sub-basin as shown in Appendix C.

The Sand Creek DBPS assumed the Sterling Ranch Filing No. 5 property to have a "large lot residential" use for the majority of the site however, the proposed Sterling Ranch master plan is a mix of; school, multi-family, single-family, and commercial land uses, resulting in higher runoff. The "Master Development Drainage Plan for Sterling Ranch"; (MDDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018 assumed a mix of a school site and single family residential lots ranging in size from 0.1 to 0.33 acres for the Sterling Ranch Filing No. 5 site.

Any additional runoff has been provided for with the extended detention basin, “Pond W-5”, located at the southern edge of the Sterling Ranch boundary. The site generally drains from northeast to southwest. The site currently has drainage infrastructure built with prior Sterling Ranch subdivisions filings in the site’s southwest corner that collects and conveys the Sterling Ranch Filing 5 runoff to Pond W-5. Currently, the site is undeveloped vacant land. Sand Creek is located approximately 500 feet east of the site running north to south. Currently, JR engineering is performing studies and plans to address Sand Creek stabilization adjacent to the site under PCD project number CDR-20-004 and is undergoing review.

The proposed drainage on the site closely follows the approved "Master Development Drainage Plan for Sterling Ranch"; (MDDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018. The site is tributary to Pond W-5 and full-spectrum detention for the site was previously analyzed and can be found in the Final Drainage Report for Sterling Ranch Filing 2 as shown in Appendix C.

### EXISTING SUB-BASIN DRAINAGE

The existing condition of the site was broken into four on-site basins, as well as three off-site basins. The basin and sub-basin delineation is shown in the existing drainage map in Appendix D and is described as follows:

**Basin A1** ( $Q_5=1.0$  cfs,  $Q_{100}=7.6$  cfs) is 5.09 acres and 0 percent impervious consists of the northern portion of the proposed Sterling Filing No. 5 site. Runoff from this basin drains via overland flow to the south west into the existing storm sewer built with Filing 4 just north of Sterling Ranch Road located at DP 3 ( $Q_5=2.9$  cfs,  $Q_{100}=16.8$  cfs). Collected runoff is piped west to the DP 5 and then piped via existing storm infrastructure south to Pond W-5 built with Filing 2.



**Basin A2** ( $Q_5=0.8$  cfs,  $Q_{100}=5.9$  cfs) is 2.89 acres and 0 percent impervious consists of the south western portion of the proposed Sterling Filing No. 5 site. Runoff from this basin drains via overland flow to the south west into the existing storm sewer built with Filing 5 just north of Sterling Ranch Road located at DP 3 ( $Q_5=2.9$  cfs,  $Q_{100}=16.8$  cfs). Collected runoff is piped west to the DP 5 and then piped via existing storm infrastructure south to Pond W-5 built with Filing 2.

**Basin A3** ( $Q_5=0.5$  cfs,  $Q_{100}=3.7$  cfs) is 1.94 acres and 0 percent impervious consists of the southern portion of the proposed Sterling Filing No. 5 site. Runoff from this basin drains via overland flow to the south west into the existing storm sewer built with Filing 4 just north of Sterling Ranch Road located at DP 3 ( $Q_5=2.9$  cfs,  $Q_{100}=16.8$  cfs). Collected runoff is piped west to the DP 5 and then piped via existing storm infrastructure south to Pond W-5 built with Filing 2.

**Basin A4** ( $Q_5=6.8$  cfs,  $Q_{100}=16.0$  cfs) is 4.83 acres and 47 percent impervious consists of the southeastern portion of the proposed Sterling Filing No. 5 site as well as the norther portion of Sterling Ranch Road. Runoff from this basin drains via overland flow to Sterling Ranch Road, then west to the existing 15' Type R inlet located at DP 5. Collected runoff is piped via existing storm infrastructure south to Pond W-5 built with Filing 2.

**Basin OS1** ( $Q_5=1.4$  cfs,  $Q_{100}=3.1$  cfs) is 0.77 acres and 65 percent impervious, consists of the southern portion of the proposed Branding Iron at Sterling Ranch Filing No.1. Runoff from this basin drains to the south into the proposed Sterling Filing No.5 northern site sub-basin A1. Runoff is collected into the existing storm sewer built with Filing 4 just north of Sterling Ranch Road located at DP3. Collected runoff is piped west to the DP 5 and then piped via existing storm infrastructure south to Pond W-5 built with Filing 2.

**Basin OS2** ( $Q_5=14.6$  cfs,  $Q_{100}=52.8$  cfs) is 33.07 acres and 19 percent impervious and is located directly north of the site in the Barbarick subdivision per the "Final Drainage Report for Barbarick Subdivision, Portions of Lots 1, 2 and Lots 3&4" prepared by Matrix Design Group dated June 6, 2016. Historic runoff from this site drains south onto the Sterling Ranch Filing 4 site at DP 2. Detained flow from this basin will be piped through the Sterling Ranch Filing 4 site to the detention Pond W-5 and will outfall to Sand Creek. The emergency overflow path for this pond is routed east around the Sterling ranch Filing 4 lots and onto the northwest corner of Sterling Ranch Filing 5. The emergency overflow path is conveyed south via a concrete line swale and grass swale to DP3.

**Basin OS3** ( $Q_5=19.4$  cfs,  $Q_{100}=46.3$  cfs) is 13.90 acres and 49 percent impervious, consists of the Sterling Ranch Filing No.4. Runoff from this basin drains to the southwest into the storm sewer built with Sterling Ranch Filing 4 and DP 4. Collected runoff is piped south to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

## PROPOSED DRAINAGE CONDITIONS

---

### PROPOSED SUB-BASIN DRAINAGE

The proposed site was broken into ten on-site basins and two off-site basin that lead into the existing storm structures on Sterling Ranch Road and Sterling Ranch Filing 4. The proposed basin (and sub-basin) delineation is shown on the proposed drainage basin map within Appendix D and is described as follows.

**Basin A1** ( $Q_5=0.7$  cfs,  $Q_{100}=2.0$  cfs) is 0.65 acres and 37% impervious, consists of single-family residential lots, open space, lawns, concrete trail, and part of an existing concrete channel. Runoff from this basin drains via sheet flow to the swale at DP2 where runoff is collected in an area inlet. The emergency overflow path of the inlet is to the south to the proposed swale. Collected runoff is piped south to the proposed sump inlet at DP5.1. The overall runoff is piped south to Sterling Ranch Road storm infrastructure that eventually conveys runoff to the existing detention Pond W-5 built with Filing 2 and outfalls to Sand Creek.

**Basin A2** ( $Q_5=0.9$  cfs,  $Q_{100}=2.6$  cfs) is 0.78 acres and 46% impervious, consists of single-family residential lots, open space, a sound wall, and lawns. Runoff from this basin drains via sheet flow to the swale at DP1 where it is conveyed west via swale to DP2 and collected in an area inlet. Collected runoff is piped to DP2.1 and then south to DP5.1. The overall runoff is piped south to Sterling Ranch Road storm infrastructure that eventually conveys runoff to the existing detention Pond W-5 built with Filing 2 and outfalls to Sand Creek.

**Basin A3** ( $Q_5=0.8$  cfs,  $Q_{100}=2.5$  cfs) is 0.79 acres and 44% impervious, consists of single-family residential lots, open space, and lawns. Runoff from this basin drains via sheet flow to the swale at DP3 where it is conveyed to the street and sump inlet at DP5.1. The overall runoff is piped south to Sterling Ranch Road storm infrastructure that eventually conveys runoff to the existing detention Pond W-5 built with Filing 2 and outfalls to Sand Creek.

**Basin A4** ( $Q_5=2.8$  cfs,  $Q_{100}=6.0$  cfs) is 1.00 acres and 80% impervious, consists of single-family residential lots, open space, lawns, sidewalks and streets. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter to DP4, then flows to a sump inlet at DP5.1. The collected runoff is piped south to Sterling Ranch Road storm infrastructure that eventually conveys the flow to the existing detention Pond W-5 built with Filing 2 and outfalls to Sand Creek.

**Basin A5** ( $Q_5=5.5$  cfs,  $Q_{100}=13.2$  cfs) is 2.84 acres and 62% impervious, consists of single-family residential lots, open space, lawns, sidewalks and streets. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter to DP5, then flows to a sump inlet at DP5.1. The emergency overflow path of this inlet is to the south to School House Drive. Flows combine with DP.8.1 at DP8.2.



The collected runoff is piped south to Sterling Ranch Road storm structures which eventually conveys the flow to the existing detention Pond W-5 built with Filing 2 and outfalls to Sand Creek.

**Basin A6** ( $Q_5=1.4$  cfs,  $Q_{100}=3.3$  cfs) is 0.66 acres and 58% impervious, consists of single-family residential lots, a sound wall, open space, lawns, sidewalks and streets. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter offsite to the curb and gutter in Dines Boulevard. Flows will pass under the proposed sound wall and will not impact drainage patterns. The flows collect in an existing sump inlet at DP6 and are piped via an existing 24" storm pipe to an existing water quality and detention Pond W-8 on the east side of Dines and eventually outfalls to Sand Creek. Pond W-8 was analyzed with the Sterling Ranch Filing 1, Branding Iron Filing 1 and Branding Iron Filing 2 subdivisions and has a total tributary area of approximately 29 acres. The addition of the Basin A6 flows are assumed to be immaterial but will be further analyzed with the Final Drainage Report for SR Filing 5 to confirm this Preliminary Drainage Report assumption. The existing inlet shall also be checked for capacity with the additional flow to ensure no impacts to existing infrastructure.

**Basin A7** ( $Q_5=3.8$  cfs,  $Q_{100}=9.2$  cfs) is 2.04 acres and 59% impervious, consists of single-family residential lots, open space, lawns, sidewalks and streets. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter to an on-grade inlet at DP7. Flows combine with DP8 at DP8.1. The collected runoff is piped south to Sterling Ranch Road storm infrastructure that eventually conveys the flow to the existing detention Pond W-5 built with Filing 2 and outfalls to Sand Creek. Runoff that is not collected by the inlet at DP7 continues west to an existing sump inlet at DP11 built with Sterling Ranch Filing 4. In the FDR, the existing inlet shall be checked for capacity with the additional flow to ensure no impacts to existing infrastructure. The collected runoff is piped south to Sterling Ranch Road storm infrastructure that eventually conveys the flow to the existing detention Pond W-5 built with Filing 2 and outfalls to Sand Creek.

**Basin A8** ( $Q_5=3.0$  cfs,  $Q_{100}=6.4$  cfs) is 1.10 acres and 77% impervious, consists of single-family residential lots, open space, lawns, sidewalks and streets. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter to an on-grade inlet at DP8. Flows combine with flows of DP7 at DP8.1 ( $Q_5=6.4$  cfs,  $Q_{100}=14.9$  cfs). Then flows combine with DP5.1 at DP8.2 ( $Q_5=15.5$  cfs,  $Q_{100}=38.8$  cfs). The collected runoff is piped south to Sterling Ranch Road storm infrastructure that eventually conveys the flow to the existing detention Pond W-5 built with Filing 2 and outfalls to Sand Creek. Runoff that is not collected by the inlet at DP8 continues west to an existing sump inlet at DP12 built with Sterling Ranch Filing 4. In the FDR, the existing inlet shall be checked for capacity with the additional flow to ensure no impacts to existing infrastructure. The collected runoff is piped south to Sterling Ranch Road storm infrastructure that eventually conveys the flow to the existing detention Pond W-5 built with Filing 2 and outfalls to Sand Creek.

**Basin A9** ( $Q_5=0.3$  cfs,  $Q_{100}=0.8$  cfs) is 0.20 acres and 52% impervious, consists of single-family residential lots, a sound wall, open space, and lawns. Runoff from this basin drains via overland and sheet flow to the curb and gutter on Dines Boulevard. Flows will pass under the proposed sound wall





and will not impact drainage patterns. The flows collect at DP9 and run along the curb and gutter along Sterling Ranch Road to an existing on-grade inlet at DP15 built with Sterling Ranch Filing 2. In the FDR, the existing inlet shall be checked for capacity with the additional flow to ensure no impacts to existing infrastructure. The overall runoff is piped south to Sterling Ranch Road storm infrastructure that eventually conveys the flow to the existing detention Pond W-5 built with Filing 2 and outfalls to Sand Creek.

**Basin A10** ( $Q_5=1.9$  cfs,  $Q_{100}=5.1$  cfs) is 1.32 acres and 52% impervious, consists of single-family residential lots, sound walls, open space, and lawns. Runoff from this basin drains via overland flow and sheet flow to the proposed swale and continues west to the proposed area inlet at DP10. The emergency overflow path is to the west to Hazlett Drive. Flows will pass under the proposed sound wall and will not impact drainage patterns. Flows then combine with DP8.2 flows at DP10.1 ( $Q_5=17.1$  cfs,  $Q_{100}=43.1$  cfs). The overall runoff is piped south to Sterling Ranch Road storm infrastructure that eventually conveys the flow to the existing detention Pond W-5 built with Filing 2 and outfalls to Sand Creek.

**Basin OS1** ( $Q_5=1.4$  cfs,  $Q_{100}=3.4$  cfs) is 0.77 acres and 65% impervious, consists of single-family residential lots, open space, and lawns. Runoff from this basin drains via sheet flow to the swale at DP1 where it is conveyed west via swale to DP2.1 and collected in an area inlet. Collected runoff is piped south to DP5.1. The overall runoff is piped south to Sterling Ranch Road storm infrastructure that eventually conveys runoff to the existing detention Pond W-5 built with Filing 2 and outfalls to Sand Creek.

**Basin C4** ( $Q_5=5.4$  cfs,  $Q_{100}=13.5$  cfs) is 3.67 acres and 62% impervious, consists of a portion of Sterling Ranch Road, a portion of Dines Blvd, Filing 4 single-family residential lots, open space, and lawns. Runoff from this basin drains via sheet flow to the existing curb and gutter where it is conveyed west to the existing on-grade inlet at DP15 built with Sterling Ranch Filing 2. In the FDR, the existing inlet shall be checked for capacity with the additional flow to ensure no impacts to existing infrastructure. The overall runoff is piped south to Sterling Ranch Road storm infrastructure that eventually conveys the flow to the existing detention Pond W-5 built with Filing 2 and outfalls to Sand Creek.

There are several locations where proposed Filing 5 storm sewer connects to existing storm sewer built with previous Sterling Ranch Filings 2 and 4. The proposed Filing 5 flows at DP5.1 ( $Q_5=10.0$  cfs,  $Q_{100}=25.7$  cfs) are located at the same location as Filing 4 DP2.i ( $Q_5=11.6$  cfs,  $Q_{100}=25.7$  cfs) and have less than or equal to the anticipated flow at the existing 24" RCP. The proposed Filing 5 flows at DP8.1 ( $Q_5=6.4$  cfs,  $Q_{100}=14.9$  cfs) are located at the same location as Filing 4 DP3.i ( $Q_5=7.1$  cfs,  $Q_{100}=19.4$  cfs) and have less than the anticipated flow at the existing 18" RCP. The proposed Filing 5 flows at DP8.2 ( $Q_5=15.5$  cfs,  $Q_{100}=38.8$  cfs) are located at the same location as Filing 4 DP3.2 ( $Q_5=16.9$  cfs,  $Q_{100}=40.2$  cfs) and have less than the anticipated flow at the existing storm manhole. The proposed Filing 5 flows at DP10.1 ( $Q_5=17.1$  cfs,  $Q_{100}=43.1$  cfs) are located at the same location as Filing 2 DP2.2



( $Q_5=56.9$  cfs,  $Q_{100}=138.7$  cfs) and have less than the anticipated flow at the existing storm manhole. The proposed Filing 5 flows at DP11, DP12, DP13, DP14, and DP16.1 are the same flows the inlets at Filing 4 DP5, DP6.1, DP6.2, DP9, and DP7.1 capture. The proposed Filing 5 flows at DP15 ( $Q_5=5.6$  cfs,  $Q_{100}=14.1$  cfs) are located the same location as Filing 4 DP8 ( $Q_5=6.1$  cfs,  $Q_{100}=12.9$  cfs). The series of inlets along Sterling Ranch Road and Marksheffel Road to the Aspen Meadows Filing 1 development have the additional capacity to handle the change in bypass flows past this inlet. The proposed Filing 5 flows at DP17.1 ( $Q_5=73.3$  cfs,  $Q_{100}=194.0$  cfs) is located at the same location as Filing 4 DP10 ( $Q_5=55.8$  cfs,  $Q_{100}=149.7$  cfs) and Filing 2 DP2.5 ( $Q_5=96.6$  cfs,  $Q_{100}=250.7$  cfs). The downstream storm infrastructure from this design point was built in Filing 2 and the proposed flows are less than was anticipated in the existing storm manhole.

## 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. Onsite 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

### HYDRAULIC CRITERIA

The Rational Method and USDCM’s SF-2 and SF-3 forms were used to determine the runoff from the minor and major storms on the site. Sump and on-grade inlets will be sized using UDFCD UD-Inlet

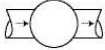



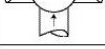

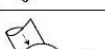


v5.02. StormCAD will be used to model the proposed storm sewer system within the site to analyze the proposed HGL calculations for the Construction Drawings. Autodesk Hydraflow express will be used to size any channels or swales. Manhole and pipe losses for the model will be obtained from the *Modeling Hydraulic and Energy Gradients in Storm Sewers: A Comparison of Computation Methods*, by AMEC Earth & Environmental, Inc. The manhole loss coefficients used in the model can be seen in Table 2 (below) this method is accurate for pipes 42” and smaller for larger pipes the Standard head-loss coefficients as recommended by Bentley were used as shown in Table 3. All hydraulic calculations will be found in the Final Drainage Report Appendices.

**Table 2: Storm Head-loss Coefficients**

StormCAD Conversion Table			
Bend Loss	Bend Angle	K coefficient Conversion	
	0	0.05	
	22.5	0.1	
	45	0.4	
	60	0.64	
	90	1.32	
Lateral Loss	1 Lateral K coefficient Conversion		
	Bend Angle	Non Surcharged	Surcharged
	45	0.27	0.47
	60	0.52	0.9
	90	1.02	1.77
	2 Laterals K coefficient Conversion		
	45	0.96	
	60	1.16	
90	1.52		

**Table 3: Storm Head-loss Coefficients**

Type of Manhole	Diagram	Headloss Coefficient
Trunkline only with no bend at the junction		0.5
Trunkline only with 45° bend at the junction		0.6
Trunkline only with 90° bend at the junction		0.8
Trunkline with one lateral		Small 0.6 Large 0.7
Two roughly equivalent entrance lines with angle < 90° between lines		0.8
Two roughly equivalent entrance lines with angle > 90° between lines		0.9
Three or more entrance lines		1.0

## **DRAINAGE FACILITY DESIGN**

---

### **GENERAL CONCEPT**

The proposed stormwater conveyance system was designed to convey the developed Sterling Ranch Filing No. 5 runoff to an existing (Filing 2) full spectrum water quality and detention Pond W-5 via existing and proposed storm sewer. The existing pond was designed to release at less than historic rates to minimize adverse impacts downstream. Treated water will outfall directly into the Sand Creek Drainageway, where it will eventually outfall into Fountain Creek. A proposed drainage map is presented in Appendix D showing locations of the pond.

### **FOUR STEP PROCESS TO MINIMIZE ADVERSE IMPACTS OF URBANIZATION**

In accordance with the El Paso County Drainage Criteria Manual Volume 2, this site has implemented the four-step process to minimize adverse impacts of urbanization. The four-step process includes reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

**Step 1 – Reducing Runoff Volumes:** The Sterling Ranch Filing No. 5 development project consists of single-family homes with open spaces and lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes. Roof drains from the structures will discharge to lawn areas, where feasible, to allow for infiltration and runoff volume reduction.

**Step 2 – Stabilize Drainage ways:** The site lies within the Sand Creek Drainage Basin. Basin and bridge fees will be due at time of platting. These funds will be used for the channel stabilization being designed by JR Engineering adjacent to the site and on future projects within the basin to stabilize drainage ways. The site does not discharge directly into the open drainage way of Sand Creek, therefore no downstream stabilization will be accomplished with this project

**Step 3 – Treat the WQCV:** Water Quality treatment for this site is provided in the existing full spectrum water quality detention Pond W-5 and Pond W-8. The runoff from this site will be collected within inlets and conveyed to the proposed ponds via storm sewer. Upon entrance to the ponds, flows will be captured in a forebay designed to promote settlement of suspended solids. A trickle channel is also incorporated into the ponds to minimize the amount of standing water. The outlet structures have been designed to detain the water quality capture volume (WQCV) for 40 hours, and the extended urban runoff volume (EURV) for 72 hours. All flows released from the pond will be reduced to less than historic rates.

**Step 4 –BMPs** will be utilized to minimize off-site contaminants and to protect the downstream receiving waters. The Filing No. 5 site is residential. There is no proposed commercial or industrial use for the site. The permanent erosion control BMPs include asphalt drives, storm inlets and storm pipe, the full spectrum detention Pond W-5 and permanent vegetation. Maintenance responsibilities and plans will be defined at the time of final platting.



## WATER QUALITY

In accordance with Section 13.3.2.1 of the CCS/EPCDCM, full-spectrum water quality and detention are provided for all developed basins. This site will drain into an existing Full-Spectrum Drainage Pond W-5 developed during the Sterling Ranch Filing Project. Further details as well as all pond volume, water quality, and outfall calculations are included in the Sterling Ranch Filing 2 Final Drainage Report. Pond W-5 corresponds to pond FSD6 from the Master Development Drainage Plan for Sterling Ranch", (MMDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018 and is releasing less than the MDDP values in the proposed design. A summary of Pond W-5 has been included below for reference. From the Filing No.2 drainage report, Pond W-5 accounted for Sterling Ranch Filing 5 area to have 65% imperviousness. The total imperviousness for the Filing 5 development is 59% imperviousness, and the total runoff is less than what was anticipated; therefore the existing Pond W-5 will function as intended. The FDR will analyze and determine if the existing off-site pond is functioning as intended.

**Table 4: Pond Volumes & Release Rates**

	REQUIRED VOLUME (AC-FT)	VOLUME PROVIDED (AC-FT)	WQCV (AC-FT)	EURV (AC-FT)	5-YEAR RELEASE (CFS)	100-YEAR RELEASE (CFS)
POND W-5	18.217	18.441	3.29	11.71	2.7	137.1

## EROSION CONTROL PLAN

We respectfully request that the Erosion Control Plan and Cost Estimate be submitted in conjunction with the grading and erosion control plan and construction assurances posted prior to obtaining a grading permit.

## OPERATION & MAINTENANCE

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. The district shall be responsible for the inspection, maintenance, rehabilitation and repair of stormwater and erosion control facilities located on the property unless another party accepts such responsibility in writing and responsibility is properly assigned through legal documentation. Access is provided from onsite facilities and easements for proposed infrastructure located offsite. A maintenance road was provided for the existing Pond W-5 and information on the road can be found in the Final Drainage Report for Sterling Ranch Filing No. 2. The maintenance road access is off Marksheffel Road and wraps around the top of the pond providing access to the inflow pipe wing walls and outlet structure for the pond. A maintenance road was provided for the existing Pond W-8 and information on the road can be found in the approved Sterling Ranch Filing No. 1 Storm Sewer Plans. The maintenance road access is off Dines Boulevard and provides access to the inflow pipe forebay and outlet structure for the pond.

## DRAINAGE AND BRIDGE FEES

The site lies within the Sand Creek Drainage Basin. Anticipated drainage and bridge fees will be



defined within the Final Drainage Report and will be due at time of platting (depending on date of plat submittal).

## **SUMMARY**

---

The proposed Sterling Ranch Filing No. 5 drainage improvements were designed to meet or exceed the El Paso County Drainage Criteria. The proposed development will not adversely affect the offsite drainage-ways or surrounding development. The existing Ponds W-5 and W-8 are to release less than 90% of the predeveloped runoff study associated with the subject site. The site is in continuity with the Sterling Ranch Filing No. 2 Drainage Report and the Sterling Ranch Filing No. 4 Drainage Report. This report is in conformance and meets the latest El Paso County Storm Drainage Criteria requirements for this site. The proposed site does not impact any downstream facility or property.



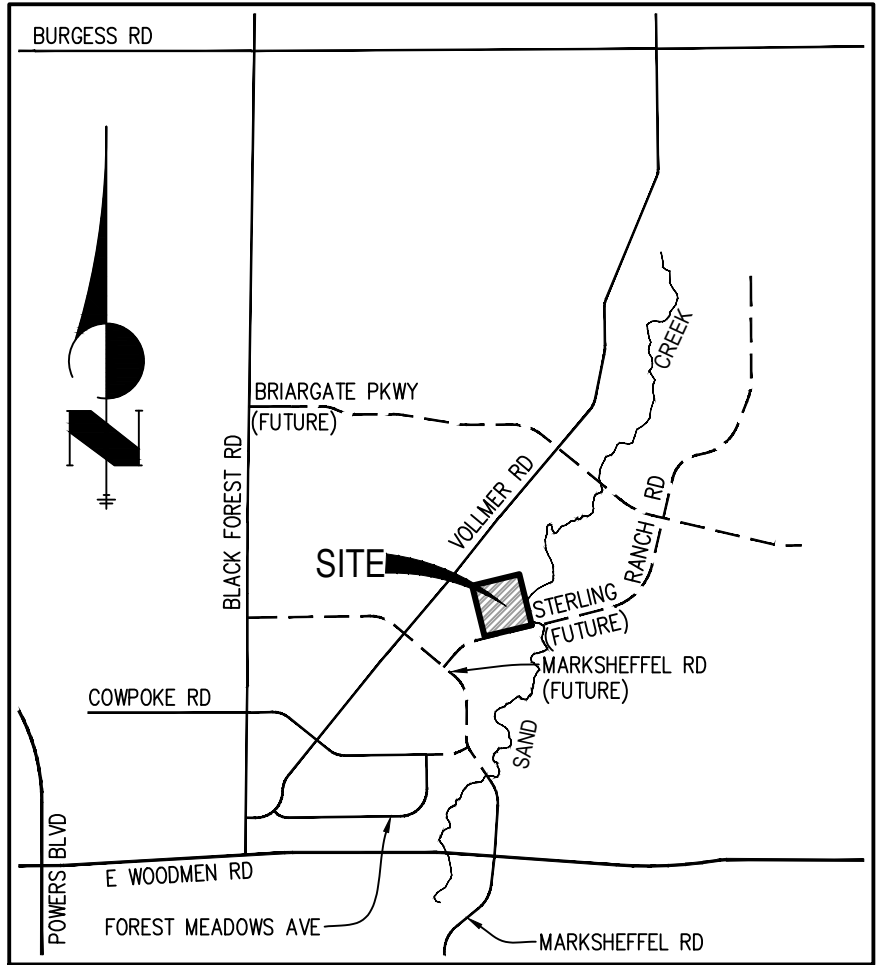
## REFERENCES

---

1. "El Paso County and City of Colorado Springs Drainage Criteria Manual, Vol I & II".
  2. Urban Storm Drainage Criteria Manual (Volumes 1, 2, and 3), prepared by Mile High Flood District, Revised August 2018, September 2017, and January 2021.
  3. "Master Development Drainage Plan for Sterling Ranch", (MMDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018.
  4. Sand Creek Drainage Basin Planning Study, prepared Kiowa Engineering Corporation, January 1993, revised March 1996.
  5. Final Drainage Report For Barbarick Subdivision Portion Of Lots 1,2 And Lots 3 and 4, prepared by Matrix Design Group, dated June 2016
  6. "Final Drainage Report for Sterling Ranch Filing No. 2", prepared by JR Engineering, dated August 2021
  7. "Final Drainage Report for Sterling Ranch Filing No. 4", prepared by JR Engineering, dated August 14, 2023
  8. "Final Drainage Report for Branding Iron at Sterling Ranch Filing No. 1", prepared by M&S Civil Consultants, Inc., dated October 2018
-

**Appendix A**  
**Vicinity Map, Soil Descriptions, FEMA Floodplain Map**





**VICINITY MAP**

N.T.S.

