



**PHASE II DRAINAGE REPORT
FOR
DAWSON TRAILS – FILING 2, TRACT V**

Castle Rock, Colorado
Town of Castle Rock Project SDP25-0004

January 22, 2025 (drainage letter)
Revised: October 8, 2025
Revised: May 12, 2026

EMK Job. No. 13477

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Reserved for Future Submittals

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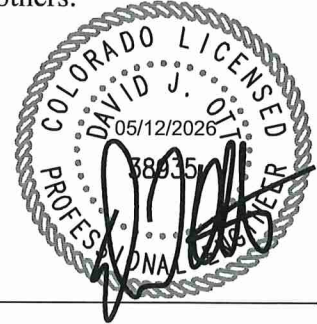
Checklist
Pond C1 Design (by others)
Variance Request

Map Pocket (paper copy) or Electronic Plan Layouts

Developed Layout

CERTIFICATION STATEMENT

I affirm that this report and plan for the Phase II drainage design of Dawson Trails, Filing 2, Tract V 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.



SIGNATURE: _____

David J. Ott

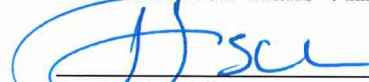
Registered Professional Engineer

State of Colorado No. 38935

For and on behalf of EMK Consultants, Inc.

ACM Dawson Trails VIII JV LLC hereby certifies that the drainage facilities for Dawson Trails Filing 2, Tract V shall be constructed according to the design presented in this report. I understand that the Town of Castle Rock does not and will not assume liability for the drainage facilities designed and/or certified by my engineer, and that the Town of Castle Rock reviews drainage plans pursuant to the Municipal Code; but cannot, on behalf of Dawson Trails Filing 2, Tract V, guarantee that final drainage design review will absolve ACM Dawson Trails VIII JV LLC and/or their successors and/or assigns of future liability for improper design.”

ACM Dawson Trails VIII JV LLC



Authorized Signature

I. General Location and Description

The purpose of this drainage report is to document drainage design calculations and decision making for Dawson Trails – Filing 2, Tract V (herein referred to as the site).

A. Site Location

Filing 2, Tract V of Dawson Trails is located west of Interstate 25, just south of the proposed Crystal Valley Interchange. More specifically, it is located in the southwest quarter of Section 22 and northwest Quarter of Section 27, Township 8 South, Range 67 West of the 6th Principal Meridian in the Town of Castle Rock. A site location map is included in Appendix A.

B. Description of Property

The site covers approximately 8.4 acres. Native grasses cover the area which drains to the east towards Plum Creek. NRCS soil maps indicate that the site is covered by Fondis-Kutch soil (HSG C) on the western portions and Sampson Loam (HSG B) on the eastern side. No floodplains or significant geologic features exist on the site.

The proposed land use consists of approximately 100 townhomes and associated amenity space. A sitewide imperviousness of 70% is used for all calculations.

II. Drainage Basins and Sub Basins

A. Major Drainage Basins

The stormwater facilities in this area of Dawson Trails area were previously studied by a Town of Castle Rock in a master plan. The master plan is:

- *Gambel Ridge and Douglas Lane Tributary Watersheds Master Plan*, prepared by RESPEC 2013.

All runoff from the site discharges to the Gambel Ridge Tributary. Runoff from the site passes through a regional full spectrum Extended Detention Basin (EDB) named Pond C1, constructed in a separate project before discharging into the Gambel Ridge drainage. The Filing 2 Drainage Report (CD23-0045) lists the project area as Basin C1.0 (and in some cases C-1). This basin's peak runoff increases from $Q_{100} = 58.5$ cfs without development to $Q_{100} = 137$ cfs with development. Basin C1.0 covers 35.2 acres.

B. Minor Drainage Basins

Streets and lots will create minor basins that will be captured in storm sewer. Runoff from the site will be directed via storm sewer towards Pond C1 northeast of the site, which will discharge north into the Gambel Ridge tributary. The drainage map at the end of the report includes peak discharge summaries for each minor basin. Detailed minor basin descriptions are included in Section V.A – Stormwater Management Facility Design. See Appendix A for hydrologic calculations.

III. Drainage Design Criteria

A. Regulations

Drainage improvements were designed in accordance with the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual (SDDTCM), February 2025. The Mile High Flood District's (MHFD) Urban Storm Drainage Criteria Manual (USDCM), March 2024, was used.

B. Drainage Studies, Master Plans, Site Constraints

The Phase III Drainage Report for Dawson Trails Filing 2 covers the overall site design for this project. This project fits within the framework of Filing 2. In addition, the Filing 2 Amendment 3 project constructs drainage improvements that tie into this project. These improvements are discussed further in section IV.A of this report.

The stormwater facilities in the Dawson Trails area were previously studied by a Town of Castle Rock a master plan. The master plan is:

- *Gambel Ridge and Douglas Lane Tributary Watersheds Master Plan*, prepared by RESPEC 2013.

C. Hydrology

Runoff for the storm sewer design was calculated using the Rational Method. The 5-year storm was used as the minor storm and the 100-yr storm was evaluated for the major storm. See Appendix A for hydrologic calculations. A sitewide imperviousness of 70% is used for calculations per the latest USDCM imperviousness documentation.

D. Hydraulics

Inlet capacities will be calculated using the latest MHFD-Inlet software.

Type 16 combination inlets are proposed for all inlets because the private streets that are part of this project most closely match drainage classification A streets.

E. Storage and Water Quality Enhancement

Detention and water quality for the site are provided by an extended detention basin (EDB). Regional water quality and detention infrastructure were developed for this area as part of the Crystal Valley Interchange Project. Pond C1 is a full spectrum EDB which will provide water quality, EURV and 100-yr volume.

Water quality enhancement can be thought of as a four-step process.

Step 1: Water quality enhancement starts with runoff reduction.

The project will try to reduce imperviousness area as much as possible. This project includes areas designated for parks and greenbelts.

Step 2: Provide detention for water quality capture volume and flood control via full spectrum detention.

Full-spectrum detention helps reduce the negative effects of urban development on flooding and stream degradation by capturing excess urban runoff and slowly releasing it. This helps reduce runoff peaks, improves water quality, and mimics historic runoff rates. This project drains to a full-spectrum detention pond.

Step 3: Implementation of stream stabilization.

This project does not utilize any stream stabilization as there are no streams within the project limits

Step 4: The final step is undertaking source control

This project does not plan on utilizing any source control techniques.

IV. Stormwater Management Facility Design

A. Stormwater Conveyance Facilities

Storm sewer will start in the central portion of the project at an area inlet. Two additional sets of inlets will capture runoff near the northeastern corner of the site. This storm sewer will tie in into storm sewer constructed with Filing 2, Amendment 3 near the intersection of Pat Haven Street and Quandary Peak Drive. An interceptor swale along with an associated inlet and piping will capture runoff along the western fringe of the project.

The Filing 2, Amendment 3 Drainage Report (F2A3 Report) analyzed the downstream discharge path capacity and assumptions to ensure conformance with the Filing 2 Drainage Report. The F2A3 report found a similar flowrate at design point 13E as compared to Filing 2 at design point 4C in the SWMM model. The imperviousness assumed with this report of 70% matches the F2A3 report.

Peak discharge summary tables are included below. Specific basin summaries follow the tables.

PEAK DISCHARGE SUMMARY

Developed Conditions - Pipe Flow

Design Point	Catchment(s)	Tributary Area (acres)	5-Year (cfs)	100-Year (cfs)
8E	E8	2.5	0.6	7.7
1T	T1	1.2	3.2	7.4
2T	DP 1T + T2	3.6	7.9	18.5
3T	DP 2T + T3	6.5	14.1	32.8
11E	E11	0.8	1.9	3.6
11Eb	E11b	0.7	1.8	3.3

PEAK DISCHARGE SUMMARY

Developed Conditions - Direct Runoff

Catchment	Tributary Area (acres)	5-Year (cfs)	100-Year (cfs)
E8	2.5	0.6	7.7
T1	1.2	3.2	7.4
T2	2.4	5.3	12.3
T3	2.9	6.5	15.3
E11	0.8	1.9	4.6
E11b	0.7	1.9	4.4

Basin T1 covers the central portion of the townhome development. An area inlet captures runoff from the central landscape area. Emergency overflow is via an open space northeast into Tract G, which is the street.

Basin T2 covers the southern portion of the townhome development. Type 16 on-grade inlets will capture runoff and convey it north to design point 3T. Emergency overflow is to the north in the street.

Basin T3 covers the northern portion of the townhome development. Type 16 sump inlets will capture runoff and convey in east into storm designed with Filing 2, Amendment 3. Emergency overflow is north into Quandary Peak Drive.

Basin E8 covers town open space areas to the west. A concrete interceptor swale is proposed along the western fringe of the site to capture runoff from Basin E8. Emergency overflow is to the east via a swale that runs along the southern fringe of the property.

Basins E11 and E11b capture runoff from the eastern portion of the townhome development. Details for these inlets are contained in the Filing 2 Amendment 3 Drainage Report.

B. Stormwater Storage Facilities

All runoff from the site is conveyed to full spectrum EDB Pond C1. A Pond C1 was designed and constructed with the Crystal Valley Interchange project by Jacobs Engineering Group. Runoff from Pond C1 discharges into the Gambel Ridge Tributary.

C. Water Quality Enhancement Control Measures

The site will drain to the regional detention Pond C1, which is an extended detention basin. Pond C1 will provide water quality enhancement.

D. Floodplain Modification

No regulatory floodplains exist within the project limits.

E. Geotechnical Investigation and Sub-surface Collection System Design

Subsurface collection systems will be installed along the edge of road as required by the town.

F. Operation and Maintenance

Maintenance of all offsite ponds will be the responsibility of a metro district or homeowner's association. This is covered in drainage reports for the surrounding areas.

G. Additional Permitting Requirements

There are no other permitting requirements for this project known at this time.

H. General

Relevant excerpts from the Pond C1 design are included.

V. Conclusions

A. Compliance With Standards

The proposed design complies with the Town's SDDTCM, and Chatfield Reservoir Control Regulation No. 73.

B. Variances

No variances are requested.

