

DRAINAGE CONFORMANCE LETTER

for

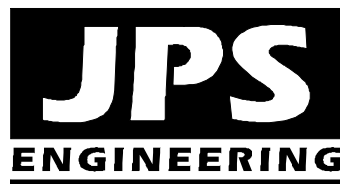
**FOUNTAIN FIRE STATION #4
8422 WATCHMEN ROAD
LOT 228, ASPEN RANCH FILING NO. 1**

Prepared for:

**City of Fountain Fire Department
116 S. Main Street
Fountain, CO 80817**

May 20, 2026

Prepared by:



**19 E. Willamette Ave.
Colorado Springs, CO 80903
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JPS Project No. 072501

FOUNTAIN FIRE STATION #4
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**DRAINAGE REPORT STATEMENTS
LOT 228, ASPEN RANCH FILING NO. 1**

Engineer's Statement:

This report and plan for the drainage design of Lot 228, Aspen Ranch Filing No. 1 was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Fountain does not and will not assume liability for drainage facilities designed by others. I accept responsibility for liability caused by negligent acts, errors or omissions on my part in preparing this report.

John P. Schwab, Colorado P.E. No. 29891

Date

Developer's Statement:

City of Fountain hereby certifies that the drainage facilities for Lot 228, Aspen Ranch Filing No. 1 shall be constructed according to the design presented in this report. I understand that the City of Fountain does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Fountain pursuant to the City Code; and cannot, on behalf of City of Fountain, guarantee that final drainage design review will absolve City of Fountain and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

City of Fountain
Name of Developer

Authorized Signature

Date

Printed Name

Title

Address: 116 S. Main Street, Fountain, CO 80817

City of Fountain Statement:

Filed in accordance with the Code of the City of Fountain, 2019, as amended.

Benjamin E. Sheets, P.E., City Engineer

Date

I. INTRODUCTION

A. General Project Description

The City of Fountain (Owner) is planning to construct a new Fire Station on the vacant 1-acre site at 8422 Watchmen Road in the City of Fountain, Colorado. The 1-acre developed site is platted as Lot 228, Aspen Ranch Filing No. 1 (El Paso County Assessor's No. 56041-03-059).

The north boundary of the property adjoins a vacant tract of land platted as Tract A, Aspen Ranch Filing No. 1. The east boundary of the property adjoins developed single-family residential lots platted as Lots 55-58, Aspen Ranch Filing No. 1.

The west boundary of the property adjoins Link Road, which is an improved public street (arterial), and the south boundary of the property adjoins Watchmen Road, which is a fully-improved public street (collector).

Previous development of the Aspen Ranch subdivision included construction of a public storm sewer system collecting drainage from the adjoining Watchmen Road along the south boundary of this site and the adjoining Pinpoint Drive to the north of this site, conveying developed runoff to the existing subdivision detention pond at the intersection of Link Road and Kane Road.

The proposed site development consists of a new 8,000 square-foot, single-story City Fire Station building with associated parking and site improvements.

The total disturbed area associated with this project is approximately 0.97 acres. Stormwater detention and water quality treatment for this site is provided in the existing subdivision detention pond.

B. Scope

This Drainage Conformance Letter has been prepared in support of the Site Development Plan for the project. The Drainage Letter format is appropriate because the site disturbance is under 1-acre.

The report is intended to meet the requirements of a site-specific "Drainage Conformance Letter" confirming that the proposed project is consistent with the previously approved drainage planning for this site. This Drainage Letter provides detailed design for the proposed on-site drainage facilities and confirms that the developed drainage patterns associated with the project are fully consistent with the assumptions in the previously approved Drainage Report for this subdivision.

C. References

City of Colorado Springs "Drainage Criteria Manual, Volume 1," revised January, 2021.

City of Colorado Springs "Drainage Criteria Manual, Volume 2," revised December, 2020.
Drg-Ltr-Fnt-FS-4-0526

Matrix, “Preliminary & Final Drainage Report for Aspen Ranch Filing No. 1,” March, 2021 (approved 10/6/21).

Mile High Flood District, “Urban Storm Drainage Criteria Manual, Volume 1,” revised August, 2018.

Mile High Flood District, “Urban Storm Drainage Criteria Manual, Volume 2,” revised September, 2017.

Mile High Flood District, “Urban Storm Drainage Criteria Manual, Volume 3,” revised January, 2021.

II. DRAINAGE CRITERIA

In accordance with the City of Colorado Springs Drainage Criteria Manual Volume 1 (DCM 1), Rational Method procedures were utilized for hydrologic calculations for the on-site tributary drainage basins below 100 acres.

Hydrologic calculations were based on the following assumptions:

- Design storm (minor): 5-year
- Design storm (major): 100-year

Hydrologic calculations were performed using the standard Rational Method equation:

- $Q = CiA$
- $Q =$ Peak Flow (cubic feet per second, cfs)
- $C =$ Runoff Coefficient
- $i =$ Rainfall Intensity (inches per hour, in/hr)
- $A =$ Tributary Drainage Area (acres, ac)

Runoff times of concentration were calculated based on guidance in DCM 1, using a maximum overland flow length of 100 feet for urban areas. Overland flow times have been calculated based on Equation 3.2.1 (DCM1), and travel times have been calculated based on Equation 3.2.2 (DCM1), as detailed in the rational method calculation table in Appendix A.

Rainfall intensities were derived from City of Colorado Springs Intensity-Duration-Frequency (IDF) curves. Runoff coefficients were selected based on the existing and proposed land uses according to DCM 1 Table 6-6. Hydrologic calculations are enclosed in Appendix A, and peak design flows are identified on the drainage basin drawings.

Hydraulic design criteria are based on guidelines delineated in the City of Colorado Springs Drainage Criteria Manual (DCM). Storm inlet design and related gutter flow calculations have been performed using the “MHFD-Inlet_v5.03” design software published by the Mile High Flood District (MHFD).

III. PROPOSED DRAINAGE CONDITIONS

As detailed in Appendix A, the soils within this site are identified as “Ascalon sandy loam” soils, which are classified as hydrologic soils group A (high infiltration rate).

The existing site generally slopes downward to the southwest, and the previous subdivision development included construction of a public storm sewer system adjoining this site, conveying runoff to a regional subdivision detention pond south of this property.

This site is located beyond the limits of the 100-year FEMA floodplain. The current floodplain limits in vicinity of this site are shown in the FEMA floodplain map for this area, FIRM Panel No. 08041C0958G, dated December 7, 2018 (see Firmette Exhibit in Appendix C).

Drainage planning for this site was previously studied in the “Preliminary & Final Drainage Report (FDR) for Aspen Ranch Filing No. 1” dated March, 2021 by Matrix. The Matrix report identifies an existing detention pond at the northeast corner of Link Road and Kane Road as being designed to provide full-spectrum detention to mitigate developed drainage impacts from the full development of the Aspen Ranch Subdivision.

The proposed Fire Station #4 is located within parts of Basins B-10, B-12a, and B-12b as delineated in the approved FDR.

Basin A1

The majority of the developed area within this site has been delineated as Basin A1 (0.61-acres) which will drain southwesterly across the site by sheet flow and curb and gutter, flowing into the existing public storm inlet (15' Type R) along Watchmen Road near the southwest corner of this site. Basin A1 is a part of Basin B-12a as delineated in the subdivision FDR.

Proposed private Storm Inlet A1 (5' Type R) will intercept surface drainage from the southeast corner of the site and proposed private Storm Sewer A1 (8" HDPE) will convey the developed flows from Inlet A1 westerly across the south side of the new building to the existing public storm inlet in Watchmen Road. In the event of clogging, overflows from Inlet A1 would sheet flow in a southwesterly direction, flowing to the existing public storm sewer system in Watchmen Road.

The balance of developed flows from Basin A1 will sheet flow to the curb and gutter along the north and west edges of the site driveways and parking areas, flowing southwesterly to the existing public storm inlet in Watchmen Road.

Developed peak flows from Basin A1 are calculated as $Q_5 = 2.1$ cfs and $Q_{100} = 5.1$ cfs. The FDR identified a total inflow of $Q_{100} = 11.0$ cfs from Basin B-12a entering the existing public storm inlet on Watchmen Road, and the proposed Fire Station development is reasonably consistent with the assumed flows contributing to the existing storm inlet.

Basin A2

A small area at the northeast corner of the site has been delineated as Basin A2 (0.18-acres) which will drain northwesterly into the private storm sewer collecting developed flows from the northeast corner of the fire station site. Proposed private Storm Inlet A2 (5' Type R) will intercept surface drainage from the northeast corner of the site and proposed private Storm Sewer A2 (8" HDPE) will convey the developed flows from Inlet A2 northwesterly to the existing public storm inlet at the south end of Pinpoint Drive.

Developed peak flows from Basin A2 are calculated as $Q_5 = 0.7$ cfs and $Q_{100} = 1.6$ cfs. The FDR identified a total inflow of $Q_{100} = 26.5$ cfs from Basin B-10 entering the existing public storm inlet on Pinpoint Drive, and the proposed flows from the Fire Station development are negligible in comparison to the design flows in the FDR.

In the event of clogging, overflows from Inlet A2 would sheet flow in a southerly direction along the east side of the fire station building, flowing to the existing public storm sewer system in Watchmen Road.

Basin B1

The small landscaped area along the west fringe of the property has been delineated as Basin B1 (0.18-acres), which will sheet flow southwesterly into the existing downstream public storm sewer system along Link Road.

Developed peak flows from Basin B1A2 are calculated as $Q_5 = 0.1$ cfs and $Q_{100} = 0.6$ cfs. The FDR identified a total inflow of $Q_{100} = 10.9$ cfs from Basin B-12b entering the existing public storm system, so the proposed flows from the Fire Station development are negligible in comparison to the design flows in the FDR.

