PRELIMINARY DRAINAGE REPORT for

Bradley Ridge Apartments Filing No. 1

Colorado Springs, CO

Prepared for:

Lincoln Avenue Communities
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Project #: 296008001

Prepared: November 2024

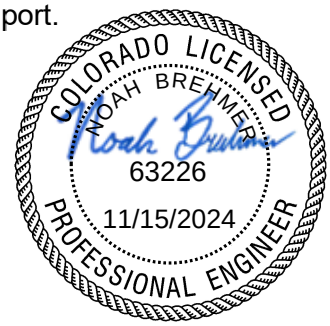
ProjectDox Number: STM-REV24-1099
ProjectDox Master Number: STM-MP24-0368

Kimley»Horn

CERTIFICATIONS

ENGINEER'S STATEMENT

This report and plan for the drainage design of Bradley Ridge Apartments 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): _____ 11/15/2024

Colorado P.E. No. 63226 Date

DEVELOPER'S STATEMENT

Lincoln Avenue Communities hereby certifies that the drainage facilities of Bradley Ridge Apartments 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 7.4.701 of the City Code; and cannot, on behalf of Bradley Ridge Apartments guarantee that final drainage design review will absolve Lincoln Avenue Communities 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.

Lincoln Avenue Communities

Name of Developer

Authorized Signature Date

Ben Taylor

Printed Name

Vice President

Title

44 Cook Street, Suite 510, Denver, CO 8020

Address:

CITY OF COLORADO SPRINGS STATEMENT

Filed in accordance with Section 7.4.701 of the Code of the City of Colorado Springs, 2023, as amended.

	11/19/2024
For SWENT Manager	Date

Conditions:

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INTRODUCTION

PURPOSE AND SCOPE OF STUDY

The purpose of this Preliminary Drainage Report ("PDR") is to outline the drainage plan for the proposed development of Bradley Ridge Apartments and to show the compliance with the approved plans for the area. The proposed multi-family development is located on the southwest corner of Legacy Hills Drive and Bradley Landing Boulevard (the "Site") in El Paso County, City of Colorado Springs, Colorado (the "City"). This PDR identifies onsite and off-site drainage patterns and proposes to safely route developed stormwater to adequate outfalls at less than historic flow rates. The 20.68-acre Site is currently vacant and is located within Jimmy Camp Creek Drainage Basin. The total area of disturbance associated with the development is 21.1-acres.

PREVIOUS DRAINAGE STUDIES

The site is located within the Jimmy Camp Creek Drainage Basin per the "Master Development Drainage Plan Amendment for Bradley Heights" by Matrix, dated April 2022 (hereby the "MDDP"). The "Master Development Drainage Plan Amendment for Bradley Heights" report serves as the current, approved MDDP for Bradley Heights. The proposed development will conform to the standards and requirements set forth in the MDDP. Applicable excerpts from the previous drainage studies are provided within **Appendix G.**

Historically, the runoff flows south towards the MDDP West Fork Jimmy Camp Creek (WFJCC) Pond #1. The historic drainage pattern will generally be maintained and unaffected with the proposed Project.

GENERAL PROJECT DESCRIPTION

The proposed improvements consist of the construction of 336 multi-family apartment units (the "Project"). The Project will include construction of landscaping, stormwater and utility improvements, carports, and internal roadways. Additionally, connections to existing public roadways are proposed off Legacy Hill Drive to the north and Bradley Landing Boulevard to the east.

The Project is located in the north portion of Section 15, Township 15 South, Range 65 West of the Sixth Principal Meridian, within the City of Colorado Springs, County of El Paso, State of Colorado. **Appendix A** includes a vicinity map for the Project.

The Site is currently undeveloped and consists of natural vegetation including sparse grasses and scrub. The following provides plat and use information for the adjacent properties.

- South of the Site: RJMJ LLC (Rec. No. 222074546)
  City of Colorado Springs (Unplatted)
  Marksheffel-Woodmen Invest LLC Case Lindsay J (Unplatted)
- North of the Site: Legacy Hill Drive (74' Public R.O.W.)
- West of the Site: Lot 1 The Trails at Aspen Ridge Filing No. 1 (Schedule No: 5509301001)
  Lot 2 The Trails at Aspen Ridge Filing No.1 (Schedule No: 5509301002)
  Lot 3 The Trails at Aspen Ridge Filing No. 1(Schedule No: 5509301003)
  TR A1 The Trails at Aspen Ridge Filing No. 1A (Schedule No: 5509301140)
- East of the Site: Bradley Landing Boulevard (74' Public R.O.W.)

PROJECT CHARACTERISTICS

The proposed Project will route stormwater for the entire development to the existing storm sewer network located in the southeast corner of the Site.

Runoff from the Site will sheet flow to proposed curb and gutter before being captured in proposed private inlets. Flows are then conveyed through the proposed private underground storm network where it outfalls into the existing storm water stub at DP-BB as described in the MDDP. Ultimately, the runoff is then conveyed through the existing storm network where it outfalls into WFJCC Pond #1.

No offsite flows enter the Site and there are no major irrigation facilities within the Site. The Site does not currently provide on-site water quality or detention for the Project area. The existing private above ground full spectrum extended detention basin, West Fork Jimmy Camp Creek Pond #1, will provide water quality and detention for the Site. The site is not located within the streamside zone and the existing land use is vacant land. The proposed land use is multi-residential residential.

SOILS CONDITIONS

NRCS soil data is available for this Site, and it has been noted that soils onsite fall under Hydrologic Groups B. The NRSC Soils map is provided in **Appendix B.**

FEMA FLOODPLAIN STATEMENT

The Flood Insurance Rate Maps (FIRM) 08041C0768G effective date December 7, 2018, by FEMA, indicates that the Site is located in Zone X (outside of the 500-year flood plain). This panel is included in **Appendix A**.

DRAINAGE DESIGN CRITERIA

REGULATIONS

Water quality and detention is required for this Project per the City of Colorado Springs Drainage Criteria Manual Volumes 1 and 2 (the “DCM”), dated May 2014, and revised January 2021.

The proposed project will be developed in two phases, this PDR outlines the preliminary drainage approach for the final buildout of both phases. A Final Drainage Report (FDR) will be submitted as a separate, stand-alone document prior to approval of the Final GEC Plans, PCM Plans, and Storm Plan and Profile Plans for both phases. It is understood that Grading and Erosion Control Plans and Storm Plan and Profile Construction Documents are required to be submitted as a separate, stand-alone document in ProjectDox and that these plans cannot be approved until an FDR is approved.

No public storm infrastructure is proposed and no reimbursable costs are associated with the project.

DESIGN CRITERIA REFERENCE AND CONSTRAINTS

The Project follows the City of Colorado Springs Storm Drainage Criteria Manual Volume 1 (May 2014, revised January 2021), and Volume 2 (May 2014, revised December 2020) (the “DCM”) and the MHFD Urban Storm Drainage Criteria Manual Volumes 1, 2, and 3 (the “USDCM”). Project area drainage is not significantly impacted by such constraints as utilities or existing development. Further detail regarding onsite drainage patterns is provided in the Proposed Drainage Conditions section of this report.

The 5-year and 100-year design storm events were used in determining rainfall and runoff for the proposed drainage system per Section 6 of the DCM. Table 6-2 of the DCM is the source for rainfall data for the 5-year and 100-year design storm events. Developed runoff was calculated using the Rational Method for existing and proposed conditions as established in the DCM and the USDCM. Runoff coefficients for the proposed development were determined using Table 6-6 of the DCM by calculating weighted impervious values for each specific site basin. The runoff

coefficients used for each delineated basin correspond with the predominant soil type with in that specific sub-basin as outlined in Table 6-6 of the DCM (i.e. if the basin has HSG B then the associated HSG A/B runoff coefficient from Table 6-6 was used). These soil types are denoted within the HSG Column on Form SF-1 in **Appendix C**.

HYDRAULIC CRITERIA

The proposed drainage facilities are designed in accordance with the DCM and the USDCM. Hydraulic calculations for inlet and street capacity and sizing were computed using MHFD spreadsheets. The inlet size needed per basin to capture the basin's developed flow was determined from these calculations. The inlet capacity calculations are provided in **Appendix D**.

Hydraulic calculations for rip rap sizing and street capacities will be computed using MHFD spreadsheets. Pipe flows, capacities, and hydraulic grade line calculations will be computed using StormCAD implementing the standard step headloss method.

VARIANCES FROM CRITERIA

There are no proposed variances related to hydrology, PCM's, or channels from the City of Colorado Springs Drainage Criteria, dated May 2014 (Revised January 2021), for the proposed development. Any other variances from the DCM's criteria will be requested with the Final Drainage Report for this development at a later date.

EXISTING DRAINAGE CONDITIONS

In the existing conditions, stormwater sheet flows from north to south at slopes of approximately 8%. The existing Site has been divided into three (3) sub-basins, E1 – E3. A description of each sub-basin is listed below. Calculations of the existing sub-basins on the Project Site have been completed using current stormwater criteria. The weighted imperviousness of the entire 20.62-acre drainage area under existing conditions is 0%. There is currently a public stormwater stub designated for future development located in the southeast corner of the site. The existing public stub does not currently accept any flows. There is an existing electrical easement located along the western portion of the Site but is not anticipated to affect drainage conditions. The historic runoff pattern will generally be maintained and unaffected with the proposed project.

EXISTING DRAINAGE BASINS

The Site is divided into three (3) existing sub-basins. The existing drainage along with the existing hydrologic calculations for this development are provided in **Appendix C**. The existing drainage exhibit is provided in **Appendix F**.

Table 1: Existing Drainage Basin Runoff and Outfall Summary

DESIGN POINT	TRIBUTARY BASINS	AREA (AC)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	% IMPERV.	IMMEDIATE OUTFALL			ULTIMATE OUTFALL
						CONVEYANCE	INLET TYPE	LOCATION	
E1	E1	8.96	2.59	18.99	0%	SWALE	AREA INLET	NW	WFJCC POND #1
E2	E2	9.83	2.85	20.96	0%	C&G	TYPE R CURB INLET	N	WFJCC POND #1
E3	E3	1.45	3.84	28.18	0%	C&G	TYPE R CURB INLET	NW	WFJCC POND #1
LH2	LH2	0.18	0.00	0.00	69%	C&G	TYPE R CURB INLET	E	WFJCC POND #1
WF3	WF3	0.75	0.00	0.00	60%	C&G	TYPE R CURB INLET	E	WFJCC POND #1
WF6	WF6	1.06	0.00	0.00	68%	C&G	TYPE R CURB INLET	SE	WFJCC POND #1
WF7	WF7	13.41	0.00	0.00	0%	OVERLAND	N/A	N/A	ADJACENT SITE
Total (WF4)		**35.63**	**9.28**	**68.14**	**4%**				

SUB-BASIN WF4

The existing conditions sub-basins E1-E3 are located in Sub-basin WF4 as described in the MDDP. Flows generated within sub-basin WF4 is designed to be captured and treated within the

existing FSD pond (West Fork Jimmy Camp Creek Pond #1). Applicable excerpts from the previous drainage studies are provided in **Appendix G**.

PROPOSED DRAINAGE CONDITIONS

BASIN DESCRIPTIONS

The developed runoff from the Bradley Heights Apartments project will generally be collected by means of proposed curb and gutter and private storm sewer system with inlets located within landscape areas and internal drives of each delineated sub-basin area. Runoff from the proposed building roofs will daylight and be captured in landscape area drains that will connect to the on-site private underground storm sewer network. Runoff captured by the proposed private inlets will be conveyed via three underground storm networks (A, B, and C) and will be connected to the existing storm sewer network at design point BB located southeast of the site. Ultimately the existing storm sewer network will route flows to the existing FSD pond (West Fork Jimmy Camp Creek Pond #1) located south of the proposed Site. The total imperviousness for the developed site is 49%.

The site has been divided into sub-basins P1-P15, OS-1, LH2, WF3, & WF6 which are outlined in the table below. Reference **Appendix F** for the Proposed Drainage Map and delineation of proposed sub-basins. Reference the Proposed Rational Calculations Summary table below for each sub-basin area, minor storm runoff, and major storm runoff. There is no offsite drainage affecting the Site. All proposed storm infrastructure will be private unless otherwise noted. All proposed private storm pipes are RCP. The emergency overflow path for all proposed inlets in sump conditions will be discussed in the FDR for this development.

Table 2: Proposed Stormwater Runoff Calculation and Sub-basin outfall Descriptions

DESIGN POINT	TRIBUTARY BASINS	AREA (AC)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	% IMPERV.	IMMEDIATE OUTFALL				ULTIMATE OUTFALL
						CONVEYANCE	CONVEYANCE DIRECTION	INLET TYPE	LOCATION	
P1	P1	0.48	0.78	1.93	42%	SWALE	EAST	AREA INLET	SUMP	WFJCC POND #1
P2	P2	1.33	3.43	7.14	63%	C&G	SOUTHEAST	TYPE R CURB INLET	SUMP	WFJCC POND #1
P3	P3	0.40	1.63	3.05	85%	C&G	SOUTH	TYPE R CURB INLET	SUMP	WFJCC POND #1
P4	P4	0.51	1.83	3.54	76%	C&G	SOUTHEAST	TYPE R CURB INLET	SUMP	WFJCC POND #1
P5	P5	2.99	7.19	15.61	56%	C&G	SOUTHWEST	TYPE R CURB INLET	SUMP	WFJCC POND #1
P6	P6	0.63	2.69	4.96	91%	C&G	SOUTH	TYPE R CURB INLET	SUMP	WFJCC POND #1
P7	P7	0.82	2.50	4.86	76%	C&G	SOUTH	TYPE R CURB INLET	SUMP	WFJCC POND #1
P8	P8	0.30	0.76	1.63	59%	C&G	SOUTH	TYPE R CURB INLET	SUMP	WFJCC POND #1
P9	P9	1.73	3.56	7.91	54%	SWALE	SOUTHEAST	AREA INLET	SUMP	WFJCC POND #1
P10	P10	0.43	1.54	3.00	75%	C&G	SOUTHWEST	TYPE R CURB INLET	SUMP	WFJCC POND #1
P11	P11	1.95	2.87	7.10	42%	SWALE	SOUTHEAST	AREA INLET	SUMP	WFJCC POND #1
P12	P12	3.26	7.48	15.99	58%	C&G/SWALE	SOUTH	AREA INLET	SUMP	WFJCC POND #1
P13	P13	1.46	1.42	7.04	52%	C&G	SOUTH	TYPE R CURB INLET	SUMP	WFJCC POND #1
P14	P14	0.86	0.60	1.20	27%	SWALE	SOUTH	AREA INLET	SUMP	WFJCC POND #1
P15	P15	0.12	2.69	5.04	77%	C&G	SOUTH	TYPE R CURB INLET	SUMP	WFJCC POND #1

Table 2: Proposed Stormwater Runoff Calculation and Sub-basin outfall Descriptions (cont.)

OS-1	OS-1	2.97	1.42	7.04	6%	OVERLAND FLOW	SOUTH	N/A	N/A	ADJACENT SITE
LH2	LH2	0.18	0.60	1.20	70%	C&G	EAST	10' TYPE R CURB INLET	LEGACY HILL DR	WFJCC POND #1
WF3	WF3	0.75	2.69	5.04	85%	C&G	EAST	10' TYPE R CURB INLET	LEGACY HILL DR	WFJCC POND #1
WF6	WF6	1.06	2.50	5.13	65%	C&G	SOUTHEAST	10' TYPE R CURB INLET	BRADLEY LANDING BLVD	WFJCC POND #1
WF7	WF7	13.41	3.84	28.18	0%	OVERLAND FLOW	SOUTHWEST	N/A	N/A	ADJACENT SITE

FOUR-STEP PROCESS

The four-step process per the USDCM provides guidance and requirements for the selection and siting of permanent Control Measures (CMs) for new development and significant redevelopment. Compliance with this process is outlined below. The total area of disturbance associated with the development is 21.1-acres. Water quality treatment for the disturbed areas of the Site will be provided via 75% infiltration and a proposed WQCV/EURV Pond.

Step 1: Employ Runoff Reduction Practices

Currently the site is vacant land. Development of the site will increase current runoff conditions due to a portion of the proposed development area currently being vacant land. However, he proposed development is not anticipated to have negative impacts to downstream infrastructure. Implementation of landscaping throughout the Site will help slow runoff and encourage infiltration. Stormwater runoff reduction techniques will be used to promote stormwater infiltration and reduce the amount of developed runoff exiting the Site.

As documented in the runoff reduction calculations and exhibit found in the Appendix, the site was divided into Upstream Impervious Areas (UIA), Receiving Pervious Area (RPA), Directly Connected Impervious Area (DCIA), and Separate Pervious Area (SPA) per the City of Colorado Springs Green Infrastructure Manual. Where feasible, developed stormwater runoff from the Site will be directed over the various RPA's. Reference **Appendix F** for the proposed Green Infrastructure Exhibit. Reference **Appendix C** for the UD-BMP spreadsheet by Mile High Flood District used to determine the runoff reduction.

The total WQCV reduction for the total disturbed area is 10%, which meets the required minimum of 10%. All project phases are to show compliance with Green Infrastructure requirements in their respective reports.

