Galloway

MASTER DEVELOPMENT DRAINAGE PLAN AMENDMENT & FINAL DRAINAGE REPORT

Bradley Ridge Subdivision Filing No. 3

Colorado Springs, CO

PREPARED FOR:
ROI Property Group, LLC
1280 S. 800 E.
Orem, UT 84097

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

DATE:
December 5, 2023

STM-REV23-0658

Signature Page
Bradley Ridge Subdivision Filing No. 3

Engineer's Statement

This report and plan for the drainage design of Bradley Ridge Subdivision Filing No. 3 was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

SIGNATURE (Affix Seal): ______________________________

Treven Edwards, PE #60124

COLORADO LICENSED
TREVEN J. EDWARDS
60124
12/05/2023
PROFESSIONAL ENGINEER

Developer's Statement

ROI Property Group, LLC hereby certifies that the drainage facilities for Bradley Ridge Subdivision Filing No. 3 shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of Bradley Ridge Subdivision Filing No. 3, guarantee that final drainage design review will absolve ROI Property Group, LLC and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

ROI Property Group, LLC
Name of Developer

______________________________ 12/6/2023
Authorized Signature Date

Rob Fuller
Printed Name

Manager
Title

1280 S. 800 E., Orem, UT 84097
Address

METRO DISTRICT'S STATEMENT:

BRADLEY HEIGHTS METRO DISTRICT NO. 2 acknowledges that they are assuming responsibility for constructing the Jimmy Camp Creek drainage improvements being required by the City of Colorado Springs adjacent to the BRADLEY RIDGE SUBDIVISION FILING NO. 3 property.

BRADLEY HEIGHTS METRO DISTRICT NO. 2

DocuSigned by:
Randle Case II, Board President 12/5/2023
293CF22537AE478...

Authorized Signature Date

Randle W. Case II

Printed Name

Board President

Title

City of Colorado Springs Statement:

Filed in accordance with Section 7-7-906 of the Code of the City of Colorado Springs, 2001, as amended.

Hao Vo 12/13/2023

For City Engineer Date
Conditions:
Building permits will not be released until assurances for channel improvements have been posted or channel improvements have been installed and accepted.

The City of Colorado Springs approves this FDR based upon the non-jurisdictional status of the facility. It is the design engineer's responsibility to follow up with the State Division of Water Resources for jurisdictional determination. If upon State review the classification changes to Jurisdictional, additional City review and approval will be necessary.

TABLE OF CONTENTS

I. INTRODUCTION

This document is the Master Development Drainage Plan Amendment & Final Drainage Report for the proposed 39.20-acre single family residential development named Bradley Ridge Subdivision Filing No. 3. The project site is currently unplatted and zoned for PUD use.

The purpose of this report is to identify onsite and offsite drainage patterns associated with the Bradley Ridge Subdivision Filing No. 3 property. This report will also provide hydrologic and hydraulic analyses of this project area, locate and identify tributary or downstream drainage features and facilities that impact the site, and identify which types of drainage facilities will be needed and where they will be located to ensure compliance with the City of Colorado Springs Drainage Criteria Manual (DCM).

LOCATION

The project site is located south of Bradley Ridge Road, west of Bradley Ridge Filing No.1, and north & east of undeveloped property.

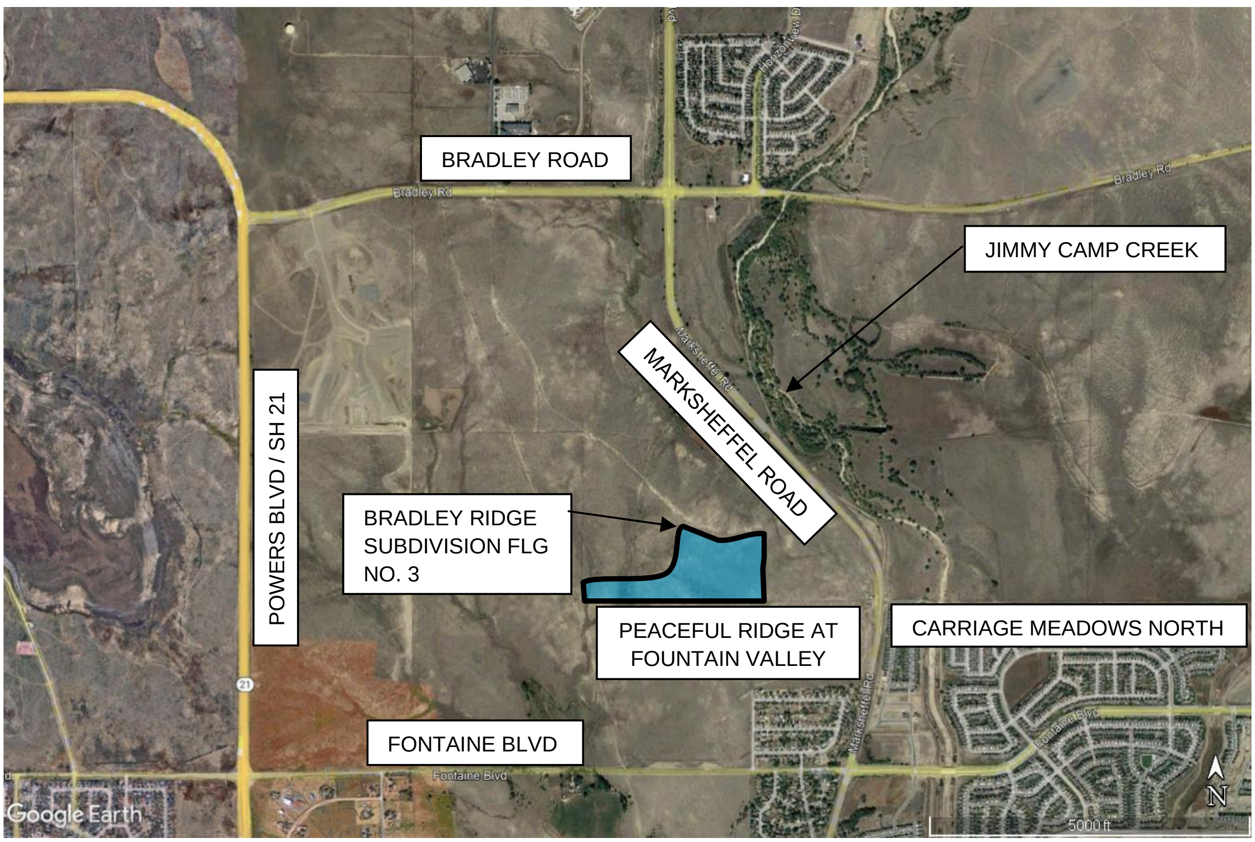


Figure 1 – Vicinity Map
Scale (1 : 5,000)

More specifically, the Bradley Ridge Subdivision Filing No. 3 is located in the north half of Section 15, Township 15 South, Range 65 West of the 6th Principal Meridian, City of Colorado Springs, County of El Paso, State of Colorado.

DESCRIPTION OF PROPERTY

Bradley Ridge Filing No. 3 occupies 39.20 acres and is comprised of undeveloped land covered entirely by native grasses and weeds. The site does not lie within a streamside zone. The site generally drains from the northeast to the southwest and to the east at approximately 7%. The land will be platted into 230 single family lots.

PROPOSED DEVELOPMENT

The project will disturb ±58.15 acres. The proposed improvements include 230 single-family lots, public internal roadways, wet/dry utilities, open space and landscaping in common areas. Additionally, the District collector road, Campo Drive, and WFJCC Pond #2 (Private) will be constructed with Bradley Ridge Filing No. 3.

The project area is located within both the Jimmy Camp Creek (JCC) & West Fork Jimmy Camp Creek (WFJCC) Drainage Basins and is situated southwest of the existing Colorado Center Regional Detention Pond.

The site is located outside of the 100-year floodplain per FIRM Map Panel #08041C0956G & Panel #08041C0957G, effective 12/07/2018. There are no major drainage ways or irrigation facilities located through the site. The development will not affect the floodplain. A copy of the FEMA FIRM Map can be found in **Appendix A** for reference.

Soils can be classified in four different hydrologic groups, A, B, C, or D to help predict stormwater runoff rates. Hydrologic group "A" is characterized by deep, well-drained coarse-grained soils with a rapid infiltration rate when thoroughly wet and having a low runoff potential. Group "D" typically has a clay layer at or near to the surface, or very shallow depth to impervious bedrock and has a very slow infiltration rate and a high runoff potential. According to the Natural Resources Conservation Service (NRCS) Web Soil Survey, the project site consists of a mix of soil types and Hydrologic Soil Groups (HSGs) which are summarized in **Table 1** below

Table 1 – USDA NRCS Soil Data

Soil Name	HSG	Percent of Site
Stoneham Sandy Loam	B	3.1%
Nelson-Tassel Fine Sandy Loams	B	3.7%
Razor-Midway Complex	D	93.2%

The predominant on-site HSG is 'D'. Refer to **Appendix A**.

No variances from drainage criteria are requested at this time.

II. HISTORIC DRAINAGE

OVERALL BASIN DESCRIPTION

Bradley Ridge Subdivision Filing No. 3 is located within the Jimmy Camp Creek & West Fork Jimmy Camp Creek Drainage basins as described in the "Master Development Drainage Plan Amendment for Bradley Heights" by Matrix Design Group, Inc., May 06, 2022 (**MDDPA**). The Jimmy Camp Creek basin generally flows in a south-southwesterly direction in the Jimmy Camp Creek channel, entering Fountain Creek approximately one-half a mile east from the Interstate 25 and South Santa Fe Avenue Interchange. Existing drainage patterns onsite flow mostly from the east to southwest at grades ranging from 6.0% up to 9.0%.

HISTORIC SUB-BASIN DESCRIPTION

A Pre-development Conditions basin map was delineated in the approved MDDPA and has been provided in **Appendix B** and can be used to reference. Bradley Ridge Filing 3 lies within sub-basins J-1, M-1 & W-3 and are described as follows:

Basin J-1 (46.6 Ac, Q5=15.0 cfs, Q100=80.3) sheet flows to the southeast corner of the property to an existing roadside swale for Marksheffel ROW, which conveys flows offsite to the south to an existing RCBC (unknown size), which conveys flows directly into Jimmy Camp Creek.

Basin M-1 (97.9 Ac, Q5=18.8 cfs, Q100=167.7) sheet flows to the existing outfall from the Colorado center Regional Pond where runoff crosses beneath Marksheffel Road in a double 12' x 9' RCBC, which conveys flows directly into Jimmy Camp Creek.

Basin W-3 (87.7 Ac, Q5=29.0 cfs, Q100=155.4) sheet flows to an existing naturally channelized area. Flows are then conveyed to West Fork Jimmy Camp Creek located ~1,600 feet southwest of the Bradley Ridge development.

EXISTING CONDITIONS SUB-BASIN DESCRIPTION

An existing conditions basin map was delineated for the platted region of Bradley Ridge Filing 3, Filing 3A and Campo Dr. ROW; as well as the tributary off-site areas that flow onto the site. Onsite flows are denoted with "EX" and offsite flows with "OS". The existing conditions map has been provided in **Appendix F** and can be used to reference the basins discussed below:

Basin EX OS-1 (55.23 ac, Q5 = 24.7 cfs, Q100 = 132.1 cfs): an offsite sub-basin defining an area immediately adjacent to the proposed development situated to the northwest. This basin is currently undeveloped and consists of natural vegetation. Runoff will be routed via naturally channelized flow to **Basin EX-5.**

Basin EX OS-2 (25.33 ac, Q5 = 12.4 cfs, Q100 = 66.2 cfs): an offsite sub-basin defining an area immediately adjacent to the proposed development situated to the north. This basin is currently mostly undeveloped and consists of natural vegetation. An existing temporary sediment basin & swale is located within the basin to treat flow from MDDPA basins **WF10 & WF11**. Runoff will be routed via existing temporary channel to **DP 1.**

Basin EX-1 (5.30 ac, Q5 = 3.0 cfs, Q100 = 16.2 cfs): a sub-basin defining an area along the eastern property boundary. This basin is currently undeveloped and consists of natural vegetation. Runoff will be routed via sheet flow into Bradley Ridge Filing No. 1 where flows will eventually become channelized within curb & gutter and be captured by the existing public storm drain system. Flows will then be routed to either existing Pond #3 (Private) or Pond #4 (Private).

Basin EX-2 (5.48 ac, Q5 = 3.2 cfs, Q100 = 17.1 cfs): a sub-basin defining an area along the northern property boundary. This basin is currently undeveloped and consists of natural vegetation. Runoff will be routed via sheet flow into Bradley Ridge Drive where flows will eventually become channelized within curb & gutter and be captured by the existing public storm drain system. Flows will then be routed to existing Pond #4 (Private).

Basin EX-3 (28.08 ac, Q5 = 14.9 cfs, Q100 = 77.1 cfs): a sub-basin defining an area along a portion of the western property boundary. This basin is currently undeveloped and consists of natural vegetation. Runoff will be routed via sheet flow to **Basin EX OS-2**.

Basin EX-4 (7.84 ac, Q5 = 4.2 cfs, Q100 = 22.7 cfs): a sub-basin defining an area along a portion of the southern property boundary. This basin is currently undeveloped and consists of natural vegetation. Additionally, an existing cattle grazing pond exists within this sub-basin. Runoff will be routed via naturally channelized flow to **DP 2**.

Basin EX-5 (2.85 ac, Q5 = 1.7 cfs, Q100 = 9.1 cfs): a sub-basin defining an area along a portion of the southern property boundary. This basin is currently undeveloped and consists of natural vegetation. Runoff will be routed via naturally channelized flow to **DP 3**.

Design Point 1 (Q5 = 22.5 cfs, Q100 = 84.6 cfs): a point representing combined flows of **Basins EX-3 & EX OS-2**. Flows are conveyed via an existing temporary channel to an existing cattle grazing pond within **Basin EX-4**.

Design Point 2 (Q5 = 26.7 cfs, Q100 = 107.3 cfs): a point representing combined flows of **DP 1** & **Basin EX-4**. Flows are conveyed via an existing natural formed channel off-site to the south. Flows are then routed southeast ~1,600 ft to West Fork Jimmy Camp Creek.

Design Point 3 (Q5 = 26.4 cfs, Q100 = 141.2 cfs): a point representing combined flows of **Basins EX-5 & EX OS-1**. Flows are conveyed via an existing natural formed channel off-site to the south. Flows are then routed southeast ~1,600 ft to West Fork Jimmy Camp Creek.

III. DESIGN CRITERIA

DEVELOPMENT CRITERIA REFERENCE

The analysis and design of the drainage concept and stormwater management system for this project was prepared in accordance with the criteria set forth in the Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual (USDCM) dated January 2016 and the City of Colorado Springs Drainage Criteria Manual (DCM) Volumes 1 dated January 2021 and the City of Colorado Springs Drainage Criteria Manual (DCM) Volume 2 dated December 2020.

The drainage calculations were based on the City of Colorado Springs drainage criteria manual Figure 6-5 and IDF equations to determine the intensity and are listed in **Table 2** below.

Table 2 – Precipitation Data

Return Period	One Hour Depth (in)
5-year	1.50
100-year	2.52

*The intensities above are calculated using Tc=5 minutes

HYDROLOGIC CRITIERIA

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 from the City of Colorado Springs Drainage Criteria Manual Volume 1, Eq 6-5:

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. Composite percent impervious and composite C values were calculated using the streets, commercial use, parks, < 1/8 acre lots, and lawn coefficients found in Table 6-6 of the DCM Vol. 1. The City DCM does not include C values or imperviousness for school sites, so Table 6-3 of the MHFD USDCM Vol. 1 was used to determine imperviousness and Table 6-4 was utilized to calculate the minor and major C values for the hydrologic soil group type. The corresponding coefficients for the HSG D soils were used for the 5-year and 100-year storm event. The associated calculations can be found in **Appendix C**.

Time of Concentration

Time of concentrations have been adapted from the equation 6-7 of The City of Colorado Springs Drainage Criteria Manual, Volume 1 which are as follows:

$T_c = t_t + t_t$

Where:

T_c = time of concentration (min)
T_i = overland (initial) flow time (min)
T_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min)

Overland (Initial) Flow Time: from equations 6-8 from the City of Colorado Springs Drainage Criteria Manual, Volume 1.

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

Where:

T_i = overland (initial) flow
C_5 = runoff coefficient for 5-year frequency
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope

Travel Time

$V = C_v * S_w^{0.5}$

Where:

V = Velocity (ft/s)
C_v = conveyance coefficient
S_w = watercourse slope (ft/ft)

The 100-year event was used as the major storm event for pipes and inlets. The 5-year event was used as the minor event. All the flows in the Rational Method calculations were routed to account for time of concentration on the surface and travel time in the pipe. As the travel time across a basin or in a pipe increases, the peak flowrate also decreases.

HYDRAULIC CRITERIA

Swales

Swales were designed using criteria with the City DCM Vol.1, Chapter 12, section 3 and were analyzed using Federal Highway Administration (FHWA) Hydraulic Toolbox for a 100-year major storm event. This tool calculates the capacity and stability of swales. Stability is determined by ensuring that the permissible shear stress is greater than the maximum shear stress calculated in the swale. The FHWA Hydraulic Toolbox software utilizes equations for shear stress from HEC 15.

In the instances when the maximum shear stress exceeds the permissible shear stress Pmax 300 lining from North American Green (NAG) is proposed. Swale stability analysis in these scenarios were analyzed using NAG Erosion Control Materials Design Software (ECMDS). This software will compute channel stability for the proposed swale utilizing an appropriate NAG lining.

A minimum of 1.0’ freeboard was included with the design of the proposed swales. A summary of the swale design inputs used for analysis is provided in **Section IV** of this report, under the ***“Stormwater Conveyance Facilities”*** header. Computations can be found in **Appendix D**.

Storm Inlets

Colorado Springs D-10-R Storm Inlets were sized using the UD-Inlet_v5.01 spreadsheet from Mile High Flood District and Figure 8-12 Inlet Capacity Chart for sump conditions. These calculations are provided in **Appendix D**.

Detention Pond

The proposed *WFJCC Pond #2 Extended Detention Basin (Private)*, was designed using the full spectrum detention design approach. Full Spectrum Detention (FSD) is a design concept introduced by Mile High Flood District (MHFD); It is the recommended design approach because it provides better control of the full range of runoff rates that pass through the detention facility compared to the traditional multi-stage concept. Volume 2 of the Urban Storm Drainage Criteria Manual (USDCM) describes the FSD approach as:

The intent of full spectrum detention is to reduce the flooding and stream degradation impacts associated with urban development by controlling peak flows in the stream for a range of events.

The detention criteria provided by the MHFD's design spreadsheets *MHFD-Detention_v4.04* was used to determine the adequate storage capacity of the detention pond, and the associated elements of the outlet structure. The UDFCD Manual provides approximate, empirical equations that are utilized in the spreadsheet provided by MHFD. These equations and methods are further described in the USDCM Vol. 2, Ch. 12. The required volume calculations as well as the outlet structure design calculations are provided in **Appendix E** of this report.

IV. DRAINAGE PLAN

GENERAL CONCEPT

The proposed drainage system is designed to safely convey the storm runoff generated from the proposed development to the proposed private detention ponds. The proposed detention ponds will provide full spectrum detention which includes water quality and 100-year detention.

The Bradley Ridge Subdivision Filing No. 3 will be developed as a single-family development. Runoff from the project site will flow onto the proposed public internal roadways. The roadways will direct channelized runoff to Colorado Springs D-10-R Storm Inlets that capture runoff. Storm sewer will then carry the collected flows directly to the detention ponds.

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

- **a.** Minimize Directly Connected Impervious Area (MDCIA): The roof drains for the proposed lots will drain to grass-lined swales between proposed lots where feasible. Additionally, in portions of the site, the back portion of the roof will drain through pervious landscape areas instead of draining directly to impervious areas.
- **b.** Planned Infiltration Areas (PIA): In accordance with City Green Infrastructure Manual guidelines, PIA's have been designed to serve as Receiving Pervious Areas (RPA) mitigating the impacts of the on-site impervious areas. The proposed drainage plan incorporates grass-lined drainage swales that receive the flows from roof drains from the proposed lots. The landscape buffer between the road and sidewalk has also been analyzed as an RPA to receive the flows from impervious sidewalks.
- **c.** Runoff Reduction Calculations: Runoff reduction has been calculated using the MHFD "UD-BMP_v3.07" software package. Print outs from this software are provided in **Appendix C.**

d. Runoff Reduction Calculations are summarized below:

Table 3: Water Quality and Runoff Reduction

Downstream Design Point	Total Area, SF	DCIA, SF	Separate Pervious Area, (SPA), SF	Upstream Impervious Area (UIA), SF	RPA, SF	Volume Reduction, %
Pr. WFJCC Pond #2 (Private)	2,031,408	1,067,076	862,771	40,779	60,782	4%
Ex. JCC Pond #3 (Private)	35,719	21,181	14,538	0	0	0%
Ex. MKJCC Pond #4 (Private)	433,422	251,651	142,436	20,538	18,797	8%
Off-Site (Un-Treated)	32,629	0	32,629	0	0	0%
Total Disturbed	2,533,178	1,339,908	1,052,374	61,317	79,579	4%

Note: The tributary area for Ex. JCC Pond #3 was too small to accurately calculate runoff reduction using the MHFD "UD-BMP_v3.07" software

The proposed development consists of 93.2% Type D soils as shown in the NRCS Web Soil Survey provided in **Appendix A**. Per the City of Colorado Springs DCM Volume 2, Chapter 1 section 4, developments with >50% Type D soils are exempt from meeting the volume reduction requirements.

2. Implement PCM's That Provide a Water Quality Capture Volume with Slow Release

The proposed development utilizes formalized water quality capture volume to slow the release of runoff from the site. Three proposed ponds; WFJCC Pond #2 (Private), JCC Pond #3 (Private) & MKJCC Pond #4 (Private). Of these three ponds, two were designed with the approved Bradley Ridge Filing 1 (JCC Pond #3 & MKJCC Pond #4) FDR (STM-REV22-0328), and one is to be constructed with Bradley Ridge Filing 3 (WFJCC Pond #2) as described in this report. The approved calculations for Pond #3 (Private) can be found in **Appendix E.** Construction of MKJCC Pond #4 (Private) and JCC Pond #3 (Private) are to be completed prior to or concurrently with Bradley Ridge Filing No. 3. At no point will Bradley Ridge Filing No. 3 development occur prior to the construction of MKJCC Pond #4 (Private), JCC Pond #3 (Private), and WFJCC Pond #2 (Private).

These ponds will provide EURV volume for the new development which incorporates a 72-hour release. These ponds will also provide WQCV which will be released in no less than 40 hours. By providing detention, the downstream channel has more than adequate capacity to handle the developed flows. The release rates from this development will be at or less than the site's historic release rates, which will help the overall stability of the channel.

Table 4 – Water Quality Treated Areas

Description	WQ Facility	Area (Ac)	Percent of Disturbance
A Basins & Basin OS-2	JCC Pond #3 (Private)	0.82	1.4%
B Basins	MKJCC Pond #4 (Private)	9.95	17.1%

C Basins & Basin OS-1	WFJCC Pond #2 (Private)	46.63	80.2%
Portion of Basin C-17	Untreated	0.75	1.3%
	Total Disturbed Area	**58.15**	**100.0%**

3. Stabilize Drainageways

This step implements stabilization of channels to accommodate developed flows while protecting infrastructure and controlling sediment loading from erosion in the drainageways. Jimmy Camp Creek has had improvements made in the past to stabilize it as well as proposed improvements as part of the proposed developments immediately upstream of the existing Colorado Center Regional Pond, including grouted sloping boulder drops and riprap lining on the banks to prevent scouring.

West Fork Jimmy Camp Creek (WFJCC) is located off-site approximately 1,600 ft southeast of Bradley Ridge Filing 3 and is described in the West Fork Jimmy Camp Creek DBPS prepared by Kiowa, dated October 17, 2003. Because WFJCC is located on an adjacent property, improvements cannot be made at the time of this development. The adjacent property owner will be responsible for providing necessary improvements to the channel as required by the DBPS and City of Colorado Springs.

All new development projects within the Bradley Heights Metropolitan District are required to construct or participate in the funding of channel stabilization measures. Drainage basin fees, paid at the time of platting, go towards channel stabilization within the drainage basin. The proposed site outfalls to three locations. *MKJCC Pond #4 (Private)* discharges treated flows to the existing double 12' x 9' RCBC, which conveys flows directly into Jimmy Camp Creek. *JCC Pond #3 (Private)* discharges treated runoff to the existing 42" RCP storm sewer stub provided as part of the Peaceful Ridge at Fountain Valley development situated immediately to the south of Bradley Ridge Subdivision Filing No. 1. *WFJCC Pond #2 (Private)* discharges treated flows to an existing naturally formed channel tributary to WFJCC, which conveys flows directly into WFJCC off site.

4. Implement Site Specific and Other Source Control CM's

The biggest source control CM is public education which can be found on the City of Colorado Springs website and discuss topics such as: pet waste, car washing, private maintenance landscaping, fall leaves, and snow melt and deicer. Dumping of waste materials in the proposed storm sewer system is not permitted. During construction, the contractor will have designated concrete washout areas and will implement sediment control logs and inlet protection in order to control pollutants at their source. There are no plans for outdoor stockpiling of materials onsite after construction has been completed, therefore, no other source control CM's are anticipated at this time.

MDDP AMENDMENT

An MDDP amendment is required with Bradley Ridge Filing 3 due to the proposed site layout being revised from the original concept plan provided within the original MDDPA prepared by Matrix, Dated April 2022. The following basins were revised: WF12a, WF12b, WF14, WF15, WF17, MK11, & MK13. Additionally, an off-site sub-basin (basing WF12c) was added to discuss existing condition flows that are currently being routed through the Bradley Ridge development.

The general location and description of each basin in the proposed condition is described as follows. The Proposed MDDPA Drainage Map has been provided in **Appendix F** and can be used to reference the basins discussed below:

Basin WF12a (13.68 ac, Q5 = 17.6 cfs, Q100 = 29.5 cfs): a basin defining an area located at the southwest corner of Bradley Ridge Dr. & Campo Dr. This basin consists of future single family residential development and park area. Runoff from this basin will be routed via future public storm infrastructure to **DP AI**.

Basin WF12b (43.33 ac, Q5 = 65.0 cfs, Q100 = 109.0 cfs): a basin defining an area located at the southwest corner of the Bradley Ridge development. This basin consists of future single family residential development, WFJCC Pond #2 and future school site. Runoff from this basin will be routed via future public storm infrastructure to **DP AO2**.

Basin WF12c (29.61 ac, Q5 = 14.8 cfs, Q100 = 24.8 cfs): a basin defining an off-site area directly adjacent to the eastern boundary line of the Bradley Ridge development. This basin consists of currently un-developed area with native vegetation. Runoff from this basin will be routed via future public storm infrastructure to **DP AO2**. When the basin is developed, the adjacent property owner is responsible for re-routing or capturing developed flows for treatment and releasing flows at less than historic, un-developed, flows prior to discharging into the Bradley Ridge development.

Basin WF14 (3.50 ac, Q5 = 7.2 cfs, Q100 = 12.1 cfs): a basin defining a portion of Campo Drive & Bradley Ridge Drive public ROW. This basin consists of future single family residential development and collector roads. Runoff from this basin will be routed via curb & gutter to a public COS type D-10-R sump inlet at **DP AJ2**. In the event that the inlet becomes fully clogged, emergency overflows will overtop the ROW of Campo Drive and sheet flow west to the proposed WFJCC Pond #2 (Private). Flows will then be conveyed to WFJCC Pond #2 (Private) via public storm drain system.

Basin WF15 (25.75 ac, Q5 = 49.9 cfs, Q100 = 83.8 cfs): a basin defining a portion of Bradley Ridge Filing 3. This basin consists of future single family residential development. Runoff from this basin will be routed via future public storm drain system to **DP AK1**.

Basin WF17 (0.59 ac, Q5 = 0.8 cfs, Q100 = 1.3 cfs): a basin defining a portion of Campo Drive & Bradley Ridge Filing 3. This basin consists of future single family residential development and collector roads. Runoff from this basin will be routed via curb & gutter to a public COS type D-10-R at-grade inlet at **DP AM**. Flows will then be conveyed to WFJCC Pond #2 (Private) via public storm drain system.

Basin MK11 (4.17 ac, Q5 = 10.2 cfs, Q100 = 17.1 cfs): a basin defining a portion of Bradley Ridge Filing 1, Filing 3 & Bradley Ridge Dr. This basin consists of future single family residential development and collector road. Runoff from this basin will be routed via curb & gutter to an existing public COS Type D-10-R sump inlet (Public) located at **DP S**. Flows are then conveyed to MKJCC Pond #4 (Private) via an existing public storm drain system.

Basin MK13 (14.84 ac, Q5 = 26.8 cfs, Q100 = 45.1 cfs): a basin defining a portion of Bradley Ridge Filing 1 and Filing 3. This basin consists of future single family residential development. Runoff from this basin will be routed via an existing public storm drain system to **DP U2**. Flows are then conveyed to MKJCC Pond #4 (Private) via an existing public storm drain system.

A table has been provided below to show the difference in area and runoff between the original MDDP values and the MDDP Amendment values of the basins described above:

	APPROVED MDDP			MDDP AMENDMENT		
BASIN	AREA (Ac)	Q5	Q100	AREA (Ac)	Q5	Q100
WF12a	31.32	40.3	101.6	13.68	17.6	29.5
WF12b	25.68	40.3	89.8	43.33	65.0	109.0
WF14	3.16	9.1	18.3	3.50	7.2	12.1
WF15	28.83	52.1	116.0	25.75	49.9	83.8
WF17	0.27	0.5	1.5	0.59	0.8	1.3
MK11	4.49	10.0	21.8	4.17	10.2	17.1
MK13	15.75	31.2	67.2	14.84	26.8	45.1

FINAL DRAINAGE REPORT PLAN

Basins WF10, WF11, WF13, and WF16 have been utilized as part of the proposed design for Bradley Ridge Subdivision Filing No. 3. Analysis of these basins have previously been completed within the approved "*Master Development Drainage Report Amendment for Bradley Heights & Final Drainage Report for Phase I Bradley Heights Road Improvements*" by Matrix Design Group, Inc., May 06, 2022**.** There have been no changes to these basins. Additionally, Basins WF12a, WF12c, WF14, & WF17 were utilized, and analysis of these basins is provided in the MDDP Amendment section of this report.

A proposed conditions basin map was delineated for the platted region of Bradley Ridge Filing 3, Filing 3A and Campo Dr. ROW; as well as the tributary off-site areas that flow onto the site. Flows conveyed to JCC Pond #3 (Private) are denoted with "A", flows conveyed to MKJCC Pond #4 (Private) are denoted with "B", and flows conveyed to WFJCC Pond #2 (Private) are denoted with "C". Offsite flows entering Bradley Ridge Filing 3 are denoted with "OS" and MDDP basins are denoted as shown on the approved MDDPA and the MDDP amendment described within this report. The proposed condition map is provided in **Appendix F** and can be used to reference the basins discussed below:

Basin A-1 (0.20 ac, Q5 = 0.5 cfs, Q100 = 0.9 cfs): a sub-basin defining a portion of Fault Line Dr. on the southeast corner of the site. The basin consists of roadway and some single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed offsite to the east, into Bradley Ridge Filing No. 1. Flows will then continue east along Fault Line Dr. to Bradley Ridge Filing 1 at **DP A1.** Flows from this design point are channelized within existing curb & gutter in Bradley Ridge Filing 1 and continue east to an existing COS Type-D-10-R, public, at-grade inlet described as **DP B12** in the drainage report for that filing. The inlet calculations showing that the inlets from Bradley Ridge Filing 1 can adequately capture these proposed flows can be found in **Appendix B.**

Basin A-2 (0.45 ac, Q5 = 0.9 cfs, Q100 = 1.6 cfs): a sub-basin defining a portion of Fault Line Dr. on the southeast corner of the site. The basin consists of roadways and some single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed offsite to the east, into Bradley Ridge Filing No. 1 at **DP A2**. Flows will then continue east along Fault Line Dr. to Bradley Ridge Filing 1 at **DP A2**. Flows from this design point are channelized within existing curb & gutter within Bradley Ridge Filing 1 and continue east to an existing COS Type-D-10-R, public, at-grade inlet described as **DP B13** in the drainage report for that filing. The inlet calculations showing that the inlets from Bradley Ridge Filing 1 can adequately capture these proposed flows can be found in **Appendix B.**

Basin B-1 (1.79 ac, Q5 = 3.6 cfs, Q100 = 6.0 cfs): a sub-basin defining a portion of Tuff Rd. & Graben St. on the southeast corner of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP B1**. Captured flows will then be conveyed via public storm pipe to **DP B5**. Bypass flows will be routed downstream via curb & gutter to **DP B6**.

Basin B-2 (1.81 ac, Q5 = 3.9 cfs, Q100 = 6.5 cfs): a sub-basin defining a portion of Blueschist Dr. on the east side of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP B2**. Captured flows will then be conveyed via public storm pipe to **DP B4**. Bypass flows will be routed downstream via curb & gutter to **DP B6**.

Basin B-3 (0.65 ac, Q5 = 1.4 cfs, Q100 = 2.3 cfs): a sub-basin defining a portion of Blueschist Dr. on the east side of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP B3**. Captured flows will then be conveyed via public storm pipe to **DP B4**. Bypass flows will be routed downstream via curb & gutter to **DP B6**.

Basin B-4 (0.78 ac, Q5 = 1.7 cfs, Q100 = 2.9 cfs): a sub-basin defining a portion of Graben St. on the east side of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP B6**. Captured flows will then be conveyed via public storm pipe to **DP B8**. Bypass flows will be routed downstream via curb & gutter to **Basin B-8**.

Basin B-5 (0.46 ac, Q5 = 1.2 cfs, Q100 = 2.0 cfs): a sub-basin defining a portion of Graben St. on the east side of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP B7**. Captured flows will then be conveyed via public storm pipe to **DP B8**. Bypass flows will be routed downstream via curb & gutter to **Basin B-8**.

Basin B-6 (0.87 ac, Q5 = 1.7 cfs, Q100 = 3.8 cfs): a sub-basin defining a portion of Aquifer Wy. & Strike Slip Wy. on the northeast side of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP B9**. Captured flows will then be conveyed via public storm pipe to **DP B11**. Bypass flows will be routed downstream via curb & gutter to **Basin B-8**.

Basin B-7 (0.78 ac, Q5 = 1.7 cfs, Q100 = 2.9 cfs): a sub-basin defining a portion of Strike Slip Wy. on the northeast side of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP B10**. Captured flows will then be conveyed via public storm pipe to **DP B11**. Bypass flows will be routed downstream via curb & gutter to **Basin B-9**.

Basin B-8 (0.09 ac, Q5 = 0.4 cfs, Q100 = 0.6 cfs): a sub-basin defining a portion of Strike Slip Wy. on the northeast side of the site. The basin consists of roadways. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed east, off-site to Bradley Ridge Filing 1. Flows will then continue east along Strike Slip Wy. To an existing COS Type D-10-R, public, sump inlet.

Basin B-9 (0.14 ac, Q5 = 0.3 cfs, Q100 = 0.5 cfs): a sub-basin defining a portion of Strike Slip Wy. on the northeast side of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed east, off-site to Bradley Ridge Filing 1. Flows will then continue east along Strike Slip Wy. To an existing COS Type D-10-R, public, sump inlet.

Basin B-10 (0.52 ac, Q5 = 1.3 cfs, Q100 = 2.1 cfs): a sub-basin defining a portion east of Graben St. on the east side of the site. The basin consists of landscape. Runoff from the basin will sheet flow off-site to Bradley Ridge Filing 1. Flows will then continue east to the existing curb & gutter along the west side of Attrition Dr. Flows will then be conveyed to the north to an existing COS Type D-10-R, public, at-grade inlet. The flows from this basin were already accounted for in the Bradley Ridge Filing 1 FDR.

Basin C-1 (4.25 ac, Q5 = 6.5 cfs, Q100 = 10.8 cfs): a sub-basin defining a portion of Fault Line Dr. on the south portion of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP C1**. Captured flows will then be conveyed via public storm pipe to **DP C3**. Bypass flows will be routed downstream via curb & gutter to **DP C8**.

Basin C-2 (1.73 ac, Q5 = 3.0 cfs, Q100 = 5.0 cfs): a sub-basin defining a portion of Fault Line Dr. on the south portion of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP C2**. Captured flows will then be conveyed via public storm pipe to **DP C3**. Bypass flows will be routed downstream via curb & gutter to **DP C9**.

Basin C-3 (3.81 ac, Q5 = 6.8 cfs, Q100 = 11.4 cfs): a sub-basin defining a portion of Tuff Rd. on the south portion of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP C4**. Captured flows will then be conveyed via public storm pipe to **DP C6**. Bypass flows will be routed downstream via curb & gutter to **DP C9**.

Basin C-4 (1.74 ac, Q5 = 3.1 cfs, Q100 = 5.2 cfs): a sub-basin defining a portion of Tuff Rd. on the south portion of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP C5**. Captured flows will then be conveyed via public storm pipe to **DP C6**. Bypass flows will be routed downstream via curb & gutter to **DP C9**.

Basin C-5 (0.62 ac, Q5 = 1.1 cfs, Q100 = 1.9 cfs): a sub-basin defining a portion of Strike Slip Wy. on the southwest portion of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP C8**. Captured flows will then be conveyed via public storm pipe to **DP C10**. Bypass flows will be routed downstream via curb & gutter to **DP C19**.

Basin C-6 (0.89 ac, Q5 = 1.7 cfs, Q100 = 2.9 cfs): a sub-basin defining a portion of Strike Slip Wy. & Tuff Rd. on the southwest portion of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS

Type D-10-R, public, at-grade inlet at **DP C9**. Captured flows will then be conveyed via public storm pipe to **DP C10**. Bypass flows will be routed downstream via curb & gutter to **DP C19**.

Basin C-7 (1.71 ac, Q5 = 3.2 cfs, Q100 = 5.4 cfs): a sub-basin defining a portion of Strike Slip Wy. on the north portion of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, sump inlet at **DP C11**. Captured flows will then be conveyed via public storm pipe to **DP C13**. In the case where the inlet becomes fully clogged, flows would overtop the crown of the road to a proposed COS Type D-10-R, public, sump inlet at **DP C12**.

Basin C-8 (1.27 ac, Q5 = 2.4 cfs, Q100 = 4.0 cfs): a sub-basin defining a portion of Strike Slip Wy., Scree Wy. & Aquifer Wy. on the north portion of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, sump inlet at **DP C12**. Captured flows will then be conveyed via public storm pipe to **DP C13**. In the case where the inlet becomes fully clogged, flows would overtop the adjacent gutter & sidewalk to the south and be conveyed via a proposed drainage swale within **Basin C-9** to **DP C14**.

Basin C-9 (2.22 ac, Q5 = 8.7 cfs, Q100 = 14.6 cfs): a sub-basin defining an area located centrally on the site. The basin was analyzed assuming a future commercial use that will likely be an HOA clubhouse. Runoff from the basin would be routed west to a proposed grass lined drainage swale **SW-C9**. Captured runoff is then conveyed via channelized flow south to a proposed CDOT Type ‘C’, public, sump inlet at **DP C14**. In the case where the inlet becomes fully clogged, flows would overtop the swale and flow across the sidewalk into the curb & gutter on the north side of Blueschist Dr. and be conveyed west to a proposed COS Type D-10-R, public, at-grade inlet at **DP C20**.

Basin C-10 (0.84 ac, Q5 = 1.8 cfs, Q100 = 3.0 cfs): a sub-basin defining a portion of Strike Slip Wy. on the northwest portion of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP C15**. Captured flows will then be conveyed via public storm pipe to **DP C17**. Bypass flows will be routed downstream via curb & gutter to **DP C20**.

Basin C-11 (1.32 ac, Q5 = 2.5 cfs, Q100 = 4.1 cfs): a sub-basin defining a portion of Strike Slip Wy. on the northwest portion of the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP C16**. Captured flows will then be conveyed via public storm pipe to **DP C17**. Bypass flows will be routed downstream via curb & gutter to **DP C20**.

Basin C-12 (3.07 ac, Q5 = 6.5 cfs, Q100 = 10.8 cfs): a sub-basin defining a portion of Blueschist Dr. located centrally on the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP C19**. Captured flows will then be conveyed via public storm pipe to **DP C21**. Bypass flows will be routed downstream via curb & gutter to a proposed COS Type D-10-R, public, sump inlet at **DP AJ2**.

Basin C-13 (2.28 ac, Q5 = 5.0 cfs, Q100 = 8.4 cfs): a sub-basin defining a portion of Blueschist Dr. located centrally on the site. The basin consists of roadways and single-family development. Runoff from the basin will sheet flow to proposed curb & gutter and be conveyed to a proposed COS Type D-10-R, public, at-grade inlet at **DP C20**. Captured flows will then be conveyed via public storm pipe to **DP C21**. Bypass flows will be routed downstream via curb & gutter to a proposed COS Type D-10-R, public, sump inlet at **DP AJ2**.

Basin C-14 (41.94 ac, Q5 = 64.4 cfs, Q100 = 108.2 cfs): a sub-basin defining a portion of land west of Campo Dr. This area consists of Bradley Ridge Filing 3a (which is the platted area on the south in which WFJCC Pond #2 (Private) is located) and un-platted area north. This basin consists of future single-family development, future school site, landscape and WFJCC Pond #2 (Private). Runoff from the basin would be routed west to a proposed grass lined drainage swale **SW-C14**. Captured runoff is then conveyed via channelized flow south to a proposed FES at **DP AO2**. In the case where the inlet becomes fully clogged, flows would overtop the swale and flow directly into WFJCC Pond #2 (Private).

Basin C-15 (1.41 ac, Q5 = 1.2 cfs, Q100 = 2.0 cfs): a sub-basin defining a portion of land within Bradley Ridge Filing 3A, outside of WFJCC Pond #2 (Private) to the south. This basin consists of landscape and undeveloped land. Runoff from this basin sheet flows directly offsite to the south becoming channelized within the tributary channel to WFJCC as described in the DBPS.

Basin OS-1 (1.25 ac, Q5 = 1.0 cfs, Q100 = 1.7 cfs): a sub-basin defining a portion of land off-stie adjacent to the southern property boundary of the site. This basin consists of landscape and undeveloped land. Runoff from this basin will sheet flow on-site, to **Basin C-1**.

Basin OS-2 (0.17 ac, Q5 = 0.2 cfs, Q100 = 0.3 cfs): a sub-basin defining a portion of land off-stie adjacent to the southern property boundary of the site. This basin consists of landscape. Runoff from this basin will sheet flow on-site, to **Basin A-2**.

STORMWATER CONVEYANCE FACILITIES

Runoff generated from the project site will be conveyed through the site via overland flow and side lot swales to curb and gutter where the flows will be intercepted by proposed storm sewer inlets and conveyed to the either MKJCC Pond #4 (Private), JCC Pond #3 (Private), or WFJCC Pond #2 (Private) by the public and private storm sewer pipe systems.

Private swales were also utilized as stormwater conveyance systems on the site. The table below summarizes the proposed swales included as part of this development.

Table 3 – Swale Analysis Summary Table

Swale ID	Assoc. DP	Armoring Type	Min Slope (%)	Max Slope (%)	Q_{100} (cfs)	v_{100} (ft/s)	Q_{100} Min Depth (ft)	Q_{100} Max Depth (ft)	Total Depth (ft)
SW-C9	C14	NAG Shoremax P300 w/ Vegetation	1.04	1.04	14.6	3.43	1.036	1.036	3.00
SW-C14	A03	NAG Shoremax P300 w/ Vegetation	2.00	2.00	81.2	6.645	1.459	1.459	4.00

STORMWATER STORAGE FACILITIES

Three (3) detention facilities will provide Full Spectrum detention for Bradley Ridge Filing 3. Two of the facilities (JCC Pond #3 (Private) & MKJCC Pond #4 (Private)) were designed and constructed with Bradley Ridge Filing No. 1. Conformance to the existing pond designs is described below for each pond. WFJCC Pond #2 (Private) is proposed with Bradley Ridge Filing 3 and the design is described in more detail below.

MKJCC Pond #4 (Private) is to be constructed with Bradley Heights Filing No. 1 (located east of this development) and will provide water quality and detention for a portion of the site. The design of MKJCC Pond #4 (Private) included the developed flows from MDDP Sub-Basin MK13, denoted as sub-basins 'B' within this report. Supporting calculations from the approved *"Bradley Ridge Filing No. 1 Final Drainage Report,"* by Galloway & Company, Dated April 26, 2023, can be found in **Appendix B**. A tabulated summary showing that the proposed 'B' basins are in conformance with Sub-Basin MK13 used in the pond design are shown in **Table 5** below.

JCC Pond #3 (Private) is to be constructed with Bradley Heights Filing No. 1 (located east of this development) and will provide water quality and detention for a portion of the site. The design of MKJCC Pond #4 (Private) included the developed flows from MDDP Sub-Basin JC3, denoted as sub-basins 'A' within this report. Supporting calculations from the approved *"Bradley Ridge Filing No. 1 Final Drainage Report,"* by Galloway & Company, Dated April 26, 2023, can be found in **Appendix B**. A tabulated summary showing that the proposed 'A' basins are in conformance with Sub-Basin JC3 used in the pond design are shown in **Table 5** below.

Table 5 – Sub-Basin Conformance Summary Table

Anticipated Pond Design Flows From Filing 3					Proposed Contributing Flows				
Receiving PCM	Area (Ac)	% Imp	Q_5 (cfs)	Q_{100} (cfs)	Basin ID	Area (Ac)	% Imp	Q_5 (cfs)	Q_{100} (cfs)
JCC Pond #3	0.82	51.9	1.5	2.7	A Basins + OS-2	0.82	51.9	1.5	2.7
MKJCC Pond #4	9.35	65.0	20.5	45.7	B Basins	8.95	44.4	19.1	32.1

For *WFJCC Pond #2 (Private),* three (3) proposed forebays will provide energy dissipation baffles for the pond inlet pipes. Riprap will also be provided per the DCM Vol. 1, Figure 13-9. The pond will provide maintenance access to within 24' of the forebays & outlet structure. A trickle channel and micropool will also be provided and have been sized in accordance with the USDCM Volume 2 & DCM Volume 1. Computations for the sizing are provided in **Appendix E**.

The proposed detention pond will ultimately discharge into West Fork Jimmy Camp Creek Channel located ~1,600 ft south of the pond outfall. The maximum outflow from the proposed outlet structure will be 196.0 cfs in the 100-year storm event.

An emergency spillway will convey any runoff above the 100-year volume for the proposed pond. The spillway will directly discharge into the adjacent un-named tributary to WFJCC located offsite. The spillway will be armored by type L riprap per DCM Vol 1, Figure 13-12d. The proposed pond calculations have been included in **Appendix E**.

V. OWNERSHIP & MAINTENANCE

Internal roadways and adjacent roadways are to be dedicated as Public ROW and as such will be owned and maintained by the City of Colorado Springs. This includes all storm drainage infrastructure proposed within the ROW. Public drainage easements are provided in instances where the storm drain leaves the ROW. The storm drain system will remain public up to entering the Full Spectrum EDB's.

Proposed drainage swales (other than side lot swales) within the development are to be owned and maintained by Bradley Heights Metro District #2. Additionally, WFJCC Pond #2 (Private) is to be owned and maintained by the District as well.

VI. PERMITTING

A grading and erosion control plan (GEC) will be submitted to the Stormwater Enterprise for review and approval prior to construction. The GEC incorporates straw waddles, check dams, silt fence, vehicle tracking control, inlet & outlet control, sedimentation basins and other construction control measures (CCM) as identified the DCM Volume 2.

An addendum to this report will be submitted to Stormwater Enterprise for review of the storm pipe analysis during the Storm Plan construction document review process to reduce the number of variances and amendments required.

VII. BASIN FEES & ENGINEERING COST OPINION

The property is located in the Jimmy Camp Creek Drainage Basin and was not previously platted. Therefore, drainage and/or bridge fees are as follow:

Bradley Ridge Subdivision Filing No. 3 Final Drainage Report 2023 Original Drainage and Bridge Fees						
	Platted Area (Ac.)	Fee/ Platted Acre	Fee Due	Reimbursable Const. Costs	Fee Due at Platting	Drainage Fee Credit
Jimmy Camp Creek Drainage Fee						
Drainage Fee	47.14	$10,030	$472,814.20	$0.00	$472,814.20	$0.00
Pond Facility Fee	47.14	$3,269	$154,100.66	$0.00	$154,100.66	$0.00
				$0.00	***$626,914.86***	***$0.00***

Items listed in the construction cost estimate below are public unless otherwise noted. All items are non-reimbursable.

***Fees to be deferred and used by the Bradley Heights Metro District No. 2 for drainage improvements.**

COST OPINION

Item	Quantity	Unit	Unit Cost	Cost
Storm Drain Infrastructure (Public)				
15" RCP	42	LF	$60.00	$2,520.00
18" RCP	42	LF	$76.00	$3,192.00
24" RCP	492	LF	$91.00	$44,772.00
36" RCP	31	LF	$140.00	$4,340.00
42" RCP	493	LF	$187.00	$92,191.00
48" RCP	542	LF	$228.00	$123,576.00
15” HP PP	380	LF	$60.00	$22,800.00
18” HP PP	408	LF	$76.00	$31,008.00
24” HP PP	1,151	LF	$91.00	$104,741.00
36” HP PP	25	LF	$140.00	$3,500.00
42" HP PP	124	LF	$187.00	$23,188.00
COS D-10-R 6' Curb Inlet	4	EA	$5,500.00	$22,000.00
COS D-10-R 8' Curb Inlet	5	EA	$6,500.00	$32,500.00
COS D-10-R 10' Curb Inlet	8	EA	$7,500.00	$60,000.00
COS D-10-R 12' Curb Inlet	2	EA	$8,500.00	$17,000.00
COS D-10-R 14' Curb Inlet	1	EA	$9,000.00	$9,000.00
COS D-10-R 16' Curb Inlet	3	EA	$10,000.00	$30,000.00
COS D-10-R 18' Curb Inlet	1	EA	$12,500.00	$12,500.00
CDOT Type 'C' Inlet	1	EA	$12,500.00	$12,500.00
COS Type I Storm Manhole	6	EA	$7,500.00	$45,000.00

COS Type II Storm Manhole	18	EA	$3,500.00	$63,000.00
Subtotal				**$759,328.00**
Total (Public)				**$759,328.00**
Contingency			**10%**	**$75,932.80**
Grand Total (Public)				**$835,260.80**
Storm Drain Infrastructure (Private)				
36" RCP	87	LF	$60.00	$5,220.00
48" RCP	296	LF	$76.00	$22,496.00
54" RCP	47	LF	$114.00	$5,358.00
Trapezoidal Channel	283	LF	$8.00	$2,264.00
COS Type I Storm Manhole	1	EA	$7,500.00	$7,500.00
Subtotal				**$42,838.00**
Pond #5 (Private)				
Forebay	3	EA	$5,000.00	$15,000.00
Earthwork	28,667	CY	$15.00	$430,005.00
Hand Rail Fence (Forebays)	184	LF	$6.00	$1,104.00
Outlet Structure w/ Concrete Micropool	1	EA	$10,000.00	$10,000.00
Type L RipRap (Emergency Spillway)	172	CY	$120.00	$20,640.00
Trickle Channel	993	LF	$15.00	$14,895.00
Gravel Maintenance Access	618	CY	$45.00	$27,810.00
Subtotal				**$519,454.00**
Total (Private)				**$562,292.00**
Contingency			**10%**	**$56,229.20**
Grand Total (Private)				**$618,521.20**

VIII. CONCLUSIONS

This report for Bradley Ridge Subdivision Filing No. 3 has demonstrated that the proposed development will comply with the governing DCM**,** MDDP, and City of Colorado Springs MS4 permit. No adverse effect on downstream infrastructure is anticipated. Therefore, we recommend approval of the proposed development.

IX. REFERENCES

1. Drainage Criteria Manual Volume 1, City of Colorado Springs (January 2021)
2. Drainage Criteria Manual Volume 2, City of Colorado Springs (December 2020)
3. Urban Storm Drainage Criteria Manual, Vol. 1-3, Mile High Flood District, January 2016 (with current revisions).
4. Flood Insurance Rate Map – El Paso County, Colorado and Incorporated Areas Community Panel No. 08041C0957G, Effective December 7th, 2018.
5. Soil Map – El Paso County Area, Colorado as available through the Natural Resources Conservation Service National Cooperative Soil Survey web site via Web Soil Survey 2.0.
6. West Fork Jimmy Camp Creek Drainage Basin Planning Study, Kiowa Engineering Corp., October 17, 2003.
7. Master Development Drainage Report Amendment for Bradley Heights & Final Drainage Report for Phase I Bradley Heights Road Improvements, Matrix Design Group, Inc., May 06, 2022
8. Final Drainage Report for Bradley Ridge Filing No. 1, Galloway & Company, Inc., April 26, 2023.

APPENDIX A

Exhibits & Figures

United States Department of Agriculture

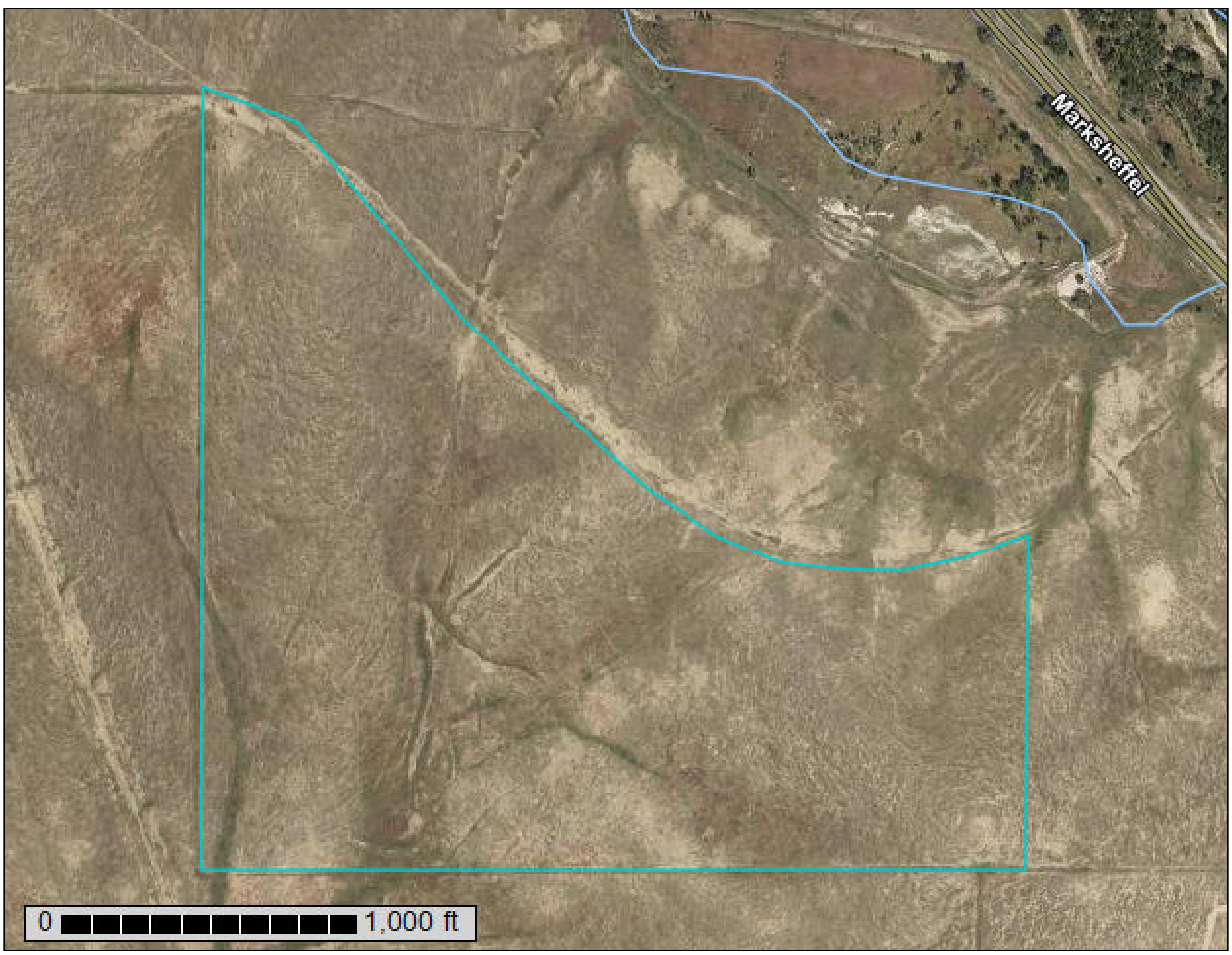
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

El Paso County Area, Colorado



June 12, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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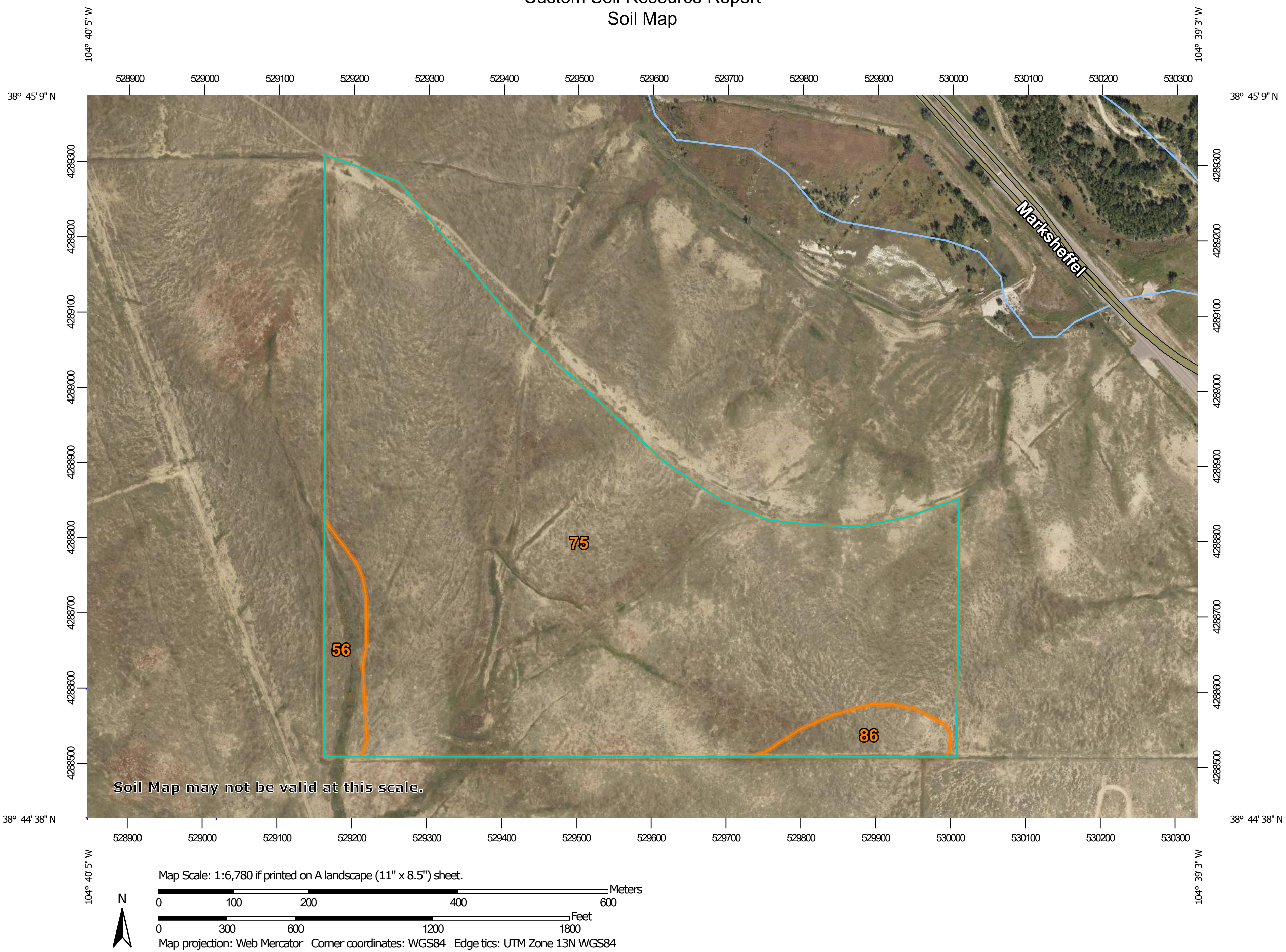
Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map


104° 40' 5" W
104° 39' 3" W
38° 45' 9" N
38° 44' 38" N
528900
529000
529100
529200
529300
529400
529500
529600
529700
529800
529900
530000
530100
530200
530300
4289300
4289200
4289100
4289000
4288900
4288800
4288700
4288600
4288500
Marksheffel
75
56
86
Soil Map may not be valid at this scale.
Map Scale: 1:6,780 if printed on A landscape (11" x 8.5") sheet.
Meters
0
100
200
400
600
Feet
0
300
600
1200
1800
N
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 20, Sep 2, 2022

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

Date(s) aerial images were photographed: Aug 14, 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
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	3.7	3.7%
75	Razor-Midway complex	94.0	93.2%
86	Stoneham sandy loam, 3 to 8 percent slopes	3.1	3.1%
Totals for Area of Interest		**100.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

56—Nelson-Tassel fine sandy loams, 3 to 18 percent slopes

Map Unit Setting

National map unit symbol: 3690
Elevation: 5,600 to 6,400 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Nelson and similar soils: 55 percent
Tassel and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nelson

Setting

Landform: Hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous residuum weathered from interbedded sedimentary rock

Typical profile

A - 0 to 5 inches: fine sandy loam
Ck - 5 to 23 inches: fine sandy loam
Cr - 23 to 27 inches: weathered bedrock

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R067BY045CO - Shaly Plains
Other vegetative classification: SHALY PLAINS (069AY046CO)
Hydric soil rating: No

Description of Tassel

Setting

Landform: Hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous slope alluvium over residuum weathered from sandstone

Typical profile

A - 0 to 4 inches: fine sandy loam
C - 4 to 10 inches: fine sandy loam
Cr - 10 to 14 inches: weathered bedrock

Properties and qualities

Slope: 3 to 18 percent
Depth to restrictive feature: 6 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: R067BY045CO - Shaly Plains
Other vegetative classification: SHALY PLAINS (069AY046CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

75—Razor-Midway complex

Map Unit Setting

National map unit symbol: 369p
Elevation: 5,300 to 6,100 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Razor and similar soils: 60 percent
Midway and similar soils: 35 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Razor

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear
Parent material: Clayey slope alluvium over residuum weathered from shale

Typical profile

A - 0 to 4 inches: stony clay loam
Bw - 4 to 22 inches: cobbly clay loam
Bk - 22 to 29 inches: cobbly clay
Cr - 29 to 33 inches: weathered bedrock

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 15.0
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): 6e

Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R069XY047CO - Alkaline Plains
Other vegetative classification: ALKALINE PLAINS (069AY047CO)
Hydric soil rating: No

Description of Midway

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Slope alluvium over residuum weathered from shale

Typical profile

A - 0 to 4 inches: clay loam
C - 4 to 13 inches: clay
Cr - 13 to 17 inches: weathered bedrock

Properties and qualities

Slope: 3 to 25 percent
Depth to restrictive feature: 6 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 15 percent
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 15.0
Available water supply, 0 to 60 inches: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R069XY046CO - Shaly Plains
Other vegetative classification: SHALY PLAINS (069AY045CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

86—Stoneham sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 36b2
Elevation: 5,100 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Stoneham and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stoneham

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous loamy alluvium

Typical profile

A - 0 to 4 inches: sandy loam
Bt - 4 to 8 inches: sandy clay loam
Btk - 8 to 11 inches: sandy clay loam
Ck - 11 to 60 inches: loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R067BY024CO - Sandy Plains

Other vegetative classification: SANDY PLAINS (069AY026CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

NOTES TO USERS

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

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

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

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

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

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

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

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

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

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

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

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

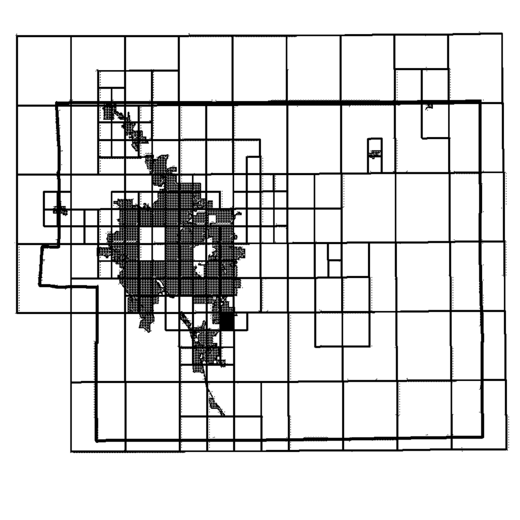
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this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

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

El Paso County Vertical Datum Offset Table

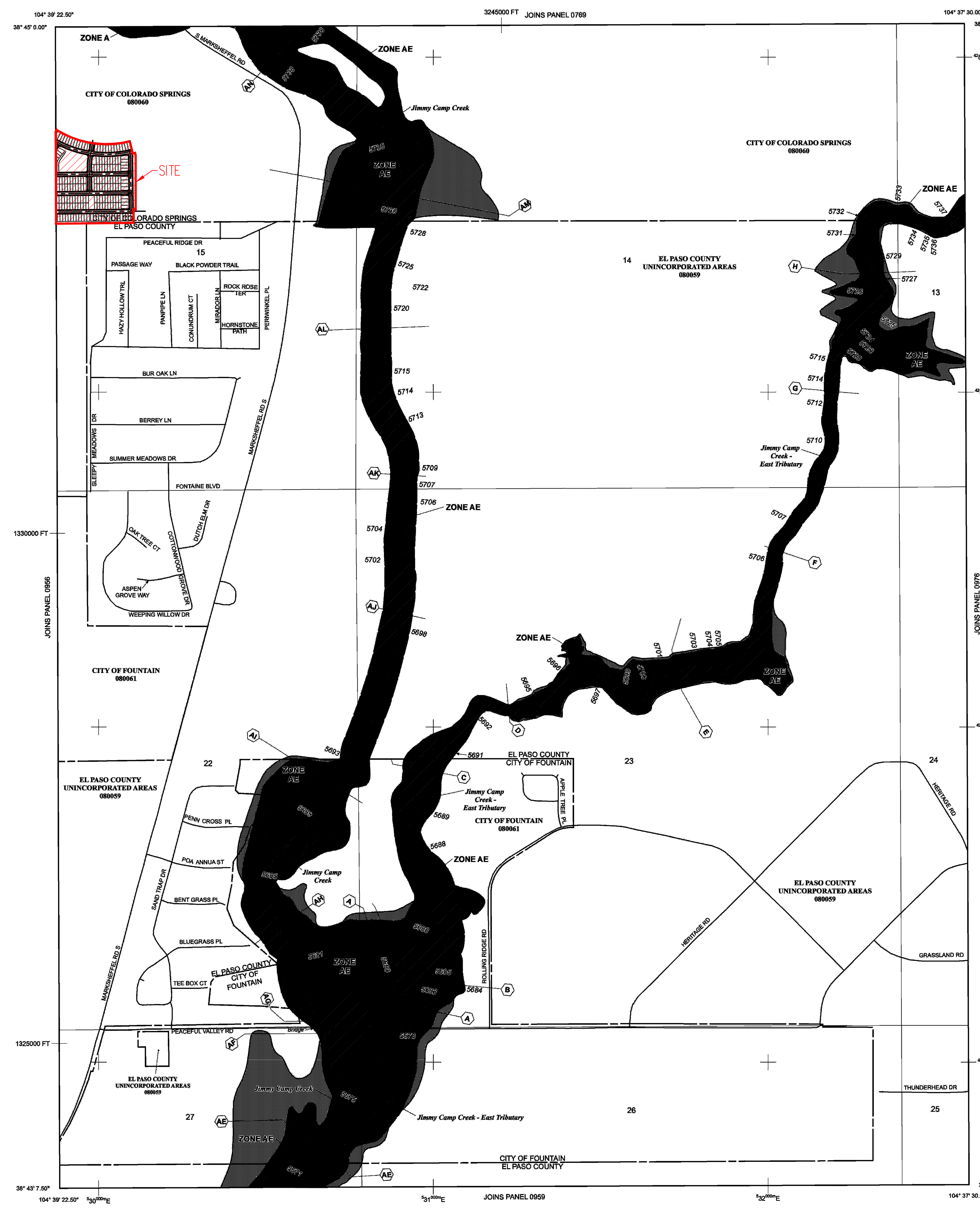
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 15 SOUTH, RANGE 65 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	Floodplain boundary
	Floodway boundary
	Zone D Boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

(A)—(A)	Cross section line
(23)- - - -(23)	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0957G

NATIONAL FLOOD INSURANCE PROGRAM

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

PANEL 957 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0957	G
EL PASO COUNTY	080059	0957	G
FOUNTAIN, CITY OF	080061	0957	G

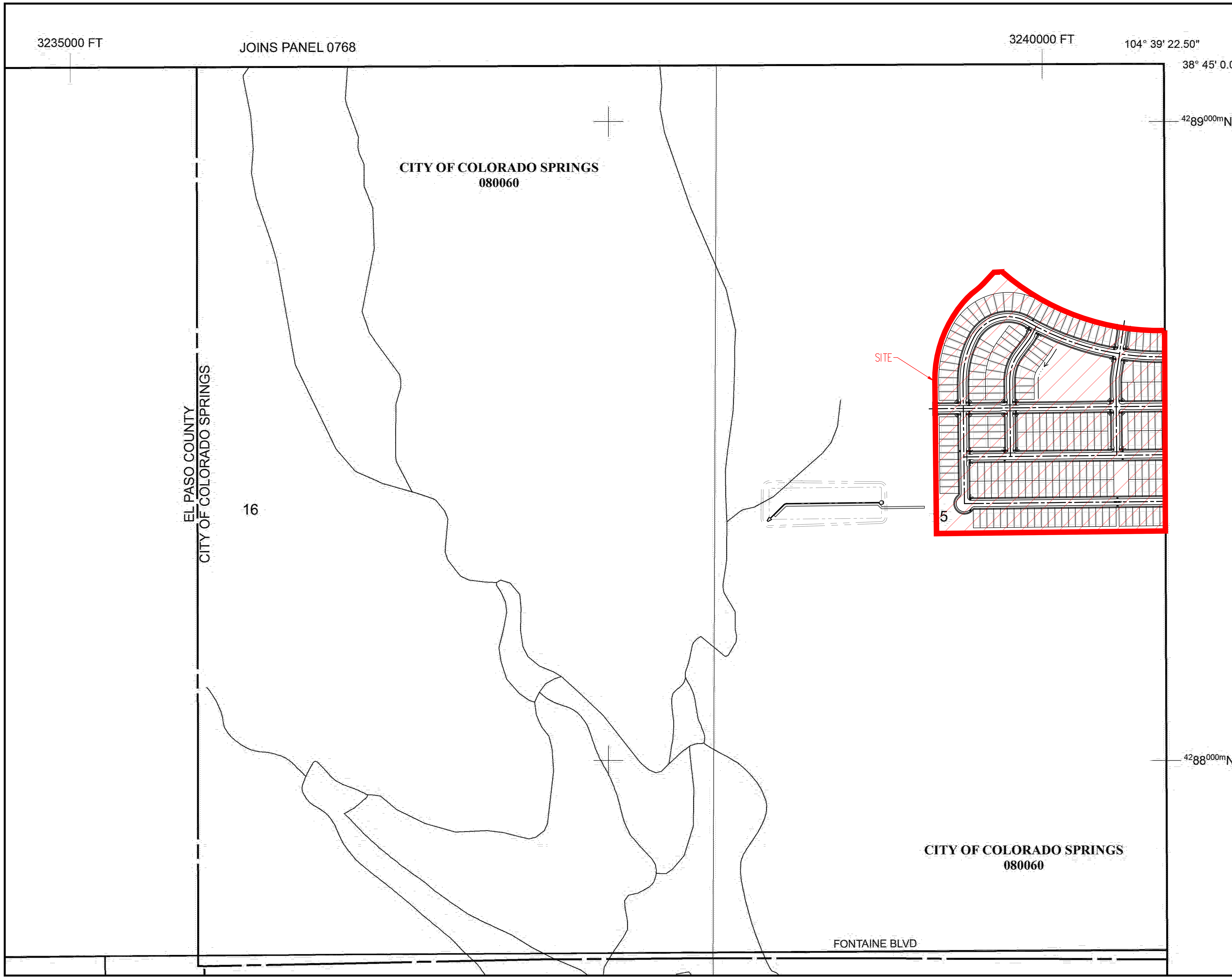
Notice: This map was reissued on 05/15/2020 to make a correction. This version replaces any previous versions. See the Notice-to-User Letter that accompanied this correction for details.

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
08041C0957G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency



MAP SCALE 1" = 500'

0 500 1000 FEET

0 150 300 METERS

NFIP

PANEL 0956G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO

AND INCORPORATED AREAS

PANEL 956 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0956	G
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MAP NUMBER
08041C0956G

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.

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

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

3.2 Time of Concentration

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

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

Table 6-3. Recommended percentage imperviousness values

Land Use or Surface Characteristics	Percentage Imperviousness (%)
Business:	
Downtown Areas	95
Suburban Areas	75
Residential lots (lot area only)**:**	
Single-family	
2.5 acres or larger	12
0.75 – 2.5 acres	20
0.25 – 0.75 acres	30
0.25 acres or less	45
Apartments	75
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	10
Playgrounds	25
Schools	55
Railroad yard areas	50
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2

2023 DRAINAGE, BRIDGE AND POND FEES
CITY OF COLORADO SPRINGS

Basin Name	DBPS Year	Drainage Fee/Acre	Bridge Fee/Acre	Pond Land Fee/Acre	Pond Facility Fee/Acre	Surcharge/ Acre
19th Street	1964	$5,068				
21st Street	1977	$7,736				
Bear Creek	1980	$4,979	$469			
Big Johnson, Crews	1991	$19,264	$1,583	$308		
Black Squirrel Creek	1989	$17,648		$4,784		
Camp Creek	1964	$2,854				
Cottonwood Creek[1,2]	2019	$17,578	$1,421			$909
Douglas Creek	1981	$16,008	$358			
Dry Creek[3]	1966	$0				
Elkhorn Basin[4]	n/a	$0				
Fishers Canyon[5]	1991	$0				
Fountain Creek[6]	n/a	VAR				
Jimmy Camp Creek	2015	$10,030			$3,269	
Kettle Creek[7] Old Ranch Trib.	2001	$0				
Little Johnson	1988	$16,812		$1,570		
Mesa	1986	$13,456				
Middle Tributary	1987	$30,121		$1,434		
Miscellaneous[8]	n/a	$14,973				
Monument Branch[12]	1987	$0				
North Rockrimmon	1973	$7,737				
Park Vista (MDDP)	2004	$21,550				
Peterson Field	1984	$16,256	$749			
Pine Creek[9]	1988	$0				
Pope's Bluff	1976	$5,152	$882			
Pulpit Rock	1968	$8,532				
Sand Creek	2021	$22,015				
Shooks Run[10]	1994	$0				
Smith Creek[11]	2002	$0				
South Rockrimmon	1976	$6,049				
Southwest Area	1984	$17,197				
Spring Creek	1968	$13,344				
Templeton Gap	1977	$8,740	$97			
Windmill Gulch	1992	$18,355	$341	$3,909		

All Drainage, Bridge and Detention Pond Facilities Fees adjusted by 9.2% over 2022 by City Council Resolution No. 202-22 on November 22, 2022 to be effective on January 1, 2023. Land Fees are based on the Community Park Land Dedication Fee which is currently $98,010/acre for Community Parks (0% change for inflation in 2022).

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[1] The 2023 Cottonwood Creek drainage fee consists of a capital improvement fee of $13,650 per acre and land fee of $3,928 per acre for a total of $17,578 per acre. These fees are adjusted annually using different procedures but are combined for collection purposes. **The surcharge fee of $909/ac is due in cash; credits for prior facility construction cannot be used to offset this fee,** which is deposited into a separate City fund known as the "Cottonwood Creek Surcharge" fund.
[2] The Wolf Ranch portion of the Cottonwood Creek Drainage Basin was approved as a "no fee" basin **as to Drainage Fees only** by City Council on August 28, 2018 by Resolution No. 96-18
[3] Dry Creek is a closed basin per City Council Resolution No.118-08 on June 24, 2008
[4] Elkhorn Basin is a closed basin per the Annexation Agreements for the area.
[5] Fishers Canyon is a closed basin per City Council Resolution No. 74-08 on April 22, 2008.
[6] Pursuant to the recommendation of the Subdivision Storm Drainage Board adopted at its meeting of September 15, 1977, there are exempted and excluded from the provisions of this part construction of the main Fountain Creek Channel from the confluence of Fountain Creek with Monument Creek northwest to the City limits. Land developments taking place adjacent to Fountain Creek shall remain responsible for dedicating rights of way necessary for the channelization of Fountain Creek, and the developers shall continue to pay to the City as a condition of subdivision plat approval the applicable drainage fees. Drainage fees are required in accordance with the appropriate basin study.
[7] Kettle Creek Old Ranch Tributary is a closed basin per City Council Resolution 139-02 on August 27, 2002.
[8] Miscellaneous fee is assessed on unstudied areas and the Roswell and Westside Basins.
[9] Pine Creek is a closed basin per City Council Resolution No.236-88 on December 13, 1988.
[10] Shooks Run is a closed basin pursuant to the recommendation of the Drainage Board, adopted at its meeting on October 15, 1963.
[11] Smith Creek is a closed basin per City Council Resolution 140-02 on August 27, 2002
[12] Monument Branch Basin is a closed basin per City Council Res. 177-10 on October 12, 2010

APPENDIX B

Excerpts From Existing Drainage Studies

EXCERPT FROM PREVIOUS STUDY

WEST FORK JIMMY CAMP CREEK
DRAINAGE BASIN PLANNING STUDY

Prepared for:

New Generation Homes, Inc.
3 Widefield Boulevard
Colorado Springs, CO 80911

Prepared by:

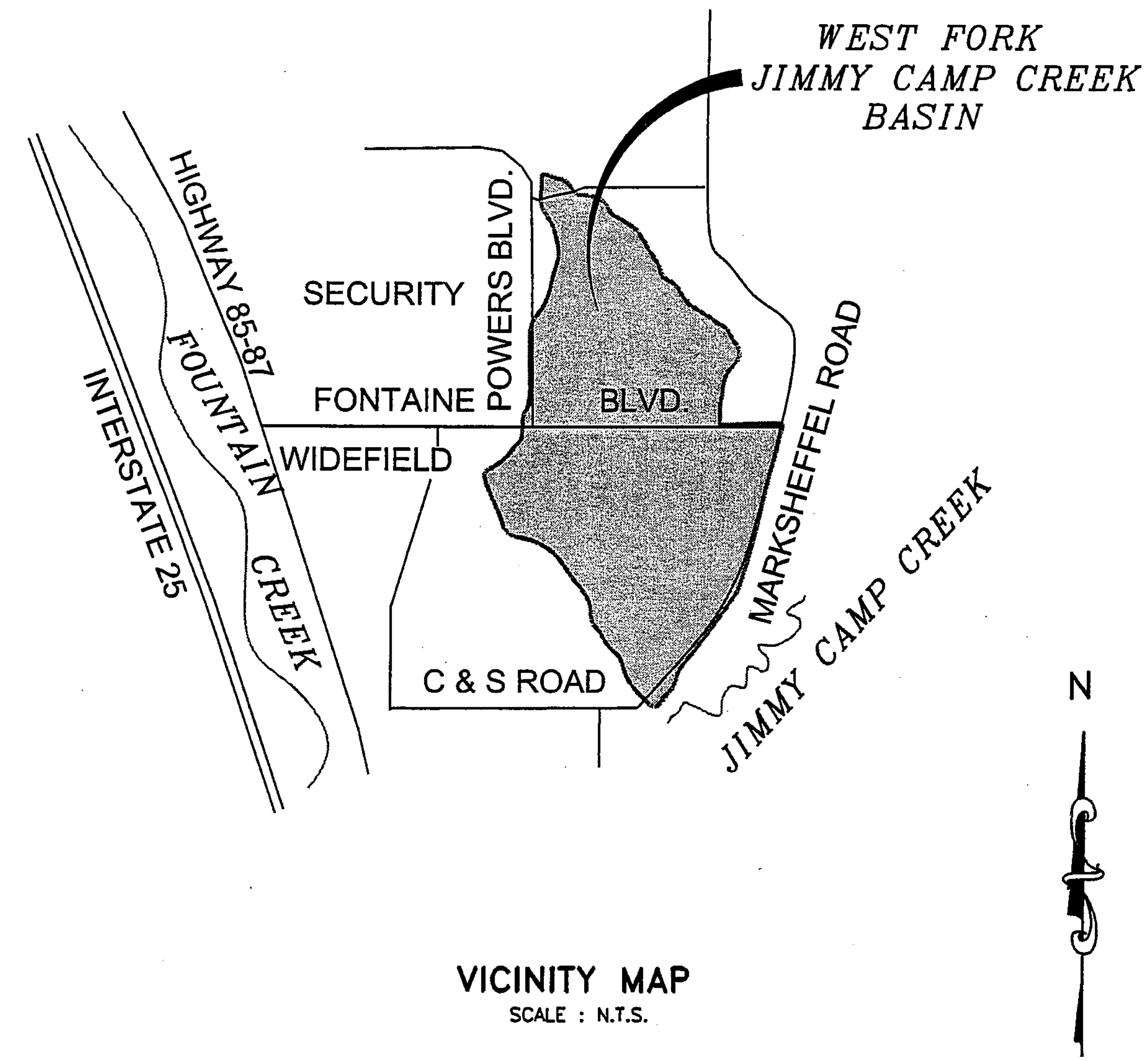
Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, CO 80904

KIOWA Project No. 98.93
wfjc*.doc

June 1999
July 2000
November 2000
October 17, 2003

EXCERPT FROM PREVIOUS STUDY

Land-use information related to the existing and future conditions were reviewed as part of the planning effort. This information is used in the hydrologic analysis to predict runoff rates and volumes for the purposes of facility evaluation. The identification of land uses abutting the drainageways is also useful in the identification of feasible plans for stabilization and aesthetic treatment of the creek. Presented on Figure 2 is the proposed land use map that was used in the development of soil curve numbers (i.e., CN-values). Figure 2 is not intended to reflect the future zoning or land use policies of the City(s) or the County. Land-use information for the areas described above were obtained from published drainage reports and master development plans.



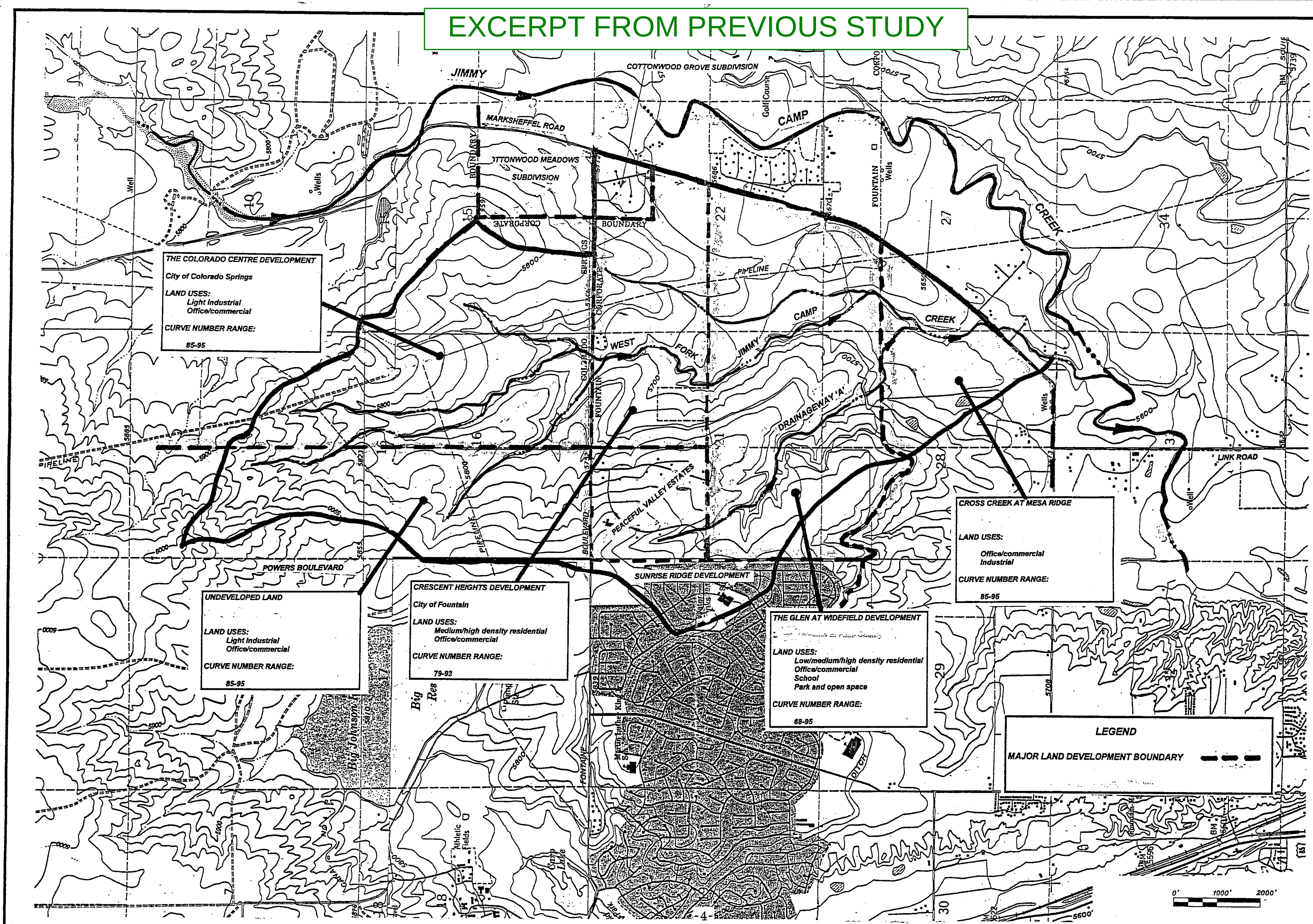
VICINITY MAP
SCALE : N.T.S.

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904-4208
(719) 630-7342

JIMMY CAMP CREEK WEST TRIBUTARY
COLORADO SPRINGS, COLORADO
FIGURE 1

PROJECT NO.: 98093
DATE: 03/10/04
DESIGN: RNW
REVISIONS:

EXCERPT FROM PREVIOUS STUDY



Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904
(719) 630-7342

West Fork Jimmy Camp Creek
Drainage Basin Planning Study
MAJOR DEVELOPMENT & LAND USE MAP
EL PASO COUNTY, COLORADO

Project No.: 9893
Date: 6/99
Design: RNW
Drawn: CAD
Check: RNW
Revisions:

FIGURE 2

TABLE 2: SUMMARY OF SUB- BASIN DISCHARGES
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

EXCERPT FROM PREVIOUS STUDY

SUB-BASIN NUMBER	EX/FUT DRAINAGE AREA (sm)	EX/FUT DRAINAGE AREA (ac)	XISITING CONDITION (cfs) 5 YR	XISITING CONDITION (cfs) 100 YR	FUTURE CONDITION (cfs) 5 YR	FUTURE CONDITION (cfs) 100YR
2010	0.125	80.0	40	142	40	142
2020	0.062	39.7	9	47	19	68
2030	0.021	13.4	5	22	6	24
2040	0.026	16.6	5	26	7	29
2045	0.061	39.0	48	124	48	124
2050	0.020	12.8	4	17	4	19
2060	0.024	15.4	5	24	8	30
2070	0.068	43.5	8	44	17	65
2080	0.057	36.5	12	58	15	64
2090	0.019	12.2	3	14	5	19
2100	0.095	60.8	13	64	24	89
2110	0.034	21.8	6	29	8	33
2120	0.047	30.1	9	45	9	45
2130	0.010	6.4	2	11	2	11
2140	0.007	4.5	2	4	2	9
2150	0.015	9.6	6	20	6	21
2160	0.012	7.7	8	18	17	35
3000	0.420	268.8	140	474	190	568
3005	0.240	153.6	107	347	144	407
3010	0.220	140.8	81	288	138	383
3012	0.210	134.4	54	199	94	272
3015	0.110	70.4	55	181	75	212
3020	0.190	121.6	69	231	204	428
3025	0.260	166.4	82	324	347	712
3030	0.260	166.4	65	262	116	361
3035	0.160	102.4	63	234	106	306
3040	0.115	73.6	23	110	31	129
3050	0.049/074	31.4/47.4	18	61	56	136
3060	0.119	76.2	48	163	63	189
3070	0.077	49.3	23	78	27	87
3080	0.050	32.0	16	58	23	68
3090	0.082/.05	52.5/32.0	27	93	21	67
3100	0.095	60.8	35	123	61	166
3110	0.018	11.5	5	17	14	31
4010	0.190	121.6	38	153	108	279
4020	0.135	86.4	26	90	39	114
4030	0.018	11.5	7	25	20	44
5010	0.156	99.8	35	133	101	246
5020	0.200	128.0	52	200	1514	362

TABLE 3: SUMMARY OF DESIGN POINT DISCHARGES
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

DESIGN POINT NUMBER	EX/FUT DRAINAGE AREA (sm)	EX/FUT DRAINAGE AREA (acres)	EXISITING CONDITION 5 YR cfs	EXISITING CONDITION 100 YR cfs	FUTURE CONDITION 5 YR cfs	FUTURE CONDITION 100YR cfs
2020	0.190	121.6	47	189	57	210
2040	0.300	192.0	97	335	109	362
2060	0.340	217.6	105	372	120	406
2080	0.130	83.2	17	88	28	113
2090	0.480	307.2	123	473	152	535
2100	0.610	390.4	140	558	181	651
2120	0.660	422.4	148	600	189	692
2130	0.670	428.8	145	594	186	687
2160	0.700	448.0	151	624	196	723
3000	0.660	422.4	147	233	317	935
3020	1.650	1056.0	528	1857	1059	2737
3030	2.070	1324.8	601	2216	1209	3267
3040	2.180	1395.2	618	2316	1239	3364
3050	2.26/2.23	1446/1427	627	2351	1275	3444
3070	0.200	128.0	67	235	86	270
3080	.25/.05	160/32	82	290	23	72
3090	.33/.11	211/70	106	373	44	138
3091	2.560	1638.4	732	2722	1380	3843
3100	2.660	1702.4	757	2828	1428	3990
3110	2.670	1708.8	761	2845	1442	4022
4020	0.320	204.8	63	238	145	383
5010	3.730	2387.2	943	3550	1722	4904

EXCERPT FROM PREVIOUS STUDY

IV. HYDRAULIC ANALYSIS AND FLOODPLAIN DESCRIPTION

A hydraulic analysis was conducted to ascertain the conveyance capacity of existing hydraulic structures along the major drainageways of the West Fork Jimmy Camp Creek Basin. Field verifications of roadway crossings and existing channel improvements were conducted and the general physical condition of the structure(s) noted. In some areas of the basin, a hydraulic analysis was conducted using the U. S. Army Corps of Engineers (COE) HEC-2 water surface profile program. Cross section data for the areas analyzed were obtained by using the two-foot contour interval planimetric topographic mapping compiled in 1997 for the Glen at Widefield property. The future condition 100-year peak discharge data shown on Table 3 was used in the estimation of the 100-year flood profiles through the Glen at Widefield property.

The capacity of the existing roadway crossing culverts structures were estimated using the HYDRAIN culvert modeling program. The 5- and 100-year existing condition flow rates were used in determining whether an existing culvert was judged to have adequate capacity.

The West Fork Jimmy Camp Creek floodplain has been included within the City of Colorado Springs and El Paso County Flood Insurance Study (FIS), from its confluence with Jimmy Camp Creek to Fontaine Boulevard. No other tributaries to the West Fork have been studied in the FIS. The floodplain data and associated base flood elevations presented in the FIS is used in the regulation of the floodplain as it relates to the County's participation in the National Flood Insurance Program. The floodplains developed in this report are not intended to replace the FIS data and are only being used to determine the area along the drainageways which would be prone to flooding in the 100-year event.

Hydraulic Structure Inventory

As part of the field investigation, the existing drainage facilities were verified and inventoried. The size, type, and condition were recorded for all the bridges, culverts, channels, inlets, pipes, and miscellaneous drainage features in the basin. Hydraulic capacities were estimated for the culverts and bridges over the major drainageways. An inventory of the roadway crossings along the major drainageways is presented on Table 4. The hydraulic capacity of crossings was calculated for a headwater to depth ratio of 1.2. Culvert capacity was assumed to be reached when the 100-year, future condition undetained discharge overtopped the culvert. The location of the structures listed on Table 4 is shown on Figure 4.

The physical condition of the major drainageways was reviewed in the field and using existing topographic mapping. Presented on Table 5 is a summary of the major drainageway characteristics. A description of each drainageway segment follows. The locations of the segments are presented on Figure 4.