IV. STORMWATER DETENTION AND WATER QUALITY

The total disturbed area associated with this project is approximately 0.97 acres. The disturbed site area is less than one acre and therefore stormwater detention and water quality facilities are not required based on the City of Colorado Springs Drainage Criteria Manual Volumes 1 and 2. The proposed site development project is part of a larger common plan of development (Aspen Ranch Filing No. 1), which has been previously planned for stormwater detention and water quality treatment in the existing subdivision detention pond.

V. DRAINAGE BASIN FEES

This parcel is located within the Jimmy Camp Creek Drainage Basin. No public drainage facilities are required for the proposed site development. The site consists of a previously platted lot, so no drainage or bridge fees are applicable at this time.

VI. SUMMARY

The proposed drainage patterns associated with the new Fire Station #4 on Lot 228, Aspen Ranch Filing No. 1 will remain fully consistent with the established drainage plan for this subdivision. Site drainage will flow into the existing public storm sewer system adjacent to this site, following the existing drainage patterns. Proper site grading, in conjunction with proper erosion control practices during and after construction, will ensure that this site development project has no significant adverse drainage impact on downstream or surrounding areas. In summary, the drainage planning in this report is in full conformance with the previously approved subdivision drainage report and current City drainage criteria. In accordance with the subdivision drainage plan, proposed site runoff will not adversely affect the downstream and surrounding developments.

APPENDIX A

EXCERPTS FROM SUBDIVISION DRAINAGE REPORT

**PRELIMINARY & FINAL
DRAINAGE REPORT**

For

ASPEN RANCH FILING NO. 1

Prepared for:
City of Fountain
116 S. Main Street
Fountain, CO 80817

On Behalf of:
COLA, LLC.
555 Middle Creek Parkway, Suite 380
Colorado Springs, CO 80921

Prepared by:



Matrix

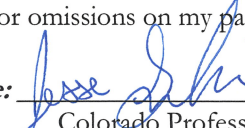
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March 2021

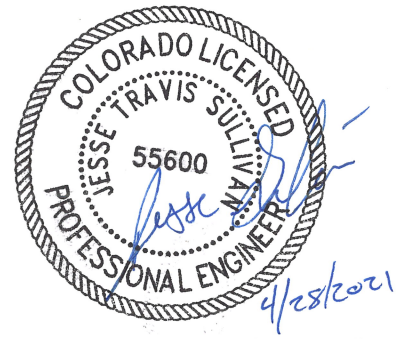
Project No. 19.866.023

ENGINEER'S STATEMENT:

This report and plan for the drainage design of Aspen Ranch Filing No. 1 was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Fountain does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, error or omissions on my part in preparing this report.

Signature: 
Colorado Professional Engineer No. 55600

Date: 4/28/2021



DEVELOPER'S STATEMENT:

COLA hereby certifies that the drainage facilities for Aspen Ranch Filing No. 1 shall be constructed according to the design presented in this report. I understand that the City of Fountain does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Fountain pursuant to the City Code; and cannot, on behalf of Aspen Ranch Filing No. 1, guarantee that final drainage design review will absolve COLA and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

Name of Developer: COLA

Authorized Signature:  Date: 4/28/21

Printed Name: Stephen Schoonover

Title: Development Manager

Address: 555 Middle Creek Parkway, Suite 380
Colorado Springs, CO 80921

CITY OF FOUNTAIN STATEMENT: 2019
Filed in accordance with the Code of the City of Fountain, ~~2009~~, as amended.

Benjamin E. Sheets 10-06-21
For the City Engineer Date

Conditions:

I. Introduction

A. PURPOSE AND SCOPE OF STUDY

The proposed Aspen Ranch Filing No. 1 development is located at the northeast corner of the intersection of Kane and Link road in Fountain, Colorado. This project will involve construction of roads, utilities and storm sewer infrastructure associated with single-family residential development. The purpose of this report is the identification of offsite and onsite drainage patterns and design of storm sewer infrastructure associated with the proposed development, analysis of impacts from upstream drainage, and impacts to downstream facilities. This PDR/FDR has been prepared based on the guidelines and criteria presented in the City of Colorado Springs Drainage Criteria Manual (DCM).



**FIGURE 1. PROJECT LOCATION
(NOT TO SCALE)**

Also located at Existing Design Point 1 is an existing detention pond which was constructed as a part of a previous attempt to develop this parcel. At some point, the 42-inch discharge pipe across Link Road was buried by the landowner or tenant of the property west of Link Road. The drainage swale downstream of the 42-inch discharge pipe was also filled in. These items combined to create a condition where the intersection of Link and Kane Roads, under existing conditions, is often overtopped by relatively minor storm events.

Aspen Ranch Filing No. 1 Existing Conditions Basin Summary Table				
Sub-basin ID	Area (Acres)	Q5 (cfs)	Q100 (cfs)	
OSB1.1A1	251.0	14.0	87.0	
OSB1.1A2	223.8	13.5	87.8	
OSB1.1B	44.4	15.9	80.4	

Aspen Ranch Filing No. 1 Existing Conditions Drainage Point Summary Table				
Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
OS	OSB1.1A1 & OSB1.1A2	474.78	27.5	174.8
OS2	OSB1.1B	44.38	15.9	80.4
Totals:		519.16	43.45	255.19

Note: The Eagleside View FDR anticipates Q5: 15.7 cfs and Q100: 39.0 cfs at Existing Design Point OS2.

2. Developed Drainage Conditions

The development of the project separates the project site into three distinct basins, development occurring north of the gas easement, the gas easement and pass through of upstream offsite tributary basins, and development south of the gas easement. Also described are three offsite basins which will be routed around the development. Developed hydrology calculations for the basins and pipe networks can be referenced in Appendix A.

North Basin:

The north basin is defined from the ridgeline north of the property, Crescent Moon to the east, Link Road to the west and the gas easement to the south. In general, with the larger northern basin flows drain from the northeast to the southwest where a series of inlets and storm sewer intercept the flows and convey them westerly to Link Rd and then southerly to the full spectrum detention facility. A 36" RCP storm sewer trunk main (Public) is proposed along Link Road to the detention facility that the internal storm drain system will connect to. Sub-basins B3, and B10-B12 comprise the tributary sub-basins and are as follows:

Basin Name	Acreage	Peak Flows			
		2-Year	5-Year	10-Year	100-Year
B3a1	2.2	2.9	3.7	4.3	8.1
B3b	1.6	2.0	2.6	3.0	5.7
B10	7.0	9.6	12.0	14.1	26.5

B11	3.8	5.3	6.6	7.8	14.6
B12	2.7	5.3	6.7	7.8	13.2

Gas Easement Basin (Onsite):

Crescent Moon is anticipated to be designed to provide a low point for collection at the historic natural swale location where inlets will join the 30-inch RCP pipe crossings (Public) under the respective roadways. Flows from B5 will sheet flow to a grass lined open channel and conveyed east. Additional flows from Sub-basins B4, B6, B7, B8, and B9 will be captured by street inlets and added to the channel at the locations indicated on DR-02. At culvert roadway crossings drainage travels from east to west, with the ultimate discharge to the proposed full spectrum detention pond. An additional benefit of this swale is separation of impervious surfaces, which provides more opportunity for infiltration and reduction in the volume of runoff from the developed area. The tributary sub-basins within the Gas Easement Basin are as follows:

Basin Name	Acreage	Peak Flows			
		2-Year	5-Year	10-Year	100-Year
B3a2	0.1	0.2	0.3	0.3	0.6
B4	1.2	1.4	1.8	2.1	4.0
B5	6.5	2.0	2.6	3.0	11.3
B6	5.1	6.9	8.7	10.2	19.2
B7	4.6	6.3	8.0	9.3	17.5
B8	0.3	0.1	0.2	0.2	0.9
B9	2.1	4.0	5.1	6.0	10.6

South Basin:

The south basin is defined by the gas easement to the north, Crescent Moon to the East, Kane Road to the south and Link Road to the west. Internal flows from the development, and runoff from the bounding streets, drain east to west, with a series of internal collection points that are tributary to a 36" RCP (Public) that discharges to the full spectrum detention facility. Surface street flows from Crescent Moon will drain within a gutter system south to Kane Rd where they are conveyed west to an inlet collection point just prior to the intersection of Link and Kane Roads. Collected curb inlet flows are piped north via a 30-inch RCP (Public) pipe to the Full Spectrum Detention Facility. The tributary sub-basins within the South Basin are as follows:

Basin Name	Acreage	Peak Flows			
		2-Year	5-Year	10-Year	100-Year
B1a	1.5	2.0	2.5	2.9	5.9
B1b	3.6	5.2	6.5	7.6	14.1
B1c	5.9	2.8	3.5	4.1	13.4
B2a	3.3	3.0	3.8	4.4	9.6
B2b	3.8	4.5	5.7	6.6	12.5
B2c	2.6	2.7	3.5	4.0	7.6
B2d	0.3	0.4	0.4	0.5	1.0

Offsite Basin (Southeast)

The historic offsite basin OB1.1A2 drains westerly and is defined by Kane Road on the north boundary and Link Road on the west boundary. At the intersection of Link Rd and Kane Rd, the Aspen Ranch Filing No. 1 development will install a 36-inch pipe (Public) and custom end section

C. INLET SIZING

The table below describes the inlet capacities and sizes for the proposed development by design point.

