FINAL DRAINAGE REPORT

CONSTITUTION STORAGE DEVELOPMENT

El Paso County, Colorado

PREPARED FOR:
Johnson Development Associates, Inc.
100 Dunbar Street, Suite 400
Spartanburg, SC 29306

PREPARED BY:
Galloway & Company, Inc.
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920

DATE:
July 8, 2022

PCD Filing No.: PPR-2224

ENGINEER'S STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable 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.

_____ _____

Brady A. Shyrock, PE #38164 Date
For and on behalf of Galloway & Company, Inc.

DEVELOPER'S CERTIFICATION

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

By:_____ _____

Date

Address: Johnson Development Associates, Inc.
101 N. Pacific Coast Hwy, Suite 308
El Segundo, CA 90245

EL PASO COUNTY CERTIFICATION

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

_____ _____

Joshua Palmer, P.E. Date
Interim County Engineer

Conditions:

TABLE OF CONTENTS

I. Purpose

The purpose of this Final Drainage Report is to identify on and offsite drainage patterns, locate and identify tributary or downstream drainage features and facilities that impact the site, and to identify which types of drainage facilities will be needed and where they will be located. This report will remain in general compliance with the approved FDR prepared by Costin Engineering Company, dated February 2, 1983.

II. General Description

The project is a self-storage commercial development located in the Cimarron Hills area of El Paso County, Colorado. The site is located in a portion of Section 05, Township 14 South, Range 65 West of the 6th Principal Meridian, County of El Paso, State of Colorado. The subject property is bounded by Constitution Avenue to the north, Canada Drive to the east, Peterson Road to the west, and existing Northcrest Filing No. 3 residential development to the south. A Vicinity Map is included in **Appendix A**.

This final drainage report is the basis for the drainage facility design in conformance with the previously approved FDR for the site prepared by Costin Engineering Company, "*Amendment Number 1, Final Drainage Study, Cimarron Northcrest Filing No. 3",* Costin Engineering Company, February 1983 (**FDR**). The site consists of approximately 3.716 acres and includes 929 storage units.

The existing soil types within the proposed site as determined by the NRCS Web Soil Survey for El Paso County Area consist of Truckton Sandy Loam (hydrologic soil group A). See the soils map included in **Appendix A**.

III. Drainage Criteria

Hydrology calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014.

The drainage calculations were based on the criteria manual Figure 6-5 and IDF equations to determine the intensity and are listed in Table 1 below.

Table 1 - Precipitation Data

Return Period	One Hour Depth (in).	Intensity (in/hr)
5-year	1.50	5.17
100-year	2.52	8.68

The rational method was used to calculate peak flows as the tributary areas are less than 100 acres. The rational method has been proven to be accurate for basins of this size and is based on the following formula:

Q = CIA

Where:

Q = Peak Discharge (cfs)
C = Runoff Coefficient
I = Runoff intensity (inches/hour)
A = Drainage area (acres)

The runoff coefficients are calculated based on land use, percent imperviousness, and design storm for each basin, as shown in the drainage criteria manual (Table 6-6). Composite percent impervious and C values were calculated using the residential, streets, roofs, and lawns coefficients found in Table 6-6 of the manual.

The 100-year event was used as the major storm event. The 5-year event was used as the minor event. The UD-Inlets v5.01 spreadsheet was utilized for the sizing of the proposed sump inlets.

The UD-Detention v4.04 spreadsheet was utilized for the design of the proposed on-site water quality ponds, Ponds A, B, C, D, E.

IV. Existing Drainage Conditions

The site lies within the existing Sand Creek drainage basin (see Reference Map). Based on this report, existing topography, and proposed future developments, no off-site basins will impact the site. Stormwater from this site generally drains to the southeast and southwest and will be routed to a single (1) private full spectrum detention facility designated as FSD-1 which has been sized to accommodate the developed flows from this site. The rational method was used to analyze the individual basins within the site because their size permits it.

The property presently discharges via sheet flow along the southern property line onto the adjacent Eight Line Inc. property and Alvarado property. Portions of the site along the eastern and western property lines also drain to the adjacent right-of-ways.

While the **FDR** shows a total of 26 basins that were analyzed as part of the overall Northcrest Filing No. 3 development, for the purposes of this report, only one (1) of the Basins within the FDR will be used for analysis. This Basin, C-4 (6.3 AC, Q_5 = 7.0 cfs, Q_{100} = 18.30 cfs) is located at the northwest corner of the approved FDR study area and drains through properties to the south to Allyn Way.

For a more in-depth analysis of existing tributary conditions as it pertains to this phase of development, an existing basin map has been prepared. The existing map can be found in **Appendix F** and basins are described below. The site has been divided into six (6) sub-basins to better show where runoff flows in the current conditions.

Basin EX-1 (0.05 AC, Q_5 = 0.0 cfs, Q_{100} = 0.1 cfs): This basin encompasses a portion of the southwest of the site in the existing condition. This basin consists of un-developed land. Runoff from this basin will sheet flow to the south before outfalling onto the adjacent Eight Line Inc. property. **(DP 1)**.

Basin EX-2 (0.26 AC, Q_5 = 0.0 cfs, Q_{100} = 0.4 cfs): This basin encompasses the southwest portion of the site in the existing condition. This basin consists of un-developed land. Runoff from this basin will sheet flow to the south before outfalling onto the adjacent Alvarado property. **(DP 2)**.

Basin EX-3 (0.39 AC, Q_5 = 0.0 cfs, Q_{100} = 0.7 cfs): This basin encompasses the western portion of the site in the existing condition, as well as a portion of the Peterson Road right-of-way. This basin consists of un-developed land and a portion of existing sidewalk. Runoff from this basin will sheet flow to the southwest before outfalling into Peterson Road. **(DP 3)**.

Basin EX-4 (0.03 AC, Q_5 = 0.1 cfs, Q_{100} = 0.2 cfs): This basin encompasses a portion of the northwest of the site in the existing condition. This basin consists mostly of existing sidewalk. Runoff from this basin will sheet flow to the north before outfalling into Constitution Avenue. **(DP 4)**.

Basin EX-5 (2.69 AC, Q_5 = 0.4 cfs, Q_{100} = 4.8 cfs): This basin encompasses the majority of the site in the existing condition, as well as a portion of Constitution Avenue right-of-way that is currently undeveloped. This basin consists of un-developed land, access drive, and a single-family home. Runoff from this basin will sheet flow to the south before outfalling onto the adjacent Eight Line Inc. property. **(DP 5)**.

Basin EX-6 (0.36 AC, Q_5 = 0.0 cfs, Q_{100} = 0.5 cfs): This basin encompasses the eastern portion of the site in the existing condition, as well as a portion of Constitution Avenue right-of-way that is currently undeveloped. This basin consists of un-developed land. Runoff from this basin will sheet flow to the southeast before outfalling into Canada Drive. **(DP 6)**.

V. Four Step Process

The Four Step Process is used to minimize the adverse impacts of urbanization and is a vital component of developing a balanced, sustainable project. Below identifies the approach to the four-step process:

1. Employ Runoff Reduction Practices

This step uses low impact development (LID) practices to reduce runoff at the source. Generally, rather than creating point discharges that are directly connected to impervious areas runoff is routed through pervious areas to promote infiltration. The Impervious Reduction Factor (IRF) method was used, and calculations can be found in **Appendix E**. For the majority of the site this is not practical, however portions of the site do drain through landscaped swales prior to entering the storm sewer system.

2. Stabilize Channels

This step implements stabilization to channels to accommodate developed flows while protecting infrastructure and controlling sediment loading from erosion in the drainageways. This project does not discharge to a channel. Flows are detained onsite to control release rates from the site down to existing rates and not adversely impact downstream facilities. The site is designed to release at or below the existing release rate for the site and will not negatively impact the downstream infrastructure.

3. Provide Water Quality Capture Volume (WQCV)

This step utilizes formalized water quality capture volume to slow the release of runoff from the site. The EURV volume will release in 72 hours, while the WQCV will release in no less than 12 hours because a sand filter is being utilized for water quality. An on-site water quality control volume detention pond will provide water quality treatment for all of the developed areas (utilizing a sand filter), prior to the runoff being released into existing curb flowlines at Canada Dr and Peterson Rd. Refer to WQCV Plan in **Appendix F.**

4. Consider Need for Industrial and Commercial BMPs

As this project is a commercial development, roof drains connecting directly to proposed water quality and detention facility, surface flows being routed to inlets that capture developed runoff and direct flows to proposed water quality and detention facility. Stockpile and concrete washout BMPs will be implemented onsite. At the Contractor's discretion, additional specialized BMPs which would be associated with an industrial or commercial site may be implemented.

VI. Proposed Drainage Conditions

The proposed development lies completely within the Sand Creek Drainage Basin and consists of eleven (11) sub-basins. Site runoff will be collected via sheet flows, roof drains, inlets & pipes and diverted to the one (1) proposed full spectrum detention pond (FSD-1). Within the pond, there will be a sand filter to infiltrate the water quality flows. All necessary calculations can be found within the appendices of this report.

According to the **FDR**, the proposed project site lies within Basin C-4 (6.3 AC, Q_5 = 7.0 cfs, Q_{100} = 18.30 cfs) is located at the northwest corner of the approved FDR study area. The property presently discharges via sheet flow along the southern property line onto the adjacent Eight Line Inc. property.

The site will provide one (1) Full Spectrum Sand Filter Basin (SFB). Ponds FSD-1 will discharge treated runoff at historic rates directly into the existing curb flowline at Canada Drive.

As has been mentioned previously, the site is proposed to have a land use of commercial self-storage. The site will consist of 929 storage units along with associated parking, drive aisles, RV storage, detention pond, and landscaping areas.

Basin PR-1 (0.24 AC, Q_5 = 0.0 cfs, Q_{100} = 0.3 cfs): Located at the southwestern corner of the site, Basin PR-1 contains the proposed landscaping improvements immediately adjacent to the existing residential development (Northcrest Filing No. 3). Runoff from this basin will sheet flow to the existing southern boundary into the Alvarado property as it does in the existing condition (Basin EX-2) **(DP 1)**.

Basin PR-2A (0.11 AC, Q_5 = 0.1 cfs, Q_{100} = 0.3 cfs): Located on the western boundary of the site, this basin consists of driveway and landscaping. Runoff from this basin will sheet flow from the driveway to proposed curb and gutter at the driveway and Peterson Rd. Flows will then be routed, via curb & gutter downstream to the existing curb & gutter at the southwestern corner of the project site **(DP 2A)**.

Basin PR-2B (0.01 AC, Q_5 = 0.0 cfs, Q_{100} = 0.1 cfs): Located on the northwestern corner of the site, this basin consists of sidewalk and landscaping. Runoff from this basin will sheet flow from the to existing curb and gutter at Peterson Rd. Flows will then be routed, via existing curb & gutter at the northwestern corner of the project site **(DP 2B)**.

Basin PR-3 (0.22 AC, Q_5 = 0.2 cfs, Q_{100} = 0.7 cfs): Located on the northern boundary of the site, this basin consists of sidewalk and landscaping, as well as offsite areas within the Constitution right-of-way being developed. Runoff from this basin will sheet flow to existing curb and gutter in Constitution Ave. Flows will then be routed, via existing curb & gutter downstream to the northeastern corner of the project site **(DP 3)**.

Basin PR-4 (0.24 AC, Q_5 = 0.1 cfs, Q_{100} = 0.6 cfs): Located on the eastern boundary of the site, this basin consists of driveway and landscaping. Runoff from this basin will sheet flow from the driveway to

proposed curb and gutter at the driveway and Canada Dr. Flows will then be routed, via curb & gutter downstream to the existing curb & gutter at the southeastern corner of the project site **(DP 4)**.

Basin PR-5 (1.32 AC, Q_5 = 3.9 cfs, Q_{100} = 9.0 cfs): Located on the northcentral portion of the site, this basin consists entirely of the proposed two-story building. Flows will be captured by roof drains and routed, via pipe **(DP 5)**, to the proposed (private) full spectrum detention (FSD-1) sand filter basin (SFB) located at the northeast corner of the site **(DP 10)**.

Basin PR-6 (0.83 AC, Q_5 = 0.9 cfs, Q_{100} = 2.6 cfs): Located on the central portion of the site, west and south of Basin PR-5. This basin consists of landscaping and driveway. Runoff from this basin will sheet flow from the driveway to the proposed curb and gutter to the proposed (private) 8' Colorado Springs D-10-R inlet **(DP 6A)** where flows will be routed, via pipe, to the proposed (private) full spectrum detention (FSD-1) sand filter basin (SFB) located at the northeast corner of the site **(DP 10)**. Emergency overflows will be routed downstream via proposed curb and gutter to Canada Drive.

Basin PR-7 (0.19 AC, Q_5 = 0.6 cfs, Q_{100} = 1.3 cfs): Located on the northcentral portion of the site east of Basin PR-5, this basin consists of landscaping, and RV storage. Runoff from this basin will sheet flow to the edge of the proposed RV storage area to a proposed (private) 18" Nyloplast Drain Basin inlet in sump condition **(DP 7),** where flows will be routed, via pipe, to the proposed (private) full spectrum detention (FSD-1) sand filter basin (SFB) located at the northeast corner of the site **(DP 10)**. Emergency overflows will be routed downstream via proposed curb and gutter to Canada Drive.

Basin PR-8 (0.13 AC, Q_5 = 0.0 cfs, Q_{100} = 0.2 cfs): Located on the northern portion of the site, this basin consists entirely of landscaped area and swale north of the building. Runoff from this basin will sheet flow to the proposed swale to the proposed (private) CDOT Type C inlet **(DP 8)** where flows will be routed, via pipe, to the proposed (private) full spectrum detention (FSD-1) sand filter basin (SFB) located at the northeast corner of the site **(DP 10)**. Emergency overflows will be routed downstream via proposed curb and gutter to Canada Drive.

Basin PR-9 (0.18 AC, Q_5 = 0.5 cfs, Q_{100} = 1.3 cfs): Located in the eastern portion of the site, this basin consists of drive aisle and parking. Runoff from this basin will sheet flow to a proposed (private) 4' Colorado Springs D-10-R inlet in sump conditions, located on the south side of the eastern most parking stalls **(DP 9)** where flows will be routed, via pipe, to the proposed (private) full spectrum detention (FSD-1) sand filter basin (SFB) located at the northeast corner of the site **(DP 10)**. Emergency overflows will be routed downstream via proposed curb and gutter to Canada Drive.

Basin PR-10 (0.31 AC, Q_5 = 0.0 cfs, Q_{100} = 0.6 cfs): Located at the northeastern corner of the site, Basin PR-8 contains the entirety of the proposed (private) full spectrum detention (FSD-1) and adjacent landscaped area. Runoff from this basin will sheet flow directly to the (private) full spectrum detention (FSD-1) **(DP 10)**.

VII. Storm Sewer System

All development is anticipated to be urban and will include storm sewer & street inlets. Storm sewers collect storm water runoff and convey the water to the water quality facility prior to discharging. Storm sewer systems will be designed to the 100-year storm and checked with the 5-year storm. Inlets will be placed at sump areas and locations where street flow is larger than street capacity. UDFCD Inlet spreadsheet has been used to determine the size of all sump inlets.

There will be a proposed storm system within the site. The storm sewer system will discharge storm water into the proposed private full spectrum detention facility (FSD-1). The proposed system will consist of HDPE pipe, CDOT Type C inlets, Colorado Springs D-10-R inlets, Nyloplast Drain Basins, and storm sewer manholes.

