
Phase III Drainage Report

HILLSIDE AT CASTLE ROCK Phase 3 & 4

Northeast Corner of Wolfsenberger Road and
Stagecoach Road
Castle Rock, Douglas County
Colorado, 80109

Initial Submittal: August 25, 2023

1st Resubmittal:

3rd Resubmittal:

4th Resubmittal:

5th Resubmittal:

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“I affirm that this report and plan for the Phase III drainage design of Hillside at Castle Rock Phase 3 & 4 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: _____
Registered Professional Engineer State
Of Colorado No. 48230

BLVD Hillside hereby certifies that the drainage facilities for Hillside at Castle Rock Phase 3 & 4 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 of 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 BLVD Hillside, guarantee that final drainage design review will absolve BLVD Hillside and/or their successors and/or assigns of future liability for improper design.

BLVD Hillside

Aaron Foy

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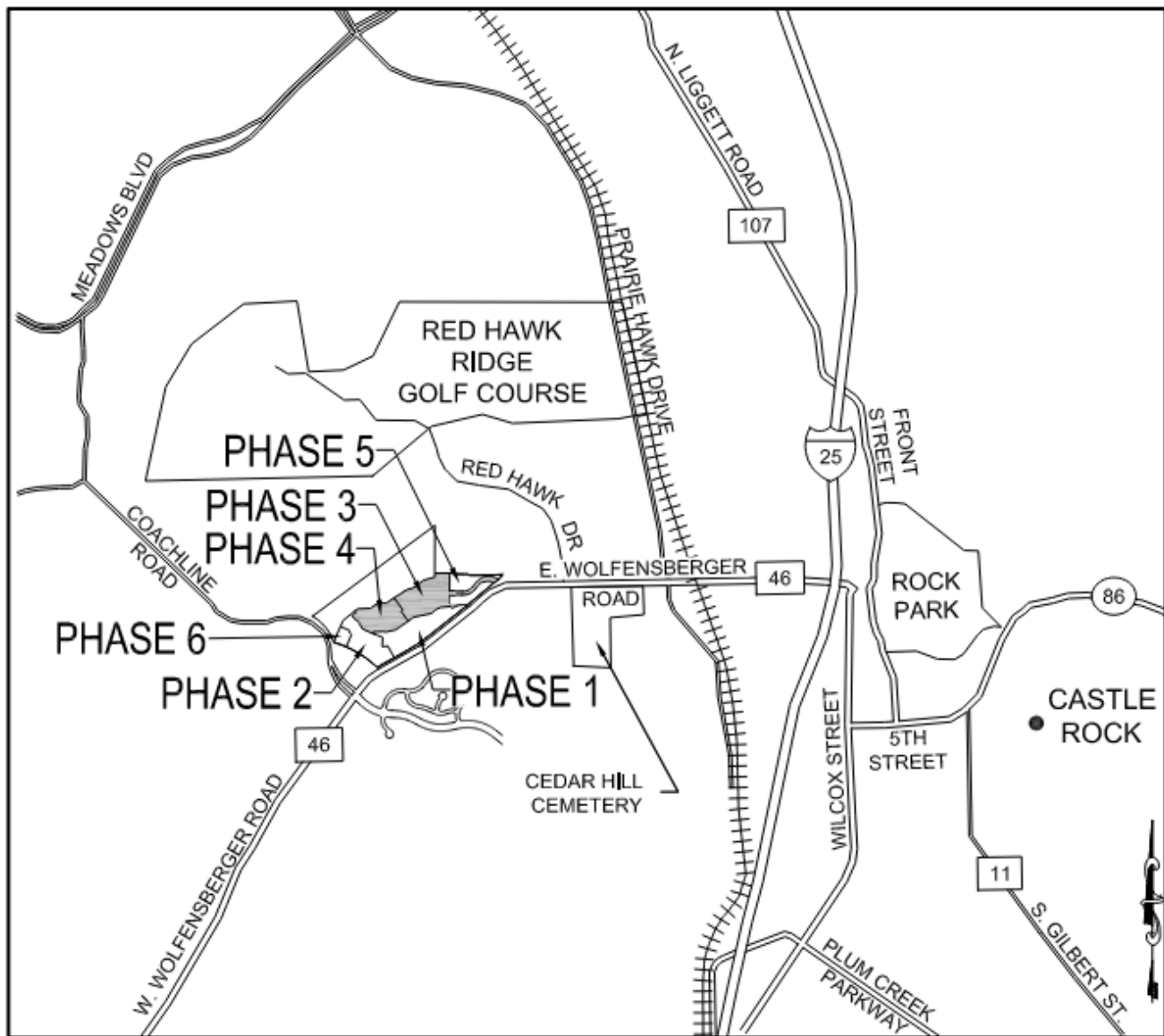
APPENDICIES

- Appendix A – Soil Survey and FIRMette
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I. GENERAL LOCATION AND DESCRIPTION

Site Location

The Hillside at Castle Rock site occupies approximately 51.9 acres and is located in the Southwest Quarter of Section 3 and Southeast Quarter of Section 4, Township 8 South, Range 67 West, 6th Principal Meridian, Douglas County, Town of Castle Rock, Colorado. More specifically, approximately 1 mile west of Interstate I-25 and northeast of the intersection of Wolfensberger Road and Coachline Road. The site is bordered on the north and west by the Meadows PD Fourth Amendment, unincorporated Douglas County to the east, north of Wolfensberger Road, and east of Coachline Road. See Vicinity Map below.



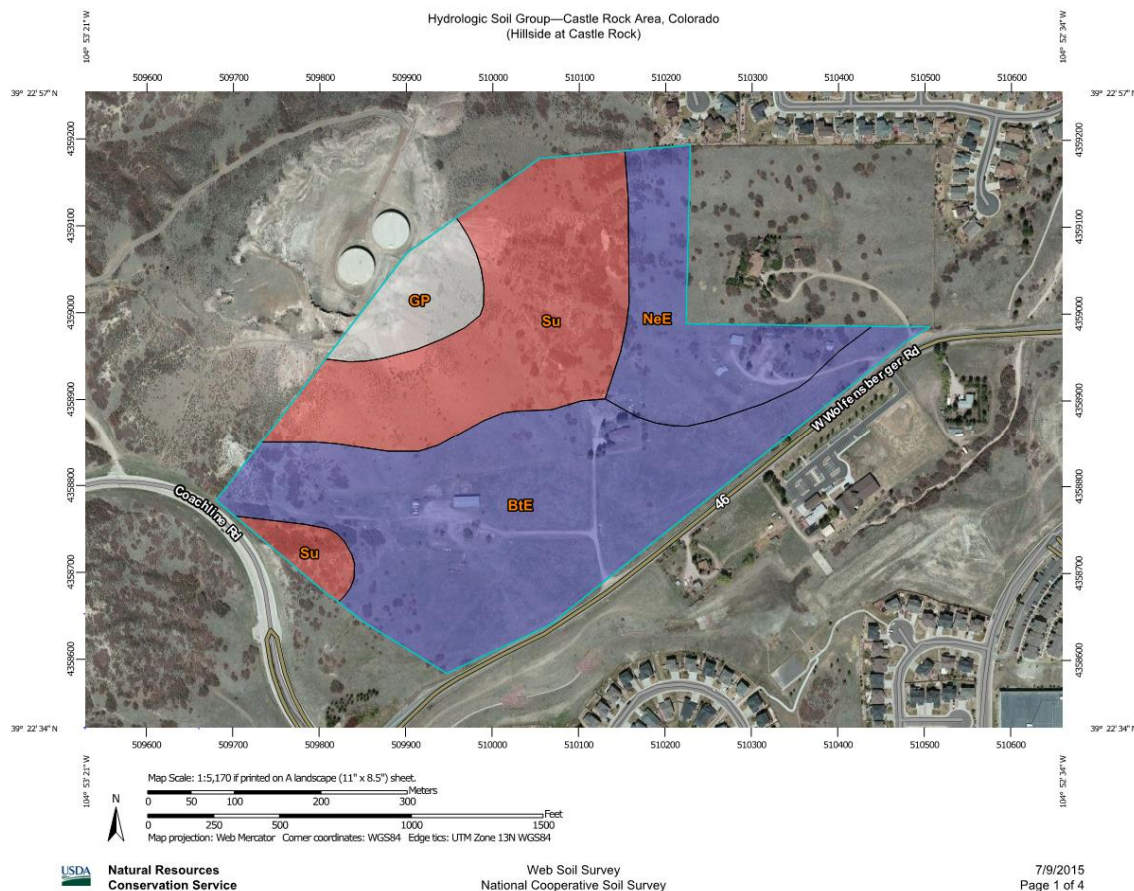
VICINITY MAP

SCALE: 1" = 2,000'±

Description of Property

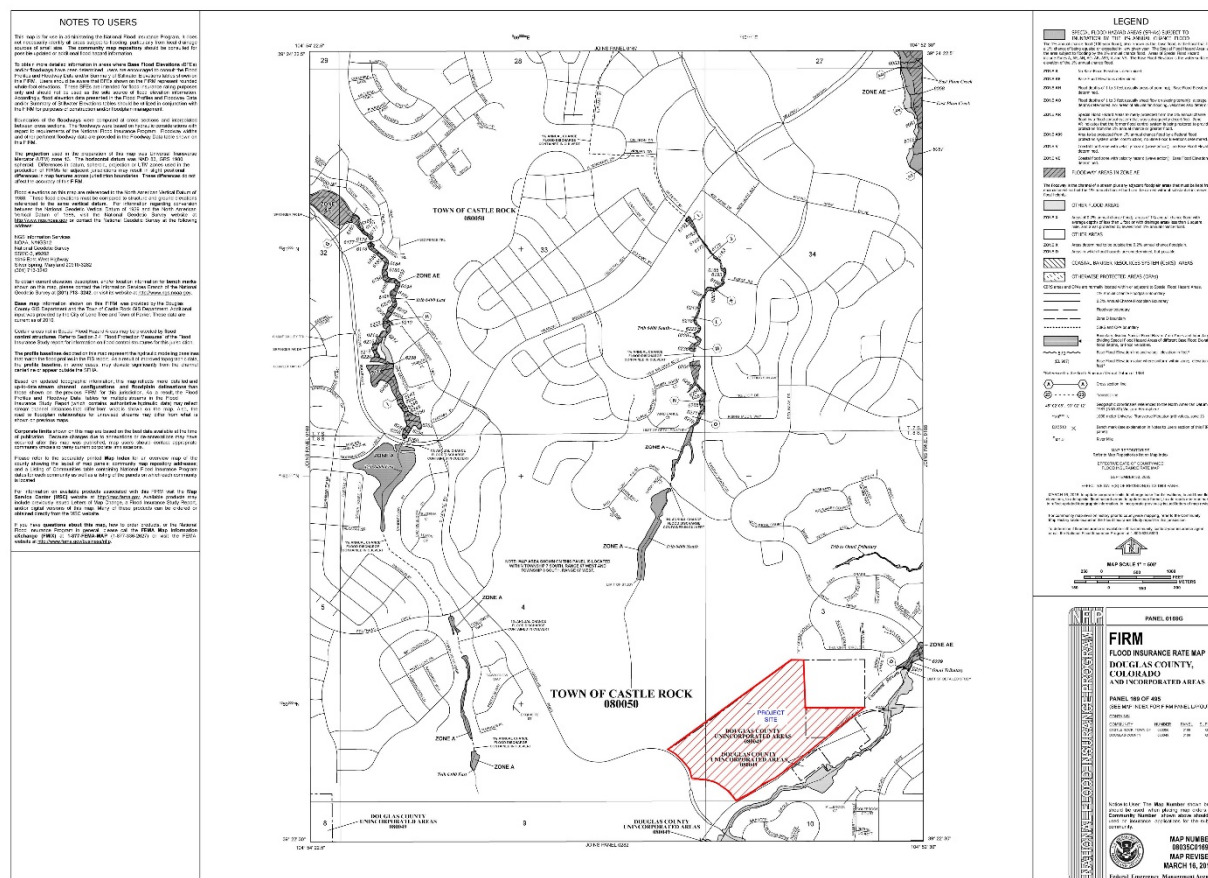
Phases 3, 4 & 5 of Hillside at Castle Rock site encompasses approximately 14.27 acres and is currently covered with native vegetation including pine trees, scrub oak, native grasses, and weeds. The site is located on the side of a hill with elevations ranging from 6270 to 6600. Slopes across the site are steep with grades ranging from 5% to 50%.

