

PHASE II DRAINAGE REPORT

FOR

HEROES HALL

LOCATED AT

**595 FAIRGROUNDS ROAD
LOT 1A, BLOCK 1, PLUM CREEK COMMERCIAL
FILING NO. 2 AMENDMENT NO. 2
CASTLE ROCK, COLORADO 80104**

Owner/Developer:

**DOUGLAS COUNTY BOARD OF COUNTY COMMISSIONERS
100 THIRD STREET
CASTLE ROCK, COLORADO 80104**

Prepared For:

**TOWN OF CASTLE ROCK
100 N WILCOX STREET
CASTLE ROCK, COLORADO 80104**

Prepared By:

**COLLINS ENGINEERS, INC.
455 SHERMAN STREET, SUITE 160
DENVER, CO 80203
(303) 447-0090
BRYAN FRANTZ
COLLINS JOB NO. 16346-25**

**November 21, 2025
Revised: April 16, 2026**

CERTIFICATION STATEMENT

I affirm that this report and plan for the Phase II drainage design of HEROES HALL was prepared by me (or under my direct supervision) in accordance with the provisions of the Town of Castle Rock Drainage Design and Technical Criteria for the owners thereof. I understand that the Town of Castle Rock does not and will not assume liability for drainage facilities designed by others.

Bryan Frantz, P.E.
Registered Professional Engineer
State of Colorado No. 37362

Table of Contents

PURPOSE 1

I. GENERAL LOCATION AND DESCRIPTION 1

II. DRAINAGE BASINS AND SUB-BASINS 2

III. DRAINAGE DESIGN CRITERIA..... 5

IV. STORMWATER MANAGEMENT FACILITY DESIGN..... 7

V. CONCLUSIONS 10

VI. REFERENCES..... 11

APPENDIX A 12

APPENDIX B 16

APPENDIX C 17

APPENDIX D 18

PHASE II DRAINAGE REPORT
FOR
HEROES HALL
IN
TOWN OF CASTLE ROCK, COLORADO

PURPOSE

This report provides hydrologic and hydraulic concepts for the proposed site improvements for the Heroes Hall project located at Lot 1A, Block 1, Plum Creek Commercial Filing No. 2 Amendment No. 2 in Castle Rock, Colorado. This report has been prepared in accordance with the *Douglas County and Town of Castle Rock Storm Drainage Design and Technical Criteria Manual (SDDTC)*, the *Mile High Flood District Criteria Manuals (latest edition) (MHFD)*, other criteria manuals referenced herein, and standard engineering practices.

I. GENERAL LOCATION AND DESCRIPTION

A. Site Location

1. The Heroes Hall project is located in Lot 1A, Block 1, Plum Creek Commercial Filing No. 2 Amendment No. 2 and situated in Southeast 1/4 of Section 11, Township 8 South, Range 67 West of the 6th Principal Meridian. The project is located at 595 Fairgrounds Road in the Town of Castle Rock, County of Douglas, State of Colorado.
2. The project site is located at the intersection of East Plum Creek Parkway and Fairgrounds Road and zoned Planned Development. Adjacent properties are zoned Residential and Planned Development. The site limits are shown on the Vicinity Map, located in ***Appendix A***.

B. Description of Property and Land Use

1. The overall property is approximately 4.35 acres in size and is currently vacant. The proposed improvements to the site include a 14,061 SF building with event space, parking lot, retaining walls, and associated storm infrastructure.
2. Existing soils were determined by the *USDA NRCS (National Resources Conservation Service) Custom Soil Report*. The project site was determined to be majority (65.4%) Newlin gravelly sandy loam, a Type B soil. Existing grades of the site are mainly moderate slopes ranging from 8 to 30%. Ground cover consists mostly of native grasses. The site generally drains from south to north. Refer to ***Appendix A*** for the soils report.

3. This project is located within floodplain Zone X: "Areas of Minimal Flood Hazard" per *National Flood Hazard Layer FIRMette 08035C0301G dated 03/16/2016*, prepared by the Federal Emergency Management Agency (FEMA). A copy of the FEMA Map is in **Appendix A**.
4. There are no existing irrigation facilities and no major or minor drainageways.

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Drainage Basins

1. The project site is located in the Plum Creek Basin and situated between East Plum Creek and Sellers Gulch. There are no existing water quality or detention facilities on the site. A proposed full spectrum-extended detention basin (FS-EDB) will provide water quality and detention onsite. Refer to **Appendix D** for the *Existing Plum Creek Basin Map*.
2. The proposed FS-EDB will outfall to the existing channel located in the 52' wide storm drainage, public access and maintenance easement (Reception No. DC99061088). Refer to the *Proposed Drainage Map* in **Appendix D**.

B. Minor Drainage Basins

1. The existing site is made up of one basin (EX-1). Refer to **Appendix D** for the *Existing Drainage Map*.

Basin EX-1

Basin EX-1 is approximately 4.35 acres and includes the vacant lot covered in mostly native grasses. Runoff from this basin generally sheet flows north to an existing storm drainage easement.

2. The proposed storm improvements will consist of inlets around the building and in the parking lot, a FS-EDB with outlet structure and forebay, and other associated infrastructure. The site has been divided into seven on-site basins (A-1, B-1 through B-3, C-1 and C-2, and D-1) making up 3.99 acres and five off-site basins (O-1, O-2, O-3, O-4, and O-5). Basins A-1 through D-1, and O-1 through O-3 represent the areas tributary to the FS-EDB, making up 4.25 acres that will be treated onsite. Basins O-4 through O-6 represent disturbed areas that are flowing offsite and will not be treated for water quality, making up 0.54 acres. Refer to the *Summary of Water Quality Conformance to MS4 Permit Form*. Refer to the *Proposed Drainage Map* in **Appendix D**.

Basin A-1

Basin A-1 consists of 0.57 acres of the site. It is composed of the proposed FS-EDB. The pond consists of a 10-foot-wide maintenance access road, concrete trickle channel, concrete outlet structure, concrete forebay, and riprap emergency spillway. The proposed storm sewer system will convey runoff from all on-site basins and offsite basins O-1 through O-3 to the pond at Design Pt. #1, where the drainage will be released through the outlet structure and discharged to the existing storm drainage easement.

Basin B-1

Basin B-1 consists of 0.20 acres of the site. It is composed of the landscaped area behind the building and retaining walls. Runoff from Basin B-1 and O-1 will be captured in area inlets at Design Pt. #2.

Basin B-2

Basin B-2 consists of 0.32 acres of the site. It is composed of the proposed building. Drainage will be captured in roof drains at Design Pt. #3 and conveyed to the storm sewer system in Basin B-1.

Basin B-3

Basin B-3 consists of 0.10 acres of the site. It is composed of the vehicular concrete ramp to the basement floor of the building, sidewalk, and landscaped areas. Runoff from Basin B-3 and O-2 will be captured in a chase drain at Design Pt. #4.

Basin C-1

Basin C-1 consists of 0.77 acres of the site. It is composed of the asphalt parking lot, landscaped plaza area, and concrete patio. Runoff will be captured in an inlet at Design Pt. #5.

Basin C-2

Basin C-2 consists of 1.21 acres of the site. It is composed of the asphalt parking lot, landscaped areas, retaining wall, and concrete patio. Runoff from Basin C-2 and O-3 will be captured in an inlet at Design Pt. #6.

Basin D-1

Basin D-1 consists of 0.82 acres of the site. It is composed of the asphalt parking lot and landscaped areas. Runoff from Basin D-1 will be captured in an inlet at Design Pt. #7.

Basin O-1

Basin O-1 consists of 0.11 acres of the site. It is composed of landscaped area that is not on the project site. Runoff from Basin O-1 sheet flows into Basin B-1.

Basin O-2

Basin O-2 consists of 0.02 acres of the site. It is composed of landscaped area and sidewalk that is not on the project site. Runoff from Basin O-2 sheet flows into Basin B-3.

Basin O-3

Basin O-3 consists of 0.13 acres of the site. It is composed of landscaped area that is not on the project site. Runoff from Basin O-3 sheet flows into Basin C-2.

Basin O-4

Basin O-4 consists of 0.14 acres of the site. It is composed of landscaped area that is located on the project site. Runoff from Basin O-4 sheet flows offsite.

Basin O-5

Basin O-5 consists of 0.22 acres of the site. It is composed of landscaped area that is located on the project site. Runoff from Basin O-5 sheet flows offsite.

Basin O-6

Basin O-6 consists of 0.18 acres of the site. It is composed of landscaped area, sidewalk, and driveway entrance that will be disturbed offsite and not treated for water quality. Runoff from Basin O-6 sheet flows offsite.

III. DRAINAGE DESIGN CRITERIA

A. Regulations

1. Town of Castle Rock Storm Drainage and Technical Criteria Manual; dated February 18, 2025.
2. Urban Storm Drainage Criteria Manual (USDCM); Volumes 1, 2 and 3, prepared by Mile High Flood District (MHFD), latest revision.

B. Drainage Studies, Master Plans, Site Constraints

1. There are no drainage studies or master plans for this project site.
2. The existing site primarily drains from south to north. The existing site has approximately a 30-foot drop in elevation across the property. The proposed site has been designed and graded to capture as much of the site runoff as possible into the FS-EDB. The site grading includes retaining walls to balance the earthwork (cut/fill) as much as possible.

There are some areas of the site that cannot be captured due to the site being at a higher elevation than the existing property tie-ins. The pond is capturing additional offsite areas (basins O-1, O-2, and O-3) that are flowing onto the site. The total site area is 4.35 acres with 0.36 acres (from basins O-4 and O-5) of the property flowing offsite and not being treated for water quality. Per MS4 requirements, the off-site basins not being treated by the water quality / detention pond cannot exceed 20% or 1 acre of the total onsite area. The table below shows the breakdown of how the site is complying with the MS4 requirement. The total offsite area not being treated for water quality is less than 1 acre (0.36 acres) and is less than 20% (8.28%) of the total site area.

Category	Basin	Area (ac)
Total on-site treated	A-1 through D-1	3.99
Total on-site not treated	O-4, O-5	0.36
Total Site Area (ac)		4.35
Total On-Site Disturbed Area Not Treated (%)		8.28
Additional off-site treated	O-1, O-2, O-3	0.26
Off-site not treated	O-6	0.18

C. Hydrology

1. The design storm frequencies for this project site are the 5-year event for the minor storm and the 100-year event for the major storm.
2. The rainfall intensities were taken from Table 6-1 in Section 6.1 of the *SDDTC*. The one-hour rainfall values for the Castle Rock area in inches are as follows:

5-YR (IN.)	100-YR (IN.)
1.43	2.60

3. The Rational Method was used to compute peak runoff. This method is defined as follows:

$$Q = CIA$$

Where: Q = Peak Discharge in Cubic Feet per Second (cfs)

C = Runoff Coefficient

I = Rainfall Intensity

A = Drainage Area in Acres

The runoff coefficient for each sub-basin was determined based on Table 6-3 of the *Urban Storm Drainage Criteria Manual* provided by MHFD. Refer to **Appendix B** for hydrologic calculations.

4. The computation method used for the water quality and detention volumes is the *MHFD-Detention* spreadsheet. Refer to **Appendix C** for the calculations.

D. Hydraulics

1. The design storm frequencies for this project site are the 5-year event for the minor storm and the 100-year event for the major storm.
2. The *MHFD-Detention* spreadsheet was used in the hydraulic analysis. *Hydraflow Storm Sewers Extension for Civil 3D* was used to size the private storm pipes. Refer to **Appendix C** for calculations.
3. The 5-year and 100-year storm will be used to size the private storm pipes. The storm pipes will be designed to convey the minor storm without surcharging the pipe. 5-year and 100-year HGL's for the storm sewer system will be provided using *Hydraflow Storm Sewers Extension for Civil 3D*. The 5-year and 100-year modeled HGLs will be calculated using the pipe crown for the 5-year tailwater elevation and the WSEL for the 100-year tailwater at the outfall. The WSEL for the pond was calculated from the maximum ponding depth provided by *MHFD-Detention* spreadsheet. Refer to **Appendix C** for HGL calculations.

Tailwater Elevations for the Minor (5-YR) and Major (100-YR) Storm Events:

Storm Infrastructure	5-YR Tailwater	100-YR Tailwater
Storm Lines 1, 2, 3	6248.51'	6250.38'

4. Inlet capacities were calculated using the *Nyloplast Inlet Capacity Calculator*, developed by ADS and the Street Capacity and Inlet Hydraulics workbook, *MHFD-Inlet, v5.03*, developed by Mile High Flood District. Overflow arrows are shown on the proposed drainage map to show the path of water if sump inlets become clogged. In this event, water will drain away from the building and run offsite to the existing channel in the existing storm drainage easement.

E. Storage and Water Quality Enhancement

1. EURV and 100-year detention are provided in a pond onsite. The vertical rectangular orifice has been designed to allow for a 72-hour drain time for the EURV.
2. Water quality is provided in a pond onsite. The pond orifice plate has been designed to allow for a 40-hour drain time for the WQCV.

IV. STORMWATER MANAGEMENT FACILITY DESIGN

A. Stormwater Conveyance Facilities

1. The intent of the proposed storm drainage system is to collect as much of the onsite runoff and offsite runoff as possible and provide water quality and detention in the onsite pond. The offsite basins that will not be treated will follow historic drainage patterns. The developed site generally flows from south to north and runoff will be captured in the proposed storm sewer system before being conveyed to the FS-EDB.
2. The table below summarizes the percent impervious, runoff coefficients, and corresponding discharges for the minor and major storms. All 5-year and 100-year flows shown in the tables below are specific to each basin and are not accounting for routed runoff. Total flows can be found in the hydrologic calculations in *Appendix B*.

Q5/Q100 = Cubic Feet per Second

Basin	Design Point	Area (AC)	I%	C5	C100	Q5	Q100
A-1	1	0.57	44.60	0.37	0.63	1.00	3.14
B-1	2	0.20	26.58	0.21	0.55	0.20	0.95
B-2	3	0.32	95.00	0.81	0.87	1.28	2.49
B-3	4	0.10	64.10	0.54	0.73	0.26	0.65
C-1	5	0.77	77.25	0.65	0.79	2.01	4.41
C-2	6	1.21	84.10	0.71	0.82	3.53	7.37
D-1	7	0.82	87.04	0.74	0.83	2.78	5.70
O-1	8	0.11	20.00	0.15	0.52	0.08	0.50
O-2	9	0.02	30.36	0.24	0.57	0.02	0.10
O-3	10	0.13	20.00	0.15	0.52	0.10	0.60
O-4	11	0.14	20.00	0.15	0.52	0.10	0.62
O-5	12	0.22	24.36	0.19	0.54	0.20	1.07
O-6	13	0.18	69.40	0.58	0.75	0.51	1.19

B. Stormwater Storage Facilities

1. Detention Pond Design Volume and Emergency Spillway:

The total pond volume has been designed to capture the 100-year peak inflow of **23.5 cfs for 5 acres**. To mimic the 23.5 cfs peak inflow in the MHFD spreadsheet, the watershed area and imperviousness were increased. A riprap spillway will be provided to route larger storm events away from the proposed infrastructure and into the existing channel.

The FS-EDB, emergency spillway, and outlet structure have been sized using Mile High Flood District's spreadsheet, *MHFD Detention, Version 4.07 (June 2025)*. The water surface elevation/max storage elevations are listed below.

Stage Storage Table:

Stage	Provided Stage (ac-ft)	Max Storage Elevation (ft)
Initial	0	6245.00'
Zone 1 (WQCV)	0.168	6247.80'
Zone 2 (EURV)	0.447	6249.39'
Zone 3 (1/2WQCV+100-year)	0.681	6250.38'

Similarly, the 100-year storm event is fully contained within the pond with a WSEL of 6250.38' and a spillway invert of 6250.70'. The top of embankment has an elevation of 6252.00'. This allows for 1 foot of freeboard over the emergency overflow water surface elevation. Refer to **Appendix C** for the FS-EDB and spillway calculations.