PROPOSED INLET SUMMARY											
ASPEN RANCH FILING NO. 1											
DESIGN POINT	SUB-BASINS	TOTAL AREA (AC)	INLET			Q(5) BYPASS FLOWS (cfs)	Q(5) TOTAL INFLOW (cfs)	Q(100) BYPASS FLOWS (cfs)	Q(100) TOTAL INFLOW (cfs)	INLET CAPACITY (cfs)	NOTES:
			SIZE (Ft.)	TYPE	CONDITION						
1	B-10	6.99	15	R	Sump		12.05		26.53	27.00	9" Sump Depth
2	B-11	3.85	10	R	At-Grade	1.5	6.65	6.8	14.64	10.50	DP 11a Receives Bypass
3	B-12a	2.69	15, 5	R	At-Grade (x2) 15' North 5' South		6.71	2.18	11.00	11.00	20% to south inlet
4b	B-12b	2.39	15	R	At-Grade		4.96	2.3	10.88	10.88	Receives bypass from DP3
5a	B3a1	2.24	5	R	Sump		3.70		8.14	10.20	
5b	B-3b	3.83	5	R	Sump		2.58		5.68	10.20	
7a	B-9	2.08	10	R	Sump (x2)		5.10		10.58	16.00	
7b (west)	B-7	1.14	10	R	At-Grade		1.99		4.38	7.50	No Bypass 25% of Sub-basin B7
7b (east)	B-7	3.42	10	R	At-Grade	1.7	5.97	7.4	13.15	7.50	DP 12 Receives Bypass 75% of Sub-basin B7
8	B-6	5.13	10	R	Sump (x2)		8.72		19.21	32.00	DP 13 Receives Bypass 75% of Sub-basin B6
11a	B-4	1.24	10	R	Sump		3.30		10.77	16.00	Q5: 1.5 CFS, Q100: 6.8 CFS BYPASS FROM DP 2
11b	B-3a	0.11	5	R	Sump		0.25		0.56	10.20	
12	B-2a	3.34	10	R	Sump		5.50		16.96	19.00	7.4 CFS Q100 BYPASS FLOWS RECEIVED Slightly over 8" Sump Depth
13	B-2b	3.77	10	R	Sump		5.69		12.53	16.00	
14b	B-2c, B-2d	2.88	5	R	Sump		3.90		8.60	10.20	
15a	B-1a, B-1b	5.05	15	R	Sump		8.78		21.47	22.60	
22	B13- Link RD	0.32	5	R	At-Grade		0.75		1.35	9.00	Link Road Flows only

The table below describes the various swales included in the project:

Swale Capacities								
Aspen Ranch Filing No. 1								
<i>Design Point</i>	<i>Sub-basin</i>	<i>Slope %</i>	<i>SWALE CAPACITY MINOR STORM (cfs)</i>	<i>Q(5) TOTAL FLOW (cfs)</i>	<i>Q(5) VELOCITY (FT/S)</i>	<i>SWALE CAPACITY MAJOR STORM (cfs)</i>	<i>Q(100) TOTAL FLOW (cfs)</i>	<i>Q(100) VELOCITY (FT/S)</i>
9	B-5	2.3	23.6	11.4	2.4	74.4	24.9	3.6
10	B-5	2.3	23.6	12.2	2.4	74.4	31.3	3.2
Park	B-5	1.4	86.3	2.6	1.4	101.5	11.3	2.1
11b	B-5	2.3	23.6	19.9	2.9	74.4	49.6	4.6
21	West of Site	0.3	247	28.2	2.4	309	155.8	3.8
1	B-10 (EO)	4.4	11.3	12.0	4.0	24.9	26.5	4.9
7a	B-9 (EO)	25.0	6.5	4.2	3.1	18.5	9.1	4.3
8	B-6 (EO)	25.0	8.7	8.7	4.4	19.1	19.2	5.1
14b	B-2abc (EO)	2.0	17.5	13.9	3.2	53.0	35.8	4.4
9	B-5	2.3	23.6	11.4	2.4	74.4	24.9	3.6

NOTE:

- Capacities determined by maximum allowable velocity (Erosive Soils: Minor Storm: 3.5 ft/s, Major Storm: 5ft/s).
- 11b (Pond) will be protected by Type M Rip Rap and represents the swale as it brings flows from Design Point 7b into the detention pond. Further calculations of channel stability are included in Appendix A.
- (EO=Sump Inlet Emergency Overflow-Because of rare flows not subject to channel velocity limitations)

E. DETENTION

In accordance with the City of Fountain drainage criteria, the proposed Aspen Ranch Filing No. 1 development will provide onsite full spectrum detention facilities to mitigate developed drainage impacts. Detained flows will release westerly to a proposed 36-inch RCP pipe (replacing the existing 42-inch RCP and 30-inch x 19-inch HERCP pipes) crossing Link Rd and continue, as it has historically done, through the Eagleside Ranch development (specifically, through a property owned by Integrity Bank and Trust). The Emergency Spillway for the pond will be a broad crested weir discharging to Link Rd, where it will continue west across the road to Jimmy Camp Creek via historic drainage paths. Sizing for the full spectrum extended detention basin was performed utilizing UD-Detention, is enclosed in Appendix A and summarized as follows:

Selected Pond Type: Extended Detention Basin (EDB)

Tributary Area: 60.37 Acres

Required Area for Pond Footprint: 2.3 Acres

Pond Volumes

Water quality Capture Volume (WQCV): 0.981 Acre-Ft

Excess Urban Runoff Volume (EURV): 3.143 Acre-Ft

2-yr Detention Volume: 2.110 Acre-Ft
5-yr Detention Volume: 2.979 Acre-Ft
100-yr Detention Volume: 6.591 Acre-Ft
Micropool (0.3% of WQCV): 137.5 Cubic Feet

Forebay Design Information

Forebay Volumes (3% of WQCV)
North Forebay (DP 15b): 909 Cubic Feet
East Forebay (DP 14b): 436 Cubic Feet
West Forebay (DP15a): 224 Cubic Feet

Forebay Discharge Slots (per UD-BMP):
Northwest Forebay (DP 15b): 6.4 inches
East Forebay (DP 14b): 6.6 inches
West Forebay (DP 15a): 6.5 inches

Outlet Structure:

<u>Stage (Feet)</u>	<u>Outlet Component</u>
-2.5	Floor of structure and micro-pool
-1.47	36" Discharge Pipe (Restrictor Plate 24.25 inches above pipe flowline)
0	1-15/16" Diameter Orifice
1.	1-15/16" Diameter Orifice
2.	1-15/16" Diameter Orifice
3.14	2" (Vertical) x 6.31" (Horizontal) Orifice Dimensions
4.54	Top of Structure 8' x 8' square opening with 4:1 slope from east to west

Pond Discharges

5-year: 1.2 cfs

100-year: 62.5 cfs

Note: The 5-year discharge almost exactly matches the MDDP while the 100-year discharge is slightly lower than the MDDP (Q100: 70.3 cfs)

Emergency Spillway Information

Shape: Trapezoidal

Crest Length: 70 feet

Depth: 2.0 feet

Emergency Flow Depth: 0.9 feet

Freeboard: 1.1 foot

See UD-Detention models in Appendix A. The model indicates that the discharge from the proposed detention pond will be approximately 70% of the estimated historic flows from the site.

In addition to the proposed Aspen Ranch Filing No. 1 development, the proposed detention pond is sized to handle the ultimate buildout of the portions of Link Road and Kent Road which will be captured by inlets and directed into the pond (DP 15a & 15b). The equivalent discharge to Historic Design Point 1 under proposed conditions will be Q₅: 27.5 cfs and Q₁₀₀: 151.2 cfs. This is less than

the predevelopment values calculated in this report: $Q_5 = 31.96$ cfs and $Q_{100} = 182.48$ cfs and, also complies with the values indicated in the Eagleside Ridge MDDP: $Q_5 = 36.4$ cfs and $Q_{100} = 228.0$ cfs. The overall discharges across Link Road are slightly higher than the those indicated in the MDDP for post development conditions (Aspen Ranch MDDP Flows: $Q_5: 23.9$ cfs and $Q_{100}: 147.4$ cfs), however the difference, due to small changes in the modeling of offsite flows, is small and does not push the discharge values out of compliance with the other previous studies of the area mentioned above. Discharge from the development remains below predevelopment values.

The existing 42" pipe across Link Road was buried at some point after its installation. Balancing function of the pond and prevention of flooding to Link and Kane Roads with concerns of the receiving land owner (Integrity Bank) required raising the design discharge elevation from the pond to approximately 5-feet above the previous invert of that 42-inch pipe (now 36" diameter), adding a 48" storm pipe crossing for the bypass flows and re-grading the drainage swale through the Integrity property. Calculations included in appendix A indicate that the channel will be stable through the proposed alignment with 6" (Type VL) Rip Rap protection. To provide an additional level of protection the rip rap (or alternate Turf Reinforcement Mat) will also be provided outside of the channel curve. Yet another additional level of protection is provided in the form of Type M Rip Rap stilling basins at both the pond discharge location and the discharge of the offsite bypass pipe (located near the intersection of Link and Kane roads). (Outlet Protection design calculations indicate that 9-inch (Type L) rip rap spill pads should suffice.)

F. FLOODPLAINS

Per the ***Flood Insurance Rate Map (FIRM) 08041C 0958 G***, effective date December 7, 2018, published by the Federal Emergency Management Agency (FEMA), no portion of Aspen Ranch Filing No. 1 lies within any designated 100-year floodplain. A FIRMette of the project area is included in Appendix D.

G. WATER TABLE CONSIDERATIONS

At the time of this report initial investigations of the water table towards the south end of the proposed development indicate that the natural water table is around 15' below the surface of the ground and that water releases from the FMIC significantly raise the water table in the south portion of the proposed development. The below image shows the effects of the FMIC irrigation release early in May 2020 through early July at Monitoring Well 2 which is located near the existing excavation (see illustration in Appendix C).