Step 2: Treat and slowly release the WQCV

The water quality capture volume will be provided and slowly released from the outlet structure of the proposed WQCV/EURV Pond for the Site in a minimum of 40 hours. Water quality treatment for the disturbed areas not tributary to the proposed WQCV/EURV Pond will be provided via 75% infiltration. Therefore, 100% of the Site is treated for water quality. Reference the table below for a breakdown of each sub-basin and the control measure providing water quality treatment.

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Table 3: Treatment Method Summary

DESIGN POINT	TOTAL AREA (AC)	ASSOCIATED DISTURBANCE AREA (AC)	TREATMENT METHOD	OWNERSHIP/ MAINTENANCE
P1	0.48	0.48	WFJCC POND #1	PRIVATE
P2	1.33	1.33	WFJCC POND #1	PRIVATE
P3	0.40	0.40	WFJCC POND #1	PRIVATE
P4	0.51	0.51	WFJCC POND #1	PRIVATE
P5	2.99	2.99	WFJCC POND #1	PRIVATE
P6	0.63	0.63	WFJCC POND #1	PRIVATE
P7	0.82	0.82	WFJCC POND #1	PRIVATE
P8	0.30	0.30	WFJCC POND #1	PRIVATE
P9	1.73	1.73	WFJCC POND #1	PRIVATE
P10	0.43	0.43	WFJCC POND #1	PRIVATE
P11	1.95	1.95	WFJCC POND #1	PRIVATE
P12	3.26	3.26	WFJCC POND #1	PRIVATE
P13	1.46	1.46	WFJCC POND #2	PRIVATE
P14	0.86	0.86	WFJCC POND #3	PRIVATE
P15	0.12	0.12	WFJCC POND #4	PRIVATE
OS-1	2.97	2.97	75% REDUCTION	PRIVATE
LH2	0.18	0.05	WFJCC POND #1	PRIVATE
WF3	0.75	0.30	WFJCC POND #1	PRIVATE
WF6	1.06	0.17	WFJCC POND #1	PRIVATE
WF7	13.41	0.36	WFJCC POND #1	PRIVATE
Total	**22.2**	**21.1**		
Total Treated Disturbed Area (AC):		**21.1**		
Total Untreated Disturbed Area (AC):		**0.00**		
Resulting Treatment Percentage:		**100.00%**		

Step 3: Stabilize Drainageways

There are no open channels on or adjacent to this site, therefore no stabilization will be necessary. All new and re-development projects 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 downstream outlet has sufficient stabilization. Development site is 1211 ft from Jimmy Camp Creek.

Step 4: Implement Site Specific and Other Source Control CMs

The Site does not require “Covering of Storage/Handling Areas” or “Spill Containment and Control” (permanent CMs) in the final constructed condition. There is no proposed material storage or other site operations that would introduce contaminants to the City’s MS4 that would require site specific control or source control CM for the proposed project.

Total Disturbed Area Exclusions

Utility connections to public utilities located in public Legacy Hill Drive and Bradley Landing Boulevard ROW are anticipated. The 4 step process is applied to the total disturbed area, except, per the SWENT Policy Clarification titled “4 Step Process Exclusions”, the area of disturbance associated with the utility trenching, which can be excluded from the 4 step process requirements. The total utility trenching area which is excluded as a part of this project is 0.025-acres.

WATER QUALITY AND DETENTION

DETENTION

Per the Master Development Drainage Plan for Bradley Heights by Matrix, the existing private FSD Pond south of the Site will provide 100-year detention for the Site. The pond was sized for the Bradley Heights Master Development which includes 76.22 acres. The WFJCC Pond #1 is owned and maintained by the landowner of Bradley Heights Metropolitan District No. 2 per the approved PCM Plans for Bradley Heights Metropolitan District WFJCC Pond #1. The site is situated in the master planned basin WF4, which ultimately outfalls into this FSD Pond.

WATER QUALITY

The water quality treatment for the Site will be provided within the existing WQCV/EURV Pond and via 75% infiltration. Basins P1-P12 will be captured at the planned design point BB for the master planned WF4 basin and OS-1 basin will outfall into master planned WF9 basin following the current conditions which provides water quality treatment through 75% infiltration.

DOWNSTREAM FLOWS

The total flows developed from the Site are expected to increase from the existing to the proposed condition due to the master study incorrectly sizing the basin. However, because the impervious area is lower than the planned impervious area for the WF4 basin, it will not have any adverse effects to water quality treatment. Reference the table below for details on the existing and proposed flows at West and East design points.

DESIGN POINT	Tributary Basins (Existing)	Area (AC)	Existing 5-yr Flow (cfs)	Existing 100-yr Flow (cfs)	Tributary Basins (Proposed)	Area (AC)	Proposed 5-yr Flow (cfs)	Proposed 100-yr Flow (cfs)
North	LH2, WF3	0.93	2.35	4.88	LH2, WF3	0.93	2.74	6.60
South	E1-E3, WF6, WF7	34.71	12.38	76.72	P1-P12, OS1, WF6, WF7	34.71	33.59	116.86

COMPLIANCE WITH PREVIOUS STUDIES

The MDDP includes the proposed Project Site within its drainage study area. Per the MDDP, the Site is located in sub-basin WF-4 and a portion of WF-7, and has offsite improvements located within LH2, WF-3, and WF-6. These basins are routed south to Design Point BB which conveys flows to the WFJCC Pond #1 which provides detention and water quality before discharging into Jimmy Camp Creek. Per the post development drainage conditions map, the study accounts for the Site to be part neighborhoods/multi-family and undeveloped/pervious areas. The offsite improvements in LH2, WF-3, and WF-6 are planned to be part of the commercial areas. This PDR onsite improvements in MDDP basin WF-4 and a portion in MDDP sub-basin WF-7. The portion of MDDP sub-basin WF-7 that is located within proposed sub-basin P12 has been accounted for in the MDDP. There are no proposed site improvements or changes to imperviousness within this portion of the proposed sub-basin P12. This combined area is to be treated and detained within the WFJCC Pond #1. This lower overall weighted imperviousness basins will help with the extended release of flows and provide water quality treatment to more flows than what was approved in the MDDP, therefore the proposed Project Site is generally in compliance with the MDDP.

MDDP BASIN	MDDP BASIN AREA	PROPOSED SITE AREA WITHIN BASIN	MDDP PLANNED IMPERVIOUSNESS	PROPOSED SITE WEIGHTED IMPERVIOUSNESS
WF-4	20.24	20.24	56%	49%
LH-2	0.18	0.18	95%	70%
WF-3	0.75	0.75	95%	85%
WF-6	1.06	1.06	95%	65%
WF-7	13.41	0.31	65%	0%

GRADING AND EROSION CONTROL PLAN

Grading and Erosion Control Plans will be submitted separately as a standalone construction document.

DRAINAGE AND BRIDGE FEES

The Site is located within the Jimmy Camp Creek Drainage Basin. A table is provided below detailing the published 2024 Drainage, Bridge, and Pond Fees for the City of Colorado Springs and the associated fees for the proposed Site. The drainage fee will be due at the time of the first platting of the property. The total fees due will be $222,983.38.

Fee	$/acre	Acres	Fee Total
Drainage	$10,793	20.68	$223,199.24
		Total	**$223,199.24**

GEOTECHNICAL AND GROUNDWATER CONSIDERATIONS

A geotechnical investigation was prepared for the Site and pertinent excerpts are included in **Appendix E** of this report. The report did not find any geologic hazard which would preclude development of the site based on the proposed design.

Per the Geotechnical Report, groundwater was not encountered during drilling operations in the borings and is not considered a constraint to construction of this project.

SUMMARY

COMPLIANCE WITH STANDARDS

The drainage design presented within this report for Bradley Heights Apartments conforms to the City of Colorado Springs Storm Drainage Criteria Manual, Volumes 1 and 2 (with latest revisions) and the Mile High Flood District Manual. Additionally, the Site runoff and storm drain facilities will not adversely affect the downstream and surrounding developments.

This report and findings are in general conformance with all previously approved reports and/or studies which include this Site, including the planned runoff from the Site as outlined in the Bradley Heights MDDP. The proposed Project is not anticipated to adversely impact the peak flows downstream within Jimmy Camp Creek.

REFERENCES

1. City of Colorado Springs Drainage Criteria Manual, Vol. 1 & 2, May 2014 (Vol. 1 revised January 2021, Vol. 2 revised December 2020).

2. Mile High Flood District Drainage Criteria Manual Vol. 1, prepared by Wright-McLaughlin Engineers, June 2001, with latest revisions.

3. The Federal Emergency Management Agency, FEMA FIRMette published December 28, 2021, Map Number 08041C0768G, effective date December 7, 2018, by the Federal Emergency Management Agency (FEMA).

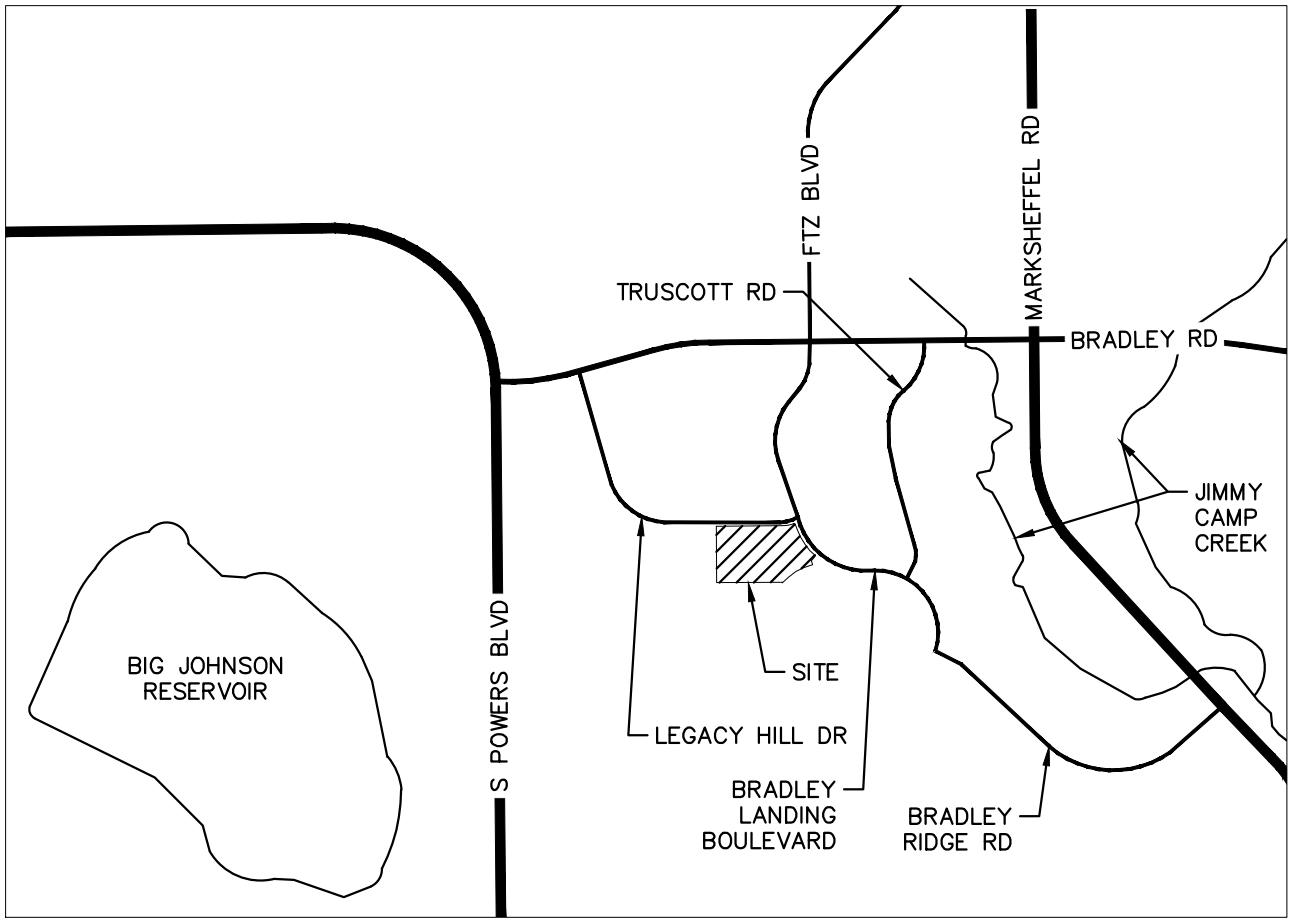
4. Natural Resources Conservation Service (NRCS), United States Department of Agriculture (USDA). Web Soil Survey. Available online. Accessed 12/17/2023.

5. “Master Development Drainage Plan Amendment for Bradley Heights” by Matrix, Dated April 2022

6. “Jimmy Camp Creek Drainage Basin Planning Study, Development of Alternatives & Design of Selected Plan Report” by Kiowa Engineering Corporation for the City of Colorado Springs, Dated March 9, 2015

7. “Geotechnical Evaluation for Proposed Industrial Development Bradley Road & Foreign Trade Zone Boulevard Colorado Springs, Colorado” by Ninyo & Moore., prepared December 1, 2023.

APPENDIX A – VICINITY MAP



VICINITY MAP

(NOT TO SCALE)

APPENDIX B – SOILS MAP AND FEMA FIRM PANEL

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.

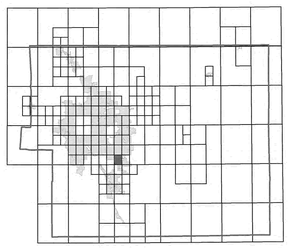
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this 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

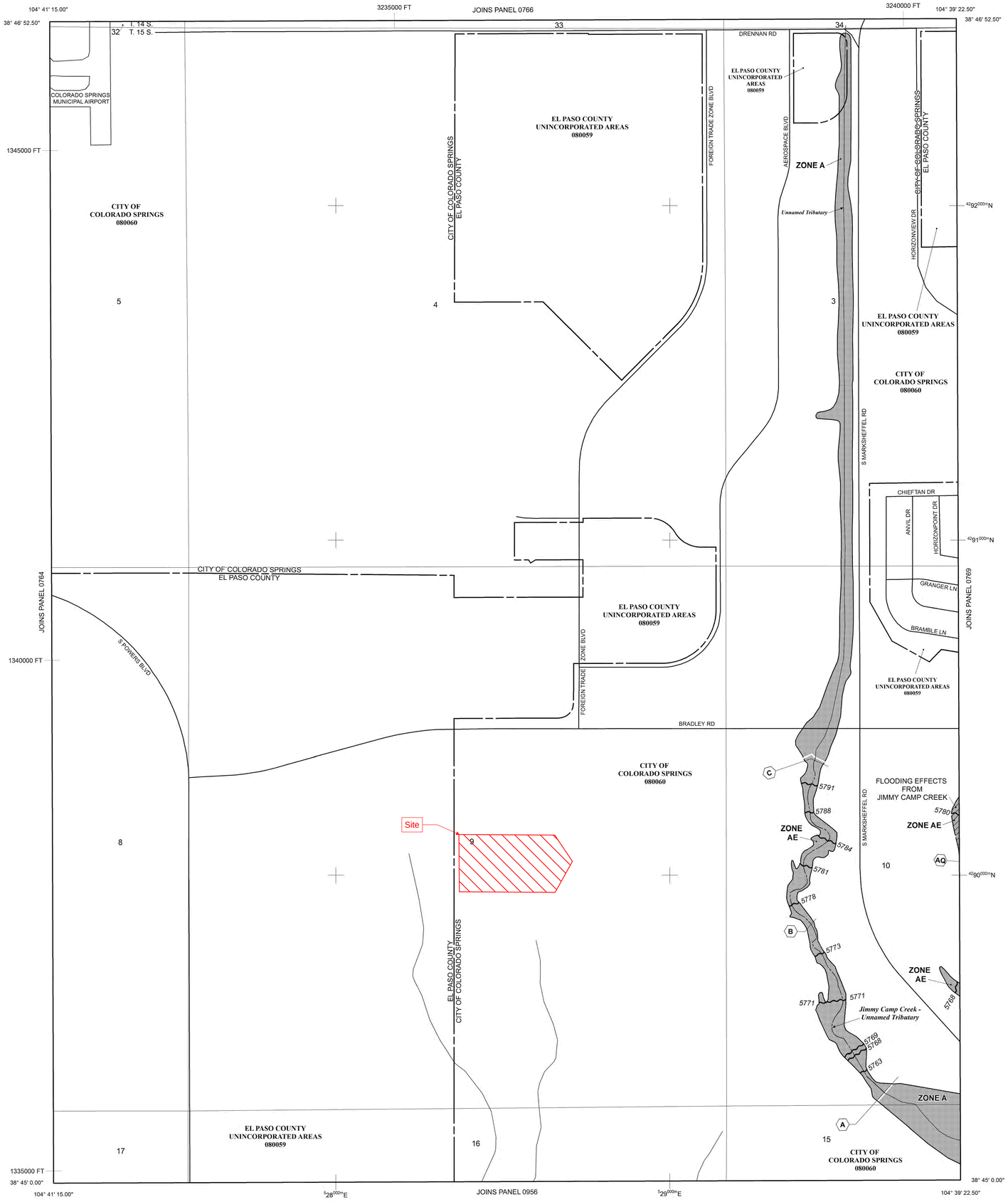
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