Additionally, there are two (2) proposed drainage swales that run along the north and west side of the proposed building, respectively within sub-basins PR-8 and PR-6. The swales were analyzed using the Bentley software FlowMaster to properly size a triangular channel to convey the 100-year flows from the basins to FSD-1, while providing 1.0-ft of freeboard. The sizing calculations can be found in **Appendix D.**

Subsequent submittals will include details concerning at-grade inlet locations, street capacity, storm sewer sizing, outlet protection and location. Preliminary sump inlets have been sized and the calculations can be found in **Appendix D**.

VIII. Proposed Water Quality Detention Ponds

One (1) Water Quality Capture Volume Detention Pond (FSD-1) will be provided for the proposed site. The proposed pond will be privately owned and maintained by Johnson Development Associates Inc., once established. This detention pond is proposed to be full spectrum and will provide water quality and detention. Flows will be routed into the pond with the proposed (private) storm sewer system and release onto riprap pads into the pond. The WQCV release will be controlled by infiltration within the sand filter basin (SFB). The release rates for the WQCV and EURV will be 25-hours and 32-hours, respectively, and will pond to depths of 6499.37 and 6500.16. Flows exceeding the WQCV will be controlled by orifices and a modified Type C Outlet Structure and will be designed to release at or below the pre-development flow rate. A proposed outlet structure has been designed with this report. See **Appendix E** for calculations.

Basins PR-5 through PR-10 drain to FSD-1, totaling 2.96 acres and 80% of the project site. Per ECM Section I.7.1.C.1, 20% of the site may free release offsite, not to exceed 1 acre. Basins PR-1 through PR-4 free release, totaling 0.76 acres and 20% of the site area.

FSD-1: Located at the northeastern corner of the site, just west of existing Canada Dr. This pond will discharge to the existing western curb line within Canada Dr. The required volume WQCV and EURV are 0.057 Ac-Ft & 0.275 Ac-Ft, respectively. The total required detention basin volume is 0.424 Ac-Ft. See **Appendix E** for volume calculations.

IX. Proposed Channel Improvements

There are no proposed channel improvements as part of this report.

X. Maintenance

After completion of construction, the drainage facility (FSD-1) will be privately owned and maintained by Johnson Development Associates, Inc.

XI. Wetlands Mitigation

There are no existing wetlands within the project site.

XII. Floodplain Statement

No portion of the project sit lies with the designated Flood Zone as defined by the FIRM Map number 08041C0752G effective December 7, 2018. A copy of the FIRM Panel is included in **Appendix A.**

XIII. Drainage Fees & Maintenance

Drainage fees do not apply for Site Development Plans and are therefore not applicable to this project.

Below is a cost estimate for the improvements proposed with this filing.

Item	Quantity	Unit	Unit Cost	Cost
Storm Drain Improvements (Private)				
CDOT Type C Inlet (Private)	1	EA	$ 5,138.00	$ 5,138.00
Nyoplast Area Inlet -Single (Private)	1	EA	$ 2,750.00	$ 2,750.00
4' Type D-10 R Inlet (Private)	1	EA	$ 6,138.00	$ 6,138.00
8' Type D-10 R Inlet (Private)	1	EA	$ 8,447.00	$ 8,447.00
Storm Sewer Manhole, Slab Base	3	EA	$ 7,082.00	$ 21,246.00
18" Storm Drain - RCP (Private)	355	LF	$ 70.00	$ 24,850.00
18" Storm Drain - HDPE (Private)	475	LF	$ 60.00	$ 28,500.00
18" FES	1	EA	$ 420.00	$ 420.00
Subtotal				$ 119,188.00
WQCV Detention Ponds (Private)				
Pond (FSD-1)	1	EA	$ 45,000.00	$ 45,000.00
Subtotal				$ 45,000.00
Total				**$ 164,188.00**
Contingency			10%	$ 16,418.80
Grand Total				**$ 180,606.80**

XIV. Conclusion

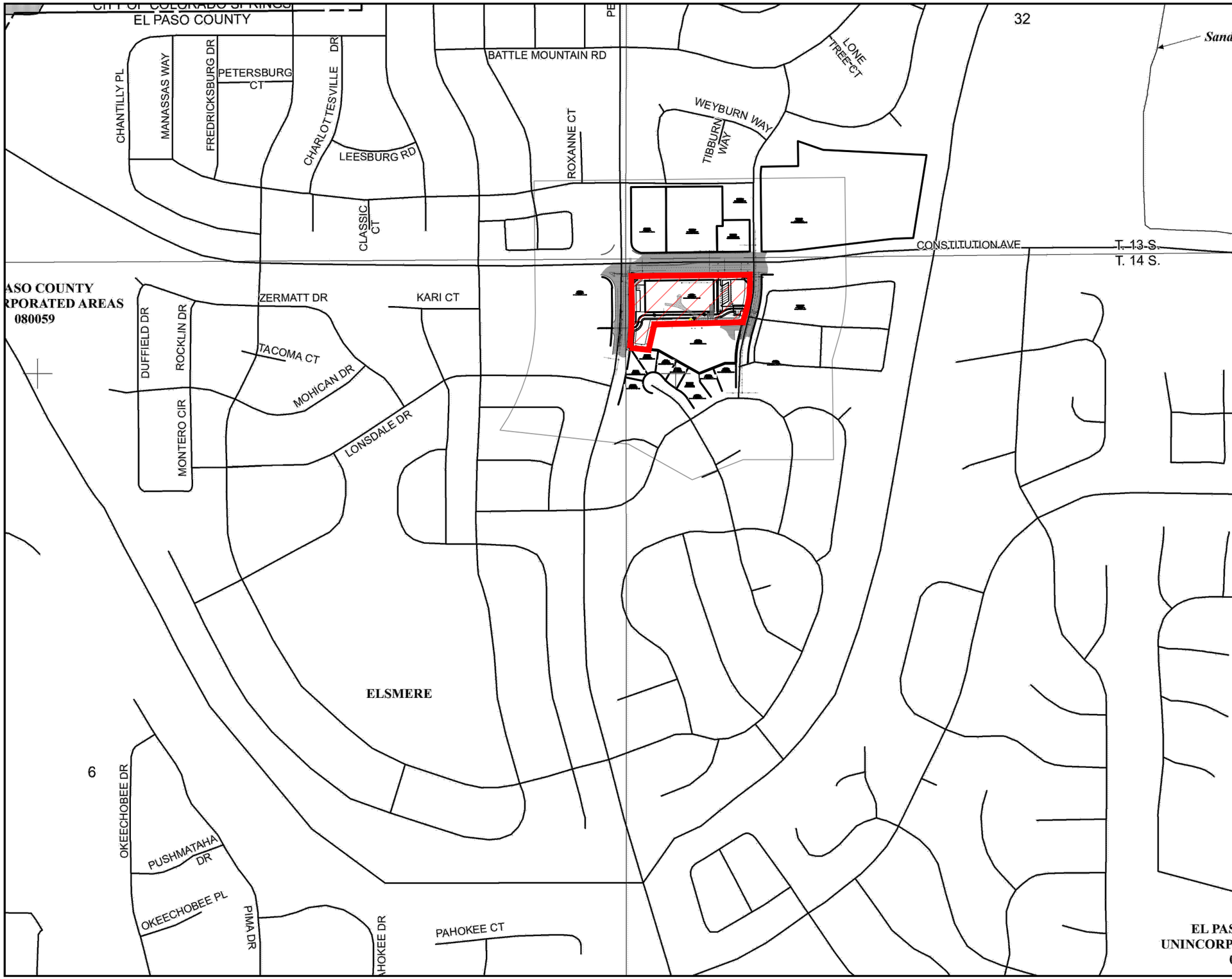
The Constitution Storage commercial development lies within the Sand Creek Drainage Basin. Water quality for the site is provided in a single on-site, private, Full Spectrum Detention Pond; FSD-1. All drainage facilities within this report were sized according to the El Paso County Drainage Criteria Manuals. The private full spectrum detention facility (FSD-1) will be maintained by Johnson Development Associates, Inc. The Constitution Storage development will not adversely impact any downstream facilities.

XV. References

1. *El Paso County Drainage Criteria Manual*, 1990.
2. *Drainage Criteria Manual, Volume 2*, City of Colorado Springs, 2002.
3. *El Paso County Drainage Criteria Manual Update*, 2015.
4. *El Paso County Engineering Criteria Manual*, 2020.

5. *Urban Storm Drainage Criteria Manual*, Urban Drainage and Flood Control District, January 2016 (with current revisions).
6. *Amendment Number 1, Final Drainage Study, Cimarron Northcrest Filing No. 3",* Costin Engineering Company, February 1983.

APPENDIX A
Exhibits and Figures



MAP SCALE 1" = 500'

250 0 500 1000 FEET

0 0 150 300 METE

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0752G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO

AND INCORPORATED AREAS

PANEL 752 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0752	G
EL PASO COUNTY	080059	0752	G

Notice: This map was reissued on 05/15/2020 to make a correction.This version replaces any previous versions, See the Notice-to-User Letter that accompanied this correction for details.

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0752G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

This is an official FIRMette showing a portion of the above-referenced flood map created from the MSC FIRMette Web tool. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For additional information about how to make sure the map is current, please see the Flood Hazard Mapping Updates Overview Fact Sheet available on the FEMA Flood Map Service Center home page at https://msc.fema.gov.

El Paso County Area, Colorado

97—Truckton sandy loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2x0j2
Elevation: 5,300 to 6,850 feet
Mean annual precipitation: 14 to 19 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 85 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Truckton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Truckton

Setting

Landform: Interfluves, hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Re-worked alluvium derived from arkose

Typical profile

A - 0 to 4 inches: sandy loam
Bt1 - 4 to 12 inches: sandy loam
Bt2 - 12 to 19 inches: sandy loam
C - 19 to 80 inches: sandy loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline (0.1 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Blakeland

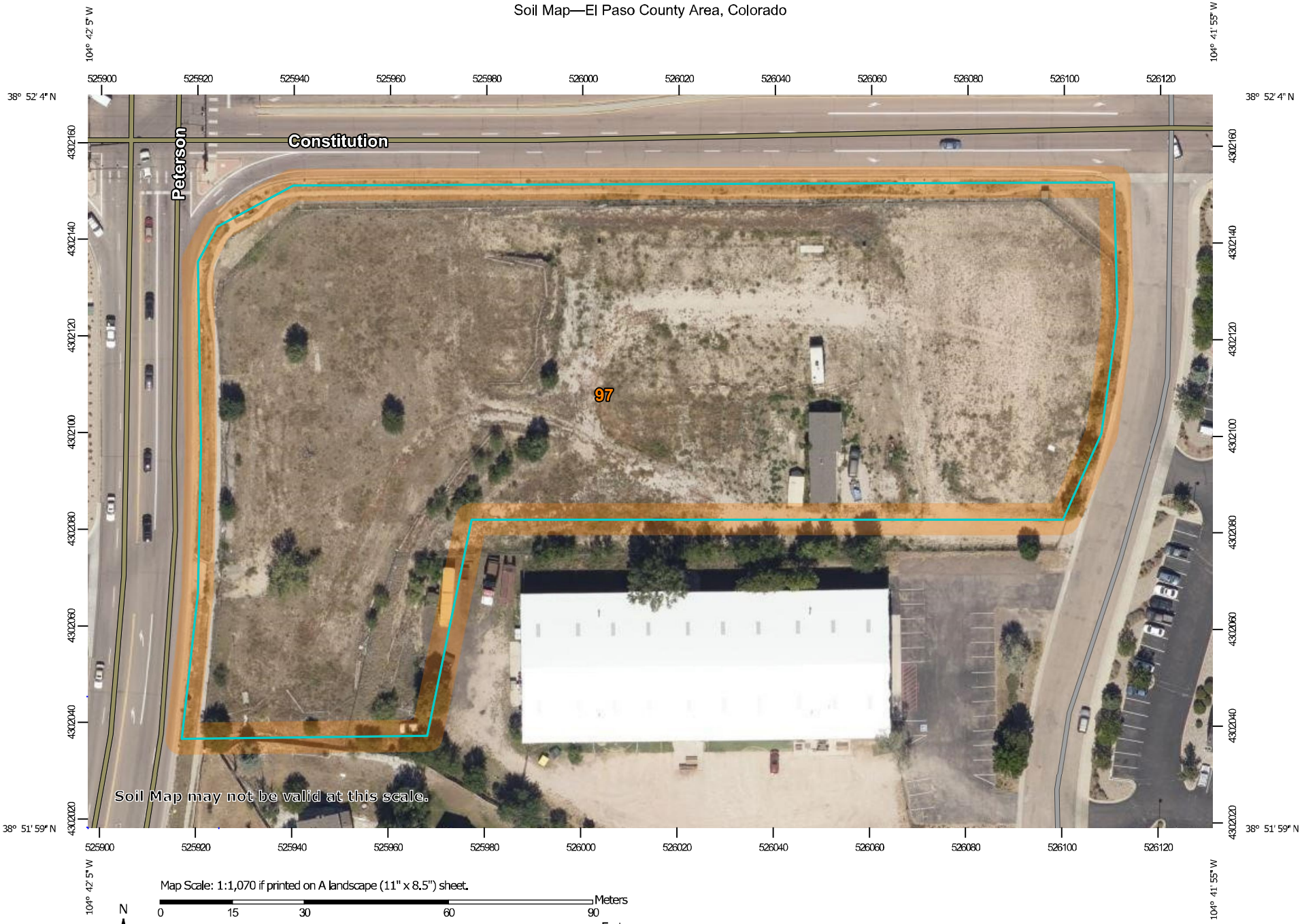
Percent of map unit: 8 percent
Landform: Interfluves, hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Bresser

Percent of map unit: 7 percent
Landform: Interfluves, low hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Data Source Information

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



Map Scale: 1:1,070 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
97	Truckton sandy loam, 3 to 9 percent slopes	3.8	100.0%
Totals for Area of Interest		**3.8**	**100.0%**

APPENDIX B

Standard Design Charts & Tables

Detailed descriptions of the curve number loss method and the dimensionless unit hydrograph can be found in these references:

- U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) 1986. *Urban Hydrology for Small Watersheds*. Technical Release 55 (TR-55) (Second Edition). Prepared by Conservation Engineering Division.
- U.S. Army Corps of Engineers (USACE) 2010. *Hydrologic Modeling System HEC-HMS User's Manual*. Hydrologic Engineering Center, CPD-74A.

While it is possible to perform hydrograph analysis using the NRCS curve number loss method and dimensionless unit hydrograph using spreadsheet tools, it is cumbersome. More commonly, computer models such as the USACE HEC-HMS model are used. This section describes model input requirements for pre- and post-development modeling using HEC-HMS. Primary inputs include basin characteristics such as the drainage area, curve number and lag time. In addition, channel routing parameters are specified in HEC-HMS.

Other computer programs that use the NRCS loss method and dimensionless unit hydrograph may also be used, provided that the model results can be replicated using HEC-HMS. However, the curve number option for calculating rainfall losses in EPA SWMM is not acceptable because it is not an accurate implementation of the NRCS method and may produce results that vary significantly from HEC-HMS and TR-55.

4.1 NRCS Curve Numbers

NRCS curve numbers range from 0 to 100 (the recommended lower limit is 40) and can be used to calculate the volume of runoff from a storm event based on land use characteristics. A curve number of 0 would represent zero runoff (100% losses), and a curve number of 100 would represent zero losses (100% runoff).

The selection of a curve number value depends on the type of soil, identified by the NRCS hydrologic soil group (HSG), the land cover or treatment, and the antecedent runoff condition (ARC).