VICINITY MAP  
 HOMESTEAD FILING NO. 5  
 JOB NO. 25188.16  
 8/26/22  
 SHEET 1 OF 1

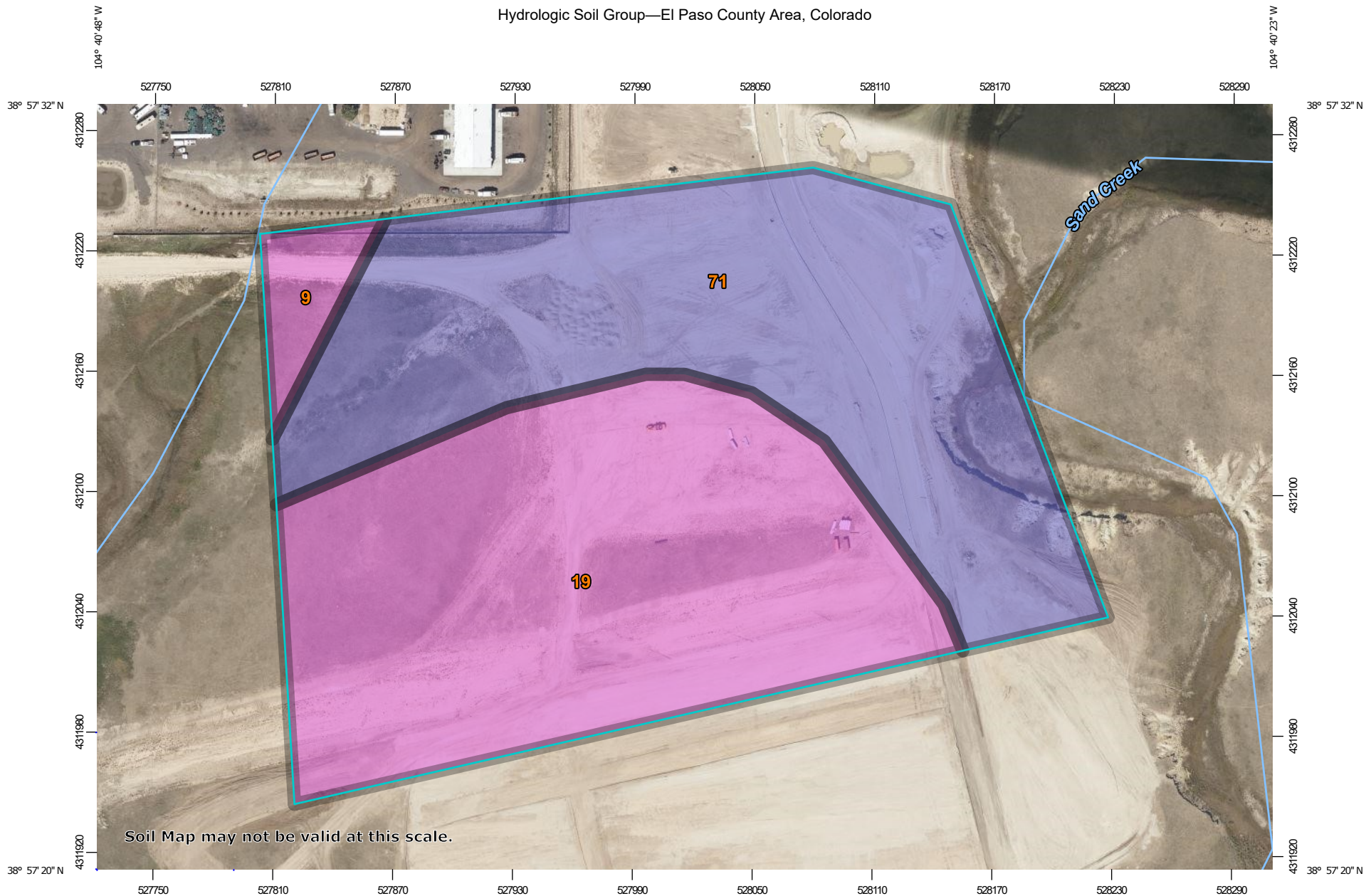


**J·R ENGINEERING**

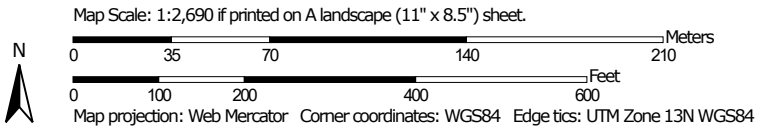
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593  
 Fort Collins 970-491-9888 • [www.jrengineering.com](http://www.jrengineering.com)

































Hydrologic Soil Group—El Paso County Area, Colorado



Soil Map may not be valid at this scale.



### 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
- Water Features**
  -  Streams and Canals
- Transportation**
  -  Rails
  -  Interstate Highways
  -  US Routes
  -  Major Roads
  -  Local Roads
- Background**
  -  Aerial Photography
- Other**
  -  C
  -  C/D
  -  D
  -  Not rated or not available

### 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—Oct 20, 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
9	Blakeland-Fluvaquentic Haplaquolls	A	0.8	3.3%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	12.0	49.0%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	11.7	47.7%
<b>Totals for Area of Interest</b>			<b>24.5</b>	<b>100.0%</b>

### 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.



## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

**NOTES TO USERS**

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The projection used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The horizontal datum was NAD83. GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones across users in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD88). These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov/> or contact the National Geodetic Survey at the following address:

NGS Information Services  
 NOAA, NNGS12  
 National Geodetic Survey  
 SSMC-3, #9222  
 1315 East-West Highway  
 Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for bench marks shown on this map, please contact the information Services Branch of the National Geodetic Survey at (202) 733-3242 or visit its website at <http://www.ngs.noaa.gov/>.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date stream channel configurations and floodplain delineations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed Map Index for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

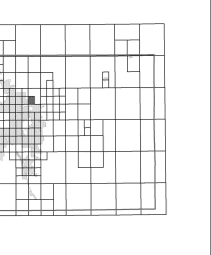
Contact FEMA Map Service Center (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at <http://www.msc.fema.gov/>.

If you have questions about this map or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/inf>.

**El Paso County Vertical Datum Offset Table**

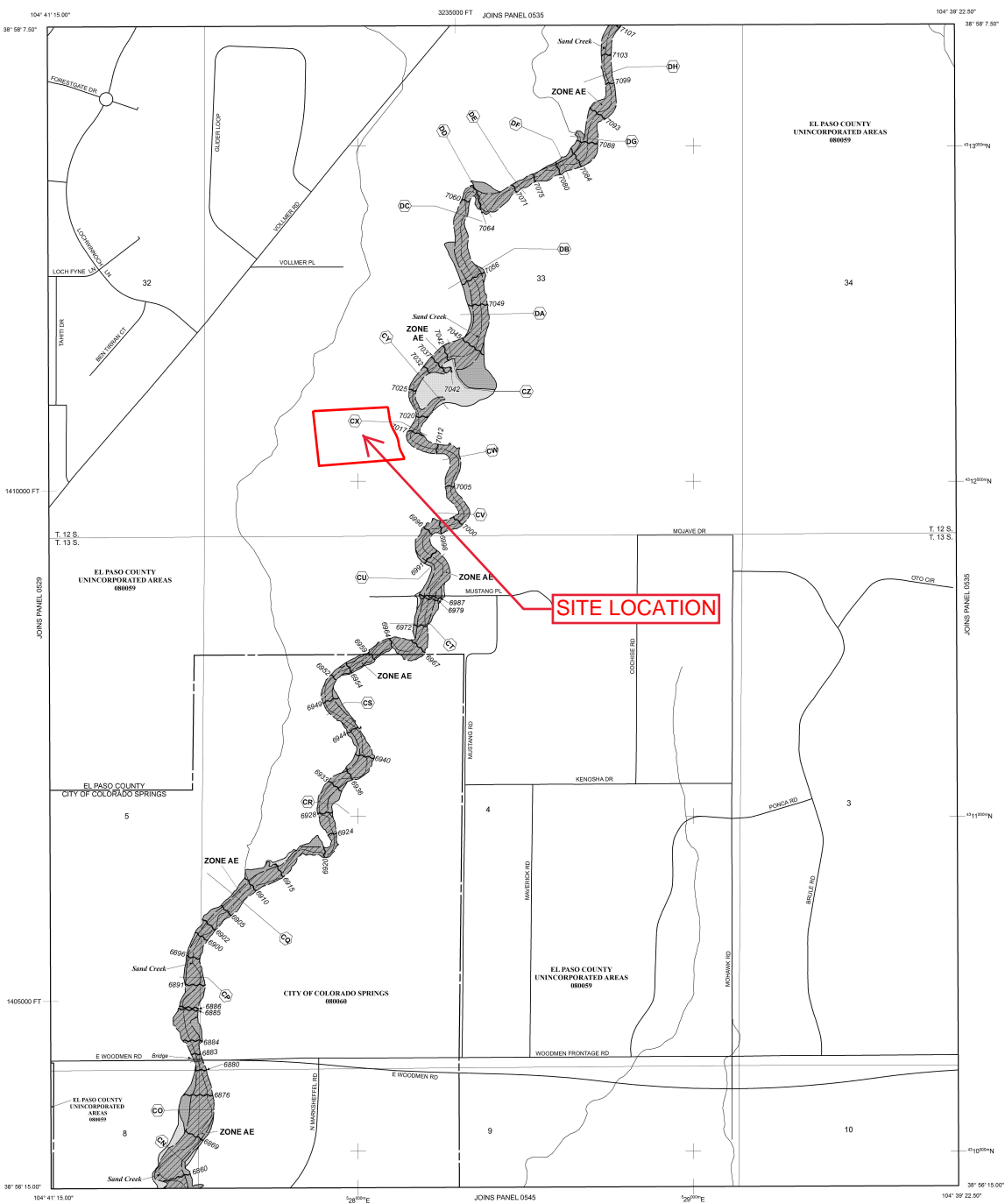
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM/STREAM VERTICAL DATUM CONVERSION INFORMATION	

**Panel Location Map**



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Plan (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST, AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.

**LEGEND**

- SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD
  - ZONE AE** The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AV, and VE. The base flood elevation is the water-surface elevation of the 1% annual chance flood.
  - ZONE A** No Base Flood Elevations determined.
  - ZONE AH** Base Flood Elevations determined.
  - ZONE AO** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
  - ZONE AR** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
  - ZONE AV** Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was previously determined. Zone AV indicates that the former flood control system is being retained to provide protection from the 1% annual chance or greater flood.
  - ZONE VE** Areas to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
  - ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
  - ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.
  - FLOODWAY AREAS IN ZONE AE**
  - OTHER FLOOD AREAS**
  - ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with velocities less than 1 square mile; and areas protected by levees from 1% annual chance flood.
  - OTHER AREAS**
  - ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
  - ZONE D** Areas in which flood hazards are undetermined, but possible.
  - COASTAL BARRIER PROTECTION SYSTEM (CBPS) AREAS**
  - OTHERWISE PROTECTED AREAS (OPA)**
- CBPS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
- Floodplain boundary
  - Floodway boundary
  - Zone D boundary
  - CBPS and OPA boundary
  - Boundary of Special Flood Hazard Area of different Base Flood Elevations, Flood Depths or Flood Velocities
  - Base Flood Elevation line and value, elevation in feet (EL 5.87)
  - Base Flood Elevation value where uniform within zone; elevation in feet
  - Cross section line
  - Transect line
  - Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
  - 1000-meter Universal Transverse Mercator grid ticks, zone 13
  - 500-foot grid ticks, Colorado State Plane coordinate system, central zone (FIPS/DOCS)
  - Lambert Conformal Conic Projection
  - Bench mark (see explanation in Notes to Users section of this FIRM report)
  - River Mile
- MIP REPOSITORIES**  
 Refer to Map Repository list on Map Index
- EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP**  
 MARCH 17, 1997
- EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**  
 DECEMBER 7, 2018 to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Change.
- For community map revision history prior to courtsway mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.
- To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

**NATIONAL FLOOD INSURANCE PROGRAM**

**PANEL 0533G**

**FIRM**  
**FLOOD INSURANCE RATE MAP**  
**EL PASO COUNTY,**  
**COLORADO**  
**AND INCORPORATED AREAS**

**PANEL 533 OF 1300**  
 (SEE MAP INDEX FOR FIRM PANEL LAYOUT)

**CONTAINS:**

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS CITY OF	08008	0003	0
EL PASO COUNTY	08008	0003	0

**MAP NUMBER**  
**08041C0533G**

**MAP REVISED**  
**DECEMBER 7, 2018**

**Federal Emergency Management Agency**

## **Appendix B**

### **Hydrologic Calcs**

## COMPOSITE % IMPERVIOUS & COMPOSITE EXISTING RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Sterling Ranch Subdivision- Existing  
 Location: El Paso County

Project Name: Sterling Ranch Filing 5  
 Project No.: 25188.16  
 Calculated By: DIG  
 Checked By: RAB  
 Date: 11/3/23

Basin ID	Total Area (ac)	Streets (100% Impervious)				Residential (65% Impervious)				Light Industrial (80% Impervious)				Lawns (0% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C <sub>5</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>5</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>5</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>5</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>5</sub>	C <sub>100</sub>	
A1	5.09	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	5.09	0.0%	0.08	0.35	0.0%
A2	2.89	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	2.89	0.0%	0.08	0.35	0.0%
A3	1.94	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	1.94	0.0%	0.08	0.35	0.0%
A4	4.83	0.90	0.96	1.75	36.2%	0.45	0.59	0.80	10.8%	0.59	0.70	0.00	0.0%	0.08	0.35	2.28	0.0%	0.44	0.61	47.0%
OS1	0.77	0.90	0.96	0.00	0.0%	0.45	0.59	0.77	65.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.45	0.59	65.0%
OS2	33.07	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	7.91	19.1%	0.08	0.35	25.16	0.0%	0.20	0.43	19.1%
OS3	13.90	0.90	0.96	2.35	16.9%	0.45	0.59	6.86	32.1%	0.59	0.70	0.00	0.0%	0.08	0.35	4.69	0.0%	0.40	0.57	49.0%
TOTAL (A1-A4)	14.75																			0.0%
TOTAL (OS1-OS3)	47.74																			28.6%
TOTAL	62.49																			25.5%

**EXISTING  
STANDARD FORM SF-2  
TIME OF CONCENTRATION**

Subdivision: Sterling Ranch Subdivision- Existing  
Location: El Paso County

Project Name: Sterling Ranch Filing 5  
Project No.: 25188.16  
Calculated By: DIG  
Checked By: RAB  
Date: 11/3/23

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t <sub>c</sub> CHECK			FINAL
DATA						(T <sub>i</sub> )			(T <sub>i</sub> )					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C <sub>s</sub>	C <sub>100</sub>	L (ft)	S <sub>o</sub> (%)	t <sub>i</sub> (min)	L <sub>t</sub> (ft)	S <sub>t</sub> (%)	K	VEL. (ft/s)	t <sub>t</sub> (min)	COMP. t <sub>c</sub> (min)	TOTAL LENGTH (ft)	Urbanized t <sub>c</sub> (min)	
A1	5.09	B	0%	0.08	0.35	180	1.4%	22.1	497	1.6%	10.0	1.3	6.5	28.7	677.0	33.3	28.7
A2	2.89	A	0%	0.08	0.35	125	4.6%	12.4	385	5.2%	10.0	2.3	2.8	15.3	510.0	29.1	15.3
A3	1.94	A	0%	0.08	0.35	80	1.7%	13.8	385	2.5%	10.0	1.6	4.1	17.9	465.0	30.5	17.9
A4	4.83	A	47%	0.44	0.61	100	3.0%	8.3	1466	1.5%	20.0	2.4	10.0	18.3	1566.0	30.8	18.3
OS1	0.77	A	65%	0.45	0.59	88	2.0%	8.8	122	2.0%	10.0	1.4	1.4	10.2	210.0	15.7	10.2
OS2	33.07	A	19%	0.20	0.43	298	3.0%	19.5	1664	2.7%	10.0	1.6	16.9	36.4	1962.0	37.2	36.4
OS3	13.90	A	49%	0.40	0.57	100	1.8%	10.4	796	1.7%	20.0	2.6	5.1	15.5	896.0	24.1	15.5

NOTES:

$$t_c = t_i + t_t$$

Equation 6-2

$$t_t = \frac{0.395(1.1 - C_s)\sqrt{L_t}}{S_o^{0.33}}$$

Equation 6-3

Where:

t<sub>c</sub> = computed time of concentration (minutes)

t<sub>i</sub> = overland (initial) flow time (minutes)

t<sub>t</sub> = channelized flow time (minutes).

Where:

t<sub>t</sub> = overland (initial) flow time (minutes)

C<sub>s</sub> = runoff coefficient for 5-year frequency (from Table 6-4)

L<sub>t</sub> = length of overland flow (ft)

S<sub>o</sub> = average slope along the overland flow path (ft/ft).

Use a minimum t<sub>c</sub> value of 5 minutes for urbanized areas and a minimum t<sub>c</sub> 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  $t_t = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_o}}$

Equation 6-5

Where:

t<sub>t</sub> = channelized flow time (travel time, min)

L<sub>t</sub> = waterway length (ft)

S<sub>o</sub> = waterway slope (ft/ft)

V<sub>t</sub> = travel time velocity (ft/sec) = K√S<sub>o</sub>

K = NRCS conveyance factor (see Table 6-2).

Where:

t<sub>c</sub> = minimum time of concentration for first design point when less than t<sub>c</sub> from Equation 6-1.

L<sub>t</sub> = length of channelized flow path (ft)

i = imperviousness (expressed as a decimal)

S<sub>o</sub> = 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 Subdivision- Existing  
 Location: El Paso County  
 Design Storm: 5-Year

Project Name: Sterling Ranch Filing 5  
 Project No.: 25188.16  
 Calculated By: DIG  
 Checked By: RAB  
 Date: 11/3/23

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE			TRAVEL TIME			REMARKS	
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street/swale</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)		t <sub>t</sub> (min)
	1	OS1	0.77	0.45	10.2	0.35	4.10	1.4															
	2	OS2	33.07	0.20	36.4	6.68	2.19	14.6															Offsite Barbarick Pond Release Piped to DP4
		A1	5.09	0.08	28.7	0.41	2.55	1.0															
		A2	2.89	0.08	15.3	0.23	3.50	0.8															
		A3	1.94	0.08	17.9	0.16	3.26	0.5															
	3								28.7	1.15	2.55	2.9											Sum of basins A1-A3 and OS1, drain to Ex storm Piped west and south to Ex. Pond W-5
	4	OS3	13.90	0.40	15.5	5.58	3.47	19.4															
	5	A4	4.83	0.44	18.3	2.12	3.22	6.8															Runoff to Ex. Inlet in Sterling Ranch Road Piped south to Ex. Pond W-5

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



STANDARD FORM SF-3 - EXISTING  
STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Filing 5  
 Project No.: 25188.16  
 Calculated By: DIG  
 Checked By: RAB  
 Date: 11/3/23

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)	$t_c$ (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	OS1	0.77	0.59	10.2	0.45	6.88	3.1															
	2	OS2	33.07	0.43	36.4	14.34	3.68	52.8															Offsite Barbarick Pond Release Piped to DP4
		A1	5.09	0.35	28.7	1.78	4.28	7.6															
		A2	2.89	0.35	15.3	1.01	5.87	5.9															
		A3	1.94	0.35	17.9	0.68	5.47	3.7															
	3								28.7	3.92	4.28	16.8											Sum of basins A1-A3 and OS1, drain to Ex storm Piped west and south to Ex. Pond W-5
	4	OS3	13.90	0.57	15.5	7.94	5.83	46.3															
	5	A4	4.83	0.61	18.3	2.95	5.41	16.0															Runoff to Ex. Inlet in Sterling Ranch Road Piped south to Ex. Pond W-5

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

## COMPOSITE % IMPERVIOUS & COMPOSITE PROPOSED RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Sterling Ranch Subdivision -Proposed  
 Location: El Paso County

Project Name: Sterling Ranch Filing 5  
 Project No.: 25188.16  
 Calculated By: GAG  
 Checked By: \_\_\_\_\_  
 Date: 11/3/23

Basin ID	Total Area (ac)	Paved/Streets (100% Impervious)				Residential (65% Impervious)				Lawns (0% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C <sub>5</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>5</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>5</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>5</sub>	C <sub>100</sub>	
A1	0.65	0.90	0.96	0.07	10.8%	0.45	0.59	0.26	26.0%	0.08	0.35	0.32	0.0%	0.32	0.51	36.8%
A2	0.78	0.90	0.96	0.03	3.8%	0.45	0.59	0.50	41.7%	0.08	0.35	0.25	0.0%	0.35	0.53	45.5%
A3	0.79	0.90	0.96	0.00	0.0%	0.45	0.59	0.54	44.4%	0.08	0.35	0.25	0.0%	0.33	0.51	44.4%
A4	1.00	0.90	0.96	0.59	59.0%	0.45	0.59	0.32	20.8%	0.08	0.35	0.09	0.0%	0.68	0.79	79.8%
A5	2.84	0.90	0.96	0.74	26.1%	0.45	0.59	1.55	35.5%	0.08	0.35	0.55	0.0%	0.50	0.64	61.5%
A6	0.66	0.90	0.96	0.10	15.2%	0.45	0.59	0.43	42.3%	0.08	0.35	0.13	0.0%	0.45	0.60	57.5%
A7	2.04	0.90	0.96	0.71	34.8%	0.45	0.59	0.76	24.2%	0.08	0.35	0.57	0.0%	0.50	0.65	59.0%
A8	1.10	0.90	0.96	0.51	46.4%	0.45	0.59	0.52	30.7%	0.08	0.35	0.07	0.0%	0.64	0.75	77.1%
A9	0.20	0.90	0.96	0.00	0.0%	0.45	0.59	0.16	52.0%	0.08	0.35	0.04	0.0%	0.38	0.54	52.0%
A10	1.32	0.90	0.96	0.01	0.8%	0.45	0.59	1.05	51.7%	0.08	0.35	0.26	0.0%	0.38	0.55	52.5%
OS1	0.77	0.90	0.96	0.00	0.0%	0.45	0.59	0.77	65.0%	0.08	0.35	0.00	0.0%	0.45	0.59	65.0%
C4	3.67	0.90	0.96	1.75	47.7%	0.45	0.59	0.83	14.7%	0.08	0.35	1.09	0.0%	0.55	0.70	62.4%
TOTAL (A1-A10)	11.38															59.0%
TOTAL	15.82															60.1%

## PROPOSED STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Sterling Ranch Subdivision -Proposed  
Location: El Paso County

Project Name: Sterling Ranch Filing 5  
Project No.: 25188.16  
Calculated By: GAG  
Checked By: \_\_\_\_\_  
Date: 11/3/23

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t <sub>c</sub> CHECK			FINAL
DATA						(T <sub>i</sub> )			(T <sub>t</sub> )					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C <sub>5</sub>	C <sub>100</sub>	L (ft)	S <sub>o</sub> (%)	t <sub>i</sub> (min)	L <sub>t</sub> (ft)	S <sub>t</sub> (%)	K	VEL. (ft/s)	t <sub>t</sub> (min)	COMP. t <sub>c</sub> (min)	TOTAL LENGTH (ft)	Urbanized t <sub>c</sub> (min)	t <sub>c</sub> (min)
A1	0.65	B	37%	0.32	0.51	70	2.2%	9.1	335	0.7%	7.0	0.6	9.3	18.5	405.0	24.4	18.5
A2	0.78	B	46%	0.35	0.53	70	2.0%	9.0	345	1.0%	7.0	0.7	8.2	17.2	415.0	22.0	17.2
A3	0.79	A	44%	0.33	0.51	115	2.5%	11.0	420	1.5%	7.0	0.9	8.2	19.1	535.0	22.2	19.1
A4	1.00	A	80%	0.68	0.79	30	2.0%	3.3	950	1.6%	20.0	2.5	6.4	9.6	980.0	18.7	9.6
A5	2.84	A	62%	0.50	0.64	30	2.0%	4.8	1035	1.6%	20.0	2.5	6.8	11.6	1065.0	23.3	11.6
A6	0.66	A	58%	0.45	0.60	30	2.0%	5.2	300	1.9%	20.0	2.8	1.8	7.0	330.0	18.3	7.0
A7	2.04	A	59%	0.50	0.65	95	2.0%	8.4	750	1.6%	20.0	2.6	4.9	13.2	845.0	21.6	13.2
A8	1.10	A	77%	0.64	0.75	30	2.0%	3.7	830	1.6%	20.0	2.5	5.5	9.1	860.0	18.4	9.1
A9	0.20	A	52%	0.38	0.54	85	2.3%	9.2	170	1.5%	20.0	2.4	1.2	10.3	255.0	18.6	10.3
A10	1.32	A	52%	0.38	0.55	75	3.5%	7.4	665	1.0%	20.0	2.0	5.5	13.0	740.0	23.9	13.0
OS1	0.77	A	65%	0.45	0.59	90	2.0%	8.9	125	2.0%	10.0	1.4	1.5	10.3	215.0	15.8	10.3
C4	3.67	A	62%	0.55	0.70	20	2.0%	3.5	1745	1.5%	10.0	1.2	23.7	27.2	1765.0	28.8	27.2

NOTES:

$$t_c = t_i + t_t$$

Equation 6-2

Where:

t<sub>c</sub> = computed time of concentration (minutes)

t<sub>i</sub> = overland (initial) flow time (minutes)

t<sub>t</sub> = channelized flow time (minutes).

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

Where:

t<sub>t</sub> = channelized flow time (travel time, min)  
L<sub>t</sub> = waterway length (ft)  
S<sub>o</sub> = waterway slope (ft/ft)  
V<sub>t</sub> = travel time velocity (ft/sec) = K√S<sub>o</sub>  
K = NRCS conveyance factor (see Table 6-2).

Use a minimum t<sub>c</sub> value of 5 minutes for urbanized areas and a minimum t<sub>c</sub> value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S_o^{0.33}}$$

Equation 6-3

Where:

t<sub>i</sub> = overland (initial) flow time (minutes)  
C<sub>5</sub> = runoff coefficient for 5-year frequency (from Table 6-4)  
L = length of overland flow (ft)  
S<sub>o</sub> = average slope along the overland flow path (ft/ft).