West Fork Jimmy Camp Creek Drainageways

Segment 5010: This segment is the outfall drainageway to Jimmy Camp Creek. The channel cross-section is poorly defined and passes through a low density residential area. The drainageway is fully contained within the Jimmy Camp Creek floodplain. This segment of channel is currently stable and generally well vegetated. No base flow exists. The existing channel slope is estimated at 0.3 percent.

Segment 3110: This segment passes though the proposed Cross Creek at Mesa Ridge development. The channel cross-section is poorly defined and has no apparent base flow. The drainageway has a wide but shallow floodplain. This segment of channel is currently stable and generally well vegetated. The existing channel slope is estimated at 0.6 percent.

Segment 3030: This segment passes though the proposed Glen at Widefield development. The channel is well defined and has a base flow. The drainageway has a generally narrow floodplain except at the outfall point to segment 3110. Within this segment is an embankment which stores water behind it, but has limited flood storage capacity above the mean water surface. It is believed that this impoundment is fed by groundwater and irrigation seepage. There is no record of this impoundment at the State Engineer's office. This segment of channel is currently stable and well vegetated. The existing channel slope is estimated at 0.7 percent.

Segment 3020: This segment passes though the proposed Crescent Heights development. The channel is well defined and has a base flow. The drainageway has a generally narrow floodplain with depths ranging from two to four feet. As in segment 3030, this segment is an embankment which stores water behind it, but has limited flood storage capacity above the mean water surface. It is believed that this impoundment is fed by groundwater and irrigation seepage. There is no record of this impoundment at the State Engineer's office. This segment of channel is currently stable and well vegetated. The existing channel slope is estimated at 0.8 percent.

EXCERPT FROM PREVIOUS STUDY

Segment 3000: This segment is contained within the Colorado Centre development. The channel is well defined and has no base flow. This segment of channel is currently stable and well vegetated. The existing channel slope is estimated at 1.0 percent.

Segment 3010: This segment is contained within the Colorado Centre development. The channel is well defined and has no base flow. This segment of channel is currently stable and well vegetated. The existing channel slope is estimated at 1.0 percent.

Segment 3021: This segment is contained within the Colorado Centre development. The channel is well defined and has no base flow. This segment of channel is currently stable and well vegetated. The existing channel slope is estimated at 0.8 percent.

Drainageway "A" Drainageways

Segment 2160: This segment outfalls to West Fork Jimmy Camp Creek. This segment lies within the proposed Cross Creek development. The channel cross-section is poorly defined. This segment of channel is currently stable and generally well vegetated. No base flow exists. The existing channel slope is estimated at 2.6 percent.

Segment 2090: This segment passes though the proposed Glen at Widefield development. The channel is well defined and has a base flow. The drainageway has a generally narrow floodplain with depths ranging from two to four feet. Within this segment is an embankment which stores water behind it, but has limited flood storage capacity above the mean water surface. It is believed that this impoundment is fed by groundwater and irrigation seepage. The impoundment lies within a parcel of land owned by the Fountain Mutual Irrigation Company. There is no record of this impoundment at the State Engineer's office. This segment of channel is currently stable and well vegetated. The existing channel slope is estimated at 1.8 percent.

Fountain Mutual Irrigation Ditch

The Fountain Mutual Irrigation ditch traverses the study area in generally a southwest to northeast direction. The ditch crosses through portions of the proposed Cross Creek at Mesa Ridge, the Glen at Widefield and the Crescent Heights developments. There is one siphon along the ditch within the study area which takes the flow in the ditch under Drainageway A, just downstream of design point 2090. As part of the drainage planning for the West Fork Jimmy Camp Creek basin, it was assumed that the irrigation ditch would convey only the adjudicated water right through the basin. Existing and proposed runoff was assumed to be passed over or under the ditch in the hydrologic modeling of the basin. There was no diversion of runoff by the ditch assumed in compilation of the hydrologic model for this basin.

Floodplains

Floodplains for the 100-year existing condition discharge have been delineated for the West Fork Jimmy Camp Creek within the Colorado Springs and El Paso County Flood Insurance Study (FIS). Shown on Figure 5 is the FIS floodplain and base flood elevation data. There are no other drainageways within this basin which have been studied by FEMA. As part of the Master development drainage planning process the floodplains along the major drainageways should be determined. Channel improvements along the West Fork Jimmy Camp Creek which would alter the floodplain information as developed by FEMA would require the preparation of a Letter of Map Revision in accordance with FEMA technical criteria and specifications.

There are not any significant areas of existing flood hazard within the basin mainly because of the undeveloped nature of the basin and because the drainageways are unencroached at this time. Some damage could occur to roadway crossings wherever culverts lack sufficient capacity to convey the runoff reaching them without overtopping the roadway. The affect of development within the basin will be to generally increase runoff rate, frequency and velocity along the major drainageways.

EXCERPT FROM PREVIOUS STUDY

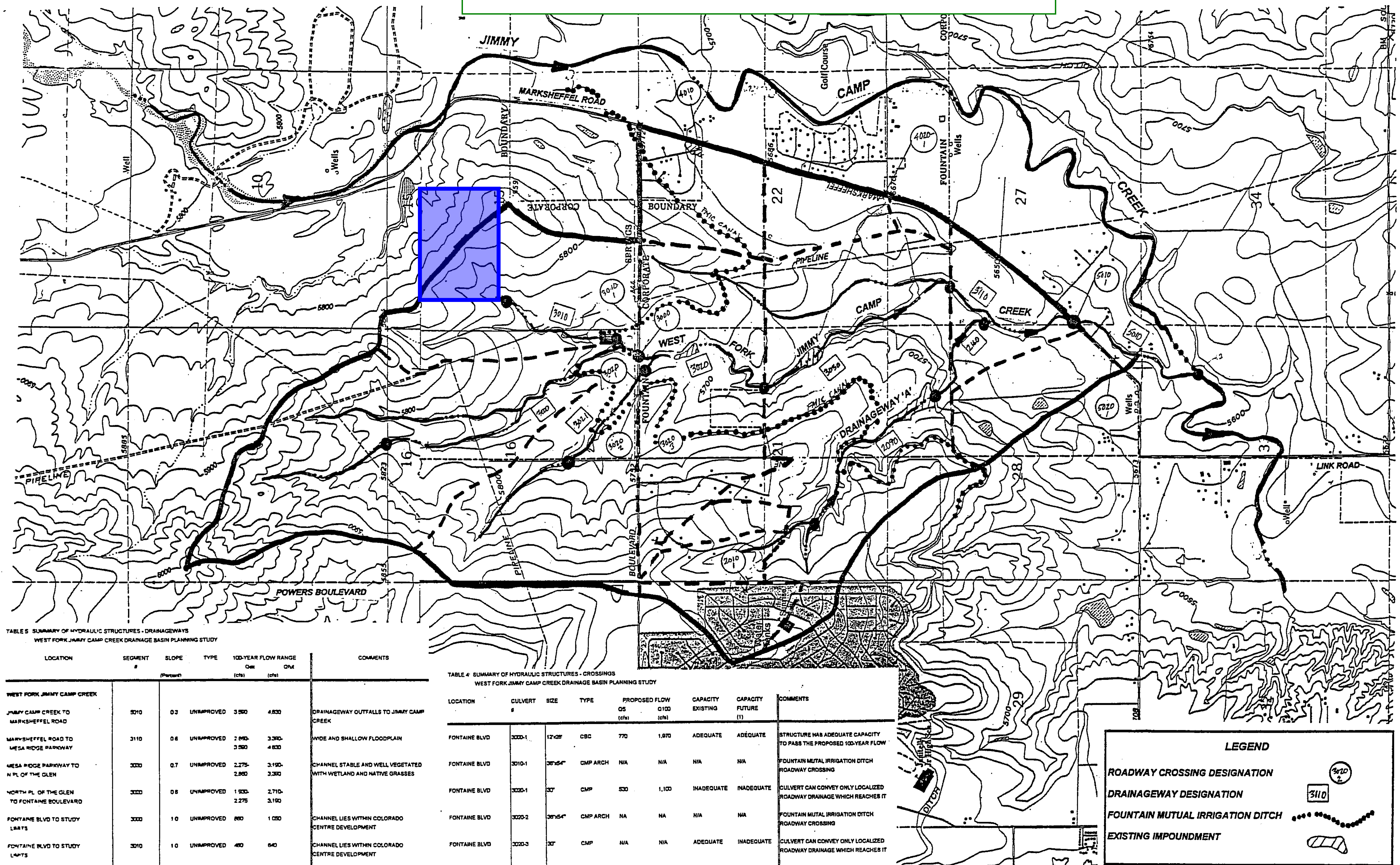


TABLE 5 SUMMARY OF HYDRAULIC STRUCTURES - DRAINAGEWAYS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

LOCATION	SEGMENT #	SLOPE (Percent)	TYPE	100-YEAR FLOW RANGE Qex (cfs)	Qfut (cfs)	COMMENTS
WEST FORK JIMMY CAMP CREEK						
JIMMY CAMP CREEK TO MARKSHEFFEL ROAD	5010	0.3	UNIMPROVED	3,590	4,830	DRAINAGEWAY OUTFALLS TO JIMMY CAMP CREEK
MARKSHEFFEL ROAD TO MESA RIDGE PARKWAY	3110	0.6	UNIMPROVED	2,860-3,590	3,390-4,830	WIDE AND SHALLOW FLOODPLAIN
MESA RIDGE PARKWAY TO N PL OF THE GLEN	3030	0.7	UNIMPROVED	2,275-2,860	3,190-3,390	CHANNEL STABLE AND WELL VEGETATED WITH WETLAND AND NATIVE GRASSES
NORTH PL OF THE GLEN TO FONTAINE BOULEVARD	3020	0.8	UNIMPROVED	1,930-2,275	2,710-3,190	
FONTAINE BLVD TO STUDY LIMITS	3000	1.0	UNIMPROVED	880	1,050	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
FONTAINE BLVD TO STUDY LIMITS	3010	1.0	UNIMPROVED	480	640	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
FONTAINE BLVD TO STUDY LIMITS	3021	0.8	UNIMPROVED	620	1,100	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
DRAINAGEWAY A						
CONFLUENCE WITH WEST FORK JIMMY TO LAKE	2180	2.6	UNIMPROVED	620	720	
LAKE TO DESIGN POINT DP2040	2090	1.8	UNIMPROVED	335-620	390-720	CHANNEL STABLE AND WELL VEGETATED WITH WETLAND AND NATIVE GRASSES

TABLE 4 SUMMARY OF HYDRAULIC STRUCTURES - CROSSINGS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

LOCATION	CULVERT #	SIZE	TYPE	PROPOSED FLOW Q5 (cfs)	Q100 (cfs)	CAPACITY EXISTING	CAPACITY FUTURE (1)	COMMENTS
FONTAINE BLVD	3000-1	12'x28'	CBC	770	1,970	ADEQUATE	ADEQUATE	STRUCTURE HAS ADEQUATE CAPACITY TO PASS THE PROPOSED 100-YEAR FLOW
FONTAINE BLVD	3010-1	38"x54"	CMP ARCH	N/A	N/A	N/A	N/A	FOUNTAIN MUTAL IRRIGATION DITCH ROADWAY CROSSING
FONTAINE BLVD	3020-1	30"	CMP	530	1,100	INADEQUATE	INADEQUATE	CULVERT CAN CONVEY ONLY LOCALIZED ROADWAY DRAINAGE WHICH REACHES IT
FONTAINE BLVD	3020-2	38"x54"	CMP ARCH	NA	NA	N/A	N/A	FOUNTAIN MUTAL IRRIGATION DITCH ROADWAY CROSSING
FONTAINE BLVD	3020-3	30"	CMP	N/A	N/A	ADEQUATE	INADEQUATE	CULVERT CAN CONVEY ONLY LOCALIZED ROADWAY DRAINAGE WHICH REACHES IT
MARKSHEFFEL ROAD	5010-1	36"	CMP	1,700	4,830	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED
MARKSHEFFEL ROAD	5020-1	36"	CMP	150	360	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED
POWERS BOULEVARD	2010-1	30"	CMP	40	142	ADEQUATE	ADEQUATE	CULVERT TO BE REPLACED WITH CONSTRUCTION OF POWERS BOULEVARD
MARKSHEFFEL ROAD	4010-1	N/A	DETENTION BASIN	N/A	N/A	ADEQUATE	ADEQUATE	DETENTION BASIN SERVES THE COTTONWOOD GROVE SUBDIVISION
MARKSHEFFEL ROAD	4020-1	36" (est)	CMP	145	383	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED

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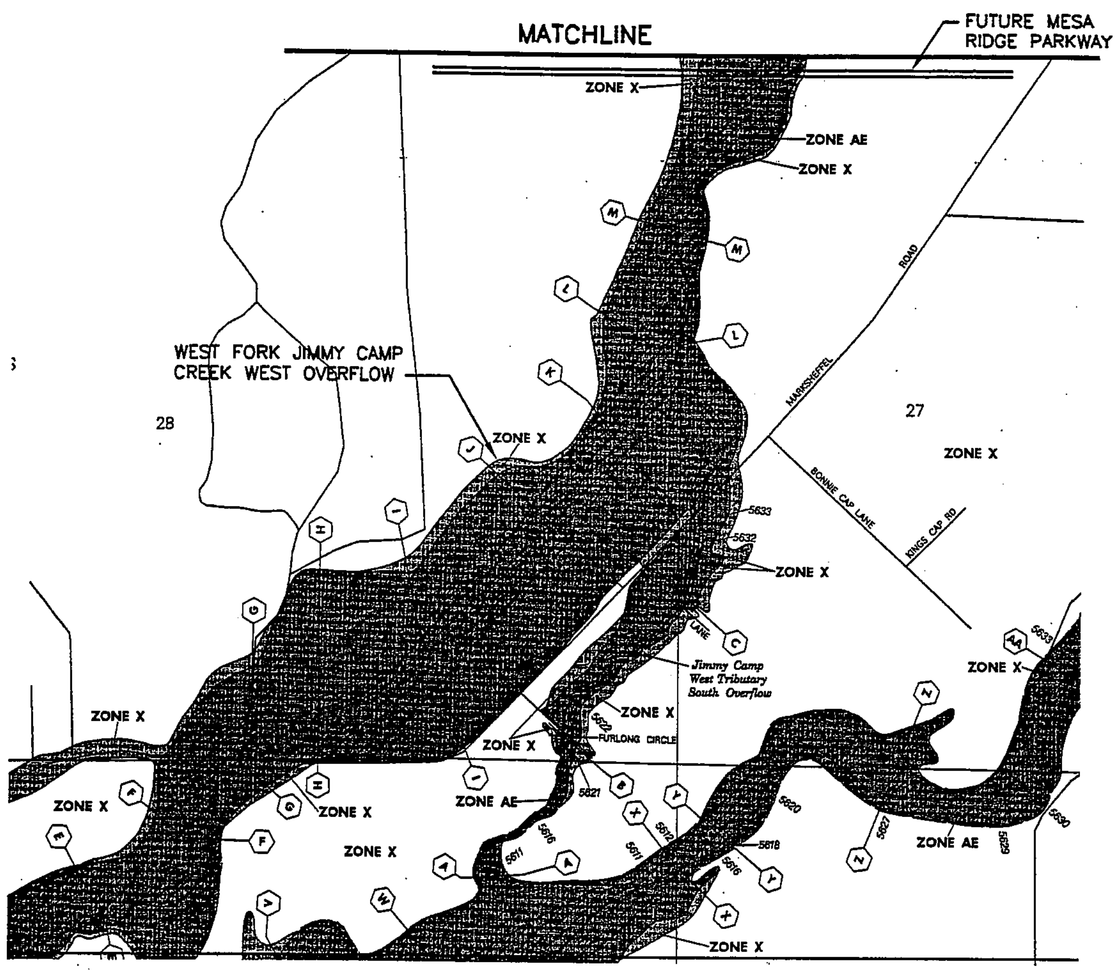
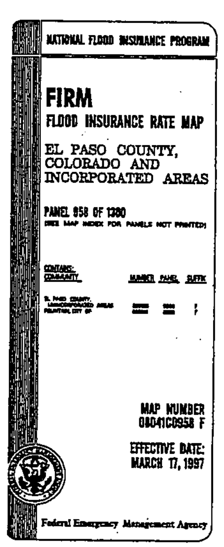
West Fork Jimmy Camp Creek
Drainage Basin Planning Study
INVENTORY OF EXISTING DRAINAGE STRUCTURES
EL PASO COUNTY, COLORADO

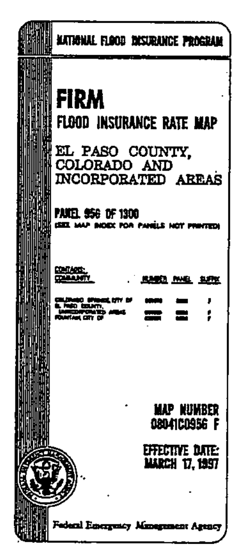
Project No.: 9893
Date: 6/99
Design: RNW
Drawn: CAD
Check: RNW
Revisions:

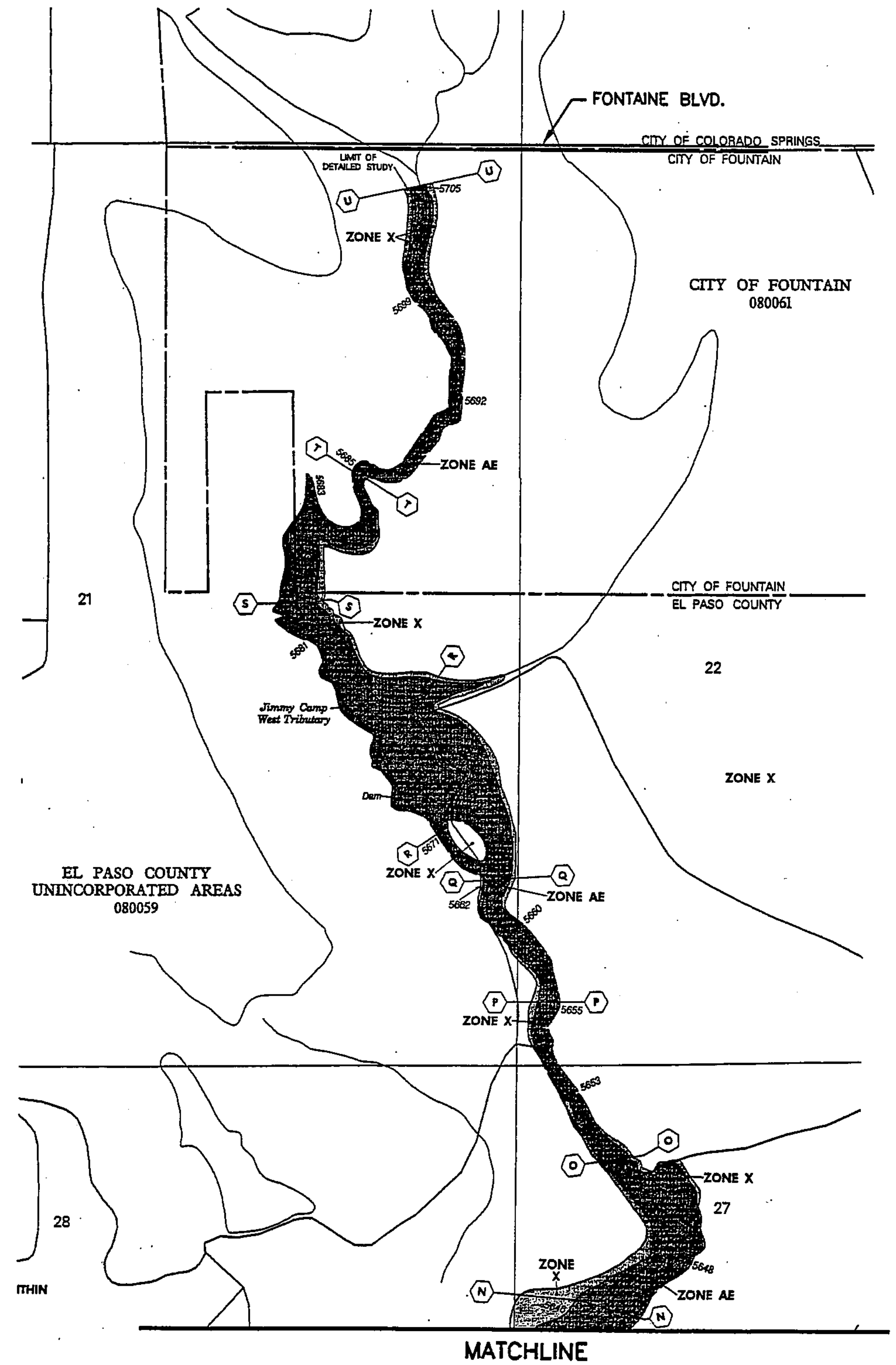
FIGURE 4

EXCERPT FROM PREVIOUS STUDY









SCALE: 1" = 1000'

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West Fork Jimmy Camp Creek
Drainage Basin Planning Study
FLOOD INSURANCE STUDY FLOODPLAINS
EL PASO COUNTY, COLORADO

Project No.: 9893
Date: 3/04
Design: RNW
Drawn: CAD
Check: RNW
Revisions:

FIG.5

V. EVALUATION OF ALTERNATIVES

Introduction

Alternative drainageway improvement concepts have been examined that address the existing and future stormwater management needs of the basin. Quantitative and qualitative comparisons are presented, and a recommendation made as to which concepts are most feasible to advance to preliminary design and eventually implementation.

The general planning goals to be achieved during the alternative evaluation phase were:

1. Identify stormwater facilities that will reduce existing floodplains and flooding problems within urbanized areas;
2. Provide stormwater management within developing areas of the basin in order to reduce the detrimental effects of runoff and sedimentation from disturbed areas;
3. Provide stormwater facilities that preserve and/or enhance the existing drainageway and areas adjacent to the drainageway that provide an environmental resource in the area;
4. Identify facilities which will minimize future operations and maintenance costs; and
5. Provide stormwater management facilities that will at least maintain and/or enhance the water quality characteristics of the basin.

The City/County Drainage Criteria Manual was used as a guide in the conceptual sizing of facilities. Planning goals were developed through the agency/individual coordination process.

Evaluation Parameters

The following list of parameters were considered when evaluating alternatives for addressing the long-term stormwater management needs for the basin:

- Flood Control
- Erosion Control
- Operation and Maintenance
- Recreation
- Right-of-way
- Transportation - Roadway and Trails
- Open Space/Aesthetics
- Land Use
- Water Quality
- Habitat
- Construction Cost
- Administration and Implementation

By reviewing the relative impact of future storm water runoff upon the major drainageways, each of the above evaluation parameters can be ranked. A minimal impact was assumed wherever the increase of runoff due to urbanization would cause little physical change along the drainageways with respect to a specific parameter. Neutral impact upon a given parameter was considered wherever the negative effects of increased runoff due to urbanization can be planned and mitigated for. High impact was considered wherever the existing channel section would be rendered unsuitable to provide for a given parameter in the future flow condition. Using data gathered with respect to flood hazard, habitat, erosion control, open space, transportation (more specifically trails), and right-of-way, conceptual alternatives were compared.

Environmental Resource Review

An environmental resource review was conducted for the major drainageways of the West Fork Jimmy Camp Creek basin. The resource review was conducted using aerial photographs of the basin and field visits to view areas of significant environmental resource. The most significant factors that have created the existing vegetative setting along the major drainageway (i.e., the West Fork and Drainageway A), have been the irrigation facilities and the land uses within the basin. Irrigation facilities that lie within the basin include the Fountain Mutual Irrigation Ditch and two open water storage areas that lie below the irrigation canal. Seepage from the ditch as well as from the lakes is the source of the water supply that has created and supported wetland areas along some segments of Drainageway A. Previous agricultural land use within the basin has changed the native vegetative cover due to over grazing and cultivation. Large areas of non-native vegetation has developed over the years along the drainageway and significant areas of weed infestation has occurred. It was also noted while viewing historic photographs of the basin that some of the wetland vegetation that has developed along Drainageway A has occurred after the development of the land that lies west of Powers Boulevard. It is suspected that lawn watering within these areas has contributed to the groundwater resources that support the growth of the wetland vegetation.

Two open water lakes exist within the basin. One occurs along segment 2160 of Drainageway A, north of future Mesa Ridge Parkway, and the other along segment 3040 of the West Fork Jimmy Camp Creek. Historically these lakes were used as a water supply to support the agricultural use of the land. At the perimeter and for three to four hundred feet upstream of the lakes, significant medium to high quality wetland and riparian zones exist. It is the intent of the landowner of the property adjacent to and upstream of these lakes to leave the lakes and the drainageways that outfall to them as open space.

Wetland and riparian zones were identified along segments 2090, 2050 and 2040 of Drainageway A. Wetland and riparian zones were identified along segments 3110, 3090, 3040, and 3030 of the West Fork Jimmy Camp Creek drainageway. The only other wetland resource identified occurs just north of Fontaine Boulevard, and below the Fountain Mutual Irrigation Canal. It is likely that disturbance and/or encroachment into these areas resulting from land development activities will require notification of the U. S. Army Corps of Engineers and probably the issuance of a 404 permit. Because of the quality and extent of the wetland and riparian areas the 404 permitting of drainageway improvements to handle the anticipated increase in runoff due to urbanization will have to consider avoidance and minimization of impact in the development of channel and detention basin alternatives.

Preliminary Matrix of Conceptual Alternatives

The alternative planning process included the evaluation of general drainageway planning concepts. The alternatives that are generally available when planning stormwater management facilities include:

1. Floodplain preservation (do nothing alternative),
2. Channelization, using various materials and of varying capacity,
3. Detention, on-site or regional,
4. Selective stabilization, and
5. Combinations of the above.

These concepts were qualitatively evaluated for each of the major drainageways and to some degree within each of the major land development parcels presented on Figure 2. The qualitative assessments were made using the information gathered in the field and from past or ongoing drainage assessments for areas within the West Fork Jimmy Camp Creek basin. A table that summarizes the qualitative evaluation of impacts is contained within Appendix B of this report.

Drainageway System Alternatives

A review of each drainageway alternative with respect to the evaluation parameters listed earlier was conducted. Based upon the technical work and field visits the alternative drainage concepts were developed. Alternatives for floodplain and channel sections and detention facilities have been evaluated.

Detention

As presented in the Hydrology Section of this report, it has been estimated that peak discharges and volumes will increase significantly along the major drainageways of the West Fork Jimmy Camp Creek as a result of urbanization within the basin. Another impact that urbanization will have upon the basin hydrology is that "everyday" rainfall events will increase in their peak rates of runoff, frequency, and duration. This will create greater instability in the existing channel sections as well as increase flood hazards if the runoff is allowed to flow through the basin in the developed condition. Detention schemes were analyzed in the alternative planning process in order to address this situation. Because of the high level of urbanization that has been assumed for this basin, increases in peak flows for the frequencies analyzed can double or triple. The increase in runoff becomes a significant burden for those properties lying low in the basin, such as the Glen at Widefield and the Cross Creek at Mesa Ridge developments. At this time the City of Fountain requires detention to limit flows to downstream drainageways to historic levels.

Two distinct types of detention can be considered within this basin. One form of stormwater detention is onsite detention. Onsite detention is accomplished within a single subdivision or within each developed parcel. Onsite detention basins are generally small with 100-year storage volumes typically less than two to three acre-feet. These detention basins typically discharge to a storm sewer system or collector channels that in turn discharge to the major drainageways. One of the negative aspects of this concept is that the detention basins present a long-term maintenance responsibility to private property owners and for the local agencies that may provide for stormwater facility maintenance. In Colorado Springs and El Paso County, onsite detention basins have generally been categorized as private drainage facilities and the long-term maintenance is left up to the property owner(s). There is currently one onsite detention facility in the basin within the Cottonwood Grove Subdivision.

The other form of detention is regional stormwater detention. Regional detention basins usually serve a greater drainage area and many times more than one property. Regional detention basins have storage volumes in excess of 5-acre feet. Regional detention basins can be constructed along of and off of the main drainageways. Whether on stream or off stream regional detention basins are to be considered depend upon the total flow volume, site availability and peak flow rates. For the West Fork Jimmy Camp Creek basin, on stream detention facilities are feasible within the upper portions of the West Fork Jimmy Camp Creek (i.e., above Fontaine Boulevard), and along Drainageway A. In the lower reaches of the West Fork Jimmy Camp Creek drainageway, the use of on stream detention is not as feasible since site availability is limited.

Based upon the qualitative review of impacts, it is recommended that regional detention be considered over onsite detention. The primary reasons for this recommendation is founded on the environmental impact, maintenance and ownership aspects associated with stormwater detention. Regional detention facilities are less maintenance intensive compared to onsite facilities simply because there would be fewer regional detention basins required. Regional detention basins have greater accessibility with respect to maintenance and can be designed to be physically more open and broad in their design. Regional detention basins can also offer a resource to the area in regard to open space dedication and wetland mitigation areas if necessary. For the West Fork Jimmy Camp Creek basin, regional detention may be a more feasible solution to implement owing to the fact that there are a limited number of major developments within the basin which will develop at their own pace. Once a regional detention facility was established, a greater area of development can then proceed without being encumbered by the construction of small onsite facilities.

Floodplain Preservation

This concept involves the preservation of the natural floodplains in combination with the provision of open space buffer adjacent to the urbanized area. This concept works well wherever the floodplain and channel area is well defined and stable with respect to vegetative invert and bank linings. Within the West Fork Jimmy Camp Creek basin, channel segments 3030, 2090, 3000, 3010 and 3021 each have characteristics that make the implementation of a floodplain preservation concept feasible. These channels and floodplains are well defined and naturally stabilized with native vegetation. For channels 5010, 3110, 3020 and 2160 floodplain preservation is less feasible due to the poor channel definition that presently characterizes these segments. This situation is most evident in segments 5010, 3110 and 2160 where the 100-year floodplain is very wide and uncontained by the existing banks of the drainageway.

The implementation of a floodplain preservation plan can not be considered without the assumption that the channel invert will remain stable. To achieve this grade control structures need to be constructed at an interval that depends upon the existing stream gradient and the invert soils. Selective areas of bank lining may also be required to implement a floodplain preservation concept. Lining of the low flow area of the floodplain on one or both sides may be necessary at outside bends and at the inlet and outlet of culverts and bridges.

Channelization

This concept would involve the construction of lined channels generally trapezoidal in shape. Riprap lined channels are the most common lining material. Within the West Fork Jimmy Camp Creek basin, channel segments 5010, 3110, 3020 and 2160 have the greatest feasibility for channelization due to the reasons pointed out above. Grade control structures to maintain the channel invert at constant and stable gradient would be required.

<u>Conclusions</u>

Based upon the qualitative alternative evaluation process, the following findings were established:

1. Detention is a desirable and feasible alternative to addressing the future stormwater management needs of the basin. The primary advantages of the implementation of a regional detention concept are in the areas of floodplain hazard and damage reduction, reduction in channel and roadway crossing costs, habitat preservation, and in open space. Disadvantages with the concept are in the areas of implementation and detention basin right-of-way or land acquisition issues.

2. Feasible channel alternatives for the major drainageway range from the floodplain preservation, or "do nothing" alternate to riprap bank linings. Along the West Fork Jimmy Camp Creek drainageways, floodplain preservation is feasible in segments 3030, 2090, 3000, 3010 and 3021. The implementation of the floodplain preservation concept will maintain the existing floodplains and natural vegetation that is presently keeping the channel bank and invert stable. Proposing to channelize these segments may result in permitting or environmental concerns by the 404 review agencies. Grade control structures to stabilize the drainageways will be required to address the potential for stream invert degradation that can occur because of increased runoff volumes due to urbanization.

3. Channelization is feasible within segments 5010, 3110, 3020 and 2160. Grade control structures to stabilize the invert of the channel will be required. The channelization of segments 5010 and 3110 would result in significant reductions in the extent of the 100-year floodplain.

EXCERPT FROM PREVIOUS STUDY

VI. SELECTED PLAN

The results of the drainage basin planning analysis are summarized in this section. The alternative drainage concepts have been quantitatively and qualitatively evaluated. Field visits have been conducted in order to refine the channel treatments suggested for use along drainageways of the West Fork Jimmy Camp Creek basin. The conceptual plan for the recommended alternatives is shown on Figure 6 contained in the map pocket at the rear of this report.

Criteria

The City of Colorado Springs, El Paso County Drainage Criteria Manual was used in the development of the typical sections and plans for the major drainageways within the Basin. The City/County manual was supplemented by various criteria manuals with more specific application. These were:

1. Urban Storm Drainage Criteria Manual, Volumes I, II, and III, prepared by the Urban Drainage and Flood Control District.

The design plans and report for the Powers Boulevard extension through the basin were reviewed in order to prepare the conceptual design plans. The master land development plans for the Cross Creek at Mesa Ridge, The Glen at Widefield, and the Crescent Heights developments were reviewed and taken into account in the selection of the channel sections and detention basin locations. Hydrologic data prepared for the Colorado Centre contained in the Jimmy Camp Creek Drainage Basin Planning Study prepared by Wilson & Company was reviewed and incorporated into this plan.

The general design criteria followed for the sizing of the facilities shown on Figure 6 were:

1. Average channelized velocity for riprap channels: 7 feet per second
2. Maximum 100-year channel depth: 5-feet
3. Degraded channel slope: One-half of existing slope
4. Maximum culvert headwater to depth ratio: 1.2
5. Bridge velocity: 10 feet per second
6. Maximum height of detention basin embankment: 10-feet

Hydrology

Presented on Table 6 is the selected detention basin plan hydrologic data to be used for the sizing of major drainageway improvements within the Basin. **Peak flow rates for the 5- and 100-year frequency incorporating and the regional detention alternative for the West Fork Jimmy Camp Creek Basin are summarized for key points along the major drainageways.** Contained within the appendices of this report are the HEC-1 input and output data for the baseline and detention basin hydrologic conditions.

Land development activities may alter the location of design points along the drainageways and therefore slight alteration in a sub-basin's characteristics such as length, slope and area may occur. The methods outlined in the City/County Drainage Criteria Manual should be applied during master development and final development drainage plan phases.

Channels

The recommended channel sections for each reach of drainageway has been presented on Sheets 1 through 7 at the rear of this report. In general, the banks of the West Fork of Jimmy Camp Creek within segments 5010, 2160, 3110 and 3020 are to be lined with riprap to 100-year flow depth. Within segments 3030, 2090, 3000, 3010, and 3021 the drainageway low flow areas should have selectively lined riprap bank protection such as at outside bends, at bridge or culvert outlets, and at the confluence with side tributaries. In conjunction with the selective improvement measures, the 100-year floodplain should be preserved and regulated.

Check Structures

Check structures have been sited along the drainageways in order to maintain the channel invert at a stable gradient. A degraded slope of no more than one-half of the existing slope was assumed when estimating the number of check structures needed along a given segment. The checks have been conceptually designed to allow for a maximum drop of three feet once the degraded slope has been reached. Check structures are needed along the floodplain preservation and channelized segments. In the segments to be selectively lined, check structures will protect the native vegetation from the detrimental effects of stream invert headcutting. A typical check structure detail has been presented on Sheet 7.

Detention

The recommended plan calls for the construction of regional detention basins within the West Fork Jimmy Camp Creek Basin. The locations of the regional detention basins are shown on sheets 1 through 6. The purpose of the detention basins is to limit peak discharges at the basin's outfall to Jimmy Camp Creek to the existing hydrologic condition. The regional basins have also been sited within each of the major land developments in order to more locally control runoff to existing levels. Regional detention basins at design points 3030, 3020 and 2090 are onstream basins and the remainder will be off-stream basins. It is not anticipated that any of the regional detention basins will be subject to State Engineer's regulations. Each of the regional basins will have to be designed taking into account the geotechnical considerations at each site. Specific design criteria for detention basins can be found in the City/County Storm Drainage Criteria Manual. It may be possible to consolidate two or more of the smaller detention basins. This can be determined during the master development and final development planning phases. During the initial development stages of a sub-basin that is tributary to a regional detention facility, temporary detention basins may need to be constructed until such time that the regional facility shown in this plan has been constructed. A summary of the detention basin characteristics is presented on Table 7 and on sheets 1 through 6.

Stormwater quality measures should be designed into the regional stormwater detention basins. These measures would include the provision of a water quality and sediment pool area in addition to the volume required for stormwater detention. Forebays at the inlet to all of the regional detention facilities is recommended. The water quality capture volume for each of the detention basins should be calculated as part of the final design of these facilities. Criteria and methodology for the sizing and the design of the water quality measures for stormwater detention facilities features can be found within Volume III of the Urban Storm Drainage Criteria Manual.

Roadway Crossings

Summarized on Sheets 1 through 7 are the size, type and location of roadway crossings along the major drainageways. The location of future arterials and collector streets was obtained from the various development plans for the major land developments within the basin. A summary of the roadway crossings is provided on Table 8.

Trails

Trails for access to the detention basins and drainageways need to be incorporated into the design of the improvements. For this basin, multi-purpose trails that can be used for open space, channel maintenance and utility access is recommended. The siting of a trail along a drainageway should be carried out taking into account hydraulic considerations, utilities in the area, access to dedicated parks and roadway crossings. Maintenance access to the drainageway and to existing utilities within the drainageway corridor can offer a multiple use aspect to a trail project. The design of the trails along the drainageways will be mostly dependent upon the type of development adjacent to the particular drainageway.

Maintenance and Revegetation

Maintenance of drainageway facilities is essential in preventing long term degradation of the drainageway and overbank areas. Along the drainageway, clearing of debris and dead vegetation should be considered within the low flow area of the creek and its tributaries. On the overbanks, limited maintenance of the existing vegetative cover is recommended. Yearly clearing of trash and debris at roadway crossings is also recommended to ensure the design capacity of the crossing, and to enhance the crossings for trail users if a trail exists. Caution should be taken when clearing culverts of sediment so as not to leave the dredged soil within the channel or overbank area. This disturbs the native vegetation and creates a potential water quality concern if the dredged material is subsequently washed into the drainageway by natural erosion. In those reaches designated to be selectively lined and the floodplain preserved, maintenance activities should be carried out while minimizing the disturbances to native vegetation.

Right-of-Way

For the most part the main channels within the basin which pass through undeveloped areas and the right-of-way can be dedicated as part of the land development process. For those segments of the drainageway where floodplain preservation is the recommended plan, a combination of open space dedication (such as park-land and greenbelts), in combination with a more narrow dedicated right-of-way along the low flow area of the drainageway should be obtained through the land development process. Land acquisition will be required for the regional detention basins. The dedication of easements and right-of-way for the drainageways and detention basins would be accomplished at the time of development planning and platting of the parcels that lie adjacent to or upstream of the stormwater facility.

Erosion and Sedimentation Control

Soils in the West Fork Jimmy Camp Creek basin vary widely and because of this, areas within the basin are subject to varying degrees of hazard resulting from sediment being transported to the drainageway(s). During the collection of field and drainage inventory data, some areas were noted which were being impacted by either erosion (of one form or another), or sediment deposition. The soil make up of the basin is generally highly erodible, and this is particularly the case in the upper portions of the drainageway where the channel has a sand bottom and the watersheds have poor to fair vegetative cover. The disturbance of the native

EXCERPT FROM PREVIOUS STUDY

TABLE 7

SUMMARY OF DETENTION BASIN DATA

WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

DETENTION BASIN NO.	STORAGE (AF)	JURISDICTION	OUTLET PIPE SIZE	Q100 IN (cfs)	Q100 OUT (cfs)
3021	80.0	CITY OF CS	2-8'Hx15'W CBC	2740	1810
4011	8.4	CITY OF FOUNTAIN	54" RCP	279	157
3061	2.0	CITY OF FOUNTAIN	60" RCP	190	165
3031	12.0	CITY OF FOUNTAIN	2-8'Hx15'W CBC	2010	1970
4021	8.4	EL PASO COUNTY	4'H x 8'W CBC	265	210
3091	4.0	EL PASO COUNTY	48" CMP	138	107
3101	6.1	EL PASO COUNTY	54" CMP	166	116
2091	4.1	EL PASO COUNTY	N/A	535	473
5011	9.0	EL PASO COUNTY	60" CMP	250	130
5021	10.5	EL PASO COUNTY	4'H x 8'W	360	190

TABLE 8

SUMMARY OF MAJOR ROADWAY CROSSINGS

WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

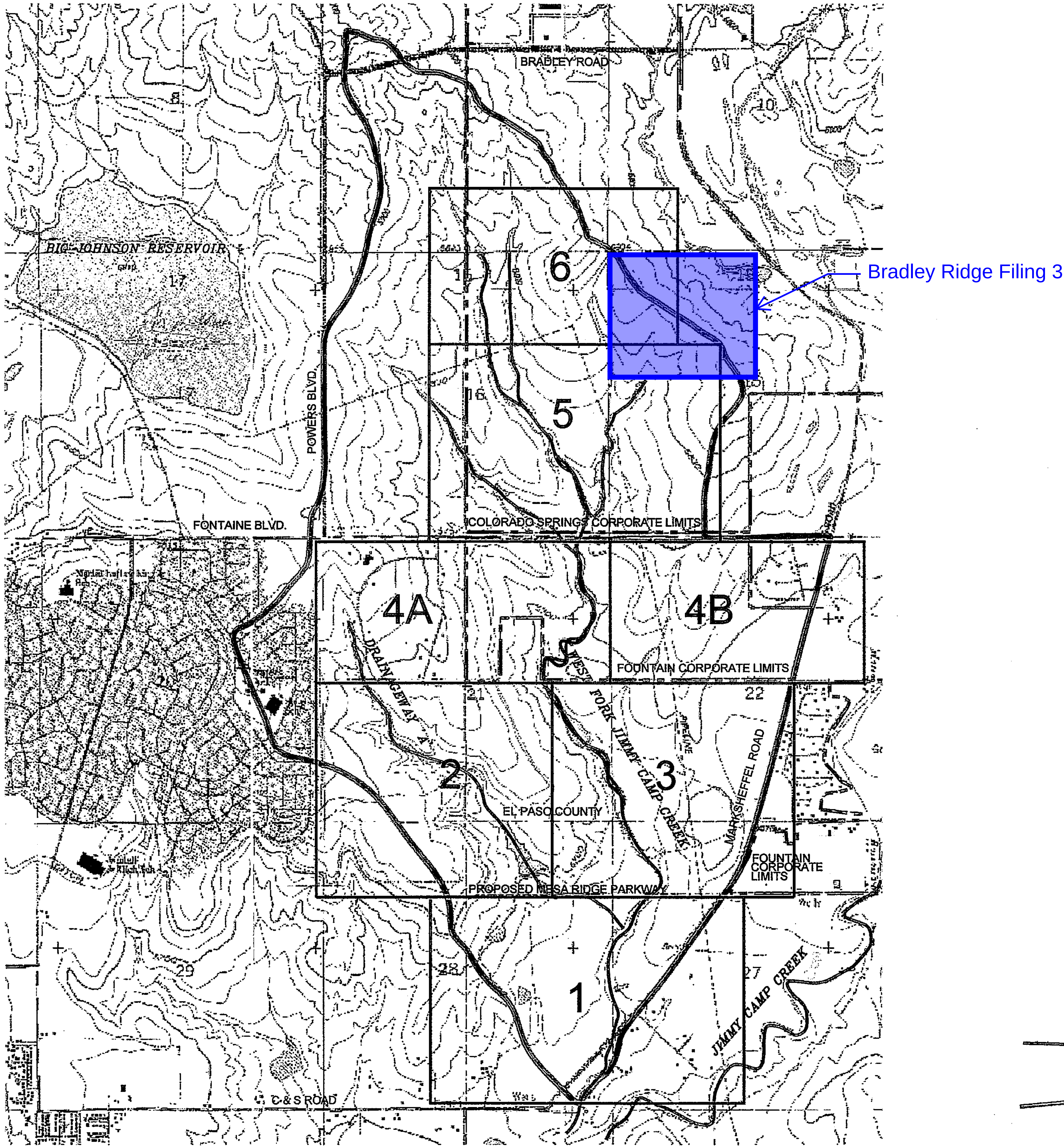
ROADWAY CROSSING #	TRIBUTARY DRAINAGEWAY	ROADWAY	FLOW RATE 100-year (cfs)	SIZE	TYPE
2160	DRAINAGEWAY A	MESA RIDGE PARKWAY	620	2-5'x8'	CBC
2160	DRAINAGEWAY A	PROPOSED SNEFFELS ROAD	620	2-5'x8'	CBC
2091	DRAINAGEWAY A	FUTURE ARTERIAL	470	1-5'x12'	CBC
2050	DRAINAGEWAY A	WAYFARER LANE	430	1-4'x12'	CBC
2110	TRIBUTARY TO DRAINAGEWAY A	FUTURE ARTERIAL	30	1-36"	CMP
5011	WEST FORK JIMMY CAMP CREEK	MARKSHEFFEL ROAD	3320	75'	BRIDGE
5010	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	3320	5-6'H x 15'W	CBC
3110	WEST FORK JIMMY CAMP CREEK	MESA RIDGE PARKWAY	2630	50'	BRIDGE
3092	WEST FORK JIMMY CAMP CREEK	FUTURE EAST ARTERIAL	2510	50'	BRIDGE
3081	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	105	54"	RCP
3080	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	72	48"	RCP
3070	TRIBUTARY DRAINAGEWAY	FUTURE EAST ARTERIAL	190	4'H x 8'W	CBC
3000-1	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	570	5'H x 18'W'	CBC
3000-2	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	380	5'H x 12'W'	CBC
3005-1	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	205	4'H x 9'W'	CBC
3005-2	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	410	5'H x 12'W'	CBC
3000	WEST FORK JIMMY CAMP CREEK	FUTURE ARTERIAL	935	2-6'H x 12'W	CBC
3010	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	380	5'H x 12'W	CBC
3020	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	420	5'H x 12'W	CBC
3025	TRIBUTARY DRAINAGEWAY	FUTURE ARTERIAL	910	2-6'H x 12'W	CBC
3030	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	1850	2-8'x15'	CBC
3040	TRIBUTARY DRAINAGEWAY	FUTURE EAST ARTERIAL	360	5'H x 10'W	CBC
3040	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	360	5'H x 10'W	CBC
3060	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	195	4'H x 8'W	CBC
4030	DFA 4030	MARKSHEFFEL ROAD	50	42"	CMP
4010	DFA 4010	FUTURE COLLECTOR	280	4'H x 10'W	CBC

EXCERPT FROM PREVIOUS STUDY

SELECTED PLAN DRAWINGS
SHEETS 1 - 7

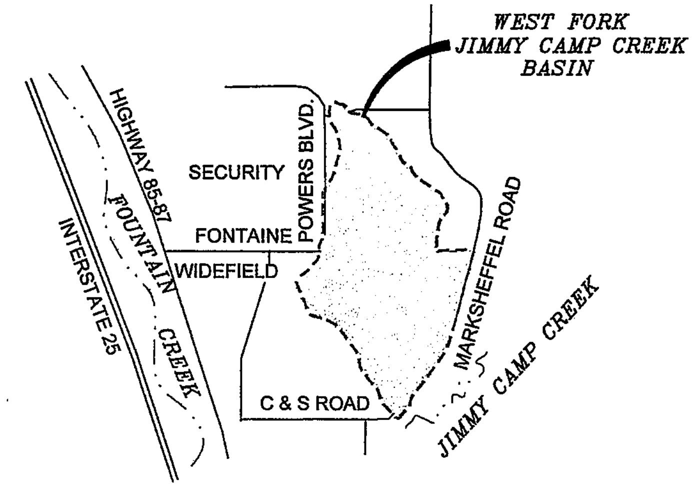
APPENDIX C

EXCERPT FROM PREVIOUS STUDY



INDEX MAP

NTS



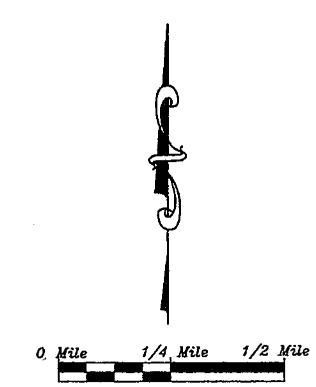
VICINITY MAP

NTS

LEGEND

STREAM INVERT

BASIN DIVIDE



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WEST FORK JIMMY CAMP CREEK
DRAINAGE BASIN PLANNING STUDY
PRELIMINARY PLAN
EL PASO COUNTY, COLORADO

Project No.: 9893
Date: 2/00
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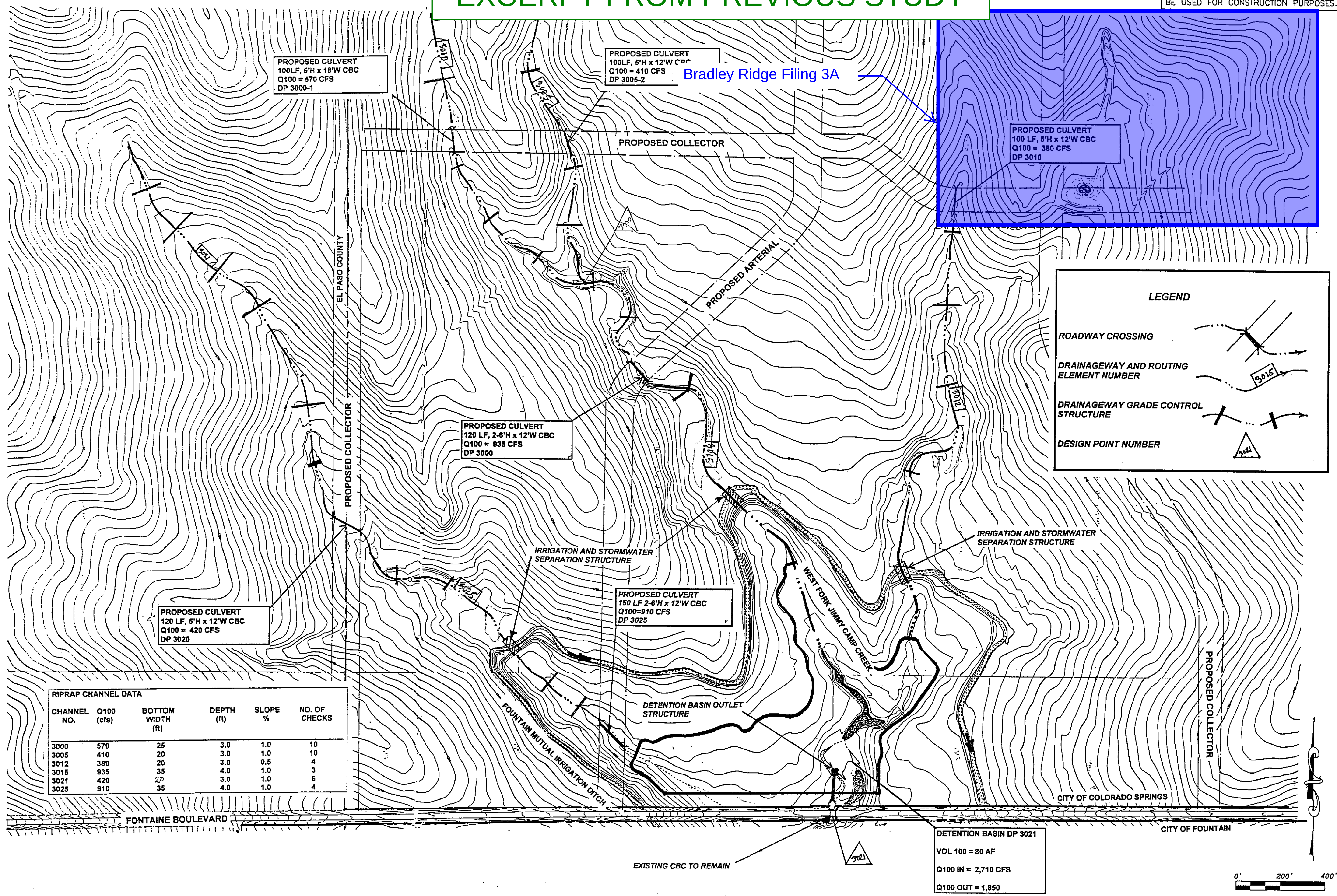
Drawn: CAD
Check: RNW
Revisions:

INDEX

EXCERPT FROM PREVIOUS STUDY

THIS DRAWING IS A MASTER PLANNING SHEET REPRESENTING PRELIMINARY AND CONCEPTUAL ENGINEERING. IT SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.



RIPRAP CHANNEL DATA

CHANNEL NO.	Q100 (cfs)	BOTTOM WIDTH (ft)	DEPTH (ft)	SLOPE %	NO. OF CHECKS
3000	570	25	3.0	1.0	10
3005	410	20	3.0	1.0	10
3012	380	20	3.0	0.5	4
3015	935	35	4.0	1.0	3
3021	420	20	3.0	1.0	6
3025	910	35	4.0	1.0	4

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WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

PRELIMINARY PLAN
EL PASO COUNTY, COLORADO

Project No.: 9893
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EXCERPT FROM PREVIOUS STUDY

TABLE 4: SUMMARY OF HYDRAULIC STRUCTURES - CROSSINGS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

LOCATION	CULVERT #	SIZE	TYPE	PROPOSED FLOW Q5 (cfs)	PROPOSED FLOW Q100 (cfs)	CAPACITY EXISTING	CAPACITY FUTURE (1)	COMMENTS
FONTAINE BLVD	3000-1	12'x28'	CBC	770	1,970	ADEQUATE	ADEQUATE	STRUCTURE HAS ADEQUATE CAPACITY TO PASS THE PROPOSED 100-YEAR FLOW
FONTAINE BLVD	3010-1	36"x54"'	CMP ARCH	N/A	N/A	N/A	N/A	FOUNTAIN MUTAL IRRIGATION DITCH ROADWAY CROSSING
FONTAINE BLVD	3020-1	30"	CMP	530	1,100	INADEQUATE	INADEQUATE	CULVERT CAN CONVEY ONLY LOCALIZED ROADWAY DRAINAGE WHICH REACHES IT
FONTAINE BLVD	3020-2	36"x54"'	CMP ARCH	NA	NA	N/A	N/A	FOUNTAIN MUTAL IRRIGATION DITCH ROADWAY CROSSING
FONTAINE BLVD	3020-3	30"	CMP	N/A	N/A	ADEQUATE	INADEQUATE	CULVERT CAN CONVEY ONLY LOCALIZED ROADWAY DRAINAGE WHICH REACHES IT
MARKSHEFFEL ROAD	5010-1	36"	CMP	1,700	4,830	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED
MARKSHEFFEL ROAD	5020-1	36"	CMP	150	360	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED
POWERS BOULEVARD	2010-1	30"	CMP	40	142	ADEQUATE	ADEQUATE	CULVERT TO BE REPLACED WITH CONSTRUCTION OF POWERS BOULEVARD
MARKSHEFFEL ROAD	4010-1	N/A	DETENTION BASIN	N/A	N/A	ADEQUATE	ADEQUATE	DETENTION BASIN SERVES THE COTTONWOOD GROVE SUBDIVISION
MARKSHEFFEL ROAD	4020-1	36" (est)	CMP	145	383	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED

EXCERPT FROM PREVIOUS STUDY

TABLE 5: SUMMARY OF HYDRAULIC STRUCTURES - DRAINAGEWAYS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

LOCATION	SEGMENT #	SLOPE (Percent)	TYPE	100-YEAR FLOW RANGE Qex (cfs)	Qfut (cfs)	COMMENTS
WEST FORK JIMMY CAMP CREEK						
JIMMY CAMP CREEK TO MARKSHEFFEL ROAD	5010	0.3	UNIMPROVED	3,590	4,830	DRAINAGEWAY OUTFALLS TO JIMMY CAMP CREEK
MARKSHEFFEL ROAD TO MESA RIDGE PARKWAY	3110	0.6	UNIMPROVED	2,860-3,590	3,390-4,830	WIDE AND SHALLOW FLOODPLAIN
MESA RIDGE PARKWAY TO N PL OF THE GLEN	3030	0.7	UNIMPROVED	2,275-2,860	3,190-3,390	CHANNEL STABLE AND WELL VEGETATED WITH WETLAND AND NATIVE GRASSES
NORTH PL OF THE GLEN TO FONTAINE BOULEVARD	3020	0.8	UNIMPROVED	1,930-2,275	2,710-3,190	
FONTAINE BLVD TO STUDY LIMITS	3000	1.0	UNIMPROVED	880	1,050	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
FONTAINE BLVD TO STUDY LIMITS	3010	1.0	UNIMPROVED	480	640	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
FONTAINE BLVD TO STUDY LIMITS	3021	0.8	UNIMPROVED	620	1,100	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
DRAINAGEWAY A						
CONFLUENCE WITH WEST FORK JIMMY TO LAKE	2160	2.6	UNIMPROVED	620	720	
LAKE TO DESIGN POINT DP2040	2090	1.8	UNIMPROVED	335-620	360-720	CHANNEL STABLE AND WELL VEGETATED WITH WETLAND AND NATIVE GRASSES

EXCERPT FROM PREVIOUS STUDY

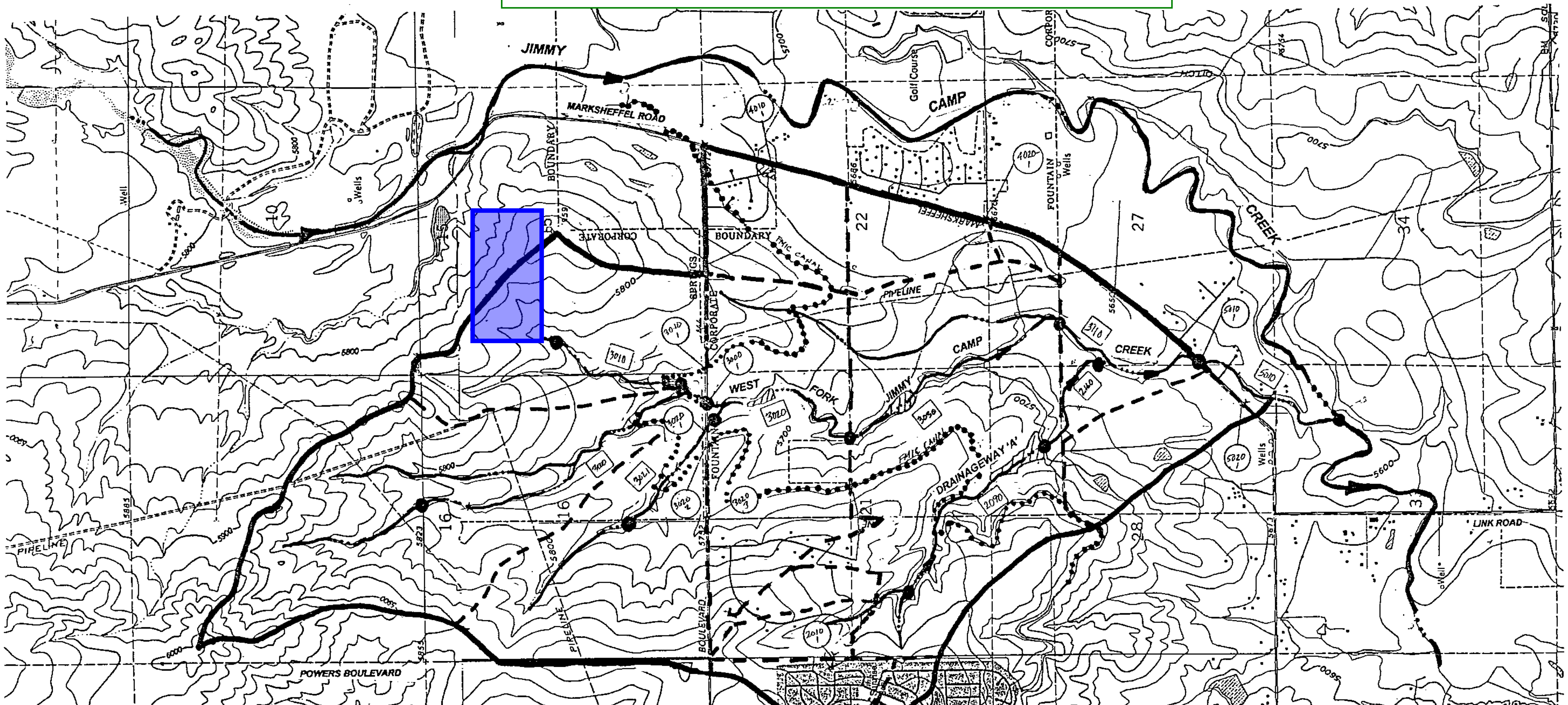

TABLE 5 SUMMARY OF HYDRAULIC STRUCTURES - DRAINAGEWAYS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

LOCATION	SEGMENT #	SLOPE (Percent)	TYPE	100-YEAR FLOW RANGE Qex (cfs)	Qful (cfs)	COMMENTS
WEST FORK JIMMY CAMP CREEK						
JIMMY CAMP CREEK TO MARKSHEFFEL ROAD	5010	0.3	UNIMPROVED	3,580	4,630	DRAINAGEWAY OUTFALLS TO JIMMY CAMP CREEK
MARKSHEFFEL ROAD TO MESA RIDGE PARKWAY	3110	0.6	UNIMPROVED	2,860-3,580	3,390-4,630	WIDE AND SHALLOW FLOODPLAIN
MESA RIDGE PARKWAY TO N. PL. OF THE GLEN	3030	0.7	UNIMPROVED	2,275-2,860	3,190-3,390	CHANNEL STABLE AND WELL VEGETATED WITH WETLAND AND NATIVE GRASSES
NORTH PL. OF THE GLEN TO FONTAINE BOULEVARD	3020	0.8	UNIMPROVED	1,930-2,275	2,710-3,190	
FONTAINE BLVD TO STUDY LIMITS	3000	1.0	UNIMPROVED	860	1,060	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
FONTAINE BLVD TO STUDY LIMITS	3010	1.0	UNIMPROVED	480	640	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
FONTAINE BLVD TO STUDY LIMITS	3021	0.8	UNIMPROVED	420	1,100	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
DRAINAGEWAY A						
CONFLUENCE WITH WEST FORK JIMMY TO LAKE	2100	2.6	UNIMPROVED	620	720	
LAKE TO DESIGN POINT DP2040	2090	1.8	UNIMPROVED	335-620	390-720	CHANNEL STABLE AND WELL VEGETATED WITH WETLAND AND NATIVE GRASSES

TABLE 4 SUMMARY OF HYDRAULIC STRUCTURES - CROSSINGS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

LOCATION	CULVERT #	SIZE	TYPE	PROPOSED FLOW Q5 (cfs)	Q100 (cfs)	CAPACITY EXISTING	CAPACITY FUTURE (1)	COMMENTS
FONTAINE BLVD	3000-1	12'x28'	CBC	770	1,970	ADEQUATE	ADEQUATE	STRUCTURE HAS ADEQUATE CAPACITY TO PASS THE PROPOSED 100-YEAR FLOW
FONTAINE BLVD	3010-1	36"x54"	CMP ARCH	N/A	N/A	N/A	N/A	FOUNTAIN MUTAL IRRIGATION DITCH ROADWAY CROSSING
FONTAINE BLVD	3020-1	30"	CMP	530	1,100	INADEQUATE	INADEQUATE	CULVERT CAN CONVEY ONLY LOCALIZED ROADWAY DRAINAGE WHICH REACHES IT
FONTAINE BLVD	3020-2	36"x54"	CMP ARCH	NA	N/A	N/A	N/A	FOUNTAIN MUTAL IRRIGATION DITCH ROADWAY CROSSING
FONTAINE BLVD	3020-3	30"	CMP	N/A	N/A	ADEQUATE	INADEQUATE	CULVERT CAN CONVEY ONLY LOCALIZED ROADWAY DRAINAGE WHICH REACHES IT
MARKSHEFFEL ROAD	5010-1	36"	CMP	1,700	4,630	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED
MARKSHEFFEL ROAD	5020-1	36"	CMP	150	360	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED
POWERS BOULEVARD	2010-1	30"	CMP	40	142	ADEQUATE	ADEQUATE	CULVERT TO BE REPLACED WITH CONSTRUCTION OF POWERS BOULEVARD
MARKSHEFFEL ROAD	4010-1	N/A	DETENTION BASIN	N/A	N/A	ADEQUATE	ADEQUATE	DETENTION BASIN SERVES THE COTTONWOOD GROVE SUBDIVISION
MARKSHEFFEL ROAD	4020-1	36" (est)	CMP	145	383	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED

LEGEND

- ROADWAY CROSSING DESIGNATION (3020 2)
- DRAINAGEWAY DESIGNATION (3110)
- FOUNTAIN MUTUAL IRRIGATION DITCH
- EXISTING IMPOUNDMENT

0' 1000' 2000'

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West Fork Jimmy Camp Creek
Drainage Basin Planning Study
INVENTORY OF EXISTING DRAINAGE STRUCTURES
EL PASO COUNTY, COLORADO

Project No.: 9893
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Drawn: CAD
Check: RNW
Revisions:

FIGURE 4

EXCERPT FROM PREVIOUS STUDY

TABLE 8
SUMMARY OF MAJOR ROADWAY CROSSINGS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

ROADWAY CROSSING #	TRIBUTARY DRAINAGEWAY	ROADWAY	FLOW RATE 100-year (cfs)	SIZE	TYPE
2160	DRAINAGEWAY A	MESA RIDGE PARKWAY	620	2-5'x8'	CBC
2160	DRAINAGEWAY A	PROPOSED SNEFFELS ROAD	620	2-5'x8'	CBC
2091	DRAINAGEWAY A	FUTURE ARTERIAL	470	1-5'x12'	CBC
2050	DRAINAGEWAY A	WAYFARER LANE	430	1-4'x12'	CBC
2110	TRIBUTARY TO DRAINAGEWAY A	FUTURE ARTERIAL	30	1-36"	CMP
5011	WEST FORK JIMMY CAMP CREEK	MARKSHEFFEL ROAD	3320	75'	BRIDGE
5010	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	3320	5-6'H x 15'W	CBC
3110	WEST FORK JIMMY CAMP CREEK	MESA RIDGE PARKWAY	2630	50'	BRIDGE
3092	WEST FORK JIMMY CAMP CREEK	FUTURE EAST ARTERIAL	2510	50'	BRIDGE
3081	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	105	54"	RCP
3080	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	72	48"	RCP
3070	TRIBUTARY DRAINAGEWAY	FUTURE EAST ARTERIAL	190	4'H x 8'W	CBC
3000-1	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	570	5'H x 18'W'	CBC
3000-2	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	380	5'H x 12'W'	CBC
3005-1	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	205	4'H x 9'W'	CBC
3005-2	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	410	5'H x 12'W'	CBC
3000	WEST FORK JIMMY CAMP CREEK	FUTURE ARTERIAL	935	2-6'H x 12' W	CBC
3010	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	380	5'H x 12'W	CBC
3020	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	420	5'H x 12'W	CBC
3025	TRIBUTARY DRAINAGEWAY	FUTURE ARTERIAL	910	2-6'H x 12'W	CBC
3030	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	1850	2-8'x15'	CBC
3040	TRIBUTARY DRAINAGEWAY	FUTURE EAST ARTERIAL	360	5'H x 10'W	CBC
3040	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	360	5'H x 10'W	CBC
3060	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	195	4'H x 8'W	CBC
4030	DFA 4030	MARKSHEFFEL ROAD	50	42"	CMP
4010	DFA 4010	FUTURE COLLECTOR	280	4'H x 10'W	CBC

EXCERPT FROM PREVIOUS STUDY

HYDRAULIC CALCULATIONS

APPENDIX B

EXCERPT FROM PREVIOUS STUDY

WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

SUMMARY OF CHANNEL IMPROVEMENTS
RIPRAP LINED

"n"= 0.04 SS 3 H TO 1 V.
DEPTH = 3 FT AVERAGE VELOCITY = 7 FPS MAX VEL 9 FPS

CHANNEL NUMBER	DRAINAGE NAME	CHANNEL LENGTH (FT)	100-YEAR FLOW (CFS)	REQD. AREA (S.F.)	CHANNEL DEPTH (FT)	EX. SLOPE (FT/FT)	FUTURE SLOPE (FT/FT)	CHANNEL BOTTOM WIDTH	CHANNEL TOP WIDTH	HYDR. RADIUS (FEET)	R.O.W. REQD. (FEET)	DROP IN SEGMENT (FT)	NUMBER OF CHECK STRUC.
5012	WFJC	1400	3320	474	5.0	0.003	0.003	100	130	4.43	160	0.0	0
5011	WFJC	1270	3190	456	5.0	0.006	0.004	90	120	4.38	150	2.5	2
5010	WFJC	2050	2640	377	4.0	0.006	0.004	90	114	3.59	144	4.1	3
3110	WFJC	870	2500	357	4.0	0.006	0.004	90	114	3.59	144	1.7	1
3040	WFJC	2350	360	51	3.0	0.025	0.010	20	38	2.28	68	35.3	11
3030-1	WFJC	1060	1850	264	4.0	0.030	0.010	65	89	3.47	119	21.2	5
3030-2	WFJC	900	1760	251	4.0	0.030	0.010	60	84	3.43	114	18.0	8
3000	WFJC	3230	570	81	3.0	0.020	0.010	25	43	2.37	73	32.3	10
3005	WFJC	3000	410	59	3.0	0.020	0.010	20	38	2.28	68	[illegible]	[illegible]
3012	WFJC	2000	380	54	3.0	0.010	0.005	20	38	2.28	68	10.0	4
3015	WFJC	1550	935	134	4.0	0.015	0.010	35	59	3.18	89	7.8	3
3021	WFJC	1750	420	60	3.0	0.020	0.010	20	38	2.28	68	17.5	6
3025	WFJC	1380	910	130	4.0	0.018	0.010	35	59	3.18	89	11.0	4
3060	WFJC	2000	190	27	2.0	0.015	0.010	20	32	1.62	62	10.0	3
3070	WFJC	800	190	27	4.0	0.015	0.010	10	34	2.54	64	4.0	1
2160	DRWY A	1030	620	89	3.0	0.026	0.013	30	48	2.44	78	13.4	11
4020 (1)	DFA	2500	265	53	3.0	0.005	0.005	20	38	2.28	68	0.0	4
4010 (1)	DFA	900	280	56	3.0	0.005	0.005	20	38	2.28	68	0.0	0

(1) Grasslined channel section

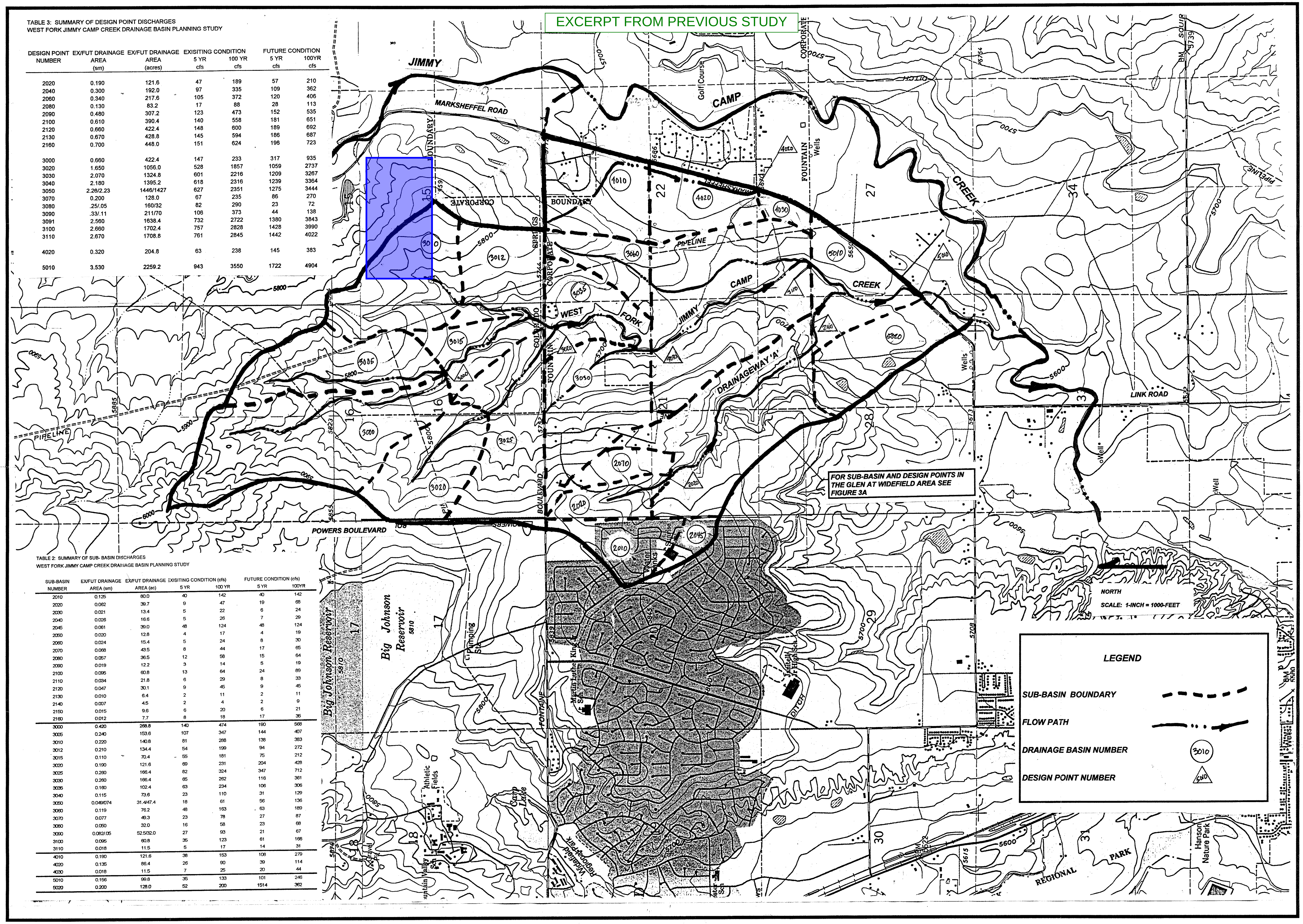
EXCERPT FROM PREVIOUS STUDY

TABLE 3: SUMMARY OF DESIGN POINT DISCHARGES
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

DESIGN POINT NUMBER	EX/FUT DRAINAGE AREA (sm)	EX/FUT DRAINAGE AREA (acres)	EXISITING CONDITION 5 YR cfs	EXISITING CONDITION 100 YR cfs	FUTURE CONDITION 5 YR cfs	FUTURE CONDITION 100YR cfs
2020	0.190	121.6	47	189	57	210
2040	0.300	192.0	97	335	109	362
2060	0.340	217.6	105	372	120	406
2080	0.130	83.2	17	88	28	113
2090	0.480	307.2	123	473	152	535
2100	0.610	390.4	140	558	181	651
2120	0.660	422.4	148	600	189	692
2130	0.670	428.8	145	594	186	687
2160	0.700	448.0	151	624	196	723
3000	0.660	422.4	147	233	317	935
3020	1.650	1056.0	528	1857	1059	2737
3030	2.070	1324.8	601	2216	1209	3267
3040	2.180	1395.2	618	2316	1239	3364
3050	2.26/2.23	1446/1427	627	2351	1275	3444
3070	0.200	128.0	67	235	86	270
3080	.25/.05	160/32	82	290	23	72
3090	.33/.11	211/70	106	373	44	138
3091	2.560	1638.4	732	2722	1380	3843
3100	2.660	1702.4	757	2828	1428	3990
3110	2.670	1708.8	761	2845	1442	4022
4020	0.320	204.8	63	238	145	383
5010	3.530	2259.2	943	3550	1722	4904

TABLE 2: SUMMARY OF SUB- BASIN DISCHARGES
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

SUB-BASIN NUMBER	EX/FUT DRAINAGE AREA (sm)	EX/FUT DRAINAGE AREA (ac)	EXISITING CONDITION (cfs) 5 YR	EXISITING CONDITION (cfs) 100 YR	FUTURE CONDITION (cfs) 5 YR	FUTURE CONDITION (cfs) 100YR
2010	0.125	80.0	40	142	40	142
2020	0.062	39.7	9	47	19	68
2030	0.021	13.4	5	22	6	24
2040	0.026	16.6	5	26	7	29
2045	0.061	39.0	48	124	48	124
2050	0.020	12.8	4	17	4	19
2060	0.024	15.4	5	24	8	30
2070	0.068	43.5	8	44	17	65
2080	0.057	36.5	12	58	15	64
2090	0.019	12.2	3	14	5	19
2100	0.095	60.8	13	64	24	89
2110	0.034	21.8	6	29	8	33
2120	0.047	30.1	9	45	9	45
2130	0.010	6.4	2	11	2	11
2140	0.007	4.5	2	4	2	9
2150	0.015	9.6	6	20	6	21
2160	0.012	7.7	8	18	17	35
3000	0.420	268.8	140	474	190	568
3005	0.240	153.6	107	347	144	407
3010	0.220	140.8	81	288	138	383
3012	0.210	134.4	54	199	94	272
3015	0.110	70.4	55	181	75	212
3020	0.190	121.6	69	231	204	428
3025	0.260	166.4	82	324	347	712
3030	0.260	166.4	65	262	116	361
3035	0.160	102.4	63	234	106	306
3040	0.115	73.6	23	110	31	129
3050	0.049/074	31.4/47.4	18	61	56	136
3060	0.119	76.2	48	163	63	189
3070	0.077	49.3	23	78	27	87
3080	0.050	32.0	16	58	23	68
3090	0.082/.05	52.5/32.0	27	93	21	67
3100	0.095	60.8	35	123	61	166
3110	0.018	11.5	5	17	14	31
4010	0.190	121.6	38	153	108	279
4020	0.135	86.4	26	90	39	114
4030	0.018	11.5	7	25	20	44
5010	0.156	99.8	35	133	101	246
5020	0.200	128.0	52	200	1514	362



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West Fork Jimmy Camp Creek
Drainage Basin Planning Study
HYDROLOGIC SUB-BASIN MAP
EL PASO COUNTY, COLORADO

Project No.: 9893
Date: 6/99
Design: RNW
Drawn: CAD
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Revisions:

FIGURE 3

EXCERPT FROM PREVIOUS STUDY

MASTER DEVELOPMENT DRAINAGE PLAN AMENDMENT

For

BRADLEY HEIGHTS

Prepared for:

BRADLEY HEIGHTS METROPOLITAN DISTRICT
614 North Tejon Street
Colorado Springs, CO 80903
(719) 447-1777

Prepared by:

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

April 2022

Project No. 21.1213.001

STM-REV22-0046

D. MAJOR DRAINAGEWAYS

1. Marksheffel Tributary to Jimmy Camp Creek

Most of the site is within this drainageway. Approximately 3302 total acres sheet flow off of the basin's rolling sparsely vegetated hills at slopes ranging from 0.2% to 10%. The flows are eventually channelized in the Marksheffel Tributary to Jimmy Camp Creek which conveys the flows into the existing Colorado Centre Detention Pond, eventually discharging across Marksheffel Road to a confluence with the main branch of Jimmy Camp Creek via an existing public double 9-foot x 12-foot CBC.

2. West Fork – Jimmy Camp Creek

This basin makes up the portion of the basin south of the ridge running through the site. Flows in this drainage way sheet flow off of the sloped hills at slopes ranging from 3% to 10%. The slopes of this basin within the Bradley Heights area mostly continue through or terminate in the vicinity of the area's boundaries. Channelized flows will continue south via the West Fork Tributary to Jimmy Camp Creek drainage way eventually reaching the main branch of Jimmy Camp Creek several miles to the south.

3. Jimmy Camp Creek

A small portion of the Bradley Heights area drains to this basin. Approximately, 47.9 acres at the southeast corner of the area drain to an existing 7-foot by 4-foot CBC across Marksheffel Road. This area is considered as part of the main branch of Jimmy Camp Creek in DPBS-JC. Under existing conditions flows in this basin sheet flow down slopes varying from 1% to 10%. Channelized flows in the Marksheffel Road ditch are conveyed across Marksheffel Road via an existing 7-foot by 4-foot CBC. From this point flows shortly arrive in the main branch of Jimmy Camp Creek.

E. LAND USES

Presently, the site is unplatted and consists mostly of undeveloped land. The 529.5-acre area is entirely designated as PUD type use. More specific uses will be determined as development of the area progresses.

III. Hydrologic Analysis

A. MAJOR BASINS AND SUBBASINS

The majority of Bradley Heights is located within the Marksheffel Tributary to Jimmy Camp Creek Drainage Basin with a small portion of the site tributary to the main branch of Jimmy Camp Creek and roughly a third of the area located in the West Fork Jimmy Camp Creek Drainage Basin. Runoff presently flows overland until reaching an existing natural drainage swale on the site. This drainage swale directs the site's flows internally in an arcing pattern, commencing at the northwestern corner and traveling in a south and east direction until reaching an approximate longitudinal midpoint of the site. At this point, the flows turn and begin to flow south and west to existing box culverts south of the site boundary. Drainage from the fully developed conditions will be directed to multiple on-site detention ponds, where the runoff will be treated for water quality and detained to maintain the historic major event discharge rate from the site.

Design Point M1 (HMS) (Q_5 = 82 cfs, Q_{100} = 1029.9 cfs) (Area: 3310.8 Ac.) (Slopes: 0.2 to 10 %) represent the confluence of flows from Design Point M2 with runoff from Sub-basin M1

Design Point M0 (HMS) (Q_5 = 82 cfs, Q_{100} = 1029.9 cfs) (Area: 3310.8 Ac.) (Slopes: 0.2 to 25%) This point represents the final discharge from the Bradley Heights at the 9-foot by 12-foot concrete box culvert across Marksheffel Road.

Jimmy Camp Creek Drainage Fee Basin

Design Point JC (Q_5 = 15.0 cfs, Q_{100} = 80.3 cfs) (Area: 46.62 Ac.) (Slopes: 2 to 10 %) represents the site discharge at the southeast corner of the site to the Marksheffel Road ditch. Runoff from the sub-basin sheet flows to the east until being channelized in the Marksheffel Road ditch.

West Fork - Jimmy Camp Creek Drainage Fee Basin

Design Point WF1 (Q_5 = 35.6 cfs, Q_{100} = 298.9 cfs) (Sub-basin: TAR-EP, W1; Area: 258.80 Ac.) (Slopes: 5 to 25 %) represents the site discharge at the southwest corner of the site. Flows from the Trails at Aspen Ridge East Pond are combined with flows from the Future City of Colorado Springs electric substation and the portion of Bradley Heights draining to this point. Flows sheet flow offsite until eventually being channelized in the tributary.

Design Point WF2 (Q_5 = 29.4 cfs, Q_{100} = 157.4 cfs) (sub-basin: W2, W3; Area: 88.88 Ac.) (Slopes: 5 to 25 %) represents the combination of two Bradley Heights areas which drain into the West Fork Jimmy Camp Creek Tributary. Flows in these sub-basins sheet flow offsite where they are eventually channelized in the tributary.

b. The ***fully developed conditions*** for the site are as follows:

At this Master Development stage of design for the drainage, general locations of Design Points have been defined in order to size the trunk mains of the proposed storm system (see Appendix D for Storm Exhibit). Many of the proposed sub-basins will have their own internal storm systems that convey the flows to the Design Points mentioned in this report and will be outlined in each parcel's respective Preliminary/Final Drainage Report. (Bradley Heights East and Redemption Hill Church are two such concurrent Preliminary/Final Drainage Reports being submitted.) Infrastructure may need to be modified in the future depending on design of future developments and future drainage criteria. Please note that, for the Marksheffel Tributary to Jimmy Camp Creek design points and sub-basins within the Bradley Heights area, there may be differences between predevelopment and post development areas because development of the Bradley Heights Metro District area will change break lines between basins and thus alter the tributary areas. The ultimate 100-year discharge from the Metro District will remain at or below the modeled predevelopment value. Drawings DR-04 and DR-05 in Appendix D illustrate the proposed drainage conditions for this report.

Marksheffel Tributary to Jimmy Camp Creek

Note: These design points are also addressed in the FDR for the Bradley Heights Phase I Road Improvements.

and P. Flows will be conveyed downstream via a proposed 24-inch public storm pipe to Design Point R.

Design Point R (Q_5 =34.9 cfs, Q_{100} = 72.7 cfs) (Sub-basins: MK2-MK5; Area: 15.16 Ac.) represents the proposed public manhole combining flows from the three proposed public 5-foot Type R sump inlets at Design Points N, O, and P with flows from Sub-basin MK2. Flows will be conveyed downstream via a proposed 42-inch public storm pipe into an interim swale in Sub-basin MK6 which will eventually discharge into proposed private MKJCC Pond #5 (EURV&WQ Detention). Design of the pond and swale will be included in a future FDR for the development or for Bradley Heights Phase II Road Improvements depending on the relative timing of future development.

MKJCC Pond #6 (Inflow: Q_5 = 54.1 cfs, Q_{100} = 116.6 cfs, Outflow: Q_5 = 17.0 cfs, Q_{100} = 89.0 cfs) (Sub-basins: MK9; Area: 41.24 Ac.) represents the future detention pond for sub-basin MK9 which is the future development area between Marksheffel Tributary to Jimmy Camp Creek and Marksheffel Road. Runoff will be conveyed via future internal streets and storm sewer to the proposed detention pond just upstream of the Colorado Centre Detention Pond.

Construction of this pond will likely be by others as the area is developed. The interim conditions may require a temporary detention pond for the Bradley Heights Phase II Road Improvements. Design of this item will be completed as part of a future FDR for either the development containing the detention pond or for the Bradley Heights Phase II Road Improvements depending on relative timing of future improvements.

Design Point M1 (HEC-HMS) (Q_5 = 330.7 cfs, Q_{100} = 1217.9 cfs) (Sub-basins: M4-M27, MK1-MK6, MK9, BHE, BHE3, BH1, BH2, RHC1-4, BS1-6, BHC, BHE2, TAR-NE; Area: 3248.5 Ac.) represents the cumulative flows to the Marksheffel Tributary to Jimmy Camp Creek at a point on the stream just southeast of MKJCC Pond #5. Flows at this design point are determined via HEC-HMS modeling due to the size of the tributary area and the means of modeling the upstream flows. From this point flows will be conveyed in the proposed channel section, described in the channel improvement section of this report, directly into the existing Colorado Centre detention pond.

Design Point S (Q_5 =6.3 cfs, Q_{100} = 11.5 cfs) (Sub-basins: MK9; Area: 1.79 Ac,) represents the proposed public 5-foot Type R sump inlet on the west side of the first north/south collector west of Marksheffel Road off of Bradley Ridge (Bridgegate Place). Flows captured in the inlet will be conveyed downstream via proposed 24-inch public storm pipe to Design Point U.

Design Point T (Q_5 = 1.6 cfs, Q_{100} = 2.9 cfs) (Sub-basins: MK10; Area: 0.38 Ac.) represents the proposed public 5-foot Type R sump inlet on Bridgegate Place. Flows captured in the inlet will be conveyed downstream via proposed 18-inch public storm pipe to Design Point U.

Design Point U (Q_5 = 7.5 cfs, Q_{100} = 13.8 cfs) (Sub-basins: MK9, MK10; Area: 2.17 Ac.) represents the proposed public manhole combining flows from Design Points S and T. Flows will be conveyed downstream via proposed 24-inch public storm pipe to design point U2.

Design Point U2 (Q_5 = 38.2 cfs, Q_{100} = 82.3 cfs) (Sub-basins: MK9, MK10, MK11; Area: 18.46 Ac.) represents the proposed public manhole combining flows from Design Points U with flows

Design Point AC (Q_5 = 6.0 cfs, Q_{100} = 11.0 cfs) (Sub-basins: JC1-JC2; Area: 1.48 Ac.) represents a proposed public manhole combining flows from Design Points AB and AA. Flows will be conveyed downstream to Design Point AD via proposed 24-inch public storm sewer.

Design Point AD (Q_5 = 41.6 cfs, Q_{100} = 90.9 cfs) (Sub-basins: JC1-JC3; Area: 21.33 Ac.) represents the proposed public manhole combining flows from Design Point AC with flows from Sub-basin JC3. The combined flows will be conveyed downstream via proposed 42-inch public storm sewer to Design Point AE at the Full Spectrum Detention JCC Pond #3.

Design Point AE (Q_5 = 69.7 cfs, Q_{100} = 153.5 cfs) (Sub-basins: JC1-JC4; Area: 38.07 Ac.) represents the combination of flows from Design Point AD with flows from Sub-basin JC4 at FSD JCC Pond #3.

Design Point JC (Q_5 = 18.2 cfs, Q_{100} = 83.3 cfs) (Sub-basins: JC1-JC5; Area: 45.58 Acres) represents the ultimate discharge from Bradley Heights to the Marksheffel Road ditch at the southeasternmost corner of the Bradley Heights Metro District. From this point flows will be conveyed onwards via the existing ditch and downstream storm facilities eventually reaching the main channel of Jimmy Camp Creek approximately 1500 feet downstream. Swale capacity calculations indicate that the road ditch has adequate capacity for the runoff and that velocities comply with the DCM criteria for Q100 channel flows in erosive soils. The report indicating this calculation can be found in Appendix A.

West Fork - Jimmy Camp Creek

Design Point AF (Q_5 = 6.0 cfs, Q_{100} = 10.9 cfs) (Sub-basins: WF10; Area: 1.56 Ac.) represents a sump inlet on the north side of Bradley Ridge Road west of its intersection with the second north/south collector west of Marksheffel Road. Flows captured in this sump inlet will be conveyed downstream via proposed 18-inch public storm pipe to Design Point AH.

Design Point AG (Q_5 = 4.2 cfs, Q_{100} = 7.6 cfs) (Sub-basins:WF11; Area: 1.08 Ac.) represents a sump inlet on the south side of Bradley Ridge Road west of its intersection with the second north/south collector west of Marksheffel Road. Flows captured in this sump inlet will be conveyed downstream via proposed 18-inch public storm pipe to Design Point AH.

Design Point AH (Q_5 = 10.1 cfs, Q_{100} = 18.5 cfs) (Sub-basins:WF10-WF11; Area: 2.64 Ac.) represents the storm proposed public manhole combining flows from Design Points AF and AG. Flows will be conveyed east to the second north/south collector west of Marksheffel off of Bradley Ridge Road and then southwest to Design Point AI via proposed 24-inch public storm pipe.

Design Point AI (Q_5 = 43.1 cfs, Q_{100} = 106.8 cfs) (Sub-basins:WF12-WF13; Area: 32.34 Ac.) represents a pair of sump inlets on a residential side road teeing into Collector 2 from the west. The sump inlets will be sized by a future FDR for the development and will capture flows from the west half of Collector 2. Captured flows will be conveyed downstream via proposed 48-inch public storm pipe.

Design Point AJ (Q_5 = 59.7 cfs, Q_{100} = 131.4 cfs) (Sub-basins: WF14-WF15; Area: 31.99 Ac.) represents a pair of sump inlets on a residential side road across Collector 2 from DP AI. The sump inlets will be sized by a future FDR for the development and will capture flows from the east half of

Collector 2. Captured flows from the development will be conveyed downstream via proposed 48-inch public storm pipe.

Design Point AK (Q_5 = 92.0 cfs, Q_{100} = 210.9 cfs) (Sub-basins: WF10-WF15; Area: 66.97 Ac.) represents a proposed public manhole combining flows from Design Points AH, AI, and AJ. The combined flows will be conveyed downstream via proposed 48-inch public storm pipe.

Design Point AL (Q_5 = 0.4 cfs, Q_{100} = 0.7 cfs) (Sub-basins: WF16; Area: 0.09 Ac.) represents an at grade inlet on the south boundary of Bradley Heights capturing flows from the west portion of Collector 2. Captured flows will be conveyed downstream via 18-inch public storm pipe.

Design Point AM (Q_5 = 0.4 cfs, Q_{100} = 0.7 cfs) (Sub-basins: WF17; Area: 0.09 Ac.) represents an at grade inlet on the south boundary of Bradley Heights capturing flows from the east portion of Collector 2. Captured flows will be conveyed downstream via 18-inch public storm pipe.

Design Point AN (Q_5 = 0.8 cfs, Q_{100} = 1.4 cfs) (Sub-basins:WF16-WF17; Area: 0.18 Ac.) represents the proposed public manhole combining flows from Design Points AM and AL. The combined flows will be conveyed north to Design Point AO by 18-inch public storm sewer.

Design Point AO (Q_5 = 92.5 cfs, Q_{100} = 212.2 cfs) (Sub-basins:WF10-WF17 (Excluding WF12a); Area: 67.33 Ac.) represents the combination of flows from Design Points AN and AK. Flows will be conveyed downstream via proposed 48-inch public storm pipe. Please note that the flows to this point are conservative as it is likely that flows to this point may be somewhat less than accounted for here. (Future design consideration: The pipe calculations indicate pressure flows here as well, so it may be beneficial for the future development to consider a larger pipe size if HGLs exceed DCM criteria)

Design Point AP (Q_5 = 128.7 cfs, Q_{100} = 293.0 cfs) (Sub-basins:WF10-WF17 (Including WF12a); Area: 93.01 Ac.) represents the total flows into WFJCC Pond #2 in the Bradley Ridge development.