There are two different soil types within the Hillside at Castle Rock development with predominately Type B soils in the proposed development area. There are Type D soils in the upper elevation zones but tend to be outside of the developed area. A soils map obtained from the United States Department of Agriculture Natural Resources Conservation Service (NRCS Web Soil Survey) is included below.



The site is located on the side of a steep hill and slopes generally toward the south and east, toward Wolfensberger Road. The lower portions have grades ranging from 5% to 30% and are considered developable while the upper areas exceed 3:1 and are considered undevelopable. These areas are labeled as rock fall mitigation areas. There are no major and minor drainage ways, existing irrigation canals or ditches within the limits of the site. Per the FEMA Flood Insurance Rate Map (FIRM) Map 08035C0169G revised March 16, 2016, the site lies entirely within flood Zone X (unshaded), areas determined to be outside the 0.2% annual chance floodplain.

*Phase III Drainage Report
Hillside at Castle Rock – Phase 3 & 4*



The proposed land use is intended to be an active adult, single family attached residential development with 3 different lot type / building configurations. This Phase III report is for Phase 3 & 4 construction which consists of the following residential units:

Phase 3

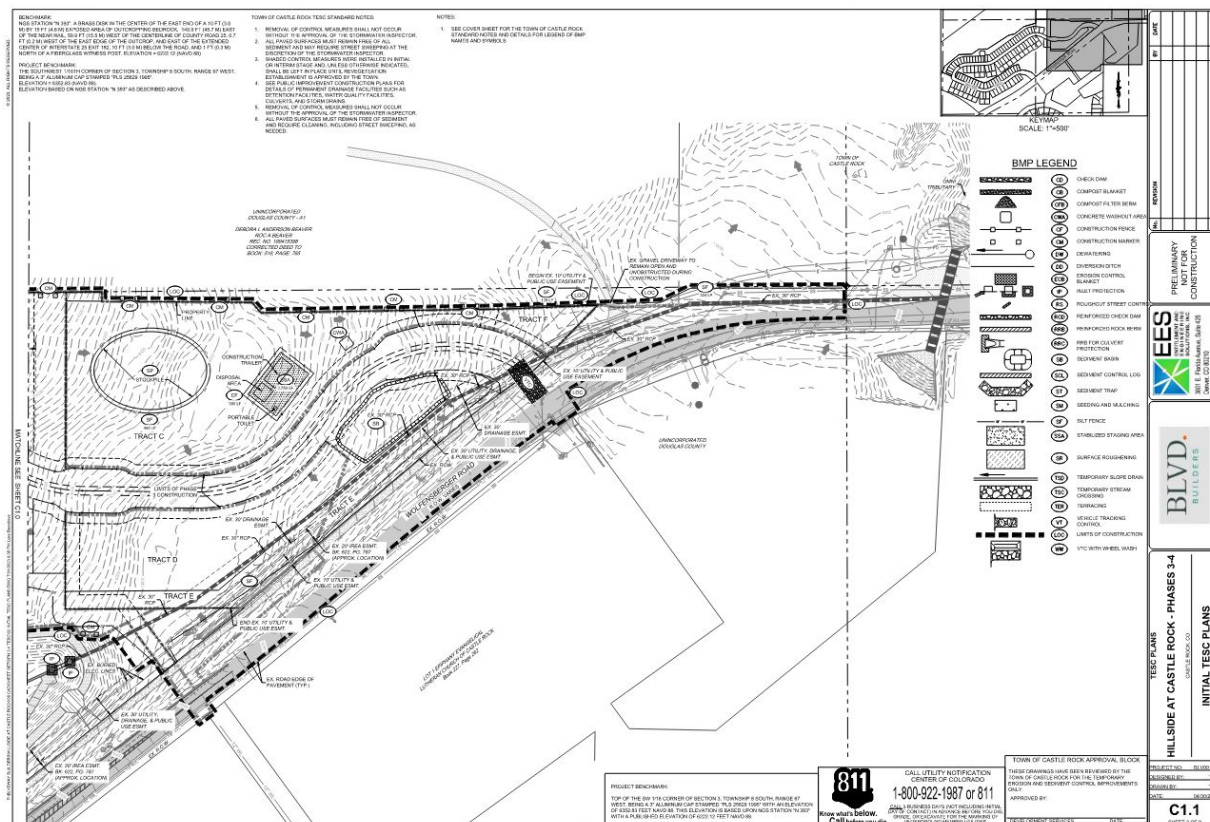
- 8 Duplex Buildings
10 Single Family Homes
6 Attached Cottages

Phase 4

- 7 Duplex Buildings
10 Single Family Homes
5 Attached Cottages

Total number of dwelling units is 66.

Phase III Drainage Report
Hillside at Castle Rock – Phase 3 & 4



PHASED STORMWATER MANAGEMENT

As shown below, a sedimentation basin and diversion channel will be installed to direct upstream runoff to Detention Pond B. This will insure that proposed walls and residences are protected in the interim condition. Erosion control measures such as sediment control logs, silt fence, seeding and mulching will protect Phase 1 construction from Phase 2 overlot runoff. Calculations for the sediment basin and diversion ditch and be found in the Hillside at Castle Rock Phase 3 & 4 TESC report/plans.

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Drainage Basins

The site lies within the Omni Tributary of the Plum Creek major drainage basin and is located approximately 1 mile west of the Plum Creek channel. The basin sites in a valley and extends approximately 2.75 miles west of the Plum Creek channel and encompasses approximately 1.69 square miles. The western 2/3rds of the basin is undeveloped with sporadic single family homes located in the lower regions. Due to the steepness of the terrain, it is not anticipated that this area will have much additional development. The eastern 1/3rd has been developed with commercial and residential developments. The proposed site is located mostly at the west limits of the developable area.

The existing site is currently undeveloped with the exception of on going construction of Phases 1 & 2. It is located on a hillside with steep slopes and receives offsite flows from the OS Basins. This runoff will be captured by rockfall mitigation channel designed to carry the 100-yr runoff to Detention Pond A via Storm Sewer System A at full buildout. The Phase 1 portion of the channel will convey offsite runoff to Detention Pond A via, temporary slope drains, a Sedimentation Basin and diversion channel. The proposed development of the site is as a single family active adult community.

The Omni, Industrial and Westfield Watershed Master Plan Final Preliminary Design Report further examined the Omni Basin and was completed in January 2011. The report examined drainage issues for the basin and proposed different alternatives to rectify damages being caused. Relevant pages from the report are included in Appendix D along with exhibits illustrating the existing drainage conveyance methods along Wolfensberger Road from Coachline Road to east end of the site. Although the area is within the Plum Creek Major Drainage Basin, there have been no specific OSP's or FHAD Studies associated with it.

Minor Drainage Basin

According to the Omni Industrial Westfield Watersheds FHAD prepared in April 2013, by CH2MHill for the Town of Castle Rock, the project site situates within sub-basin 21 of the Plum Creek Basin and tributaries to Omni open channel that ultimately to the East Plum Creek. The 2010 Stormwater Master Plan, prepared by Castle Rock Water Engineering, updated March, 2011, suggests a couple alternatives to stabilize it and includes engineered stream sections, grade and drop structure to improve water quality and flood control.

As mentioned in Section II.A above, the site is located on a hillside with steep slopes and receives offsite flows from the OS Basins. The historic drainage pattern for much of the site is from the northwest to the southeast. Flows typically sheet flow to shallow swales, open channels and are conveyed to the Wolfensberger Road roadside ditch. Existing flows from the western third of the site are conveyed in the roadside ditch to an existing 24" CMP storm sewer, located just prior to an existing gravel driveway. Refer to maps in the Appendix D. The culvert conveys the flows to the drainage channel on the south side of the Wolfensberger Road. As mentioned above, historical runoff from the site is conveyed to Omni tributary and ultimately to East Plum Creek. Likewise, existing flows from the area east of the driveway is conveyed in the roadside ditch along the north side of Wolfensberger Road then outfalls into an existing Omni open channel approximately ¼ mile east of the property. This channel is undeveloped and remains in its natural alignment.

III. DRAINAGE DESIGN CRITERIA

A. Regulations

The Town of Castle Rock Storm Drainage Design and Technical Criteria manual (TOCR SDD&TCM) and the Urban Drainage and Flood Control District's (UD&FCD) Urban Storm Drainage Criteria Manual, latest online version, were used to establish the storm drainage calculations within this report.

Drainage Studies, Master Plans, Site Constraints

The site was studied in the 2010 Castle Rock Storm Water Master Plan Update. The plan was adopted by the Castle Rock Town Council in February 2004 and revised in 2011. The Report further examined the Omni Basin and was completed in January 2011. Relevant pages of the study are contained in Appendix D along with exhibits illustrating the existing drainage conveyance methods along Wolfensberger Road from Coachline Road to east end of the site. The site has not been part of any other OSP or FHAD Study.

The primary objective of this Phase III Drainage Report is to ensure that the proposed runoff from the site will follow the same historical pattern via surface flow, grass swales, streets' curbs and gutters and intercepted into proposed storm sewer systems that ultimately discharged into a proposed detention pond.

The historical release rates as well as basins' imperviousness were carefully studied and compared to proposed drainage design. It is shown that the proposed release rates are smaller than the historical release rates, therefore, there will be no negative impacts on existing structures and downstream infrastructure.

Hydrology

Rainfall data for the minor and major events follow the TOCR SDD&TCM. The runoff coefficient for each storm event was calculated using the method established in Chapter 5 of the UD&FCD manual, Volume I. The impervious percentages used were taken from Table 6-3 for multi-family attached. Runoff coefficients were obtained from Table 6-5, Runoff Coefficients. The rainfall intensity value for each basin was used from Table 6-1 of the TOCR SDD&TCM.

Both the Town of Castle Rock Storm Drainage Design and Technical Criteria and the UD&FCD Manual state that if a site is relatively simple, requires minimal routing and is less than 160 acres in size, the rational method is an acceptable method to use to calculate the storm drainage flows impacting the proposed development.

Based on the Town of Castle Rock criteria, the 5-year and 100-year storm events were used to establish the minor and major storm flows.

The design rainfall is based upon Table 6-1 for one-hour point rainfall values for the TOCR. The information from the Hydrology section was input into the SF-2 and SF-3 spreadsheets to determine the drainage flows from each basin.

Hydraulics

Detention volumes and release rates are calculated with UD-Detention, Version 3.07. Total detention volume is WQCV plus 100-yr detention volume. UDSewer is used to model flows in the storm sewer systems and to calculate the 5-yr and 100-yr hydraulic grade lines in the storm sewer system. UD-Inlet Version 4.05, is used to calculate street capacity and inlet sizes.

Storage and Water Quality Enhancement

With the proposed development less than 90 acres, onsite detention will be used for water quality and detention. The proposed development is designed to comply with Colorado Revised Statute 37-92-602(8) pertaining to Stormwater Detention and Infiltration Facilities.

The proposed site has been divided into 2 separate detention basins. This report addresses Detention Pond A as existing and Detention Pond B as proposed. Storage and water quality will be addressed using the UD&FCD Detention spreadsheet and criteria defined in Volume 3 of the UD&FCD Manual.

Design procedures for proposed water quality BMPs conform to the following the four-step approach outlined in TOCR SDD&TCM Section 14.1.1:

Reduce Runoff Volume to the Maximum Extent Practical (Step 1 of 4):

At least 20-percent of the upstream imperviousness is disconnected and drain throughs a receiving pervious area comprising at least 10-percent of the upstream disconnected impervious area.

Provide Water Quality Capture Volume and Flood Control Detention Via Full-Spectrum Detention (Step 2 of 4):

Proposed Pond ‘B’ will provide water quality and detention for the site via Full-Spectrum detention.

Utilize Stream Channel Stabilization Techniques (Step 3 of 4):

Proposed streets, inlets, storm sewer system and low flow channels are the major drainageway for the site as well as the offsite improved roadside ditch. Onsite drainage and low flow channels are concrete and do not require further stabilization. The Wolfensberger roadside ditch has 8:1 side slopes and a longitudinal slope of approximately 3%. The roadside ditch will be stabilized with reinforced rock berms, seeding and mulching (See the approved Hillside at Castle Rock Phase 3 & 4 TESC Report TES xx-xxxx)

Undertake Source Control (Step 4 of 4):

During construction and overlot grading, sediment BMP’s need to be employed to minimize sediment deposit in detention facilities. Detention facilities will be required to have daily inspection and during before and after storm, and repair as necessary (See the Hillside at Castle Rock Phase 3 & 4 TESC Report TES xx-xxxx).