C. Drainage Concept

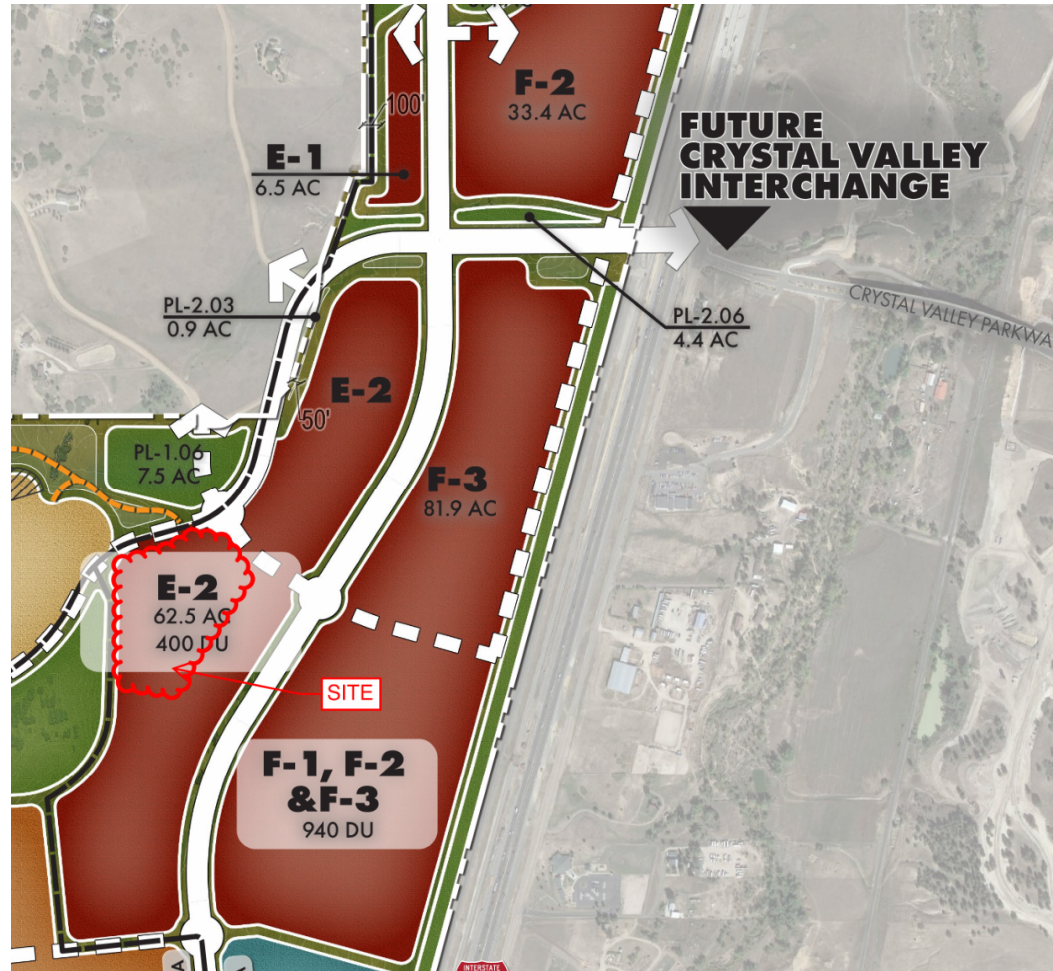
The proposed concept captures site runoff into inlets and pipes and safely conveys it to an existing major drainage system without damage to downstream properties.

VI. References

1. Town of Castle Rock Storm Drainage Design and Technical Criteria Manual, February 2025.
2. Town of Castle Rock Transportation Design Criteria Manual, December 2018.
3. Town of Castle Rock Stormwater Management Facility Operation and Maintenance (O&M) General Guidelines, December 2012. Accessed online at www.crgov.com/1796/Stormwater-Facility-Maintenance
4. Urban Storm Drainage Criteria Manual, Volumes 1-3, accessed online at www.mhfd.org, March 2024.
5. Stormwater Management Facility Operation and Maintenance (O&M) General Guidelines, Town of Castle Rock, 2012.
6. Dawson Trails Filing 2 Phase III Drainage Report, prepared by EMK Consultants, Inc. 2025.
7. Dawson Trails Filing 2 Amendment 3 Phase III Drainage Report, prepared by EMK Consultants, Inc, 2025.
8. Crystal Valley Interchange Package 2 Phase III Drainage Report, prepared by Jacobs Engineering Group, 2023.
9. Gambel Ridge and Douglas Lane Tributary Watershed Master Plan, prepared by RESPEC, August 2014.

DRAINAGE REPORT
for
DAWSON TRAILS - FILING 2, AMENDMENT 4

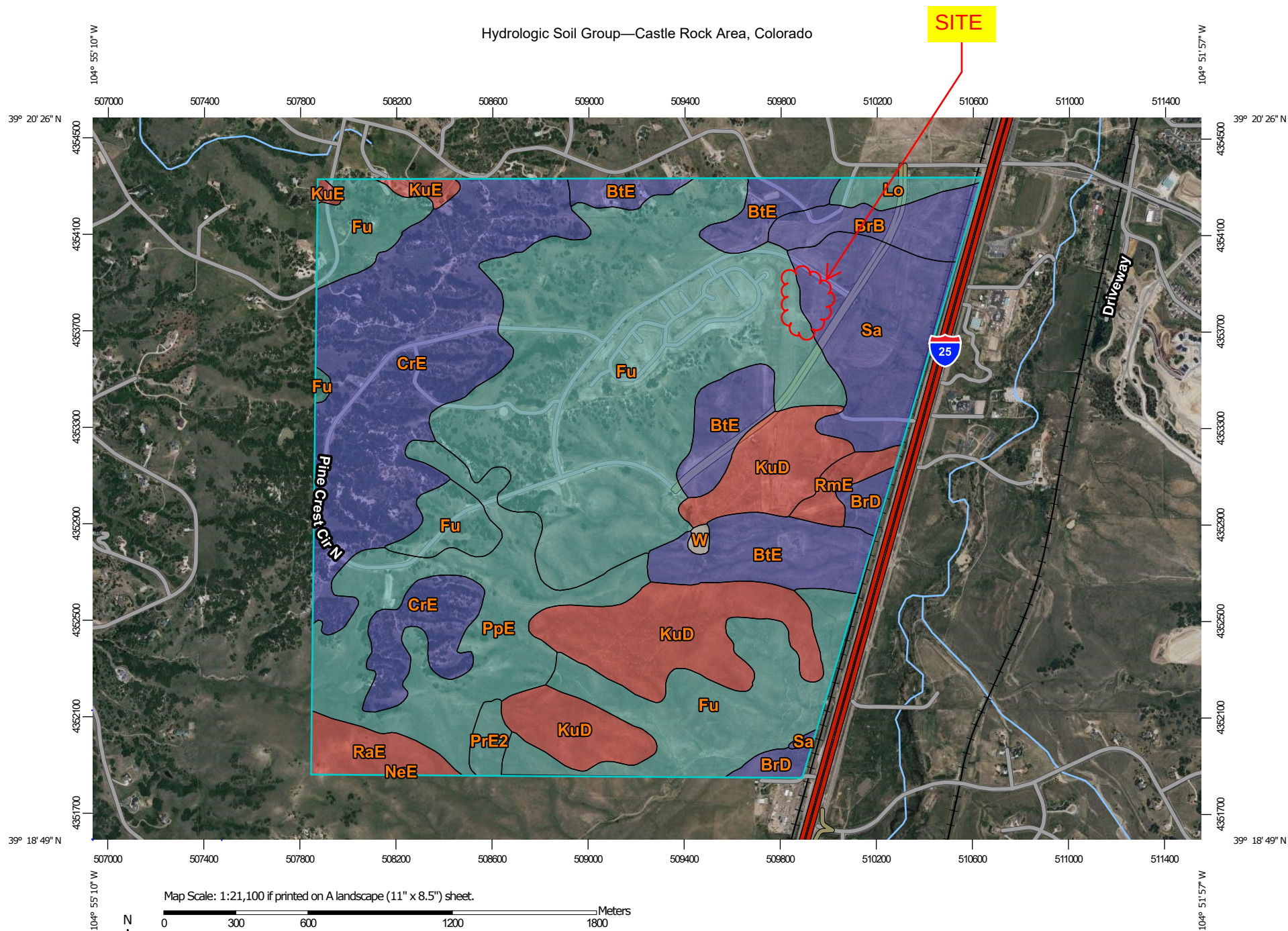
APPENDIX A
Hydrologic Computations



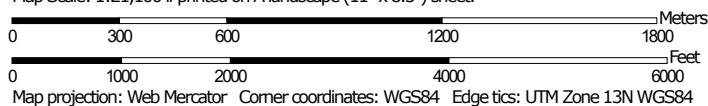
DAWSON TRAILS - FILING 2, AMENDMENT 4 SITE LOCATION MAP

(NTS)

Hydrologic Soil Group—Castle Rock Area, Colorado



Map Scale: 1:21,100 if printed on A landscape (11" x 8.5") sheet.



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

8/23/2023
Page 1 of 4

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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 15, Sep 1, 2022

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BrB	Bresser sandy loam, cool, 1 to 3 percent slopes	B	36.3	2.5%
BrD	Bresser sandy loam, cool, 5 to 9 percent slopes	B	17.0	1.2%
BtE	Bresser-Truckton sandy loams, 5 to 25 percent slopes	B	118.7	8.0%
CrE	Crowfoot-Tomah sandy loams, 5 to 25 percent slopes	B	270.2	18.3%
Fu	Fondis-Kutch association	C	544.7	36.8%
KuD	Kutch clay loam, 4 to 8 percent slopes	D	167.0	11.3%
KuE	Kutch clay loam, 8 to 20 percent slopes	D	7.8	0.5%
Lo	Loamy alluvial land	C	13.8	0.9%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	B	0.6	0.0%
PpE	Peyton-Pring-Crowfoot sandy loams, 5 to 25 percent slopes	C	152.6	10.3%
PrE2	Peyton-Pring-Crowfoot complex, 3 to 15 percent slopes, eroded	C	9.8	0.7%
RaE	Razor clay, 3 to 25 percent slopes	D	24.9	1.7%
RmE	Renohill-Buick complex, 5 to 25 percent slopes	D	14.5	1.0%
Sa	Sampson loam	B	99.2	6.7%
W	Water		2.3	0.2%
Totals for Area of Interest			1,479.5	100.0%