4.1.1 Hydrologic Soil Groups (HSG)

HSGs are determined by soil surveys published by the NRCS, which are generally done on a county-wide basis. The NRCS Soil Survey Geographic (SSURGO) Database is an online tool that may be used to characterize soils and HSGs.

The locations of each soil type for the drainage basin being studied must be identified by their HSG designation. The four hydrologic soil groups are defined by soil scientists, according to their runoff potential, as:

Assumed infiltration rate for sand filter. 0.30 in/hr * 6985 sf = 0.05 cfs infiltration

- **Group A**: Low runoff potential. Soils having low runoff potential and high infiltration rates even when thoroughly wetted. These consist chiefly of deep, well to excessively drained sand or gravel and have a high rate of water transmission (> 0.30 in/hr).
- **Group B**: Moderate runoff potential. Soils having moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15-0.30 in/hr).

APPENDIX C

Hydrologic Computations

COMPOSITE % IMPERVIOUS CALCULATIONS

Exisitng Conditions

Subdivision:
Location: CO, Colorado Springs

Project Name: 6855 Constitution Ave Storage Site
Project No.: JDA000002
Calculated By: DDJ
Checked By: BS
Date: 7/8/22

		Paved Roads			Lawns			Roofs			
Basin ID	Total Area (ac)	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	Basins Total Weighted % Imp.
EX-1	0.05	100	0.00	0.0	2	0.05	2.0	90	0.00	0.00	2.0
EX-2	0.26	100	0.00	0.0	2	0.26	2.0	90	0.00	0.00	2.0
EX-3	0.39	100	0.02	4.2	2	0.38	1.9	90	0.00	0.00	6.1
EX-4	0.03	100	0.02	77.0	2	0.01	0.5	90	0.00	0.00	77.5
EX-5	2.69	100	0.16	6.0	2	2.50	1.9	90	0.03	1.00	8.9
EX-6	0.36	100	0.00	0.0	2	0.36	2.0	90	0.00	0.00	2.0

Galloway

STANDARD FORM SF-2
TIME OF CONCENTRATION

Existing Conditions

Subdivision:
Location: CO, Colorado Springs

Project Name: 6855 Constitution Ave Storage Site
Project No.: JDA000002
Calculated By: DDJ
Checked By: BS
Date: 7/8/22

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					Tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	Hydrologic Soils Group	Impervious (%)	C_{100}	C_5	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	Cv	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	TOTAL LENGTH (FT)	Urbanized T_c (MIN)	T_c (MIN)
EX-1	0.05	A	2.0	0.22	0.00	61	27.0	5.2	0	1.5	20.0	2.4	0.0	5.2	61.0	10.3	5.2
EX-2	0.26	A	2.0	0.22	0.00	100	3.0	14.0	130	7.3	15.0	4.1	0.5	14.5	230.0	11.3	11.3
EX-3	0.39	A	6.1	0.25	0.03	210	3.0	19.7	0	1.5	20.0	2.4	0.0	19.7	210.0	11.2	11.2
EX-4	0.03	A	77.5	0.63	0.53	16.5	2.0	3.4	16	1.5	20.0	2.4	0.1	3.5	32.5	10.2	5.0
EX-5	2.69	A	8.9	0.27	0.05	300	2.0	26.4	0	1.5	20.0	2.4	0.0	26.4	300.0	11.7	11.7
EX-6	0.36	A	2.0	0.22	0.00	200	5.0	16.7	0	1.5	20.0	2.4	0.0	16.7	200.0	11.1	11.1

NOTES:

T_i = (0.395*(1.1 - C_5)*(L)^0.5)/((S)^0.33), S in ft/ft

T_t=L/60V (Velocity From Fig. 501)

Velocity V=Cv*S^0.5, S in ft/ft

Tc Check = 10+L/180

For Urbanized basins a minimum T_c of 5.0 minutes is required.

For non-urbanized basins a minimum T_c of 10.0 minutes is required

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)
Exisitng Conditions

Subdivision:
Location: CO, Colorado Springs
Design Storm: 2-Year

Project Name: 6855 Constitution Ave Storage Site
Project No.: JDA000002
Calculated By: DDJ
Checked By: BS
Date: 7/8/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
	1	EX-1	0.05	0.00	5.2	0.00	4.06	0.0													Free-release offsite to Eight Line Inc. property
	2	EX-2	0.26	0.00	11.3	0.00	3.15	0.0													Free-release offsite to Alvarado property
	3	EX-3	0.39	0.03	11.2	0.01	3.16	0.0													Free-release offsite to Peterson Road
	4	EX-4	0.03	0.53	5.0	0.02	4.12	0.1													Free-release offsite to Constitution Avenue
	5	EX-5	2.69	0.05	11.7	0.13	3.11	0.4													Free-release offsite to Eight Line Inc. property
	6	EX-6	0.36	0.00	11.1	0.00	3.17	0.0													Free-release offsite to Canada Drive

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)
Existing Conditions

Subdivision:
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: 6855 Constitution Ave Storage Site
Project No.: JDA000002
Calculated By: DDJ
Checked By: BS
Date: 7/8/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
	1	EX-1	0.05	0.22	5.2	0.01	8.56	0.1													Free-release offsite to Eight Line Inc. property
	2	EX-2	0.26	0.22	11.3	0.06	6.63	0.4													Free-release offsite to Alvarado property
	3	EX-3	0.39	0.25	11.2	0.10	6.65	0.7													Free-release offsite to Peterson Road
	4	EX-4	0.03	0.63	5.0	0.02	8.68	0.2													Free-release offsite to Constitution Avenue
	5	EX-5	2.69	0.27	11.7	0.73	6.54	4.8													Free-release offsite to Eight Line Inc. property
	6	EX-6	0.36	0.22	11.1	0.08	6.67	0.5													Free-release offsite to Canada Drive

Galloway

COMPOSITE % IMPERVIOUS CALCULATIONS

Proposed Conditions

Subdivision:
Location: CO, Colorado Springs

Project Name: 6855 Constitution Ave Storage Site
Project No.: JDA000002
Calculated By: DDJ
Checked By: BS
Date: 7/8/22

		Paved Roads			Lawns			Roofs			
Basin ID	**Total Area (ac)**	**% Imp.**	**Area (ac)**	**Weighted % Imp.**	**% Imp.**	**Area (ac)**	**Weighted % Imp.**	**% Imp.**	**Area (ac)**	**Weighted % Imp.**	**Basins Total Weighted % Imp.**
PR-1	0.24	100	0.00	0.0	2	0.24	2.0	90	0.00	0.00	2.0
PR-2A	0.11	100	0.04	39.7	2	0.07	1.2	90	0.00	0.00	40.9
PR-2B	0.01	100	0.008	75.5	2	0.003	0.5	90	0.00	0.00	76.0
PR-3	0.22	100	0.07	30.8	2	0.15	1.4	90	0.00	0.00	32.2
PR-4	0.24	100	0.06	23.2	2	0.18	1.5	90	0.00	0.00	24.7
PR-5	1.32	100	0.00	0.0	2	0.00	0.0	90	1.32	90.00	90.0
PR-6	0.83	100	0.49	58.6	2	0.34	0.8	90	0.00	0.00	59.4
PR-7	0.19	100	0.17	91.7	2	0.02	0.2	90	0.00	0.00	91.9
PR-8	0.13	100	0.00	0.0	2	0.13	2.0	90	0.00	0.00	2.0
PR-9	0.18	100	0.17	90.9	2	0.02	0.2	90	0.00	0.00	91.1
PR-10	0.31	100	0.00	0.0	2	0.31	2.0	90	0.00	0.00	2.0

Galloway

STANDARD FORM SF-2
TIME OF CONCENTRATION

Proposed Condtions

Subdivision:
Location: CO, Colorado Springs

Project Name: 6855 Constitution Ave Storage Site
Project No.: JDA000002
Calculated By: DDJ
Checked By: BS
Date: 7/8/22

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					Tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	Hydrologic Soils Group	Impervious (%)	C_{100}	C_5	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	Cv	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	TOTAL LENGTH (FT)	Urbanized T_c (MIN)	T_c (MIN)
PR-1	0.24	A	2.0	0.22	0.00	137	10.0	10.9	0	3.0	20.0	3.5	0.0	10.9	137.0	10.8	10.8
PR-2A	0.11	A	40.9	0.41	0.25	42	2.0	8.0	54	2.0	20.0	2.8	0.3	8.3	96.0	10.5	8.3
PR-2B	0.01	A	76.0	0.62	0.51												5.0
PR-3	0.22	A	32.2	0.38	0.20												5.0
PR-4	0.24	A	24.7	0.35	0.16	93	6.0	9.1	0	3.0	20.0	3.5	0.0	9.1	93.0	10.5	9.1
PR-5	1.32	A	90.0	0.79	0.71												5.0
PR-6	0.83	A	59.4	0.49	0.36	57	2.0	8.1	370	0.5	20.0	1.4	4.4	12.5	427.0	12.4	12.4
PR-7	0.19	A	91.9	0.81	0.74	42	2.0	3.4	47	0.5	20.0	1.4	0.6	3.9	89.0	10.5	5.0
PR-8	0.13	A	2.0	0.22	0.00	25	2.0	8.0	390	2.5	20.0	3.2	2.1	10.0	415.0	12.3	10.0
PR-9	0.18	A	91.1	0.80	0.73	96	4.0	4.2	59	4.0	20.0	4.0	0.2	4.4	155.0	10.9	5.0
PR-10	0.31	A	2.0	0.22	0.00												5.0

NOTES:

T_i = (0.395*(1.1 - C_5)*(L)^0.5)/((S)^0.33), S in ft/ft

T_t=L/60V (Velocity From Fig. 501)

Velocity V=Cv*S^0.5, S in ft/ft

Tc Check = 10+L/180

For Urbanized basins a minimum T_c of 5.0 minutes is required.

For non-urbanized basins a minimum T_c of 10.0 minutes is required

Galloway

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

Subdivision:
Location: CO, Colorado Springs
Design Storm: 2-Year

Project Name: 6855 Constitution Ave Storage Site
Project No.: JDA000002
Calculated By: DDJ
Checked By: BS
Date: 7/8/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
	1	PR-1	0.24	0.00	10.8	0.00	3.21	0.0													Free Release to Alvarado property
	2A	PR-2A	0.11	0.25	8.3	0.03	3.51	0.1													Free Release to Peterson Road
	2B	PR-2B	0.01	0.51	5.0	0.01	4.12	0.0													Free Release to Peterson Road
	3	PR-3	0.22	0.20	5.0	0.04	4.12	0.2													Free Release to Constitution Avenue
	4	PR-4	0.24	0.16	9.1	0.04	3.40	0.1													Free Release to Canada Drive
	5	PR-5	1.32	0.71	5.0	0.94	4.12	3.9													Roof drains to DP-6B
	6A	PR-6	0.83	0.36	12.4	0.30	3.04	0.9													D-10R inlet to DP-6B
	6B								12.4	1.24	3.04	3.8									Max flow at DP-6B to DP-7
	7	PR-7	0.19	0.74	5.0	0.14	4.12	0.6	12.4	1.38	3.04	4.2									Area inlet & Maximum flow at DP-7 to DP-8
	8	PR-8	0.13	0.00	10.0	0.00	3.29	0.0	12.4	1.38	3.04	4.2									Area inlet & Flows from PR-5, PR-6, PR-7, PR-8 into FSD
	9	PR-9	0.18	0.73	5.0	0.13	4.12	0.5													Max flow at DP-9 into FSD
	10	PR-10	0.31	0.00	5.0	0.00	4.12	0.0	12.4	1.51	3.04	4.6									Maximum flow into FSD

Galloway

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

Subdivision:
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: 6855 Constitution Ave Storage Site
Project No.: JDA000002
Calculated By: DDJ
Checked By: BS
Date: 7/8/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
	1	PR-1	0.24	0.22	10.8	0.05	6.75	0.3													Free Release to Alvarado property
	2A	PR-2A	0.11	0.41	8.3	0.04	7.39	0.3													Free Release to Peterson Road
	2B	PR-2B	0.01	0.62	5.0	0.01	8.68	0.1													Free Release to Peterson Road
	3	PR-3	0.22	0.38	5.0	0.08	8.68	0.7													Free Release to Constitution Avenue
	4	PR-4	0.24	0.35	9.1	0.08	7.16	0.6													Free Release to Canada Drive
	5	PR-5	1.32	0.79	5.0	1.04	8.68	9.0													Roof drains to DP-6B
	6A	PR-6	0.83	0.49	12.4	0.41	6.40	2.6													D-10R inlet to DP-6B
	6B								12.4	1.45	6.40	9.3									Max flow at DP-6B to DP-7
	7	PR-7	0.19	0.81	5.0	0.15	8.68	1.3	12.4	1.60	6.40	10.2									Area inlet & Maximum flow at DP-7 to DP-8
	8	PR-8	0.13	0.22	10.0	0.03	6.92	0.2	12.4	1.63	6.40	10.4									Area inlet & Flows from PR-5, PR-6, PR-7, PR-8 into FSD
	9	PR-9	0.18	0.80	5.0	0.15	8.68	1.3													Max flow at DP-9 into FSD
	10	PR-10	0.31	0.22	5.0	0.07	8.68	0.6	12.4	1.85	6.40	11.8									Maximum flow into FSD

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APPENDIX D

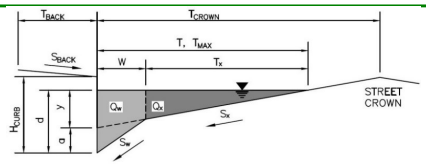
Hydraulic Computations

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

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

Project: 6855 Constitution Ave Self Storage

Inlet ID: INLET DP-6A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0		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} =	0.013		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	120.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.005		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		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	25.0	40.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

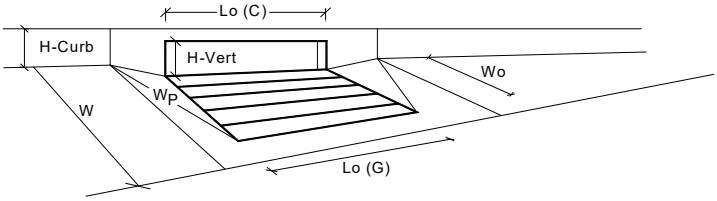
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	1.50	2.40	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.87	1.87	inches
Water Depth at Gutter Flowline	d =	3.37	4.27	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	23.0	38.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.372	0.207	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	68.8	102.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	66.8	100.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.104	0.065	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	0.0	0.0	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



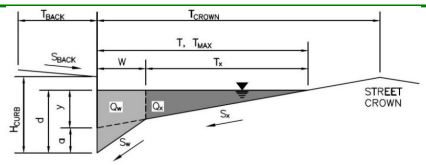
Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.4	4.3	inches
Grate Information			MINOR	MAJOR	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
Area Opening 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	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	8.00	8.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	81.00	81.00	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	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.12	0.19	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.34	0.43	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.81	0.89	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**1.2**	**2.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	0.9	2.6	cfs

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

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

Project: 6855 Constitution Ave Self Storage

Inlet ID: INLET DP-9



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	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} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	27.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.040	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	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	5.0	9.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

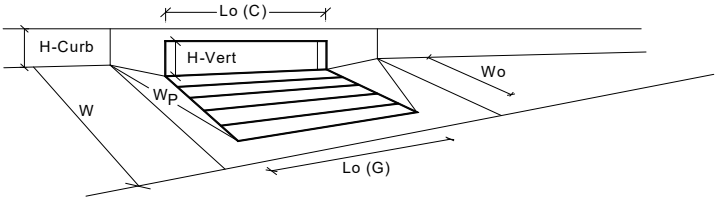
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	2.40	4.32	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.03	1.03	inches
Water Depth at Gutter Flowline	d =	3.43	5.35	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	3.0	7.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.815	0.542	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	14.5	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	8.4	12.5	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.482	0.356	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	0.0	0.0	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