Trickle/Low Flow Channel:

The trickle channel has been designed to meet the criteria of Town of Castle Rock and MHFD. The 6" curb concrete channel has a bottom width of 2 feet and a longitudinal slope of 0.75%. The bottom of the pond has been sloped to the trickle channel at a minimum of 4% slope.

2. Energy Dissipation/Outfall Conditions:

The proposed concrete forebay has been designed using *MHFD Chapter 4 Section 5.2.2 Forebay* criteria and the *SCM-Design-v4.02* spreadsheet. The forebay captures runoff from 2-5 acres of impervious area. The forebay has a volume of 1% of the WQCV (0.0017 ac-ft), drains in 4-5 minutes, and is 18 inches in depth. Equation 4-1 was used to size the forebay notch width.

$$w = 9.23 \left(\frac{A_{FB}}{t} \right) \left(\frac{1}{\sqrt{h_{max}}} \right)$$

where:

w = width of the rectangular vertical notch (inches)

A_{FB} = surface area of the forebay (square feet)

t = emptying time of the brim-full forebay (4-5 min)

$h_{\max}$ = maximum depth of the forebay (ft)

The proposed FS-EDB will outfall to the existing channel located in the 52' wide storm drainage, public access and maintenance easement (Reception No. DC99061088). The proposed 24" outfall pipe capacity was analyzed using *Express Extension for Civil 3D* and can hold the 100-year peak outflow of **23.5 cfs**. Refer to **Appendix C** for calculations. A concrete headwall with riprap apron will be used at the pipe outfall to prevent erosion of the existing embankment.

3. Easements and Maintenance

A 10-foot-wide gravel maintenance access road has been provided with a maximum cross slope of 2% and maximum longitudinal slope of 10%. A drainage easement has been provided from the public right-of-way to all portions of the pond for maintenance access. A 25' storm drainage easement has been provided for the pond outfall storm infrastructure. Refer to the *Proposed Drainage Map* in **Appendix D**.

C. Water Quality Enhancement Control Measures

1. Water Quality Pond Design:

Water quality is provided for the site in the form of a FS-EDB. The WQCV has been designed for the full tributary area to allow for a 40-hour drain time.

The WQCV has been designed to drain through the vertical orifice plate containing one orifice. The EURV has been designed to drain through the rectangular vertical orifice measuring 1.50" high by 1.25" wide. The release rate analysis per *MHFD-Detention* spreadsheet is given below:

Outflow Controls:

WQCV/EURV Orifice Plate: 1.07 sq. inch (1-1/8"D) @ 6245.00', and 1.50" high x 1.25" wide orifice

100-YR +1/2WQCV Outlet Pipe Circular Orifice Restrictor Pipe: 24" above invert of the 24" pipe (Not Needed to Control Release Rate)

Control Frequency	Allowable Release Rate	Peak Outflow (cfs)
WQCV	N/A	0.1
EURV	N/A	0.1
5-year	N/A	0.1
100-year	11.34	3.1

The proposed outflow from the water quality and detention pond has been determined per *MHFD* criteria. The maximum allowable 100-year release rate for a full spectrum extended detention basin is 90 percent of the predevelopment discharge as calculated by the *MHFD-Detention* spreadsheet. The FS-EDB is providing a release rate of 20 percent of the predevelopment outflow.

D. Floodplain Modification

1. There will be no floodplain modification as part of this project. The project site is not located within a 100-year floodplain. Refer to **Appendix A** for the FEMA map.

E. Geotechnical Investigation and Sub-surface Collection System Design

1. There is no geotechnical report at this time.

F. Operation and Maintenance

1. Douglas County will be responsible for the maintenance of the privately owned water quality pond and storm sewer system. Refer to the *Douglas County Stormwater Management Facility Operation and Maintenance Manual*.
2. All stormwater management facilities shall be inspected by a qualified individual at a minimum of one time per year. Routine and non-routine maintenance activities shall be conducted per *Douglas County Standard Operating Procedure for Extended Detention Basin*.

G. Additional Permitting Requirements

1. No additional permitting requirements are anticipated as part of this project.

V. CONCLUSIONS

A. Compliance with Standards

1. The Phase II Drainage Report for the Heroes Hall project was prepared in accordance with the *Town of Castle Rock Storm Drainage Design and Technical Criteria Manual (SDDTC)* and *Urban Storm Drainage Criteria Manual (USDCM)*, Volumes 1, 2 and 3 by Mile High Flood District.

B. Variances

1. A variance is requested for **Section 13.3.12 Trash Racks** to allow for a well-screen trash rack with the orifice size being less than 2.5 inches in diameter.

C. Drainage Concept

1. The site improvements surrounding the proposed building are designed to create positive drainage away from the building.
2. The storm water drainage system for this site has been designed to safely convey the 100-year storm through the site to the existing drainageway.
3. The proposed FS-EDB has been designed in accordance with Mile High Flood District.
4. The emergency spillway has been designed to have 1 foot of freeboard over the emergency overflow water surface elevation.
5. The proposed site improvements, including storm drains and site runoff, will have no adverse effect on the adjacent property and downstream conditions.

VI. REFERENCES

Urban Storm Drainage Criteria Manual (USDCM); Volumes 1, 2 and 3, prepared by Mile High Flood District (MHFD), latest revision.

FIRM (Flood Insurance Rate Map), Panel No. 08035C0301G, dated March 16, 2016.

Custom Soil Resource Report for Castle Rock Area, Colorado; Prepared by United States Department of Agriculture, Natural Resources Conservation Service, dated August 8, 2025.

Town of Castle Rock Storm Drainage and Technical Criteria Manual; dated February 18, 2025.

Douglas County Storm Drainage and Technical Criteria Manual; July 8, 2008.

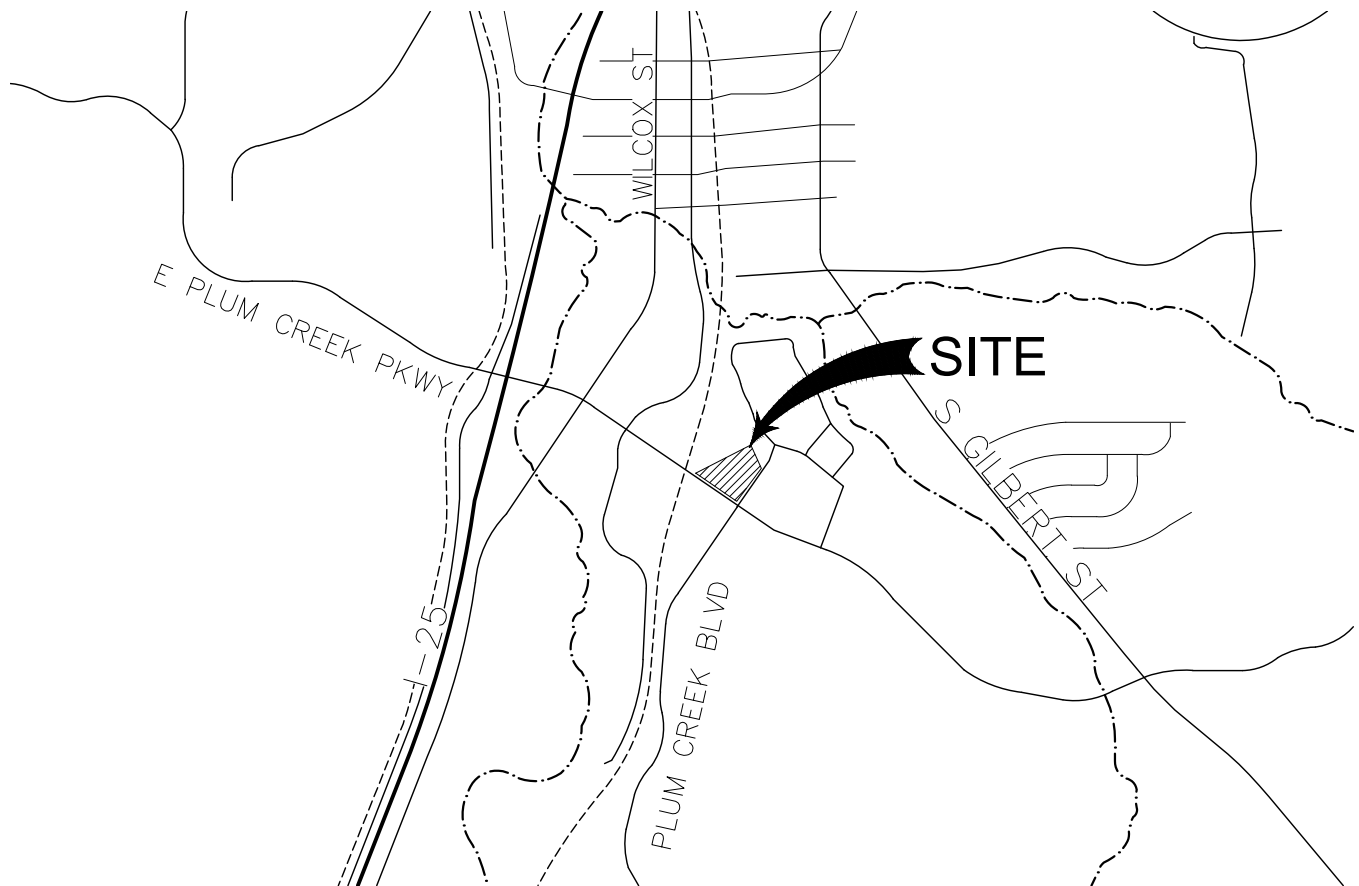
Douglas County Stormwater Management Facility Operation and Maintenance Manual.

Douglas County Standard Operating Procedure for Extended Detention Basin.

APPENDIX A

Maps

Site Vicinity Map



LOCATION MAP

SCALE: 1" = 2000'



**COLLINS
ENGINEERS^{PC}**

455 Sherman Street, Suite 160
Denver, Colorado 80203
voice: (303) 447-0090
fax: (303) 447-9141
web: collinsengr.com

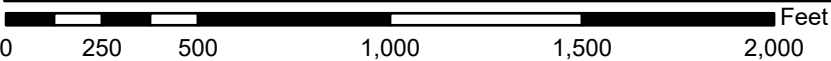
HEROES HALL
CASTLE ROCK, COLORADO
VICINITY MAP

FEMA Map

National Flood Hazard Layer FIRMette



104°51'38"W 39°22'4"N



1:6,000

104°51'W 39°21'37"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
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
OTHER FEATURES		Levee, Dike, or Floodwall
		Cross Sections with 1% Annual Chance Water Surface Elevation
MAP PANELS		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
		Digital Data Available
		No Digital Data Available
		Unmapped



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 **11/16/2025 at 5:55 PM** 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.

Soils Map



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 **Castle Rock Area, Colorado**



August 8, 2025

Preface

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

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

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

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface	2
How Soil Surveys Are Made	5
Soil Map	8
Soil Map.....	9
Legend.....	10
Map Unit Legend.....	11
Map Unit Descriptions.....	11
Castle Rock Area, Colorado.....	13
BIE—Blakeland sandy loam, 1 to 15 percent slopes.....	13
BtE—Bresser-Truckton sandy loams, 5 to 25 percent slopes.....	14
Lo—Loamy alluvial land.....	16
NeE—Newlin gravelly sandy loam, 8 to 30 percent slopes.....	17
References	19

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Soil Map may not be valid at this scale.

Map Scale: 1:1,710 if printed on A landscape (11" x 8.5") sheet.

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

Custom Soil Resource Report

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 1:20,000.

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: Castle Rock Area, Colorado
Survey Area Data: Version 17, Aug 29, 2024

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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
BIE	Blakeland sandy loam, 1 to 15 percent slopes	0.1	0.9%
BtE	Bresser-Truckton sandy loams, 5 to 25 percent slopes	0.9	14.9%
Lo	Loamy alluvial land	1.2	18.9%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	4.1	65.4%
Totals for Area of Interest		6.2	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.

Castle Rock Area, Colorado

BIE—Blakeland sandy loam, 1 to 15 percent slopes

Map Unit Setting

National map unit symbol: jqy4
Elevation: 5,500 to 6,600 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, hillsides
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or eolian deposits

Typical profile

H1 - 0 to 13 inches: sandy loam
H2 - 13 to 24 inches: loamy coarse sand
H3 - 24 to 60 inches: loamy coarse sand

Properties and qualities

Slope: 1 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Truckton

Percent of map unit: 10 percent
Hydric soil rating: No

Bresser

Percent of map unit: 5 percent

Hydric soil rating: No

Stapleton

Percent of map unit: 5 percent

Hydric soil rating: No

BtE—Bresser-Truckton sandy loams, 5 to 25 percent slopes

Map Unit Setting

National map unit symbol: jqy9

Elevation: 5,500 to 6,600 feet

Mean annual precipitation: 15 to 19 inches

Mean annual air temperature: 47 to 52 degrees F

Frost-free period: 120 to 135 days

Farmland classification: Not prime farmland

Map Unit Composition

Bresser and similar soils: 50 percent

Truckton and similar soils: 35 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bresser

Setting

Landform: Terraces

Landform position (three-dimensional): Riser, tread

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy eolian deposits

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 30 inches: sandy clay loam

H3 - 30 to 60 inches: loamy sand

Properties and qualities

Slope: 5 to 15 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
(0.20 to 2.00 in/hr)*

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Description of Truckton

Setting

Landform: Terraces
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkosic sedimentary rock

Typical profile

H1 - 0 to 4 inches: sandy loam
H2 - 4 to 19 inches: sandy loam
H3 - 19 to 60 inches: sandy loam

Properties and qualities

Slope: 10 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Newlin

Percent of map unit: 5 percent
Hydric soil rating: No

Blakeland

Percent of map unit: 5 percent
Hydric soil rating: No

Stapleton

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

Aquic haplustolls

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

Lo—Loamy alluvial land

Map Unit Setting

National map unit symbol: jqzb
Elevation: 7,000 to 8,000 feet
Mean annual precipitation: 17 to 19 inches
Mean annual air temperature: 44 to 46 degrees F
Frost-free period: 115 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Loamy alluvial land: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Loamy Alluvial Land

Setting

Landform: Swales, flood plains
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

H1 - 0 to 20 inches: sandy loam
H2 - 20 to 40 inches: stratified loamy sand to clay loam
H3 - 40 to 60 inches: sand and gravel

Properties and qualities

Slope: 1 to 5 percent
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.20 to 6.00 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: Frequent
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C
Ecological site: R049XY036CO - Overflow
Hydric soil rating: No

Minor Components

Sampson

Percent of map unit: 7 percent
Hydric soil rating: No

Bresser

Percent of map unit: 7 percent
Hydric soil rating: No

Sandy alluvial land

Percent of map unit: 5 percent

Fluvaquentic haplustolls

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

NeE—Newlin gravelly sandy loam, 8 to 30 percent slopes

Map Unit Setting

National map unit symbol: jqzg
Elevation: 5,500 to 6,600 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 49 to 51 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Newlin

Setting

Landform: Plateaus, mesas, terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Unconformable sandy and gravelly and/or mixed source alluvium

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam
H2 - 8 to 17 inches: gravelly sandy clay loam
H3 - 17 to 22 inches: gravelly sandy loam
H4 - 22 to 60 inches: very gravelly sand

Properties and qualities

Slope: 8 to 30 percent
Depth to restrictive feature: More than 80 inches

Custom Soil Resource Report

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.20 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: B