APPENDIX A

HYDROLOGIC AND HYDRAULIC CALCULATIONS

Sub-Basin Descriptions	
Sub-Basin	Description
B9	This sub-basin represents the drainage area tributary to Crescent Moon along the east side of the Aspen Ranch Filing No. 1 development. Flows will sheet flow off of the adjacent right of way to the Crescent Moon curb and gutter. Once reaching the street flows will be conveyed to DP7a at a slope ranging from 1% to 4%.
B10	This sub-basin represents the area tributary to DP1. Flows in this sub-basin will sheet flow at a 5% slope to Silex Street and Pin Point Drive. Once reaching the curb and gutter the flows will be conveyed to DP1 via curb and gutter at slopes ranging from 3.7% to 4%
B11	Flows in this sub-basin will sheet flow off the back of lots along Silex Street and off the whole of lots along Tijeras Street to Tijeras street at slopes ranging from 7.4% to 5%. Once reaching Tijeras Street, flows are conveyed westward at a slope of 3.7% to Cronin Street. The east side of Cronin Street will then convey the flows south to DP2 at slopes ranging from 1.3% to 2.9%.
B12a	This sub-basin represents the area on each side of Watchmen Road and the west side of Cronin north of Watchmen. Runoff will sheet flow off the front of the lots adjacent to Cronin Street at a slope of 5% and Runoff along Watchmen will sheet flow off of Lot 218 (future Fire Station) to Watchmen at slopes ranging from 1.8% to 5%. Once reaching Cronin, Flows will be conveyed via curb and gutter at a slope of 2.9% to Watchmen Road. Watchmen Road will convey flows from Cronin and the adjacent lot at a slope of 4.6% to DP3.
B12b	This sub-basin represents flows on the east side of Link Road several hundred feet to either side of Watchmen Road. Flows in this sub-basin will sheet flow off of Lot 218 at a slope of around 5% to Link Road. Flows will also sheet flow off the back of lots along Treasureval Trail at a slope of 5% to Link Road. Once reaching Link Road these flows will be conveyed via curb and gutter to DP 4b at slopes ranging from 0.3% to 1.4%.
B13	This is a (mostly) offsite basin. Flows will sheet flow off of the undeveloped area north of the proposed Aspen Ranch Filing No.1 development to a proposed swale running west at slopes ranging from 1% to 7% along the north of the cut at the north boundary of the development, entering the development just east of Link Road. From here the flows will sheet flow to DP 22.
OB1.1A1- Reduced (Less Developed Area)	This represents the large sub-basin east of the project area. Flows will sheet flow off of the surrounding hills at grades of 2% to 9% towards the natural drainage way running at an estimated 2% grade towards the project area. These flows will be captured at DP 18 and be conveyed around the project via 48-inch Storm sewer sized to handle both natural flows and FMIC flows simultaneously.
OB1.1A2 (Not Reduced by Development)	This represents the large sub-basin south of the proposed project. Flows will sheet flow off of the surrounding hills at grades ranging from 3% to 9% towards a natural drainage way which terminates at the Southeast quadrant of the intersection of Link and Kane Roads. These flows will be captured by a 36-inch RCP storm sewer and be conveyed around the project via a 48-inch RCP storm sewer after crossing Kane Road.
OB1.1B- Reduced (Less Developed Area)	This is a sub-basin located to the north of the proposed project. Runoff in this undeveloped sub-basin will sheet flow off of the surrounding hills at slopes ranging from 3% to 9% into sub-basin B13 where the grades are designed to convey flows to an extended existing cross road pipe at DP 22.

RATIONAL METHOD - PROPOSED CONDITIONS

Project Name: ASPEN RANCH
 Project Location: FOUNTAIN, CO
 Designer: JTS
 Notes: Proposed Conditions



Channel Flow Type Key
 Heavy Meadow 2
 Tillage/Field 3
 Short Pasture and Lawns 4
 Nearly Bare Ground 5
 Grassed Waterway 6
 Paved Areas 7

Basin	Description	Area		Rational 'C' Values												Flow Lengths				Initial Flow				Channel Flow				Rainfall Intensity & Rational Flow Rate													
		SF	Acres	Surface Type 1 (Parks & Cemeteries)			Surface Type 2 (Greenbelts & Agriculture)			Surface Type 3 (Single-Family 1/8 Ac. Lots)			Surface Type 4 (Impervious)			Weighted C-Factor	Initial	True Initial	Channel	True Channel	High Point	Low Point	Average	Initial	High Point	Low Point	Average	Channel Flow Type (See Key above)	Velocity	Channel	Tc	i2	Q2	i5	Q5	i10	Q10	i100	Q100	% Imp	
				C5	C100	Area (SF)	C5	C100	Area (SF)	C5	C100	Area	C5	C100	Area	C5	C100	ft	Length ft	ft	Length ft	Elevation	Elevation	Slope	Tc (min)	Elevation	Elevation	Slope	Ground Type	(ft/s)	Tc (min)	(min)	in/hr	cfs	in/hr	cfs	in/hr	cfs	in/hr	cfs	
B1a	Pond and Kane Road	63555	1.46	0.12	0.39	32325	0.09	0.36	10870	0.90	0.96	20340	0.43	0.61	50	50	1104	1104	5628	5626	0.040	5.6	5626	5595	2.81	7	3.3	5.5	11.1	3.1	2.0	2.5	4.6	2.9	6.6	5.9	46.7%				
B1b	Pond and Kane Road	156343	3.59	0.12	0.39	46339	0.09	0.36	53099	0.90	0.96	56095	0.52	0.67	50	50	1682	1682	5627	5624	0.060	4.2	5624	5595	1.72	7	2.6	10.8	15.0	2.7	5.2	3.5	6.5	4.0	7.6	5.8	14.1	60.5%			
B1c	Pond and Kane Road	256686	5.89	0.12	0.39	207971	0.09	0.36	48715	0.90	0.96	50	0.19	0.43	50	50	762	762	5627	5626	0.020	9.6	5626	5595	4.07	4	1.4	9.1	18.6	2.5	2.8	3.1	3.5	3.6	4.1	5.2	13.4	18.0%			
B2a	Single Family Residential	145434	3.34	0.12	0.39	40780	0.09	0.36	10454	0.90	0.96	0	0.36	0.54	100	100	775	775	5632	5631	0.010	13.8	5631	5616	1.94	7	2.8	4.7	18.5	2.5	3.0	3.1	3.8	3.7	4.4	5.3	9.6	48.7%			
B2b	Single Family Residential	164219	3.77	0.12	0.39	0	0.09	0.36	164219	0.90	0.96	0	0.45	0.59	95	95	736	736	5630	5629	0.011	11.6	5629	5616	1.77	7	2.6	4.7	16.4	2.6	4.5	3.3	5.7	3.9	6.6	5.6	12.5	65.0%			
B2c	Single Family Residential	113362	2.60	0.12	0.39	0	0.09	0.36	113362	0.90	0.96	0	0.45	0.59	100	100	1132	1132	5630	5629	0.010	12.2	5629	5616	1.15	7	2.1	9.0	21.1	2.3	2.7	2.9	3.5	3.4	4.0	4.9	7.6	65.0%			
B2d	Single Family Residential	12115	0.28	0.12	0.39	0	0.09	0.36	12115	0.90	0.96	0	0.45	0.59	50	50	201	201	5618	5618	0.003	12.8	5618	5616	1.04	7	2.0	1.7	14.5	2.8	0.4	3.5	0.4	4.1	0.5	5.9	1.0	65.0%			
B3a1	Single Family Residential	97624	2.24	0.12	0.39	0	0.09	0.36	97624	0.90	0.96	0	0.45	0.59	94	94	583	583	5627	5626	0.016	10.1	5626	5613	2.14	7	2.9	3.4	13.4	2.9	2.9	3.6	3.7	4.2	4.3	6.1	8.1	65.0%			
B3a2	Single Family Residential	4811	0.11	0.12	0.39	0	0.09	0.36	4811	0.90	0.96	0	0.45	0.59	25	25	126	126	5620	5619	0.040	3.8	5619	5618	0.79	7	1.7	1.3	5.1	4.0	0.2	5.1	0.3	5.9	0.3	8.5	0.6	65.0%			
B3b	Single Family Residential	69081	1.59	0.12	0.39	0	0.09	0.36	69081	0.90	0.96	0	0.45	0.59	94	94	631	631	5627	5626	0.016	10.1	5626	5613	1.98	7	2.8	3.8	13.9	2.8	2.0	3.6	2.6	4.2	3.0	6.0	5.7	65.0%			
B4	Single Family Residential	54121	1.24	0.12	0.39	0	0.09	0.36	54121	0.90	0.96	0	0.45	0.59	109	109	644	644	5628	5627	0.009	13.1	5627	5618	1.40	7	2.3	4.7	17.8	2.5	1.4	3.2	1.8	3.7	2.1	5.4	4.0	65.0%			
B5	Open Space	281095	6.45	0.12	0.39	248425	0.09	0.36	32670	0.90	0.96	0	0.16	0.42	173	173	999	999	5646	5638	0.046	13.9	5638	5614	2.40	4	1.1	15.4	29.2	2.0	2.0	2.5	2.6	2.9	3.0	4.1	11.3	13.7%			
B6	Single Family Residential	223314	5.13	0.12	0.39	0	0.09	0.36	223314	0.90	0.96	0	0.45	0.59	100	100	1093	1093	5655	5647	0.080	6.1	5647	5625	2.01	7	2.8	6.4	12.5	3.0	6.9	3.7	8.7	4.4	10.2	6.3	19.2	65.0%			
B7	Single Family Residential	198614	4.56	0.12	0.39	0	0.09	0.36	198614	0.90	0.96	0	0.45	0.59	100	100	1220	1220	5675	5661	0.140	5.0	5661	5632	2.38	7	3.0	6.7	11.7	3.1	6.3	3.9	8.0	4.5	9.3	6.5	17.5	65.0%			
B8	Open Space	14478	0.33	0.12	0.39	14478	0.09	0.36	0	0.90	0.96	0	0.12	0.39	88	88	88	88	5634	5625	0.102	7.9	5625	5623	2.27	4	1.0	1.4	9.3	3.3	0.1	4.2	0.2	4.9	0.2	7.1	0.9	7.0%			
B9	Gravel Mound	90669	2.08	0.12	0.39	35921	0.09	0.36	0	0.45	0.59	0	0.60	0.74	20	20	1580	1580	5677	5676	0.050	2.4	5676	5631	2.85	7	3.3	7.9	10.3	3.9	4.0	4.1	5.1	4.7	6.0	6.8	10.6	63.2%			
B10	Single Family Residential	304668	6.99	0.12	0.39	0	0.09	0.36	304668	0.90	0.96	0	0.45	0.59	100	100	1400	1400	5674	5661	0.130	5.2	5661	5621	2.86	7	3.3	7.0	12.1	3.0	9.6	3.8	12.0	4.4	14.1	6.4	26.5	65.0%			
B11	Single Family Residential	167635	3.85	0.12	0.39	0	0.09	0.36	167635	0.90	0.96	0	0.45	0.59	100	100	1040	1040	5661	5655	0.060	6.7	5655	5627	2.69	7	3.2	5.4	12.1	3.0	5.3	3.8	6.6	4.4	7.8	6.4	14.6	65.0%			
B12a	Open Space/Public Safety	117349	2.69	0.12	0.39	0	0.09	0.36	66112	0.90	0.96	51237	0.65	0.76	100	100	818	818	5639	5638	0.010	8.4	5638	5610	3.42	7	3.7	3.7	12.1	3.0	5.3	3.8	6.7	4.4	7.8	6.4	13.2	80.3%			
B12b	Open Space/Public Safety	104287	2.39	0.12	0.39	39227	0.09	0.36	630	0.45	0.59	25100	0.90	0.96	39330	0.50	0.66	100	100	664	664	5627	5613	0.120	4.9	5613	5607	1.20	7	2.2	5.1	10.0	3.3	3.9	4.1	5.0	4.8	5.8	6.9	11.0	56.0%
B13	Open Space, Offsite Undeveloped, Small Portion of Single Family	361044	8.29	0.12	0.39	0	0.09	0.36	302609	0.45	0.59	43731	0.90	0.96	14704	0.17	0.42	205	205	5685	5684	0.005	31.6	5684	5614	4.31	4	1.5	18.6	50.3	1.4	2.0	1.8	2.5	2.1	2.9	3.0	10.5	13.6%		
OBI.1A1-Reduced (Less Developed Area)	Offsite Sub-basin East of Development Area. SCS Calculations from AutoDesk S-AS	9017468	207.01	0.12	0.39	0	0.09	0.36	0	0.45	0.59	0	0.90	0.96	0	0.12	0.39	300	300	5649	5646	0.010	31.7	5646	5626	2.16	4	1.0	15.2	47.0	1.5	0.9	1.9	1.1	2.2	1.3	3.1	6.3	7.0%		
OBI.1A1-Kane Drainage (18a)	Sub-basin within OBI.1A1-Reduced Used to size storm pipe capturing North portion of Kane Road to the east of Aspen Ranch	223571	5.13	0.12	0.39	0	0.09	0.36	0	0.45	0.59	0	0.90	0.96	0	0.12	0.39	300	300	5649	5646	0.010	31.7	5646	5626	2.16	4	1.0	15.2	47.0	1.5	0.9	1.9	1.1	2.2	1.3	3.1	6.3	7.0%		
OBI.1A2 (Not Reduced in Development)	Offsite Sub-basin South of Development SCS Calculations from AutoDesk S-AS	9748453	223.79	0.12	0.39	0	0.09	0.36	0	0.45	0.59	0	0.90	0.96	0	0.12	0.39	300	300	5685	5675	0.033	21.2	5675	5614	3.05	4	1.2	27.5	48.7	1.4	4.9	1.8	6.1	2.1	7.1	3.0	33.4	7.0%		
OBI.1B-Reduced (Less Developed Area)	Offsite Sub-basin North of Development	1219563	28.00	0.12	0.39	1219563	0.09	0.36	0	0.45	0.59	0	0.90	0.96	0	0.12	0.39	300	300	5685	5675	0.033	21.2	5675	5614	3.05	4	1.2	27.5	48.7	1.4	4.9	1.8	6.1	2.1	7.1	3.0	33.4	7.0%		