IV. STORMWATER MANAGEMENT FACILITY DESIGN

A. Stormwater Conveyance Facilities

The site is being laid out to match the existing topography as much as possible and therefore will follow the existing drainage patterns. The anticipated flows within the site will be conveyed within the street curb & gutter sections to the greatest extent possible. When street capacities are met, storm sewer inlets will be designed to intercept flows and convey them to the proposed detention facilities. As mentioned above, the site locates within Sub-basin 21 of the Plum Creek Basin and tributaries to Omni drainageway that conveys stormwater to East Plum Creek.

After leaving the onsite water quality detention ponds, stormwater will be discharged into an existing Omni Tributary culvert underneath Wolfensberger Road and ultimately to East Plum Creek. Refer to maps in the Appendix D for offsite stormwater conveyance. Due to grading constraints, runoff from some proposed drainage basins (D-4 and D-5) will be undetained and sheet flow to the existing roadside ditch along north side of Wolfensberger Road. These basins will be discussed in detail below to meet the TOCR SDD&TCM criteria on undetained flows that bypass the onsite stormwater quality.

Construction Phasing and Interim Runoff Conveyance

The site will be developed in phases, including phased grading, utilities and streets. This report covers Phase 3 & 4 construction and also includes updated Rational and Detention Pond Calculations for Detention Pond A and its tributary basins.

Basin Details-Phase 1 and Phase 2

Basin ID	Design Point	C ₅	C ₁₀₀	Q ₅ (cfs)	Q ₁₀₀ (cfs)
OS-1	5	0.05	0.49	1.00	17.79

Basin OS-1 consists of approximately 6.25 acres in the northwest portion of the site. The upper portion of this basin includes land owned by Castle Rock Land Company, LLC. Runoff originating from this basin will be intercepted by a 3-foot wide concrete rock mitigation and drainage channel and conveyed to D.P. 5. A temporary slope drain will convey runoff from the channel to a sedimentation basin located downstream in Basin OS-2. The sedimentation releases runoff via a perforated stand pipe or overflow spillway, depending on the magnitude of runoff, to a diversion channel which conveys runoff the Design Point 3. Runoff is then conveyed by another temporary slope drain to the north forebay of Detention Pond A. If construction of Phase 2 improvements does not begin within 2-years of construction plan approval, the temporary sedimentation basin will have to be replace with a permanent structure.

Basin ID	Design Point	C ₅	C ₁₀₀	Q ₅ (cfs)	Q ₁₀₀ (cfs)
OS-2	3	0.05	0.49	2.04	36.33

Basin OS-2 consists of approximately 19.77 acres of undeveloped land in the north central portion of the site. The upper portion of this basin includes land owned by Castle Rock Land Company, LLC. This basin sheet flows in a southerly direction to Design Point 3 and will remain undeveloped in Phase 1 & 2 except for the improvements required to convey runoff from Basin OS-1 to Detention Pond A as mentioned in the Basin OS-1 description above.

Basin ID	Design Point	C ₅	C ₁₀₀	Q ₅ (cfs)	Q ₁₀₀ (cfs)
OS-3	19	0.05	0.49	2.28	40.54

Basin OS-3 consists of approximately 16.05 acres in the northeastern portion of the site. The upper portion of this basin includes land owned by Castle Rock Land Company, LLC. This basin sheet flows in a southerly direction to the rock mitigation channel and will remain undeveloped in Phase 1 & 2 except for the improvements required to convey runoff from Basin OS-1 to Detention Pond A.

Basin ID	Design Point	C ₅	C ₁₀₀	Q ₅ (cfs)	Q ₁₀₀ (cfs)
A-1	1	0.46	0.70	8.21	21.51

Basin A-1 is 5.01 acres located in the western portion of the site. Basin improvements include residential lots, open space and streets. Developed runoff will be conveyed via street curb and gutter and to D.P. 1. The 5-yr and 100-yr flow rates are below street capacity. Runoff will be captured by four Triple Type 16 Combination inlets. Runoff will be then discharged to Detention Pond A through 30" RCP storm pipes. Refer to Appendix C for inlet hydraulic calculations. The four Triple Type 16 Combination inlets are on a continuous grade and are designed to capture 100% of the 5-yr storm runoff and 100% of the 100-yr storm runoff. In case of these inlets become clogged, runoff will travel to Detention Pond B.

Basin ID	Design Point	C ₅	C ₁₀₀	Q ₅ (cfs)	Q ₁₀₀ (cfs)
A-2	2	0.64	0.78	8.54	18.94

Basin A-2 is 3.59 acres located in the western portion of the site. Basin improvements include residential lots, open space and streets. Developed runoff will be conveyed via street curb and gutter and to D.P. 2. The 5-yr and 100-yr flow rates are below street capacity. Runoff will be captured by four Triple Type 16 Combination inlets. Runoff will be then discharged to Detention Pond A through 30" RCP storm pipes. Refer to Appendix C for inlet hydraulic calculations. The four Triple Type 16 Combination inlets are on a continuous grade and are designed to capture 100% of the 5-yr storm runoff and 100% of the 100-yr storm runoff. In case of these inlets become clogged, runoff will travel to Detention Pond B.

Basin ID	Design Point	C ₅	C ₁₀₀	Q ₅ (cfs)	Q ₁₀₀ (cfs)
C-1	3	0.52	0.71	1.40	3.48

Basin C-1 is approximately 0.56 acres consisting of roadway paving, sidewalk, and landscaping. Developed runoff will be conveyed via street curb and gutter and to D.P. 3. The 5-yr and 100-yr flow rates are below street capacity. Runoff will be captured by two Triple Type 16 Combination inlets. Runoff will be then discharged to Detention Pond B through 30" RCP storm pipes. Refer to Appendix C for inlet hydraulic calculations. The two Triple Type 16 Combination inlets are on a continuous grade and are designed to capture 100% of the 5-yr storm runoff and 100% of the 100-yr storm runoff. In case of these inlets become clogged, runoff will be passed to the Wolfsenberger ROW.

Basin ID	Design Point	C ₅	C ₁₀₀	Q ₅ (cfs)	Q ₁₀₀ (cfs)
C-2	4	0.82	0.87	1.38	2.67

Basin C-2 is approximately 0.35 acres consisting of roadway paving, sidewalk, and landscaping. Developed runoff will be conveyed via street curb and gutter and to D.P. 4. The 5-yr and 100-yr flow rates are below street capacity. Runoff will be captured by two Triple Type 16 Combination inlets. Runoff will be then discharged to Detention Pond B through 30" RCP storm pipes. Refer to Appendix C for inlet hydraulic calculations. The two Triple Type 16 Combination inlets are on a continuous grade and are designed to capture 100% of the 5-yr storm runoff and 100% of the 100-yr storm runoff. In case of these inlets become clogged, runoff will be passed to the Wolfsenberger ROW.

Basin ID	Design Point	C ₅	C ₁₀₀	Q ₅ (cfs)	Q ₁₀₀ (cfs)
C-3	5	0.53	0.73	4.20	10.43

Basin C-3 is approximately 2.15 acres consisting of future multi-family. Developed runoff will be conveyed via a soil riprap lined swale and to D.P. 5. The 5-yr and 100-yr flow rates are below street capacity. Runoff will be captured by a Type C inlet. Runoff will be then discharged to Detention Pond B through 18" RCP storm pipes. Refer to Appendix C for inlet hydraulic calculations. The Type C inlet is in sump and designed to capture 100% of the 5-yr storm runoff and 100% of the 100-yr storm runoff. In case of this inlet becoming clogged, runoff will be passed to the Wolfsenberger ROW.

Basin ID	Design Point	C ₅	C ₁₀₀	Q ₅ (cfs)	Q ₁₀₀ (cfs)
C-4	6	0.37	0.64	2.06	6.48

Basin C-4 is approximately 1.56 acres consisting of future multi-family and Detention Pond B. Developed runoff will be conveyed via a soil riprap lined swale and to D.P. 6 within Detention Pond B.

Basin ID	Design Point	C ₅	C ₁₀₀	Q ₅ (cfs)	Q ₁₀₀ (cfs)
C-5	7	0.01	0.44	0.02	3.04

Basin C-5 is approximately 0.51 acres consisting of future multi-family and landscaping. Developed runoff will be conveyed via a soil riprap lined swale along Wolfsenberger Road to a proposed Type C inlet at D.P. 7.

Basin ID	Design Point	C ₅	C ₁₀₀	Q ₅ (cfs)	Q ₁₀₀ (cfs)
C-6	8	0.38	0.63	0.92	3.04

Basin C-6 consists of approximately 0.51 acres of roadway paving, sidewalk and landscaping. Developed runoff is concentrated in curb and gutter and passed offsite to the Wolfsenberger ROW.

In addition, the table below summaries basins that are discharged:

Treated & Untreated Basin Analysis Data Table

Basin ID	Total Untreated Area (ac)	Total Area (ac)
C-6	0.51	0.51

The total percent of untreated area 6.7%. The allowable undetained release per the TOCR and the Stormwater Discharges Associated with Municipal Separate Storm Sewer Systems (MS4s) is zero cfs, therefore, we will apply for a variance for the undetained runoff.

Stormwater Storage Facilities

The proposed Phase 3 & 4 improvements will utilize one existing detention pond and Proposed Pond B. Detention Pond b has been designed based on current UDFCD and Town of Castle Rock design manuals.

Pond B is located east of the easterly entrance and at full buildout, will process flows from Major Basin C. Detention and water quality Pond A improvements consist of a one concrete forebay, 2-foot wide concrete low flow channel, 2.5-feet deep integrated micro-pool, one 12-foot wide gravel maintenance roads with working benches, EURV and 100-yr outlet structure, and 12-foot wide access road on top of the embankment.

Total routed flows from the above basins contribute to this pond is 23.06 cfs for 100-year storm event. The WQCV is 0.116 ac-ft; EURV capture volume is 0.390 ac-ft and 100-yr plus ½ WQCV volume is 0.701 ac-ft. The EURV release time is 71 hours and the 100-year release rate is 8.2 cfs which is 90% of the allowable release rate. An outfall pipe, 18” RCP storm sewer, conveys runoff to existing 30” storm sewer in the Wolfensberger Road. A 20-foot wide emergency overflow spillway is also designed to convey runoff to the roadside ditch on Wolfensberger Road. Refer to Appendix C for hydraulic calculations.

According to the Colorado Revised Statute 37-92-602(8) pertaining Stormwater Detention and Infiltration Facilities, the Detention Pond A is designed to continuously release or infiltrate at least 97% of all of the runoff from a rainfall event that is less than or equal to a 5-year storm within 72 hours after the end of the event; and continuous release or infiltrate as quickly as practical, but in all cases, releases or infiltrates at least 99% of the runoff within 120 hours after the end of events greater than a 5-year storm.

Water Quality Enhancement Best Management Practices

Non-structural practices are those practices which when implemented will minimize erosion and sediment transport. These practices include interim and permanent practices and include, but are not limited to: maintaining existing permanent vegetation, mulching, surface roughening, and vegetative buffer strips. Existing and proposed roadside ditches offsite will be improved for better stormwater quality when Wolfensberger Road is improved.

Floodplain Modifications

There are no major and minor drainage ways, existing irrigation canals or ditches within the limits of the site and it does not lie within a designated floodplain as shown on FEMA FIRM Map 08035C0169G revised March 16, 2016, included in Appendix A. There are no proposed floodplain modifications.

Additional Permitting Requirements

There are no additional permitting requirements.

General

The proposed development of the site will utilize the UD&FCD Detention spreadsheet to meet the Full Spectrum detention criteria as stated in the UD&FCD manual. Refer to Appendix for the use of tables and figures.

Operation and Maintenance Procedures

EDBs are sedimentation basins with forebays, micropools and a slow release outlet designed to detain stormwater for many hours after storm runoff ends. The basins are considered to be “dry” because the majority of the basin is designed not to have a significant permanent pool of water remaining between runoff events. See Appendix E for full details regarding operations and maintenance of EDBs.

V. CONCLUSION

A. Compliance with Standards

This final drainage report complies with the guidelines and policies of the current TOCR SDD&TCM and the UD&FCD Urban Storm Drainage Criteria Manual. The construction of this multi-family development, parks and roadways on the site is being done in a manner to preserve the existing drainage patterns and provide locations for water quality and detention.

Variances

Variances for undetained release of runoff are required and will be submitted along with this report.

Drainage Concept

The site is being laid out to match the existing topography as much as possible and therefore will follow the existing drainage patterns. The anticipated flows within the site will be conveyed within the street curb and gutter, storm sewer and drainage channels to the proposed water quality and detention pond.