Equation 6-4

$$t_t = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Equation 6-5

Where:

t<sub>t</sub> = minimum time of concentration for first design point when less than t<sub>c</sub> from Equation 6-1.  
L<sub>t</sub> = length of channelized flow path (ft)  
i = imperviousness (expressed as a decimal)  
S<sub>t</sub> = 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 Subdivision -Proposed  
Location: El Paso County  
Design Storm: 5-Year

Project Name: Sterling Ranch Filing 5  
Project No.: 25188.16  
Calculated By: GAG  
Checked By: \_\_\_\_\_  
Date: 11/3/23

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE			TRAVEL TIME			REMARKS	
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street/swale</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)		t <sub>t</sub> (min)
		OS1	0.77	0.45	10.3	0.35	4.08	1.4															Off-site flows overland into Basin A2 Combines flow in swale at DP1
		A2	0.78	0.35	17.2	0.27	3.31	0.9															Flows overland into swale at DP1 Combines flow in swale at DP1
	1								17.2	0.62	3.31	2.1											Combined flow of Basin OS1 and Basin A2 within swale Flows continue in swale to DP2
	2	A1	0.65	0.32	18.5	0.21	3.21	0.7															Flows overland into swale at DP2 Combines flow in area inlet at DP2.1
	2.1								18.5	0.83	3.21	2.7											Combined flow of DP1 and DP2 within area inlet Flows piped to sump inlet at DP5.1
	3	A3	0.79	0.33	19.1	0.26	3.16	0.8															Flows overland into swale at DP3 Combines flow at sump inlet at DP5
	4	A4	1.00	0.68	9.6	0.68	4.18	2.8															Flows along c&g at DP4 Combines flow at sump inlet at DP5
		A5	2.84	0.50	11.6	1.41	3.91	5.5															Flows along c&g at within Basin A5 Combines flow at sump inlet at DP5
	5								19.1	2.35	3.16	7.4											Combined flow of DP3, DP4, and Basin A5 within sump inlet Flows piped to sump inlet at DP5.1
	5.1								19.1	3.18	3.16	10.0											Combined flow of DP2.1 and DP5 within pipe Flows piped to manhole at DP8.2
	6	A6	0.66	0.45	7.0	0.29	4.67	1.4															Flows off-site along ex. Dines Blvd. c&g to ex. sump inlet at DP6 Flows piped to ex. Pond W-8
	7	A7	2.04	0.50	13.2	1.03	3.71	3.8															Flows along c&g to the on-grade inlet at DP7 Captured flows piped to manhole at DP8.1, bypass runoff to ex. sump inlet at DP11
	8	A8	1.10	0.64	9.1	0.70	4.27	3.0															Flows along c&g to the on-grade inlet at DP8 Captured flows piped to manhole at DP8.1
	8.1								13.2	1.73	3.71	6.4											Combined flow of DP7 and DP8 at manhole Flows piped to manhole at DP8.2
	8.2								19.1	4.91	3.16	15.5											Combined flow of DP5.1 and DP8.1 at manhole Flows piped to ex. manhole at DP10.1
	9	A9	0.20	0.38	10.3	0.08	4.08	0.3															Flows off-site along ex. Dines Blvd. c&g to ex. Sterling Ranch Road c&g Flows to ex. inlet at DP15
	10	A10	1.32	0.38	13.0	0.50	3.74	1.9															Flows into swale to area inlet at DP10 Piped to manhole at DP10.1
	10.1								19.1	5.41	3.16	17.1											Combined flow of DP8.2 and DP10 at manhole Piped to ex. Filing 4 storm sewer and combines at manhole at DP17.1

**STANDARD FORM SF-3 - PROPOSED**  
**STORM DRAINAGE SYSTEM DESIGN**  
(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Filing 5  
Project No.: 25188.16  
Calculated By: GAG  
Checked By: \_\_\_\_\_  
Date: 11/3/23

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE			TRAVEL TIME			REMARKS	
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street/swale</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)		t <sub>t</sub> (min)
	11	EX F4 DP5					12.0								12.0								Captured runoff to ex. sump inlet at Filing 4 DP5 Piped to sump inlet at DP13
	12	EX F4 DP6.1					3.9								3.9								Captured runoff to ex. sump inlet at Filing 4 DP6.1 Piped to sump inlet at DP13
	13	EX F4 DP6.2					2.0								2.0								Captured runoff to ex. sump inlet at Filing 4 DP6.2 Piped to sump inlet at DP13
	13.1	EX F4 DP6.3					16.9																Combined captured flow DP11, DP12, and DP13 at Filing 4 DP6.3 Piped to manhole at DP17.1
	14	EX F4 DP9					3.8								3.8								Combined flow of DP9 and Basin C4 Piped to ex. Filing 4 storm sewer and combines at manhole at DP17.1
		C4	3.67	0.55	27.2	2.04	2.63	5.4															Flows off-site along ex. Dines Blvd. c&g to ex. Sterling Ranch Road c&g Flows to ex. inlet at DP15
	15							27.2	2.12	2.63	5.6												Combined flow of DP9 and Basin C4 Piped to ex. Filing 4 storm sewer and combines at manhole at DP17.1
	16.1	EX F4 DP7.1					30.0																Total runoff to ex. manhole at Filing 4 DP7.1 Piped to DP15 and combines at manhole at DP17.1
	17.1										73.3												Combined flow of DP10.1, DP13.1, DP14, DP15 and DP16.1. Filing 4 DP10. Total runoff piped to ex. Pond W-5

Notes:  
Street and Pipe C\*A values are determined by Q/i using the catchment's intensity value.  
Values in **BLUE** indicate they are from the approved "Final Drainage Report for Sterling Ranch Filing No. 4" dated August 14, 2023 by JR Engineering

**STANDARD FORM SF-3 - PROPOSED**  
**STORM DRAINAGE SYSTEM DESIGN**  
 (RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Filing 5  
 Project No.: 25188.16  
 Calculated By: GAG  
 Checked By: \_\_\_\_\_  
 Date: 11/3/23

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coef.	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street/swale</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>c</sub> (min)	
		OS1	0.77	0.59	10.3	0.45	7.48	3.4															Off-site flows overland into Basin A2 Combines flow in swale at DP1
		A2	0.78	0.53	17.2	0.41	6.33	2.6															Flows overland into swale at DP1 Combines flow in swale at DP1
	1								17.2	0.86	6.33	5.4											Combined flow of Basin OS1 and Basin A2 within swale Flows continue in swale to DP2
	2	A1	0.65	0.51	18.5	0.33	6.17	2.0															Flows overland into swale at DP2 Combines flow in area inlet at DP2.1
	2.1								18.5	1.19	6.17	7.3											Combined flow of DP1 and DP2 within area inlet Flows piped to sump inlet at DP5.1
	3	A3	0.79	0.51	19.1	0.41	6.09	2.5															Flows overland into swale at DP3 Combines flow at sump inlet at DP5
	4	A4	1.00	0.79	9.6	0.79	7.64	6.0															Flows along c&g at DP4 Combines flow at sump inlet at DP5
		A5	2.84	0.64	11.6	1.82	7.23	13.2															Flows along c&g at within Basin A5 Combines flow at sump inlet at DP5
	5								19.1	3.02	6.09	18.4											Combined flow of DP3, DP4, and Basin A5 within sump inlet Flows piped to sump inlet at DP5.1
	5.1								19.1	4.21	6.09	25.7											Combined flow of DP2.1 and DP5 within pipe Flows piped to manhole at DP8.2
	6	A6	0.66	0.60	7.0	0.40	8.37	3.3															Flows off-site along ex. Dines Blvd. c&g to ex. sump inlet at DP6 Flows piped to ex. Pond W-8
	7	A7	2.04	0.65	13.2	1.33	6.92	9.2															Flows along c&g to the on-grade inlet at DP7 Captured flows piped to manhole at DP8.1, bypass runoff to ex. sump inlet at DP11
	8	A8	1.10	0.75	9.1	0.82	7.76	6.4															Flows along c&g to the on-grade inlet at DP8 Captured flows piped to manhole at DP8.1
	8.1								13.2	2.15	6.92	14.9											Combined flow of DP7 and DP8 at manhole Flows piped to manhole at DP8.2
	8.2								19.1	6.36	6.09	38.8											Combined flow of DP5.1 and DP8.1 at manhole Flows piped to ex. manhole at DP10.1
	9	A9	0.20	0.54	10.3	0.11	7.49	0.8															Flows off-site along ex. Dines Blvd. c&g to ex. Sterling Ranch Road c&g Flows to ex. inlet at DP15
	10	A10	1.32	0.55	13.0	0.72	6.97	5.0															Flows into swale to area inlet at DP10 Piped to manhole at DP10.1
	10.1								19.1	7.08	6.09	43.1											Combined flow of DP8.2 and DP10 at manhole Piped to ex. Filing 4 storm sewer and combines at manhole at DP17.1

**STANDARD FORM SF-3 - PROPOSED**  
**STORM DRAINAGE SYSTEM DESIGN**  
(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Filing 5  
Project No.: 25188.16  
Calculated By: GAG  
Checked By: \_\_\_\_\_  
Date: 11/3/23

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street/swale</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>c</sub> (min)	
	11	EX F4 DP5					25.9								13.5								Captured runoff to ex. sump inlet at Filing 4 DP5 Piped to sump inlet at DP13
	12	EX F4 DP6.1					19.3								16.2								Captured runoff to ex. sump inlet at Filing 4 DP6.1 Piped to sump inlet at DP13
	13	EX F4 DP6.2					7.3								7.3								Captured runoff to ex. sump inlet at Filing 4 DP6.2 Piped to sump inlet at DP13
	13.1	EX F4 DP6.3					35.6																Combined captured flow DP11, DP12, and DP13 at Filing 4 DP6.3 Piped to manhole at DP17.1
	14	EX F4 DP9					7.9								7.7								Combined flow of DP9 and Basin C4 Piped to ex. Filing 4 storm sewer and combines at manhole at DP17.1
		C4	3.67	0.70	27.2	2.55	5.30	13.5															Flows off-site along ex. Dines Blvd. c&g to ex. Sterling Ranch Road c&g Flows to ex. inlet at DP15
	15							27.2	2.66	5.30	14.1												Combined flow of DP9 and Basin C4 Piped to ex. Filing 4 storm sewer and combines at manhole at DP17.1
	16.1	EX F4 DP7.1					93.5																Total runoff to ex. manhole at Filing 4 DP7.1 Piped to DP15 and combines at manhole at DP17.1
	17.1										194.0												Combined flow of DP10.1, DP13.1, DP14, DP15 and DP16.1. Filing 4 DP10. Total runoff piped to ex. Pond W-5

Notes:  
Street and Pipe C\*A values are determined by Q/I using the catchment's intensity value.  
Values in BLUE indicate they are from the approved "Final Drainage Report for Sterling Ranch Filing No. 4" dated August 14, 2023 by JR Engineering



**Appendix C**  
**Reference Material**

# MASTER DEVELOPMENT DRAINAGE PLAN FOR STERLING RANCH

OCTOBER 2018

Prepared for:

**Morley-Bentley Investments, LLC**  
20 Boulder Crescent, 2<sup>nd</sup> Floor  
Colorado Springs, CO 80903  
(719) 471-1742

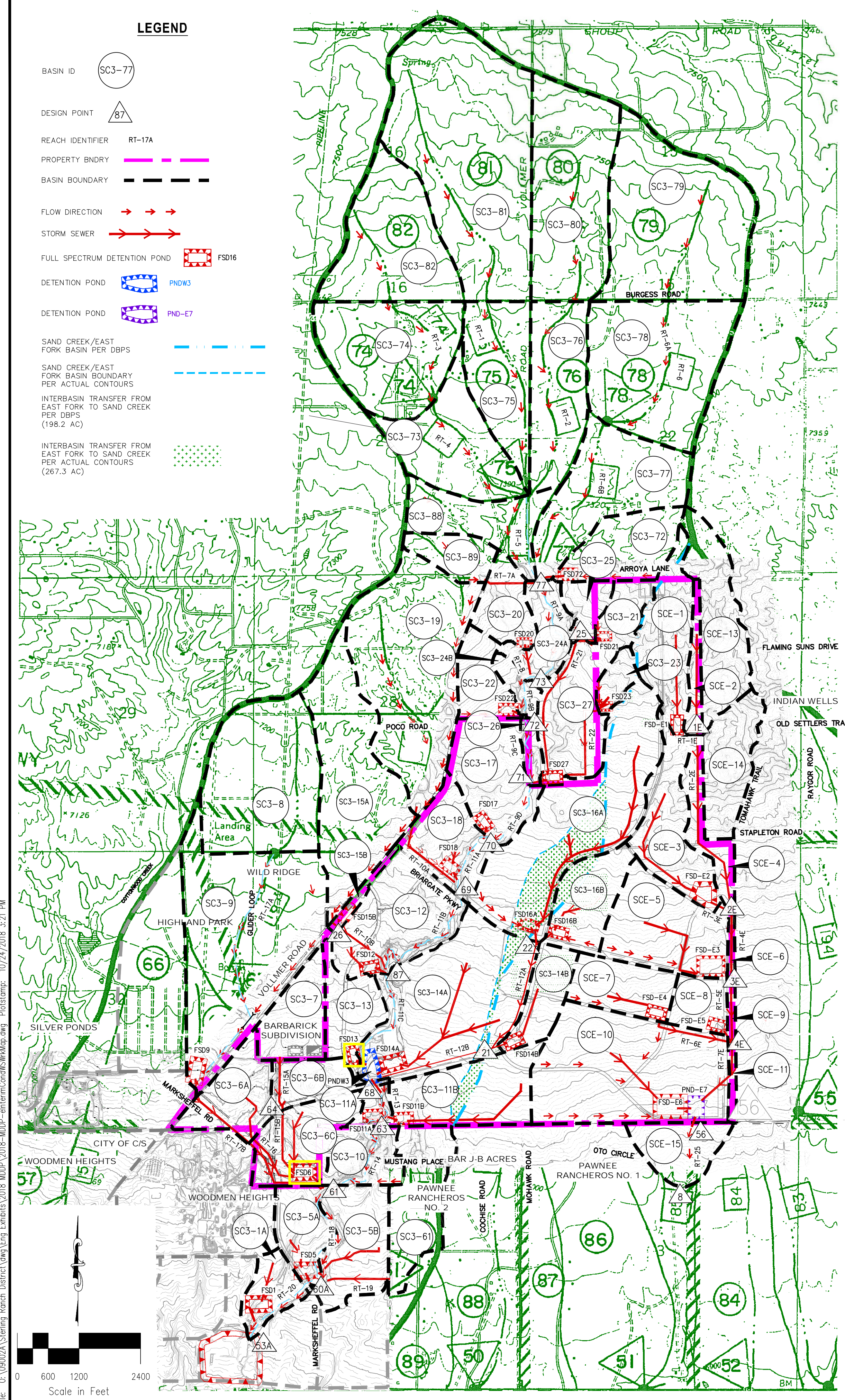
Prepared by:



20 Boulder Crescent, Suite 110  
Colorado Springs, CO 80903  
(719) 955-5485

Project #09-002  
SKP-18-003  
SF-17-024





BASIN	CN	AREA (ac)	AREA (sq mi)	Q <sub>5</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>50</sub> (cfs)	Q <sub>100</sub> (cfs)	Q <sub>200</sub> (cfs)
SC3-1A	73	27.8	0.044	16.3	23.3	33.0	45.8	57.1	68.9
SC3-5A	84	39.1	0.061	40.6	53.7	71.0	92.4	110.6	129.1
SC3-5B	81	63.0	0.098	53.8	73.0	98.5	130.8	158.6	187.0
SC3-6A	88	49.3	0.077	61.4	79.3	102.2	130.1	153.6	177.1
SC3-6B	85	30.9	0.048	32.9	43.4	57.0	73.9	88.2	102.7
SC3-6C	82	58.0	0.091	53.9	72.5	97.1	128.0	154.5	181.5
SC3-7	88	45.7	0.071	54.0	69.9	90.3	115.2	136.2	157.2
SC3-8	62	143.4	0.224	25.4	42.1	66.7	100.7	132.3	166.2
SC3-9	66	217.4	0.340	45.8	71.5	108.6	158.9	204.9	254.0
SC3-10	63	36.0	0.056	7.6	12.3	19.4	29.1	38.0	47.7
SC3-11A	70	10.7	0.017	5.3	7.8	11.3	15.9	20.0	24.3
SC3-11B	80	76.6	0.120	59.4	81.3	110.8	148.1	180.5	213.7
SC3-12	81	88.2	0.138	77.8	105.6	142.5	189.1	229.1	270.0
SC3-13	85	41.0	0.064	43.9	57.8	76.0	98.5	117.6	136.9
SC3-14A	79	164.9	0.258	127.6	175.4	239.8	321.9	393.2	466.3
SC3-14B	77	34.7	0.054	24.6	34.3	47.4	64.2	79.0	94.1
SC3-15A	62	139.7	0.218	21.3	35.5	56.3	85.3	112.1	141.0
SC3-15B	87	7.9	0.012	10.8	14.0	18.2	23.3	27.6	31.9
SC3-16A	74	168.1	0.263	84.4	120.4	170.0	234.8	292.2	351.8
SC3-16B	78	50.7	0.079	39.0	53.7	73.6	99.0	121.1	143.8
SC3-17	73	70.6	0.110	41.8	59.6	85.2	119.0	149.1	180.6
SC3-18	81	53.8	0.084	49.3	67.1	91.0	121.2	147.3	174.0
SC3-19	62	184.0	0.287	28.8	47.7	75.7	114.4	150.2	188.8
SC3-20	65	34.2	0.053	9.9	15.5	23.8	35.1	45.5	56.6
SC3-21	66	23.3	0.036	7.0	10.8	16.3	23.7	30.4	37.5
SC3-22	65	33.9	0.053	9.4	14.8	22.5	32.9	42.5	52.6
SC3-23	67	14.5	0.023	5.5	8.3	12.4	18.0	23.0	28.4
SC3-24A	65	35.7	0.056	13.0	20.4	31.1	45.7	59.0	73.2
SC3-24B	65	12.2	0.019	3.4	5.3	8.1	11.8	15.2	18.9
SC3-25	66	19.0	0.030	5.8	8.9	13.4	19.5	25.1	31.0
SC3-26	63	10.0	0.016	2.5	4.0	6.2	9.2	12.1	15.1
SC3-27	71	70.0	0.109	35.1	51.2	73.8	103.7	130.3	158.3
SC3-61	63	65.5	0.102	13.7	22.0	34.4	51.6	67.6	84.8
SC3-72	64	56.2	0.088	12.8	20.2	31.4	46.7	60.9	76.0
SC3-73	63	90.0	0.141	16.4	26.4	41.3	62.1	81.3	102.0
SC3-74	63	119.7	0.187	22.3	36.5	57.3	85.9	112.3	140.7
SC3-75	63	79.3	0.124	13.1	21.5	33.7	50.5	66.1	82.8
SC3-76	63	86.4	0.135	14.2	23.1	36.4	54.6	71.4	89.6
SC3-77	62	106.9	0.167	16.6	27.6	43.8	66.2	87.0	109.4
SC3-78	63	155.6	0.243	28.1	45.3	70.6	106.2	139.1	174.5
SC3-79	63	189.0	0.295	34.9	57.0	89.5	134.3	175.6	220.1
SC3-80	63	147.7	0.231	27.3	44.3	69.6	104.5	136.8	171.4
SC3-81	62	262.9	0.411	42.6	70.3	111.0	167.4	219.6	275.7
SC3-82	62	117.8	0.184	10.0	33.2	52.8	80.0	105.1	132.3
SC3-88	62	60.2	0.094	10.5	17.4	27.6	41.8	54.9	69.0
SC3-89	62	27.5	0.043	8.1	10.7	15.7	23.6	30.8	38.6
SCE-1	65	64.4	0.101	23.3	35.9	53.8	79.1	102.4	127.4
SCE-2	64	15.0	0.023	4.4	7.0	10.8	15.9	20.7	25.7
SCE-3	70	67.5	0.105	30.6	45.2	65.9	93.3	118.0	143.9
SCE-4	70	29.5	0.046	13.3	19.6	28.6	40.6	52.8	62.6
SCE-5	87	85.5	0.134	100.4	130.6	169.6	217.4	257.8	298.4
SCE-6	64	3.8	0.006	1.6	2.5	3.7	5.4	7.0	8.6
SCE-7	89	44.9	0.070	58.9	75.5	96.6	122.2	143.7	165.2
SCE-8	92	25.5	0.040	38.6	48.4	60.7	75.4	87.7	99.9
SCE-9	64	4.0	0.006	1.5	2.4	3.6	5.3	6.8	8.5
SCE-10	83	174.3	0.272	7.6	189.4	19.4	29.1	398.9	467.5
SCE-11	64	5.8	0.009	2.3	3.6	5.5	8.0	10.3	12.8
SCE-13	63	78.6	0.123	19.6	31.3	48.7	73.1	95.7	120.0
SCE-14	63	52.5	0.082	13.2	21.2	33.3	49.9	65.2	81.7
SCE-15	51	39.7	0.062	2.2	5.1	10.1	17.7	25.1	33.4

DESIGN POINT	AREA (sq ft)	Q <sub>5</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>50</sub> (cfs)	Q <sub>100</sub> (cfs)	LOCATION
DP-74	0.371	39.3	65.3	104.8	158.9	209.1	262.8
DP-75	1.413	141.2	235.1	376.6	566.6	750.9	950.5
DP-77	2.343	209.9	351.9	580.6	886.6	1168.4	1467.7
DP-78	0.538	59.7	98.4	154.0	232.6	306.2	385.3
DP-73	2.471	207.5	354.3	588.5	897.1	1187.2	1506.7
DP-72	2.543	206.2	352.5	586.7	897.2	1195.3	1518.6
DP-71	2.757	205.9	349.3	610.5	932.4	1226.9	1612.2
DP-70	2.867	205.3	349.8	614.0	940.1	1260.6	1636.7
DP-69	3.238	212.7	366.6	653.7	1010.6	1364.1	1775.7
DP-87	3.594	216.9	374.6	681.9	1072.1	1471.5	1905.9
DP-68	4.312	214.6	374.5	714.9	1187.6	1674.9	2204.1
DP-64	0.119	85.9	112.1	145.9	187.5	222.6	258.0
DP-63	4.449	154.4	201.0	375.7	615.9	1112.1	1385.1
DP-61	5.356	156.6	223.9	428.0	692.8	1287.3	1620.1
DP-60A	5.661	161.6	224.8	439.1	760.4	1309.5	1661.8
DP-53A	5.661	161.6	225.7	441.8	761.1	1329.0	1688.9
DP-1E	0.247	23.9	38.3	70.1	132.8	173.0	220.9
DP-2E	0.486	48.9	76.8	123.0	228.7	319.7	419.4
DP-3E	0.626	48.5	75.7	122.2	271.1	387.1	500.1
DP-4E	0.745	48.1	76.2	122.4	286.9	407.3	534.8
DP-56	1.017	23.1	35.3	71.5	108.3	152.1	196.4
DP-8	1.079	24.1	37.2	73.5	111.3	155.4	200.7
DP-21	0.396	0.6	8.8	17.8	57.1	116.8	174.9
DP-22	0.342	0.6	8.8	17.6	56.8	105.1	156.4
DP-25	0.066	5.9	9.1	16.3	35.1	46.4	58.2
DP-26	0.012	0.1	1.1	3.2	7.3	9.5	12.0

DESIGN POINT	AREA (sq ft)	V <sub>2</sub> (ac-ft)	V <sub>5</sub> (ac-ft)	V <sub>10</sub> (ac-ft)	V <sub>25</sub> (ac-ft)	V <sub>50</sub> (ac-ft)	V <sub>100</sub> (ac-ft)	LOCATION
DP-74	0.371	5.9	9.0	13.6	19.8	25.5	31.6	
DP-75	1.413	22.7	34.5	51.7	75.4	97.1	120.5	
DP-77	2.343	37.7	57.4	85.9	125.1	161.1	199.9	
DP-78	0.538	8.9	13.5	20.1	29.3	37.7	46.7	
DP-73	2.471	40.0	60.8	91.0	132.5	170.7	217.1	
DP-72	2.543	41.3	62.9	94.0	135.8	176.2	218.5	
DP-71	2.757	46.3	70.0	104.3	151.3	194.5	240.8	
DP-70	2.867	49.5	74.5	110.6	160.1	205.4	254.0	
DP-69	3.238	57.5	86.1	127.4	183.8	235.3	290.6	
DP-87	3.594	66.5	98.9	145.6	209.1	267.1	329.1	
DP-68	4.312	81.8	123.7	183.9	264.9	338.0	415.8	
DP-64	0.119	7.0	9.1	11.8	15.2	18.1	21.1	
DP-63	4.449	85.6	129.5	192.3	276.7	352.8	433.5	
DP-61	5.356	103.7	157.8	235.1	338.4	431.3	529.8	
DP-60A	5.661	111.0	168.6	250.4	359.5	457.7	561.5	
DP-53A	5.661	112.0	170.0	252.6	362.6	461.7	566.5	
DP-1E	0.247	3.1	5.2	8.4	12.7	16.6	20.9	
DP-2E	0.480	6.1	10.4	16.9	25.7	33.7	42.2	
DP-3E	0.620	7.0	13.7	23.4	36.1	47.4	59.3	
DP-4E	0.736	7.6	15.6	27.2	43.0	57.2	72.0	
DP-56	1.017	7.7	16.1	28.6	51.3	71.7	92.9	
DP-8	1.079	8.0	16.7	26.6	53.0	74.0	95.9	
DP-21	0.396	6.3	11.3	18.3	27.5	35.6	44.0	
DP-22	0.342	6.3	10.7	16.7	24.6	31.5	38.7	
DP-25	1.017	1.3	1.9	2.8	4.1	5.2	6.4	
DP-26	1.079	0.7	0.9	1.2	1.5	1.8	2.1	

FSD1	STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)		16.3	23.3	33.0	45.8	57.1	68.9
ALLOWABLE RELEASE (CFS)		0.1	1.7	3.3	10.9	17.5	25.5
MODELED RELEASE (CFS)		0.1	1.6	3.2	10.9	17.4	25.4
STORED VOLUME (AC-FT)		2.4	2.6	3.0	3.6	4.1	4.7

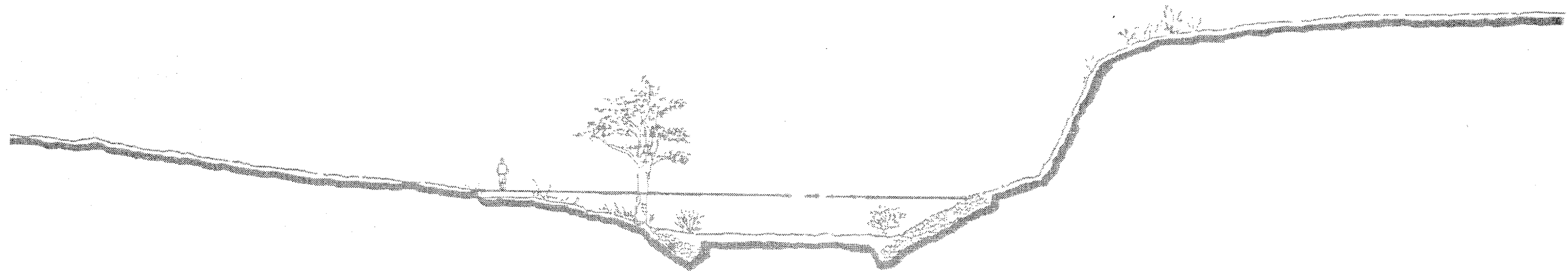
FSD5	STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)		40.6	53.7	71.0	92.4	110.6	129.1
ALLOWABLE RELEASE (CFS)		0.1	1.4	2.6	11.3	19.8	30.2
MODELED RELEASE (CFS)		0.1	1.4	2.6	11.2	19.7	30.1
STORED VOLUME (AC-FT)		3.0	3.2	3.8	4.1	4.7	5.2

FSD6	STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)		196.5	258.5	339.1	438.7	523.3	608.6
ALLOWABLE RELEASE (CFS)		0.5	7.6	14.6	58.4	99.6	149.7
MODELED RELEASE (CFS)		0.5	7.5	14.5	58.2	99.6	149.6
STORED VOLUME (AC-FT)		15.5	16.4	18.7	20.8	23.3	26.0

FSD9	STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)		64.6	105.6	169.5	252.3	327.1	410.1
ALLOWABLE RELEASE (CFS)		1.7	24.9	49.8	141.1	207.2	290.0
MODELED RELEASE (CFS)		1.7	24.9	49.8	141.1	207.0	289.9
STORED VOLUME (AC-FT)		8.7	8.7				



**SAND CREEK DRAINAGE BASIN PLANNING STUDY**  
**PRELIMINARY DESIGN REPORT**  
**CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO**

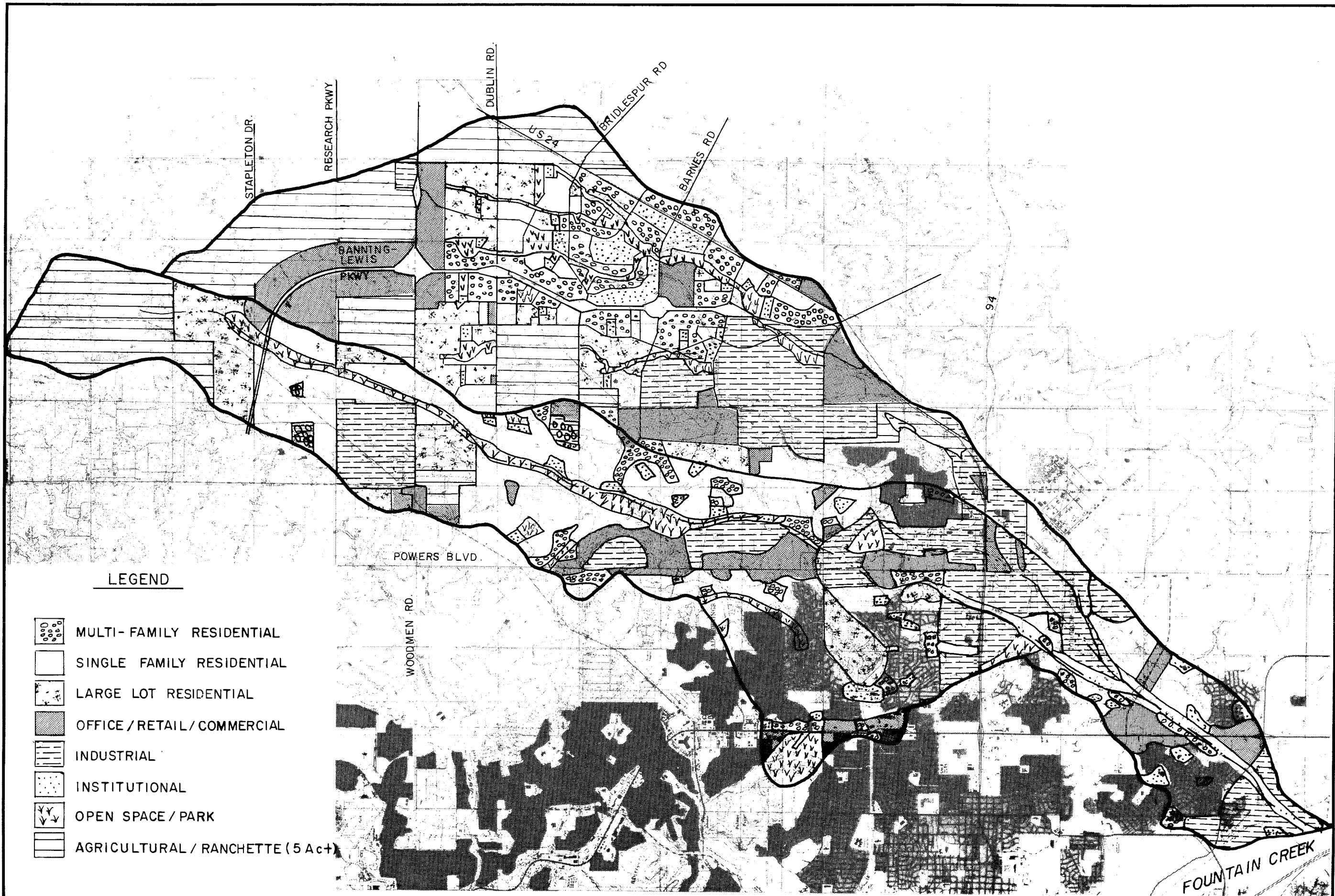


**PREPARED FOR:**









City of Colorado Springs  
Department of Comprehensive Planning, Development and Finance  
Engineering Division  
30 S. Nevada  
Colorado Springs, Colorado 80903

**PREPARED BY:**

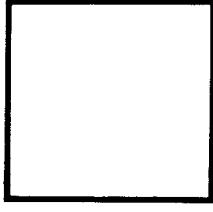
Kiowa Engineering Corporation  
1011 North Weber  
Colorado Springs, CO 80903