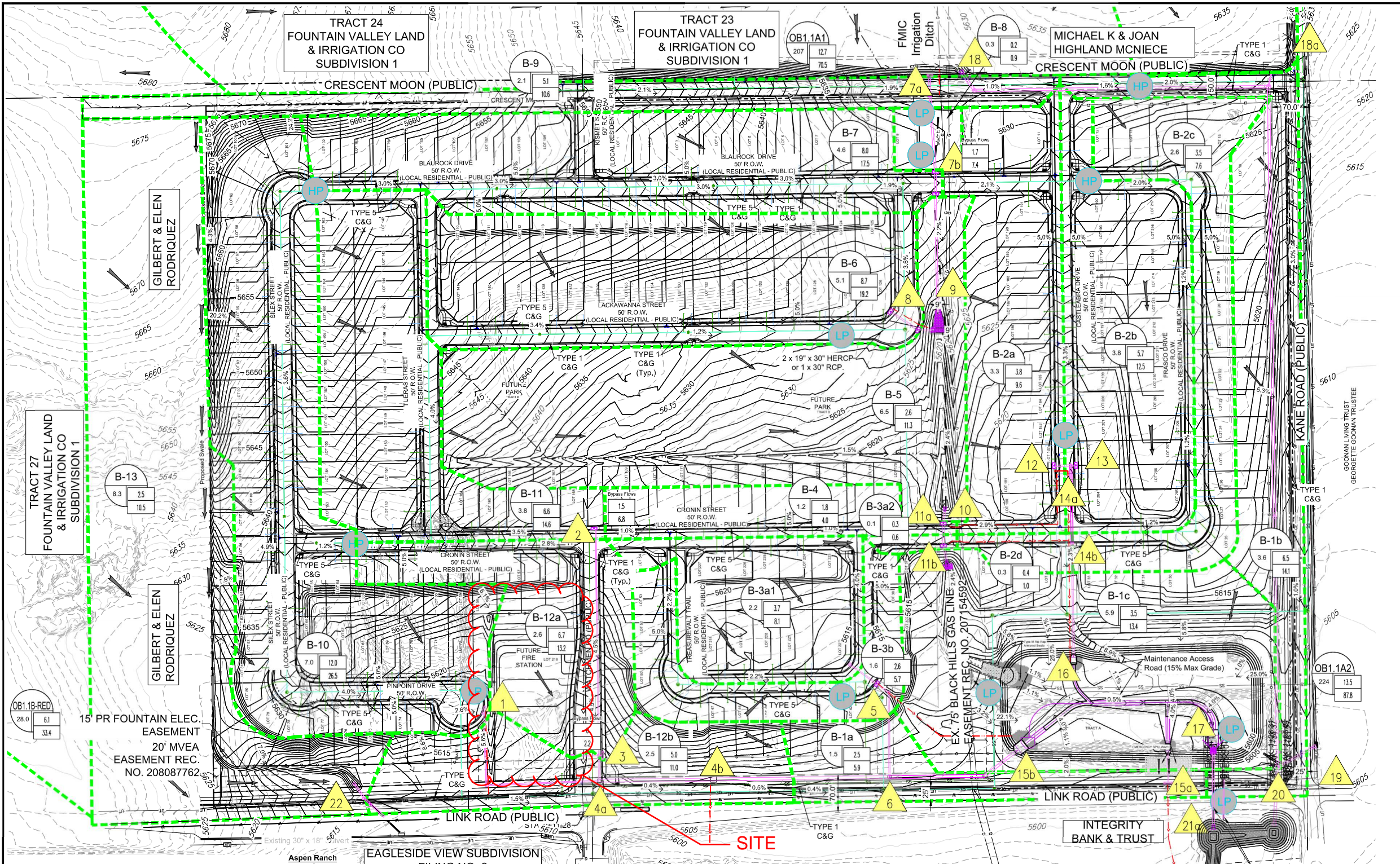
SCS METHOD

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SCS METHOD

SCS METHOD

Note: Q2, Q5 & Q10 are based on C5; Q25, Q50 & Q100 are based on C100



Aspen Ranch Proposed Conditions Basin Summary Table

Area ID	Area (Acres)	Q5 (cfs)	Q100 (cfs)
B1a	1.46	2.5	5.9
B1b	3.59	6.5	14.1
B1c	5.89	3.5	13.4
B2a	3.34	3.8	9.6
B2b	3.77	5.7	12.5
B2c	2.60	3.5	7.6
B2d	0.28	0.4	1.0
B3a2	0.11	0.3	0.6
B3b	1.59	2.6	5.7
B4	1.24	1.8	4.0
B5	6.45	2.6	11.3
B6	5.13	8.7	19.2
B7	4.56	8.0	17.5
B8	0.33	0.2	0.9
B9	2.08	5.1	10.6
B10	6.99	12.0	26.5
B11	3.85	6.6	14.6
B12a	2.69	6.7	13.2
B12b	2.39	5.0	11.0
B13	8.29	2.5	10.5
OB1.1A1-Reduced (Less Developed Area)	207.01	12.7	70.5
OB1.1A2 (Not Reduced by Development)	223.79	13.5	87.8
OB1.1B-Reduced (Less Developed Area)	28.00	6.1	33.4