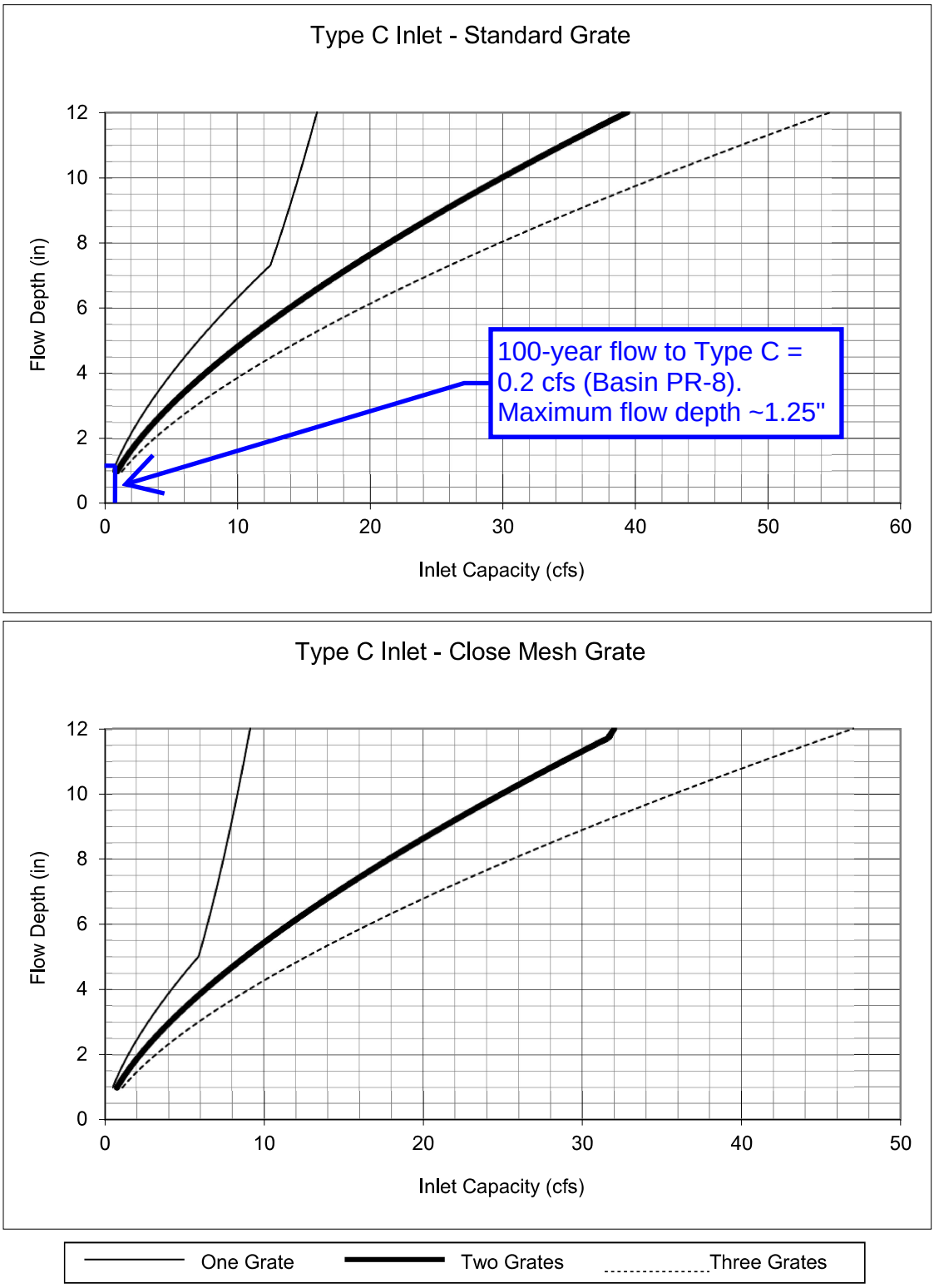
INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.4	5.4	inches
Grate Information			MINOR	MAJOR	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
Area Opening 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	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	4.00	4.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	81.00	81.00	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	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.12	0.28	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.48	0.75	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**1.0**	**3.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	0.5	1.3	cfs

Figure 8-10. Inlet Capacity Chart Sump Conditions, Area (Type C) Inlet



Notes:
1. The standard inlet parameters must apply to use these charts.

Nyloplast Inlet Capacity Table

DISCLAIMER: SAFETY FACTORS ARE NOT INCLUDED IN THESE CALCULATIONS. ACTUAL CALCULATIONS SHOULD BE CARRIED OUT AND VERIFIED BY THE DESIGN ENGINEER TAKING INTO ACCOUNT ALL LOCAL CONDITIONS. NYLOPLAST RECOMMENDS USING A MINIMUM SAFETY FACTOR OF 1.25 FOR PAVED AREAS AND 2.0 FOR TURF AREAS. ADS/NYLOPLAST IS NOT RESPONSIBLE FOR MISUSE OF THIS TOOL.

Input	
Type of Grate	18" Standard
Head (ft)	0.45

maximum ponding depth ~4.5"

Properties	
Orifice Flow Area (in)	116.72
Orifice Flow Area (ft)	0.81
Weir Flow Perimeter (in)	52.04
Weir Flow Perimeter (ft)	4.34

Solution	
Capacity (cfs)	2.60
Capacity (gpm)	1167.00

Basin PR-7: 100-year flow = 1.3 cfs (doubled to account for 50% clogging)

$$Q_{weir} = CLH^{3/2}$$

$C = 3.33$ *Weir Discharge Coefficient*

$L =$ *Perimeter of Grate Opening* (ft)

$H =$ *Flow Height of Water Surface Above Weir* (ft)

$$Q_{orifice} = CA\sqrt{2gh}$$

$C = 0.60$ *Orifice Discharge Coefficient*

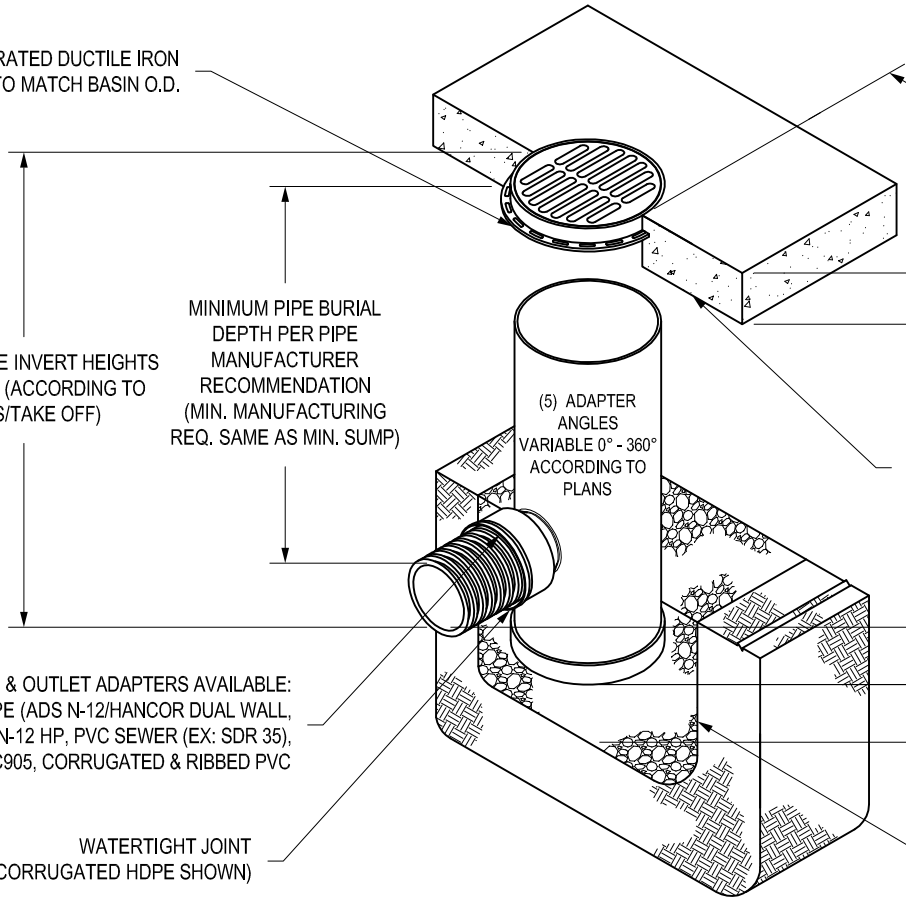
$A =$ *Area of the Orifice* (ft^2)

$g =$ *Gravitational Constant* $\left(32.2\frac{ft}{s^2}\right)$

$H =$ *Depth of Water Above Center of Orifice* (ft)

REV 2.1.21

NYLOPLAST 18" DRAIN BASIN: 2818AG _ _ X

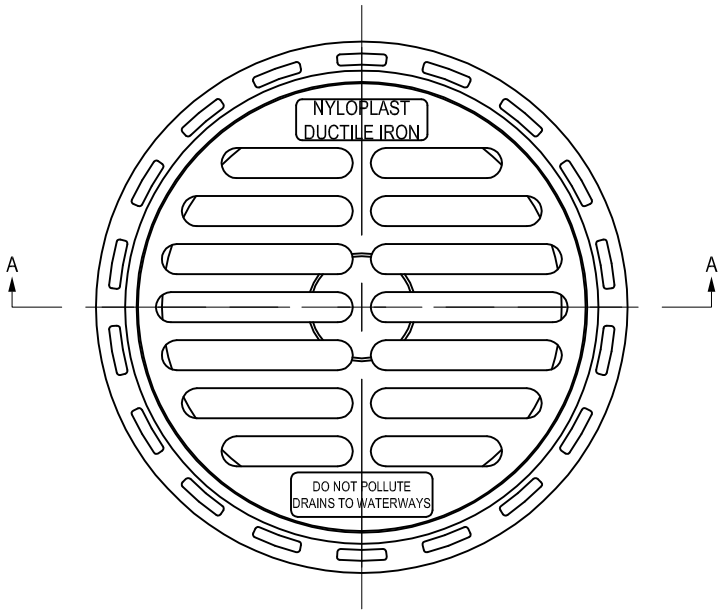


GRATE OPTIONS	LOAD RATING	PART #	DRAWING #
PEDESTRIAN	MEETS H-10	1899CGP	7001-110-212
STANDARD	MEETS H-20	1899CGS	7001-110-213
SOLID COVER	MEETS H-20	1899CGC	7001-110-214
DOME	N/A	1899CGD	7001-110-215
DROP IN GRATE	LIGHT DUTY	1801DI	7001-110-074

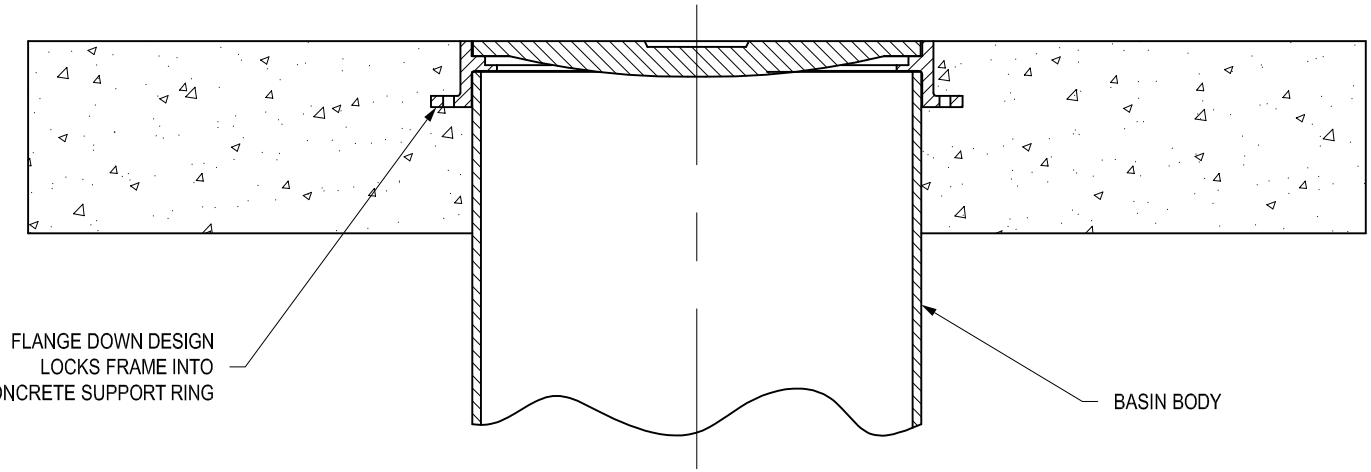
1 - GRATES/SOLID COVER SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05.
2 - FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05.
3 - DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS. RISERS ARE NEEDED FOR BASINS OVER 84" DUE TO SHIPPING RESTRICTIONS. SEE DRAWING NO. 7001-110-065.
4 - DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS N-12/HANCOR DUAL WALL), N-12 HP, & PVC SEWER.
5 - ADAPTERS CAN BE MOUNTED ON ANY ANGLE 0° TO 360°. TO DETERMINE MINIMUM ANGLE BETWEEN ADAPTERS SEE DRAWING NO. 7001-110-012.