Ecological site: R049XY214CO - Gravelly Foothill

Hydric soil rating: No

Minor Components

Bresser

Percent of map unit: 5 percent

Hydric soil rating: No

Stapleton

Percent of map unit: 4 percent

Hydric soil rating: No

Satanta

Percent of map unit: 4 percent

Hydric soil rating: No

Aquic haplustolls

Percent of map unit: 2 percent

Landform: Swales

Hydric soil rating: Yes

References

- American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
- American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.
- Federal Register. July 13, 1994. Changes in hydric soils of the United States.
- Federal Register. September 18, 2002. Hydric soils of the United States.
- Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.
- National Research Council. 1995. Wetlands: Characteristics and boundaries.
- Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262
- Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577
- Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580
- Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.
- United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.
- United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374
- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelpdb1043084>

Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

APPENDIX B

Hydrologic Computations

Existing Conditions

COMPOSITE 'C' FACTORS																										
LOCATION: Castle Rock, CO						Preliminary Drainage Report								BY: MAB				Soil Type: B				DATE: 11/20/2025				
BASIN DESIGNATION						Asphalt				Concrete				Roof				Lawn				COMPOSITE C FACTOR				% IMPERVIOUS
	Asphalt	Concrete	Roof	Lawn	TOTAL	2YR	5 YR	10 YR	100 YR	2YR	5 YR	10 YR	100 YR	2YR	5 YR	10 YR	100 YR	2YR	5 YR	10 YR	100 YR	2YR	5 YR	10 YR	100 YR	
Imperviousness =						95				95				95				20								
EX-1	0.000	0.000	0.000	4.347	4.35	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87	0.13	0.15	0.22	0.52	0.13	0.15	0.22	0.52	20.00
Total	0.000	0.000	0.000	4.347	4.347																	TOTAL IMPERVIOUS %				20.00
																		TOTAL AREA TRIBUTARY TO POND (AC)					4.35			

Existing Conditions

STANDARD FORM SF-2 TIME OF CONCENTRATION (DEVELOPED)														REMARKS
LOCATION: Castle Rock, CO				Preliminary Drainage Report					BY: MAB		DATE: 11/20/2025			FORMULAS: * $T_i = 0.395 (1.1-C5)L^{0.5}/S/100^{1/3}$ ** $V=Cv^{*}(S/100)^{0.5}$
SUB-BASIN DATA			INIT./OVERLAND TIME (Ti)			TRAVEL TIME (Tt)				TOTAL	Tc Check (Urbanized Basins)		FINAL Tc	
DESIGNATION	C5	AREA (AC)	LENGTH (FT)	SLOPE %	Ti (Min.)*	GRASS/ PAVED	LENGTH (FT)	SLOPE %	VEL. (FPS)**	Tt (Min.)	Ti+Tt (Min.)	LGTH. (FT)	Tc = (L/180) + 10 (minutes)	
EX-1	0.15	4.35	480	5.00	22.32	GRASS	0	1.00	0.70	0.00	22.32	480.00	12.67	

Existing Conditions

STORM DRAINAGE SYSTEM DESIGN: EXISTING (RATIONAL METHOD PROCEDURE, STANDARD FORM SF-3) DESIGN STORM: 5-YEAR DEVELOPED														Calc. by: MAB Chk'd by: BMF Date: 11/20/2025
Heroes Hall		Preliminary Drainage Report						Castle Rock, CO						
DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF					REMARKS	
	BASIN	AREA (AC)	COEFF. (C)	Tc (Min.)	C*A	I (in./ hr.)	Q (cfs)	Sum Area	Tc (min)	I (in./hr.)	Sum C*A	Total Q (cfs)		
	1	EX-1	4.35	0.15	12.67	0.65	3.51	2.29	4.35	12.7	3.51	0.65	2.29	EX-1

Existing Conditions

STORM DRAINAGE SYSTEM DESIGN: EXISTING (RATIONAL METHOD PROCEDURE, STANDARD FORM SF-3) DESIGN STORM: 100-YEAR DEVELOPED													
Heroes Hall		Preliminary Drainage Report						Castle Rock, CO		Calc. by: MAB Chk'd by: BMF Date: 11/20/2025			
DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF					REMARKS
	BASIN	AREA (AC)	COEFF. (C)	Tc (Min.)	C*A	I (in./hr.)	Q (cfs)	Sum Area	Tc (min)	I (in./hr.)	Sum C*A	Total Q (cfs)	
1	EX-1	4.35	0.52	12.67	2.26	6.38	14.41	4.35	12.7	6.38	2.26	14.41	EX-1

Proposed Conditions

COMPOSITE 'C' FACTORS																																						
LOCATION: Castle Rock, CO							Preliminary Drainage Report												BY: MAB				Soil Type: B				DATE: 4/15/2026											
BASIN							Asphalt				Concrete				EDB				WQ				Roof				Lawn				COMPOSITE C FACTOR				% IMPERVIOUS			
DESIGNATION	Asphalt	Concrete	EDB	WQ	Roof	Lawn	TOTAL	2YR	5 YR	10 YR	100 YR	2YR	5 YR	10 YR	100 YR	2YR	5 YR	10 YR	100 YR	2YR	5 YR	10 YR	100 YR	2YR	5 YR	10 YR	100 YR	2YR	5 YR	10 YR	100 YR	2YR	5 YR	10 YR		100 YR		
							Imperviousness =	95				95				25				100				95				20										
A-1	0.000	0.000	0.418	0.148	0.000	0.000	0.57	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87	0.17	0.19	0.26	0.54	0.84	0.86	0.86	0.89	0.79	0.81	0.82	0.87	0.13	0.15	0.22	0.52	0.35	0.37	0.42	0.63	44.60		
B-1	0.000	0.017	0.000	0.000	0.000	0.179	0.20	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87	0.17	0.19	0.26	0.54	0.84	0.86	0.86	0.89	0.79	0.81	0.82	0.87	0.13	0.15	0.22	0.52	0.19	0.21	0.27	0.55	26.58		
B-2	0.000	0.000	0.000	0.000	0.325	0.000	0.32	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87	0.17	0.19	0.26	0.54	0.84	0.86	0.86	0.89	0.79	0.81	0.82	0.87	0.13	0.15	0.22	0.52	0.79	0.81	0.82	0.87	95.00		
B-3	0.000	0.059	0.000	0.000	0.000	0.042	0.10	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87	0.17	0.19	0.26	0.54	0.84	0.86	0.86	0.89	0.79	0.81	0.82	0.87	0.13	0.15	0.22	0.52	0.52	0.54	0.57	0.73	64.10		
C-1	0.451	0.138	0.000	0.000	0.000	0.183	0.77	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87	0.17	0.19	0.26	0.54	0.84	0.86	0.86	0.89	0.79	0.81	0.82	0.87	0.13	0.15	0.22	0.52	0.63	0.65	0.68	0.79	77.25		
C-2	0.844	0.187	0.000	0.000	0.000	0.175	1.21	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87	0.17	0.19	0.26	0.54	0.84	0.86	0.86	0.89	0.79	0.81	0.82	0.87	0.13	0.15	0.22	0.52	0.69	0.71	0.73	0.82	84.10		
D-1	0.615	0.121	0.000	0.000	0.000	0.087	0.82	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87	0.17	0.19	0.26	0.54	0.84	0.86	0.86	0.89	0.79	0.81	0.82	0.87	0.13	0.15	0.22	0.52	0.72	0.74	0.76	0.83	87.04		
O-1	0.000	0.000	0.000	0.000	0.000	0.109	0.109	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87	0.17	0.19	0.26	0.54	0.84	0.86	0.86	0.89	0.79	0.81	0.82	0.87	0.13	0.15	0.22	0.52	0.13	0.15	0.22	0.52	20.00		
O-2	0.000	0.003	0.000	0.000	0.000	0.018	0.021	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87	0.17	0.19	0.26	0.54	0.84	0.86	0.86	0.89	0.79	0.81	0.82	0.87	0.13	0.15	0.22	0.52	0.22	0.24	0.30	0.57	30.36		
O-3	0.000	0.000	0.000	0.000	0.000	0.131	0.131	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87	0.17	0.19	0.26	0.54	0.84	0.86	0.86	0.89	0.79	0.81	0.82	0.87	0.13	0.15	0.22	0.52	0.13	0.15	0.22	0.52	20.00		
Total	1.910	0.525	0.418	0.148	0.325	0.923	4.249																											TOTAL IMPERVIOUS %				71.99
TOTAL AREA TRIBUTARY TO POND (AC)																																				4.25		
OFFSITE BASINS																																						
O-4	0.000	0.000			0.000	0.135	0.135	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87					0.79	0.81	0.82	0.87	0.13	0.15	0.22	0.52	0.13	0.15	0.22	0.52	0.13	0.15	0.22	0.52	20.00		
O-5	0.008	0.005			0.000	0.211	0.224	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87					0.79	0.81	0.82	0.87	0.13	0.15	0.22	0.52	0.17	0.19	0.25	0.54	0.17	0.19	0.25	0.54	24.36		
O-6	0.015	0.103			0.000	0.061	0.179	0.79	0.81	0.82	0.87	0.79	0.81	0.82	0.87					0.79	0.81	0.82	0.87	0.13	0.15	0.22	0.52	0.56	0.58	0.62	0.75	0.56	0.58	0.62	0.75	69.40		
Total	0.023	0.108			0.000	0.407	0.538																											TOTAL IMPERVIOUS %				38.27
TOTAL OFFSITE AREA (AC)																																				0.54		

Proposed Conditions

STANDARD FORM SF-2 TIME OF CONCENTRATION (DEVELOPED)														REMARKS	
LOCATION: Castle Rock, CO			Preliminary Drainage Report							BY: MAB		DATE: 4/15/2026		FORMULAS:	
SUB-BASIN DATA			INIT./OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					TOTAL	Tc Check (Urbanized Basins)		FINAL Tc	* Ti = 0.395 (1.1-C5)L^0.5/S/100^1/3
DESIGNATION	C5	AREA (AC)	LENGTH (FT)	SLOPE %	Ti (Min.)*	GRASS/ PAVED	LENGTH (FT)	SLOPE %	VEL. (FPS)**	Tt(Min.)	Ti+Tt(Min.)	LGTH. (FT)	Tc = (L/180) + 10	(minutes)	** V=Cv*(S/100)^0.5
A-1	0.37	0.57	70	25.00	3.86	GRASS	50	1.00	0.70	1.19	5.05	120.00	10.67	5.05	
B-1	0.21	0.20	25	25.00	2.80	GRASS	100	1.50	0.86	1.94	4.74	125.00	10.69	5.00	
B-2	0.81	0.32	50	5.00	2.20	PAVED	50	5.00	4.47	0.19	2.38	100.00	10.56	5.00	ROOF USE 5 MIN
B-3	0.54	0.10	60	7.00	4.17	PAVED	60	15.00	7.75	0.13	4.30	120.00	10.67	5.00	
C-1	0.65	0.77	290	4.00	8.78	PAVED	55	1.00	2.00	0.46	9.23	345.00	11.92	9.23	
C-2	0.71	1.21	300	4.00	7.72	PAVED	100	1.00	2.00	0.83	8.55	400.00	12.22	8.55	
D-1	0.74	0.82	245	5.00	6.04	PAVED	40	5.00	4.47	0.15	6.19	285.00	11.58	6.19	

OFFSITE

O-1	0.15	0.11	25	20.00	3.21	GRASS	0	2.00	0.99	0.00	3.21	25.00	10.14	5.00	
O-2	0.24	0.02	25	20.00	2.90	GRASS	0	2.00	0.99	0.00	2.90	25.00	10.14	5.00	
O-3	0.15	0.13	30	30.00	3.07	GRASS	0	2.00	0.99	0.00	3.07	30.00	10.17	5.00	
O-4	0.15	0.13	15	30.00	2.17	GRASS	0	2.00	0.99	0.00	2.17	15.00	10.08	5.00	
O-5	0.19	0.22	50	25.00	4.04	GRASS	0	2.00	0.99	0.00	4.04	50.00	10.28	5.00	
O-6	0.58	0.18	40	4.00	3.76	PAVED	0	2.00	2.83	0.00	3.76	40.00	10.22	5.00	

Proposed Conditions

STORM DRAINAGE SYSTEM DESIGN: PROPOSED (RATIONAL METHOD PROCEDURE, STANDARD FORM SF-3) DESIGN STORM: 5-YEAR DEVELOPED

Calc. by: MAB
Chk'd by: BMF
Date: 4/15/2026

Heroes Hall

Preliminary Drainage Report

Castle Rock, CO

DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF					REMARKS
	BASIN	AREA (AC)	COEFF. (C)	Tc (Min.)	C*A	I (in./hr.)	Q (cfs)	Sum Area	Tc (min)	I (in./hr.)	Sum C*A	Total Q (cfs)	
1	A-1	0.57	0.37	5.05	0.21	4.84	1.00	4.25	9.2	3.99	2.58	10.29	ALL BASINS + O-1 + O-2 + O-3
2	B-1	0.20	0.21	5.00	0.04	4.85	0.20	0.63	5.0	4.85	0.32	1.55	B-1 + B-2 + O-1
3	B-2	0.32	0.81	5.00	0.26	4.85	1.28	0.32	5.0	4.85	0.26	1.28	B-2
4	B-3	0.10	0.54	5.00	0.05	4.85	0.26	0.12	5.0	4.85	0.06	0.29	B-3 + O-2
5	C-1	0.77	0.65	9.23	0.50	3.99	2.01	0.77	9.2	3.99	0.50	2.01	C-1
6	C-2	1.21	0.71	8.55	0.86	4.10	3.53	1.34	8.6	4.10	0.88	3.62	C-2 + O-3
7	D-1	0.82	0.74	6.19	0.61	4.57	2.78	0.82	6.2	4.57	0.61	2.78	D-1

OFFSITE

8	O-1	0.11	0.15	5.00	0.02	4.85	0.08	0.11	5.0	4.85	0.02	0.08	O-1
9	O-2	0.02	0.24	5.00	0.00	4.85	0.02	0.02	5.0	4.85	0.00	0.02	O-2
10	O-3	0.13	0.15	5.00	0.02	4.85	0.10	0.13	5.0	4.85	0.02	0.10	O-3
11	O-4	0.13	0.15	5.00	0.02	4.85	0.10	0.13	5.0	4.85	0.02	0.10	O-4
12	O-5	0.22	0.19	5.00	0.04	4.85	0.20	0.22	5.0	4.85	0.04	0.20	O-5
13	O-6	0.18	0.58	5.00	0.10	4.85	0.51	0.18	5.0	4.85	0.10	0.51	O-6