**LEGEND**

-  MULTI-FAMILY RESIDENTIAL
-  SINGLE FAMILY RESIDENTIAL
-  LARGE LOT RESIDENTIAL
-  OFFICE / RETAIL / COMMERCIAL
-  INDUSTRIAL
-  INSTITUTIONAL
-  OPEN SPACE / PARK
-  AGRICULTURAL / RANCHETTE (5 Ac+)

Kiowa Engineering Corporation  
 419 W. Bijou Street  
 Colorado Springs, Colorado  
 80905-1308



**SAND CREEK DRAINAGE  
 BASIN PLANNING STUDY  
 PROPOSED LAND USE**

Project No.	90-04-09
Date:	9/90
Design:	
Drawn:	EAK
Check:	
Revisions:	

**Table III-1. Percent Impervious Values.**

Land Use Classification	Percent Impervious	Land Use Density
Multi-Family Residential	65-80	10-24 DU/AC
Single-Family Residential	45-65	6-10 DU/AC
Low Density Residential	30-45	1-6 DU/AC
Large Lot Residential/ Agricultural	5-20	1 DU/AC
Office/Commercial	80-90	
Industrial	85-95	
Institutional	50-75	
Dedicated Open Space/Park	5-10	
Rangeland - Poor to Good Condition	5- 20	

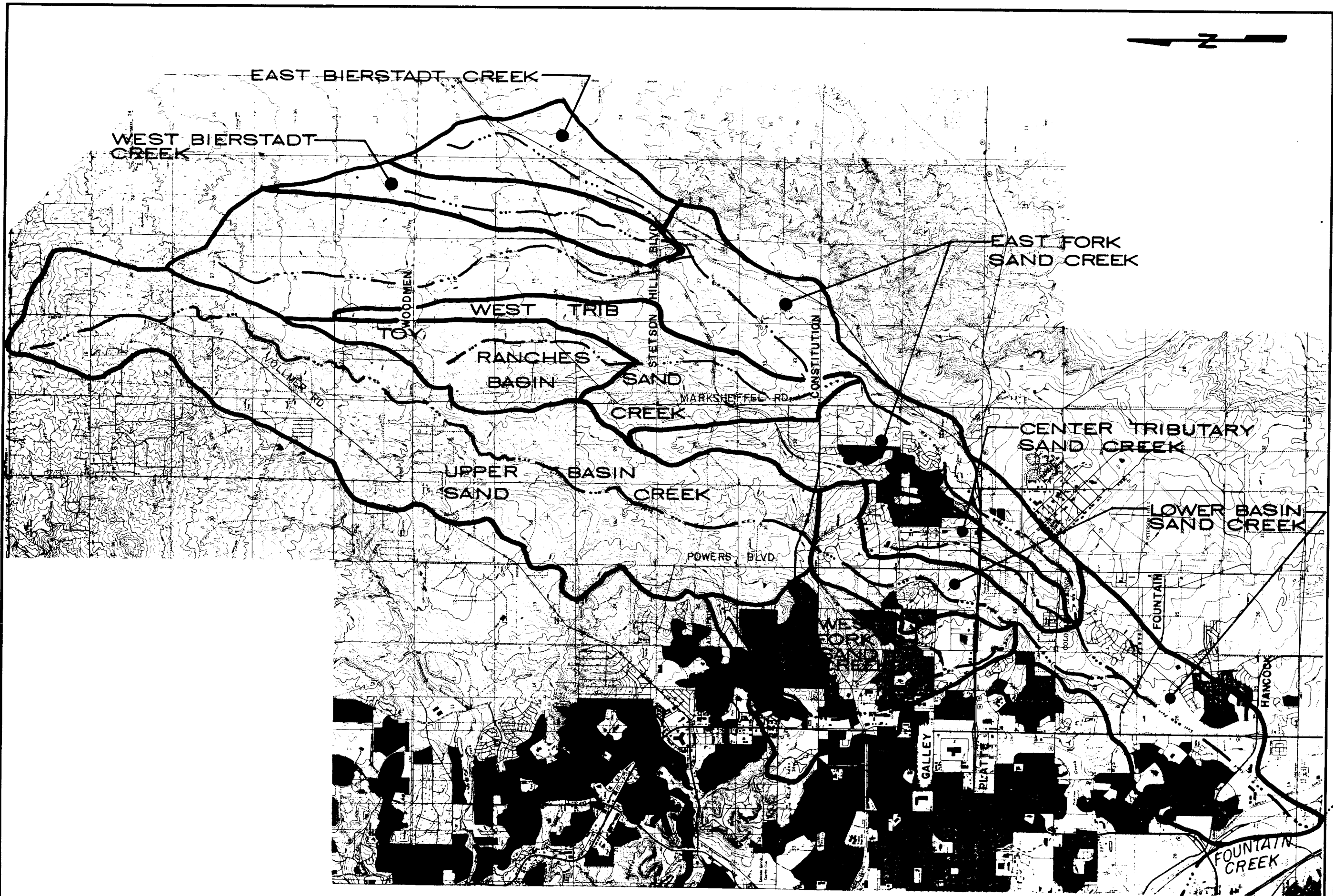
NOTE: The above data was used in the preparation of the hydrologic analysis for the Sand Creek Drainage Basin Planning Study. These data are not intended to reflect future land use planning within the City or the County.

**Table III-2:**

**Summary of Peak Discharges  
24-hour Duration Storm, AMC-II  
Baseline Hydrologic Conditions**

Design Point	Location	Area s.m.	100-year (cfs) Existing	Future	10-year (cfs) Existing	Future
<b>SAND CREEK (1)</b>						
1	@ Fountain Creek	54.1	16900	25800	7470	11800
12	Hancock Blvd.	53.1	16100	25000	7250	11600
19	Fountain Blvd.	50.7	13600	22100	6230	10800
27	West Fork Sand Creek	23.0	11300	18900	5920	8790
99	C.R.I. & P. RR	16.0	5820	14530	2360	7400
20	North Carefree	13.5	4030	10260	1520	4810
37	Stetson Hills Blvd.	10.0	3230	6690	840	3060
60	Woodmen Road	5.4	2630	3300	760	950
75	Black Forest Road	1.4	1000	1030	320	350
<b>WEST FORK SAND CREEK</b>						
27	@ Sand Creek	5.0	6840	6840	3200	3200
52	U. S. 24	4.8	6860	6860	3230	3230
59	Constitution Ave.	2.1	3450	3450	1680	1680
69	South Carefree	1.0	1630	1630	810	810
<b>CENTER TRIBUTARY SAND CREEK</b>						
42	Airport Road	1.6	1530	2010	650	1200
43	Powers Blvd.	1.3	1300	1710	590	980
44	U. S. 24	1.1	1200	1680	580	960
45	Galley Road	0.8	1180	1340	530	650
<b>EAST FORK SAND CREEK</b>						
1	@ Center Tributary	24.3	3970	15600	700	6530
9	@ East Fork Sub. Tributary	19.8	3730	13990	650	6050
29	@ W. Bierstadt Creek	10.6	2080	7460	400	3330
40	@ Tamlin Road	4.6	950	3570	210	1820
52	@ Woodmen Road	1.7	460	2120	80	1210
<b>EAST FORK SUB-TRIBUTARY SAND CREEK</b>						
11	@ Constitution Avenue	5.9	1330	4100	240	1630
15	@ Chicago & Rock Island RR	5.2	1250	3540	230	1370
26	@ Confluence w/Toy Ranch	1.0	220	820	50	370
47	@ Proposed Dublin Blvd.	0.4	100	300	20	140
<b>WEST BIERSTADT CREEK</b>						
31	@ Confluence w/ East Fork	1.8	480	1590	80	600
39	@ Tamlin Road	0.8	270	680	50	290
54	@ Woodmen Road	0.5	230	420	55	150
<b>EAST BIERSTADT CREEK</b>						
32	@ Conf. w/W Bierstadt	2.4	520	1520	90	580
38	@ Chicago & Rock Island RR	0.4	120	350	15	130

(1) Future baseline condition discharges for Sand Creek compiled with the assumption that the discharges from the East Fork Sand Creek basin are maintained at existing rates as shown on this Table.



Kiowa Engineering Corporation  
 419 W. Bijou Street  
 Colorado Springs, Colorado  
 80905-1308

SAND CREEK DRAINAGE  
 BASIN PLANNING STUDY  
 REGIONAL SUB-BASINS

Project No	90-04-09
Date:	11/90
Design:	
Drawn:	EAK
Check:	
Revisions:	

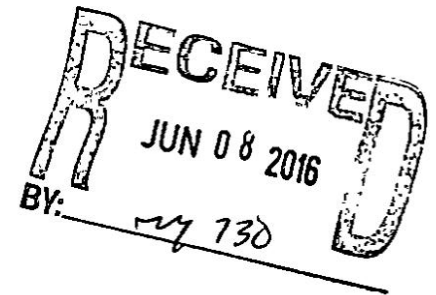


**FINAL DRAINAGE REPORT**

For

**BARBARICK SUBDIVISION,  
PORTIONS OF LOTS 1, 2 and LOTS 3 & 4  
El Paso County, Colorado****Sand Creek Drainage Basin**

Prepared for:  
**El Paso County Development Services  
Engineering Division**



On Behalf of:  
**Wykota Construction**  
430 Beacon Light Road, Suite 130  
Monument, CO 80132

Prepared by:



2435 Research Parkway, Suite 300  
Colorado Springs, CO 80920  
(719) 575-0100  
Fax (719) 572-0208

June 6, 2016

15.789.001

# STERLING RANCH FILING NO. 1

## PRELIMINARY DRAINAGE REPORT

### (CDOT Type R Inlet Calculations - Sump Condition)

Urban Local Roadway-50' ROW-30' Pavement-6" Vertical Curb  
 Maximum allowable depth for MINOR (0.43') & MAJOR (0.66') storm

Inlet Length	Storm	Depth	Eqn. 7-31 $Q_w = C_w N_w L_e D^{3/2}$	Eqn. 7-32 $Q_o = C_o N_o (L_e H_c) (2g(D - 0.5H_c))^{1/2}$	Eqn. 7-28 $Q_m = C_m (Q_w Q_o)^{1/2}$
5	Q5	0.43	5.1	5.7	5.0
5	Q100	0.66	9.7	8.8	8.5
6	Q5	0.43	6.1	6.8	6.0
6	Q100	0.66	11.6	10.3	10.2
8	Q5	0.43	8.1	9.1	8.0
8	Q100	0.66	15.4	13.8	13.6
10	Q5	0.43	10.2	11.4	10.0
10	Q100	0.66	19.3	17.2	17.0
12	Q5	0.43	12.2	13.7	12.0
12	Q100	0.66	23.2	20.7	20.3
14	Q5	0.43	14.2	16.0	14.0
14	Q100	0.66	27.0	24.1	23.7
15	Q5	0.43	15.2	17.1	15.0
15	Q100	0.66	29.0	25.8	25.4
16	Q5	0.43	16.2	18.2	16.0
16	Q100	0.66	30.9	27.5	27.1

Table 7-7. Coefficients for various inlets in sumps

Inlet Type	Nw	Cw	No	Co	Cm
CDOT Type 13 Grate	0.7	3.3	0.43	0.6	0.93
Denver No. 16 Grate	0.73	3.6	0.31	0.6	0.9
Curb Opening for Type 13/No. 16 Combination	1	3.7	1	0.66	0.86
CDOT Type R Curb Opening	1	3.6	1	0.67	0.93

Pond FDS - Barbarack Subdivision Restrictor  
plate

**Worksheet for FSD Outlet Orifice Plate**

Project Description

Solve For                                  Diameter

Input Data

Discharge	45.90	ft <sup>3</sup> /s	(16.5 H <sub>15</sub> + 29.4 P <sub>2cc</sub> )
Headwater Elevation	4.70	ft	
Centroid Elevation	0.00	ft	
Tailwater Elevation	0.00	ft	
Discharge Coefficient	0.60		

Results

Diameter	2.37	ft
Headwater Height Above Centroid	4.70	ft
Tailwater Height Above Centroid	0.00	ft
Flow Area	4.40	ft <sup>2</sup>
Velocity	10.43	ft/s

**Worksheet for FSD Overflow - Pass**

Project Description

Solve For Discharge

Input Data

Headwater Elevation		0.90	ft
Crest Elevation		0.00	ft
Tailwater Elevation		0.00	ft
Crest Surface Type	Gravel		
Crest Breadth		12.00	ft
Crest Length		36.00	ft

Results

Discharge	86.22	ft <sup>3</sup> /s
Headwater Height Above Crest	0.90	ft
Tailwater Height Above Crest	0.00	ft
Weir Coefficient	2.80	US
Submergence Factor	1.00	
Adjusted Weir Coefficient	2.80	US
Flow Area	32.40	ft <sup>2</sup>
Velocity	2.66	ft/s
Wetted Perimeter	37.80	ft
Top Width	36.00	ft

*(55 DSI + 29.4 pucc = 84.4 cfs)*

**Worksheet for SFB Overflow Developed**

**Project Description**

Solve For Discharge

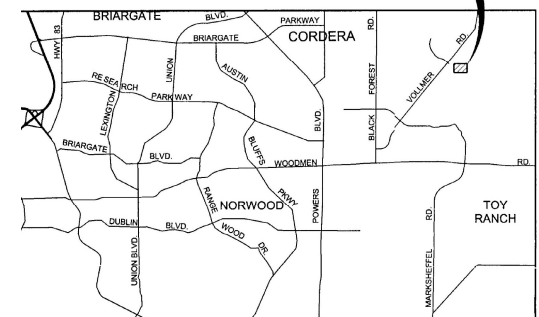
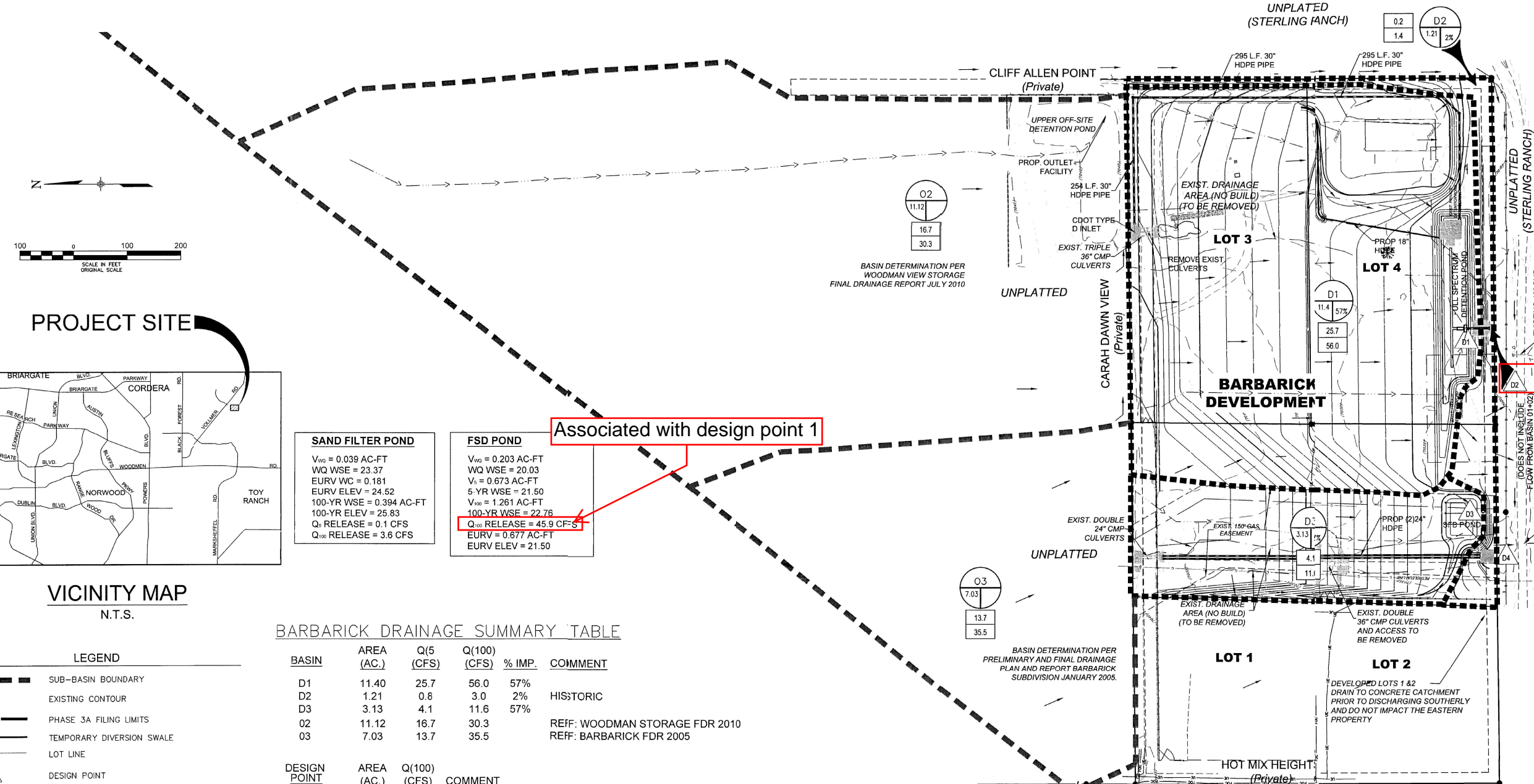
**Input Data**

Headwater Elevation		0.45	ft
Crest Elevation		0.00	ft
Tailwater Elevation		0.00	ft
Crest Surface Type	Gravel		
Crest Breadth		6.00	ft
Crest Length		10.00	ft

**Results**

Discharge		8.08	ft <sup>3</sup> /s
Headwater Height Above Crest		0.45	ft
Tailwater Height Above Crest		0.00	ft
Weir Coefficient		2.68	US
Submergence Factor		1.00	
Adjusted Weir Coefficient		2.68	US
Flow Area		4.50	ft <sup>2</sup>
Velocity		1.80	ft/s
Wetted Perimeter		10.90	ft
Top Width		10.00	ft





VICINITY MAP  
N.T.S.

**SAND FILTER POND**

V<sub>100</sub> = 0.039 AC-FT  
 WQ WSE = 23.37  
 EURV WC = 0.181  
 EURV ELEV = 24.52  
 100-YR WSE = 0.394 AC-FT  
 100-YR ELEV = 25.83  
 Q<sub>5</sub> RELEASE = 0.1 CFS  
 Q<sub>100</sub> RELEASE = 3.6 CFS

**FSD POND**

V<sub>100</sub> = 0.203 AC-FT  
 WQ WSE = 20.03  
 V<sub>5</sub> = 0.673 AC-FT  
 5-YR WSE = 21.50  
 V<sub>100</sub> = 1.261 AC-FT  
 100-YR WSE = 22.76  
 Q<sub>100</sub> RELEASE = 45.9 CFS  
 EURV = 0.677 AC-FT  
 EURV ELEV = 21.50

Associated with design point 1

BARBARICK DRAINAGE SUMMARY TABLE

BASIN	AREA (AC.)	Q(5) (CFS)	Q(100) (CFS)	% IMP.	COMMENT
D1	11.40	25.7	56.0	57%	
D2	1.21	0.8	3.0	2%	HISTORIC
D3	3.13	4.1	11.6	57%	
O2	11.12	16.7	30.3		REF: WOODMAN STORAGE FDR 2010
O3	7.03	13.7	35.5		REF: BARBARICK FDR 2005

DESIGN POINT	AREA (AC.)	Q(100) (CFS)	COMMENT
D1	11.40	85.4	D1 BASIN TO FSD + O2; PASS THROUGH
D2	22.52	48.9	POND RELEASE + D2
D3	3.13	11.6	D3 BASIN TO SFB
D4	10.16	39.1	POND RELEASE + O3. PIPE PASS THROUGH

- LEGEND**
- SUB-BASIN BOUNDARY
  - EXISTING CONTOUR
  - PHASE 3A FILING LIMITS
  - TEMPORARY DIVERSION SWALE
  - LOT LINE
  - DESIGN POINT
  - SUB BASIN DESIGNATION
  - SUB BASIN PERCENT IMPERVIOUS
  - SUB BASIN AREA (AC.)
  - 5-YEAR STORM EVENT PEAK FLOW (CFS)
  - 100-YEAR STORM EVENT PEAK FLOW (CFS)
  - PROPOSED FLOW DIRECTION
  - EXISTING FLOW DIRECTION

NO.	DATE	DESCRIPTION	BY
REVISIONS			
BENCHMARK DATA (ELEV.)			
(DATUM)			
(DESCRIPTION/LOCATION)			

NAME: S:\15.789.001 Tri Lakes\DWG\CD\Drainage\20160605-DP01.dwg  
 PCP: Matrix.cdb  
 PLOT DATE: Tue Jun 07, 2016 12:49pm

**VERTICAL BENCHMARK**  
 THE VERTICAL INFORMATION ON THIS MAP IS BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 AND THE 1960 SUPPLEMENTARY ADJUSTMENT BEING A FOUND 3.25" ALUMINUM CAP IN A ROAD BOX DESIGNATED AS FACILITIES INFORMATION MANAGEMENT SYSTEM (FIMS) MONUMENT "F-69" AND HAVING PUBLISHED ELEVATION OF 6975.62 FEET WAS USED TO REFERENCE THIS VERTICAL DATUM. THE BENCHMARK IS LOCATED ON THE WEST SIDE OF BLACK FOREST ROAD, ABOUT 1.95 MILES SOUTH OF OLD RANCH ROAD, JUST SOUTH OF THE SCHMIDT CONSTRUCTION COMPANY DRIVEWAY. A CORNER FENCE POST IS 28.1 FEET TO THE SOUTHWEST, AND THE MOST SOUTHERLY GUARD RAIL POST IS 25.7 FEET TO THE NORTH.

**BASIS OF BEARINGS**  
 THE BASIS OF BEARINGS FOR THIS MAP IS THE NORTH LINE OF BARBARICK SUBDIVISION ACCORDING TO THE OFFICIAL MAP THEREOF RECORDED FEBRUARY 12, 2008 IN THE OFFICE OF THE EL PASO COUNTY CLERK AND RECORDER UNDER RECEPTION NUMBER 208712754, SAID LINE MONUMENTED ON THE WEST END BY A FOUND 5/8" REBAR AND ON THE EAST BY A FOUND 4/8" REBAR WITH 1" ALUMINUM CAP STAMPED "LS 2154" BEING A POINT ON THE NORTH LINE BEARING NORTH 89°12'41.64"S 1287.35 FEET FROM THE WEST END THEREOF.

PREPARED UNDER MY DIRECT SUPERVISION, FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.



2435 Research Parkway, Suite 300  
 Colorado Springs, CO 80920  
 Phone 719-575-0100  
 Fax 719-575-0208

BARBARICK SUBDIVISION LOTS 1-4

PROPOSED DRAINAGE PLAN

DESIGNED BY: B.J.H.	SCALE: HORIZ: 1"=100'	DATE ISSUED: April 2016
DRAWN BY: B.J.H.	VERT: N/A	SHEET NO. 1 OF 2 SHEETS
CHECKED BY: ES		

DP02

**FINAL DRAINAGE REPORT  
FOR  
STERLING RANCH FILING NO. 2**

**Prepared For:  
SR Land, LLC  
20 Boulder Crescent, Suite 210  
Colorado Springs, CO 80903**

**August 2021  
Project No. 25188.01**

**Prepared By:  
JR Engineering, LLC  
5475 Tech Center Drive  
Colorado Springs, CO 80919  
719-593-2593**

**PCD File No. SF-20-015**

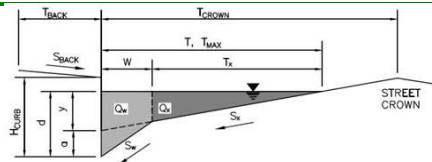


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:  
Inlet ID:

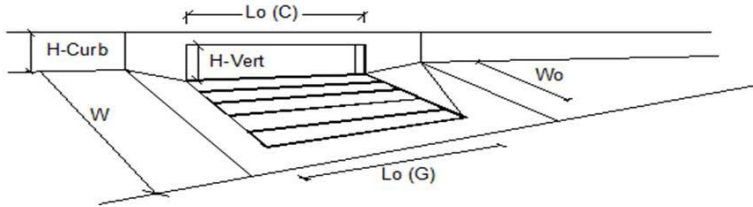
**Sterling Ranch Filing No. 2**  
**A8**



Gutter Geometry (Enter data in the blue cells)													
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 7.0$ ft												
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft												
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$												
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches												
Distance from Curb Face to Street Crown	$T_{CROWN} = 26.0$ ft												
Gutter Width	$W = 2.00$ ft												
Street Transverse Slope	$S_x = 0.020$ ft/ft												
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft												
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.007$ ft/ft												
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$												
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td><math>T_{MAX} =</math></td> <td>19.3</td> <td>26.0</td> <td>ft</td> </tr> <tr> <td><math>d_{MAX} =</math></td> <td>6.0</td> <td>7.7</td> <td>inches</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} =$	19.3	26.0	ft	$d_{MAX} =$	6.0	7.7	inches
	Minor Storm	Major Storm											
$T_{MAX} =$	19.3	26.0	ft										
$d_{MAX} =$	6.0	7.7	inches										
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> <input type="checkbox"/> check = yes												
<b>MINOR STORM Allowable Capacity is based on Depth Criterion</b>													
<b>MAJOR STORM Allowable Capacity is based on Depth Criterion</b>													
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'													
	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td><math>Q_{allow} =</math></td> <td>11.5</td> <td>26.7</td> <td>cfs</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$Q_{allow} =$	11.5	26.7	cfs				
	Minor Storm	Major Storm											
$Q_{allow} =$	11.5	26.7	cfs										

## INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017

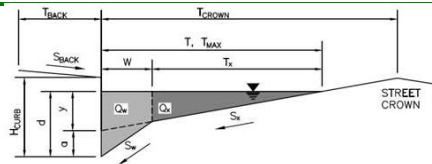


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
<b>Street Hydraulics: OK - <math>Q &lt; \text{Allowable Street Capacity}</math>.</b>			
Total Inlet Interception Capacity	3.0	10.6	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	1.9	cfs
Capture Percentage = $Q_b/Q_o =$	100	85	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

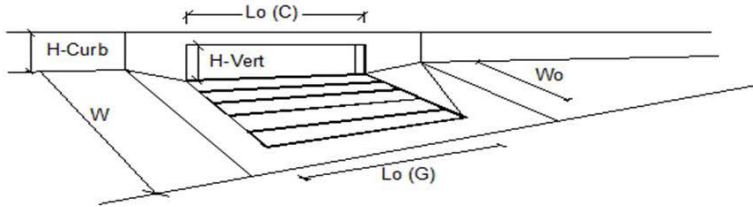
Project: **Sterling Ranch Filing No. 2**  
 Inlet ID: **A9**



Gutter Geometry (Enter data in the blue cells)													
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 7.0$ ft												
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft												
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$												
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches												
Distance from Curb Face to Street Crown	$T_{CROWN} = 26.0$ ft												
Gutter Width	$W = 2.00$ ft												
Street Transverse Slope	$S_x = 0.020$ ft/ft												
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft												
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.007$ ft/ft												
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$												
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td><math>T_{MAX} =</math></td> <td>19.3</td> <td>26.0</td> <td>ft</td> </tr> <tr> <td><math>d_{MAX} =</math></td> <td>6.0</td> <td>7.7</td> <td>inches</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} =$	19.3	26.0	ft	$d_{MAX} =$	6.0	7.7	inches
	Minor Storm	Major Storm											
$T_{MAX} =$	19.3	26.0	ft										
$d_{MAX} =$	6.0	7.7	inches										
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> <input type="checkbox"/> check = yes												
<b>MINOR STORM Allowable Capacity is based on Depth Criterion</b>													
<b>MAJOR STORM Allowable Capacity is based on Depth Criterion</b>													
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'													
$Q_{allow} =$	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td></td> <td>11.5</td> <td>26.9</td> <td>cfs</td> </tr> </tbody> </table>		Minor Storm	Major Storm			11.5	26.9	cfs				
	Minor Storm	Major Storm											
	11.5	26.9	cfs										

## INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



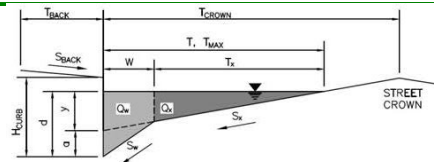
<b>Design Information (Input)</b>	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening	
Local Depression (additional to continuous gutter depression 'a')		$R_{LOCAL} =$	3.0	3.0
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o =$	10.00	10.00
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o =$	N/A	N/A
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_{T-G} =$	N/A	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C-C =$	0.10	0.10
<b>Street Hydraulics: OK - <math>Q &lt; \text{Allowable Street Capacity}</math>.</b>				
Total Inlet Interception Capacity		$Q =$	2.1	4.5
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_b =$	0.0	0.3
Capture Percentage = $Q_s/Q_o =$		$C\% =$	100	94
				cfs
				cfs
				%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:  
Inlet ID:

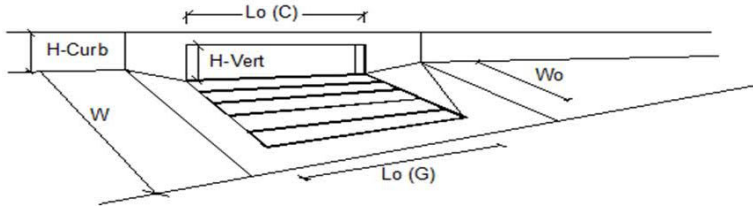
**Sterling Ranch Filing No. 2**  
**A11**



Gutter Geometry (Enter data in the blue cells)													
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 15.0$ ft												
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft												
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$												
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches												
Distance from Curb Face to Street Crown	$T_{CROWN} = 38.0$ ft												
Gutter Width	$W = 2.00$ ft												
Street Transverse Slope	$S_x = 0.020$ ft/ft												
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft												
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.012$ ft/ft												
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$												
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td><math>T_{MAX} =</math></td> <td>33.0</td> <td>38.0</td> <td>ft</td> </tr> <tr> <td><math>d_{MAX} =</math></td> <td>6.0</td> <td>9.1</td> <td>inches</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} =$	33.0	38.0	ft	$d_{MAX} =$	6.0	9.1	inches
	Minor Storm	Major Storm											
$T_{MAX} =$	33.0	38.0	ft										
$d_{MAX} =$	6.0	9.1	inches										
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> <input type="checkbox"/> check = yes												
MINOR STORM Allowable Capacity is based on Depth Criterion													
MAJOR STORM Allowable Capacity is based on Depth Criterion													
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'													
$Q_{allow} =$	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td></td> <td>15.1</td> <td>63.3</td> <td>cfs</td> </tr> </tbody> </table>		Minor Storm	Major Storm			15.1	63.3	cfs				
	Minor Storm	Major Storm											
	15.1	63.3	cfs										

## INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



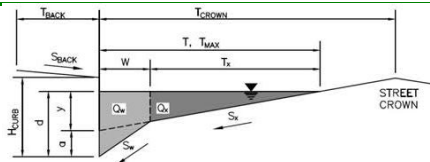
Design Information (Input)	CDOT Type R Curb Opening	
Type of Inlet	Type = CDOT Type R Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0 inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1
Length of a Single Unit Inlet (Grate or Curb Opening)	15.00	15.00 ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10
<b>Street Hydraulics: OK - Q &lt; Allowable Street Capacity.</b>		
Total Inlet Interception Capacity	Q = 8.9	13.8 cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q <sub>b</sub> = 0.6	6.1 cfs
Capture Percentage = Q <sub>i</sub> /Q <sub>o</sub> =	C% = 93	69 %

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:  
Inlet ID:

**Sterling Ranch Filing No. 2**  
**A15**



**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb  
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK} = 7.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

Height of Curb at Gutter Flow Line  
Distance from Curb Face to Street Crown

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 26.0$  ft

Gutter Width

$W = 2.00$  ft

Street Transverse Slope

$S_X = 0.020$  ft/ft

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

$S_W = 0.083$  ft/ft

Street Longitudinal Slope - Enter 0 for sump condition

$S_D = 0.023$  ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	19.3	26.0	ft
$d_{MAX} =$	6.0	7.7	inches

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

check = yes

**MINOR STORM** Allowable Capacity is based on Depth Criterion

**MAJOR STORM** Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	19.2	36.4	cfs

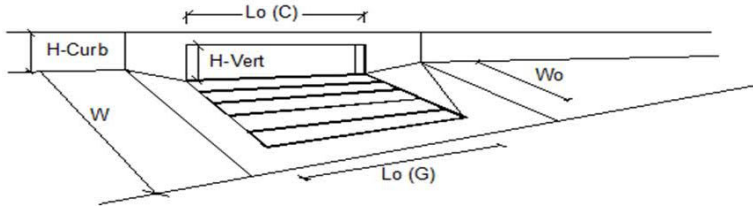
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

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



## INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017

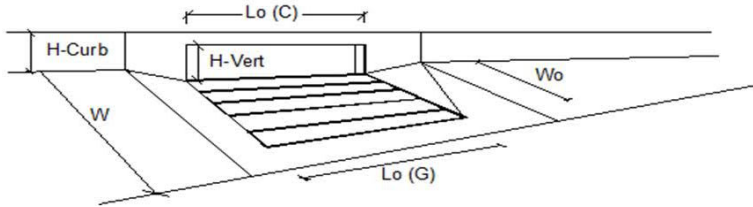


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
<b>Street Hydraulics: OK - <math>Q &lt; \text{Allowable Street Capacity}</math>.</b>			
Total Inlet Interception Capacity	5.4	10.3	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	1.4	cfs
Capture Percentage = $Q_b/Q_o =$	100	88	%



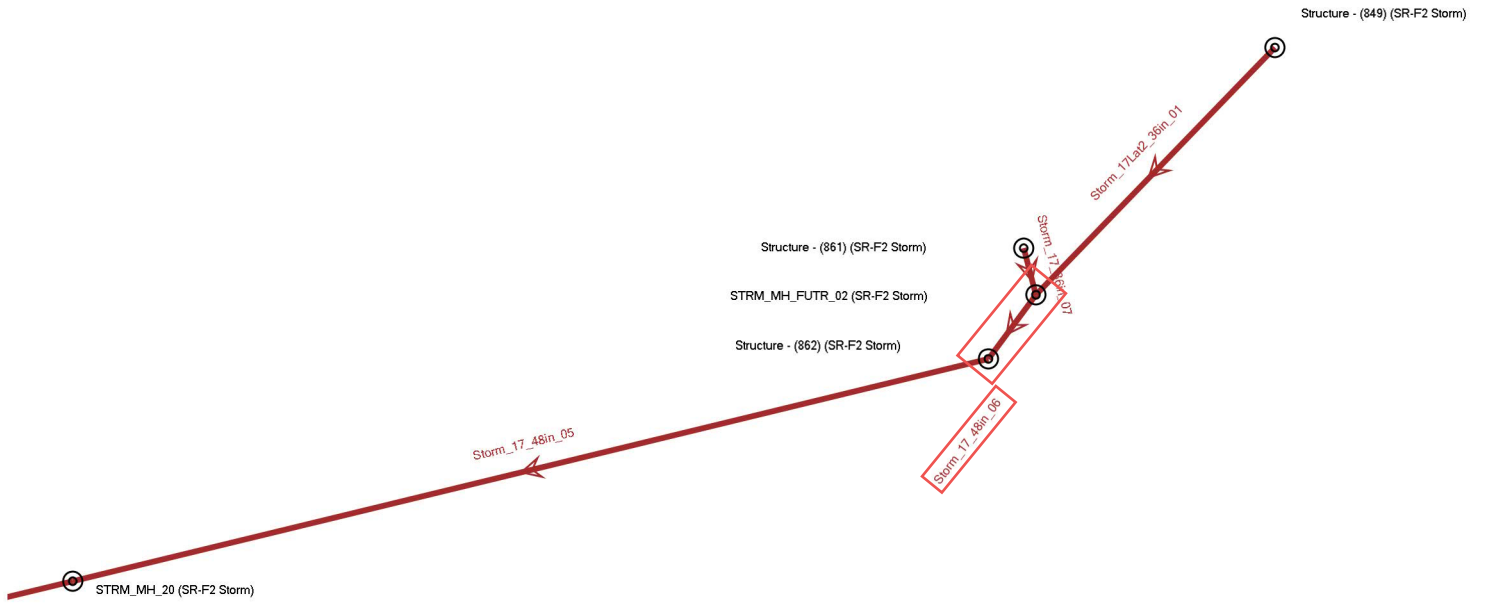
## INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
<b>Street Hydraulics: OK - Q &lt; Allowable Street Capacity.</b>			
Total Inlet Interception Capacity	4.3	7.0	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.1	2.6	cfs
Capture Percentage = $Q_b/Q_o$ =	97	73	%

# Sterling Ranch 5yr



**Scenario: 5-YEAR**  
**Current Time Step: 0.000 h**  
**FlexTable: Conduit Table**

Label	Flow (cfs)	Diameter (in)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
Storm_21_48in_01	55.10	48.0	57.3	-0.030	0.013	15.91	248.76	6,984.23	6,981.75
Storm_21_48in_02	52.50	48.0	25.8	-0.030	0.013	15.69	248.66	6,984.95	6,984.69
Storm_16_48in_02	68.80	48.0	348.6	-0.024	0.013	15.49	220.31	6,979.03	6,972.39
Storm_17_48in_01	63.70	48.0	15.6	-0.020	0.013	14.28	202.74	6,989.18	6,988.44
Storm_17_48in_05	56.90	48.0	292.3	-0.020	0.013	13.87	203.11	7,000.43	6,994.63
Storm_16_48in_03	56.40	48.0	50.4	-0.020	0.013	13.85	203.42	6,980.18	6,979.56
Storm_16_48in_04	56.40	48.0	42.5	-0.020	0.013	13.83	203.12	6,981.03	6,980.64
Storm_17_48in_06	56.90	48.0	22.6	-0.020	0.013	13.82	202.28	7,000.88	7,000.89
Storm_14_66in_05	96.60	66.0	354.4	-0.014	0.013	13.79	397.24	6,984.12	6,978.30
Storm_16_48in_05	55.10	48.0	26.8	-0.020	0.013	13.74	203.11	6,981.54	6,981.49
Storm_19_Lat 2_18in_01	12.60	18.0	76.7	-0.049	0.013	13.39	23.16	7,006.61	7,002.92
Storm_14_66in_04	96.60	66.0	512.4	-0.012	0.013	13.02	366.67	6,976.96	6,972.10
Storm_17Lat2_36in_01	16.00	36.0	110.1	-0.040	0.013	12.71	133.20	7,005.28	7,001.34
Storm_19_30in_03	25.90	30.0	165.0	-0.024	0.013	12.37	64.17	6,992.63	6,988.66
Storm_18_18in_02	8.70	18.0	82.7	-0.050	0.013	12.29	23.47	6,985.92	6,983.18
Storm_17_48in_04	56.90	48.0	82.9	-0.014	0.013	12.29	172.06	6,994.40	6,993.44
Storm_17_48in_03	56.90	48.0	150.3	-0.014	0.013	12.28	171.79	6,993.21	6,991.28
Storm_17_48in_02	56.90	48.0	102.0	-0.014	0.013	12.19	170.08	6,991.05	6,989.03
Storm_19_24in_05	17.60	24.0	177.0	-0.030	0.013	12.14	39.18	7,002.55	6,996.67
Storm_14_48in_06	38.10	48.0	59.3	-0.017	0.013	11.72	187.87	6,989.32	6,987.79
Storm_14_84in_01	189.80	84.0	107.3	-0.005	0.013	11.25	453.09	6,970.13	6,969.23
Storm_14_72in_03	162.00	72.0	74.5	-0.005	0.013	10.99	306.40	6,971.03	6,971.00
CO-6	23.20	48.0	9.5	-0.021	0.013	10.94	208.41	6,989.62	6,989.67
Storm_14_72in_02	162.00	72.0	127.9	-0.005	0.013	10.80	299.58	6,970.64	6,970.48
Storm_23_54in_05	30.70	54.0	120.0	-0.015	0.013	10.39	240.88	6,957.68	6,955.40
Storm_23_54in_09	30.70	54.0	402.5	-0.015	0.013	10.39	240.88	6,978.16	6,971.61
Storm_23_54in_08	30.70	54.0	567.0	-0.015	0.013	10.39	240.76	6,969.87	6,960.87
Storm_23_54in_06	30.70	54.0	93.0	-0.015	0.013	10.38	240.46	6,959.07	6,957.97
Storm_19_18in_06	6.00	18.0	339.5	-0.040	0.013	10.23	20.95	7,016.00	7,002.92
Storm_17_36in_07	17.60	36.0	9.8	-0.020	0.013	10.21	94.31	7,001.15	7,001.34
Storm_23_54in_10	30.70	54.0	298.5	-0.014	0.013	10.14	232.69	6,982.73	6,978.06
Storm_23_54in_11	30.70	54.0	333.6	-0.014	0.013	10.14	232.65	6,993.98	6,988.82
Storm_23_54in_12	30.70	54.0	412.3	-0.014	0.013	10.14	232.63	7,002.09	6,995.83
Storm_15_18in_02-W	4.30	18.0	25.5	-0.049	0.013	10.08	23.36	6,973.60	6,972.01
Storm_14_36in_07	15.70	36.0	76.3	-0.020	0.013	9.89	94.31	6,991.27	6,989.33
Storm_18_18in_01	17.30	18.0	22.4	-0.059	0.013	9.79	25.59	6,982.43	6,981.79
Storm_19_Lat 1_18in_01	5.00	18.0	36.4	-0.030	0.013	8.78	18.18	6,993.84	6,993.02
Storm_19_Lat 2_18in_02	9.50	18.0	35.3	-0.015	0.013	7.97	12.86	7,007.49	7,007.05
Storm_19_36in_02	25.90	36.0	144.5	-0.006	0.013	7.26	51.15	6,987.99	6,987.48
Storm_19_36in_01	25.90	36.0	302.2	-0.006	0.013	7.25	51.04	6,987.14	6,985.83
Storm_19_Lat 3_18in_01	4.20	18.0	6.0	-0.020	0.013	7.22	14.84	7,016.37	7,016.40
Storm_15_42in_01-E	38.80	42.0	63.9	-0.004	0.013	7.09	65.41	6,971.94	6,971.67
Storm_23_54in_13	30.70	54.0	265.9	-0.005	0.013	6.98	138.03	7,010.66	7,009.20
Storm_21_42in_03	27.50	42.0	101.2	-0.005	0.013	6.92	71.15	6,985.78	6,985.83
Storm_23_54in_14	27.40	54.0	43.7	-0.005	0.013	6.70	136.36	7,011.10	7,011.18
Storm_22_30in_02	8.30	30.0	79.4	-0.009	0.013	6.22	38.24	7,016.69	7,016.15
Storm 23 three 42in_04	32.10	42.0	258.8	-0.008	0.013	6.19	264.00	6,954.49	6,952.34
STRM_29_02	1.60	18.0	79.6	-0.027	0.013	6.11	17.27	7,015.72	7,013.40
Storm_20_48in_01	3.40	48.0	57.9	-0.020	0.013	6.07	203.30	6,961.20	6,959.87
Storm_22_30in_01	16.00	30.0	113.0	-0.005	0.013	6.06	29.03	7,016.09	7,015.50
Storm_16_Lat 1_18in_01	2.10	18.0	13.2	-0.020	0.013	5.99	15.01	6,982.08	6,981.67
Storm_23_84in_02	35.50	84.0	27.0	-0.003	0.013	5.81	347.91	6,947.59	6,947.51
Storm_28_30in_01	8.40	30.0	90.0	-0.007	0.013	5.81	34.60	7,044.20	7,044.15
Storm_19_Lat 3_18in_02	1.90	18.0	29.3	-0.020	0.013	5.79	14.90	7,016.36	7,016.40
Storm_28_30in_01	18.40	30.0	35.4	-0.004	0.013	5.71	25.78	7,044.15	7,043.91
Storm_17_Lat 1_24in_01	9.60	24.0	8.8	-0.006	0.013	5.58	17.03	6,989.73	6,989.65
Storm_23_84in_01	35.50	84.0	200.4	-0.003	0.013	5.55	325.38	6,948.26	6,947.85
STRM_29_01	3.30	18.0	66.2	-0.008	0.013	4.85	9.40	7,013.34	7,012.73
Storm_23_66in_03	32.10	66.0	167.7	-0.002	0.013	4.77	139.63	6,951.31	6,951.02
Storm_17_Lat 1_24in_02	4.30	24.0	53.4	-0.007	0.013	4.76	18.29	6,989.80	6,989.84
Storm_23_66in_02	32.10	66.0	549.0	-0.002	0.013	4.75	138.58	6,950.94	6,949.73
Storm_26_24in_01	2.10	24.0	80.7	-0.010	0.013	4.51	22.68	7,017.31	7,016.41
Storm_19_24in_04	0.50	24.0	144.7	-0.030	0.013	4.31	39.18	6,995.97	6,993.02
Storm_21_Lat 1_18in_01	3.00	18.0	19.4	-0.005	0.013	3.87	7.16	6,985.26	6,985.15
Storm_16_42in_01	68.80	42.0	158.3	-0.002	0.013	3.58	90.47	6,972.29	6,972.10
Storm_25_30in_01	1.40	30.0	28.2	0.005	0.013	3.11	29.93	6,955.70	6,955.54

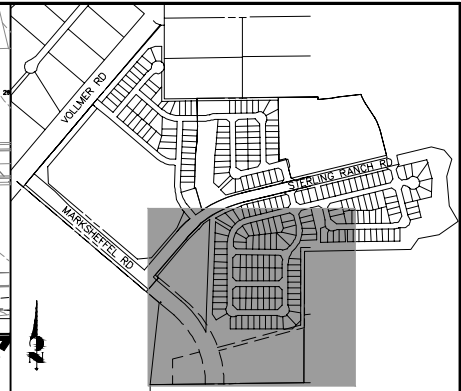
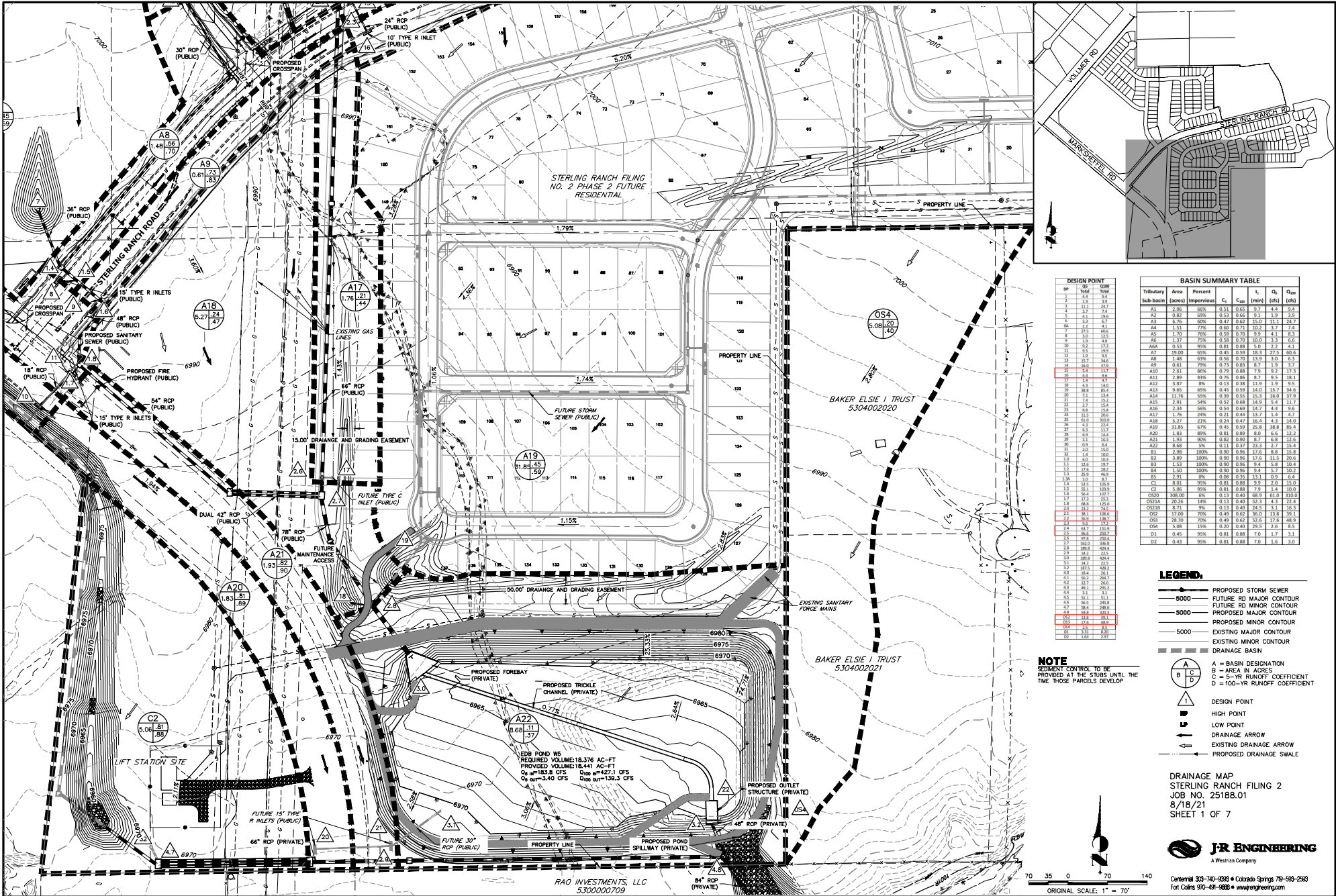
X:\2510000.all\2518801\StormCAD\2518801 StormCAD Model.stsw

**Scenario: 100-YEAR**  
**Current Time Step: 0.000 h**  
**FlexTable: Conduit Table**

Label	Flow (cfs)	Diameter (in)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
Storm_17_48in_01	151.90	48.0	15.6	-0.020	0.013	17.70	202.74	6,990.38	6,989.68
Storm_14_66in_05	250.70	66.0	354.4	-0.014	0.013	17.68	397.24	6,985.83	6,982.04
Storm_20_48in_01	139.30	48.0	57.9	-0.020	0.013	17.42	203.30	6,964.17	6,962.31
Storm_17_48in_05	138.70	48.0	292.3	-0.020	0.013	17.39	203.11	7,001.66	6,996.18
Storm_23_54in_11	233.40	54.0	333.6	-0.014	0.013	16.67	232.65	6,996.60	6,991.45
Storm_23_54in_12	233.40	54.0	412.3	-0.014	0.013	16.67	232.63	7,004.71	6,998.44
Storm_17Lat2_36in_01	37.90	36.0	110.1	-0.040	0.013	16.24	133.20	7,006.00	7,003.91
Storm_14_48in_06	106.60	48.0	59.3	-0.017	0.013	15.42	187.87	6,990.60	6,988.91
Storm_17_48in_04	138.70	48.0	82.9	-0.014	0.013	15.23	172.06	6,995.63	6,994.99
Storm_17_48in_03	138.70	48.0	150.3	-0.014	0.013	15.21	171.79	6,994.44	6,992.83
CO-6	74.50	48.0	9.5	-0.021	0.013	15.20	208.41	6,991.39	6,991.40
Storm_17_48in_02	138.70	48.0	102.0	-0.014	0.013	15.09	170.08	6,992.28	6,991.01
Storm_19_Lat 2_18in_01	19.70	18.0	76.7	-0.049	0.013	14.72	23.16	7,006.74	7,003.66
Storm_23_54in_10	233.40	54.0	298.5	-0.014	0.013	14.68	232.69	6,986.54	6,982.33
Storm_23_54in_09	233.40	54.0	402.5	-0.015	0.013	14.68	240.88	6,981.49	6,975.82
Storm_23_54in_08	233.40	54.0	567.0	-0.015	0.013	14.68	240.76	6,974.99	6,967.00
Storm_23_54in_05	233.40	54.0	120.0	-0.015	0.013	14.68	240.88	6,962.34	6,960.65
Storm_23_54in_13	233.40	54.0	265.9	-0.005	0.013	14.68	138.03	7,015.89	7,011.98
Storm_23_54in_06	233.40	54.0	93.0	-0.015	0.013	14.68	240.46	6,965.32	6,964.01
Storm_18_18in_01	25.30	18.0	22.4	-0.059	0.013	14.32	25.59	6,984.40	6,983.10
Storm_23_54in_14	221.60	54.0	43.7	-0.005	0.013	13.93	136.36	7,019.46	7,018.90
Storm_19_24in_05	30.00	24.0	177.0	-0.030	0.013	13.74	39.18	7,002.90	6,997.04
Storm_19_24in_04	30.00	24.0	144.7	-0.030	0.013	13.74	39.18	6,997.59	6,994.14
Storm_14_36in_07	34.60	36.0	76.3	-0.020	0.013	12.31	94.31	6,991.91	6,991.40
Storm_14_72in_03	336.80	72.0	74.5	-0.005	0.013	11.91	306.40	6,977.10	6,976.63
Storm_14_72in_02	336.80	72.0	127.9	-0.005	0.013	11.91	299.58	6,976.08	6,975.27
Storm_19_18in_06	10.30	18.0	339.5	-0.040	0.013	11.81	20.95	7,016.29	7,003.66
Storm_17_48in_06	138.70	48.0	22.6	-0.020	0.013	11.04	202.28	7,002.97	7,002.76
Storm_14_84in_01	424.40	84.0	107.3	-0.005	0.013	11.03	453.09	6,974.79	6,974.32
Storm_14_66in_04	250.70	66.0	512.4	-0.012	0.013	10.55	366.67	6,981.61	6,978.75
Storm_23_66in_02	243.40	66.0	549.0	-0.002	0.013	10.24	138.58	6,957.00	6,954.11
Storm_23_66in_03	243.40	66.0	167.7	-0.002	0.013	10.24	139.63	6,958.28	6,957.40
Storm_19_Lat 1_18in_01	8.70	18.0	36.4	-0.030	0.013	10.18	18.18	6,994.36	6,994.14
Storm_16_48in_02	125.00	48.0	348.6	-0.024	0.013	9.95	220.31	6,982.33	6,979.69
Storm_23_84in_02	382.70	84.0	27.0	-0.003	0.013	9.94	347.91	6,951.54	6,951.16
Storm_23_84in_01	382.70	84.0	200.4	-0.003	0.013	9.94	325.38	6,953.31	6,952.64
Storm_19_30in_03	46.90	30.0	165.0	-0.024	0.013	9.55	64.17	6,993.43	6,991.28
Storm_15_42in_01-E	85.40	42.0	63.9	-0.004	0.013	8.88	65.41	6,975.73	6,975.27
Storm_16_48in_03	107.70	48.0	50.4	-0.020	0.013	8.57	203.42	6,983.38	6,983.10
Storm_16_48in_04	107.70	48.0	42.5	-0.020	0.013	8.57	203.12	6,984.19	6,983.95
Storm 23 three 42in_04	243.40	42.0	258.8	-0.008	0.013	8.43	264.00	6,960.38	6,958.69
Storm_21_48in_02	105.90	48.0	25.8	-0.030	0.013	8.43	248.66	6,986.94	6,986.80
Storm_19_Lat 2_18in_02	14.70	18.0	35.3	-0.015	0.013	8.32	12.86	7,008.40	7,007.71
Storm_21_48in_01	103.90	48.0	57.3	-0.030	0.013	8.27	248.76	6,986.27	6,985.97
Storm_16_48in_05	103.90	48.0	26.8	-0.020	0.013	8.27	203.11	6,984.90	6,984.76
Storm_15_18in_02-W	14.00	18.0	25.5	-0.049	0.013	7.92	23.36	6,975.72	6,975.27
Storm_18_18in_02	12.80	18.0	82.7	-0.050	0.013	7.24	23.47	6,987.22	6,985.99
Storm_19_Lat 3_18in_02	3.80	18.0	29.3	-0.020	0.013	7.05	14.90	7,016.96	7,016.97
Storm_17_36in_07	48.90	36.0	9.8	-0.020	0.013	6.92	94.31	7,003.97	7,003.91
STRM_29_01	11.80	18.0	66.2	-0.008	0.013	6.68	9.40	7,019.74	7,018.90
Storm_19_36in_02	46.90	36.0	144.5	-0.006	0.013	6.63	51.15	6,990.59	6,989.88
Storm_19_36in_01	46.90	36.0	302.2	-0.006	0.013	6.63	51.04	6,989.53	6,988.04
Storm_16_42in_01	125.00	42.0	158.3	-0.002	0.013	6.50	90.47	6,979.36	6,978.75
Storm_28_30in_01	12.20	30.0	90.0	-0.007	0.013	6.44	34.60	7,044.41	7,044.53
Storm_21_42in_03	60.60	42.0	101.2	-0.005	0.013	6.30	71.15	6,988.41	6,988.04
Storm_21_Lat 1_18in_01	10.60	18.0	19.4	-0.005	0.013	6.00	7.16	6,986.99	6,986.80
Storm_28_30in_01	26.10	30.0	35.4	-0.004	0.013	5.99	25.78	7,044.53	7,044.20
Storm_22_30in_01	29.10	30.0	113.0	-0.005	0.013	5.93	29.03	7,022.08	7,021.51
Storm_17_Lat 1_24in_01	17.20	24.0	8.8	-0.006	0.013	5.47	17.03	6,991.06	6,991.01
Storm_26_24in_01	14.50	24.0	80.7	-0.010	0.013	4.62	22.68	7,022.43	7,022.10
Storm_19_Lat 3_18in_01	6.60	18.0	6.0	-0.020	0.013	3.73	14.84	7,016.99	7,016.97
Storm_22_30in_02	13.70	30.0	79.4	-0.009	0.013	2.79	38.24	7,022.22	7,022.13
Storm_16_Lat 1_18in_01	4.50	18.0	13.2	-0.020	0.013	2.55	15.01	6,984.79	6,984.76
STRM_29_02	4.10	18.0	79.6	-0.027	0.013	2.32	17.27	7,020.00	7,019.88
Storm_17_Lat 1_24in_02	7.00	24.0	53.4	-0.007	0.013	2.23	18.29	6,991.23	6,991.18
Storm_25_30in_01	10.00	30.0	28.2	0.005	0.013	2.04	29.93	6,960.67	6,960.65