DRAWN BY EBC	MATERIAL	ADS Nyloplast	3130 VERONA AVE BUFORD, GA 30518 PHN (770) 932-2443 FAX (770) 932-2490 www.nyloplast-us.com
DATE 04-03-06			
REVISED BY NMH	PROJECT NO./NAME	TITLE 18 IN DRAIN BASIN QUICK SPEC INSTALLATION DETAIL	
DATE 03-14-16			
DWG SIZE A	SCALE 1:30 SHEET 1 OF 1	DWG NO. 7001-110-191	REV E

18" , 24" , & 30" DRAIN BASIN FRAME & GRATE (18" STD GRATE SHOWN)



1899CG _
2499CG _
3099CG _



SECTION A - A

DRAWN BY CJA	MATERIAL	ADS Nyloplast	3130 VERONA AVE BUFORD, GA 30518 PHN (770) 932-2443 FAX (770) 932-2490 www.nyloplast-us.com
DATE 12-10-99			
APPD BY CJA	PROJECT NO./NAME	TITLE 18 IN, 24 IN, & 30 IN FRAME & GRATE EXAMPLE	
DATE 12-10-99			
DWG SIZE A	SCALE 1:8 SHEET 1 OF 1	DWG NO. 7001-110-005	REV D

12" @ 1% Capacity

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Normal Depth	1.00	ft
Diameter	1.00	ft
Discharge	3.56	ft^3/s

Results

Discharge	3.56	ft^3/s
Normal Depth	1.00	ft
Flow Area	0.79	ft^2
Wetted Perimeter	3.14	ft
Hydraulic Radius	0.25	ft
Top Width	0.00	ft
Critical Depth	0.81	ft
Percent Full	100.0	%
Critical Slope	0.01032	ft/ft
Velocity	4.54	ft/s
Velocity Head	0.32	ft
Specific Energy	1.32	ft
Froude Number	0.00	
Maximum Discharge	3.83	ft^3/s
Discharge Full	3.56	ft^3/s
Slope Full	0.01000	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

12" @ 1% Capacity

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.00	ft
Critical Depth	0.81	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.01032	ft/ft

18" @ 1% Capacity

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Normal Depth	1.50	ft
Diameter	1.50	ft
Discharge	10.50	ft^3/s

Results

Discharge	10.50	ft^3/s
Normal Depth	1.50	ft
Flow Area	1.77	ft^2
Wetted Perimeter	4.71	ft
Hydraulic Radius	0.38	ft
Top Width	0.00	ft
Critical Depth	1.25	ft
Percent Full	100.0	%
Critical Slope	0.00977	ft/ft
Velocity	5.94	ft/s
Velocity Head	0.55	ft
Specific Energy	2.05	ft
Froude Number	0.00	
Maximum Discharge	11.30	ft^3/s
Discharge Full	10.50	ft^3/s
Slope Full	0.01000	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

18" @ 1% Capacity

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	1.25	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00977	ft/ft

Curb Chase Capacity

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02000	ft/ft
Bottom Width	2.00	ft
Discharge	1.07	ft^3/s

Results

Normal Depth	0.14	ft
Flow Area	0.27	ft^2
Wetted Perimeter	2.27	ft
Hydraulic Radius	0.12	ft
Top Width	2.00	ft
Critical Depth	0.21	ft
Critical Slope	0.00535	ft/ft
Velocity	3.93	ft/s
Velocity Head	0.24	ft
Specific Energy	0.38	ft
Froude Number	1.88	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.14	ft
Critical Depth	0.21	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.00535	ft/ft

Basin PR-6 Swale

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.04000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Discharge	1.00	ft^3/s

Results

Normal Depth	0.36	ft
Flow Area	0.38	ft^2
Wetted Perimeter	2.26	ft
Hydraulic Radius	0.17	ft
Top Width	2.15	ft
Critical Depth	0.37	ft
Critical Slope	0.03362	ft/ft
Velocity	2.60	ft/s
Velocity Head	0.11	ft
Specific Energy	0.46	ft
Froude Number	1.08	
Flow Type	Supercritical	

Note: Flow reduced from PR-6 basin flow since swale only captures small portion of landscaped flows

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.36	ft
Critical Depth	0.37	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.03362	ft/ft

Basin PR-8 Swale

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.02000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Discharge	0.20	ft^3/s

Results

Normal Depth	0.22	ft
Flow Area	0.15	ft^2
Wetted Perimeter	1.41	ft
Hydraulic Radius	0.11	ft
Top Width	1.34	ft
Critical Depth	0.19	ft
Critical Slope	0.04167	ft/ft
Velocity	1.34	ft/s
Velocity Head	0.03	ft
Specific Energy	0.25	ft
Froude Number	0.71	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.22	ft
Critical Depth	0.19	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.04167	ft/ft

APPENDIX E

Pond Computations

Worksheet Protected

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.60	inches
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		
Max Intensity for Optional User Defined Storm	0		

Designer:	**DDJ**
Company:	**Galloway & Co.**
Date:	**July 8, 2022**
Project:	**6855 Constitution Ave Self Storage**
Location:	**FSD**

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier		**PR-5**	**PR-6**	**PR-7**	**PR-8**	**PR-9**	**PR-10**							
Receiving Pervious Area Soil Type		Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam							
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)		1.320	0.830	0.190	0.130	0.180	0.310							
Directly Connected Impervious Area (DCIA, acres)		1.320	0.490	0.170	0.000	0.170	0.000							
Unconnected Impervious Area (UIA, acres)		0.000	0.000	0.000	0.000	0.000	0.000							
Receiving Pervious Area (RPA, acres)		0.000	0.000	0.000	0.000	0.000	0.000							
Separate Pervious Area (SPA, acres)		0.000	0.340	0.020	0.130	0.010	0.310							
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)		C	C	C	C	C	C							

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)		1.320	0.830	0.190	0.130	0.180	0.310							
Directly Connected Impervious Area (DCIA, %)		100.0%	59.0%	89.5%	0.0%	94.4%	0.0%							
Unconnected Impervious Area (UIA, %)		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%							
Receiving Pervious Area (RPA, %)		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%							
Separate Pervious Area (SPA, %)		0.0%	41.0%	10.5%	100.0%	5.6%	100.0%							
A_R (RPA / UIA)		0.000	0.000	0.000	0.000	0.000	0.000							
I_a Check		1.000	1.000	1.000	1.000	1.000	1.000							
f / I for WQCV Event:		1.7	1.7	1.7	1.7	1.7	1.7							
f / I for 5-Year Event:		0.5	0.5	0.5	0.5	0.5	0.5							
f / I for 100-Year Event:		0.3	0.3	0.3	0.3	0.3	0.3							
f / I for Optional User Defined Storm CUHP:														
IRF for WQCV Event:		1.00	1.00	1.00	1.00	1.00	1.00							
IRF for 5-Year Event:		1.00	1.00	1.00	1.00	1.00	1.00							
IRF for 100-Year Event:		1.00	1.00	1.00	1.00	1.00	1.00							
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: I_{total}		100.0%	59.0%	89.5%	0.0%	94.4%	0.0%							
Effective Imperviousness for WQCV Event:		100.0%	59.0%	89.5%	0.0%	94.4%	0.0%							
Effective Imperviousness for 5-Year Event:		100.0%	59.0%	89.5%	0.0%	94.4%	0.0%							
Effective Imperviousness for 100-Year Event:		100.0%	59.0%	89.5%	0.0%	94.4%	0.0%							
Effective Imperviousness for Optional User Defined Storm CUHP:														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	N/A	0.0%	0.0%	0.0%	N/A	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	N/A	0.0%	0.0%	0.1%	N/A	0.1%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	**72.6%**
Total Site Effective Imperviousness for WQCV Event:	**72.6%**
Total Site Effective Imperviousness for 5-Year Event:	**72.6%**
Total Site Effective Imperviousness for 100-Year Event:	**72.6%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

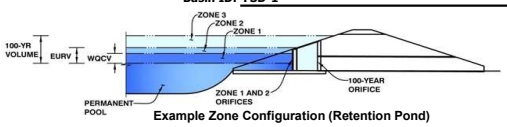
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: **6855 Constitution Ave Self Storage**

Basin ID: **FSD-1**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**SF**	
Watershed Area =	2.96	acres
Watershed Length =	520	ft
Watershed Length to Centroid =	225	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	72.60%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.057	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.275	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.99 in.) =	0.154	acre-feet	0.99	inches
5-yr Runoff Volume (P1 = 1.27 in.) =	0.203	acre-feet	1.27	inches
10-yr Runoff Volume (P1 = 1.53 in.) =	0.251	acre-feet	1.53	inches
25-yr Runoff Volume (P1 = 1.94 in.) =	0.335	acre-feet	1.94	inches
50-yr Runoff Volume (P1 = 2.29 in.) =	0.413	acre-feet	2.29	inches
100-yr Runoff Volume (P1 = 2.67 in.) =	0.504	acre-feet	2.67	inches
500-yr Runoff Volume (P1 = 3.68 in.) =	0.744	acre-feet	3.68	inches
Approximate 2-yr Detention Volume =	0.150	acre-feet		
Approximate 5-yr Detention Volume =	0.198	acre-feet		
Approximate 10-yr Detention Volume =	0.246	acre-feet		
Approximate 25-yr Detention Volume =	0.326	acre-feet		
Approximate 50-yr Detention Volume =	0.375	acre-feet		
Approximate 100-yr Detention Volume =	0.424	acre-feet		

Define Zones and Basin Geometry

Select Zone 1 Storage Volume (Required) =		acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =		acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	N/A	ft
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =		ft^2
Surcharge Volume Length (L_{ISV}) =		ft
Surcharge Volume Width (W_{ISV}) =		ft
Depth of Basin Floor (H_{FLOOR}) =		ft
Length of Basin Floor (L_{FLOOR}) =		ft
Width of Basin Floor (W_{FLOOR}) =		ft
Area of Basin Floor (A_{FLOOR}) =		ft^2
Volume of Basin Floor (V_{FLOOR}) =		ft^3
Depth of Main Basin (H_{MAIN}) =		ft
Length of Main Basin (L_{MAIN}) =		ft
Width of Main Basin (W_{MAIN}) =		ft
Area of Main Basin (A_{MAIN}) =		ft^2
Volume of Main Basin (V_{MAIN}) =		ft^3
Calculated Total Basin Volume (V_{total}) =		acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Media Surface									

Required Detention Volumes

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: **Private FSD Pond - Constitution Storage**

Facility Location & Jurisdiction: **6855 Constitution Ave; Colorado Springs, CO 80915 Sand Creek Basin - El Paso County**

User Input: Watershed Characteristics

Watershed Slope =	0.020	ft/ft
Watershed Length =	520	ft
Watershed Area =	2.96	acres
Watershed Imperviousness =	72.6%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent

Location for 1-hr Rainfall Depths (use dropdown):

User Input

WQCV Treatment Method = Sand Filter

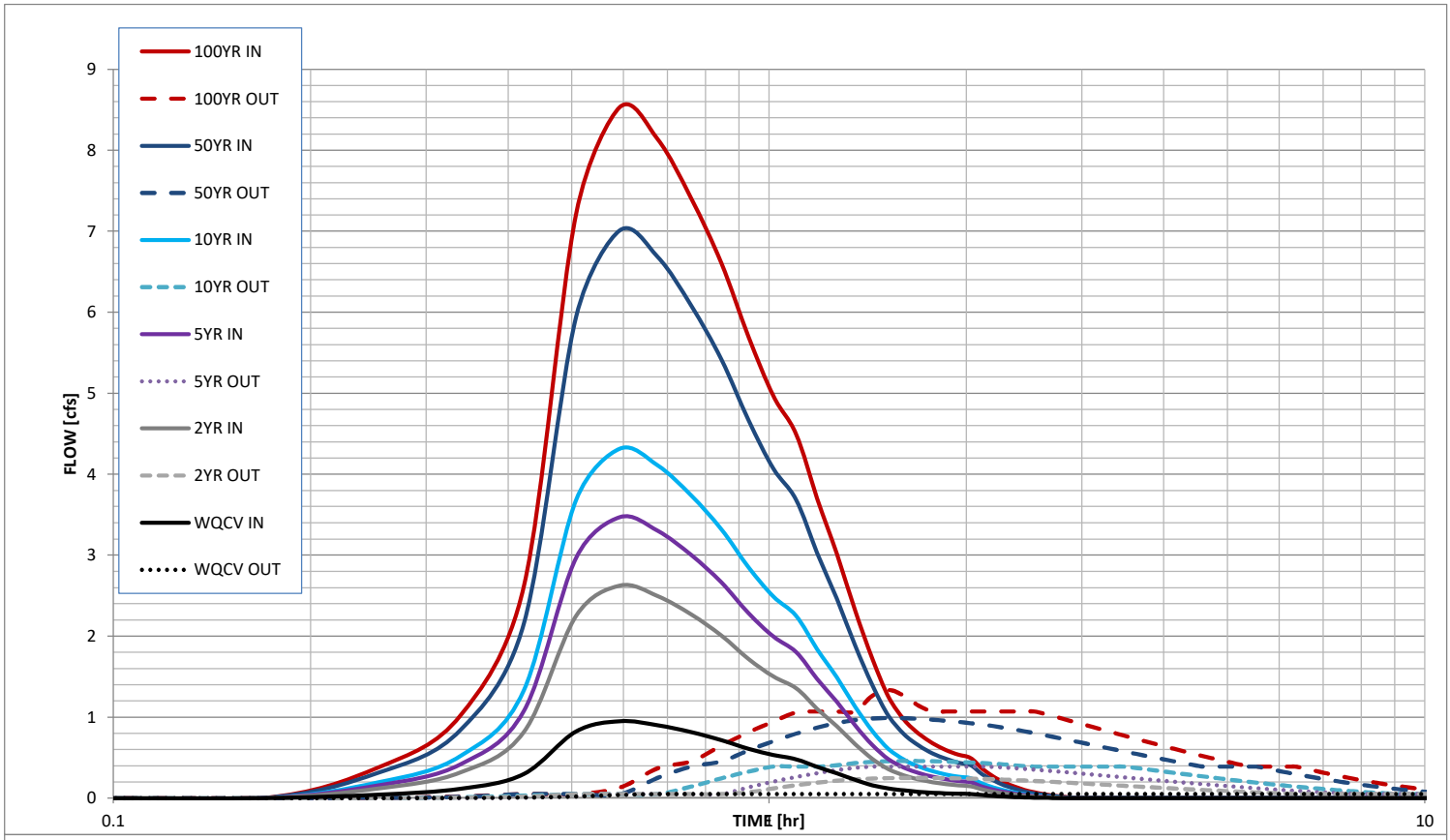
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	6,985	0.00	0.00
0.09	7,526	0.09	0.05
0.51	7,743	0.51	0.05
0.93	8,682	0.93	0.39
1.09	8,826	1.09	0.39
1.86	9,000	1.86	1.07
2.09	9,119	2.09	1.07
3.09	9,302	3.09	12.47
4.09	9,465	4.09	15.51
5.09	9,627	5.09	18.04

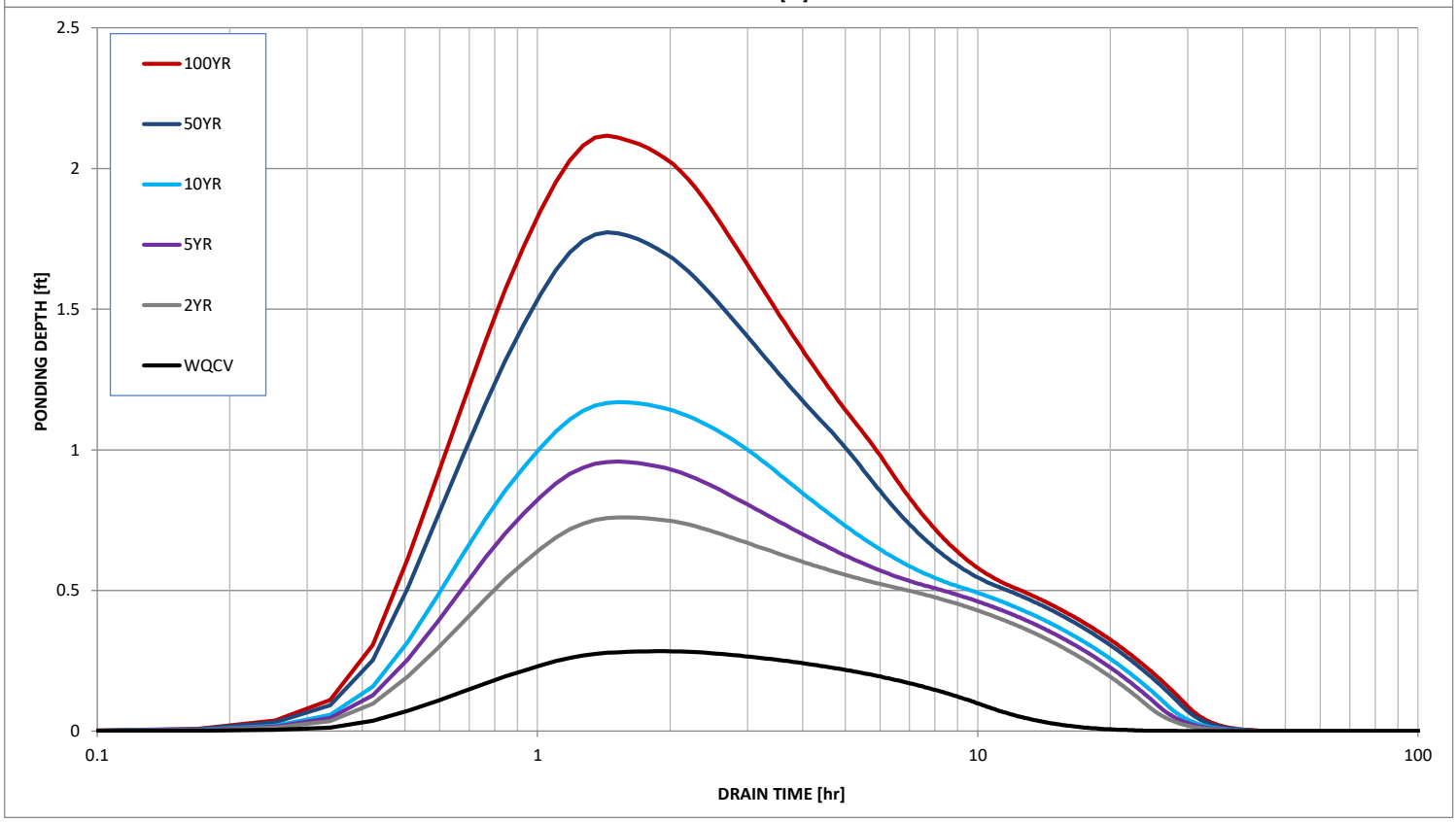
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.60	0.99	1.27	1.53	2.29	2.67	in
Calculated Runoff Volume =	0.057	0.158	0.209	0.262	0.427	0.521	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	0.056	0.158	0.209	0.261	0.426	0.520	acre-ft
Time to Drain 97% of Inflow Volume =	18.3	28.6	**28.9**	29.4	29.7	29.8	hours
Time to Drain 99% of Inflow Volume =	22.2	32.5	32.8	33.4	33.7	**33.8**	hours
Maximum Ponding Depth =	0.28	0.76	0.96	1.17	1.77	2.12	ft
Maximum Ponded Area =	0.18	0.19	0.20	0.20	0.21	**0.21**	acres
Maximum Volume Stored =	0.048	0.134	0.173	0.216	0.339	0.410	acre-ft