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 14 SOUTH, RANGE 65 WEST, AND 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 0768G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 768 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0768	G
EL PASO COUNTY	080059	0768	G

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
08041C0768G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

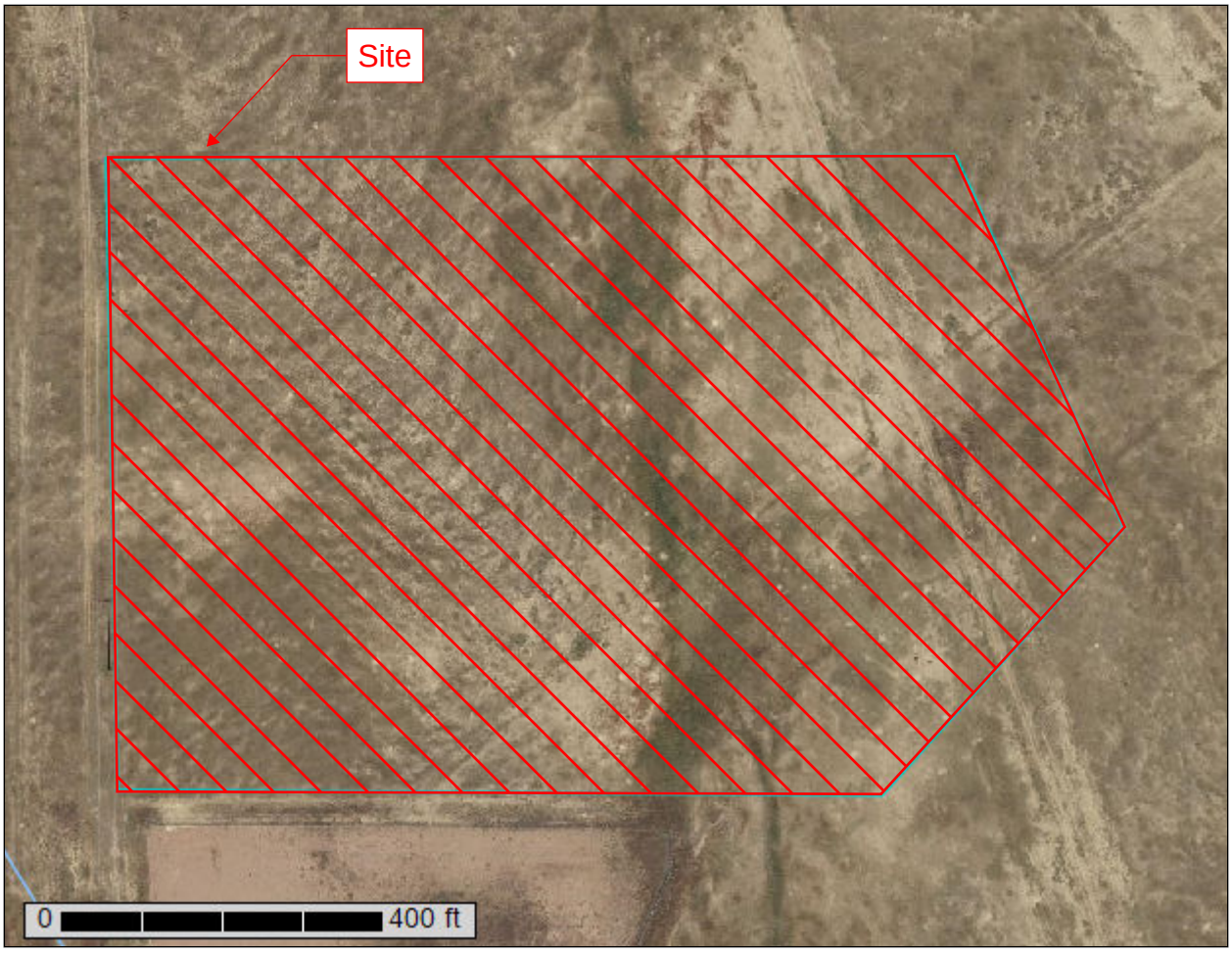
United States Department of Agriculture

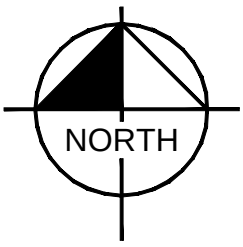
NRCS

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

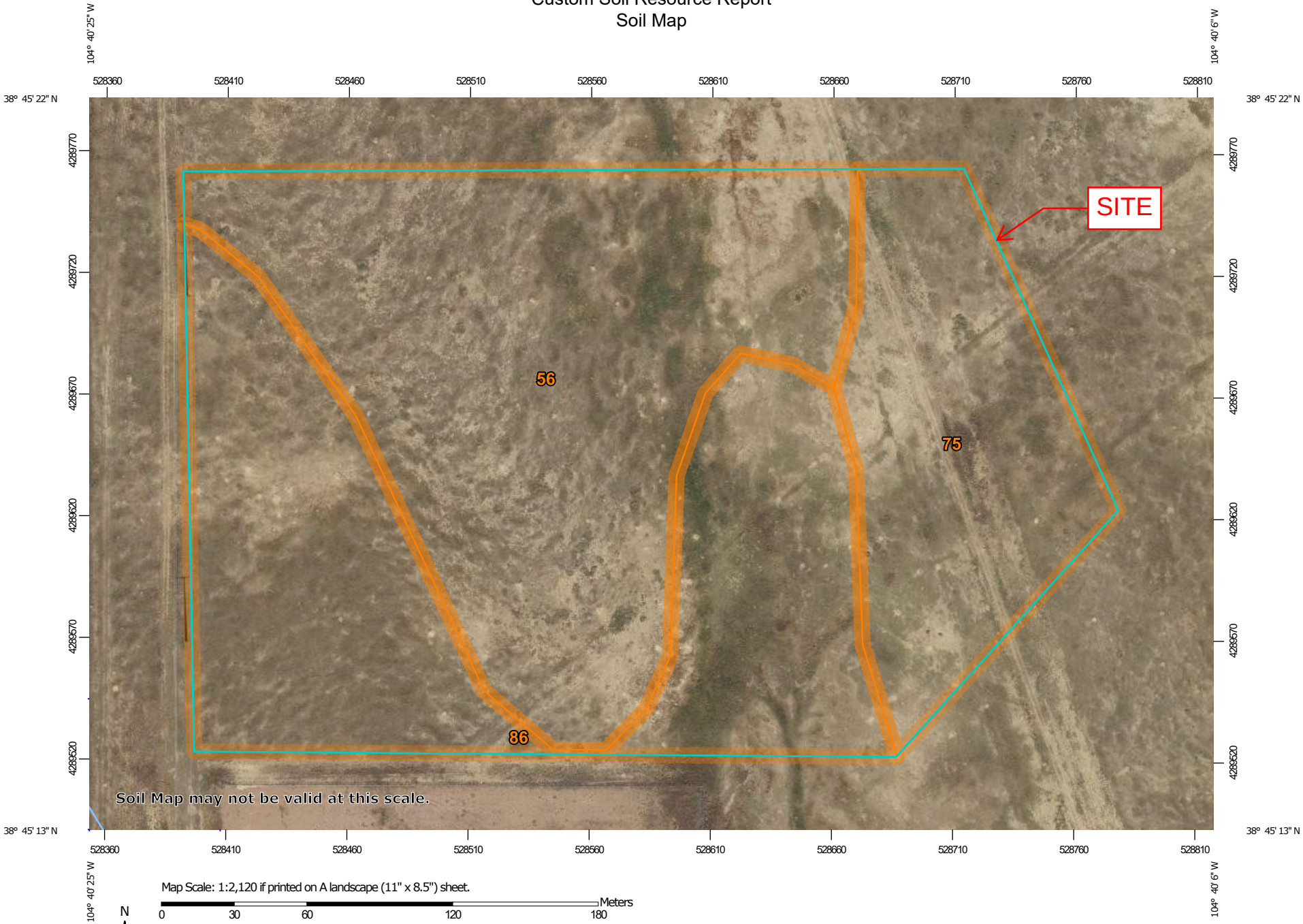
Custom Soil Resource Report for El Paso County Area, Colorado





July 16, 2024

Custom Soil Resource Report
Soil Map



Map Scale: 1:2,120 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

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 21, Aug 24, 2023

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	9.1	43.9%
75	Razor-Midway complex	4.2	20.2%
86	Stoneham sandy loam, 3 to 8 percent slopes	7.4	35.9%
Totals for Area of Interest		**20.6**	**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

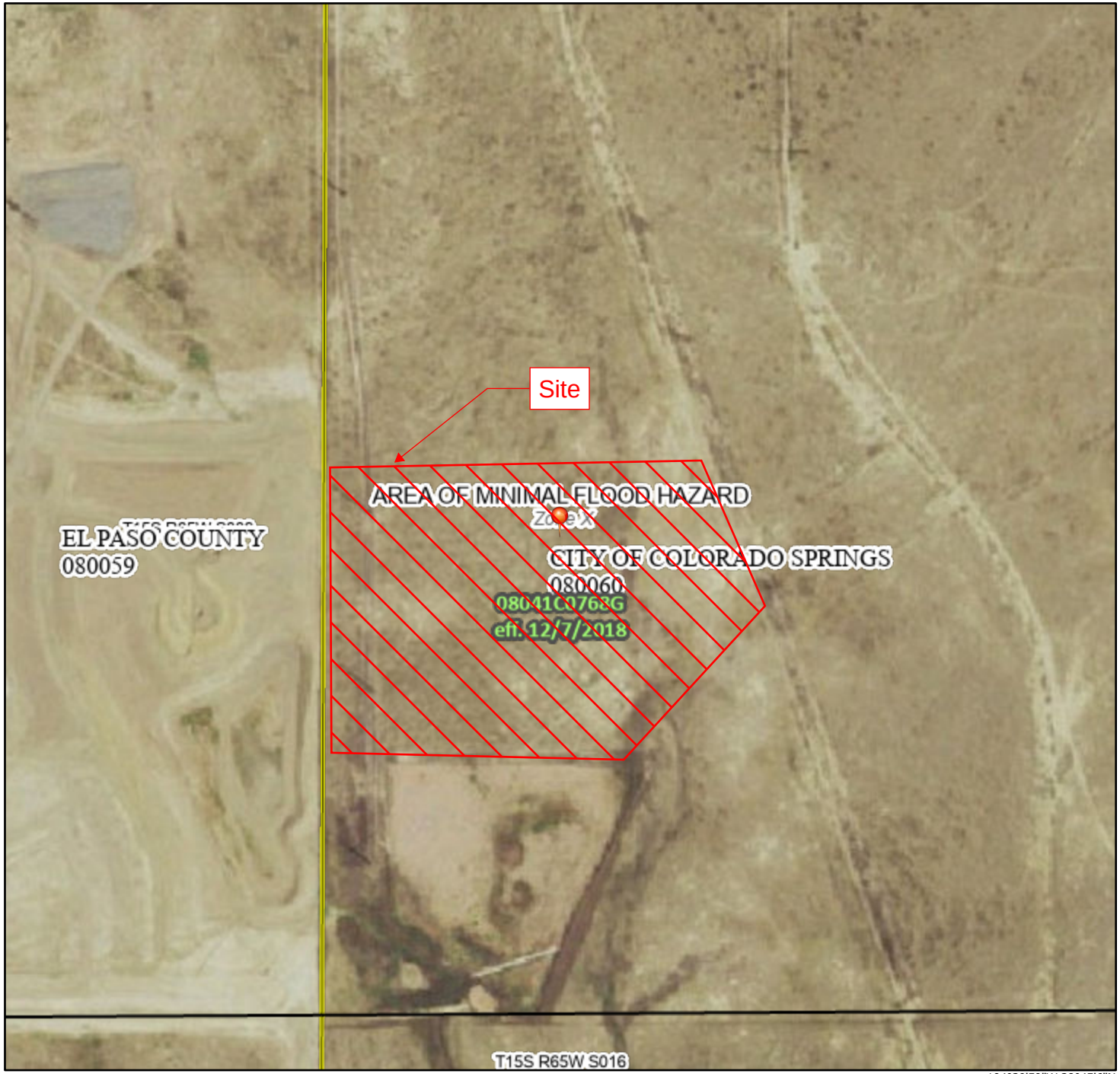
Pleasant

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

National Flood Hazard Layer FIRMette

FEMA

104°40'36"W 38°45'34"N



0 250 500 1,000 1,500 2,000 Feet

1:6,000

104°39'59"W 38°45'6"N

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/8/2024 at 11:09 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX C – HYDROLOGIC CALCULATIONS

Kimley»Horn

STANDARD FORM SF-1
RUNOFF COEFFICIENTS - IMPERVIOUS CALCULATION
PROPOSED CONDITIONS

SOIL: B

LAND USE:	DRIVES/WALKS AREA	ROOFS AREA	LANSCAPE AREA
2-YEAR COEFF.	0.89	0.71	0.02
5-YEAR COEFF.	0.90	0.73	0.08
10-YEAR COEFF.	0.92	0.75	0.15
100-YEAR COEFF.	0.96	0.81	0.35
IMPERVIOUS %	100%	90%	0%

DESIGN BASIN	DESIGN POINT	DRIVES/WALKS AREA (AC)	ROOFS AREA (AC)	LANSCAPE AREA (AC)	TOTAL AREA (AC)	C(2)	C(5)	C(10)	C(100)	Imp %
PDR BASINS										
P1	P1	0.00	0.22	0.26	**0.48**	0.34	0.38	0.43	0.57	42%
P2	P2	0.63	0.22	0.48	**1.33**	0.55	0.58	0.62	0.72	63%
P3	P3	0.34	0.00	0.06	**0.40**	0.76	0.78	0.81	0.87	85%
P4	P4	0.39	0.00	0.12	**0.51**	0.68	0.71	0.74	0.82	76%
P5	P5	1.27	0.44	1.28	**2.99**	0.49	0.52	0.56	0.68	56%
P6	P6	0.57	0.00	0.06	**0.63**	0.81	0.83	0.85	0.90	91%
P7	P7	0.62	0.00	0.20	**0.82**	0.68	0.70	0.73	0.81	76%
P8	P8	0.07	0.13	0.11	**0.30**	0.50	0.53	0.57	0.67	59%
P9	P9	0.31	0.69	0.73	**1.73**	0.45	0.49	0.53	0.64	54%
P10	P10	0.32	0.00	0.10	**0.43**	0.68	0.70	0.73	0.81	75%
P11	P11	0.08	0.81	1.05	**1.95**	0.34	0.39	0.43	0.57	42%
P12	P12	1.66	0.24	1.36	**3.26**	0.51	0.55	0.59	0.70	58%
P13	P13	0.56	0.22	0.68	**1.46**	0.46	0.49	0.53	0.65	52%
P14	P14	0.03	0.22	0.60	**0.86**	0.23	0.28	0.33	0.49	27%
P15	P15	0.09	0.00	0.03	**0.12**	0.69	0.71	0.75	0.82	77%
OS-1	OS-1	0.19	0.00	2.78	**2.97**	0.07	0.13	0.20	0.39	6%
LH2	LH2	0.13	0.00	0.05	**0.18**	0.63	0.66	0.69	0.78	70%
WF3	WF3	0.64	0.00	0.11	**0.75**	0.76	0.78	0.80	0.87	85%
WF6	WF6	0.68	0.00	0.38	**1.06**	0.58	0.61	0.65	0.74	65%
WF7	WF7	0.00	0.00	13.41	**13.41**	0.02	0.08	0.15	0.35	0.0%

TOTAL - TRIBUTARY TO POND (P1-P15, LH2, WF3, and WF6)	**8.40**	**3.19**	**7.66**	**19.26**	**0.51**	**0.55**	**0.59**	**0.69**	**59%**
	44%	**17%**	**40%**	**100%**					
TOTAL - TRIBUTARY TO DESIGN POINT BB (P1-P15)	**6.96**	**3.19**	**7.12**	**17.27**	**0.50**	**0.53**	**0.57**	**0.68**	**57%**
	40%	**18%**	**41%**	**100%**					
TOTAL - ONSITE BASINS (P1-P12 and OS-1)	**7.14**	**3.19**	**9.90**	**20.24**	**0.44**	**0.47**	**0.52**	**0.64**	**49%**
	35%	**16%**	**49%**	**100%**					

Note: Land use coefficients sourced from City of Colorado Springs Drainage Criteria Manual, Volume 1, Table 6-6.