Design Point WF2 (Q_5 = 22.60 cfs, Q_{100} = 153.50 cfs) (Sub-basins: WF10-WF17; Area: 93.01 Ac.) represents the site discharge to the south boundary of Bradley Heights. The proposed development will discharge at or below historic rates. A future FDR for the site will provide more detailed information on the discharge. The DBPS indicates an anticipated Q100 discharge of 380 cfs near this point, therefore the proposed conditions are in compliance with DBPS-WFJCC.

Design Point AQ (Q_5 = 0.75 cfs, Q_{100} = 1.38 cfs) (Sub-basins: LH1; Area: 0.18 Ac.) represents a 10-foot at grade inlet capturing all the flows off of the portion of the north half of Legacy Hill Drive draining westwards towards the Trails at Aspen Ridge Development. The inlet will fully capture all flows and direct them to Design Point AS via proposed 18-inch public storm sewer.

Design Point AR (Q_5 = 0.75 cfs, Q_{100} = 1.38 cfs) (Sub-basins: LH2; Area: 0.18 Ac.) represents a 10-foot at grade inlet capturing all the flows off of the portion of the south half of Legacy Hill Drive draining westwards towards the Trails at Aspen Ridge Development. The inlet will fully capture all flows and direct them to Design Point AS via proposed 18-inch public storm sewer.

Design Point AS (Q_5 = 1.51 cfs, Q_{100} = 2.75 cfs) (Sub-basins: LH1 & LH2; Area: 0.36 Ac.) represents the proposed public manhole combining runoff from Design Points AR and AQ. The

b. Proposed Detention Facilities

Initial design of the proposed detention facilities has been completed using the Mile High Flood District MHFD-Detention program. The results of these calculations are summarized in the table below.

Proposed Pond Summary BRADLEY HEIGHTS MDDP									
Pond	Trib. Area	% Imp.	Pre-Development Peak		Pond Outflow		Pre vs. Post Ratio		NOTES
			Q5	Q100	Q5	Q100	Q5	Q100	
1	76.22	49.06%	33.5	124.8	10.7	106.7	0.3	0.9	FSD: SEE FUTURE FDR
2	90.75	77.79%	56.3	179.6	22.6	153.5	0.4	0.9	FSD: SEE FUTURE FDR
3	38.07	66.17%	19.9	65.7	7.4	59.8	0.4	0.9	FSD: SEE FUTURE FDR
4	49.03	67.94%	23.7	77.0	10.0	70.3	0.4	0.9	FSD: SEE FUTURE FDR
5	67.29	66.73%	37.6	119.8	24.2	203.5	0.6	1.7	WQCV & EURV: SEE FUTURE FDR
6	41.24	70.00%	12.7	43.8	17.0	89.0	1.3	2.0	WQCV & EURV: SEE FUTURE FDR
7	69.95	75.34%	33.4	110.1	23.5	177.2	0.7	1.6	WQCV & EURV: SEE FUTURE FDR
8	12.97	75.92%	3.4	12.4	3.6	11.3	1.1	0.9	FSD: SEE RHC FDR
9	51.93	60.00%	28.5	103.5	12.2	103.1	0.4	1.0	FSD: SEE BRADLEY HEIGHTS EAST F1&2 FDR
10	13.98	95.00%	4.4	18.6	0.4	16.7	0.1	0.9	FSD: SEE FUTURE FDR
11	8.00	65.00%	2.8	11.7	1.4	10.6	0.5	0.9	FSD: SEE BRADLEY HEIGHTS EAST F3&4 FDR
TAR-NEP OFFSITE	9.09	59.05%	0.2	11.2	0.2	7.9	1.0	0.7	FSD: SEE TAR F4 DRAINAGE REPORTS
TAR-EP OFFSITE	160.87	44.95%	5.3	191.8	5.8	139.5	1.1	0.7	FSD: SEE TAR MDDPA

NOTE: *Pond information is preliminary in nature. Please see the final drainage reports of each development for final pond information*

The Colorado Centre Detention Pond was originally analyzed in the Detention Report titled ***Phase I Detention for Colorado Centre***, by JR Developers, LTD and dated October 1985. This report indicated that the detention facility would provide detention for approximately 832 acres of industrial and business development and 122 acres of residential development. This area was modified by ***MDDP-2015*** to approximately 779 acres of developed tributary area. Please see the drawing in Appendix C demonstrating that Bradley Heights is within this tributary area. The remainder of the tributary area was (and will continue to be) required to provide onsite detention. Please see excerpts of both reports included in Appendix C.

APPENDIX A

HYDROLOGIC AND HYDRAULIC CALCULATIONS

EXCERPT FROM PREVIOUS STUDY

Rational Method - Existing Conditions

Project Name:	BRADLEY HEIGHTS MDDP
Project Location:	COLORADO SPRINGS, EL PASO COUNTY, CO
Designer	JTS
Notes:	

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

Average Channel Velocity 4 ft/s (If specific channel vel is used, this will be ignored)
Average Slope for Initial Flow 0.04 ft/ft (If Elevations are used, this will be ignored)

		Area		Rational 'C' Values											Flow Lengths				Initial Flow		Channel Flow				Tc	Rainfall Intensity & Rational Flow Rate			
				Surface Type 1 (Neighborhoods)			Surface Type 2 (Impervious)			Surface Type 3 (Undeveloped)			Composite								Average (%)	Channel Flow Type (See Key above)	Velocity						
Major Basin / Sub-basin	**Comments**	sf	acres	C5	C100	Area (SF)	C5	C100	Area (SF)	C5	C100	Area	C5	C100	Initial ft	True Initial Length ft	Channel ft	rue Channe Length ft	Average Slope	Initial Tc (min)	Slope	Ground Type	(ft/s)	Channel Tc (min)	Total (min)	i5 in/hr	Q5 cfs	i100 in/hr	Q100 cfs
M-1	***Marksheffel Tributary-SCS***	4,255,918.0	97.70	0.65	0.80		0.90	0.96		0.16	0.51	4255918.00	0.16	0.51	300	300	2248	2248	0.050	17.14	0.5	4	0.5	75.7	92.8	1.2	**18.8**	2.0	**167.7**
M-2	***Marksheffel Tributary-SCS***	6,457,173.0	148.24	0.65	0.80		0.90	0.96		0.16	0.51	6457173.00	0.16	0.51	300	300	4513	4513	0.050	17.14	0.5	4	0.5	152.0	169.1	0.8	**26.2**	1.3	**228.8**
M-3	***Marksheffel Tributary-SCS***	6,350,933.0	145.80	0.65	0.80		0.90	0.96		0.16	0.51	6350933.00	0.16	0.51	300	300	6127	6127	0.050	17.14	0.5	4	0.5	206.3	223.4	0.6	**9.4**	1.1	**150.7**
W1	***To WFJCC***	4,265,912.0	97.93	0.65	0.80		0.90	0.96		0.16	0.51	4265912.00	0.16	0.51	300	300	2680	2680	0.050	17.14	5.0	4	1.6	28.5	45.7	1.9	**29.8**	3.2	**159.4**
W2	***To WFJCC***	47,791.0	1.10	0.65	0.80		0.90	0.96		0.16	0.51	47791.00	0.16	0.51	50	50	278	278	0.050	7.00	5.0	4	1.6	4.0	11.0	2.9	**0.7**	6.6	**2.7**
W3	***To WFJCC***	3,823,833.0	87.78	0.65	0.80		0.90	0.96		0.16	0.51	3823833.00	0.16	0.51	300	300	2130	2130	0.050	17.14	5.0	4	1.6	22.7	39.8	2.1	**29.0**	3.4	**155.4**
J1	***Southeast corner of Bradley Heights***	2,030,559.0	46.62	0.65	0.80		0.90	0.96		0.16	0.51	2030559.00	0.16	0.51	300	300	2300	2300	0.050	17.14	5.0	4	1.6	24.5	41.6	2.0	**15.0**	3.4	**80.3**
TAR-EP	***Trails at Aspen Ridge East Pond Discharge***	7,007,497.2	160.87	0.65	0.80		0.90	0.96		0.16	0.51	7007497.20	0.16	0.51													**5.8**		**139.5**
EXISTING CONDITIONS - DESIGN POINTS	***INCLUDED SUB-BASINS***																												
WF1	***W1, TAR-EP***	11,273,409.2	258.80	0.65	0.80	0.0	0.90	0.96	0.0	0.16	0.51	11,273,409.2	0.16	0.51	300	300	2680	2680	0.05	17.14	5.0	4	1.6	28.5	45.7	1.9	**35.6**	3.2	**298.9**
WF2	***W2,W3***	3,871,554.0	88.88			0.0	0.90	0.96	0.0	0.16	0.51	3,871,554.0	0.16	0.51	300	300	2130	2130	0.05	17.14	5.0	4	1.6	22.7	39.8	2.1	**29.4**	3.4	**157.4**
JC	***J1***	2,030,559.0	46.62	0.65	0.80	0.0	0.90	0.96	0.0	0.16	0.51	2,030,559.0	0.16	0.51	300	300	2300	2300	0.05	17.14	5.0	4	1.6	24.5	41.6	2.0	**15.0**	3.4	**80.3**
See SCS table for Marksheffel Tributary Design Points																													

HEC HMS

EXCERPT FROM PREVIOUS STUDY

Rational Method - Proposed Conditions

Project Name: BRADLEY HEIGHTS MDDP
Project Location: COLORADO SPRINGS, EL PASO COUNTY, CO
Designer: JTS
Notes: Proposed Condition

Average Channel Velocity 4.00 ft/s (If specific channel vel is used, this will be ignored)
Average Slope for Initial Flow 0.04 ft/ft (If Elevations are used, this will be ignored)
SOIL TYPE CHOSEN BASED ON WORST CASE FOR TRIBUTARY AREA

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

PCT Impervious: Commercial 95%, Residential (1/8 or less) 65%, Pavement 100%, Neighborhoods/Multi-Family 70%, Residential (1/3 Acre) 30%, Undeveloped/Pervious 2%

Sub-basin	Comments	Area sf	Area acres	Area Sq. Mi.	Soil Group	Commercial Areas (95% Impervious) C5	Commercial C100	Commercial Area	Residential (1/8 or less) (65% Impervious) C5	Residential 1/8 C100	Residential 1/8 Area (SF)	Pavement (100% Impervious) C5	Pavement C100	Pavement Area (SF)	Neighborhoods/Multi-Family (70% Impervious) C5	Neighborhoods C100	Neighborhoods Area	Residential (1/3 Acre) (30% Impervious) C5	Residential 1/3 C100	Residential 1/3 Area	Undeveloped/Pervious Areas (2% Impervious) C5	Undeveloped C100	Undeveloped Area	Composite C5	Composite C100	Percent Impervious	Flow Lengths Initial ft	True Initial Length ft	Channel ft	True Channel Length ft	Average Slope (decimal)	Initial Tc (min)	Average (%) Slope	Channel Flow Type (See Key above) Ground Type	Velocity (ft/s)	Channel Tc (min)	Tc Total (min)	i5 in/hr	Q5 cfs	i100 in/hr	Q100 cfs	Sub-basin
BR1	NORTH OF TRAILS AT ASPEN RIDGE	121992	2.80	0.0044	B	0.81	0.88	42600	0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36	79392	0.34	0.54	34.48	100	100	1268	1268	0.02	10.84	3.0	4	1.21	17.43	28.26	2.51	2.4	4.21	6.4	BR1
BH1	NE CORNER OF TRAILS, NW CORNER OF BRADLEY HEIGHTS	69052	1.59	0.0025	B	0.81	0.88		0.45	0.59		0.90	0.96	11729	0.49	0.62		0.25	0.47		0.09	0.36	57323	0.23	0.46	18.65	100	100	549	549	0.02	12.46	3.0	4	1.21	7.55	20.01	3.01	1.1	5.06	3.7	BH1
BH2	DITCH BETWEEN BRADLEY ROAD & BRADLEY HEIGHTS EAST	130927	3.01	0.0047	B	0.81	0.88		0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36	130927	0.09	0.36	2.00	20	20	1233	1233	0.05	4.75	2.0	4	0.99	20.76	25.51	2.65	0.7	4.45	4.9	BH2
BHE	BRADLEY HEIGHTS EAST F 1&2 UNDEVELOPED/DISCHARGE FROM MKJCC Pond #	1755694	40.31	0.0630	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	1755694	0.16	0.51	2.00	100	100	2332	2332	0.05	9.89	2.0	7	2.83	13.74	23.63	2.76	8.8	4.64	86.4	BHE
BHE2	BRADLEY HEIGHTS EAST F 3&4 UNDEVELOPED/DISCHARGE FROM MKJCC POND #11	382000	8.77	0.0137	B	0.81	0.88		0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36	382000	0.09	0.36	2.00	100	100	898	898	0.05	10.63	3.0	4	1.21	12.34	22.97	2.81	0.9	4.71	18.9	BHE2
BHE3	BRADLEY HEIGHTS EAST F 5&6 - DEVELOPED FLOWS	941040	21.60	0.0338	D	0.82	0.89		0.49	0.65	941040	0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.49	0.65	65.00	100	100	1100	1100	0.05	6.42	3.0	7	3.46	5.29	11.71	3.85	41.1	6.47	91.6	BHE3
BHC	BRADLEY HEIGHTS COMMERCIAL UNDEVELOPED/DISCHARGE FROM MKJCC POND #10	612207	14.05	0.0220	B	0.81	0.88		0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36	612207	0.09	0.36	2.00	100	100	1166	1166	0.05	10.63	2.0	4	0.99	19.63	30.26	2.41	3.1	4.05	20.7	BHC
TAR-NE	NORTHEAST TRAILS AT ASPEN RIDGE (PART OF TAR F4) UNDEVELOPED/DISCHARGE FROM FSD	398439	9.15	0.0143	B	0.81	0.88		0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36	398439	0.09	0.36	2.00	100	100	1750	1750	0.05	10.63	2.0	7	2.83	10.31	20.94	2.94	0.2	4.95	7.9	TAR-NE
BL1	WEST HALF OF BRADLEY LANDING DRAINING TO NORTH. PORTION OF BRADLEY ROAD DRAINING EAST	130000	2.98	0.0047	B	0.81	0.88	130000	0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36		0.81	0.88	95.00	20	20	1372	1372	0.03	1.62	3.0	7	3.46	6.60	8.21	4.41	10.7	7.40	19.6	BL1
BL2	EAST HALF OF BRADLEY LANDING	60354	1.39	0.0022	B	0.81	0.88	60354	0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36		0.81	0.88	95.00	20	20	1212	1212	0.05	1.37	3.3	7	3.63	5.56	6.92	4.66	5.3	7.83	9.6	BL2
RHC1	SOUTH HALF OF BRADLEY ROAD BETWEEN BLISS AND BRADLEY LANDING	107935	2.48	0.0039	B	0.81	0.88	107935	0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36		0.81	0.88	95.00	92	92	1343	1343	0.02	3.97	1.9	7	2.76	8.12	12.09	3.80	7.7	6.39	14.0	RHC1
RHC2	EAST HALF OF BLISS ROAD ADJACENT TO REDEMPTION HILL CHURCH	25483	0.59	0.0009	B	0.81	0.88	25483	0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36		0.81	0.88	95.00	20	20	546	546	0.02	1.85	1.0	7	2.00	4.55	6.40	4.77	2.3	8.01	4.2	RHC2
RHC3	REDEMPTION HILL CHURCH	431154	9.90	0.0155	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68	431154	0.30	0.57		0.16	0.51		0.53	0.68	70.00	100	100	1110	1110	0.02	8.14	2.0	7	2.83	6.54	14.68	3.50	18.5	5.87	39.9	RHC3
RHC4	RHC ADJACENT PROPERTY OWNED BY THE CHURCH	1055503	24.23	0.0379	D	0.82	0.89		0.49	0.65	1055503	0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.49	0.65	65.00	100	100	1035	1035	0.05	6.42	3.0	7	3.46	4.98	11.40	3.90	46.6	6.55	103.9	RHC4
BS1	BLISS ROAD	137852	3.16	0.0049	B	0.81	0.88	60390	0.45	0.59	77462	0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36		0.61	0.72	78.14	100	100	980	980	0.05	5.18	1.8	7	2.68	6.09	11.26	3.92	7.6	6.58	15.0	BS1
BS2	BLISS ROAD	35937	0.83	0.0013	B	0.81	0.88	35937	0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36		0.81	0.88	95.00	20	20	980	980	0.05	1.37	1.8	7	2.68	6.09	7.45	4.55	3.1	7.64	5.6	BS2
BS3	BLISS ROAD	33528	0.77	0.0012	D	0.82	0.89	33528	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	100	100	737	737	0.05	2.95	2.3	7	3.03	4.05	6.99	4.64	3.0	7.80	5.4	BS3
BS4	BLISS ROAD	30562	0.70	0.0011	D	0.82	0.89	30562	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	50	50	737	737	0.05	2.08	2.3	7	3.03	4.05	6.13	4.83	2.8	8.12	5.1	BS4
BS5	BLISS ROAD	52249	1.20	0.0019	D	0.82	0.89	52249	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	50	50	1147	1147	0.05	2.08	1.8	7	2.68	7.12	9.20	4.23	4.2	7.11	7.6	BS5
BS6	BLISS ROAD	21806	0.50	0.0008	D	0.82	0.89	21806	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	50	50	555	555	0.05	2.08	1.8	7	2.68	3.45	5.53	4.97	2.1	8.35	3.8	BS6
MK1	SCHOOL & PUD	912529	20.95	0.1388	D	0.82	0.89	912529	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	100	100	1170	1170	0.05	2.95	3.0	7	3.46	5.63	8.57	4.34	75.1	7.29	137.0	MK1
MK2	PUD-MARKSHEFFEL-WOODMEN INVESTMENTS, LLC	491552	11.28	0.1079	D	0.82	0.89		0.49	0.65	491552	0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.49	0.65	65.00	100	100	1056	1056	0.05	6.42	3.0	7	3.46	5.08	11.50	3.88	21.6	6.52	48.2	MK2
MK3	BRADLEY LANDING BOULEVARD	71539	1.64	0.1660	D	0.82	0.89	71539	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	50	50	1303	1303	0.05	2.08	1.2	7	2.19	9.91	11.99	3.82	5.2	6.41	9.4	MK3
MK4	BRADLEY LANDING BOULEVARD	71100	1.63	0.2257	D	0.82	0.89	71100	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	50	50	830	830	0.05	2.08	1.2	7	2.19	6.31	8.39	4.37	5.9	7.35	10.8	MK4
MK5	BRADLEY RIDGE ROAD	26108	0.60	0.1136	D	0.82	0.89	26108	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	50	50	157	157	0.05	2.08	1.0	7	2.00	1.31	5.00	5.10	2.5	8.58	4.6	MK5
MK6	PUD-MARKSHEFFEL-WOODMEN INVESTMENTS, LLC	2270661	52.13	0.0924	D	0.82	0.89		0.49	0.65	2270661	0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.49	0.65	65.00	100	100	1500	1500	0.05	6.42	3.0	7	3.46	7.22	13.63	3.61	93.0	6.07	207.3	MK6
MK7	PUD-MARKSHEFFEL-WOODMEN INVESTMENTS, LLC	1085533	24.92	0.2321	D	0.82	0.89		0.49	0.65	1085533	0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.49	0.65	65.00	100	100	1650	1650	0.05	6.42	3.0	7	3.46	7.94	14.35	3.53	43.5	5.93	96.9	MK7
MK8	MARKSHEFFEL ROAD/MARKSHEFFEL TRIB. DOWNSTREAM OF CC POND.	351015	8.06	0.2844	D	0.82	0.89	98617	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	252398	0.35	0.62	28.13	50	50	1200	1200	0.02	7.62	1.8	4	0.94	21.30	28.91	2.47	6.9	4.16	20.8	MK8
MK9	PUD-PIKES PEAK COUNCIL BOYS MULTI-FAMILY IN MDDP-2015	1796376	41.24	0.2554	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68	1796376	0.30	0.57		0.16	0.51		0.53	0.68	70.00	100	100	2500	2500	0.05	6.00	0.8	7	1.79	23.29	29.29	2.46	54.1	4.13	116.6	MK9
MK10	BRADLEY RIDGE ROAD	85832	1.97	0.3000	D	0.82	0.89	85832	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	50	50	2150	2150	0.05	2.08	4.0	7	4.00	8.96	11.04	3.95	6.4	6.63	11.7	MK10
CC	COLORADO CENTRE POND/MARKSHEFFEL TRIBUTARY	2259954	51.88	0.1399	D	0.82	0.89	207592	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	2052362	0.22	0.54	10.54	300	100	6000	6200	0.05	16.03	0.5	4	0.49	208.76	224.79	0.63	7.3	1.06	30.2	CC
MK11	BRADLEY RIDGE ROAD	195555	4.49	0.2290	D	0.82	0.89	77886	0.49	0.65		0.90	0.96		0.53	0.68	72375	0.30	0.57		0.16	0.51	45294	0.56	0.72	64.21	50	50	1673	1673	0.05	4.02	4.0	7	4.00	6.97	10.99	3.95	10.0	6.64	21.8	MK11
MK12	MARKSHEFFEL [illegible]	16546	0.38	0.1033	D	0.82	0.89	16546	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	50	50	400	400	0.05	2.08	3.7	7	3.85	1.73	5.00	5.10	1.6	8.58	2.9	MK12
MK13	BRADLEY RIDGE DEVELOPMENT	685860	15.75	0.2075	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68	685860	0.30	0.57		0.16	0.51		0.53	0.68	70.00	100	100	1425	1425	0.05	6.00	3.0	7	3.46	6.86	12.85	3.71	31.2	6.23	67.2	MK13
MK14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	MK14
MK15	BRADLEY RIDGE ROAD	29148	0.67	0.0010	D	0.82	0.89	29148	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	50	50	550	550	0.05	2.08	4.0	7	4.00	2.29	5.00	5.10	2.8	8.58	5.1	MK15
MK16	MARKSHEFFEL ROAD & UNDEVELOPED CITY PROPERTY	293102	6.73	0.0105	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	293102	0.16	0.51	2.00	50	50	760	760	0.05	7.00	4.8	4	1.53	8.26	15.25	3.44	3.7	5.77	20.0	MK16
JC1	1ST COLLECTOR WEST OF MARKSHEFFEL-WEST SIDE	80679	1.85	0.1556	D	0.82	0.89	35729	0.49	0.65		0.90	0.96		0.53	0.68	30402	0.30	0.57		0.16	0.51	14548	0.59	0.74	68.81	20	20	795	795	0.05	2.39	2.3	7	3.03	4.37	6.76	4.69	5.2	7.88	10.9	JC1
JC2	1ST COLLECTOR WEST OF MARKSHEFFEL-EAST SIDE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	JC2
JC3	BRADLEY RIDGE DEVELOPMENT 70% impervious used to provide more conservative flow	788205	18.09	0.1786	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68	788205	0.30	0.57		0.16	0.51		0.53	0.68	70.00	100	100	1150	1150	0.05	6.00	4.0	7	4.00	4.79	10.79	3.98	38.5	6.69	83.0	JC3
JC4	BRADLEY RIDGE DEVELOPMENT	729417	16.75	0.1931	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68	729417	0.30	0.57		0.16	0.51		0.53	0.68	70.00	100	100	1181	1181	0.05	6.00	2.5	7	[illegible]	6.49	12.48	3.75	33.6	6.31	72.4	JC4
JC5	MARKSHEFFEL ROAD & UNDEVELOPED CITY PROPERTY	326813	7.50	0.0117	D	0.82	0.89	207805	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	119008	0.58	0.75	61.13	100	100	1692	1692	0.05	5.48	2.9	4	1.19	23.66	29.13	2.46	10.8	4.14	23.5	JC5
WF1	BRADLEY HEIGHTS EAST FILINGS 3&4	696679	15.99	0.0250	B	0.81	0.88		0.45	0.59	696679	0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36		0.45	0.59	65.00	100	100	1466	1466	0.05	6.84	2.0	7	2.83	8.64	15.48	3.41	24.8	5.73	54.5	WF1
WF2	BRADLEY LANDING (WEST SIDE) & LEGACY HILL DR (NORTH SIDE)	201537	4.63	0.0072	B	0.81	0.88	17670	0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36	183867	0.15	0.41	10.15	50	50	1070	1070	0.05	7.05	4.1	7	4.05	4.40	11.45	3.89	2.8	6.53	12.4	WF2
WF3	SOUTH HALF OF LEGACY HILL DRIVE	32652	0.75	0.0012	B	0.81	0.88	32652	0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36		0.81	0.88	95.00	30	30	589	589	0.05	1.67	1.0	7	2.00	4.91	6.58	4.73	2.9	7.95	5.3	WF3
LH1	LEGACY HILL NORTHSIDE DRAINING WEST	7884	0.18	0.0003	B	0.81	0.88	7884	0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36		0.81	0.88	95.00	20	20	180	180	0.05	1.37	2.0	7	2.83	1.06	5.00	5.10	0.8	8.58	1.4	LH1
LH2	LEGACY HILL NORTHSIDE DRAINING EAST	7884	0.18	0.0003	B	0.81	0.88	7884	0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36		0.81	0.88	95.00	20	20	180	180	0.05	1.37	2.0	7	2.83	1.06	5.00	5.10	0.8	8.58	1.4	LH2
WF4	BRADLEY HEIGHTS MULTI-FAMILY	883225	20.28	0.0317	B	0.81	0.88		0.45	0.59		0.90	0.96		0.49	0.62	697669	0.25	0.47		0.09	0.36	185556	0.41	0.57	55.71	100	100	1484	1484	0.05	7.31	1.0	7	2.00	12.37	19.67	3.04	25.2	5.11	59.0	WF4
WF5	BRADLEY HEIGHTS EAST FILINGS 3&4	280402	6.44	0.0101	D	0.82	0.89		0.49	0.65	280402	0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.49	0.65	65.00	100	100	1471	1471	0.05	6.42	1.1	7	2.10	11.69	18.10	3.17	10.1	5.32	22.4	WF5
WF6	BRADLEY LANDING (WEST SIDE)	46250	1.06	0.0017	D	0.82	0.89	46250	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	50	50	961	961	0.05	2.08	1.1	7	2.10	7.64	9.71	4.15	3.6	6.97	6.6	WF6
WF7	BRADLEY RIDGE DEVELOPMENT SOUTHWEST OF BRADLEY RIDGE ROAD	584103	13.41	0.0210	D	0.82	0.89		0.49	0.65	584103	0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.49	0.65	65.00	100	100	823	823	0.05	6.42	3.0	7	3.46	3.96	10.38	4.04	26.8	6.79	59.7	WF7
WF8	WFJCC POND #1	579521	13.30	0.0208	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	579521	0.16	0.51	2.00	100	100	1025	1025	0.05	9.89	2.0	4	0.99	17.26	27.15	2.56	5.5	4.30	29.4	WF8
WF9	OFFSITE AREAS: CSU FUTURE SUBSTATION	550374	12.63	0.0197	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	550374	0.16	0.51	2.00	100	100	819	819	0.05	9.89	2.0	4	0.99	13.79	23.68	2.76	5.6	4.64	30.1	WF9
WF10	NORTH SIDE OF BRADLEY RIDGE ROAD	67865	1.56	0.0024	B	0.81	0.88	67865	0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36		0.81	0.88	95.00	50	50	765	765	0.05	2.16	1.7	7	2.61	4.89	7.04	4.63	5.9	7.78	10.8	WF10
WF11	SOUTH SIDE OF BRADLEY RIDGE ROAD	47120	1.08	0.0017	D	0.82	0.89	47120	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	50	50	765	765	0.05	2.08	1.7	7	2.61	4.89	6.97	4.65	4.2	7.81	7.6	WF11
WF12a	BRADLEY RIDGE DEVELOPMENT SOUTWEST OF BRADLEY RIDGE AND COLLECTOR 2	1364268	31.32	0.0489	D	0.82	0.89		0.49	0.65	1037630	0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	326638	0.41	0.62	49.92	100	100	2777	2777	0.05	7.25	4.0	7	4.00	11.57	18.82	3.11	40.3	5.22	101.6	WF12a
WF12b	BRADLEY RIDGE DEVELOPMENT SOUTWEST OF BRADLEY RIDGE AND COLLECTOR 2	1118584	25.68	0.0401	D	0.82	0.89		0.49	0.65	1118584	0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.49	0.65	65.00	100	100	2777	2777	0.05	6.42	4.0	7	4.00	11.57	17.99	3.18	40.3	5.34	89.8	WF12b
WF13	WEST HALF OF COLLECTOR 2	44672	1.03	0.0016	D	0.82	0.89	44672	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	50	50	1050	1050	0.05	2.08	4.6	7	4.29	4.08	6.16	4.82	4.1	8.10	7.5	WF13
WF14	EAST HALF OF COLLECTOR 2	137679	3.16	0.0049	D	0.82	0.89	48793	0.49	0.65		0.90	0.96		0.53	0.68	88886	0.30	0.57		0.16	0.51		0.63	0.75	78.86	50	50	1050	1050	0.05	3.48	4.6	7	4.29	4.08	7.55	4.53	9.1	7.61	18.3	WF14
WF15	BRADLEY RIDGE DEVELOPMENT SOUTH OF BRADLEY RIDGE AND EAST OF COLLECTOR 2	1255752	28.83	0.0450	D	0.82	0.89		0.49	0.65	1255752	0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.49	0.65	65.00	100	100	1645	1645	0.05	6.42	4.0	7	4.00	6.85	13.27	3.66	52.1	6.14	116.0	WF15
WF16	WEST HALF OF COLLECTOR 2 NEAR SOUTH BOUND OF BRADLEY HEIGHTS	3901	0.09	0.0001	D	0.82	0.89	3901	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.82	0.89	95.00	20	20	118	118	0.05	1.32	1.0	7	2.00	0.98	5.00	5.10	0.4	8.58	0.7	WF16
WF17	EAST HALF OF COLLECTOR 2 NEAR SOUTH BOUND OF BRADLEY HEIGHTS	11725	0.27	0.0004	D	0.82	0.89	4177	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	7548	0.40	0.65	35.13	20	20	118	118	0.05	3.32	1.0	7	2.00	0.98	5.00	5.10	0.5	8.58	1.5	WF17
[illegible]	Trails at Aspen Ridge Sub-basin OS East Side Undeveloped electric easement.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

EXCERPT FROM PREVIOUS STUDY

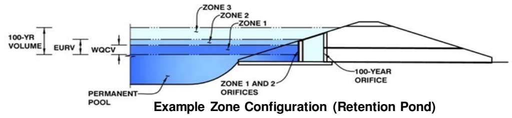
DESIGN POINTS	Sub-basins/Comments	Area			Soil Group	Rational 'C' Values																					Flow Lengths										Tc	Rainfall Intensity & Rational Flow Rate				DESIGN POINTS
						Commercial Areas (95% Impervious)			Residential (1/8 or less) (65% Impervious)			Pavement (100% Impervious)			Neighborhoods/Multi-Family (70% Impervious)			Residential (1/3 Acre) (30% Impervious)			Undeveloped/Pervious Areas (2% Impervious)			Composite		Percent Impervious	Initial	True Initial	Channel	True Channel	Average (decimal)	Initial	Average (%)	Channel Flow Type (See Key above)	Velocity	Channel	Total	i5	Q5	i100	Q100	
		sf	acres	Sq. Mi.		C5	C100	Area	C5	C100	Area (SF)	C5	C100	Area (SF)	C5	C100	Area	C5	C100	Area	C5	C100	Area	C5	C100		ft	Length ft	ft	Length ft	Slope	Tc (min)	Slope	Ground Type	(ft/s)	Tc (min)	(min)	in/hr	cfs	in/hr	cfs	
TAR-NEP	TRAILS AT ASPEN RIDGE NORTHEAST POND	398439	9.15	0.0143	B	0.81	0.88		0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36	398439	0.09	0.36	2.00	100	100	1150	1150	0.05	10.63	2.9	4	1.19	16.08	26.71		0.2		7.9	TAR-NEP
A	1ST ENTRANCE EAST OF TAR	589483	13.53	0.0211	B	0.81	0.88	42600	0.45	0.59	0	0.90	0.96	11729	0.49	0.62	0	0.25	0.47	0	0.09	0.36	535154	0.16	0.41	10.67	100	100	1882	1882	0.05	9.91	3.0	4	1.21	25.87	35.78	2.19	1.3	3.67	11.6	A
B	2ND ENTRANCE EAST OF TAR	1583690	36.36	0.0568	B	0.81	0.88	42600	0.45	0.59	0	0.90	0.96	11729	0.49	0.62	0	0.25	0.47	0	0.09	0.36	917154	0.08	0.24	4.45	100	100	2432	2432	0.05	10.73	3.0	4	1.21	33.43	44.16	1.92	5.7	3.23	28.3	B
C	BRADLEY LANDING BLVD CROSSING	1583690	36.36	0.0568	B	0.81	0.88	42600	0.45	0.59	0	0.90	0.96	11729	0.49	0.62	0	0.25	0.47	0	0.09	0.36	1529361	0.12	0.38	5.23	100	100	2830	2830	0.05	10.36	3.0	4	1.21	38.90	49.26	1.80	5.7	3.02	28.3	C
D	BLISS ROAD BYPASS STORM	1714617	39.36	0.0615	B	0.81	0.88	42600	0.45	0.59	0	0.90	0.96	11729	0.49	0.62	0	0.25	0.47	0	0.09	0.36	1660288	0.11	0.38	4.98	100	100	4063	4063	0.05	10.39	3.0	4	1.21	55.85	66.23	1.48	6.7	2.49	37.3	D
E	MKJCC POND #9 DISCHARGE & DP D	3470311	79.67	0.1245	B	0.81	0.88	42600	0.45	0.59	0	0.90	0.96	11729	0.49	0.62	0	0.25	0.47	0	0.09	0.36	3415982	0.10	0.37	3.47	100	100	4063	4063	0.05	10.51	3.0	4	1.21	55.85	66.36	1.48	15.5	2.49	123.7	E
BL-1	INLET BL-1	130000	2.98	0.0047	B	0.81	0.88	130000	0.45	0.59	0	0.90	0.96	0	0.49	0.62	0	0.25	0.47	0	0.09	0.36	0	0.81	0.88	95.00	20	20	1372	1372	0.03	1.62	3.0	7	3.46	6.60	8.21	4.41	10.7	7.40	19.6	BL-1
BL-2	INLET BL-2 OUTFLOW	190354	4.37	0.0068	B	0.81	0.88	190354	0.45	0.59	0	0.90	0.96	0	0.49	0.62	0	0.25	0.47	0	0.09	0.36	0	0.81	0.88	95.00	20	20	1372	1372	0.03	1.62	3.0	7	3.46	6.60	8.21	4.41	15.7	7.40	28.7	BL-2
F	BS1	137852	3.16	0.0049	B	0.81	0.88	60390	0.45	0.59	77462	0.90	0.96	0	0.49	0.62	0	0.25	0.47	0	0.09	0.36	0	0.61	0.72	78.14	100	100	980	980	0.05	5.18	1.8	7	2.68	6.09	11.26	3.92	7.6	6.58	15.0	F
G	BS2	35937	0.83	0.0013	B	0.81	0.88	35937	0.45	0.59	0	0.90	0.96	0	0.49	0.62	0	0.25	0.47	0	0.09	0.36	0	0.81	0.88	95.00	20	20	980	980	0.05	1.37	1.8	7	2.68	6.09	7.45	4.55	3.1	7.64	5.6	G
H	BS1-2	173789	3.99	0.0062	B	0.81	0.88	96327	0.45	0.59	77462	0.90	0.96	0	0.49	0.62	0	0.25	0.47	0	0.09	0.36	0	0.65	0.75	81.63	100	100	980	980	0.05	4.74	1.8	7	2.68	6.09	10.82	3.98	10.4	6.68	20.2	H
RH1	RHC1	107935	2.48	0.0039	B	0.81	0.88	107935	0.45	0.59	0	0.90	0.96	0	0.49	0.62	0	0.25	0.47	0	0.09	0.36	0	0.81	0.88	95.00	92	92	1343	1343	0.02	3.97	1.9	7	2.76	8.12	12.09	3.80	7.7	6.39	14.0	RH1
RH2	RHC1-RHC2	133418	3.06	0.0048	B	0.81	0.88	133418	0.45	0.59	0	0.90	0.96	0	0.49	0.62	0	0.25	0.47	0	0.09	0.36	0	0.81	0.88	95.00	92	92	1343	1343	0.02	3.97	1.9	7	2.76	8.12	12.09	3.80	9.5	6.39	17.4	RH2
MKJCC POND #8	RHC1-RHC3 (SEE PDR/FDR FOR MORE DETAILED ANALYSIS OF THE REDEMPTION HILL CHURCH SITE	564572	12.96	0.0203	D	0.82	0.89	133418	0.49	0.65	0	0.90	0.96	0	0.53	0.68	431154	0.30	0.57	0	0.16	0.51	0	0.60	0.73	75.91	100	100	2443	2443	0.02	7.16	1.9	7	2.76	14.77	21.93	2.87	22.5	4.83	46.0	MKJCC POND #8
MKJCC POND #8	OUTFLOW	564572	12.96	0.0203	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.00	0.00	0.00		0		0		#DIV/0!							3.6		11.3	MKJCC POND #8
DP-M3	HEC-HMS CALCS CUMULATIVE OF OFFSITE FLOWS, MKJCC POND #8-MKJCC POND#11	133507044	3064.90	4.7889	B	0.81	0.88		0.45	0.59		0.90	0.96		0.49	0.62		0.25	0.47		0.09	0.36		0.00	0.00	0.00													284.6		1209.3	DP-M3
I	BS3, BS5	85777	1.97	0.0031	D	0.82	0.89	85777	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	100	100	737	737	0.05	2.95	2.3	7	3.03	4.05	6.99	4.64	7.6	7.80	13.8	I
J	BS4, BS6	52368	1.20	0.0019	D	0.82	0.89	52368	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	20	20	737	737	0.05	1.32	2.3	7	3.03	4.05	5.36	5.01	5.0	8.42	9.1	J
K	BS3-BS6	138145	3.17	0.0050	D	0.82	0.89	138145	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	100	100	737	737	0.05	2.95	2.3	7	3.03	4.05	6.99	4.64	12.2	7.80	22.2	K
L	BS3-BS6, BHE3	1079185	24.77	0.0387	D	0.82	0.89	138145	0.49	0.65	941040	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.53	0.68	68.84	100	100	1400	1400	0.05	5.98	2.5	7	3.16	7.38	13.35	3.65	48.5	6.13	104.1	L
MKJCC POND #7	BS3-BS6, BHE3, MK1, RHC4	3047217	69.95	0.1093	D	0.82	0.89	1050674	0.49	0.65	1996543	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.60	0.73	75.34	100	100	2435	2435	0.05	5.22	2.5	7	3.16	12.83	18.05	3.17	135.1	5.33	275.4	MKJCC POND #7
MKJCC POND #7	OUTFLOW	3047217	69.95	0.1093	D	0.82	0.89	1050674	0.49	0.65	1996543	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.60	0.73	75.34	100	100	2435	2435	0.05	5.22	2.5	7					23.5		177.2	MKJCC POND #7
DP-M2	HEC-HMS CALCS CUMULATIVE OF OFFSITE FLOWS, MKJCC PONDS #6, #7, & #8	139962636	3213.10	5.0205	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.00	0.00	0.00													305.9		1220.2	DP-M2
N	MK3	71539	1.64	0.0026	D	0.82	0.89	71539	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	50	50	1384	1384	0.05	2.08	1.2	7	2.19	10.53	12.61	3.74	5.1	6.28	9.2	N
O	MK5	26108	0.60	0.0009	D	0.82	0.89	26108	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	50	50	541	541	0.05	2.08	1.2	7	2.19	4.12	6.19	4.82	2.4	8.09	4.4	O
P	MK4	71100	1.63	0.0026	D	0.82	0.89	71100	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	50	50	830	830	0.05	2.08	1.2	7	2.19	6.31	8.39	4.37	5.9	7.35	10.8	P
Q	MK3-MK5	168747	3.87	0.0061	D	0.82	0.89	168747	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	50	50	1384	1384	0.05	2.08	1.2	7	2.19	10.53	12.61	3.74	12.0	6.28	21.8	Q
R	MK2-5	660299	15.16	0.0237	D	0.82	0.89	168747	0.49	0.65	491552	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.57	0.71	72.67	100	100	1100	1100	0.05	5.53	3.0	7	3.46	5.29	10.82	3.98	34.9	6.68	72.7	R
MKJCC POND #5	MK2-MK6	2930960	67.29	0.1051	D	0.82	0.89	168747	0.49	0.65	2762213	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.51	0.66	66.73	100	100	2050	2050	0.05	6.22	4.0	7	4.00	8.54	14.76	3.49	120.4	5.86	263.8	MKJCC POND #5
MKJCC POND #5	OUTFLOW	2930960	67.29	0.1051	D	0.82	0.89	168747	0.49	0.65	2762213	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.51	0.66	66.73	100	100	2050	2050	0.05	6.22	4.0	7					24.2		203.5	MKJCC POND #5
DP-M1	HEC-HMS CALCS CUMULATIVE OF OFFSITE FLOWS AND MKJCC PONDS #5-#8	141505972	3248.53	5.0758				168747			2762213			0			0			0			0	0.00	0.00	1.38													330.7		1217.9	DP-M1
COLORADO CENTRE DETENTION POND	HEC-HMS CALCS CUMULATIVE OF OFFSITE FLOWS AND MKJCC PONDS #5-#8, AND MARKSHEFFEL TRIBUTARY TO JIMMY CAMP CREEK CHANNEL FLOWS SOUTH OF BRADLEY ROAD	141505972	3248.53	5.0758				376339			2762213			0			0			0			2052362	0.00	0.00	1.55													327.1		1001.2	COLORADO CENTRE DETENTION POND
S	MK11	195555	4.49	0.0070	D	0.82	0.89	77886	0.49	0.65	0	0.90	0.96	0	0.53	0.68	72375	0.30	0.57	0	0.16	0.51	45294	0.56	0.72	64.21	50	50	1673	1673	0.05	4.02	4.0	7	4.00	6.97	10.99	3.95	10.0	6.64	21.8	S
T	MK12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	T
U	MK11-MK12	212101	4.87	0.0076	D	0.82	0.89	94432	0.49	0.65	0	0.90	0.96	0	0.53	0.68	72375	0.30	0.57	0	0.16	0.51	45294	0.58	0.74	66.61	50	50	1673	1673	0.05	3.87	3.7	7	3.85	7.25	11.11	3.94	11.2	6.61	23.9	U
U2	MK11-MK13	897961	20.61	0.0322	D	0.82	0.89	94432	0.49	0.65	0	0.90	0.96	0	0.53	0.68	758235	0.30	0.57	0	0.16	0.51	45294	0.54	0.69	69.20	50	50	1673	1673	0.05	4.15	3.7	7	3.85	7.25	11.40	3.90	43.9	6.55	94.3	U2
V	MK11-MK14	1029465	23.63	0.0369	D	0.82	0.89	94432	0.49	0.65	0	0.90	0.96	0	0.53	0.68	889739	0.30	0.57	0	0.16	0.51	45294	0.54	0.69	69.30	50	50	1873	1873	0.05	4.17	3.7	7	3.85	8.11	12.28	3.78	48.6	6.35	104.6	V
W	MK15	29148	0.67	0.0010	D	0.82	0.89	29148	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	50	50	550	550	0.05	2.08	4.0	7	4.00	2.29	5.00	5.10	2.8	8.58	5.1	W
X	MK10	85832	1.97	0.0031	D	0.82	0.89	85832	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	50	50	2150	2150	0.05	2.08	4.0	7	4.00	8.96	11.04	3.95	6.4	6.63	11.7	X
Y	MK10, MK15	114980	2.64	0.0041	D	0.82	0.89	114980	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	50	50	2150	2150	0.05	2.08	4.0	7	4.00	8.96	11.04	3.95	8.6	6.63	15.7	Y
Z	MK10-MK15	1144445	26.27	0.0411	D	0.82	0.89	209412	0.49	0.65	0	0.90	0.96	0	0.53	0.68	889739	0.30	0.57	0	0.16	0.51	45294	0.57	0.71	71.88	50	50	2150	2150	0.05	3.96	4.0	7	4.00	8.96	12.91	3.70	55.7	6.22	117.1	Z
MKJCC POND #4	MK7, MK10-MK16-INFLOW	2229978	51.19	0.0800	D	0.82	0.89	209412	0.49	0.65	1085533	0.90	0.96	0	0.53	0.68	889739	0.30	0.57	0	0.16	0.51	45294	0.53	0.68	68.53	100	100	2050	2050	0.05	6.00	4.0	7	4.00	8.54	14.53	3.51	96.1	5.90	207.6	MKJCC POND #4
MKJCC POND #4	MK7, MK10-MK16-OUTFLOW	2229978	51.19	0.0800	D	0.82	0.89	209412	0.49	0.65	1085533	0.90	0.96	0	0.53	0.68	889739	0.30	0.57	0	0.16	0.51	45294	0.53	0.68	68.53													10.0		70.3	MKJCC POND #4
MKJCC POND #6	MK9	1796376	41.24	0.0644	D	0.82	0.89	0	0.49	0.65	0	0.90	0.96	0	0.53	0.68	1796376	0.30	0.57	0	0.16	0.51	0	0.53	0.68	70.00	100		2500		0.05		0.8	7					17.0		89.0	MKJCC POND #6
DP-M0	HEC-HMS CALCS CUMULATIVE OF OFFSITE FLOWS, COLORADO CENTRE REGIONAL POND DISCHARGE, POND MKJCC #4 DISCHARGE, AND MK-8	143993179	3305.63	5.1650	D	0.82	0.89	684368	0.49	0.65	3847746	0.90	0.96	0	0.53	0.68	889739	0.30	0.57	0	0.16	0.51	2350054	0.02	0.03	2.65													338.4		1003.8	DP-M0
AA	JC1	80679	1.85	0.0029	D	0.82	0.89	35729	0.49	0.65	0	0.90	0.96	0	0.53	0.68	30402	0.30	0.57	0	0.16	0.51	14548	0.59	0.74	68.81	20	20	795	795	0.05	2.39	2.3	7	3.03	4.37	6.76	4.69	5.2	7.88	10.9	AA
AB	JC2	32553	0.75	0.0012	D	0.82	0.89	32553	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	20	20	795	795	0.05	1.32	2.3	7	3.03	4.37	5.68	4.94	3.0	8.29	5.6	AB
AC	JC1-JC2	113232	2.60	0.0041	D	0.82	0.89	68282	0.49	0.65	0	0.90	0.96	0	0.53	0.68	30402	0.30	0.57	0	0.16	0.51	14548	0.66	0.78	76.34	20	20	795	795	0.05	2.08	2.3	7	3.03	4.37	6.45	4.76	8.2	7.99	16.4	AC
AD	JC1-JC3	901437	20.69	0.0323	D	0.82	0.89	68282	0.49	0.65	0	0.90	0.96	0	0.53	0.68	818607	0.30	0.57	0	0.16	0.51	14548	0.55	0.69	70.80	100	100	1150	1150	0.05	5.83	4.0	7	4.00	4.79	10.62	4.01	45.6	6.73	97.4	AD
AE	JC1-JC4	1630854	37.44	0.0585	D	0.82	0.89	68282	0.49	0.65	0	0.90	0.96	0	0.53	0.68	1548024	0.30	0.57	0	0.16	0.51	14548	0.54	0.69	70.44	100	100	1450	1450	0.05	5.91	4.0	7	4.00	6.04	11.94	3.82	77.7	6.42	166.6	AE
JCC POND #3	JC1-JC4	1630854	37.44	0.0585	D	0.82	0.89	68282	0.49	0.65	0	0.90	0.96	0	0.53	0.68	1548024	0.30	0.57	0	0.16	0.51	14548	0.54	0.69	70.44	100	100	1450	1450	0.05	5.91	4.0	7	4.00	6.04	11.94	3.82	7.4	6.42	59.8	JCC POND #3
JC	JC1-JC5	1957667	44.94	0.0702	D	0.82	0.89	276087	0.49	0.65	0	0.90	0.96	0	0.53	0.68	1548024	0.30	0.57	0	0.16	0.51	133556	0.55	0.70	68.89	100	100	1450	1450	0.05	5.84	4.0	7	4.00	6.04	11.87	3.83	18.2	6.44	83.3	JC
AF	WF10	67865	1.56	0.0024	D	0.82	0.89	67865	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	50	50	765	765	0.05	2.08	1.7	7	2.61	4.89	6.97	4.65	6.0	7.81	10.9	AF
AG	WF11	47120	1.08	0.0017	D	0.82	0.89	47120	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	50	50	765	765	0.05	2.08	1.7	7	2.61	4.89	6.97	4.65	4.2	7.81	7.6	AG
AH	WF10-WF11	114985	2.64	0.0041	D	0.82	0.89	114985	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	50	50	765	765	0.05	2.08	1.7	7	2.61	4.89	6.97	4.65	10.1	7.81	18.5	AH
AI	WF12b & WF13	1408940	32.34	0.0505	D	0.82	0.89	44672	0.49	0.65	1037630	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	326638	0.42	0.63	51.35	100	100	2777	2777	0.05	7.12	4.0	7	4.00	11.57	18.68	3.12	43.1	5.24	106.8	AI
AJ	WF14 & WF15	1393431	31.99	0.0500	D	0.82	0.89	48793	0.49	0.65	1255752	0.90	0.96	0	0.53	0.68	88886	0.30	0.57	0	0.16	0.51	0	0.50	0.66	66.37	100	100	1645	1645	0.05	6.27	4.0	7	4.00	6.85	13.12	3.67	59.7	6.17	131.4	AJ
AK	WF10-WF15 (Excluding WF12a)	2917356	66.97	0.1046	D	0.82	0.89	208450	0.49	0.65	2293382	0.90	0.96	0	0.53	0.68	88886	0.30	0.57	0	0.16	0.51	326638	0.48	0.65	60.24	100	100	3777	3777	0.05	6.55	4.0	7	4.00	15.74	22.28	2.85	92.0	4.79	210.9	AK
AL	WF16	3901	0.09	0.0001	D	0.82	0.89	3901	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	20	20	118	118	0.05	1.32	1.0	7	2.00	0.98	5.00	5.10	0.4	8.58	0.7	AL
AM	WF17	11725	0.27	0.0004	D	0.82	0.89	4177	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	7548	0.40	0.65	35.13	20	20	118	118	0.05	3.32	1.0	7	2.00	0.98	5.00	5.10	0.5	8.58	1.5	AM
AN	WF16-WF17	15626	0.36	0.0006	D	0.82	0.89	8078	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	7548	0.50	0.71	50.08	20	20	118	118	0.05	2.82	1.0	7	2.00	0.98	5.00	5.10	0.9	8.58	2.2	AN
AO	WF10-WF17 (Excluding WF12a)	2932982	67.33	0.1052	D	0.82	0.89	216528	0.49	0.65	2293382	0.90	0.96	0	0.53	0.68	88886	0.30	0.57	0	0.16	0.51	334186	0.48	0.65	60.19	100	100	3777	3777	0.05	6.55	4.0	7	4.00	15.74	22.28	2.85	92.5	4.79	212.2	AO
WFJCC POND #2-INFLOW	DP AO and Sub-basin WF12a DESIGN POINT AP: POND INFLOWS	4051566	93.01	0.1453	D	0.82	0.89	216528	0.49	0.65	3411966	0.90	0.96	0	0.53	0.68	88886	0.30	0.57	0	0.16	0.51	334186	0.48	0.65	61.52	100	100	3777	3777	0.05	6.51	4.0	7	4.00	15.74	22.25	2.85	128.7	4.79	293.0	WFJCC POND #2-INFLOW
WFJCC POND #2-OUTFLOW	DP AO and Sub-basin WF12a DESIGN POINT AP: POND DISCHARGE	4051566	93.01	0.1453	D	0.82	0.89	216528	0.49	0.65	3411966	0.90	0.96	0	0.53	0.68	88886	0.30	0.57	0	0.16	0.51	334186	0.48	0.65	61.52	100	100	3777	3777	0	6.51	4	7	4.00	15.74	22.25	2.85	22.6	4.79	153.5	WFJCC POND #2-OUTFLOW
WF2	SITE DISCHARGE TO SOUTH	4051566	93.01	0.1453	D	0.82	0.89	216528	0.49	0.65	3411966	0.90	0.96	0	0.53	0.68	88886	0.30	0.57	0	0.16	0.51	334186	0.48	0.65	61.52	100	100	3777	3777	0	6.51	4	7	4.00	15.74	22.25	2.85	22.6	4.79	153.5	WF2
AQ	LH1 - AT GRADE AT BORDER WITH TRAILS AT ASPEN RIDGE	7884	0.18	0.0003	B	0.81	0.88	7884	0.45	0.59	0	0.90	0.96	0	0.49	0.62	0	0.25	0.47	0	0.09	0.36	0	0.81	0.88	95.00	20	20	180	180	0	1.37	2	7	2.83	1.06	5.00	5.10	0.8	8.58	1.4	AQ
AR	LH2 - AT GRADE AT BORDER WITH TRAILS AT ASPEN RIDGE	7884	0.18	0.0003	B	0.81	0.88	7884	0.45	0.59	0	0.90	0.96	0	0.49	0.62	0	0.25	0.47	0	0.09	0.36	0	0.81	0.88	95.00	20	20	180	180	0	1.37	2	7	2.83	1.06	5.00	5.10	0.8	8.58	1.4	AR
AS	LH1-LH2	15768	0.36	0.0006	B	0.81	0.88	15768	0.45	0.59	0	0.90	0.96	0	0.49	0.62	0	0.25	0.47	0	0.09	0.36	0	0.81	0.88	95.00	20	20	180	180	0.05	1.37	2.0	7	2.83	1.06	5.00	5.10	1.5	8.58	2.8	AS
AT	WF3	32652	0.75	0.0012	B	0.81	0.88	32652	0.45	0.59	0	0.90	0.96	0	0.49	0.62	0	0.25	0.47	0	0.09	0.36	0	0.81	0.88	95.00	30	30	589	589	0.05	1.67	1	7	2.00	4.91	6.58	4.73	2.9	7.95	5.3	AT
AU	WF2	201537	4.63	0.0072	B	0.81	0.88	17670	0.45	0.59	0	0.90	0.96	0	0.49	0.62	0	0.25	0.47	0	0.09	0.36	183867	0.15	0.41	10.15	50	50	1070	1070	0	7.05	4	7	4.05	4.40	11.45	3.89	2.8	6.53	12.4	AU
AV	WF2-WF3, LH1-LH2	249957	5.74	0.0090	B	0.81	0.88	66090	0.45	0.59	0	0.90	0.96	0	0.49	0.62	0	0.25	0.47	0	0.09	0.36	183867	0.28	0.50	26.59	50	50	1070	1070	0.05	6.10	4.1	7	4.05	4.40	10.50	4.03	6.5	6.76	19.5	AV
AW	WF1-WF3, LH1-LH2	946636	21.73	0.0340	B	0.81	0.88	66090	0.45	0.59	696679	0.90	0.96	0	0.49	0.62	0	0.25	0.47	0	0.09	0.36	183867	0.41	0.57	54.86	50	50	1070	1070	0.05	5.17	4.1	7	4.05	4.40	9.57	4.17	37.0	7.01	86.8	AW
AX	WF5	280402	6.44	0.0101	D	0.82	0.89	0	0.49	0.65	280402	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.49	0.65	65.00	100	100	1471	1471	0	6.42	1	7	2.10	11.69	18.10	3.17	10.1	5.32	22.4	AX
AY	WF6	46250	1.06	0.0017	D	0.82	0.89	46250	0.49	0.65	0	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00	50	50	961	961	0	2.08	1	7	2.10	7.64	9.71	4.15	3.6	6.97	6.6	AY
AZ	WF5-WF6	326652	7.50	0.0117	D	0.82	0.89	46250	0.49	0.65	280402	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.54	0.68	69.25	100	100	1471	1471	0.05	5.93	1.1	7	2.10	11.69	17.61	3.21	13.0	5.39	27.9	AZ
BA	WF1-WF3, WF5-WF6, LH1, LH2	1273288	29.23	0.0457	D	0.82	0.89	112340	0.49	0.65	977081	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	183867	0.47	0.65	58.55	100	100	1471	1471	0.05	6.62	1.1	7	2.10	11.69	18.30	3.15	43.8	5.29	101.5	BA
BB	WF1-WF6, LH1-LH2	2156513	49.51	0.0774	D	0.82	0.89	112340	0.49	0.65	977081	0.90	0.96	0	0.53	0.68	697669	0.30	0.57	0	0.16	0.51	369423	0.46	0.65	57.39	100	100	1471	1471	0.05	6.70	1.1	7	2.10	11.69	18.38	3.14	72.7	5.28	170.9	BB
BC	WF1-WF8, LH1-LH2 INTO WFJCC POND #1	3320137	76.22	0.1191	D	0.82	0.89	112340	0.49	0.65	1561184	0.90	0.96	0	0.53	0.68	697669	0.30	0.57	0	0.16	0.51	948944	0.42	0.62	49.06	100	100	1971	1971	0.05	7.21	1.1	7	2.10	15.66	22.86	2.81	89.7	4.73	226.7	BC
WFJCC POND #1	POND DISCHARGE	3320137	76.22	0.1191	D	0.82	0.89	112340	0.49	0.65	1561184	0.90	0.96	0	0.53	0.68	697669	0.30	0.57	0	0.16	0.51	948944	0.42	0.62	49.06													10.7		106.7	WFJCC POND #1
TAR-EP	TRAILS AT ASPEN RIDGE-EAST POND FULL BUILD-OUT DISCHARGE	7007497	160.87	0.2514	B																					44.95													5.8		139.5	TAR-EP
WF1	TAR-EP, WF9, WFJCC POND #1 DISCHARGE	10878008	249.72	0.3902	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51		0.00	0.00	44.03													22.1		276.3	WF1

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: BRADLEY HEIGHTS MDDP - WFJCC POND #2

Basin ID: WEST FORK JIMMY CAMP CREEK



Example Zone Configuration (Retention Pond)

Depth Increment = 0.25 ft

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	90.86	acres		
Watershed Length =	2,000	ft		
Watershed Length to Centroid =	1,000	ft		
Watershed Slope =	0.040	ft/ft		
Watershed Imperviousness =	77.77%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	5.0%	percent		
Percentage Hydrologic Soil Groups C/D =	95.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths = Denver - Capitol Building				

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) =	2.384	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	6.970	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	7.285	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	9.711	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	11.712	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	13.835	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	15.875	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	18.193	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.55 in.) =	26.646	acre-feet	3.55	inches
Approximate 2-yr Detention Volume =	6.256	acre-feet		
Approximate 5-yr Detention Volume =	8.548	acre-feet		
Approximate 10-yr Detention Volume =	9.874	acre-feet		
Approximate 25-yr Detention Volume =	10.477	acre-feet		
Approximate 50-yr Detention Volume =	10.742	acre-feet		
Approximate 100-yr Detention Volume =	11.404	acre-feet		

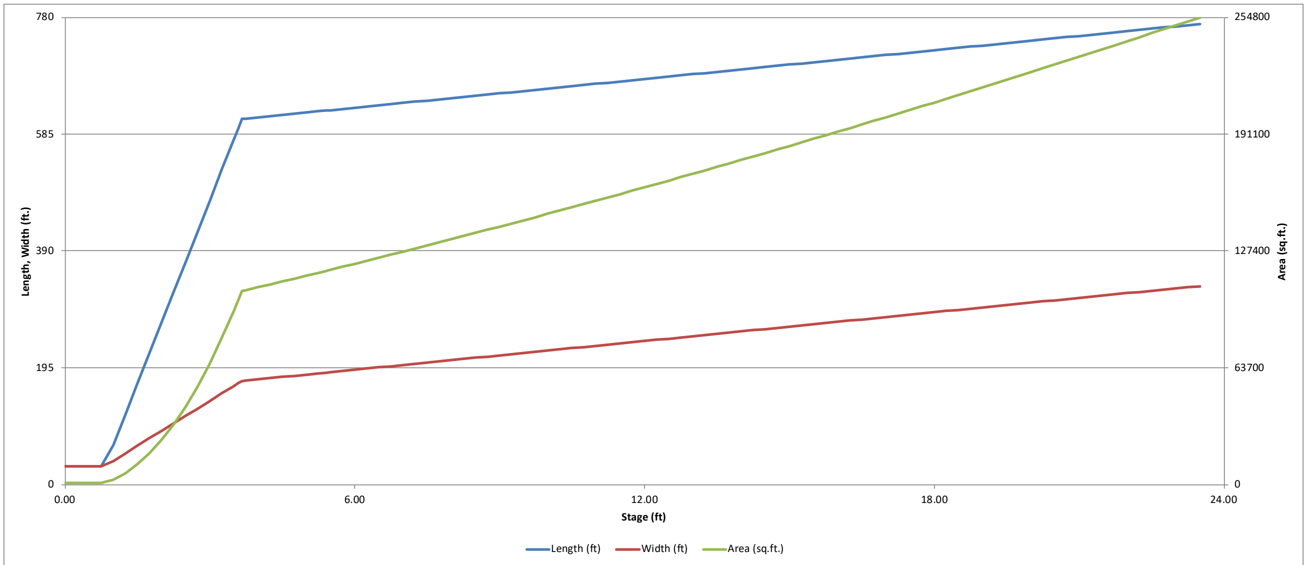
Define Zones and Basin Geometry

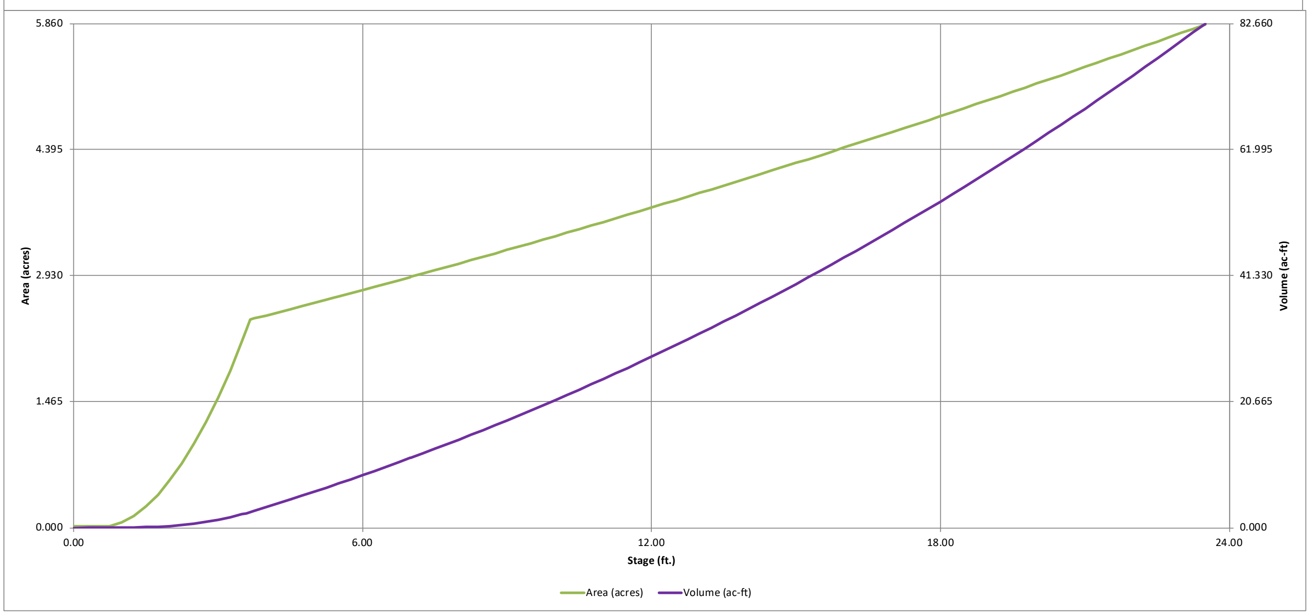
Zone 1 Volume (WQCV) =	2.384	acre-feet
Zone 2 Volume (EURV - Zone 1) =	4.586	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.433	acre-feet
Total Detention Basin Volume =	11.404	acre-feet
Initial Surcharge Volume (ISV) =	312	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	7.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	4	
Initial Surcharge Area (A_{ISV}) =	944	ft^2
Surcharge Volume Length (L_{ISV}) =	30.7	ft
Surcharge Volume Width (W_{ISV}) =	30.7	ft
Depth of Basin Floor (H_{FLOOR}) =	2.84	ft
Length of Basin Floor (L_{FLOOR}) =	610.1	ft
Width of Basin Floor (W_{FLOOR}) =	172.7	ft
Area of Basin Floor (A_{FLOOR}) =	105,379	ft^2
Volume of Basin Floor (V_{FLOOR}) =	110,096	ft^3
Depth of Main Basin (H_{MAIN}) =	3.33	ft
Length of Main Basin (L_{MAIN}) =	636.7	ft
Width of Main Basin (W_{MAIN}) =	199.4	ft
Area of Main Basin (A_{MAIN}) =	126,943	ft^2
Volume of Main Basin (V_{MAIN}) =	386,260	ft^3
Calculated Total Basin Volume (V_{total}) =	**11.413**	acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		30.7	30.7	944		0.022		
ISV	0.33		30.7	30.7	944		0.022	312	0.007
	0.50		30.7	30.7	944		0.022	472	0.011
	0.75		30.7	30.7	944		0.022	708	0.016
	1.00		65.4	39.2	2,566		0.059	1,074	0.025
	1.25		116.4	51.7	6,022		0.138	2,121	0.049
	1.50		167.4	64.2	10,752		0.247	4,191	0.096
	1.75		218.4	76.7	16,758		0.385	7,603	0.175
	2.00		269.4	89.2	24,039		0.552	12,676	0.291
	2.25		320.4	101.7	32,594		0.748	19,729	0.453
	2.50		371.4	114.2	42,425		0.974	29,079	0.668
	2.75		422.4	126.7	53,531		1.229	41,047	0.942
	3.00		473.4	139.2	65,912		1.513	55,951	1.284
	3.25		524.4	151.7	79,567		1.827	74,109	1.701
	3.50		575.4	164.2	94,498		2.169	95,841	2.200
Zone 1 (WQCV)	3.59		593.8	168.7	100,185		2.300	104,601	2.401
Floor	3.67		610.1	172.7	105,379		2.419	112,822	2.590
	3.75		610.7	173.4	105,881		2.431	121,273	2.784
	4.00		612.7	175.4	107,453		2.467	147,939	3.396
	4.25		614.7	177.4	109,033		2.503	175,000	4.017
	4.50		616.7	179.4	110,621		2.540	202,456	4.648
	4.75		618.7	181.4	112,217		2.576	230,311	5.287
	5.00		620.7	183.4	113,822		2.613	258,566	5.936
	5.25		622.7	185.4	115,434		2.650	287,223	6.594
Zone 2 (EURV)	5.40		623.9	186.6	116,405		2.672	304,610	6.993
	5.50		624.7	187.4	117,054		2.687	316,283	7.261
	5.75		626.7	189.4	118,682		2.725	345,750	7.937
	6.00		628.7	191.4	120,318		2.762	375,625	8.623
	6.25		630.7	193.4	121,963		2.800	405,910	9.318
	6.50		632.7	195.4	123,615		2.838	436,607	10.023
	6.75		634.7	197.4	125,275		2.876	467,718	10.737
Zone 3 (100-year)	6.99		636.6	199.3	126,876		2.913	497,976	11.432
	7.00		636.7	199.4	126,943		2.914	499,245	11.461
	7.25		638.7	201.4	128,619		2.953	531,191	12.194
	7.50		640.7	203.4	130,304		2.991	563,556	12.937
	7.75		642.7	205.4	131,996		3.030	596,343	13.690
	8.00		644.7	207.4	133,696		3.069	629,554	14.453
	8.25		646.7	209.4	135,404		3.108	663,192	15.225
	8.50		648.7	211.4	137,120		3.148	697,257	16.007
	8.75		650.7	213.4	138,845		3.187	731,752	16.799
	9.00		652.7	215.4	140,577		3.227	766,680	17.601
	9.25		654.7	217.4	142,317		3.267	802,041	18.412
	9.50		656.7	219.4	144,065		3.307	837,839	19.234
	9.75		658.7	221.4	145,821		3.348	874,075	20.066
	10.00		660.7	223.4	147,585		3.388	910,750	20.908
	10.25		662.7	225.4	149,358		3.429	947,868	21.760
	10.50		664.7	227.4	151,138		3.470	985,430	22.622
	10.75		666.7	229.4	152,926		3.511	1,023,438	23.495
	11.00		668.7	231.4	154,722		3.552	1,061,894	24.378
	11.25		670.7	233.4	156,526		3.593	1,100,800	25.271
	11.50		672.7	235.4	158,339		3.635	1,140,158	26.174
	11.75		674.7	237.4	160,159		3.677	1,179,970	27.088
	12.00		676.7	239.4	161,987		3.719	1,220,238	28.013
	12.25		678.7	241.4	163,823		3.761	1,260,964	28.948
	12.50		680.7	243.4	165,667		3.803	1,302,150	29.893
	12.75		682.7	245.4	167,520		3.846	1,343,798	30.849
	13.00		684.7	247.4	169,380		3.888	1,385,910	31.816
	13.25		686.7	249.4	171,248		3.931	1,428,489	32.794
	13.50		688.7	251.4	173,124		3.974	1,471,535	33.782
	13.75		690.7	253.4	175,008		4.018	1,515,051	34.781
	14.00		692.7	255.4	176,901		4.061	1,559,040	35.791
	14.25		694.7	257.4	178,801		4.105	1,603,502	36.811
	14.50		696.7	259.4	180,709		4.149	1,648,441	37.843
	14.75		698.7	261.4	182,625		4.192	1,693,858	38.886
	15.00		700.7	263.4	184,549		4.237	1,739,754	39.939
	15.25		702.7	265.4	186,482		4.281	1,786,133	41.004
	15.50		704.7	267.4	188,422		4.326	1,832,996	42.080
	15.75		706.7	269.4	190,370		4.370	1,880,344	43.167
	16.00		708.7	271.4	192,326		4.415	1,928,181	44.265
	16.25		710.7	273.4	194,290		4.460	1,976,508	45.374
	16.50		712.7	275.4	196,262		4.506	2,025,327	46.495
	16.75		714.7	277.4	198,243		4.551	2,074,640	47.627
	17.00		716.7	279.4	200,231		4.597	2,124,449	48.771
	17.25		718.7	281.4	202,227		4.642	2,174,756	49.926
	17.50		720.7	283.4	204,231		4.689	2,225,563	51.092
	17.75		722.7	285.4	206,243		4.735	2,276,872	52.270
	18.00		724.7	287.4	208,264		4.781	2,328,686	53.459
	18.25		726.7	289.4	210,292		4.828	2,381,005	54.660
	18.50		728.7	291.4	212,328		4.874	2,433,832	55.873
	18.75		730.7	293.4	214,372		4.921	2,487,170	57.098
	19.00		732.7	295.4	216,424		4.968	2,541,019	58.334
	19.25		734.7	297.4	218,485		5.016	2,595,382	59.582
	19.50		736.7	299.4	220,553		5.063	2,650,262	60.842
	19.75		738.7	301.4	222,629		5.111	2,705,660	62.113
	20.00		740.7	303.4	224,713		5.159	2,761,577	63.397
	20.25		742.7	305.4	226,805		5.207	2,818,017	64.693
	20.50		744.7	307.4	228,906		5.255	2,874,980	66.000
	20.75		746.7	309.4	231,014		5.303	2,932,470	67.320
	21.00		748.7	311.4	233,130		5.352	2,990,488	68.652
	21.25		750.7	313.4	235,254		5.401	3,049,036	69.996
	21.50		752.7	315.4	237,386		5.450	3,108,116	71.353
	21.75		754.7	317.4	239,527		5.499	3,167,730	72.721
	22.00		756.7	319.4	241,675		5.548	3,227,880	74.102
	22.25		758.7	321.4	243,831		5.598	3,288,568	75.495
	22.50		760.7	323.4	245,995		5.647	3,349,796	76.901
	22.75		762.7	325.4	248,167		5.697	3,411,566	78.319
	23.00		764.7	327.4	250,347		5.747	3,473,880	79.749
	23.25		766.7	329.4	252,536		5.797	3,536,740	81.192
	23.50		768.7	331.4	254,732		5.848	3,600,149	82.648

EXCERPT FROM PREVIOUS STUDY

EXCERPT FROM PREVIOUS STUDY





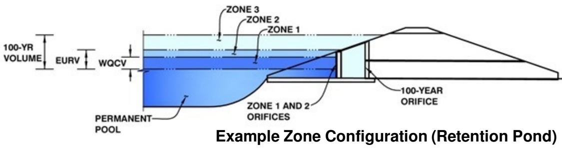
EXCERPT FROM PREVIOUS STUDY

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: BRADLEY HEIGHTS MDDP - WFJCC POND #2

Basin ID: WEST FORK JIMMY CAMP CREEK



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.59	2.384	Orifice Plate
Zone 2 (EURV)	5.40	4.586	Circular Orifice
Zone 3 (100-year)	6.99	4.433	Weir&Pipe (Restrict)
Total (all zones)		11.404	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.59	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	14.40	inches
Orifice Plate: Orifice Area per Row =	6.55	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	4.549E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.20	2.39					
Orifice Area (sq. inches)	6.55	6.55	6.55					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	3.59	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	5.40	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	5.24	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.15	N/A	ft^2
Vertical Orifice Centroid =	0.22	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.40	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	44.00	N/A	feet
Overflow Weir Grate Slope =	8.00	N/A	H:V
Horiz. Length of Weir Sides =	8.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.40	N/A	feet
Overflow Weir Slope Length =	8.06	N/A	feet
Grate Open Area / 100-yr Orifice Area =	17.32	N/A	
Overflow Grate Open Area w/o Debris =	248.32	N/A	ft^2
Overflow Grate Open Area w/ Debris =	124.16	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	60.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	41.10		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	14.33	N/A	ft^2
Outlet Orifice Centroid =	1.92	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.95	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	137.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.98	feet
Stage at Top of Freeboard =	9.48	feet
Basin Area at Top of Freeboard =	3.30	acres
Basin Volume at Top of Freeboard =	19.17	acre-ft

Routed Hydrograph Results

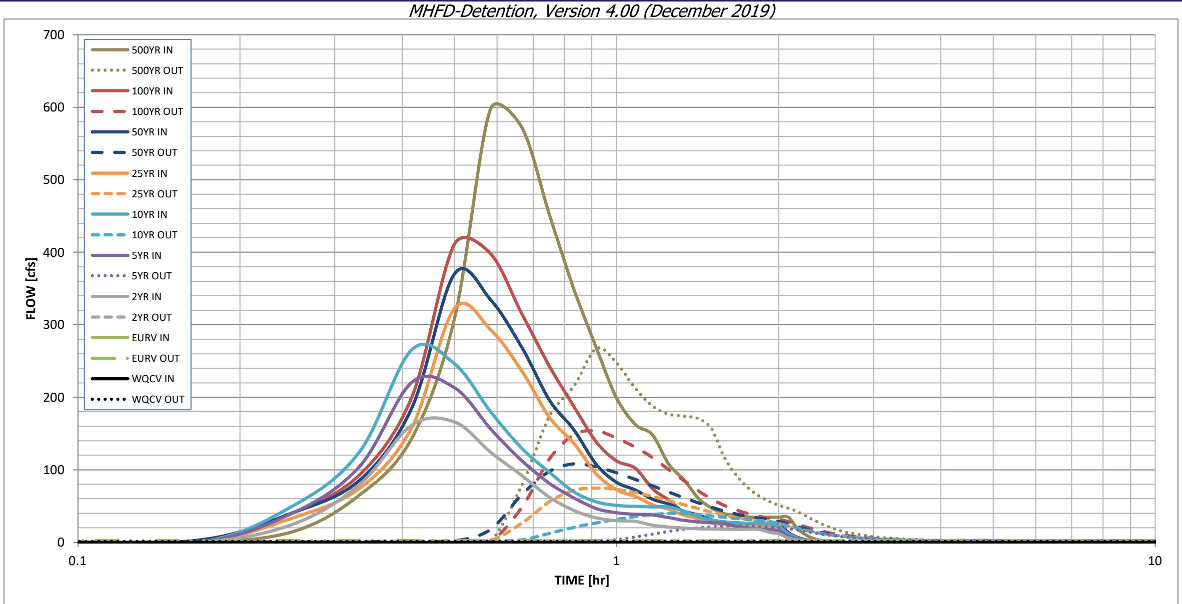
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

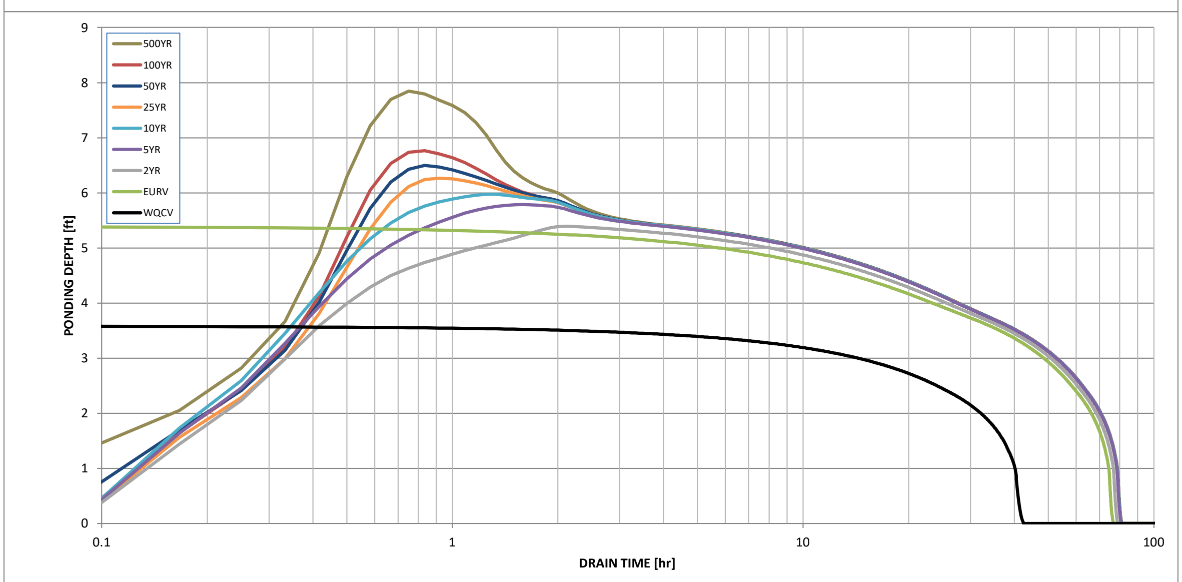
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.55
CUHP Runoff Volume (acre-ft) =	2.384	6.970	7.285	9.711	11.712	13.835	15.875	18.193	26.646
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	7.285	9.711	11.712	13.835	15.875	18.193	26.646
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	26.6	56.3	77.5	118.5	146.0	179.6	291.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.29	0.62	0.85	1.30	1.61	1.98	3.21
Peak Inflow Q (cfs) =	N/A	N/A	166.2	220.6	265.5	322.5	370.0	411.1	596.8
Peak Outflow Q (cfs) =	1.0	2.2	2.2	22.6	40.0	74.9	108.2	153.5	267.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.5	0.6	0.7	0.9	0.9
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.1	0.3	0.4	0.6	0.7
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	68	70	71	69	68	66	65	60
Time to Drain 99% of Inflow Volume (hours) =	**40**	72	75	76	75	75	74	73	71
Maximum Ponding Depth (ft) =	3.59	5.40	5.39	5.79	5.97	6.27	6.50	6.76	7.85
Area at Maximum Ponding Depth (acres) =	2.30	2.67	2.67	2.73	2.76	2.80	2.84	2.88	3.04
Maximum Volume Stored (acre-ft) =	2.401	6.993	6.966	8.019	8.540	9.346	9.995	10.766	13.964

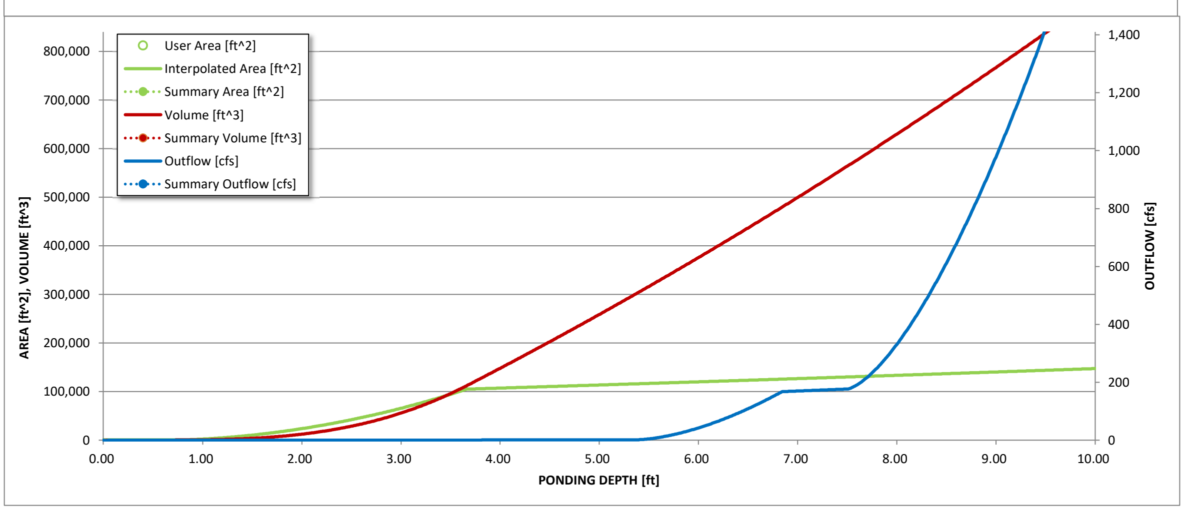
EXCERPT FROM PREVIOUS STUDY

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)



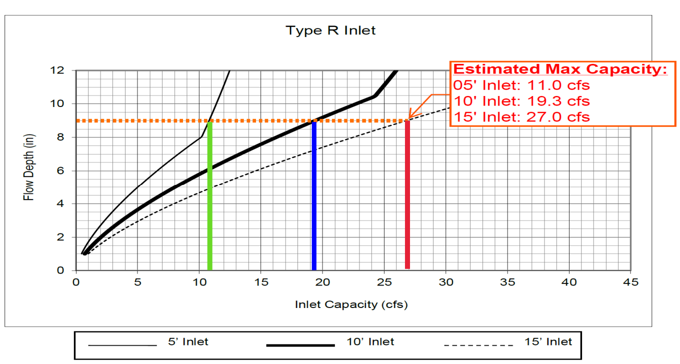




EXCERPT FROM PREVIOUS STUDY

INLET SUMMARY
BRADLEY HEIGHTS MDDP

DESIGN POINT or SUB-BASIN	SUB-BASINS/ DESCRIPTION	TOTAL AREA (AC)	INLET SIZE (Ft.)	INLET TYPE	INLET CONDITION	Q(5) TOTAL INFLOW	Q5 INLET CAPACTIY	Q(100) BYPASS FLOWS (cfs)	Q(100) TOTAL INFLOW (cfs)	MAX INLET CAPACITY	NOTES:
RHC1	RHC1	2.48	10	R	SUMP	7.7	7.7	0.0	14.0	19.3	FDR
RHC2	RHC2	0.59	10	R	SUMP	2.3	2.3	0.0	4.2	19.3	FDR
BL1	WEST HALF OF BRADLEY LANDING DRAINING TO	2.88	10	R	SUMP	10.3	10.3	0.0	18.9	19.3	FDR
BL2	EAST HALF OF BRADLEY LANDING	1.39	10	R	SUMP	5.3	5.3	0.0	9.6	19.3	FDR
G	BS2	0.83	15	R	AT-GRADE	3.1	3.1	0.0	5.6	5.6	FDR
F	BS1	3.16	15	R	AT-GRADE	7.6	7.6	2.8	15.0	12.2	FDR-BYPASS TO BHE 1-2 SUMP INLET
I	10a	1.97	10	R	SUMP	7.6	7.6	0.0	13.8	19.3	
J	10b	1.20	10	R	SUMP	5.0	5.0	0.0	9.1	19.3	
N	N	1.64	5	R	SUMP	5.1	5.1	0.0	9.2	11.0	
P	P	1.63	5	R	SUMP	5.9	5.9	0.0	10.8	11.0	
S	MK11	1.79	5	R	SUMP	6.3	6.3	0.0	11.5	11.5	FLOWS EQUALIZE ACROSS CROWN IN MAJOR EVENT
T	MK12	0.38	5	R	SUMP	1.6	1.6	0.0	2.9	11.0	
X	MK10	1.97	15	R	SUMP	6.4	6.4	0.0	11.7	27.0	
W	MK15	0.67	10	R	SUMP	2.8	2.8	0.0	5.1	19.3	
AA	JC1	0.74	5	R	SUMP	3.0	3.0	0.0	5.5	11.0	
AB	JC2	0.75	5	R	SUMP	3.0	3.0	0.0	5.6	11.0	
AG	WF11	1.08	5	R	SUMP	4.2	4.2	0.0	7.6	11.0	
AF	WF10	1.56	5	R	SUMP	6.0	6.0	0.0	10.9	11.0	
WF13	WEST HALF OF COLLECTOR 2	1.03	15	R	SUMP	4.1	4.1	0.0	7.5	27.0	INLETS ARE OVER SIZED TO ACCOUNT FOR ADDITIONAL FLOWS IN THE DEVELOPMENT ADJACENT
WF14	EAST HALF OF COLLECTOR 2	1.17	15	R	SUMP	4.7	4.7	0.0	8.5	27.0	
AL	WF16	0.09	5	R	AT-GRADE	0.4	0.4	0.0	0.7	0.7	
AM	WF17	0.09	5	R	AT-GRADE	0.4	0.4	0.0	0.7	0.7	
AQ	LH1 - AT GRADE AT BORDER WITH TRAILS AT	0.18	10	R	AT-GRADE	0.8	0.8	0.0	1.4	1.4	
AR	LH2 - AT GRADE AT BORDER WITH TRAILS AT	0.18	10	R	AT-GRADE	0.8	0.8	0.0	1.4	1.4	
AU	WF2	4.63	10	R	SUMP	2.8	2.8	0.0	12.4	19.3	
AT	WF3	0.75	5	R	SUMP	2.9	2.9	0.0	5.3	11.0	
AX	WF5	6.44	10	R	AT-GRADE	10.1	10.1	0.0	22.4	22.4	4 INLETS FOR FULL CAPTURE
AY	WF6	1.06	10	R	AT-GRADE	3.6	3.6	0.0	6.6	6.6	2 INLETS FOR FULL CAPTURE
AQ	LH1 - AT GRADE AT BORDER WITH TRAILS AT	0.18	10	R	AT-GRADE	0.8	0.8	0.0	1.4	1.4	
AS	LH1-LH2	0.36	10	R	AT-GRADE	1.5	1.5	0.0	2.8	2.8	



EXCERPT FROM PREVIEW STUDY

APPENDIX D

MAPS

EXCERPT FROM PREVIOUS STUDY

Existing Design Point Summary - Rational Method				
BRADLEY HEIGHTS MDDP				
Design Point	**Sub-Basins**	**Total Area (ac.)**	**Q(5) (cfs)**	**Q(100) (cfs)**
WF1	W1, TAR-EP	258.80	35.56	298.86
WF2	W2,W3	88.88	29.39	157.39
JC	J1	46.62	15.00	80.34

BRADLEY HEIGHTS MDDP
EXISTING CONDITIONS
HEC-HMS - SCS METHOD

Sub-basin	**Area**		Q5	Q100
	Acres	**Sq. Mi.**	CFS	CFS
M1	***97.6***	***0.1526***	18.8	167.7
M2	***148.2***	***0.2316***	26.2	228.8
M3	***145.8***	***0.2278***	9.4	150.7
M4	***149.4***	***0.2334***	10.6	162.9
M5	***105.9***	***0.1654***	3.3	48.5
M6	***144.4***	***0.2256***	4.5	75.3
M7	***108.3***	***0.1692***	3.8	115.3
M8	***158.4***	***0.2475***	22.8	183.2
M9	***150.8***	***0.2357***	2.9	60.0
M10	***88.8***	***0.1388***	1.8	17.5
M11	***69.1***	***0.1079***	2.0	31.0
M12	***106.2***	***0.1660***	3.1	12.8
M13	***144.4***	***0.2257***	3.7	25.6
M14	***72.7***	***0.1136***	2.0	10.6
M15	***59.1***	***0.0924***	2.2	5.3
M16	***148.5***	***0.2321***	3.7	18.3
M17	***182.0***	***0.2844***	4.9	121.9
M18	***163.5***	***0.2554***	4.2	107.7
M19	***192.0***	***0.3000***	4.7	32.5
M20	***89.5***	***0.1399***	2.1	5.1
M21	***146.6***	***0.2290***	4.6	11.6
M22	***66.1***	***0.1033***	2.1	5.3
M23	***132.8***	***0.2075***	2.8	6.9
M24	***99.6***	***0.1556***	3.1	22.3
M25	***101.8***	***0.1591***	3.2	37.1
M26	***114.3***	***0.1786***	2.0	4.7
M27	***124.9***	***0.1951***	2.1	5.0
Design Points				
DP-M0	***3310.8***	***5.1731***	82	1029.9
DP-M1	***3310.8***	***5.1731***	82	1029.9
DP-M2	***3213.1***	***5.0205***	79.2	990.9
DP-M3	***3064.9***	***4.7889***	69	897.5
DP-M4	***2919.1***	***4.5611***	62	804.4
DP-M5	***250.2***	***0.3910***	7.6	122.8
DP-M6	***2102.0***	***3.2844***	27	371.6
DP-M7	***451.6***	***0.7056***	8	70.4
DP-M8	***1561.6***	***2.4400***	17.7	284.3
DP-M9	***875.6***	***1.3681***	12.9	67.8
DP-M10	***368.9***	***0.5764***	9.1	23.2
DP-M11	***239.2***	***0.3737***	4	9.7

CITY OF COLORADO SPRINGS
BRADLEY HEIGHTS METRO DISTRICT
MASTER DEVELOPMENT DRAINAGE REPORT
PREDEVELOPMENT DRAINAGE CONDITIONS

DESIGNED BY: JAO
DRAWN BY: JTS
CHECKED BY: JTS
SCALE HORIZ. 1" = 250'
VERT. N/A
DATE ISSUED: March 2022
SHEET 1 OF 5
DRAWING No. DR-01

SEAL
PRELIMINARY
THIS DRAWING HAS NOT BEEN APPROVED BY GOVERNING AGENCIES AND IS SUBJECT TO CHANGE

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.
PROJECT No. 21.1213.004

PREPARED BY:
Matrix

No.	DATE	DESCRIPTION	BY

REVISIONS

COMPUTER FILE MANAGEMENT
FILE NAME: S:\21.1213.001 Bradley Heights Metro District\200 Drainage\201 Drainage Reports\MDDP\DWG\BRADLEY HEIGHTS DR.dwg
CTB FILE: ----
PLOT DATE: April 21, 2022 12:50:51 PM
THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE.