Aspen Ranch Proposed Conditions Design Point Summary Table

Design Point: Sub-basins	Description	Area (Acres)	Q5 (cfs)	Q100 (cfs)	Outlet Pipe Size (inches)	Type
1: B10	Capture by: 15-foot sump Type-R Curb Inlet	7.0	12.0	26.5	24	RCP
2: B11	Capture by: 10-foot At-grade Type-R Curb Inlet	3.8	6.6	14.6	18	RCP
3: B11, B12a	Capture by: 15-foot & 5-foot At-Grade Type R Curb Inlets	6.5	13.7	28.1	30	RCP
4a: B10, B11, B12a	Manhole in Link Road combining B12a & DP 3	9.2	20.8	42.4	42	RCP
4b: B10, B11, B12a, 12b	Sump Inlet on Link Road and MH Combining DP 4b w/ Sub-basin B12b	11.6	22.3	46.3	42	RCP
5: B3a1 & B3b	On-Grade Inlets 15' Type R south, 5' Type R north	3.8	6.2	13.7	18	RCP
6: B3b, B10, B11, B12a, B12b	Manhole in Link Road combining DP5 & DP4b	15.5	27.0	56.4	42	RCP
7a: B8, B9	Surface flow to inlet in B9	2.4	4.2	9.1	18	RCP
7b: B7, B8, B9	At-Grade Inlets	7.0	10.6	23.4	36	RCP
8: B6	Sump Inlets	5.1	8.7	19.2	30-inch pipe.	RCP
9: B6, B7, B8, B9	Trapezoidal swale	12.1	11.4	24.9	8' bottom width 5:1 side slopes	Swale
10: B5, B6, B7, B8, B9	36-inch Flared End Section	18.6	12.2	31.3	36	RCP
11a: B4, B5, B6, B7, B8, B9	10-foot At Grade Inlet	19.8	19.8	49.5	36	RCP
11b: B3a2, B4, B5, B6, B7, B8, B9	5-foot At Grade Inlet	19.9	19.9	49.6	36	RCP
12: B2a + Flow Bypass from DP 7b	Sump Inlet	3.3	5.5	17.0	24	RCP

13: B2b	Sump Inlet	3.8	5.7	12.5	24	RCP
14a: B2a, B2b	Manhole combining flows from DP 12 & 13	7.1	11.0	29.2	30	RCP
14b: B2a, B2b, B2c, B2d	Sump Inlet	10.0	13.9	35.8	30	RCP
15a: B1a, B1b	Link and Kane Roads	5.0	8.8	19.2	24	RCP
15b: B1a, B1b, B3b, B10, B11, B12a, B12b	Northwest Forebay	20.5	8.5	18.9	24	RCP
16: B1a, B1b, B1c, B2a, B2b, B2c, B3a, B3b, B4, B5, B6, B7, B8, B9	See UD-Detention for Basin Volume Analysis	60.6	38.3	90.7	Trickle Channel	Concrete
17: Detention Pond Discharge	See UD-Detention for outlet structure design information	60.6	1.1	62.1	42	RCP
18: OB1.1A1	48" Storm Pipe Routing around development	207.0	12.7	70.5	48	RCP
18a (Sub-area within OB1.1A1)	18" FES These flows are included under DP18 and are thus not added again to the flows in the bypass storm sewer.	5.1	1.1	6.3	18	RCP
19: OB1.1A2	42" Crossroad pipe to 48" Storm Pipe Routing around development	223.8	13.5	87.8	36	RCP
20: OB1.1A1, OB1.1A2	48" Storm Pipe Routing around development	430.8	27.3	154.8	48	RCP
21: B1a, B1b, B1c, B2a, B2b, B2c, B3a, B3b, B4, B5, B6, B7, B8, B9, OB1.1A1, OB1.1A2	Crossroad discharge pipe	491.4	28.2	155.8	48 Swale(8' bottom width, 4:1 side slopes)	RCP Swale
22: B13, OB1.1B-Reduced	Combination of offsite undeveloped with Sub-basin B13 (which contains only open space and offsite). Storm water will continue to be treated and detained by Existing Pond B to the west.	36.3	7.3	35.1	30 x 18	HERCP

NOTES:

- THE "REDUCED" NOTE IN THE TABLE ABOVE INDICATES THAT THE SUB-BASINS NOTED HAVE HAD THEIR AREAS REDUCED RELATIVE TO THE PRE-DEVELOPMENT CONDITION BY THE AREA OF THE PROPOSED ASPEN RANCH DEVELOPMENT WHICH HAS BEEN BROKEN OUT OF THE LARGER PRE-DEVELOPMENT SUB-BASIN FOR THE PURPOSE OF POST DEVELOPMENT ANALYSIS.
- NO FEMA DESIGNATED REGULATORY FLOODPLAIN ON OR ADJACENT TO PROJECT SITE.

PREPARED BY:

Matrix

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Phone 719.575.0100

ASPEN RANCH

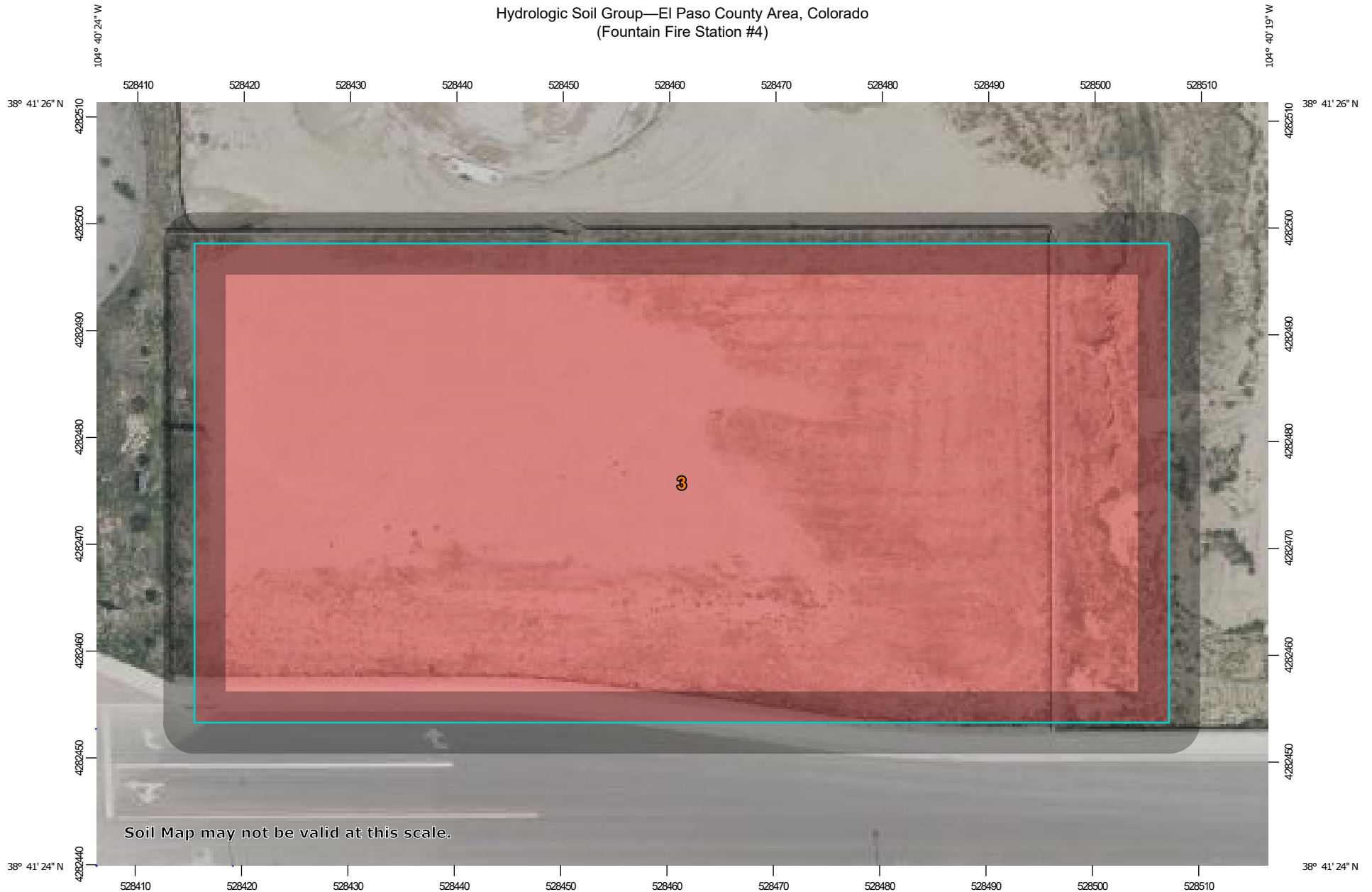
COLA FOUNTAIN, CO

PROPOSED CONDITIONS

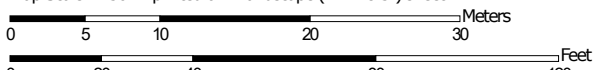
DESIGNED BY: JO SCALE: DATE ISSUED: MARCH 2021 DRAWING No. DR02
 DRAWN BY: JTS HORIZ. 1" = 100' SHEET: 02 OF 03
 CHECKED BY: GS VERT. N/A

APPENDIX B
HYDROLOGIC CALCULATIONS

Hydrologic Soil Group—El Paso County Area, Colorado
(Fountain Fire Station #4)



Map Scale: 1:504 if printed on A landscape (11" x 8.5") sheet.