Kimley»Horn

STANDARD FORM SF-2
Time of Concentration

PROJECT NAME: BRADLEY HEIGHTS
PROJECT NUMBER: 296008001
CALCULATED BY: MEL
CHECKED BY: NMB

PROPOSED CONDITIONS

DATE: ########

SUB-BASIN DATA			INITIAL TIME (T_i)			TRAVEL TIME (T_t)					Tc CHECK (URBANIZED BASINS)					FINAL Tc
DESIGN BASIN (1)	AREA Ac (2)	C5 (3)	LENGTH Ft (4)	SLOPE % (5)	T_i Min. (6)	LENGTH Ft. (7)	SLOPE % (8)	C_v (9)	VEL fps (11)	T_t Min. (12)	COMP. (13)	TOTAL tc (14)	TOTAL SLOPE (15)	TOTAL IMP. (16)	Tc Min. (17)	Min.
PDR BASINS																
P1	0.48	0.38	50	2.0%	7.4	100	1.5%	7.0	0.9	1.9	9.3	150	1.7%	42%	10.8	9.3
P2	1.33	0.58	50	2.0%	5.4	175	2.5%	7.0	1.1	2.6	8.0	225	2.4%	63%	11.3	8.0
P3	0.40	0.78	25	3.5%	1.9	100	5.0%	20.0	4.5	0.4	2.3	125	4.7%	85%	10.7	5.0
P4	0.51	0.71	100	4.0%	4.5	150	4.0%	20.0	4.0	0.6	5.2	250	4.0%	76%	11.4	5.2
P5	2.99	0.52	100	8.0%	5.3	430	3.0%	20.0	3.5	2.1	7.4	530	3.9%	56%	12.9	7.4
P6	0.63	0.83	30	4.0%	1.7	200	4.0%	20.0	4.0	0.8	2.6	230	4.0%	91%	11.3	5.0
P7	0.82	0.70	50	2.0%	4.1	400	4.5%	7.0	1.5	4.5	8.6	450	4.2%	76%	12.5	8.6
P8	0.30	0.53	50	2.0%	5.9	75	5.0%	7.0	1.6	0.8	6.7	125	3.8%	59%	10.7	6.7
P9	1.73	0.49	50	2.0%	6.3	300	6.0%	7.0	1.7	2.9	9.2	350	5.4%	54%	11.9	9.2
P10	0.43	0.70	100	6.0%	4.1	125	4.0%	20.0	4.0	0.5	4.6	225	4.9%	75%	11.3	5.0
P11	1.95	0.39	100	2.0%	10.4	300	1.0%	7.0	0.7	7.1	17.5	400	1.3%	42%	12.2	12.2
P12	3.26	0.55	100	2.0%	8.1	400	5.0%	20.0	4.5	1.5	9.5	500	4.4%	58%	12.8	9.5
P13	1.46	0.49	50	3.0%	5.5	240	3.5%	20.0	3.7	1.1	6.5	290	3.4%	52%	11.6	6.5
P14	0.86	0.28	50	12.0%	4.6	75	4.5%	20.0	4.2	0.3	4.9	125	7.5%	27%	10.7	5.0
P15	0.12	0.71	60	6.6%	2.9	50	4.0%	20.0	4.0	0.2	3.1	110	5.4%	77%	10.6	5.0
OS-1	2.97	0.13	100	5.1%	10.3	600	3.3%	7.0	1.3	7.9	18.2	700	3.5%	6%	13.9	13.9
LH2	0.18	0.66	40	2.1%	4.0	123	1.8%	20.0	2.7	0.8	4.8	163	1.9%	70%	10.9	5.0
WF3	0.75	0.78	100	1.8%	4.9	380	1.8%	20.0	2.7	2.4	7.2	480	1.8%	85%	12.7	7.2
WF6	1.06	0.61	100	1.2%	8.5	400	1.0%	20.0	2.0	3.3	11.8	500	1.0%	65%	12.8	11.8
WF7	13.41	0.08	100	1.2%	17.6	700	1.0%	7.0	0.7	16.7	34.3	800	1.0%	0.0%	14.4	14.4

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_0^{0.33}} \qquad t_c = \frac{L}{180} + 10 \qquad V = C_v S_w^{0.5}$$

Note: Conveyance coefficient from Table 6-7 of DCM

Kimley»Horn

STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 5 YEAR EVENT

PROJECT NAME: BRADLEY HEIGHTS
PROJECT NUMBER: 296008001
CALCULATED BY: MEL
CHECKED BY: NMB

PROPOSED CONDITIONS

DATE: 1/0/1900

STORM LINE		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			DESIGN BASIN	AREA (AC)	RUNOFF COEFF	t_c (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY	tt (min)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
		P1	P1	0.48	0.38	9.30	0.18	4.24	0.78	12.22	9.16	3.21	**29.43**									ONSITE FLOWS
		P2	P2	1.33	0.58	8.00	0.77	4.46	3.43													
		P3	P3	0.40	0.78	5.00	0.31	5.17	1.63													
		P4	P4	0.51	0.71	5.17	0.36	5.12	1.83													
		P5	P5	2.99	0.52	7.36	1.57	4.59	7.19													
		P6	P6	0.63	0.83	5.00	0.52	5.17	2.69													
		P7	P7	0.82	0.70	8.58	0.57	4.36	2.50													
		P8	P8	0.30	0.53	6.67	0.16	4.74	0.76													
		P9	P9	1.73	0.49	9.24	0.84	4.25	3.56													
		P10	P10	0.43	0.70	5.00	0.30	5.17	1.54													
		P11	P11	1.95	0.39	12.22	0.75	3.83	2.87													
		P12	P12	3.26	0.55	9.55	1.78	4.20	7.48													
		P13	P13	1.46	0.49	6.55	0.72	4.76	3.43													
		P14	P14	0.86	0.28	5.00	0.24	5.17	1.24													
		P15	P15	0.12	0.71	5.00	0.08	5.17	0.44													
		OS-1	OS-1	2.97	0.13	13.89	0.39	3.64	1.42													
		LH2	LH2	0.18	0.66	5.00	0.12	5.17	0.60													
		WF3	WF3	0.75	0.78	7.25	0.58	4.61	2.69													
		WF6	WF6	1.06	0.61	11.81	0.64	3.88	2.50													
		WF7	WF7	13.41	0.08	14.44	1.07	3.58	3.84													
										7.25	0.70	3.92	**2.74**									NORTH DP
										14.44	11.27	2.98	**33.59**									SOUTH DP

$$I_5 = -1.5\ln(t_{c,min}) + 7.583$$

Note: Rainfall intensity from Figure 6-5 IDF Equations

Kimley»Horn

STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 100 YEAR EVENT

PROJECT NAME: BRADLEY HEIGHTS
PROJECT NUMBER: 296008001
CALCULATED BY: MEL
CHECKED BY: NMB

PROPOSED CONDITIONS

DATE: 1/0/1900

STORM LINE		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			DESIGN BASIN	AREA (AC)	RUNOFF COEFF	tc (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY	tt (min)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
		P1	P1	0.48	0.57	9.30	0.27	7.11	1.93	12.22	11.76	6.85	**80.52**									ONSITE FLOWS
		P2	P2	1.33	0.72	8.00	0.95	7.49	7.14													
		P3	P3	0.40	0.87	5.00	0.35	8.68	3.05													
		P4	P4	0.51	0.82	5.17	0.41	8.59	3.54													
		P5	P5	2.99	0.68	7.36	2.03	7.71	15.61													
		P6	P6	0.63	0.90	5.00	0.57	8.68	4.96													
		P7	P7	0.82	0.81	8.58	0.66	7.32	4.86													
		P8	P8	0.30	0.67	6.67	0.21	7.95	1.63													
		P9	P9	1.73	0.64	9.24	1.11	7.13	7.91													
		P10	P10	0.43	0.81	5.00	0.35	8.68	3.00													
		P11	P11	1.95	0.57	12.22	1.10	6.43	7.10													
		P12	P12	3.26	0.70	9.55	2.27	7.05	15.99													
		P13	P13	1.46	0.65	6.55	0.96	8.00	7.65													
		P14	P14	0.86	0.49	5.00	0.42	8.68	3.67													
		P15	P15	0.12	0.82	5.00	0.10	8.68	0.85													
		OS-1	OS-1	2.97	0.39	13.89	1.15	6.10	7.04													
		LH2	LH2	0.18	0.78	5.00	0.14	8.68	1.20													
		WF3	WF3	0.75	0.87	7.25	0.65	7.74	5.04													
		WF6	WF6	1.06	0.74	11.81	0.79	6.51	5.13													
		WF7	WF7	13.41	0.35	14.44	4.69	6.01	28.18													
										7.25	0.79	8.36	**6.60**									NORTH DP
										14.44	18.39	6.35	**116.86**									SOUTH DP

$$I_{100} = -2.52\ln(t_{c,min}) + 12.735$$

Note: Rainfall intensity from Figure 6-5 IDF Equations

Kimley»Horn

PROJECT NAME: BRADLEY HEIGHTS
PROJECT NUMBER: 296008001
CALCULATED BY: MEL
CHECKED BY: NMB

PROPOSED CONDITIONS RATIONAL CALCULATIONS SUMMARY

DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	Q5	Q100	% IMPERVIOUS
PDR Basins					
P1	P1	0.48	0.78	1.93	42%
P2	P2	1.33	3.43	7.14	63%
P3	P3	0.40	1.63	3.05	85%
P4	P4	0.51	1.83	3.54	76%
P5	P5	2.99	7.19	15.61	56%
P6	P6	0.63	2.69	4.96	91%
P7	P7	0.82	2.50	4.86	76%
P8	P8	0.30	0.76	1.63	59%
P9	P9	1.73	3.56	7.91	54%
P10	P10	0.43	1.54	3.00	75%
P11	P11	1.95	2.87	7.10	42%
P12	P12	3.26	7.48	15.99	58%
P13	P13	1.46	3.43	7.65	52%
P14	P14	0.86	1.24	3.67	27%
P15	P15	0.12	0.44	0.85	77%
OS-1	OS-1	2.97	1.42	7.04	6%
LH2	LH2	0.18	0.60	1.20	70%
WF3	WF3	0.75	2.69	5.04	85%
WF6	WF6	1.06	2.50	5.13	65%
WF7	WF7	13.41	3.84	28.18	0%

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: SLG
Company: Kimley-Horn
Date: October 22, 2024
Project: Bradley Heights (TOTAL DISTURBED AREA CALCULATION TO MEET STEP 1) (10% REDUCTION)
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	DCIA	SPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA			
Area ID	SITE IMPERVIOUS	SITE PERVIOUS	FLUSH C&G 1	FLUSH C&G 2	CY 5/7	CY 10/9	BLDG 9	BLDG 8	BLDG 11			
Downstream Design Point ID	MASTER STUDY POND	MASTER STUDY POND	FLUSH C&G 1	FLUSH C&G 2	CY5/8	CY 10/10	BLDG 9	BLDG 8	BLDG 11			
Downstream BMP Type	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB			
DCIA (ft^2)	538,442	--	--	--	--	--	--	--	--			
UIA (ft^2)	--	--	48,860	26,000	1,076	585	5,030	5,030	5,030			
RPA (ft^2)	--	--	10,933	9,992	1,958	3,068	1,941	3,453	8,318			
SPA (ft^2)	--	250,037	--	--	--	--	--	--	--			
HSG A (%)	--	0%	0%	0%	0%	0%	0%	0%	0%			
HSG B (%)	--	100%	100%	100%	100%	100%	100%	100%	100%			
HSG C/D (%)	--	0%	0%	0%	0%	0%	0%	0%	0%			
Average Slope of RPA (ft/ft)	--	--	0.330	0.250	0.020	0.050	0.130	0.130	0.050			
UIA:RPA Interface Width (ft)	--	--	555.00	267.00	182.00	112.00	21.00	24.00	29.00			

CALCULATED RUNOFF RESULTS

Area ID	SITE IMPERVIOUS	SITE PERVIOUS	FLUSH C&G 1	FLUSH C&G 2	CY 5/7	CY 10/9	BLDG 9	BLDG 8	BLDG 11			
UIA:RPA Area (ft^2)	--	--	59,793	35,992	3,034	3,653	6,971	8,483	13,348			
L / W Ratio	--	--	0.19	0.50	0.09	0.29	15.81	14.73	15.87			
UIA / Area	--	--	0.8172	0.7224	0.3546	0.1601	0.7216	0.5930	0.3768			
Runoff (in)	0.50	0.00	0.21	0.07	0.00	0.00	0.05	0.00	0.00			
Runoff (ft^3)	22435	0	1027	222	0	0	30	0	0			
Runoff Reduction (ft^3)	0	12502	1009	862	45	24	180	210	210			

CALCULATED WQCV RESULTS

Area ID	SITE IMPERVIOUS	SITE PERVIOUS	FLUSH C&G 1	FLUSH C&G 2	CY 5/7	CY 10/9	BLDG 9	BLDG 8	BLDG 11			
WQCV (ft^3)	22435	0	2036	1083	45	24	210	210	210			
WQCV Reduction (ft^3)	0	0	1009	862	45	24	180	210	210			
WQCV Reduction (%)	0%	0%	50%	80%	100%	100%	86%	100%	100%			
Untreated WQCV (ft^3)	22435	0	1027	222	0	0	30	0	0			

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	MASTER STUDY POND	FLUSH C&G 1	FLUSH C&G 2	CY5/8	CY 10/10	BLDG 9	BLDG 8	BLDG 11				
DCIA (ft^2)	538,442	0	0	0	0	0	0	0				
UIA (ft^2)	0	48,860	26,000	1,076	585	5,030	5,030	5,030				
RPA (ft^2)	0	10,933	9,992	1,958	3,068	1,941	3,453	8,318				
SPA (ft^2)	250,037	0	0	0	0	0	0	0				
Total Area (ft^2)	788,479	59,793	35,992	3,034	3,653	6,971	8,483	13,348				
Total Impervious Area (ft^2)	538,442	48,860	26,000	1,076	585	5,030	5,030	5,030				
WQCV (ft^3)	22,435	2,036	1,083	45	24	210	210	210				
WQCV Reduction (ft^3)	0	1,009	862	45	24	180	210	210				
WQCV Reduction (%)	0%	50%	80%	100%	100%	86%	100%	100%				
Untreated WQCV (ft^3)	22,435	1,027	222	0	0	30	0	0				

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	919,753
Total Impervious Area (ft^2)	630,053
WQCV (ft^3)	26,252
WQCV Reduction (ft^3)	2,538
WQCV Reduction (%)	10%
Untreated WQCV (ft^3)	23,714

21.1-ACRES

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018) **Sheet 1 of 1**

Designer: MEL
Company: Kimley-Horn
Date: November 15, 2024
Project: Bradley Heights (PROVIDED TO SHOW COMPLIANCE WITH STEP 2) (95% TREATMENT)
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	SPA	UIA:RPA										
Area ID	SITE PERVIOUS	SIDEWALK										
Downstream Design Point ID	OS1	OS1										
Downstream BMP Type	EDB	EDB										
DCIA (ft^2)	--	--										
UIA (ft^2)	--	8,166										
RPA (ft^2)	--	67,228										
SPA (ft^2)	53,809	--										
HSG A (%)	0%	0%										
HSG B (%)	100%	100%										
HSG C/D (%)	0%	0%										
Average Slope of RPA (ft/ft)	--	0.050										
UIA:RPA Interface Width (ft)	--	400.00										

CALCULATED RUNOFF RESULTS

Area ID	SITE PERVIOUS	SIDEWALK										
UIA:RPA Area (ft^2)	--	75,394										
L / W Ratio	--	0.47										
UIA / Area	--	0.1083										
Runoff (in)	0.00	0.00										
Runoff (ft^3)	0	0										
Runoff Reduction (ft^3)	2690	340										

CALCULATED WQCV RESULTS

Area ID	SITE PERVIOUS	SIDEWALK										
WQCV (ft^3)	0	340										
WQCV Reduction (ft^3)	0	340										
WQCV Reduction (%)	0%	100%										
Untreated WQCV (ft^3)	0	0										

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	OS1											
DCIA (ft^2)	0											
UIA (ft^2)	8,166											
RPA (ft^2)	67,228											
SPA (ft^2)	53,809											
Total Area (ft^2)	129,203											
Total Impervious Area (ft^2)	8,166											
WQCV (ft^3)	340											
WQCV Reduction (ft^3)	340											
WQCV Reduction (%)	100%											
Untreated WQCV (ft^3)	0											

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	129,203
Total Impervious Area (ft^2)	8,166
WQCV (ft^3)	340
WQCV Reduction (ft^3)	340
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

APPENDIX D – HYDRAULIC CALCULATIONS

Preliminary Inlet Sizing. Full inlet calculations to be provided with Final Drainage Report.