5 YR

Proposed Conditions

STORM DRAINAGE SYSTEM DESIGN: PROPOSED
(RATIONAL METHOD PROCEDURE, STANDARD FORM SF-3)
DESIGN STORM: 100-YEAR DEVELOPED

Calc. by: MAB

Chk'd by: BMF

Date: 4/15/2026

Heroes Hall

Preliminary Drainage Report

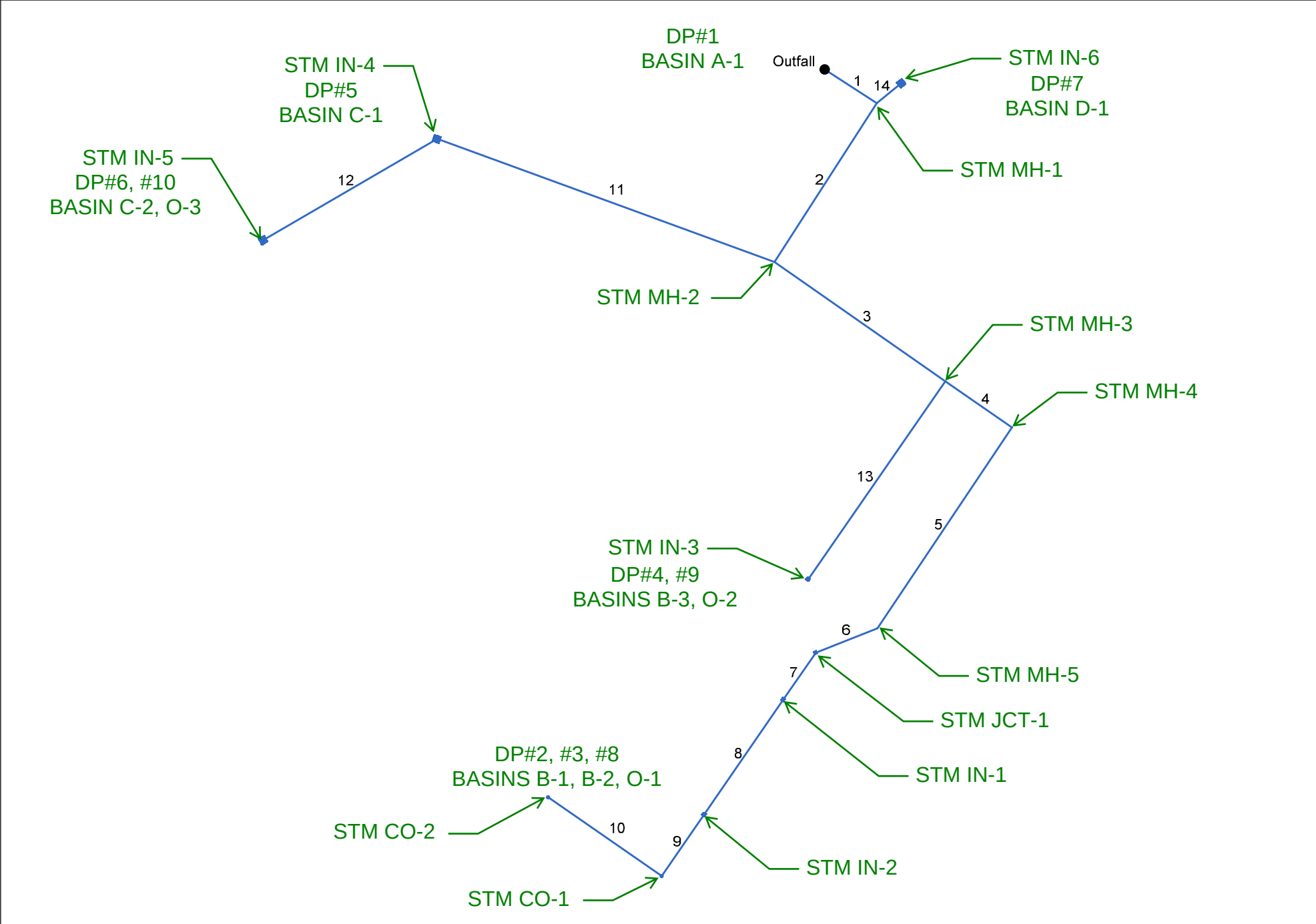
Castle Rock, CO

DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF					REMARKS
	BASIN	AREA (AC)	COEFF. (C)	Tc (Min.)	C*A	I (in./hr.)	Q (cfs)	Sum Area	Tc (min)	I (in./hr.)	Sum C*A	Total Q (cfs)	
1	A-1	0.57	0.63	5.05	0.36	8.80	3.14	4.25	9.2	7.25	3.24	23.49	ALL BASINS + O-1 + O-2 + O-3
2	B-1	0.20	0.55	5.00	0.11	8.82	0.95	0.63	5.0	8.82	0.45	3.94	B-1 + B-2 + O-1
3	B-2	0.32	0.87	5.00	0.28	8.82	2.49	0.32	5.0	8.82	0.28	2.49	B-2
4	B-3	0.10	0.73	5.00	0.07	8.82	0.65	0.12	5.0	8.82	0.08	0.75	B-3 + O-2
5	C-1	0.77	0.79	9.23	0.61	7.25	4.41	0.77	9.2	7.25	0.61	4.41	C-1
6	C-2	1.21	0.82	8.55	0.99	7.46	7.37	1.34	8.6	7.46	1.06	7.88	C-2 + O-3
7	D-1	0.82	0.83	6.19	0.69	8.30	5.70	0.82	6.2	8.30	0.69	5.70	D-1
OFFSITE													
8	O-1	0.11	0.52	5.00	0.06	8.82	0.50	0.11	5.0	8.82	0.06	0.50	O-1
9	O-2	0.02	0.57	5.00	0.01	8.82	0.10	0.02	5.0	8.82	0.01	0.10	O-2
10	O-3	0.13	0.52	5.00	0.07	8.82	0.60	0.13	5.0	8.82	0.07	0.60	O-3
11	O-4	0.13	0.52	5.00	0.07	8.82	0.62	0.13	5.0	8.82	0.07	0.62	O-4
12	O-5	0.22	0.54	5.00	0.12	8.82	1.07	0.22	5.0	8.82	0.12	1.07	O-5
13	O-6	0.18	0.75	5.00	0.13	8.82	1.19	0.18	5.0	8.82	0.13	1.19	O-6

APPENDIX C

Hydraulic Computations

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Heroes Hall_Storm Lines 1 thru 3_100 YR_2026-04-16.stm	Number of lines: 14	Date: 4/16/2026
--	---------------------	-----------------

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Pipe - (1)	9.81	30	Cir	33.184	6246.01	6246.26	0.753	6248.51	6248.52	0.07	6248.59	End	Manhole
2	Pipe - (17)	7.40	24	Cir	101.221	6246.86	6247.62	0.751	6248.59	6248.59	n/a	6248.59 j	1	Manhole
3	Pipe - (2)	1.85	18	Cir	111.572	6247.72	6248.56	0.753	6248.59	6249.07	n/a	6249.07 j	2	Manhole
4	Pipe - (3)	1.56	18	Cir	43.445	6255.09	6255.59	1.151	6255.47	6256.06	n/a	6256.06	3	Manhole
5	Pipe - (4)	1.56	18	Cir	129.392	6255.69	6256.98	0.997	6256.08	6257.45	n/a	6257.45	4	Manhole
6	Pipe - (5)	1.56	18	Cir	35.670	6257.08	6257.44	1.009	6257.46	6257.91	n/a	6257.91	5	Manhole
7	Pipe - (7)	1.56	18	Cir	30.237	6257.54	6257.84	0.992	6257.92	6258.31	n/a	6258.31	6	Generic
8	Pipe - (7) (1)	1.04	12	Cir	74.750	6258.44	6259.16	0.963	6258.80	6259.59	n/a	6259.59	7	Generic
9	Pipe - (8)	0.52	12	Cir	40.315	6259.26	6259.66	0.993	6259.59	6259.96	n/a	6259.96 j	8	Manhole
10	Pipe - (10)	0.52	12	Cir	74.085	6259.66	6260.60	1.269	6259.96	6260.90	n/a	6260.90	9	Generic
11	Pipe - (12)	5.55	24	Cir	192.795	6247.82	6249.42	0.830	6248.59	6250.25	0.38	6250.25	2	Generic
12	Pipe - (13)	3.64	18	Cir	108.000	6250.02	6251.10	1.000	6250.60	6251.83	0.28	6251.83	11	Generic
13	Pipe - (11)	0.29	12	Cir	128.810	6248.66	6250.00	1.040	6249.07	6250.22	n/a	6250.22 j	3	Generic
14	Pipe - (14)	2.77	18	Cir	16.862	6247.36	6247.53	1.008	6248.59	6248.16	0.24	6248.16	1	Generic

Project File: Heroes Hall_Storm Lines 1 thru 3_5 YR_2026-04-16.stm

Number of lines: 14

Run Date: 4/16/2026

NOTES: Return period = 5 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (I) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	33.184	0.00	2.80	0.00	0.00	1.97	0.0	9.2	4.0	9.81	35.60	2.05	30	0.75	6246.01	6246.26	6248.51	6248.52	6251.00	6253.78	Pipe - (1)
2	1	101.221	0.00	1.98	0.00	0.00	1.36	0.0	9.2	4.0	7.40	19.60	3.74	24	0.75	6246.86	6247.62	6248.59	6248.59	6253.78	6258.43	Pipe - (17)
3	2	111.572	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	1.85	9.11	2.61	18	0.75	6247.72	6248.56	6248.59	6249.07	6258.43	6260.39	Pipe - (2)
4	3	43.445	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	1.56	11.27	3.90	18	1.15	6255.09	6255.59	6255.47	6256.06	6260.39	6260.98	Pipe - (3)
5	4	129.392	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	1.56	10.49	3.78	18	1.00	6255.69	6256.98	6256.08	6257.45	6260.98	6266.57	Pipe - (4)
6	5	35.670	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	1.56	11.43	3.92	18	1.01	6257.08	6257.44	6257.46	6257.91	6266.57	6263.50	Pipe - (5)
7	6	30.237	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	1.56	11.33	3.91	18	0.99	6257.54	6257.84	6257.92	6258.31	6263.50	6263.48	Pipe - (7)
8	7	74.750	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	1.04	3.79	3.67	12	0.96	6258.44	6259.16	6258.80	6259.59	6263.48	6263.42	Pipe - (7) (1)
9	8	40.315	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.52	3.84	2.48	12	0.99	6259.26	6259.66	6259.59	6259.96	6263.42	6268.20	Pipe - (8)
10	9	74.085	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.52	4.35	2.64	12	1.27	6259.66	6260.60	6259.96	6260.90	6268.20	6265.25	Pipe - (10)
11	2	192.795	0.77	1.98	0.65	0.50	1.36	9.2	9.2	4.0	5.55	20.61	4.75	24	0.83	6247.82	6249.42	6248.59	6250.25	6258.43	6253.96	Pipe - (12)
12	11	108.000	1.21	1.21	0.71	0.86	0.86	8.6	8.6	4.1	3.64	11.38	5.00	18	1.00	6250.02	6251.10	6250.60	6251.83	6253.96	6255.13	Pipe - (13)
13	3	128.810	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.29	3.93	1.60	12	1.04	6248.66	6250.00	6249.07	6250.22	6260.39	6263.91	Pipe - (11)
14	1	16.862	0.82	0.82	0.74	0.61	0.61	6.2	6.2	4.6	2.77	10.54	2.85	18	1.01	6247.36	6247.53	6248.59	6248.16	6253.78	6253.35	Pipe - (14)
Project File: Heroes Hall_Storm Lines 1 thru 3_5 YR_2026-04-16.stm																Number of lines: 14				Run Date: 4/16/2026		
NOTES:Intensity = 37.95 / (Inlet time + 9.50) ^ 0.77; Return period =Yrs. 5 ; Pipe travel time suppressed. ; c = cir e = ellip b = box																						

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	30	9.81	6246.01	6248.51	2.50	4.91	2.00	0.06	6248.57	0.057	33.184	6246.26	6248.52	2.26	4.67	2.10	0.07	6248.59	0.050	0.054	0.018	1.00	0.07
2	24	7.40	6246.86	6248.59	1.73	1.50	2.56	0.38	6248.97	0.000	101.22	6247.62	6248.59 j	0.97**	1.50	4.93	0.38	6248.96	0.000	0.000	n/a	1.00	0.38
3	18	1.85	6247.72	6248.59	0.87	0.53	1.75	0.19	6248.77	0.000	111.57	6248.56	6249.07 j	0.51**	0.53	3.48	0.19	6249.26	0.000	0.000	n/a	1.00	n/a
4	18	1.56	6255.09	6255.47	0.38*	0.35	4.48	0.17	6255.64	0.000	43.445	6255.59	6256.06	0.47**	0.47	3.31	0.17	6256.23	0.000	0.000	n/a	1.00	n/a
5	18	1.56	6255.69	6256.08	0.39*	0.37	4.26	0.17	6256.25	0.000	129.39	6256.98	6257.45	0.47**	0.47	3.31	0.17	6257.62	0.000	0.000	n/a	0.62	n/a
6	18	1.56	6257.08	6257.46	0.37*	0.34	4.52	0.17	6257.63	0.000	35.670	6257.44	6257.91	0.47**	0.47	3.31	0.17	6258.08	0.000	0.000	n/a	0.61	n/a
7	18	1.56	6257.54	6257.92	0.38*	0.35	4.50	0.17	6258.09	0.000	30.237	6257.84	6258.31	0.47**	0.47	3.31	0.17	6258.48	0.000	0.000	n/a	0.50	n/a
8	12	1.04	6258.44	6258.80	0.36*	0.25	4.11	0.16	6258.96	0.000	74.750	6259.16	6259.59	0.43**	0.32	3.24	0.16	6259.75	0.000	0.000	n/a	0.50	n/a
9	12	0.52	6259.26	6259.59	0.33	0.20	2.31	0.11	6259.70	0.000	40.315	6259.66	6259.96 j	0.30**	0.20	2.64	0.11	6260.07	0.000	0.000	n/a	1.00	n/a
10	12	0.52	6259.66	6259.96	0.30*	0.20	2.64	0.11	6260.07	0.000	74.085	6260.60	6260.90	0.30**	0.20	2.64	0.11	6261.01	0.000	0.000	n/a	1.00	n/a
11	24	5.55	6247.82	6248.59	0.77	1.11	5.01	0.31	6248.90	0.000	192.79	6249.42	6250.25	0.83**	1.23	4.50	0.31	6250.56	0.000	0.000	n/a	1.21	0.38
12	18	3.64	6250.02	6250.60	0.58*	0.64	5.72	0.28	6250.89	0.000	108.00	6251.10	6251.83	0.73**	0.85	4.28	0.28	6252.11	0.000	0.000	n/a	1.00	0.28
13	12	0.29	6248.66	6249.07	0.41	0.13	0.95	0.08	6249.15	0.000	128.81	6250.00	6250.22 j	0.22**	0.13	2.24	0.08	6250.30	0.000	0.000	n/a	1.00	0.08
14	18	2.77	6247.36	6248.59	1.23	0.71	1.78	0.24	6248.83	0.000	16.862	6247.53	6248.16	0.63**	0.71	3.92	0.24	6248.40	0.000	0.000	n/a	1.00	0.24

Project File: Heroes Hall_Storm Lines 1 thru 3_5 YR_2026-04-16.stm

Number of lines: 14

Run Date: 4/16/2026

Notes: * Crown depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Pipe - (1)	21.83	30	Cir	33.184	6246.01	6246.26	0.753	6250.38*	6250.47*	0.31	6250.78	End	Manhole
2	Pipe - (17)	16.90	24	Cir	101.221	6246.86	6247.62	0.751	6250.78*	6251.35*	0.45	6251.80	1	Manhole
3	Pipe - (2)	4.68	18	Cir	111.572	6247.72	6248.56	0.753	6251.80*	6252.02*	0.11	6252.13	2	Manhole
4	Pipe - (3)	3.93	18	Cir	43.445	6255.09	6255.59	1.151	6255.70	6256.35	0.30	6256.35	3	Manhole
5	Pipe - (4)	3.93	18	Cir	129.392	6255.69	6256.98	0.997	6256.35	6257.74	0.19	6257.74	4	Manhole
6	Pipe - (5)	3.93	18	Cir	35.670	6257.08	6257.44	1.009	6257.74	6258.20	0.18	6258.20	5	Manhole
7	Pipe - (7)	3.93	18	Cir	30.237	6257.54	6257.84	0.992	6258.20	6258.60	0.15	6258.60	6	Generic
8	Pipe - (7) (1)	2.62	12	Cir	74.750	6258.44	6259.16	0.963	6259.05	6259.85	0.16	6259.85	7	Generic
9	Pipe - (8)	1.31	12	Cir	40.315	6259.26	6259.66	0.993	6259.85	6260.14	n/a	6260.14 j	8	Manhole
10	Pipe - (10)	1.31	12	Cir	74.085	6259.66	6260.60	1.269	6260.14	6261.08	n/a	6261.08	9	Generic
11	Pipe - (12)	12.22	24	Cir	192.795	6247.82	6249.42	0.830	6251.80*	6252.36*	0.28	6252.64	2	Generic
12	Pipe - (13)	7.98	18	Cir	108.000	6250.02	6251.10	1.000	6252.64*	6253.18*	0.32	6253.49	11	Generic
13	Pipe - (11)	0.75	12	Cir	128.810	6248.66	6250.00	1.040	6252.13*	6252.18*	0.01	6252.19	3	Generic
14	Pipe - (14)	5.64	18	Cir	16.862	6247.36	6247.53	1.008	6250.78*	6250.83*	0.16	6250.99	1	Generic