Description

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

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

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

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

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

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

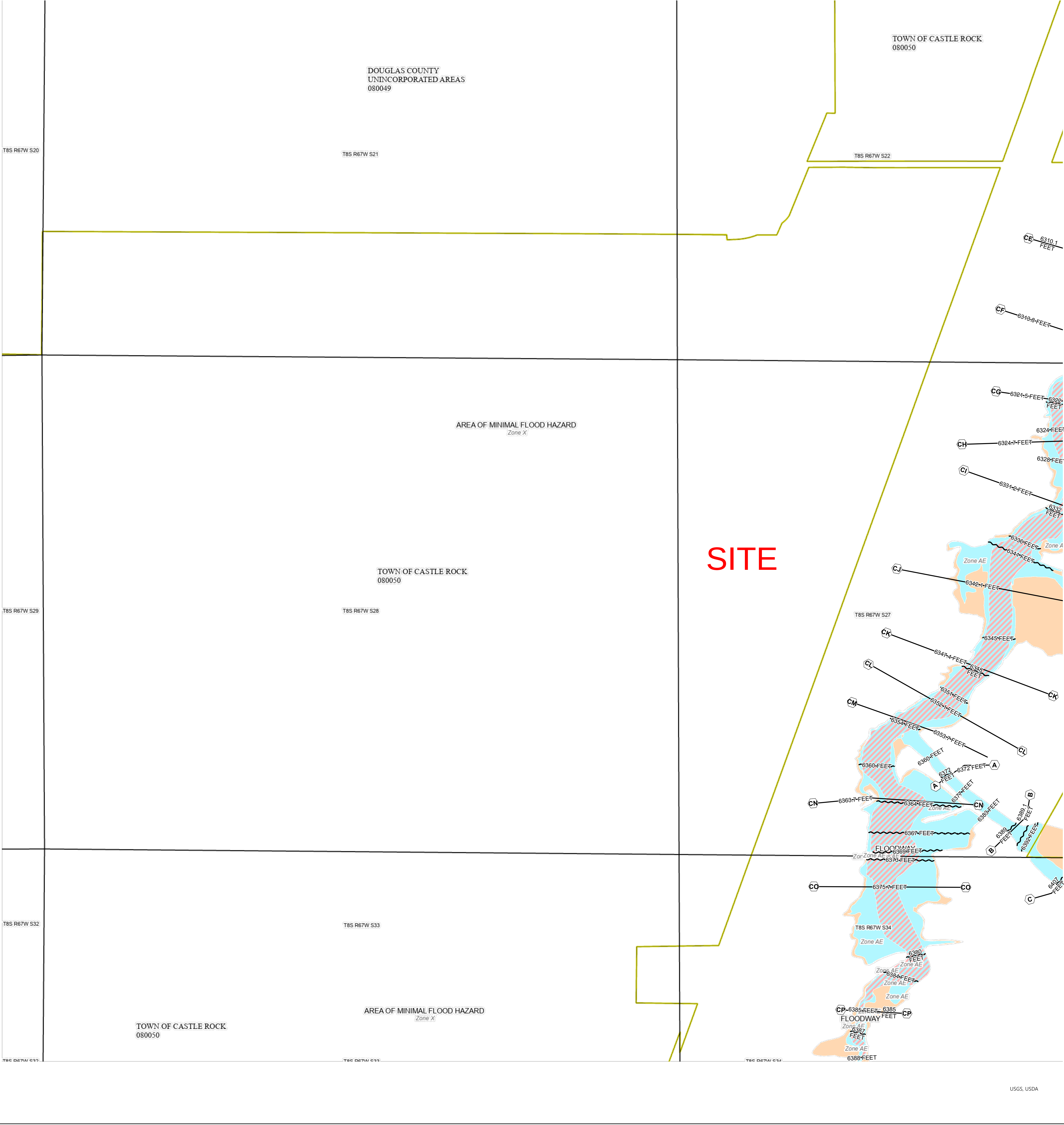
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



FLOOD HAZARD INFORMATION

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i>
		With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i>
		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 <i>Zone X</i>
		Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i>
		Area with Reduced Flood Risk due to Levee See Notes <i>Zone X</i>
		Area with Flood Risk due to Levee <i>Zone D</i>
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard <i>Zone X</i>
		Effective LOMRs
		Area of Undetermined Flood Hazard <i>Zone D</i>
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		Cross Sections with 1% Annual Chance
		Water Surface Elevation
		Coastal Transect
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-6627) or visit the FEMA Flood Map Service Center website at <https://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to the Flood Insurance Study Report for this jurisdiction.

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

Basemap information shown on this FIRM was provided in digital format by the United States Geological Survey (USGS). The basemap shown is the USGS National Map: Orthoimagery. Last refreshed October, 2020.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **8/23/2023 4:14 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. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at <https://www.fema.gov/media-library/assets/documents/118418>

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. 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.

SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88

For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map, please see the Flood Insurance Study (FIS) Report for your community at <https://msc.fema.gov>

1 inch = 500 feet

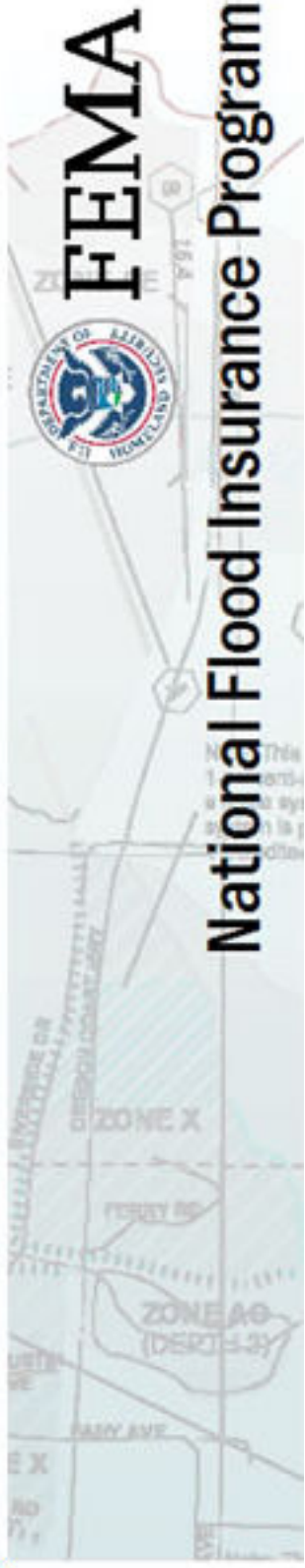
1:6,000

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

0 50 100 200 300 400

Feet

Meters



NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

PANEL 284 OF 461		
Panel Contains:		
COMMUNITY	NUMBER	PANEL
TOWN OF CASTLE ROCK	080050	0284
DOUGLAS COUNTY	080049	0284

PERCENT IMPERVIOUS CALCULATIONS
PROPOSED CONDITIONS - DAWSON TRAILS - FILING 2, AMENDMENT 3/4

Basin	Total Area	Commercial - Medium to High Density	MFH - High Density MFH (>20 du/ac)	SFH - High- density (5-20 du/ac) and Commercial - Low-density	SFH - Low & Medium-density (5-20 du/ac)	Community Parks	Neighborhood Parks	Open Space - Undisturbed Native Grass	Composite Percent Impervious
%IMP	(acres)	80% (acres)	70% (acres)	65% (acres)	55% (acres)	25% (acres)	15% (acres)	5% (acres)	
E8	2.53							2.53	5.0%
E11	0.82		0.82						70.0%
E11b	0.74		0.74						70.0%
T1	1.22		1.22						70.0%
T2	2.39		2.39						70.0%
T3	2.92		2.92						70.0%

TABLE 6-3. RECOMMENDED IMPERVIOUSNESS BY SURFACE TYPES

SURFACE TYPES		IMPERVIOUSNESS
Roadways and Paved Streets		95%
Concrete Driveways and Walks		95%
Roofs		95%
Gravel	No Traffic (Pedestrian Use)	40%
	Low-traffic Areas (Maintenance Paths and Substations)	60%
	High-traffic Areas (Roadways and Parking)	80%
Disturbed Soil (Including Lawns, Managed/Active Turf, Landscaped Areas with Water-Wise Vegetation, and Uncompacted Gravel/Mulch Planting Beds)		20%
Undisturbed or Decompacted Soil (Native Grasses and Open Space Areas)		5%
Artificial Turfs ¹	Landscape Applications (without Subgrade Drainage Layer)	25% – 45%
	Sport Fields (with Underdrain Pipe System)	60% – 80%
Water Surfaces (Lakes/Reservoirs/Irrigation Ponds)		100%
Solar Fields ²	Grass Cover (Varies with Panel Orientation Relative to Ground Contours)	10% – 45%
	Gravel Cover (Varies with Panel Orientation Relative to Ground Contours)	50% – 75%
Historic Flow Analysis, Greenbelts, Agricultural		5%
Newly Graded Areas		65%
Stormwater Control Measures ³	Retention Ponds & Constructed Wetland Ponds	100%
	Rooftop Systems – Blue Roofs	95%
	Rooftop Systems – Green Roofs (extensive)	65%
	Rooftop Systems – Green Roofs (intensive)	50%
	Permeable Pavement – CGP/PGP/RGP	55%
	Permeable Pavement – PICP	45%
	Extended Detention Basins	25%
	Receiving Pervious Areas (incl. Grass Buffers & Grass Swales)	20%
	Bioretention & Sand Filters	10%

¹ Consult with the manufacturer to get a recommended value.

² Assumes 1:1 ratio of panels to aisles. See MHFD's technical memorandum regarding *Determination of Solar Panel Field Runoff Coefficients and Imperviousness Values* for additional information on procedures for determining percent imperviousness based on panel width, panel spacing, and panel orientation relative to ground contours and how to reflect other impervious areas such as roads and pads that may be part of a solar field and layouts with wider inter-panel spacing.

³ See MHFD's technical memorandum regarding *Evaluation of Percent Imperviousness for Stormwater Control Measures* for background information.

TABLE 6-2. RECOMMENDED IMPERVIOUSNESS BY LAND USE

LAND USE/DENSITY	IMPERVIOUSNESS
Residential	
Single-family Housing (SFH) – Rural (0 – 3 du/ac)	35%
SFH – Low & Medium-density (3 – 5 du/ac)	55%
SFH – High-density (5 - 20 du/ac)	65%
Manufactured Housing (>= 10 du/ac)	65%
Multi-family Housing (MFH) – Medium-density (5 – 20 du/ac)	65%
MFH – High-density MFH (>20 du/ac)	70%
Commercial	
Commercial – Low-density	65%
Commercial – Medium- to High-density	80%
Commercial – Urban Core	90%
Industrial/Institutional	
Schools	55%
Office/Institutional	65%
Industrial Areas	75%
Solar Fields, Gravel Cover ^{1,2}	60%
Solar Fields, Grass Cover ^{1,2}	45%
Parks and Open Space	
Open Space, Undisturbed Native Grasses	5%
Community Parks	25%
Neighborhood Parks	15%
Golf Courses	30%
Cemeteries	25%

Note: Recommended imperviousness values shown in the table are the minimum imperviousness values for a specific land use. It is the engineer's responsibility to select imperviousness values that appropriately reflect the actual density of the proposed development.