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	5' TYPE R	10' TYPE R	15' TYPE R
Site Type (Urban or Rural)			
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump		
Inlet Type	CDOT Type R Curb Opening		

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	2.2	3.8	4.3
Major Q_{Known} (cfs)	4.1	7.0	8.2

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	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
Major Bypass Flow Received, Q_b (cfs)	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

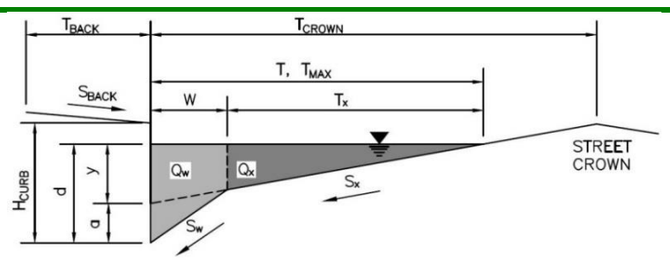
Minor Total Design Peak Flow, Q (cfs)	**2.2**	**3.8**	**4.3**
Major Total Design Peak Flow, Q (cfs)	**4.1**	**7.0**	**8.2**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A		
Major Flow Bypassed Downstream, Q_b (cfs)	N/A		

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

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

Project:

Inlet ID: **5' TYPE R**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	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} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	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} =	0.013	

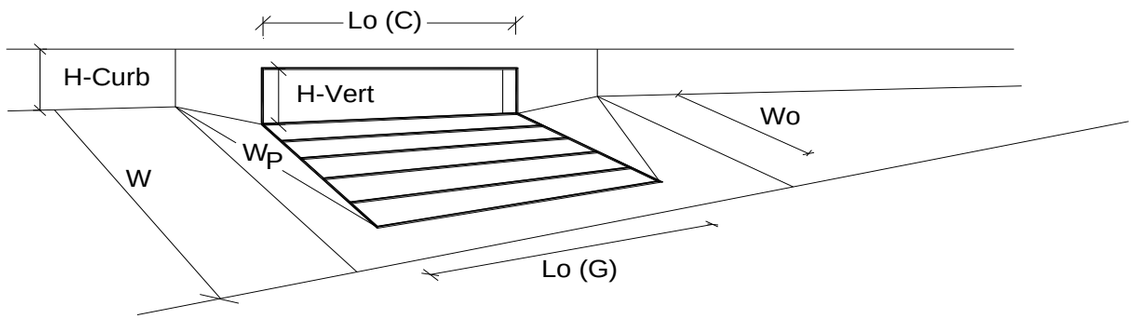
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		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**

8.2

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.8	5.8	inches

Override Depths

Grate Information		MINOR	MAJOR	
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) =	5.00	5.00	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} =	0.32	0.32	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.75	0.75	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

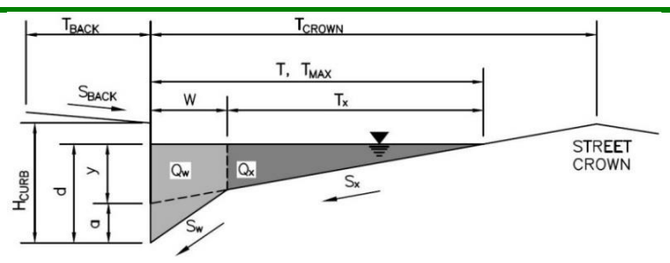
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.0**	**5.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.2	4.1	cfs

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

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

Project:

Inlet ID: **10' TYPE R**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =		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} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	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	

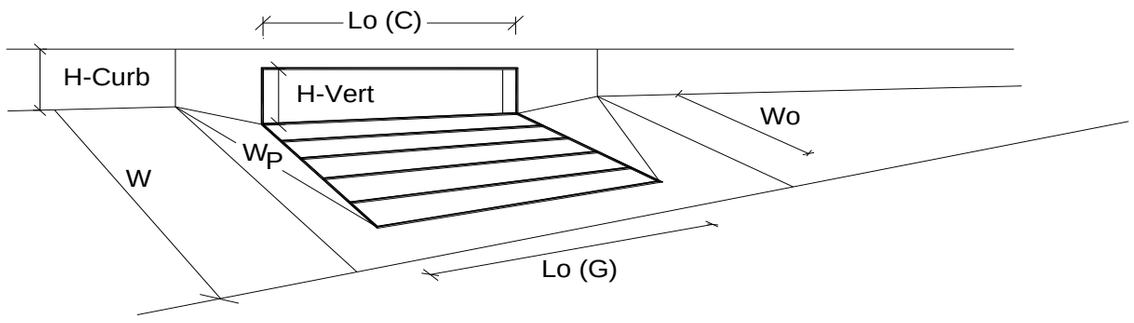
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

	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**

8.2

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.8	5.8	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} =	0.32	0.32	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.55	0.55	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.92	0.92	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

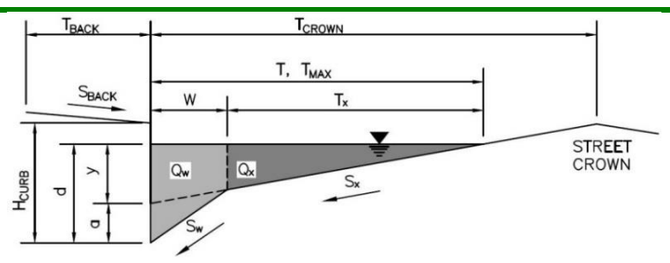
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**7.7**	**7.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.8	7.0	cfs

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

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

Project:

Inlet ID: **15' TYPE R**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =		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} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	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	

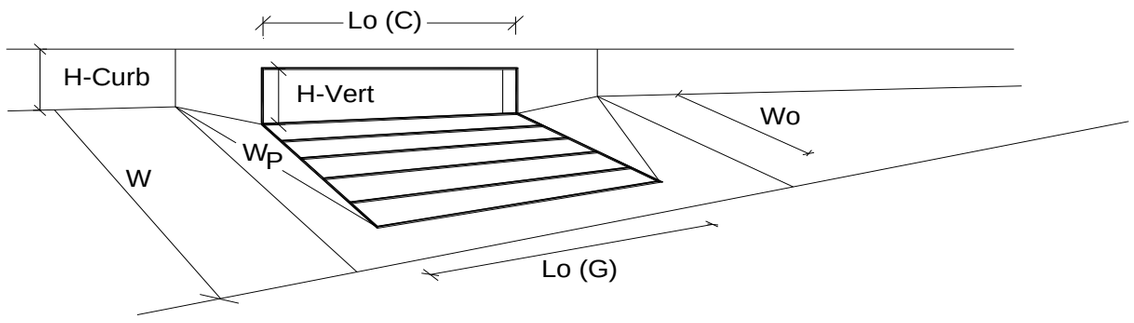
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

	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**

8.2

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.8	5.8	inches

Override Depths

Grate Information		MINOR	MAJOR	
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) =	15.00	15.00	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} =	0.32	0.32	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.55	0.55	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.78	0.78	
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 =**	**9.0**	**9.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	4.3	8.2	cfs

APPENDIX E – GEOTECHNICAL / GEOHAZARD REPORT

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599

PRELIMINARY SUBSURFACE SOIL INVESTIGATION
BRADLEY HEIGHTS
PARCEL NO. 55000-00-388
LEGACY HILL AND BRADLEY LANDING
COLORADO SPRINGS, COLORADO

Prepared for:

[redacted]

August 1, 2023

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Logan L. Langford, P.G.
Geologist

Reviewed by:

COLORADO REGISTERED JOSEPH COLLIN GOODE JR. 23725 8-4-2023 PROFESSIONAL ENGINEER

Joseph C. Goode, Jr., P.E.
President

LLL:JCG/

ENTECH ENGINEERING, INC.

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List of Appendices

1 INTRODUCTION

The project consists of the construction of fourteen apartment buildings, clubhouse/office building, and other associated site improvements. The site is located within the Bradley Heights Subdivision, in the southeastern portion of Colorado Springs, Colorado. The site is located southwest of the intersection of Legacy Hill Drive and Bradley Landing. The approximate location of the project site is shown on the Vicinity Map, Figure 1.

This report describes the preliminary subsurface investigation conducted for the planned structures and provides soil conditions and preliminary recommendations for foundation design and construction. The Subsurface Soil Investigation included the drilling of 8 test borings across the site, collecting soil samples, and conducting a geotechnical evaluation of the investigation findings. All drilling and subsurface investigation activities were performed by Entech Engineering, Inc. (Entech). The contents of this report, including the geotechnical evaluation and preliminary recommendations, are subject to the limitations and assumptions presented in Section 5.0.

2 PROJECT AND SITE DESCRIPTION

The project will consist of the construction of fourteen apartment buildings, clubhouse/office building, and other associated site improvements. The apartment buildings are anticipated to be 2 to 3 stories. We understand that the proposed buildings are expected to have shallow foundations with post-tensioned slabs.

The site is located in Bradley Heights Subdivision. At the time of drilling, the site was vacant and vegetation consisted of field grasses, weeds, cacti, and yuccas. Legacy Hill along the northern side of the site is rough graded and utilities installed, Bradley Landing is rough graded and utilities are currently being installed. Building loads are expected to be moderate. The site is bordered with vacant land for future residential development to the north and east, existing residential development to the west, and drainage facility to the south.

3 SUBSURFACE EXPLORATIONS AND LABORATORY TESTING

Subsurface conditions in the planned building sites were explored by 8 test borings, designated TB-1 through TB-8. The test borings were completed to depths of 20 feet below the existing ground surface (bgs) at the approximate locations shown on Figure 2. The drilling was performed

using a truck-mounted drill rig utilizing continuous flight auger techniques, supplied and operated by Entech. Descriptive boring logs are presented in Appendix A providing lithologies of the subsurface conditions encountered during drilling. Groundwater levels were measured in each of the open boreholes at the conclusion of drilling and subsequent to drilling.

Soil and bedrock samples were obtained from the borings utilizing the Standard Penetration Test (ASTM D-1586) using a split-barrel California sampler. Results of the Standard Penetration Test (SPT) are included on the boring logs in terms of N-values expressed in blows per foot (bpf). Soil and bedrock samples recovered from the borings were visually classified and recorded on the boring logs. The soil and bedrock classifications were later verified utilizing laboratory testing and grouped by soil type. The soil and bedrock type numbers are included on the boring logs. It should be understood that the soil and bedrock descriptions shown on the boring logs may vary between boring location and sample depths. It should also be noted that the lines of stratigraphic separation shown on the boring logs represent approximate boundaries between soil and bedrock types and the actual stratigraphic transitions may be more gradual or variable with location.

Water content testing (ASTM D-2216) was performed on the samples recovered from the borings, and the results are shown on the boring logs. Grain-Size Analysis (ASTM D-422) and Atterberg Limits testing (ASTM D-4318) were performed on selected samples to assist in classifying the materials encountered in the borings. Volume change testing was performed on selected samples using the Swell/Consolidation Test (ASTM D-4546) in order to evaluate potential expansion characteristics of the soil and bedrock. Soluble sulfate testing was performed on select soil samples to evaluate the potential for below grade degradation of concrete due to sulfate attack. The laboratory testing results are presented in Appendix B and summarized on Table B-1.

4 SUBSURFACE CONDITIONS

4.1 Soil and Bedrock

One primary soil type and one bedrock type were encountered in the test borings drilled for the preliminary subsurface investigation. Each soil and bedrock type were classified in accordance with the Unified Soil Classification System (USCS) using the laboratory testing results and the observations made during drilling.

Soil Type 1 classified as sandy clay (CL). The clay was encountered in the test boring from the ground surface to depths ranging from 1 to 15 feet bgs. The clay was encountered at medium stiff

to hard consistencies. Swell/Consolidation Testing on a sample of clay resulted in a volume changes of 0.2 to 1 percent, which indicates low to moderate expansion potentials.

Soil Type 2 classified as claystone, or clay with sand and clay, slightly sandy when classified as a soil (CL). The claystone bedrock was encountered in all of the borings at depths ranging from 1 to 15 feet bgs and extending to the termination of borings at 20 feet bgs. Swell/Consolidation Testing on a sample of clay resulted in a volume changes of 1.2 to 3.0 percent, which indicates low to high expansion potentials.

4.2 Groundwater

Depth to groundwater was measured in each of the borings at the conclusion of, and subsequent to drilling. Groundwater was not encountered in the test borings; the borings were drilled to 20 feet bgs. During our site investigation standing water and saturated soils from heavy precipitation were observed in the eastern portion of the parcel within a low lying minor drainage that flows in a southerly direction. Groundwater is not expected to affect the development. It should be noted that groundwater levels could change due to seasonal variations, changes in land runoff characteristics and future development of nearby areas.

5 GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

The following discussion is based on the subsurface conditions encountered in the borings drilled on the planned lots for construction. Additional Investigation is required as plans are prepared and site grading is completed.

As discussed in Section 2.0, we understand that the site will be developed with fourteen apartment buildings, clubhouse/office building, and other associated site improvements. The proposed structures are expected to have shallow foundations resting on suitable controlled sandy clay overlot/mass excavated fills are anticipated. Anticipated subsurface conditions will consist of sandy clay and claystone bedrock. It is our understanding portions of the site will be filled to achieve the desired grade. If moderate to highly expansive soils are encountered, penetration or removal and replacement with approved on-site clays or imported structural fill may be required. Soft zones encountered beneath foundations and floor slabs will require recompaction. Uncontrolled fill, if encountered, must be completely penetrated. Design considerations are discussed in the following sections.

5.5 Surface and Subsurface Drainage

Positive surface drainage is recommended around the any building's perimeter to minimize infiltration of surface water into the supporting foundation soils. A minimum ground surface slope of 5 percent in the first 10 feet adjacent to exterior foundation walls is recommended for unpaved areas. For paved areas and other impervious surfaces, a minimum slope of 2 percent is adequate. All roof drains and gutter downspouts should be extended to discharge well beyond the building's foundation backfill zone or be connected to a storm sewer system.

To help minimize infiltration of water into the foundation zone, vegetative plantings placed close to foundation walls should be limited to those species having low watering requirements and irrigated grass should not be located within 5 feet of the foundation. Similarly, sprinklers are not recommended to discharge water within 5 feet of foundations. Irrigation near foundations should be limited to the minimum amount sufficient to maintain vegetation. Application of more irrigation water than necessary can increase the potential for slab and foundation movement.

Perimeter drains are recommended for usable space below grade. Subsurface perimeter drains may also be recommended around the entire structure if an overexcavation is required. A typical perimeter drain detail is shown in Figure 3.

6 CONSTRUCTION RECOMMENDATIONS

6.1 Earthwork Recommendations for Structures

6.1.1 Subgrade Preparation

Foundations and on-grade floor slabs may be placed on controlled, well compacted, site grading fill, or structural fill. All soil beneath the foundation and slabs should be free of organics, debris and cobbles sized larger than 3 inches in diameter. Overexcavation and replacement with granular fill may be required where organics, expansive soils with high clay contents are encountered or in areas of differential bearing capacities.

Shallow claystone bedrock (less than 10 feet) was encountered in six of the test borings and will likely encountered in shallow foundation excavations. If shallow sandstone is encountered, foundations should be supported by soils with a similar bearing capacity (i.e., entirely on sand or granular fill, or entirely on sandstone bedrock).

Uncontrolled fill or loose soil will require removal to suitable, dense underlying soils and replacement with granular fill.

Groundwater was encountered in several test borings at depths of 9 to 19 feet. Fluctuation in groundwater levels can change due to seasonal variations and changes in land runoff characteristics. It is anticipated groundwater is at sufficient depth on the majority of the site as to not affect the proposed construction. Groundwater, if encountered near foundation grade, will likely create unstable subgrade conditions and stabilization with shot rock and/or geogrid may be required.

6.1.2 Swell Mitigation

Expansive soils or bedrock must be penetrated or removed and replaced with recompacted granular fill (Section 6.1.3 and 6.1.4) if encountered within 4 feet of the bottom foundation elevation or on-grade floor slab elevation. An overexcavation depth of 4 to 5 feet is anticipated for the site. The depth of overexcavation should be determined at the time of the excavation observation on each building.

Overexcavations should extend laterally beyond planned footings a minimum distance equal to the depth below planned footings (e.g. a four foot overexcavation should extend four feet beyond the edge of the foundation). The final overexcavation subgrade should be scarified a minimum of 12 inches, moisture conditioned 0 to +3 percent and be compacted to a minimum of 95 percent of its Standard Proctor Dry Density ASTM D-698 or Modified Proctor Dry Density ASTM D-1557 for cohesive (claystone) or cohesionless (sandstone) materials, respectively.

6.1.3 Granular Fill

Granular fill placed beneath foundation components and floor slabs shall consist of non-expansive, granular soil, free of organic matter, unsuitable materials, debris and cobbles greater than 3-inches in diameter. If approved by Entech, on-site granular soils and properly processed and broken down non-expansive sandstone may be used as granular fill. Entech should approve any imported granular or structural fill to be used within the foundation area prior to delivery to the site. All granular fill shall be compacted in accordance with Section 6.1.4.