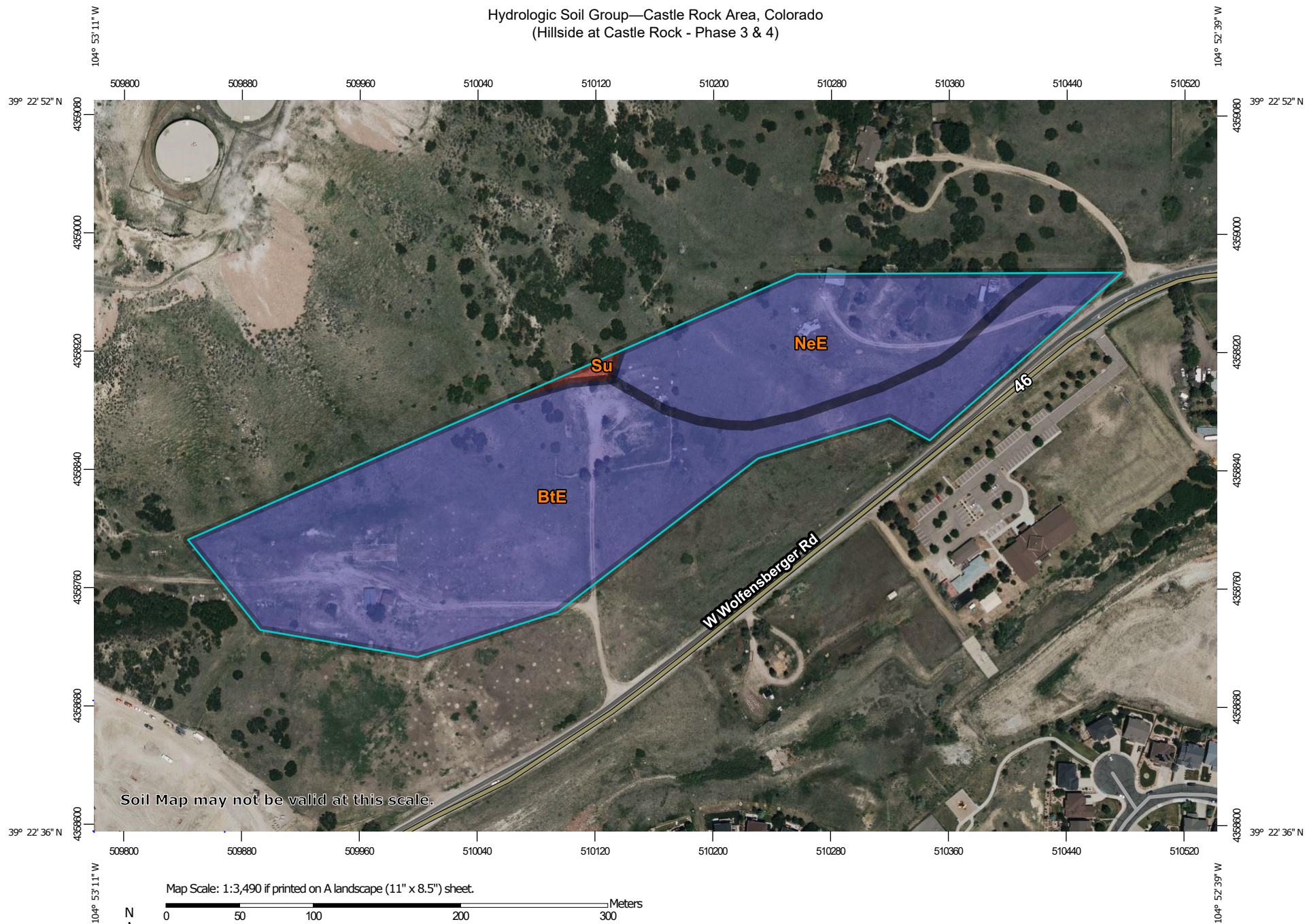
VI. REFERENCES

1. Town of Castle Rock Storm Drainage Design and Technical Criteria Manual, September 2007, Revised June 2019
2. Drainage Criteria Manual, Volumes 1, 2, & 3, Urban Drainage and Flood Control District, Volume 1 & 2 – Originally Published September 1969, Updated March 2017: Volume 3 – Originally Published September 1992, Updated January 2021.
3. Omni, Industrial and Westfield Watershed Master Plan Final Preliminary Design Report, CH2MHill, January 2011
4. 2010 Stormwater Master Plan Update, Castle Rock Engineering, March 2011
5. Castle Highlands Filing No. 2 Phase III Drainage Study, JR Engineering, August 21, 2001
6. Town of Castle Rock Stormwater Management Facility Operation and Maintenance (O&M) General Guidelines, December 2012.

APPENDIX A

Soil Survey and FIRMette

Hydrologic Soil Group—Castle Rock Area, Colorado (Hillside at Castle Rock - Phase 3 & 4)



Hydrologic Soil Group—Castle Rock Area, Colorado
(Hillside at Castle Rock - Phase 3 & 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.

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 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
BtE	Bresser-Truckton sandy loams, 5 to 25 percent slopes	B	12.1	72.4%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	B	4.5	26.8%
Su	Stony rough land	D	0.1	0.8%
Totals for Area of Interest			16.7	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

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

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

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

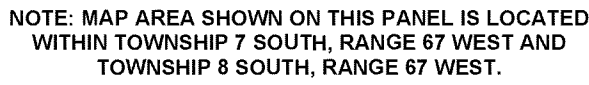
To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

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

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations** and **floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unreviewed streams may differ from what is shown on previous maps.

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

If you have **questions about this map**, how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfip>.



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

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

 FLOODWAY AREAS IN ZONE AE

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

 COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

 OTHERWISE PROTECTED AREAS (OPAs)

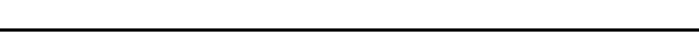
(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

• M1.5 River Mile

SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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



NATIONAL FLOOD INSURANCE PROGRAM	PANEL 0169G			
	FIRM			
	FLOOD INSURANCE RATE MAP			
	DOUGLAS COUNTY, COLORADO AND INCORPORATED AREAS			
	PANEL 169 OF 495 (SEE MAP INDEX FOR FIRM PANEL LAYOUT)			
	CONTAINS:			
	<u>COMMUNITY</u>	<u>NUMBER</u>	<u>PANEL</u>	<u>SUFFIX</u>
	CASTLE ROCK TOWN OF	080050	0169	G
	DOUGLAS COUNTY	080049	0169	G
	<p>Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.</p>			
U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT	MAP NUMBER 08035C0169G MAP REVISED MARCH 16, 2016			
	Federal Emergency Management Agency			

VIII. APPENDIX B - HYDROLOGY



Paragon Engineering Consultants
7852 S. Elati Street, Suite 106
Littleton, CO 80120
Office (303) 794-8604

RUNOFF COEFFICIENTS - DEVELOPED

FOR REFERENCE ONLY

FOR REFERENCE ONLY HILLSIDE PHASE II DRAINAGE REPORT UPDATE

PROJECT NAME: Hillside at Castle Rock - Phase II
PROJECT NUMBER: 15-005
CALCULATED BY: TWD
CHECKED BY: TWD

DATE: April 3, 2019

Land Use	2-Yr Coeff.	5-YEAR Coeff.	100-YEAR Coeff.	Impervious	Type D Soils	Type B Soils		Type B Soil	
					Historic / Open Space	M.F. Detached	Tract / Open Space	M.F. Attached	Streets
					Area	Area	Area	Area	Area
					0.01	0.46	0.01	0.60	0.84
					0.05	0.49	0.01	0.63	0.86
					0.49	0.71	0.44	0.78	0.89
					2%	60%	2%	75%	100%

Note: Runoff coefficients shown were obtained from UDFCD Table 6-3 and 6-5

Design Basin	Design Point	Historic / Open Space Area (AC)	M.F. Detached Area (AC)	Tract / Open Space Area (AC)	M.F. Attached Area (AC)	Streets Area (AC)	Area (AC)	CC ₂	CC ₅	CC ₁₀₀	% Imp.
A1	1		4.76				4.76	0.46	0.49	0.71	60%
A2	4		3.60				3.60	0.46	0.49	0.71	60%
SUBTOTAL FOR BASIN A		0.00	8.36	1.83	0.00	0.00	8.36	0.46	0.49	0.81	60%
		0.0%	100.0%	21.9%	0.0%	0.0%	122%				
B1	8		4.42	1.83			6.25	0.33	0.35	0.63	43%
B2	7		3.42				3.42	0.46	0.49	0.71	60%
B3	9		1.03				1.03	0.46	0.49	0.71	60%
B4	6		0.41	0.33			0.74	0.26	0.28	0.59	34%
B5	20		0.70	0.38			1.08	0.30	0.32	0.61	39%
B6				2.88			2.88	0.01	0.01	0.44	2%
SUBTOTAL FOR BASIN B		0.00	9.97	5.43	0.00	0.00	15.40	0.30	0.32	0.61	40%
		0.0%	64.7%	35.3%	0.0%	0.0%	100%				
C1	10				1.83		1.83	0.60	0.63	0.78	75%
C2	11				1.04		1.04	0.60	0.63	0.78	75%
C3	12			1.53			1.53	0.01	0.01	0.44	2%
C4	13			0.30		0.15	0.45	0.29	0.30	0.59	35%
SUBTOTAL FOR BASIN C		0.00	0.00	1.83	2.87	0.15	4.85	0.39	0.40	0.66	48%
		0.0%	0.0%	37.7%	59.1%	3.2%	100%				
D1	14		0.45	1.04		0.11	1.61	0.20	0.21	0.55	25%
D2	15			1.09		0.25	1.34	0.17	0.17	0.53	21%
D3	16			0.20		0.14	0.34	0.35	0.35	0.62	42%
D4	17					0.12	0.12	0.84	0.86	0.89	100%
D5	18			1.30		0.52	1.82	0.25	0.25	0.57	30%
SUBTOTAL FOR BASIN C		0.00	0.45	3.63	0.00	1.15	2.95	0.41	0.42	1.00	51%
		0.0%	15.4%	123.0%	0.0%	38.9%	177%				
OS-1	5	6.25					6.25	0.01	0.05	0.49	2%
OS-2	3	15.28					15.28	0.01	0.05	0.49	2%
OS-3	19	5.64					5.64	0.01	0.05	0.49	2%
SUBTOTAL FOR BASIN OS		27.17	0.00	0.00	0.00	0.00	27.17	0.01	0.05	0.49	2%
		100.0%	0.0%	0.0%	0.0%	0.0%	100%				
TOTAL STUDY AREA		27.17	18.79	12.72	2.87	1.30	58.73	0.20	0.23	0.61	26.4%
		46.3%	32.0%	21.7%	4.9%	2.2%	100.0%				

West Pond SD B		6.25	8.53	2.42	0.00	0.14	17.34	0.24	0.27	0.59	31%
West Pond SD A		15.28	9.80	0.33	0.00	0.00	25.41	0.18	0.22	0.57	24%
West Pond Total		21.53	18.33	5.63	0.00	0.14	45.63	0.19	0.22	0.57	26%



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7852 S. Elati Street, Suite 106
Littleton, CO 80120
Office (303) 794-8604

STANDARD FORM SF-2 - DEVELOPED

Time of Concentration

FOR REFERENCE ONLY

PROJECT NAME: Hillside at Castle Rock - Phase II
PROJECT NUMBER: 15-005
CALCULATED BY: TWD
CHECKED BY: TWD