REFERENCE DRAWINGS

EXCERPT FROM PREVIOUS STUDY

BRADLEY HEIGHTS
COMPARISON OF PREDEVELOPMENT AND POST-DEVELOPMENT CONDITIONS

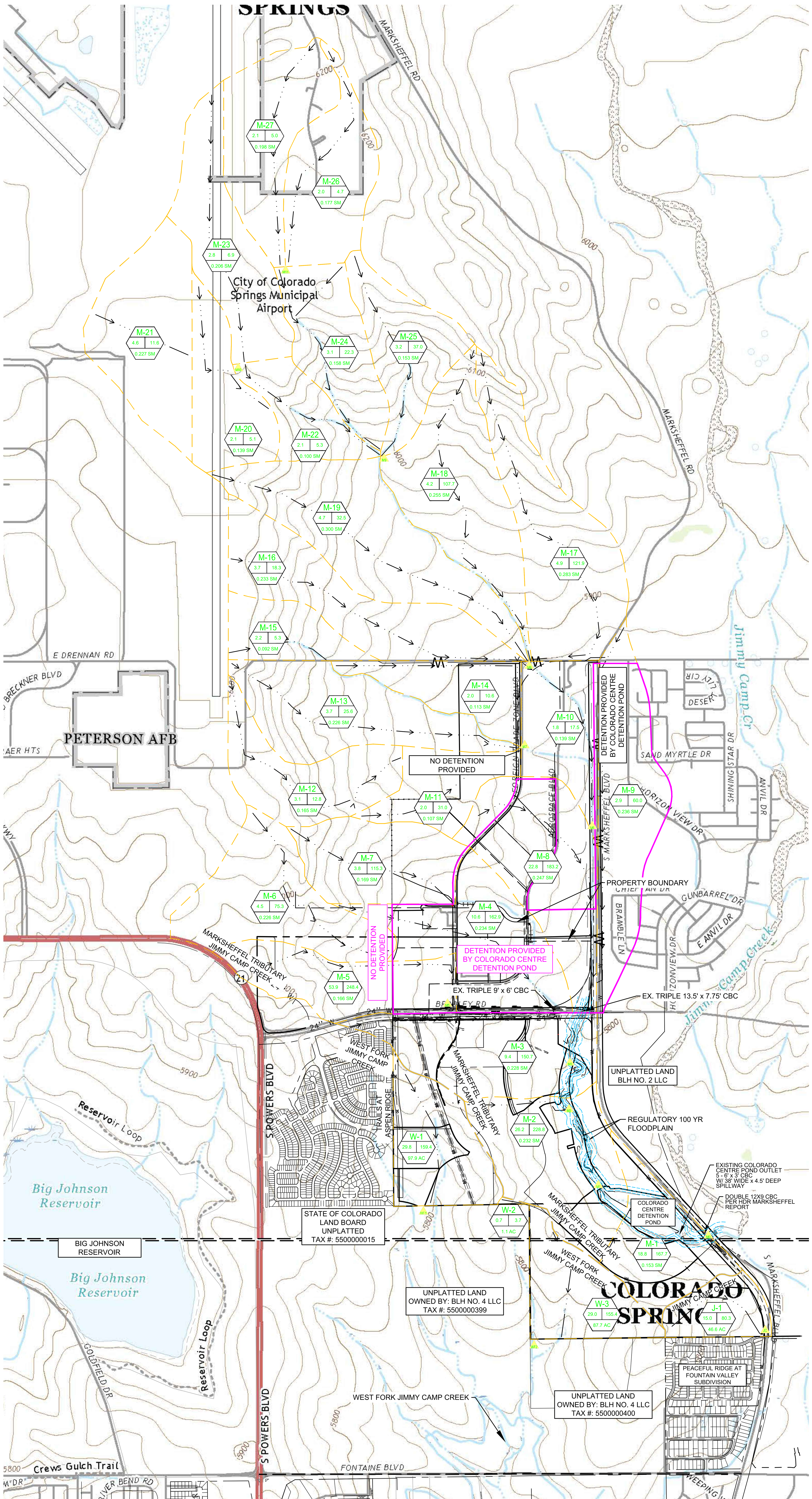
Sub-basin	Area		Q2		DELTA	Q5		DELTA	Q10		DELTA	Q100		DELTA
	Acres	Sq. Mi.	EX	PR	Q	EX	PR	Q	EX	PR	Q	EX	PR	Q
M1	97.6	0.15256	8.8	-	-	18.8	-	-	87	-	-	167.7	-	-
M2	148.2	0.23162	12.3	-	-	26.2	-	-	118.1	-	-	228.8	-	-
M3	145.8	0.22781	3.3	-	-	9.4	-	-	67	-	-	150.7	-	-
BH2	3.0	0.00470	-	0.4	-	-	0.9	-	-	4	-	-	7.4	-
CC	51.9	0.08109	-	5.3	-	-	8	-	-	19.6	-	-	33.2	-
MK8	8.1	0.01260	-	6.4	-	-	8.8	-	-	19.4	-	-	29.7	-
M4	149.4	0.23337	3.7	65.2	61.5	10.6	88.3	77.7	73.3	204.6	131.3	162.9	328.1	165.2
M5	105.9	0.16539	2.6	38.2	35.6	3.3	53.9	50.6	12.2	147.2	135	48.5	248.4	199.9
M6	144.4	0.22559	3.6	3.6	0	4.5	4.5	0	20.4	20.7	0.3	75.3	76	0.7
M7	108.3	0.16917	3	4.5	1.5	3.8	5.6	1.8	43.9	47.2	3.3	115.3	119.7	4.4
M8	158.4	0.24746	11	70.5	59.5	22.8	96.2	73.4	94.5	205.8	111.3	183.2	317.2	134
M9	150.8	0.23570	1.9	38.6	36.7	2.9	52.3	49.4	23.3	111.3	88	60	178.4	118.4
M10	88.8	0.13880	1.5	1.5	0	1.8	1.8	0	4.3	4.3	0	17.5	17.5	0
M11	69.1	0.10790	1.6	1.6	0	2	2	0	8.2	8.2	0	31	31	0
M12	106.2	0.16600	2.4	2.4	0	3.1	3.1	0	5.5	5.5	0	12.8	12.8	0
M13	144.4	0.22570	2.9	2.9	0	3.7	3.7	0	6.7	6.7	0	25.6	25.6	0
M14	72.7	0.11360	1.6	1.6	0	2	2	0	3.5	3.5	0	10.6	10.6	0
M15	59.1	0.09240	1.7	1.7	0	2.2	2.2	0	3.8	3.8	0	5.3	5.3	0
M16	148.5	0.23210	3	3	0	3.7	3.7	0	6.6	6.6	0	18.3	18.3	0
M17	182.0	0.28440	3.9	3.9	0	4.9	4.9	0	43.3	43.3	0	121.9	121.9	0
M18	163.5	0.25540	3.3	3.3	0	4.2	4.2	0	39.5	39.5	0	107.7	107.7	0
M19	192.0	0.30000	3.8	3.8	0	4.7	4.7	0	8.6	8.6	0	32.5	32.5	0
M20	89.5	0.13990	1.6	1.6	0	2.1	2.1	0	3.6	3.6	0	5.1	5.1	0
M21	146.6	0.22900	3.7	3.7	0	4.6	4.6	0	8.2	8.2	0	11.6	11.6	0
M22	66.1	0.10330	1.7	1.7	0	2.1	2.1	0	3.8	3.8	0	5.3	5.3	0
M23	132.8	0.2075	2.2	2.2	0	2.8	2.8	0	4.9	4.9	0	6.9	6.9	0
DP-M0	3310.8	5.17307	45.6	205.5	159.9	82	338.4	256.4	417.9	624.5	206.6	1029.9	1003.8	-26.1
DP-M1	3310.8	5.17307	45.6	203.6	158	82	330.7	248.7	417.9	672.8	254.9	1029.9	1217.9	188
DP-M2	3213.1	5.02052	45	201.9	156.9	79.2	305.9	226.7	386.5	673.2	286.7	990.9	1220.2	229.3
DP-M3	3064.9	4.78890	40.8	199.2	158.4	69	284.6	215.6	322.3	668.7	346.4	897.5	1209.3	311.8
DP-M4	2919.1	4.56109	38.2	197.3	159.1	62	269.7	207.7	291.3	661.8	370.5	804.4	1206.8	402.4
DP-M5	250.2	0.39098	6	41.3	35.3	7.6	58.1	50.5	32	161.2	129.2	122.8	311.3	188.5

BRADLEY HEIGHTS
COMPARISON OF PREDEVELOPMENT AND POST-DEVELOPMENT CONDITIONS

Sub-basin	Area		Q2		DELTA	Q5		DELTA	Q10		DELTA	Q100		DELTA
	Acres	Sq. Mi.	EX	PR	Q	EX	PR	Q	EX	PR	Q	EX	PR	Q
DP-M6	2102.0	3.28440	21.2	21.2	0	27	27	0	122.3	122.3	0	371.6	371.6	0
DP-M7	451.6	0.70560	6.3	6.3	0	8	8	0	19.8	19.8	0	70.4	70.4	0
DP-M8	1561.6	2.44000	13.9	13.9	0	17.7	17.7	0	98.7	98.7	0	284.3	284.3	0
DP-M9	875.6	1.36810	10.2	10.2	0	12.9	12.9	0	25.1	25.1	0	67.8	67.6	0
DP-M10	368.9	0.57640	7.2	7.2	0	9.1	9.1	0	16.3	16.3	0	23.2	23.2	0
DP-M11	239.2	0.37370	3.2	3.2	0	4	4	0	6.9	6.9	0	9.7	9.7	0
MKJCC POND 4	49.0	0.07662	-	1.1	-	-	10	-	-	18.7	-	-	70.3	-
MKJCC POND 5	67.3	0.10513	-	2.9	-	-	24.2	-	-	50.2	-	-	203.5	-
MKJCC POND 6	41.2	0.06444	-	1.7	-	-	17	-	-	28.3	-	-	89	-
MKJCC POND 7	70.0	0.10930	-	1.5	-	-	23.5	-	-	44.6	-	-	177.2	-
MKJCC POND 8	13.0	0.02027	-	0.3	-	-	3.6	-	-	6.8	-	-	11.3	-
MKJCC POND 9	51.9	0.08114	-	1	-	-	12.2	-	-	24.7	-	-	103.1	-
MKJCC POND 10	14.0	0.02184	-	0.4	-	-	2	-	-	5.1	-	-	16.7	-
MKJCC POND 11	8.0	0.01251	-	0.2	-	-	0.4	-	-	2.4	-	-	16.4	-
TAR-NE	9.1	0.01421	-	0.2	-	-	0.2	-	-	1.8	-	-	7.9	-
MRK-1	3248.5	5.07583	-	203.4	-	-	327.1	-	-	621.8	-	-	1001.2	-

BRADLEY HEIGHTS MDDP
EXISTING CONDITIONS
HEC-HMS - SCS METHOD

Sub-basin	Area		Q5	Q100
	Acres	Sq. Mi.	CFS	CFS
M1	97.6	0.1526	18.8	167.7
M2	148.2	0.2316	26.2	228.8
M3	145.8	0.2278	9.4	150.7
M4	149.4	0.2334	10.6	162.9
M5	105.9	0.1654	3.3	48.5
M6	144.4	0.2256	4.5	75.3
M7	108.3	0.1692	3.8	115.3
M8	158.4	0.2475	22.8	183.2
M9	150.8	0.2357	2.9	60.0
M10	88.8	0.1388	1.8	17.5
M11	69.1	0.1079	2.0	31.0
M12	106.2	0.1660	3.1	12.8
M13	144.4	0.2257	3.7	25.6
M14	72.7	0.1136	2.0	10.6
M15	59.1	0.0924	2.2	5.3
M16	148.5	0.2321	3.7	18.3
M17	182.0	0.2844	4.9	121.9
M18	163.5	0.2554	4.2	107.7
M19	192.0	0.3000	4.7	32.5
M20	89.5	0.1399	2.1	5.1
M21	146.6	0.2290	4.6	11.6
M22	66.1	0.1033	2.1	5.3
M23	132.8	0.2075	2.8	6.9
M24	99.6	0.1556	3.1	22.3
M25	101.8	0.1591	3.2	37.1
M26	114.3	0.1786	2.0	4.7
M27	124.9	0.1951	2.1	5.0
Design Points				
DP-M0	3310.8	5.1731	82	1029.9
DP-M1	3310.8	5.1731	82	1029.9
DP-M2	3213.1	5.0205	79.2	990.9
DP-M3	3064.9	4.7889	69	897.5
DP-M4	2919.1	4.5611	62	804.4
DP-M5	250.2	0.3910	7.6	122.8
DP-M6	2102.0	3.2844	27	371.6
DP-M7	451.6	0.7056	8	70.4
DP-M8	1561.6	2.4400	17.7	284.3
DP-M9	875.6	1.3681	12.9	67.8
DP-M10	368.9	0.5764	9.1	23.2
DP-M11	239.2	0.3737	4	9.7



BRADLEY HEIGHTS MDDP
DEVELOPED CONDITIONS
HEC-HMS - SCS METHOD

Sub-basin	Area		Q5	Q100
	Acres	Sq. Mi.	CFS	CFS
BH2	3.0	0.0047	0.9	7.4
CC	51.9	0.0811	8.0	33.2
MK8	8.1	0.0126	8.8	29.7
M4	149.4	0.2334	88.3	328.1
M5	105.9	0.1654	53.9	248.4
M6	144.4	0.2256	4.5	76.0
M7	108.3	0.1692	5.6	119.7
M8	158.4	0.2475	96.2	317.2
M9	150.8	0.2357	52.3	178.4
M10	88.8	0.1388	1.8	17.5
M11	69.1	0.1079	2.0	31.0
M12	106.2	0.1660	3.1	12.8
M13	144.4	0.2257	3.7	25.6
M14	72.7	0.1136	2.0	10.6
M15	59.1	0.0924	2.2	5.3
M16	148.5	0.2321	3.7	18.3
M17	182.0	0.2844	4.9	121.9
M18	163.5	0.2554	4.2	107.7
M19	192.0	0.3000	4.7	32.5
M20	89.5	0.1399	2.1	5.1
M21	146.6	0.2290	4.6	11.6
M22	66.1	0.1033	2.1	5.3
M23	132.8	0.2075	2.8	6.9
M24	99.6	0.1556	3.1	22.3
M25	101.8	0.1591	3.2	37.0
M26	114.3	0.1786	2.0	4.7
M27	124.9	0.1951	2.1	5.0
Design Points				
DP-M0	3305.6	5.1650	338.4	1003.8
DP-M1	3248.5	5.0758	330.7	1217.9
DP-M2	3140.0	4.9063	305.9	1220.2
DP-M3	3018.2	4.7159	284.6	1209.3
DP-M4	2919.2	4.5612	269.7	1206.8
DP-M5	250.2	0.3910	58.1	311.3
DP-M6	2102.0	3.2844	27	371.6
DP-M7	451.6	0.7056	8	70.4
DP-M8	1561.6	2.4400	17.7	284.3
DP-M9	875.6	1.3681	12.9	67.6
DP-M10	368.9	0.5764	9.1	23.2
DP-M11	239.2	0.3737	4	9.7
MKJCC POND 4	49.0	0.0766	10	70.3
MKJCC POND 5	67.3	0.1051	24.2	203.5
MKJCC POND 6	41.2	0.0644	17	89
MKJCC POND 7	70.0	0.1093	23.5	177.2
MKJCC POND 8	13.0	0.0203	3.6	11.3
MKJCC POND 9	51.9	0.0811	12.2	103.1
MKJCC POND 10	14.0	0.0218	2	16.7
MKJCC POND 11	8.0	0.0125	0.4	16.4
TAR-NE	9.1	0.0142	0.2	7.9
MRK-1	3248.5	5.0758	327.1	1001.2

LEGEND

BASIN BOUNDARY
EXISTING CONTOUR
EXISTING STORM DRAIN PIPE
FLOW DIRECTION
EXISTING EDGE OF ROAD
PROPERTY LINE
COLORADO CENTRE DETENTION BOUNDARY
STREAM SIDE BUFFER OVERLAY
BASIN — SUB BASIN DESIGNATION
PREDEVELOPMENT VALUES
Q5 — 5-YEAR STORM EVENT PEAK FLOW (CFS)
Q100 — 100-YEAR STORM EVENT PEAK FLOW (CFS)
AREA — SUB BASIN AREA (AC. OR SQ. MI.)
2 — DESIGN POINT

N

GRAPHIC SCALE
1000' 0' 1000' 2000'
(IN FEET)
1 inch = 1000 ft.

REFERENCE DRAWINGS
X-1213-PR_BASE MATRIX
X-1213-EX BASE HRGREEN EAST
X-1213-EX BASE NES SOUTH
PR-BASE UTIL
X-1213-EX_BASE-From Others
X-MDG30x42
X-1213-EX BASE TERRA NOVA CHURCH
D-886-EX-TOPO-TAR

No.	DATE	DESCRIPTION	BY

REVISIONS

COMPUTER FILE MANAGEMENT
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CTB FILE: ----
PLOT DATE: March 28, 2022 2:30:56 PM
THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE.

PREPARED BY: Matrix

SEAL
PRELIMINARY
THIS DRAWING HAS NOT BEEN APPROVED BY GOVERNING AGENCIES AND IS SUBJECT TO CHANGE

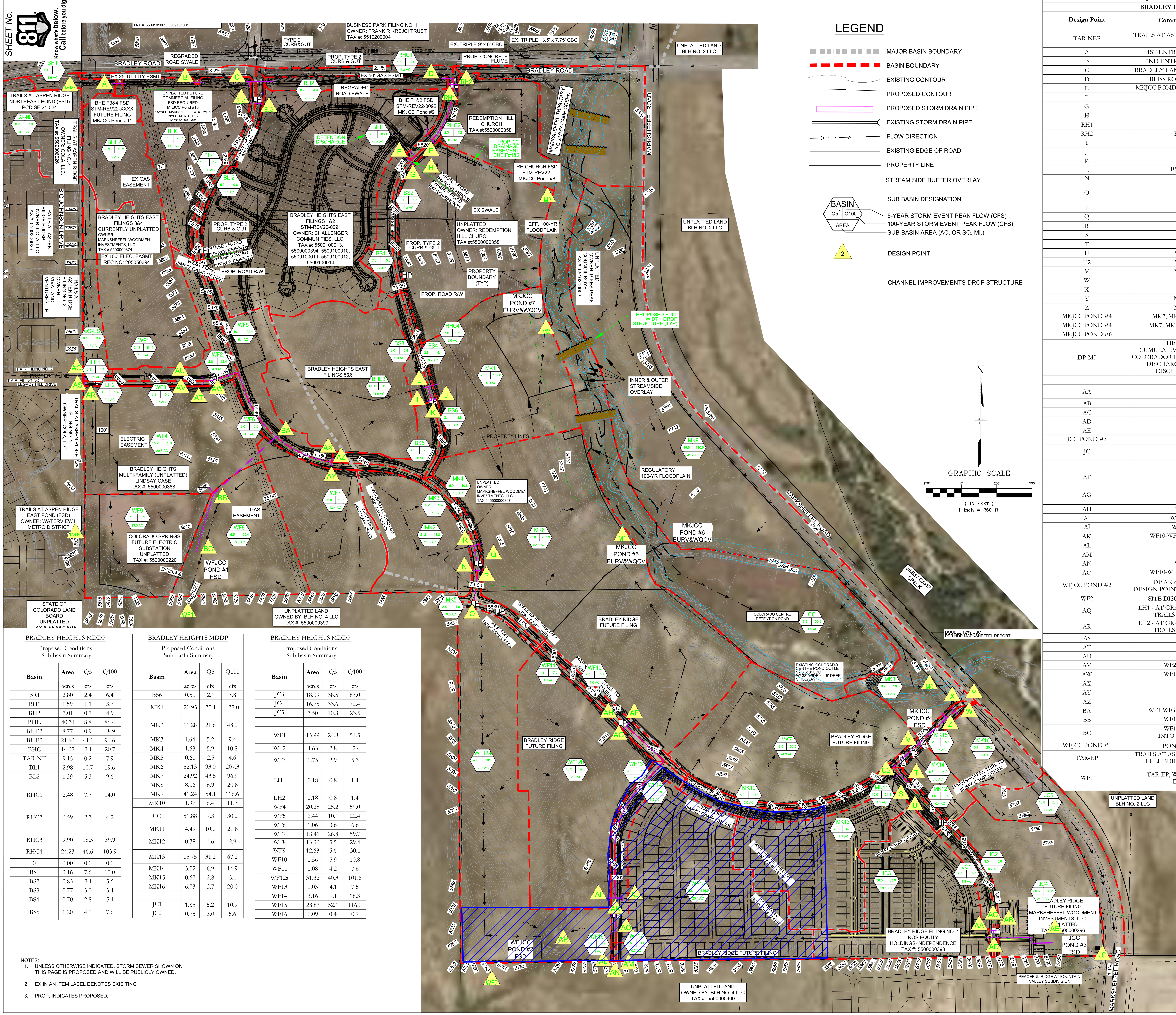
FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.
PROJECT No. 21.1213.004

CITY OF COLORADO SPRINGS
BRADLEY HEIGHTS METRO DISTRICT
MASTER DEVELOPMENT DRAINAGE REPORT

MARKSHEFFEL TRIB. TO JIMMY CAMP CREEK

DESIGNED BY: JAO
DRAWN BY: JTS
CHECKED BY: JTS
SCALE HORIZ. 1" = 1000'
VERT. N/A
DATE ISSUED: March 2022
SHEET 3 OF 5
DRAWING No. DR-03

EXCERPT FROM PREVIOUS STUDY



LEGEND

- MAJOR BASIN BOUNDARY
- BASIN BOUNDARY
- EXISTING CONTOUR
- PROPOSED CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- FLOW DIRECTION
- EXISTING EDGE OF ROAD
- PROPERTY LINE
- STREAM SIDE BUFFER OVERLAY
- BASIN / Q5 / Q100 / AREA: SUB BASIN DESIGNATION; 5-YEAR STORM EVENT PEAK FLOW (CFS); 100-YEAR STORM EVENT PEAK FLOW (CFS); SUB BASIN AREA (AC. OR SQ. MI.)
- 2: DESIGN POINT
- CHANNEL IMPROVEMENTS-DROP STRUCTURE

BRADLEY HEIGHTS MDDP Proposed Conditions Sub-basin Summary			
Basin	Area	Q5	Q100
	acres	cfs	cfs
BR1	2.80	2.4	6.4
BH1	1.59	1.1	3.7
BH2	3.01	0.7	4.9
BHE	40.31	8.8	86.4
BHE2	8.77	0.9	18.9
BHE3	21.60	41.1	91.6
BHC	14.05	3.1	20.7
TAR-NE	9.15	0.2	7.9
BL1	2.98	10.7	19.6
BL2	1.39	5.3	9.6
RHC1	2.48	7.7	14.0
RHC2	0.59	2.3	4.2
RHC3	9.90	18.5	39.9
RHC4	24.23	46.6	103.9
0	0.00	0.0	0.0
BS1	3.16	7.6	15.0
BS2	0.83	3.1	5.6
BS3	0.77	3.0	5.4
BS4	0.70	2.8	5.1
BS5	1.20	4.2	7.6

BRADLEY HEIGHTS MDDP Proposed Conditions Sub-basin Summary			
Basin	Area	Q5	Q100
	acres	cfs	cfs
BS6	0.50	2.1	3.8
MK1	20.95	75.1	137.0
MK2	11.28	21.6	48.2
MK3	1.64	5.2	9.4
MK4	1.63	5.9	10.8
MK5	0.60	2.5	4.6
MK6	52.13	93.0	207.3
MK7	24.92	43.5	96.9
MK8	8.06	6.9	20.8
MK9	41.24	54.1	116.6
MK10	1.97	6.4	11.7
CC	51.88	7.3	30.2
MK11	4.49	10.0	21.8
MK12	0.38	1.6	2.9
MK13	15.75	31.2	67.2
MK14	3.02	6.9	14.9
MK15	0.67	2.8	5.1
MK16	6.73	3.7	20.0
JC1	1.85	5.2	10.9
JC2	0.75	3.0	5.6

BRADLEY HEIGHTS MDDP Proposed Conditions Sub-basin Summary			
Basin	Area	Q5	Q100
	acres	cfs	cfs
JC3	18.09	38.5	83.0
JC4	16.75	33.6	72.4
JC5	7.50	10.8	23.5
WF1	15.99	24.8	54.5
WF2	4.63	2.8	12.4
WF3	0.75	2.9	5.3
LH1	0.18	0.8	1.4
LH2	0.18	0.8	1.4
WF4	20.28	25.2	59.0
WF5	6.44	10.1	22.4
WF6	1.06	3.6	6.6
WF7	13.41	26.8	59.7
WF8	13.30	5.5	29.4
WF9	12.63	5.6	30.1
WF10	1.56	5.9	10.8
WF11	1.08	4.2	7.6
WF12a	31.32	40.3	101.6
WF13	1.03	4.1	7.5
WF14	3.16	9.1	18.3
WF15	28.83	52.1	116.0
WF16	0.09	0.4	0.7

NOTES:
1. UNLESS OTHERWISE INDICATED, STORM SEWER SHOWN ON THIS PAGE IS PROPOSED AND WILL BE PUBLICLY OWNED.
2. EX IN AN ITEM LABEL DENOTES EXISITING
3. PROP. INDICATES PROPOSED.

Proposed Design Point Summary BRADLEY HEIGHTS MDDP				
Design Point	Comments/Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
TAR-NEP	TRAILS AT ASPEN RIDGE NORTHEAST POND	9.15	0.20	7.90
A	1ST ENTRANCE EAST OF TAR	13.53	1.30	11.64
B	2ND ENTRANCE EAST OF TAR	36.36	5.68	28.34
C	BRADLEY LANDING BLVD CROSSING	36.36	5.68	28.34
D	BLISS ROAD BYPASS STORM	39.36	6.68	37.29
E	MKJCC POND #9 DISCHARGE & DP D	79.67	15.48	123.69
F	BS1	3.16	7.59	15.05
G	BS2	0.83	3.06	5.59
H	BS1-2	3.99	10.39	20.18
RH1	RHC1	2.48	7.70	14.05
RH2	RHC1-RHC2	3.06	9.51	17.36
I	BS3, BS5	1.97	7.56	13.78
J	BS4, BS6	1.20	4.98	9.08
K	BS3-BS6	3.17	12.17	22.19
L	BS3-BS6, BHE3	24.77	48.47	104.14
N	MK3	1.64	5.07	9.25
O	MK5	0.60	2.39	4.35
P	MK4	1.63	5.90	10.76
Q	MK3-MK5	3.87	11.97	21.82
R	MK2-5	15.16	34.92	72.65
S	MK11	4.49	10.02	21.77
T	MK12	0.38	1.60	2.92
U	MK11-MK12	4.87	11.21	23.93
U2	MK11-MK13	20.61	43.87	94.33
V	MK11-MK14	23.63	48.64	104.63
W	MK15	0.67	2.82	5.15
X	MK10	1.97	6.43	11.72
Y	MK10, MK15	2.64	8.61	15.70
Z	MK10-MK15	26.27	55.69	117.15
MKJCC POND #4	MK7, MK10-MK16-INFLOW	51.19	96.11	207.57
MKJCC POND #4	MK7, MK10-MK16-OUTFLOW	51.19	10.00	70.30
MKJCC POND #6	MK9	41.24	17.00	89.00
DP-M0	HEC-HMS CALCS CUMULATIVE OF OFFSITE FLOWS, COLORADO CENTRE REGIONAL POND DISCHARGE, POND MKJCC #4 DISCHARGE, AND MK-8	3305.63	338.40	1003.80
AA	JC1	1.85	5.18	10.92
AB	JC2	0.75	3.05	5.56
AC	JC1-JC2	2.60	8.20	16.44
AD	JC1-JC3	20.69	45.65	97.36
AE	JC1-JC4	37.44	77.75	166.60
JCC POND #3	JC1-JC4	37.44	7.40	59.80
JC	JC1-JC5	44.94	18.20	83.32
AF	WF10	1.56	5.98	10.91
AG	WF11	1.08	4.16	7.58
AH	WF10-WF11	2.64	10.14	18.49
AI	WF12b & WF13	32.34	43.11	106.80
AJ	WF14 & WF15	31.99	59.72	131.43
AK	WF10-WF15 (Excluding WF12a)	66.97	91.97	210.95
AL	WF16	0.09	0.38	0.69
AM	WF17	0.27	0.55	1.50
AN	WF16-WF17	0.36	0.93	2.19
AO	WF10-WF17 (Excluding WF12a)	67.33	92.49	212.17
WFJCC POND #2	DP AK and Sub-basin WF12a DESIGN POINT AP: POND DISCHARGE	93.01	22.60	153.50
WF2	SITE DISCHARGE TO SOUTH	93.01	22.60	153.50
AQ	LH1 - AT GRADE AT BORDER WITH TRAILS AT ASPEN RIDGE	0.18	0.75	1.38
AR	LH2 - AT GRADE AT BORDER WITH TRAILS AT ASPEN RIDGE	0.18	0.75	1.38
AS	LH1-LH2	0.36	1.51	2.75
AT	WF3	0.75	2.90	5.28
AU	WF2	4.63	2.78	12.36
AV	WF2-WF3, LH1-LH2	5.74	6.53	19.46
AW	WF1-WF3, LH1-LH2	21.73	37.02	86.80
AX	WF5	6.44	10.07	22.45
AY	WF6	1.06	3.64	6.64
AZ	WF5-WF6	7.50	13.03	27.89
BA	WF1-WF3, WF5-WF6, LH1, LH2	29.23	43.77	101.53
BB	WF1-WF6, LH1-LH2	49.51	72.74	170.87
BC	WF1-WF8, LH1-LH2 INTO WFJCC POND #1	76.22	89.73	226.69
WFJCC POND #1	POND DISCHARGE	76.22	10.70	106.70
TAR-EP	TRAILS AT ASPEN RIDGE-EAST POND FULL BUILD-OUT DISCHARGE	160.87	5.80	139.50
WF1	TAR-EP, WF9, WFJCC POND #1 DISCHARGE	249.72	22.13	276.32

CITY OF COLORADO SPRINGS
BRADLEY HEIGHTS METRO DISTRICT
MASTER DEVELOPMENT DRAINAGE REPORT
POST DEVELOPMENT DRAINAGE CONDITIONS

PRELIMINARY
THIS DRAWING HAS NOT BEEN APPROVED BY GOVERNING AGENCIES AND IS SUBJECT TO CHANGE

SEAL

PREPARED BY: Matrix
FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.
PROJECT No. 21.1213.004

DATE ISSUED: March 2022
DRAWING No. DR-04
SHEET 4 OF 5

REVISIONS: No. | DATE | DESCRIPTION | BY

COMPUTER FILE MANAGEMENT

EXCERPT FROM PREVIOUS STUDY

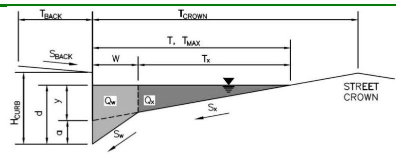
MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project: Bradley Heights Metro District (Phase 4)

Inlet ID: DP-AA



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		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} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	24.0	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		☐	☐	

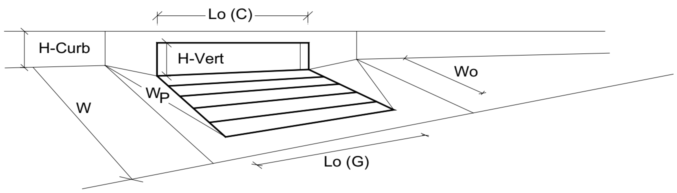
MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion

		Minor Storm	Major Storm	
	Q_{allow} =	**SUMP**	**SUMP**	**cfs**

EXCERPT FROM PREVIOUS STUDY

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	1.00	1.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	7.3	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) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
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} =	0.33	0.44	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.69	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	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 =**	**8.3**	**13.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.2	10.9	cfs

EXCERPT FROM PREVIOUS STUDY

BRADLEY HEIGHTS METRO DISTRICT (PHASE 4)

FINAL DRAINAGE REPORT

(FOR ROAD & STORM IMPROVEMENTS)

Prepared for:

BRADLEY HEIGHTS METROPOLITAN DISTRICT
614 North Tejon Street
Colorado Springs, CO 80903
(719) 447-1777

Prepared by:

Matrix

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

June 2023

Project No. 21.1213.001

STM-REV22-1245

EXCERPT FROM PREVIOUS STUDY

Engineer's Statement:

This report and plan for the drainage design of Bradley Heights Metro District (Phase 4) was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

COLORADO LICENSED
JESSE TRAVIS SULLIVAN
55600
PROFESSIONAL ENGINEER

2/13/2023

______________________________ ____________
Jesse Sullivan Date
Registered Professional Engineer
State of Colorado
No. 55600

Developer's Statement:

Bradley Heights Metro District hereby certifies that the drainage facilities for Bradley Heights Metro District (Phase 4) shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of Bradley Heights Metro District (Phase 4), guarantee that final drainage design review will absolve Bradley Heights Metro District and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

Bradley Heights Metropolitan District
Business Name

DocuSigned by:
By: Randle Case, II - Board President 2/13/2023
293CF22537AE478...
Randle Case, II Date

Title: Board President

Address: 614 North Tejon Street
Colorado Springs, CO 80903

EXCERPT FROM PREVIOUS STUDY

City of Colorado Springs:

Filed in accordance with section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

Heidi M. McMacken 06/06/2023

For the City Engineer Heidi McMacken Date

Conditions:

Building permits will not be released until assurances for channel improvements have been posted or channel improvements have been installed and accepted.

An interim FSD facility is being constructed as an interim measure until the downstream sub regional detention facility, located southwest of the interim facility, is constructed. If the downstream facility is not constructed within five years of the approval date of this report, it is the owner's responsibility to provide permanent full spectrum detention for the site. Subsequent report approvals will not extend this deadline.

proposed 18-inch public storm pipe before draining into the proposed private WQ Pond. See the inlet overflow routing table below for overflow routing.

Design Point Y (Q_5 =9.9 cfs, Q_{100} = 31.2 cfs) (Sub-basins: MK10b, MK10c, MK15b, MK16; Area: 7.39 Ac.) (***Total into*** Marksheffel ***WQ Pond)*** represents the combination of flows from Design Points W3, X, and sub-basin MK10c. The combined flows from design points W3 and X will be conveyed downstream via proposed 24-inch public storm pipe, draining into the proposed private Marksheffel WQ Pond. Flows from sub-basin MK10c will sheet flow into the proposed private pond. The Marksheffel WQ Pond has been designed as a Full Spectrum Sand Filter to provide the necessary treatment and detention for areas developed as a part of Phase 4 but not captured by MKJCC Pond #4.

Jimmy Camp Creek

Design Point AA (Q_5 = 5.2 cfs, Q_{100} = 10.9 cfs) (Sub-basin: JC1; Area: 1.85 Ac.) represents a proposed public 5-foot Type R sump inlet on the first north-south collector off of Bradley Ridge west of Marksheffel Road (Bridgegate Place). Captured flows will be directed downstream via proposed 18-inch public storm sewer to Design Point AC. See the inlet overflow routing table below for overflow routing.

Design Point AB (Q_5 = 4.1 cfs, Q_{100} = 7.4 cfs) (Sub-basin: JC2; Area: 1.00 Ac.) represents a proposed public 5-foot Type R sump inlet on Bridgegate Place. Captured flows will be directed downstream via proposed 18-inch public storm sewer to Design Point AC. See the inlet overflow routing table below for overflow routing.

Design Point JCa (Q_5 = 9.2 cfs, Q_{100} = 18.3 cfs) (Sub-basins: JC1-JC2; Area: 2.85 Ac.) represents a proposed public manhole combining flows from Design Points AB and AA. Flows will be conveyed downstream to Design Point AD via proposed 24-inch public storm sewer.

Design Point AD (Q_5 = 52.0 cfs, Q_{100} = 106.8 cfs) (Sub-basins: JC1-JC3; Area: 20.95 Ac.) represents the proposed public manhole combining flows from Design Point AC with flows from Sub-basin JC3. The combined flows will be conveyed downstream via proposed 42-inch public storm sewer to the edge of right of way for Bridgegate Place. From the edge of right of way storm sewer by the developer, to be constructed in parallel with the proposed Phase 4 improvements, will convey the runoff into the proposed private full spectrum detention facility Pond JCC #3. Please see the FDR for Bradley Ridge Filing No. 1 for storm sewer and detention pond design information. This pond is anticipated to be constructed concurrently with the proposed metro district improvements.

West Fork - Jimmy Camp Creek

Design Point AF (Q_5 = 4.4 cfs, Q_{100} = 10.3 cfs) (Sub-basins: WF10; Area: 2.04 Ac.) represents a proposed public 10-foot Type R sump inlet on the north side of Bradley Ridge Road west of its intersection with the second north/south collector west of Marksheffel Road. Flows captured in this sump inlet will be conveyed downstream via proposed 18-inch public storm pipe to Design Point AH. See the inlet overflow routing table below for overflow routing.

EXCERPT FROM PREVIOUS STUDY

Design Point AG (Q_5 = 4.2 cfs, Q_{100} = 11.6 cfs) (Sub-basins:WF11; Area: 2.60 Ac.) represents a proposed public 10-foot Type R sump inlet on the south side of Bradley Ridge Road west of its intersection with the second north/south collector west of Marksheffel Road. Flows captured in this sump inlet will be conveyed downstream via proposed 18-inch public storm pipe to Design Point AH. See the inlet overflow routing table below for overflow routing.

Design Point AH (Q_5 = 8.6 cfs, Q_{100} = 21.9 cfs) (Sub-basins:WF10-WF11; Area: 4.65 Ac.) represents the proposed public manhole combining flows from Design Points AF and AG. Flows will be conveyed east to the second north/south collector west of Marksheffel off of Bradley Ridge Road and then southwest to a proposed private interim swale that will direct the flows toward TDF AH.

Design Point TDF AH (Q_5 = 12.1 cfs, Q_{100} = 33.6 cfs) (Sub-basins:WF10-WF11, TEMP 1; Area: 8.76 Ac.) represents the total discharge into TDF AH. A proposed private stilling basin located at Design Point TDF-AH has been designed in accordance with Figure 9-37 of the ***Urban Storm Drainage Criteria Manual: Volume 2*** to provide energy dissipation to the stormwater entering the pond from the interim swale. The stilling basin is to be lined with grouted type M rip rap which will provide stabilization. Hydraulic toolbox calculations indicating that Type M riprap will provide proper stabilization can be found in Appendix A. A proposed private interim Full Spectrum detention facility will be constructed at this discharge point to provide the necessary treatment and detention for the roadway. Development of Sub-basin WF-12a, or 12b will trigger the need to construct WFJCC Pond #2(FSD, Future, Private).

Design Point TDF AH-OUT (Q_5 = 2.6 cfs, Q_{100} = 7.8 cfs) (Sub-basins:WF10-WF11, TEMP 1; Area: 8.76 Ac.) represents the total discharge from TDF AH. A proposed private interim swale will be constructed at this design point to convey the discharge flows from the pond. This swale has been designed to accommodate undetained 100-year flows from TDF AH.

Design Point AP (Q_5 = 2.8 cfs, Q_{100} = 9.1 cfs) (Sub-basins:WF10-WF11, TEMP 1, TEMP 2; Area: 9.14 Ac.) represents the discharge from interim swale TDF AH-OUT. Flows from the swale will discharge along historic paths and exit the site to the south.

Design Point WF2a (MDDP Indicated Discharge) (Q_5 = 22.6 cfs, Q_{100} = 153.5 cfs) (Sub-basins: WF10-WF17; Area: 99.13 Ac.) represents the site discharge to the south boundary of Bradley Heights. The proposed development will discharge at or below historic rates. A future FDR for the site will provide more detailed information on the discharge. The DBPS indicates an anticipated Q100 discharge of 380 cfs near this point, therefore the proposed conditions are in compliance with DBPS-WFJCC.

Because the proposed interim private detention pond will provide full spectrum treatment in the interim, the proposed improvements comply with the MDDP and the DBPS.

Notes:

- **MHFD or UD-Detention Analysis for ponds which will be constructed as part of the Improvements associated with Bradley Heights Metro District (Phase 4) can be found in Appendix A of this report.**

EXCERPT FROM PREVIOUS STUDY

V. Hydraulic Analysis

a. Proposed Inlets

INLET SUMMARY BRADLEY HEIGHTS METRO DISTRICT (PHASE 4)										
DESIGN POINT or SUB-BASIN	*SUB-BASINS/ DESCRIPTION*	*TOTAL AREA (AC)*	*INLET*			*Q(5) TOTAL INFLOW*	*Q5 INLET CAPACTIY*	*Q(100) BYPASS FLOWS (cfs)*	*Q(100) TOTAL INFLOW (cfs)*	*MAX INLET CAPACITY*
			SIZE (Ft.)	**TYPE**	**CONDITION**					
S	**MK11**	4.61	15	R	**SUMP**	9.1	**9.7**	**0.0**	21.0	**26.4**
T	**MK12**	0.38	10	R	**SUMP**	1.6	**8.3**	**0.0**	2.9	**13.4**
V	**MK15a**	0.22	10	R	**AT GRADE**	0.6	**0.6**	**0.0**	1.4	**1.4**
V2	**MK10a**	2.16	20	R	**AT GRADE**	4.3	**4.3**	**0.0**	9.8	**9.8**
W	**MK16**	6.13	3X6	D	**SUMP**	5.2	**36.7**	**0.0**	20.1	**40.5**
W2	**MK15b**	0.58	5	R	**SUMP**	2.5	**5.4**	**0.0**	4.5	**7.6**
X	**MK10b**	0.44	5	R	**SUMP**	1.9	**5.4**	**0.0**	3.4	**7.6**
AA	**JC1**	1.85	10	R	**SUMP**	5.2	**8.3**	**0.0**	10.9	**13.4**
AB	**JC2**	1.00	5	R	**SUMP**	4.1	**5.4**	**0.0**	7.4	**7.6**
AF	**WF10**	2.04	10	R	**SUMP**	4.4	**8.3**	**0.0**	10.3	**13.4**
AG	**WF11**	2.60	10	R	**SUMP**	4.2	**8.3**	**0.0**	11.6	**13.4**

Note: Inlet sizes indicated are minimums. Larger sizes may be used in the construction plans for conservative design.

Inlet Overflow Routing	
Inlet	*Overflow Routing Under Sump Inlet Blockage Conditions*
W	Blockage of this inlet will cause runoff to surcharge the sump and direct runoff into inlet W2. In the case of both inlets being blocked, flows will surcharge the crown of the road and drain to inlet X.
AF & AG	Blockage of either of these inlets will cause runoff to surcharge the crown of the road and enter the opposite inlet. In the case where both inlets are blocked, runoff will surcharge the curb and gutter on both sides of Bradley Ridge Road and flow overland to the north towards the Marksheffel Tributary to Jimmy Camp Creek or south to the West Fork of Jimmy Camp Creek where flows will then follow historic paths. Development of adjacent Sub-basins MK6 or WF12b should consider overtopping flows in flow path design.
S & T	Blockage of either of these inlets will cause runoff to surcharge the crown of the road and enter the opposite inlet. In the case where both inlets are blocked, runoff will back up via curb and gutter to Bradley Ridge Road and continue eastward along the road curb and gutter to Design Point W2.
X & W2	Blockage of either of these inlets will cause runoff to surcharge the crown of the road and enter the opposite inlet. In the case where both inlets are blocked, runoff will surcharge the curb and gutter on the west side of Bradley Ridge Road and flow downslope to the west into the Marksheffel Tributary to Jimmy Camp Creek where flows will then follow historic paths.
AA & AB	Blockage of either of these inlets will cause runoff to surcharge the crown of the road and enter the opposite inlet. In the case where both inlets are blocked, runoff will back up via curb and gutter to the stubbed road section into the adjacent future development to the east. From this point flows will continue eastward and enter the proposed private FSD JCC Pond #3 (By others)

b. Swales

Swale analysis was performed using the Federal Highway Administration (FHWA) Hydraulic Toolbox. This tool helps determine the stability of each proposed swale cross section based on the flows, cross section, and type of material used for the swale (Note: TDF indicates Temporary Detention Facility). Swale WF2 has been sized to accommodate the existing flows at design point WF2 described in the MDDP (153.5 cfs) and will outfall to the existing swale and exit the site to the south. The table below summarizes the various swales included as part of these improvements.

Swale Capacities BRADLEY HEIGHTS METRO DISTRICT (PHASE 4)						
Design Point	**Armoring Type**	**Anticipated Slope %**	**CHANNEL CAPACITY MAJOR STORM (cfs)**	**Q(100) TOTAL FLOW (cfs)**	**Q(100) VELOCTIY (FT/S)**	**Q100 Flow Depth (ft)**
TDF AH-OUT	TYPE VL RIPRAP	1.1%	**33.6**	33.6	3.9	**1.0**
TDF AH	VEGETATED	1.0%	**33.6**	33.6	2.9	**1.2**
TDF AH	GROUTED RIPRAP	12.8%	**33.6**	33.6	5.4	**0.7**
WF2	VEGETATED	0.5%	**153.5**	153.5	3.2	**2.7**

EXCERPT FROM PREVIOUS STUDY

c. Detention

MKJCC Pond #4, JCC Pond #3, Marksheffel WQ Pond, and Interim Detention Facility AH (TDF-AH) will provide detention and water quality treatment for stormwater runoff generated within the Bradley Heights Phase 4 site. MKJCC Pond #4 and JCC Pond #3 are to be constructed in parallel with the phase 4 construction as a part of the Bradley Ridge Filing No. 1 development. Design information including calculations are included in the ***Bradley Ridge Filing No. 1 Final Drainage Report***, *by Galloway, dated April 2023*. Excerpts from the Bradley ridge FDR can be found in Appendix C. The table below shows a comparison of the proposed sub-basins tributary to MKJCC Pond #4 and JCC Pond #3, and the assumed sub-basins from the MDDPA.

EXISTING POND COMPARISON BRADLEY HEIGHTS METRO DISTRICT (PHASE 4)								
PROPOSED SUB-BASIN	*AREA (acres)*	*IMPERVIOUS AREA (acres)*	*PERCENT IMPERVIOUS*	**MDDPA SUB-BASIN**	**AREA (acres)**	*IMPERVIOUS AREA (acres)*	*PERCENT IMPERVIOUS*	*POND*
Portion of sub-basin MK10a located within MDDPA sub-basin MK10	**1.97**	**1.20**	**52.00%**	**MK10**	**1.97**	**1.87**	**95.00%**	**MKJCC POND #4**
Portion of sub-basin MK11 located within MDDPA sub-basin MK11	**4.49**	**2.60**	**55.32%**	**MK11**	**4.49**	**2.88**	**64.21%**	**MKJCC POND #4**
MK12	**0.38**	**0.36**	**95.00%**	**MK12**	**0.38**	**0.36**	**95.00%**	**MKJCC POND #4**
Portion of sub-basins MK15a and MK15b located within MDDPA sub-basin MK15	**0.67**	**0.64**	**95.00%**	**MK15**	**0.67**	**0.64**	**95.00%**	**MKJCC POND #4**
JC1	**1.85**	**1.27**	**68.81%**	**JC1**	**1.85**	**1.27**	**68.81%**	**JCC POND #3**
JC2	**0.75**	**0.71**	**95.00%**	**JC2**	**0.75**	**0.71**	**95.00%**	**JCC POND #3**

TDF AH is to be provided in an interim condition as part of Phase 4 as a means of compliance until the property to the west of the site is developed. TDF AH has been designed as a Full Spectrum Sand Filter due to its low impervious tributary area. The stilling basin located at Design Point TDF-AH has been designed in accordance with Figure 9-37 of the ***Urban Storm Drainage Criteria Manual: Volume 2*** to provide energy dissipation to the stormwater entering the pond from the interim swale. Figure 9-38 of the ***Urban Storm Drainage Criteria Manual: Volume 2***, shown below, has been utilized to determine the minimum size of riprap to be utilized in the stilling basin. The stilling basin is to be lined with type M grouted riprap which will provide stabilization.

EXCERPT FROM PREVIOUS STUDY

APPENDIX A

HYDROLOGIC AND HYDRAULIC CALCULATIONS

EXCERPT FROM PREVIOUS STUDY

Rational Method - Proposed Conditions

Project Name:	BRADLEY HEIGHTS METRO DISTRICT (PHASE 4)
Project Location:	COLORADO SPRINGS, EL PASO COUNTY, CO
Designer	WCG
Notes:	Proposed Condition

Average Channel Velocity 4.00 ft/s (If specific channel vel is used, this will be ignored)
Average Slope for Initial Flow 0.04 ft/ft (If Elevations are used, this will be ignored)
SOIL TYPE CHOSEN BASED ON WORST CASE FOR TRIBUTARY AREA

Channel Flow Type Key

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

		Area				Rational 'C' Values																	
					PCT Impervious	95%			65%			100%			70%			30%			2%		
Sub-basin	Comments				Soil Group	Commercial Areas (95% Impervious)			Residential (1/8 or less) (65% Impervious)			Pavement (100% Impervious)			Neighborhoods/Multi-Family (70% Impervious)			Residential (1/3 Acre) (30% Impervious)			Undeveloped/Pervious Areas (2% Impervious)		
		sf	acres	Sq. Mi.		C5	C100	Area	C5	C100	Area (SF)	C5	C100	Area (SF)	C5	C100	Area	C5	C100	Area	C5	C100	Area
MK7	PUD-MARKSHEFFEL-WOODMEN INVESTMENTS, LLC	2155041	49.47	0.2321	D	0.82	0.89		0.49	0.65	2155041	0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	
MK10a	BRADLEY RIDGE ROAD	94090	2.16	0.2844	D	0.82	0.89	54413	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	39677
MK10b	BRADLEY RIDGE ROAD	19360	0.44	0.3000	D	0.82	0.89	19360	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	
MK10c	MKJCC WQ Pond	9987	0.23	0.3000	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	9987
MK11	BRADLEY RIDGE ROAD	200831	4.61	0.2290	D	0.82	0.89	59997	0.49	0.65		0.90	0.96		0.53	0.68	78477	0.30	0.57		0.16	0.51	62357
MK12	1ST COLLECTOR WEST OF MARKSHEFFEL	16546	0.38	0.1033	D	0.82	0.89	16546	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	
MK13	BRADLEY RIDGE FILING NO. 1 100% IMPERVIOUS ADDED IN ORDER TO MATCH VALUES FROM BRADLEY RIDGE FILING NO. 1 FDR DP A8	685860	15.75	0.2075	D	0.82	0.89		0.49	0.65		0.90	0.96	210000	0.53	0.68	475860	0.30	0.57		0.16	0.51	
MK14	BRADLEY RIDGE DEVELOPMENT	131504	3.02	0.0047	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	131504
MK15a	BRDLEY RIDGE ROAD	9418	0.22	0.0003	D	0.82	0.89	5551	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	3867
MK15b	BRADLEY RIDGE ROAD	25411	0.58	0.0009	D	0.82	0.89	25411	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	
MK16	MARKSHEFFEL ROAD & UNDEVELOPED CITY PROPERTY	266955	6.13	0.0096	D	0.82	0.89	31702	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	235253
JC1	1ST COLLECTOR WEST OF MARKSHEFFEL-WEST SIDE	80679	1.85	0.1556	D	0.82	0.89	35729	0.49	0.65		0.90	0.96		0.53	0.68	30402	0.30	0.57		0.16	0.51	14548
JC2	1ST COLLECTOR WEST OF MARKSHEFFEL-EAST SIDE	43607	1.00	0.1591	D	0.82	0.89	43607	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	
JC3	BRADLEY RIDGE DEVELOPMENT 100% IMPERVIOUS AREA ADDED TO MODIFY Q100 TO MATCH VALUES FROM BRADLEY RIDGE FILING NO. 1, DP B18	788205	18.09	0.1786	D	0.82	0.89		0.49	0.65		0.90	0.96	128000	0.53	0.68	660205	0.30	0.57		0.16	0.51	
JC4	BRADLEY RIDGE DEVELOPMENT	729417	16.75	0.1951	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68	729417	0.30	0.57		0.16	0.51	
JC5	MARKSHEFFEL ROAD & UNDEVELOPED CITY PROPERTY	326813	7.50	0.0117	D	0.82	0.89	207805	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	119008
			0.00																				
WF10	NORTH SIDE OF BRADLEY RIDGE ROAD	88890	2.04	0.0032	D	0.82	0.89	46161	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	42729
WF11	SOUTH SIDE OF BRADLEY RIDGE ROAD	113461	2.60	0.0041	D	0.82	0.89	40517	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	72944
TEMP 1	TEMPORARY BASIN AT INTERSECTION OF BRADLEY RIDGE ROAD & COLLECTOR 2. THIS BASIN WILL BE ABSORBED INTO BASINS WF13 & WF14 IN THE DRAINAGE REPORT COMPLETED FOR THE CONSTRUCTION PLANS FOR COLLECTOR 2.	179341	4.12	0.0064	D	0.82	0.89	46458	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	132883
TEMP 2	TEMPORARY SWALE CARRYING FLOWS FROM THE TEMPORARY POND	16619	0.38	0.0006	D	0.82	0.89	0	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	16619
WF12a	BRADLEY RIDGE DEVELOPMENT SOUTWEST OF BRADLEY RIDGE AND COLLECTOR 2	1364268	31.32	0.0489	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	1364268
WF12b	BRADLEY RIDGE DEVELOPMENT SOUTWEST OF BRADLEY RIDGE AND COLLECTOR 2	1118584	25.68	0.0401	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	1118584
WF13	WEST HALF OF COLLECTOR 2	44672	1.03	0.0016	D	0.82	0.89	0	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	44672
WF14	EAST HALF OF COLLECTOR 2	137679	3.16	0.0049	D	0.82	0.89	48793	0.49	0.65		0.90	0.96		0.53	0.68	88886	0.30	0.57		0.16	0.51	
WF15	BRADLEY RIDGE DEVELOPMENT SOUTH OF BRADLEY RIDGE AND EAST OF COLLECTOR 2	1255752	28.83	0.0450	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	1255752
WF16	WEST HALF OF COLLECTOR 2 NEAR SOUTH BOUND OF BRADLEY HEIGHTS	3901	0.09	0.0001	D	0.82	0.89		0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	3901
WF17	EAST HALF OF COLLECTOR 2 NEAR SOUTH BOUND OF BRADLEY HEIGHTS	11725	0.27	0.0004	D	0.82	0.89	0	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	11725

				Flow Lengths										Tc	Rainfall Intensity & Rational Flow Rate				
Sub-basin	Composite		Percent Impervious	Initial	True Initial	Channel	True Channel	Average (decimal)	Initial	Average (%)	Channel Flow Type (See Key above)	Velocity	Channel	Total	i5	Q5	i100	Q100	Sub-basin
	C5	C100		ft	Length ft	ft	Length ft	Slope	Tc (min)	Slope	Ground Type	(ft/s)	Tc (min)	(min)	in/hr	cfs	in/hr	cfs	
MK7	0.49	0.65	65.00%	100	100	1650	1650	0.05	6.42	3.0	7	3.46	7.94	14.35	3.53	**86.3**	5.93	**192.4**	MK7
MK10a	0.54	0.73	55.78%	50	50	1750	1750	0.03	4.93	3.2	7	3.58	8.15	13.07	3.68	**4.3**	6.18	**9.8**	MK10a
MK10b	0.82	0.89	95.00%	50	50	400	400	0.05	2.08	4.0	7	4.00	1.67	5.00	5.10	**1.9**	8.58	**3.4**	MK10b
MK10c	0.16	0.51	2.00%	50	50	50	50	0.25	4.09	25.0	4	3.50	0.24	5.00	5.10	**0.2**	8.58	**1.0**	MK10c
MK11	0.50	0.69	56.35%	50	50	1673	1673	0.05	4.45	4.0	7	4.00	6.97	11.42	3.89	**9.1**	6.54	**21.0**	MK11
MK12	0.82	0.89	95.00%	50	50	400	400	0.05	2.08	3.7	7	3.85	1.73	5.00	5.10	**1.6**	8.58	**2.9**	MK12
MK13	0.64	0.77	79.19%	100	100	912	912	0.05	4.81	3.0	7	3.46	4.39	9.19	4.23	**40.0**	7.11	**89.8**	MK13
MK14	0.16	0.51	2.00%	100	100	610	610	0.05	9.89	3.0	7	3.46	2.93	12.82	3.71	**1.8**	6.23	**9.7**	MK14
MK15a	0.55	0.73	56.81%	50	50	150	150	0.05	4.10	4.0	7	4.00	0.63	5.00	5.10	**0.6**	8.58	**1.4**	MK15a
MK15b	0.82	0.89	95.00%	50	50	400	400	0.05	2.08	4.0	7	4.00	1.67	5.00	5.10	**2.5**	8.58	**4.5**	MK15b
MK16	0.24	0.56	13.04%	50	50	760	760	0.05	6.41	4.8	4	1.53	8.26	14.67	3.50	**5.2**	5.88	**20.1**	MK16
JC1	0.59	0.74	68.81%	20	20	795	795	0.05	2.39	2.3	7	3.03	4.37	6.76	4.69	**5.2**	7.88	**10.9**	JC1
JC2	0.82	0.89	95.00%	20	20	795	795	0.05	1.32	2.3	7	3.03	4.37	5.68	4.94	**4.1**	8.29	**7.4**	JC2
JC3	0.59	0.73	74.87%	100	100	1150	1150	0.05	5.37	4.0	7	4.00	4.79	10.15	4.08	**43.9**	6.85	**90.7**	JC3
JC4	0.53	0.68	70.00%	100	100	1181	1181	0.05	6.00	2.3	7	3.03	6.49	12.48	3.75	**33.6**	6.31	**72.4**	JC4
JC5	0.58	0.75	61.13%	100	100	1692	1692	0.05	5.48	2.9	4	1.19	23.66	29.13	2.46	**10.8**	4.14	**23.5**	JC5
WF10	0.50	0.71	50.30%	50	50	765	765	0.05	4.45	1.7	7	2.61	4.89	9.33	4.21	**4.4**	7.07	**10.3**	WF10
WF11	0.40	0.65	35.21%	50	50	765	765	0.05	5.24	1.7	7	2.61	4.89	10.13	4.08	**4.2**	6.86	**11.6**	WF11
TEMP 1	0.33	0.61	26.09%	20	20	1050	1050	0.05	3.62	1.0	7	2.00	8.75	12.37	3.77	**5.2**	6.33	**16.0**	TEMP 1
TEMP 2	0.16	0.51	2.00%	50	50	540	540	0.03	8.30	3.3	6	2.72	3.30	11.59	3.87	**0.2**	6.50	**1.3**	TEMP 2
WF12a	0.16	0.51	2.00%	100	100	2777	2777	0.05	9.89	4.0	7	4.00	11.57	21.46	2.91	**14.7**	4.88	**78.6**	WF12a
WF12b	0.16	0.51	2.00%	100	100	2777	2777	0.05	9.89	4.0	7	4.00	11.57	21.46	2.91	**12.0**	4.88	**64.5**	WF12b
WF13	0.16	0.51	2.00%	50	50	1050	1050	0.05	7.00	4.6	7	4.29	4.08	11.07	3.94	**0.7**	6.62	**3.3**	WF13
WF14	0.63	0.75	78.86%	50	50	1050	1050	0.05	3.48	4.6	7	4.29	4.08	7.55	4.53	**9.1**	7.61	**18.3**	WF14
WF15	0.16	0.51	2.00%	100	100	1645	1645	0.05	9.89	4.0	7	4.00	6.85	16.74	3.29	**15.3**	5.53	**81.9**	WF15
WF16	0.16	0.51	2.00%	20	20	118	118	0.05	4.43	1.0	7	2.00	0.98	5.40	5.00	**0.1**	8.41	**0.4**	WF16
WF17	0.16	0.51	2.00%	20	20	118	118	0.05	4.43	1.0	7	2.00	0.98	5.40	5.00	**0.2**	8.41	**1.2**	WF17

EXCERPT FROM PREVIOUS STUDY

Rational Method - Proposed Conditions

DESIGN POINTS	Sub-basins/Comments	Area sf	Area acres	Area Sq. Mi.	Soil Group	Commercial Areas (95% Impervious) C5	Commercial C100	Commercial Area	Residential (1/8 or less) (65% Impervious) C5	Residential (1/8) C100	Residential (1/8) Area (SF)
S	MK11	200831	4.61	0.0072	D	0.82	0.89	59997	0.49	0.65	0
T	MK12	16546	0.38	0.0006	D	0.82	0.89	16546	0.49	0.65	0
U	MK11-MK12	217377	4.99	0.0078	D	0.82	0.89	76543	0.49	0.65	0
U2	MK11-MK13	903237	20.74	0.0324	D	0.82	0.89	76543	0.49	0.65	0
V	MK15a	9418	0.22	0.0003	D	0.82	0.89	5551	0.49	0.65	0
V2	MK10a	94090	2.16	0.0034	D	0.82	0.89	54413	0.49	0.65	0
V3	MK10a, MK15a	103508	2.38	0.0037	D	0.82	0.89	59964	0.49	0.65	0
W2	MK15b	25411	0.58	0.0009	D	0.82	0.89	25411	0.49	0.65	0
W	MK16	266955	6.13	0.0096	D	0.82	0.89	31702	0.49	0.65	0
W3	MK15b, MK16	292366	6.71	0.0105	D	0.82	0.89	57113	0.49	0.65	0
X	MK10b	19360	0.44	0.0007	D	0.82	0.89	19360	0.49	0.65	0
Y	MK10b, MK10c, MK15b, MK16	321713	7.39	0.0115	D	0.82	0.89	76473	0.49	0.65	0
MKJCC POND #4 In	MK7, MK10a, MK11-MK14, MK15a-INFLOW (Pond Design by Others)	3293290	75.60	0.1181	D	0.82	0.89	136507	0.49	0.65	2155041
MKJCC POND #4 Out	MK7, MK10-MK16-OUTFLOW (Pond Design by Others)	3293290	75.60	0.1181	D	0.82	0.89	136507	0.49	0.65	2155041
AA	JC1	80679	1.85	0.0029	D	0.82	0.89	35729	0.49	0.65	0
AB	JC2	43607	1.00	0.0016	D	0.82	0.89	43607	0.49	0.65	0
JCa	JC1-JC2	124286	2.85	0.0045	D	0.82	0.89	79336	0.49	0.65	0
AD	JC1-JC3	912491	20.95	0.0327	D	0.82	0.89	79336	0.49	0.65	0
JCC POND #3	JC1-JC4 (Pond Design by Others)	1641908	37.69	0.0589	D	0.82	0.89	79336	0.49	0.65	0
JC	JC1-JC5	1968721	45.20	0.0706	D	0.82	0.89	287141	0.49	0.65	0
AF	WF10	88890	2.04	0.0032	D	0.82	0.89	46161	0.49	0.65	0
AG	WF11	113461	2.60	0.0041	D	0.82	0.89	40517	0.49	0.65	0
AH	WF10-WF11	202351	4.65	0.0073	D	0.82	0.89	86678	0.49	0.65	0
TDF AH	WF10-WF11, TEMP 1	381692	8.76	0.0137	D	0.82	0.89	133136	0.49	0.65	0
TDF AH-OUT	DISCHARGE	381692	8.76	0.0137	D	0.82	0.89	133136	0.49	0.65	0
AP	WF10-WF11, TEMP 1, TEMP 2	398311	9.14	0.0143	D	0.82	0.89	133136	0.49	0.65	0
DP WF2a	MDDP: SITE DISCHARGE TO SOUTH	4318273	99.13	0.1549	D	0.82	0.89	181929	0.49	0.65	0
WQ Pond In	MK10b, MK10c, MK15b, MK16-INFLOW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WQ Pond Out	MK10b, MK10c, MK15b, MK16-OUFLOW	321713	7.39	0.0115	D	0.82	0.89	76473	0.49	0.65	0

DESIGN POINTS	Pavement (100% Impervious) C5	Pavement C100	Pavement Area (SF)	Neighborhoods/Multi-Family (70% Impervious) C5	Neighborhoods C100	Neighborhoods Area	Residential (1/3 Acre) (30% Impervious) C5	Residential (1/3) C100	Residential (1/3) Area	Undeveloped/Pervious Areas (2% Impervious) C5	Undeveloped C100	Undeveloped Area	Composite C5	Composite C100	Percent Impervious
S	0.90	0.96	0	0.53	0.68	78477	0.30	0.57	0	0.16	0.51	62357	0.50	0.69	56.35%
T	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00%
U	0.90	0.96	0	0.53	0.68	78477	0.30	0.57	0	0.16	0.51	62357	0.53	0.71	59.30%
U2	0.90	0.96	210000	0.53	0.68	554337	0.30	0.57	0	0.16	0.51	62357	0.62	0.75	74.40%
V	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	3867	0.55	0.73	56.81%
V2	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	39677	0.54	0.73	55.78%
V3	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	43544	0.54	0.73	55.88%
W2	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00%
W	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	235253	0.24	0.56	13.04%
W3	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	235253	0.29	0.58	20.17%
X	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00%
Y	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	245240	0.32	0.60	24.11%
MKJCC POND #4 In	0.90	0.96	210000	0.53	0.68	554337	0.30	0.57	0	0.16	0.51	237405	0.51	0.67	64.78%
MKJCC POND #4 Out	0.90	0.96	210000	0.53	0.68	554337	0.30	0.57	0	0.16	0.51	237405	0.51	0.67	64.78%
AA	0.90	0.96	0	0.53	0.68	30402	0.30	0.57	0	0.16	0.51	14548	0.59	0.74	68.81%
AB	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	0	0.82	0.89	95.00%
JCa	0.90	0.96	0	0.53	0.68	30402	0.30	0.57	0	0.16	0.51	14548	0.67	0.79	78.00%
AD	0.90	0.96	128000	0.53	0.68	690607	0.30	0.57	0	0.16	0.51	14548	0.60	0.73	75.30%
JCC POND #3	0.90	0.96	128000	0.53	0.68	1420024	0.30	0.57	0	0.16	0.51	14548	0.57	0.71	72.94%
JC	0.90	0.96	128000	0.53	0.68	1420024	0.30	0.57	0	0.16	0.51	133556	0.57	0.72	70.98%
AF	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	42729	0.50	0.71	50.30%
AG	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	72944	0.40	0.65	35.21%
AH	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	115673	0.44	0.67	41.84%
TDF AH	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	248556	0.39	0.64	34.44%
TDF AH-OUT	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	248556	0.39	0.64	34.44%
AP	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	265175	0.38	0.64	33.09%
DP WF2a	0.90	0.96	0	0.53	0.68	88886	0.30	0.57	0	0.16	0.51	4047458	0.20	0.53	7.32%
WQ Pond In	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WQ Pond Out	0.90	0.96	0	0.53	0.68	0	0.30	0.57	0	0.16	0.51	245240	0.32	0.60	24.11%

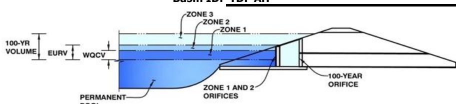
DESIGN POINTS	Flow Lengths: Initial ft	True Initial Length ft	Channel ft	True Channel Length ft	Average (decimal) Slope	Initial Tc (min)	Average (%) Slope	Channel Flow Type (See Key above) Ground Type	Velocity (ft/s)	Channel Tc (min)	Tc Total (min)	i5 in/hr	Q5 cfs	i100 in/hr	Q100 cfs	DESIGN POINTS
S	50	50	1673	1673	0.05	4.45	4.0	7	4.00	6.97	11.42	3.89	**9.1**	6.54	**21.0**	S
T	50	50	400	400	0.05	2.08	3.7	7	3.85	1.73	5.00	5.10	**1.6**	8.58	**2.9**	T
U	50	50	1673	1673	0.05	4.27	3.7	7	3.85	7.25	11.52	3.88	**10.3**	6.52	**23.1**	U
U2	50	50	1673	1673	0.05	3.61	3.7	7	3.85	7.25	10.85	3.97	**51.1**	6.68	**104.8**	U2
V	50	50	150	150	0.05	4.10	4.0	7	4.00	0.63	5.00	5.10	**0.6**	8.58	**1.4**	V
V2	50	50	1750	1750	0.03	4.93	3.2	7	3.58	8.15	13.07	3.68	**4.3**	6.18	**9.8**	V2
V3	50	50	1750	1750	0.03	4.92	3.2	7	3.58	8.15	13.07	3.68	**4.8**	6.18	**10.8**	V3
W2	50	50	400	400	0.05	2.08	4.0	7	4.00	1.67	5.00	5.10	**2.5**	8.58	**4.5**	W2
W	50	50	760	760	0.05	6.41	4.8	4	1.53	8.26	14.67	3.50	**5.2**	5.88	**20.1**	W
W3	50	50	760	760	0.05	6.04	4.8	4	1.53	8.26	14.29	3.54	**6.9**	5.95	**23.5**	W3
X	50	50	760	760	0.05	2.08	4.0	7	4.00	3.17	5.25	5.04	**1.9**	8.47	**3.4**	X
Y	50	50	760	760	0.05	5.83	4.0	7	4.00	3.17	8.99	4.27	**10.1**	7.17	**32.0**	Y
MKJCC POND #4 In	100	100	2050	2050	0.05	6.18	4.0	7	4.00	8.54	14.72	3.49	**136.5**	5.87	**301.6**	MKJCC POND #4 In
MKJCC POND #4 Out	N/A												**28.2**		**129.2**	MKJCC POND #4 Out
AA	20	20	795	795	0.05	2.39	2.3	7	3.03	4.37	6.76	4.69	**5.2**	7.88	**10.9**	AA
AB	20	20	795	795	0.05	1.32	2.3	7	3.03	4.37	5.68	4.94	**4.1**	8.29	**7.4**	AB
JCa	20	20	795	795	0.05	2.02	2.3	7	3.03	4.37	6.38	4.77	**9.2**	8.02	**18.3**	JCa
AD	100	100	1150	1150	0.05	5.25	4.0	7	4.00	4.79	10.04	4.10	**52.0**	6.88	**106.8**	AD
JCC POND #3	100	100	1450	1450	0.05	5.58	4.0	7	4.00	6.04	11.62	3.87	**6.0**	6.50	**49.2**	JCC POND #3
JC	100	100	1450	1450	0.05	5.57	4.0	7	4.00	6.04	11.60	3.87	**16.8**	6.50	**72.7**	JC
AF	50	50	765	765	0.05	4.45	1.7	7	2.61	4.89	9.33	4.21	**4.4**	7.07	**10.3**	AF
AG	50	50	765	765	0.05	5.24	1.7	7	2.61	4.89	10.13	4.08	**4.2**	6.86	**11.6**	AG
AH	50	50	765	765	0.05	4.89	1.7	7	2.61	4.89	9.78	4.14	**8.6**	6.95	**21.9**	AH
TDF AH	50	50	1430	1430	0.05	5.28	1.7	7	2.61	9.14	14.42	3.52	**12.1**	5.92	**33.6**	TDF AH
TDF AH-OUT													**2.6**		**7.8**	TDF AH-OUT
AP	50	50	1430	1430	0.05	5.35	1.7	7	2.61	9.14	14.49	3.52	**2.8**	5.91	**9.1**	AP
DP WF2a	50	50	2800	2800	0.05	6.73	1.7	7	2.61	17.90	24.62	2.70	**22.6**	4.54	**153.5**	DP WF2a
WQ Pond In	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	WQ Pond In
WQ Pond Out	50	50	760	760	0.05	5.83	4.8	4	1.53	8.26	14.08	3.56	**3.9**	5.98	**12.0**	WQ Pond Out

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: **Bradley Heights Phase 4 (Road & Storm)**

Basin ID: **TDF AH**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**SF**	
Watershed Area =	8.76	acres
Watershed Length =	1,550	ft
Watershed Length to Centroid =	775	ft
Watershed Slope =	0.029	ft/ft
Watershed Imperviousness =	34.44%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	Denver - Capitol Building	

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) =	0.061	acre-feet	0.061	acre-feet
Excess Urban Runoff Volume (EURV) =	0.277	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.361	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.561	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.739	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.956	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.143	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.381	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.55 in.) =	2.169	acre-feet	3.55	inches
Approximate 2-yr Detention Volume =	0.240	acre-feet		
Approximate 5-yr Detention Volume =	0.387	acre-feet		
Approximate 10-yr Detention Volume =	0.446	acre-feet		
Approximate 25-yr Detention Volume =	0.496	acre-feet		
Approximate 50-yr Detention Volume =	0.518	acre-feet		
Approximate 100-yr Detention Volume =	0.622	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.061	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.216	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.345	acre-feet
Total Detention Basin Volume =	0.622	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}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

EXCERPT FROM PREVIOUS STUDY

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Media Surface	--	0.00	--	--	--	4,827	0.111		
5789.5	--	0.50	--	--	--	5,790	0.133	2,654	0.061
5790	--	1.00	--	--	--	6,445	0.148	5,713	0.131
5790.5	--	1.50	--	--	--	7,220	0.166	9,129	0.210
5791	--	2.00	--	--	--	8,025	0.184	12,940	0.297
5791.5	--	2.50	--	--	--	8,859	0.203	17,161	0.394
5792	--	3.00	--	--	--	9,722	0.223	21,807	0.501
5792.5	--	3.50	--	--	--	10,613	0.244	26,890	0.617
5793	--	4.00	--	--	--	11,532	0.265	32,427	0.744
5793.5	--	4.50	--	--	--	12,482	0.287	38,430	0.882
5794	--	5.00	--	--	--	13,459	0.309	44,915	1.031
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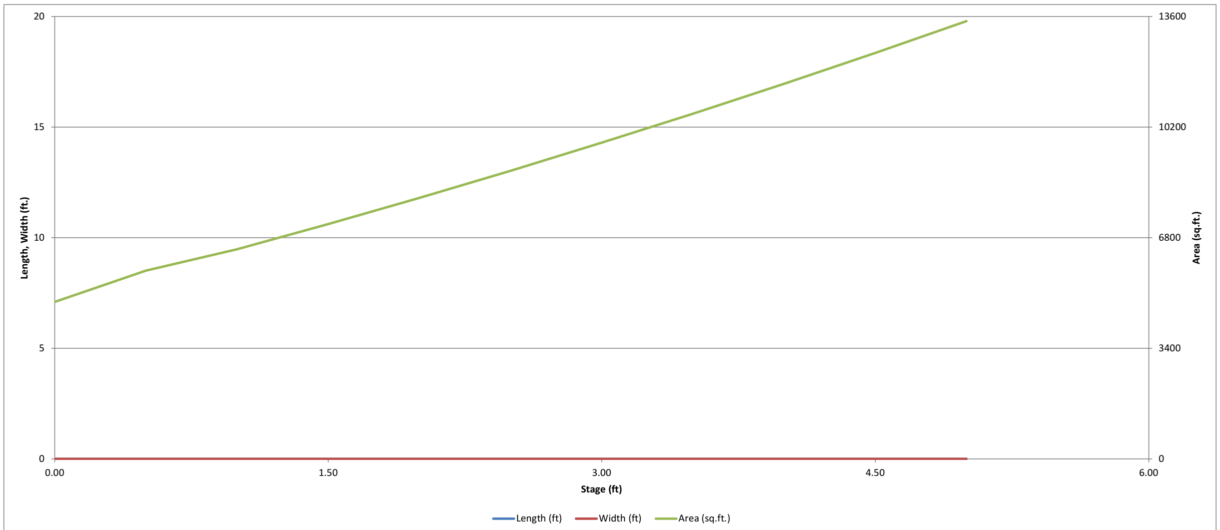
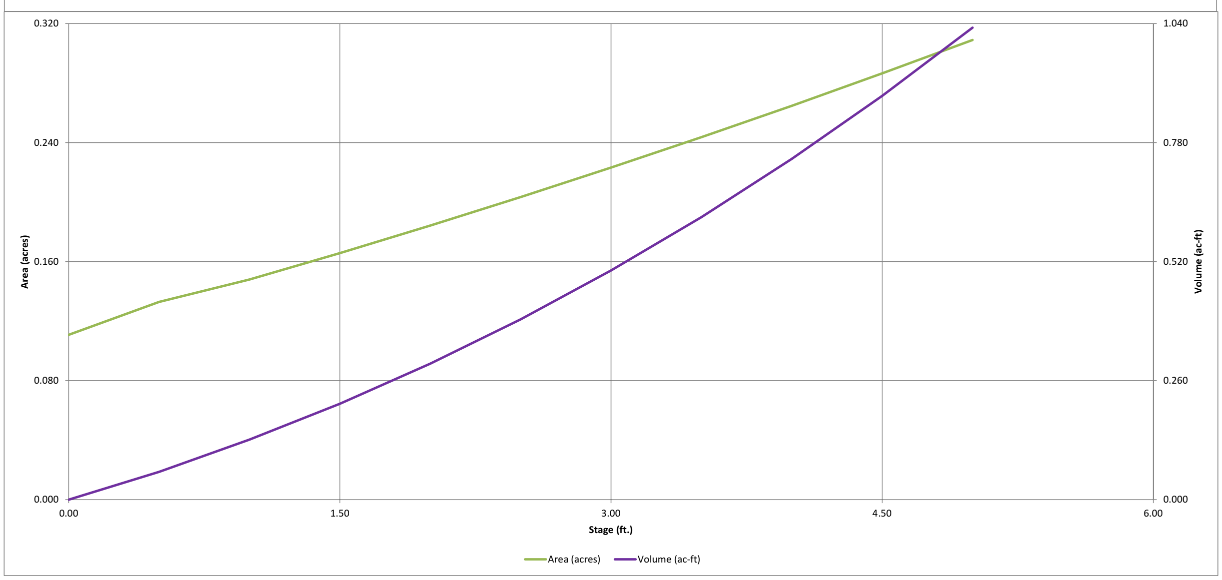
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

EXCERPT FROM PREVIOUS STUDY





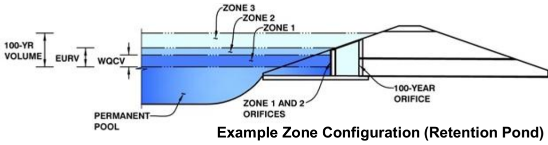
EXCERPT FROM PREVIOUS STUDY

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: Bradley Heights Phase 4 (Road & Storm)

Basin ID: TDF AH



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.51	0.061	Filtration Media
Zone 2 (EURV)	1.90	0.216	Orifice Plate
Zone 3 (100-year)	3.52	0.345	Weir&Pipe (Restrict)
Total (all zones)		0.622	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	2.50	ft (distance below the filtration media surface)	Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Diameter =	1.19	inches	Underdrain Orifice Centroid =	0.05	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Calculated Parameters for Plate

Centroid of Lowest Orifice =	0.52	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.847E-02	ft^2
Depth at top of Zone using Orifice Plate =	1.93	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.66	sq. inches (diameter = 1-13/16 inches)	Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.52	1.00						
Orifice Area (sq. inches)	2.66	2.66						

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.00	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	2.00	N/A	feet
Overflow Weir Front Edge Length =	3.00	N/A	feet	Overflow Weir Slope Length =	3.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	8.99	N/A	
Horiz. Length of Weir Sides =	3.00	N/A	feet	Overflow Grate Open Area w/o Debris =	6.26	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	3.13	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected			Zone 3 Restricto	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.70	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.36	N/A	feet
Restrictor Plate Height Above Pipe Invert =	7.50		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.40	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage=	3.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.22	feet
Spillway Crest Length =	41.00	feet	Stage at Top of Freeboard =	4.72	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.30	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.95	acre-ft

Routed Hydrograph Results

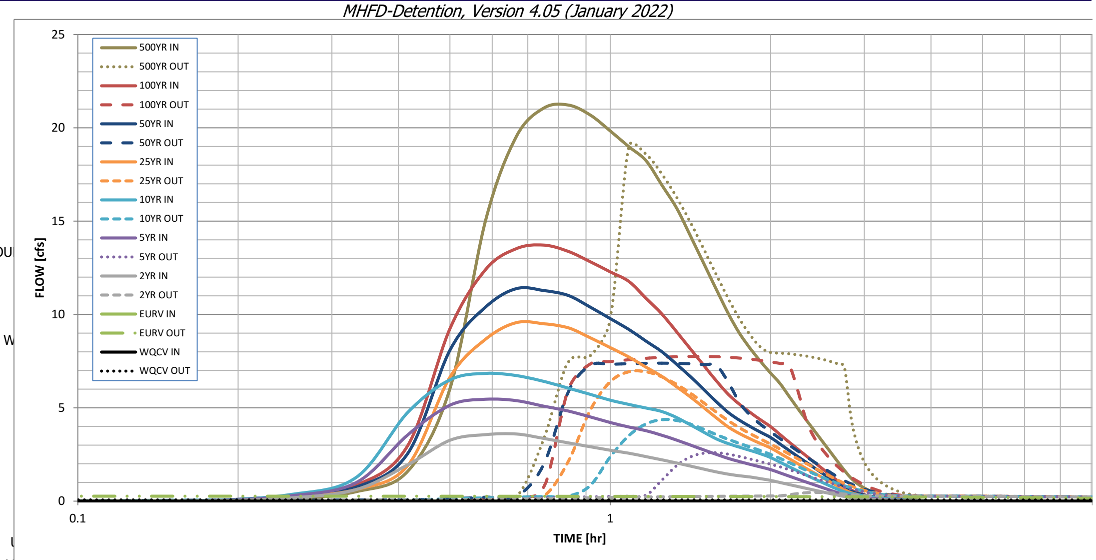
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF

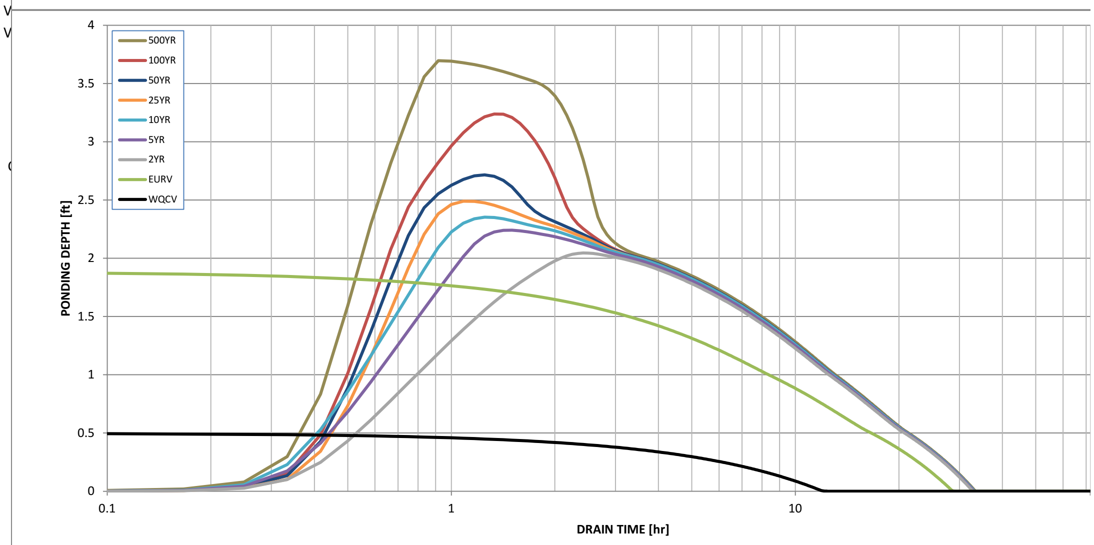
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.55
CUHP Runoff Volume (acre-ft) =	0.061	0.277	0.361	0.561	0.739	0.956	1.143	1.381	2.169
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.361	0.561	0.739	0.956	1.143	1.381	2.169
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.2	2.6	3.6	5.8	7.1	8.9	14.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.14	0.29	0.41	0.66	0.81	1.02	1.67
Peak Inflow Q (cfs) =	N/A	N/A	3.6	5.5	6.8	9.6	11.4	13.7	21.2
Peak Outflow Q (cfs) =	0.1	0.3	0.5	2.6	4.4	6.9	7.4	7.8	19.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	1.2	1.2	1.0	0.9	1.3
Structure Controlling Flow =	Filtration Media	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	0.03	0.4	0.6	1.1	1.1	1.2	1.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	12	27	31	30	29	27	26	25	21
Time to Drain 99% of Inflow Volume (hours) =	**12**	28	32	32	32	31	31	30	29
Maximum Ponding Depth (ft) =	0.51	1.89	2.05	2.24	2.35	2.49	2.72	3.24	3.70
Area at Maximum Ponding Depth (acres) =	0.13	0.18	0.19	0.19	0.20	0.20	0.21	0.23	0.25
Maximum Volume Stored (acre-ft) =	0.062	0.277	0.304	0.342	0.364	0.390	0.438	0.553	0.664

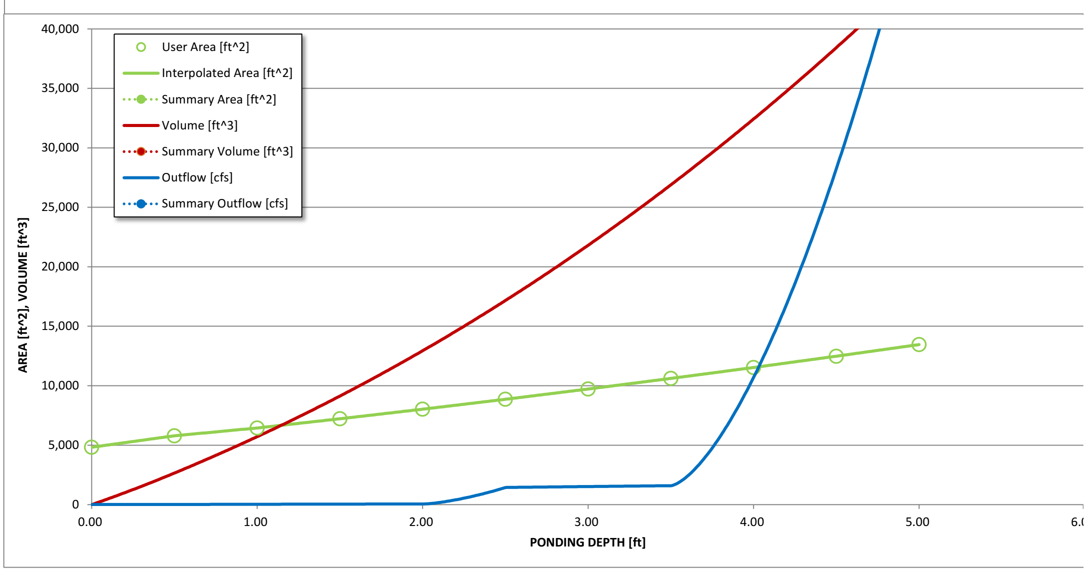
EXCERPT FROM PREVIOUS STUDY

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)





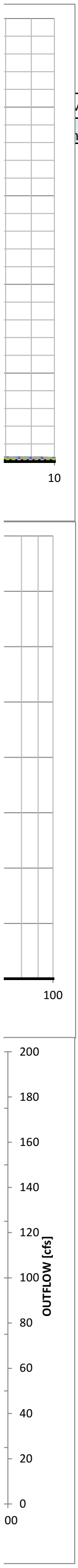


S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

EXCERPT FROM PREVIOUS STUDY

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:



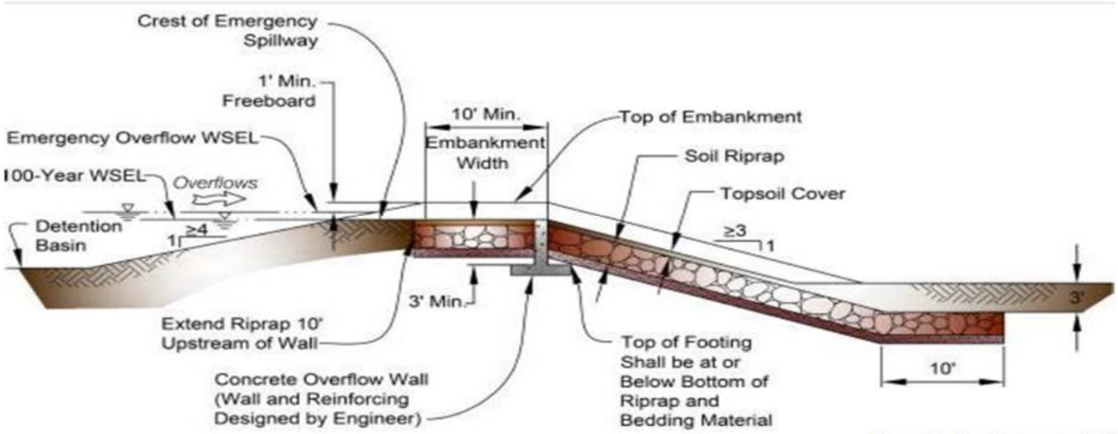
Inflow Hydrographs

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

SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.10
0:15:00	0.00	0.00	0.17	0.28	0.35	0.23	0.29	0.29	0.51
0:20:00	0.00	0.00	0.62	0.99	1.27	0.62	0.75	0.86	1.60
0:25:00	0.00	0.00	1.95	3.55	4.76	1.91	2.56	2.98	6.03
0:30:00	0.00	0.00	3.26	5.14	6.49	6.64	8.09	9.25	15.05
0:35:00	0.00	0.00	3.56	5.46	6.84	8.68	10.40	12.41	19.55
0:40:00	0.00	0.00	3.59	5.38	6.73	9.56	11.38	13.53	21.06
0:45:00	0.00	0.00	3.36	5.08	6.42	9.50	11.28	13.72	21.22
0:50:00	0.00	0.00	3.12	4.83	6.05	9.29	11.02	13.38	20.69
0:55:00	0.00	0.00	2.92	4.51	5.72	8.75	10.40	12.83	19.83
1:00:00	0.00	0.00	2.72	4.21	5.41	8.22	9.78	12.28	18.99
1:05:00	0.00	0.00	2.57	3.97	5.18	7.72	9.20	11.77	18.24
1:10:00	0.00	0.00	2.38	3.77	4.99	7.18	8.57	10.87	16.93
1:15:00	0.00	0.00	2.21	3.53	4.80	6.68	8.00	10.02	15.68
1:20:00	0.00	0.00	2.04	3.26	4.47	6.12	7.32	9.06	14.16
1:25:00	0.00	0.00	1.87	3.00	4.07	5.56	6.65	8.13	12.70
1:30:00	0.00	0.00	1.71	2.74	3.68	5.00	5.96	7.25	11.31
1:35:00	0.00	0.00	1.56	2.50	3.33	4.45	5.31	6.42	10.03
1:40:00	0.00	0.00	1.44	2.28	3.08	3.96	4.74	5.71	8.97
1:45:00	0.00	0.00	1.36	2.11	2.88	3.61	4.33	5.18	8.16
1:50:00	0.00	0.00	1.29	1.96	2.71	3.33	3.98	4.74	7.47
1:55:00	0.00	0.00	1.20	1.83	2.53	3.08	3.69	4.35	6.86
2:00:00	0.00	0.00	1.11	1.69	2.33	2.85	3.41	3.99	6.30
2:05:00	0.00	0.00	1.00	1.51	2.08	2.56	3.06	3.57	5.61
2:10:00	0.00	0.00	0.89	1.34	1.84	2.27	2.71	3.16	4.96
2:15:00	0.00	0.00	0.78	1.17	1.61	2.00	2.39	2.78	4.34
2:20:00	0.00	0.00	0.68	1.02	1.39	1.75	2.08	2.42	3.77
2:25:00	0.00	0.00	0.59	0.87	1.19	1.50	1.78	2.08	3.21
2:30:00	0.00	0.00	0.50	0.73	1.00	1.27	1.50	1.74	2.68
2:35:00	0.00	0.00	0.41	0.59	0.82	1.04	1.22	1.42	2.16
2:40:00	0.00	0.00	0.32	0.46	0.65	0.82	0.96	1.10	1.66
2:45:00	0.00	0.00	0.25	0.35	0.50	0.61	0.72	0.81	1.22
2:50:00	0.00	0.00	0.19	0.27	0.40	0.45	0.53	0.59	0.92
2:55:00	0.00	0.00	0.15	0.22	0.33	0.34	0.41	0.45	0.70
3:00:00	0.00	0.00	0.12	0.18	0.28	0.26	0.32	0.34	0.54
3:05:00	0.00	0.00	0.10	0.15	0.23	0.21	0.25	0.26	0.41
3:10:00	0.00	0.00	0.09	0.12	0.19	0.16	0.20	0.19	0.31
3:15:00	0.00	0.00	0.07	0.10	0.15	0.13	0.16	0.15	0.24
3:20:00	0.00	0.00	0.06	0.08	0.12	0.10	0.12	0.11	0.18
3:25:00	0.00	0.00	0.05	0.07	0.10	0.08	0.10	0.09	0.14
3:30:00	0.00	0.00	0.04	0.05	0.08	0.06	0.08	0.07	0.11
3:35:00	0.00	0.00	0.03	0.04	0.06	0.05	0.06	0.05	0.09
3:40:00	0.00	0.00	0.03	0.03	0.05	0.04	0.05	0.04	0.07
3:45:00	0.00	0.00	0.02	0.02	0.03	0.03	0.04	0.03	0.05
3:50:00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.02	0.04
3:55:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.03
4:00:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
4:05:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

EXCERPT FROM PREVIOUS STUDY

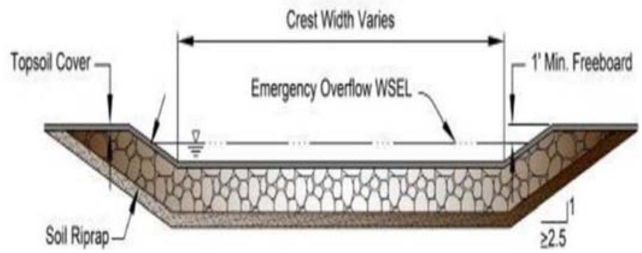
Figure 13-12b. Emergency Spillway Profile at Embankment