¹ Use these values at the master planning scale or when the specific layout of panels is not known. Use values from the surface type (Table 6-3) at the site planning and design stage when panel width, panel spacing, and panel orientation relative to contours are known.

² Assumes 1:1 ratio of panels to aisles. See MHFD's technical memorandum regarding *Determination of Solar Panel Field Runoff Coefficients and Imperviousness Values* for additional information on procedures to reflect other impervious areas such as roads and pads that may be part of a solar field and layouts with wider inter-panel spacing.

Calculation of Peak Runoff using Rational Method	
--	--

[illegible]

JOB NO: 13301.00
PROJECT: Dawson Trails - Filing 2, Amendment 3/4
DSGN STRM: 5-year
CALC BY: DJO

**RATIONAL METHOD
(5-YEAR DEVELOPED CONDITION)**

DATE: 9/11/25

$I=28.5 \cdot P^1 / ((10+T)^{0.786})$

1 HR STORM= 1.43				Direct RUNOFF				TOTAL RUNOFF				TRAVEL TIME				STREET FLOW		INLET	INLET INTERCEPT		CARRYOVER FLOW		DP CAPTURING CARRYOVER FLOW	PIPE FLOW		Notes
Design Point	Basin	Ac	C	Tc	A"C	I	Q	Tc	A"C	I	Q	Length	Vel.	Time	From	A"C	Q		A"C	Q	A"C	Q		A"C	Q	
						IN/HR	CFS			IN/HR	CFS		fps	(Min.)	To		CFS			CFS		CFS			CFS	
1T	T1	1.22	0.58	6.68	0.71	4.5	3.2					89	10	0.1	1T to 2T	0.7	3.2	1T	0.7	3.2				0.71	3.2	DIRECT/ INLET INTERCEPT
	T2	2.39	0.61	11.31	1.45	3.7	5.3									1.4	5.3	2T	1.45	5.33			DP 3T			DIRECT/ INLET INTERCEPT
2T	DP 1T + T2							11.3	2.16	3.7	7.9	148	10	0.2	2T to 3T									2.16	7.9	COMBINED
	T3	2.92	0.58	10.14	1.70	3.8	6.5									1.7	6.5	3T	1.70	6.53						DIRECT/ INLET INTERCEPT
3T	DP 2T + T3							11.6	3.85	3.6	14.1	68	10	0.1	3T to 11E									3.85	14.1	COMBINED
11E	E11	0.82	0.58	8.70	0.48	4.1	1.9									0.5	1.9	11E	0.46	1.87	0.02	0.08	11Eb	0.46	1.9	DIRECT/ INLET INTERCEPT
11Eb	E11b	0.74	0.58	7.44	0.43	4.3	1.9									0.43	1.9	11Eb	0.41	1.78	0.02	0.1		0.41	1.8	DIRECT/ INLET INTERCEPT

JOB NO: 13301.00

PROJECT: Dawson Trails - Filing 2, Amendment 3/4

DSGN STRM: 100-year

CALC BY: DJO

RATIONAL METHOD
(100-YEAR DEVELOPED CONDITION)

DATE: 9/11/25

$I=28.5 \cdot P^{1/(10+T)} \cdot 0.786$

1 HR STORM= 2.60				DIRECT RUNOFF				TOTAL RUNOFF				TRAVEL TIME				STREET FLOW		INLET	INLET INTERCEPT		DP CAPTURING CARRYOVER FLOW				PIPE FLOW		Notes
Design Point	Basin	Ac	C	Tc	A'C	I	Q	Tc	A'C	I	Q	Length	Vel.	Time (Min.)	From	A'C	Q		A'C	Q	A'C	Q		A'C	Q		
1T	T1	1.22	0.75	6.68	0.92	8.1	7.4					89	10	0.1	1T to 2T	0.9	7.4	1T	0.9	7.4				0.92	7.4	DIRECT/ INLET INTERCEPT	
	T2	2.39	0.77	11.31	1.84	6.7	12.3									1.8	12.3	2T	1.84	12.32						DIRECT/ INLET INTERCEPT	
2T	DP 1T + T2							11.3	2.76	6.7	18.5	148	10	0.2	2T to 3T									2.76	18.5	COMBINED	
	T3	2.92	0.75	10.14	2.19	7.0	15.3									2.2	15.3	3T	2.19	15.35						DIRECT/ INLET INTERCEPT	
3T	DP 2T + T3							11.6	4.95	6.6	32.8	68	10	0.1	3T to 11E									4.95	32.8	COMBINED	
11E	E11	0.82	0.75	8.70	0.62	7.4	4.6			12.1						0.6	4.6	11E	0.48	3.58	0.13	0.99		11Eb	0.48	3.6	DIRECT/ INLET INTERCEPT
11Eb	E11b	0.74	0.75	7.44	0.56	7.8	4.4									0.56	4.4	11Eb	0.42	3.27	0.14	1.1			0.42	3.3	DIRECT/ INLET INTERCEPT

DRAINAGE REPORT
for
DAWSON TRAILS - FILING 2, AMENDMENT 4

APPENDIX B
Hydraulic Computations

Reserved for Phase III Report
No hydraulic calculations in this report

DRAINAGE REPORT
for
DAWSON TRAILS - FILING 2, AMENDMENT 4

APPENDIX C
Water Quality Enhancement Control Measures



Summary of Water Quality Conformance to MS4 Permit

The purpose of this worksheet is to document conformance with the Town of Castle Rock's MS4 permit with regard to permanent water quality on land disturbance projects.

Project Name Dawson Trails Filing 2, Amendment 4

Project Owner ACM Dawson Trails JV LLC

Project Location Southwest of the new Crystal Valley Interchange

ToCR Project Number CD23-0045

Total Site Area 8.4 **acres**

Total Size of Common Plan of Development 445 +/- **acres**

Check all that apply:

☒ **Project within Plum Creek Basin**

☐ **Project within Cherry Creek Basin**

Estimated construction completion date December 2026

1. The water quality control measure(s) for applicable development sites shall meet one of the following base design standards as per the SDDTCM Section 14.4. Please select all design standards that were applied to meet conformance with the MS4 on this site.

- ☒ WQCV standard
- ☐ Pollutant removal standard
- ☐ Runoff reduction standard
- ☐ Applicable site draining to regional WQVC control measure (accepts drainage prior to discharging to WOTS)
- ☐ Applicable site draining to regional WQVC control facility (with receiving pervious area control measure upstream of WOTS)
- ☐ Constrained redevelopment sites standard
 - Imperviousness of existing site / (Imp. Ac/Site Ac) = %
 - Variance required TCV No.
- ☐ Existing control measure with WQCV per previous criteria standards
 - Reference Construction Permit No.
- ☐ Cherry Creek Basin only, choose one: ☐ Tier 1 ☐ Tier 2 ☐ Tier 3
- ☐ No control measures provided (See Permanent WQ Worksheet for applicability)

Summary of Water Quality Conformance to MS4 Permit

2. Was an exclusion to water quality applied as per SDDTCM Section 13.1.5? ☐ Yes ☒ No

i. If yes, please select all that apply, provide total excluded impervious area(s) and submit variance, as applicable: TCV No. _____

☐ Pavement management site

Excluded impervious area: _____ acres

☐ Excluded roadway redevelopment

Excluded impervious area: _____ acres

☐ Excluded existing roadway areas

Excluded impervious area: _____ acres

☐ Above ground and below ground utilities

☐ Large lot single family home

☐ Non-residential and non-commercial infiltration

Excluded impervious area: _____ acres

☐ Land disturbance for land to remain undeveloped

Excluded impervious area: _____ acres

☐ Stream Stabilization Sites

Excluded impervious area: _____ acres

☐ Trails

Excluded impervious area: _____ acres

☐ Oil and Gas Exploration

3. For Development and Redevelopment sites, following any exclusions claimed above, was any portion of the site excluded up to 20% of the site and not to exceed one acre? ☐ Yes ☒ No

If yes, complete the following:

Excluded area: _____ acres

Total Site area: _____ acres, _____ % site excluded

4. For Constrained sites, was any portion of the site excluded up to 50% of the site and not to exceed 50% of the impervious area? ☐ Yes ☒ No

If yes, complete the following:

Excluded area: _____ acres

Excluded impervious area: _____ acres

Total Site area: _____ acres, _____ % site excluded

Total Impervious area: _____ acres, _____ % impervious excluded

Permanent Water Quality Determination Worksheet (Taken from 2019 SDDTCM Sections 13.1.4 and 13.1.5)

Project:		Project#		Applicant:
Section	Questions	Response	Check those that apply	Instructions
1	Non-applicable Sites			
1.1	Will the project result in a temporary disturbance of greater than one acre?	No Yes	☐ ☒	Proceed to section 1.2. Proceed to section 2.
1.2	Is the project part of a larger common plan of development or sale where multiple separate and distinct construction activities may be taking place at different times on different schedules, but remain related and are within 1/4 mile of each other? (A common plan of development will generally be documented on a site development plan, master plan, or equivalent, for the property/project)	No Yes	☐ ☐	Proceed to section 1.3. Proceed to section 2.
1.3	Is the project within the Cherry Creek Watershed?	Yes No	☐ ☐	Permanent water quality control measures may be required. Refer to Water Quality Control Regulation 72.7 for details and allowable exclusions. Permanent water quality control measures are not required.
2	Applicable Site Types and Exclusions by Variance			
2.1	Does the project have more than 35% impervious area on the existing site?	No Yes	☐ ☒	Project is an applicable Development Site. Proceed to section 3. Proceed to 2.2.
2.2	Does the project have greater than 75% impervious area on the existing site?	No Yes	☒ ☐	Project is an applicable Redevelopment Site. Proceed to section 3. Project is an applicable Constrained Redevelopment Site. Proceed to 2.3.
2.3	Will 100% of the runoff from the existing and proposed site be captured and treated using one or more of the allowable design standards for permanent water quality?	Yes No	☐ ☐	No further action required. Proceed to 2.4.
2.4	Do any other water quality exclusions apply to the site?	No Yes	☐ ☐	Portions of the project are excluded. Proceed with design in accordance with Constrained Redevelopment standards and apply for variance for <u>Constrained Redevelopment Sites</u> . Proceed to section 3. Following approval of other exclusions, design remaining site in accordance with Constrained Redevelopment standards and apply for variance for <u>Constrained Redevelopment Sites</u> .
3	Applicable Sites with Other Exclusions by Variance			
3.1	Category 1: Roadways, bridges and trails only			
3.1.1	Is the project a bike or pedestrian trail?	Yes No	☐ ☐	Proceed to next line. Proceed to 3.1.2.
	Is the trail for a roadway?	Yes No	☐ ☐	Proceed to 3.1.2. Project is excluded. Submit variance for <u>Trails Excluded from Permanent Water Quality Requirements</u> .
3.1.2	Is the project primarily used for parking or access to parking?	Yes No	☐ ☐	This exclusion does not apply. Permanent water quality is required. Proceed to 3.1.3.
3.1.3	Does the project add impervious area?	No Yes	☐ ☐	Project is excluded. Submit variance for <u>Pavement Management Sites Excluded from Permanent Water Quality Requirements</u> . Proceed to 3.1.4.