FOR REFERENCE ONLY HILLSIDE PHASE II DRAINAGE REPORT UPDATE

DATE: April 3, 2019

SUB-BASIN DATA			INITIAL TIME (T _i)			TRAVEL TIME (T _t)						t _c CHECK (URBANIZED BASINS)			FINAL t _c		
DESIGN BASIN (1)	AREA Ac (2)	C _s (3)	LENGTH Ft (4)	SLOPE % (5)	T _i Min. (6)	LENGTH Ft. (7)	SLOPE % (8)	C _v (9)	Land Surface (10)	VEL fps (11)	T _t Min. (12)	COMP. t _c (13)	TOTAL LENGTH (14)	t _c =(L/180)+10 Min. (15)	Min. (16)	C10 (17)	C100 (18)
A1	4.76	0.49	100	2.0%	8.9	1,350	6.0%	20.0	Paved Areas	4.9	4.6	13.5	1450	18.1	13.5	0.49	0.71
A2	3.60	0.49	100	2.0%	8.9	1,410	6.0%	20.0	Paved Areas	4.9	4.8	13.7	1510	18.4	13.7	0.49	0.71
A3	#N/A	#N/A	18	2.0%	#N/A	1,291	6.0%	20.0	Paved Areas	4.9	4.4	#N/A	1309	17.3	#N/A	#N/A	#N/A
B1	6.25	0.35	100	2.0%	10.9	1,395	6.0%	20.0	Paved Areas	4.9	4.7	15.7	1495	18.3	15.7	0.35	0.63
B2	3.42	0.49	102	32.4%	3.5	1,472	5.3%	20.0	Paved Areas	4.6	5.3	8.9	1574	18.7	8.9	0.49	0.71
B3	1.03	0.49	156	10.9%	6.3	563	3.9%	20.0	Paved Areas	4.0	2.4	8.7	719	14.0	8.7	0.49	0.71
B4	0.74	0.28	79	36.7%	4.0	12	20.8%	20.0	Paved Areas	9.1	0.0	4.1	91	10.5	5.0	0.28	0.59
B5	1.08	0.32	50	2.0%	8.0	591	16.0%	20.0	Paved Areas	8.0	1.2	9.3	641	13.6	9.3	0.32	0.61
B6	2.88	0.01	220	19.1%	11.1	254	1.1%	20.0	Paved Areas	2.1	2.0	13.1	474	12.6	12.6	0.01	0.44
C1	1.83	0.63	25	2.0%	3.4	570	6.0%	20.0	Paved Areas	4.9	1.9	5.4	595	13.3	5.4	0.63	0.78
C2	1.04	0.63	90	2.0%	6.5	570	6.0%	20.0	Paved Areas	4.9	1.9	8.4	660	13.7	8.4	0.63	0.78
C3	1.53	0.01	50	25.0%	4.8	150	2.0%	20.0	Paved Areas	2.8	0.9	5.7	200	11.1	5.7	0.01	0.44
C4	0.45	0.30	50	25.0%	3.6	1,100	4.0%	20.0	Paved Areas	4.0	4.6	8.1	1150	16.4	8.1	0.30	0.59
D1	1.61	0.21	50	10.0%	5.4	212	4.0%	7.0	Short Pasture/Lawn	1.4	2.5	7.9	262	11.5	7.9	0.21	0.55
D2	1.34	0.17	50	10.0%	5.6	415	4.0%	7.0	Short Pasture/Lawn	1.4	4.9	10.5	465	12.6	10.5	0.17	0.53
D3	0.34	0.35	50	10.0%	4.5	150	4.0%	7.0	Short Pasture/Lawn	1.4	1.8	6.3	200	11.1	6.3	0.35	0.62
D4	0.12	0.86	20	2.0%	1.6	50	4.0%	20.0	Paved Areas	4.0	0.2	1.8	70	10.4	5.0	0.86	0.89
D5	1.82	0.25	170	16.0%	8.0	591	1.7%	7.0	Short Pasture/Lawn	0.9	10.8	18.9	761	14.2	14.2	0.25	0.57
OS-1	6.25	0.05	500	39.6%	12.6	503	33.8%	5.0	Tillage/Field	2.9	2.9	15.5		N/A	15.5	0.05	0.49
OS-2	15.28	0.05	500	39.6%	12.6	1,863	8.1%	5.0	Tillage/Field	1.4	21.9	34.5		N/A	34.5	0.05	0.49
OS-3	5.64	0.05	500	39.6%	12.6	877	17.1%	5.0	Tillage/Field	2.1	7.1	19.7		N/A	19.7	0.05	0.49

$$T_i = \frac{0.395(1.1-C)L^{1/2}}{S^{1/3}}$$

$$T_t = \frac{L}{60V}$$

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

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

FOR REFERENCE ONLY

PROJECT NAME: Hillside at Castle Rock - Phase II
PROJECT NUMBER: 15-005
CALCULATED BY: TWD
CHECKED BY: TWD

P₁ (1-Hour Rainfall)	1.43
--	-------------

DATE: April 3, 2019

HILLSIDE PHASE II DRAINAGE REPORT

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C ₅	t _c (min)	C*A(ac)	I (in/hr)	Q (cfs)	t _c (min)	Σ(C*A)(ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	t _t (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	1	OS-2	15.28	0.05	34.5	0.76	2.06	1.58	34.5	0.97	2.06	2.0									
	5	OS-1	6.25	0.05	15.5	0.31	3.19	1.00													
OS-2+A1	3	A1	4.76	0.49	13.5	2.33	3.41	7.96	34.5	3.10	2.06	6.4									
OS-2+A1+A2	4	A2	3.60	0.49	13.7	1.76	3.39	5.98	34.5	4.86	2.06	10.0									West Pond
OS-2+A1+A2+B3+B4		B3	1.62	0.49	8.7	0.79	4.08	3.24	34.5	5.86	2.06	12.1									
B3+B4		B4	0.74	0.28	5.0	0.20	4.85	0.99	8.7	1.00	4.08	4.1									
Inlet OS-1+B1	7	B1	6.25	0.35	15.7	2.18	3.18	6.94	15.7	2.49	3.18	7.9									
Pipe OS-1+B1+B5+D3	7	B1	6.25	0.35	15.7	2.18	3.18	6.94	15.7	2.96	3.18	9.4									
OS-1+B1+B2+B5+D3	8	B2	3.42	0.49	8.9	1.68	4.05	6.79	15.7	4.64	3.18	14.7									
	9	B3	1.03	0.49	8.7	0.50	4.08	2.06													West Pond
D3+B5	20	B5	1.08	0.32	9.3	0.34	3.98	1.37	9.3	0.47	3.98	1.9									
West Pond Inflow									34.5	10.63	2.06	21.9									
OS-3+C1	10	C1	1.83	0.63	5.4	1.15	4.76	5.49	19.7	1.43	2.84	4.1									
OS-3+C1+C2	11	C2	1.04	0.63	8.4	0.66	4.13	2.70	19.7	2.09	2.84	5.9									
OS-3+C1+C2+C3	12	C3	1.53	0.01	5.7	0.02	4.68	0.07	19.7	2.11	2.84	6.0									East Pond
	13	C4	0.45	0.30	8.1	0.13	4.18	0.56													Discharge offsite
	19	OS-3	5.64	0.05	19.7	0.28	2.84	0.80													East Pond
	14	D1	1.61	0.21	7.9	0.33	4.22	1.40													Discharge offsite
	15	D2	1.34	0.17	10.5	0.23	3.79	0.87													Discharge offsite
	16	D3	0.34	0.35	6.3	0.12	4.55	0.55													To inlet then to Pond A
	17	D4	0.12	0.86	5.0	0.10	4.85	0.50													Dischrage offsite
	18	D5	1.82	0.57	14.2	1.04	3.33	3.44													Offsite Basin



HILLSIDE PHASE II DRAINAGE REPORT

DATE: April 3, 2019

PROJECT NAME: Hillside at Castle Rock - Phase II
PROJECT NUMBER: 15-005
CALCULATED BY: TWD
CHECKED BY: TWD

P₁ (1-Hour Rainfall) = 2.60

[illegible]

PROPOSED CONDITIONS
Runoff Coefficients

Project: Hillside at Castle Rock - Phase 3 & 4
Section:

Created by: OWS
Checked by: MSG

Date: 3/31/2023
Date: 3/31/2023

Sub-Basin Data			Composite C					Sub Area (Apartments)						Sub Area (Paving)						Sub Area (Drives and Walks)						Sub Area (Landscape)					
Basin ID	Description	Total Area (ac)	C ₂	C ₅	C ₁₀	C ₁₀₀	I (%)	C ₂	C ₅	C ₁₀	C ₁₀₀	I (%)	Area (ac)	C ₂	C ₅	C ₁₀	C ₁₀₀	I (%)	Area (ac)	C ₂	C ₅	C ₁₀	C ₁₀₀	I (%)	Area (ac)	C ₂	C ₅	C ₁₀	C ₁₀₀	I (%)	Area (ac)
On/Off-Site Detained																															
A-1	Apartments, Paving, Drives/Walks & Landscaping	5.01	0.46	0.48	0.52	0.70	57.7	0.60	0.63	0.66	0.78	75	2.92	0.84	0.86	0.86	0.89	100	0.43	0.74	0.76	0.78	0.84	90	0.27	0.01	0.01	0.07	0.44	2	1.39
A-2	Apartments, Paving, Drives/Walks & Landscaping	3.59	0.62	0.64	0.67	0.78	87.9	0.60	0.63	0.66	0.78	90	2.76	0.84	0.86	0.86	0.89	100	0.43	0.74	0.76	0.78	0.84	90	0.26	0.01	0.01	0.07	0.44	2	0.14
C-1	Paving, Drives/Walks, & Landscaping	0.56	0.51	0.52	0.54	0.71	60.9	0.60	0.63	0.66	0.78	90	0.00	0.84	0.86	0.86	0.89	100	0.22	0.74	0.76	0.78	0.84	90	0.13	0.01	0.01	0.07	0.44	2	0.21
C-2	Paving, Drives/Walks, & Landscaping	0.35	0.80	0.82	0.83	0.87	96.3	0.60	0.63	0.66	0.78	90	0.00	0.84	0.86	0.86	0.89	100	0.22	0.74	0.76	0.78	0.84	90	0.13	0.01	0.01	0.07	0.44	2	0.00
C-3	Apartments & Landscaping	2.15	0.51	0.53	0.57	0.73	76.0	0.60	0.63	0.66	0.78	90	1.81	0.84	0.86	0.86	0.89	100	0.00	0.74	0.76	0.78	0.84	90	0.00	0.01	0.01	0.07	0.44	2	0.34
C-4	Apartments, Landscaping & Detention Pond	1.65	0.35	0.37	0.41	0.64	52.9	0.60	0.63	0.66	0.78	90	0.95	0.84	0.86	0.86	0.89	100	0.00	0.74	0.76	0.78	0.84	90	0.00	0.01	0.01	0.07	0.44	2	0.70
C-5	Landscaping	0.40	0.01	0.01	0.07	0.44	2.0	0.60	0.63	0.66	0.78	90	0.00	0.84	0.86	0.86	0.89	100	0.00	0.74	0.76	0.78	0.84	90	0.00	0.01	0.01	0.07	0.44	2	0.40
C-6	Paving, Drives/Walks, & Landscaping	0.56	0.33	0.34	0.38	0.61	40.1	0.60	0.63	0.66	0.78	90	0.00	0.84	0.86	0.86	0.89	100	0.14	0.74	0.76	0.78	0.84	90	0.08	0.01	0.01	0.07	0.44	2	0.33
Total		5.67	0.43	0.44	0.48	0.68	60.2	0.60	0.63	0.66	0.78	90	2.76	0.84	0.86	0.86	0.89	100	0.58	0.74	0.76	0.78	0.84	90	0.34	0.01	0.01	0.07	0.44	2	1.98

PROPOSED CONDITIONS

Time of Concentration

Project: Hillside at Castle Rock - Phase 3 & 4

Section:

Created by: OWS
Checked by: MSG

Date: 3/31/2023
Date: 3/31/2023

Urban TOC_{min} = 5 min
Rural TOC_{min} = 10 min

	SUB-BASIN DATA			INITIAL/OVERLAND FLOW (t _o)			TRAVEL TIME (t _t)								Tc CHECK (Urbanized basins)				FINAL Tc (min)	
									Type of Land Surface						TOTAL					
Basin ID	Description	C _s	Area (ac)	Length (ft)	Slope (ft/ft)	t _o (min)	Length (ft)	S _w (ft/ft)	Code	Description	Convey Coef (C _c)	Velocity (ft/s)	Time (min)	t _c = t _i + t _t (min)	(Yes /No)	Length (ft)	T _c max (min)	Tc _{max} > t _c		
On/Off-Site Detained																				
A-1	Apartments, Paving, Drives/Walks & Landscaping	0.48	5.01	177	0.038	9.53	1,220	0.060	6	Paved areas and shallow paved swales	20.00	4.88	4.17	13.70	Yes	1397	17.76	OK	13.70	
A-2	Apartments, Paving, Drives/Walks & Landscaping	0.64	3.59	303	0.063	7.80	987	0.060	6	Paved areas and shallow paved swales	20.00	4.90	3.36	11.16	Yes	1290	17.17	OK	11.16	
C-1	Paving, Drives/Walks, & Landscaping	0.52	0.56	27	0.058	3.06	595	0.061	6	Paved areas and shallow paved swales	20.00	4.93	2.01	5.07	Yes	622	13.46	OK	5.07	
C-2	Paving, Drives/Walks, & Landscaping	0.82	0.35	20	0.063	1.22	630	0.060	6	Paved areas and shallow paved swales	20.00	4.88	2.15	3.37	Yes	650	13.61	OK	5.00	
C-3	Apartments & Landscaping	0.53	2.15	317	0.058	10.23	253	0.062	5	Grassed waterway	15.00	3.73	1.13	11.36	Yes	570	13.17	OK	11.36	
C-4	Apartments, Paving, Landscaping & Detention Pond	0.37	1.65	173	0.040	10.99	480	0.020	5	Grassed waterway	15.00	2.12	3.77	14.77	Yes	653	13.63	Use Regional Tc	13.63	
C-5	Landscaping	0.01	0.40	-	-	-	-	-	-	BY INSPECTION	-	-	-	-	-	-	-	-	5.00	
C-6	Paving, Drives/Walks, & Landscaping	0.34	0.56	-	-	-	-	-	-	BY INSPECTION	-	-	-	-	-	-	-	-	5.00	