X:\2510000.all\2518801\StormCAD\2518801 StormCAD Model.stsw





DESIGN POINT	SP	TP	LP	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	Q <sub>4</sub>	Q <sub>5</sub>
A1	1.44	1.13	1.13	0.00	0.00	0.00	0.00	0.00
A2	1.11	0.67	0.67	0.00	0.00	0.00	0.00	0.00
A3	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A4	1.11	0.67	0.67	0.00	0.00	0.00	0.00	0.00
A5	1.70	1.13	1.13	0.00	0.00	0.00	0.00	0.00
A6	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A7	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A8	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A9	1.70	1.13	1.13	0.00	0.00	0.00	0.00	0.00
A10	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A11	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A12	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A13	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A14	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A15	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A16	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A17	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A18	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A19	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A20	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A21	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00
A22	1.17	1.06	1.06	0.00	0.00	0.00	0.00	0.00

BASIN SUMMARY TABLE									
Tributary	Area (acres)	Percent Impervious	C <sub>s</sub>	C <sub>100</sub>	t <sub>s</sub> (hrs)	Q <sub>1</sub> (cfs)	Q <sub>2</sub> (cfs)	Q <sub>3</sub> (cfs)	Q <sub>4</sub> (cfs)
A1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

- LEGEND:**
- PROPOSED STORM SEWER
  - FUTURE RD MAJOR CONTOUR
  - FUTURE RD MINOR CONTOUR
  - PROPOSED MAJOR CONTOUR
  - PROPOSED MINOR CONTOUR
  - EXISTING MAJOR CONTOUR
  - EXISTING MINOR CONTOUR
  - DRAINAGE BASIN
  - DESIGN POINT
  - HIGH POINT
  - LOW POINT
  - DRAINAGE ARROW
  - EXISTING DRAINAGE ARROW
  - PROPOSED DRAINAGE SILL
- NOTE:** SEDIMENT CONTROL TO BE PROVIDED AT THE STUBS UNTIL THE TIME THOSE PARCELS DEVELOP
- EDB POND W5:**  
 REQUIRED VOLUME: 18,376 AC-FT  
 PROVIDED VOLUME: 18,441 AC-FT  
 Q<sub>1</sub> @ 5-YR RCP: 153.8 CFS  
 Q<sub>2</sub> @ 5-YR RCP: 427.1 CFS  
 Q<sub>3</sub> @ 100-YR RCP: 136.3 CFS

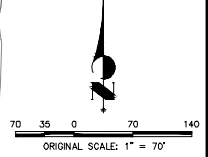
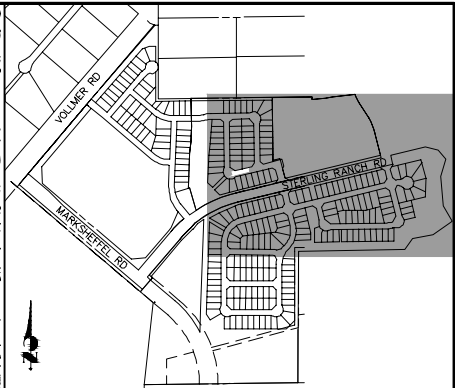
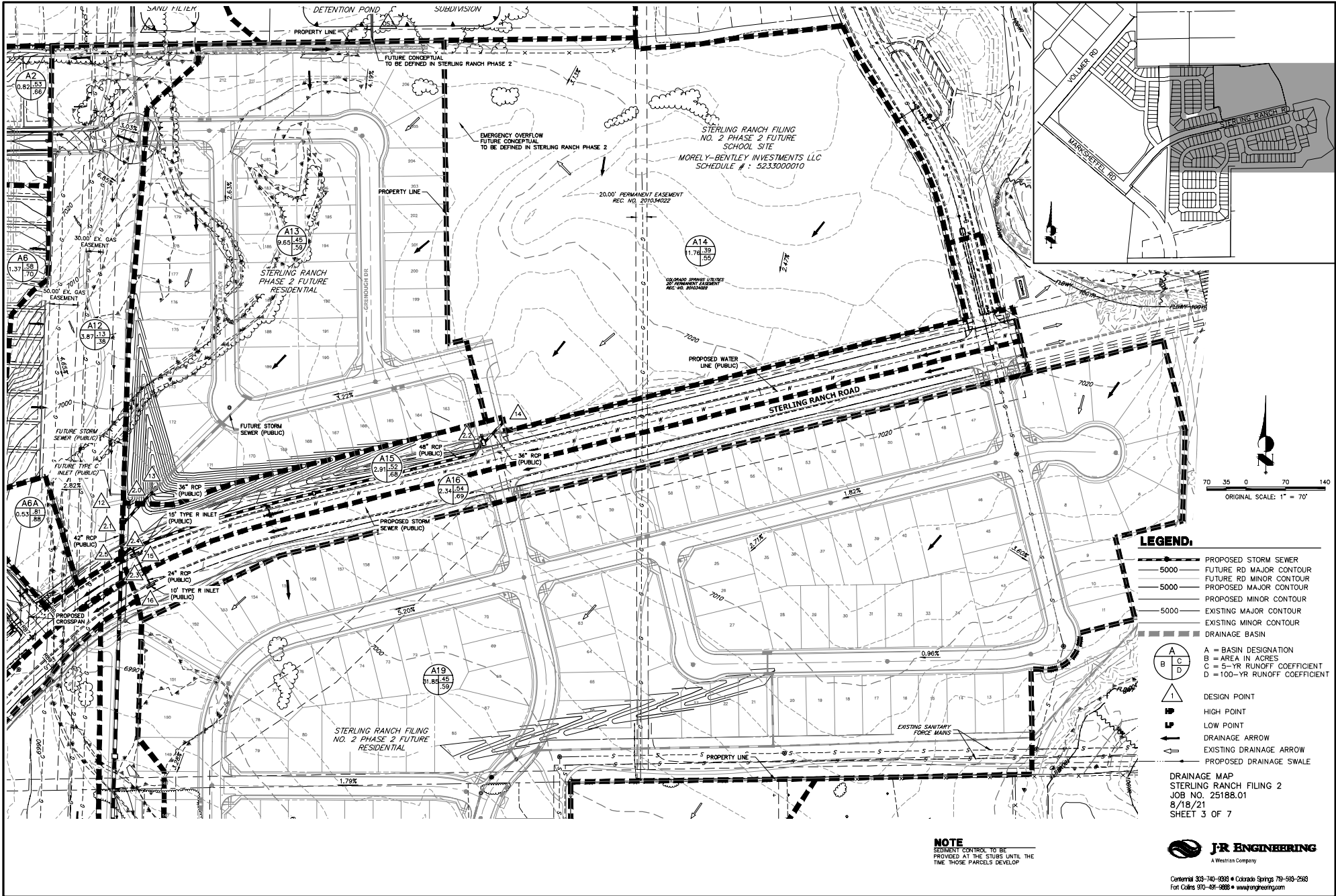
**DRAINAGE MAP**  
 STERLING RANCH FILING 2  
 JOB NO. 25188.01  
 8/18/21  
 SHEET 1 OF 7



Callend 333-740-9929 • Colorado Springs 719-589-2958  
 Fort Collins 970-498-9888 • www.jrengineering.com

RAO INVESTMENTS, LLC  
 530000709

ORIGINAL SCALE: 1" = 70'



- LEGEND:**
- PROPOSED STORM SEWER
  - 5000 FUTURE RD MAJOR CONTOUR
  - 5000 FUTURE RD MINOR CONTOUR
  - PROPOSED MAJOR CONTOUR
  - PROPOSED MINOR CONTOUR
  - 5000 EXISTING MAJOR CONTOUR
  - EXISTING MINOR CONTOUR
  - DRAINAGE BASIN
  - A = BASIN DESIGNATION  
B = AREA IN ACRES  
C = 5-YR RUNOFF COEFFICIENT  
D = 100-YR RUNOFF COEFFICIENT
  - DESIGN POINT
  - HIGH POINT
  - LOW POINT
  - DRAINAGE ARROW
  - EXISTING DRAINAGE ARROW
  - PROPOSED DRAINAGE SWALE

DRAINAGE MAP  
STERLING RANCH FILING 2  
JOB NO. 25188.01  
8/18/21  
SHEET 3 OF 7

**NOTE**  
SEDIMENT CONTROL TO BE PROVIDED AT THE STUBS UNTIL THE TIME THOSE PARCELS DEVELOP



Colorado 303-740-0202 • Colorado Springs 719-589-2960  
Fort Collins 970-497-9888 • [www.jrengineering.com](http://www.jrengineering.com)

X:\210200\210200.dwg (P:\Projects\210200.dwg) Plot Date: 8/18/21 10:58:02 AM. Plot File: 210200.dwg. Plot Scale: 1" = 70'. Plot Sheet: 3 of 7.



**FINAL DRAINAGE REPORT  
FOR  
STERLING RANCH FILING NO. 4**

**Prepared For:**

**SR Land, LLC  
20 Boulder Crescent, Suite 200  
Colorado Springs, CO 80903  
(719) 491-3024**

**August 14, 2023  
Project No. 25188.11**

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

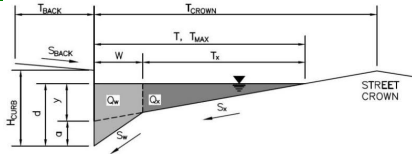
**PCD Filing No.:  
SF-22-030**

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

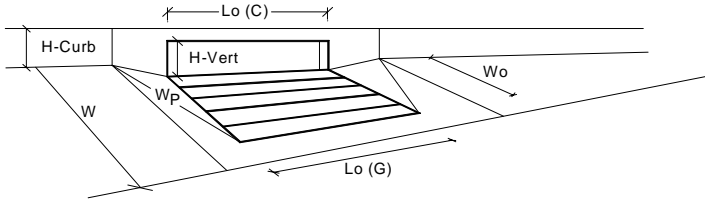
Inlet ID: Inlet DP5



<b>Gutter Geometry:</b>						
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 8.0$ ft					
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft					
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$					
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches					
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ ft					
Gutter Width	$W = 2.00$ ft					
Street Transverse Slope	$S_X = 0.020$ ft/ft					
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_W = 0.083$ ft/ft					
Street Longitudinal Slope - Enter 0 for sump condition	$S_O = 0.000$ ft/ft					
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$					
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td rowspan="2" style="text-align: right; padding-left: 5px;">ft</td> </tr> <tr> <td style="text-align: center;"><math>T_{MAX} = 17.0</math></td> <td style="text-align: center;"><math>17.0</math></td> </tr> </table>	Minor Storm	Major Storm	ft	$T_{MAX} = 17.0$	$17.0$
Minor Storm	Major Storm	ft				
$T_{MAX} = 17.0$	$17.0$					
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td rowspan="2" style="text-align: right; padding-left: 5px;">inches</td> </tr> <tr> <td style="text-align: center;"><math>d_{MAX} = 6.0</math></td> <td style="text-align: center;"><math>7.0</math></td> </tr> </table>	Minor Storm	Major Storm	inches	$d_{MAX} = 6.0$	$7.0$
Minor Storm	Major Storm	inches				
$d_{MAX} = 6.0$	$7.0$					
Check boxes are not applicable in SUMP conditions	<input type="checkbox"/> <input type="checkbox"/>					
MINOR STORM Allowable Capacity is not applicable to Sump Condition						
MAJOR STORM Allowable Capacity is not applicable to Sump Condition						
	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td rowspan="2" style="text-align: right; padding-left: 5px;">cfs</td> </tr> <tr> <td style="text-align: center;"><math>Q_{allow} =</math> SUMP</td> <td style="text-align: center;">SUMP</td> </tr> </table>	Minor Storm	Major Storm	cfs	$Q_{allow} =$ SUMP	SUMP
Minor Storm	Major Storm	cfs				
$Q_{allow} =$ SUMP	SUMP					

# INLET IN A SUMP OR SAG LOCATION

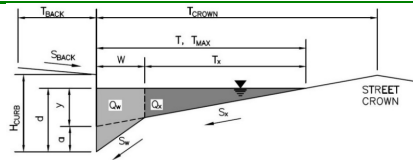
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	1	1	
Water Depth at Flowline (outside of local depression)	7.1	7.4	inches
<b>Grate Information</b>	MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
<b>Curb Opening Information</b>	MINOR	MAJOR	
Length of a Unit Curb Opening	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>	MINOR	MAJOR	
Depth for Grate Midwidth	N/A	N/A	ft
Depth for Curb Opening Weir Equation	0.43	0.45	ft
Grated Inlet Performance Reduction Factor for Long Inlets	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	0.85	0.86	
Combination Inlet Performance Reduction Factor for Long Inlets	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)	12.2	13.5	cfs
<b>WARNING: Inlet Capacity &lt; Q Peak for Major Storm</b>	12.0	25.9	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**  
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

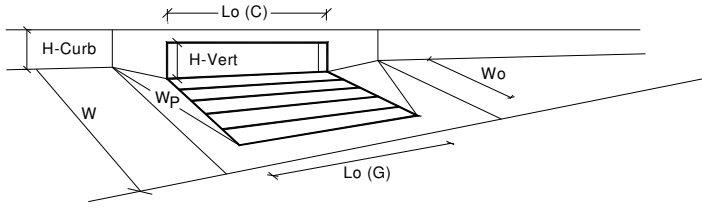
Project: **Sterling Ranch Filing 4**  
 Inlet ID: **Inlet DP6.1**



<b>Gutter Geometry:</b>	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 8.0$ ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ ft
Gutter Width	$W = 2.00$ ft
Street Transverse Slope	$S_x = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.000$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 17.0 & 17.0 \end{matrix}$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 6.0 & 7.0 \end{matrix}$ inches
Check boxes are not applicable in SUMP conditions	<input type="checkbox"/> <input type="checkbox"/>
<a href="#">MINOR STORM Allowable Capacity is not applicable to Sump Condition</a>	
<a href="#">MAJOR STORM Allowable Capacity is not applicable to Sump Condition</a>	
$Q_{allow} =$	$\begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ \text{SUMP} & \text{SUMP} \end{matrix}$ cfs

# INLET IN A SUMP OR SAG LOCATION

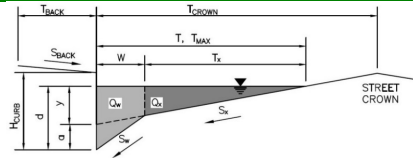
MHFD-Inlet, Version 5.02 (August 2022)



		MINOR	MAJOR	
<b>Design Information (Input)</b>				
Type of Inlet	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		$a_{local} = 3.00$	$3.00$	inches
Number of Unit Inlets (Grate or Curb Opening)		No = 1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth = 5.6	8.0	inches
<b>Grate Information</b>				<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		$L_o (G) = N/A$	$N/A$	feet
Width of a Unit Grate		$W_o = N/A$	$N/A$	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		$A_{ratio} = N/A$	$N/A$	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_f (G) = N/A$	$N/A$	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w (G) = N/A$	$N/A$	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o (G) = N/A$	$N/A$	
<b>Curb Opening Information</b>				
Length of a Unit Curb Opening		$L_o (C) = 10.00$	$10.00$	feet
Height of Vertical Curb Opening in Inches		$H_{vert} = 6.00$	$6.00$	inches
Height of Curb Orifice Throat in Inches		$H_{throat} = 6.00$	$6.00$	inches
Angle of Throat (see USDCM Figure ST-5)		Theta = 63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		$W_p = 2.00$	$2.00$	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_f (C) = 0.10$	$0.10$	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w (C) = 3.60$	$3.60$	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o (C) = 0.67$	$0.67$	
<b>Low Head Performance Reduction (Calculated)</b>				
Depth for Grate Midwidth		$d_{Grate} = N/A$	$N/A$	ft
Depth for Curb Opening Weir Equation		$d_{Curb} = 0.30$	$0.50$	ft
Grated Inlet Performance Reduction Factor for Long Inlets		$RF_{Grate} = N/A$	$N/A$	
Curb Opening Performance Reduction Factor for Long Inlets		$RF_{Curb} = 0.91$	$1.00$	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination} = N/A$	$N/A$	
Total Inlet Interception Capacity (assumes clogged condition)		$Q_a = 6.9$	$16.2$	cfs
<b>WARNING: Inlet Capacity &lt; Q Peak for Major Storm</b>		$Q_{PEAK REQUIRED} = 3.9$	$19.3$	cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**  
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

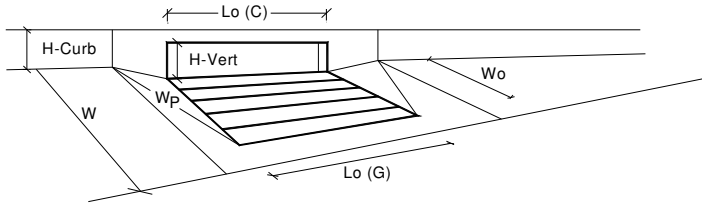
Project: **Sterling Ranch Filing 4**  
 Inlet ID: **Inlet DP6.2**



<b>Gutter Geometry:</b>	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 8.0$ ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ ft
Gutter Width	$W = 2.00$ ft
Street Transverse Slope	$S_x = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.000$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 17.0 & 17.0 \end{matrix}$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 6.0 & 6.0 \end{matrix}$ inches
Check boxes are not applicable in SUMP conditions	<input type="checkbox"/> <input type="checkbox"/>
<a href="#">MINOR STORM Allowable Capacity is not applicable to Sump Condition</a>	
<a href="#">MAJOR STORM Allowable Capacity is not applicable to Sump Condition</a>	
$Q_{allow} =$	$\begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ \text{SUMP} & \text{SUMP} \end{matrix}$ cfs

# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



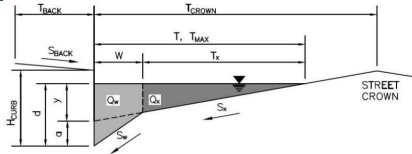
Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	1	1	
Water Depth at Flowline (outside of local depression)	5.6	8.0	inches
<b>Grate Information</b>			
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
<b>Curb Opening Information</b>			
Length of a Unit Curb Opening	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>			
Depth for Grate Midwidth	N/A	N/A	ft
Depth for Curb Opening Weir Equation	0.30	0.50	ft
Grated Inlet Performance Reduction Factor for Long Inlets	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	0.91	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>			
<b>Inlet Capacity IS GOOD for Minor and Major Storms (&gt;Q Peak)</b>	<b>6.9</b>	<b>16.3</b>	<b>cfs</b>
Q PEAK REQUIRED =	2.0	7.3	cfs

## ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Ex Inlet DP8

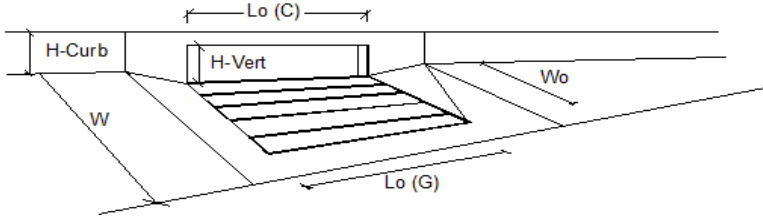


<b>Gutter Geometry:</b>						
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 10.0$ ft					
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft					
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$					
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches					
Distance from Curb Face to Street Crown	$T_{CROWN} = 30.0$ ft					
Gutter Width	$W = 2.00$ ft					
Street Transverse Slope	$S_x = 0.020$ ft/ft					
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft					
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.015$ ft/ft					
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$					
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td rowspan="2" style="padding: 0 10px;">ft</td> </tr> <tr> <td style="text-align: center;"><math>T_{MAX} = 15.0</math></td> <td style="text-align: center;"><math>30.0</math></td> </tr> </table>	Minor Storm	Major Storm	ft	$T_{MAX} = 15.0$	$30.0$
Minor Storm	Major Storm	ft				
$T_{MAX} = 15.0$	$30.0$					
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td rowspan="2" style="padding: 0 10px;">inches</td> </tr> <tr> <td style="text-align: center;"><math>d_{MAX} = 6.0</math></td> <td style="text-align: center;"><math>6.0</math></td> </tr> </table>	Minor Storm	Major Storm	inches	$d_{MAX} = 6.0$	$6.0$
Minor Storm	Major Storm	inches				
$d_{MAX} = 6.0$	$6.0$					
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </table>	Minor Storm	Major Storm	<input type="checkbox"/>	<input type="checkbox"/>	
Minor Storm	Major Storm					
<input type="checkbox"/>	<input type="checkbox"/>					
<a href="#">MINOR STORM Allowable Capacity is based on Spread Criterion</a>						
<a href="#">MAJOR STORM Allowable Capacity is based on Depth Criterion</a>						
Minor storm max. allowable capacity GOOD - greater than the design peak flow of 6.10 cfs on sheet 'Inlet Management'						
Major storm max. allowable capacity GOOD - greater than the design peak flow of 13.00 cfs on sheet 'Inlet Management'						



# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



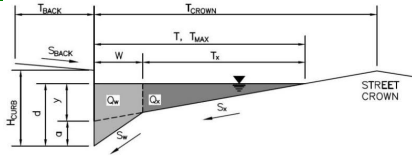
Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			
Total Inlet Interception Capacity	6.1	10.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	2.2	cfs
Capture Percentage = $Q_i/Q_o$	100	83	%

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

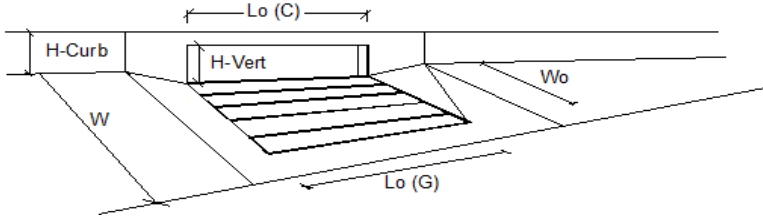
Inlet ID: Ex Inlet DP9



<b>Gutter Geometry:</b>									
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 10.0$ ft								
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft								
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$								
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches								
Distance from Curb Face to Street Crown	$T_{CROWN} = 30.0$ ft								
Gutter Width	$W = 2.00$ ft								
Street Transverse Slope	$S_x = 0.020$ ft/ft								
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft								
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.015$ ft/ft								
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$								
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th>ft</th> </tr> <tr> <td><math>T_{MAX} =</math></td> <td>15.0</td> <td>30.0</td> <td></td> </tr> </table>		Minor Storm	Major Storm	ft	$T_{MAX} =$	15.0	30.0	
	Minor Storm	Major Storm	ft						
$T_{MAX} =$	15.0	30.0							
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1"> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th>inches</th> </tr> <tr> <td><math>d_{MAX} =</math></td> <td>6.0</td> <td>6.0</td> <td></td> </tr> </table>		Minor Storm	Major Storm	inches	$d_{MAX} =$	6.0	6.0	
	Minor Storm	Major Storm	inches						
$d_{MAX} =$	6.0	6.0							
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	<table border="1"> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> </tr> <tr> <td></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table>		Minor Storm	Major Storm		<input type="checkbox"/>	<input type="checkbox"/>		
	Minor Storm	Major Storm							
	<input type="checkbox"/>	<input type="checkbox"/>							
MINOR STORM Allowable Capacity is based on Spread Criterion									
MAJOR STORM Allowable Capacity is based on Depth Criterion									
Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.80 cfs on sheet 'Inlet Management'									
Major storm max. allowable capacity GOOD - greater than the design peak flow of 7.90 cfs on sheet 'Inlet Management'									
	<table border="1"> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th>cfs</th> </tr> <tr> <td><math>Q_{allow} =</math></td> <td>9.8</td> <td>16.9</td> <td></td> </tr> </table>		Minor Storm	Major Storm	cfs	$Q_{allow} =$	9.8	16.9	
	Minor Storm	Major Storm	cfs						
$Q_{allow} =$	9.8	16.9							

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



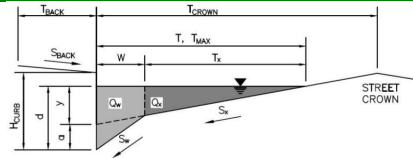
<b>Design Information (Input)</b> Type of Inlet: <span style="border: 1px solid black; padding: 2px;">CDOT Type R Curb Opening</span> Local Depression (additional to continuous gutter depression 'a') Total Number of Units in the Inlet (Grate or Curb Opening) Length of a Single Unit Inlet (Grate or Curb Opening) Width of a Unit Grate (cannot be greater than W, Gutter Width) Clogging Factor for a Single Unit Grate (typical min. value = 0.5) Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">MINOR</th> <th style="text-align: center;">MAJOR</th> <th></th> </tr> </thead> <tbody> <tr> <td>Type =</td> <td colspan="2" style="text-align: center;">CDOT Type R Curb Opening</td> <td></td> </tr> <tr> <td>a<sub>LOCAL</sub> =</td> <td style="text-align: center;">3.0</td> <td style="text-align: center;">3.0</td> <td>inches</td> </tr> <tr> <td>No =</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td></td> </tr> <tr> <td>L<sub>o</sub> =</td> <td style="text-align: center;">15.00</td> <td style="text-align: center;">15.00</td> <td>ft</td> </tr> <tr> <td>W<sub>o</sub> =</td> <td style="text-align: center;">N/A</td> <td style="text-align: center;">N/A</td> <td>ft</td> </tr> <tr> <td>C<sub>f</sub> (G) =</td> <td style="text-align: center;">N/A</td> <td style="text-align: center;">N/A</td> <td></td> </tr> <tr> <td>C<sub>f</sub> (C) =</td> <td style="text-align: center;">0.10</td> <td style="text-align: center;">0.10</td> <td></td> </tr> </tbody> </table> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">MINOR</th> <th style="text-align: center;">MAJOR</th> <th></th> </tr> </thead> <tbody> <tr> <td>Q =</td> <td style="text-align: center;">3.8</td> <td style="text-align: center;">7.7</td> <td>cfs</td> </tr> <tr> <td>Q<sub>b</sub> =</td> <td style="text-align: center;">0.0</td> <td style="text-align: center;">0.2</td> <td>cfs</td> </tr> <tr> <td>C% =</td> <td style="text-align: center;">100</td> <td style="text-align: center;">98</td> <td>%</td> </tr> </tbody> </table>		MINOR	MAJOR		Type =	CDOT Type R Curb Opening			a <sub>LOCAL</sub> =	3.0	3.0	inches	No =	1	1		L <sub>o</sub> =	15.00	15.00	ft	W <sub>o</sub> =	N/A	N/A	ft	C <sub>f</sub> (G) =	N/A	N/A		C <sub>f</sub> (C) =	0.10	0.10			MINOR	MAJOR		Q =	3.8	7.7	cfs	Q <sub>b</sub> =	0.0	0.2	cfs	C% =	100	98	%
	MINOR	MAJOR																																															
Type =	CDOT Type R Curb Opening																																																
a <sub>LOCAL</sub> =	3.0	3.0	inches																																														
No =	1	1																																															
L <sub>o</sub> =	15.00	15.00	ft																																														
W <sub>o</sub> =	N/A	N/A	ft																																														
C <sub>f</sub> (G) =	N/A	N/A																																															
C <sub>f</sub> (C) =	0.10	0.10																																															
	MINOR	MAJOR																																															
Q =	3.8	7.7	cfs																																														
Q <sub>b</sub> =	0.0	0.2	cfs																																														
C% =	100	98	%																																														

## ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Inlet DP2e



**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb  
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK}$ =	10.0	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.016	

Height of Curb at Gutter Flow Line  
 Distance from Curb Face to Street Crown  
 Gutter Width  
 Street Transverse Slope  
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)  
 Street Longitudinal Slope - Enter 0 for sump condition  
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$H_{CURB}$ =	6.00	inches
$T_{CROWN}$ =	30.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_w$ =	0.083	ft/ft
$S_o$ =	0.037	ft/ft
$n_{STREET}$ =	0.016	

Max. Allowable Spread for Minor & Major Storm  
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm  
 Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX}$ =	30.0	30.0	ft
$d_{MAX}$ =	6.0	6.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

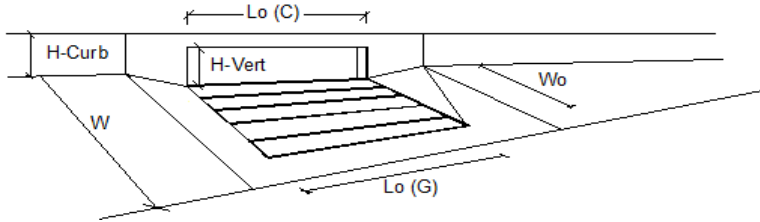
MINOR STORM Allowable Capacity is based on Depth Criterion  
 MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow}$ =	16.7	16.7	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 4.00 cfs on sheet 'Inlet Management'  
 Major storm max. allowable capacity GOOD - greater than the design peak flow of 13.00 cfs on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			
Total Inlet Interception Capacity	4.0	10.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	2.1	cfs
Capture Percentage = $Q_i/Q_o$	100	84	%





Know what's below.  
Call before you dig.