Project File: Heroes Hall_Storm Lines 1 thru 3_100 YR_2026-04-16.stm

Number of lines: 14

Run Date: 4/16/2026

NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (I) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	33.184	0.00	2.80	0.00	0.00	2.28	0.0	9.2	7.3	21.83	35.60	4.45	30	0.75	6246.01	6246.26	6250.38	6250.47	6251.00	6253.78	Pipe - (1)
2	1	101.221	0.00	1.98	0.00	0.00	1.60	0.0	9.2	7.3	16.90	19.60	5.38	24	0.75	6246.86	6247.62	6250.78	6251.35	6253.78	6258.43	Pipe - (17)
3	2	111.572	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	4.68	9.11	2.65	18	0.75	6247.72	6248.56	6251.80	6252.02	6258.43	6260.39	Pipe - (2)
4	3	43.445	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.93	11.27	5.10	18	1.15	6255.09	6255.59	6255.70	6256.35	6260.39	6260.98	Pipe - (3)
5	4	129.392	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.93	10.49	4.83	18	1.00	6255.69	6256.98	6256.35	6257.74	6260.98	6266.57	Pipe - (4)
6	5	35.670	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.93	11.43	4.83	18	1.01	6257.08	6257.44	6257.74	6258.20	6266.57	6263.50	Pipe - (5)
7	6	30.237	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.93	11.33	4.83	18	0.99	6257.54	6257.84	6258.20	6258.60	6263.50	6263.48	Pipe - (7)
8	7	74.750	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.62	3.79	4.86	12	0.96	6258.44	6259.16	6259.05	6259.85	6263.48	6263.42	Pipe - (7) (1)
9	8	40.315	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	1.31	3.84	3.09	12	0.99	6259.26	6259.66	6259.85	6260.14	6263.42	6268.20	Pipe - (8)
10	9	74.085	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	1.31	4.35	3.49	12	1.27	6259.66	6260.60	6260.14	6261.08	6268.20	6265.25	Pipe - (10)
11	2	192.795	0.77	1.98	0.79	0.61	1.60	9.2	9.2	7.3	12.22	20.61	3.89	24	0.83	6247.82	6249.42	6251.80	6252.36	6258.43	6253.96	Pipe - (12)
12	11	108.000	1.21	1.21	0.82	0.99	0.99	8.6	8.6	7.4	7.98	11.38	4.52	18	1.00	6250.02	6251.10	6252.64	6253.18	6253.96	6255.13	Pipe - (13)
13	3	128.810	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.75	3.93	0.96	12	1.04	6248.66	6250.00	6252.13	6252.18	6260.39	6263.91	Pipe - (11)
14	1	16.862	0.82	0.82	0.83	0.68	0.68	6.2	6.2	8.3	5.64	10.54	3.19	18	1.01	6247.36	6247.53	6250.78	6250.83	6253.78	6253.35	Pipe - (14)
Project File: Heroes Hall_Storm Lines 1 thru 3_100 YR_2026-04-16.stm																Number of lines: 14				Run Date: 4/16/2026		
NOTES:Intensity = 73.75 / (Inlet time + 10.00) ^ 0.78; Return period =Yrs. 100 ; Pipe travel time suppressed. ; c = cir e = ellip b = box																						

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	30	21.83	6246.01	6250.38	2.50	4.91	4.45	0.31	6250.69	0.284	33.184	6246.26	6250.47	2.50	4.91	4.45	0.31	6250.78	0.283	0.284	0.094	1.00	0.31
2	24	16.90	6246.86	6250.78	2.00	3.14	5.38	0.45	6251.23	0.558	101.221	6247.62	6251.35	2.00	3.14	5.38	0.45	6251.80	0.558	0.558	0.565	1.00	0.45
3	18	4.68	6247.72	6251.80	1.50	1.77	2.65	0.11	6251.91	0.199	111.572	6248.56	6252.02	1.50	1.77	2.65	0.11	6252.13	0.199	0.199	0.222	1.00	0.11
4	18	3.93	6255.09	6255.70	0.61*	0.68	5.80	0.30	6256.00	0.000	43.445	6255.59	6256.35	0.76**	0.90	4.39	0.30	6256.65	0.000	0.000	n/a	1.00	0.30
5	18	3.93	6255.69	6256.35	0.66	0.75	5.27	0.30	6256.65	0.000	129.392	6256.98	6257.74	0.76**	0.90	4.39	0.30	6258.04	0.000	0.000	n/a	0.62	0.19
6	18	3.93	6257.08	6257.74	0.66	0.75	5.27	0.30	6258.04	0.000	35.670	6257.44	6258.20	0.76**	0.90	4.39	0.30	6258.50	0.000	0.000	n/a	0.61	0.18
7	18	3.93	6257.54	6258.20	0.66	0.75	5.27	0.30	6258.50	0.000	30.237	6257.84	6258.60	0.76**	0.90	4.39	0.30	6258.90	0.000	0.000	n/a	0.50	0.15
8	12	2.62	6258.44	6259.05	0.61*	0.50	5.20	0.32	6259.37	0.000	74.750	6259.16	6259.85	0.69**	0.58	4.51	0.32	6260.17	0.000	0.000	n/a	0.50	0.16
9	12	1.31	6259.26	6259.85	0.59	0.38	2.70	0.19	6260.04	0.000	40.315	6259.66	6260.14 j	0.48**	0.38	3.49	0.19	6260.33	0.000	0.000	n/a	1.00	n/a
10	12	1.31	6259.66	6260.14	0.48*	0.38	3.49	0.19	6260.33	0.000	74.085	6260.60	6261.08	0.48**	0.38	3.49	0.19	6261.27	0.000	0.000	n/a	1.00	n/a
11	24	12.22	6247.82	6251.80	2.00	3.14	3.89	0.24	6252.03	0.292	192.795	6249.42	6252.36	2.00	3.14	3.89	0.24	6252.59	0.292	0.292	0.562	1.21	0.28
12	18	7.98	6250.02	6252.64	1.50	1.77	4.52	0.32	6252.96	0.493	108.000	6251.10	6253.18	1.50	1.77	4.52	0.32	6253.49	0.492	0.492	0.532	1.00	0.32
13	12	0.75	6248.66	6252.13	1.00	0.79	0.96	0.01	6252.14	0.038	128.810	6250.00	6252.18	1.00	0.79	0.95	0.01	6252.19	0.038	0.038	0.049	1.00	0.01
14	18	5.64	6247.36	6250.78	1.50	1.77	3.19	0.16	6250.94	0.289	16.862	6247.53	6250.83	1.50	1.77	3.19	0.16	6250.99	0.289	0.289	0.049	1.00	0.16

Project File: Heroes Hall_Storm Lines 1 thru 3_100 YR_2026-04-16.stm

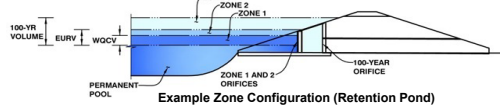
Number of lines: 14

Run Date: 4/16/2026

Notes: * Crown depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

MHFD-Detention, Version 4.07 (June 2025)

Basin ID: Inv = 6245.00

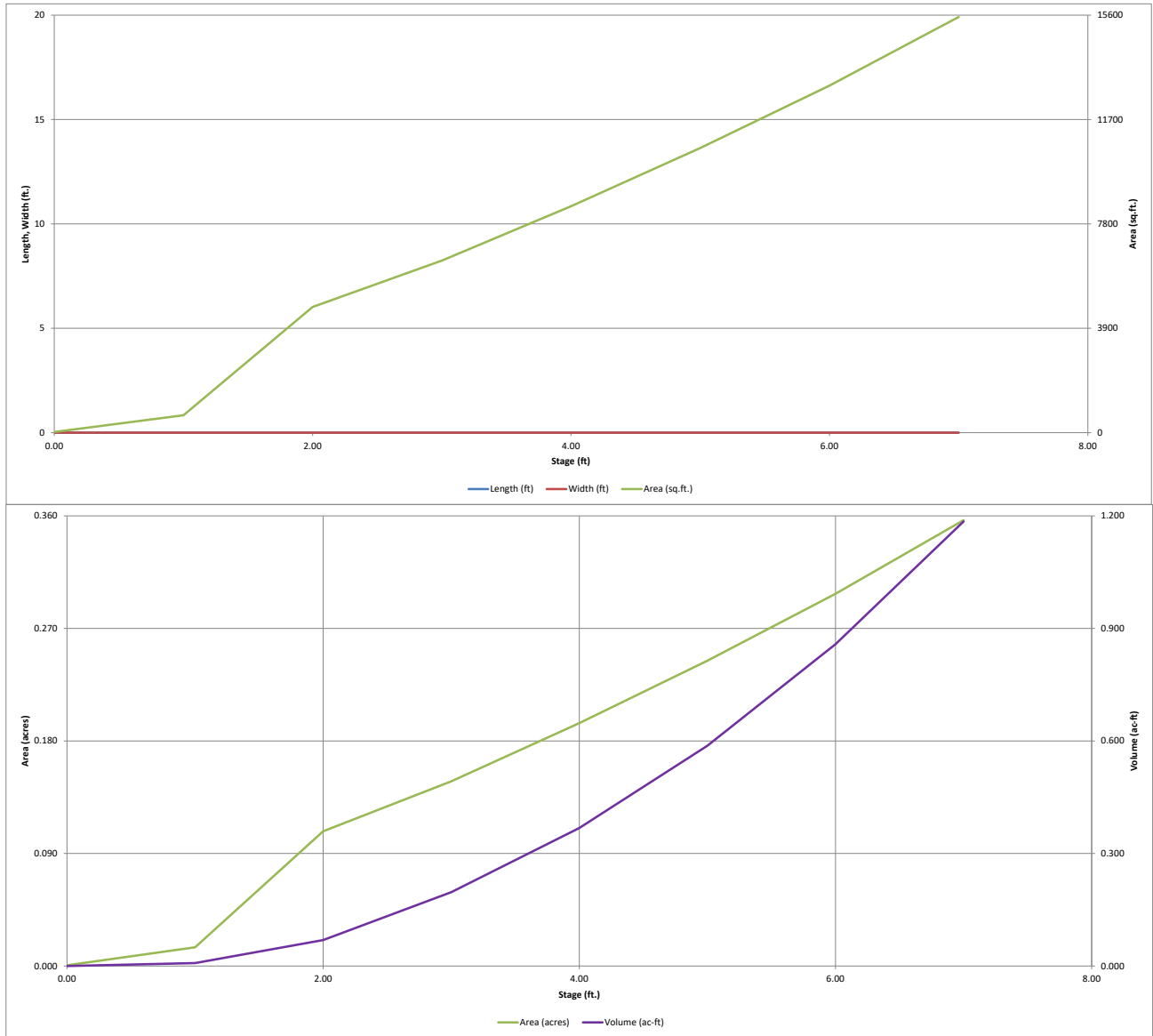


Initial Surcharge Area (A_{IS}) =	user	ft ²
Surcharge Volume Length (L_{IS}) =	user	ft
Surcharge Volume Width (W_{IS}) =	user	ft
Depth of Basin Floor (H_{LFloor}) =	user	ft
Length of Basin Floor (L_{LFloor}) =	user	ft
Width of Basin Floor (W_{LFloor}) =	user	ft
Area of Basin Floor (A_{LFloor}) =	user	ft ²
Volume of Basin Floor (V_{LFloor}) =	user	ft ³
Depth of Main Basin (H_{Main}) =	user	ft
Length of Main Basin (L_{Main}) =	user	ft
Width of Main Basin (W_{Main}) =	user	ft
Area of Main Basin (A_{Main}) =	user	ft ²
Volume of Main Basin (V_{Main}) =	user	ft ³
Calculated Total Basin Volume (V_{Total}) =	user	acre-feet

[illegible]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

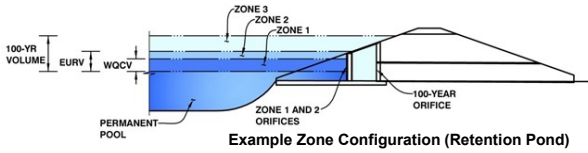


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project: Heroes Hall

Basin ID: Inv = 6245.00



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.80	0.167	Orifice Plate
Zone 2 (EURV)	4.39	0.279	Rectangular Orifice
3 (100+1/2WQCV)	5.84	0.364	Weir&Pipe (Restrict)
Total (all zones)		0.810	

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

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

Calculated Parameters for Underdrain
Underdrain Orifice Area = ft²
Underdrain Orifice Centroid = feet

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

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = 2.80 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = N/A inches
Orifice Plate: Orifice Area per Row = 1.07 sq. inches (diameter = 1-1/8 inches)

Calculated Parameters for Plate
WQ Orifice Area per Row = 7.431E-03 ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00							
Orifice Area (sq. inches)	1.07							

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

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = 3.00 Not Selected ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = 4.39 Not Selected ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height = 1.50 Not Selected inches
Vertical Orifice Width = 1.25 Not Selected inches

Calculated Parameters for Vertical Orifice
Zone 2 Rectangular Not Selected
Vertical Orifice Area = 0.01 Not Selected ft²
Vertical Orifice Centroid = 0.06 Not Selected feet

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

Overflow Weir Front Edge Height, H_o = 4.75 Not Selected ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = 2.92 Not Selected feet
Overflow Weir Grate Slope = 4.00 Not Selected H:V
Horiz. Length of Weir Sides = 5.67 Not Selected feet
Overflow Grate Type = Close Mesh Grate Not Selected
Debris Clogging % = 50% Not Selected %

Calculated Parameters for Overflow Weir
Zone 3 Weir Not Selected
Height of Grate Upper Edge, H_u = 6.17 Not Selected feet
Overflow Weir Slope Length = 5.84 Not Selected feet
Grate Open Area / 100-yr Orifice Area = 4.30 Not Selected
Overflow Grate Open Area w/o Debris = 13.50 Not Selected ft²
Overflow Grate Open Area w/ Debris = 6.75 Not Selected ft²

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

Depth to Invert of Outlet Pipe = 3.00 Not Selected ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = 24.00 Not Selected inches
Restrictor Plate Height Above Pipe Invert = 24.00 Not Selected inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Zone 3 Restrictor Not Selected
Outlet Orifice Area = 3.14 Not Selected ft²
Outlet Orifice Centroid = 1.00 Not Selected feet
Half-Central Angle of Restrictor Plate on Pipe = 3.14 Not Selected radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 5.70 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 40.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway
Spillway Design Flow Depth = 0.30 feet
Stage at Top of Freeboard = 7.00 feet
Basin Area at Top of Freeboard = 0.36 acres
Basin Volume at Top of Freeboard = 1.19 acre-ft