Notes:
t_i = (0.395*(1.1-C_s)*(L^0.5))/(S^0.33), from UDFCD Eqn RO-3
Velocity from V = C_c*S_w^0.5, from UDFCD Eqn RO-4, C_c from Table RO-2 (See Sheet Design Info)
t_t = L/60V
t_c max = 10+L/180, from UDFCD Eqn RO-5
Final Tc > 10 min for nonurban watersheds

UDFCD Table RO-2 Land Surface Coefficients	
Code	Description
1	Heavy meadow
2	Tillage/field
3	Short pasture and lawns
4	Nearly bare ground
5	Grassed waterway
6	Paved areas and shallow paved swales
7	Rail Ballast

PROPOSED CONDITIONS - 5 YEAR MINOR STORM
Storm Drainage System Design (Rational Method Procedure)

Project: Hillside at Castle Rock - Phase 3 & 4
Section:

Created by: OWS
Checked by: MSG
3/31/2023
3/31/2023

DEVELOPED CONDITIONS
Design Storm: 5-yr P = 1.43 in

LOCATION		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			AREA DESIGN (name)	AREA (AC)	RUNOFF COEFF (S Yr)	t _c (MIN)	C.A. (AC)	I IN / HR	Q (CFS)	t _c (MIN)	SUM (C' A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (in)	LENGTH (FT)	VELOCITY (FPS)	t _t (MIN)	
DP	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)		(21)	(22)
1	A-1	Apartments, Paving, Drives/Walks & Landscaping	DP-1	5.01	0.48	13.70	2.43	3.39	8.21													Downspout to EX1
2	A-2	Apartments, Paving, Drives/Walks & Landscaping	DP-2	3.59	0.64	11.16	2.31	3.70	8.54													Pan to Rain Garden
3	C-1	Paving, Drives/Walks, & Landscaping	DP-3	0.56	0.52	5.07	0.29	4.83	1.40													Sheet flow to adj. site
4	C-2	Paving, Drives/Walks, & Landscaping	DP-4	0.35	0.82	5.00	0.29	4.85	1.38													Sheet flow to adj. site
5	C-3	Apartments & Landscaping	DP-5	2.15	0.53	11.36	1.14	3.67	4.20													Sheet flow to adj. site
6	C-4	Apartments, Landscaping & Detention Pond	DP-6	1.65	0.37	13.63	0.61	3.39	2.06													Colfax ROW
7	C-5	Landscaping	DP-7	0.40	0.01	5.00	0.00	4.85	0.02													
8	C-6	Paving, Drives/Walks, & Landscaping	DP-8	0.56	0.34	5.00	0.19	4.85	0.92													Colfax ROW

- (1) Basin Description linked to C-Value Sheet

(2) Basin Design Point

(3) Enter the Basin Name from C Value Sheet

(4) Basin Area linked to C-Value Sheet

(5) Composite C linked to C-Value Sheet

(6) Time of Concentration linked to C-Value Sheet
- (7) =Column 4 x Column 5

(8) =28.5*P/(10+Column 6)^0.786

(9) =Column 7 x Column 8

(10) =Column 6 x Column 21

(11) Add the Basin Areas (7) to get the combined basin AC

(12) ~28.5*P/(10+Column 10)^0.786
- (13) Sum of Qs

(14) Additional Street Overland Flow

(15) Additional Street Overland Flow

(16) Additional Pipe Flow

(17) Additional Pipe Flow

(18) Additional Pipe Flow
- (19) Additional Flow Length

(20) Overland Velocity

(21) =(Column 16 / Column 20 / 60

PROPOSED CONDITIONS - 5 YEAR MINOR STORM
Storm Drainage System Design (Rational Method Procedure)

Project: Hillside at Castle Rock - Phase 3 & 4
Section:

Created by: OWS
Checked by: MSG
3/31/2023
3/31/2023

DEVELOPED CONDITIONS
Design Storm: 100-yr
P = 2.60 in

LOCATION		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			AREA DESIGN (name)	AREA (AC)	RUNOFF COEFF (100 Yr)	t _c (MIN)	C.A. (AC)	I IN / HR	Q (CFS)	t _c (MIN)	SUM (C' A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (in)	LENGTH (FT)	VELOCITY (FPS)	t _t (MIN)	
DP	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)		(21)	(22)
1	A-1	Apartments, Paving, Drives/Walks & Landscaping	DP-1	5.01	0.70	13.70	3.49	6.16	21.51													Downspout to EX1
2	A-2	Apartments, Paving, Drives/Walks & Landscaping	DP-2	3.59	0.78	11.16	2.81	6.73	18.94													Pan to Rain Garden
3	C-1	Paving, Drives/Walks, & Landscaping	DP-3	0.56	0.71	5.07	0.40	8.79	3.48													Sheet flow to adj. site
4	C-2	Paving, Drives/Walks, & Landscaping	DP-4	0.35	0.87	5.00	0.30	8.82	2.67													Sheet flow to adj. site
5	C-3	Apartments & Landscaping	DP-5	2.15	0.73	11.36	1.56	6.68	10.43													Sheet flow to adj. site
6	C-4	Apartments, Landscaping & Detention Pond	DP-6	1.65	0.64	13.63	1.05	6.17	6.48													Colfax ROW
7	C-5	Landscaping	DP-7	0.40	0.44	5.00	0.18	8.82	1.55													
8	C-6	Paving, Drives/Walks, & Landscaping	DP-8	0.56	0.61	5.00	0.35	8.82	3.04													

- (1) Basin Description linked to C-Value Sheet

(2) Basin Design Point

(3) Enter the Basin Name from C Value Sheet

(4) Basin Area linked to C-Value Sheet

(5) Composite C linked to C-Value Sheet

(6) Time of Concentration linked to C-Value Sheet
- (7) =Column 4 x Column 5

(8) =28.5*P/(10+Column 6)^0.786

(9) =Column 7 x Column 8

(10) =Column 6 x Column 21

(11) Add the Basin Areas (7) to get the combined basin AC

(12) =28.5*P/(10+Column 10)^0.786
- (13) Sum of Qs

(14) Additional Street Overland Flow

(15) Additional Street Overland Flow

(16) Additional Pipe Flow

(17) Additional Pipe Flow

(18) Additional Pipe Flow
- (19) Additional Flow Length

(20) Overland Velocity

(21) =Column 16 / Column 20 / 60

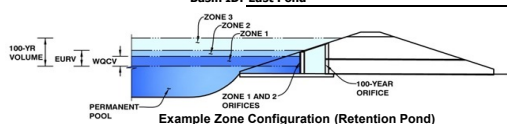
APPENDIX B

Hydrology

MHFD-Detention, Version 4.06 (July 2022)

Project: Hillside at Castle Rock - Phase 3 & 4

Basin ID: East Pond



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	5.38	acres
Watershed Length =	579	ft
Watershed Length to Centroid =	376	ft
Watershed Slope =	0.060	ft/ft
Watershed Imperviousness =	66.30%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	99.2%	percent
Percentage Hydrologic Soil Group C/D =	0.8%	percent
Target WQVC Drain Time =	40.0	hours
Location for 1-hr Rainfall Depth =	Highlands Ranch - High	

Location for 1-hr Rainfall Depths = Highlands Ranch - Highlands Ranch Mansion

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) =	0.116	acre-feet
Excess Urban Runoff Volume (EURV) =	0.390	acre-feet
2-yr Runoff Volume ($P1 = 1.06$ in.) =	0.286	acre-feet
5-yr Runoff Volume ($P1 = 1.43$ in.) =	0.428	acre-feet
10-yr Runoff Volume ($P1 = 1.66$ in.) =	0.520	acre-feet
25-yr Runoff Volume ($P1 = 1.67$ in.) =	0.542	acre-feet
50-yr Runoff Volume ($P1 = 2.26$ in.) =	0.795	acre-feet
100-yr Runoff Volume ($P1 = 2.6$ in.) =	0.956	acre-feet
500-yr Runoff Volume ($P1 = 3.01$ in.) =	1.138	acre-feet
Approximate 2-yr Detention Volume =	0.270	acre-feet
Approximate 5-yr Detention Volume =	0.387	acre-feet
Approximate 10-yr Detention Volume =	0.489	acre-feet
Approximate 25-yr Detention Volume =	0.463	acre-feet
Approximate 50-yr Detention Volume =	0.580	acre-feet
Approximate 100-yr Detention Volume =	0.643	acre-feet

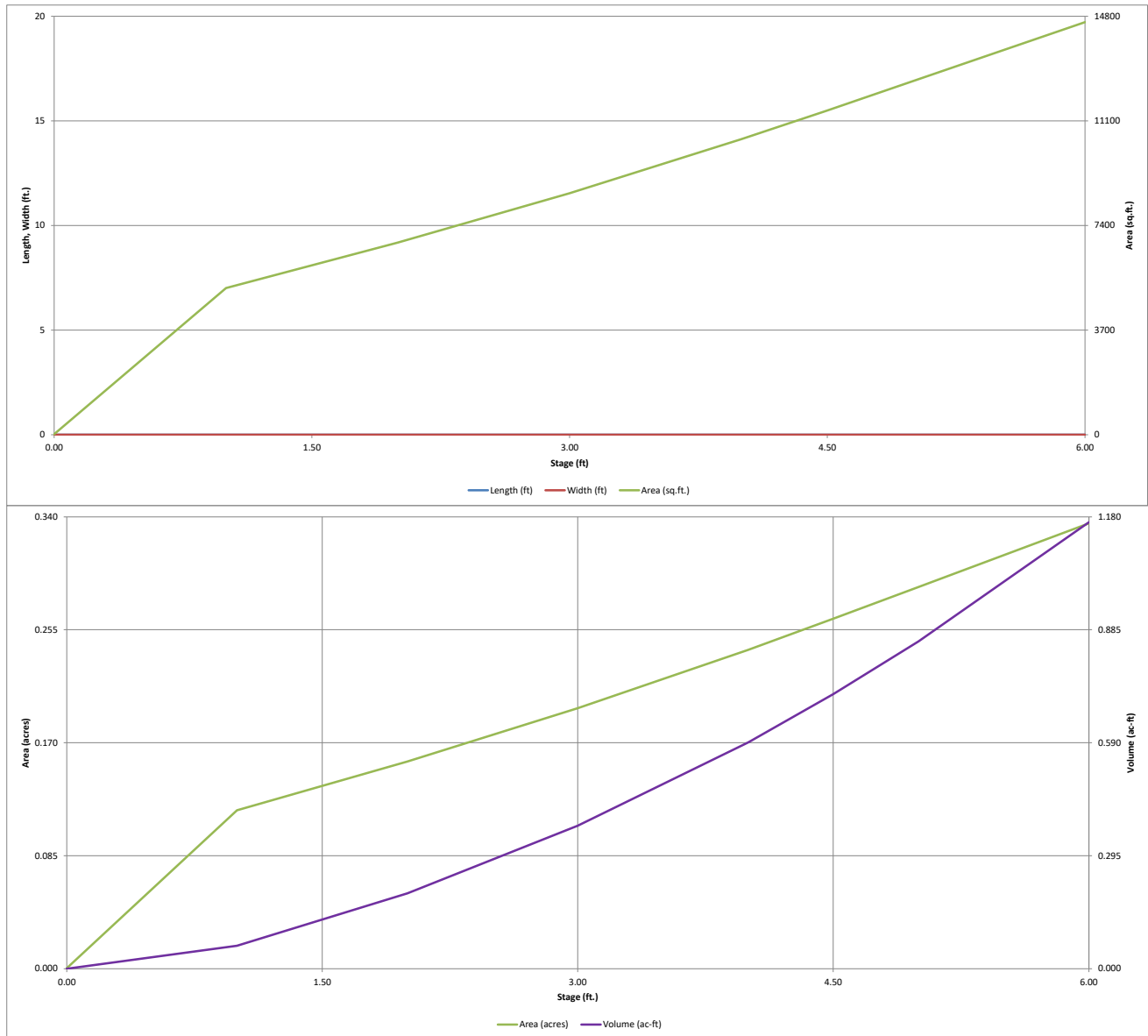
Define Zones and Basin Geometry

Zone 1 Volume (WQV_1) =	0.116	acre-feet
Zone 2 Volume ($EURV - Z_1$) =	0.273	acre-feet
Zone 3 ($100yr - 1/2 WQV_1 - Zones 1 \& 2$) =	0.311	acre-feet
Total Detention Basin Volume =	0.701	acre-feet
Initial Surge Volume (ISV) =	user	ft ³
Initial Surge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{DAV}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{MAN}) =	user	H:V
Basin Length-to-Width Ratio (L_{TW}) =	user	
Initial Surge Area (A_{ISV}) =	user	ft ²
Surge Volume Length (L_{ISV}) =	user	ft
Surge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft ²
Volume of Basin Floor (V_{FLOOR}) =	user	ft ³
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft ²
Volume of Main Basin (V_{MAIN}) =	user	ft ³
Calculated Total Basin Volume (V_{DAV}) =	user	acre-feet