Section	Questions	Response	Check those that apply	Instructions
3.1.4	Does the project add more than 8.25 feet of paved width at any location to the existing roadway?	No Yes	☐ ☐	Project is excluded. Submit variance for <u>Roadway Redevelopment Sites Excluded from Permanent Water Quality Requirements</u> . Proceed to next line.
	Does the project add more than one acre of paved area per mile to an existing roadway?	No Yes	☐ ☐	Project is excluded. Submit variance for <u>Roadway Redevelopment Sites Excluded from Permanent Water Quality Requirements</u> . Proceed to next line.
	Does the project increase the width by two times or more, on average, of the original roadway area?	No Yes	☐ ☐	Existing areas of site are excluded only. Submit variance for <u>Existing Roadway Surfaces Only Excluded from Permanent Water Quality Requirements</u> . This exclusion does not apply. Permanent water quality is required.
3.2	Category 2: Non-residential and non-commercial projects only			
3.2.1	Is the project associated with oil and gas exploration, production, processing, or treatment operations or transmission facilities, including activities necessary to prepare a site for drilling and the movement and placement of drilling equipment?	Yes No	☐ ☐	Project is excluded. Submit variance for <u>Oil and Gas Exploration Sites Excluded from Permanent Water Quality Requirements</u> . Proceed to 3.2.2.
3.2.2	Is the project for stream stabilization?	Yes No	☐ ☐	Project is excluded. Submit variance for <u>Stream Stabilization Sites Excluded from Permanent Water Quality Requirements</u> . Proceed to 3.2.3.
3.2.3	Is the project for installation or maintenance of aboveground or underground utilities or infrastructure that does not permanently alter the terrain, ground cover, or drainage patterns from those present prior to the construction activity including activities to install, replace or maintain utilities under roadways or other paved areas that return the surface to the same condition?	Yes No	☐ ☐	Project is excluded. Submit variance for <u>Aboveground and Underground Utilities Excluded from Permanent Water Quality Requirements</u> . Proceed to 3.2.4.
3.2.4	Is the project on undeveloped land (land with no human-made structures such as buildings or pavement) that will remain undeveloped after the project?	Yes No	☐ ☐	Project is excluded. Submit variance for <u>Sites with Land Disturbances to Undeveloped Land that will Remain Undeveloped Excluded from Permanent Water Quality Requirements</u> . Proceed to 3.2.5.
3.2.5	Will the post-project condition result in surface water discharge during the 80th percentile storm runoff event?	No Yes	☐ ☐	Project is excluded. Submit study along with variance for <u>Non-residential and Non-commercial Infiltration Conditions Excluded from Permanent Water Quality Requirements</u> . This exclusion does not apply. Permanent water quality is required.
3.3	Category 3: Residential, Agricultural and Commercial projects			
3.3.1	Is the project a single-family residential lot, or agricultural zoned lands, greater than or equal to 2.5 acres in size per dwelling unit?	Yes No	☐ ☒	Proceed to next line. Proceed to 3.3.2.
	Is the project site greater than 10% impervious?	No Yes	☐ ☐	Project is excluded. Submit variance for <u>Large Lot Single Family Sites Excluded from Permanent Water Quality Requirements</u> . Proceed to next line.
	Is the project site greater than 20% impervious?	Yes No	☐ ☐	This exclusion does not apply. Permanent water quality is required. Proceed to next line.
	Will the post-project condition result in surface water discharge during the 80th percentile storm runoff event?	No Yes	☐ ☐	Project is excluded. Submit study along with variance for <u>Large Lot Single Family Sites Excluded from Permanent Water Quality Requirements</u> . This exclusion does not apply. Permanent water quality is required.

Section	Questions	Response	Check those that apply	Instructions
3.3.2	Will 100% of the runoff from the residential or commercial site be captured?	Yes	☒	This exclusion does not apply. Permanent water quality is required.
		No	☐	Proceed to next line.
	Is all or a portion of the site undeveloped or will it remain undeveloped after construction?	Yes	☐	This portion of the project is excluded. Submit variance for <u>Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped Excluded from Permanent Water Quality Requirements</u> . Proceed to next line.
		No	☐	Proceed to next line.
	Is the remaining untreated impervious area greater than 20% of the site?	Yes	☐	This exclusion does not apply. Permanent water quality is required.
		No	☐	Proceed to next line.
	Is the remaining untreated impervious area greater than one acre?	Yes	☐	This exclusion does not apply. Permanent water quality is required.
		No	☐	Proceed to next line.
	Is it practicable to capture runoff from portions of the site that will not drain to a control measure?	No	☐	Document justification demonstrating that it is not practicable to capture runoff from this portion of the site in the drainage report . No further action is needed.
		Yes	☐	This exclusion does not apply. Permanent water quality is required.

DRAINAGE REPORT
for
DAWSON TRAILS - FILING 2, AMENDMENT 4

APPENDIX D
Referenced Information



Phase II Drainage Report Checklist

The Phase II Drainage Report must be in conformance with the latest Town of Castle Rock Storm Drainage Design and Technical Criteria Manual available on the Town's website.

The Phase II Drainage Report must be signed and sealed by a Professional Engineer licensed in the State of Colorado. The purpose of the Phase II Drainage Report is to identify and refine conceptual storm-water management solutions to the challenges that may be present or occur on-site and off-site.

The preparer should contact and work with the Town Stormwater Engineering Staff regarding any design, master planning and existing system questions (720-733-6000). The following outline sets forth the **required minimum** content to be provided in the Phase II Drainage Report that shall be submitted with the Planned Development Plan or Straight Zoning documents. A copy of this checklist must be submitted with the Phase II Drainage Report.

Please see Chapter 4 of the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual for additional details and information. Please check off the following items to assure your report is complete. Appropriate notations shall be provided with the checklist. For example, if a specific item is not addressed or not applicable, an explanation needs to be provided.

Included	N/A	
☒		I. COVER SHEET
☒		A. Name of Project, including legal name of development
	☒	B. Address
☒		C. Owner
☒		D. Developer
☒		E. Engineer
☒		F. Submittal date and revision dates as applicable
☒		II. GENERAL LOCATION AND DESCRIPTION
☒		A. Site Location
☒		B. Description of Property and Land Use
☒		III. DRAINAGE BASIN AND SUB-BASINS
☒		A. Major Drainage Basins
☒		B. Minor Drainage Basins
☒		IV. DRAINAGE DESIGN CRITERIA
☒		A. Regulations
☒		B. Drainage Studies, Master Plans, Site Constraints
☒		C. Hydrology
☒		D. Hydraulics
☒		E. Water Quality Enhancement

Phase II Drainage Report Checklist

Included	N/A	
		V. STORMWATER MANAGEMENT FACILITY DESIGN
		A. Stormwater Conveyance Facilities
		B. Stormwater Storage Facilities
		C. Water Quality Enhancement Best Management Practices
		D. Floodplain Modification
		E. Additional Permitting Requirements
		F. General
		VI. CONCLUSIONS
		A. Compliance with Standards
		B. Variances
		C. Drainage Concept
		VII. REFERENCES
		VIII. APPENDICES
		A. Hydrologic Computations
		B. Hydraulic Computations (If known at this time—not required)
		C. Water Quality Enhancement Best Management Practices
		D. Referenced Information
		OVERALL DRAINAGE PLAN (IN POCKET)
		DETAILED DRAINAGE PLANS (IN POCKET)

Same sheet - One sheet only

Notes/Comments:

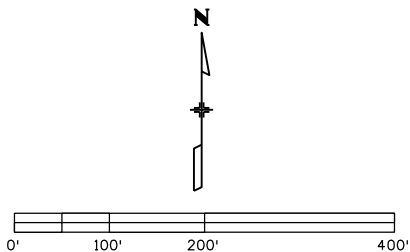


Crystal Valley Interchange Project
Package 2:
Phase III Drainage Report
NHPP M185-016
CIP23-0004
October 2023

Prepare For:
Town of Castle Rock – Public Works
4175 North Castleton Court
Castle Rock, Colorado 80104