APPENDIX F – PREVIOUS DRAINAGE STUDIES

MASTER DEVELOPMENT DRAINAGE PLAN AMENDMENT

For

BRADLEY HEIGHTS

Prepared for:

BRADLEY HEIGHTS METROPOLITAN DISTRICT
614 North Tejon Street
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April 2022

Project No. 21.1213.001

STM-REV22-0046

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

Sub-basin	Comments	Area sf	Area acres	Area Sq. Mi.	Soil Group	Commercial Areas (95% Impervious) C5	C100	Area	Residential (1/8 or less) (65% Impervious) C5	C100	Area (SF)	Pavement (100% Impervious) C5	C100	Area (SF)	Neighborhoods/Multi-Family (70% Impervious) C5	C100	Area	Residential (1/3 Acre) (30% Impervious) C5	C100	Area	Undeveloped/Pervious Areas (2% Impervious) C5	C100	Area
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
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
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
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
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
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	
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
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
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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
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	
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	
CC	COLORADO CENTRE POND/MARKSHEFFEL TRIBUTARY FUTURE FLOW PATH	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
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
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 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	
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	131504	0.30	0.57		0.16	0.51	
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	
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
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	32553	0.75	0.1591	D	0.82	0.89	32553	0.49	0.65		0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	
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	
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
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	
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
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	
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	
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	
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
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	
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	
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	
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
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
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	
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	
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
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	
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	
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	1255752	0.90	0.96		0.53	0.68		0.30	0.57		0.16	0.51	
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	
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
OS-ES	Trails at Aspen Ridge Sub-basin OS-East Side. Undeveloped electric easement.	184090	4.23	0.0066	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	184090

Sub-basin	Composite C5	Composite C100	Percent Impervious	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	Sub-basin
BR1	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	0.53	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	0.53	0.68	70.00	100	100	610	610	0.05	6.00	3.0	7	3.46	2.93	8.93	4.28	**6.9**	7.19	**14.9**	MK14
MK15	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	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	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	**3.0**	8.29	**5.6**	JC2
JC3	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	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
WF1	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	0.49	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	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	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
OS-ES	0.09	0.36	2.00	50	50	1274	1274	0.05	7.52	3.0	4	1.21	17.51	25.03	2.68	**0.1**	4.50	**3.4**	OS-ES

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

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

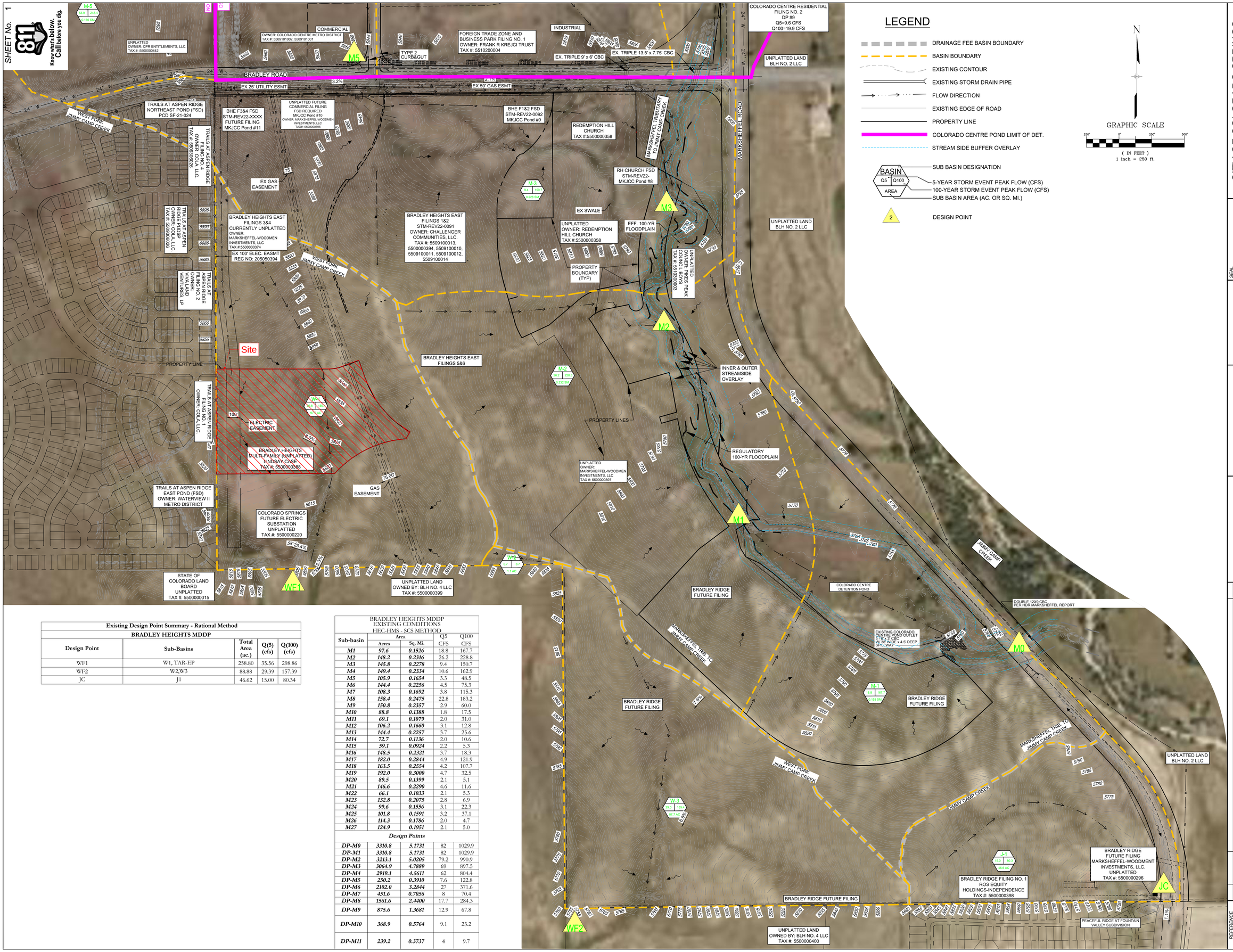
3.2 Time of Concentration

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

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_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.

SHEET No. 1

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



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: MO
DRAWN BY: JTS
CHECKED BY: JTS
SCALE: HORIZ 1" = 250' VERT. NA
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

BRADLEY HEIGHTS
COMPARISON OF PREDEVELOPMENT AND POST-DEVELOPMENT CONDITIONS

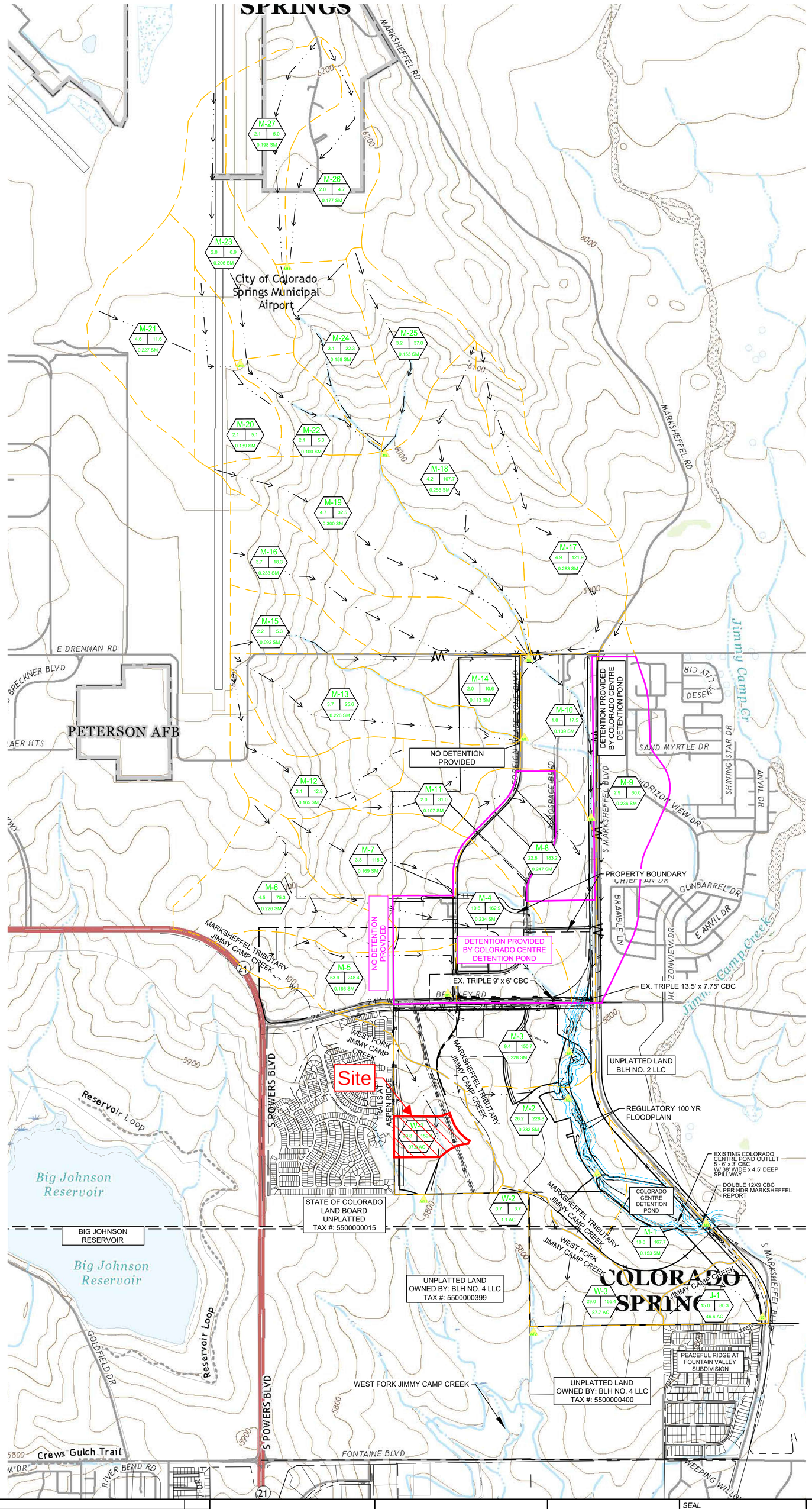
Sub-basin	Area		Q2		DELTA	Q5		DELTA	Q10		DELTA	Q100		DELTA
	Acres	Sq. Mi.	EX	PR	Q	EX	PR	Q	EX	PR	Q	EX	PR	Q
M1	97.6	0.15256	8.8	-	-	18.8	-	-	87	-	-	167.7	-	-
M2	148.2	0.23162	12.3	-	-	26.2	-	-	118.1	-	-	228.8	-	-
M3	145.8	0.22781	3.3	-	-	9.4	-	-	67	-	-	150.7	-	-
BH2	3.0	0.00470	-	0.4	-	-	0.9	-	-	4	-	-	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 (Q5 | Q100 / AREA) — SUB BASIN DESIGNATION
PREDEVELOPMENT VALUES
5-YEAR STORM EVENT PEAK FLOW (CFS)
100-YEAR STORM EVENT PEAK FLOW (CFS)
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 HRG/REEN EAST
X-1214-EX BASE NES SOUTH
PM-BASE UTS
X-1213-EX_BASE-From Others
X-MDG3XN2
X-1214-EX BASE TERRA NOVA CHURCH
0-886-EX-TOPO-TAR

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: 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

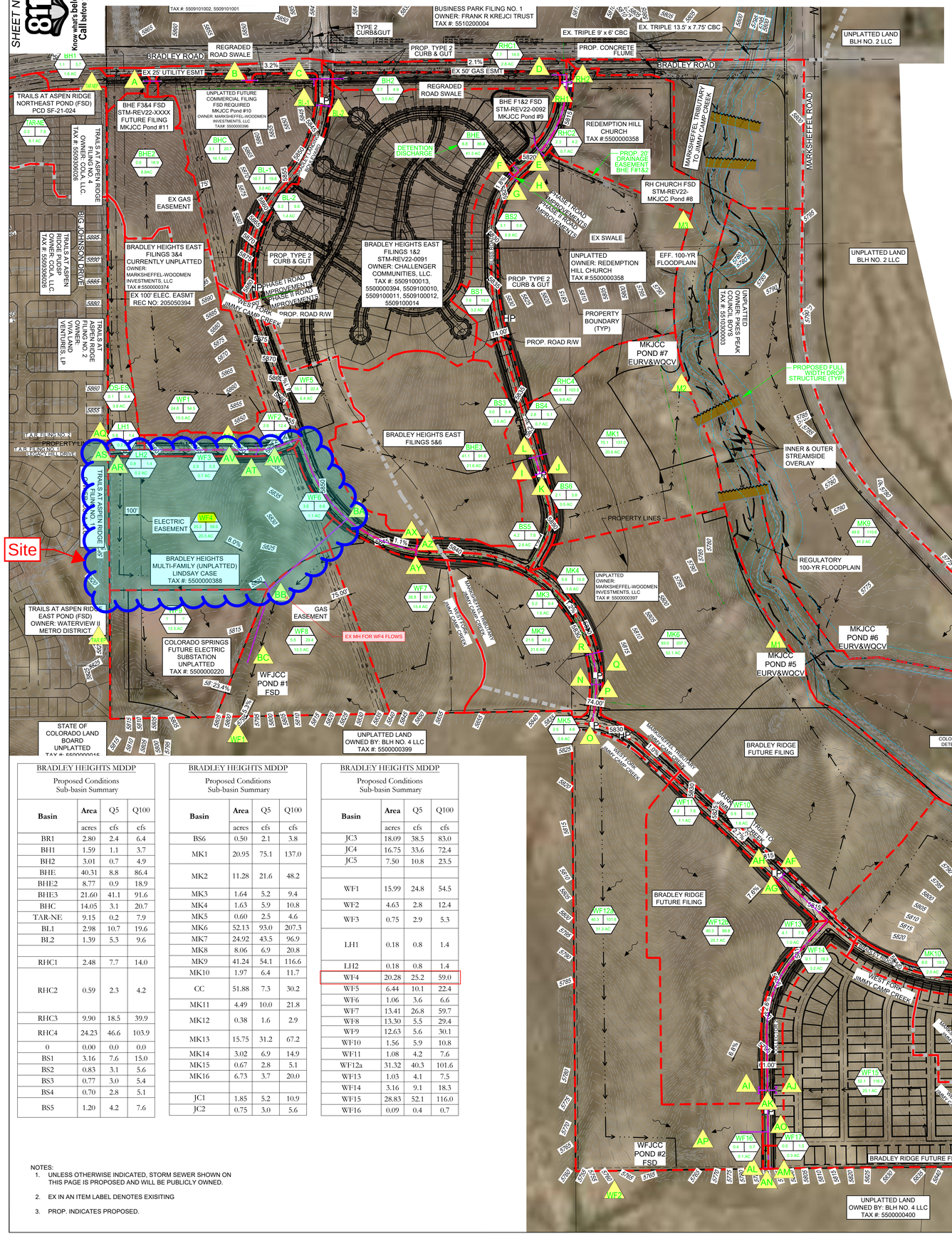
CITY OF COLORADO SPRINGS
BRADLEY HEIGHTS METRO DISTRICT
MASTER DEVELOPMENT DRAINAGE REPORT

MARKSHEFFEL TRIB. TO JIMMY CAMP CREEK

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

SHEET No. 4

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



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.

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

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

DESIGNED BY: MO | SCALE | DATE-ISSUED: March 2022 | DRAWING No. DR-04
DRAWN BY: JTS | HORIZ 1" = 250' | SHEET 4 OF 5
CHECKED BY: JTS | VERT. N/A

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

SEAL

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

PREPARED BY: Matrix

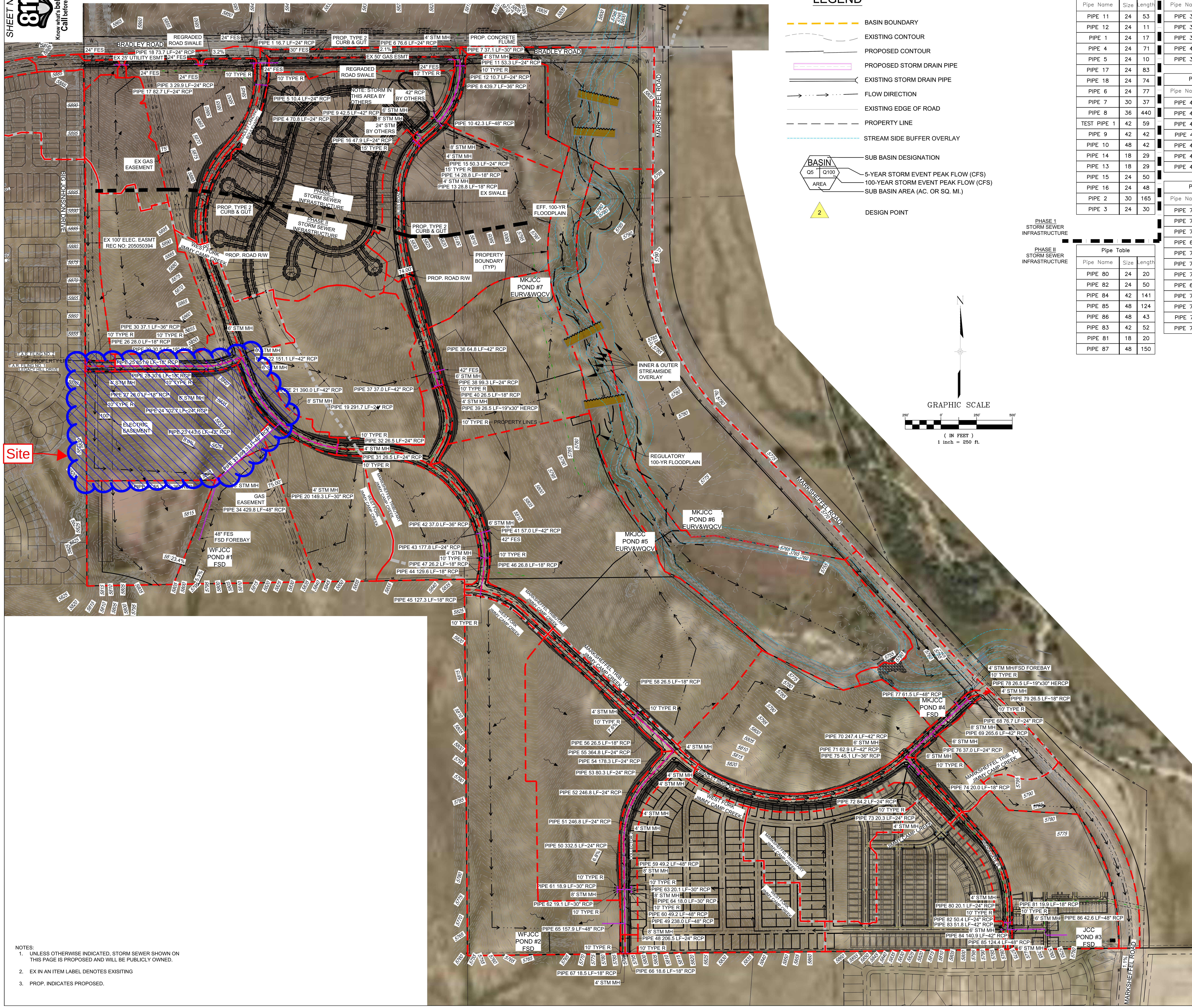
No.	DATE	DESCRIPTION	BY
		REVISIONS	

COMPUTER FILE MANAGEMENT
FILE NAME: S:\21.1213.001 Bradley Heights Metro District\200 Drainage\201 Drainage Reports\MDDP\DWG\BRADLEY HEIGHTS DR.dwg
PLOT DATE:March 28, 2022 2:47:27 PM
THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE

REFERENCE DRAWINGS

SHEET No. 5

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



LEGEND

- 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

GRAPHIC SCALE

250' 0' 250' 500'

(IN FEET)
1 inch = 250 ft.