[illegible]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

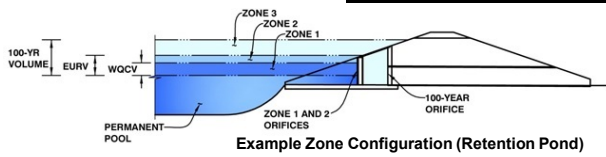


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD- Detention, Version 4.06 (July 2022)

Project: Hillside at Castle Rock - Phase 3 & 4

Basin ID: East Pond



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.45	0.116	Orifice Plate
Zone 2 (EURV)	3.09	0.273	Orifice Plate
Zone 3 (100+1/2WQCV)	4.44	0.311	Weir&Pipe (Restrict)
Total (all zones)		0.701	

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 (diameter = 1-1/8 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	1.03	2.06					
Orifice Area (sq. inches)	1.03	1.03	1.03					

	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 Orif
Vertical Orifice Area = ft²
Vertical Orifice Centroid = feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Gate 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 Gate Slope = H:V
Horiz. Length of Weir Sides = feet
Overflow Gate Type =
Debris Clogging % = %

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

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 = degrees

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

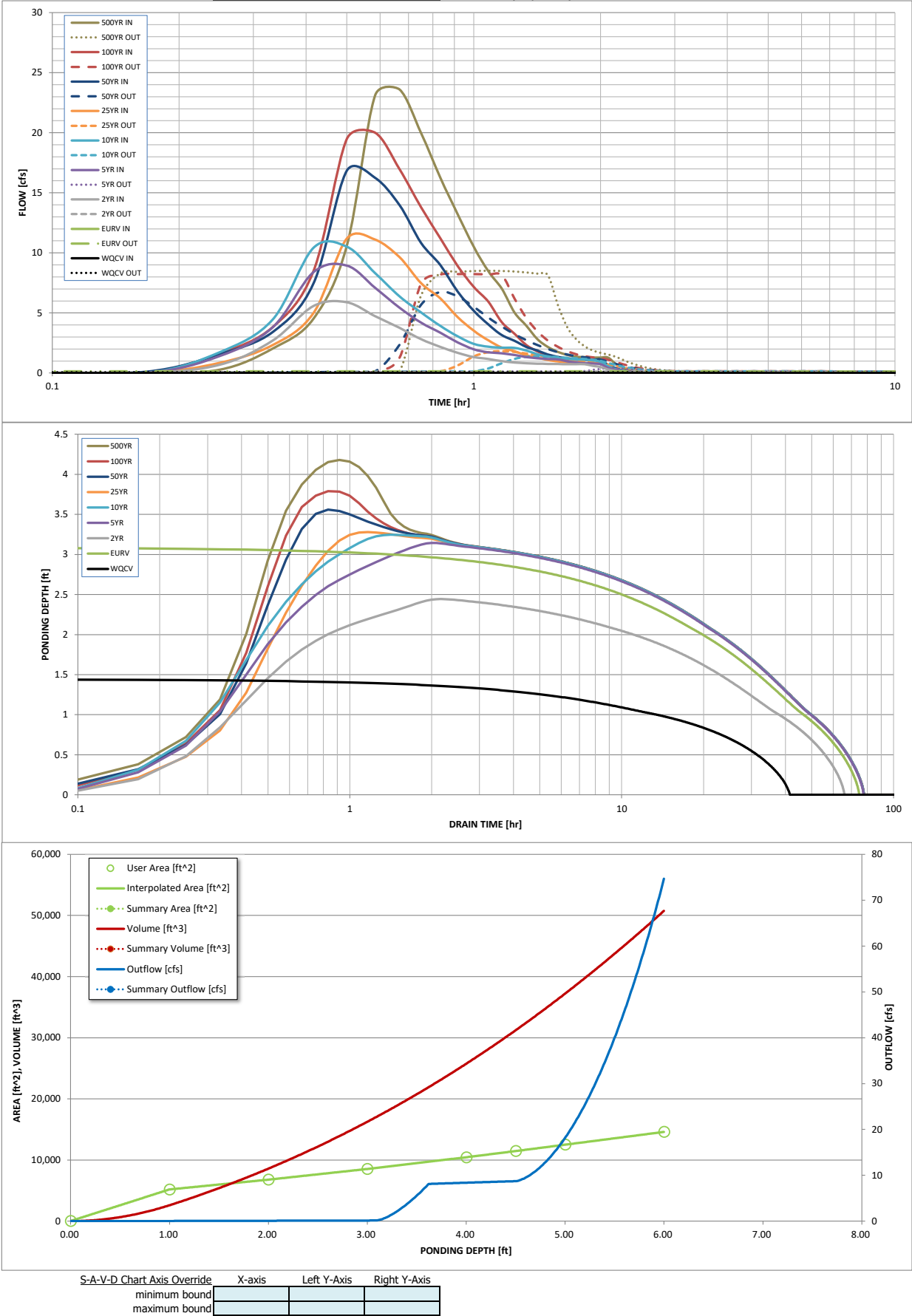
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Design Storm Return Period =	N/A	N/A	1.06	1.43	1.66	1.67	2.26	2.60
One-Hour Rainfall Depth (in) =	N/A	N/A	1.06	1.43	1.66	1.67	2.26	2.60
CUHP Runoff Volume (acre-ft) =	0.116	0.390	0.286	0.428	0.520	0.542	0.795	0.956
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.286	0.428	0.520	0.542	0.795	0.956
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	1.8	2.7	3.7	7.0	9.14
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.02	0.33	0.50	0.69	1.31	1.70
Peak Inflow Q (cfs) =	N/A	N/A	5.9	8.9	10.5	11.2	16.8	20.0
Peak Outflow Q (cfs) =	0.1	0.1	0.1	0.4	1.4	1.8	6.7	8.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.5	0.5	1.0	0.90
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	0.0	0.2	0.2	0.9	1.1
Max Velocity through Gate 2 (fps) =	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	59	69	68	67	64	62
Time to Drain 99% of Inflow Volume (hours) =	40	71	63	74	73	73	72	71
Maximum Ponding Depth (ft) =	1.45	3.09	2.44	3.14	3.24	3.28	3.56	3.79
Area at Maximum Ponding Depth (acres) =	0.14	0.20	0.17	0.20	0.21	0.21	0.22	0.23
Maximum Volume Stored (acre-ft) =	0.117	0.391	0.270	0.401	0.421	0.428	0.488	0.539

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-*Detention*, Version 4.06 (July 2022)



INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet A-1	Inlet A-2	Inlet C-1
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	Denver No. 16 Combination	Denver No. 16 Combination	Denver No. 16 Combination

USER-DEFINED INPUT**User-Defined Design Flows**

Minor Q_{Known} (cfs)	8.2	8.5	1.4
Major Q_{Known} (cfs)	21.5	18.9	3.5

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)	8.2	8.5	1.4
Major Total Design Peak Flow, Q (cfs)	21.5	18.9	3.5
Minor Flow Bypassed Downstream, Q_b (cfs)	-1.0	-1.0	-0.2
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	-0.6	-0.2

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet C-2
Site Type (Urban or Rural)	URBAN
Inlet Application (Street or Area)	STREET
Hydraulic Condition	On Grade
Inlet Type	Denver No. 16 Combination

USER-DEFINED INPUT**User-Defined Design Flows**

Minor Q_{Known} (cfs)	1.4
Major Q_{Known} (cfs)	2.7

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0

Watershed Characteristics

Subcatchment Area (acres)	
Percent Impervious	
NRCS Soil Type	

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

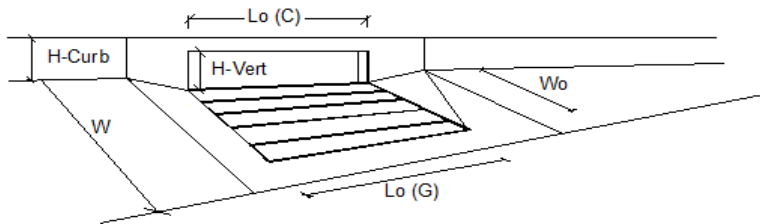
Design Storm Return Period, T_r (years)	
One-Hour Precipitation, P_1 (inches)	

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	1.4
Major Total Design Peak Flow, Q (cfs)	2.7
Minor Flow Bypassed Downstream, Q_b (cfs)	-0.2
Major Flow Bypassed Downstream, Q_b (cfs)	-0.3

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



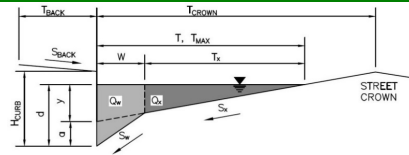
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Denver No. 16 Combination	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		N_o =	4	4	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	9.00	9.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < Q_{allowable}$ Street Capacity		MINOR		MAJOR	
Total Inlet Interception Capacity		Q =	9.2	21.5	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_o =	-1.0	0.0	cfs
Capture Percentage = Q_o/Q_o		$C\%$ =	112	100	%

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

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

Project: Hillside at Castle Rock - Phase 3 & 4

Inlet ID: Inlet A-2

**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}	=	6.5	ft
S_{BACK}	=	0.020	ft/ft
n_{BACK}	=	0.016	

H_{CURB}	=	4.00	inches
T_{CROWN}	=	16.0	ft
W	=	2.00	ft
S_x	=	0.020	ft/ft
S_y	=	0.083	ft/ft
S_0	=	0.060	ft/ft
n_{STREET}	=	0.016	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
T_{MAX}	16.0	16.0	ft
d_{MAX}	4.0	12.0	inches
	☐	☐	

MINOR STORM Allowable Capacity is based on Depth Criterion

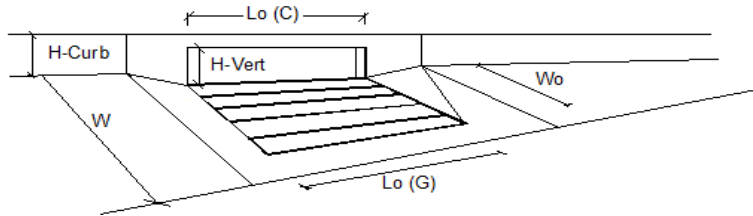
MAJOR STORM Allowable Capacity is based on Spread Criterion

	Minor Storm	Major Storm	
Q_{allow}	8.3	24.2	cfs

WARNING: MINOR STORM max. allowable capacity is less than the design peak flow of 8.54 cfs on sheet 'Inlet Management'**Major storm max. allowable capacity GOOD - greater than the design peak flow of 18.94 cfs on sheet 'Inlet Management'**

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



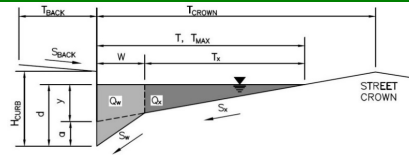
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Denver No. 16 Combination	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	4	4	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_u =	9.00	9.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_u =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR & MAJOR STORM					
Total Inlet Interception Capacity		Q =	9.5	19.6	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_s =	-1.0	-0.6	cfs
Capture Percentage = Q_i/Q_o		C% =	112	103	%