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

Hydrologic Soil Group—El Paso County Area, Colorado
(Fountain Fire Station #4)



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





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

Soil Rating Lines


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

Soil Rating Points






-  A
-  A/D
-  B
-  B/D

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


Water Features

 Streams and Canals

Transportation

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

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 23, Aug 29, 2025

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

Date(s) aerial images were photographed: Jul 23, 2024—Aug 4, 2024

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
3	Ascalon sandy loam, 3 to 9 percent slopes	B	1.0	100.0%
Totals for Area of Interest			1.0	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis-- Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_r) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_r) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

$$t_c = t_i + t_t \quad (\text{Eq. 6-7})$$

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min)

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i , may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad (\text{Eq. 6-8})$$

Where:

t_i = overland (initial) flow time (min)

C_5 = runoff coefficient for 5-year frequency (see Table 6-6)

L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)

S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t , which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t , can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad (\text{Eq. 6-9})$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \quad (\text{Eq. 6-10})$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional “calibration” of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

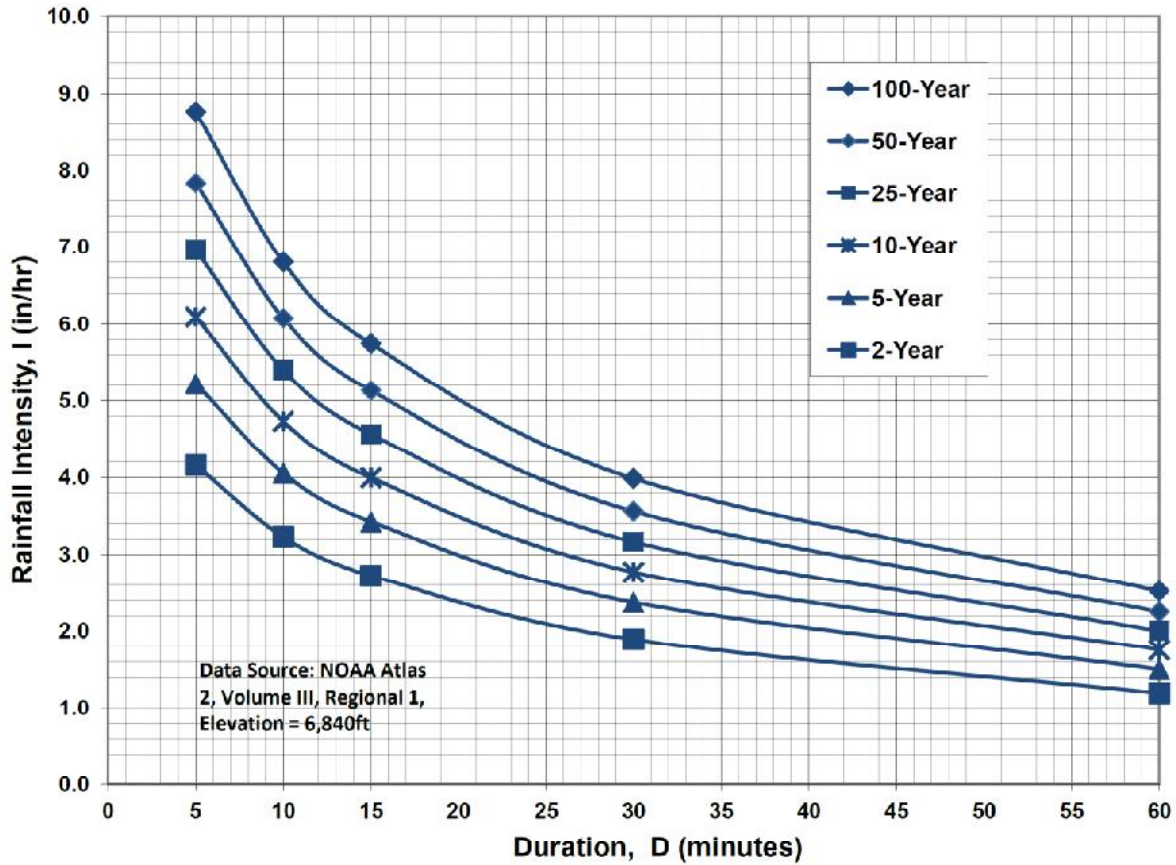
3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

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

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

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

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

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

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

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

**FOUNTAIN FIRE STATION #4
COMPOSITE RUNOFF COEFFICIENTS**

DEVELOPED CONDITIONS											
5-YEAR C VALUES											
BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A1	0.61	0.52	BUILDINGS/PAVEMENT	0.9	0.09	LANDSCAPE	0.08				0.779
A2	0.18	0.17	BUILDINGS/PAVEMENT	0.9	0.01	LANDSCAPE	0.08				0.854
B1	0.22	0.00	BUILDINGS/PAVEMENT	0.9	0.22	LANDSCAPE	0.08				0.080
A1,A2,B1	1.01										0.640
100-YEAR C VALUES											
BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A1	0.61	0.52	BUILDINGS/PAVEMENT	0.96	0.09	LANDSCAPE	0.35				0.870
A2	0.18	0.17	BUILDINGS/PAVEMENT	0.96	0.01	LANDSCAPE	0.35				0.926
B1	0.22	0.00	BUILDINGS/PAVEMENT	0.96	0.22	LANDSCAPE	0.35				0.350
A1,A2,B1	1.01										0.767
IMPERVIOUS AREAS											
BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
A1	0.61	0.52	BUILDINGS/PAVEMENT	100	0.09	LANDSCAPE	0				85.246
A2	0.18	0.17	BUILDINGS/PAVEMENT	100	0.01	LANDSCAPE	0				94.444
B1	0.22	0.00	BUILDINGS/PAVEMENT	100	0.22	LANDSCAPE	0				0.000
A1,A2,B1	1.01										68.317

FALCON FIRE STATION #4
RATIONAL METHOD

DEVELOPED FLOWS

BASIN	DESIGN POINT	AREA (AC)	Overland Flow					Channel flow						TOTAL T _c ⁽⁶⁾ (MIN)	TOTAL T _c ⁽⁶⁾ (MIN)	INTENSITY ⁽⁷⁾		PEAK FLOW	
			C		LENGTH (FT)	SLOPE (FT/FT)	T _{co} ⁽³⁾ (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT C	SLOPE (FT/FT)	SCS ⁽⁴⁾ VELOCITY (FT/S)	T _t ⁽⁵⁾ (MIN)	5-YR (IN/HR)			100-YR (IN/HR)	Q5 ⁽¹⁾ (CFS)	Q100 ⁽¹⁾ (CFS)	
			5-YEAR ⁽²⁾	100-YEAR ⁽²⁾															
A1	A1	0.61	0.779	0.870	50	0.016	3.6	280	20	0.024	3.10	1.5	5.1	5.1	4.41	9.57	2.10	5.08	
A2	A2	0.18	0.854	0.926	35	0.014	2.4	240	20	0.010	2.00	2.0	4.4	5.0	4.42	9.60	0.68	1.60	
B1	B1	0.22	0.080	0.350	50	0.030	9.2	100	15	0.030	2.60	0.6	9.8	9.8	3.58	7.77	0.06	0.60	
A1,A2,B1	1	1.01	0.640	0.767									9.8	9.8	3.58	7.77	2.32	6.02	

1) RATIONAL METHOD: Q (FLOW, CFS) = C (RUNOFF COEFFICIENT) * I (INTENSITY, IN/HR) * A (TRIBUTARY AREA, AC)

2) WEIGHTED AVERAGE C VALUES FOR COMBINED BASINS

3) OVERLAND FLOW T_{co} = (0.395*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^{0.5})/(SLOPE^{0.333}))

4) SCS VELOCITY = C * (SLOPE(FT/FT)^{0.5})

C = 2.5 FOR HEAVY MEADOW

C = 5 FOR TILLAGE/FIELD

C = 7 FOR SHORT PASTURE AND LAWNS

C = 10 FOR NEARLY BARE GROUND

C = 15 FOR GRASSED WATERWAY

C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES

5) CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)