Q=10.1 CFS
LENGTH=41 Feet
UNIT FLOW RATE: 0.25 CFS/FT

=> TYPE VL RIP RAP

Figure 13-12c. Emergency Spillway Protection



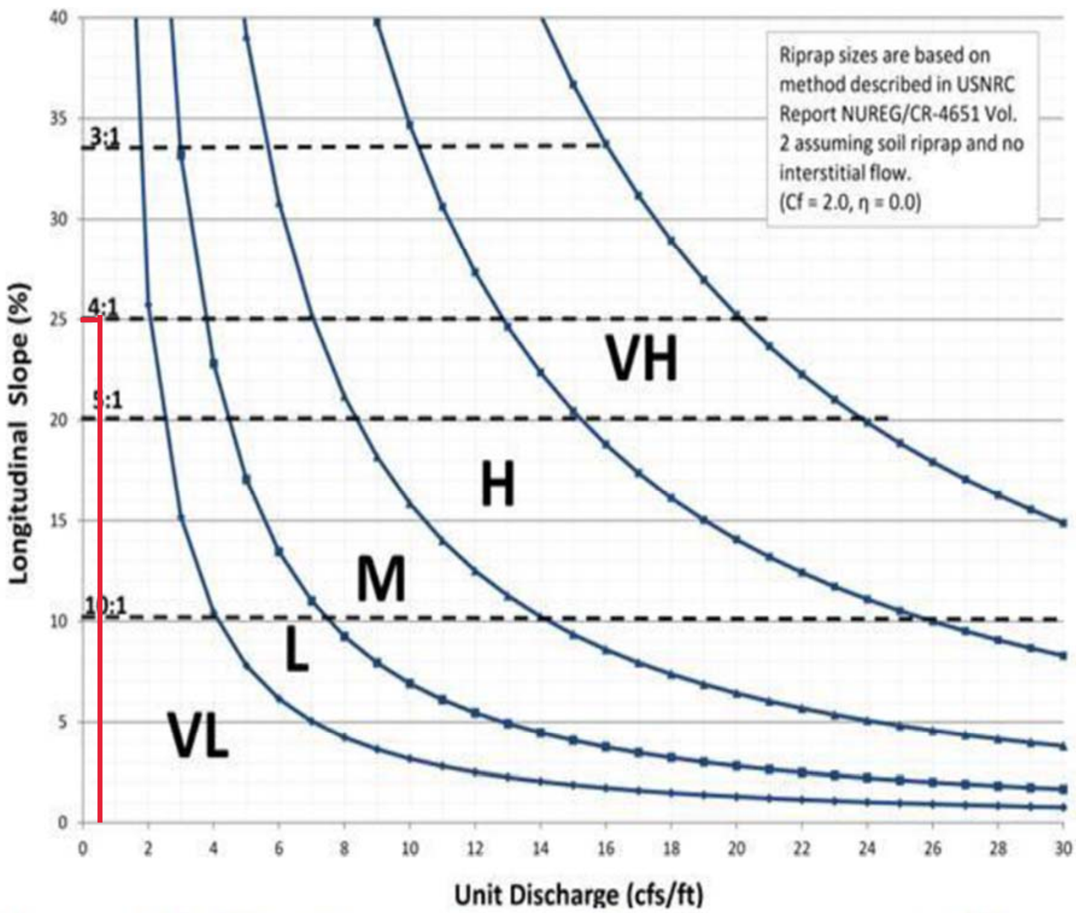


Figure 13-12d. Riprap Types for Emergency Spillway Protection

EXCERPT FROM PREVIOUS STUDY

SWALE CALCULATIONS

EXCERPT FROM PREVIOUS STUDY

SWALE ANALYSIS

Hydraulic Analysis Report

Project Data

Project Title: Bradley Heights Metro District Phase 4

Designer:

Project Date: Tuesday, September 27, 2022

Project Units: U.S. Customary Units

Notes:

Channel Analysis: TDF AH Channel Analysis

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width: 6.0000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0454

Flow: 33.6000 cfs

Result Parameters

Depth: 1.1974 ft

Area of Flow: 11.4861 ft^2

Wetted Perimeter: 13.5732 ft

Hydraulic Radius: 0.8462 ft

Average Velocity: 2.9253 ft/s

Top Width: 13.1846 ft

Froude Number: 0.5523

Critical Depth: 0.8536 ft

Critical Velocity: 4.5983 ft/s

Critical Slope: 0.0358 ft/ft

Critical Top Width: 11.12 ft

Calculated Max Shear Stress: 0.7472 lb/ft^2

Calculated Avg Shear Stress: 0.5280 lb/ft^2

EXCERPT FROM PREVIOUS STUDY

SWALE ANALYSIS

Channel Lining Analysis: TDF AH Channel Lining Design Analysis

Notes:

Lining Input Parameters

Channel Lining Type: Vegetation

Specific Weight of Water: 62.4 lb/ft^3

Height of Vegetation: 0.333 ft

Vegetation Condition is good

Growth Form of Vegetation is mixed

Cf: 0.75

See HEC-15, Table 4.5 (default: 0.75 for Good cover factor and Mixed growth form)

soil is noncohesive

D75: 0.1

Safety Factor: 1

Lining Results

Cn: 0.165205

Permissible Soil Shear Stress: 0.04 lb/ft^2

Mean Boundary Shear Stress: 0.528049 lb/ft^2

Maximum Shear Stress on the Channel Bottom: 0.747196 lb/ft^2

Manning's n: 0.045429

Soil Grain Roughness: 0.0177136

Effective Shear Stress: 0.0231712 lb/ft^2

Permissible Shear Stress on Vegetation: 1.05238 lb/ft^2

This value is compared with the maximum shear stress times the safety factor to determine lining stability

Channel Bottom Shear Results

channel bottom is stable

Channel Lining Stability Results

the channel is stable

Channel Summary

Name of Selected Channel: TDF AH Channel Analysis

EXCERPT FROM PREVIOUS STUDY

SWALE ANALYSIS

Channel Analysis: TDF AH OUT Channel Analysis

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width: 6.0000 ft

Longitudinal Slope: 0.0560 ft/ft

Manning's n: 0.0656

Flow: 33.6000 cfs

Result Parameters

Depth: 0.9220 ft

Area of Flow: 8.0823 ft^2

Wetted Perimeter: 11.8313 ft

Hydraulic Radius: 0.6831 ft

Average Velocity: 4.1572 ft/s

Top Width: 11.5320 ft

Froude Number: 0.8751

Critical Depth: 0.8535 ft

Critical Velocity: 4.5988 ft/s

Critical Slope: 0.0745 ft/ft

Critical Top Width: 11.12 ft

Calculated Max Shear Stress: 3.2219 lb/ft^2

Calculated Avg Shear Stress: 2.3871 lb/ft^2

EXCERPT FROM PREVIOUS STUDY

SWALE ANALYSIS

Channel Lining Analysis: TDF AH OUT Channel Lining Design Analysis

Notes:

Lining Input Parameters

Channel Lining Type: Riprap, Cobble, or Gravel

D50: 0.75 ft

Riprap Specific Weight: 165 lb/ft^3

Water Specific Weight: 62.4 lb/ft^3

Riprap Shape is Angular

Safety Factor: 1

Calculated Safety Factor: 1.12347

Lining Results

Angle of Repose: 41.7 degrees

Relative Flow Depth: 0.934478

Manning's n method: Bathurst

Manning's n: 0.0655606

Channel Bottom Shear Results

V*: 1.2894

Reynold's Number: 79462

Shield's Parameter: 0.0724037

shear stress on channel bottom: 3.22186 lb/ft^2

Permissible shear stress for channel bottom: 4.94276 lb/ft^2

channel bottom is stable

Stable D50: 0.549239 ft

Channel Side Shear Results

K1: 0.868

K2: 1

Kb: 0

shear stress on side of channel: 3.22186 lb/ft^2

Permissible shear stress for side of channel: 4.94276 lb/ft^2

Stable Side D50: 0.47674 lb/ft^2

side of channel is stable

EXCERPT FROM PREVIOUS STUDY

SWALE ANALYSIS

Channel Lining Stability Results

the channel is stable

Channel Summary

Name of Selected Channel: TDF AH OUT Channel Analysis

EXCERPT FROM PREVIOUS STUDY

SWALE ANALYSIS

Channel Analysis: TDF AH Steep Channel Analysis

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width: 6.0000 ft

Longitudinal Slope: 0.1280 ft/ft

Manning's n: 0.0631

Flow: 28.7000 cfs

Result Parameters

Depth: 0.6613 ft

Area of Flow: 5.2801 ft^2

Wetted Perimeter: 10.1827 ft

Hydraulic Radius: 0.5185 ft

Average Velocity: 5.4355 ft/s

Top Width: 9.9680 ft

Froude Number: 1.3161

Critical Depth: 0.7783 ft

Critical Velocity: 4.4239 ft/s

Critical Slope: 0.0707 ft/ft

Critical Top Width: 10.67 ft

Calculated Max Shear Stress: 5.2822 lb/ft^2

Calculated Avg Shear Stress: 4.1417 lb/ft^2

EXCERPT FROM PREVIOUS STUDY

SWALE ANALYSIS

Channel Lining Analysis: TDF AH Steep Channel Lining Design Analysis

Notes:

Lining Input Parameters

Channel Lining Type: Riprap, Cobble, or Gravel

D50: 1 ft

Riprap Specific Weight: 165 lb/ft^3

Water Specific Weight: 62.4 lb/ft^3

Riprap Shape is Angular

Safety Factor: 1

Calculated Safety Factor: 1.2991

Lining Results

Angle of Repose: 41.7 degrees

Relative Flow Depth: 0.529707

Manning's n method: Bathurst

Manning's n: 0.0631297

Channel Bottom Shear Results

V*: 1.65099

Reynold's Number: 135661

Shield's Parameter: 0.108582

shear stress on channel bottom: 5.28224 lb/ft^2

Permissible shear stress for channel bottom: 8.80785 lb/ft^2

channel bottom is stable

Stable D50: 0.779093 ft

Channel Side Shear Results

K1: 0.868

K2: 1

Kb: 0

shear stress on side of channel: 5.28224 lb/ft^2

Permissible shear stress for side of channel: 8.80785 lb/ft^2

Stable Side D50: 0.676253 lb/ft^2

side of channel is stable

EXCERPT FROM PREVIOUS STUDY

SWALE ANALYSIS

Channel Lining Stability Results

the channel is stable

Channel Summary

Name of Selected Channel: TDF AH Steep Channel Analysis

EXCERPT FROM PREVIOUS STUDY

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Dec 15 2022

TDF AH Out

Trapezoidal

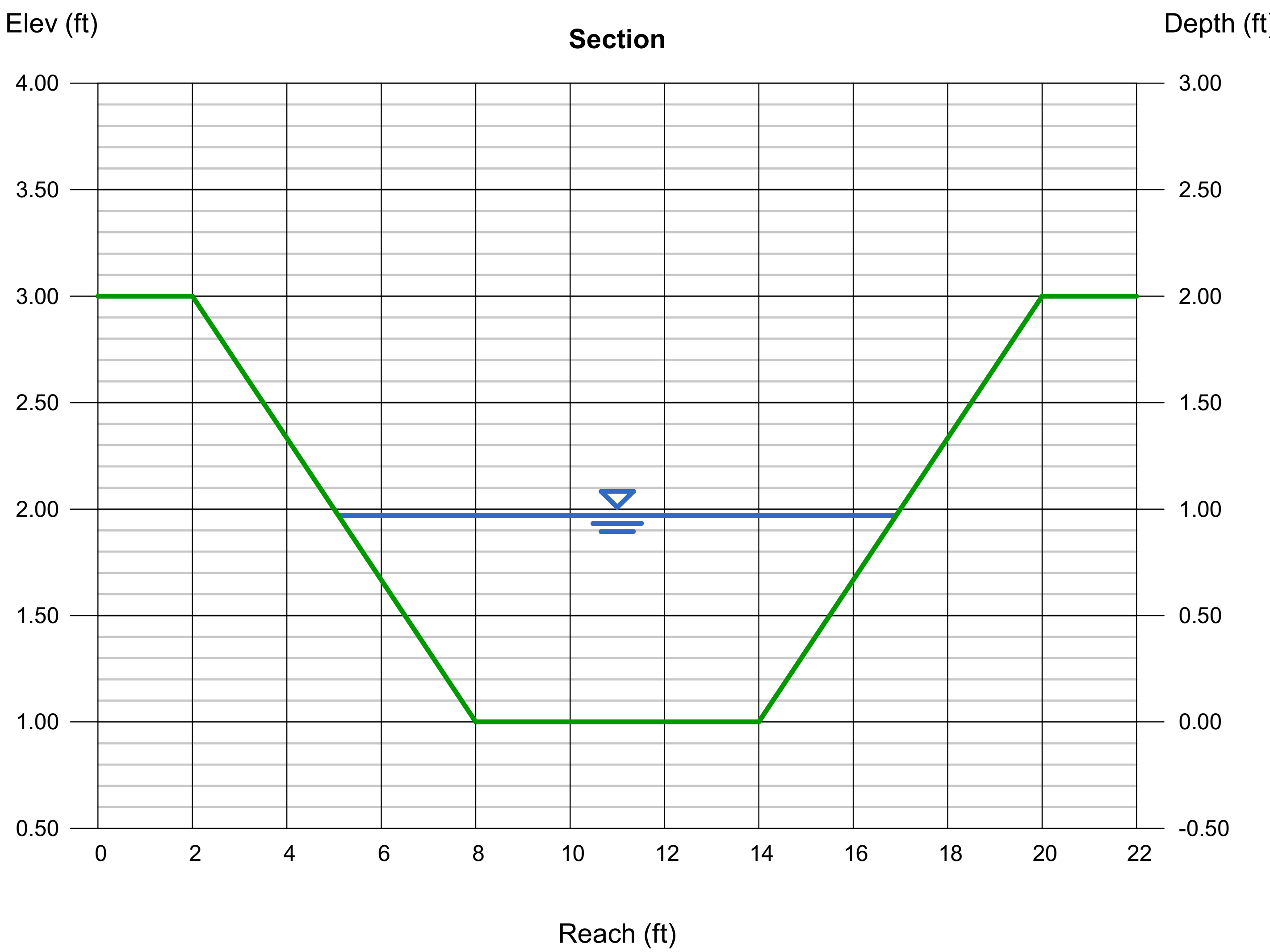
Bottom Width (ft)	= 6.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.11
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 33.60

Highlighted

Depth (ft)	= 0.97
Q (cfs)	= 33.60
Area (sqft)	= 8.64
Velocity (ft/s)	= 3.89
Wetted Perim (ft)	= 12.13
Crit Depth, Yc (ft)	= 0.86
Top Width (ft)	= 11.82
EGL (ft)	= 1.20



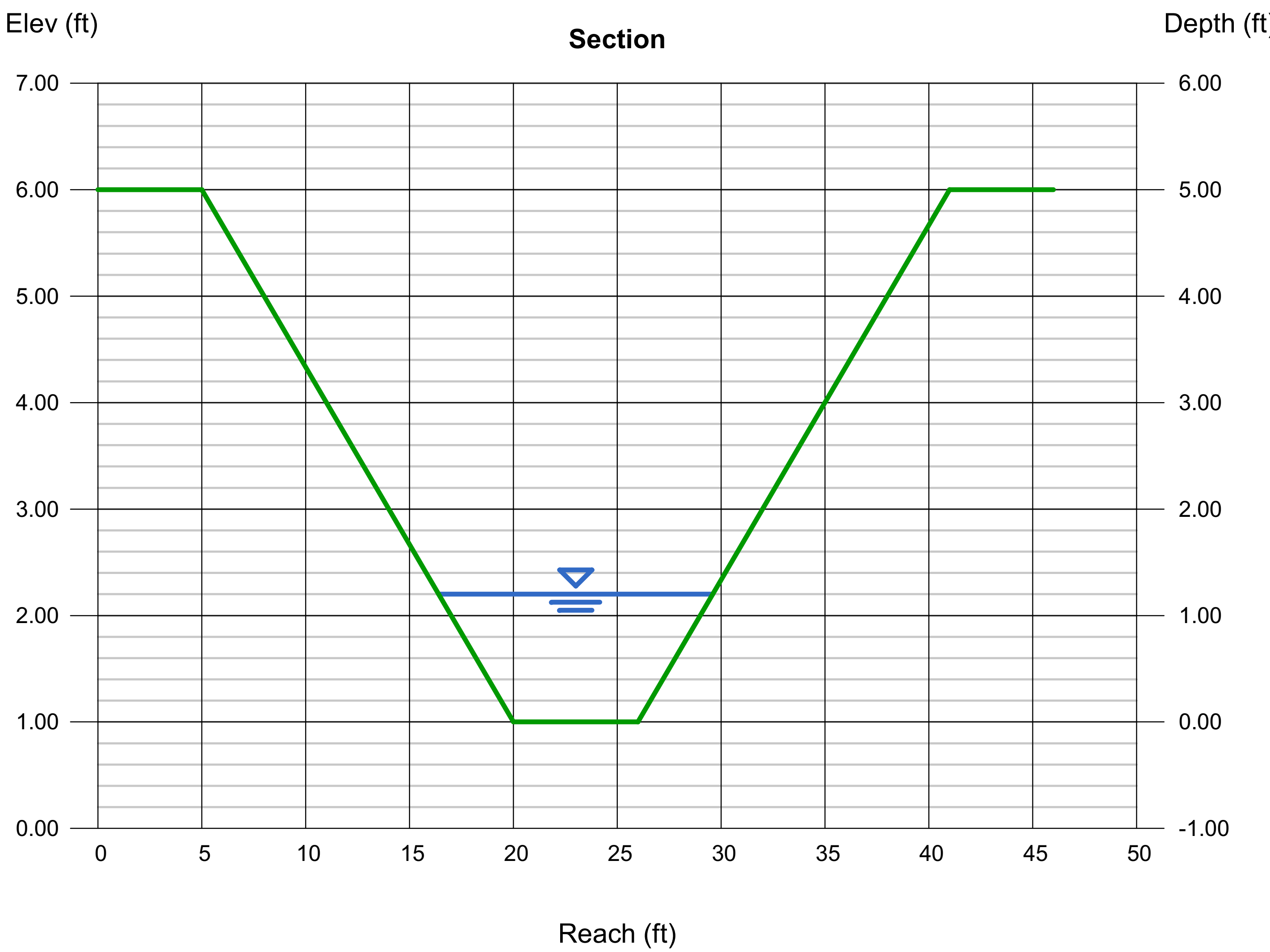
EXCERPT FROM PREVIOUS STUDY

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jun 1 2023

TDF-AH

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 6.00	Depth (ft)	= 1.20
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 33.60
Total Depth (ft)	= 5.00	Area (sqft)	= 11.52
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 2.92
Slope (%)	= 1.00	Wetted Perim (ft)	= 13.59
N-Value	= 0.045	Crit Depth, Yc (ft)	= 0.86
		Top Width (ft)	= 13.20
Calculations		EGL (ft)	= 1.33
Compute by:	Known Q		
Known Q (cfs)	= 33.60		



EXCERPT FROM PREVIOUS STUDY

APPENDIX D

MAPS

SHEET No. 2

Know what's below. Call before you dig.

LEGEND

- MAJOR BASIN BOUNDARY
- PHASE 4 BASIN BOUNDARY
- FUTURE DEVELOPMENT BASIN BOUNDARY
- EXISTING CONTOUR
- PROPOSED CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED STORM BY OTHERS
- FLOW DIRECTION
- FLOW DIRECTION
- EXISTING EDGE OF ROAD
- PROPERTY LINE
- STREAM BUFFER OVERLAYS

BASIN / Q5 / Q100 / AREA
- SUB BASIN DESIGNATION
- 5-YEAR STORM EVENT PEAK FLOW (CFS)
- 100-YEAR STORM EVENT PEAK FLOW (CFS)
- SUB BASIN AREA (AC. OR SQ. MI.)

2 — PHASE 3 DESIGN POINT

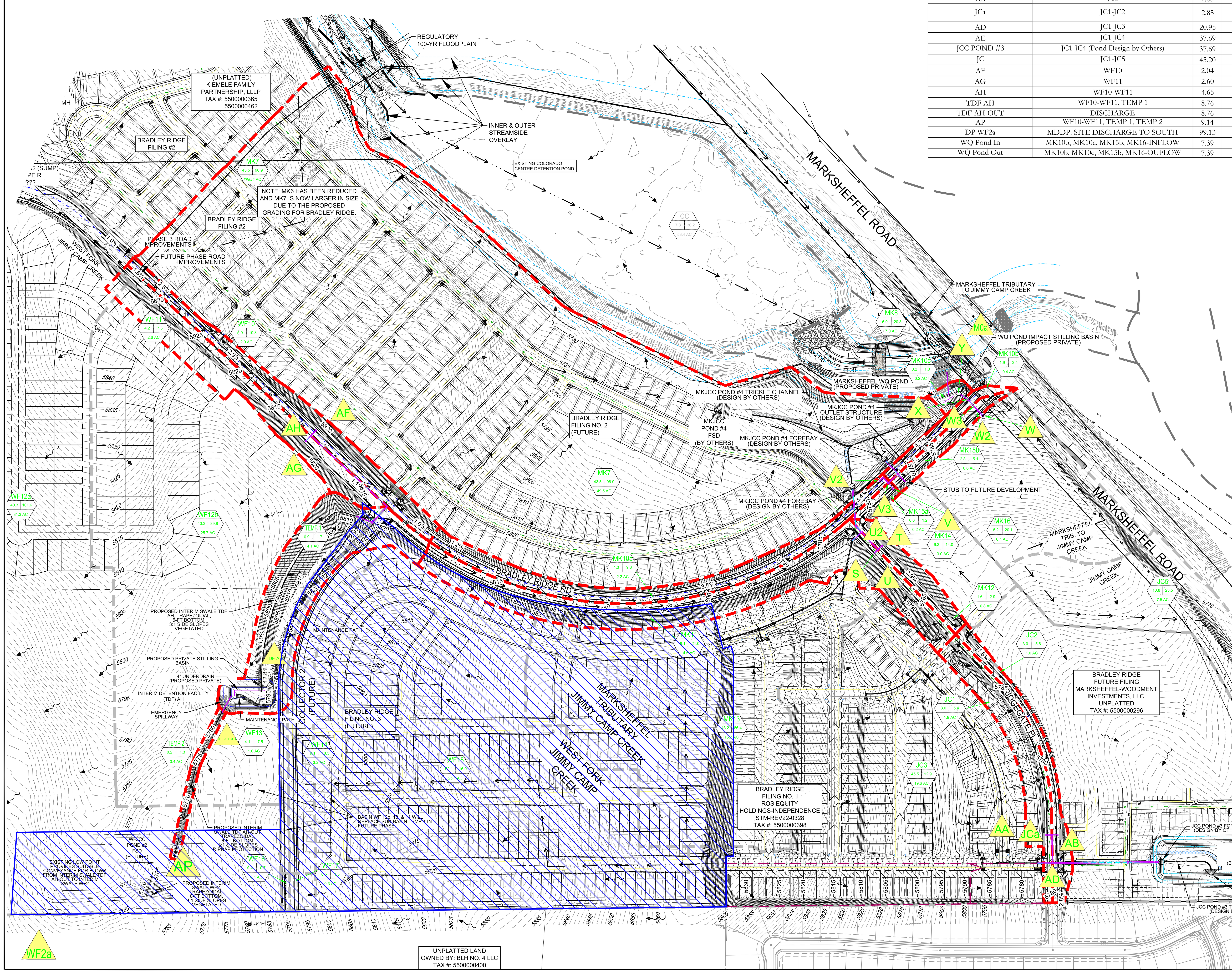
H — PREVIOUS PHASE DESIGN POINT

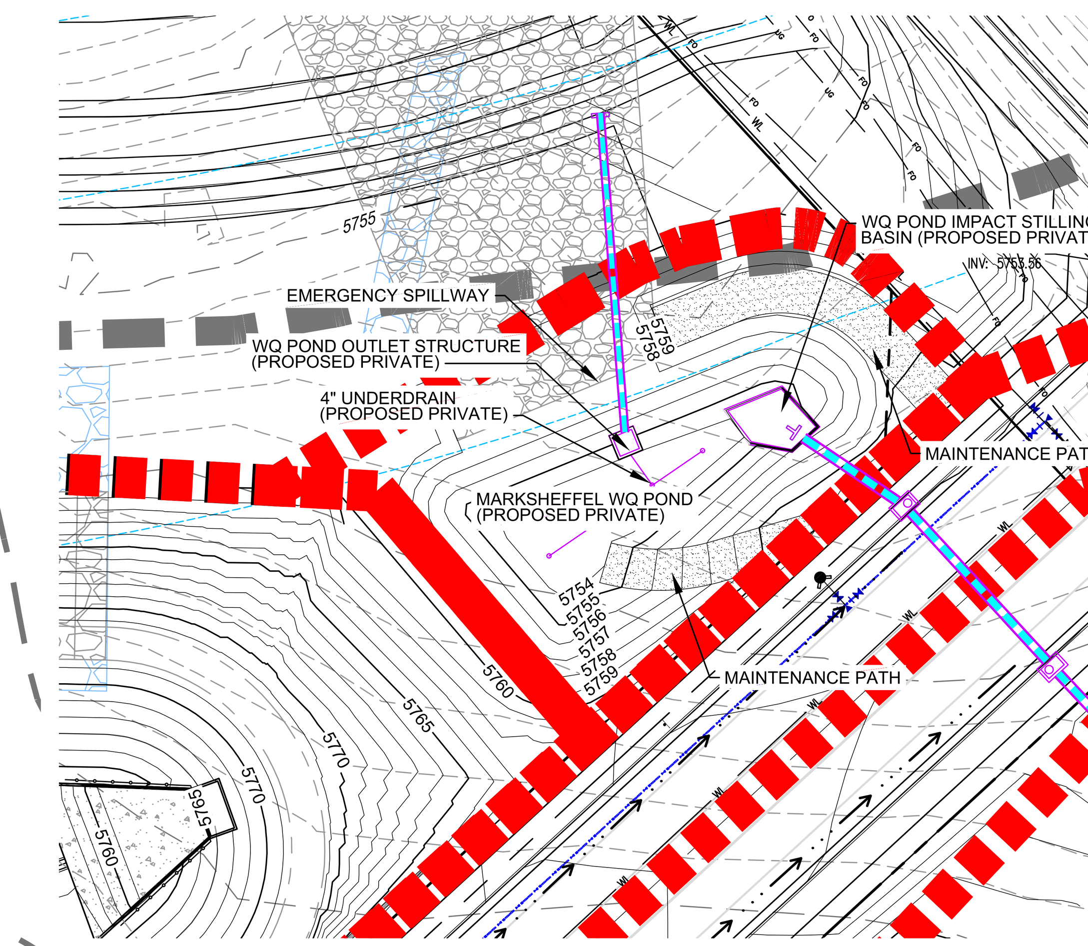
EXCERPT FROM PREVIOUS STUDY

NOTES:
1. UNLESS OTHERWISE INDICATED, STORM SEWER SHOWN ON THIS PAGE IS PROPOSED AND WILL BE PUBLICLY OWNED.
2. EX IN AN ITEM LABEL DENOTES EXISTING
3. PROP. INDICATES PROPOSED.
4. ALL CURB & GUTTER PROPOSED IN THIS PHASE IS TYPE 2 UNLESS OTHERWISE NOTED.
5. STORM SEWER SHALL BE RCP OR APPROVED EQUAL
6. SEE THE REFERENCED DRAINAGE REPORTS FOR STORM SEWER SIZES AND MATERIALS TRIBUTARY TO THE PHASE 2 IMPROVEMENTS.
7. CURB & GUTTER IN THE ADJACENT DEVELOPMENTS (ALL BY OTHERS) IS ANTICIPATED TO BE TYPE 5 IN FRONT OF RESIDENTIAL LOTS AND TYPE 2 IN ALL OTHER LOCATIONS.

Proposed Design Point Summary				
BRADLEY HEIGHTS METRO DISTRICT (PHASE 4)				
Design Point	**Comments/Sub-Basins**	**Total Area (ac.)**	**Q(5) (cfs)**	**Q(100) (cfs)**
S	MK11	4.61	9.08	20.97
T	MK12	0.38	1.60	2.92
U	MK11-MK12	4.99	10.27	23.12
U2	MK11-MK13	20.74	51.09	104.83
V	MK15a	0.22	0.61	1.37
V2	MK10a	2.16	4.34	9.82
V3	MK10a, MK15a	2.38	4.78	10.81
W2	MK15b	0.58	2.46	4.49
W	MK16	6.13	5.15	20.15
W3	MK15b, MK16	6.71	6.92	23.50
X	MK10b	0.44	1.85	3.38
Y	MK10b, MK10c, MK15b, MK16	7.39	10.07	32.04
MKJCC POND #4 In	MK7, MK10a, MK11-MK14, MK15a-INFLOW (Pond Design by Others)	75.60	136.46	301.63
MKJCC POND #4 Out	MK7, MK10-MK16-OUTFLOW (Pond Design by Others)	75.60	28.20	129.20
AA	JC1	1.85	5.18	10.92
AB	JC2	1.00	4.08	7.45
JCa	JC1-JC2	2.85	9.22	18.32
AD	JC1-JC3	20.95	52.00	106.77
AE	JC1-JC4	37.69	83.67	175.34
JCC POND #3	JC1-JC4 (Pond Design by Others)	37.69	6.00	49.20
JC	JC1-JC5	45.20	16.80	72.72
AF	WF10	2.04	4.35	10.29
AG	WF11	2.60	4.24	11.63
AH	WF10-WF11	4.65	8.58	21.89
TDF AH	WF10-WF11, TEMP 1	8.76	12.15	33.60
TDF AH-OUT	DISCHARGE	8.76	2.60	7.80
AP	WF10-WF11, TEMP 1, TEMP 2	9.14	2.80	9.10
DP WF2a	MDDP: SITE DISCHARGE TO SOUTH	99.13	22.60	153.50
WQ Pond In	MK10b, MK10c, MK15b, MK16-INFLOW	7.39	8.40	26.75
WQ Pond Out	MK10b, MK10c, MK15b, MK16-OUFLOW	7.39	3.90	12.10

BRADLEY HEIGHTS METRO DISTRICT (PHASE 4) Proposed Conditions Sub-basin Summary			
Basin	**Area**	Q5	Q100
	acres	cfs	cfs
MK7	49.47	86.3	192.4
MK10a	2.16	4.3	9.8
MK10b	0.44	1.9	3.4
MK10c	0.23	0.2	1.0
MK11	4.61	9.1	21.0
MK12	0.38	1.6	2.9
MK13	15.75	40.0	89.8
MK14	3.02	1.8	9.7
MK15a	0.22	0.6	1.4
MK15b	0.58	2.5	4.5
MK16	6.13	5.2	20.1
JC1	1.85	5.2	10.9
JC2	1.00	4.1	7.4
JC3	18.09	43.9	90.7
JC4	16.75	33.6	72.4
JC5	7.50	10.8	23.5
WF10	2.04	4.4	10.3
WF11	2.60	4.2	11.6
TEMP 1	4.12	5.2	16.0
TEMP 2	0.38	0.2	1.3
WF12a	31.32	14.7	78.6
WF12b	25.68	12.0	64.5
WF13	1.03	0.7	3.5
WF14	3.16	9.1	18.3
WF15	28.83	15.3	81.9
WF16	0.09	0.1	0.4
WF17	0.27	0.2	1.2





MARKSHEFFEL WQ POND

H: 1" = 30'

GRAPHIC SCALE

(IN FEET)

1 inch = 150 ft.

CITY OF COLORADO SPRINGS

BRADLEY HEIGHTS METRO DISTRICT

MASTER DEVELOPMENT DRAINAGE REPORT

POST DEVELOPMENT DRAINAGE CONDITIONS

DRAWING No. DR-02

SHEET 2 OF 3

PRELIMINARY

THIS DRAWING HAS NOT BEEN APPROVED BY GOVERNING AGENCIES AND IS SUBJECT TO CHANGE

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC. PROJECT No. 21.1213.004

PREPARED BY: Matrix

SEAL

No.	DATE	REVISIONS DESCRIPTION	BY

REFERENCE DRAWINGS

COMPUTER FILE MANAGEMENT

FILE NAME: S:\21.1213.001 Bradley Heights Metro District\200 Drainage\201 Drainage Reports\FDR PHASE IV\DWG\DR-02 PHASE IV.dwg

PLOT DATE: June 1, 2023 1:25:03 PM

EXCERPT FROM PREVIOUS STUDY

SHEET No. 3

811 Know what's below. Call before you dig.

STRUCTURE TABLE				
STRUCTURE NAME	STRUCTURE DETAILS	STRUCTURE TYPE	NORTHING & EASTING	CUT
INLET 30 (SUMP)	RIM = 5776.564 SUMP = 5766.141 PIPE 82 INV OUT (24") = 5766.391	10' TYPE R	N: 333732.70 E: 243123.49	10.42
INLET 31 (SUMP)	RIM = 5776.560 SUMP = 5766.379 PIPE 83 INV OUT (18") = 5766.588	10' TYPE R	N: 333733.14 E: 243163.47	10.18
MH - 153	RIM = 5768.398 SUMP = ??? PIPE 85 INV OUT (42") = 5764.310	Null Structure	N: 333633.44 E: 243092.71	???
MH 43	RIM = 5777.298 SUMP = 5762.270 PIPE 84 INV IN (24") = 5764.770 PIPE 85 INV IN (42") = 5763.270 PIPE 86 INV OUT (42") = 5762.270	6' TYPE I STM MH	N: 333634.04 E: 243144.69	15.03
MH 44	RIM = 5776.301 SUMP = 5765.890 PIPE 82 INV IN (24") = 5766.190 PIPE 83 INV IN (18") = 5766.389 PIPE 84 INV OUT (24") = 5765.890	5' TYPE II STM MH	N: 333732.92 E: 243143.59	10.41
MH 45	RIM = 5777.193 SUMP = 5757.230 PIPE 86 INV IN (42") = 5761.230 PIPE 87 INV OUT (42") = 5757.230	6' TYPE I STM MH	N: 333634.60 E: 243196.66	19.96
MH 46	RIM = 5760.468 SUMP = 5748.970 PIPE 87 INV IN (42") = 5752.970 PIPE 88 INV OUT (42") = 5748.970	6' TYPE I STM MH	N: 333636.73 E: 243409.83	11.50
MH 47	RIM = 5753.615 SUMP = 5746.440 PIPE 88 INV IN (42") = 5747.060 PIPE 89 INV OUT (42") = 5746.440	6' TYPE I STM MH	N: 333638.23 E: 243505.11	7.17

STRUCTURE TABLE				
STRUCTURE NAME	STRUCTURE DETAILS	STRUCTURE TYPE	NORTHING & EASTING	CUT
INLET 26 (SUMP)	RIM = 5780.348 SUMP = 5773.668 PIPE 75 INV OUT (24") = 5773.668	15' TYPE R	N: 334720.88 E: 242516.80	6.68
INLET 27 (SUMP)	RIM = 5780.343 SUMP = 5773.760 PIPE 76 INV OUT (18") = 5773.760	10' TYPE R	N: 334748.15 E: 242546.43	6.58
INLET 28 (AT-GRADE)	RIM = 5761.035 SUMP = 5754.884 PIPE 80 INV IN (24") = 5754.984 PIPE 105 INV OUT (24") = 5754.884	10' TYPE R	N: 335261.79 E: 242848.09	6.15
INLET 29 (AT-GRADE)	RIM = 5761.035 SUMP = 5756.000 PIPE 106 INV IN (24") = 5756.100 PIPE 80 INV OUT (24") = 5756.000	10' TYPE R	N: 335222.78 E: 242883.91	5.04
INLET 32	RIM = 5760.150 SUMP = 5756.350 PIPE 106 INV OUT (24") = 5756.350	TYPE D INLET	N: 335204.52 E: 242900.99	3.80
INLET 33	RIM = 5776.262 SUMP = 5769.064 PIPE 101 INV OUT (24") = 5769.064	10' TYPE R	N: 334979.14 E: 242540.74	7.20
INLET 34	RIM = 5775.547 SUMP = 5768.630 PIPE 101 INV IN (24") = 5768.930 PIPE 104 INV OUT (24") = 5768.630	10' TYPE R	N: 334988.21 E: 242550.55	6.92
INLET 35	RIM = 5775.562 SUMP = 5768.632 PIPE 103 INV OUT (24") = 5768.632	10' TYPE R	N: 334948.61 E: 242586.69	6.93
MH - 146	RIM = 5765.290 SUMP = ???	Null Structure	N: 334983.04 E: 242639.02	???
MH - 192	RIM = 5775.317 SUMP = ??? PIPE 77 INV OUT (36") = 5771.801	Null Structure	N: 334766.03 E: 242441.54	???

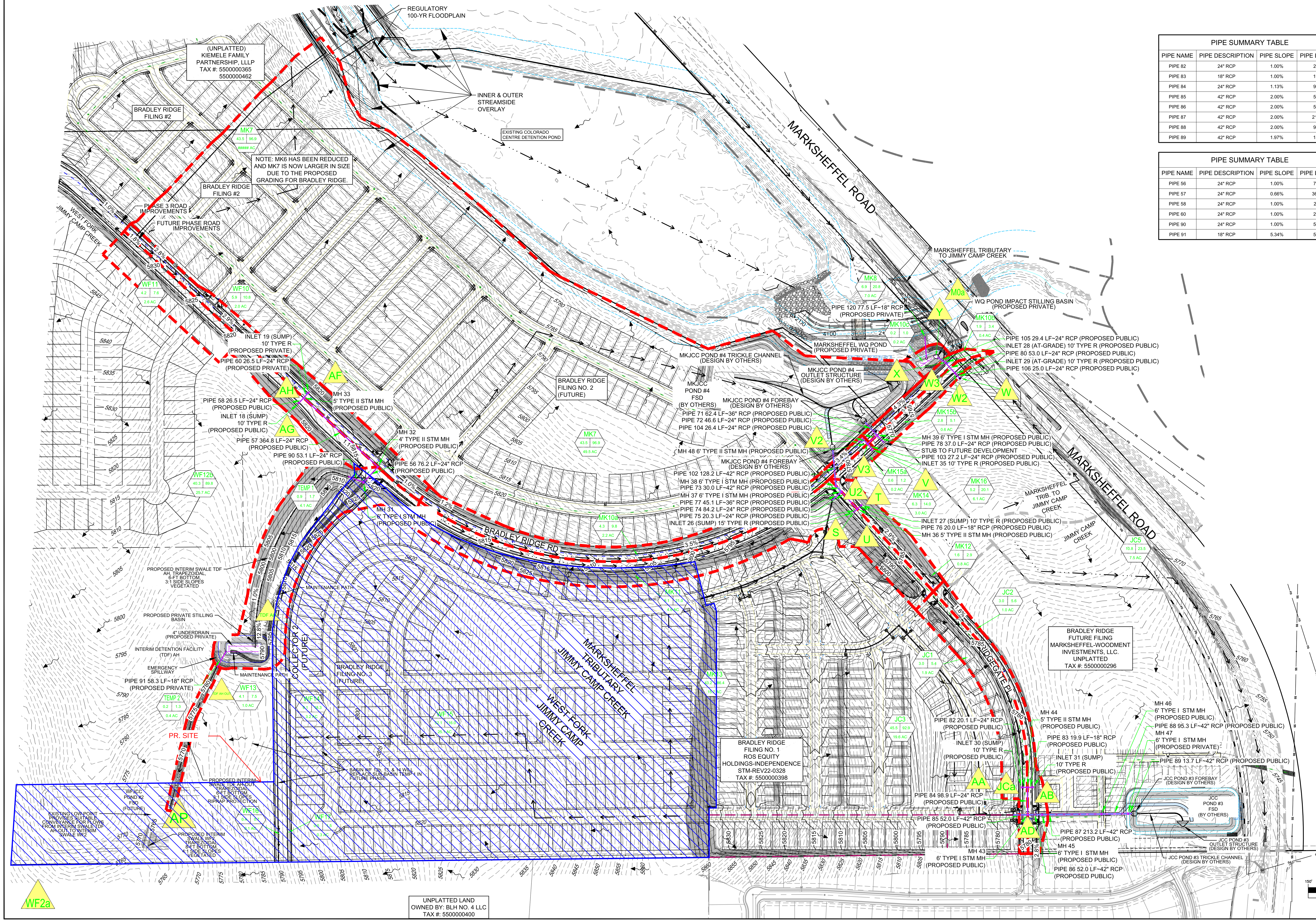
STRUCTURE TABLE				
STRUCTURE NAME	STRUCTURE DETAILS	STRUCTURE TYPE	NORTHING & EASTING	CUT
MH - 319	RIM = 5774.294 SUMP = ??? PIPE 102 INV IN (42") = 5765.400	Null Structure	N: 334946.34 E: 242443.54	???
MH - 333	RIM = 0.000 SUMP = ???	Null Structure	N: 335278.23 E: 242823.67	0.00
MH - 342	RIM = 5753.764 SUMP = ???	Null Structure	N: 335277.22 E: 242780.52	???
MH 36	RIM = 5780.082 SUMP = 5772.762 PIPE 75 INV IN (24") = 5773.060 PIPE 76 INV IN (18") = 5773.560 PIPE 74 INV OUT (24") = 5772.762	5' TYPE II STM MH	N: 334734.61 E: 242531.71	7.32
MH 37	RIM = 5780.843 SUMP = 5770.349 PIPE 74 INV IN (24") = 5771.850 PIPE 77 INV IN (36") = 5771.350 PIPE 73 INV OUT (42") = 5770.349	6' TYPE I STM MH	N: 334796.55 E: 242474.70	10.49
MH 38	RIM = 5781.423 SUMP = 5768.605 PIPE 73 INV IN (42") = 5769.600 PIPE 102 INV OUT (42") = 5768.605	6' TYPE I STM MH	N: 334818.62 E: 242454.41	12.82
MH 39	RIM = 5772.918 SUMP = 5765.434 PIPE 72 INV IN (24") = 5766.430 PIPE 78 INV IN (24") = 5766.430 PIPE 71 INV OUT (36") = 5765.434	6' TYPE I STM MH	N: 335000.04 E: 242602.87	7.48
MH 48	RIM = 5775.411 SUMP = 5767.362 PIPE 104 INV IN (24") = 5768.360 PIPE 103 INV IN (24") = 5768.360 PIPE 72 INV OUT (24") = 5767.362	6' TYPE II STM MH	N: 334968.68 E: 242568.38	8.05

STRUCTURE TABLE				
STRUCTURE NAME	STRUCTURE DETAILS	STRUCTURE TYPE	NORTHING & EASTING	CUT
FES 12	RIM = 5805.037 SUMP = ??? PIPE 90 INV IN (24") = 5802.703	24" FES	N: 334849.47 E: 240706.00	5826.00
FES 13	RIM = 5785.176 SUMP = ??? PIPE 91 INV IN (18") = 5783.384	18" FES	N: 334168.64 E: 240230.85	5783.00
INLET 18 (SUMP)	RIM = 5813.038 SUMP = 5807.559 PIPE 58 INV OUT (24") = 5807.559	10' TYPE R	N: 335114.85 E: 240521.93	5.48
INLET 19 (SUMP)	RIM = 5813.112 SUMP = 5807.555 PIPE 60 INV OUT (24") = 5807.555	10' TYPE R	N: 335153.70 E: 240558.00	5.56
MH - 231	RIM = 5805.505 SUMP = ???	Null Structure	N: 334822.85 E: 240748.67	???
MH 31	RIM = 5816.267 SUMP = 5803.234 PIPE 56 INV IN (24") = 5803.530 PIPE 90 INV OUT (24") = 5803.234	6' TYPE I STM MH	N: 334830.18 E: 240755.47	13.03
MH 32	RIM = 5816.311 SUMP = 5804.292 PIPE 57 INV IN (24") = 5804.590 PIPE 56 INV OUT (24") = 5804.292	4' TYPE II STM MH	N: 334886.04 E: 240807.34	12.02
MH 33	RIM = 5812.910 SUMP = 5806.740 PIPE 58 INV IN (24") = 5807.294 PIPE 60 INV IN (24") = 5807.290 PIPE 57 INV OUT (24") = 5806.990	5' TYPE II STM MH	N: 335134.28 E: 240539.96	6.17

PIPE SUMMARY TABLE			
PIPE NAME	PIPE DESCRIPTION	PIPE SLOPE	PIPE LENGTH
PIPE 82	24" RCP	1.00%	20.10
PIPE 83	18" RCP	1.00%	19.89
PIPE 84	24" RCP	1.13%	98.88
PIPE 85	42" RCP	2.00%	51.98
PIPE 86	42" RCP	2.00%	51.98
PIPE 87	42" RCP	2.00%	213.18
PIPE 88	42" RCP	2.00%	95.29
PIPE 89	42" RCP	1.97%	13.73

PIPE SUMMARY TABLE			
PIPE NAME	PIPE DESCRIPTION	PIPE SLOPE	PIPE LENGTH
PIPE 56	24" RCP	1.00%	76.23
PIPE 57	24" RCP	0.66%	364.84
PIPE 58	24" RCP	1.00%	26.51
PIPE 60	24" RCP	1.00%	26.50
PIPE 90	24" RCP	1.00%	53.10
PIPE 91	18" RCP	5.34%	58.34

PIPE SUMMARY TABLE			
PIPE NAME	PIPE DESCRIPTION	PIPE SLOPE	PIPE LENGTH
PIPE 71	36" RCP	1.00%	62.37
PIPE 72	24" RCP	2.00%	46.61
PIPE 73	42" RCP	2.50%	29.98
PIPE 74	24" RCP	1.08%	84.19
PIPE 75	24" RCP	3.00%	20.27
PIPE 76	18" RCP	1.00%	20.00
PIPE 77	36" RCP	1.00%	45.06
PIPE 78	24" RCP	1.00%	36.98
PIPE 80	24" RCP	1.92%	52.96
PIPE 101	24" RCP	1.00%	13.36
PIPE 102	42" RCP	2.50%	128.18
PIPE 103	24" RCP	1.00%	27.16
PIPE 104	24" RCP	1.02%	26.44
PIPE 105	24" RCP	3.00%	29.45
PIPE 106	24" RCP	1.00%	25.00
PIPE 120	18" RCP	2.27%	77.52



LEGEND

- MAJOR BASIN BOUNDARY
- PHASE 4 BASIN BOUNDARY
- FUTURE DEVELOPMENT BASIN BOUNDARY
- EXISTING CONTOUR
- PROPOSED CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED STORM BY OTHERS
- FLOW DIRECTION
- EXISTING EDGE OF ROAD
- PROPERTY LINE
- STREAM BUFFER OVERLAYS

BASIN / Q5 / Q100 / AREA:
- SUB BASIN DESIGNATION
- 5-YEAR STORM EVENT PEAK FLOW (CFS)
- 100-YEAR STORM EVENT PEAK FLOW (CFS)
- SUB BASIN AREA (AC. OR SQ. MI.)

2 — PHASE 3 DESIGN POINT

H — PREVIOUS PHASE DESIGN POINT

NOTES:
1. UNLESS OTHERWISE INDICATED, STORM SEWER SHOWN ON THIS PAGE IS PROPOSED AND WILL BE PUBLICLY OWNED.
2. EX IN AN ITEM LABEL DENOTES EXISITING
3. PROP. INDICATES PROPOSED.
4. ALL CURB & GUTTER PROPOSED IN THIS PHASE IS TYPE 2 UNLESS OTHERWISE NOTED.
5. STORM SEWER SHALL BE RCP OR APPROVED EQUAL
6. SEE THE REFERENCED DRAINAGE REPORTS FOR STORM SEWER SIZES AND MATERIALS TRIBUTARY TO THE PHASE 2 IMPROVEMENTS.
7. CURB & GUTTER IN THE ADJACENT DEVELOPMENTS (ALL BY OTHERS) IS ANTICIPATED TO BE TYPE 5 IN FRONT OF RESIDENTIAL LOTS AND TYPE 2 IN ALL OTHER LOCATIONS.

GRAPHIC SCALE
150' 0' 150' 300'
(IN FEET)
1 inch = 150 ft.

REFERENCE DRAWINGS

No. | DATE | DESCRIPTION | BY
REVISIONS

COMPUTER FILE MANAGEMENT
FILE NAME: S:\21.1213.001 Bradley Heights Metro District\200 Drainage\201 Drainage Reports\FDR PHASE IV\DWG\DR-02 PHASE IV.dwg
CTB FILE: ----
PLOT DATE: June 1, 2023 1:24:08 PM
THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE.

PREPARED BY: Matrix

SEAL

PRELIMINARY
THIS DRAWING HAS NOT BEEN APPROVED BY GOVERNING AGENCIES AND IS SUBJECT TO CHANGE

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.
PROJECT No. 21.1213.004

CITY OF COLORADO SPRINGS

BRADLEY HEIGHTS METRO DISTRICT
MASTER DEVELOPMENT DRAINAGE REPORT

POST DEVELOPMENT DRAINAGE CONDITIONS

DESIGNED BY: JAO
DRAWN BY: WCG
CHECKED BY: JTS
SCALE: HORIZ. 1" = 150'; VERT. N/A
DATE ISSUED: February 23
SHEET 3 OF 3
DRAWING No. DR-03

EXCERPT FROM PREVIOUS STUDY

Galloway

FINAL DRAINAGE REPORT AMENDMENT

Bradley Ridge Subdivision Filing No. 1

Colorado Springs, CO

PREPARED FOR:
ROI Property Group, LLC
1280 S. 800 E.
Orem, UT 84097

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

DATE:
September 13, 2023

STM-REV23-0994

EXCERPT FROM PREVIOUS STUDY

II. Drainage Plans

PROPOSED SUB-BASINS

The general location and description of each revised basin in the proposed condition is described as follows. Sub-basins not provided in this report are assumed to be un-changed from the approved FDR. The off-site drainage basins that drain to *JCC Pond #3* were revised to better account for the future conditions of those basins. The changes made to the proposed basins have been summarized in **Table 1** below. The Proposed Drainage Map has been provided in **Appendix E** and can be used to reference the basins discussed below:

Basin OS-2a (0.19 ac, Q5 = 0.5 cfs, Q100 = 1.1 cfs): an offsite sub-basin defining an area immediately adjacent to the proposed development situated to the west. For the purposes of the proposed development analyses, this sub-basin is assumed to be fully developed. This offsite basin will have a single-family use with similar density to the proposed subdivision. Runoff will be routed via sheet flow and concentrated channel flow to proposed curb and gutter within the proposed subdivision at **Design Point B11a**. Flows will be routed via curb and gutter downstream to Design Points B12. Emergency overflows will be routed downstream via proposed curb and gutter to Design Point B16 within Fault Line Drive.

OS-2A AND 2B CORRELATE TO THIS REPORTS BASINS A-1 AND A-2 RESPECTIVELY

Basin OS-2B (0.59 ac, Q5 = 1.0 cfs, Q100 = 2.6 cfs): an offsite sub-basin defining [illegible] adjacent to the proposed development situated to the west. For the purposes of th[illegible] development analyses, this sub-basin is assumed to be fully developed. This offsi[illegible] single-family use with similar density to the proposed subdivision. Runoff will be r[illegible] concentrated channel flow to proposed curb and gutter within the proposed subdivision at **Design Point B11b**. Flows will be routed via curb and gutter downstream to Design Points B13. Emergency overflows will be routed downstream via proposed curb and gutter to Design Point B17 within Fault Line Drive.

Basin	Area, acres	Q5, cfs	Q100, cfs
OS-2 (Original)	0.60	1.2	2.7
OS-2a	0.19	0.5	1.1
OS-2b	0.62	1.0	2.6
OS-2a + OS-2b	0.82	1.5	2.7

Table 1: Revised Off-site Basin Comparison

STORMWATER CONVEYANCE FACILITIES

As a part of this amendment, the primary material for the proposed storm sewer system has been revised from Reinforced Concrete Pipe (RCP) to High Performance Polypropylene Pipe (HP PP). The hydraulic model (StormCAD) for the proposed development was revised to account for this material change. Printouts from that model can be found in **Appendix C.**

STORMWATER STORAGE FACILITIES

The detention facilities for the site, *MKJCC Pond #4 and JCC Pond #3 Full Spectrum Extended Detention Basins (Private)* are located in the northeast and southeast corners of the site. Each pond will provide full spectrum detention for the entire Bradley Ridge Subdivision Filing No. 1 development (including a portion

EXCERPT FROM PREVIOUS STUDY

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: Bradley Ridge Filing No. 1
Location: Colordo Springs, Co

Project Name: Bradley Ridge Filing No. 1
Project No.: RJL01.21
Calculated By: TJE
Checked By: BAS
Date: 4/24/23

			Paved Roads				Un-Developed Area/Lawns				< 1/8 Acre Lots				Composite		
Basin ID	Total Area (ac)	HSG	% Imp.	C5	C100	Area (ac)	% Imp.	C5	C100	Area (ac)	% Imp.	C5	C100	Area (ac)	C5	C100	Basins Total Weighted % Imp.
EXISTING CONDITION																	
EX-1	6.07	D	100	0.90	0.96	0.00	2	0.16	0.51	6.07	65	0.49	0.65	0.00	0.16	0.51	2.0
EX-2	17.23	D	100	0.90	0.96	0.00	2	0.16	0.51	17.23	65	0.49	0.65	0.00	0.16	0.51	2.0
EX OS-1	5.01	D	100	0.90	0.96	0.00	2	0.16	0.51	5.01	65	0.49	0.65	0.00	0.16	0.51	2.0
EX OS-2	0.13	D	100	0.90	0.96	0.00	2	0.16	0.51	0.13	65	0.49	0.65	0.00	0.16	0.51	2.0
EX OS-3	0.93	D	100	0.90	0.96	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.93	0.49	0.65	65.0
EX OS-4	0.06	D	100	0.90	0.96	0.06	2	0.16	0.51	0.00	65	0.49	0.65	0.00	0.90	0.96	100.0
PROPOSED CONDITION																	
A-1	2.44	D	100	0.90	0.96	0.00	2	0.16	0.51	0.00	65	0.49	0.65	2.44	0.49	0.65	65.0
A-2	1.28	D	100	0.90	0.96	0.00	2	0.16	0.51	0.00	65	0.49	0.65	1.28	0.49	0.65	65.0
A-3	1.51	D	100	0.90	0.96	0.00	2	0.16	0.51	0.00	65	0.49	0.65	1.51	0.49	0.65	65.0
A-4	1.17	D	100	0.90	0.96	0.00	2	0.16	0.51	0.00	65	0.49	0.65	1.17	0.49	0.65	65.0
B-2	0.57	D	100	0.90	0.96	0.27	2	0.16	0.51	0.00	65	0.49	0.65	0.30	0.68	0.80	81.6
B-3	2.15	D	100	0.90	0.96	0.00	2	0.16	0.51	0.00	65	0.49	0.65	2.15	0.49	0.65	65.0
B-4	2.94	D	100	0.90	0.96	0.00	2	0.16	0.51	0.00	65	0.49	0.65	2.94	0.49	0.65	65.0
B-5	1.32	D	100	0.90	0.96	0.00	2	0.16	0.51	0.00	65	0.49	0.65	1.32	0.49	0.65	65.0
B-6	0.87	D	100	0.90	0.96	0.04	2	0.16	0.51	0.00	65	0.49	0.65	0.83	0.51	0.66	66.6
B-7	2.71	D	100	0.90	0.96	0.00	2	0.16	0.51	1.16	65	0.49	0.65	1.55	0.35	0.59	38.0
B-8	1.09	D	[illegible]	[illegible]	[illegible]	[illegible]	2	0.16	0.51	0.00	65	0.49	0.65	1.09	0.49	0.65	65.0
B-9	1.02	D	[illegible]	[illegible]	[illegible]	[illegible]	2	0.16	0.51	0.00	65	0.49	0.65	1.02	0.49	0.65	65.0
B-10	2.92	D	[illegible]	[illegible]	[illegible]	[illegible]	2	0.16	0.51	0.00	65	0.49	0.65	2.92	0.49	0.65	65.0
B-11	0.28	D	100	0.90	0.96	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.28	0.49	0.65	65.0
B-12	0.82	D	100	0.90	0.96	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.82	0.49	0.65	65.0
OS-1	9.35	D	100	0.90	0.96	0.00	2	0.16	0.51	0.00	65	0.49	0.65	9.35	0.49	0.65	65.0
OS-2A	0.19	D	100	0.90	0.96	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.19	0.49	0.65	65.0
OS-2B	0.62	D	100	0.90	0.96	0.00	2	0.16	0.51	0.17	65	0.49	0.65	0.45	0.40	0.61	47.7
OS-3	0.93	D	100	0.90	0.96	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.93	0.49	0.65	65.0
OS-4	0.06	D	100	0.90	0.96	0.06	2	0.16	0.51	0.00	65	0.49	0.65	0.00	0.90	0.96	100.0

Revised OS-2a & OS-2b basins

OS-2A AND OS-2B CORRELATE TO A-1 AND A-2 RESPECITVELY

Galloway

EXCERPT FROM PREVIOUS STUDY

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Bradley Ridge Filing No. 1
Location: CO, Colorado Springs

Project Name: Bradley Ridge Filing No. 1
Project No.: RJL01.21
Calculated By: TJE
Checked By: BAS
Date: 9/8/23

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)
EXISTING CONDITION																	
EX-1	6.07	D	2.0	0.51	0.16	300	7.5	15.2	694	7.5	10.0	2.7	4.2	19.5	994.0	15.5	15.5
EX-2	17.23	D	2.0	0.51	0.16	300	7.3	15.4	867	7.3	10.0	2.7	5.3	20.7	1167.0	16.5	16.5
EX OS-1	5.01	D	2.0	0.51	0.16	300	6.5	16.0	480	6.5	10.0	2.5	3.1	19.1	780.0	14.3	14.3
EX OS-2	0.13	D	2.0	0.51	0.16	50	5.0	7.1	0	0.0	10.0	0.0	0.0	7.1	50.0	10.3	7.1
EX OS-3	0.93	D	65.0	0.65	0.49	300	6.0	10.7	115	6.0	20.0	4.9	0.4	11.0	415.0	12.3	11.0
EX OS-4	0.06	D	100.0	0.96	0.90	0	0.0	0.0	90	6.0	20.0	4.9	0.3	0.3	90.0	10.5	5.0
PROPOSED CONDITION																	
A-1	2.44	D	65.0	0.65	0.49	190	3.3	10.4	637	3.4	20.0	3.7	2.9	13.3	827.0	14.6	13.3
A-2	1.28	D	65.0	0.65	0.49	78	2.0	7.8	697	3.5	20.0	3.7	3.1	10.9	775.0	14.3	10.9
A-3	1.51	D	65.0	0.65	0.49	100	1.0	11.2	400	3.5	20.0	3.7	1.8	13.0	500.0	12.8	12.8
A-4	1.17	D	65.0	0.65	0.49	143	5.0	7.8	376	2.9	20.0	3.4	1.8	9.6	519.0	12.9	9.6
B-2	0.57	D	81.6	0.80	0.68	137	4.0	5.6	340	3.7	20.0	3.8	1.5	7.1	477.0	12.7	7.1
B-3	2.15	D	65.0	0.65	0.49	225	5.3	9.6	620	2.9	20.0	3.4	3.0	12.7	845.0	14.7	12.7
B-4	2.94	D	65.0	0.65	0.49	150	11.0	6.2	592	1.9	20.0	2.8	3.6	9.7	742.0	14.1	9.7
B-5	1.32	D	65.0	0.65	0.49	225	4.6	10.1	320	1.0	20.0	2.0	2.7	12.7	545.0	13.0	12.7
B-6	0.87	D	66.6	0.66	0.51	70	1.0	9.1	315	1.0	20.0	2.0	2.6	11.7	385.0	12.1	11.7
B-7	2.71	D	38.0	0.59	0.35	103	14.0	5.8	554	1.8	20.0	2.7	3.4	9.2	657.0	13.7	9.2
B-8	1.09	D	65.0	0.65	0.49	68	1.0	9.2	570	1.8	20.0	2.7	3.5	12.7	638.0	13.5	12.7
B-9	1.02	D	65.0	0.65	0.49	50	5.0	4.6	825	5.9	20.0	4.9	2.8	7.5	875.0	14.9	7.5
B-10	2.92	D	65.0	0.65	0.49	32	9.0	3.0	825	5.9	20.0	4.9	2.8	5.9	857.0	14.8	5.9
B-11	0.28	D	65.0	0.65	0.49	51	5.0	4.7	195	5.9	20.0	4.9	0.7	5.3	246.0	11.4	5.3
B-12	0.82	D	65.0	0.65	0.49	122	3.3	8.3	137	5.9	20.0	4.9	0.5	8.8	259.0	11.4	8.8
OS-1	9.35	D	65.0	0.65	0.49	195	10.0	7.2	140	2.9	20.0	3.4	0.7	7.9	335.0	11.9	7.9
OS-2A	0.19	D	65.0	0.65	0.49	100	21.0	4.1	130	3.8	20.0	3.9	0.6	4.6	230.0	11.3	5.0
OS-2B	0.62	D	47.7	0.61	0.40	100	2.5	9.5	215	4.2	20.0	4.1	0.9	10.3	315.0	11.8	10.3
OS-3	0.93	D	65.0	0.65	0.49	300	6.0	10.7	115	6.0	20.0	4.9	0.4	11.0	415.0	12.3	11.0
OS-4	0.06	D	100.0	0.96	0.90	0	0.0	0.0	90	6.0	20.0	4.9	0.3	0.3	90.0	10.5	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

Revised OS-2a & OS-2b basin

OS-2A AND OS-2B CORRELATE TO A-1 AND A-2 RESPECITVELY

Galloway

EXCERPT FROM PREVIOUS STUDY

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

Subdivision: Bradley Ridge Filing No. 1
Location: CO, Colorado Springs
Design Storm: 5-Year

Project Name: Bradley Ridge Filing No. 1
Project No.: RJL01.21
Calculated By: TJE
Checked By: BAS
Date: 9/8/23

		DIRECT RUNOFF							TOTAL RUNOFF CAPTURED				STREET		PIPE			TRAVEL TIME			
STREET	Design Point	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
		B-7	2.71	0.35	9.2	0.95	4.25	4.0													
	B8											4.0			4.0						Pr. On-Grade COS D-10-R (4'x12') - 0.0 cfs Bypass
		B-8	1.09	0.49	12.7	0.53	3.77	2.0													
	B9											2.0			2.0						Pr. On-Grade COS D-10-R (4'x10') - 0.0 cfs Bypass
	B10														21.9						Combined Flow from DP B7, B8 & B9
		B-9	1.02	0.49	7.5	0.50	4.57	2.3													
	B12											2.8		0.0	2.8						Pr. On-Grade COS D-10-R (4'x10') - 0.0 cfs Bypass
		OS-2A	0.19	0.49	5.0	0.09	5.17	0.5													
	B11a											0.5									Future Flows from Filing 3 to Inlet B12
		OS-2B	0.62	0.40	10.3	0.25	4.08	1.0													
	B11b											1.0									Future Flows from Filing 3 to Inlet B13
		B-10	2.92	0.49	5.9	1.43	4.93	7.0													Receives Flows from DP B11b
	B13											8.1		0.9	7.1						Pr. On-Grade COS D-10-R (4'x12') - 1.0 cfs Bypass
	B14														9.9						Combined Flow from DP B12 & DP B13
	B15														31.8						Combined Flow from DP B14 & DP B10
		B-11	0.28	0.49	5.3	0.14	5.07	0.7				0.7									Receives Bypass Flows from DP B8, B9 & B12
	B16													0.0	0.7						Pr. On-Grade COS D-10-R (4'x16') - 0.0 cfs Bypass
		B-12	0.82	0.49	8.8	0.40	4.33	1.7													Receives flow from DP B13
	B17											2.7		0.0	2.7						Pr. On-Grade COS D-10-R (4'x20') - 0.0 cfs Bypass
	B18														35.2						Combined Flow from DP B15, B16 & B17
		OS-3	0.93	0.49	11.0	0.46	3.98	1.8													Flows from Peaceful Ridge Subdivision
		JC1	0.70					5.2													From Approved MDDP
	AA											7.0									Ex. Sump COS D-10-R (4'x16')
		OS-4	0.06	0.90	5.0	0.05	5.17	0.3													Flows from Peaceful Ridge Subdivision
		JC2	1.00					4.9													From Approved MDDP
	AB											5.2									Combined Flow from Basins OS-4 & JC2
	AC											12.2									Combined Flow from DP AA & DP AB
	AD											47.5									Combined Flow from DP B18 & DP AC
		JC4						33.6													From Approved MDDP

Revised OS-2a,2b basins

OS-2A AND OS-2B CORRELATE TO A-1 AND A-2 RESPECITVELY

Galloway

EXCERPT FROM PREVIOUS STUDY

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

Subdivision: Bradley Ridge Filing No. 1
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Bradley Ridge Filing No. 1
Project No.: RJL01.21
Calculated By: TJE
Checked By: BAS
Date: 9/8/23

Revised OS-2a,2b basins

OS-2A AND OS-2B CORRELATE TO A-1 AND A-2 RESPECITVELY

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF CAPTURED				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)	
	B8	B-7	2.71	0.59	9.2	1.60	7.14	11.4				11.4		2.8	8.6						Pr. On-Grade COS D-10-R (4'x12') - 2.8 cfs Bypass
	B9	B-8	1.09	0.65	12.7	0.71	6.33	4.5				4.5		0.2	4.3						Pr. On-Grade COS D-10-R (4'x10') - 0.2 cfs Bypass
	B10														47.9						Combined Flow from DP B7, B8 & B9
	B12	B-9	1.02	0.65	7.5	0.66	7.67	5.1				6.1		0.5	5.6						Pr. On-Grade COS D-10-R (4'x10') - 0.2 cfs Bypass
	B11a	OS-2A	0.19	0.65	5.0	0.12	8.68	1.0				1.0									
	B11b	OS-2B	0.62	0.61	10.3	0.38	6.85	2.6				2.6									Offiste Flows - Based on MDDP Basin JC3
	B13	B-10	2.92	0.65	5.9	1.90	8.28	15.7				18.3		7.2	11.1						Receives Flows from DP B11 Pr. On-Grade COS D-10-R (4'x12') - 8.0 cfs Bypass
	B14											16.7			16.7						Combined Flow from DP B12 & DP B13
	B15														64.6						Combined Flow from DP B14 & DP B10
	B16	B-11	0.28	0.65	5.3	0.18	8.52	1.5				4.9		0.0	4.9						Received Bypass Flows from DP B8, B9 & B12 Pr. On-Grade COS D-10-R (4'x16') - 0.0 cfs Bypass
	B17	B-12	0.82	0.65	8.8	0.53	7.27	3.9				11.1		0.0	11.1						Receives Bypass Flows from DP B13 Pr. On-Grade COS D-10-R (4'x20') - 0.1 cfs Bypass
	B18														80.6						Combined Flow from DP B15, B16 & B17
		OS-3	0.93	0.65	11.0	0.60	6.68	4.0													Flows from Peaceful Ridge Subdivision
	AA	JC1	1.90					10.9				14.9									From Approved MDDP Ex. Sump COS D-10-R (4'x16')
		OS-4	0.06	0.96	5.0	0.06	8.68	0.5													Flows from Peaceful Ridge Subdivision
	AB	JC2	1.00					7.4				7.9									From Approved MDDP Combined Flow from Basins OS-4 & JC2
	AC											22.8									Combined Flow from DP AA & DP AB
	AD											103.4									Combined Flow from DP B18 & DP AC
	AE	JC4	16.75					72.4				175.8									From Approved MDDP Combined Flow from DP AD & Basin JC4 - To Pond 3

Galloway

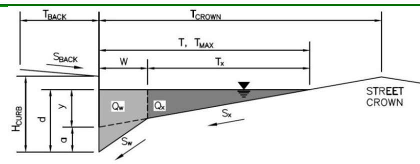
EXCERPT FROM PREVIOUS STUDY

MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project: RJL01.21 - Kiemele Subdivision
Inlet ID: DP AA



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.8	10.2	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 =	4.32	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 =	1.51	1.51	inches
Water Depth at Gutter Flowline	d =	5.83	5.83	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	16.0	16.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.330	0.330	
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

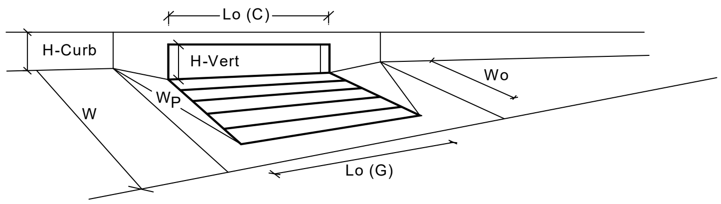
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.9	36.2	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.9	34.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.333	0.159	
Theoretical Discharge outside the Gutter Section 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 $\geq$ 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**

EXCERPT FROM PREVIOUS STUDY

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 =	5.8	10.2	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) =	16.00	16.00	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	

Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**

Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.31	1.31	
Clogging Factor for Multiple Units	Clog =	0.04	0.04	
Curb Opening as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	9.8	39.0	cfs
Interception with Clogging	Q_{wa} =	9.4	37.4	cfs
Curb Opening as an Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	40.0	53.0	cfs
Interception with Clogging	Q_{oa} =	38.4	50.8	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	18.4	42.3	cfs
Interception with Clogging	Q_{ma} =	17.6	40.6	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**9.4**	**37.4**	**cfs**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	16.00	16.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	17.9	36.2	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	4.4	inches
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} =	0.32	0.68	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.55	0.96	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.77	0.98	
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 =**	**9.4**	**37.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	7.0	14.9	cfs

EXCERPT FROM PREVIOUS STUDY

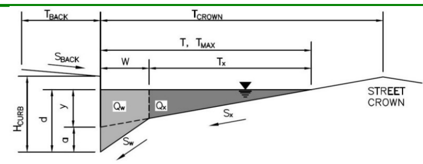
MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project: RJL01.21 - Kiemele Subdivision

Inlet ID: DP B12



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060	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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	4.08	4.08	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 =	1.51	1.51	inches
Water Depth at Gutter Flowline	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	17.3	17.3	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	9.3	9.3	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 =**	**26.6**	**26.6**	**cfs**
Flow Velocity within the Gutter Section	V =	12.2	12.2	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	5.7	5.7	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.9	26.2	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	10.9	24.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.460	0.224	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.3	61.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.3	57.2	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	6.2	17.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	2.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.6	77.2	cfs
Average Flow Velocity Within the Gutter Section	V =	10.4	15.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	4.0	10.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm	R =	1.00	0.35	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.6**	**26.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.60	5.60	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.01	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} =**	**13.6**	**26.8**	**cfs**

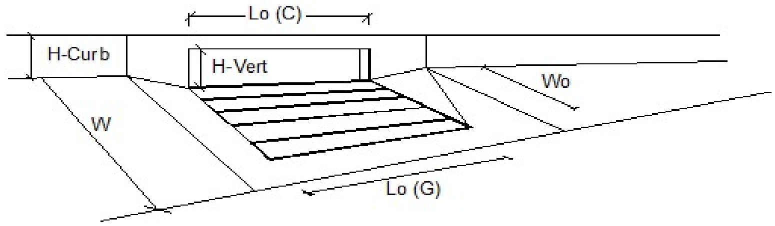
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

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

EXCERPT FROM PREVIOUS STUDY

INLET ON A CONTINUOUS GRADE

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')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	2.8	6.1	cfs
Water Spread Width		T =	6.0	9.0	ft
Water Depth at Flowline (outside of local depression)		d =	2.9	3.7	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.825	0.631	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.5	2.3	cfs
Discharge within the Gutter Section W		Q_w =	2.3	3.8	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.32	0.45	sq ft
Velocity within the Gutter Section W		V_W =	7.1	8.6	fps
Water Depth for Design Condition		d_{LOCAL} =	6.9	7.7	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o-GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb or Slotted Inlet Opening Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)		S_e =	0.209	0.165	ft/ft
Required Length L_T to Have 100% Interception		L_T =	7.51	12.48	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	7.51	10.00	ft
Interception Capacity		Q_i =	2.8	5.8	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.06	0.06	
Effective (Unclogged) Length		L_e =	8.75	8.75	ft
Actual Interception Capacity		**Q_a =**	**2.8**	**5.6**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.5**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**2.8**	**5.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.5**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**92**	**%**

EXCERPT FROM PREVIOUS STUDY

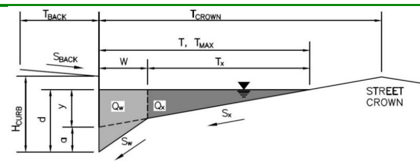
MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project: RJL01.21 - Kiemele Subdivision

Inlet ID: DP B13



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5		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} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	15.8		ft
Gutter Width	W =	0.83		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060		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} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	3.80	3.80	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	0.8	0.8	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	0.63	0.63	inches
Water Depth at Gutter Flowline	d =	4.43	4.43	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.151	0.151	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	17.3	17.3	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.1	3.1	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 =**	**20.4**	**20.4**	**cfs**
Flow Velocity within the Gutter Section	V =	1.9	1.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.7	0.7	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.6	29.9	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\ TH}$ =	15.7	29.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.144	0.077	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	19.6	100.8	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	19.6	86.3	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.3	8.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	2.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	22.9	96.9	cfs
Average Flow Velocity Within the Gutter Section	V =	2.0	2.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.7	1.9	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm	R =	0.91	0.35	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**20.9**	**33.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.47	5.24	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.04	0.82	inches

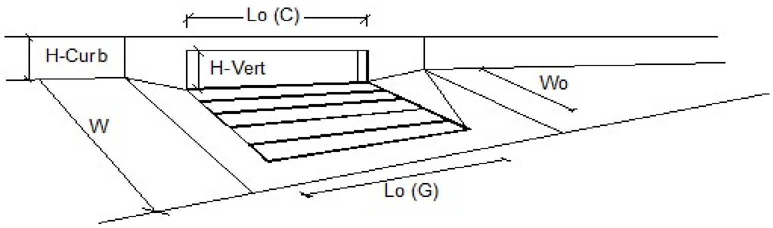
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**20.4**	**33.6**	**cfs**

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

EXCERPT FROM PREVIOUS STUDY

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



		MINOR	MAJOR	
Design Information (Input) — Colorado Springs D-10-R				
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	12.00	12.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	8.1	18.3	cfs
Water Spread Width	T =	11.1	15.2	ft
Water Depth at Flowline (outside of local depression)	d =	3.3	4.3	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.219	0.157	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	6.3	15.4	cfs
Discharge within the Gutter Section W	Q_w =	1.8	2.9	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.20	0.27	sq ft
Velocity within the Gutter Section W	V_W =	8.9	10.8	fps
Water Depth for Design Condition	d_{LOCAL} =	7.3	8.3	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o-GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.121	0.093	ft/ft
Required Length L_T to Have 100% Interception	L_T =	16.58	28.41	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	12.00	12.00	ft
Interception Capacity	Q_i =	7.3	11.5	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.05	0.05	
Effective (Unclogged) Length	L_e =	10.50	10.50	ft
Actual Interception Capacity	**Q_a =**	**7.1**	**11.1**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**1.0**	**7.2**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.1**	**11.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**1.0**	**7.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**88**	**61**	**%**

EXCERPT FROM PREVIOUS STUDY

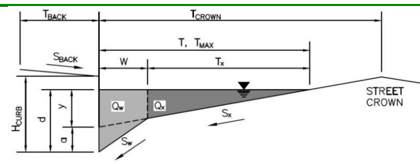
MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project: RJL01.21 - Kiemele Subdivision

Inlet ID: DP B16



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5		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} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060		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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	4.08	4.08	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 =	1.51	1.51	inches
Water Depth at Gutter Flowline	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	17.3	17.3	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	9.3	9.3	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 =**	**26.6**	**26.6**	**cfs**
Flow Velocity within the Gutter Section	V =	12.2	12.2	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	5.7	5.7	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.9	26.2	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\ TH}$ =	10.9	24.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.460	0.224	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	7.3	61.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.3	57.2	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	6.2	17.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	2.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.6	77.2	cfs
Average Flow Velocity Within the Gutter Section	V =	10.4	15.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	4.0	10.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm	R =	1.00	0.35	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.6**	**26.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.60	5.60	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.01	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} =**	**13.6**	**26.8**	**cfs**

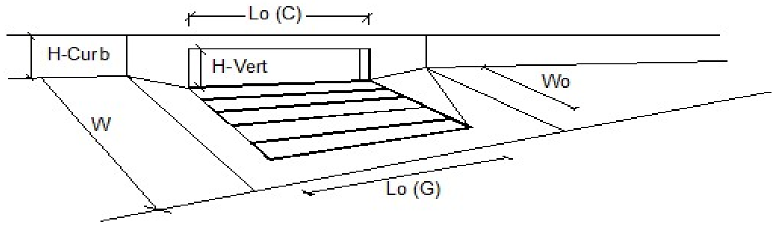
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

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

EXCERPT FROM PREVIOUS STUDY

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



		MINOR	MAJOR	
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')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	16.00	16.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.7	4.9	cfs
Water Spread Width	T =	1.9	8.1	ft
Water Depth at Flowline (outside of local depression)	d =	1.9	3.5	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	1.012	0.681	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.0	1.6	cfs
Discharge within the Gutter Section W	Q_w =	0.7	3.4	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.14	0.41	sq ft
Velocity within the Gutter Section W	V_W =	4.9	8.2	fps
Water Depth for Design Condition	d_{LOCAL} =	5.9	7.5	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.250	0.176	ft/ft
Required Length L_T to Have 100% Interception	L_T =	3.41	10.85	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	3.41	10.85	ft
Interception Capacity	Q_i =	0.7	4.9	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	13.90	13.90	ft
Actual Interception Capacity	**Q_a =**	**0.7**	**4.9**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.7**	**4.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

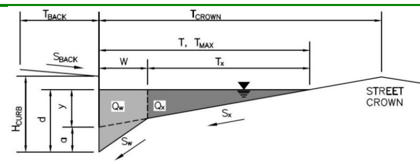
EXCERPT FROM PREVIOUS STUDY

MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project: RJL01.21 - Kiemele Subdivision
Inlet ID: DP B17



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	15.8	ft
Gutter Width	W =	0.83	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060	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} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	3.80	3.80	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	0.8	0.8	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	0.63	0.63	inches
Water Depth at Gutter Flowline	d =	4.43	4.43	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.151	0.151	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	17.3	17.3	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.1	3.1	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 =**	**20.4**	**20.4**	**cfs**
Flow Velocity within the Gutter Section	V =	1.9	1.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.7	0.7	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.6	29.9	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.7	29.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.144	0.077	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	19.6	100.8	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	19.6	86.3	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.3	8.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	2.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	22.9	96.9	cfs
Average Flow Velocity Within the Gutter Section	V =	2.0	2.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.7	1.9	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm	R =	0.91	0.35	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**20.9**	**33.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.47	5.24	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.04	0.82	inches

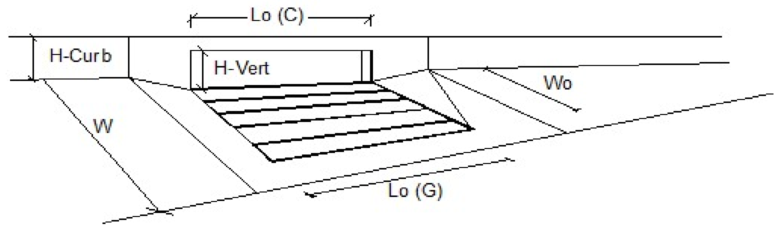
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**20.4**	**33.6**	**cfs**

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

EXCERPT FROM PREVIOUS STUDY

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



		MINOR	MAJOR	
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')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	20.00	20.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	2.7	11.1	cfs
Water Spread Width	T =	7.2	12.6	ft
Water Depth at Flowline (outside of local depression)	d =	2.4	3.6	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.345	0.192	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	1.8	9.0	cfs
Discharge within the Gutter Section W	Q_w =	0.9	2.1	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.13	0.22	sq ft
Velocity within the Gutter Section W	V_W =	6.9	9.6	fps
Water Depth for Design Condition	d_{LOCAL} =	6.4	7.6	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.180	0.109	ft/ft
Required Length L_T to Have 100% Interception	L_T =	7.85	20.43	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	7.85	20.00	ft
Interception Capacity	Q_i =	2.7	11.1	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.33	1.33	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.03	0.03	
Effective (Unclogged) Length	L_e =	17.34	17.34	ft
Actual Interception Capacity	**Q_a =**	**2.7**	**11.0**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.7**	**11.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

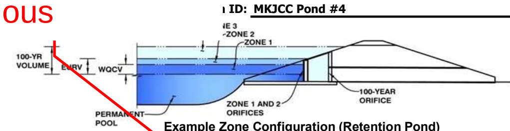
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Revised area & % Impervious

ject: **BRADLEY RIDGE**

ID: **MKJCC Pond #4**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	75.61	acres
Watershed Length =	3,422	ft
Watershed Length to Centroid =	1,700	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	61.80%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.527	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	4.496	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	4.975	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	6.881	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	8.484	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	10.277	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	11.942	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	13.908	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.55 in.) =	20.845	acre-feet	3.55	inches
Approximate 2-yr Detention Volume =	4.014	acre-feet		
Approximate 5-yr Detention Volume =	5.734	acre-feet		
Approximate 10-yr Detention Volume =	6.550	acre-feet		
Approximate 25-yr Detention Volume =	7.004	acre-feet		
Approximate 50-yr Detention Volume =	7.218	acre-feet		
Approximate 100-yr Detention Volume =	7.948	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.527	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.969	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.452	acre-feet
Total Detention Basin Volume =	7.948	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.50 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	748	0.017		
5762	--	0.50	--	--	--	748	0.017	374	0.009
	--	1.00	--	--	--	1,276	0.029	880	0.020
5763	--	1.50	--	--	--	3,279	0.075	2,019	0.046
	--	2.00	--	--	--	7,988	0.183	4,835	0.111
5764	--	2.50	--	--	--	14,781	0.339	10,528	0.242
	--	3.00	--	--	--	25,736	0.591	20,657	0.474
5765	--	3.50	--	--	--	40,221	0.923	37,146	0.853
	--	4.00	--	--	--	55,545	1.275	61,088	1.402
5766	--	4.50	--	--	--	72,296	1.660	93,048	2.136
	--	5.00	--	--	--	90,000	2.066	133,622	3.068
5767	--	5.50	--	--	--	114,599	2.631	184,771	4.242
	--	6.00	--	--	--	117,856	2.706	242,885	5.576
5768	--	6.50	--	--	--	121,214	2.783	302,653	6.948
	--	7.00	--	--	--	124,548	2.859	364,093	8.358
5769	--	7.50	--	--	--	127,915	2.937	427,209	9.807
	--	8.00	--	--	--	131,322	3.015	492,018	11.295
5770	--	8.50	--	--	--	134,777	3.094	558,543	12.822
	--	9.00	--	--	--	138,276	3.174	626,806	14.389
5771	--	9.50	--	--	--	141,812	3.256	696,828	15.997
	--		--	--	--				
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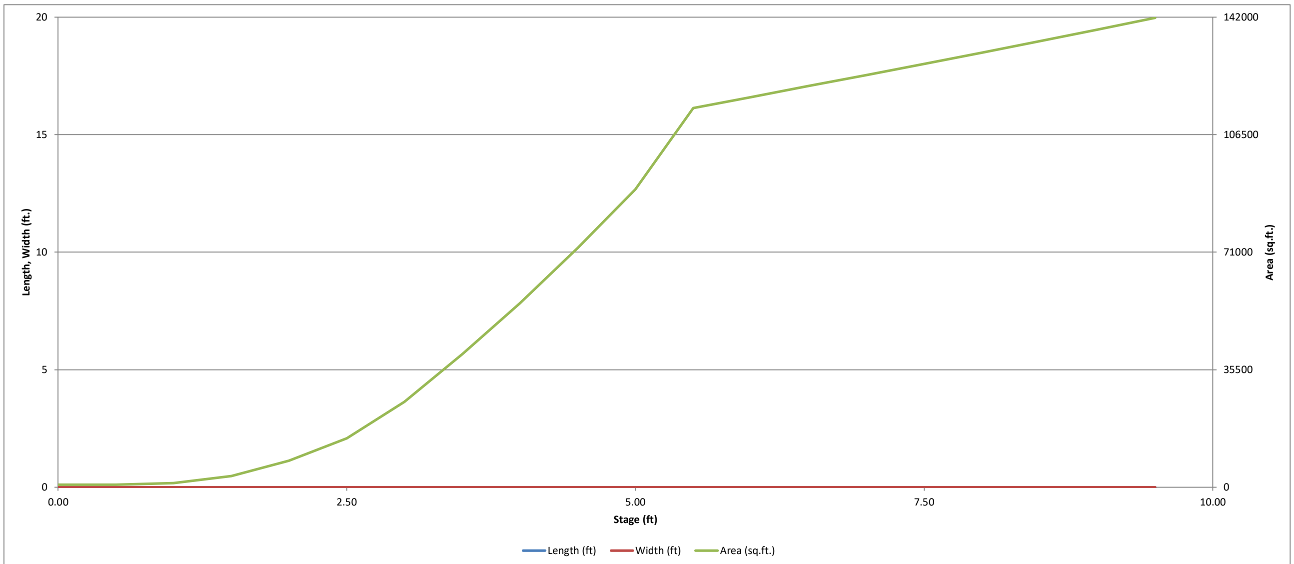
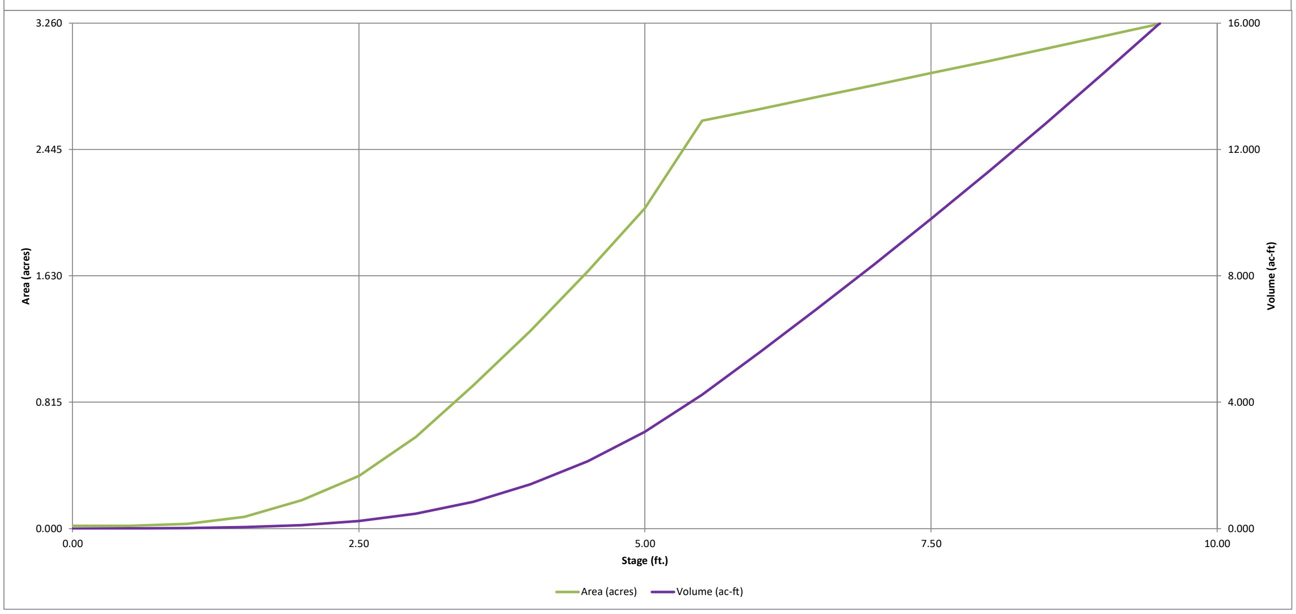
EXCERPT FROM PREVIOUS STUDY

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

EXCERPT FROM PREVIOUS STUDY





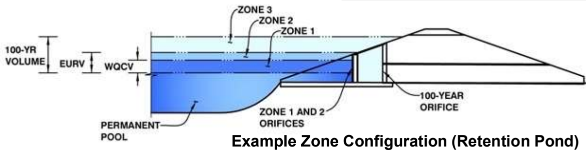
EXCERPT FROM PREVIOUS STUDY

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **BRADLEY RIDGE**

Basin ID: **MKJCC Pond #4**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.10	1.527	Orifice Plate
Zone 2 (EURV)	5.60	2.969	Rectangular Orifice
Zone 3 (100-year)	6.86	3.452	Weir&Pipe (Restrict)
Total (all zones)		7.948	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	4.10	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	18.00	inches
Orifice Plate: Orifice Area per Row =	4.14	sq. inches (use rectangula

Revised orifice area

Calculated Parameters for Plate

WQ Orifice Area per Row =	2.872E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.50	3.00					
Orifice Area (sq. inches)	4.14	4.14	4.14					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	4.12	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	5.60	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	2.50	N/A	inches
Vertical Orifice Width =	7.50		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.13	N/A	ft^2
Vertical Orifice Centroid =	0.10	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.80	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	12.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.80	N/A	feet
Overflow Weir Slope Length =	6.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.21	N/A	
Overflow Grate Open Area w/o Debris =	50.11	N/A	ft^2
Overflow Grate Open Area w/ Debris =	25.06	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	42.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	28.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	6.95	N/A	ft^2
Outlet Orifice Centroid =	1.33	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.94	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.25	ft (relative to basin
Spillway Crest Length =	140.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Revised outlet invert

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.69	feet
Stage at Top of Freeboard =	8.94	feet
Basin Area at Top of Freeboard =	3.16	acres
Basin Volume at Top of Freeboard =	14.20	acre-ft

Routed Hydrograph Results

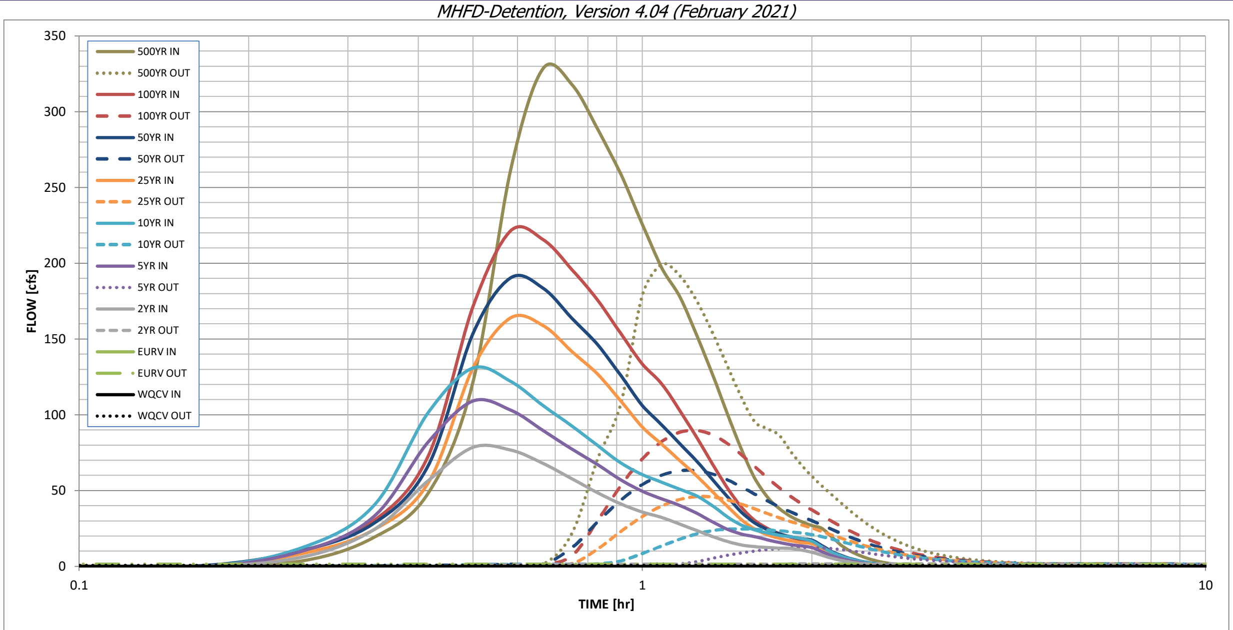
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

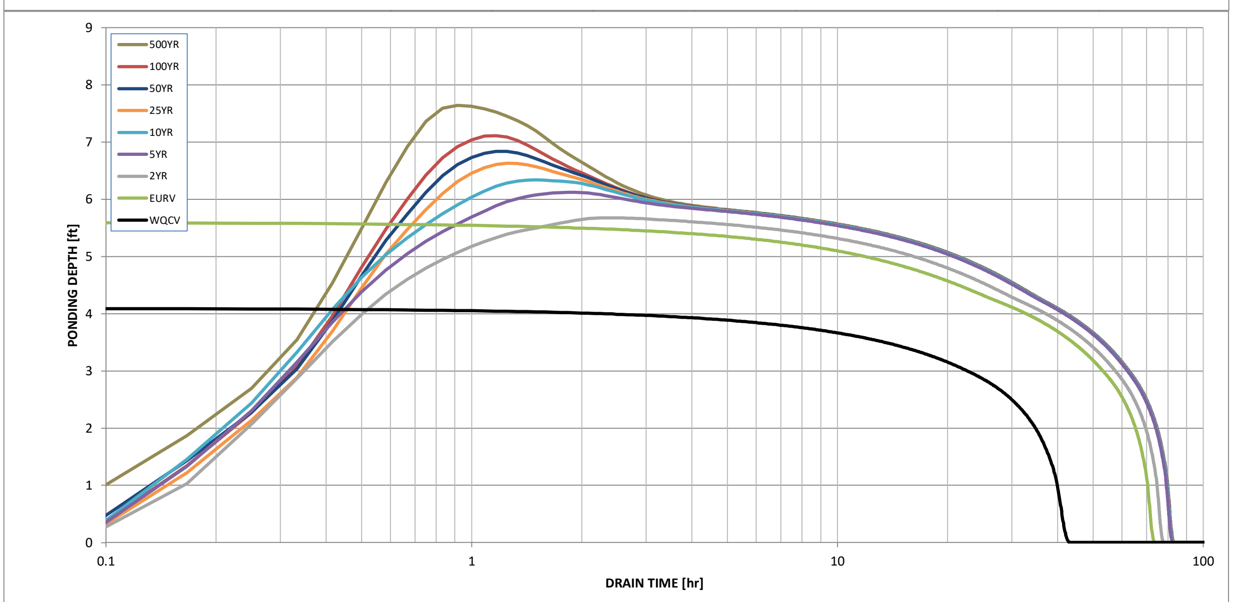
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.55
CUHP Runoff Volume (acre-ft) =	1.527	4.496	4.975	6.881	8.484	10.277	11.942	13.908	20.845
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.975	6.881	8.484	10.277	11.942	13.908	20.845
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	13.9	29.2	40.5	63.6	78.3	98.2	159.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.18	0.39	0.54	0.84	1.04	1.30	2.11
Peak Inflow Q (cfs) =	N/A	N/A	78.4	109.0	130.8	163.9	190.2	221.1	328.5
Peak Outflow Q (cfs) =	0.6	1.6	1.6	12.4	24.7	46.0	63.1	89.6	199.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.7	0.8	0.9	1.2
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.5	0.9	1.2	1.8	1.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	64	68	71	69	68	66	64	59
Time to Drain 99% of Inflow Volume (hours) =	**40**	69	73	76	76	75	74	74	71
Maximum Ponding Depth (ft) =	4.10	5.60	5.68	6.12	6.34	6.63	6.84	7.12	7.65
Area at Maximum Ponding Depth (acres) =	1.35	2.65	2.66	2.72	2.76	2.80	2.83	2.88	2.96
Maximum Volume Stored (acre-ft) =	1.534	4.506	4.691	5.902	6.477	7.311	7.875	8.674	10.220

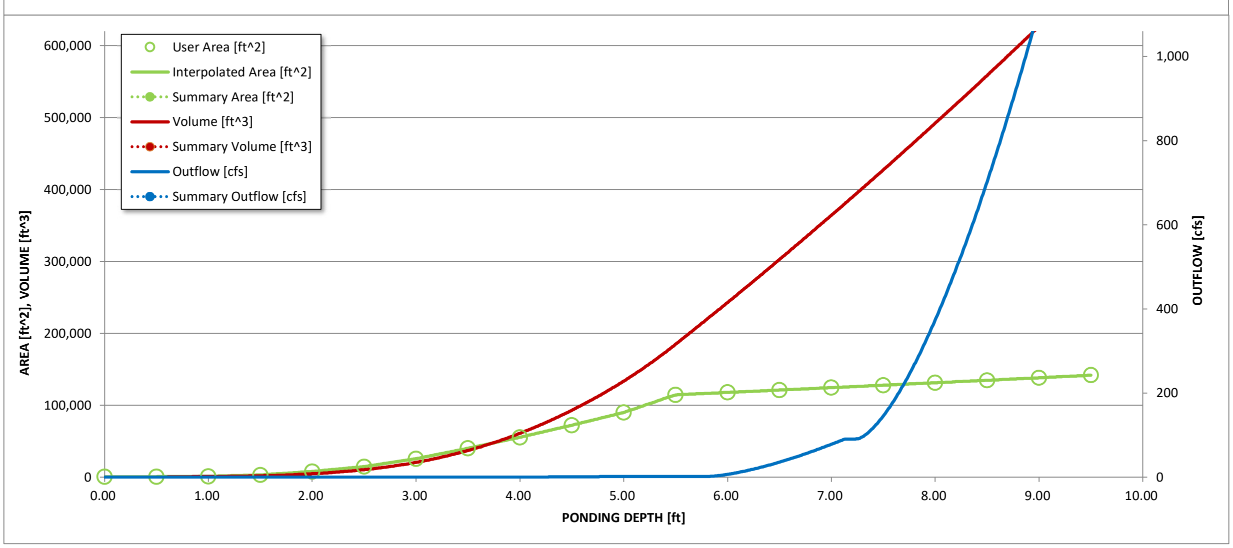
EXCERPT FROM PREVIOUS STUDY

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

EXCERPT FROM PREVIOUS STUDY

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.07	3.76
	0:15:00	0.00	0.00	6.31	10.30	12.74	8.55	10.85	10.43	18.93
	0:20:00	0.00	0.00	24.10	32.62	39.78	24.06	28.16	29.93	48.25
	0:25:00	0.00	0.00	56.60	81.95	101.36	55.11	66.38	72.85	120.92
	0:30:00	0.00	0.00	78.43	108.95	130.78	130.48	153.20	170.80	261.01
	0:35:00	0.00	0.00	76.79	103.17	122.05	163.87	190.15	221.15	328.50
	0:40:00	0.00	0.00	67.98	89.60	106.03	158.91	183.57	215.48	317.85
	0:45:00	0.00	0.00	57.76	77.33	92.52	141.72	163.58	195.78	288.42
	0:50:00	0.00	0.00	48.54	67.05	79.62	126.69	146.19	175.54	258.34
	0:55:00	0.00	0.00	41.13	56.99	68.14	108.89	125.64	153.38	225.60
	1:00:00	0.00	0.00	35.85	49.56	60.61	91.90	106.18	133.49	196.78
	1:05:00	0.00	0.00	32.22	44.48	55.44	80.52	93.19	120.23	177.58
	1:10:00	0.00	0.00	27.90	40.17	50.85	69.64	80.77	102.53	151.99
	1:15:00	0.00	0.00	23.55	34.99	46.30	59.58	69.25	84.78	126.38
	1:20:00	0.00	0.00	19.68	29.33	39.96	49.15	57.10	67.38	100.52
	1:25:00	0.00	0.00	16.41	24.48	32.59	39.64	45.94	51.76	77.11
	1:30:00	0.00	0.00	14.16	21.33	27.26	30.84	35.74	38.95	58.28
	1:35:00	0.00	0.00	12.98	19.66	24.14	24.63	28.61	30.29	45.72
	1:40:00	0.00	0.00	12.42	17.59	22.06	20.89	24.30	25.11	38.11
	1:45:00	0.00	0.00	12.09	15.72	20.56	18.47	21.48	21.65	32.98
	1:50:00	0.00	0.00	11.88	14.38	19.51	16.82	19.57	19.27	29.45
	1:55:00	0.00	0.00	10.65	13.39	18.35	15.70	18.26	17.59	26.93
	2:00:00	0.00	0.00	9.32	12.36	16.58	14.93	17.36	16.38	25.11
	2:05:00	0.00	0.00	7.31	9.74	12.93	11.86	13.78	12.81	19.64
	2:10:00	0.00	0.00	5.42	7.14	9.42	8.62	10.01	9.26	14.18
	2:15:00	0.00	0.00	4.00	5.25	6.86	6.31	7.31	6.79	10.38
	2:20:00	0.00	0.00	2.93	3.83	4.99	4.62	5.35	5.01	7.66
	2:25:00	0.00	0.00	2.12	2.72	3.59	3.32	3.84	3.63	5.54
	2:30:00	0.00	0.00	1.50	1.88	2.55	2.34	2.72	2.57	3.92
	2:35:00	0.00	0.00	1.03	1.31	1.79	1.68	1.95	1.84	2.81
	2:40:00	0.00	0.00	0.67	0.88	1.20	1.15	1.34	1.27	1.92
	2:45:00	0.00	0.00	0.39	0.55	0.73	0.73	0.84	0.80	1.20
	2:50:00	0.00	0.00	0.19	0.30	0.38	0.40	0.46	0.43	0.65
	2:55:00	0.00	0.00	0.08	0.12	0.15	0.17	0.19	0.18	0.27
	3:00:00	0.00	0.00	0.02	0.03	0.03	0.03	0.04	0.04	0.05
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

EXCERPT FROM PREVIOUS STUDY

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

EXCERPT FROM PREVIOUS STUDY

PIPE OUTFALL RIPRAP SIZING CALCULATIONS

Subdivision: Bradley Ridge Filing No. 1
Location: CO, Colorado Springs

Project Name: Bradley Ridge Filing No. 1
Project No.: RJL01.21
Calculated By: TJE
Checked By: BAS
Date: 9/8/23

Revised Q100 values

	STORM DRAIN SYSTEM			
	Pond #3 Spillway	Pond #4 Spillway	Pond #4 Outfall	
Q100 (cfs)	175.8	221.1	89.6	Flows are the greater of proposed vs. future
D or H (in)	7.08	8	42	
W (ft)	100	140		
Slope (%)	25.00	25	3	
Yn (in)	7.08	8.00	39.72	
Yt (ft)	Unknown	Unknown	Unknown	If "unknown" Yt/D=0.4
Yt/D, Yt/H	0.40	0.40	0.40	Per section 11-3
Supercritical	Yes	Yes	Yes	
Q/D^2.5, Q/WH^1.5	3.88	2.90	3.91	
Q/D^1.5, Q/WH^0.5				
Da, Ha (in) *	7.08	8.00	40.86	Da=0.5(D+Yn), Ha=0.5(H+Yn)
Q/Da^1.5, Q/WHa^0.5 *	2.29	1.93	14.26	
d50 (in), Required	0.96	0.81	12.33	
Required Riprap Size	L	L	H	Fig. 8-34
Use Riprap Size	**L**	**L**	**H**	
d50 (in)	9	9	18	Fig. 8-34
1/(2 tan q)	4.00	2.80	3.00	Fig. 9-35 OR Fig 9-36
Erosive Soils	Yes	Yes	Yes	
At	31.96	40.20	16.29	At=Q/5.5
L	141.8	30.1	24.4	L=(1/(2 tan q))(At/Yt - D)
Min L	1.8	2.0	10.5	Min L=3D or 3H
Max L	5.9	6.7	35.0	Max L=10D or 10H
Length (ft)	5.9	6.7	25.0	
Bottom Width (ft)	1.8	2.0	10.5	Width=3D (Minimum)
Riprap Depth (in)	18	18	36	Depth=2(d50)
Type II Base Depth (in)	6	6	8	Table 8-34 fine grained soils)
Cutoff Wall	No	No	Yes	
Cutoff Wall Depth (ft)			3.7	Depth of Riprap and Base
Cutoff Wall Width (ft)			9.9	

Galloway

EXCERPT FROM PREVIOUS STUDY

FOREBAY SIZING CALCULATIONS

Subdivision: Bradley Ridge Filing No. 1
Location: CO, Colorado Springs

Project Name: Bradley Ridge Filing No. 1
Project No.: RJL01.21
Calculated By: TJE
Checked By: BAS
Date: 9/8/23

Revised % Impervious & Tributary Areas

	JCC Pond #3 Forebay B-1	MKJCC Pond #4 Forebay A-1	MKJCC Pond #4 Forebay A-2	
Impervious % (I)	66.1%	65.70%	79.00%	Total impervious area of contributing upstream basins
WQCV Drain Time Coeff (a)	1	1	1	a = 1 for 40 Hr WQCV Drain Time
Tributary Area (Ac)	37.86	19.92	5.66	
Forebay Depth (Ft)	2.50	1.50	1.50	(see Table EDB-4 of the USDCM Volume 3 for depth requirement)
% of WQCV for Forebay Volume	3.0%	3.0%	2.00%	(see Table EDB-4 of the USDCM Volume 3 for requirement)
100-year Discharge (Q)	169.8	121.40	31.70	100-Year Flow entering Forebay (un-detained)
WQCV Depth (in)	0.26	0.26	0.32	WQCV Depth = $a(0.91*I^3 - 1.19*I^2 + 0.78*I)$
WQCV Volume (Ac-Ft)	0.82	0.43	0.15	
Forebay Volume (Cu. Ft.)	1066	557	132	
Forebay Discharge (Q)	3.40	2.43	0.63	(Release 2% of 100-year discharge via notch or berm/pipe configuration)
Forebay Notch Height (in)	27.00	15.00	15.00	(3" depression @ top of forebay assumed per COS DCM Volume 1, 13-30)
Forebay Deisgn Results				
Minimum Forebay Area (Sq. Ft.)	**426**	**371**	**88**	
Forebay Notch width (in)	**4**	**6**	**3**	From $Q=C_w*W*H^{1.5}$ assuming C_w=3.33 for sharp-crested weir - **If notch width <3", use 3" minimum.**

Galloway

Micropool/ISV SIZING CALCULATIONS

Subdivision: Bradley Ridge Filing No. 1
Location: CO, Colorado Springs

Bradley Ridge Filing No. 1
RJL01.21
TJE
BAS
9/8/23

	Pond #3 (JCC)	Pond #4 (MKJCC)	
WQCV Volume (Ac-Ft)	0.823	1.527	From MHFD-Detention Spreadsheet
Provided ISV Depth (in)	6.00	6.00	4" Min. per USDCM, Volume 3
Provided Micropool/ISV Area (Sq. Ft.)	358.50	748.40	
Provided ISV Volume (Cu. Ft.)	142.60	289.30	
Micropool/ISV Deisgn Results			
Minimum Micropool Area (Sq. Ft.)	**215**	**399**	Assuming ISV above - Min. 10 ft^2 per USDCM, Volume 3
Required ISV Volume (Cu. Ft.)	**108**	**200**	0.3% of WQCV, per USDCM, Volume 3
Is Required Micropool Area Met?	**YES**	**YES**	
Is Required ISV Volume Met?	**YES**	**YES**	

EXCERPT FROM PREVIOUS STUDY

Galloway

DETENTION POND TRIBUTARY AREAS

Subdivision: Bradley Ridge Filing No. 1
Location: CO, Colorado Springs

Project Name: Bradley Ridge Filing No. 1
Project No.: RJL01.21
Calculated By: TJE
Checked By: BAS
Date: 9/8/23

Revised OS-2A, OS-2B basins

OS-2A AND OS-2B CORRELATE TO A-1 AND A-2 RESPECITVELY

JCC Pond #3

Basin	Area	% Imp
B-2	0.57	81.6
B-3	2.15	65.0
B-4	2.94	65.0
B-5	1.32	65.0
B-6	0.87	66.6
B-7	2.71	38.0
B-8	1.09	65.0
B-9	1.02	65.0
B-10	2.92	65.0
B-11	0.28	65.0
B-12	0.82	65.0
OS-2A	0.19	65.0
OS-2B	0.62	47.7
OS-3	0.93	65.0
OS-4	0.06	100.0
*JC1	1.85	68.8
*JC2	1	95.0
*JC4	16.75	70.0
Total	**38.09**	**66.3**

* Values taken from the MDDP for Bradley Heights prepared by Matrix, dated June 2023.