PHASE 1 STORM SEWER INFRASTRUCTURE

PHASE II STORM SEWER INFRASTRUCTURE

Pipe Table

Pipe Name	Size	Length
PIPE 11	24	53
PIPE 12	24	11
PIPE 1	24	17
PIPE 4	24	71
PIPE 5	24	10
PIPE 17	24	83
PIPE 18	24	74
PIPE 6	24	77
PIPE 7	30	37
PIPE 8	36	440
TEST PIPE 1	42	59
PIPE 9	42	42
PIPE 10	48	42
PIPE 14	18	29
PIPE 13	18	29
PIPE 15	24	50
PIPE 16	24	48
PIPE 2	30	165
PIPE 3	24	30

Pipe Table

Pipe Name	Size	Length
PIPE 80	24	20
PIPE 82	24	50
PIPE 84	42	141
PIPE 85	48	124
PIPE 86	48	43
PIPE 83	42	52
PIPE 81	18	20
PIPE 87	48	150

Pipe Table

Pipe Name	Size	Length
PIPE 39	30	26
PIPE 38	24	99
PIPE 36	42	65
PIPE 40	18	26
PIPE 37	42	37

Pipe Table

Pipe Name	Size	Length
PIPE 45	18	127
PIPE 44	18	130
PIPE 43	24	178
PIPE 41	42	57
PIPE 42	36	37
PIPE 47	18	26
PIPE 46	18	27

Pipe Table

Pipe Name	Size	Length
PIPE 73	24	20
PIPE 72	24	84
PIPE 70	42	247
PIPE 69	42	266
PIPE 77	48	61
PIPE 74	18	20
PIPE 79	18	26
PIPE 68	24	77
PIPE 78	30	26
PIPE 76	24	37
PIPE 71	42	63
PIPE 75	36	45

Pipe Table

Pipe Name	Size	Length
PIPE 29	18	31
PIPE 24	24	103
PIPE 23	42	143
PIPE 22	42	151
PIPE 21	42	390
PIPE 33	48	599
PIPE 34	48	430
PIPE 28	18	31
PIPE 30	36	37
PIPE 35	36	55
PIPE 32	24	27
PIPE 19	24	292
PIPE 20	30	149
PIPE 31	24	27
PIPE 26	18	28
PIPE 25	18	852
PIPE 27	18	28

Pipe Table

Pipe Name	Size	Length
PIPE 56	18	27
PIPE 55	24	365
PIPE 54	24	178
PIPE 53	24	80
PIPE 52	24	247
PIPE 51	24	247
PIPE 50	24	333
PIPE 49	48	238
PIPE 65	48	158
PIPE 61	30	19
PIPE 59	48	49
PIPE 62	30	19
PIPE 63	30	20
PIPE 60	48	49
PIPE 64	30	18
PIPE 67	18	19
PIPE 48	24	206
PIPE 66	18	19
PIPE 58	18	27

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.

CITY OF COLORADO SPRINGS

BRADLEY HEIGHTS METRO DISTRICT
MASTER DEVELOPMENT DRAINAGE REPORT

PRELIMINARY STORM SEWER

DESIGNED BY:	JAO	SCALE	DATE ISSUED: March 2022	DRAWING No.
DRAWN BY:	JTS	HORIZ. 1" = 250'		DR-05
CHECKED BY:	JTS	VERT. N/A	SHEET 5 OF 5	

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	

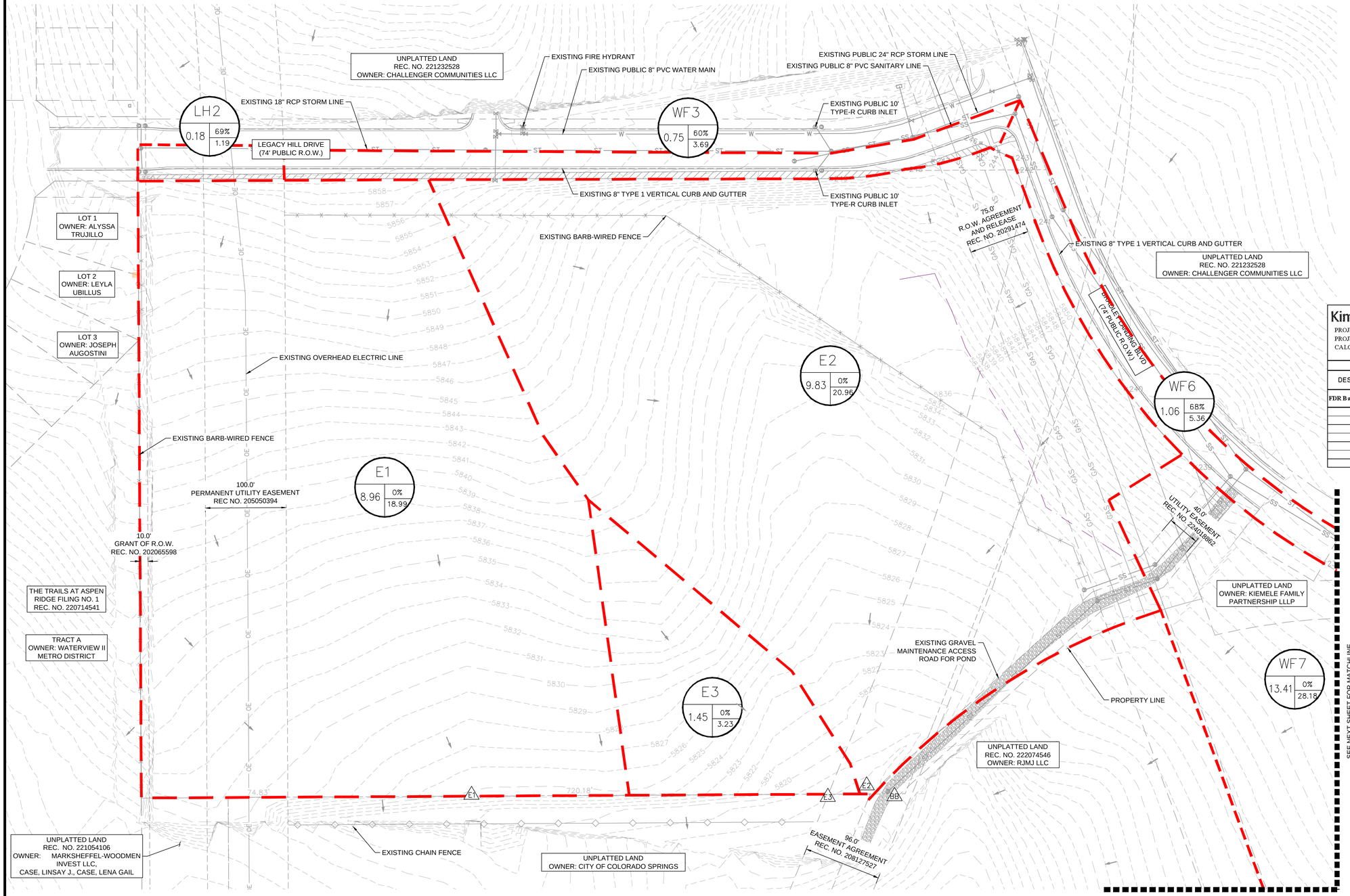
COMPUTER FILE MANAGEMENT
FILE NAME: S:\21.1213.001 Bradley Heights Metro District\200 Drainage\201 Drainage Reports\MDDP\DWG\BRADLEY HEIGHTS DR.dwg
CTB FILE: ----
PLOT DATE: March 28, 2022 3:43:08 PM
THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE.

REFERENCE DRAWINGS

APPENDIX G – DRAINAGE MAPS

BRADLEY RIDGE APARTMENTS

EXISTING DRAINAGE MAP



LEGEND

A = BASIN DESIGNATION
B = AREA (ACRES)
C = PERCENT IMPERVIOUSNESS
D = 100-YR DESIGN STORM RUNOFF (CFS)

= DESIGN POINT

FLOW DIRECTION

BASIN BOUNDARY

PROPERTY LINE

EXISTING LOT LINE

EASEMENT LINE

6000 EXISTING MAJOR CONTOUR

6001 EXISTING MINOR CONTOUR

Kimley»Horn

PROJECT NAME: BRADLEY HEIGHTS
PROJECT NUMBER: 67607115
CALCULATED BY: MEL
CHECKED BY: NMB

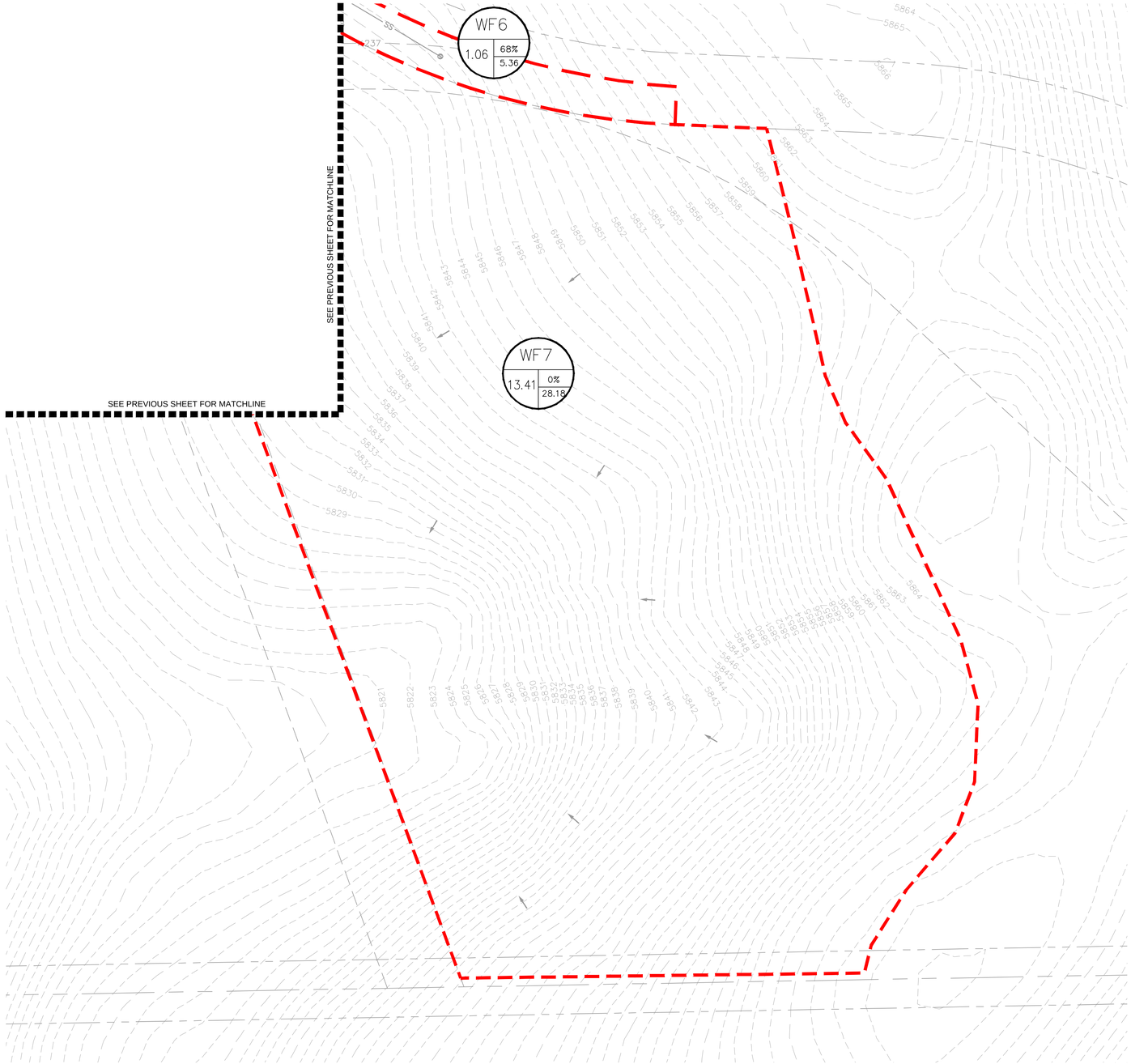
EXISTING CONDITIONS RATIONAL CALCULATIONS SUMMARY

DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	CFS Q5	CFS Q100	% IMPERVIOUS
FDR Basins					
E1	E1	8.96	2.59	18.99	0%
E2	E2	9.83	2.85	20.96	0%
E3	E3	1.45	0.44	3.23	0%
LH2	LH2	0.18	0.59	1.19	69%
WF3	WF3	0.75	1.76	3.69	60%
WF6	WF6	1.06	2.66	5.36	68%
WF7	WF7	13.41	3.84	28.18	0%

2 NORTH NEVADA AVENUE, SUITE 900
COLORADO SPRINGS, COLORADO 80903 (719) 453-0180

BRADLEY RIDGE APARTMENTS

EXISTING DRAINAGE MAP



LEGEND

A = BASIN DESIGNATION
B = AREA (ACRES)
C = PERCENT IMPERVIOUSNESS
D = 100-YR DESIGN STORM RUNOFF (CFS)

= DESIGN POINT

FLOW DIRECTION

BASIN BOUNDARY

PROPERTY LINE

EXISTING LOT LINE

EASEMENT LINE

EXISTING MAJOR CONTOUR

EXISTING MINOR CONTOUR

Kimley»Horn

PROJECT NAME: BRADLEY HEIGHTS
PROJECT NUMBER: 67607115
CALCULATED BY: MEL
CHECKED BY: NMB

EXISTING CONDITIONS RATIONAL CALCULATIONS SUMMARY

DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	CFS		% IMPERVIOUS
			Q5	Q100	
FDR Basins					
E1	E1	8.96	2.59	18.99	0%
E2	E2	9.83	2.85	20.96	0%
E3	E3	1.45	0.44	3.23	0%
LH2	LH2	0.18	0.59	1.19	69%
WF3	WF3	0.75	1.76	3.69	60%
WF6	WF6	1.06	2.66	5.36	68%
WF7	WF7	13.41	3.84	28.18	0%