6) T_c = T_{co} + T_t

*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED

7) INTENSITY BASED ON I-D-F CURVE IN EL PASO COUNTY DRAINAGE CRITERIA MANUAL, REVISED BY CITY OF COLORADO SPRINGS 1/1/03

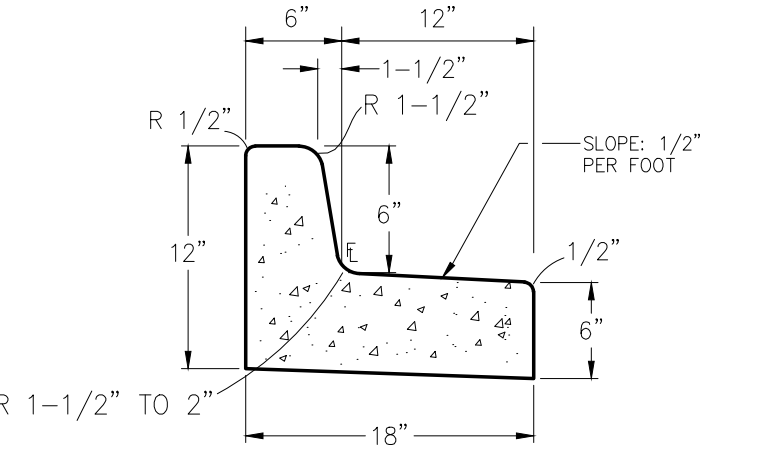
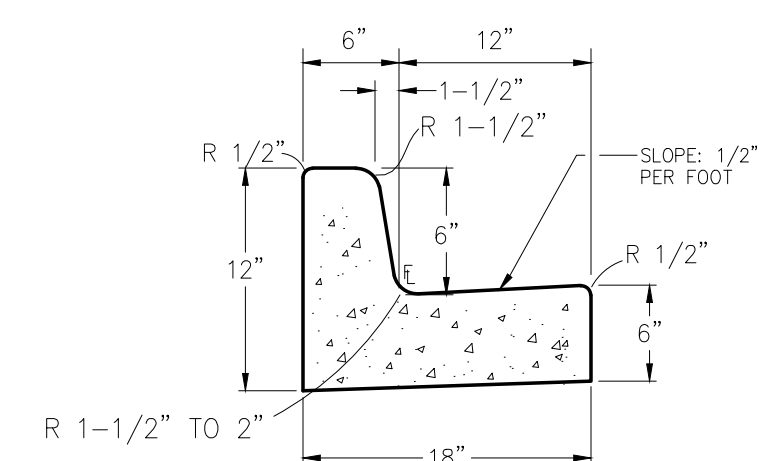
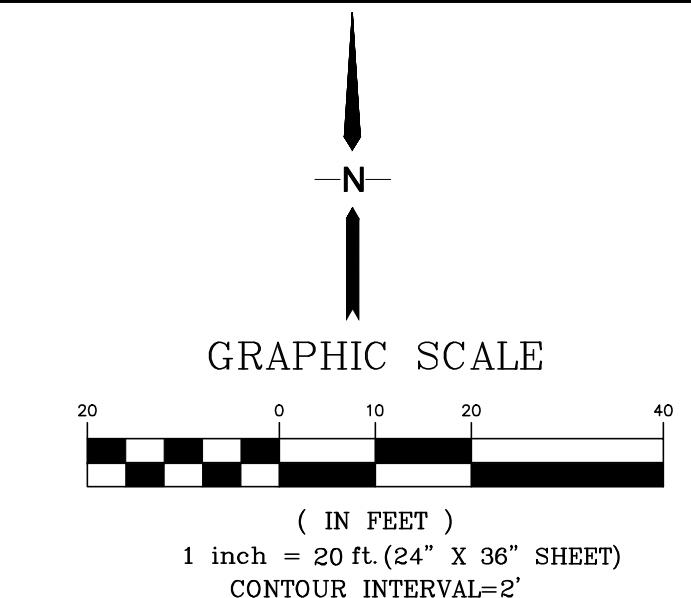
$$I = (A * P) / (B + Td)^C$$

5-YEAR VALUES: A = 26.65; P1 = 1.35 IN (1-HOUR DEPTH); B = 10.0; C = 0.76

100-YEAR VALUES: A = 26.65; P1 = 2.82 IN (1-HOUR DEPTH); B = 10.0; C = 0.76

APPENDIX C

FIGURES



LEGEND

- FEMA 100-YEAR FLOODWAY
- - - FEMA 100-YR FLOODPLAIN
- PROPERTY BOUNDARY
- DRAINAGE BASIN BOUNDARY
- STREAMSIDE OVERLAY LIMITS
- 5620 PROPOSED CONTOUR
- 5620 EXISTING CONTOUR
- FLOWLINE
- FLOW DIRECTION ARROW
- LOD LIMIT OF CONSTRUCTION/DISTURBANCE
- RD ROOF DRAIN CONNECTION TO SITE STORM SEWER (PROVIDE TRANSITION COUPLINGS & CONNECT TO 6" & 8" PVC SD @ 1.0% MIN. SLOPE)
- △ DESIGN POINT
- BASIN DESIGNATION
- BASIN AREA (ACRES)
- (E) EXISTING
- (P) PROPOSED
- GI GRATED INLET (18" NYOPLAST OR EQUAL)

BASIN SUMMARY TABLE

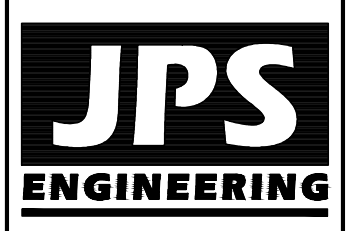
BASIN	Q5 (CFS)	Q100 (CFS)
A1	2.1	5.1
A2	0.7	1.6
B1	0.1	0.6

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
1	2.3	6.0

**FOUNTAIN FIRE STATION #4
LOT 228, ASPEN RANCH FILING NO. 1**

**DEVELOPED
DRAINAGE PLAN**



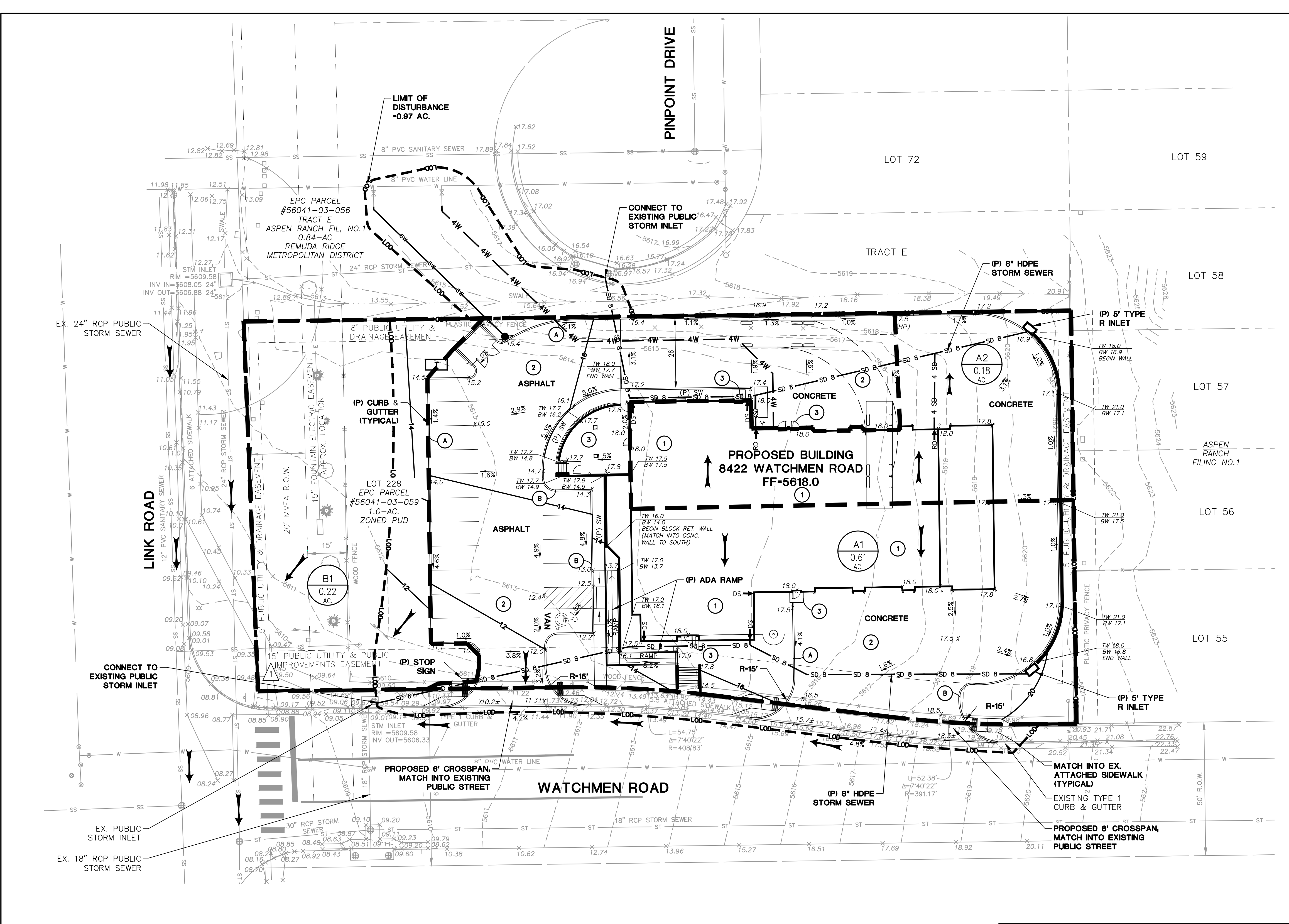
19 E. Wilamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpseng.com

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MEMBER UTILITIES.

NO.	REVISION	BY	DATE

DEVELOPED DRAINAGE PLAN

HORZ. SCALE:	1"=20'	DRAWN:	PV
VERT. SCALE:	NA	DESIGNED:	JPS
SURVEYED:	DREXEL	CHECKED:	JPS
CREATED:	07/10/25	LAST MODIFIED:	05/20/26
PROJECT NO.:	072501	MODIFIED BY:	PV
SHEET:	D1		



IMPERVIOUS AREA CALCULATION
A1 BASIN AREA = 0.61 AC.

SURFACE TYPE	AREA
BUILDING	5,087SF
ASPHALT	6,857SF
CONCRETE	10,523SF = 0.52 AC
TOTAL IMPERVIOUS AREA	22,467SF = 85.2%

IMPERVIOUS AREA CALCULATION
B1 BASIN AREA = 0.22 AC.

SURFACE TYPE	AREA
BUILDING	0000 SF
ASPHALT	0000 SF
CONCRETE	0000 SF = 0.0 AC
TOTAL IMPERVIOUS AREA	0000 SF = 0%

IMPERVIOUS AREA CALCULATION
A2 BASIN AREA = 0.18 AC.

SURFACE TYPE	AREA
BUILDING	4,357SF
ASPHALT	0000 SF
CONCRETE	2,966SF = 0.17 AC
TOTAL IMPERVIOUS AREA	7,323SF = 94.4%

BENCHMARK:
RIM OF EXISTING STORM INLET AT SW CORNER OF PROPERTY.
RIM EL=5609.58