Stormwater Detention and Infiltration Design Data Sheet





Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.06, November 2016)

Designer: DDJ
Company: Galloway
Date: July 8, 2022
Project: 6955 Constitution Ave Self Storage
Location:

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of sand filter)	I_a = 72.6 %
B) Tributary Area's Imperviousness Ratio ($i = I_a/100$)	i = 0.726
C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time $WQCV = 0.8 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i)$	WQCV = 0.23 watershed inches
D) Contributing Watershed Area (including sand filter area)	Area = 128,938 sq ft
E) Water Quality Capture Volume (WQCV) Design Volume $V_{WQCV} = WQCV / 12 * Area$	V_{WQCV} = 2,469 cu ft
F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = _____ in
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume	$V_{WQCV\ OTHER}$ = _____ cu ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{WQCV\ USER}$ = _____ cu ft
2. Basin Geometry	
A) WQCV Depth	D_{WQCV} = 0.46 ft
B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.	Z = 50.00 ft / ft
C) Minimum Filter Area (Flat Surface Area)	A_{Min} = 1170 sq ft
D) Actual Filter Area	A_{Actual} = 2500 sq ft
E) Volume Provided	V_T = 4478 cu ft
3. Filter Material	Choose One: (●) 18" CDOT Class B or C Filter Material; ( ) Other (Explain): _____
4. Underdrain System	
A) Are underdrains provided?	Choose One: ( ) YES; (●) NO
B) Underdrain system orifice diameter for 12 hour drain time	
i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice	y = N/A ft
ii) Volume to Drain in 12 Hours	Vol_{12} = N/A cu ft
iii) Orifice Diameter, 3/8" Minimum	D_O = N/A in

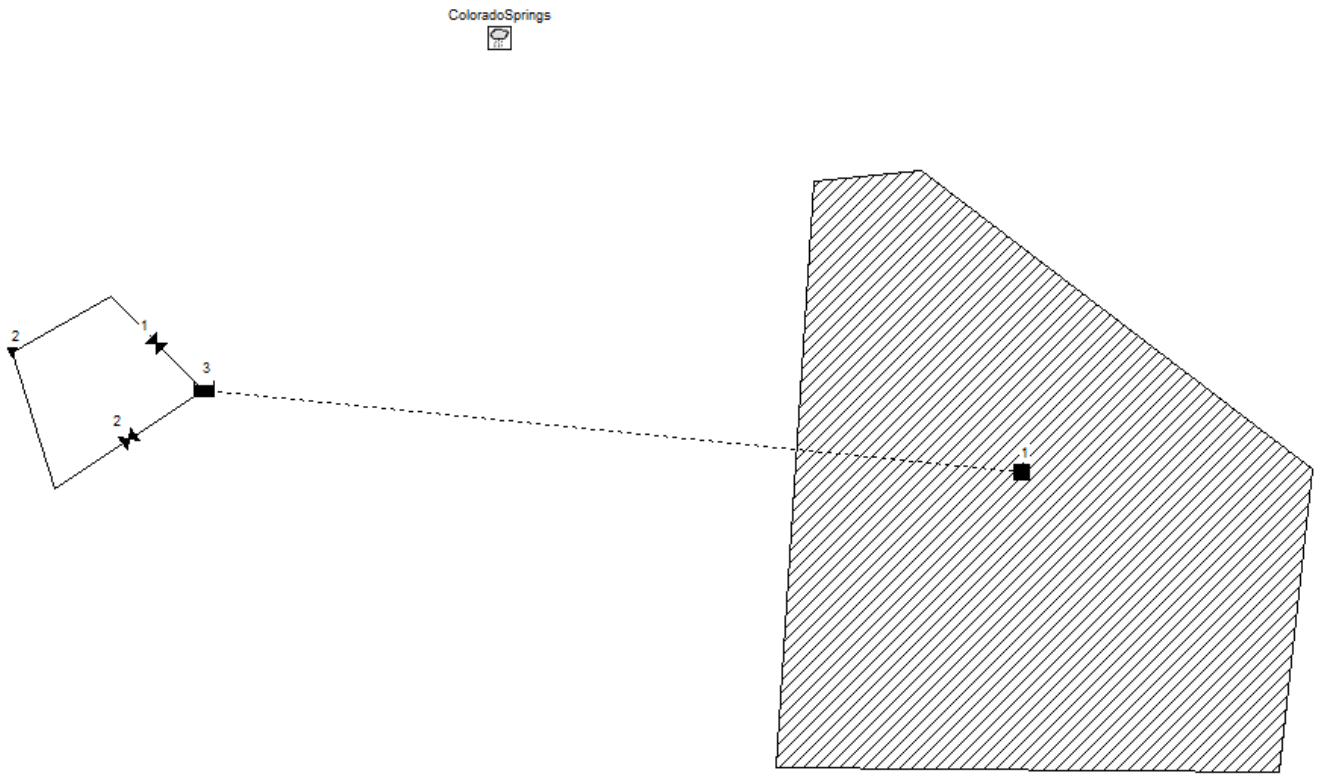
Design Procedure Form: Sand Filter (SF)

Designer: DDJ
Company: Galloway
Date: July 8, 2022
Project: 6955 Constitution Ave Self Storage
Location:

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?	Choose One ○ YES ◉ NO
6-7. Inlet / Outlet Works A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet	

Notes:

SWMM Layout



SWMM Input Summary

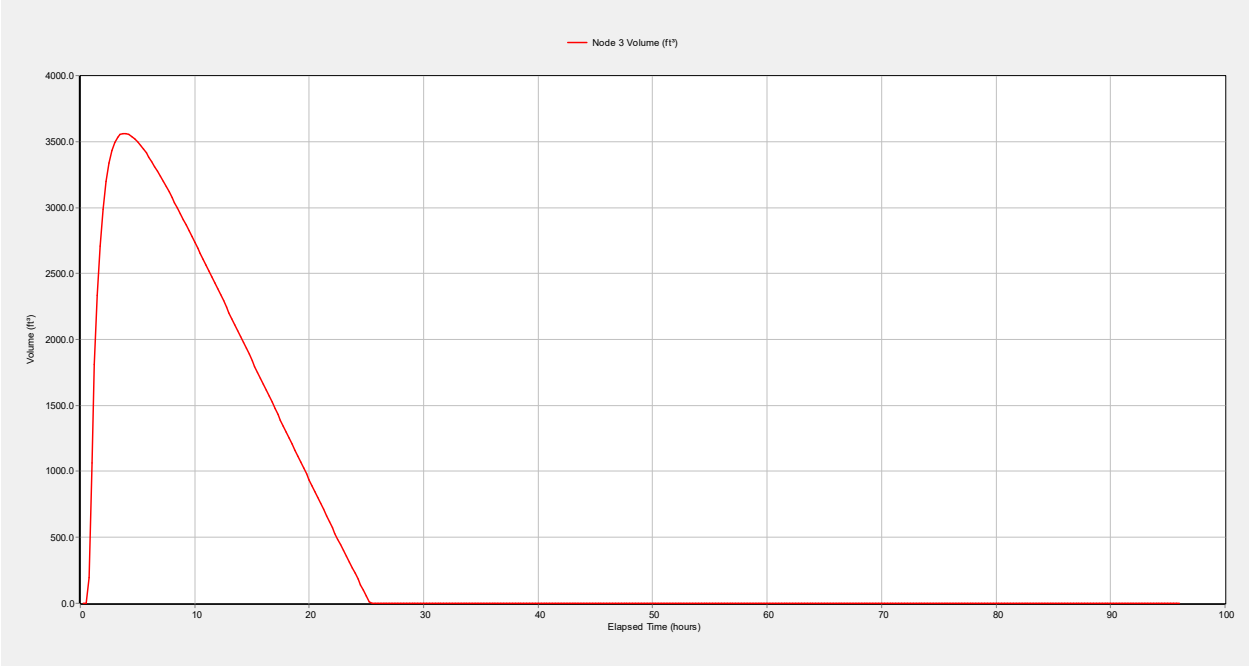
```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           CFS
INFILTRATION         HORTON
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           04/20/2022
START_TIME           00:00:00
REPORT_START_DATE    04/20/2022
REPORT_START_TIME    00:00:00
END_DATE             04/24/2022
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:15:00
WET_STEP             00:05:00
DRY_STEP             01:00:00
ROUTING_STEP         0:00:30
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.566
MAX_TRIALS           8
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- ------ ------ ----------
ColoradoSprings  CUMULATIVE 0:05     1.0      TIMESERIES 100yr

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
1                ColoradoSprings  3                2.96     72.6     20       2        0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
1                .011       .24        .1         .35        25         OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
```

```
;;-------------- ---------- ---------- ---------- ---------- ----------
1                5          1          2.52       7          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
2                0          FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params
N/A      Fevap    Psi      Ksat     IMD
;;-------------- -------- ---------- ----------- ----------
---------------------------- -------- --------          -------- --------
3                0        5          0          TABULAR    FSB-1
0        0        0        .29      0

[ORIFICES]
;;Name           From Node        To Node          Type         Offset     Qcoeff
Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ---------- ----------
-------- ----------
1                3                2                SIDE         .51        0.65
NO       0

[OUTLETS]
;;Name           From Node        To Node          Offset     Type
QTable/Qcoeff    Qexpon     Gated
;;-------------- ---------------- ---------------- ---------- ---------------
---------------- ---------- --------
2                3                2                2.09       FUNCTIONAL/DEPTH
10.0             0.5        NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4
Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ----------
---------- ----------
1                CIRCULAR     .5               0          0          0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
OutletStructure  Rating     0.00       0.00
OutletStructure             0.20       2.66
OutletStructure             0.40       7.53
OutletStructure             0.60       11.02
OutletStructure             0.80       11.77
OutletStructure             1.00       12.47
OutletStructure             1.20       13.13
OutletStructure             1.40       13.77
OutletStructure             1.60       14.37
OutletStructure             1.80       14.95
OutletStructure             2.00       15.51
OutletStructure             2.20       16.05
OutletStructure             2.40       16.57
OutletStructure             2.60       17.07
OutletStructure             2.80       17.56
OutletStructure             3.00       18.04
;
FSB-1            Storage    0          6985
FSB-1                       0.09       7526.48
FSB-1                       1.09       8825.82
FSB-1                       2.09       9119.29
FSB-1                       3.09       9302.02
FSB-1                       4.09       9464.61
FSB-1                       5.09       9627

[TIMESERIES]
;;Name           Date       Time       Value
```

```
;;-------------- ---------- ---------- ----------
5-yr                          0:00       0
5-yr                          0:05       0.01778
5-yr                          0:10       0.05842
5-yr                          0:15       0.10033
5-yr                          0:20       0.1524
5-yr                          0:25       0.22733
5-yr                          0:30       0.32766
5-yr                          0:35       0.53467
5-yr                          0:40       0.90424
5-yr                          0:45       1.04648
5-yr                          0:50       1.13284
5-yr                          0:55       1.18745
5-yr                          1:00       1.23444
5-yr                          1:05       1.27508
5-yr                          1:10       1.29286
5-yr                          1:15       1.3081
5-yr                          1:20       1.32207
5-yr                          1:25       1.33604
5-yr                          1:30       1.35001
5-yr                          1:35       1.36144
5-yr                          1:40       1.37414
5-yr                          1:45       1.38557
5-yr                          1:50       1.397
5-yr                          1:55       1.40843
5-yr                          2:00       1.42113
;
WQ                            0:00       0
WQ                            0:05       0.0084
WQ                            0:10       0.0276
WQ                            0:15       0.0474
WQ                            0:20       0.072
WQ                            0:25       0.1074
WQ                            0:30       0.1548
WQ                            0:35       0.2526
WQ                            0:40       0.4272
WQ                            0:45       0.4944
WQ                            0:50       0.5352
WQ                            0:55       0.561
WQ                            1:00       0.5832
WQ                            1:05       0.6024
WQ                            1:10       0.6108
WQ                            1:15       0.618
WQ                            1:20       0.6246
WQ                            1:25       0.6312
WQ                            1:30       0.6378
WQ                            1:35       0.6432
WQ                            1:40       0.6492
WQ                            1:45       0.6546
WQ                            1:50       0.66
WQ                            1:55       0.6654
WQ                            2:00       0.6714
;
100yr                         0:00       0
100yr                         0:05       0.03738
100yr                         0:10       0.12282
100yr                         0:15       0.21093
100yr                         0:20       0.3204
100yr                         0:25       0.47793
100yr                         0:30       0.68886
100yr                         0:35       1.12407
100yr                         0:40       1.90104
100yr                         0:45       2.20008
100yr                         0:50       2.38164
100yr                         0:55       2.49645
100yr                         1:00       2.59524
100yr                         1:05       2.68068
100yr                         1:10       2.71806
100yr                         1:15       2.7501
```

```
100yr                       1:20       2.77947
100yr                       1:25       2.80884
100yr                       1:30       2.83821
100yr                       1:35       2.86224
100yr                       1:40       2.88894
100yr                       1:45       2.91297
100yr                       1:50       2.937
100yr                       1:55       2.96103
100yr                       2:00       2.98773

[REPORT]
;;Reporting Options
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
2                -972.461           6075.731
3                -266.781           5938.038

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
1                -611.015           6282.272
2                -817.556           5576.592

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
1                2383.821           6746.988
1                3829.604           5645.439
1                3709.122           4526.678
1                1850.258           4543.890
1                1987.952           6712.565

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
ColoradoSprings  834.768            7228.916
```