EXCERPT FROM PREVIOUS STUDY

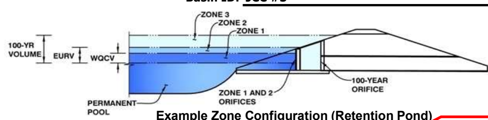
Galloway

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **BRADLEY RIDGE FILING NO. 1 - KIEMELE SUBDIVISION**

Basin ID: **JCC #3**



Example Zone Configuration (Retention Pond)

Revised watershed area & impervious &%

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	38.09	acres
Watershed Length =	1,771	ft
Watershed Length to Centroid =	700	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	66.30%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	16.1%	percent
Percentage Hydrologic Soil Groups C/D =	83.9%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.823	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.495	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.580	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.522	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	4.316	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	5.198	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	6.019	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	6.981	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.55 in.) =	10.402	acre-feet	3.55	inches
Approximate 2-yr Detention Volume =	2.183	acre-feet		
Approximate 5-yr Detention Volume =	3.052	acre-feet		
Approximate 10-yr Detention Volume =	3.551	acre-feet		
Approximate 25-yr Detention Volume =	3.792	acre-feet		
Approximate 50-yr Detention Volume =	3.908	acre-feet		
Approximate 100-yr Detention Volume =	4.249	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.823	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.672	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.755	acre-feet
Total Detention Basin Volume =	4.249	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

				Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
				--	--	358	0.008		
				--	--	358	0.008	179	0.004
5745	--	1.00	--	--	--	615	0.014	422	0.010
	--	1.50	--	--	--	2,061	0.047	1,091	0.025
5746	--	2.00	--	--	--	5,788	0.133	3,053	0.070
	--	2.50	--	--	--	13,441	0.309	7,861	0.180
5747	--	3.00	--	--	--	24,716	0.567	17,400	0.399
	--	3.50	--	--	--	33,246	0.763	31,890	0.732
5748	--	4.00	--	--	--	39,542	0.908	50,087	1.150
	--	4.50	--	--	--	41,360	0.949	70,313	1.614
5749	--	5.50	--	--	--	43,212	0.992	112,599	2.585
	--	6.00	--	--	--	45,142	1.036	134,687	3.092
5750	--	6.50	--	--	--	47,075	1.081	157,742	3.621
	--	7.00	--	--	--	49,034	1.126	181,769	4.173
5751	--	7.50	--	--	--	51,023	1.171	206,783	4.747
	--	8.00	--	--	--	53,046	1.218	232,800	5.344
5752	--	8.50	--	--	--	55,115	1.265	259,841	5.965
	--	9.00	--	--	--	57,216	1.313	287,923	6.610
5753	--	9.50	--	--	--	59,350	1.362	317,065	7.279
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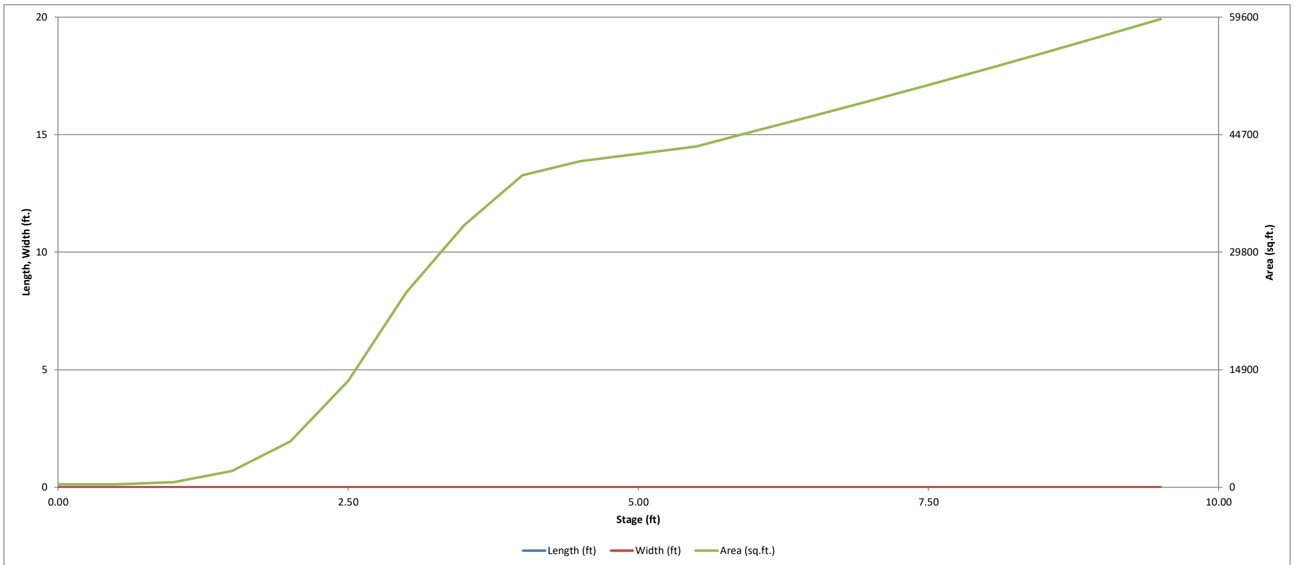
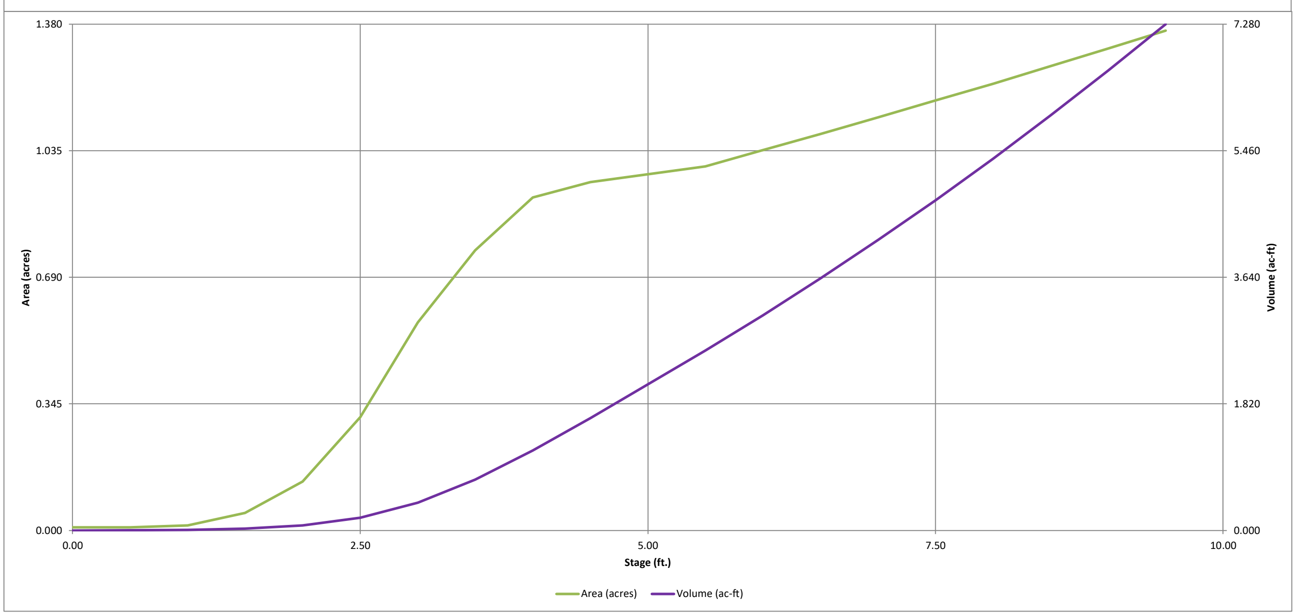
EXCERPT FROM PREVIOUS STUDY

EXCERPT FROM PREVIOUS STUDY





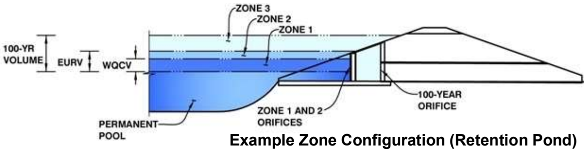
EXCERPT FROM PREVIOUS STUDY

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: BRADLEY RIDGE FILING NO. 1 - KIEMELE SUBDIVISION

Basin ID: JCC #3



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.62	0.823	Orifice Plate
Zone 2 (EURV)	5.41	1.672	Rectangular Orifice
Zone 3 (100-year)	7.07	1.755	Weir&Pipe (Restrict)
Total (all zones)		4.249	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Calculated Parameters for Plate

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.510E-02	ft^2
Depth at top of Zone using Orifice Plate =	3.64	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	15.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.18	sq. inches (diameter = 1-5/8 inches)	Elliptical Slot Area =	N/A	ft^2

Revised orifice areas

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.20	2.40	3.60				
Orifice Area (sq. inches)	2.18	2.18	2.18	2.18				

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected			Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	3.75	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.06	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	5.60	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.05	N/A	feet
Vertical Orifice Height =	1.25	N/A	inches				
Vertical Orifice Width =	7.00		inches				

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.50	N/A	feet
Overflow Weir Front Edge Length =	10.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.37	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	27.84	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	13.92	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	4.37	N/A	ft^2
Outlet Pipe Diameter =	42.00	N/A		Outlet Orifice Centroid =	0.94	N/A	feet
Restrictor Plate Height Above Pipe Invert =	19.50			le of Restrictor Plate on Pipe =	1.50	N/A	radians

Revised outlet invert

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.59	feet
Spillway Crest Length =	100.00	feet	Stage at Top of Freeboard =	8.59	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.27	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	6.08	acre-ft

Routed Hydrograph Results

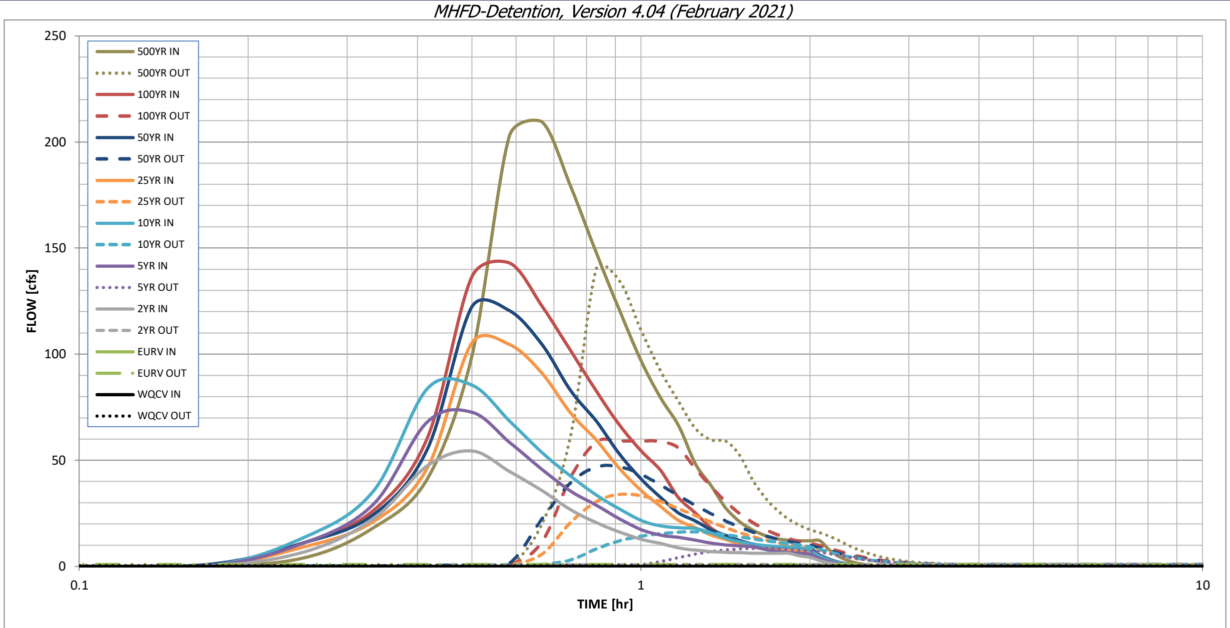
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

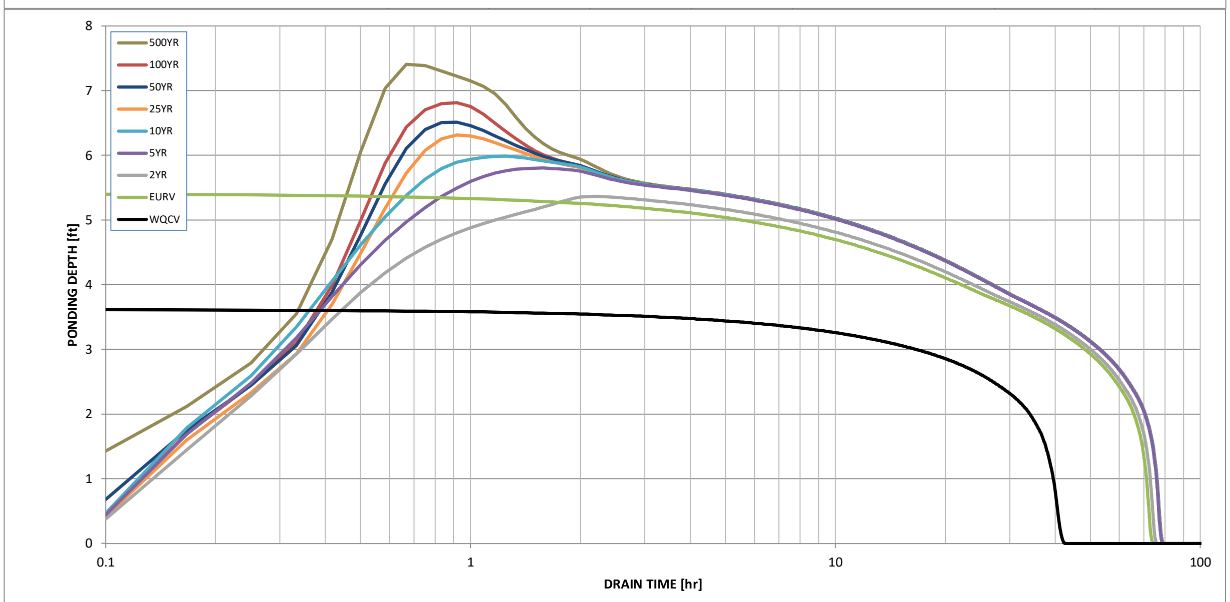
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.55
CUHP Runoff Volume (acre-ft) =	0.823	2.495	2.580	3.522	4.316	5.198	6.019	6.981	10.402
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.580	3.522	4.316	5.198	6.019	6.981	10.402
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	9.2	19.9	27.7	43.2	53.3	65.7	107.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.24	0.52	0.73	1.13	1.40	1.72	2.82
Peak Inflow Q (cfs) =	N/A	N/A	54.4	72.7	85.4	105.3	122.3	143.0	209.4
Peak Outflow Q (cfs) =	0.3	0.9	0.9	8.5	16.3	33.9	46.9	59.1	140.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.8	0.9	0.9	1.3
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.3	0.6	1.2	1.6	2.1	2.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	66	67	68	67	65	64	62	57
Time to Drain 99% of Inflow Volume (hours) =	**40**	69	71	73	73	72	71	71	68
Maximum Ponding Depth (ft) =	3.62	5.41	5.36	5.80	5.99	6.31	6.51	6.81	7.41
Area at Maximum Ponding Depth (acres) =	0.80	0.99	0.99	1.02	1.03	1.06	1.08	1.11	1.16
Maximum Volume Stored (acre-ft) =	0.826	2.496	2.446	2.887	3.071	3.407	3.632	3.950	4.630

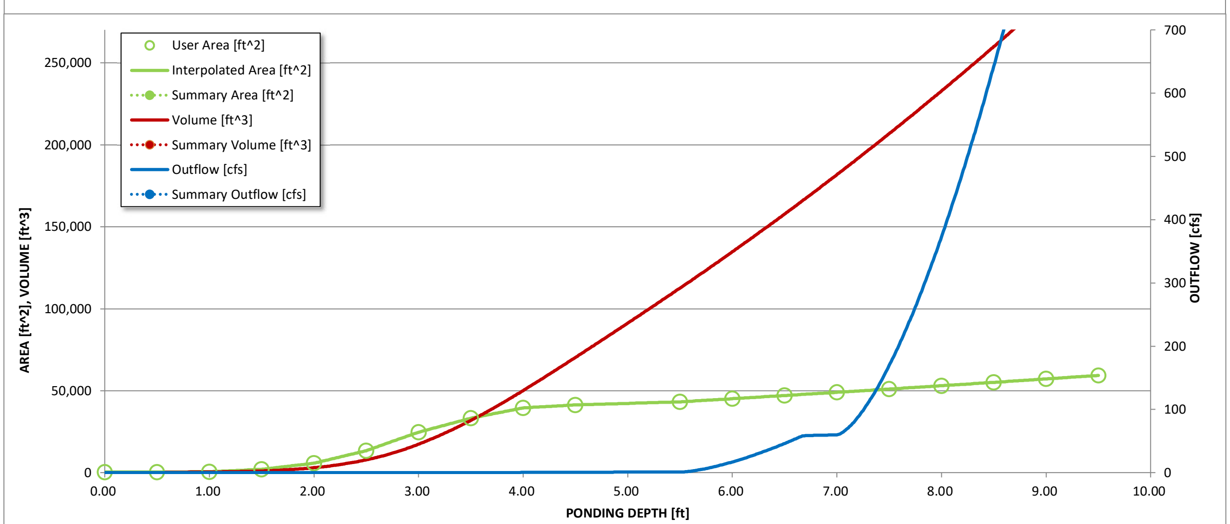
EXCERPT FROM PREVIOUS STUDY

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

EXCERPT FROM PREVIOUS STUDY

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.08	3.96
	0:15:00	0.00	0.00	6.67	10.86	13.43	9.01	11.07	10.95	18.01
	0:20:00	0.00	0.00	22.23	29.08	35.18	21.01	24.26	26.22	41.34
	0:25:00	0.00	0.00	47.41	68.09	83.83	46.47	55.24	60.60	99.12
	0:30:00	0.00	0.00	54.35	72.68	85.44	105.29	122.27	136.53	202.83
	0:35:00	0.00	0.00	44.68	58.51	68.53	104.54	120.46	142.96	209.37
	0:40:00	0.00	0.00	35.77	45.71	53.61	90.98	104.50	122.69	178.90
	0:45:00	0.00	0.00	26.62	35.43	42.47	72.12	82.76	101.47	147.67
	0:50:00	0.00	0.00	20.58	28.80	33.65	59.55	68.34	82.57	120.38
	0:55:00	0.00	0.00	16.16	22.36	26.95	45.92	52.80	66.49	97.03
	1:00:00	0.00	0.00	12.76	17.40	21.72	35.81	41.22	54.49	79.50
	1:05:00	0.00	0.00	10.82	14.69	19.07	28.25	32.59	45.29	66.37
	1:10:00	0.00	0.00	8.74	13.66	18.18	21.69	25.20	32.45	48.31
	1:15:00	0.00	0.00	7.61	12.31	17.88	18.26	21.35	25.15	38.04
	1:20:00	0.00	0.00	6.99	10.96	15.84	14.76	17.20	18.15	27.49
	1:25:00	0.00	0.00	6.63	10.10	13.27	12.62	14.65	13.87	21.01
	1:30:00	0.00	0.00	6.40	9.59	11.59	10.46	12.13	11.29	17.08
	1:35:00	0.00	0.00	6.25	9.28	10.51	9.08	10.53	9.61	14.53
	1:40:00	0.00	0.00	6.16	7.95	9.83	8.23	9.53	8.62	13.03
	1:45:00	0.00	0.00	6.13	7.08	9.38	7.74	8.95	8.19	12.36
	1:50:00	0.00	0.00	6.13	6.54	9.10	7.46	8.63	8.02	12.07
	1:55:00	0.00	0.00	5.02	6.22	8.57	7.33	8.48	7.98	12.01
	2:00:00	0.00	0.00	4.28	5.75	7.56	7.27	8.41	7.98	12.01
	2:05:00	0.00	0.00	2.69	3.60	4.77	4.61	5.33	5.07	7.62
	2:10:00	0.00	0.00	1.64	2.18	2.93	2.86	3.30	3.14	4.71
	2:15:00	0.00	0.00	0.96	1.30	1.74	1.71	1.98	1.88	2.81
	2:20:00	0.00	0.00	0.52	0.74	0.98	0.98	1.14	1.08	1.61
	2:25:00	0.00	0.00	0.25	0.39	0.49	0.53	0.61	0.58	0.86
	2:30:00	0.00	0.00	0.09	0.16	0.18	0.21	0.25	0.23	0.34
	2:35:00	0.00	0.00	0.02	0.03	0.03	0.04	0.04	0.04	0.05
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

EXCERPT FROM PREVIOUS STUDY

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

EXCERPT FROM PREVIOUS STUDY

DETENTION POND TRIBUTARY AREAS

Subdivision: Bradley Ridge Filing No. 1
Location: CO, Colorado Springs

Project Name: Bradley Ridge Filing No. 1
Project No.: RJL01.21
Calculated By: TJE
Checked By: BAS
Date: 9/8/23

MKJCC Pond #4

Basin	Area	% Imp
A-1	2.44	65.0
A-2	1.28	65.0
A-3	1.51	65.0
A-4	1.17	65.0
OS-1	9.35	65.0
*MK7	49.47	65.0
*MK10a	2.16	55.8
*MK11	4.61	56.4
*MK12	0.38	95.0
*MK14	3.02	2.0
*MK15a	0.22	56.8
Total	**75.61**	**61.8**

* Values taken from the MDDPA/FDR for Bradley Heights (Phase 4) prepared by Matrix, dated June 2023

Revised tributary areas from MDDPA.

Galloway

Excerpt from previous study

Cross Section for Pond 4 - Forebay A-1 Trickle Channel

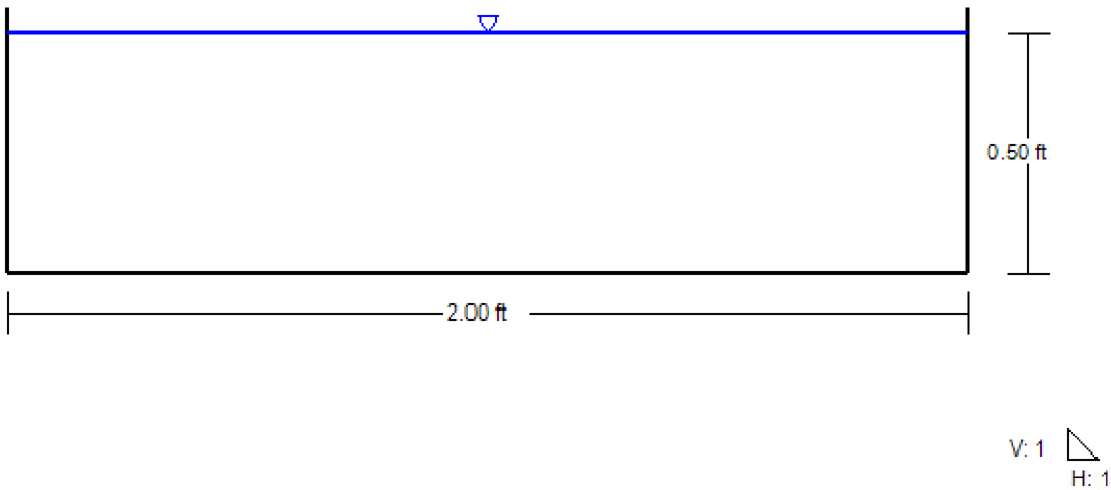
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00500	ft/ft
Normal Depth	0.50	ft
Bottom Width	2.00	ft
Discharge	3.89	ft³/s

Cross Section Image



Excerpt from previous study

Cross Section for Pond 4 - Forebay A-2 Trickle Channel

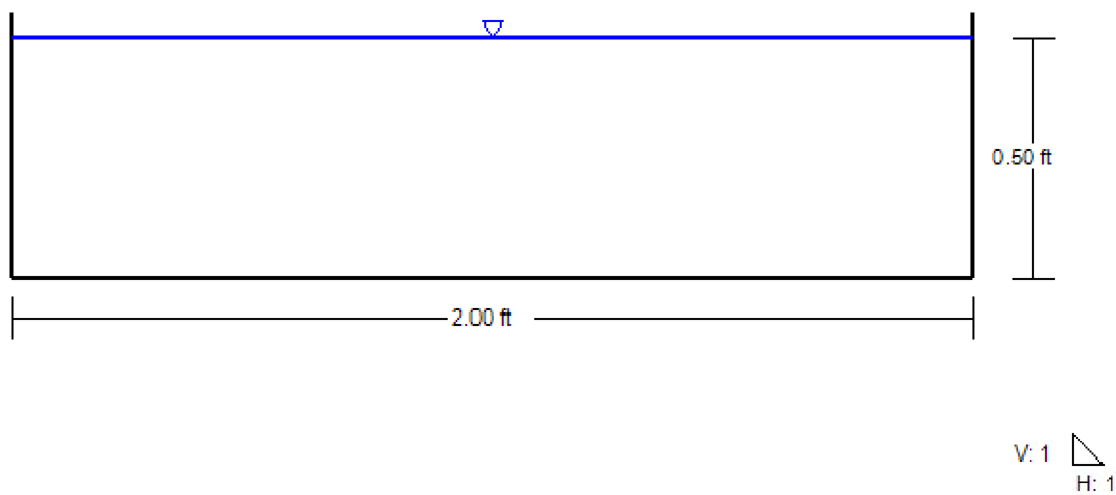
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00500	ft/ft
Normal Depth	0.50	ft
Bottom Width	2.00	ft
Discharge	3.89	ft³/s

Cross Section Image



Excerpt from previous study

Cross Section for Pond 3 Trickle Channel

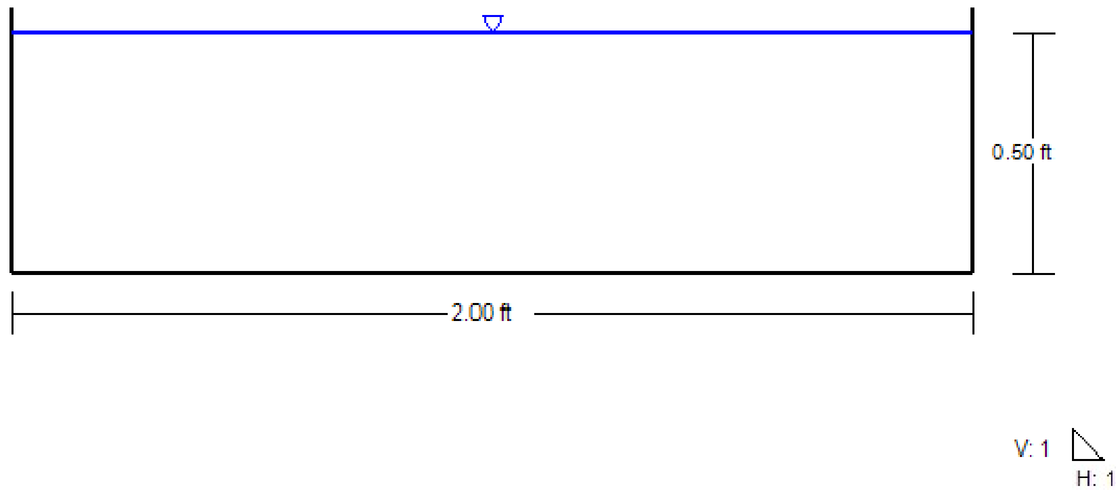
Project Description

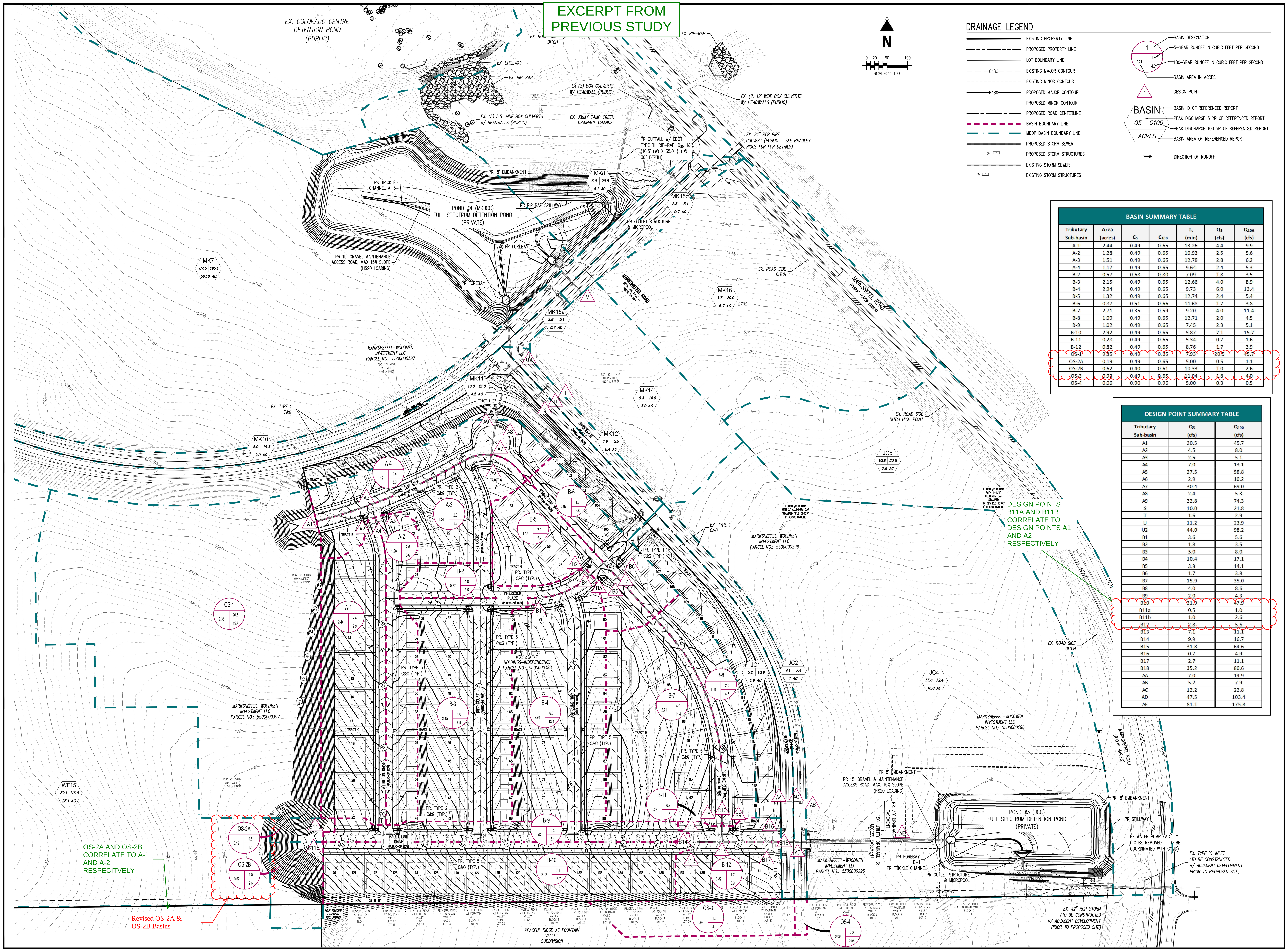
Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00500	ft/ft
Normal Depth	0.50	ft
Bottom Width	2.00	ft
Discharge	3.89	ft³/s

Cross Section Image





BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A-1	2.44	0.49	0.65	13.26	4.4	9.9
A-2	1.28	0.49	0.65	10.93	2.5	5.6
A-3	1.51	0.49	0.65	12.78	2.8	6.2
A-4	1.17	0.49	0.65	9.64	2.4	5.3
B-2	0.57	0.68	0.80	7.09	1.8	3.5
B-3	2.15	0.49	0.65	12.66	4.0	8.9
B-4	2.94	0.49	0.65	9.73	6.0	13.4
B-5	1.32	0.49	0.65	12.74	2.4	5.4
B-6	0.87	0.51	0.66	11.68	1.7	3.8
B-7	2.71	0.35	0.59	9.20	4.0	11.4
B-8	1.09	0.49	0.65	12.71	2.0	4.5
B-9	1.02	0.49	0.65	7.45	2.3	5.1
B-10	2.92	0.49	0.65	5.87	7.1	15.7
B-11	0.28	0.49	0.65	5.34	0.7	1.6
B-12	0.82	0.49	0.65	8.76	1.7	3.9
OS-1	9.35	0.49	0.65	7.93	20.5	45.7
OS-2A	0.19	0.49	0.65	5.00	0.5	1.1
OS-2B	0.62	0.40	0.61	10.33	1.0	2.6
OS-3	0.93	0.49	0.65	11.04	1.8	4.0
OS-4	0.06	0.90	0.96	5.00	0.3	0.5

DESIGN POINT SUMMARY TABLE

Tributary Sub-basin	Q_5 (cfs)	Q_{100} (cfs)
A1	20.5	45.7
A2	4.5	8.0
A3	2.5	5.1
A4	7.0	13.1
A5	27.5	58.8
A6	2.9	10.2
A7	30.4	69.0
A8	2.4	5.3
A9	32.8	74.3
S	10.0	21.8
T	1.6	2.9
U	11.2	23.9
U2	44.0	98.2
B1	3.6	5.6
B2	1.8	3.5
B3	5.0	8.0
B4	10.4	17.1
B5	3.8	14.1
B6	1.7	3.8
B7	15.9	35.0
B8	4.0	8.6
B9	2.0	4.3
B10	21.9	47.9
B11a	0.5	1.0
B11b	1.0	2.6
B12	2.8	5.6
B13	7.1	11.1
B14	9.9	16.7
B15	31.8	64.6
B16	0.7	4.9
B17	2.7	11.1
B18	35.2	80.6
AA	7.0	14.9
AB	5.2	7.9
AC	12.2	22.8
AD	47.5	103.4
AE	81.1	175.8

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GallowayUS.com

NOT FOR CONSTRUCTION

BRADLEY RIDGE FILING NO. 1 KIEMELE SUBDIVISION PROPOSED DRAINAGE MAP FOR RJ DEVELOPMENT

- COLORADO SPRINGS, CO

#	Date	Issue / Description	Init.

Project No:	RJL01.21
Drawn By:	TJE
Checked By:	BAS
Date:	09/08/2023

PROPOSED DRAINAGE MAP

DR-2

APPENDIX C

Hydrologic Computations

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs

Bradley Ridge Filing No. 3
RPG03.20
TJE
BAS
9/12/23

Basin ID	Total Area (ac)	HSG	Paved Roads				Commercial/Future Use				Parks				*School Site				Un-Developed Area/Lawns				< 1/8 Acre Lots				Composite		Basins Total Weighted % Imp.
			% Imp.	C5	C100	Area (ac)	% Imp.	C5	C100	Area (ac)	% Imp.	C5	C100	Area (ac)	% Imp.	C5	C100	Area (ac)	% Imp.	C5	C100	Area (ac)	% Imp.	C5	C100	Area (ac)	C5	C100	
EXISTING CONDITION																													
EX-1	5.30	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	5.30	65	0.49	0.65	0.00	0.16	0.51	2.0
EX-2	5.48	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	5.48	65	0.49	0.65	0.00	0.16	0.51	2.0
EX-3	28.08	D	100	0.90	0.96	0.24	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	27.84	65	0.49	0.65	0.00	0.17	0.51	2.8
EX-4	7.84	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	7.84	65	0.49	0.65	0.00	0.16	0.51	2.0
EX-5	2.85	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	2.85	65	0.49	0.65	0.00	0.16	0.51	2.0
EX OS-1	55.23	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	55.23	65	0.49	0.65	0.00	0.16	0.51	2.0
EX OS-2	25.33	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	25.33	65	0.49	0.65	0.00	0.16	0.51	2.0
MDDP AMENDMENT																													
MK11	4.17	D	100	0.90	0.96	1.37	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.35	65	0.49	0.65	2.45	0.60	0.74	71.2
MK13	14.84	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	14.84	0.49	0.65	65.0
WF12a	13.68	D	100	0.90	0.96	0.44	90	0.84	0.89	0.00	7	0.19	0.52	5.68	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	7.56	0.38	0.61	42.0
WF12b	43.33	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	22.12	2	0.16	0.51	7.95	65	0.49	0.65	13.23	0.43	0.65	48.3
WF12c	29.61	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	29.61	65	0.49	0.65	0.00	0.16	0.51	2.0
WF14	3.50	D	100	0.90	0.96	0.93	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	1.29	65	0.49	0.65	1.28	0.48	0.68	51.1
WF15	25.75	D	100	0.90	0.96	0.00	90	0.84	0.89	2.22	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	23.53	0.52	0.67	67.2
WF17	0.59	D	100	0.90	0.96	0.07	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.52	65	0.49	0.65	0.00	0.25	0.56	13.6
PROPOSED CONDITION																													
A-1	0.20	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.20	0.49	0.65	65.0
A-2	0.45	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.45	0.49	0.65	65.0
B-1	1.79	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	1.79	0.49	0.65	65.0
B-2	1.81	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	1.81	0.49	0.65	65.0
B-3	0.65	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.65	0.49	0.65	65.0
B-4	0.78	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.78	0.49	0.65	65.0
B-5	0.46	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.46	0.49	0.65	65.0
B-6	1.93	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	1.93	0.49	0.65	65.0
B-7	0.78	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.78	0.49	0.65	65.0
B-8	0.09	D	100	0.90	0.96	0.07	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.02	65	0.49	0.65	0.00	0.74	0.86	78.2
B-9	0.14	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.14	0.49	0.65	65.0
B-10	0.52	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.52	0.49	0.65	65.0
C-1	4.25	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.63	65	0.49	0.65	3.62	0.44	0.63	55.7
C-2	1.73	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	1.73	0.49	0.65	65.0
C-3	3.81	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	3.81	0.49	0.65	65.0
C-4	1.74	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	1.74	0.49	0.65	65.0
C-5	0.62	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.62	0.49	0.65	65.0
C-6	0.89	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.89	0.49	0.65	65.0
C-7	1.71	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	1.71	0.49	0.65	65.0
C-8	1.27	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	1.27	0.49	0.65	65.0
C-9	2.22	D	100	0.90	0.96	0.00	90	0.84	0.89	2.22	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.00	0.84	0.89	90.0
C-10	0.84	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	0.84	0.49	0.65	65.0
C-11	1.32	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	1.32	0.49	0.65	65.0
C-12	3.07	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	3.07	0.49	0.65	65.0
C-13	2.28	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.00	65	0.49	0.65	2.28	0.49	0.65	65.0
C-14	12.78	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	12.78	2	0.16	0.51	0.00	65	0.49	0.65	0.00	0.49	0.71	55.0
C-15	22.62	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	9.86	2	0.16	0.51	0.00	65	0.49	0.65	12.76	0.49	0.68	60.6
C-16	6.54	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	1.77	55	0.49	0.71	0.00	2	0.16	0.51	4.77	65	0.49	0.65	0.00	0.17	0.51	3.4
C-17	1.41	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	1.41	65	0.49	0.65	0.00	0.16	0.51	2.0
OS-1	1.25	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	1.25	65	0.49	0.65	0.00	0.16	0.51	2.0
OS-2	0.17	D	100	0.90	0.96	0.00	90	0.84	0.89	0.00	7	0.19	0.52	0.00	55	0.49	0.71	0.00	2	0.16	0.51	0.17	65	0.49	0.65	0.00	0.16	0.51	2.0

NOTE:
* Imperviousness value taken from the MHFD USDCM Volume 1, Table 6-3
Runoff coefficients were caluclated using MHFD USDCM Volume 1, Table 6-4

Galloway

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs

Project Name: Bradley Ridge Filing No. 3
Project No.: RPG03.20
Calculated By: TJE
Checked By: BAS
Date: 9/12/23

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)
EXISTING CONDITION																	
EX-1	5.30	D	2.0	0.51	0.16	300	7.2	15.4	510	7.2	10.0	2.7	3.2	18.6	810.0	14.5	14.5
EX-2	5.48	D	2.0	0.51	0.16	300	7.0	15.6	382	7.0	10.0	2.6	2.4	18.0	682.0	13.8	13.8
EX-3	28.08	D	2.8	0.51	0.17	300	6.0	16.3	1286	4.5	10.0	2.1	10.1	26.4	1586.0	18.8	18.8
EX-4	7.84	D	2.0	0.51	0.16	300	5.7	16.7	864	5.7	15.0	3.6	4.0	20.7	1164.0	16.5	16.5
EX-5	2.85	D	2.0	0.51	0.16	300	6.0	16.4	239	2.2	15.0	2.2	1.8	18.2	539.0	13.0	13.0
EX OS-1	55.23	D	2.0	0.51	0.16	300	6.0	16.4	2290	2.9	15.0	2.6	14.9	31.4	2590.0	24.4	24.4
EX OS-2	25.33	D	2.0	0.51	0.16	300	5.6	16.8	1598	3.1	15.0	2.6	10.1	26.9	1898.0	20.5	20.5
MDDP AMENDMENT																	
MK11	4.17	D	71.2	0.74	0.60	75	5.0	4.7	1330	4.0	20.0	4.0	5.5	10.2	1405.0	17.8	10.2
MK13	14.84	D	65.0	0.65	0.49	100	5.0	6.5	1425	3.0	20.0	3.5	6.9	13.4	1525.0	18.5	13.4
WF12a	13.68	D	42.0	0.61	0.38	100	5.0	7.7	2082	4.0	20.0	4.0	8.7	16.4	2182.0	22.1	16.4
WF12b	43.33	D	48.3	0.65	0.43	100	5.0	7.2	1343	2.0	20.0	2.8	7.9	15.1	1443.0	18.0	15.1
WF12c	29.61	D	2.0	0.51	0.16	300	5.0	17.4	1432	3.0	7.0	1.2	19.7	37.1	1732.0	19.6	19.6
WF14	3.50	D	51.1	0.68	0.48	50	5.0	4.7	1050	4.6	20.0	4.3	4.1	8.8	1100.0	16.1	8.8
WF15	25.75	D	67.2	0.67	0.52	100	5.0	6.2	1645	4.0	20.0	4.0	6.9	13.1	1745.0	19.7	13.1
WF17	0.59	D	13.6	0.56	0.25	20	5.0	4.1	118	1.0	20.0	2.0	1.0	5.1	138.0	10.8	5.1
PROPOSED CONDITION																	
A-1	0.20	D	65.0	0.65	0.49	42	4.4	4.4	130	3.8	20.0	3.9	0.6	5.0	172.0	11.0	5.0
A-2	0.45	D	65.0	0.65	0.49	100	2.0	8.9	163	3.8	20.0	3.9	0.7	9.6	263.0	11.5	9.6
B-1	1.79	D	65.0	0.65	0.49	100	3.5	7.4	495	2.1	20.0	2.9	2.9	10.3	595.0	13.3	10.3
B-2	1.81	D	65.0	0.65	0.49	53	5.4	4.6	584	1.5	20.0	2.4	4.0	8.6	637.0	13.5	8.6
B-3	0.65	D	65.0	0.65	0.49	50	2.0	6.3	396	1.5	20.0	2.4	2.7	9.0	446.0	12.5	9.0
B-4	0.78	D	65.0	0.65	0.49	50	2.0	6.3	311	4.0	20.0	4.0	1.3	7.6	361.0	12.0	7.6
B-5	0.46	D	65.0	0.65	0.49	13	7.0	2.1	672	5.0	20.0	4.5	2.5	4.6	685.1	13.8	5.0
B-6	1.93	D	65.0	0.65	0.49	72	1.9	7.6	684	1.8	20.0	2.7	4.2	11.9	756.3	14.2	11.9
B-7	0.78	D	65.0	0.65	0.49	23	2.3	4.1	435	1.0	20.0	2.0	3.6	7.7	458.2	12.5	7.7
B-8	0.09	D	78.2	0.86	0.74	34	5.6	2.2	75	0.9	20.0	1.9	0.7	2.9	109.2	10.6	5.0
B-9	0.14	D	65.0	0.65	0.49	67	2.5	6.7	56	0.7	20.0	1.7	0.5	7.3	123.3	10.7	7.3
B-10	0.52	D	65.0	0.65	0.49	81	6.2	5.5	0	1.0	20.0	2.0	0.0	5.5	81.0	10.5	5.5
C-1	4.25	D	55.7	0.63	0.44	100	2.0	9.6	1105	2.2	20.0	3.0	6.2	15.8	1205.0	16.7	15.8
C-2	1.73	D	65.0	0.65	0.49	100	2.0	8.9	1105	2.2	20.0	3.0	6.2	15.1	1205.0	16.7	15.1
C-3	3.81	D	65.0	0.65	0.49	100	2.0	8.9	945	2.4	20.0	3.1	5.1	13.9	1045.0	15.8	13.9
C-4	1.74	D	65.0	0.65	0.49	100	2.0	8.9	945	2.4	20.0	3.1	5.1	13.9	1045.0	15.8	13.9
C-5	0.62	D	65.0	0.65	0.49	100	2.0	8.9	558	1.5	20.0	2.4	3.8	12.7	658.0	13.7	12.7
C-6	0.89	D	65.0	0.65	0.49	100	2.0	8.9	420	1.5	20.0	2.4	2.9	11.7	520.0	12.9	11.7
C-7	1.71	D	65.0	0.65	0.49	100	2.0	8.9	370	1.0	20.0	2.0	3.1	11.9	470.0	12.6	11.9
C-8	1.27	D	65.0	0.65	0.49	100	2.0	8.9	370	1.0	20.0	2.0	3.1	11.9	470.0	12.6	11.9
C-9	2.22	D	90.0	0.89	0.84	100	3.0	3.3	612	2.0	20.0	2.8	3.6	6.9	712.0	14.0	6.9
C-10	0.84	D	65.0	0.65	0.49	50	5.0	4.6	443	1.0	20.0	2.0	3.7	8.3	493.0	12.7	8.3
C-11	1.32	D	65.0	0.65	0.49	100	2.0	8.9	443	1.0	20.0	2.0	3.7	12.6	543.0	13.0	12.6
C-12	3.07	D	65.0	0.65	0.49	13	2.0	3.2	1030	2.3	20.0	3.0	5.7	8.9	1043.0	15.8	8.9
C-13	2.28	D	65.0	0.65	0.49	13	2.0	3.2	888	2.3	20.0	3.0	4.9	8.1	901.0	15.0	8.1
C-14	12.78	D	55.0	0.71	0.49	100	4.5	6.8	1062	3.2	15.0	2.7	6.6	13.4	1162.0	16.5	13.4

Galloway

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs

Project Name: Bradley Ridge Filing No. 3
Project No.: RPG03.20
Calculated By: TJE
Checked By: BAS
Date: 9/12/23

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)
C-15	22.62	D	60.6	0.68	0.49	100	10.0	5.2	1960	2.0	15.0	2.1	15.4	20.6	2060.0	21.4	20.6
C-16	6.54	D	3.4	0.51	0.17	100	2.0	13.5	906	0.5	20.0	1.4	10.7	24.2	1006.0	15.6	15.6
C-17	1.41	D	2.0	0.51	0.16	45	30.0	3.7	0	0.0	10.0	0.0	0.0	3.7	45.0	10.3	5.0
OS-1	1.25	D	2.0	0.51	0.16	56	20.0	4.7	0	0.0	15.0	0.0	0.0	4.7	56.0	10.3	5.0
OS-2	0.17	D	2.0	0.51	0.16	56	20.0	4.7	0	0.0	15.0	0.0	0.0	4.7	56.0	10.3	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)

Project Name: Bradley Ridge Filing No. 3
Subdivision: Bradley Ridge Filing No. 3 **Project No.:** RPG03.20
Location: CO, Colorado Springs **Calculated By:** TJE
Design Storm: 5-Year **Checked By:** BAS
Date: 9/12/23

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF CAPTURED				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)	
EXISTING CONDITION																					
		EX-1	5.30	0.16	14.5	0.85	3.57	3.0													Sheet flows to Bradley Ridge Dr. ROW
		EX-2	5.48	0.16	13.8	0.88	3.65	3.2													Sheet flows to Bradley Ridge Filing No. 1
		EX-3	28.08	0.17	18.8	4.67	3.18	14.9													
	AF	WF10	1.56					4.2				4.2									Values from MDDP Ex. Public COS D-10-R Inlet
	AG	WF11	1.08					5.9				5.9									Values from MDDP Ex. Public COS D-10-R Inlet
	AH											10.1									Combined flows of WF10 & WF11 - From MDDP
	1	EX OS-2	25.33	0.16	20.5	4.05	3.05	12.4				22.5									Combined flows of DP AH & Basins EX-3, OS-2
	2	EX-4	7.84	0.16	16.5	1.25	3.38	4.2				26.7									Combined flows of DP 1 & Basin EX-4
		EX OS-1	55.23	0.16	24.4	8.84	2.79	24.7													
	3	EX-5	2.85	0.16	13.0	0.46	3.74	1.7				26.4									Combined flows of Basins OS-1 & EX-5

Galloway

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

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs
Design Storm: 5-Year

Project Name: Bradley Ridge Filing No. 3
Project No.: RPG03.20
Calculated By: TJE
Checked By: BAS
Date: 9/12/23

		DIRECT RUNOFF							TOTAL RUNOFF CAPTURED				STREET		PIPE			TRAVEL TIME			
STREET	Design Point	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
MDDP AMENDMENT																					
	S	MK11	4.17	0.60	10.2	2.49	4.10	10.2				10.2									Basin Amended by this Report
	T	MK12	0.38					1.6				1.6									Values per MDDP by Matrix, Dated April 2022
	U											11.8									Combined flows of DP S & T
		MK13	14.84	0.49	13.4	7.27	3.69	26.8													Basin Amended by this Report
	U2											38.6									Combined flows of DP U & Basin MK13
	AF	WF10	1.56					5.9				5.9									Values per MDDP by Matrix, Dated April 2022
	AG	WF11	1.08					4.2				4.2									Values per MDDP by Matrix, Dated April 2022
	AH											10.1									
		WF12a	13.68	0.38	16.4	5.18	3.39	17.6													Basin Amended by this Report
	AI											27.7									
		WF15	25.75	0.52	13.1	13.39	3.73	49.9													Basin Amended by this Report
	AK1											77.6									Combined flows of Basins WF12b & WF15
	AJ1	WF13	1.03					4.1				4.1									Values per MDDP by Matrix, Dated April 2022
	AJ2	WF14	3.50	0.48	8.8	1.67	4.32	7.2				7.2									Basin Amended by this Report
	AK2											88.9									Combined flows of DP's: AK1, AI & AJ
	AL	WF16	0.09					0.4				0.4									Values per MDDP by Matrix, Dated April 2022
	AM	WF17	0.59	0.25	5.1	0.15	5.15	0.8				0.8									Basin Amended by this Report
	AN											1.2									Combined flows of DP AL & AM
	AO1											90.1									Combined flows of DP AK2 & AN
		WF12b	43.33	0.43	15.1	18.51	3.51	65.0													Basin Amended by this Report
		WF12c	29.61	0.16	19.6	4.74	3.12	14.8													Off-site Basin
	AO2											79.8									
	AP											169.9									Combined flows of DP AO & Basins WF12a, WF12c
	WF2											33.8									Release flows from Pond #2 WFJCC

Galloway

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

Project Name: Bradley Ridge Filing No. 3
Subdivision: Bradley Ridge Filing No. 3
Project No.: RPG03.20
Location: CO, Colorado Springs
Calculated By: TJE
Design Storm: 5-Year
Checked By: BAS
Date: 9/12/23

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF CAPTURED				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)	
PROPOSED CONDITION																					
Fault Line Drive.	A1	A-1	0.20	0.49	5.0	0.10	5.17	0.5				0.5									Flows to east - into Bradley Ridge Filing No. 1 Flows to Inlet B12 (Bradley Ridge Filing No.1)
		OS-2	0.17	0.16	5.0	0.03	5.17	0.2													
Fault Line Drive.	A2	A-2	0.45	0.49	9.6	0.22	4.20	0.9				1.1									Flows to east - into Bradley Ridge Filing No. 1 Total runoff of Basin OS-2 & A-2 to Filing 1 B13
Graben St.	B1	B-1	1.79	0.49	10.3	0.88	4.09	3.6					2.08	0.0	3.6						Pr. Public (4'x10') COS D-10-R Inlet (At-Grade) Qcap=3.6 cfs, Qco=0 cfs to DP B6
Blueschist Dr.	B2	B-2	1.81	0.49	8.6	0.89	4.35	3.9					1.5	0.0	3.9						Pr. Public (4'x14') COS D-10-R Inlet (At-Grade) Qcap=3.9 cfs, Qco=0 cfs to DP B6
	B3	B-3	0.65	0.49	9.0	0.32	4.29	1.4					1.5	0.0	1.4						Pr. Public (4'x8') COS D-10-R Inlet (At-Grade) Qcap=1.4 cfs, Qco=0 cfs to DP B6
	B4 B5														5.3 8.9						Combined flow of DP B2 & B3 Combined flow of DP B1 & B4
Strike Slip Way	B6	B-4	0.78	0.49	7.6	0.38	4.55	1.7				0.0	4.0	0.0	1.7						Pr. Public (4'x10') COS D-10-R Inlet (At-Grade) Qcap=1.7 cfs, Qco=0 cfs
Strike Slip Way	B7	B-5	0.46	0.49	5.0	0.23	5.17	1.2					5.0	0.0	1.2						Pr. Public (4'x8') COS D-10-R Inlet (At-Grade) Qcap=1.2 cfs, Qco=0 cfs
	B8														11.8						Combined flow of DP B5, B6 & B7
Strike Slip Way	B9	B-6	1.93	0.49	11.9	0.95	3.87	3.7					1.8	0.0	3.7						Pr. Public (4'x14') COS D-10-R Inlet (At-Grade) Qcap=3.7 cfs, Qco=0 cfs
Strike Slip Way	B10	B-7	0.78	0.49	7.7	0.38	4.53	1.7					1.0	0.0	1.7						Pr. Public (4'x8') COS D-10-R Inlet (At-Grade) Qcap=1.7 cfs, Qco=0 cfs
	B11 B12														5.4 17.2						Combined flow of DP B9 & B10 Combined flow of DP B8 & B11
		B-8	0.09	0.74	5.0	0.07	5.17	0.4													Sheet flows east - into Bradley Ridge Filing No. 1
		B-9	0.14	0.49	7.3	0.07	4.60	0.3													Sheet flows east - into Bradley Ridge Filing No. 1
		B-10	0.52	0.49	5.5	0.25	5.03	1.3													Sheet flows east - into Bradley Ridge Filing No. 1

Galloway

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

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs
Design Storm: 5-Year

Project Name: Bradley Ridge Filing No. 3
Project No.: RPG03.20
Calculated By: TJE
Checked By: BAS
Date: 9/12/23

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF CAPTURED				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)	
		OS-1	1.25	0.16	5.0	0.20	5.17	1.0													
Fault Line Drive.	C1	C-1	4.25	0.44	15.8	1.87	3.45	6.5				7.5	2.2	0.0	7.5						Pr. Public (4'x16') COS D-10-R Inlet (At-Grade) Qcap=7.5 cfs, Qco=0 cfs to DP C8
Strike Slip Way	C2	C-2	1.73	0.49	15.1	0.85	3.51	3.0					2.2	0.0	3.0						Pr. Public (4'x12') COS D-10-R Inlet (At-Grade) Qcap=3 cfs, Qco=0 cfs to DP C9
Fault Line Drive.	C3														10.5						Combined flow of DP C1 & C2
Fault Line Drive.	C4	C-3	3.81	0.49	13.9	1.87	3.63	6.8					2.4	0.9	5.9						Pr. Public (4'x10') COS D-10-R Inlet (At-Grade) Qcap=5.9 cfs, Qco=0.9 cfs to DP C9
Tuff Rd.	C5	C-4	1.74	0.49	13.9	0.85	3.63	3.1					2.4	0.0	3.1						Pr. Public (4'x10') COS D-10-R Inlet (At-Grade) Qcap=3.1 cfs, Qco=0 cfs to DP C9
	C6														9.0						Combined flow of DP C4 & C5
	C7														19.5						Combined flow of DP C3 & C6
Tuff Rd.	C8	C-5	0.62	0.49	12.7	0.30	3.78	1.1				1.1	1.5	0.0	1.1						Pr. Public (4'x10') COS D-10-R Inlet (At-Grade) Qcap=1.1 cfs, Qco=0 cfs to DP C19
Fault Line Drive.	C9	C-6	0.89	0.49	11.7	0.44	3.89	1.7				2.6	1.5	0.0	2.8						Pr. Public (4'x10') COS D-10-R Inlet (At-Grade) Qcap=2.8 cfs, Qco=0 cfs to DP C19
	C10														23.4						Combined flow of DP C7, C8 & C9
Blueschist Dr.	C11	C-7	1.71	0.49	11.9	0.84	3.86	3.2					1.00	0.0	3.2						Pr. Public (4'x8') COS D-10-R Inlet (Sump)
Future Development	C12	C-8	1.27	0.49	11.9	0.62	3.86	2.4					1.0	0.0	2.4						Pr. Public (4'x8') COS D-10-R Inlet (Sump)
	C13														5.6						Combined flow of DP C11 & C12
Strike Slip Way	C14	C-9	2.22	0.84	6.9	1.86	4.68	8.7					2.0	0.0	8.7						Pr. Public CDOT Type 'C' Inlet (Sump)
	C14a														14.3						Combined piped flow of DP C14 & C13
Strike Slip Way	C15	C-10	0.84	0.49	8.3	0.41	4.41	1.8					1.0	0.0	1.8						Pr. Public (4'x6') COS D-10-R Inlet (At-Grade) Qcap=1.8 cfs, Qco=0 cfs to DP C20
Blueschist Dr.	C16	C-11	1.32	0.49	12.6	0.65	3.79	2.5					1.0	0.2	2.3						Pr. Public (4'x6') COS D-10-R Inlet (At-Grade) Qcap=2.3 cfs, Qco=0.2 cfs to DP C20
	C17														4.1						Combined flow of DP C15 & C16
	C18														41.8						Combined flow of DP C10, C14a & C17
Proposed Pond	C19	C-12	3.07	0.49	8.9	1.50	4.30	6.5				6.5	2.3	0.0	6.5						Pr. Public (4'x16') COS D-10-R Inlet (At-Grade) Qcap=6.5 cfs, Qco=0 cfs to DP AJ2
Off site 1	C20	C-13	2.28	0.49	8.1	1.12	4.45	5.0				5.2	2.3	0.0	5.3						Pr. Public (4'x14') COS D-10-R Inlet (At-Grade) Qcap=5.3 cfs, Qco=0 cfs to DP AJ2
	C21														53.6						Combined flow of DP C18, C19 & C20
	AF	WF10	1.60					5.9							5.9						Values taken from MDDP Ex. Public COS D-10-R Inlet (Sump)
	AG	WF11	1.10					4.2							4.2						Values taken from MDDP Ex. Public COS D-10-R Inlet (Sump)
	AH														10.1						Values taken from MDDP
	AI	WF12a	13.68	0.38	16.4	5.18	3.39	17.6							27.7						Future Bradley Ridge Filings Combined Flows of DP AH & Basin WF12a
	AK1														81.3						Combined flows of DP AI & C21

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

Project Name: Bradley Ridge Filing No. 3
Project No.: RPG03.20
Calculated By: TJE
Checked By: BAS
Date: 9/12/23

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs
Design Storm: 5-Year

		DIRECT RUNOFF							TOTAL RUNOFF CAPTURED				STREET		PIPE			TRAVEL TIME			
STREET	Design Point	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
	AJ1	WF13	1.00					4.1						0.0	4.1						Pr. Public (4'x10') COS D-10-R Inlet (Sump)
	AJ2	WF14	3.50	0.48	8.8	1.67	4.32	7.2				7.2		0.0	7.2						Pr. Public (4'x16') COS D-10-R Inlet (Sump)
	AK2														92.6						Combined flows of DP AK1, AJ1 & AJ2
	AL	WF16	0.10					0.4						0.0	0.4						Pr. Public (4'x6') COS D-10-R Inlet (At-Grade) Qcap=0.4 cfs, Qco=0 cfs
	AM	WF17	0.59	0.25	5.1	0.15	5.15	0.8						0.0	0.8						Pr. Public (4'x6') COS D-10-R Inlet (At-Grade) Qcap=0.8 cfs, Qco=0 cfs
	AN														1.2						Combined flow of DP AL & AM
	AO1														93.8						Combined flow of DP AK2 & AN
	AO2	C-14	12.78	0.49	13.4	6.21	3.69	22.9							40.5						East Half of School Site Combined Flow of C-14 & WF12a in Interim
		WF12c	29.61	0.16	19.6	4.74	3.12	14.8													Western off-site Existing Flows
	AO3	C-15	22.62	0.49	20.6	11.04	3.04	33.6							48.4						West Half of School Site & Bradley Ridge Filing 6 Combined Flow of C-15 & WF12c
		C-16	6.54	0.17	15.6	1.10	3.46	3.8													Opend Space & Pond #2
	AP														186.4						Total flows captured by WFJCC Pond #2
	WF2														33.8						WFJCC Pond #2 Release rate (per MHFD Detention)
		C-17	1.41	0.16	5.0	0.23	5.17	1.2													

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

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Bradley Ridge Filing No. 3
Project No.: RPG03.20
Calculated By: TJE
Checked By: BAS
Date: 9/12/23

		DIRECT RUNOFF							TOTAL RUNOFF CAPTURED				STREET		PIPE			TRAVEL TIME			
STREET	Design Point	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
EXISTING CONDITION																					
		EX-1	5.30	0.51	14.5	2.70	6.00	16.2													Sheet flows to Bradley Ridge Dr. ROW
		EX-2	5.48	0.51	13.8	2.79	6.12	17.1													Sheet flows to Bradley Ridge Filing No. 1
		EX-3	28.08	0.51	18.8	14.43	5.34	77.1													
	AF	WF10	1.56					10.8				10.8									Values from MDDP Ex. Public COS D-10-R Inlet
	AG	WF11	1.08					7.6				7.6									Values from MDDP Ex. Public COS D-10-R Inlet
	AH											18.4									Combined flows of WF10 & WF11 - From MDDP
	1	EX OS-2	25.33	0.51	20.5	12.92	5.12	66.2				84.6									Combined flows of DP AH & Basins EX-3, OS-2
	2	EX-4	7.84	0.51	16.5	4.00	5.68	22.7				107.3									Combined flows of DP 1 & Basin EX-4
		EX OS-1	55.23	0.51	24.4	28.17	4.69	132.1													
	3	EX-5	2.85	0.51	13.0	1.45	6.27	9.1				141.2									Combined flows of Basins OS-1 & EX-5

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

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Bradley Ridge Filing No. 3
Project No.: RPG03.20
Calculated By: TJE
Checked By: BAS
Date: 9/12/23

		DIRECT RUNOFF							TOTAL RUNOFF CAPTURED				STREET		PIPE			TRAVEL TIME			
STREET	Design Point	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
MDDP AMENDMENT																					
	S	MK11	4.17	0.60	10.2	2.49	6.88	17.1				17.1									Basin Amended by this Report
	T	MK12	0.38					2.9				2.9									Values per MDDP by Matrix, Dated April 2022
	U											20.0									Combined flows of DP S & T
		MK13	14.84	0.49	13.4	7.27	6.20	45.1													Basin Amended by this Report
	U2											65.1									Combined flows of DP U & Basin MK13
	AF	WF10	1.56					10.8				10.8									Values per MDDP by Matrix, Dated April 2022
	AG	WF11	1.08					7.6				7.6									Values per MDDP by Matrix, Dated April 2022
	AH											18.4									
		WF12a	13.68	0.38	16.4	5.18	5.69	29.5													Basin Amended by this Report
	AI											47.9									
		WF15	25.75	0.52	13.1	13.39	6.26	83.8													Basin Amended by this Report
	AK1											131.7									Combined flows of Basins WF12b & WF15
	AJ1	WF13	1.03					7.5				7.5									Values per MDDP by Matrix, Dated April 2022
	AJ2	WF14	3.50	0.48	8.8	1.67	7.26	12.1				12.1									Basin Amended by this Report
	AK2											151.3									Combined flows of DP's: AK1, AI & AJ
	AL	WF16	0.09					0.7				0.7									Values per MDDP by Matrix, Dated April 2022
	AM	WF17	0.59	0.25	5.1	0.15	8.65	1.3				1.3									Basin Amended by this Report
	AN											2.0									Combined flows of DP AL & AM
	AO1											153.3									Combined flows of DP AK2 & AN
		WF12b	43.33	0.43	15.1	18.51	5.89	109.0													Basin Amended by this Report
		WF12c	29.61	0.16	19.6	4.74	5.23	24.8													Off-site Basin
	AO2											133.8									
	AP											287.1									Combined flows of DP AO & Basins WF12a, WF12c
	WF2											166.5									Release flows from Pond #2 WFJCC

Galloway

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

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Bradley Ridge Filing No. 3
Project No.: RPG03.20
Calculated By: TJE
Checked By: BAS
Date: 9/12/23

		DIRECT RUNOFF							TOTAL RUNOFF CAPTURED				STREET		PIPE			TRAVEL TIME			
STREET	Design Point	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
PROPOSED CONDITION																					
Fault Line Drive.	A1	A-1	0.20	0.49	5.0	0.10	8.68	0.9				0.9									Flows to east - into Bradley Ridge Filing No. 1 Flows to Inlet B12 (Bradley Ridge Filing No.1)
Fault Line Drive.		OS-2	0.17	0.16	5.0	0.03	8.68	0.3													
Graben St.	A2	A-2	0.45	0.49	9.6	0.22	7.05	1.6				1.8									Flows to east - into Bradley Ridge Filing No. 1 Total runoff of Basin OS-2 & A-2 to Filing 1 B13
Blueschist Dr.	B1	B-1	1.79	0.49	10.3	0.88	6.87	6.0					2.1	0.7	5.3						Pr. Public (4'x10') COS D-10-R Inlet (At-Grade) Qcap=5.3 cfs, Qco=0.7 cfs to DP B6
	B2	B-2	1.81	0.49	8.6	0.89	7.31	6.5					1.5	0.1	6.4						Pr. Public (4'x12') COS D-10-R Inlet (At-Grade) Qcap=6.4 cfs, Qco=0.1 cfs to DP B6
Strike Slip Way	B3	B-3	0.65	0.49	9.0	0.32	7.21	2.3					1.5	0.0	2.3						Pr. Public (4'x8') COS D-10-R Inlet (At-Grade) Qcap=2.3 cfs, Qco=0 cfs to DP B6
	B4														8.7						Combined flow of DP B2 & B3
Strike Slip Way	B5														14.0						Combined flow of DP B1 & B4
Strike Slip Way	B6	B-4	0.78	0.49	7.6	0.38	7.64	2.9				3.8	4.0	0.0	3.8						Pr. Public (4'x10') COS D-10-R Inlet (At-Grade) Qcap=3.8 cfs, Qco=0 cfs
Strike Slip Way	B7	B-5	0.46	0.49	5.0	0.23	8.68	2.0					5.0	0.0	2.0						Pr. Public (4'x8') COS D-10-R Inlet (At-Grade) Qcap=2 cfs, Qco=0 cfs
Strike Slip Way	B8														19.8						Combined flow of DP B5, B6 & B7
Fault Line Drive.	B9	B-6	1.93	0.49	11.9	0.95	6.50	6.2					1.8	0.0	6.2						Pr. Public (4'x14') COS D-10-R Inlet (At-Grade) Qcap=6.2 cfs, Qco=0 cfs
Strike Slip Way	B10	B-7	0.78	0.49	7.7	0.38	7.60	2.9					1.0	0.0	2.9						Pr. Public (4'x8') COS D-10-R Inlet (At-Grade) Qcap=2.9 cfs, Qco=0 cfs
	B11														9.1						Combined flow of DP B9 & B10
	B12														28.9						Combined flow of DP B8 & B11
Fault Line Drive.		B-8	0.09	0.74	5.0	0.07	8.68	0.6													Sheet flows east - into Bradley Ridge Filing No. 1
Fault Line Drive.		B-9	0.14	0.49	7.3	0.07	7.73	0.5													Sheet flows east - into Bradley Ridge Filing No. 1
Fault Line Drive.		B-10	0.52	0.49	5.5	0.25	8.45	2.1													Sheet flows east - into Bradley Ridge Filing No. 1

Galloway

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

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Bradley Ridge Filing No. 3
Project No.: RPG03.20
Calculated By: TJE
Checked By: BAS
Date: 9/12/23

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF CAPTURED				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)	
Tuff Rd.		OS-1	1.25	0.16	5.0	0.20	8.68	1.7													
Tuff Rd.	C1	C-1	4.25	0.44	15.8	1.87	5.79	10.8				12.6	2.2	1.3	11.3						Pr. Public (4'x16') COS D-10-R Inlet (At-Grade) Qcap=11.3 cfs, Qco=1.3 cfs to DP C8
Fault Line Drive.	C2	C-2	1.73	0.49	15.1	0.85	5.90	5.0					2.2	0.0	5.0						Pr. Public (4'x12') COS D-10-R Inlet (At-Grade) Qcap=5 cfs, Qco=0 cfs to DP C9
Blueschist Dr.	C3														16.3						Combined flow of DP C1 & C2
Future Development	C4	C-3	3.81	0.49	13.9	1.87	6.09	11.4					2.4	3.4	8.0						Pr. Public (4'x10') COS D-10-R Inlet (At-Grade) Qcap=8 cfs, Qco=3.4 cfs to DP C9
Strike Slip Way	C5	C-4	1.74	0.49	13.9	0.85	6.09	5.2					2.4	0.2	5.0						Pr. Public (4'x10') COS D-10-R Inlet (At-Grade) Qcap=5 cfs, Qco=0.2 cfs to DP C9
	C6														13.0						Combined flow of DP C4 & C5
Strike Slip Way	C7														29.3						Combined flow of DP C3 & C6
Blueschist Dr.	C8	C-5	0.62	0.49	12.7	0.30	6.34	1.9				3.2	1.5	0.0	3.3						Pr. Public (4'x10') COS D-10-R Inlet (At-Grade) Qcap=3.3 cfs, Qco=0 cfs to DP A4
Proposed Pond	C9	C-6	0.89	0.49	11.7	0.44	6.53	2.9				6.5	1.5	0.4	6.1						Pr. Public (4'x10') COS D-10-R Inlet (At-Grade) Qcap=6.1 cfs, Qco=0.4 cfs to DP C9
Off site 1	C10														38.7						Combined flow of DP C7, C8 & C9
Off site 2	C11	C-7	1.71	0.49	11.9	0.84	6.48	5.4					1.0	0.0	5.4						Pr. Public (4'x8') COS D-10-R Inlet (Sump)
	C12	C-8	1.27	0.49	11.9	0.62	6.48	4.0					1.0	0.0	4.0						Pr. Public (4'x8') COS D-10-R Inlet (Sump)
	C13														9.4						Combined flow of DP C11 & C12
	C14	C-9	2.22	0.84	6.9	1.86	7.86	14.6					2.0	0.0	14.6						Pr. Public CDOT Type 'C' Inlet (Sump)
	C14a														24.0						Combined piped flow of DP C14 & C13
	C15	C-10	0.84	0.49	8.3	0.41	7.40	3.0					1.0	0.4	2.6						Pr. Public (4'x6') COS D-10-R Inlet (At-Grade) Qcap=2.6 cfs, Qco=0.4 cfs to DP C20
	C16	C-11	1.32	0.49	12.6	0.65	6.36	4.1					1.0	0.9	3.2						Pr. Public (4'x6') COS D-10-R Inlet (At-Grade) Qcap=3.2 cfs, Qco=0.9 cfs to DP C20
	C17														5.8						Combined flow of DP C15 & C16
	C18														68.5						Combined flow of DP C10, C14a & C17
	C19	C-12	3.07	0.49	8.9	1.50	7.22	10.8				11.2	2.3	0.1	11.1						Pr. Public (4'x16') COS D-10-R Inlet (At-Grade) Qcap=11.1 cfs, Qco=0.1 cfs to DP AJ2
	C20	C-13	2.28	0.49	8.1	1.12	7.47	8.4				9.7	2.3	0.6	9.1						Pr. Public (4'x14') COS D-10-R Inlet (At-Grade) Qcap=9.1 cfs, Qco=0.6 cfs to DP AJ2
	C21														88.7						Combined flow of DP C18, C19 & C20
	AF	WF10	1.60					10.8							10.8						Values taken from MDDP Ex. Public COS D-10-R Inlet (Sump)
	AG	WF11	1.10					7.6							7.6						Values taken from MDDP Ex. Public COS D-10-R Inlet (Sump)
	AH														18.4						Values taken from MDDP
	AI	WF12a	13.68	0.38	16.4	5.18	5.69	29.5							47.9						Future Bradley Ridge Filings Combined Flows of DP AH & Basin WF12a
	AK1														136.6						Combined flows of DP AI & C21

Galloway

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

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Bradley Ridge Filing No. 3
Project No.: RPG03.20
Calculated By: TJE
Checked By: BAS
Date: 9/12/23

		DIRECT RUNOFF							TOTAL RUNOFF CAPTURED				STREET		PIPE			TRAVEL TIME			
STREET	Design Point	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
	AJ1	WF13	1.00					7.5						0.0	7.5						Pr. Public (4'x10') COS D-10-R Inlet (Sump)
	AJ2	WF14	3.50	0.48	8.8	1.67	7.26	12.1				12.8		0.0	14.4						Pr. Public (4'x16') COS D-10-R Inlet (Sump)
	AK2														158.5						Combined flows of DP AK1, AJ1 & AJ2
	AL	WF16	0.10					0.7						0.0	0.7						Pr. Public (4'x6') COS D-10-R Inlet (At-Grade) Qcap=0.7 cfs, Qco=0 cfs
	AM	WF17	0.59	0.25	5.1	0.15	8.65	1.3						-0.1	1.4						Pr. Public (4'x6') COS D-10-R Inlet (At-Grade) Qcap=1.4 cfs, Qco=-0.1 cfs
	AN														2.1						Combined flow of DP AL & AM
	AO1														160.6						Combined flow of DP AK2 & AN
	AO2	C-14	12.78	0.49	13.4	6.21	6.19	38.4							67.9						East Half of School Site Combined Flow of C-14 & WF12a in Interim
		WF12c	29.61	0.16	19.6	4.74	5.23	24.8													Western off-site Existing Flows
	AO3	C-15	22.62	0.49	20.6	11.04	5.11	56.4							81.2						West Half of School Site & Bradley Ridge Filing 6 Combined Flow of C-15 & WF12c
		C-16	6.54	0.17	15.6	1.10	5.81	6.4													Opend Space & Pond #2
	AP														316.1						Total flows captured by WFJCC Pond #2
	WF2														33.8						WFJCC Pond #2 Release rate (per MHFD Detention)
		C-17	1.41	0.16	5.0	0.23	8.68	2.0													

Galloway

APPENDIX D

Hydraulic Computations

Inlet Sizing Computations

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP B1 (Basin B-1)	DP B2 (Basin B-2)	DP B3 (Basin B-3)	DP B6 (Basin B-4)	DP B7 (Basin B-5)	DP B9 (Basin B-6)	DP B10 (Basin B-7)
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	On Grade	On Grade	On Grade	On Grade
Inlet Type	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	3.6	3.9	1.4	1.7	1.2	3.7	1.7
Major Q_{Known} (cfs)	6.0	6.5	2.3	2.9	2.0	6.2	2.9

RECEIVES BYPASS FROM B1,B2

Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	User-Defined	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.8	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)							
Percent Impervious							
NRCS Soil Type							

Watershed Profile

Overland Slope (ft/ft)							
Overland Length (ft)							
Channel Slope (ft/ft)							
Channel Length (ft)							

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)							
One-Hour Precipitation, P_1 (inches)							

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)							
One-Hour Precipitation, P_1 (inches)							

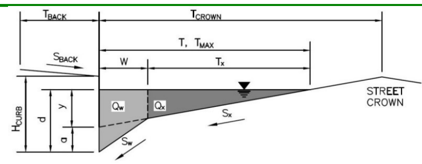
CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**3.6**	**3.9**	**1.4**	**1.7**	**1.2**	**3.7**	**1.7**
Major Total Design Peak Flow, Q (cfs)	**6.0**	**6.5**	**2.3**	**3.7**	**2.0**	**6.2**	**2.9**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.7	0.1	0.0	0.0	0.0	0.0	0.1

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

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

Project: Bradley Ridge Filing No. 3
Inlet ID: DP B1 (Basin B-1)



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	0.83	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.100	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.021	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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.0	1.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	0.80	0.80	inches
Water Depth at Gutter Flowline (y + a)	d =	4.88	4.88	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.2	16.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.144	0.144	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	12.4	12.4	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	2.1	2.1	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 =**	**14.5**	**14.5**	**cfs**
Flow Velocity within the Gutter Section	V =	6.9	6.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.8	2.8	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	15.8	29.2	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	15.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.155	0.081	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	10.2	55.6	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	10.2	49.7	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	1.9	4.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.1	56.3	cfs
Average Flow Velocity Within the Gutter Section	V =	6.6	9.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.5	6.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$	R =	1.00	0.81	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.1**	**45.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.60	7.23	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	2.35	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.1**	**14.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.60 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.00 cfs on sheet 'Inlet Management'

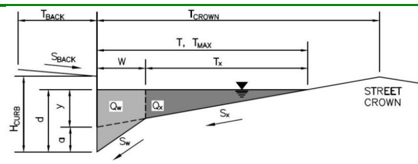
INLEET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: Bradley Ridge Filing No. 3
Inlet ID: DP B2 (Basin B-2)



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	0.83	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	0.8	0.8	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	0.63	0.63	inches
Water Depth at Gutter Flowline (y + a)	d =	4.71	4.71	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.2	16.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.140	0.140	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	10.6	10.6	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	1.7	1.7	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 =**	**12.3**	**12.3**	**cfs**
Flow Velocity within the Gutter Section	V =	5.8	5.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.3	2.3	

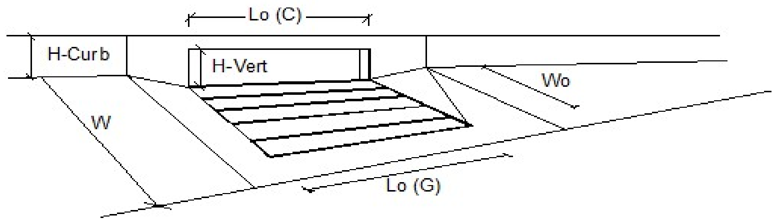
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.6	29.9	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	15.7	29.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.144	0.077	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	9.8	50.4	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	9.8	44.6	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.6	4.2	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.4	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.4	50.3	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	8.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.2	5.4	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.4**	**50.3**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.60	7.80	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	3.09	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**11.4**	**12.3**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.90 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.50 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



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')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	14.00	14.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	3.9	6.5	cfs
Water Spread Width	T =	11.0	13.3	ft
Water Depth at Flowline (outside of local depression)	d =	3.3	3.8	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.220	0.179	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	3.0	5.3	cfs
Discharge within the Gutter Section W	Q_w =	0.9	1.2	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.20	0.24	sq ft
Velocity within the Gutter Section W	V_W =	4.4	4.9	fps
Water Depth for Design Condition	d_{LOCAL} =	7.3	7.8	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.122	0.103	ft/ft
Required Length L_T to Have 100% Interception	L_T =	10.51	14.75	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	10.51	14.00	ft
Interception Capacity	Q_i =	3.9	6.5	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	10.51	13.38	ft
Actual Interception Capacity	**Q_a =**	**3.9**	**6.4**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.1**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.9**	**6.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**99**	**%**