# ASPEN MEADOWS

## COLORADO SPRINGS, CO

### PROPOSED CONDITIONS MAP

Design Point	Upstream			Design Point Summary Table			Downstream Design Point	Receiving Emergency Overflow	
	Area (Acres)	Q5 (cfs)	Q100 (cfs)	Name	Inlet Type	Size (ft)			Outlet Pipe Size/Type
DP1	4.35	5.0	14.4	A2	A2	D 10 R	12	24" RCP/HP	DP6 / Street Overtop
DP2	5.15	5.8	16.5	A1	A1	D 10 R	10	24" RCP/HP	DP3 / Street Overtop
DP3	5.53	6.2	17.7	DP2,A4	A4	D 10 R	6	18" RCP/HP	DP6 / C & G, Street Overtop
DP4	4.06	3.4	11.4	A6	D4	D 10 R	8	36" RCP/HP	DP5 / Street Overtop
DP5	5.23	4.8	15.2	DP5, A7	D5	MH	6	36" RCP/HP	DP1 / C & G
DP6	16.22	16.7	49.3	DP1,DP3,DP5,A9	D6	D 10 R	6	42" RCP/HP	DP POND / Overtop Curb, Swale
DP7	2.00	2.8	8.0	A5	A5	D 10 R	6	24" RCP/HP	DP POND / Overtop Curb, Swale
DP Pond	21.57	19.9	61.2	A1,A2,A4,A5, A6,A7,A9, A10	A9	Orifice Plate: 1.02 Sq. In. (Stage 0', 9" & 1.06') Overflow Weir/Grate: L=2', W=2' w/ slope: 0 Structure Outlet Pipe: 18" RCP/HP (10.5" Orifice Plate)		Sand Creek	Sand Creek
Detention Discharge	-	0.4	3.7						
DP8	1.95	5.9	13.2	RP-7C,A12	A12	D 10 R	16	24" RCP/HP	DP10 / C & G
DP9	1.87	5.8	13.0	DP8,RP-7D,A13	A13	D 10 R	16	24" RCP/HP	DP11 / C & G
DP10	0.71	2.7	6.0	A14	A14	D 10 R	16	18" RCP/HP	DP11 / C & G
DP11	0.71	2.6	5.9	DP9,DP10,A15	A15	D 10 R	16	30" RCP/HP	DP13 / C & G
DP12	1.90	4.8	11.6	A16	A16	D 10 R	20	24" RCP/HP	Sand Creek Bridge
DP13	3.55	8.6	20.3	DP11,DP12,A17	A17	D 10 R	16	42" RCP/HP	WQ POND / Sand Creek Bridge

Basin Summary Table					
Aspen Meadows					
Area ID	Area (Acres)	Q5 (cfs)	Q100 (cfs)	Runoff Source	Runoff Type
RP-7C	1.28	2.8	6.4	Road	Concentrated
RP-7D	1.21	2.9	6.5	Road	Concentrated
A1	5.15	5.8	16.5	5.Lots/Road	Sheet/Conc
A2	4.35	5.0	14.4	4.Lots/Road	Sheet/Conc
A4	0.38	0.5	1.5	1.Lots/Road	Sheet/Conc
A5	2.00	2.8	8.0	8.Lots/Road	Sheet/Conc
A6	4.06	3.4	11.4	4.Lots/Road	Sheet/Conc
A7	1.17	1.7	4.8	4.Lots/Road	Sheet/Conc
A9	1.11	1.6	4.6	4.Lots/Road	Sheet/Conc
A10	3.34	2.3	10.3	Pond	Sheet
A11	0.88	0.3	2.8	Channel	Concentrated
A12	0.67	2.5	5.6	Road	Concentrated
A13	0.66	2.5	5.6	Road	Concentrated
A14	0.71	2.7	6.0	Road	Concentrated
A15	0.71	2.6	5.9	Road	Concentrated
A16	1.90	4.8	11.6	11.6.Lots/Road	Sheet/Conc
A17	0.94	3.5	7.9	Road	Concentrated

NOTE: BASIN A3 & A8 OMITTED.

CONSULTANT:  
CIVIL ENGINEER/ LANDSCAPE ARCHITECT:  
**Matrix**  
Excellence by Design  
2435 Research Parkway, Suite 300  
Colorado Springs, CO 80920  
Contact: Greg Shaner, Civil Engineer  
Contact: Jason Alwine, Landscape Architect  
Phone (719) 575-0100  
Fax (719) 575-0208

PROJECT:  
**ASPEN MEADOWS**  
FILING NO. 1  
PUD DEVELOPMENT PLAN  
CITY OF COLORADO SPRINGS  
JANUARY 2020  
OWNER:  
**COLA, LLC**  
555 MIDDLE PARKWAY  
COLORADO SPRINGS, CO 80921  
(719)459-0807

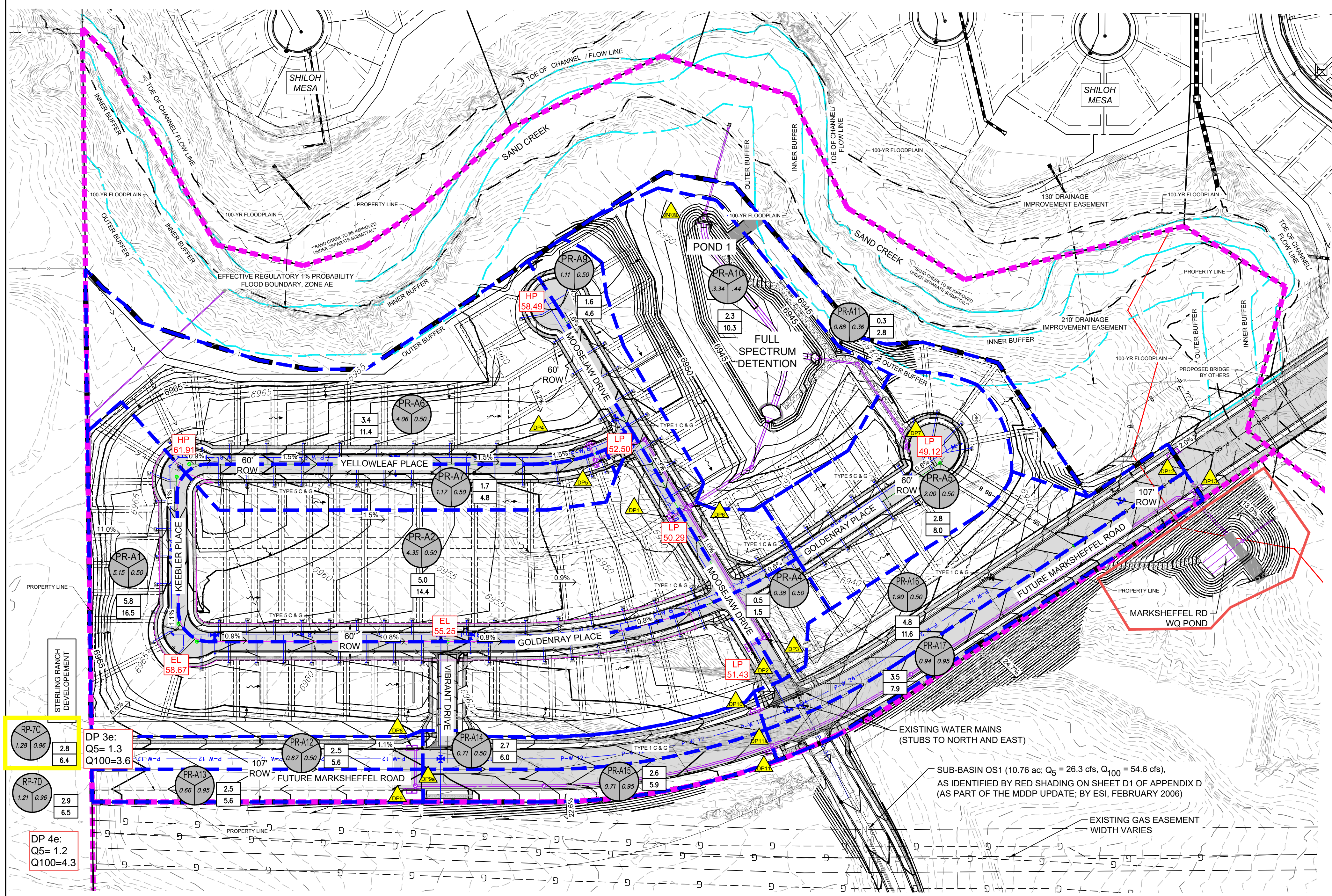
DEVELOPER:  
**COLA, LLC**  
555 MIDDLE PARKWAY  
COLORADO SPRINGS, CO 80921  
(719)459-0807  
CITY PLANNING FILE NO.: AR PUD 19-00053  
ISSUE: MARCH, 2020

DRAWING INFORMATION:  
PROJECT NO.: 17.886.004.000  
DRAWN BY: CRAIG DOLD  
CHECKED BY: JEFF ODOR  
APPROVED BY: JEFF ODOR  
SHEET TITLE:

## DRAINAGE REPORT MAP

# DR02

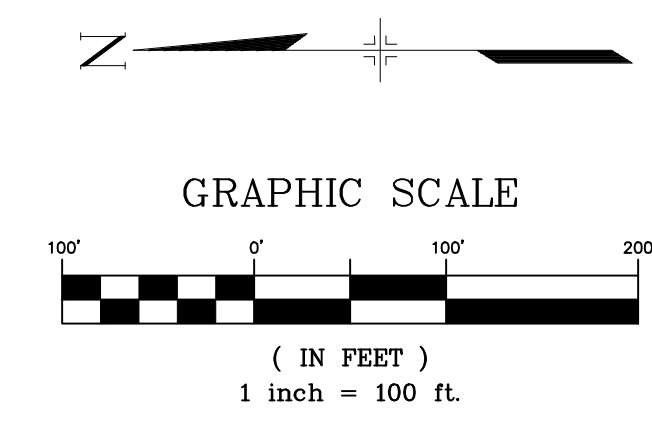
SHEET 2 OF 3



NOTES:  
1. Spot elevations subject to change with final grading design and construction.

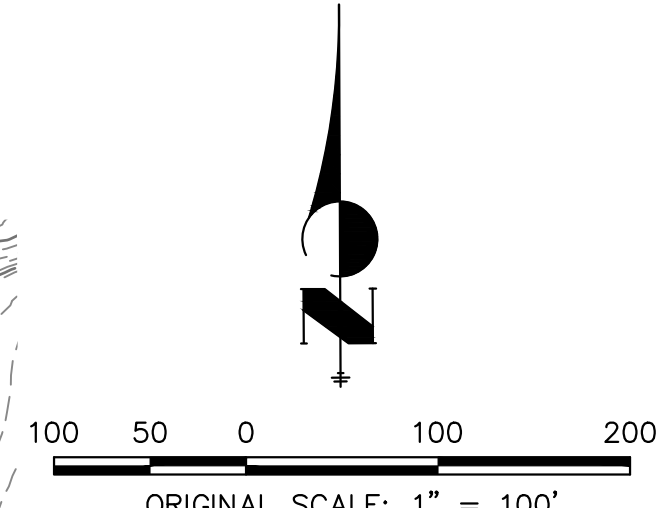
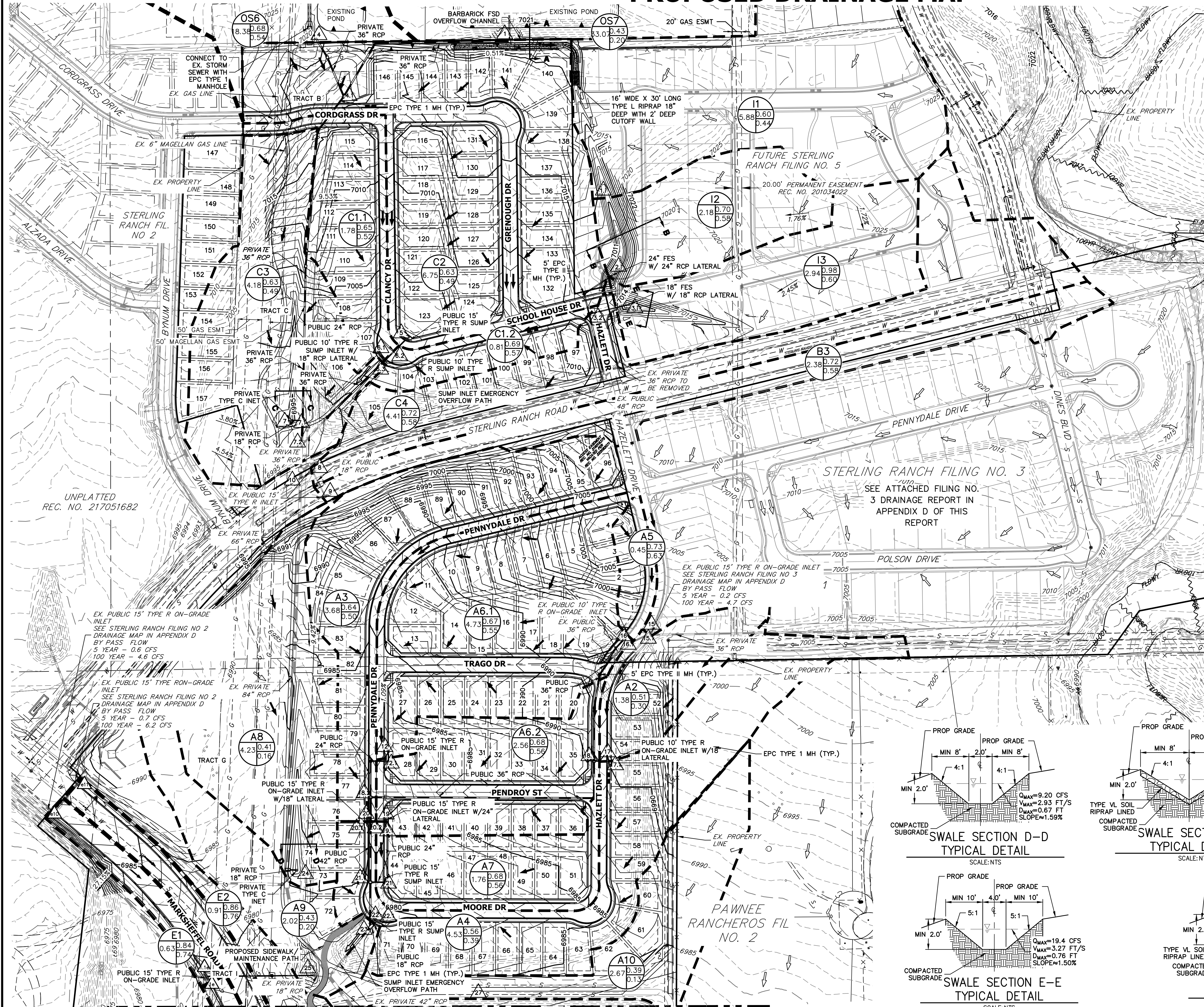
### LEGEND

- SUB-BASIN BOUNDARY
- EXISTING CONTOUR
- PROPOSED CONTOUR
- FLOW DIRECTION
- LOW POINT AND ELEVATION
- HIGH POINT AND ELEVATION
- SPOT ELEVATION
- FLOW ARROW
- SWALE
- DESIGN POINT
- SUB BASIN DESIGNATION
- SUB BASIN RUNOFF COEFFICIENT
- SUB BASIN AREA (AC.)
- 5-YEAR STORM EVENT PEAK FLOW (CFS)
- 100-YEAR STORM EVENT PEAK FLOW (CFS)
- PROPERTY LINE
- STORM PIPE





# STERLING RANCH FILING NO. 4 PROPOSED DRAINAGE MAP



### LEGEND

BASIN ID  
A: BASIN LABEL  
B: AREA  
C: -100 YR  
D: C-5 YR

DESIGN POINT  
PROPOSED FLOW DIRECTION  
EXISTING FLOW DIRECTION  
BASIN DRAINAGE AREA  
EXISTING STORM SEWER  
STORM SEWER PROPOSED  
PROPOSED R.O.W  
PROPOSED PROPERTY LINES  
PROPOSED SIDEWALK  
EXISTING PROPERTY LINE  
ROW EXISTING  
FL EXISTING  
SIDEWALK EXISTING  
DRAINAGE ACCESS & MAINTENANCE EASEMENT

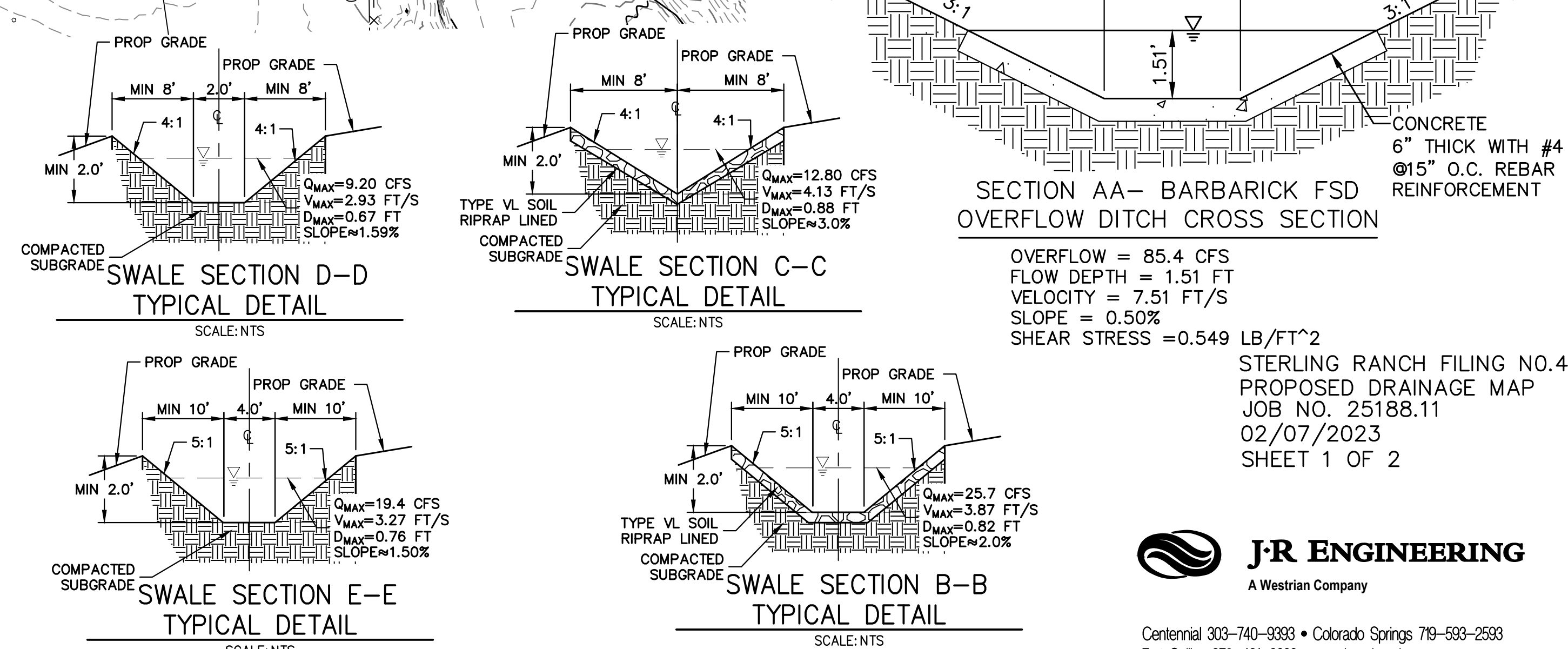
EXISTING PROPOSED

### DESIGN POINT

DP	Q5		Q100				
	Total	Total	Total	Total			
1	14.6	52.8					
4	22.3	55.6					
4.1	29.0	88.7					
5	12.0	25.9					
6.1	3.9	19.3					
6.2	2.0	6.4					
6.3	16.9	35.6					
7	3.5	12.8					
7.1	30.0	93.5					
7.2	39.8	114.9					
8	6.1	12.9					
9	3.8	7.9					
15	8.2	17.7					
15.1	21.0	43.2					
16	1.4	2.9					
16.1	21.5	44.9					
17	1.6	7.9					
17.1	1.6	7.7					
18.1	22.8	52.2					
12	10.0	20.5					
12.1	9.1	13.9					
18.2	29.2	62.0					
19	6.4	17.8					
19.1	6.4	12.9					
20	7.0	14.9					
20.1	7.0	11.7					
20.2	39.6	81.4					
21	3.8	12.6					
21.1	42.5	91.3					
22	6.3	18.3					
22.1	6.3	18.3					
23	47.4	106.2					
24	2.2	9.2					
25	1.0	4.8					
27	2.9	8.8					
1.1	7.8	17.9					
3.1	7.1	19.4					
2.1	11.6	25.7					
3.2	16.9	40.2					
e11	0.7	6.2					
1e	2.8	8.9					
1.1e	2.8	8.5					
i2	2.18	71%	0.58	70	11.9	4.9	9.9
i3	2.94	68%	0.60	98	10.8	7.1	19.4
e10	0.6	4.6					
2e	4.1	12.6					
2.1e	4.1	10.7					
3e	2.2	4.6					
4e	1.3	5.0					

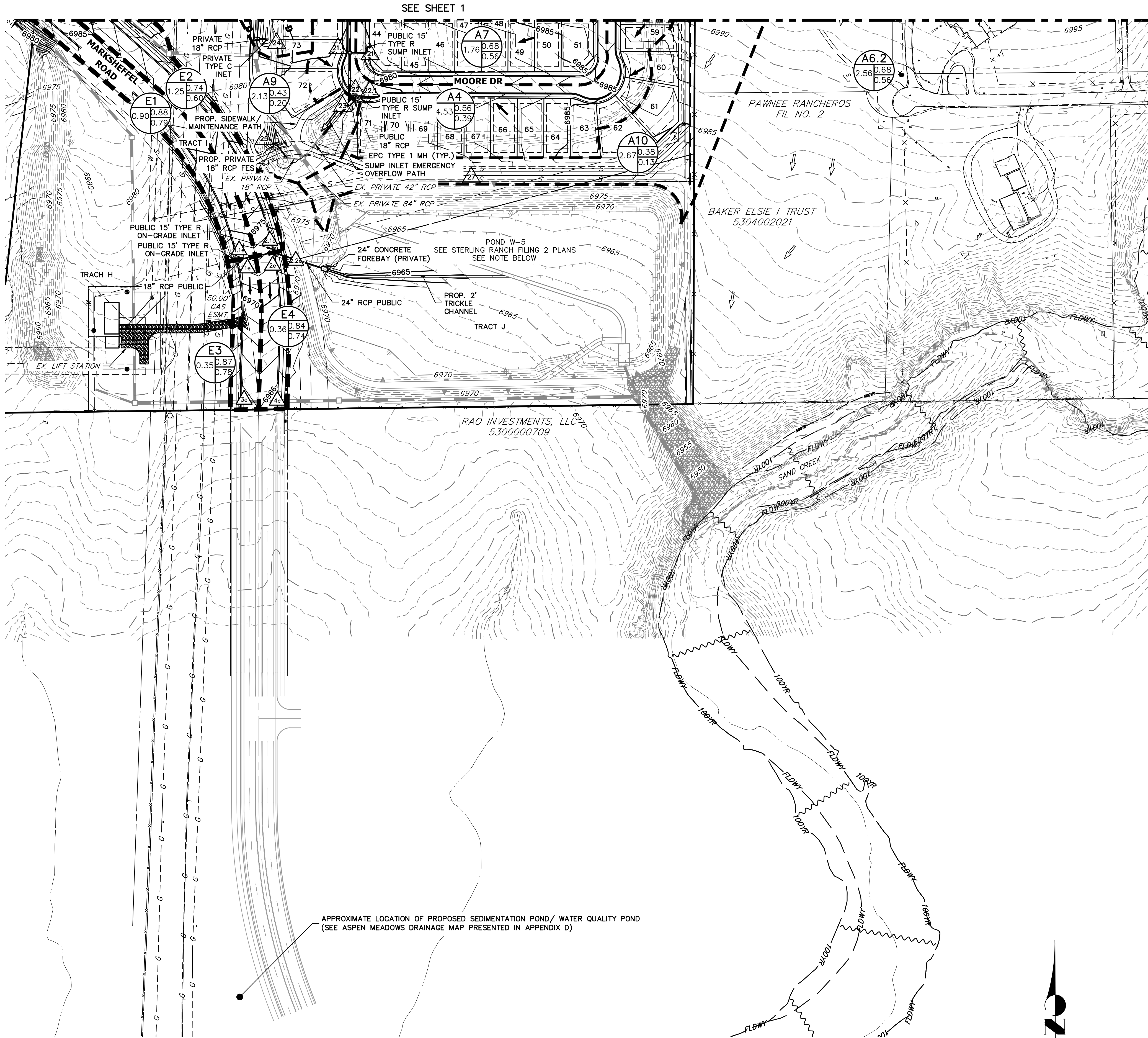
### BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C <sub>s</sub>	C <sub>100</sub>	t <sub>c</sub> (min)	Q <sub>s</sub> (cfs)	Q <sub>100</sub> (cfs)
A2	1.38	32%	0.30	0.51	10.3	1.7	4.8
A3	3.68	65%	0.50	0.64	12.5	7.0	14.9
A4	4.53	48%	0.39	0.56	15.0	6.3	15.1
A5	0.45	79%	0.63	0.73	5.0	1.4	2.9
A6.1	4.73	72%	0.55	0.67	12.1	10.0	20.5
A6.2	2.56	74%	0.56	0.68	12.1	5.6	11.3
A7	1.76	73%	0.56	0.68	9.4	4.2	8.5
A8	4.23	13%	0.16	0.41	18.9	2.2	9.2
C1.1	1.78	66%	0.52	0.65	9.2	3.9	8.3
C1.2	0.81	72%	0.57	0.69	8.3	2.0	4.2
C2	6.75	63%	0.49	0.63	14.2	12.0	25.9
C3	4.18	19%	0.20	0.43	9.3	3.5	12.8
A9	2.02	8%	0.13	0.39	13.6	1.0	4.8
A10	2.67	26%	0.27	0.49	10.7	2.9	8.8
B3	2.38	63%	0.58	0.72	25.5	3.8	7.9
C4	4.41	62%	0.54	0.68	28.3	6.1	12.9
OS6	18.38	45%	0.37	0.55	17.5	22.3	55.6
OS7	33.07	19%	0.20	0.43	36.4	14.6	52.8
e11	0.7	6.2					
1e	2.8	8.9					
1.1e	2.8	8.5					
i2	2.18	71%	0.58	70	11.9	4.9	9.9
i3	2.94	68%	0.60	98	10.8	7.1	19.4
E1	0.63	80%	0.74	0.84	6.1	2.2	4.3
E2	0.91	83%	0.76	0.86	6.0	3.4	6.4
E3	0.60	83%	0.76	0.85	5.1	2.3	4.4
E4	0.61	47%	0.46	0.64	6.6	1.3	3.1

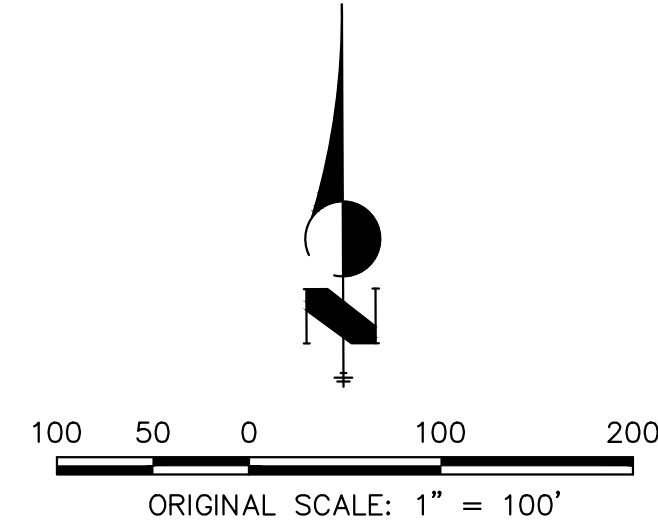




# STERLING RANCH FILING NO. 4 PROPOSED DRAINAGE MAP

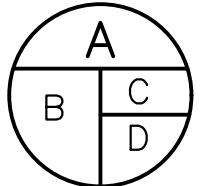


APPROXIMATE LOCATION OF PROPOSED SEDIMENTATION POND/ WATER QUALITY POND  
(SEE ASPEN MEADOWS DRAINAGE MAP PRESENTED IN APPENDIX D)



### LEGEND

BASIN ID  
A: BASIN LABEL  
B: AREA  
C: C - 100 YR  
D: C - 5 YR



- DESIGN POINT
- PROPOSED FLOW DIRECTION
- EXISTING FLOW DIRECTION
- BASIN DRAINAGE AREA
- EXISTING STORM SEWER
- STORM SEWER PROPOSED
- PROPOSED R.O.W
- PROPOSED PROPERTY LINES
- EXISTING PROPERTY LINE
- ROW EXISTING
- FL EXISTING
- SIDEWALK EXISTING
- DRAINAGE ACCESS & MAINTENANCE EASEMENT



### DESIGN POINT

DP	Q5		Q100	
	Total	Total	Total	Total
1	14.6	52.8		
4	22.3	55.6		
4.1	29.0	88.7		
5	12.0	25.9		
6.1	3.9	19.3		
6.2	2.0	13.2		
6.3	16.9	35.6		
7	3.5	12.8		
7.1	30.0	93.5		
7.2	39.8	114.9		
8	6.1	12.9		
9	3.8	7.9		
15	8.2	17.7		
15.1	21.0	43.2		
16	1.4	2.9		
16.1	21.5	44.9		
17	1.6	7.9		
17.1	1.6	7.7		
18.1	22.8	52.2		
12	10.0	20.5		
12.1	9.1	13.9		
18.2	29.2	62.0		
19	6.4	17.8		
19.1	6.4	12.9		
20	7.0	14.9		
20.1	7.0	11.7		
20.2	39.6	81.4		
21	3.8	12.6		
21.1	42.5	91.3		
22	6.3	18.3		
22.1	6.3	18.3		
23	47.4	106.2		
24	2.2	9.2		
25	1.0	5.0		
27	2.9	8.8		
1.i	7.8	17.9		
3.i	7.1	19.4		
2.i	11.6	25.7		
3.2	16.9	40.2		
e11	0.7	6.2		
1e	4.0	10.9		
1.1e	4.0	9.8		
e10	0.6	4.6		
2e	4.0	13.0		
2.1e	4.0	10.9		
2.2e	8.0	20.7		
3e	1.3	3.6		
4e	1.2	4.3		

### BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C <sub>s</sub>	C <sub>100</sub>	t <sub>c</sub> (min)	Q <sub>s</sub> (cfs)	Q <sub>100</sub> (cfs)
A2	1.38	32%	0.30	0.51	10.3	1.7	4.8
A3	3.68	65%	0.50	0.64	12.5	7.0	14.9
A4	4.53	48%	0.39	0.56	15.0	6.3	15.1
A5	0.45	79%	0.63	0.73	5.0	1.4	2.9
A6.1	4.73	72%	0.55	0.67	12.1	10.0	20.5
A6.2	2.56	74%	0.56	0.68	12.1	5.6	11.3
A7	1.76	73%	0.56	0.68	9.4	4.2	8.5
A8	4.23	13%	0.16	0.41	18.9	2.2	9.2
C1.1	1.78	66%	0.52	0.65	9.2	3.9	8.3
C1.2	0.81	72%	0.57	0.69	8.3	2.0	4.2
C2	6.75	63%	0.49	0.63	14.2	12.0	25.9
C3	4.18	19%	0.20	0.43	9.3	3.5	12.8
A9	2.13	7%	0.13	0.38	13.7	1.0	5.0
A10	2.67	26%	0.27	0.49	10.7	2.9	8.8
B3	2.38	63%	0.58	0.72	25.5	3.8	7.9
C4	4.41	62%	0.54	0.68	28.3	6.1	12.9
OS6	18.38	45%	0.37	0.55	17.5	22.3	55.6
OS7	33.07	19%	0.20	0.43	36.4	14.6	52.8
I1	5.88	54%	0.44	0.60	20.8	7.8	17.9
I2	2.18	71%	0.58	0.70	11.9	4.9	9.9
I3	2.94	68%	0.60	0.98	10.8	7.1	19.4
E1	0.90	87%	0.79	0.88	6.6	3.4	6.3
E2	1.25	63%	0.60	0.74	8.3	3.3	6.8
E3	0.35	86%	0.78	0.87	5.0	1.4	2.7
E4	0.36	81%	0.74	0.84	5.0	1.4	2.6

### NOTE:

FOR ADDITIONAL INFORMATION REGARDING DESIGN POINTS, ROUTING, AND RUNOFF VALUES ASSOCIATED WITH POND W-5. REFER TO THE FILING 2 DRAINAGE MAP, AS SHOWN IN APPENDIX D OF THIS REPORT.