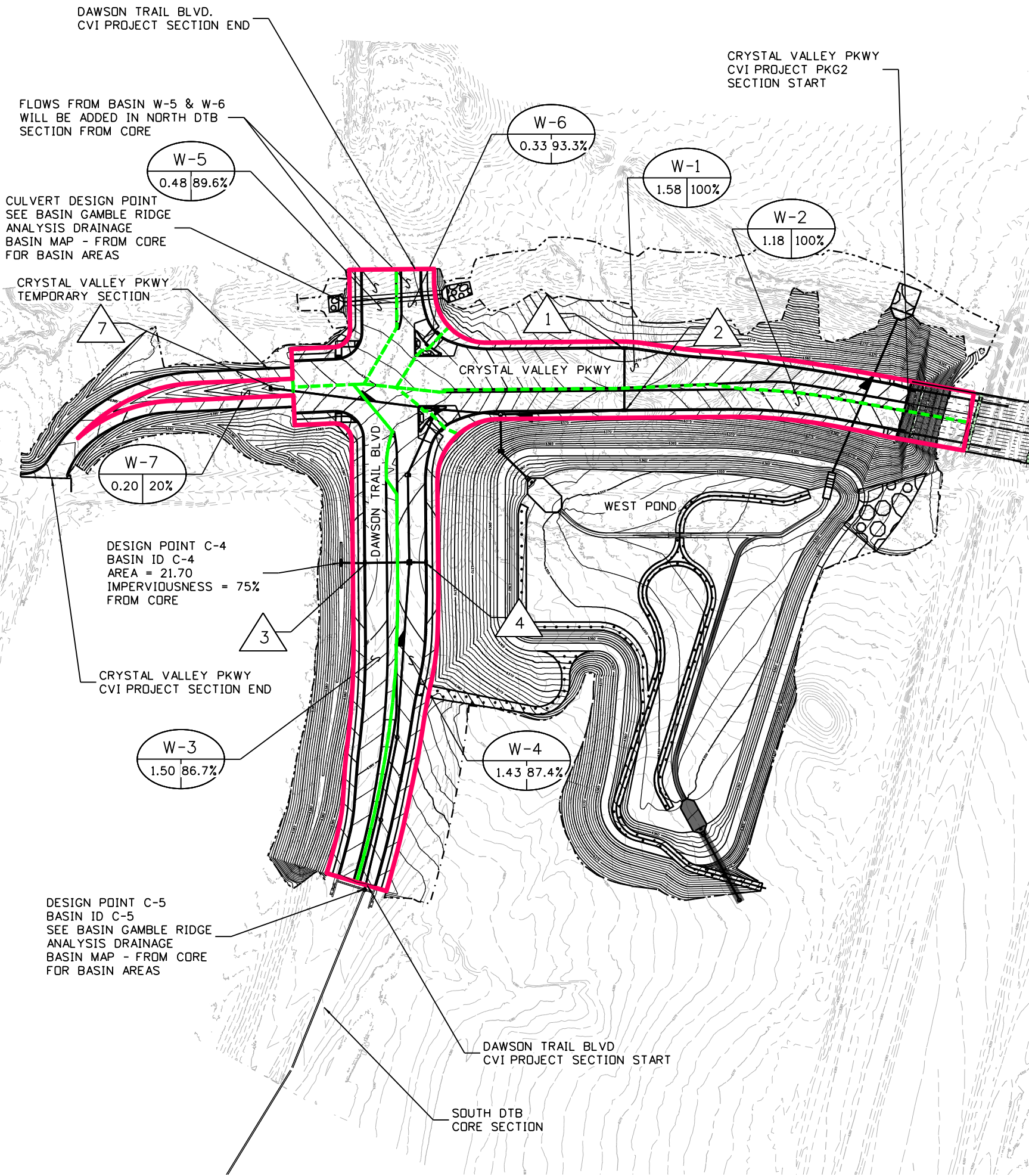
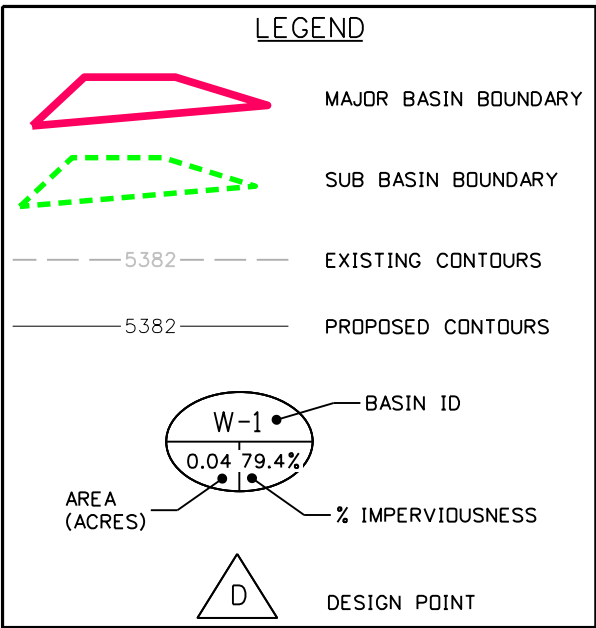
Prepared By:
Jacobs Engineering Group
6312 South Fiddlers Green Circle
Suite 300 N
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Contact:
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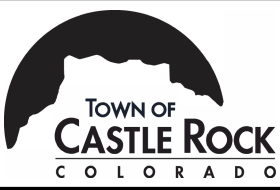
NOTES

1. ALL PROPOSED BASIN & FLOWS AT ROAD TIE IN POINTS ARE TAKEN FROM GAMBLE RIDGE ANALYSIS DRAINAGE MAP PROVIDED BY CORE CONSULTANT.



hbbise 4/24/23, PM 0:00:00, Jacobs-US-V-A-PW-Bentley.com:jacobs-us-v-a-pw-02-Documents\WXZ8300 - Crystal Valley Interchange\NHPP M185-016-24262\4-Delivery\Project_WIP\Package 2\Hydraulics (Shrewsberry)\Drawings\Reference_Files\24262-HYD-DRNBASIN01-PKG2-SHR.dgn

Print Date: 9/28/2023	
File Name: 24262_HYD-DRNBASIN01_PKG2_SHR.dgn	
Horiz. Scale: 1:202.181	Vert. Scale: As Noted
Unit Information	Unit Leader Initials



PUBLIC WORKS DEPT.
4175 NORTH CASTLETON CT.
CASTLE ROCK, CO 80109
PHONE 303 660-1020
FAX 303 660-1025

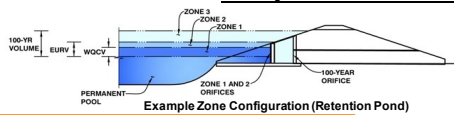
CRYSTAL VALLEY INTERCHANGE PACKAGE 2 PROPOSED DRAINAGE BASIN MAP	Project No./Code
	NHPP M185-0116
	25846
	Exhibit Number 01

PRLIMINARY DESIGN - NOT FOR CONSTRUCTION

MHFD-Detention, Version 4.06 (July 2022)

Project: CVI Package 2 - West of I-25

Basin ID: Public Regional Extended Detention Basin C-1



Selected BMP Type =	EDB	
Watershed Area =	185.18	acres
Watershed Length =	5,405	ft
Watershed Length to Centroid =	2,222	ft
Watershed Slope =	0.037	ft/ft
Watershed Imperviousness =	76.90%	percent
Hydrologic Soil Group A =	7.0%	percent
Hydrologic Soil Group B =	36.0%	percent
Hydrologic Soil Groups C/D =	57.0%	percent
Target WQCV Drain Time =	40.0	hours

Location for 1-hr Rainfall Depths = User Input

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

Water Quality Capture Volume (WQCV)	4.783	acre-feet	acre-feet
Excess Urban Runoff Volume (EUVR)	14.917	acre-feet	acre-feet
2-yr Runoff Volume ($P1 = 1.06$ in.)	12.378	acre-feet	1.06 inches
5-yr Runoff Volume ($P1 = 1.43$ in.)	18.026	acre-feet	1.43 inches
10-yr Runoff Volume ($P1 = 1.66$ in.)	21.644	acre-feet	1.66 inches
25-yr Runoff Volume ($P1 = 1.69$ in.)	22.485	acre-feet	1.69 inches
50-yr Runoff Volume ($P1 = 2.26$ in.)	31.745	acre-feet	2.26 inches
100-yr Runoff Volume ($P1 = 2.6$ in.)	37.598	acre-feet	2.60 inches
500-yr Runoff Volume ($P1 = 3.14$ in.)	46.569	acre-feet	3.14 inches

Approximate 2-yr Detention Volume =	11.140	acre-feet
Approximate 5-yr Detention Volume =	16.084	acre-feet
Approximate 10-yr Detention Volume =	19.000	acre-feet
Approximate 25-yr Detention Volume =	18.170	acre-feet
Approximate 50-yr Detention Volume =	22.359	acre-feet
Approximate 100-yr Detention Volume =	24.420	acre-feet

Zone 1 Volume (WQV_{C1}) =	4.783	acre-feet
Zone 2 Volume ($EURV - Zone 1$) =	10.135	acre-feet
Zone 3 ($100Y + 1/2 WQV_{C1} - Zones 1 \& 2$) =	11.894	acre-feet
Total Detention Basin Volume =	26.811	acre-feet
Initial Surcharge Volume (ISV) =		ft ³
Initial Surcharge Depth (ISD) =		user
Total Available Detention Depth (H_{DAV}) =		user
Depth of Trickle Channel (H_{TC}) =		user
Slope of Trickle Channel (S_{TC}) =		ft/ft
Slopes of Main Basin Sides (S_{MB}) =		H/V
Basin Length-to-Width Ratio ($R_{L/W}$) =		user

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

Watershed and Hydrology
parameters coordinated
with 04/19/2023
Correspondence between
CORE and Jacobs

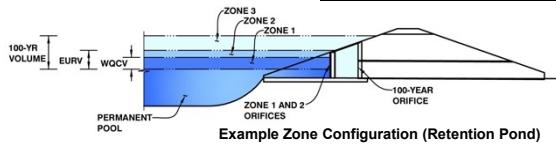
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DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: CVI Package 2 - West of I-25

Basin ID: Public Regional Extended Detention Basin C-1



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.67	4.783	Orifice Plate
Zone 2 (EURV)	6.02	10.135	Orifice Plate
Zone 3 (100+1/2WQCV)	8.26	11.894	Weir&Pipe (Restrict)
Total (all zones)		26.811	

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

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 BMP)

Centroid of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = inches
 Orifice Plate: Orifice Area per Row = sq. inches

Calculated Parameters for Plate
 WQ Orifice Area per Row = ft²
 Elliptical Half-Width = feet
 Elliptical Slot Centroid = feet
 Elliptical Slot Area = 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	2.01	4.01					
Orifice Area (sq. inches)	20.55	20.55	42.60					

	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 = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Vertical Orifice Diameter = inches

Calculated Parameters for Vertical Orifice
 Vertical Orifice Area = ft²
 Vertical Orifice Centroid = 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 = ft (relative to basin bottom at Stage = 0 ft)
 Overflow Weir Front Edge Length = feet
 Overflow Weir Grate Slope = H:V
 Horiz. Length of Weir Sides = feet
 Overflow Grate Type =
 Debris Clogging % = %

Calculated Parameters for Overflow Weir
 Height of Grate Upper Edge, H_u = feet
 Overflow Weir Slope Length = feet
 Grate Open Area / 100-yr Orifice Area =
 Overflow Grate Open Area w/o Debris = ft²
 Overflow Grate Open Area w/ Debris = ft²