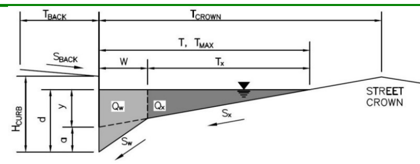
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: Bradley Ridge Filing No. 3

Inlet ID: DP B3 (Basin B-3)



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.1	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.5	1.5	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.02	1.02	inches
Water Depth at Gutter Flowline (y + a)	d =	5.10	5.10	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.329	0.329	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	8.6	8.6	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	4.2	4.2	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 =**	**12.9**	**12.9**	**cfs**
Flow Velocity within the Gutter Section	V =	5.8	5.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.5	2.5	

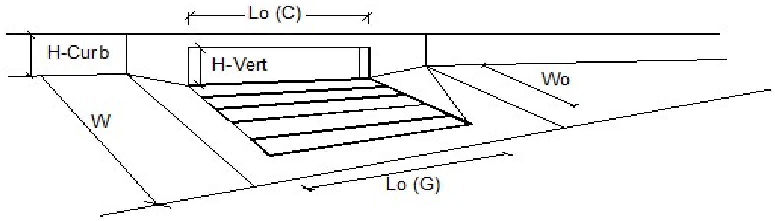
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	28.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	15.0	26.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.329	0.197	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	8.6	38.4	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	8.6	34.4	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	4.2	9.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.4	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.9	45.3	cfs
Average Flow Velocity Within the Gutter Section	V =	5.8	8.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.5	5.2	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.9**	**45.3**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.10	7.80	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	2.70	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.9**	**12.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.40 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.30 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

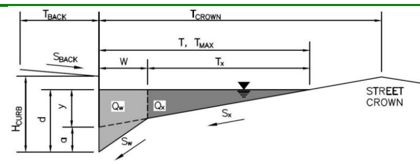


Design Information (Input)	Colorado Springs D-10-R	MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	8.00	8.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.4	2.3	cfs
Water Spread Width	T =	6.6	8.3	ft
Water Depth at Flowline (outside of local depression)	d =	2.6	3.0	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.742	0.628	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.4	0.9	cfs
Discharge within the Gutter Section W	Q_w =	1.0	1.4	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.31	0.38	sq ft
Velocity within the Gutter Section W	V_W =	3.4	3.8	fps
Water Depth for Design Condition	d_{LOCAL} =	6.6	7.0	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.175	0.151	ft/ft
Required Length L_T to Have 100% Interception	L_T =	5.28	7.27	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.28	7.27	ft
Interception Capacity	Q_i =	1.4	2.3	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	5.28	7.27	ft
Actual Interception Capacity	**Q_a =**	**1.4**	**2.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.4**	**2.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

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

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

Project: Bradley Ridge Filing No. 3
Inlet ID: DP B6 (Basin B-4)



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.1	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.5	1.5	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.02	1.02	inches
Water Depth at Gutter Flowline (y + a)	d =	5.10	5.10	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.329	0.329	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	8.6	8.6	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	4.2	4.2	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 =**	**12.9**	**12.9**	**cfs**
Flow Velocity within the Gutter Section	V =	5.8	5.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.5	2.5	

Maximum Capacity for 1/2 Street based on Allowable Depth

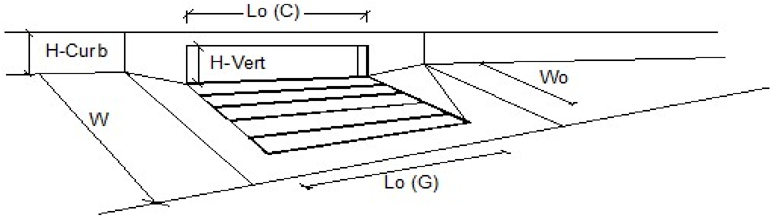
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	28.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	15.0	26.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.329	0.197	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.6	38.4	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	8.6	34.4	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	4.2	9.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.4	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.9	45.3	cfs
Average Flow Velocity Within the Gutter Section	V =	5.8	8.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.5	5.2	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.9**	**45.3**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.10	7.80	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	2.70	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.9**	**12.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.70 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.70 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

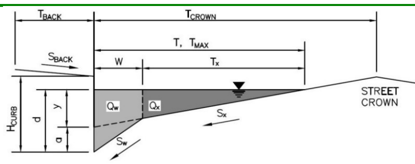


Design Information (Input)	Colorado Springs D-10-R	MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.7	3.7	cfs
Water Spread Width	T =	7.2	10.2	ft
Water Depth at Flowline (outside of local depression)	d =	2.8	3.5	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.695	0.529	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.5	1.7	cfs
Discharge within the Gutter Section W	Q_w =	1.2	2.0	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.33	0.45	sq ft
Velocity within the Gutter Section W	V_W =	3.5	4.3	fps
Water Depth for Design Condition	d_{LOCAL} =	6.8	7.5	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.165	0.131	ft/ft
Required Length L_T to Have 100% Interception	L_T =	5.98	9.92	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.98	9.92	ft
Interception Capacity	Q_i =	1.7	3.7	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	5.98	9.38	ft
Actual Interception Capacity	**Q_a =**	**1.7**	**3.7**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.7**	**3.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**99**	**%**

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

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

Project: Bradley Ridge Filing No. 3
Inlet ID: DP B7 (Basin B-5)



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040		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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.1	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.5	1.5	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.02	1.02	inches
Water Depth at Gutter Flowline (y + a)	d =	5.10	5.10	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.329	0.329	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	14.1	14.1	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	6.9	6.9	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 =**	**21.0**	**21.0**	**cfs**
Flow Velocity within the Gutter Section	V =	9.5	9.5	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	4.1	4.1	

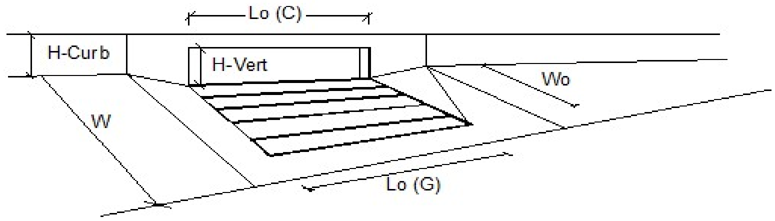
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	28.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	15.0	26.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.329	0.197	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	14.1	62.8	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	14.1	56.2	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	6.9	15.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	2.3	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	21.0	74.0	cfs
Average Flow Velocity Within the Gutter Section	V =	9.5	13.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	4.1	8.5	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	0.97	0.48	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**20.5**	**35.4**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.06	6.05	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.95	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**20.5**	**21.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.20 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.00 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



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')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	8.00	8.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.2	2.0	cfs
Water Spread Width	T =	4.6	6.1	ft
Water Depth at Flowline (outside of local depression)	d =	2.1	2.5	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.889	0.774	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.1	0.5	cfs
Discharge within the Gutter Section W	Q_w =	1.1	1.5	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.23	0.29	sq ft
Velocity within the Gutter Section W	V_W =	4.7	5.3	fps
Water Depth for Design Condition	d_{LOCAL} =	6.1	6.5	inches

Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o-GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**

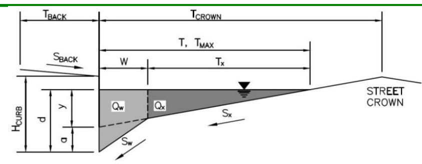
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.206	0.182	ft/ft
Required Length L_T to Have 100% Interception	L_T =	4.80	6.59	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.80	6.59	ft
Interception Capacity	Q_i =	1.2	2.0	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	4.80	6.59	ft
Actual Interception Capacity	**Q_a =**	**1.2**	**2.0**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**

Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.2**	**2.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

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

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

Project: Bradley Ridge Filing No. 3
Inlet ID: DP B9 (Basin B-6)



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.018		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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.1	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.5	1.5	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.02	1.02	inches
Water Depth at Gutter Flowline (y + a)	d =	5.10	5.10	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.329	0.329	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	9.5	9.5	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	4.6	4.6	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 =**	**14.1**	**14.1**	**cfs**
Flow Velocity within the Gutter Section	V =	6.4	6.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.7	2.7	

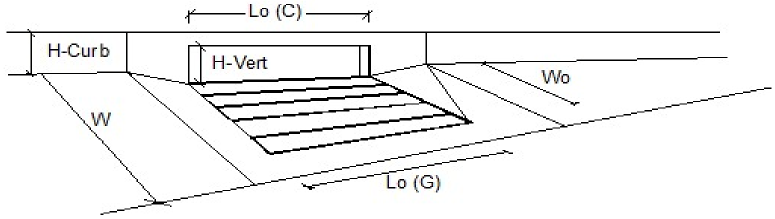
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	28.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	15.0	26.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.329	0.197	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	9.5	42.1	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	9.5	37.7	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	4.6	10.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.6	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	14.1	49.6	cfs
Average Flow Velocity Within the Gutter Section	V =	6.4	8.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.7	5.7	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.91	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**14.1**	**45.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.10	7.54	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	2.44	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**14.1**	**14.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.70 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.20 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

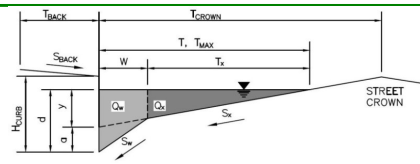


		MINOR	MAJOR	
Design Information (Input) — Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	14.00	14.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	3.7	6.2	cfs
Water Spread Width	T =	9.8	12.2	ft
Water Depth at Flowline (outside of local depression)	d =	3.4	4.0	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.546	0.451	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	1.7	3.4	cfs
Discharge within the Gutter Section W	Q_w =	2.0	2.8	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.44	0.53	sq ft
Velocity within the Gutter Section W	V_W =	4.6	5.2	fps
Water Depth for Design Condition	d_{LOCAL} =	7.4	8.0	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.134	0.114	ft/ft
Required Length L_T to Have 100% Interception	L_T =	9.90	13.87	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	9.90	13.87	ft
Interception Capacity	Q_i =	3.7	6.2	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	9.90	13.38	ft
Actual Interception Capacity	**Q_a =**	**3.7**	**6.2**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.7**	**6.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

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

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

Project: Bradley Ridge Filing No. 3
Inlet ID: DP B10 (Basin B-7)



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	0.83	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.100	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.1	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.0	1.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	0.80	0.80	inches
Water Depth at Gutter Flowline (y + a)	d =	4.88	4.88	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.2	16.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.144	0.144	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	8.6	8.6	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	1.4	1.4	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 =**	**10.1**	**10.1**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.9	1.9	

Maximum Capacity for 1/2 Street based on Allowable Depth

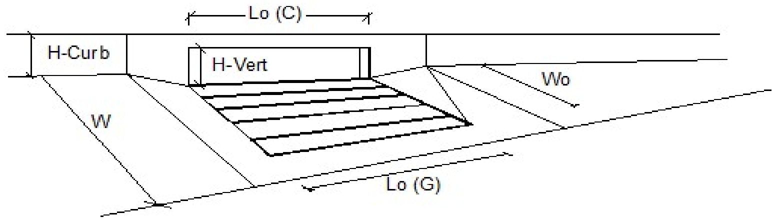
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.9	29.2	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	17.1	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.136	0.081	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	10.0	38.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	10.0	34.5	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	1.6	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.6	39.0	cfs
Average Flow Velocity Within the Gutter Section	V =	4.9	6.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.1	4.4	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.6**	**39.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.10	7.80	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.22	2.92	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**10.1**	**10.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.70 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.90 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



		MINOR	MAJOR	
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')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	8.00	8.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.7	2.9	cfs
Water Spread Width	T =	8.5	10.5	ft
Water Depth at Flowline (outside of local depression)	d =	2.8	3.3	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.301	0.239	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	1.2	2.2	cfs
Discharge within the Gutter Section W	Q_w =	0.5	0.7	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.16	0.20	sq ft
Velocity within the Gutter Section W	V_W =	3.2	3.5	fps
Water Depth for Design Condition	d_{LOCAL} =	6.8	7.3	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.165	0.135	ft/ft
Required Length L_T to Have 100% Interception	L_T =	5.85	8.43	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.85	8.00	ft
Interception Capacity	Q_i =	1.7	2.9	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	5.85	7.50	ft
Actual Interception Capacity	**Q_a =**	**1.7**	**2.8**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.1**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.7**	**2.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**98**	**%**

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP C1 (Basin C-1)	DP C2 (Basin C-2)	DP C4 (Basin C-3)	DP C5 (Basin C-4)
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	On Grade
Inlet Type	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	7.5	3.0	6.8	3.1
Major Q_{Known} (cfs)	12.5	5.0	11.4	5.2

Bypass (Carry-Over) Flow from Upstream

Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)				
Percent Impervious				
NRCS Soil Type				

Watershed Profile

Overland Slope (ft/ft)				
Overland Length (ft)				
Channel Slope (ft/ft)				
Channel Length (ft)				

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**7.5**	**3.0**	**6.8**	**3.1**
Major Total Design Peak Flow, Q (cfs)	**12.5**	**5.0**	**11.4**	**5.2**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	1.1	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	1.4	0.0	3.8	0.4

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INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP C8 (Basin C-5)	DP C9 (Basin C-6)	DP C11 (Basin C-7)	DP C12 (Basin C-8)
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	In Sump	In Sump
Inlet Type	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.1	1.7	3.2	2.4
Major Q_{Known} (cfs)	1.9	2.9	5.4	4.0

RECEIVES BYPASS FROM C2,C3,C4

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	DP C1 (Basin C-1)	User-Defined	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	1.1	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	1.4	4.2	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)				
Percent Impervious				
NRCS Soil Type				

Watershed Profile

Overland Slope (ft/ft)				
Overland Length (ft)				
Channel Slope (ft/ft)				
Channel Length (ft)				

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.1**	**2.8**	**3.2**	**2.4**
Major Total Design Peak Flow, Q (cfs)	**3.3**	**7.1**	**5.4**	**4.0**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	1.3	N/A	N/A

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INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP C15 (Basin C-10)	DP C16 (Basin C-11)	DP C19 (Basin C-12)	DP C20 (Basin C-13)
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	On Grade
Inlet Type	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.8	2.5	6.5	5.0
Major Q_{Known} (cfs)	3.0	4.1	10.8	8.4

RECEIVES BYPASS FROM C8,C9

RECEIVES BYPASS FROM C15,C16

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	User-Defined	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.3
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	1.3	1.6

Watershed Characteristics

Subcatchment Area (acres)				
Percent Impervious				
NRCS Soil Type				

Watershed Profile

Overland Slope (ft/ft)				
Overland Length (ft)				
Channel Slope (ft/ft)				
Channel Length (ft)				

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.8**	**2.5**	**6.5**	**5.3**
Major Total Design Peak Flow, Q (cfs)	**3.0**	**4.1**	**12.1**	**10.0**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.2	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.5	1.1	1.2	1.1

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INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP AJ1 (Basin WF13)	DP AJ2 (Basin WF14)	DP AL (Basin WF16)	DP AM (Basin WF17)
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	On Grade	On Grade
Inlet Type	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	4.1	7.2	0.4	0.8
Major Q_{Known} (cfs)	7.5	12.1	0.7	1.4

RECEIVES BYPASS FROM C19,C20

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	User-Defined	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	2.3	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)				
Percent Impervious				
NRCS Soil Type				

Watershed Profile

Overland Slope (ft/ft)				
Overland Length (ft)				
Channel Slope (ft/ft)				
Channel Length (ft)				

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				

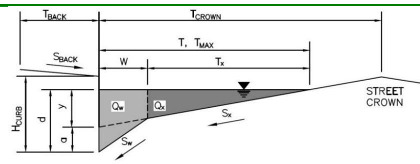
CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**4.1**	**7.2**	**0.4**	**0.8**
Major Total Design Peak Flow, Q (cfs)	**7.5**	**14.4**	**0.7**	**1.4**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	0.0	0.0

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

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

Project: Bradley Ridge Filing No. 3
Inlet ID: DP C1 (Basin C-1)



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	0.83	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.100	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.022	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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.0	1.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	0.80	0.80	inches
Water Depth at Gutter Flowline (y + a)	d =	4.88	4.88	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.2	16.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.144	0.144	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	12.8	12.8	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	2.1	2.1	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 =**	**14.9**	**14.9**	**cfs**
Flow Velocity within the Gutter Section	V =	7.1	7.1	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.9	2.9	

Maximum Capacity for 1/2 Street based on Allowable Depth

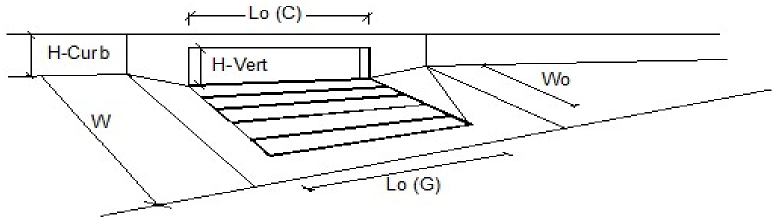
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	15.8	29.2	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	15.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.155	0.081	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	10.5	57.2	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	10.5	51.2	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	1.9	5.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.4	57.9	cfs
Average Flow Velocity Within the Gutter Section	V =	6.8	9.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	6.5	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.77	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.4**	**44.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.60	7.11	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	2.23	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.4**	**14.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 7.50 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 12.50 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

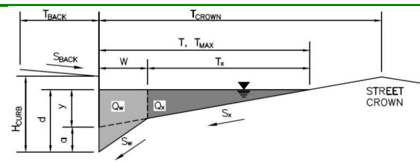


Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	16.00	16.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	7.5	12.5	cfs
Water Spread Width		T =	13.1	15.9	ft
Water Depth at Flowline (outside of local depression)		d =	3.9	4.6	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.190	0.154	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	6.1	10.6	cfs
Discharge within the Gutter Section W		Q_w =	1.4	1.9	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.24	0.28	sq ft
Velocity within the Gutter Section W		V_W =	6.0	6.7	fps
Water Depth for Design Condition		d_{LOCAL} =	7.9	8.6	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o-GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.112	0.094	ft/ft
Required Length L_T to Have 100% Interception		L_T =	15.64	21.96	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	15.64	16.00	ft
Interception Capacity		Q_i =	7.5	11.3	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	15.35	15.35	ft
Actual Interception Capacity		**Q_a =**	**7.5**	**11.1**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**1.4**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**7.5**	**11.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**1.4**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**88**	**%**

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

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

Project: Bradley Ridge Filing No. 3
Inlet ID: DP C2 (Basin C-2)



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	0.83	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.100	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.022	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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.0	1.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	0.80	0.80	inches
Water Depth at Gutter Flowline (y + a)	d =	4.88	4.88	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.2	16.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.144	0.144	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	12.8	12.8	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	2.1	2.1	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 =**	**14.9**	**14.9**	**cfs**
Flow Velocity within the Gutter Section	V =	7.1	7.1	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.9	2.9	

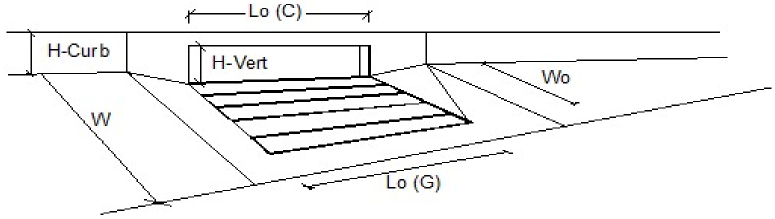
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	15.8	29.2	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	15.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.155	0.081	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	10.5	57.2	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	10.5	51.2	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.9	5.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.4	57.9	cfs
Average Flow Velocity Within the Gutter Section	V =	6.8	9.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	6.5	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.77	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.4**	**44.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.60	7.11	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	2.23	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.4**	**14.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.00 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.00 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



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')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	12.00	12.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	3.0	5.0	cfs
Water Spread Width		T =	9.1	11.2	ft
Water Depth at Flowline (outside of local depression)		d =	3.0	3.5	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.280	0.226	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	2.2	3.9	cfs
Discharge within the Gutter Section W		Q_w =	0.8	1.1	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.17	0.21	sq ft
Velocity within the Gutter Section W		V_W =	4.9	5.5	fps
Water Depth for Design Condition		d_{LOCAL} =	7.0	7.5	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.155	0.129	ft/ft
Required Length L_T to Have 100% Interception		L_T =	8.43	11.91	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	8.43	11.91	ft
Interception Capacity		Q_i =	3.0	5.0	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.05	0.05	
Effective (Unclogged) Length		L_e =	8.43	11.38	ft
Actual Interception Capacity		**Q_a =**	**3.0**	**5.0**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.0**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**3.0**	**5.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**100**	**%**

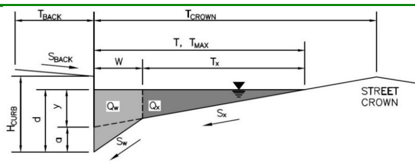
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: Bradley Ridge Filing No. 3

Inlet ID: DP C4 (Basin C-3)



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	0.83		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.100		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.024		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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.1	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.0	1.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	0.80	0.80	inches
Water Depth at Gutter Flowline (y + a)	d =	4.88	4.88	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.2	16.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.144	0.144	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	13.4	13.4	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	2.2	2.2	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 =**	**15.6**	**15.6**	**cfs**
Flow Velocity within the Gutter Section	V =	7.4	7.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	3.0	3.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	13.8	29.2	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	12.9	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.180	0.081	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.4	59.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	7.4	53.4	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.6	5.2	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.8	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	9.0	60.5	cfs
Average Flow Velocity Within the Gutter Section	V =	6.5	10.4	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.2	6.8	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.72	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**9.0**	**43.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.10	6.93	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	2.06	inches

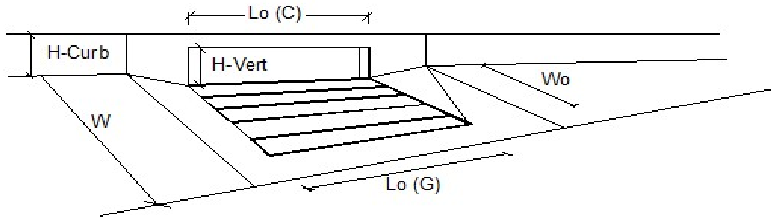
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**9.0**	**15.6**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 6.80 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 11.40 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

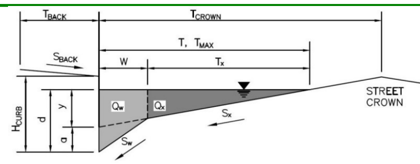


		MINOR	MAJOR	
Design Information (Input) — Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	6.8	11.4	cfs
Water Spread Width	T =	12.4	15.1	ft
Water Depth at Flowline (outside of local depression)	d =	3.8	4.4	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.201	0.163	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	5.4	9.5	cfs
Discharge within the Gutter Section W	Q_w =	1.4	1.9	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.23	0.27	sq ft
Velocity within the Gutter Section W	V_W =	6.0	6.9	fps
Water Depth for Design Condition	d_{LOCAL} =	7.8	8.4	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.117	0.099	ft/ft
Required Length L_T to Have 100% Interception	L_T =	14.64	20.58	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	10.00	10.00	ft
Interception Capacity	Q_i =	5.9	8.0	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	9.38	9.38	ft
Actual Interception Capacity	**Q_a =**	**5.7**	**7.6**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**1.1**	**3.8**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.7**	**7.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**1.1**	**3.8**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**84**	**67**	**%**

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

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

Project: Bradley Ridge Filing No. 3
Inlet ID: DP C5 (Basin C-4)



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	0.83		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.100		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.024		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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.1	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.0	1.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	0.80	0.80	inches
Water Depth at Gutter Flowline (y + a)	d =	4.88	4.88	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.2	16.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.144	0.144	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	13.4	13.4	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	2.2	2.2	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 =**	**15.6**	**15.6**	**cfs**
Flow Velocity within the Gutter Section	V =	7.4	7.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	3.0	3.0	

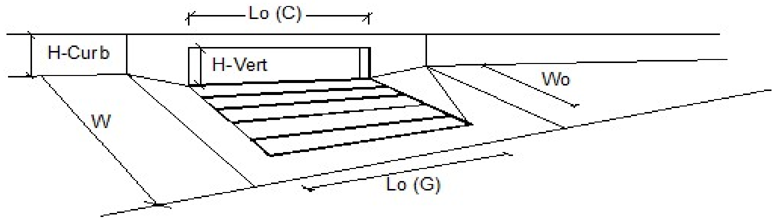
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	13.8	29.2	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	12.9	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.180	0.081	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	7.4	59.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	7.4	53.4	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	1.6	5.2	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.8	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	9.0	60.5	cfs
Average Flow Velocity Within the Gutter Section	V =	6.5	10.4	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.2	6.8	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$	R =	1.00	0.72	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**9.0**	**43.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.10	6.93	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	2.06	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**9.0**	**15.6**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.10 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.20 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

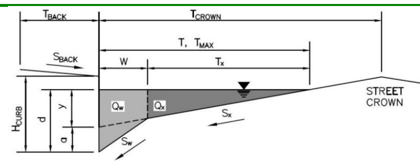


Design Information (Input)	Colorado Springs D-10-R	MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.1**	**4.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.4**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**93**	**%**

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

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

Project: Bradley Ridge Filing No. 3
Inlet ID: DP C8 (Basin C-5)



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	0.83		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.100		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.1	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.0	1.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	0.80	0.80	inches
Water Depth at Gutter Flowline (y + a)	d =	4.88	4.88	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.2	16.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.144	0.144	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	10.6	10.6	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	1.8	1.8	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 =**	**12.3**	**12.3**	**cfs**
Flow Velocity within the Gutter Section	V =	5.9	5.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.4	2.4	

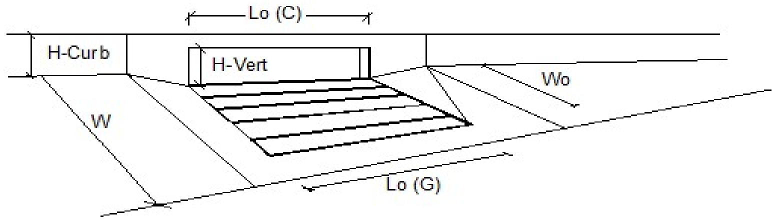
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	13.8	29.2	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	12.9	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.180	0.081	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	5.8	47.2	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	5.8	42.2	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	1.3	4.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.4	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	7.1	47.8	cfs
Average Flow Velocity Within the Gutter Section	V =	5.1	8.2	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.8	5.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, $d \geq 6$"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**7.1**	**47.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.10	7.80	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	2.92	inches

MINOR STORM Allowable Capacity is based on Depth Criterion		Minor Storm	Major Storm	
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**7.1**	**12.3**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.11 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.34 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

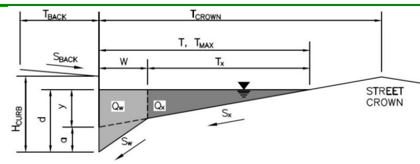


Design Information (Input) Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.1	3.3	cfs
Water Spread Width	T =	6.6	10.3	ft
Water Depth at Flowline (outside of local depression)	d =	2.4	3.3	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.394	0.246	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.7	2.5	cfs
Discharge within the Gutter Section W	Q_w =	0.4	0.8	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.13	0.19	sq ft
Velocity within the Gutter Section W	V_W =	3.4	4.3	fps
Water Depth for Design Condition	d_{LOCAL} =	6.4	7.3	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.210	0.138	ft/ft
Required Length L_T to Have 100% Interception	L_T =	4.31	9.17	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.31	9.17	ft
Interception Capacity	Q_i =	1.1	3.3	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	4.31	9.17	ft
Actual Interception Capacity	**Q_a =**	**1.1**	**3.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.1**	**3.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

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

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

Project: Bradley Ridge Filing No. 3
Inlet ID: DP C9 (Basin C-6)



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	0.83	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.100	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.1	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.0	1.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	0.80	0.80	inches
Water Depth at Gutter Flowline (y + a)	d =	4.88	4.88	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.2	16.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.144	0.144	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	10.6	10.6	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	1.8	1.8	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 =**	**12.3**	**12.3**	**cfs**
Flow Velocity within the Gutter Section	V =	5.9	5.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.4	2.4	

Maximum Capacity for 1/2 Street based on Allowable Depth

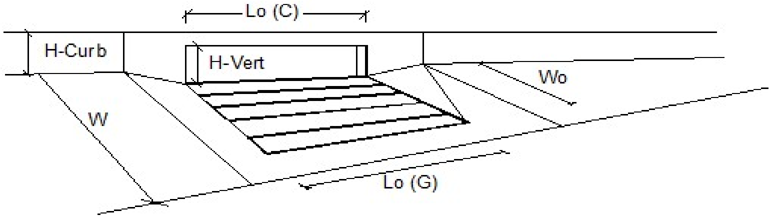
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	13.8	29.2	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	12.9	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.180	0.081	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	5.8	47.2	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	5.8	42.2	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	1.3	4.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.4	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	7.1	47.8	cfs
Average Flow Velocity Within the Gutter Section	V =	5.1	8.2	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.8	5.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**7.1**	**47.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.10	7.80	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	2.92	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**7.1**	**12.3**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.78 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 7.11 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



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')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	2.8	7.1	cfs
Water Spread Width	T =	9.6	13.8	ft
Water Depth at Flowline (outside of local depression)	d =	3.1	4.1	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.266	0.180	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	2.0	5.8	cfs
Discharge within the Gutter Section W	Q_w =	0.7	1.3	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.18	0.25	sq ft
Velocity within the Gutter Section W	V_W =	4.1	5.1	fps
Water Depth for Design Condition	d_{LOCAL} =	7.1	8.1	inches

Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o-GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**

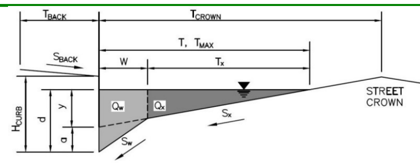
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.148	0.107	ft/ft
Required Length L_T to Have 100% Interception	L_T =	8.10	15.19	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	8.10	10.00	ft
Interception Capacity	Q_i =	2.8	6.1	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	8.10	9.38	ft
Actual Interception Capacity	**Q_a =**	**2.8**	**5.8**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**1.3**	**cfs**

Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.8**	**5.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.3**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**82**	**%**

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

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

Project: Bradley Ridge Filing No. 3
Inlet ID: DP C11 (Basin C-7)



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	0.83		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.100		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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.1	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

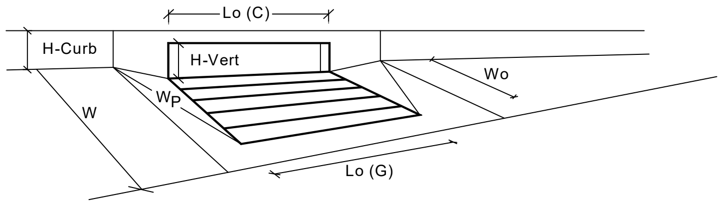
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.0	1.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	0.80	0.80	inches
Water Depth at Gutter Flowline (y + a)	d =	4.88	4.88	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.2	16.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.144	0.144	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	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} =	13.8	29.2	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	12.9	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.180	0.081	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	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 =	SUMP	SUMP	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 Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$	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 not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



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 =	4.1	4.9	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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
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 =	0.83	0.83	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	

Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on Modified HEC-22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on Modified HEC-22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**

Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.06	0.06	
Curb Capacity as a Weir (based on Modified HEC-22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	4.0	5.9	cfs
Interception with Clogging	Q_{wa} =	3.7	5.5	cfs
Curb Capacity as an Orifice (based on Modified HEC-22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	16.9	18.4	cfs
Interception with Clogging	Q_{oa} =	15.8	17.2	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	7.6	9.7	cfs
Interception with Clogging	Q_{ma} =	7.1	9.1	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**3.7**	**5.5**	**cfs**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	8.00	8.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	13.8	17.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	inches
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} =	0.26	0.32	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.88	0.94	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**3.7**	**5.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.2	5.4	cfs

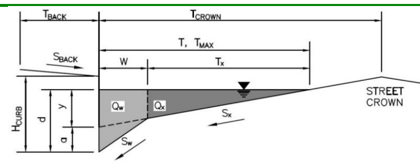
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: Bradley Ridge Filing No. 3

Inlet ID: DP C12 (Basin C-8)



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063	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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.1	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

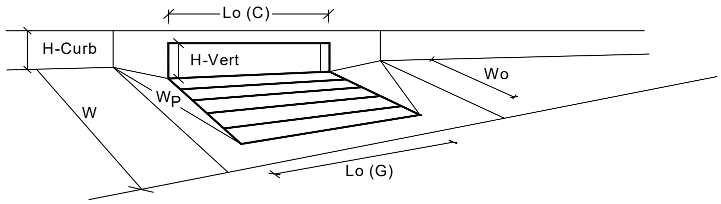
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.5	1.5	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	1.02	1.02	inches
Water Depth at Gutter Flowline (y + a)	d =	5.10	5.10	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.329	0.329	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	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} =	12.8	28.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	10.8	26.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.431	0.197	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	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 =	SUMP	SUMP	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 Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	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 not applicable to Sump Condition MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



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 =	4.1	5.1	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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
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	

Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on Modified HEC-22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on Modified HEC-22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**

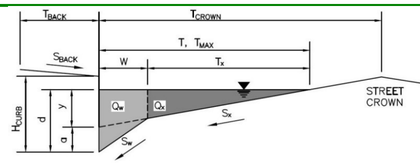
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.06	0.06	
Curb Capacity as a Weir (based on Modified HEC-22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	3.7	6.6	cfs
Interception with Clogging	Q_{wa} =	3.5	6.1	cfs
Curb Capacity as an Orifice (based on Modified HEC-22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	16.9	18.8	cfs
Interception with Clogging	Q_{oa} =	15.8	17.6	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	7.3	10.3	cfs
Interception with Clogging	Q_{ma} =	6.9	9.7	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**3.5**	**6.1**	**cfs**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	8.00	8.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	12.8	17.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	inches
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} =	0.22	0.30	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.88	0.96	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**3.5**	**6.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	2.4	4.0	cfs

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

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

Project: **Bradley Ridge Filing No. 3**
Inlet ID: **DP C15 (Basin C-10)**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	0.83		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.100		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010		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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.1	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.0	1.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	0.80	0.80	inches
Water Depth at Gutter Flowline (y + a)	d =	4.88	4.88	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.2	16.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.144	0.144	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	8.6	8.6	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	1.4	1.4	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 =**	**10.1**	**10.1**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.9	1.9	

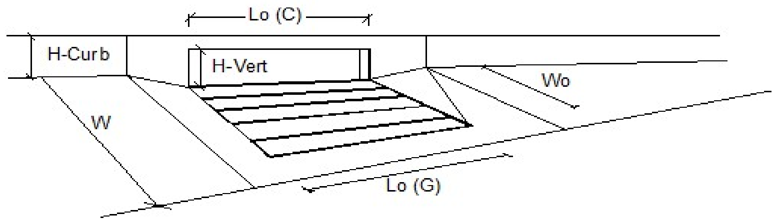
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	13.8	29.2	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	12.9	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.180	0.081	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	4.8	38.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	4.8	34.5	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.0	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	5.8	39.0	cfs
Average Flow Velocity Within the Gutter Section	V =	4.2	6.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.4	4.4	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**5.8**	**39.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.10	7.80	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	2.92	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.8**	**10.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.80 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.00 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

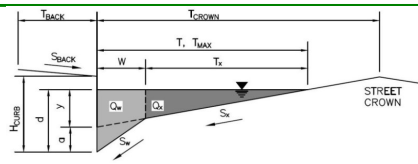


		MINOR	MAJOR	
Design Information (Input) — Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	6.00	6.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.8	3.0	cfs
Water Spread Width	T =	8.7	10.7	ft
Water Depth at Flowline (outside of local depression)	d =	2.9	3.4	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.293	0.236	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	1.3	2.3	cfs
Discharge within the Gutter Section W	Q_w =	0.5	0.7	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.17	0.20	sq ft
Velocity within the Gutter Section W	V_W =	3.2	3.6	fps
Water Depth for Design Condition	d_{LOCAL} =	6.9	7.4	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.161	0.133	ft/ft
Required Length L_T to Have 100% Interception	L_T =	6.09	8.62	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	6.00	6.00	ft
Interception Capacity	Q_i =	1.8	2.6	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.08	0.08	
Effective (Unclogged) Length	L_e =	5.50	5.50	ft
Actual Interception Capacity	**Q_a =**	**1.8**	**2.5**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.5**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.8**	**2.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.5**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**98**	**84**	**%**

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

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

Project: **Bradley Ridge Filing No. 3**
Inlet ID: **DP C16 (Basin C-11)**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	0.83		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.100		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010		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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.1	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.0	1.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	0.80	0.80	inches
Water Depth at Gutter Flowline (y + a)	d =	4.88	4.88	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.2	16.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.144	0.144	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	8.6	8.6	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	1.4	1.4	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 =**	**10.1**	**10.1**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.9	1.9	

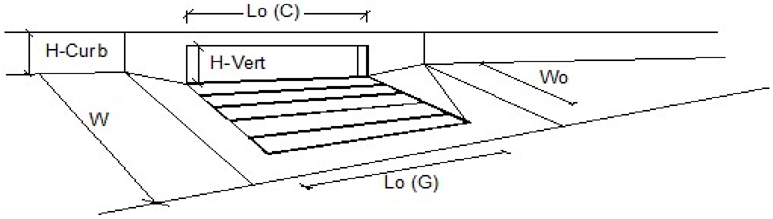
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	13.8	29.2	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	12.9	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.180	0.081	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	4.8	38.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	4.8	34.5	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	1.0	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	5.8	39.0	cfs
Average Flow Velocity Within the Gutter Section	V =	4.2	6.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.4	4.4	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**5.8**	**39.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.10	7.80	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	2.92	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.8**	**10.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.50 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.10 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



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')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	6.00	6.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	2.5	4.1	cfs
Water Spread Width		T =	9.9	12.0	ft
Water Depth at Flowline (outside of local depression)		d =	3.2	3.7	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.255	0.208	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	1.9	3.2	cfs
Discharge within the Gutter Section W		Q_w =	0.6	0.9	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.19	0.22	sq ft
Velocity within the Gutter Section W		V_W =	3.4	3.9	fps
Water Depth for Design Condition		d_{LOCAL} =	7.2	7.7	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.143	0.120	ft/ft
Required Length L_T to Have 100% Interception		L_T =	7.61	10.61	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	6.00	6.00	ft
Interception Capacity		Q_i =	2.3	3.2	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.08	0.08	
Effective (Unclogged) Length		L_e =	5.50	5.50	ft
Actual Interception Capacity		**Q_a =**	**2.3**	**3.0**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.2**	**1.1**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**2.3**	**3.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.2**	**1.1**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**90**	**73**	**%**

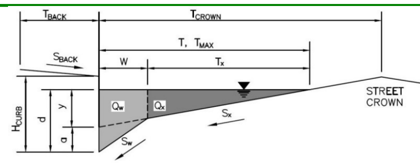
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: Bradley Ridge Filing No. 3

Inlet ID: DP C19 (Basin C-12)



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.023	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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.1	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	1.5	1.5	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.02	1.02	inches
Water Depth at Gutter Flowline (y + a)	d =	5.10	5.10	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.329	0.329	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	10.7	10.7	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	5.2	5.2	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 =**	**16.0**	**16.0**	**cfs**
Flow Velocity within the Gutter Section	V =	7.2	7.2	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	3.1	3.1	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	28.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	15.0	26.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.329	0.197	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	10.7	47.6	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	10.7	42.6	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	5.2	11.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.8	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	16.0	56.1	cfs
Average Flow Velocity Within the Gutter Section	V =	7.2	9.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	3.1	6.5	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.75	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**16.0**	**41.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.10	7.04	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.94	inches

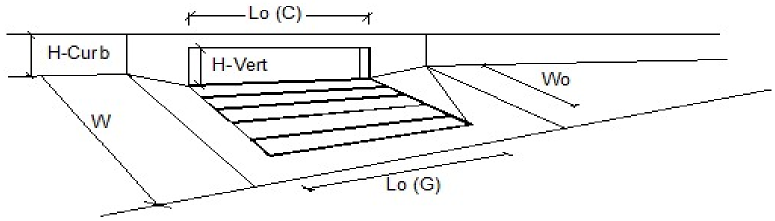
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**16.0**	**16.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 6.50 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 12.06 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



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')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	16.00	16.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	6.5	12.1	cfs
Water Spread Width	T =	11.8	15.2	ft
Water Depth at Flowline (outside of local depression)	d =	3.9	4.7	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.464	0.366	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	3.5	7.6	cfs
Discharge within the Gutter Section W	Q_w =	3.0	4.4	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.52	0.65	sq ft
Velocity within the Gutter Section W	V_W =	5.8	6.8	fps
Water Depth for Design Condition	d_{LOCAL} =	7.9	8.7	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.117	0.097	ft/ft
Required Length L_T to Have 100% Interception	L_T =	14.26	21.34	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	14.26	16.00	ft
Interception Capacity	Q_i =	6.5	11.1	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	14.26	15.35	ft
Actual Interception Capacity	**Q_a =**	**6.5**	**10.8**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**1.2**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.5**	**10.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.2**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**90**	**%**

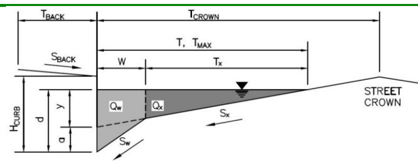
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: Bradley Ridge Filing No. 3

Inlet ID: DP C20 (Basin C-13)



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.023	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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.1	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.5	1.5	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	1.02	1.02	inches
Water Depth at Gutter Flowline (y + a)	d =	5.10	5.10	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.329	0.329	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	10.7	10.7	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	5.2	5.2	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 =**	**16.0**	**16.0**	**cfs**
Flow Velocity within the Gutter Section	V =	7.2	7.2	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	3.1	3.1	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	28.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	15.0	26.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.329	0.197	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	10.7	47.6	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	10.7	42.6	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	5.2	11.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.8	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	16.0	56.1	cfs
Average Flow Velocity Within the Gutter Section	V =	7.2	9.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	3.1	6.5	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.75	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**16.0**	**41.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.10	7.04	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.94	inches

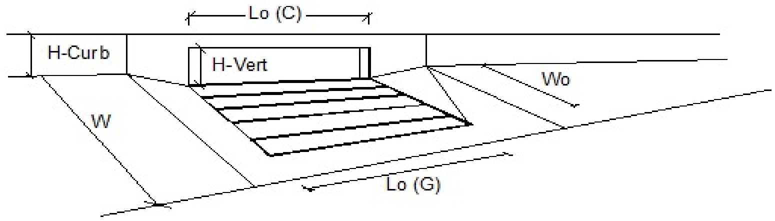
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**16.0**	**16.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 5.28 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 9.98 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

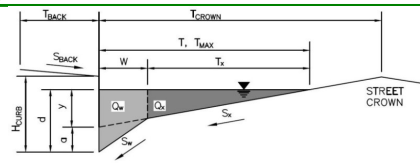


		MINOR	MAJOR	
Design Information (Input) — Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	14.00	14.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	5.3	10.0	cfs
Water Spread Width	T =	10.9	14.1	ft
Water Depth at Flowline (outside of local depression)	d =	3.6	4.4	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.502	0.394	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	2.6	6.0	cfs
Discharge within the Gutter Section W	Q_w =	2.6	3.9	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.48	0.61	sq ft
Velocity within the Gutter Section W	V_W =	5.5	6.5	fps
Water Depth for Design Condition	d_{LOCAL} =	7.6	8.4	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.125	0.102	ft/ft
Required Length L_T to Have 100% Interception	L_T =	12.44	18.87	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	12.44	14.00	ft
Interception Capacity	Q_i =	5.3	9.1	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	12.44	13.38	ft
Actual Interception Capacity	**Q_a =**	**5.3**	**8.9**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**1.1**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.3**	**8.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.1**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**89**	**%**

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

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

Project: Bradley Ridge Filing No. 3
Inlet ID: DP AJ1 (Basin WF13)



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.4	9.8	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 ($T * S_x * 12$)	y =	4.32	4.32	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.5	1.5	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.02	1.02	inches
Water Depth at Gutter Flowline (y + a)	d =	5.34	5.34	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.0	16.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.311	0.311	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	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	

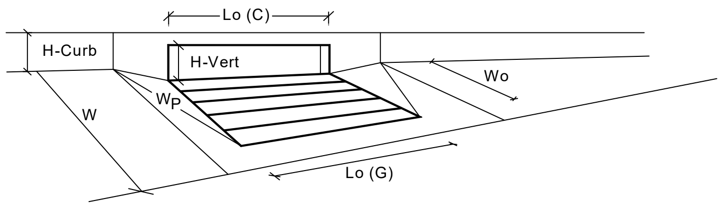
Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	18.3	36.6	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	16.3	34.6	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.307	0.151	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (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 =	SUMP	SUMP	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 Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	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 not applicable to Sump Condition MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



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 =	5.1	6.0	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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	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} =	0.30	0.38	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.88	0.93	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	

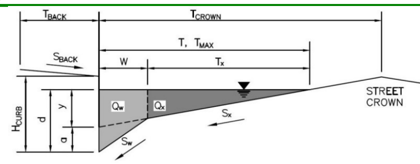
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	$\mathbf{Q_a}$ =	**6.6**	**9.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	4.1	7.5	cfs

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

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

Project: Bradley Ridge Filing No. 3

Inlet ID: DP AJ2 (Basin WF14)



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.4	9.8	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 ($T * S_x * 12$)	y =	4.32	4.32	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.5	1.5	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.02	1.02	inches
Water Depth at Gutter Flowline (y + a)	d =	5.34	5.34	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.0	16.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.311	0.311	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	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	

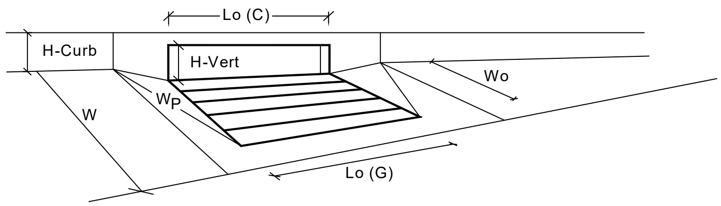
Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	18.3	36.6	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	16.3	34.6	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.307	0.151	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (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 =	SUMP	SUMP	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 Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	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 not applicable to Sump Condition MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



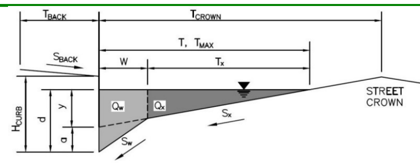
Design Information (Input)	Colorado Springs D-10-R	MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.4	8.0	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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	16.00	16.00	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} =	0.33	0.54	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.75	0.89	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**7.7**	**19.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	7.2	14.4	cfs

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

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

Project: Bradley Ridge Filing No. 3

Inlet ID: DP AL (Basin WF16)



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010		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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.4	9.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.32	4.32	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.5	1.5	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	1.02	1.02	inches
Water Depth at Gutter Flowline (y + a)	d =	5.34	5.34	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.0	16.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.311	0.311	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	8.4	8.4	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	3.8	3.8	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 =**	**12.2**	**12.2**	**cfs**
Flow Velocity within the Gutter Section	V =	4.9	4.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	18.3	36.6	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	16.3	34.6	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.307	0.151	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.7	65.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	8.7	53.0	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	3.9	11.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.6	65.8	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	7.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.2	6.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.6**	**65.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.40	9.80	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.06	4.46	inches

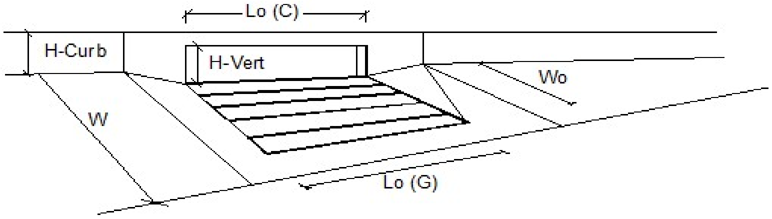
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.2**	**12.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.40 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 0.70 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

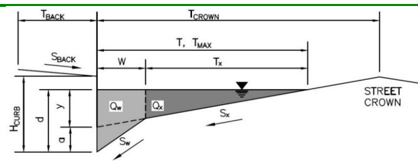


Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Colorado Springs D-10-R)	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	6.00	6.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.4	0.7	cfs
Water Spread Width	T =	3.5	5.1	ft
Water Depth at Flowline (outside of local depression)	d =	1.9	2.2	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.961	0.855	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.0	0.1	cfs
Discharge within the Gutter Section W	Q_w =	0.4	0.6	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.19	0.25	sq ft
Velocity within the Gutter Section W	V_W =	2.1	2.4	fps
Water Depth for Design Condition	d_{LOCAL} =	5.9	6.2	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.221	0.199	ft/ft
Required Length L_T to Have 100% Interception	L_T =	2.45	3.42	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	2.45	3.42	ft
Interception Capacity	Q_i =	0.4	0.7	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.08	0.08	
Effective (Unclogged) Length	L_e =	2.45	3.42	ft
Actual Interception Capacity	**Q_a =**	**0.4**	**0.7**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.4**	**0.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

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

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

Project: Bradley Ridge Filing No. 3
Inlet ID: DP AM (Basin WF17)



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010		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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.4	9.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	4.32	4.32	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	1.5	1.5	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.02	1.02	inches
Water Depth at Gutter Flowline (y + a)	d =	5.34	5.34	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	16.0	16.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.311	0.311	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	8.4	8.4	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.8	3.8	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 =**	**12.2**	**12.2**	**cfs**
Flow Velocity within the Gutter Section	V =	4.9	4.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

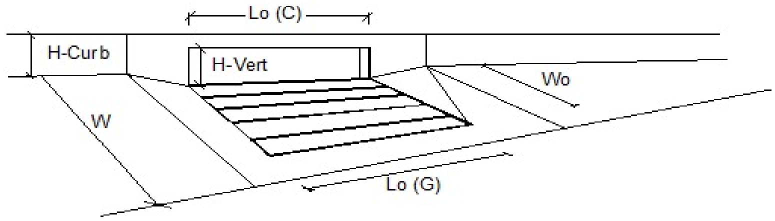
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	18.3	36.6	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	16.3	34.6	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.307	0.151	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	8.7	65.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	8.7	53.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	3.9	11.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.6	65.8	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	7.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.2	6.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.6**	**65.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.40	9.80	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.06	4.46	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.2**	**12.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.80 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 1.40 cfs on sheet 'Inlet Management'

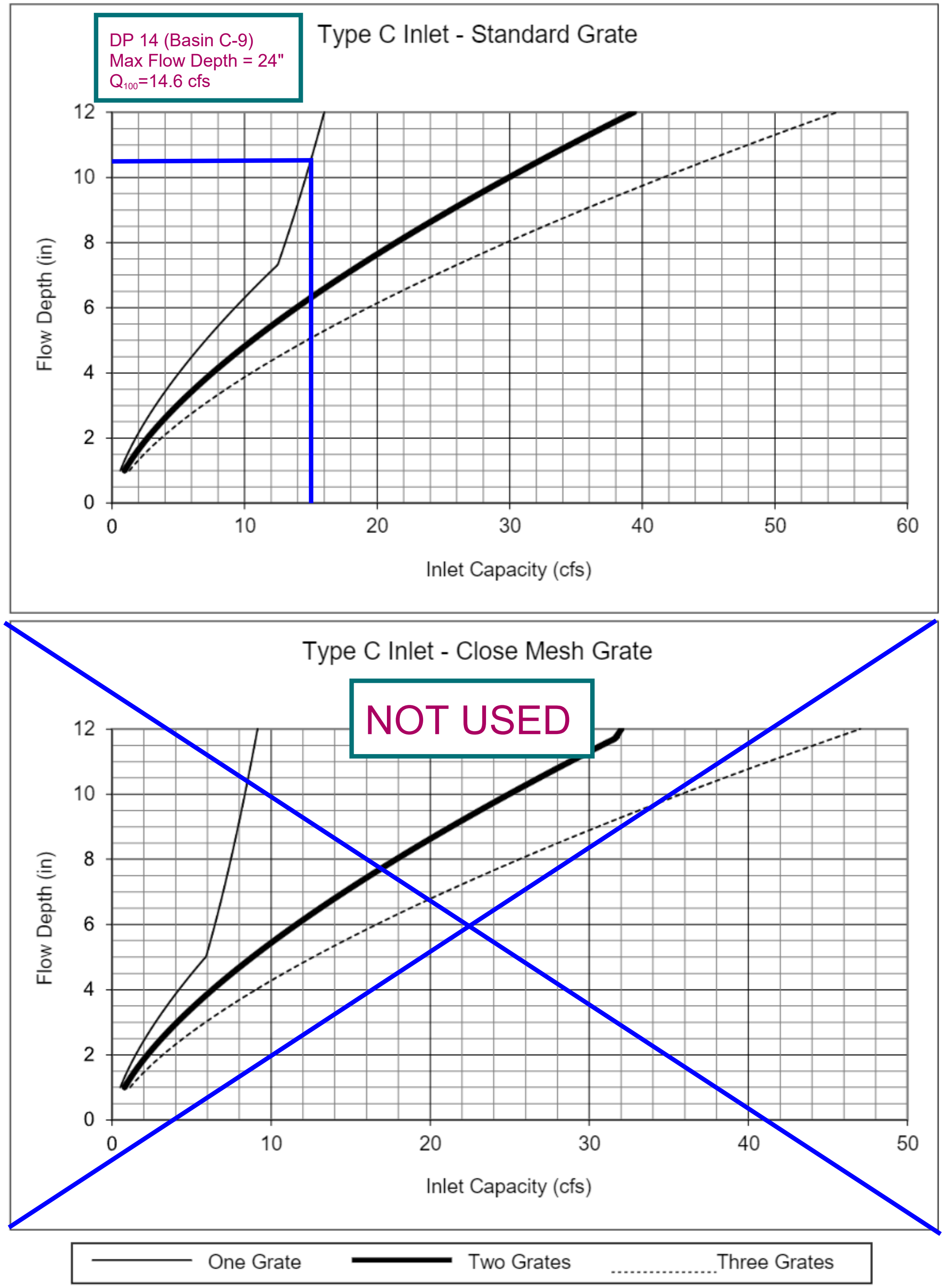
INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



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')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	6.00	6.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.8	1.4	cfs
Water Spread Width	T =	5.4	7.2	ft
Water Depth at Flowline (outside of local depression)	d =	2.3	2.8	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.825	0.695	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.1	0.4	cfs
Discharge within the Gutter Section W	Q_w =	0.7	1.0	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.26	0.33	sq ft
Velocity within the Gutter Section W	V_W =	2.5	2.9	fps
Water Depth for Design Condition	d_{LOCAL} =	6.3	6.8	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.193	0.165	ft/ft
Required Length L_T to Have 100% Interception	L_T =	3.71	5.30	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	3.71	5.30	ft
Interception Capacity	Q_i =	0.8	1.4	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.08	0.08	
Effective (Unclogged) Length	L_e =	3.71	5.30	ft
Actual Interception Capacity	**Q_a =**	**0.8**	**1.4**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.8**	**1.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

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



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

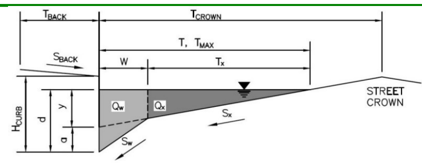
MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project: RJL01.21 - Kiemele Subdivision

Inlet ID: DP B12



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5		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} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060		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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	4.08	4.08	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 =	1.51	1.51	inches
Water Depth at Gutter Flowline	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	17.3	17.3	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	9.3	9.3	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 =**	**26.6**	**26.6**	**cfs**
Flow Velocity within the Gutter Section	V =	12.2	12.2	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	5.7	5.7	

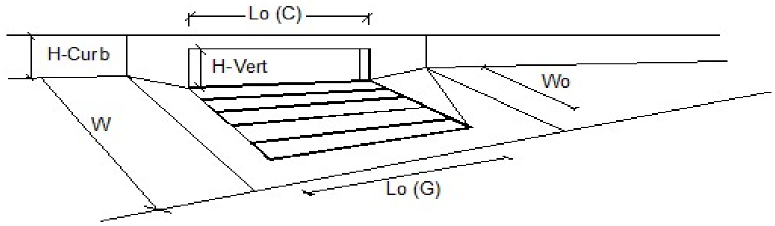
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.9	26.2	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	10.9	24.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.460	0.224	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.3	61.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.3	57.2	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	6.2	17.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	2.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.6	77.2	cfs
Average Flow Velocity Within the Gutter Section	V =	10.4	15.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	4.0	10.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm	R =	1.00	0.35	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.6**	**26.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.60	5.60	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.01	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} =**	**13.6**	**26.8**	**cfs**

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

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



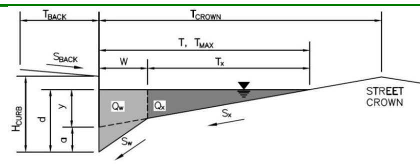
Design Information (Input)		MINOR	MAJOR	
Colorado Springs D-10-R				
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	2.8	6.0	cfs
Water Spread Width	T =	6.0	8.9	ft
Water Depth at Flowline (outside of local depression)	d =	2.9	3.7	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.825	0.635	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.5	2.2	cfs
Discharge within the Gutter Section W	Q_w =	2.3	3.8	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.32	0.44	sq ft
Velocity within the Gutter Section W	V_W =	7.1	8.6	fps
Water Depth for Design Condition	d_{LOCAL} =	6.9	7.7	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.209	0.165	ft/ft
Required Length L_T to Have 100% Interception	L_T =	7.51	12.34	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	7.51	10.00	ft
Interception Capacity	Q_i =	2.8	5.7	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	8.75	8.75	ft
Actual Interception Capacity	**Q_a =**	**2.8**	**5.6**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.4**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.8**	**5.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**93**	**%**

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

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

Project: RJL01.21 - Kiemele Subdivision

Inlet ID: DP B13



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	15.8	ft
Gutter Width	W =	0.83	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060	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} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	3.80	3.80	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	0.8	0.8	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	0.63	0.63	inches
Water Depth at Gutter Flowline	d =	4.43	4.43	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.151	0.151	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	17.3	17.3	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.1	3.1	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 =**	**20.4**	**20.4**	**cfs**
Flow Velocity within the Gutter Section	V =	1.9	1.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.7	0.7	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.6	29.9	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\ TH}$ =	15.7	29.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.144	0.077	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	19.6	100.8	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	19.6	86.3	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.3	8.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	2.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	22.9	96.9	cfs
Average Flow Velocity Within the Gutter Section	V =	2.0	2.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.7	1.9	
Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \geq 6"$) Storm	R =	0.91	0.35	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**20.9**	**33.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.47	5.24	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.04	0.82	inches

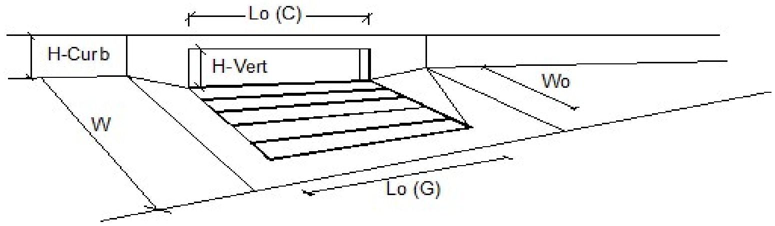
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**20.4**	**33.6**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



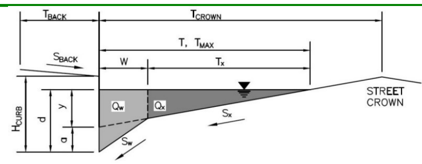
Design Information (Input)		MINOR	MAJOR	
Type of Inlet — Colorado Springs D-10-R	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	12.00	12.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	9.4	20.3	cfs
Water Spread Width	T =	11.8	15.8	ft
Water Depth at Flowline (outside of local depression)	d =	3.5	4.4	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.206	0.151	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	7.5	17.3	cfs
Discharge within the Gutter Section W	Q_w =	1.9	3.1	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.21	0.28	sq ft
Velocity within the Gutter Section W	V_W =	9.2	11.0	fps
Water Depth for Design Condition	d_{LOCAL} =	7.5	8.4	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.115	0.090	ft/ft
Required Length L_T to Have 100% Interception	L_T =	18.30	30.40	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	12.00	12.00	ft
Interception Capacity	Q_i =	8.0	12.1	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.05	0.05	
Effective (Unclogged) Length	L_e =	10.50	10.50	ft
Actual Interception Capacity	**Q_a =**	**7.8**	**11.7**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**1.6**	**8.6**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.8**	**11.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**1.6**	**8.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**83**	**57**	**%**

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

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

Project: RJL01.21 - Kiemele Subdivision

Inlet ID: DP B16



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060	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} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	4.08	4.08	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 =	1.51	1.51	inches
Water Depth at Gutter Flowline	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	17.3	17.3	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	9.3	9.3	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 =**	**26.6**	**26.6**	**cfs**
Flow Velocity within the Gutter Section	V =	12.2	12.2	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	5.7	5.7	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.9	26.2	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\ TH}$ =	10.9	24.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.460	0.224	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	7.3	61.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.3	57.2	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	6.2	17.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	2.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.6	77.2	cfs
Average Flow Velocity Within the Gutter Section	V =	10.4	15.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	4.0	10.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm	R =	1.00	0.35	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.6**	**26.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.60	5.60	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.01	inches

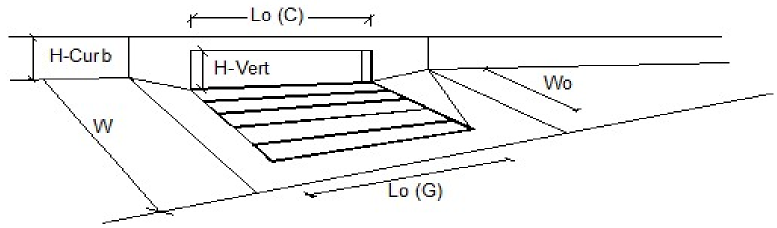
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.6**	**26.8**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Colorado Springs D-10-R)	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	16.00	16.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.7	5.0	cfs
Water Spread Width	T =	1.9	8.2	ft
Water Depth at Flowline (outside of local depression)	d =	1.9	3.5	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	1.012	0.678	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.0	1.6	cfs
Discharge within the Gutter Section W	Q_w =	0.7	3.4	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.14	0.41	sq ft
Velocity within the Gutter Section W	V_W =	4.9	8.2	fps
Water Depth for Design Condition	d_{LOCAL} =	5.9	7.5	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.250	0.176	ft/ft
Required Length L_T to Have 100% Interception	L_T =	3.41	10.95	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	3.41	10.95	ft
Interception Capacity	Q_i =	0.7	5.0	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	13.90	13.90	ft
Actual Interception Capacity	**Q_a =**	**0.7**	**5.0**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.7**	**5.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

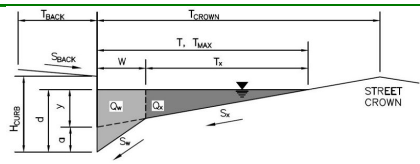
MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project: RJL01.21 - Kiemele Subdivision

Inlet ID: DP B17



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	15.8	ft
Gutter Width	W =	0.83	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060	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} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	3.80	3.80	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	0.8	0.8	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	0.63	0.63	inches
Water Depth at Gutter Flowline	d =	4.43	4.43	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.151	0.151	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	17.3	17.3	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.1	3.1	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 =**	**20.4**	**20.4**	**cfs**
Flow Velocity within the Gutter Section	V =	1.9	1.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.7	0.7	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.6	29.9	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.7	29.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.144	0.077	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	19.6	100.8	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	19.6	86.3	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.3	8.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	2.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	22.9	96.9	cfs
Average Flow Velocity Within the Gutter Section	V =	2.0	2.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.7	1.9	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm	R =	0.91	0.35	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**20.9**	**33.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.47	5.24	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.04	0.82	inches

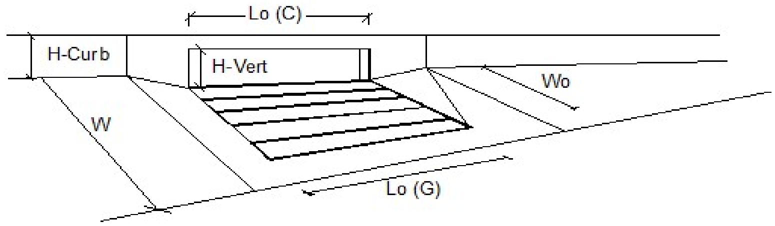
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**20.4**	**33.6**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

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')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	20.00	20.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	3.3	12.5	cfs
Water Spread Width		T =	7.8	13.2	ft
Water Depth at Flowline (outside of local depression)		d =	2.5	3.8	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.316	0.183	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	2.2	10.3	cfs
Discharge within the Gutter Section W		Q_w =	1.0	2.3	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.14	0.23	sq ft
Velocity within the Gutter Section W		V_W =	7.2	9.8	fps
Water Depth for Design Condition		d_{LOCAL} =	6.5	7.8	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb or Slotted Inlet Opening Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)		S_e =	0.167	0.105	ft/ft
Required Length L_T to Have 100% Interception		L_T =	9.04	22.15	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	9.04	20.00	ft
Interception Capacity		Q_i =	3.3	12.3	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoef =	1.33	1.33	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.03	0.03	
Effective (Unclogged) Length		L_e =	17.34	17.34	ft
Actual Interception Capacity		**Q_a =**	**3.3**	**12.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.3**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**3.3**	**12.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.3**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**98**	**%**

Swale Sizing Computations

Hydraulic Analysis Report

Project Data

Project Title: Bradley Ridge Filing No 3

Project Date: Thursday, September 14, 2023

Project Units: U.S. Customary Units

Channel Analysis: SW-C9

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Station (ft	Elevation (ft)	Manning's n
0.00	3.00	0.0300
9.00	0.00	0.0300
10.00	0.00	0.0300
19.00	3.00	-----

Longitudinal Slope: 0.0104 ft/ft

Flow 14.6000 cfs

Result Parameters

Depth 1.0340 ft

Area of Flow 4.2413 ft^2

Wetted Perimeter 7.5394 ft

Hydraulic Radius 0.5625 ft

Average Velocity 3.4423 ft/s

Top Width 7.2039 ft

Froude Number: 0.7906

Critical Depth 0.9289 ft

Critical Velocity 4.1510 ft/s

Critical Slope: 0.0172 ft/ft

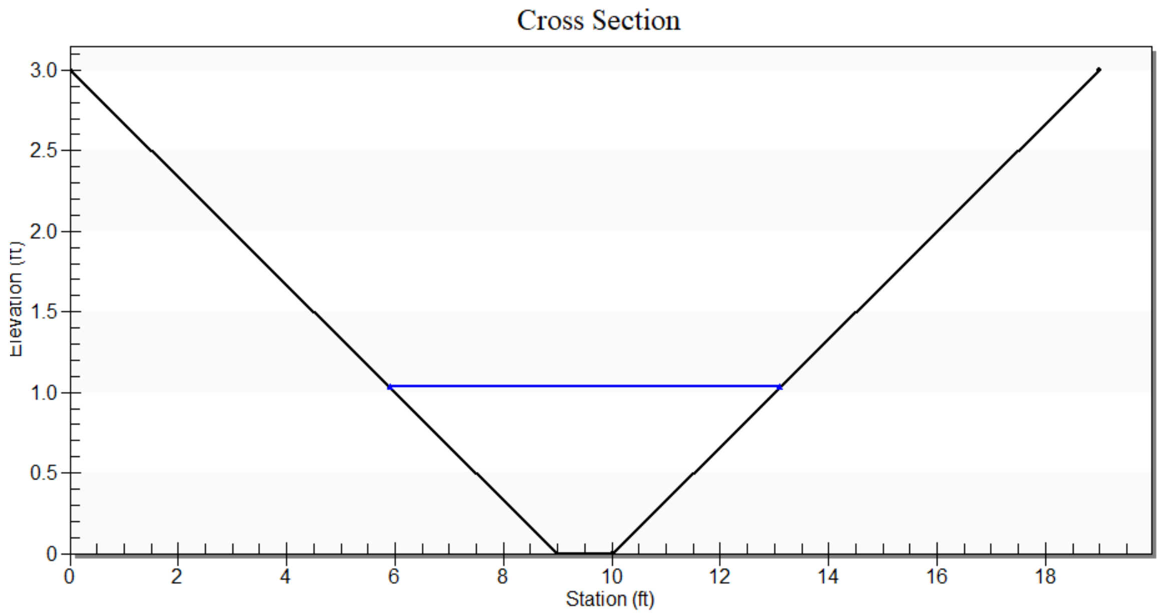
Critical Top Width 6.57 ft

Calculated Max Shear Stress 0.6710 lb/ft^2

Calculated Avg Shear Stress 0.3651 lb/ft^2

Composite Manning's n Equation: Lotter method

Manning's n: 0.0300



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CHANNEL ANALYSIS

> > > SW-C9

Name	SW-C9
Discharge	14.6
Channel Slope	0.0103
Channel Bottom Width	1
Left Side Slope	3
Right Side Slope	3
Existing Bend Radius	84.6
Low Flow Liner	
Retardence Class	C 6-12 in
Vegetation Type	Bunch Type
Vegetation Density	Good 65-79%
Soil Type	Clay Loam (CL)

Shoremax

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Shoremax w/ P300 Unvegetated	Straight	14.6 cfs	3.43 ft/s	1.04 ft	0.03	8.5 lbs/ft2	0.67 lbs/ft2	12.77	STABLE	F
Underlying Substrate	Straight	14.6 cfs	3.43 ft/s	1.04 ft	0.03	6.54 lbs/ft2	0.36 lbs/ft2	18.06	STABLE	F
Shoremax w/ P300 Reinforced Vegetation	Straight	14.6 cfs	3.43 ft/s	1.04 ft	0.03	14 lbs/ft2	0.67 lbs/ft2	21.03	STABLE	F
Underlying Substrate	Straight	14.6 cfs	3.43 ft/s	1.04 ft	0.03	8.5 lbs/ft2	0.36 lbs/ft2	23.48	STABLE	F
Shoremax w/ P300 Unvegetated	Bend	14.6 cfs	3.43 ft/s	1.04 ft	0.03	8.5 lbs/ft2	0.7 lbs/ft2	12.16	STABLE	F
Underlying Substrate	Bend	14.6 cfs	3.43 ft/s	1.04 ft	0.03	6.54 lbs/ft2	0.38 lbs/ft2	17.2	STABLE	F
Shoremax w/ P300 Reinforced Vegetation	Bend	14.6 cfs	3.43 ft/s	1.04 ft	0.03	14 lbs/ft2	0.7 lbs/ft2	20.03	STABLE	F
Underlying Substrate	Bend	14.6 cfs	3.43 ft/s	1.04 ft	0.03	8.5 lbs/ft2	0.38 lbs/ft2	22.36	STABLE	F

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ANALYSIS COMPUTATIONS
> > > > View Computation

Inputs	
Channel Discharge (Q):	14.6 cfs
Peak Flow Period (H):	hours
Channel Slope (S0):	0.0103 ft/ft
Bottom Width (B):	1 ft
Left Side Slope (ZL):	3 (H : V)
Right Side Slope (ZR):	3 (H : V)
Existing Channel Bend:	Yes
Bend Coefficient (Kb):	
Channel Bend Radius:	84.6 ft
Retardance Class of Vegetation:	C 6-12 in
Vegetation Type:	Bunch Type
Vegetation Density:	Good 65-79%
Soil Type:	Clay Loam (CL)
Channel Lining Options	
Shoremax Protection Type	Permanent

Basic Relationships
A = Cross sectional area, ft2 (m2) = (B * D) + (Z_L / 2 * D2) + (Z_R / 2 * D2)
Where:
B = Base width of channel, ft (m)
D = Flow depth, ft (m)
Z_L = Left side bank slope (H : 1 V)
Z_R = Right side bank slope (H : 1 V)
P = Wetted perimeter, ft (m) = B + Z_L * D + Z_R * D
R = Hydraulic radius, ft (m) = A / P
V = Flow velocity, ft/s (m/s) = Q / A
Where:
Q = Channel discharge, cfs (cms)
Taua Average bed shear stress, psf (Pa) = 62.4 * R * S0
Where:
S0 = Gradient of channel, ft/ft (m/m)
Tau_0 = Maximum bed shear stress, psf (Pa) = 62.4 * D * S_0

Unvegetated Conditions Computations:
n = Manning's n = a * Tauab
and (iteratively solved)
n = 1.486 / Q * A * R(2/3)$S_0^{0.5}$
Where:
n = Manning's n
a = Product specific coefficient from performance testing
b = Product specific coefficient from performance testing

SF_P = Product factor of safety = Tau_T / Tau_0
Where:
TauT = Permissible shear stress from testing, psf (Pa)
Tau_p = In place permissible shear, psf (Pa) = Tau_T / alpha * (Tau_S + alpha / 4.3)
Where:
alpha = unit conversion constant, 0.14 English, 6.5 Metric
Tau_S = Permissible shear stress of soil
SFL = Factor of safety of installed liner = Taup / Taua

Vegetated Computations:
n = Manning's n = alpha * Cn* Taua-0.4
and (iteratively solved)
n = 1.486 / Q * A * R(2/3)$S_0^{0.5}$
Where:
alpha = Unit conversion constant, 0.213 English, 1.0 Metric
Cn = Vegetation retardance coefficient
SF_P = Product factor of safety = Tau_{TV} / Tau_0
Where:
Tau_{TV} = Permissible shear stress from testing, psf (Pa)
Tau_p = In place permissible shear, psf (Pa) = Tau_S / (1 – C_{FTRM}) * (n / n_S)2
Where:
C_{FTRM} = Coefficient of TRM performance derived from testing Tau_S = Permissible shear stress of soil
n_S = Manning's of soil bed if left unprotected
SF_L = Factor of safety of installed liner = Tau_p / Tau_a

Shoremax

Phase	Mannings N	Predicted flow depth (D)	Cross sectional area (A)	Wetted perimeter (P)	Hydraulic radius (R)	Flow velocity (V)	Froude number (FR)	Calculated Shear Stress	SFP/SFL
Shoremax w/ P300 Unvegetated	0.03	1.04 ft	4.25 ft2	7.55 ft	0.56 ft	3.43 ft/s	0.81	0.67 lbs/ft2	12.77 (SFP)
Underlying Substrate	0.03	1.04 ft	4.25 ft2	7.55 ft	0.56 ft	3.43 ft/s	0.81	0.36 lbs/ft2	18.06 (SFL)
Shoremax w/ P300 Reinforced Vegetation	0.03	1.04 ft	4.25 ft2	7.55 ft	0.56 ft	3.43 ft/s	0.81	0.67 lbs/ft2	21.03 (SFP)
Underlying Substrate	0.03	1.04 ft	4.25 ft2	7.55 ft	0.56 ft	3.43 ft/s	0.81	0.36 lbs/ft2	23.48 (SFL)
Shoremax w/ P300 Unvegetated	0.03	1.04 ft	4.25 ft2	7.55 ft	0.56 ft	3.43 ft/s	0.81	0.7 lbs/ft2	12.16 (SFP)
Underlying Substrate	0.03	1.04 ft	4.25 ft2	7.55 ft	0.56 ft	3.43 ft/s	0.81	0.38 lbs/ft2	17.2 (SFL)
Shoremax w/ P300 Reinforced Vegetation	0.03	1.04 ft	4.25 ft2	7.55 ft	0.56 ft	3.43 ft/s	0.81	0.7 lbs/ft2	20.03 (SFP)
Underlying Substrate	0.03	1.04 ft	4.25 ft2	7.55 ft	0.56 ft	3.43 ft/s	0.81	0.38 lbs/ft2	22.36 (SFL)

Hydraulic Analysis Report

Project Data

Project Title: Bradley Ridge Filing No 3

Project Date: Thursday, September 14, 2023

Project Units: U.S. Customary Units

Channel Analysis: SW-C14

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Station (ft	Elevation (ft)	Manning's n
0.00	4.00	0.0300
12.00	0.00	0.0300
16.00	0.00	0.0300
28.00	4.00	-----

Longitudinal Slope: 0.0200 ft/ft

Flow 81.2000 cfs

Result Parameters

Depth 1.4588 ft

Area of Flow 12.2198 ft^2

Wetted Perimeter 13.2264 ft

Hydraulic Radius 0.9239 ft

Average Velocity 6.6450 ft/s

Top Width 12.7529 ft

Froude Number: 1.1963

Critical Depth 1.5990 ft

Critical Velocity 5.7724 ft/s

Critical Slope: 0.0136 ft/ft

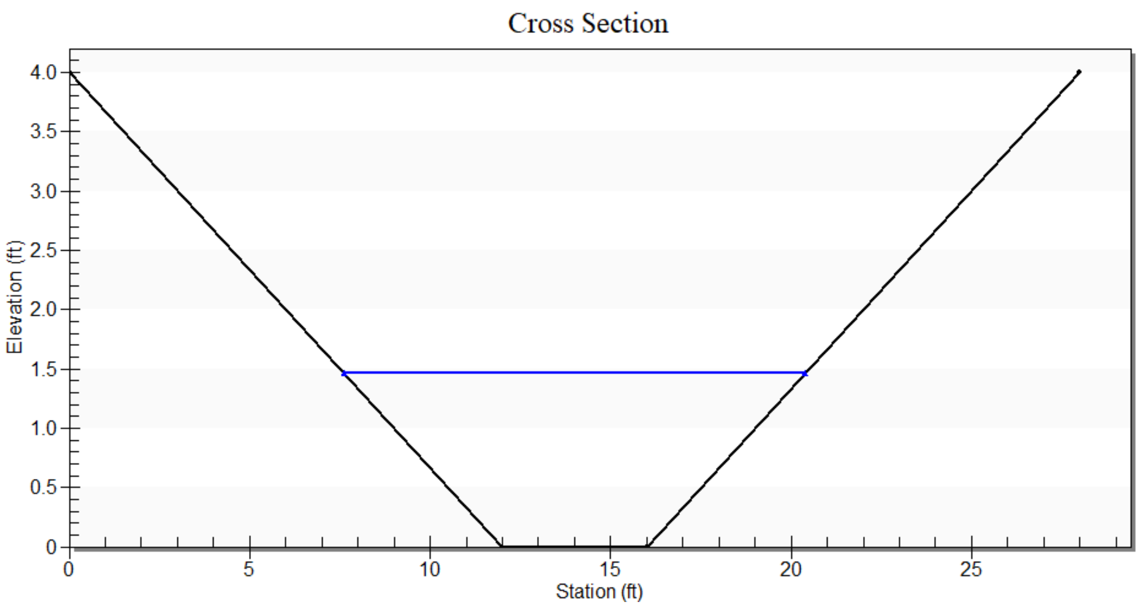
Critical Top Width 13.59 ft

Calculated Max Shear Stress 1.8206 lb/ft^2

Calculated Avg Shear Stress 1.1530 lb/ft^2

Composite Manning's n Equation: Lotter method

Manning's n: 0.0300



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ANALYSIS COMPUTATIONS

> > > > View Computation

Inputs	
Channel Discharge (Q):	132.9 cfs
Peak Flow Period (H):	hours
Channel Slope (S0):	0.02 ft/ft
Bottom Width (B):	4 ft
Left Side Slope (ZL):	3 (H : V)
Right Side Slope (ZR):	3 (H : V)
Existing Channel Bend:	No
Bend Coefficient (Kb):	1
Channel Bend Radius:	
Retardance Class of Vegetation:	C 6-12 in
Vegetation Type:	Bunch Type
Vegetation Density:	Good 65-79%
Soil Type:	Clay Loam (CL)
Channel Lining Options	
Shoremax Protection Type	Permanent

Basic Relationships
A = Cross sectional area, ft2 (m2) = (B * D) + (Z_L / 2 * D2) + (Z_R / 2 * D2)
Where:
B = Base width of channel, ft (m)
D = Flow depth, ft (m)
Z_L = Left side bank slope (H : 1 V)
Z_R = Right side bank slope (H : 1 V)
P = Wetted perimeter, ft (m) = B + Z_L * D + Z_R * D
R = Hydraulic radius, ft (m) = A / P
V = Flow velocity, ft/s (m/s) = Q / A
Where:
Q = Channel discharge, cfs (cms)
Taua Average bed shear stress, psf (Pa) = 62.4 * R * S0
Where:
S0 = Gradient of channel, ft/ft (m/m)
Tau_0 = Maximum bed shear stress, psf (Pa) = 62.4 * D * S_0

Unvegetated Conditions Computations:
n = Manning's n = a * Tauab
and (iteratively solved)
n = 1.486 / Q * A * R(2/3)$S_0^{0.5}$
Where:
n = Manning's n
a = Product specific coefficient from performance testing
b = Product specific coefficient from performance testing

SF_P = Product factor of safety = Tau_T / Tau_0
Where:
TauT = Permissible shear stress from testing, psf (Pa)
Tau_p = In place permissible shear, psf (Pa) = Tau_T / alpha * (Tau_S + alpha / 4.3)
Where:
alpha = unit conversion constant, 0.14 English, 6.5 Metric
Tau_S = Permissible shear stress of soil
SFL = Factor of safety of installed liner = Taup / Taua

Vegetated Computations:
n = Manning's n = alpha * Cn* Taua-0.4
and (iteratively solved)
n = 1.486 / Q * A * R(2/3)$S_0^{0.5}$
Where:
alpha = Unit conversion constant, 0.213 English, 1.0 Metric
Cn = Vegetation retardance coefficient
SF_P = Product factor of safety = Tau_{TV} / Tau_0
Where:
Tau_{TV} = Permissible shear stress from testing, psf (Pa)
Tau_p = In place permissible shear, psf (Pa) = Tau_S / (1 – C_{FTRM}) * (n / n_S)2
Where:
C_{FTRM} = Coefficient of TRM performance derived from testing Tau_S = Permissible shear stress of soil
n_S = Manning's of soil bed if left unprotected
SF_L = Factor of safety of installed liner = Tau_p / Tau_a

Shoremax

Phase	Mannings N	Predicted flow depth (D)	Cross sectional area (A)	Wetted perimeter (P)	Hydraulic radius (R)	Flow velocity (V)	Froude number (FR)	Calculated Shear Stress	SFP/SFL
Shoremax w/ P300 Unvegetated	0.028	1.79 ft	16.77 ft2	15.32 ft	1.09 ft	7.93 ft/s	1.34	2.23 lbs/ft2	3.8 (SFP)
Underlying Substrate	0.028	1.79 ft	16.77 ft2	15.32 ft	1.09 ft	7.93 ft/s	1.34	1.37 lbs/ft2	4.79 (SFL)
Shoremax w/ P300 Reinforced Vegetation	0.039	2.09 ft	21.42 ft2	17.2 ft	1.25 ft	6.19 ft/s	0.98	2.61 lbs/ft2	5.37 (SFP)
Underlying Substrate	0.039	2.09 ft	21.42 ft2	17.2 ft	1.25 ft	6.19 ft/s	0.98	1.55 lbs/ft2	5.47 (SFL)

APPENDIX E

Pond Computations

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: TJE
Company: Galloway
Date: November 20, 2023
Project: Bradley Ridge Filing 3 - POND #2 UIA:RPA AREAS (SHEET 1)
Location: Colorado Springs, CO

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth 0.60 inches

Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA
Area ID	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9	Area 10	Area 11	Area 12
Downstream Design Point ID	Pond 2	Pond 2	Pond 2	Pond 2	Pond 2	Pond 2	Pond 2	Pond 2	Pond 2	Pond 2	Pond 2	Pond 2
Downstream BMP Type	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB
DCIA (ft^2)	--	--	--	--	--	--	--	--	--	--	--	--
UIA (ft^2)	979	903	877	927	675	878	878	542	544	16,890	3,893	1,644
RPA (ft^2)	1,115	1,375	1,332	1,496	1,061	1,416	1,416	819	826	25,991	5,538	2,357
SPA (ft^2)	--	--	--	--	--	--	--	--	--	--	--	--
HSG A (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
HSG B (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
HSG C/D (%)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Average Slope of RPA (ft/ft)	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
UIA:RPA Interface Width (ft)	192.00	183.00	175.00	185.00	135.00	175.00	175.00	108.00	108.00	720.00	782.00	331.00

CALCULATED RUNOFF RESULTS

Area ID	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9	Area 10	Area 11	Area 12
UIA:RPA Area (ft^2)	2,094	2,278	2,209	2,423	1,736	2,294	2,294	1,361	1,370	42,881	9,431	4,001
L / W Ratio	0.06	0.07	0.07	0.07	0.10	0.07	0.07	0.12	0.12	0.08	0.06	0.06
UIA / Area	0.4675	0.3964	0.3970	0.3826	0.3888	0.3827	0.3827	0.3982	0.3971	0.3939	0.4128	0.4109
Runoff (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Runoff (ft^3)	0	0	0	0	0	0	0	0	0	0	0	0
Runoff Reduction (ft^3)	41	38	37	39	28	37	37	23	23	704	162	69

CALCULATED WQCV RESULTS

Area ID	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9	Area 10	Area 11	Area 12
WQCV (ft^3)	41	38	37	39	28	37	37	23	23	704	162	69
WQCV Reduction (ft^3)	41	38	37	39	28	37	37	23	23	704	162	69
WQCV Reduction (%)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Untreated WQCV (ft^3)	0	0	0	0	0	0	0	0	0	0	0	0

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	Pond 2											
DCIA (ft^2)	0											
UIA (ft^2)	29,630											
RPA (ft^2)	44,742											
SPA (ft^2)	0											
Total Area (ft^2)	74,372											
Total Impervious Area (ft^2)	29,630											
WQCV (ft^3)	1,235											
WQCV Reduction (ft^3)	1,235											
WQCV Reduction (%)	100%											
Untreated WQCV (ft^3)	0											

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	74,372
Total Impervious Area (ft^2)	29,630
WQCV (ft^3)	1,235
WQCV Reduction (ft^3)	1,235
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 1

Designer: TJE
Company: Galloway
Date: November 20, 2023
Project: Bradley Ridge Filing 3 - POND #2 UIA:RAP AREAS (SHEET 2)
Location: Colorado Springs, CO

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches

Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA
Area ID	Area 13	Area 14	Area 15	Area 16	Area 17	Area 18
Downstream Design Point ID	Pond 2	Pond 2	Pond 2	Pond 2	Pond 2	Pond 2
Downstream BMP Type	EDB	EDB	EDB	EDB	EDB	EDB
DCIA (ft^2)	--	--	--	--	--	--
UIA (ft^2)	2,283	2,768	3,043	925	690	1,440
RPA (ft^2)	3,168	3,815	4,193	1,470	1,145	2,249
SPA (ft^2)	--	--	--	--	--	--
HSG A (%)	0%	0%	0%	0%	0%	0%
HSG B (%)	0%	0%	0%	0%	0%	0%
HSG C/D (%)	100%	100%	100%	100%	100%	100%
Average Slope of RPA (ft/ft)	0.015	0.015	0.015	0.015	0.015	0.015
UIA:RPA Interface Width (ft)	456.00	554.00	608.00	185.00	137.00	300.00

CALCULATED RUNOFF RESULTS

Area ID	Area 13	Area 14	Area 15		Area 17	Area 18
UIA:RPA Area (ft^2)	5,451	6,583	7,236	2,395	1,835	3,689
L / W Ratio	0.06	0.06	0.06	0.07	0.10	0.06
UIA / Area	0.4188	0.4205	0.4205	0.3862	0.3760	0.3903
Runoff (in)	0.00	0.00	0.00	0.00	0.00	0.00
Runoff (ft^3)	0	0	0	0	0	0
Runoff Reduction (ft^3)	95	115	127	39	29	60

CALCULATED WQCV RESULTS

Area ID	Area 13	Area 14	Area 15	Area 16	Area 17	Area 18
WQCV (ft^3)	95	115	127	39	29	60
WQCV Reduction (ft^3)	95	115	127	39	29	60
WQCV Reduction (%)	100%	100%	100%	100%	100%	100%
Untreated WQCV (ft^3)	0	0	0	0	0	0

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	Pond 2
DCIA (ft^2)	0
UIA (ft^2)	11,149
RPA (ft^2)	16,040
SPA (ft^2)	0
Total Area (ft^2)	27,189
Total Impervious Area (ft^2)	11,149
WQCV (ft^3)	465
WQCV Reduction (ft^3)	465
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	27,189
Total Impervious Area (ft^2)	11,149
WQCV (ft^3)	465
WQCV Reduction (ft^3)	465
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 1

Designer: TJE
Company: Galloway
Date: November 20, 2023
Project: Bradley Ridge Filing 3 - POND #4 UIA:RPA AREAS (SHEET 3)
Location: Colorado Springs, CO

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches
Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA
Area ID	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9	Area 10	Area 11	Area 12
Downstream Design Point ID	Pond 4	Pond 4	Pond 4	Pond 4	Pond 4	Pond 4	Pond 4	Pond 4	Pond 4	Pond 4	Pond 4	Pond 4
Downstream BMP Type	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB
DCIA (ft^2)	--	--	--	--	--	--	--	--	--	--	--	--
UIA (ft^2)	2,381	1,054	489	489	489	489	1,022	527	467	11,679	926	526
RPA (ft^2)	3,839	1,793	784	784	740	719	1,643	906	667	4,523	1,493	906
SPA (ft^2)	--	--	--	--	--	--	--	--	--	--	--	--
HSG A (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
HSG B (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
HSG C/D (%)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Average Slope of RPA (ft/ft)	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
UIA:RPA Interface Width (ft)	476.00	236.00	97.00	97.00	97.00	97.00	203.00	102.00	93.00	455.00	185.00	103.00

CALCULATED RUNOFF RESULTS

Area ID	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9	Area 10	Area 11	Area 12
UIA:RPA Area (ft^2)	6,220	2,847	1,273	1,273	1,229	1,208	2,665	1,433	1,134	16,202	2,419	1,432
L / W Ratio	0.06	0.06	0.14	0.14	0.13	0.13	0.06	0.14	0.13	0.08	0.07	0.13
UIA / Area	0.3828	0.3702	0.3841	0.3841	0.3979	0.4048	0.3835	0.3678	0.4118	0.7208	0.3828	0.3673
Runoff (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00
Runoff (ft^3)	0	0	0	0	0	0	0	0	0	226	0	0
Runoff Reduction (ft^3)	99	44	20	20	20	20	43	22	19	260	39	22

CALCULATED WQCV RESULTS

Area ID	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9	Area 10	Area 11	Area 12
WQCV (ft^3)	99	44	20	20	20	20	43	22	19	487	39	22
WQCV Reduction (ft^3)	99	44	20	20	20	20	43	22	19	260	39	22
WQCV Reduction (%)	100%	100%	100%	100%	100%	100%	100%	100%	100%	53%	100%	100%
Untreated WQCV (ft^3)	0	0	0	0	0	0	0	0	0	226	0	0

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	Pond 4											
DCIA (ft^2)	0											
UIA (ft^2)	20,538											
RPA (ft^2)	18,797											
SPA (ft^2)	0											
Total Area (ft^2)	39,335											
Total Impervious Area (ft^2)	20,538											
WQCV (ft^3)	856											
WQCV Reduction (ft^3)	629											
WQCV Reduction (%)	74%											
Untreated WQCV (ft^3)	226											

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	39,335
Total Impervious Area (ft^2)	20,538
WQCV (ft^3)	856
WQCV Reduction (ft^3)	629
WQCV Reduction (%)	74%
Untreated WQCV (ft^3)	226

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: TJE
Company: Galloway
Date: November 20, 2023
Project: Bradley Ridge Filing 3 - RUNOFF REDUCTION SUMMARY SHEET
Location: Colorado Springs, CO

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches
Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	UIA:RPA	DCIA	SPA	DCIA	SPA	UIA:RPA	DCIA	SPA	SPA		
Area ID	SHEET 1	SHEET 2	Pond2 (DCIA)	Pond2 (SPA)	Pond3(DCIA)	Pond3(SPA)	SHEET 3	Pond4 (DCIA)	Pond4 (SPA)	Off-Site		
Downstream Design Point ID	Pond #2	Pond #2	Pond #2	Pond #2	Pond #3	Pond #3	Pond #4	Pond #4	Pond #4	Off-Site		
Downstream BMP Type	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB	None		
DCIA (ft^2)	--	--	1,067,076	--	21,181	--	--	251,651	--	--		
UIA (ft^2)	29,630	11,149	--	--	--	--	20,538	--	--	--		
RPA (ft^2)	44,742	16,040	--	--	--	--	18,797	--	--	--		
SPA (ft^2)	--	--	--	862,771	--	14,538	--	--	142,436	32,629		
HSG A (%)	0%	0%	--	0%	--	0%	0%	--	0%	0%		
HSG B (%)	0%	0%	--	0%	--	0%	0%	--	0%	0%		
HSG C/D (%)	100%	100%	--	100%	--	100%	100%	--	100%	100%		
Average Slope of RPA (ft/ft)	0.015	0.015	--	--	--	--	0.015	--	--	--		
UIA:RPA Interface Width (ft)	3269.00	1618.00	--	--	--	--	2241.00	--	--	--		