NORTH

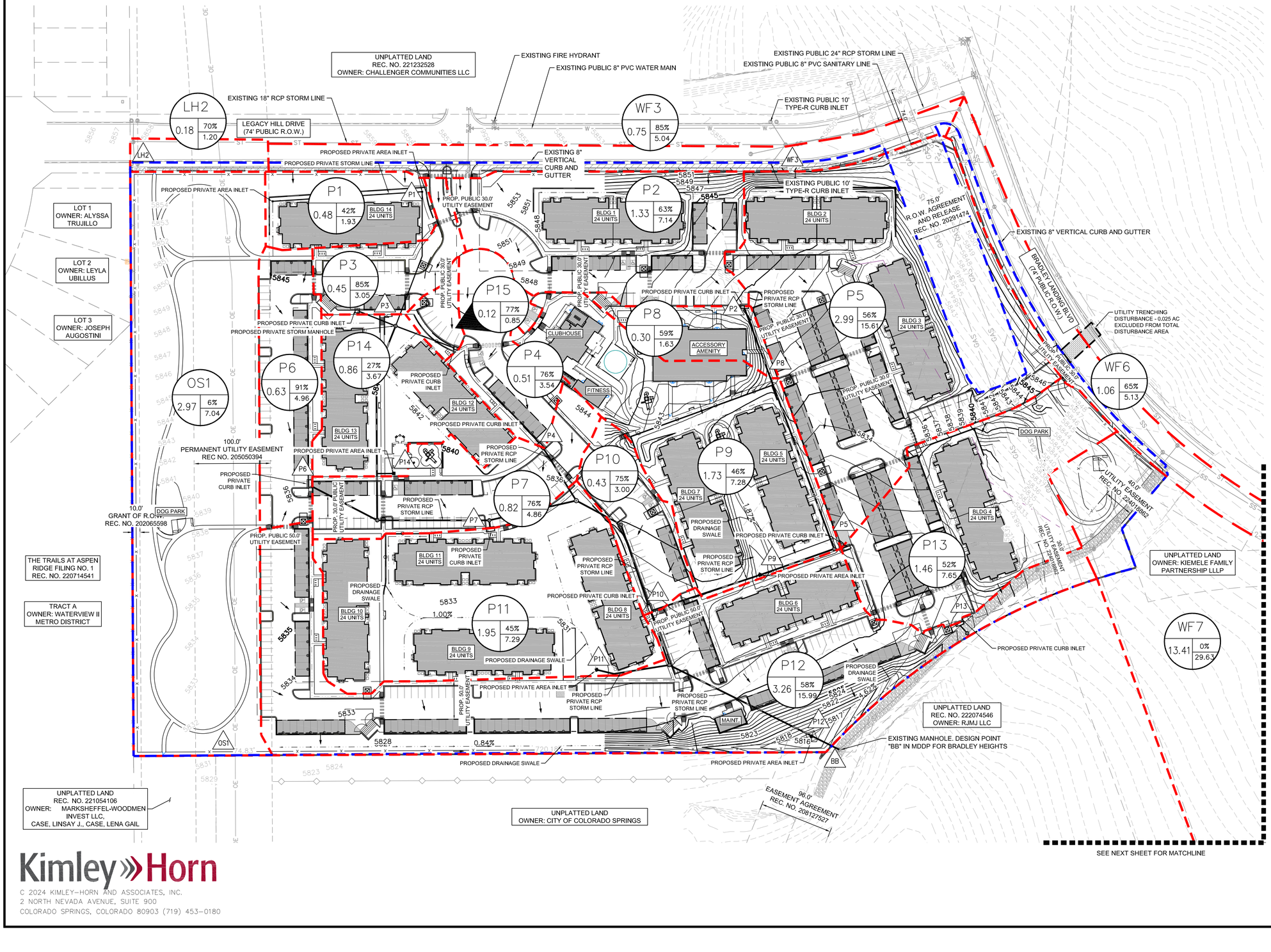
GRAPHIC SCALE IN FEET
0 30 60 120

Kimley»Horn

2 NORTH NEVADA AVENUE, SUITE 900
COLORADO SPRINGS, COLORADO 80903 (719) 453-0180

BRADLEY RIDGE APARTMENTS

PROPOSED DRAINAGE MAP



LEGEND

A = BASIN DESIGNATION
B = AREA (ACRES)
C = PERCENT IMPERVIOUSNESS
D = 100-YR DESIGN STORM RUNOFF (CFS)

= DESIGN POINT

FLOW DIRECTION
BASIN BOUNDARY
DISTURBED AREA BOUNDARY
PROPERTY LINE
EXISTING LOT LINE
EASEMENT LINE
PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
UTILITY TRENCHING AREA

NOTES:

1. ALL STORMWATER INFRASTRUCTURE DEPICTED ON THESE PLANS IS PROPOSED UNLESS OTHERWISE NOTED. INFRASTRUCTURE SIZE AND MATERIAL PER PLAN.
2. ALL STORMWATER INFRASTRUCTURE DEPICTED ON THESE PLANS IS TO BE PRIVATELY OWNED AND MAINTAINED UNLESS OTHERWISE NOTED.
3. ALL PROPOSED CURB AND GUTTER ON SITE SHALL BE COLORADO SPRINGS STANDARD TYPE 3 CURB AND GUTTER.

COLORADO SPRINGS GENERAL NOTES:

1. THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID DETAILED PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE ESTABLISHED CRITERIA FOR DETAILED DRAINAGE PLANS AND SPECIFICATIONS, AND SAID DETAILED PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH THE MASTER PLAN OF THE DRAINAGE BASIN. SAID DETAILED DRAINAGE PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR DRAINAGE FACILITY(S) IS DESIGNED. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR OMISSIONS ON MY PART IN PREPARATION OF THE DETAILED DRAINAGE PLANS AND SPECIFICATIONS.
2. PLAN REVIEW BY CITY OF COLORADO SPRINGS IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH DESIGN CRITERIA. THE CITY OF COLORADO SPRINGS IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN , DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE CITY OF COLORADO SPRINGS, THROUGH APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY FOR THIS DOCUMENT.

PROPOSED CONDITIONS RATIONAL CALCULATIONS SUMMARY

DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	Q5	Q100	% IMPERVIOUS
PDR Basins					
P1	P1	0.48	0.78	1.93	42%
P2	P2	1.33	3.43	7.14	63%
P3	P3	0.40	1.63	3.05	85%
P4	P4	0.51	1.83	3.54	76%
P5	P5	2.99	7.19	15.61	56%
P6	P6	0.63	2.69	4.96	91%
P7	P7	0.82	2.50	4.86	76%
P8	P8	0.30	0.76	1.63	59%
P9	P9	1.73	3.56	7.91	54%
P10	P10	0.43	1.54	3.00	75%
P11	P11	1.95	2.87	7.10	42%
P12	P12	3.26	7.48	15.99	58%
P13	P13	1.46	3.43	7.65	52%
P14	P14	0.86	1.24	3.67	27%
P15	P15	0.12	0.44	0.85	77%
OS-1	OS-1	2.97	1.42	7.04	6%
LH2	LH2	0.18	0.60	1.20	70%
WF3	WF3	0.75	2.69	5.04	85%
WF6	WF6	1.06	2.50	5.13	65%
WF7	WF7	13.41	3.84	28.18	0%

SEE NEXT SHEET FOR MATCHLINE

NORTH

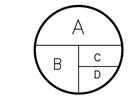
GRAPHIC SCALE IN FEET
0 30 60 120

Kimley»Horn
© 2024 KIMLEY-HORN AND ASSOCIATES, INC.
2 NORTH NEVADA AVENUE, SUITE 900
COLORADO SPRINGS, COLORADO 80903 (719) 453-0180

BRADLEY RIDGE APARTMENTS

PROPOSED DRAINAGE MAP

LEGEND



A = BASIN DESIGNATION
B = AREA (ACRES)
C = PERCENT IMPERVIOUSNESS
D = 100-YR DESIGN STORM RUNOFF (CFS)

= DESIGN POINT

FLOW DIRECTION
BASIN BOUNDARY
DISTURBED AREA BOUNDARY
PROPERTY LINE
EXISTING LOT LINE
EASEMENT LINE
PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
UTILITY TRENCHING AREA

1. ALL STORMWATER INFRASTRUCTURE DEPICTED ON THESE PLANS IS PROPOSED UNLESS OTHERWISE NOTED. INFRASTRUCTURE SIZE AND MATERIAL PER PLAN.
2. ALL STORMWATER INFRASTRUCTURE DEPICTED ON THESE PLANS IS TO BE PRIVATELY OWNED AND MAINTAINED UNLESS OTHERWISE NOTED.

COLORADO SPRINGS GENERAL NOTES:

1. THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID DETAILED PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE ESTABLISHED CRITERIA FOR DETAILED DRAINAGE PLANS AND SPECIFICATIONS, AND SAID DETAILED PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH THE MASTER PLAN OF THE DRAINAGE BASIN. SAID DETAILED DRAINAGE PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR DRAINAGE FACILITY(S) IS DESIGNED. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR OMISSIONS ON MY PART IN PREPARATION OF THE DETAILED DRAINAGE PLANS AND SPECIFICATIONS.
2. PLAN REVIEW BY CITY OF COLORADO SPRINGS IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH DESIGN CRITERIA. THE CITY OF COLORADO SPRINGS IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN , DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE CITY OF COLORADO SPRINGS, THROUGH APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY FOR THIS DOCUMENT.

PROPOSED CONDITIONS RATIONAL CALCULATIONS SUMMARY

DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	Q5	Q100	% IMPERVIOUS
PDR Basins					
P1	P1	0.48	0.78	1.93	42%
P2	P2	1.33	3.43	7.14	63%
P3	P3	0.40	1.63	3.05	85%
P4	P4	0.51	1.83	3.54	76%
P5	P5	2.99	7.19	15.61	56%
P6	P6	0.63	2.69	4.96	91%
P7	P7	0.82	2.50	4.86	76%
P8	P8	0.30	0.76	1.63	59%
P9	P9	1.73	3.56	7.91	54%
P10	P10	0.43	1.54	3.00	75%
P11	P11	1.95	2.87	7.10	42%
P12	P12	3.26	7.48	15.99	58%
P13	P13	1.46	3.43	7.65	52%
P14	P14	0.86	1.24	3.67	27%
P15	P15	0.12	0.44	0.85	77%
OS-1	OS-1	2.97	1.42	7.04	6%
LH2	LH2	0.18	0.60	1.20	70%
WF3	WF3	0.75	2.69	5.04	85%
WF6	WF6	1.06	2.50	5.13	65%
WF7	WF7	13.41	3.84	28.18	0%

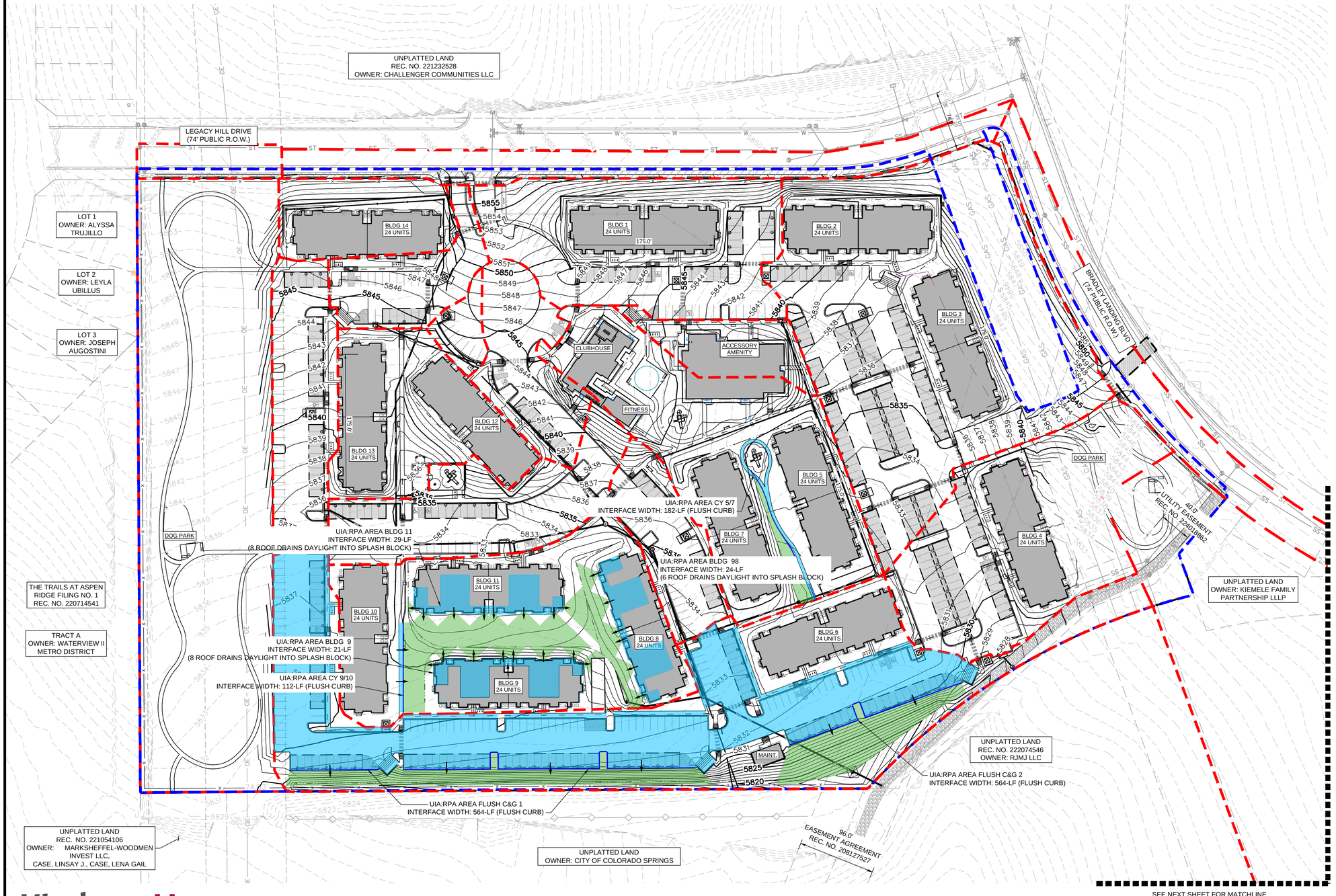
GRAPHIC SCALE IN FEET
0 30 60 120

Kimley»Horn

2 NORTH NEVADA AVENUE, SUITE 900
COLORADO SPRINGS, COLORADO 80903 (719) 453-0180

BRADLEY RIDGE APARTMENTS

GREEN INFASTRUCTURE MAP - RUNOFF REDUCTION - STEP 1



LEGEND

- FLOW DIRECTION
- BASIN BOUNDARY
- DISTURBED AREA BOUNDARY
- PROPERTY LINE
- EXISTING LOT LINE
- EASEMENT LINE
- 6000 PROPOSED MAJOR CONTOUR
- 6001 PROPOSED MINOR CONTOUR
- 6000 EXISTING MAJOR CONTOUR
- 6001 EXISTING MINOR CONTOUR
- UNCONNECTED IMPERVIOUS AREA (FLOWING TO WQ POND)
- RECEIVING PERVIOUS AREA (FLOWING TO WQ POND)
- UTILITY TRENCHING AREA

NOTES:

1. ALL STORMWATER INFRASTRUCTURE DEPICTED ON THESE PLANS IS PROPOSED UNLESS OTHERWISE NOTED. INFRASTRUCTURE SIZE AND MATERIAL PER PLAN.
2. ALL STORMWATER INFRASTRUCTURE DEPICTED ON THESE PLANS IS TO BE PRIVATELY OWNED AND MAINTAINED UNLESS OTHERWISE NOTED.

RUNOFF REDUCTION CALC SUMMARY

= 21.1 ACRES

Total Area (ft²)	919,753
Total Impervious Area (ft²)	630,053
WQCV (ft³)	26,252
WQCV Reduction (ft³)	2,538
WQCV Reduction (%)	10%
Untreated WQCV (ft³)	23,714

CUSTOM CONCRETE SPLASH BLOCKS

BLDG 9 BLDG 8 BLDG 11

NORTH

GRAPHIC SCALE IN FEET
0 30 60 120

Kimley»Horn

2 NORTH NEVADA AVENUE, SUITE 900
COLORADO SPRINGS, COLORADO 80903 (719) 453-0180

BRADLEY RIDGE APARTMENTS

GREEN INFASTRUCTURE MAP - RUNOFF REDUCTION - STEP 1

LEGEND

A = BASIN DESIGNATION
B = AREA (ACRES)
C = PERCENT IMPERVIOUSNESS
D = 100-YR DESIGN STORM RUNOFF (CFS)

= DESIGN POINT

FLOW DIRECTION

BASIN BOUNDARY

DISTURBED AREA BOUNDARY

PROPERTY LINE

EXISTING LOT LINE

EASEMENT LINE

6000 PROPOSED MAJOR CONTOUR

6001 PROPOSED MINOR CONTOUR

6000 EXISTING MAJOR CONTOUR

6001 EXISTING MINOR CONTOUR

UNCONNECTED IMPERVIOUS AREA (FLOWING TO WQ POND)

RECEIVING PERVIOUS AREA (FLOWING TO WQ POND)

UTILITY TRENCHING AREA

NOTES:

1. ALL STORMWATER INFRASTRUCTURE DEPICTED ON THESE PLANS IS PROPOSED UNLESS OTHERWISE NOTED. INFRASTRUCTURE SIZE AND MATERIAL PER PLAN.
2. ALL STORMWATER INFRASTRUCTURE DEPICTED ON THESE PLANS IS TO BE PRIVATELY OWNED AND MAINTAINED UNLESS OTHERWISE NOTED.

RUNOFF REDUCTION CALC SUMMARY

Total Area (ft^2)	919,753	= 21.1 ACRES
Total Impervious Area (ft^2)	630,053	
WQCV (ft^3)	26,252	
WQCV Reduction (ft^3)	7,272	
WQCV Reduction (%)	28%	
Untreated WQCV (ft^3)	18,980	

NORTH

GRAPHIC SCALE IN FEET
0 30 60 120

Kimley»Horn

2 NORTH NEVADA AVENUE, SUITE 900
COLORADO SPRINGS, COLORADO 80903 (719) 453-0180