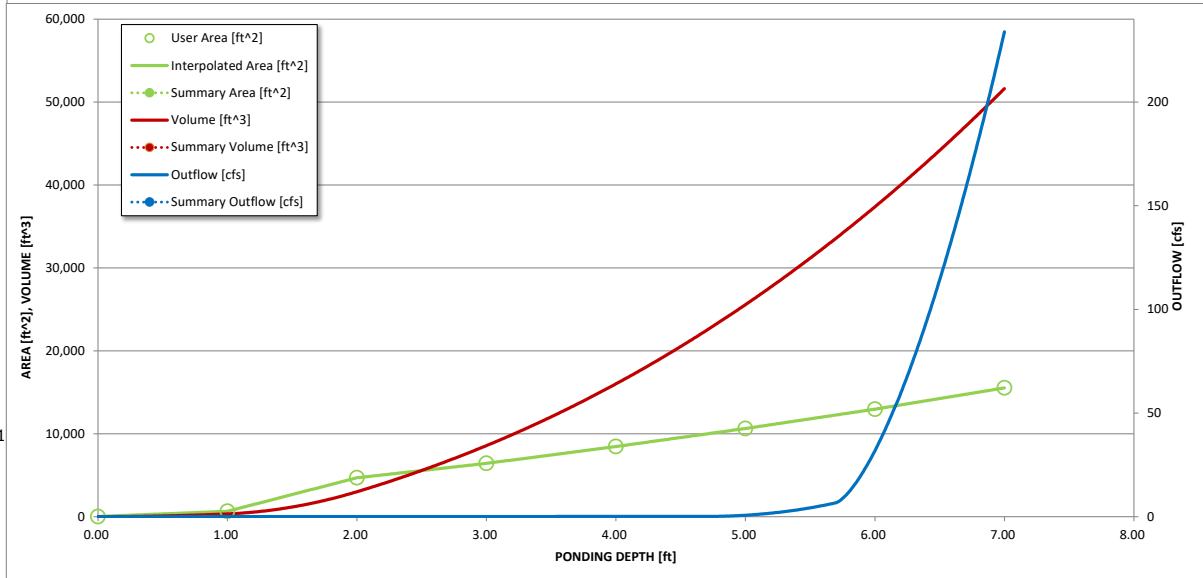
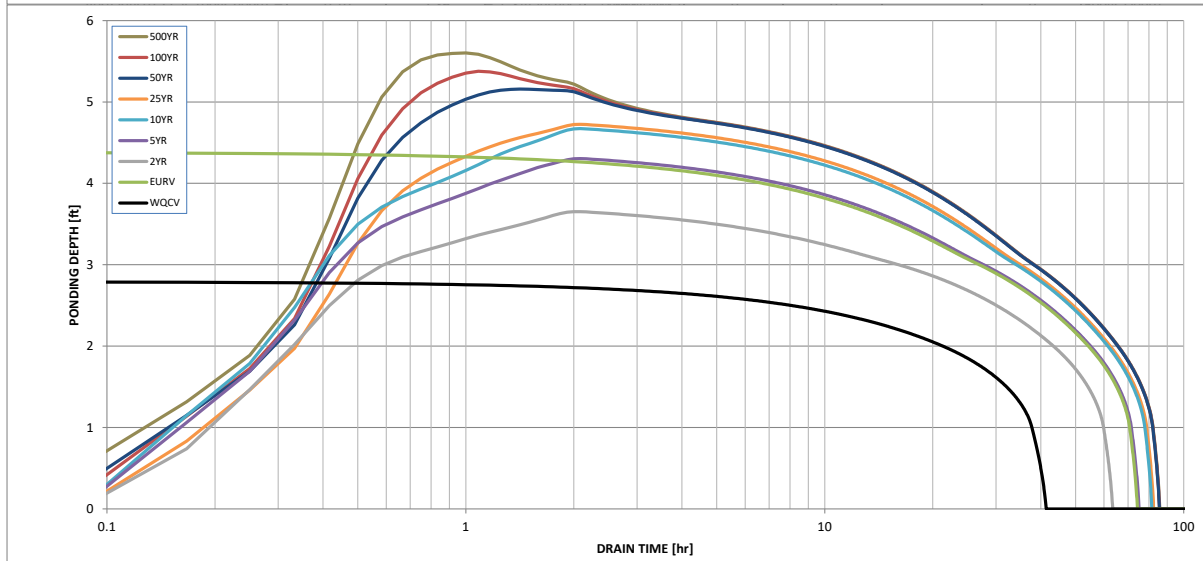
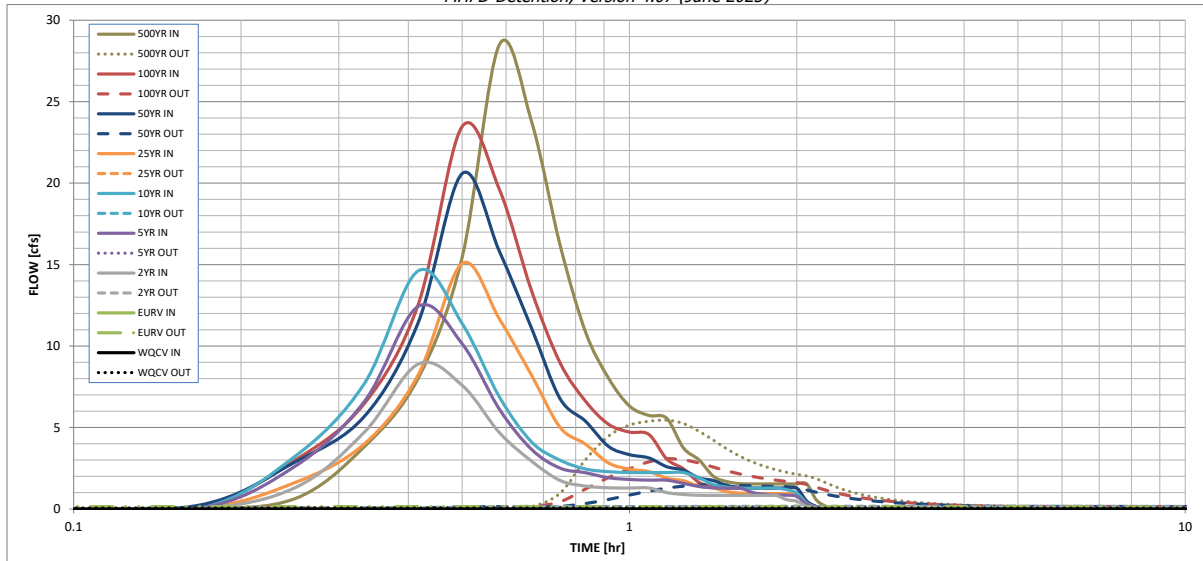
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	N/A	N/A	1.06	1.43	1.66	1.69	2.26	2.60	3.14
CUHP Runoff Volume (acre-ft) =	0.167	0.446	0.318	0.448	0.531	0.543	0.748	0.872	1.067
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.318	0.448	0.531	0.543	0.748	0.872	1.067
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.1	3.6	4.9	5.7	9.8	12.6	16.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.21	0.72	0.98	1.13	1.95	2.52	3.29
Peak Inflow Q (cfs) =	N/A	N/A	8.9	12.4	14.6	15.1	20.6	23.5	28.5
Peak Outflow Q (cfs) =	0.1	0.1	0.1	0.1	0.2	0.2	1.5	3.1	5.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.0	0.0	0.0	0.2	0.2	0.3
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	0.1	0.2	0.4
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	69	59	70	75	76	78	77	75
Time to Drain 99% of Inflow Volume (hours) =	40	72	62	73	79	80	82	82	81
Maximum Ponding Depth (ft) =	2.80	4.39	3.65	4.30	4.67	4.73	5.16	5.38	5.60
Area at Maximum Ponding Depth (acres) =	0.14	0.21	0.18	0.21	0.23	0.23	0.25	0.26	0.28
Maximum Volume Stored (acre-ft) =	0.168	0.447	0.303	0.428	0.509	0.521	0.624	0.681	0.743

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)



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

Extended Detention Basin (EDB)

SCM Design, Version 4.02 (June 2025)

Designer:

MAB

Company:

COLLINS ENGINEERS, INC

Date:

April 16, 2026

Project:

HEROES HALL

Location:

CASTLE ROCK, CO

Outfall ID:

A-1

1. Inlet and Forebay

A) Is RPA (GB/GS) used for Runoff Reduction upstream of SCM?

NO

Define inflow points for all areas tributary to the SCM below.

B) Inflow Points contributing to SCM (max 8)

Inflow Design Point ID	1						
Tributary Area to Inflow Point (ft ²)	185,130						
Imperviousness above Inflow Point (%)	75.0%						
Default WQCV for Inflow Point (ft ³)	4,621						
Optional Override WQCV for Inflow Point (ft ³)	7,318						
WQCV Reduction above Inflow Point (ft ³)	0						
Remaining WQCV at Inflow Point (ft ³)	7,318						
Will pretreatment be provided with a Sedimentation MTD (HDS)	NO						
Paired Pretreatment HDS Worksheet Name	--						
Sheet or Concentrated Flow	Conc						

C) Sheet Flow

Select sheet flow inflow feature	--						
Is Concrete Edger used?	--						
Spacing between slots, recommend ≤ 2 ft on center (ft)	--						
Slot Opening Length, recommend 1.5 (in)	--						
Select type of blind swale used to distribute flow	--						
Select energy dissipation method for level spreader	--						
Height of drop, recommend 2 to 3 (in)	--						
Is concrete mowing strip provided to facilitate maintenance?	--						

D) Concentrated Flow

Select concentrated flow inflow feature	Pipe						
Is downspout extension needed to bridge backfill zone?	--						
Depth of gutter flow line depression for curb opening, recommend 3 (in)	--						
Curb opening inlet width (ft)	--						
Height of drop to sediment pad/forebay, recommend ≥ 1 (in)	--						
Select energy dissipation method for downspouts and/or curb openings.	--						
Select energy dissipation method for swales, channels, and piped outfalls	Impact						

v) Forebay

Impervious area tributary to concentrated inflow location (ft ²)	138,848						
Forebay Type (Concrete Sediment Pad sufficient for Imp Area ≤ 2 acre)	Forebay						
Minimum Forebay Volume (ft ³)	73						
Design Forebay Volume (ft ³)	120						
Maximum Forebay Depth (in)	15.00						
Design Forebay Depth (in)	18.00						
Rectangular Weir Notch Width to Empty Forebay in 5-minutes (in)	1.23						
Design Notch Width (in)	1.50						
Forebay Drain Time (minutes)	4.1						



Nyloplast Inlet Capacity Table

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

Input	
Type of Grate	18" Pedestrian
Head (ft)	0.5
Properties	
Orifice Flow Area (in)	87.29
Orifice Flow Area (ft)	0.60
Weir Flow Perimeter (in)	51.92
Weir Flow Perimeter (ft)	4.33
Solution	
Capacity (cfs)	2.05
Capacity (gpm)	919.96

2.05 X2 = 4.10 CFS

STM IN-1 and STM IN-2 BASIN B-1
+ B-2 + O-1 Q100 = 3.94 CFS

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

$C = 3.33$ Weir Discharge Coefficient

L = Perimeter of Grate Opening (ft)

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

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

$C = 0.60$ Orifice Discharge Coefficient

A = Area of the Orifice (ft²)

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

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

REV 2.1.21

INLET MANAGEMENT

Worksheet Protected

INLET NAME	STM IN-4	STM IN-5	STM IN-6
Site Type (Urban or Rural)	URBAN		URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows			
Minor Q_{Known} (cfs)	2.0	3.6	2.8
Major Q_{Known} (cfs)	4.4	7.9	5.7

Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.			
Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
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

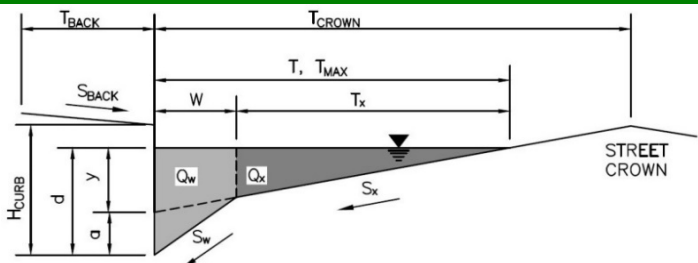
Minor Total Design Peak Flow, Q (cfs)	2.0	3.6	2.8
Major Total Design Peak Flow, Q (cfs)	4.4	7.9	5.7
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A

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

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

Project: Heroes Hall

Inlet ID: STM IN-4



Gutter Geometry:

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

$T_{BACK} = 0.0$ ft
 $S_{BACK} = 0.050$ ft/ft
 $n_{BACK} = 0.018$

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

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 11.0$ ft
 $W = 2.00$ ft
 $S_x = 0.045$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm
$T_{MAX} =$	11.0	11.0
$d_{MAX} =$	6.0	6.0

ft
inches

☐ ☐

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

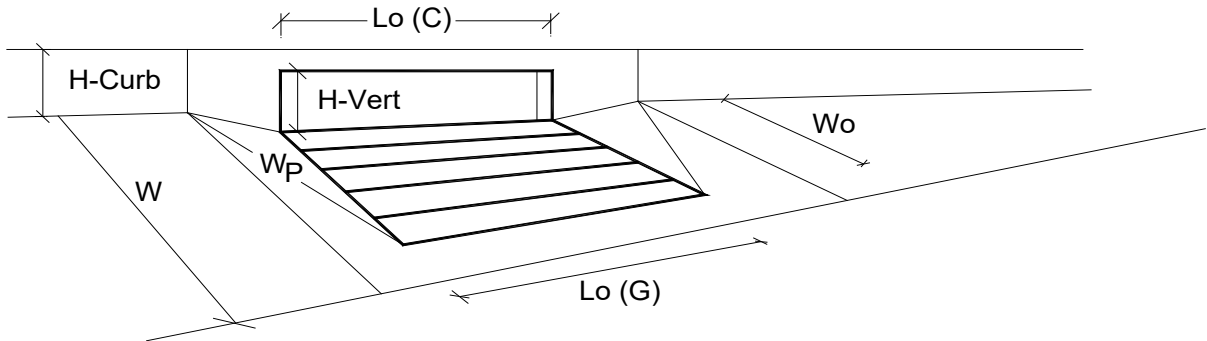
$Q_{allow} =$

Minor Storm	Major Storm
SUMP	SUMP

 cfs

INLET IN A SUMP OR SAG LOCATION

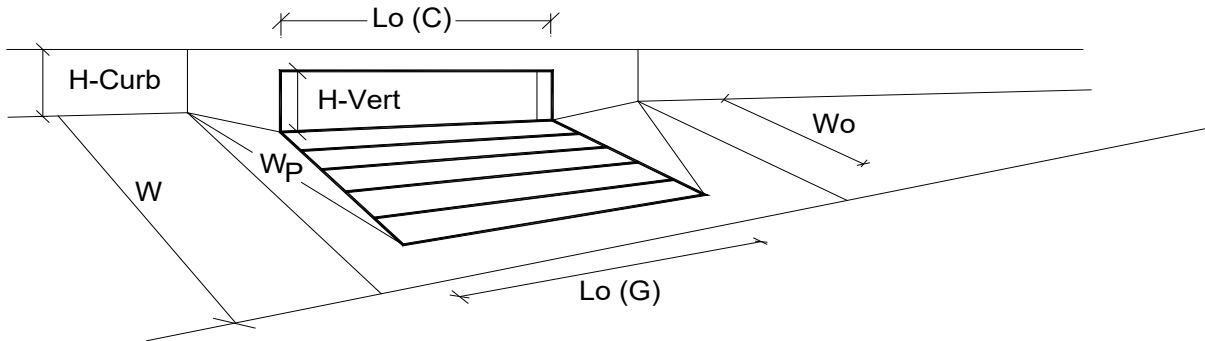
MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a _{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	2	2	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	4.0	5.0	inches
<u>Grate Information</u>			MINOR	MAJOR	☒ Override Depths
Length of a Unit Grate		L _o (G) =	N/A	N/A	feet
Width of a Unit Grate		W _o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C _f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C _w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C _o (G) =	N/A	N/A	
<u>Curb Opening Information</u>			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		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	
<u>Low Head Performance Reduction (Calculated)</u>			MINOR	MAJOR	
Depth for Grate Midwidth		d _{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d _{Curb} =	0.17	0.25	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	0.79	0.87	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _a =	2.5	5.0	cfs
		Q _{PEAK REQUIRED} =	2.0	4.4	cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