CALCULATED RUNOFF RESULTS

Area ID	SHEET 1	SHEET 2	Pond2 (DCIA)	Pond2 (SPA)	Pond3(DCIA)	Pond3(SPA)	SHEET 3	Pond4 (DCIA)	Pond4 (SPA)	Off-Site		
UIA:RPA Area (ft^2)	74,372	27,189	--	--	--	--	39,335	--	--	--		
L / W Ratio	0.06	0.06	--	--	--	--	0.06	--	--	--		
UIA / Area	0.3984	0.4101	--	--	--	--	0.5221	--	--	--		
Runoff (in)	0.00	0.00	0.50	0.00	0.50	0.00	0.00	0.50	0.00	0.00		
Runoff (ft^3)	0	0	44462	0	883	0	0	10485	0	0		
Runoff Reduction (ft^3)	1235	465	0	43139	0	727	856	0	7122	1631		

CALCULATED WQCV RESULTS

Area ID	SHEET 1	SHEET 2	Pond2 (DCIA)	Pond2 (SPA)	Pond3(DCIA)	Pond3(SPA)	SHEET 3	Pond4 (DCIA)	Pond4 (SPA)	Off-Site		
WQCV (ft^3)	1235	465	44462	0	883	0	856	10485	0	0		
WQCV Reduction (ft^3)	1235	465	0	0	0	0	856	0	0	0		
WQCV Reduction (%)	100%	100%	0%	0%	0%	0%	100%	0%	0%	0%		
Untreated WQCV (ft^3)	0	0	44462	0	883	0	0	10485	0	0		

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	Pond #2	Pond #3	Pond #4	Off-Site								
DCIA (ft^2)	1,067,076	21,181	251,651	0								
UIA (ft^2)	40,779	0	20,538	0								
RPA (ft^2)	60,782	0	18,797	0								
SPA (ft^2)	862,771	14,538	142,436	32,629								
Total Area (ft^2)	2,031,408	35,719	433,422	32,629								
Total Impervious Area (ft^2)	1,107,855	21,181	272,189	0								
WQCV (ft^3)	46,161	883	11,341	0								
WQCV Reduction (ft^3)	1,699	0	856	0								
WQCV Reduction (%)	4%	0%	8%	0%								
Untreated WQCV (ft^3)	44,462	883	10,485	0								

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	2,533,178
Total Impervious Area (ft^2)	1,401,225
WQCV (ft^3)	58,384
WQCV Reduction (ft^3)	2,555
WQCV Reduction (%)	4%
Untreated WQCV (ft^3)	55,830

THIS VALUE USED FOR POND #2 WQCV IN MHFD DETENTION SHEET

DETENTION POND TRIBUTARY AREAS

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs

Project Name: Bradley Ridge Filing No. 3
Project No.: RPG03.20
Calculated By: TJE
Checked By: BAS
Date: 9/12/23

WFJCC Pond #2

Basin	Area	% Imp
WF12A	13.68	42.0
WF11	1.10	35.2
WF10	1.60	50.3
WF12C	29.61	2.0
WF13	1.00	95.0
WF14	3.50	51.1
WF16	0.10	95.0
WF17	0.59	13.6
C-1	4.25	55.7
C-2	1.73	65.0
C-3	3.81	65.0
C-4	1.74	65.0
C-5	0.62	65.0
C-6	0.89	65.0
C-7	1.71	65.0
C-8	1.27	65.0
C-9	2.22	90.0
C-10	0.84	65.0
C-11	1.32	65.0
C-12	3.07	65.0
C-13	2.28	65.0
C-14	12.78	55.0
C-15	22.62	60.6
C-16	6.54	3.4
OS-1	1.25	2.0
Total	**120.12**	**40.2**

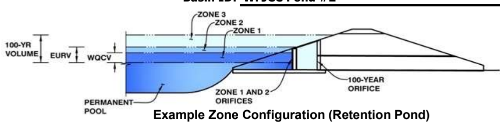
Galloway

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **Bradley Ridge Filing No. 3**

Basin ID: **WFJCC Pond #2**



Example Zone Configuration (Retention Pond)

Depth Increment = 1.00 ft

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	120.12	acres
Watershed Length =	2,500	ft
Watershed Length to Centroid =	1,200	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	40.20%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.021	acre-feet	1.021	acre-feet
Excess Urban Runoff Volume (EURV) =	4.489	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	5.588	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	8.391	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	10.823	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	13.757	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	16.331	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	19.558	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.55 in.) =	30.389	acre-feet	3.55	inches
Approximate 2-yr Detention Volume =	3.916	acre-feet		
Approximate 5-yr Detention Volume =	6.112	acre-feet		
Approximate 10-yr Detention Volume =	6.994	acre-feet		
Approximate 25-yr Detention Volume =	7.683	acre-feet		
Approximate 50-yr Detention Volume =	7.997	acre-feet		
Approximate 100-yr Detention Volume =	9.398	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.021	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.468	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.909	acre-feet
Total Detention Basin Volume =	9.398	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	520	0.012		
	--	1.00	--	--	--	886	0.020	703	0.016
	--	2.00	--	--	--	6,569	0.151	4,430	0.102
	--	3.00	--	--	--	29,198	0.670	22,314	0.512
	--	4.00	--	--	--	68,905	1.582	71,365	1.638
	--	5.00	--	--	--	111,785	2.566	161,710	3.712
	--	6.00	--	--	--	146,131	3.355	290,668	6.673
	--	7.00	--	--	--	158,173	3.631	442,820	10.166
	--	8.00	--	--	--	165,562	3.801	604,688	13.882
	--	9.00	--	--	--	173,066	3.973	774,002	17.769
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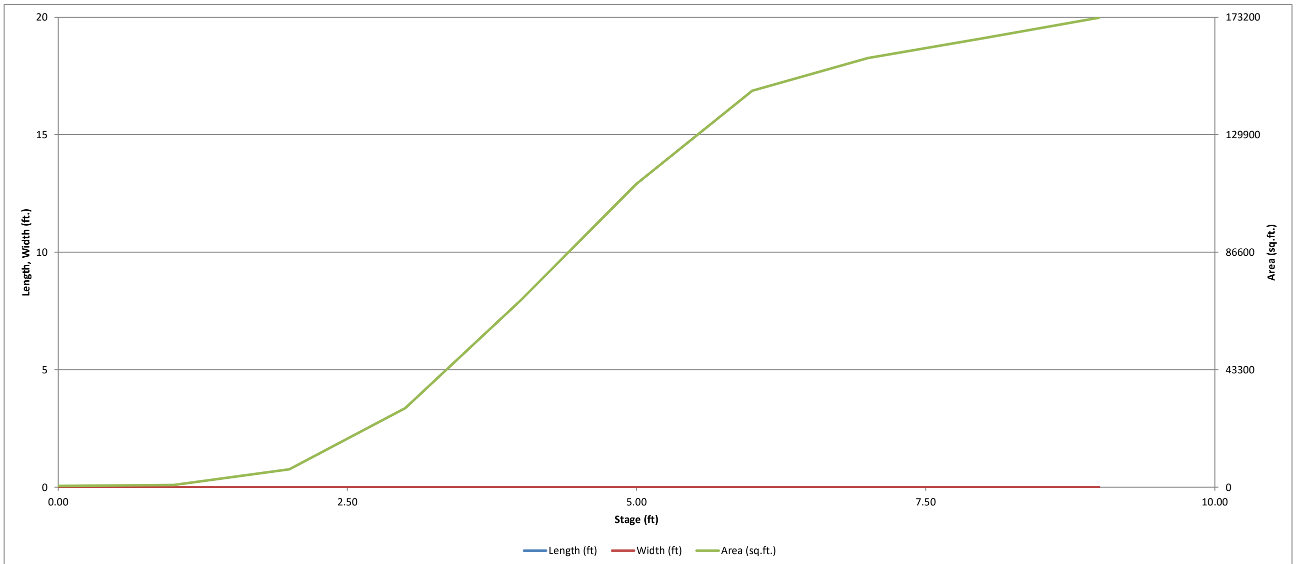
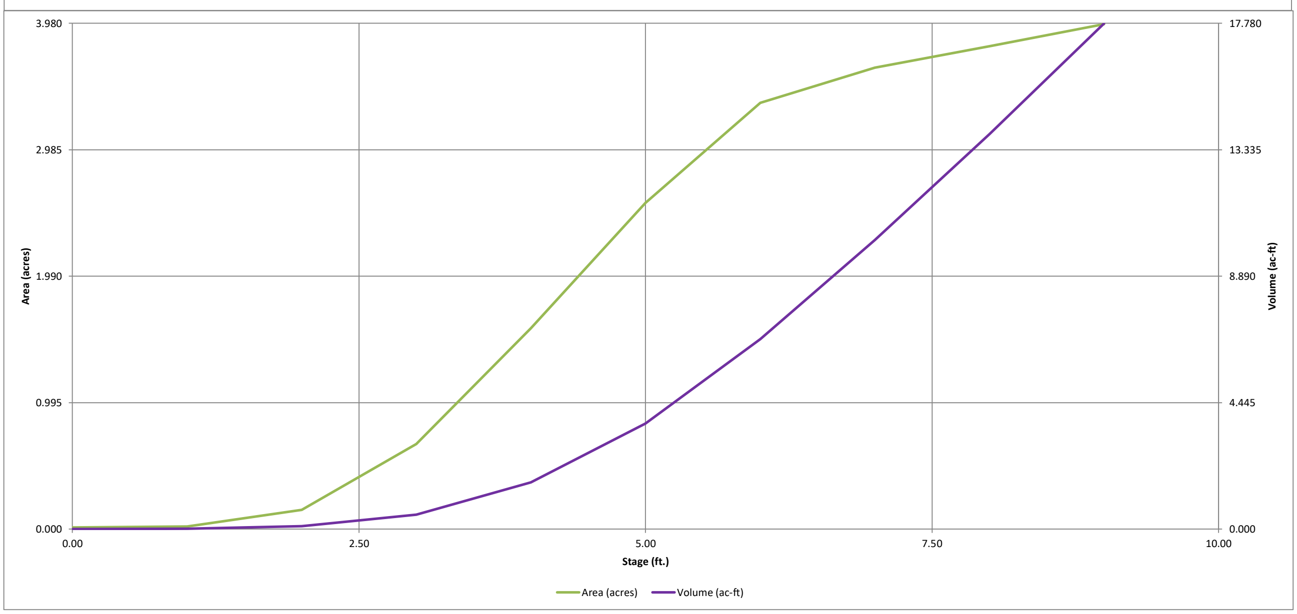
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

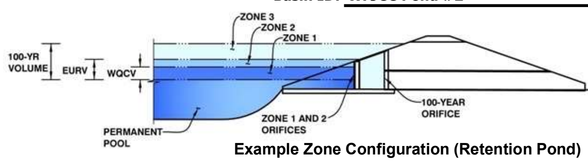




DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **Bradley Ridge Filing No. 3**
Basin ID: **WFJCC Pond #2**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.56	1.021	Orifice Plate
Zone 2 (EURV)	5.29	3.468	Rectangular Orifice
Zone 3 (100-year)	6.79	4.909	Weir&Pipe (Restrict)
Total (all zones)		9.398	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.56	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	12.00	inches
Orifice Plate: Orifice Area per Row =	2.25	sq. inches (diameter = 1-11/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.563E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	2.00	3.00				
Orifice Area (sq. inches)	2.25	2.25	2.25	2.25				

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	3.56	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	5.29	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	3.50	N/A	inches
Vertical Orifice Width =	10.00		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.24	N/A	ft^2
Vertical Orifice Centroid =	0.15	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.33	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	22.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	10.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.33	N/A	feet
Overflow Weir Slope Length =	10.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	9.63	N/A	
Overflow Grate Open Area w/o Debris =	153.12	N/A	ft^2
Overflow Grate Open Area w/ Debris =	76.56	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	54.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	54.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	15.90	N/A	ft^2
Outlet Orifice Centroid =	2.25	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	175.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.83	feet
Stage at Top of Freeboard =	8.83	feet
Basin Area at Top of Freeboard =	3.94	acres
Basin Volume at Top of Freeboard =	17.10	acre-ft

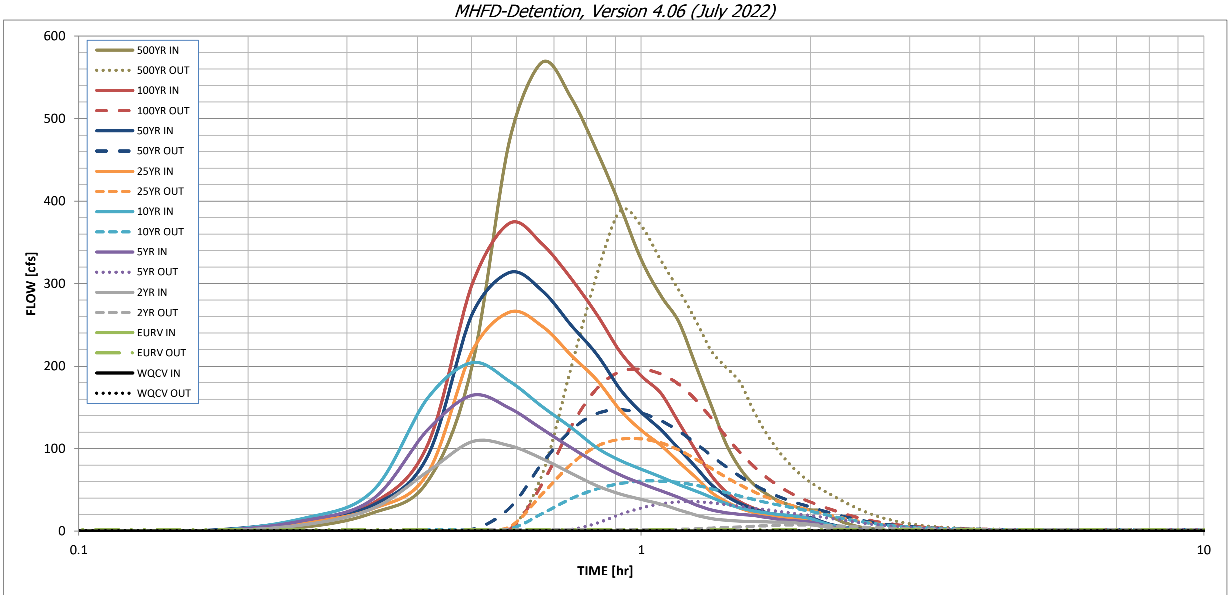
Routed Hydrograph Results

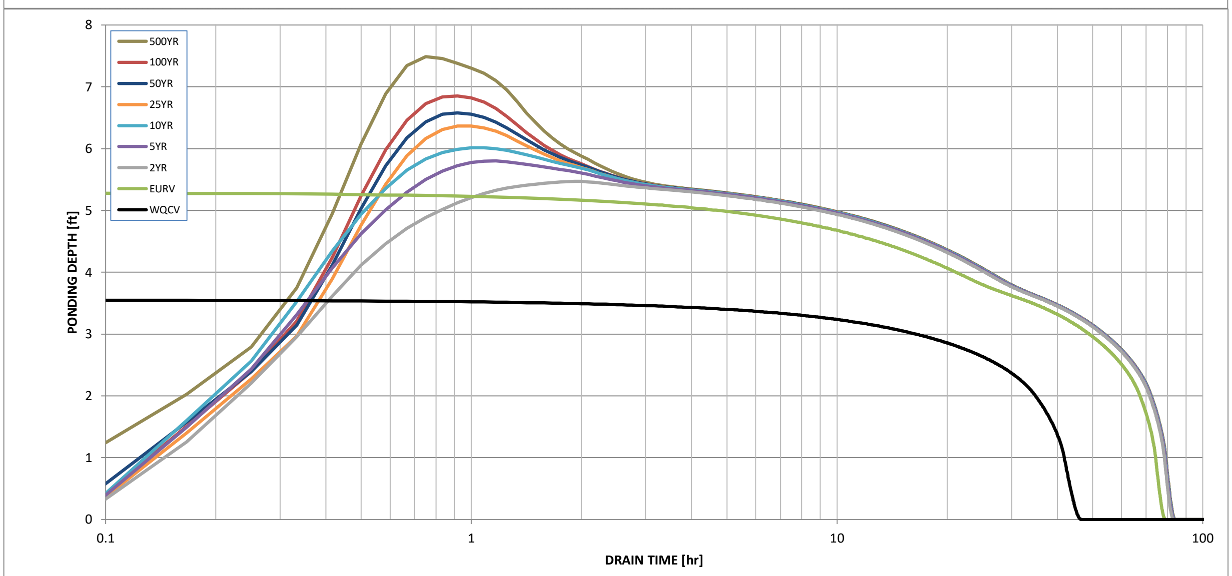
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

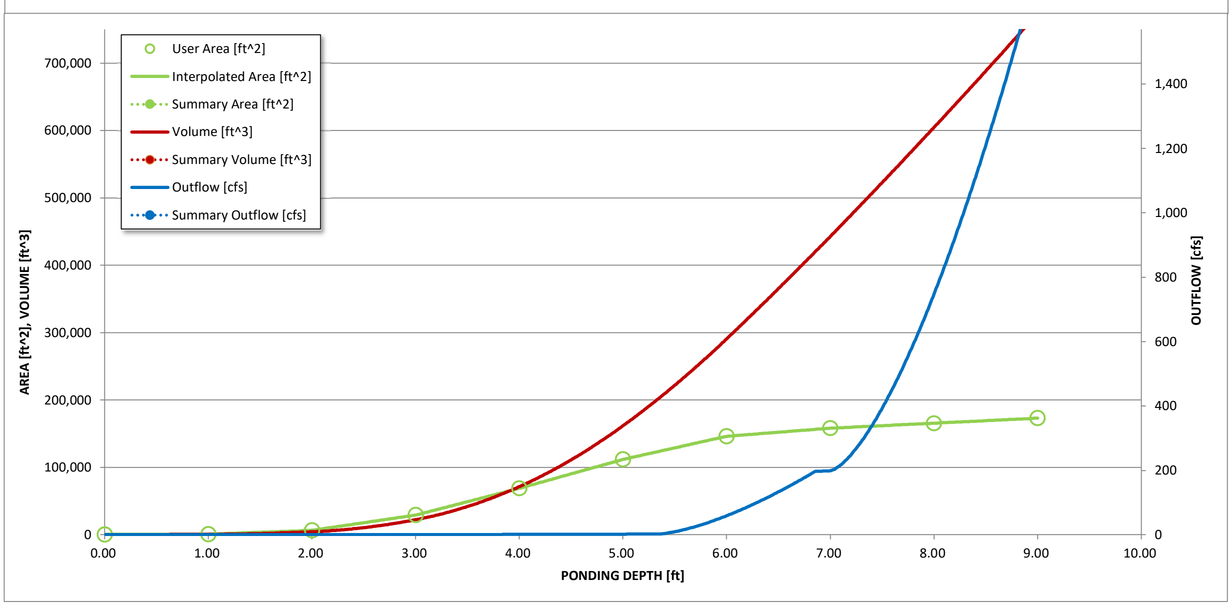
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.55
CUHP Runoff Volume (acre-ft) =	1.021	4.489	5.588	8.391	10.823	13.757	16.331	19.558	30.389
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	5.588	8.391	10.823	13.757	16.331	19.558	30.389
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	34.5	71.5	98.7	149.9	184.7	226.9	368.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.29	0.60	0.82	1.25	1.54	1.89	3.07
Peak Inflow Q (cfs) =	N/A	N/A	108.2	164.4	204.1	265.4	313.4	373.1	568.1
Peak Outflow Q (cfs) =	0.4	2.0	7.5	35.6	60.6	111.8	146.9	196.1	387.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.6	0.7	0.8	0.9	1.1
Structure Controlling Flow =	Plate	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	0.04	0.2	0.4	0.7	0.9	1.3	1.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	40	66	68	64	61	58	55	51	41
Time to Drain 99% of Inflow Volume (hours) =	**43**	72	75	73	72	70	69	67	62
Maximum Ponding Depth (ft) =	3.56	5.29	5.47	5.80	6.01	6.37	6.58	6.85	7.49
Area at Maximum Ponding Depth (acres) =	1.18	2.79	2.93	3.20	3.36	3.45	3.52	3.59	3.71
Maximum Volume Stored (acre-ft) =	1.031	4.490	4.976	6.018	6.706	7.898	8.665	9.624	11.965

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.09	4.55
	0:15:00	0.00	0.00	7.52	12.33	15.29	10.28	12.91	12.56	22.04
	0:20:00	0.00	0.00	27.39	38.69	48.69	27.05	31.53	33.76	59.53
	0:25:00	0.00	0.00	71.63	122.22	160.43	69.25	89.94	103.43	198.58
	0:30:00	0.00	0.00	108.22	164.43	204.09	217.22	261.83	297.83	473.29
	0:35:00	0.00	0.00	103.38	148.91	181.41	265.39	313.38	373.11	568.11
	0:40:00	0.00	0.00	87.82	123.55	150.89	248.37	291.36	347.83	525.41
	0:45:00	0.00	0.00	70.07	101.15	125.67	213.18	249.84	306.34	461.27
	0:50:00	0.00	0.00	55.17	82.59	101.04	183.41	214.45	263.01	394.92
	0:55:00	0.00	0.00	44.90	68.15	85.59	146.99	172.40	217.47	328.86
	1:00:00	0.00	0.00	38.28	57.70	75.00	122.13	143.89	188.13	285.40
	1:05:00	0.00	0.00	32.65	48.81	65.39	104.11	122.98	167.08	253.58
	1:10:00	0.00	0.00	25.71	40.81	56.42	83.84	99.51	131.39	200.88
	1:15:00	0.00	0.00	19.39	31.96	48.64	64.96	77.55	97.77	151.49
	1:20:00	0.00	0.00	15.16	25.63	40.78	46.94	56.14	67.18	105.56
	1:25:00	0.00	0.00	13.04	22.24	33.36	35.70	42.78	47.37	75.46
	1:30:00	0.00	0.00	11.96	20.24	28.07	27.65	33.20	35.25	56.84
	1:35:00	0.00	0.00	11.45	18.94	24.47	22.41	26.92	27.83	45.18
	1:40:00	0.00	0.00	11.11	16.49	21.96	18.85	22.63	22.66	37.03
	1:45:00	0.00	0.00	10.84	14.40	20.27	16.71	20.05	19.27	31.71
	1:50:00	0.00	0.00	10.65	12.93	19.05	15.17	18.17	16.85	27.88
	1:55:00	0.00	0.00	9.30	11.87	17.49	14.18	16.95	15.41	25.55
	2:00:00	0.00	0.00	8.06	10.81	15.19	13.62	16.25	14.93	24.70
	2:05:00	0.00	0.00	5.96	8.01	10.95	10.12	12.04	11.12	18.33
	2:10:00	0.00	0.00	4.13	5.50	7.50	6.92	8.23	7.66	12.62
	2:15:00	0.00	0.00	2.85	3.75	5.17	4.77	5.67	5.32	8.74
	2:20:00	0.00	0.00	1.95	2.49	3.50	3.24	3.85	3.61	5.92
	2:25:00	0.00	0.00	1.27	1.60	2.30	2.13	2.53	2.37	3.87
	2:30:00	0.00	0.00	0.80	1.06	1.49	1.43	1.70	1.59	2.58
	2:35:00	0.00	0.00	0.46	0.64	0.87	0.87	1.03	0.96	1.54
	2:40:00	0.00	0.00	0.22	0.33	0.42	0.45	0.53	0.49	0.77
	2:45:00	0.00	0.00	0.08	0.12	0.14	0.16	0.19	0.17	0.26
	2:50:00	0.00	0.00	0.01	0.02	0.01	0.01	0.01	0.01	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

FOREBAY SIZING CALCULATIONS

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs

Bradley Ridge Filing No. 3
RPG03.20
TJE
BAS
9/14/23

	WFJCC Pond #2 DP AO1	WFJCC Pond #2 DP AO2	WFJCC Pond #2 DP AO3	
Impervious % (I)	35.6%	48.3%	27.40%	Total impervious area of contributing upstream basins
WQCV Drain Time Coeff (a)	1	1	1	a = 1 for 40 Hr WQCV Drain Time
Tributary Area (Ac)	64.50	26.46	52.23	
Forebay Depth (Ft)	2.50	2.50	2.50	(see Table EDB-4 of the USDCM Volume 3 for depth requirement)
% of WQCV for Forebay Volume	3.0%	3.0%	3.0%	(see Table EDB-4 of the USDCM Volume 3 for requirement)
100-year Discharge (Q)	160.6	67.9	81.20	100-Year Flow entering Forebay (un-detained)
WQCV Depth (in)	0.17	0.20	0.14	WQCV Depth = $a(0.91*I^3 - 1.19*I^2 + 0.78*I)$
WQCV Volume (Ac-Ft)	0.90	0.44	0.62	
Forebay Volume (Cu. Ft.)	1179	581	814	
Forebay Discharge (Q)	3.21	1.36	1.62	(Release 2% of 100-year discharge via notch or berm/pipe configuration)
Forebay Notch Height (in)	27.00	27.00	27.00	(3" depression @ top of forebay assumed per COS DCM Volume 1, 13-30)
Forebay Deisgn Results				
Minimum Forebay Area (Sq. Ft.)	**472**	**232**	**326**	
Forebay Notch width (in)	**3**	**3**	**3**	From $Q=C_w*W*H^{1.5}$ assuming C_w=3.33 for sharp-crested weir - **If notch width <3", use 3" minimum.**

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Micropool/ISV SIZING CALCULATIONS

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs

Bradley Ridge Filing No. 3
RPG03.20
TJE
BAS
9/14/23

	Pond #2		
WQCV Volume (Ac-Ft)	1.805		From MHFD-Detention Spreadsheet
Provided ISV Depth (in)	6.00		4" Min. per USDCM, Volume 3
Provided Micropool/ISV Area (Sq. Ft.)	520.00		
Provided ISV Volume (Cu. Ft.)	260.00		
Micropool/ISV Deisgn Results			
Minimum Micropool Area (Sq. Ft.)	**472**		Assuming ISV above - Min. 10 ft^2 per USDCM, Volume 3
Required ISV Volume (Cu. Ft.)	**236**		0.3% of WQCV, per USDCM, Volume 3
Is Required Micropool Area Met?	**YES**		
Is Required ISV Volume Met?	**YES**		

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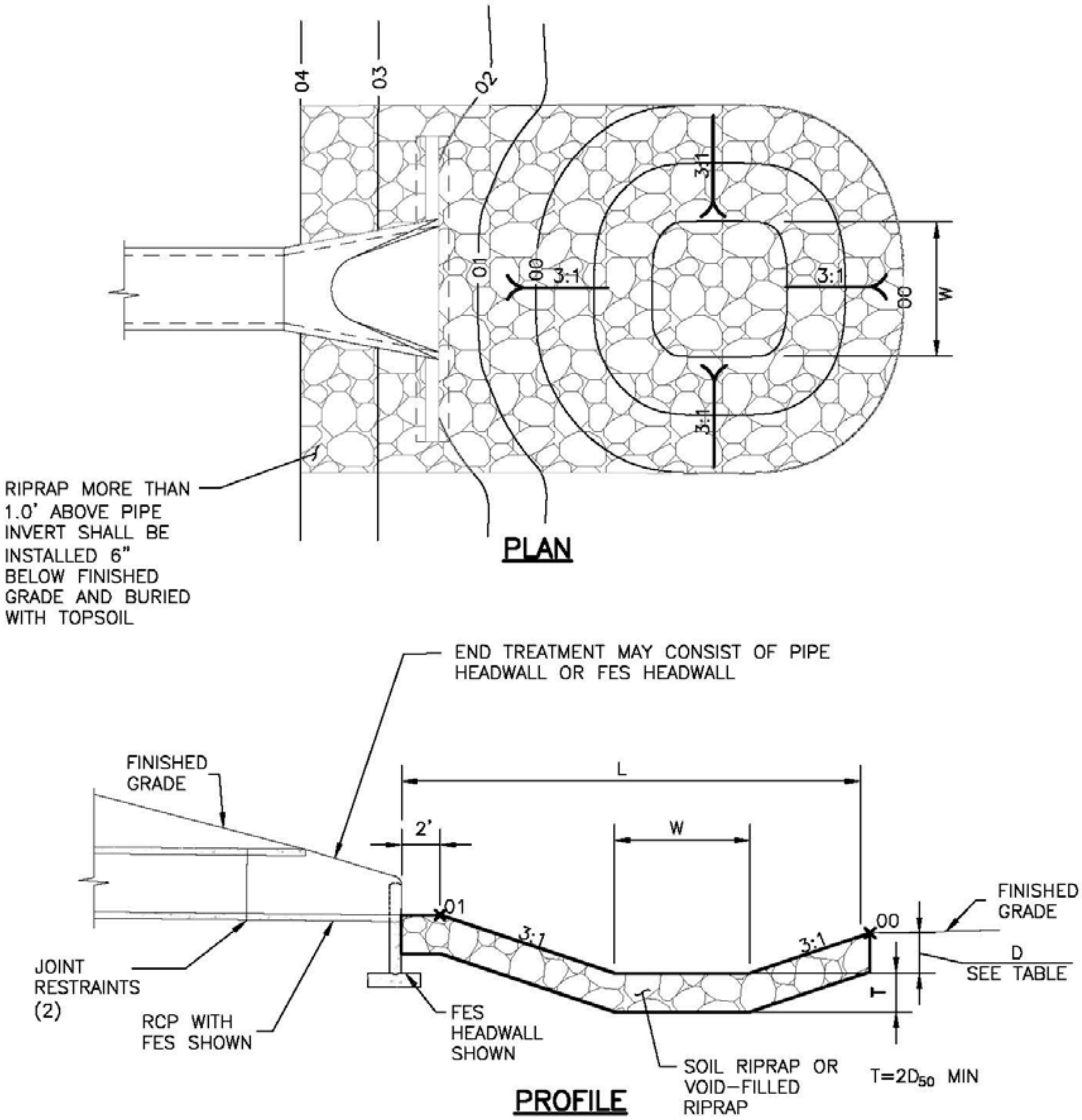
POND #2 OUTFALL TAILWATER BASIN SIZING



PIPE SIZE OR BOX HEIGHT	D	W*	L
18" – 24"	1'–0"	4'	15'
30" – 36"	1'–6"	6'	20'
42" – 48"	2'–0"	7'	24'
54" – 60"	2'–6"	8'	28'
66" – 72"	3'–0"	9'	32'

* IF OUTLET PIPE IS A BOX CULVERT WITH A WIDTH GREATER THAN W, THEN W = CULVERT WIDTH

Figure 9-37. Low tailwater riprap basin

Pond #2 Outfall Low Tailwater Basin
Rip Rap Sizing

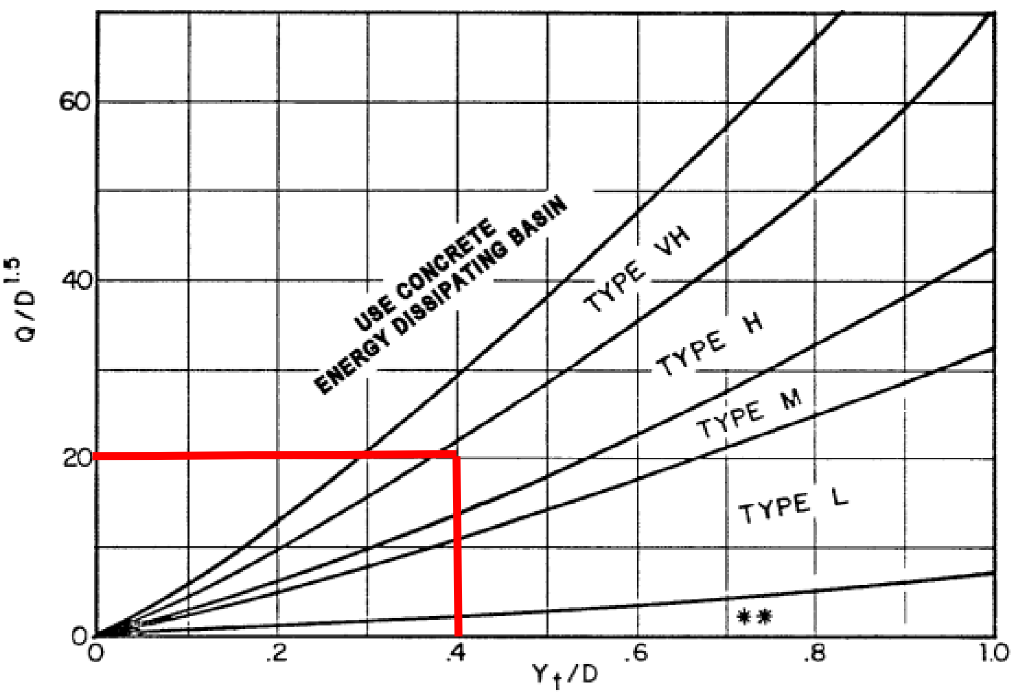


Figure 9-38. Riprap erosion protection at circular conduit outlet (valid for Q/D2.5 ≤ 6.0)

Q_{100} = 196.0 cfs, D_c = 54" RCP

Step 1:

$Q/D^{1.5}$ = 20.40

Step 2:

Y_t/D = Unknown – per MHFD USDCM Vol. 2, use **0.4** if unknown

Step 3:

Per Figure 9-38 & Results from Step 1 & 2 – Use Type H Rip-Rap

Per Figure 8-34 of the MHFD USDCM Vol. 1, use d_{50} = 18"

PIPE OUTFALL RIPRAP SIZING CALCULATIONS

Subdivision: Bradley Ridge Filing No. 3
Location: CO, Colorado Springs

Project Name: Bradley Ridge Filing No. 3
Project No.: RPG03.20
Calculated By: TJE
Checked By: BAS
Date: 10/18/23

	STORM DRAIN SYSTEM			
	Pond #2 Outfall			
Q100 (cfs)	196.0			Flows are the greater of proposed vs. future
D or H (in)	54			
W (ft)				
Slope (%)	0.73			
Yn (in)	54.00			
Yt (ft)	Unknown			If "unknown" Yt/D=0.4
Yt/D, Yt/H	0.40		0.40	Per section 11-3
Supercritical	No		Yes	
Q/D^2.5, Q/WH^1.5	4.56		#DIV/0!	
Q/D^1.5, Q/WH^0.5	20.53			
Da, Ha (in) *			0.00	Da=0.5(D+Yn), Ha=0.5(H+Yn)
Q/Da^1.5, Q/WHa^0.5 *			#DIV/0!	
d50 (in), Required	17.02		#DIV/0!	
Required Riprap Size	H		#DIV/0!	Fig. 8-34
Use Riprap Size	**H**		**H**	
d50 (in)	18		18	Fig. 8-34
1/(2 tan q)	4.00		3.00	Fig. 9-35 OR Fig 9-36
Erosive Soils	Yes		Yes	
At	35.64		0.00	At=Q/5.5
L	61.2		#DIV/0!	L=(1/(2 tan q))(At/Yt - D)
Min L	13.5		0.0	Min L=3D or 3H
Max L	45.0		0.0	Max L=10D or 10H
Length (ft)	45.0		#DIV/0!	
Bottom Width (ft)	13.5		0.0	Width=3D (Minimum)
Riprap Depth (in)	36		36	Depth=2(d50)
Type II Base Depth (in)	8		8	Table 8-34 fine grained soils)
Cutoff Wall	Yes		No	
Cutoff Wall Depth (ft)	3.7			Depth of Riprap and Base
Cutoff Wall Width (ft)	11.0			

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WFJCC Pond #2 - Spillway Rip-Rap Sizing

Figure 13-12c. Emergency Spillway Protection

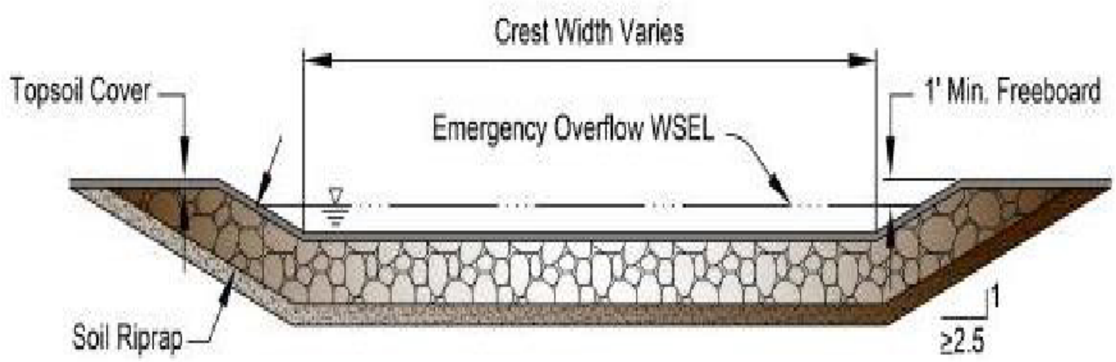
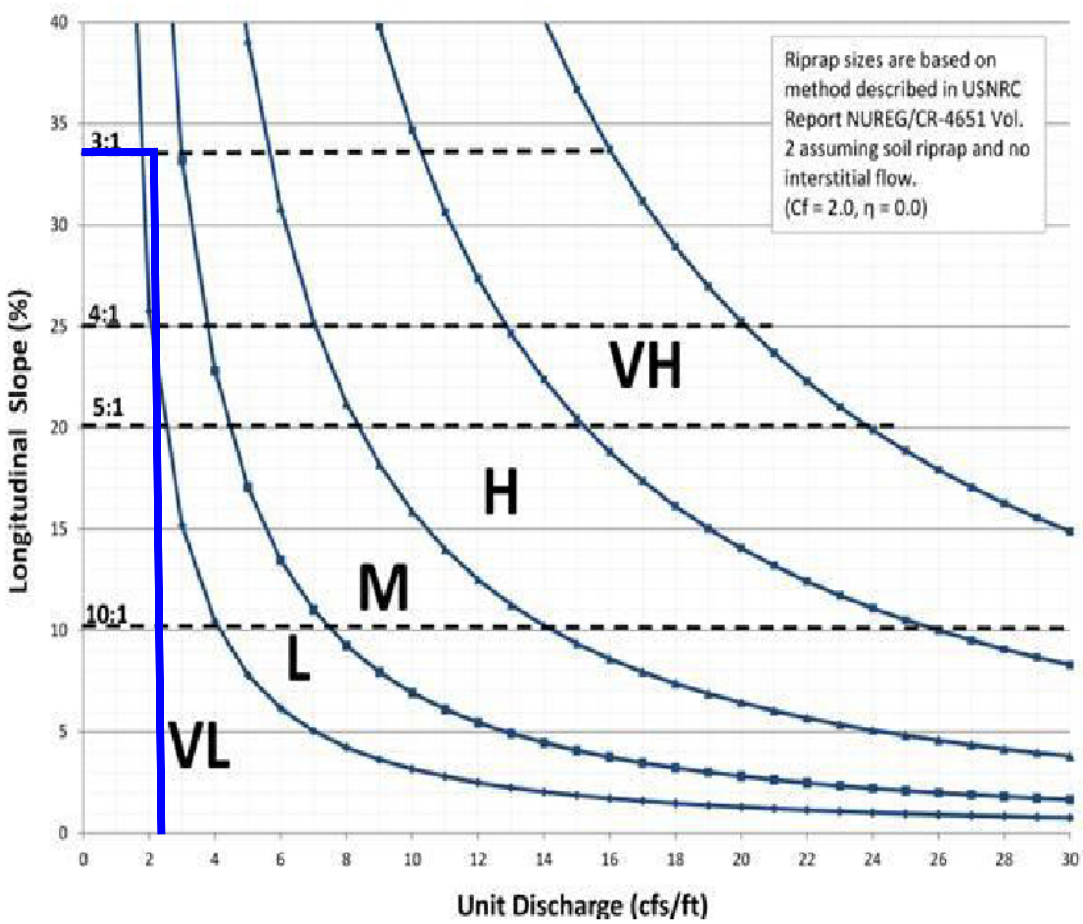


Figure 13-12d. Riprap Types for Emergency Spillway Protection



Q100 = 373.1 cfs
Spillway Crest Length, L = 175.00 ft

Unit Discharge = Q100 / L = 2.13 cfs/ft
Use Size 'L' Rip-Rap

Channel Report

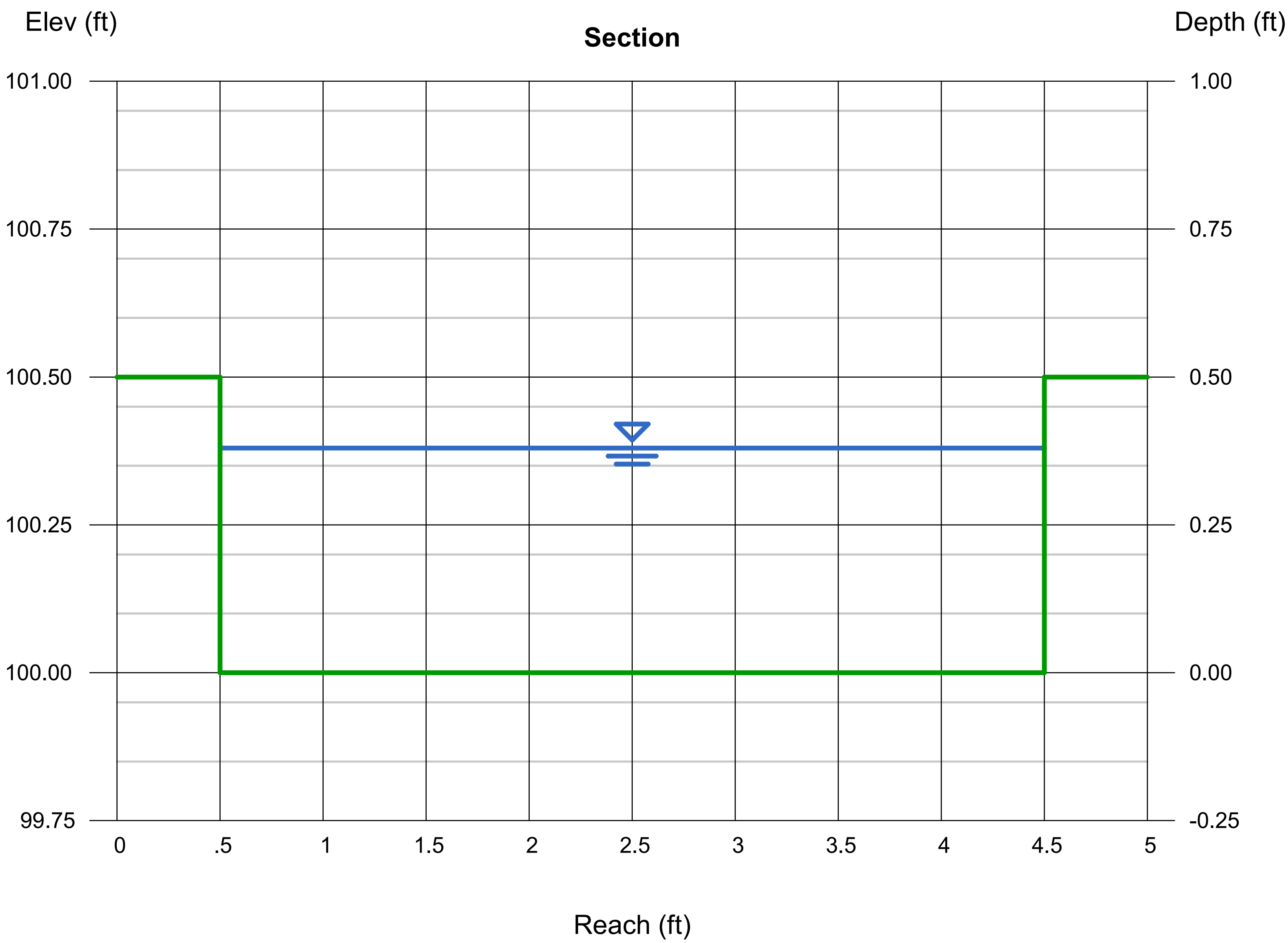
WFJCC Pond #2 - Trickle Channel

Rectangular
Bottom Width (ft) = 4.00
Total Depth (ft) = 0.50

Invert Elev (ft) = 100.00
Slope (%) = 0.50
N-Value = 0.012

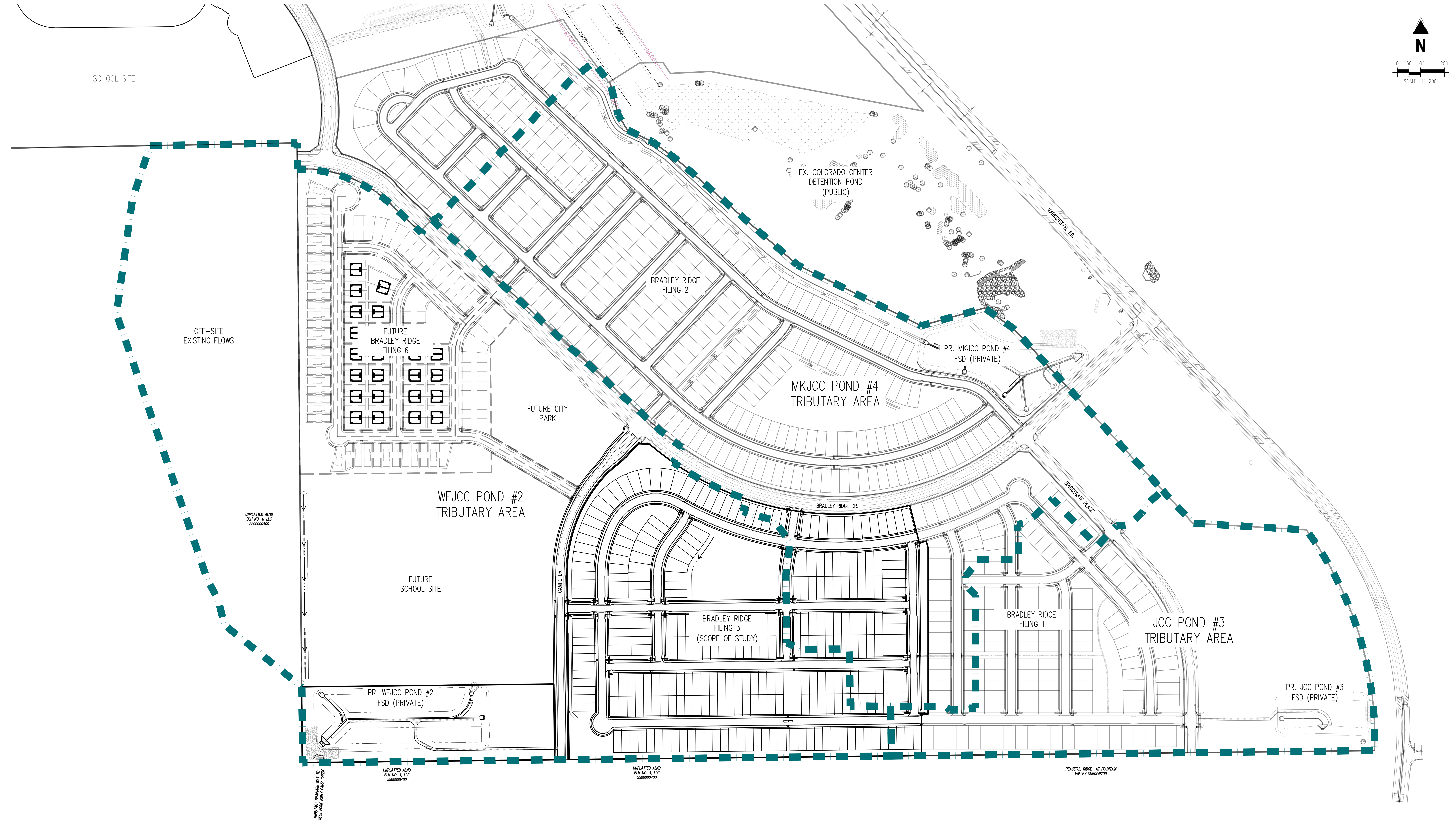
Calculations
Compute by: Known Q
Known Q (cfs) = 6.19

Highlighted
Depth (ft) = 0.38
Q (cfs) = 6.190
Area (sqft) = 1.52
Velocity (ft/s) = 4.07
Wetted Perim (ft) = 4.76
Crit Depth, Yc (ft) = 0.43
Top Width (ft) = 4.00
EGL (ft) = 0.64



APPENDIX F

Drainage Maps



Galloway
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920
719.900.7220
GallowayUS.com

NOT FOR CONSTRUCTION

STORM DRAIN
CONSTRUCTION PLANS
FOR ROI PROPERTY GROUP, LLC
BRADLEY RIDGE SUBDIVISION FILING NO. 3

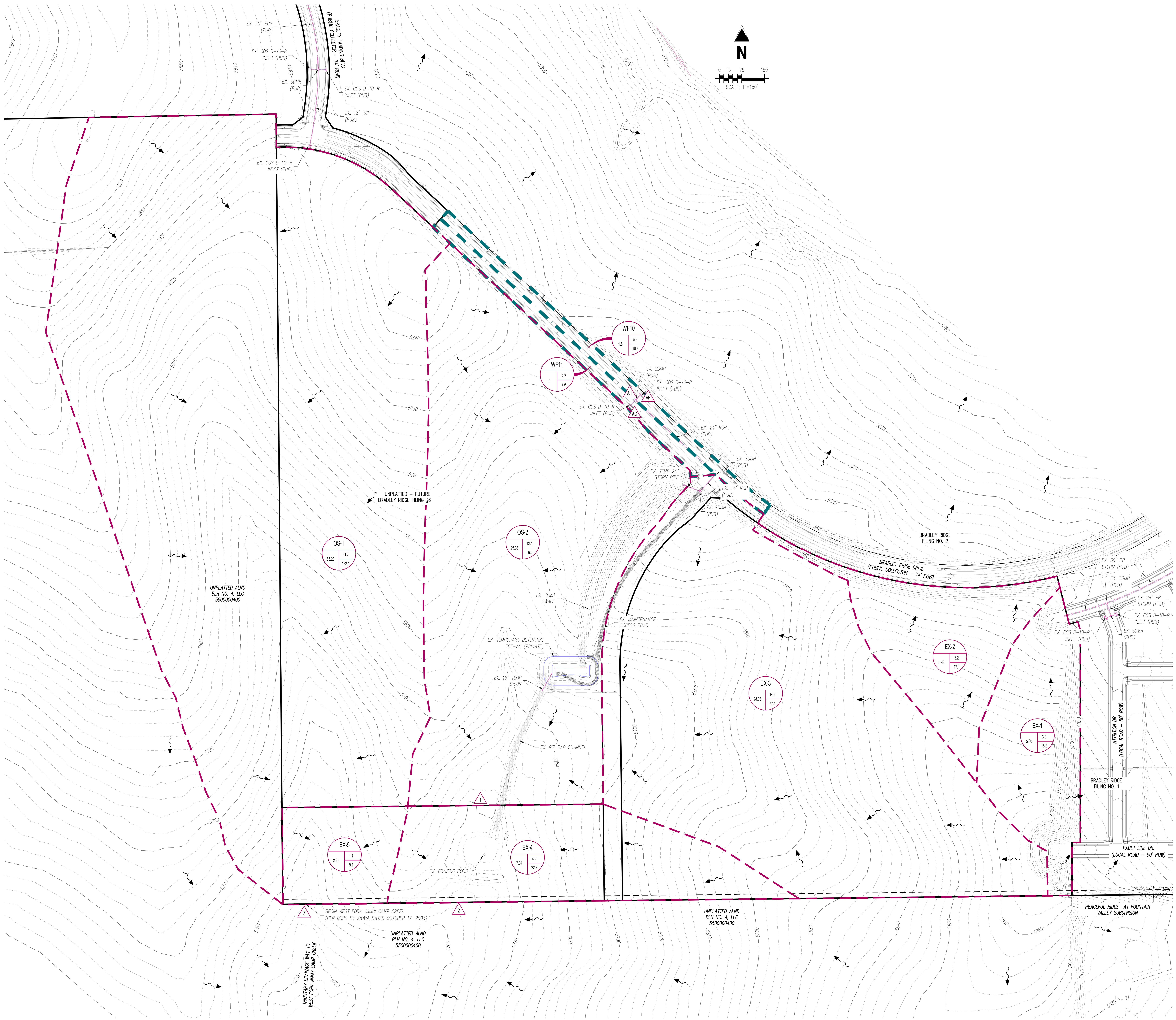
SEC OF BRADLEY RIDGE DR & CAMPO DRIVE
COLORADO SPRINGS, CO

#	Date	Issue / Description	Init.

Project No:	RPG03.20
Drawn By:	AEH
Checked By:	###
Date:	SEPTEMBER 18, 2023

PROPOSED WQ TREATMENT & DETENTION MAP

DR-1



DRAINAGE LEGEND

- EXISTING PROPERTY LINE
- RIGHT–OF–WAY LINE
- EXISTING 10' MAJOR CONTOUR
- EXISTING 2' MINOR CONTOUR
- PROPOSED ROAD CENTERLINE
- BASIN BOUNDARY LINE
- MDDP BASIN BOUNDARY LINE
- EXISTING STORM SEWER
- EXISTING STORM STRUCTURES
- BASIN DESIGNATION
- 5–YEAR RUNOFF IN CUBIC FEET PER SECOND
- 100–YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- DESIGN POINT
- EXISTING DIRECTIONAL FLOW ARROW

EXISTING BASIN SUMMARY TABLE			
Tributary Sub-basin	Area (acres)	Q_5 (cfs)	Q_{100} (cfs)
EX-1	5.30	3.0	16.2
EX-2	5.48	3.2	17.1
EX-3	28.08	14.9	77.1
EX-4	7.84	4.2	22.7
EX-5	2.85	1.7	9.1
EX OS-1	55.23	24.7	132.1
EX OS-2	25.33	12.4	66.2

DESIGN POINT SUMMARY TABLE		
Tributary Sub-basin	Q_5 (cfs)	Q_{100} (cfs)
1	22.5	84.6
2	26.7	107.3
3	26.4	141.2
AF	4.2	10.8
AG	5.9	7.6
AH	10.1	18.4

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NOT FOR CONSTRUCTION

STORM DRAIN CONSTRUCTION PLANS FOR ROI PROPERTY GROUP, LLC BRADLEY RIDGE SUBDIVISION FILING NO. 3

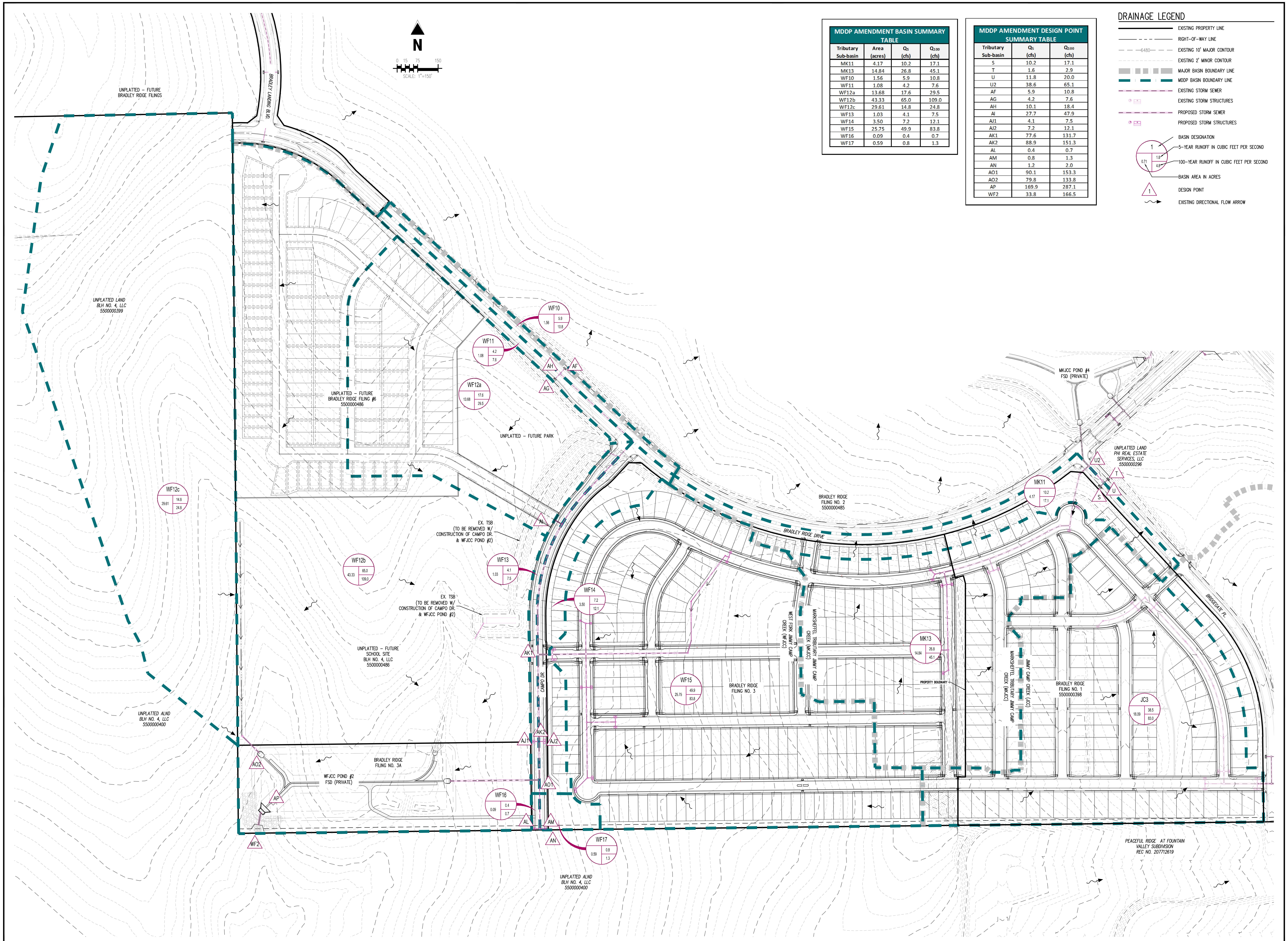
SEC OF BRADLEY RIDGE DR & CAMPO DRIVE
COLORADO SPRINGS, CO

#	Date	Issue / Description	Init.

Project No: RPG03.20
Drawn By: AEH
Checked By: BAS
Date: SEPTEMBER 18, 2023

EXISTING CONDITION DRAINAGE MAP

DR-2



MDDP AMENDMENT BASIN SUMMARY TABLE			
Tributary Sub-basin	Area (acres)	Q_5 (cfs)	Q_{100} (cfs)
MK11	4.17	10.2	17.1
MK13	14.84	26.8	45.1
WF10	1.56	5.9	10.8
WF11	1.08	4.2	7.6
WF12a	13.68	17.6	29.5
WF12b	43.33	65.0	109.0
WF12c	29.61	14.8	24.8
WF13	1.03	4.1	7.5
WF14	3.50	7.2	12.1
WF15	25.75	49.9	83.8
WF16	0.09	0.4	0.7
WF17	0.59	0.8	1.3

MDDP AMENDMENT DESIGN POINT SUMMARY TABLE		
Tributary Sub-basin	Q_5 (cfs)	Q_{100} (cfs)
S	10.2	17.1
T	1.6	2.9
U	11.8	20.0
U2	38.6	65.1
AF	5.9	10.8
AG	4.2	7.6
AH	10.1	18.4
AI	27.7	47.9
AJ1	4.1	7.5
AJ2	7.2	12.1
AK1	77.6	131.7
AK2	88.9	151.3
AL	0.4	0.7
AM	0.8	1.3
AN	1.2	2.0
AO1	90.1	153.3
AO2	79.8	133.8
AP	169.9	287.1
WF2	33.8	166.5

DRAINAGE LEGEND

- EXISTING PROPERTY LINE
- RIGHT-OF-WAY LINE
- EXISTING 10' MAJOR CONTOUR
- EXISTING 2' MINOR CONTOUR
- MAJOR BASIN BOUNDARY LINE
- MDDP BASIN BOUNDARY LINE
- EXISTING STORM SEWER
- EXISTING STORM STRUCTURES
- PROPOSED STORM SEWER
- PROPOSED STORM STRUCTURES
- BASIN DESIGNATION
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- DESIGN POINT
- EXISTING DIRECTIONAL FLOW ARROW

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STORM DRAIN CONSTRUCTION PLANS FOR ROI PROPERTY GROUP, LLC BRADLEY RIDGE SUBDIVISION FILING NO. 3

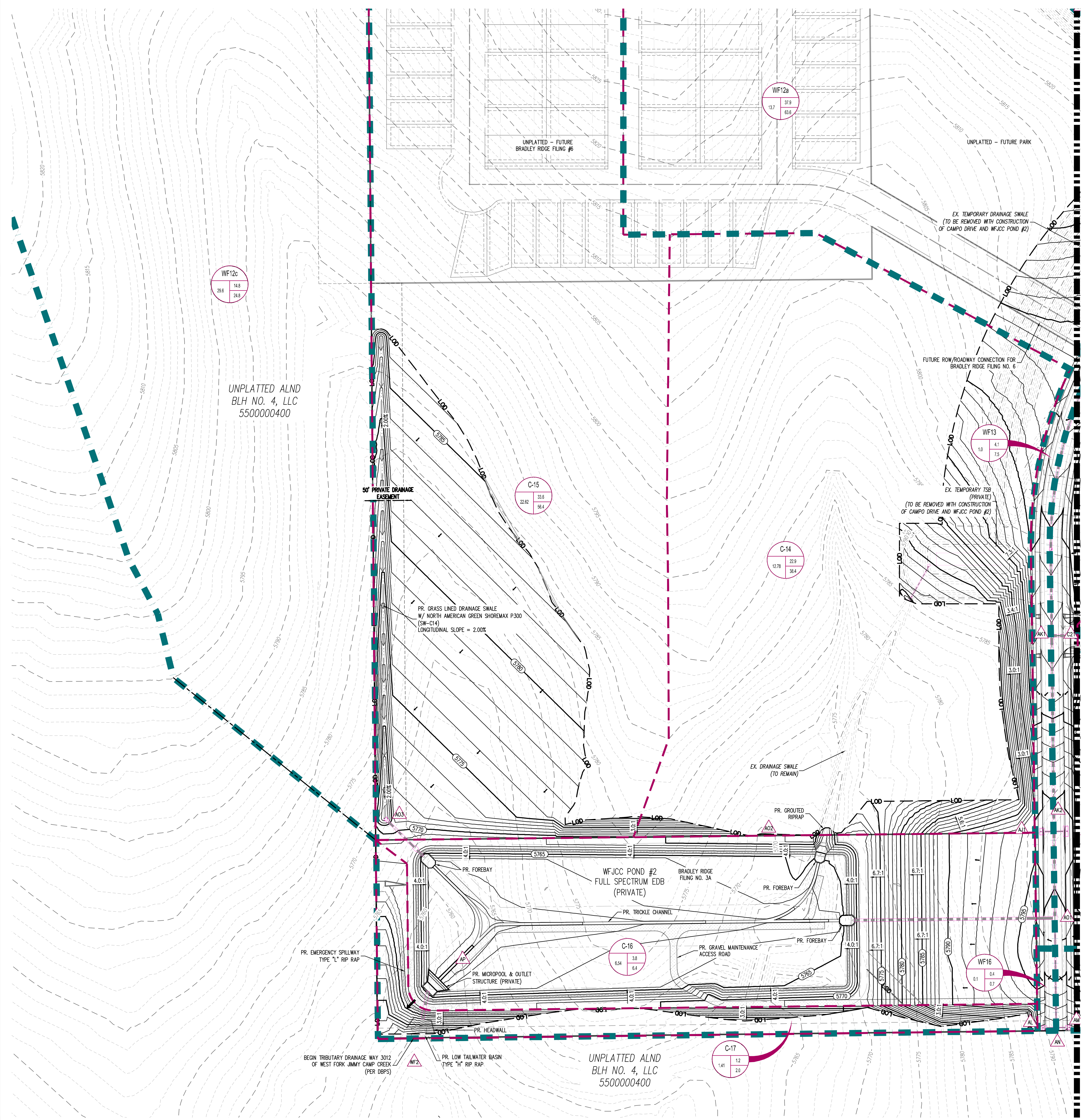
SEC OF BRADLEY RIDGE DR & CAMPO DRIVE COLORADO SPRINGS, CO

#	Date	Issue / Description	Init.

Project No:	RPG03.20
Drawn By:	AEH
Checked By:	BAS
Date:	SEPTEMBER 18, 2023

PROPOSED CONDITION MDDPA DRAINAGE MAP

DR-3



N
0 20 50 100
SCALE: 1"=100'

INFRASTRUCTURE NOTE:

DUE TO LEGIBILITY OF SHEET, ALL EXISTING AND PROPOSED INFRASTRUCTURE ARE LABELED ON A SEPARATE DRAINAGE MAP. REFER TO SHEET DR-5 & DR-6 FOR ALL EXISTING & PROPOSED INFRASTRUCTURE CALLOUTS, INCLUDING MATERIAL, SIZES, & OWNERSHIP.

DRAINAGE LEGEND

- EXISTING PROPERTY LINE
- PROPOSED PROPERTY LINE
- LOT BOUNDARY LINE
- EXISTING MAJOR CONTOUR (6480)
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR (6480)
- PROPOSED MINOR CONTOUR
- PROPOSED ROAD CENTERLINE
- BASIN BOUNDARY LINE
- MDDP BASIN BOUNDARY LINE
- LIMITS OF DISTURBANCE (LOD)
- PROPOSED STORM SEWER
- PROPOSED STORM STRUCTURES
- EXISTING STORM SEWER
- EXISTING STORM STRUCTURES
- BASIN DESIGNATION (1)
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND (1.8)
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND (4.8)
- BASIN AREA IN ACRES (0.71)
- DESIGN POINT
- DIRECTION OF RUNOFF

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Q_5 (cfs)	Q_{100} (cfs)
A-1	0.20	0.5	0.9
A-2	0.45	0.9	1.6
B-1	1.79	3.6	6.0
B-2	1.81	3.9	6.5
B-3	0.65	1.4	2.3
B-4	0.78	1.7	2.9
B-5	0.46	1.2	2.0
B-6	1.93	3.7	6.2
B-7	0.78	1.7	2.9
B-8	0.09	0.4	0.6
B-9	0.14	0.3	0.5
B-10	0.52	1.3	2.1
C-1	4.25	6.5	10.8
C-2	1.73	3.0	5.0
C-3	3.81	6.8	11.4
C-4	1.74	3.1	5.2
C-5	0.62	1.1	1.9
C-6	0.89	1.7	2.9
C-7	1.71	3.2	5.4
C-8	1.27	2.4	4.0
C-9	2.22	8.7	14.6
C-10	0.84	1.8	3.0
C-11	1.32	2.5	4.1
C-12	3.07	6.5	10.8
C-13	2.28	5.0	8.4
C-14	41.94	64.4	108.2
C-15	1.41	1.2	2.0
OS-1	1.25	1.0	1.7
OS-2	0.17	0.2	0.3
WF10	1.60	5.9	10.8
WF11	1.10	4.2	7.6
WF12a	13.70	17.6	29.5
WF12c	29.60	14.8	24.8
WF13	1.00	4.1	7.5
WF14	3.50	7.2	12.1
WF16	0.10	0.4	0.7
WF17	0.60	0.8	1.4

DESIGN POINT SUMMARY TABLE

Tributary Sub-basin	Q_5 (cfs)	Q_{100} (cfs)
A1	1.1	1.8
B1	3.6	5.3
B2	3.9	6.4
B3	1.4	2.3
B4	5.3	8.7
B5	8.9	14.0
B6	1.7	3.8
B7	1.2	2.0
B8	11.8	19.8
B9	3.7	6.2
B10	1.7	2.9
B11	5.4	9.1
B12	17.2	28.9
C1	7.5	11.3
C2	3.0	5.0
C3	10.5	16.3
C4	5.9	8.0
C5	3.1	5.0
C6	9.0	13.0
C7	19.5	29.3
C8	1.1	3.3
C9	2.8	6.1
C10	23.4	38.7
C11	3.2	5.4
C12	2.4	4.0
C13	5.6	9.4

DESIGN POINT SUMMARY TABLE

Tributary Sub-basin	Q_5 (cfs)	Q_{100} (cfs)
C14	8.7	14.6
C14a	14.3	24.0
C15	1.8	2.6
C16	2.3	3.2
C17	4.1	5.8
C18	41.8	68.5
C19	6.5	11.1
C20	5.3	9.1
C21	53.6	88.7
AF	5.9	10.8
AG	4.2	7.6
AH	10.1	18.4
AI	27.7	47.9
AJ1	4.1	7.5
AJ2	7.2	14.4
AK1	81.3	136.6
AK2	92.6	158.5
AL	0.4	0.7
AM	0.8	1.4
AN	1.2	2.1
AO1	93.8	160.6
AO2	79.2	132.9
AP	173.0	293.6
WF2	33.8	166.5

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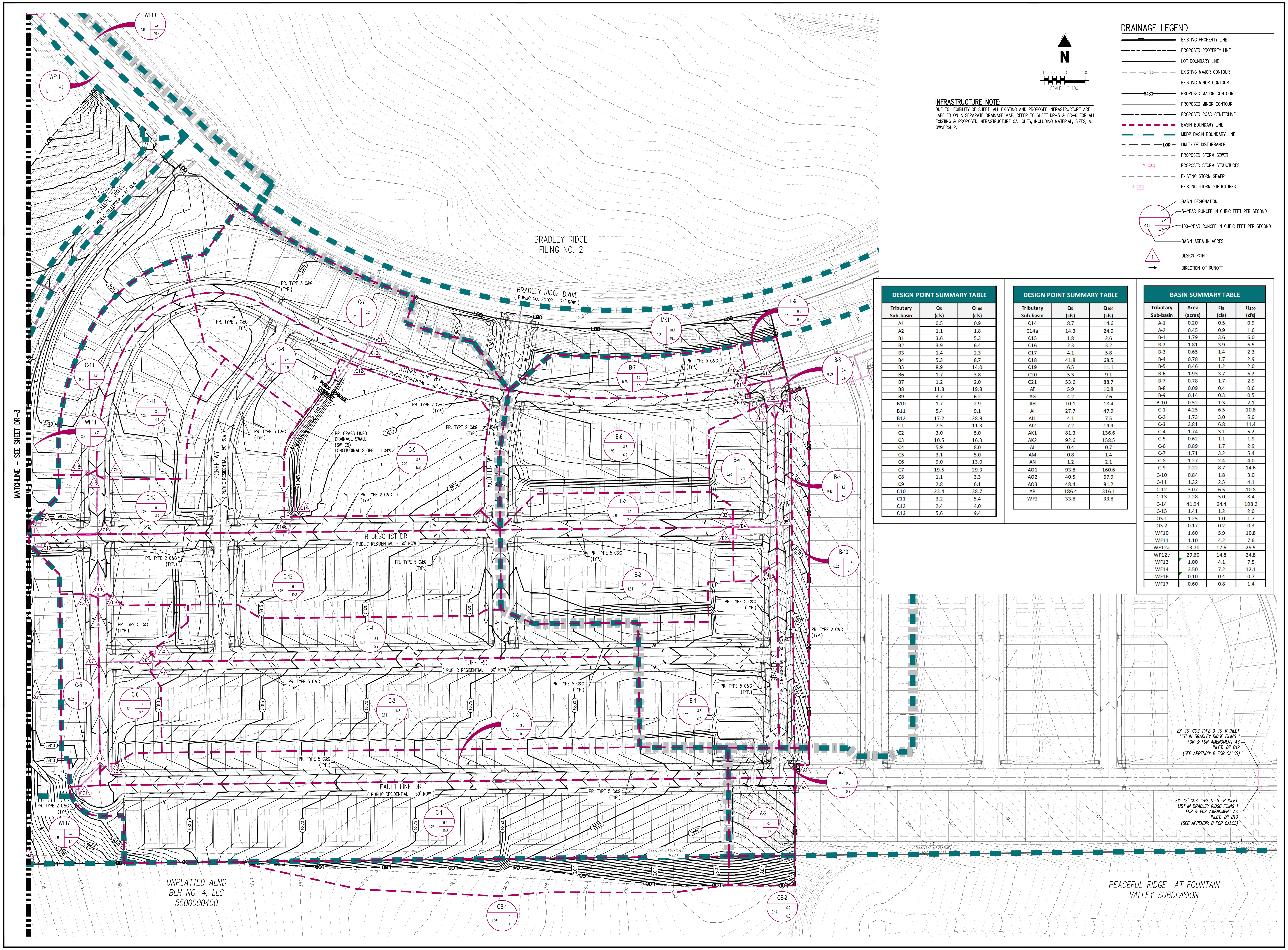
STORM DRAIN CONSTRUCTION PLANS FOR ROI PROPERTY GROUP, LLC BRADLEY RIDGE SUBDIVISION FILING NO. 3

SEC OF BRADLEY RIDGE DR & CAMPO DRIVE
COLORADO SPRINGS, CO

#	Date	Issue / Description	Init.

Project No:	RPG02.20
Drawn By:	JDM
Checked By:	BAS
Date:	SEPTEMBER 18, 2023

PR. DRAINAGE MAP 1



INFRASTRUCTURE NOTE:

DUE TO LEGIBILITY OF SHEET, ALL EXISTING AND PROPOSED INFRASTRUCTURE ARE LABELED ON A SEPARATE DRAINAGE MAP. REFER TO SHEET DR-5 & DR-6 FOR ALL EXISTING & PROPOSED INFRASTRUCTURE CALLOUTS, INCLUDING MATERIAL, SIZES, & OWNERSHIP.

DRAINAGE LEGEND

- EXISTING PROPERTY LINE
- PROPOSED PROPERTY LINE
- LOT BOUNDARY LINE
- EXISTING MAJOR CONTOUR (6480)
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR (6480)
- PROPOSED MINOR CONTOUR
- PROPOSED ROAD CENTERLINE
- BASIN BOUNDARY LINE
- MDDP BASIN BOUNDARY LINE
- LIMITS OF DISTURBANCE (LOD)
- PROPOSED STORM SEWER
- PROPOSED STORM STRUCTURES
- EXISTING STORM SEWER
- EXISTING STORM STRUCTURES
- BASIN DESIGNATION (1)
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND (1.8)
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND (4.8)
- BASIN AREA IN ACRES (0.71)
- DESIGN POINT
- DIRECTION OF RUNOFF

DESIGN POINT SUMMARY TABLE

Tributary Sub-basin	Q_5 (cfs)	Q_{100} (cfs)
A1	0.5	0.9
A2	1.1	1.8
B1	3.6	5.3
B2	3.9	6.4
B3	1.4	2.3
B4	5.3	8.7
B5	8.9	14.0
B6	1.7	3.8
B7	1.2	2.0
B8	11.8	19.8
B9	3.7	6.2
B10	1.7	2.9
B11	5.4	9.1
B12	17.2	28.9
C1	7.5	11.3
C2	3.0	5.0
C3	10.5	16.3
C4	5.9	8.0
C5	3.1	5.0
C6	9.0	13.0
C7	19.5	29.3
C8	1.1	3.3
C9	2.8	6.1
C10	23.4	38.7
C11	3.2	5.4
C12	2.4	4.0
C13	5.6	9.4

DESIGN POINT SUMMARY TABLE

Tributary Sub-basin	Q_5 (cfs)	Q_{100} (cfs)
C14	8.7	14.6
C14a	14.3	24.0
C15	1.8	2.6
C16	2.3	3.2
C17	4.1	5.8
C18	41.8	68.5
C19	6.5	11.1
C20	5.3	9.1
C21	53.6	88.7
AF	5.9	10.8
AG	4.2	7.6
AH	10.1	18.4
AI	27.7	47.9
AJ1	4.1	7.5
AJ2	7.2	14.4
AK1	81.3	136.6
AK2	92.6	158.5
AL	0.4	0.7
AM	0.8	1.4
AN	1.2	2.1
AO1	93.8	160.6
AO2	40.5	67.9
AO3	48.4	81.2
AP	186.4	316.1
WF2	33.8	33.8

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Q_5 (cfs)	Q_{100} (cfs)
A-1	0.20	0.5	0.9
A-2	0.45	0.9	1.6
B-1	1.79	3.6	6.0
B-2	1.81	3.9	6.5
B-3	0.65	1.4	2.3
B-4	0.78	1.7	2.9
B-5	0.46	1.2	2.0
B-6	1.93	3.7	6.2
B-7	0.78	1.7	2.9
B-8	0.09	0.4	0.6
B-9	0.14	0.3	0.5
B-10	0.52	1.3	2.1
C-1	4.25	6.5	10.8
C-2	1.73	3.0	5.0
C-3	3.81	6.8	11.4
C-4	1.74	3.1	5.2
C-5	0.62	1.1	1.9
C-6	0.89	1.7	2.9
C-7	1.71	3.2	5.4
C-8	1.27	2.4	4.0
C-9	2.22	8.7	14.6
C-10	0.84	1.8	3.0
C-11	1.32	2.5	4.1
C-12	3.07	6.5	10.8
C-13	2.28	5.0	8.4
C-14	41.94	64.4	108.2
C-15	1.41	1.2	2.0
OS-1	1.25	1.0	1.7
OS-2	0.17	0.2	0.3
WF10	1.60	5.9	10.8
WF11	1.10	4.2	7.6
WF12a	13.70	17.6	29.5
WF12c	29.60	14.8	24.8
WF13	1.00	4.1	7.5
WF14	3.50	7.2	12.1
WF16	0.10	0.4	0.7
WF17	0.60	0.8	1.4

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STORM DRAIN CONSTRUCTION PLANS FOR ROI PROPERTY GROUP, LLC BRADLEY RIDGE SUBDIVISION FILING NO. 3

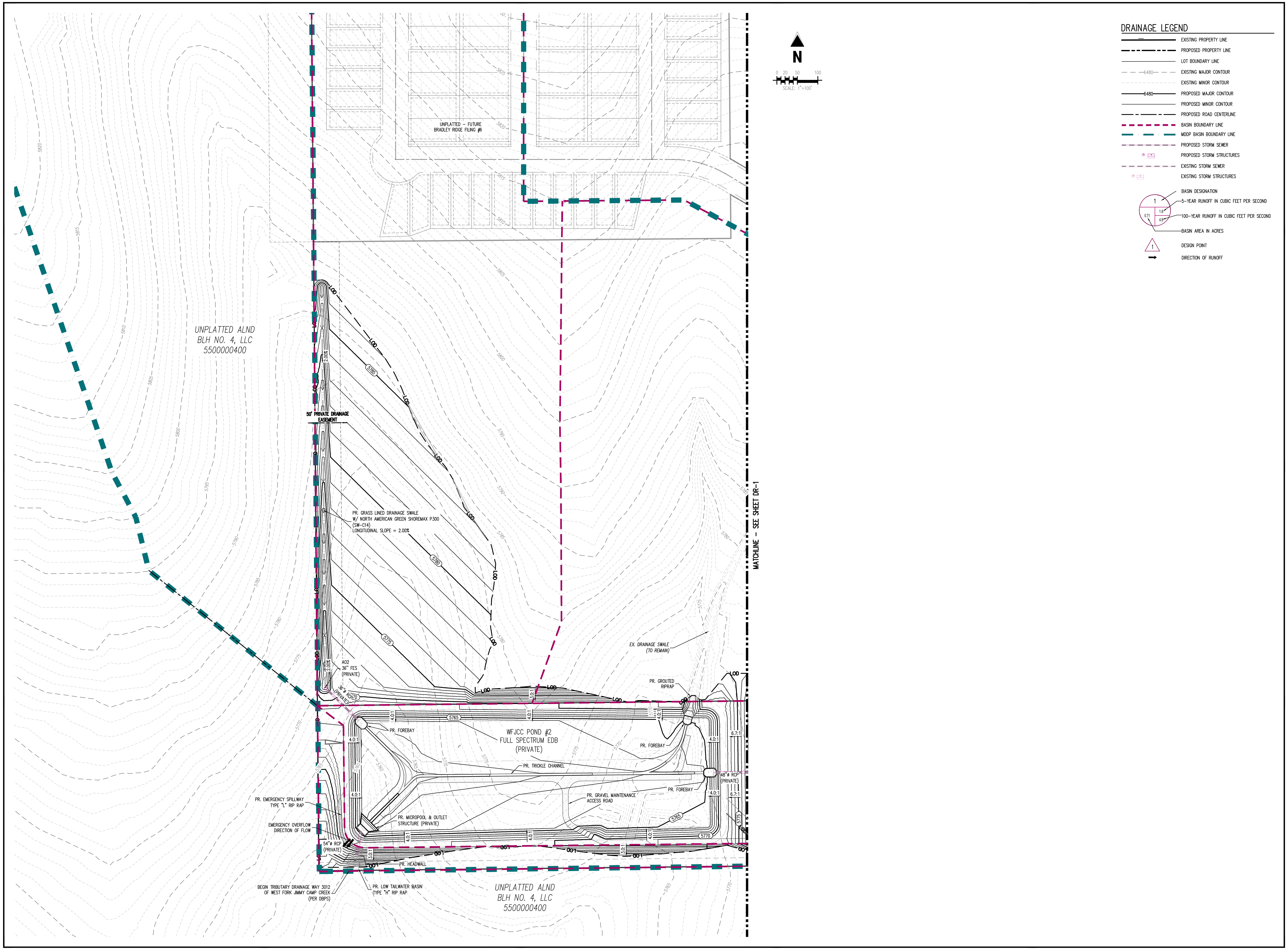
SEC OF BRADLEY RIDGE DR & CAMPO DRIVE
COLORADO SPRINGS, CO

#	Date	Issue / Description	Init.

Project No:	RPG03.20
Drawn By:	AEH
Checked By:	BAS
Date:	SEPTEMBER 18, 2023

PR. DRAINAGE MAP 2

DR-4



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STORM DRAIN
CONSTRUCTION PLANS
FOR ROI PROPERTY GROUP, LLC
BRADLEY RIDGE SUBDIVISION FILING NO. 3

SEC OF BRADLEY RIDGE DR & CAMPO DRIVE
COLORADO SPRINGS, CO

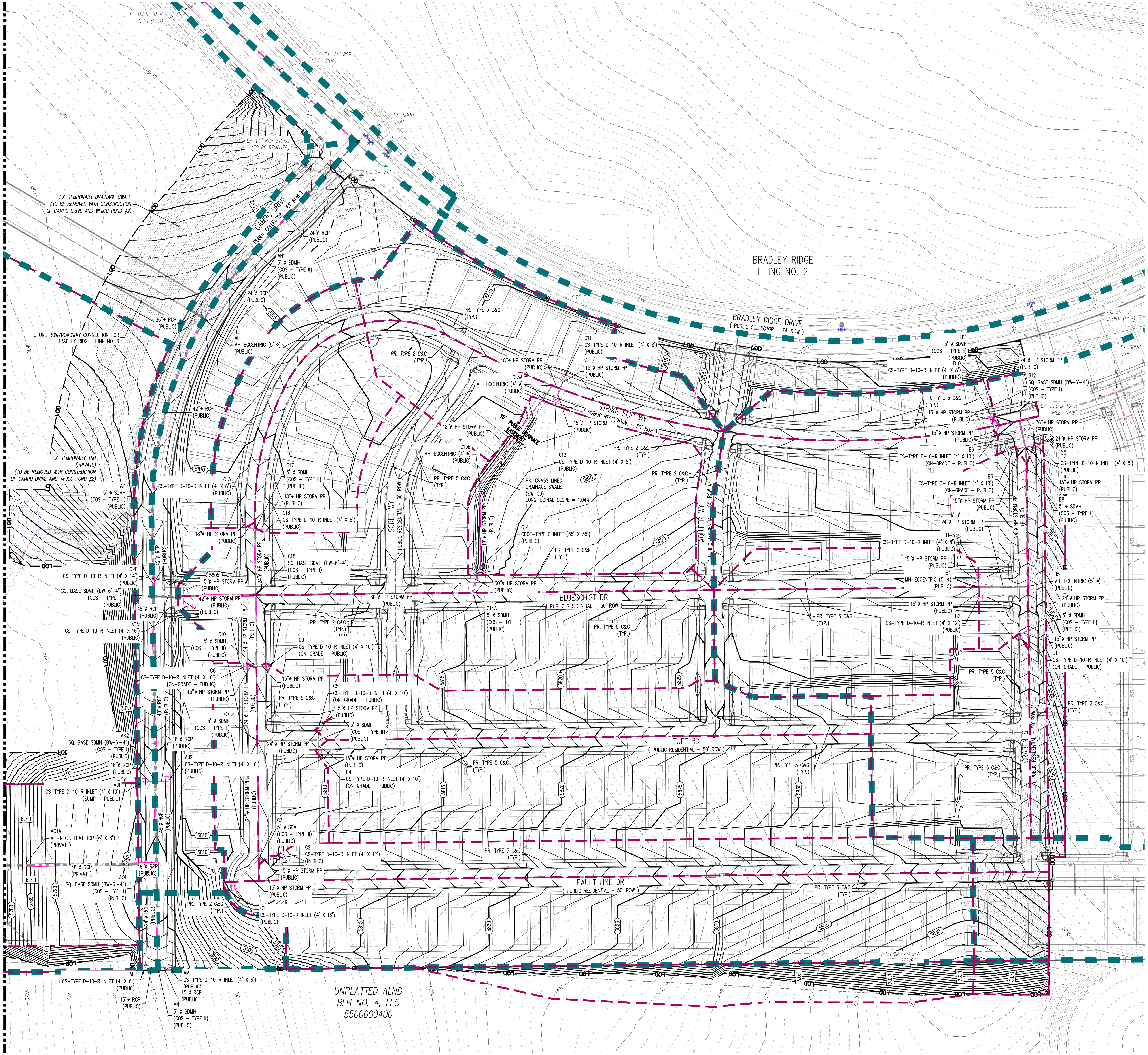
#	Date	Issue / Description	Init.

Project No:	RPG02.20
Drawn By:	JDM
Checked By:	BAS
Date:	APRIL 28, 2023

PR. STORM INFRASTRUCTURE MAP

DR-5

Sheet 1 of 2



N

0 20 50 100
SCALE: 1"=100'

DRAINAGE LEGEND

- EXISTING PROPERTY LINE
- PROPOSED PROPERTY LINE
- LOT BOUNDARY LINE
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED ROAD CENTERLINE
- BASIN BOUNDARY LINE
- MDDP BASIN BOUNDARY LINE
- PROPOSED STORM SEWER
- PROPOSED STORM STRUCTURES
- EXISTING STORM SEWER
- EXISTING STORM STRUCTURES
- BASIN DESIGNATION
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- DESIGN POINT
- DIRECTION OF RUNOFF

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SEC OF BRADLEY RIDGE DR & CAMPO DRIVE
COLORADO SPRINGS, CO

#	Date	Issue / Description	Init.

Project No:	RPG03.20
Drawn By:	AEH
Checked By:	BAS
Date:	SEPTEMBER 18, 2023

PR. STORM INFRASTRUCTURE MAP

DR-6

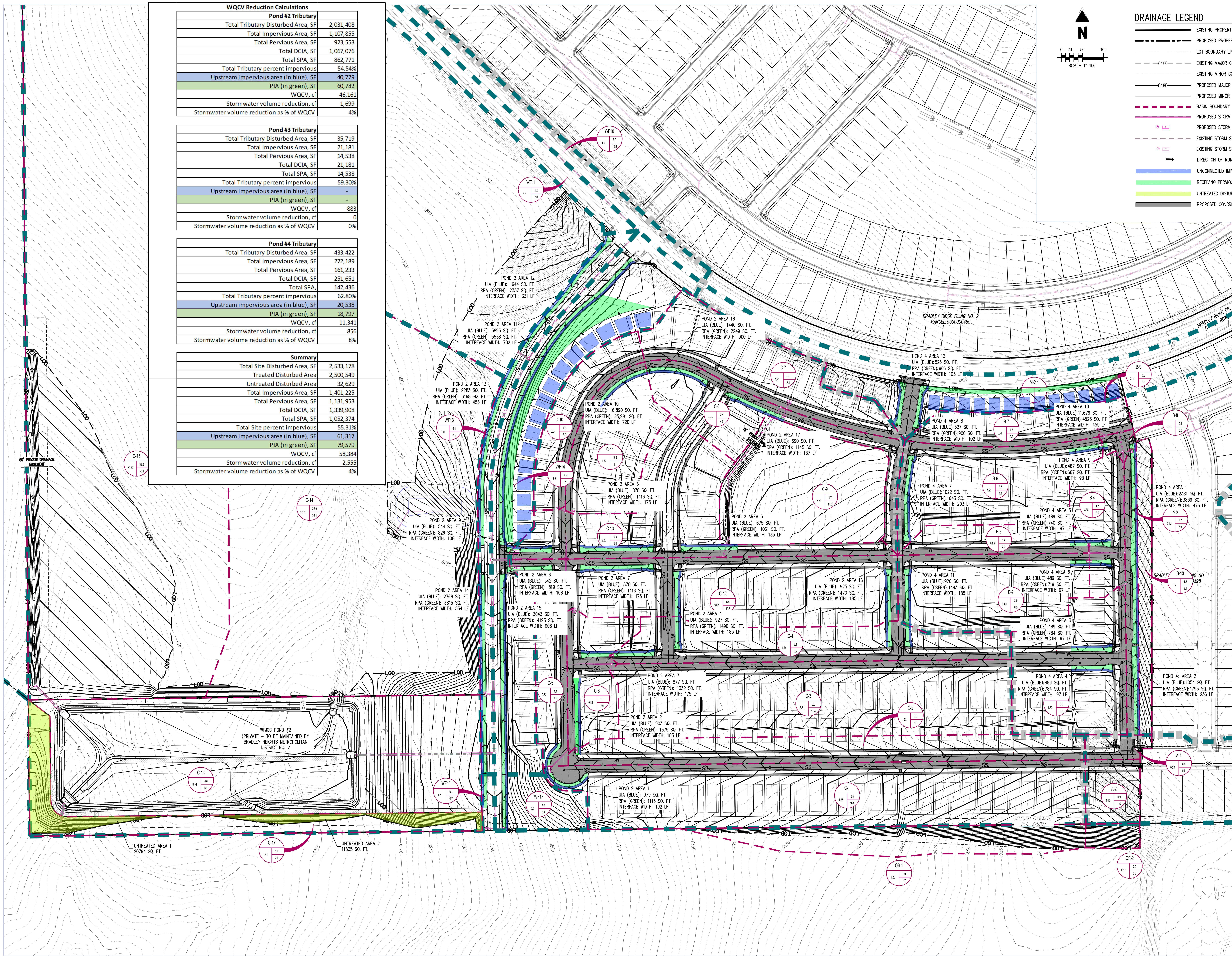
WQCV Reduction Calculations

Pond #2 Tributary	
Total Tributary Disturbed Area, SF	2,031,408
Total Impervious Area, SF	1,107,855
Total Pervious Area, SF	923,553
Total DCIA, SF	1,067,076
Total SPA, SF	862,771
Total Tributary percent impervious	54.54%
Upstream impervious area (in blue), SF	40,779
PIA (in green), SF	60,782
WQCV, cf	46,161
Stormwater volume reduction, cf	1,699
Stormwater volume reduction as % of WQCV	4%

Pond #3 Tributary	
Total Tributary Disturbed Area, SF	35,719
Total Impervious Area, SF	21,181
Total Pervious Area, SF	14,538
Total DCIA, SF	21,181
Total SPA, SF	14,538
Total Tributary percent impervious	59.30%
Upstream impervious area (in blue), SF	-
PIA (in green), SF	-
WQCV, cf	883
Stormwater volume reduction, cf	0
Stormwater volume reduction as % of WQCV	0%

Pond #4 Tributary	
Total Tributary Disturbed Area, SF	433,422
Total Impervious Area, SF	272,189
Total Pervious Area, SF	161,233
Total DCIA, SF	251,651
Total SPA,	142,436
Total Tributary percent impervious	62.80%
Upstream impervious area (in blue), SF	20,538
PIA (in green), SF	18,797
WQCV, cf	11,341
Stormwater volume reduction, cf	856
Stormwater volume reduction as % of WQCV	8%

Summary	
Total Site Disturbed Area, SF	2,533,178
Treated Disturbed Area	2,500,549
Untreated Disturbed Area	32,629
Total Impervious Area, SF	1,401,225
Total Pervious Area, SF	1,131,953
Total DCIA, SF	1,339,908
Total SPA, SF	1,052,374
Total Site percent impervious	55.31%
Upstream impervious area (in blue), SF	61,317
PIA (in green), SF	79,579
WQCV, cf	58,384
Stormwater volume reduction, cf	2,555
Stormwater volume reduction as % of WQCV	4%



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STORM DRAIN
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FOR ROI PROPERTY GROUP, LLC
BRADLEY RIDGE SUBDIVISION FILING NO. 3

SEC OF BRADLEY RIDGE DR & CAMPO DRIVE
COLORADO SPRINGS, CO

#	Date	Issue / Description	Init.

Project No:	RPG02.20
Drawn By:	CJM
Checked By:	BAS
Date:	JULY 19, 2023

WATER QUALITY MAP

DR-6