Time to Drain WQCV



EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

Water Quality Storm Report

```
*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... KINWAVE
Starting Date ............ 04/20/2022 00:00:00
Ending Date .............. 04/24/2022 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 30.00 sec


**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......         0.166         0.671
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.045         0.184
Surface Runoff ...........         0.107         0.434
Final Storage ............         0.014         0.055
Continuity Error (%) .....        -0.165


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.107         0.035
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.000         0.000
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.107         0.035
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
```

```
Routing Time Step Summary
*************************
Minimum Time Step           :    30.00 sec
Average Time Step           :    30.00 sec
Maximum Time Step           :    30.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00


***************************
Subcatchment Runoff Summary
***************************


-----------------------------------------------------------------------------------------------------------------------------------------
                          Total      Total      Total      Total     Imperv
                          Perv      Total       Total     Peak  Runoff
                         Precip      Runon       Evap      Infil     Runoff
                         Runoff     Runoff      Runoff   Runoff   Coeff
Subcatchment                 in         in         in         in         in
in         in    10^6 gal      CFS
-----------------------------------------------------------------------------------------------------------------------------------------
1                           0.67       0.00       0.00       0.18       0.43
0.00       0.43        0.03     1.05   0.646


******************
Node Depth Summary
******************

-------------------------------------------------------------------------------
                                Average  Maximum  Maximum  Time of Max    Reported
                                  Depth    Depth      HGL   Occurrence   Max Depth
Node                 Type         Feet     Feet     Feet  days hr:min        Feet
-------------------------------------------------------------------------------
2                    OUTFALL      0.00     0.00     0.00     0  00:00        0.00
3                    STORAGE      0.07     0.46     0.46     0  03:52        0.46


*******************
Node Inflow Summary
*******************


-----------------------------------------------------------------------------------------------------------------------------------------
                                Maximum  Maximum                  Lateral
                                Total        Flow
                                Lateral    Total  Time of Max      Inflow
                                Inflow     Balance
                                 Inflow   Inflow   Occurrence      Volume
                                 Volume       Error
Node                 Type           CFS      CFS  days hr:min    10^6 gal    10^6
gal     Percent
-----------------------------------------------------------------------------------------------------------------------------------------
2                    OUTFALL       0.00     0.00     0  00:00           0
0       0.000 gal
3                    STORAGE       1.05     1.05     0  00:55      0.0349
0.0349      -0.015


*********************
Node Flooding Summary
```

```
**********************

No nodes were flooded.


**********************
Storage Volume Summary
**********************


-------------------------------------------------------------------------------------------
                        Average     Avg  Evap Exfil       Maximum     Max    Time of
                        Max    Maximum
                         Volume    Pcnt  Pcnt  Pcnt        Volume    Pcnt
                         Occurrence    Outflow
Storage Unit          1000 ft3    Full  Loss  Loss      1000 ft3    Full    days
hr:min        CFS
-------------------------------------------------------------------------------------------
3                        0.514       1     0   100         3.563       8       0
03:51       0.05


************************
Outfall Loading Summary
************************

-----------------------------------------------------------
                        Flow       Avg       Max       Total
                        Freq      Flow      Flow      Volume
Outfall Node            Pcnt       CFS       CFS    10^6 gal
-----------------------------------------------------------
2                       0.00      0.00      0.00       0.000
-----------------------------------------------------------
System                  0.00      0.00      0.00       0.000


********************
Link Flow Summary
********************

-------------------------------------------------------------------------------
                                Maximum  Time of Max   Maximum    Max/    Max/
                                 |Flow|   Occurrence   |Veloc|    Full    Full
Link                  Type          CFS  days hr:min    ft/sec    Flow   Depth
-------------------------------------------------------------------------------
1                     ORIFICE      0.00     0  00:00                      0.00
2                     DUMMY        0.00     0  00:00


*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Fri Jul  8 16:22:44 2022
Analysis ended on:  Fri Jul  8 16:22:44 2022
Total elapsed time: < 1 sec
```

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.0)

5-Year Storm Report

```
****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... KINWAVE
Starting Date ............ 04/20/2022 00:00:00
Ending Date .............. 04/24/2022 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 30.00 sec


**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......         0.351         1.421
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.096         0.389
Surface Runoff ...........         0.242         0.980
Final Storage ............         0.014         0.055
Continuity Error (%) .....        -0.224


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.242         0.079
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.103         0.033
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.139         0.045
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :    30.00 sec
Average Time Step           :    30.00 sec
Maximum Time Step           :    30.00 sec
% of Time in Steady State   :     0.00
```

```
  Average Iterations per Step :     1.00
  % of Steps Not Converging   :     0.00


  **************************
  Subcatchment Runoff Summary
  **************************


  ----------------------------------------------------------------------------------------------------------------------------------------
                                  Total      Total      Total      Total     Imperv
                                  Perv      Total      Total     Peak  Runoff
                                 Precip      Runon       Evap      Infil     Runoff
                                 Runoff     Runoff     Runoff   Runoff   Coeff
  Subcatchment                       in         in         in         in         in
  in         in    10^6 gal      CFS
  ----------------------------------------------------------------------------------------------------------------------------------------
  1                                 1.42       0.00       0.00       0.39       0.98
  0.00       0.98        0.08     3.35   0.690


  ******************
  Node Depth Summary
  ******************

  -------------------------------------------------------------------------------
                                  Average  Maximum  Maximum  Time of Max    Reported
                                    Depth    Depth      HGL   Occurrence   Max Depth
  Node                  Type         Feet     Feet     Feet  days hr:min        Feet
  -------------------------------------------------------------------------------
  2                     OUTFALL      0.00     0.00     0.00     0  00:00        0.00
  3                     STORAGE      0.13     0.93     0.93     0  02:13        0.93


  *******************
  Node Inflow Summary
  *******************


  ----------------------------------------------------------------------------------------------------------------------------------------
                                   Maximum  Maximum                  Lateral
                                   Total        Flow
                                   Lateral    Total  Time of Max      Inflow
                                   Inflow     Balance
                                    Inflow   Inflow   Occurrence      Volume
                                    Volume       Error
  Node                  Type           CFS      CFS  days hr:min    10^6 gal    10^6
  gal     Percent
  ----------------------------------------------------------------------------------------------------------------------------------------
  2                     OUTFALL       0.00     0.39     0  02:13           0
  0.0335       0.000
  3                     STORAGE       3.35     3.35     0  00:50      0.0788
  0.0788       0.005


  *********************
  Node Flooding Summary
  *********************

  No nodes were flooded.


  **********************
```

Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
3	0.977	2	0	58	7.408	16	0 02:12	0.45

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
2	9.51	0.14	0.39	0.033
System	9.51	0.14	0.39	0.033

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
1	ORIFICE	0.39	0 02:13			0.00
2	DUMMY	0.00	0 00:00			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Fri Jul 8 16:58:35 2022
Analysis ended on: Fri Jul 8 16:58:35 2022
Total elapsed time: < 1 sec

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.0)
--------------------------------------------------------------
```

100-Year Storm Report

```
****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... KINWAVE
Starting Date ............ 04/20/2022 00:00:00
Ending Date .............. 04/24/2022 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 30.00 sec


**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......         0.737         2.988
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.200         0.811
Surface Runoff ...........         0.526         2.131
Final Storage ............         0.014         0.055
Continuity Error (%) .....        -0.308


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.526         0.171
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.375         0.122
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.150         0.049
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.051


*******************************
Highest Flow Instability Indexes
*******************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :    30.00 sec
Average Time Step           :    30.00 sec
Maximum Time Step           :    30.00 sec
% of Time in Steady State   :     0.00
```

```
  Average Iterations per Step :     1.00
  % of Steps Not Converging   :     0.00


  **************************
  Subcatchment Runoff Summary
  **************************


  ----------------------------------------------------------------------------------------------------------------------------------------
                                  Total      Total      Total      Total     Imperv
                                  Perv      Total      Total     Peak  Runoff
                                 Precip      Runon       Evap      Infil     Runoff
                                 Runoff     Runoff     Runoff   Runoff   Coeff
  Subcatchment                       in         in         in         in         in
  in         in    10^6 gal      CFS
  ----------------------------------------------------------------------------------------------------------------------------------------
  1                                 2.99       0.00       0.00       0.81       2.12
  0.01       2.13        0.17     9.76   0.713


  ******************
  Node Depth Summary
  ******************

  -------------------------------------------------------------------------------
                                  Average  Maximum  Maximum  Time of Max    Reported
                                    Depth    Depth      HGL   Occurrence   Max Depth
  Node                  Type         Feet     Feet     Feet  days hr:min        Feet
  -------------------------------------------------------------------------------
  2                     OUTFALL      0.00     0.00     0.00     0  00:00        0.00
  3                     STORAGE      0.18     1.86     1.86     0  01:53        1.86


  *******************
  Node Inflow Summary
  *******************


  ----------------------------------------------------------------------------------------------------------------------------------------
                                   Maximum  Maximum                  Lateral
                                   Total        Flow
                                   Lateral    Total  Time of Max      Inflow
                                   Inflow     Balance
                                    Inflow   Inflow   Occurrence      Volume
                                    Volume       Error
  Node                  Type           CFS      CFS  days hr:min    10^6 gal    10^6
  gal     Percent
  ----------------------------------------------------------------------------------------------------------------------------------------
  2                     OUTFALL       0.00     1.07     0  01:53           0
  0.122       0.000
  3                     STORAGE       9.76     9.76     0  00:45       0.171
  0.171       0.052


  *********************
  Node Flooding Summary
  *********************

  No nodes were flooded.