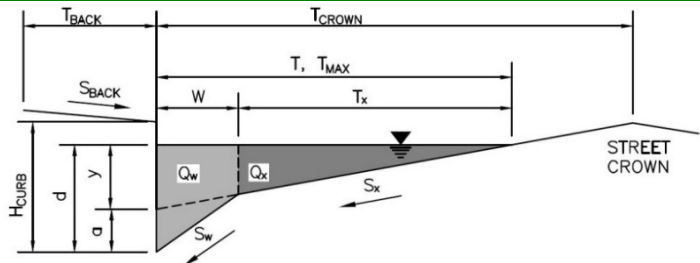
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a _{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	2	2	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	4.6	6.0	inches
<u>Grate Information</u>			MINOR	MAJOR	☒ Override Depths
Length of a Unit Grate		L _o (G) =	N/A	N/A	feet
Width of a Unit Grate		W _o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C _f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C _w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C _o (G) =	N/A	N/A	
<u>Curb Opening Information</u>			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		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	
<u>Low Head Performance Reduction (Calculated)</u>			MINOR	MAJOR	
Depth for Grate Midwidth		d _{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d _{Curb} =	0.22	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	0.84	0.93	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _a =	3.9	8.3	cfs
		Q _{PEAK REQUIRED} =	3.6	7.9	cfs

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

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

Project: Heroes Hall

Inlet ID: STM IN-6



Gutter Geometry:

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

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

$T_{BACK} = 0.0$ ft
 $S_{BACK} = 0.050$ ft/ft
 $n_{BACK} = 0.018$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 10.0$ ft
 $W = 2.00$ ft
 $S_x = 0.050$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm
$T_{MAX} =$	10.0	10.0
$d_{MAX} =$	6.0	6.0
	☐	☐

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

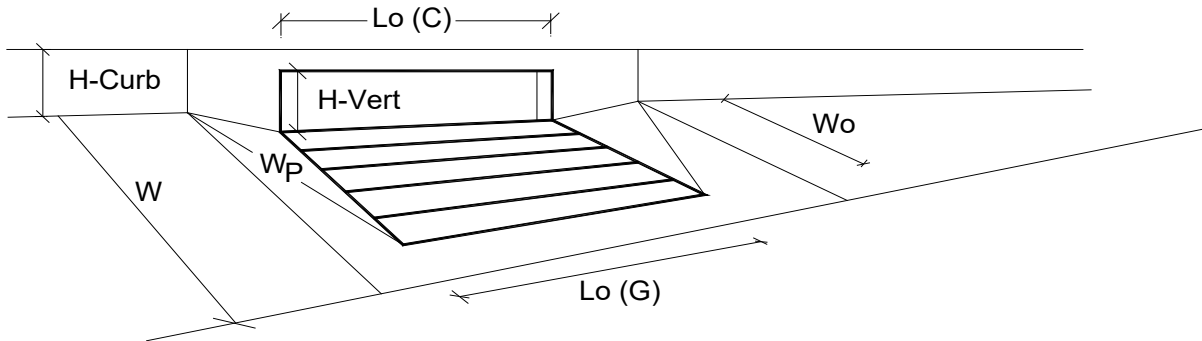
$Q_{allow} =$

Minor Storm	Major Storm
SUMP	SUMP

 cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a _{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	2	2	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	4.3	5.3	inches
<u>Grate Information</u>			MINOR	MAJOR	☒ Override Depths
Length of a Unit Grate		L _o (G) =	N/A	N/A	feet
Width of a Unit Grate		W _o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C _f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C _w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C _o (G) =	N/A	N/A	
<u>Curb Opening Information</u>			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		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	
<u>Low Head Performance Reduction (Calculated)</u>			MINOR	MAJOR	
Depth for Grate Midwidth		d _{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d _{Curb} =	0.19	0.28	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	0.81	0.89	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _a =	3.2	5.9	cfs
		Q _{PEAK REQUIRED} =	2.8	5.7	cfs

Channel Report

100 YR Peak Outflow through 24 inch Outfall Pipe

Circular

Diameter (ft) = 2.00

Invert Elev (ft) = 6240.91

Slope (%) = 2.00

N-Value = 0.012

Calculations

Compute by: Known Q

Known Q (cfs) = 23.50

Highlighted

Depth (ft) = 1.21

Q (cfs) = 23.50

Area (sqft) = 1.99

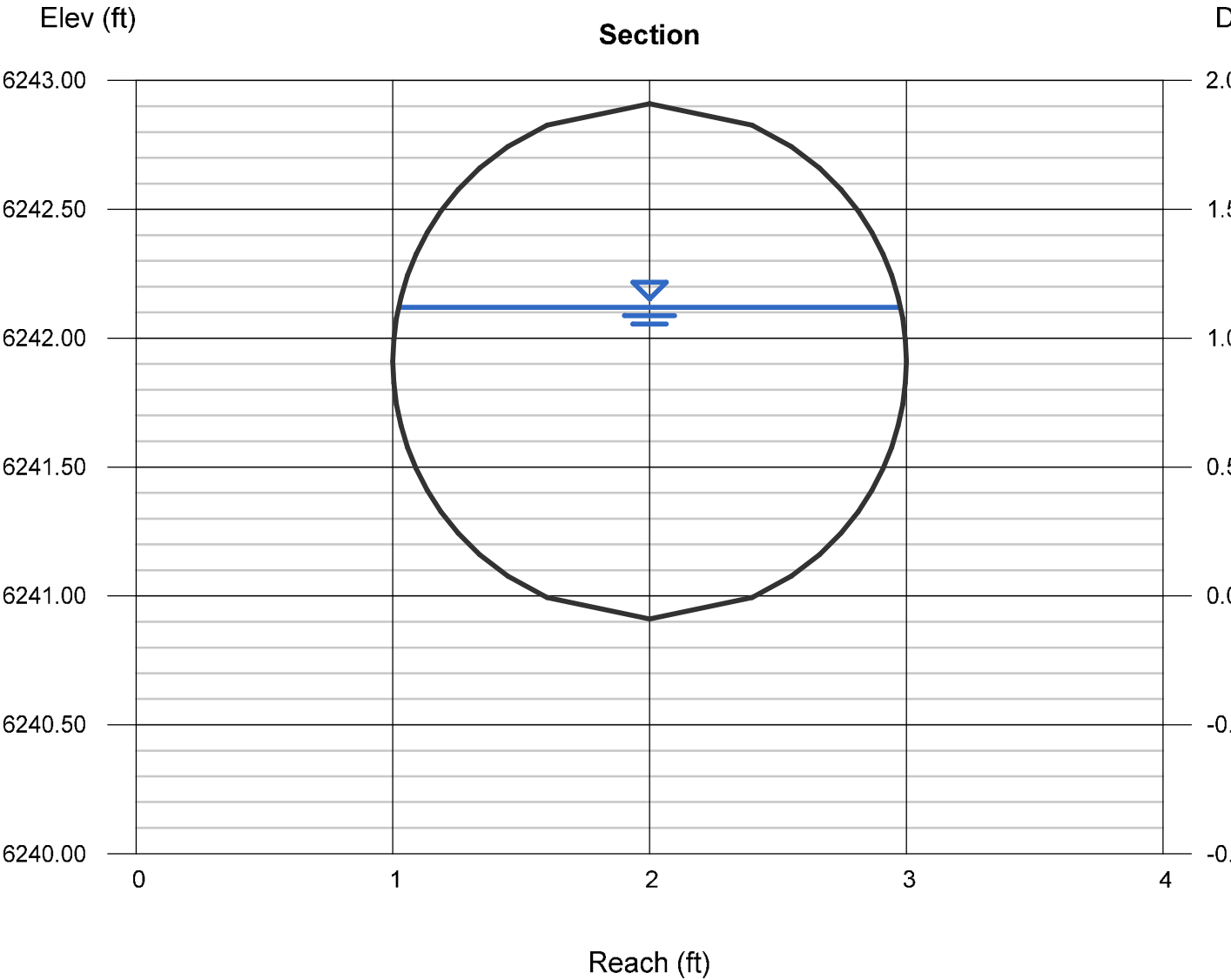
Velocity (ft/s) = 11.79

Wetted Perim (ft) = 3.57

Crit Depth, Yc (ft) = 1.73

Top Width (ft) = 1.95

EGL (ft) = 3.37

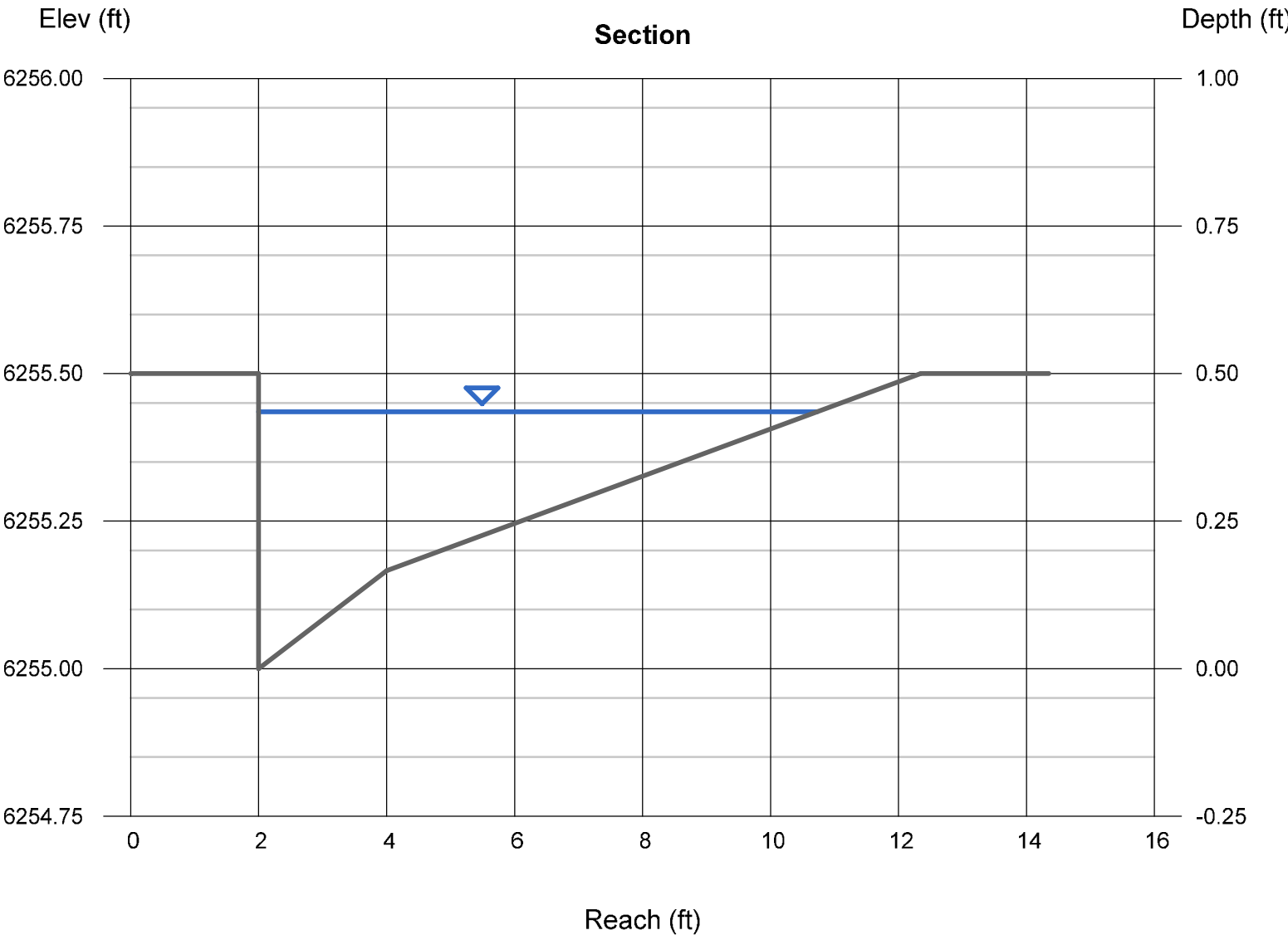


Channel Report

100 YR Curb and Gutter Capacity

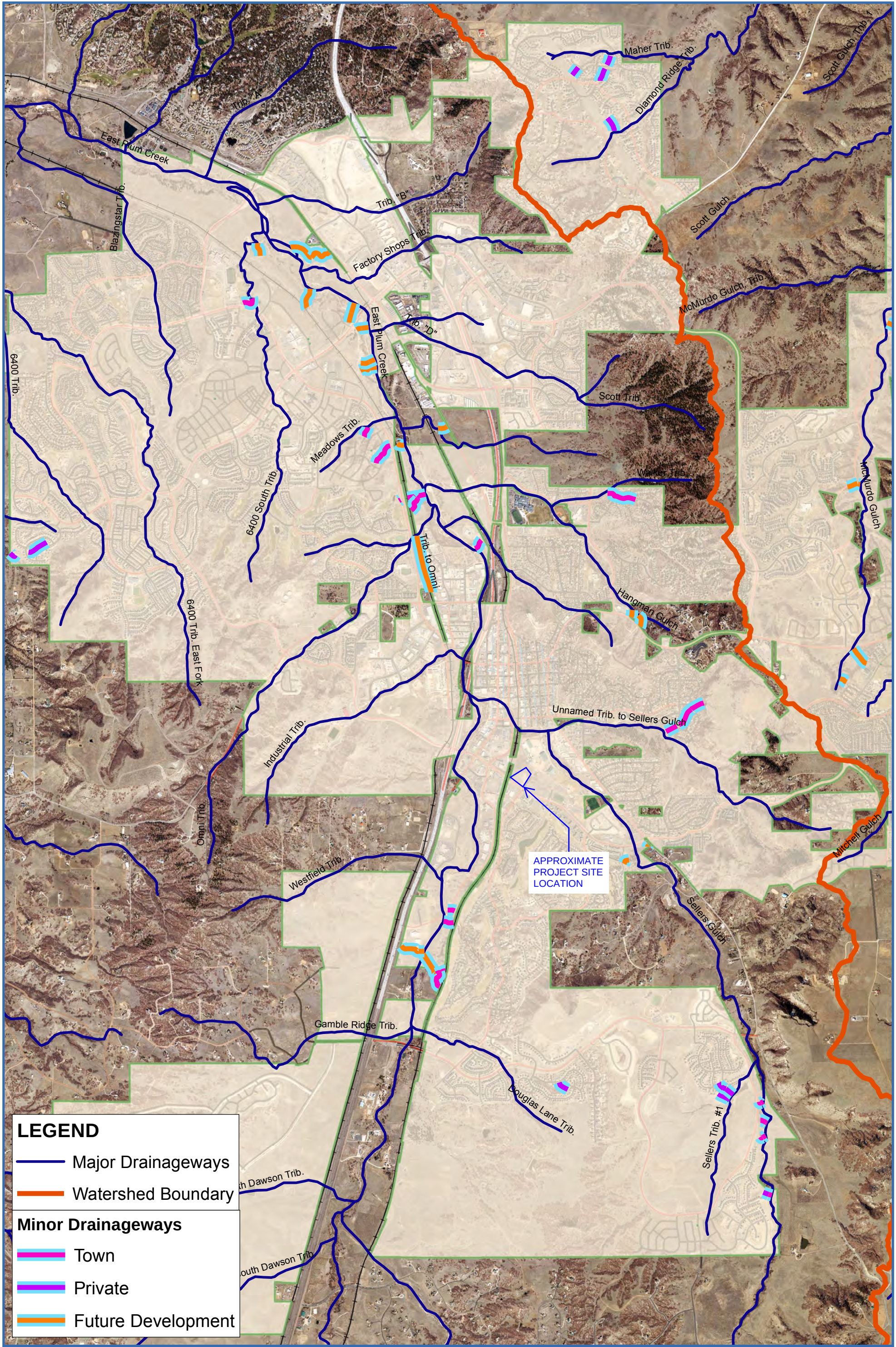
Gutter		Highlighted	
Cross SI, Sx (ft/ft)	= 0.040	Depth (ft)	= 0.43
Cross SI, Sw (ft/ft)	= 0.083	Q (cfs)	= 7.880
Gutter Width (ft)	= 2.00	Area (sqft)	= 1.61
Invert Elev (ft)	= 6255.00	Velocity (ft/s)	= 4.90
Slope (%)	= 1.00	Wetted Perim (ft)	= 9.17
N-Value	= 0.012	Crit Depth, Yc (ft)	= 0.56
Calculations		Spread Width (ft)	= 8.72
Compute by:		EGL (ft)	= 0.81
Known Q (cfs)			
= 7.88			