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

Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
 Outlet Pipe Diameter = inches
 Restrictor Plate Height Above Pipe Invert = inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
 Outlet Orifice Area = ft²
 Outlet Orifice Centroid = feet
 Half-Central Angle of Restrictor Plate on Pipe = radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway
 Spillway Design Flow Depth = feet
 Stage at Top of Freeboard = feet
 Basin Area at Top of Freeboard = acres
 Basin Volume at Top of Freeboard = 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	N/A	N/A	1.06	1.43	1.66	1.69	2.26	2.60	3.14
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)	4.783	14.917	12.378	18.026	21.644	22.485	31.745	37.598	46.569
Inflow Hydrograph Volume (acre-ft)	N/A	N/A	12.378	18.026	21.644	22.485	31.745	37.598	46.569
CUHP Predevelopment Peak Q (cfs)	N/A	N/A	5.4	45.5	70.5	98.1	177.4	233.8	312.1
OPTIONAL Override Predevelopment Peak Q (cfs)	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre)	N/A	N/A	0.03	0.25	0.38	0.53	0.96	1.26	1.69
Peak Inflow Q (cfs)	N/A	N/A	201.0	293.3	346.1	370.5	525.9	620.9	765.9
Peak Outflow Q (cfs)	2.2	5.1	4.5	8.7	21.7	24.9	74.1	115.0	172.1
Ratio Peak Outflow to Predevelopment Q	N/A	N/A	N/A	0.2	0.3	0.3	0.4	0.5	0.6
Structure Controlling Flow	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps)	N/A	N/A	N/A	0.0	0.1	0.1	0.5	0.8	0.8
Max Velocity through Grate 2 (fps)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours)	38	67	62	72	73	73	70	69	67
Time to Drain 99% of Inflow Volume (hours)	40	71	66	78	79	79	79	78	78
Maximum Ponding Depth (ft)	3.67	6.02	5.36	6.43	6.95	7.04	8.00	8.65	9.60
Area at Maximum Ponding Depth (acres)	3.24	5.06	4.75	5.15	5.27	5.29	5.50	5.65	5.88
Maximum Volume Stored (acre-ft)	4.806	14.920	11.671	17.013	19.722	20.196	25.375	28.945	34.422

Storage and Release Rate
parameters coordinated
with 04/19/2023
Correspondence between
CORE and Jacobs

CVI - Package 2

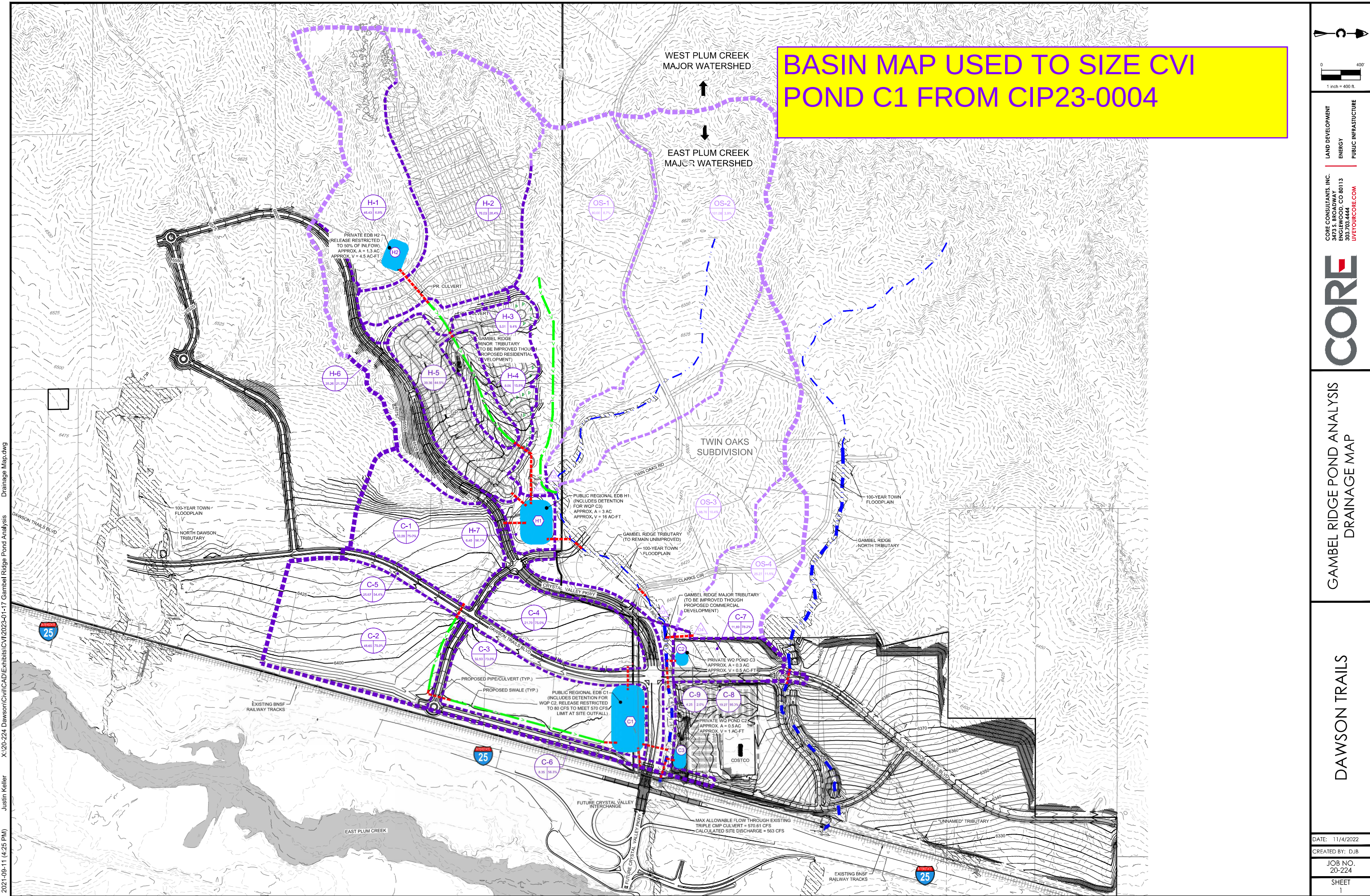
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West Pond Analysis Results

	New Iteration
Watershed Area (acres)	185.18
% Imperviousness	76.90
100 Year Inflow (cfs)	620.90
Release Rate (cfs)	115.00
Total 100-Year Detention Volume Required with restriction (acre-feet)	28.945
Total Detention Volume Provided (acre-feet)	32.263
Extra Storage Provided (acre-feet)	3.318
RCP Outfall Pipe Size (inches)	84.00
Emergency Spillway Crest Elevation (ft)	6360.22
Emergency Spillway Length (ft)	71.00
Spillway Freeboard Used (ft) - See Note 4	0.50
Minimum depth required for the spillway (including freeboard) based on inflow	1.78
100 Year WSEL stage (ft)	8.65
WSEL at 100% clogging factor (required spillway invert stage)	9.08
Provided spillway invert stage (ft)	9.22
Extra-depth provided between crest of spillway & top of third chamber (ft)	0.57
Extra-depth between crest of spillway & top of third chamber (inches)	6.84
Third chamber size (B feet x W feet)	12 x 10
Outfall pipe capacity at 100 yr storm requested by Town (cfs)	345.00
Third chamber inflow calculated using Orifice Discharge Equation - See Note 5 & Reference	229.02
Total incoming flow in outfall pipe from 3rd chamber & restriction plate	344.02
Outfall Pipe (84" RCP) Capacity Provided - Includes 115 cfs restricted flow (cfs) - See Note 7	411.50
Slip-Lined Outfall Pipe Capacity (76") Provided - Includes 115 cfs restricted flow (cfs) - See Note 6 & 7	396.96

Notes:

1. Overall pond grading/footprint remained same based on a meeting with Jacobs/Developer/Town/CORE on April 17th.
2. Pond Top Elevation = 6362.00
3. Pond Bottom Elevation = 6351.00
4. Need variance from Town for 0.5 feet freeboard requirement
5. Assumed 25% Clogging, 0.7 open area factor for 3rd chamber
6. Assumed 2" (1" walls) of slip lining for the pipe
7. Outfall pipe analysis performed in HY-8 for the pressure condition flow using depth (9.22) above 3rd chamber



2021-09-11 (4:25 PM) Justin Keller X:\20-224 Dawson\Civil\CAD\Exhibits\CVI\2023-01-17 Gambel Ridge Pond Analysis Drainage Map.dwg

LAND DEVELOPMENT

ENERGY

PUBLIC INFRASTRUCTURE

CORE

CORE CONSULTANTS, INC.
3473 S. BROADWAY
ENGLEWOOD, CO 80113
303.703.4444
LIVE@CORE.COM

GAMBEL RIDGE POND ANALYSIS
DRAINAGE MAP

DAWSON TRAILS

DATE: 11/4/2022

CREATED BY: DJB

JOB NO.
20-224

SHEET
1

footprint. Since the West Pond is sized for the ultimate future conditions and works in conjunction with other ponds in the development, the total watershed area and % imperviousness of the development area to size the pond were provided by CORE Consultants. A total watershed area of 185.18 acres with 76.90% imperviousness was used to size the West Pond. Note that the total CVI Package 2 proposed drainage basin area west of I-25 of 28.4 acres is included within the total watershed area used to size the West Pond.

The developer will be responsible for any changes to the development plan including changes to development densities or approach to meeting the water quality and detention requirements that would result in changes to flow rates provided during the project design. This may include additional FSD Ponds or modification to the pond constructed by this project west of I-25 to ensure the flow rate at the existing culvert under the railroad does not increase.

CVI CIP23-0004
Excerpt. Basin map
also included which
shows 75%
impervious.

2.3 Minor Drainage Basins

Minor drainage basins were delineated using existing and proposed topography. Existing drainage patterns will remain the same; however, new storm drainage structures will be sized and placed to accommodate proposed roadway modifications.

Regional Minor Basins

CORE Consultants provided a Regional Proposed Drainage Basin Map (**Appendix A**), which states the maximum existing flow through the existing triple barrel CMPA culvert under the railroad was 570.61 cfs. The Regional Proposed Drainage Basin Map (**Appendix A**) was prepared by CORE Consultants, which includes future proposed sub-basins and is only used to size West Pond within the CVI Package 2 project. In the Overall Proposed Gambel Ridge Pond Analysis Basin Map provided by CORE Consultants, Pond C1 (called West Pond in the CVI project) accepts flow from the future proposed sub-basins. Basin areas from Basin C-1 to Basin C-6 were used to size Pond C1. The detention for future private Water Quality (WQ) Pond located west of north DTB is also added to Pond C1. Therefore, Basin C-7 was added to the tributary area to size Pond C1. Flows from basins C-1 & C-2, and C-3 will be conveyed to Pond C1 through a future proposed open channel. Basin C-4, C-5, and C-6 will carry flows from future proposed roadways/development and will be conveyed to Pond C1 through the proposed underground storm sewer system, which will be tied into the proposed storm sewer system within the CVI Package 2 project. All flows at tie-in points coming to the CVI Project were provided by CORE Consultants and used for the analysis.

CVI Project Minor Basins

The proposed construction area has been split into minor basins as identified in the Basin Map (**Appendix A**). Stormwater generated in the project will be collected and conveyed to FSD ponds or sand filter basins located south of the proposed Crystal Valley Parkway and southbound ramps before outfalling to Gambel Ridge and ultimately into East Plum Creek.