  **********************
```

Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
3	1.405	3	0	29	15.718	35	0 01:52	1.14

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
2	12.00	0.39	1.07	0.122
System	12.00	0.39	1.07	0.122

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
1	ORIFICE	1.07	0 01:53			0.00
2	DUMMY	0.00	0 00:00			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

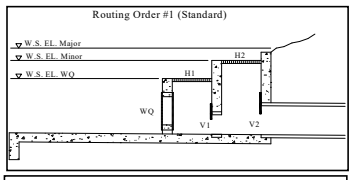
Analysis begun on: Fri Jul 8 17:00:44 2022
Analysis ended on: Fri Jul 8 17:00:44 2022
Total elapsed time: < 1 sec

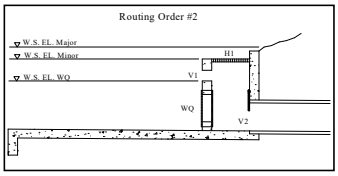
Outlet Flow Calculations for SWMM

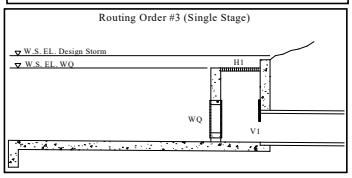
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

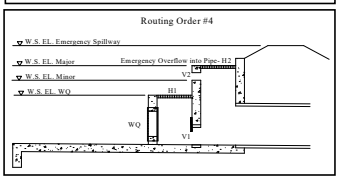
Project:
Basin ID:

This spreadsheet was used to model flows through the outlet structure. Input into the SWMM model as outlet curve.









Current Routing Order is #3

Design Information (Input):

			#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Circular Opening:	Diameter in Inches	Dia. =			18.00		inches
OR							
Rectangular Opening:	Width in Feet	W =	2.92				ft.
	Length (Height for Vertical)	L or H =	2.92				ft.
	Percentage of Open Area After Trash Rack Reduction	% open =	70		100		%
	Orifice Coefficient	C_o =	0.65		0.65		
	Weir Coefficient	C_w =	3.00				
	Orifice Elevation (Bottom for Vertical)	E_o =	0.00		-1.58		ft.

Calculation of Collection Capacity:

		#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Net Opening Area (after Trash Rack Reduction)	A_o =	5.97		1.77		sq. ft.
OPTIONAL: User-Overide Net Opening Area	A_o =					sq. ft.
Perimeter as Weir Length	L_w =	9.93	ft.			
OPTIONAL: User-Overide Weir Length	L_w =		ft.			
Top Elevation of Vertical Orifice Opening, Top =				-0.08		ft.
Center Elevation of Vertical Orifice Opening, Cen =				-0.83		ft.

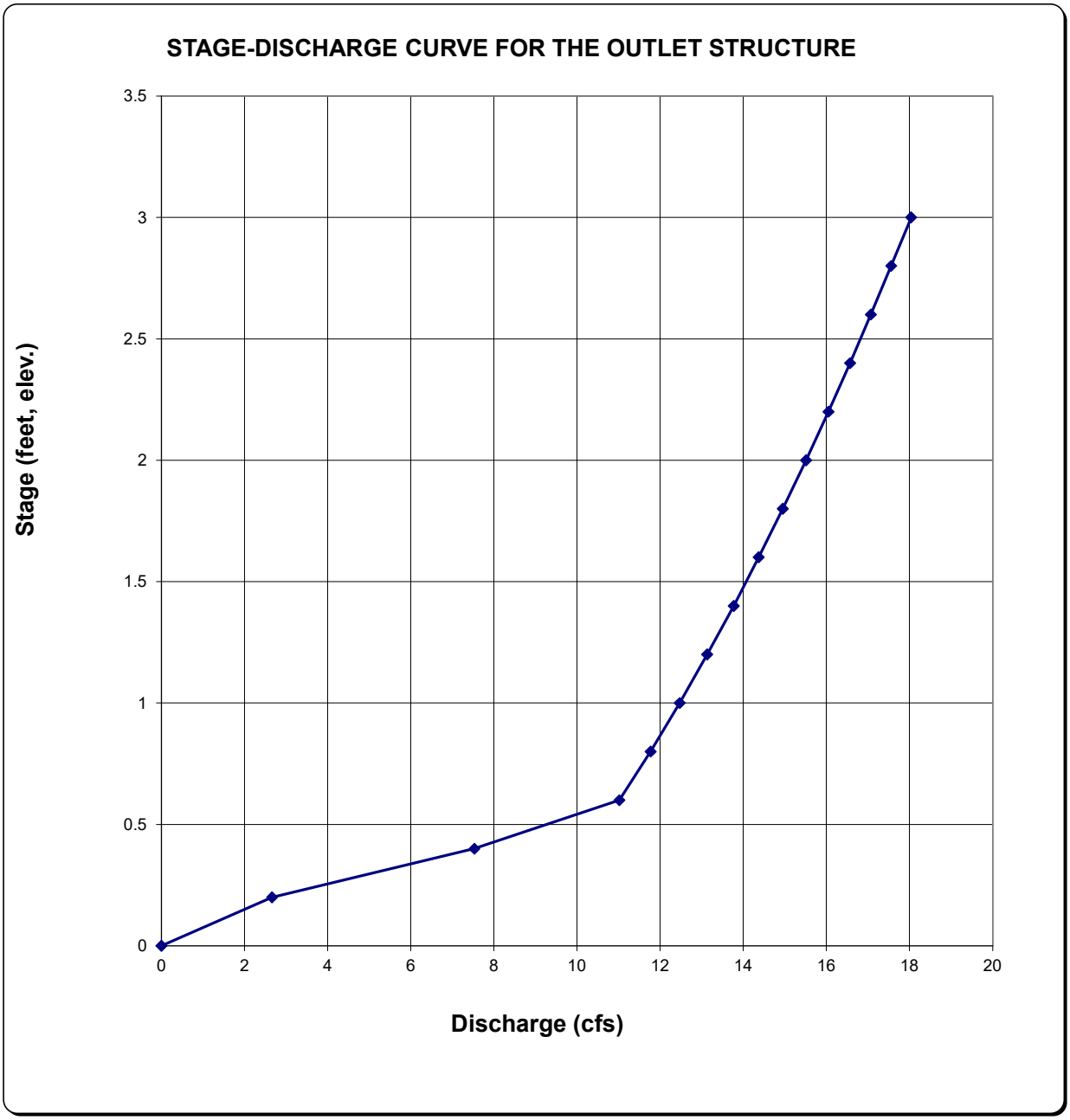
Routing 3: Single Stage - Water flows through WQCV plate and #1 horizontal opening into #1 vertical opening. This flow will be applied to culvert sheet (#2 vertical & horizontal openings is not used).

			Horizontal Orifices				**Vertical Orifices**			
Labels for WQCV, Minor, & Major Storage W.S. Elevations (input)	Water Surface Elevation ft (linked)	WQCV Plate/Riser Flow cfs (User-linked)	#1 Horiz. Weir Flow cfs (output)	#1 Horiz. Orifice Flow cfs (output)	#2 Horiz. Weir Flow cfs (output)	#2 Horiz. Orifice Flow cfs (output)	#1 Vert. Collection Capacity cfs (output)	#2 Vert. Collection Capacity cfs (output)	**Total Collection Capacity cfs (output)**	Target Volumes for WQCV, Minor, & Major Storage Volumes (link for goal seek)
	0.00		0.00	0.00	0.00	0.00	8.40	0.00	**0.00**	
	0.20		2.66	13.92	0.00	0.00	9.36	0.00	**2.66**	
	0.40		7.53	19.69	0.00	0.00	10.22	0.00	**7.53**	
	0.60		13.84	24.12	0.00	0.00	11.02	0.00	**11.02**	
	0.80		21.31	27.85	0.00	0.00	11.77	0.00	**11.77**	
	1.00		29.78	31.13	0.00	0.00	12.47	0.00	**12.47**	
	1.20		39.15	34.10	0.00	0.00	13.13	0.00	**13.13**	
	1.40		49.34	36.84	0.00	0.00	13.77	0.00	**13.77**	
	1.60		60.28	39.38	0.00	0.00	14.37	0.00	**14.37**	
	1.80		71.93	41.77	0.00	0.00	14.95	0.00	**14.95**	
	2.00		84.24	44.03	0.00	0.00	15.51	0.00	**15.51**	
	2.20		97.19	46.18	0.00	0.00	16.05	0.00	**16.05**	
	2.40		110.74	48.23	0.00	0.00	16.57	0.00	**16.57**	
	2.60		124.87	50.20	0.00	0.00	17.07	0.00	**17.07**	
	2.80		139.55	52.10	0.00	0.00	17.56	0.00	**17.56**	
	3.00		154.76	53.92	0.00	0.00	18.04	0.00	**18.04**	
			#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
			#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
			#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
			#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	

STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

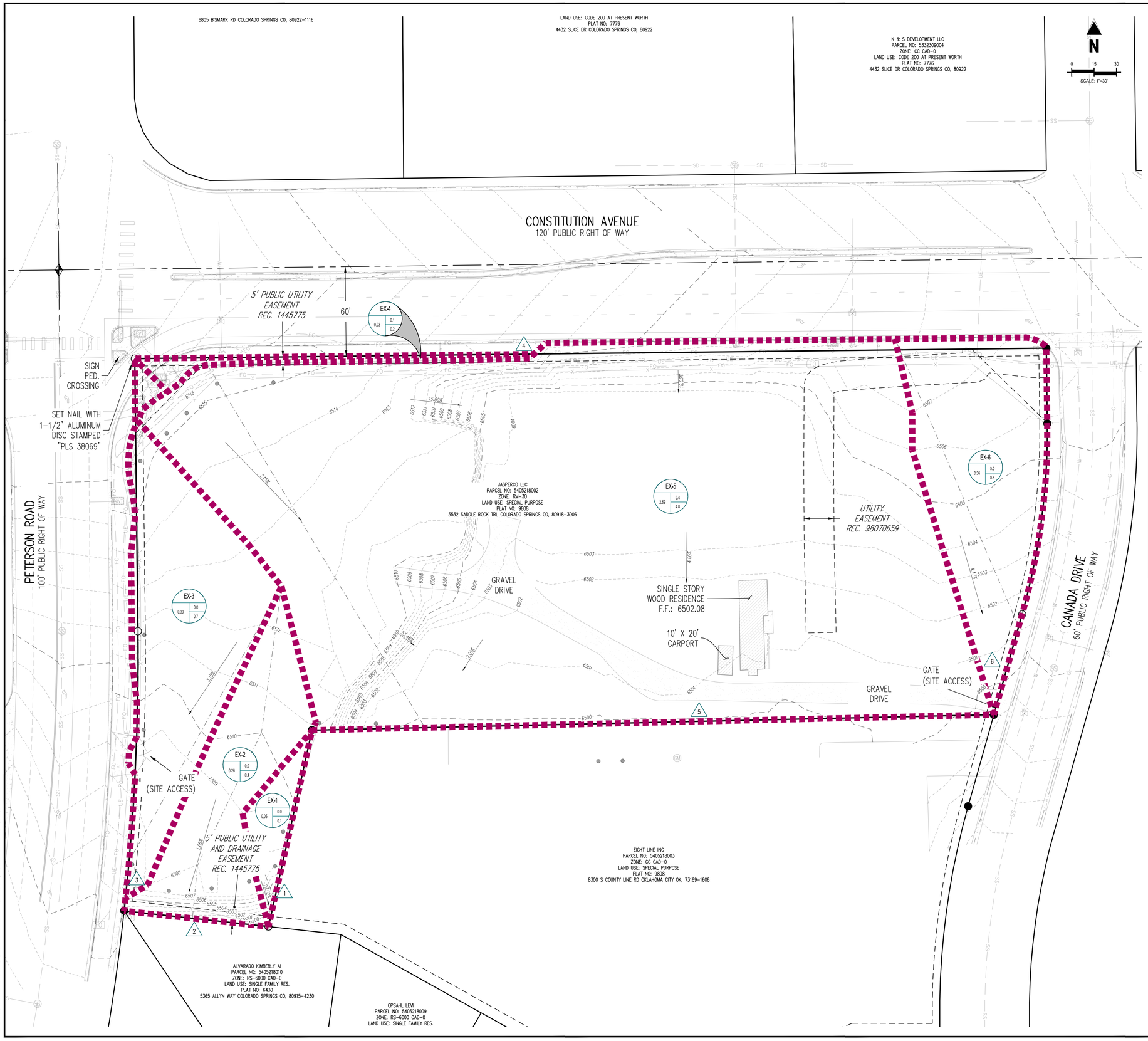
Project: _____

Basin ID: _____



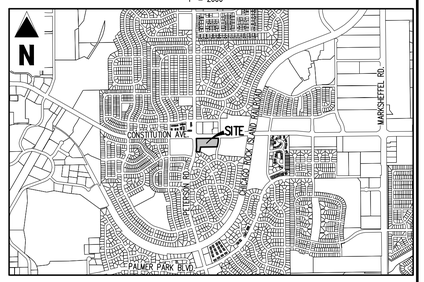
APPENDIX F

Drainage Maps



VICINITY MAP

1" = 2000'



DRAINAGE LEGEND

- EXISTING PROPERTY LINE
- 6480 EXISTING MAJOR CONTOUR
- 6479 EXISTING MINOR CONTOUR
- PROPOSED ROAD CENTERLINE
- TIME OF CONCENTRATION PATH
- BASIN BOUNDARY LINE
- EXISTING STORM SEWER
- PROPOSED STORM STRUCTURES
- 1 BASIN DESIGNATION
- 1.8 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 0.71 4.8 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- 1 DESIGN POINT
- DIRECTION OF RUNOFF

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EX-1	0.05	0.00	0.22	5.25	0.0	0.1
EX-2	0.26	0.00	0.22	11.28	0.0	0.4
EX-3	0.39	0.03	0.25	11.17	0.0	0.7
EX-4	0.03	0.53	0.63	5.00	0.1	0.2
EX-5	2.69	0.05	0.27	11.67	0.4	4.8
EX-6	0.36	0.00	0.22	11.11	0.0	0.5

Galloway
6162 S. Willow Drive, Suite 320
Greenwood Village, CO 80111
303.770.8884
GallowayUS.com

PRELIMINARY
NOT FOR BIDDING
NOT FOR CONSTRUCTION

6855 CONSTITUTION AVE. STORAGE SITE
COMMERCIAL DEVELOPMENT
DRAINAGE MAP
FOR JOHNSON DEVELOPMENT ASSOCIATES

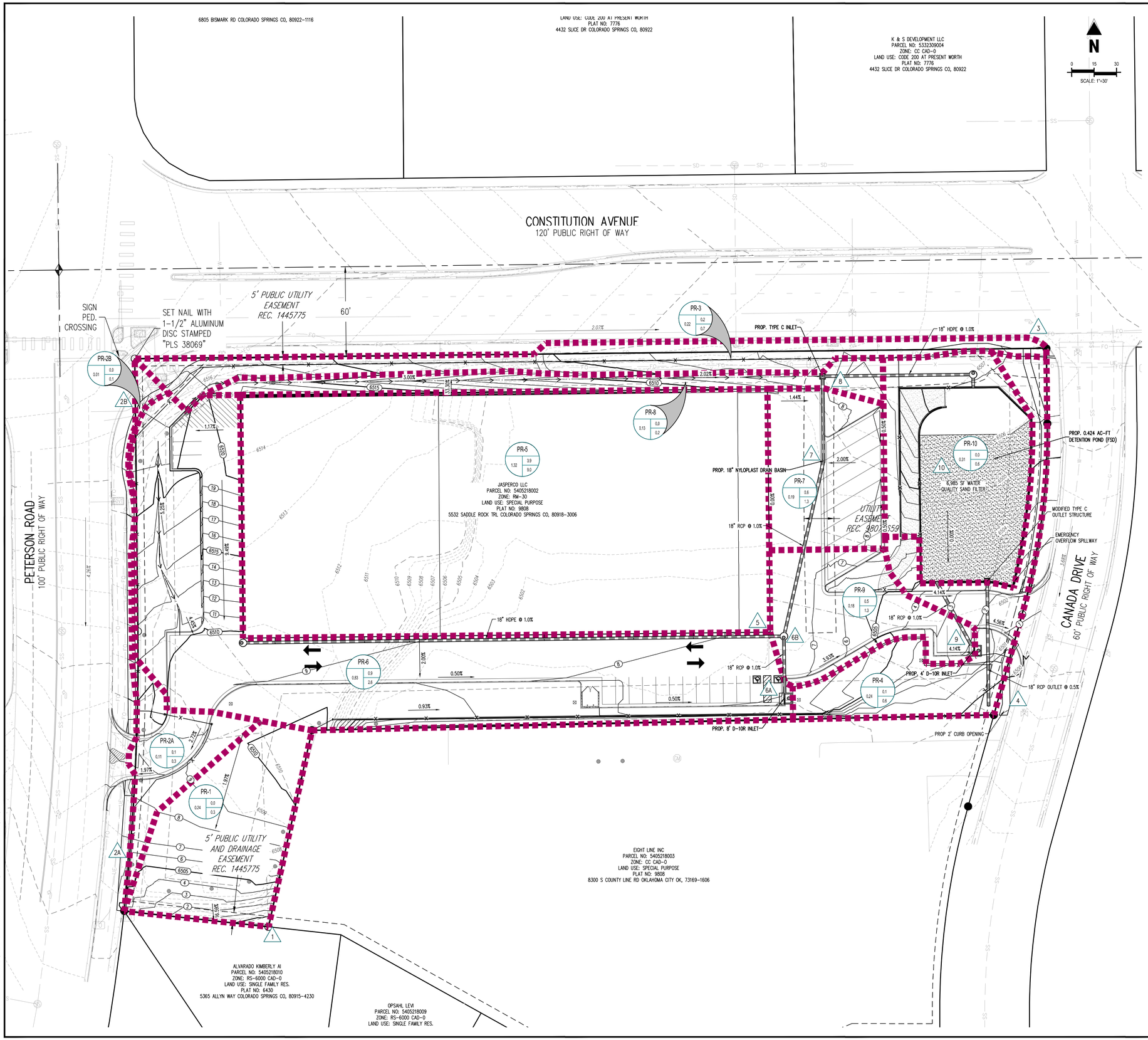
LOT 1 OF THE EIGHT LINE SUBDIVISION
COLORADO SPRINGS, CO 80915

#	Date	Issue / Description	Init.

Project No:	JDA02.20
Drawn By:	BAS
Checked By:	BAS
Date:	07.08.2022

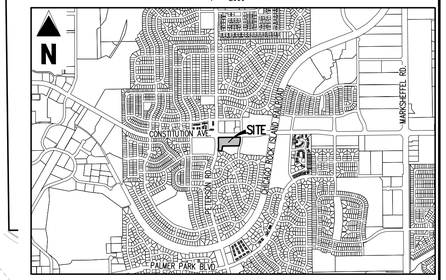
EXISTING DRAINAGE MAP

DR-1



VICINITY MAP

1" = 2000'



DRAINAGE LEGEND

- EXISTING PROPERTY LINE
- 6480 EXISTING MAJOR CONTOUR
- 6479 EXISTING MINOR CONTOUR
- 6555 PROPOSED MAJOR CONTOUR
- 54 PROPOSED MINOR CONTOUR
- TIME OF CONCENTRATION PATH
- BASIN BOUNDARY LINE
- EXISTING STORM SEWER
- PROPOSED STORM STRUCTURES
- 1 BASIN DESIGNATION
- 1.8 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 4.8 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 0.71 BASIN AREA IN ACRES
- 1 DESIGN POINT
- DIRECTION OF RUNOFF

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
PR-1	0.24	0.00	0.22	10.8	0.0	0.3
PR-2A	0.11	0.25	0.41	8.3	0.1	0.3
PR-2B	0.01	0.51	0.62	5.0	0.0	0.1
PR-3	0.22	0.20	0.38	5.0	0.2	0.7
PR-4	0.24	0.16	0.35	9.1	0.1	0.6
PR-5	1.32	0.71	0.79	5.0	3.9	9.0
PR-6	0.83	0.36	0.49	12.4	0.9	2.6
PR-7	0.19	0.74	0.81	5.0	0.6	1.3
PR-8	0.13	0.00	0.22	10.0	0.0	0.2
PR-9	0.18	0.73	0.80	5.0	0.5	1.3
PR-10	0.31	0.00	0.22	5.0	0.0	0.6
Routed Flow to FSD (DP-10)					4.6	11.8
Total Offsite Free-Release (PR-1, PR-2A, PR-2B, PR-3, PR-4)					0.4	2.0

DESIGN POINT SUMMARY TABLE

Design Point	Routed Flows Q_5 (cfs)	Routed Flows Q_{100} (cfs
1	0.0	0.3
2A	0.1	0.3
2B	0.0	0.1
3	0.2	0.7
4	0.1	0.6
5	3.9	9.0
6A	0.9	2.6
6B	3.8	9.3
7	4.2	10.2
8	4.2	10.4
9	0.5	1.3
10	4.6	11.8

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PRELIMINARY
NOT FOR BIDDING
NOT FOR CONSTRUCTION

6855 CONSTITUTION AVE. STORAGE SITE
COMMERCIAL DEVELOPMENT
DRAINAGE MAP
FOR JOHNSON DEVELOPMENT ASSOCIATES

LOT 1 OF THE EIGHT LINE SUBDIVISION
COLORADO SPRINGS, CO 80915

#	Date	Issue / Description	Init.

Project No:	JDA02.20
Drawn By:	BAS
Checked By:	BAS
Date:	07.08.2022

PROPOSED DRAINAGE MAP

DR-2