BASINS C-2 + O-3



APPENDIX D

Drainage Maps



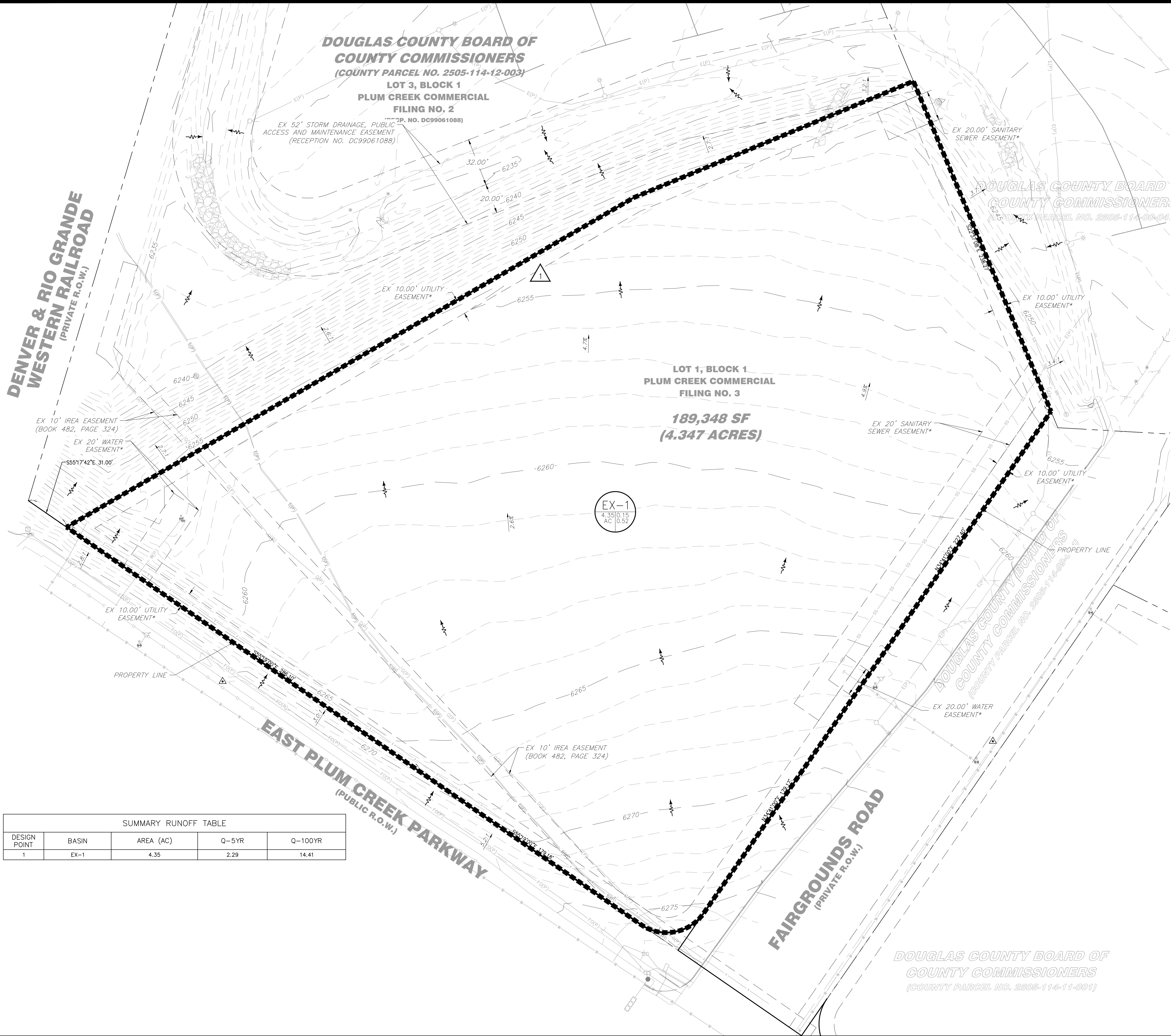
1 inch = 3,000 feet



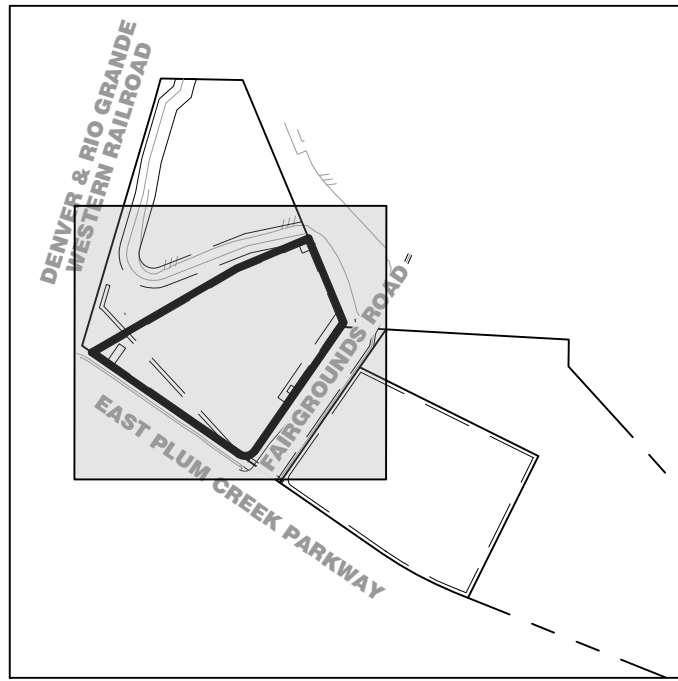
Disclaimer: The data presented has been compiled from various sources, each of which introduces varying degrees of inaccuracies or inconsistencies. Such discrepancies in data are inherent and in supplying this product the Town of Castle Rock assumes no liability for its use or accuracy. Questions or comments regarding the cartographic composition of this map including, but not limited to, errors, omissions, corrections, and/or updates, should be directed to the Utilities Department, Town of Castle Rock, (720) 733-6087. Copyright 2012, Town of Castle Rock Utilities Mapping.

**MINOR DRAINAGEWAY
LONG-TERM CAPITAL PLAN
PLUM CREEK BASIN**

P:\25-CO\16346-Heroes Hall - Douglas County\DWG\Plans\16346 EX Drainage Plan.dwg, 4/19/2028 1:11:20 PM, maddalyn bechard



SUMMARY RUNOFF TABLE				
DESIGN POINT	BASIN	AREA (AC)	Q-5YR	Q-100YR
1	EX-1	4.35	2.29	14.41



KEYMAP
SCALE: 1"=500'

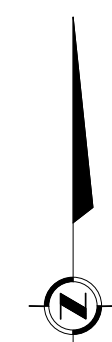
EXISTING	LEGEND	PROPOSED
	PROPERTY LINE	
	RIGHT-OF-WAY LINE	
	EASEMENT LINES	
	CATCH CURB & GUTTER	
	SPILL CURB & GUTTER	
	CONTOURS	
	CONCRETE PAVEMENT	
	ASPHALT PAVEMENT	
	BUILDINGS	
	ACCESSIBLE ROUTE	
	RETAINING WALL	
	STORM SEWER	

BASIN LEGEND	
A = BASIN DESIGNATION	
B = AREA IN ACRES	
C = 5-YR "C"	
100-YR "C"	
DESIGN POINT DESIGNATION	
PROPOSED BASIN BOUNDARY	
EXISTING BASIN DELINEATION	
PROPERTY LINE	
EXISTING CONTOURS	
PROPOSED CONTOURS	
FLOW ARROW	
OVERFLOW ARROW	

EXISTING UTILITY LOCATIONS:
COLLINS ENGINEERS INC. ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS (HORIZONTAL OR VERTICAL). THE EXISTING UTILITIES SHOWN ON THIS DRAWING HAVE BEEN PLOTTED FROM THE BEST AVAILABLE INFORMATION. IT IS HOWEVER THE RESPONSIBILITY OF THE CONTRACTOR TO FIELD VERIFY THE LOCATION OF ALL UTILITIES PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES.

NOTES:
*RECEPTION NO. 99061088

ABBREVIATIONS:
CO = CLEANOUT
FB = FOREBAY
FES = FLARED END SECTION
IN = INLET
JUNC = JUNCTION
STM = STORM
STRC = STRUCTURE
OUT = OUTLET



SCALE: 1" = 30'
30 15 12 8 5 2 0 10 20 30

COLLINS ENGINEERS^{PC}

811

Know what's below.
Call before you dig.

REV. NO.

DATE

REVISIONS DESCRIPTION

TOOR SDP SUBMITTAL #1 COMMENTS

1

2026-04-17

1

2026-04-17

2

2026-04-17

3

2026-04-17

4

2026-04-17

5

2026-04-17

6

2026-04-17

7

2026-04-17

EXISTING DRAINAGE PLAN

CONSTRUCTION DOCUMENTS

HEROES HALL

595 FAIRGROUNDS ROAD

CASTLE ROCK, COLORADO

2026

drawn by:

checked by:

approved by:

QA/QC by:

project no.:

drawing no.:

date:

25-16346

11/21/2025

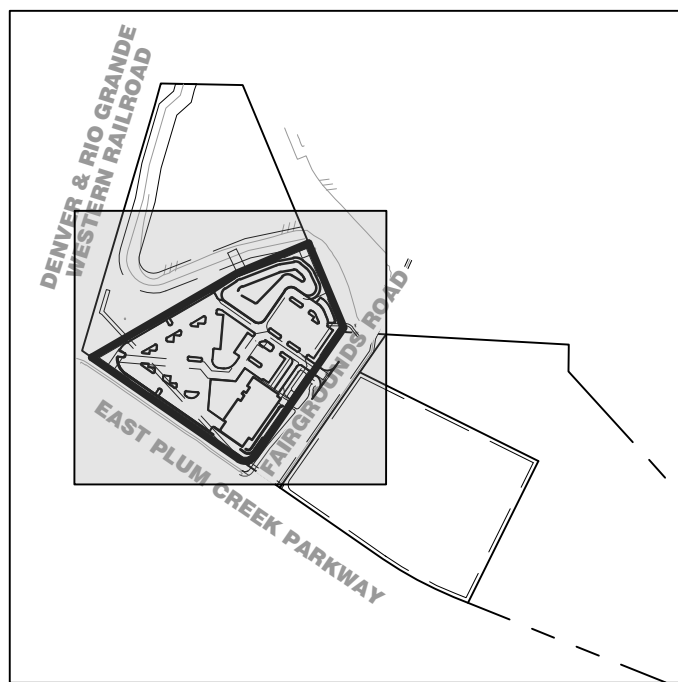
CX.0

P:\25-CO\16346-Heroes Hall - Douglas County\Work\DWG\Plans\16346 Drainage Plan.dwg, 4/19/2026 1:47:00 PM, maddym bechard

DENVER & RIO GRANDE
WESTERN RAILROAD
(PRIVATE R.O.W.)

SUMMARY RUNOFF TABLE				
DESIGN POINT	BASIN	AREA (AC)	Q-5YR	Q-100YR
1	A-1	0.57	1.00	3.14
2	B-1	0.20	0.20	0.95
3	B-2	0.32	1.28	2.49
4	B-3	0.10	0.26	0.65
5	C-1	0.77	2.01	4.41
6	C-2	1.21	3.53	7.37
7	D-1	0.82	2.78	5.70
8	O-1	0.11	0.08	0.50
9	O-2	0.02	0.02	0.10
10	O-3	0.13	0.10	0.60
11	O-4	0.13	0.10	0.62
12	O-5	0.22	0.20	1.07
13	O-6	0.18	0.51	1.19

SUMMARY OF WATER QUALITY CONFORMANCE TO MS4 PERMIT		
CATEGORY	BASIN	AREA (AC)
TOTAL ONSITE TREATED	A-1 THROUGH D-1	3.99
TOTAL ONSITE NOT TREATED	O-4, O-5	0.36
TOTAL ONSITE AREA		4.35
TOTAL ONSITE DISTURBED AREA NOT TREATED (%)		8.28
ADDITIONAL OFFSITE TREATED	O-1, O-2, O-3	0.26
OFFSITE NOT TREATED	O-6	0.18



KEYMAP
SCALE: 1"=500'

EXISTING	LEGEND	PROPOSED
---	PROPERTY LINE	---
---	RIGHT-OF-WAY LINE	---
---	EASEMENT LINES	---
---	CATCH CURB & GUTTER	---
---	SPILL CURB & GUTTER	---
---	CONTOURS	---
---	CONCRETE PAVEMENT	---
---	ASPHALT PAVEMENT	---
---	BUILDINGS	---
---	ACCESSIBLE ROUTE	---
---	RETAINING WALL	---
---	STORM SEWER	---
---	STREET INLET	---
---	LANDSCAPE INLET	---
---	FLOW ARROW	---
---	SPOT ELEVATION	---
---	SLOPE	---
---	SIGN	---
---	FIRE HYDRANT	---

BASIN LEGEND

A = BASIN DESIGNATION	A
B = AREA IN ACRES	B
C = 5-YR "C"	C
100-YR "C"	C

DESIGN POINT DESIGNATION	1
PROPOSED BASIN BOUNDARY	---
EXISTING BASIN DELINEATION	---
PROPERTY LINE	---
EXISTING CONTOURS	---
PROPOSED CONTOURS	---
FLOW ARROW	---
OVERFLOW ARROW	---

EXISTING UTILITY LOCATIONS:
COLLINS ENGINEERS INC. ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS (HORIZONTAL OR VERTICAL). THE EXISTING UTILITIES SHOWN ON THIS DRAWING HAVE BEEN PLOTTED FROM THE BEST AVAILABLE INFORMATION. IT IS HOWEVER THE RESPONSIBILITY OF THE CONTRACTOR TO FIELD VERIFY THE LOCATION OF ALL UTILITIES PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES.

NOTES:
*RECEPTION NO. 99061088

ABBREVIATIONS:
CO = CLEANOUT
FB = FOREBAY
FES = FLARED END SECTION
IN = INLET
JUNC = JUNCTION
STM = STORM
STRC = STRUCTURE
OUT = OUTLET



SCALE: 1" = 30'
30 15 12 8 5 2 0 10 20 30

COLLINS
ENGINEERS^{PC}

465 Sherman Street, Suite 160
Castle Rock, CO 80108
voice: (303) 447-0090
fax: (312) 882-2276
web: collinsengr.com



REV.	NO.	DATE	DESCRIPTION	REVISIONS
1	2026-04-17	TOOR SDP	SUBMITTAL #1	COMMENTS
2				
3				
4				
5				
6				
7				

PROPOSED DRAINAGE PLAN

CONSTRUCTION DOCUMENTS
HEROES HALL
595 FAIRGROUNDS ROAD

CASTLE ROCK, COLORADO

drawn by: _____
checked by: _____
approved by: _____
QA/QC by: _____
project no.: 25-16346
drawing no.: _____
date: 11/21/2025

CX.1