STERLING RANCH FILING NO. 4  
PROPOSED DRAINAGE MAP  
JOB NO. 25188.11  
08/10/2023  
SHEET 2 OF 2



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



**FINAL DRAINAGE REPORT FOR  
BRANDING IRON AT STERLING RANCH  
FILING NO. 1**

**EL PASO COUNTY, COLORADO**

October 2018

Prepared for:  
**SR Land, LLC**  
**20 Boulder Crescent, Suite 210**  
**Colorado Springs, CO 80903**

Prepared by:



**20 Boulder Crescent, Suite 110**  
**Colorado Springs, CO 80903**  
**(719) 955-5485**

Project #09-006  
DSD Project # SF-17-024

Ranch Filing No.1” prepared by MS Civil Consultants, dated April 2017 (henceforth referred to as "Sterling Ranch Filing Nos. 1 & 2 MDDP") and the Sterling Ranch MDDP revised April 2018. Please refer to the Sterling Ranch Filing Nos. 1 & 2 MDDP by MS Civil Consultants for detailed information regarding the historic conditions of the area and discussion regarding early overlot grading which altered the existing drainage patterns prior to the issuance of this report.

## **HYDROLOGIC CALCULATIONS**

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual and where applicable the Urban Storm Drainage Criteria Manual. The Rational Method was used to estimate stormwater runoff anticipated from design storms with 5-year and 100-year recurrence intervals.

## **HYDRAULIC CALCULATIONS**

As the Hydrologic calculations performed as a part of this analysis matched the hydraulic analysis conducted with the Sterling Ranch Filing Nos. 1 & 2 MDDP, there is no need to reproduce in duplicate the hydraulic calculations provided within the aforementioned study. As such, please refer to the hydraulic calculations located in the appendix of the Master Development Drainage Report for Sterling Ranch Filing Nos. 1 & 2, and Final Drainage Report for Sterling Ranch Filing No.1 prepared by MS Civil Consultants, dated April 2017 for the relevant data sheets detailing the hydraulic analysis.

## **FLOODPLAIN STATEMENT**

No portion of this site is within a designated F.E.M.A. floodplain as determined by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 08041C0535 F, effective date March 17, 1997 and revised to reflect LOMR, 08-08-O541P, dated July 23, 2009. An annotated FIRM Panel is included in the Appendix.

## **DRAINAGE CRITERIA**

This drainage analysis has been prepared in accordance with the current City of Colorado Springs/El Paso County Drainage Criteria Manual, Volumes I & II, dated November 1991, including subsequent updates. El Paso County has also adopted Chapter 6 and Section 3.2.1 of Chapter 13 in the City of Colorado Springs & El Paso County Drainage Criteria Manual Volumes I and II, dated May 2014. (Appendix I of the El Paso County’s Engineering Criteria Manual (ECM), 2008). In addition to the aforementioned ECMs, the Urban Storm Drainage Criteria Manuals, Volumes 1-3, published by the Urban Drainage and Flood Control District (Volumes 1 & 2 dated January 2016, Volume 3 dated November 2010 and updates) have been utilized to aid in design of the Full Spectrum Detention Facilities when required.

## **EXISTING DRAINAGE CONDITIONS**

The Branding Iron at Sterling Ranch Filing No. 1 site consists of 10.545 acres. According to the Sterling Ranch MDDP (Existing Condition Map), historically runoff from the site drained to the southern boundary of the Sterling Ranch property (portion of Basin EX-3A) before combining with offsite runoff prior to reaching Sand Creek Channel. With the approval of the Sterling Ranch Onsite Early Grading Plan,

will be treated as WQCV and Full Spectrum Detention. As such the proposed develop shall not adversely affect the downstream infrastructure.

#### **Water Quality/Full Spectrum Detention Facilities**

With the exception of the outer permeable western and southern edges of the development the majority of the developed runoff from Branding Iron at Sterling Ranch Filing No. 1 is collected within the internal streets and conveyed via existing storm sewer systems to the existing Full Spectrum Detention Facility Pond 8 that was approved for construction as a portion of the Sterling Ranch Filing No.1 improvements. Pond 8 will provide 0.46 acre feet of water quality and 2.90 acres of full spectrum detention for approximately 29 acres of Sterling Ranch development of which the Branding Iron at Sterling Ranch Filing No.1 is a portion. The pond initially sized and designed within Sterling Ranch Filing Nos. 1&2 MDDP using the Detention Design UD-Detention v3.05 workbook. It should be noted that this drainage report and the SR Filing 1 and 2 MDDP were developed concurrently. Thus the larger scale concept planning was very finite and thus allowed for the developed flow rates to align between the two documents and thereby not requiring modifications to facility which is often common between conceptual and final design. Refer to the approved Sterling Ranch Filing No. 1 Storm Sewer Plans for additional details of FSD Pond 8.

The flows generated by Basin OS13 will be routed south via overlot grading and vegetated swales to a temporary sediment basin (future Pond W-5), at the south end of the Sterling Ranch Development. Upon development of the Sterling Ranch Filing No. 2 infrastructure Pond W-5 will be constructed and flows from Basin OS13 will be treated as WQCV (see WQCV deviation request) and Full Spectrum Detention. As such the proposed develop shall not adversely affect the downstream infrastructure.

#### **EROSION CONTROL**

It is the policy of the El Paso County that a grading and erosion control plan be submitted with the drainage report. EPC approved “Early Grading Plan for Sterling Ranch Phase I Onsite Grading & Erosion Control”, November 18, 2015. And “Early Grading Plan for Sterling Ranch Phase I Offsite Grading & Erosion Control”, December 3, 2015. Grading and Erosion control operations are currently underway (August 2016). Grading and Erosion Control will cease with the final development of the site in the next 12-36 months.

#### **CONSTRUCTION COST OPINION – BRANDING IRON AT STERLING RANCH FIL. NO. 1**

##### **Drainage Facilities:**

There are no planned improvements with the development of Branding Iron at Sterling Ranch Filing No. 1. Construction costs have been accounted for in the “Master Development Drainage Report for Sterling Ranch Filing Nos. 1 &2 , and Final Drainage Report for Sterling Ranch Filing No.1” prepared by MS Civil Consultants, dated April 2017. Please see Drainage and Bridge Fees below.

#### **DRAINAGE & BRIDGE FEES – BRANDING IRON AT STERLING RANCH FIL. NO. 1**

This site is within the Sand Creek Drainage Basin. The 2017 Drainage and Bridge Fees per El Paso County for the BRANDING IRON AT STERLING RANCH FILING NO. 1 site are as follows:



# BRANDING IRON AT STERLING RANCH FILING NO. 1

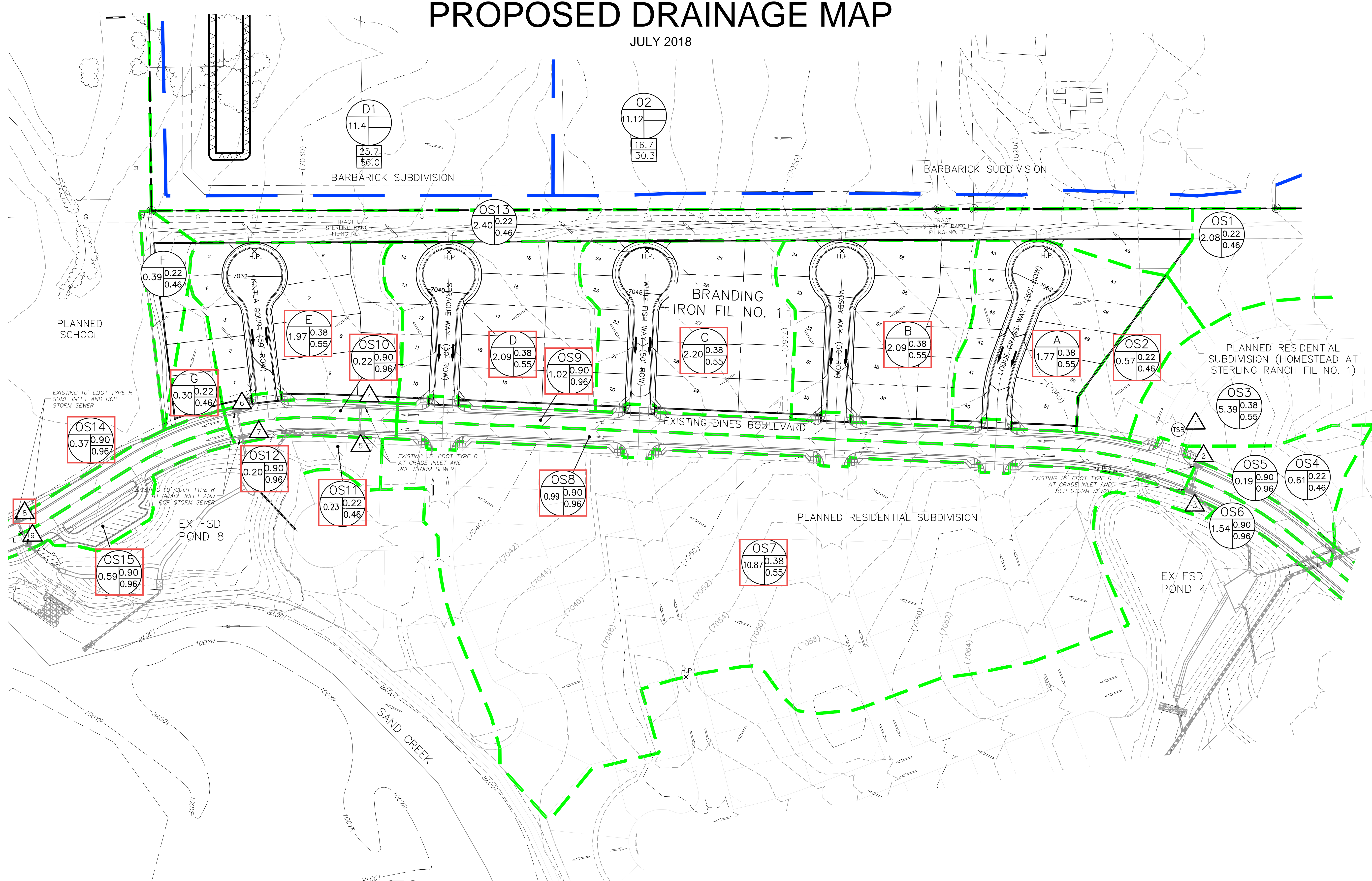
COUNTY OF EL PASO, STATE OF COLORADO

## PROPOSED DRAINAGE MAP

JULY 2018

### LEGEND

- BASIN DESIGNATION: BASIN DESIGNATION
- PIPE RUN REFERENCE LABEL: PIPE RUN REFERENCE LABEL
- SURFACE DESIGN POINT: SURFACE DESIGN POINT
- BASIN BOUNDARY: BASIN BOUNDARY
- EXISTING CONTOUR: EXISTING CONTOUR
- PROP CONTOUR: PROP CONTOUR
- BRANDING IRON FILING NO. 1 BOUNDARY: BRANDING IRON FILING NO. 1 BOUNDARY
- EXISTING STORM SEWER PIPE: EXISTING STORM SEWER PIPE
- CROSSSPAN: CROSSSPAN
- INLET: INLET
- EXISTING FLOW DIRECTION ARROW: EXISTING FLOW DIRECTION ARROW
- FLOW DIRECTION: FLOW DIRECTION
- FLARED END SECTION: FLARED END SECTION
- H.P. X: HIGH POINT
- L.P. X: LOW POINT
- TSB: TEMPORARY SEDIMENT BASIN

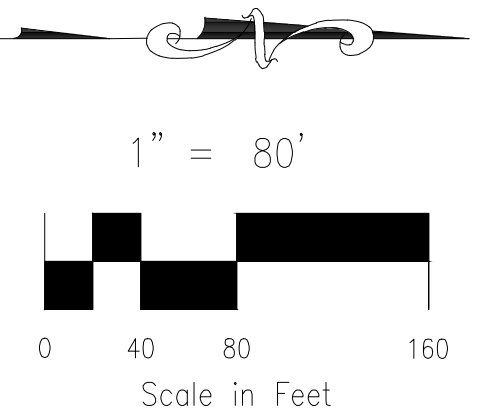


BASIN SUMMARY			
BASIN	AREA (ACRES)	Q <sub>5</sub>	Q <sub>100</sub>
A	1.77	2.6	6.3
B	2.09	3.1	7.5
C	2.20	3.3	7.9
D	2.09	3.1	7.5
E	1.97	2.9	7.1
F	0.39	0.4	1.3
G	0.30	0.3	1.0
OS1	2.08	1.6	5.7
OS2	0.57	0.5	1.8
OS3	5.39	8.0	19.3
OS4	0.61	0.5	1.9
OS5	0.19	0.9	1.6
OS6	1.54	5.6	10.0
OS7	10.87	15.3	37.3
OS8	0.99	3.9	7.0
OS9	1.02	4.0	7.2
OS10	0.22	1.0	1.8
OS11	0.23	0.2	0.7
OS12	0.20	0.9	1.7
OS13	2.40	2.0	7.0
OS14	0.37	1.7	3.1
OS15	0.59	2.7	4.9

Ex. FSD Pond 8 Contributing Area = 25.5 acres

DESIGN POINT SUMMARY			
DESIGN POINT	Q <sub>5</sub>	Q <sub>100</sub>	STRUCTURE
1	8.0	19.3	OS3
2	4.2	19.7	OS4, OS5, Sterling Ranch Filing Nos. 1&2 MDDP* Flowby DP4
3	14.1	26.7	OS6, Sterling Ranch Filing Nos. 1&2 MDDP* Basins I, J, K
4	14.1	41.6	A, B, C, OS2, OS9, Flowby DP2
5	20.5	52.0	OS7, OS8, Flowby DP3
6	5.2	27.9	E, OS10, Flowby DP4
7	6.4	30.7	OS11, OS12, Flowby DP5
8	1.4	13.2	G, OS14, Flowby DP6
9	2.0	15.9	OS15, Flowby DP7

\* For detailed information on Design Points, Basins, or Flowby see Sterling Ranch Filing Nos. 1&2 MDDP prepared by MS Civil Consultants, dated April 2017



FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES  
FOR BURIED UTILITY INFORMATION 48 HRS BEFORE YOU DIG CALL 1-800-922-1987

20 BOULDER CRESCENT, SUITE 110  
COLORADO SPRINGS, CO 80903  
PHONE: 719.955.5485

BRANDING IRON AT SR FIL NO. 1  
PROPOSED DRAINAGE MAP

PROJECT NO. 09-006	SCALE: HORIZONTAL: 1"=80' VERTICAL: N/A	DATE: 7/27/2018
DESIGNED BY: CMN	DRAWN BY: CMN	CHECKED BY: VAS
SHEET 1 OF 1		PDM

File: 0:\08066\Sterling Ranch No 3\Map\Eng Exhibit\Proposed Drainage Map.dwg Plotstamp: 7/30/2018 11:17 AM

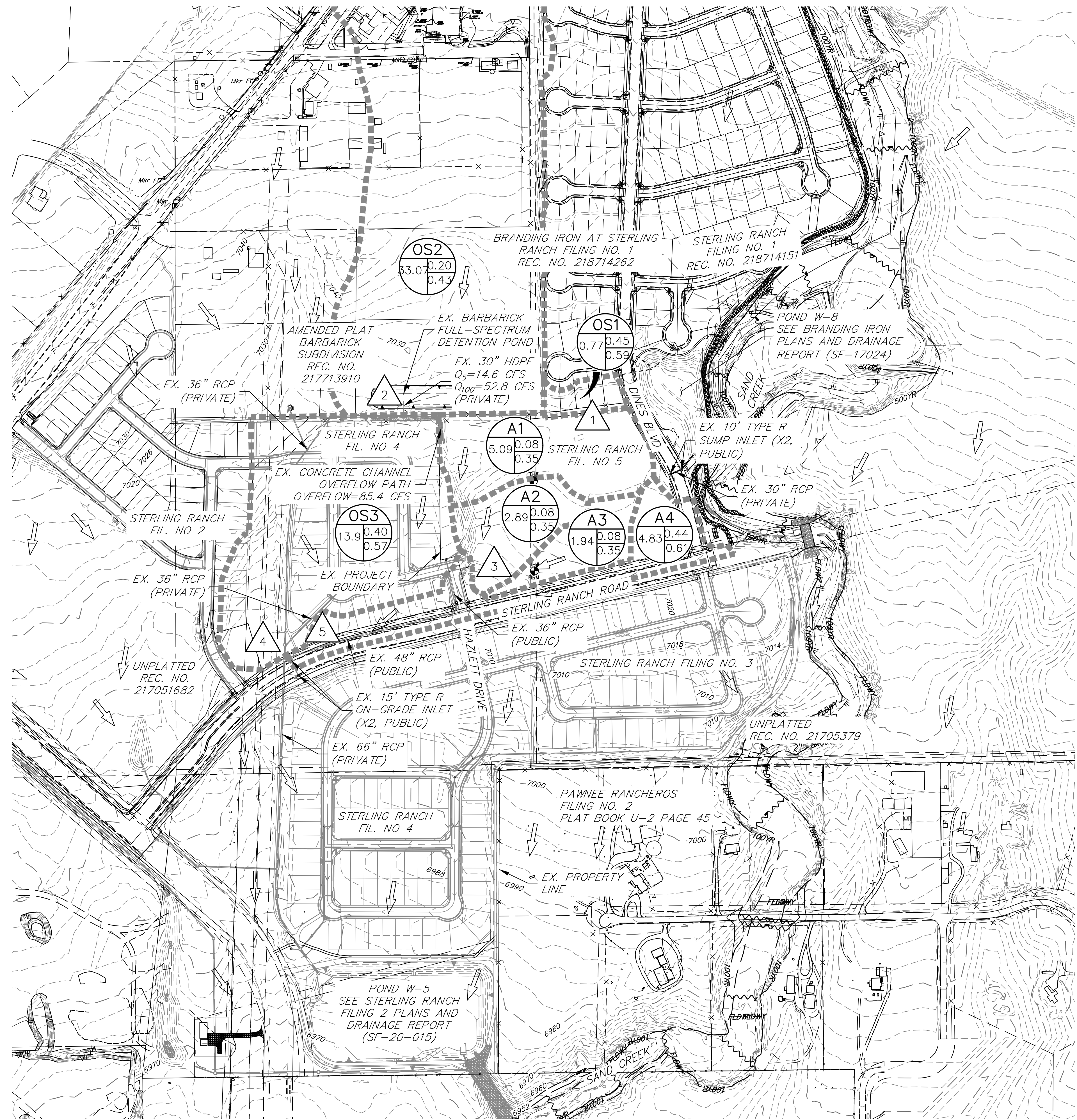


## **Appendix D**

### **Drainage Maps**



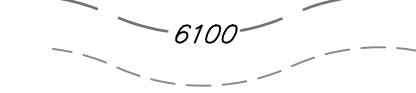
# STERLING RANCH FILING 5 EXISTING DRAINAGE MAP



### LEGEND

- BASIN ID  
A: BASIN LABEL  
B: AREA  
C: C-100 YR  
D: C-5 YR
- DESIGN POINT
- EXISTING FLOW DIRECTION
- BASIN DRAINAGE AREA
- EXISTING STORM SEWER
- SITE BOUNDARY
- EXISTING PROPERTY LINE
- ROW EXISTING
- FL EXISTING
- SIDEWALK EXISTING
- DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING

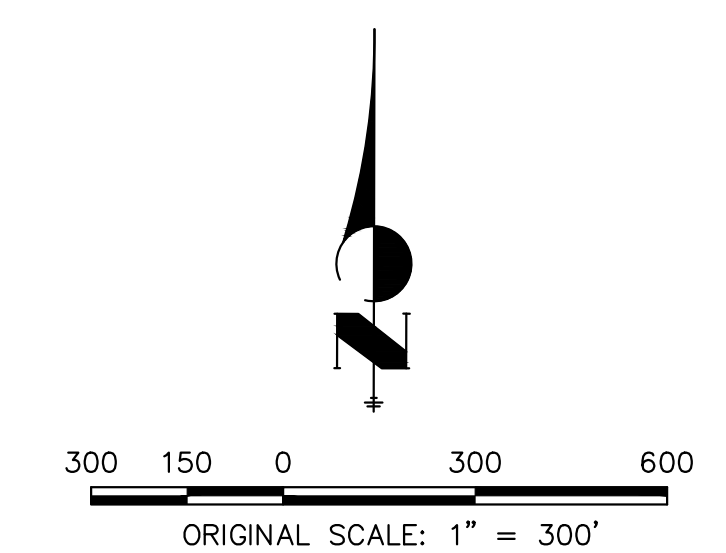


### BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C <sub>s</sub>	C <sub>100</sub>	t <sub>c</sub> (min)	Q <sub>c</sub> (cfs)	Q <sub>100</sub> (cfs)
A1	5.09	0%	0.08	0.35	28.7	1.0	7.6
A2	2.89	0%	0.08	0.35	15.3	0.8	5.9
A3	1.94	0%	0.08	0.35	17.9	0.5	3.7
A4	4.83	47%	0.44	0.61	18.3	6.8	16.0
OS1	0.77	65%	0.45	0.59	10.2	1.4	3.1
OS2	33.07	19%	0.20	0.43	36.4	14.6	52.8
OS3	13.90	49%	0.40	0.57	15.5	19.4	46.3

### DESIGN POINT

DP	Q5		Q100	
	Total	Total	Total	Total
1	1.4	3.1		
2	14.6	52.8		
3	2.9	16.8		
4	19.4	46.3		
5	6.8	16.0		



STERLING RANCH FILING 5  
EXISTING DRAINAGE MAP  
JOB NO. 25188.16  
11/03/23  
SHEET 1 OF 1



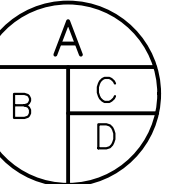
Centennial 303-740-9393 • Colorado Springs 719-593-2593  
Fort Collins 970-491-9888 • www.jrengineering.com



# STERLING RANCH FILING NO. 5 PROPOSED DRAINAGE MAP

## LEGEND

BASIN ID  
A: BASIN LABEL  
B: AREA  
C: C-100 YR  
D: C-5 YR



DESIGN POINT



PROPOSED FLOW DIRECTION



EXISTING FLOW DIRECTION



BASIN DRAINAGE AREA



EXISTING STORM SEWER



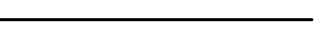
STORM SEWER PROPOSED



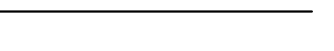
PROPOSED R.O.W



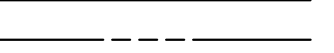
PROPOSED PROPERTY LINES



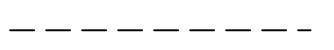
PROPOSED SIDEWALK



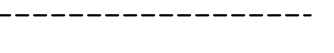
EXISTING PROPERTY LINE



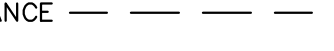
ROW EXISTING



FL EXISTING



SIDEWALK EXISTING



DRAINAGE ACCESS & MAINTENANCE



EASEMENT



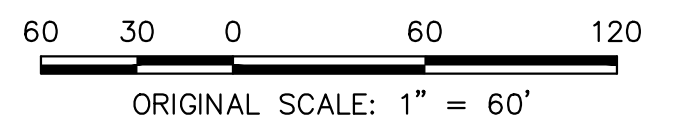
## BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C <sub>s</sub>	C <sub>100</sub>	t <sub>c</sub> (min)	Q <sub>s</sub> (cfs)	Q <sub>100</sub> (cfs)
A1	0.65	37%	0.32	0.51	18.5	0.7	2.0
A2	0.78	46%	0.35	0.53	17.2	0.9	2.6
A3	0.79	44%	0.33	0.51	19.1	0.8	2.5
A4	1.00	80%	0.68	0.79	9.6	2.8	6.0
A5	2.84	62%	0.50	0.64	11.6	5.5	13.2
A6	2.06	58%	0.45	0.60	7.0	1.4	3.3
A7	2.64	59%	0.50	0.65	13.2	3.8	9.2
A8	1.10	77%	0.64	0.75	9.1	3.0	6.4
A9	1.20	52%	0.38	0.54	10.3	0.3	0.8
A10	1.32	52%	0.38	0.55	13.0	1.9	5.0
OS1	0.77	65%	0.45	0.59	10.3	1.4	3.4
C4	3.67	62%	0.55	0.70	27.2	5.4	13.5

## DESIGN POINT

DP	Q <sub>5</sub>		Q <sub>100</sub>	
	Total	Total	Total	Total
1	2.1	5.4		
2	0.7	2.0		
2.1	2.7	7.3		
3	0.8	2.5		
4	2.8	6.0		
5	7.4	18.4		
5.1	10.0	25.7		
6	1.4	3.3		
7	3.8	9.2		
8	3.0	6.4		
8.1	6.4	14.9		
8.2	15.5	38.8		
9	0.3	0.8		
10	1.9	5.0		
10.1	17.1	43.1		
11	12.0	29.9		
12	3.9	19.3		
13	2.0	7.3		
13.1	16.9	35.6		
14	3.8	7.9		
15	5.6	14.1		
16.1	30.0	93.5		
17.1	73.3	194.0		

Values in BLUE indicate they are from the approved "Final Drainage Report for Sterling Ranch Filing No. 4" dated August 14, 2023 by JR Engineering.



STERLING RANCH FILING NO. 5  
PROPOSED DRAINAGE MAP  
JOB NO. 25188.16  
11/03/23  
SHEET 1 OF 1



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