See **Appendix A** for the Drainage Basin Map.



Flows from Basin OS-3 will enter the Gambel Ridge Tributary just west of the project boundary and CVI project area. Drainage patterns from OS-3 will generally remain unchanged from historic conditions. Hydrology of OS-3 is analyzed by CUHP method and results can be found in **Appendix B** of this report. Basin OS-3 is outside of the Town limits and there are no planning documents that anticipate further development.

Basin OS-4 (25.3 acres | 11.5% Impervious | Q100 = 39.8 cfs)

Basin OS-4 contains rural residential areas in Gambel Ridge Tributary's main stem. Flows from Basin OS-4 will enter the Gambel Ridge Tributary just west of the project boundary and CVI project area. Drainage patterns from OS-4 will generally remain unchanged from historic conditions. Hydrology of OS-4 is analyzed by CUHP method and results can be found in **Appendix B** of this report. Basin OS-4 is outside of the Town limits and there are no planning documents that anticipate further development.

Lower Gambel Ridge Tributary Watershed (Watershed C)

The Lower Gambel Ridge Watershed includes development that drain to the Gambel Ridge Tributary, re-enters the development boundary. These flows are for Dawson Trails Boulevard and Crystal Valley Parkway and F3. In the context of the Filing 2 project, these off-site areas are considered on-site improvements by separate plans. However, the separately proposed infrastructure of these off-site areas is integral to the drainage design for the northwest portion of Filing 2 and is analyzed in this report as appropriate. More details on specific drainage components of off-site projects are included in Section III.B of this report.

Filing 2, Amendment 4 is included in Basin C-1

Lower Gambel Watershed: Onsite Basins used in CUHP/SWMM Analysis: [Proposed Overall SWMM Map 2; Proposed Detailed Drainage Maps 6-8, 11-12]

Basin C-1 (35.2 acres | 2.0% Impervious | Q100 = 114 cfs)

Major Basin C-1 is bounded by Dawson Trails Boulevard on the east, Arterial A on the west, and Quandary Peak Drive on the north. It is designated within Planning area E2 in the development plan. ~~Non-residential and residential uses are permitted within the development parcel, with a specific anticipation of commercial oriented use. The area is assigned a build-out imperviousness of 75% for hydrologic analysis. This basin is tributary to the Regional Pond C1 and has been accounted for in its sizing.~~

Basin C-2 (47.2 acres | 2.0% Impervious | Q100 = 139 cfs)

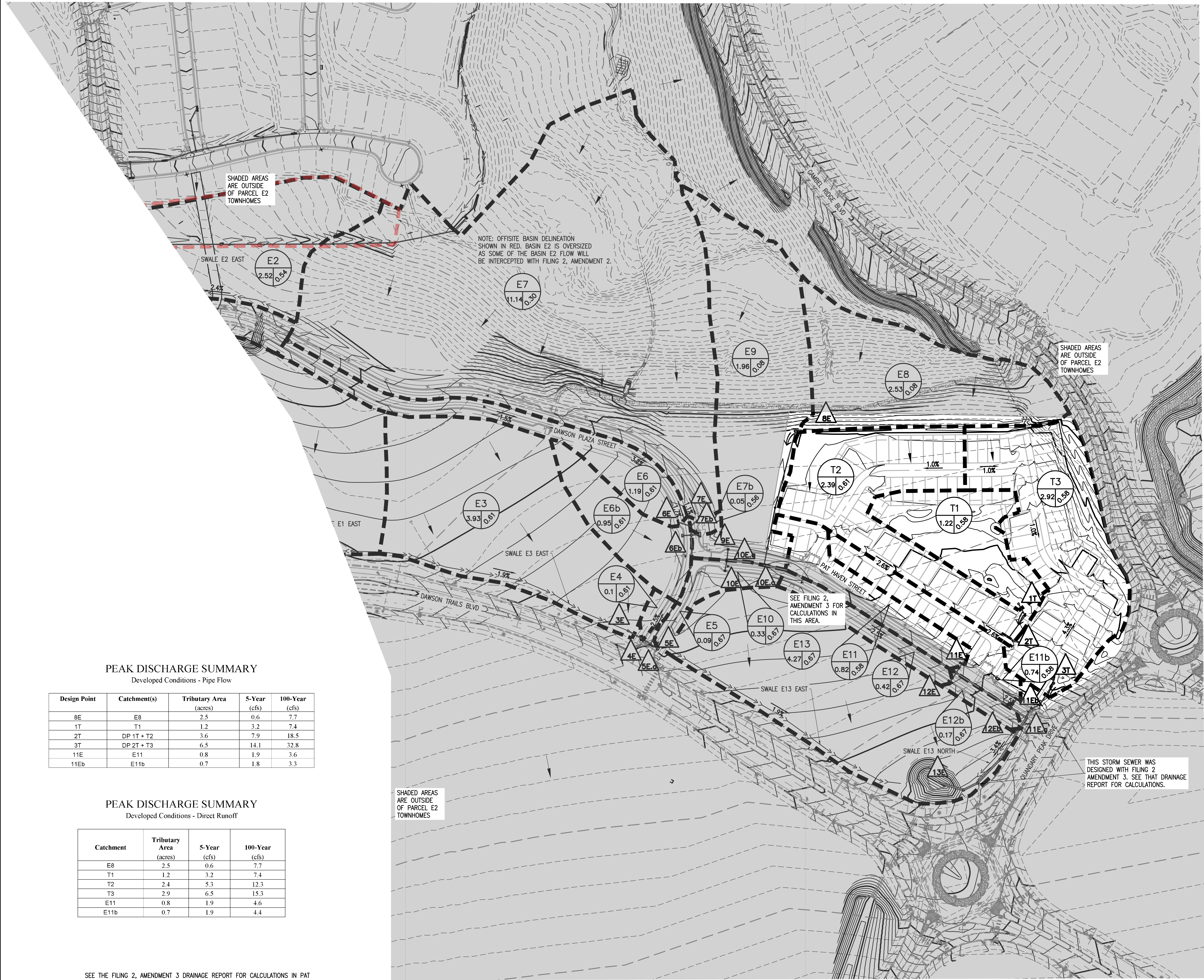
Major Basin C-2 is bounded by Dawson Trails Boulevard on the west, the BNSF rail right-of-way on the east, and Quandary Peak Drive on the north. It is designated within Planning area F3 in the development plan. Non-residential and residential uses are permitted within the development parcel, with a specific anticipation of commercial oriented use. The area is assigned a build-out imperviousness of 75% for hydrologic analysis. This basin is tributary to the Regional Pond C1 and has been accounted for in its sizing.

Basin C-3 (33.2 acres | 2.0% Impervious | Q100 = 75.7 cfs)

Major Basin C-3 is bounded by Dawson Trails Boulevard on the west, Crystal Valley Parkway on the north, Ike Street on the east, and Quandary Peak Drive on the South. It is designated within Planning area F3 in the development plan. Non-residential and residential uses are permitted within the development parcel, with a specific anticipation

**DRAINAGE REPORT
for
DAWSON TRAILS - FILING 2, AMENDMENT 4**

APPENDIX E - DRAWINGS



PEAK DISCHARGE SUMMARY
Developed Conditions - Pipe Flow

Design Point	Catchment(s)	Tributary Area (acres)	5-Year (cfs)	100-Year (cfs)
8E	E8	2.5	0.6	7.7
1T	T1	1.2	3.2	7.4
2T	DP 1T + T2	3.6	7.9	18.5
3T	DP 2T + T3	6.5	14.1	32.8
11E	E11	0.8	1.9	3.6
11Eb	E11b	0.7	1.8	3.3

PEAK DISCHARGE SUMMARY
Developed Conditions - Direct Runoff

Catchment	Tributary Area (acres)	5-Year (cfs)	100-Year (cfs)
E8	2.5	0.6	7.7
T1	1.2	3.2	7.4
T2	2.4	5.3	12.3
T3	2.9	6.5	15.3
E11	0.8	1.9	4.6
E11b	0.7	1.9	4.4

SEE THE FILING 2, AMENDMENT 3 DRAINAGE REPORT FOR CALCULATIONS IN PAT HAVEN STREET AND SURROUNDING AREAS.

LEGEND

C3

341.8

0.50

—

BASIN DESIGNATION

X

—

5-YR DEVELOPED RATIONAL COEFFICIENT

—

—

BASIN AREA IN ACRES

X

—

DESIGN POINT—RATIONAL METHOD

BASIN BOUNDARY

→

→

FLOW DIRECTION ARROW

EXISTING 2-FT CONTOUR

EXISTING 10-FT CONTOUR

PROPOSED 2-FT CONTOUR

PROPOSED 10-FT CONTOUR

—

—

STORM SEWER AND INLET, MANHOLE, FLARED END SECTION

→

→

100-YR EMERGENCY OVERFLOW PATH

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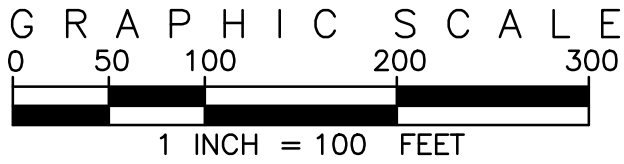
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SHADED AREAS INDICATE OUTSIDE LIMITS THIS PROJECT

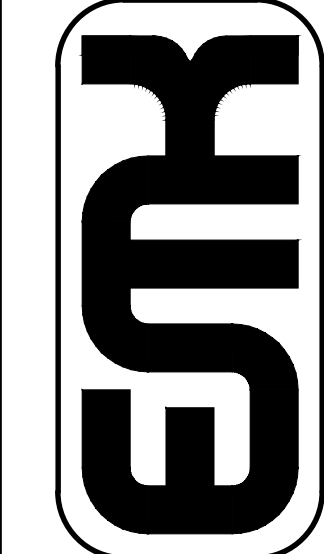
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SWALE



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(303)694-1520
WWW.EMKCO.COM



SCALE VERIFICATION BAR IS 1 INCH ON ORIGINAL DRAWING
ADJUST SCALES ACCORDINGLY IF NOT ONE INCH ON THIS SHEET.

Know what's below. Call before you dig.

811

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REVISIONS		DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
NO.	DESCRIPTION	DATE	DATE	DATE	DATE

DAWSON TRAILS

FILING 2 AMENDMENT 4
PROPOSED DRAINAGE PLAN

DATE: 09/16/2025
JOB NO: 13296.00

SCALE
HORIZONTAL
1" = 50'