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

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

Project: Hillside at Castle Rock - Phase 3 & 4

Inlet ID: Inlet C-1

**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)

$$\begin{aligned} T_{BACK} &= 13.5 \text{ ft} \\ S_{BACK} &= 0.020 \text{ ft/ft} \\ n_{BACK} &= 0.016 \end{aligned}$$

$$\begin{aligned} H_{CURB} &= 6.00 \text{ inches} \\ T_{CROWN} &= 18.0 \text{ ft} \\ W &= 2.00 \text{ ft} \\ S_x &= 0.020 \text{ ft/ft} \\ S_w &= 0.083 \text{ ft/ft} \\ S_o &= 0.060 \text{ ft/ft} \\ n_{STREET} &= 0.016 \end{aligned}$$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
T_{MAX}	18.0	18.0	ft
d_{MAX}	6.0	12.0	inches
	☐	☐	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

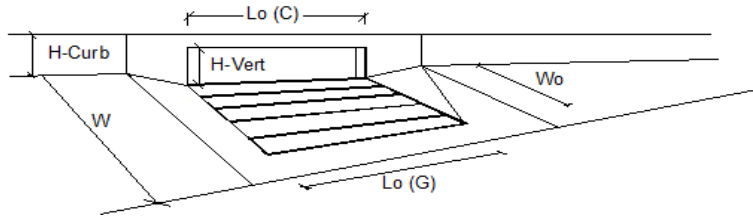
$$Q_{allow} = \begin{aligned} &\text{Minor Storm} & \text{Major Storm} \\ &14.4 & 30.7 \end{aligned} \text{ cfs}$$

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.40 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.48 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



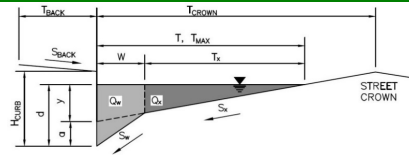
Design Information (Input)		MINOR		MAJOR
Type of Inlet	Denver No. 16 Combination	Type =	Denver No. 16 Combination	
Local Depression (additional to continuous gutter depression 'a')		a _{LOCAL} =	2.0	2.0 inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	6	6
Length of a Single Unit Inlet (Grate or Curb Opening)		L _u =	3.00	3.00 ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W _u =	1.73	1.73 ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C _f (G) =	0.50	0.50
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C _f (C) =	0.10	0.10
Street Hydraulics: OK - Q < Allowable Street Capacity			MINOR	MAJOR
Total Inlet Interception Capacity		Q =	1.6	3.7 cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q _s =	-0.2	-0.2 cfs
Capture Percentage = Q _i /Q _a		C% =	116	107 %

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

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

Project: Hillside at Castle Rock - Phase 3 & 4

Inlet ID: Inlet C-2

**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)

$$\begin{aligned} T_{\text{BACK}} &= 13.5 \text{ ft} \\ S_{\text{BACK}} &= 0.020 \text{ ft/ft} \\ n_{\text{BACK}} &= 0.016 \end{aligned}$$

$$\begin{aligned} H_{\text{CURB}} &= 6.00 \text{ inches} \\ T_{\text{CROWN}} &= 18.0 \text{ ft} \\ W &= 2.00 \text{ ft} \\ S_x &= 0.020 \text{ ft/ft} \\ S_y &= 0.083 \text{ ft/ft} \\ S_o &= 0.060 \text{ ft/ft} \\ n_{\text{STREET}} &= 0.016 \end{aligned}$$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
T_{MAX}	18.0	18.0	ft
d_{MAX}	6.0	12.0	inches
	☐	☐	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

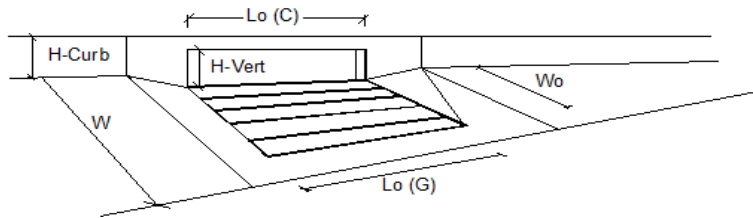
$$Q_{\text{allow}} = \begin{aligned} &\text{Minor Storm} & \text{Major Storm} \\ &14.4 & 30.7 \end{aligned} \text{ cfs}$$

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.38 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.67 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

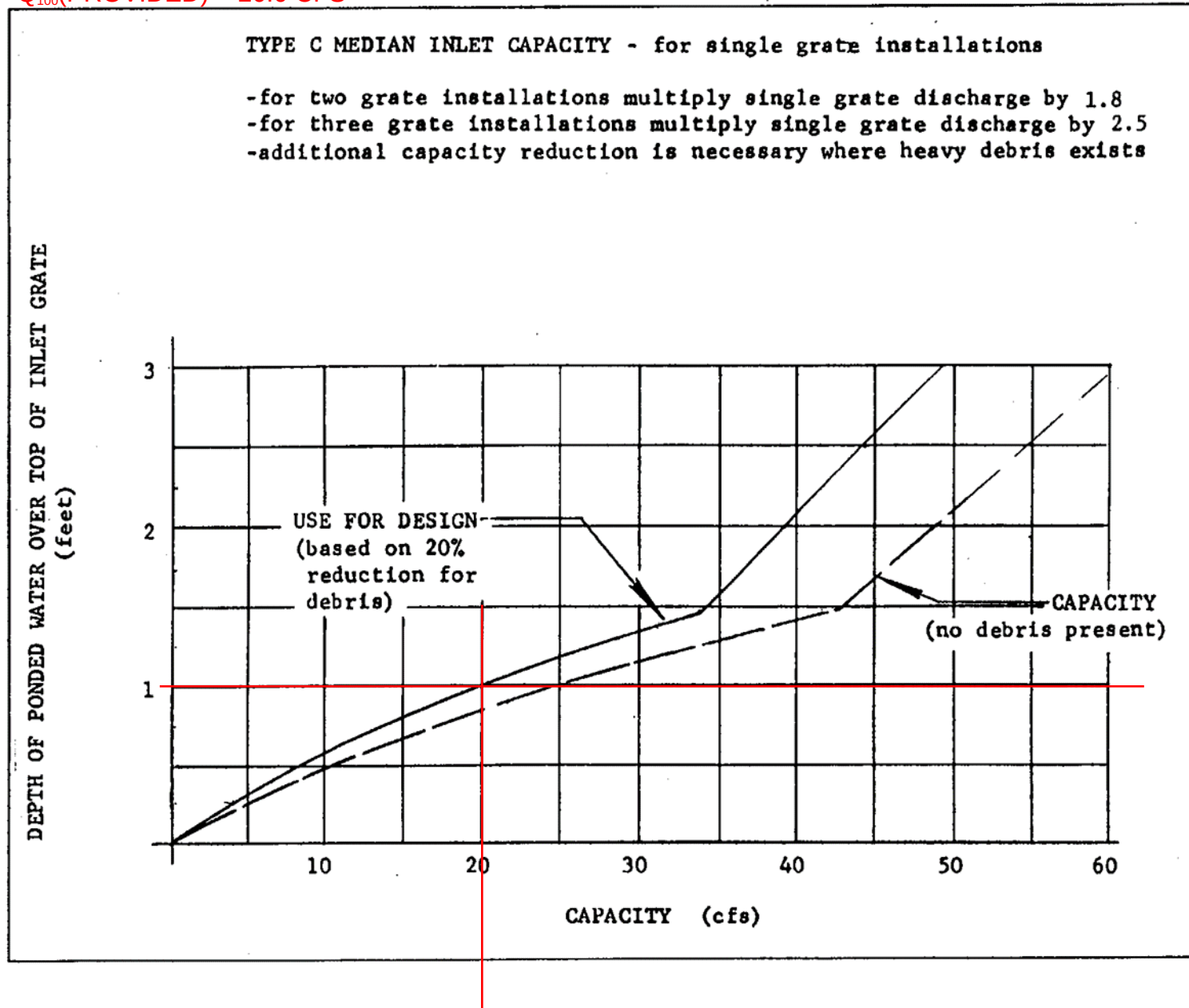


Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Denver No. 16 Combination	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')		a _{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	6	6	
Length of a Single Unit Inlet (Grate or Curb Opening)		L _u =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W _u =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C _f (G) =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C _f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity					
Total Inlet Interception Capacity		Q =	1.6	3.0	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q _s =	-0.2	-0.3	cfs
Capture Percentage = Q _i /Q _a		C% =	116	111	%

INLET C-3

$Q_{100}(\text{REQUIRED}) = 10.43 \text{ CFS}$

$Q_{100}(\text{PROVIDED}) = 20.0 \text{ CFS}$



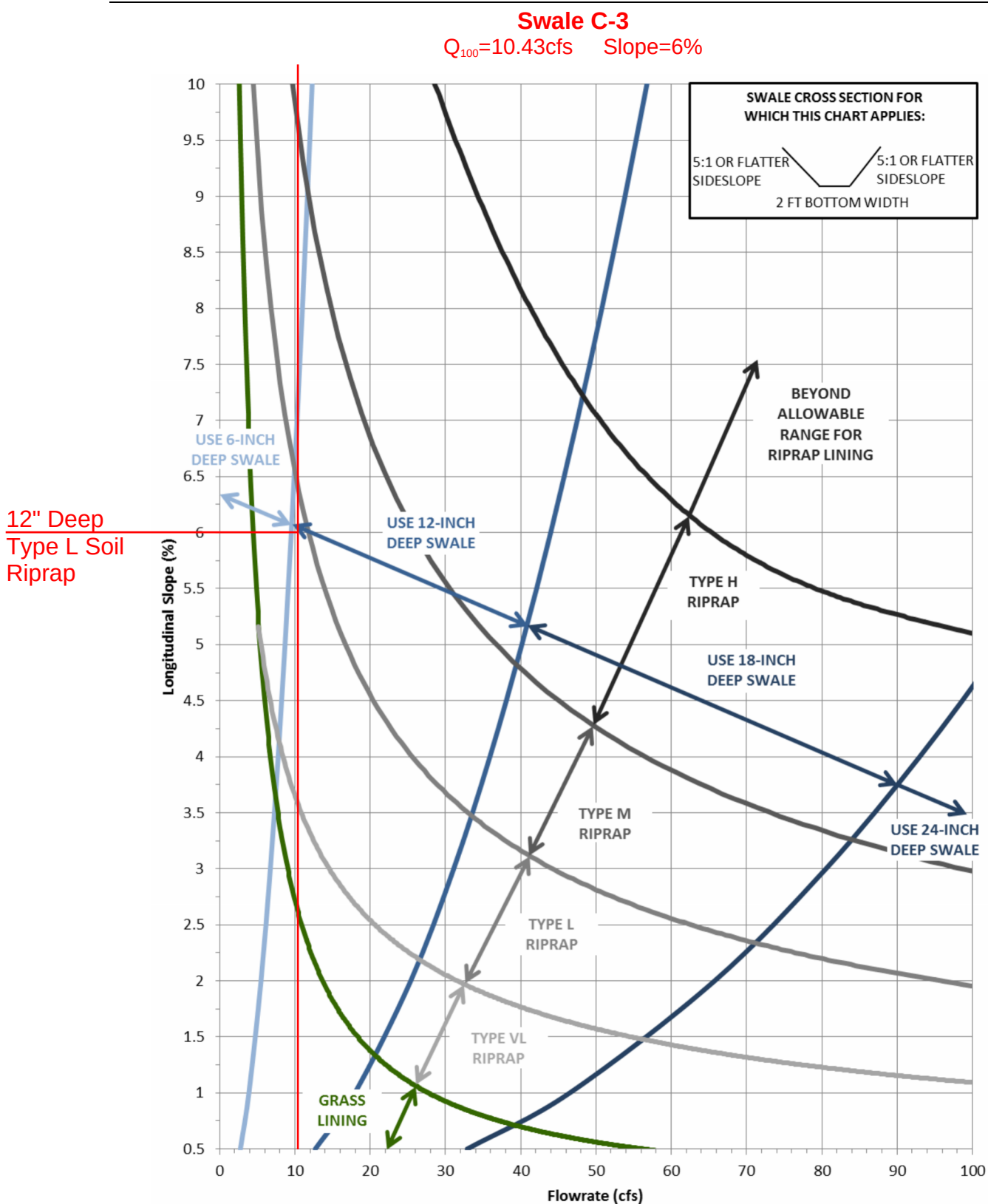


Figure 8-22. Swale stability chart; 2- to 4-foot bottom width and side slopes between 5:1 and 10:1

(Note: Riprap classifications refer to gradation for riprap used in soil riprap or void-filled riprap. See Figure 8-34 for gradations.) (Source: Muller Engineering Company)

Swale C-4
 $Q_{100}=6.48\text{cfs}$ Slope=6%

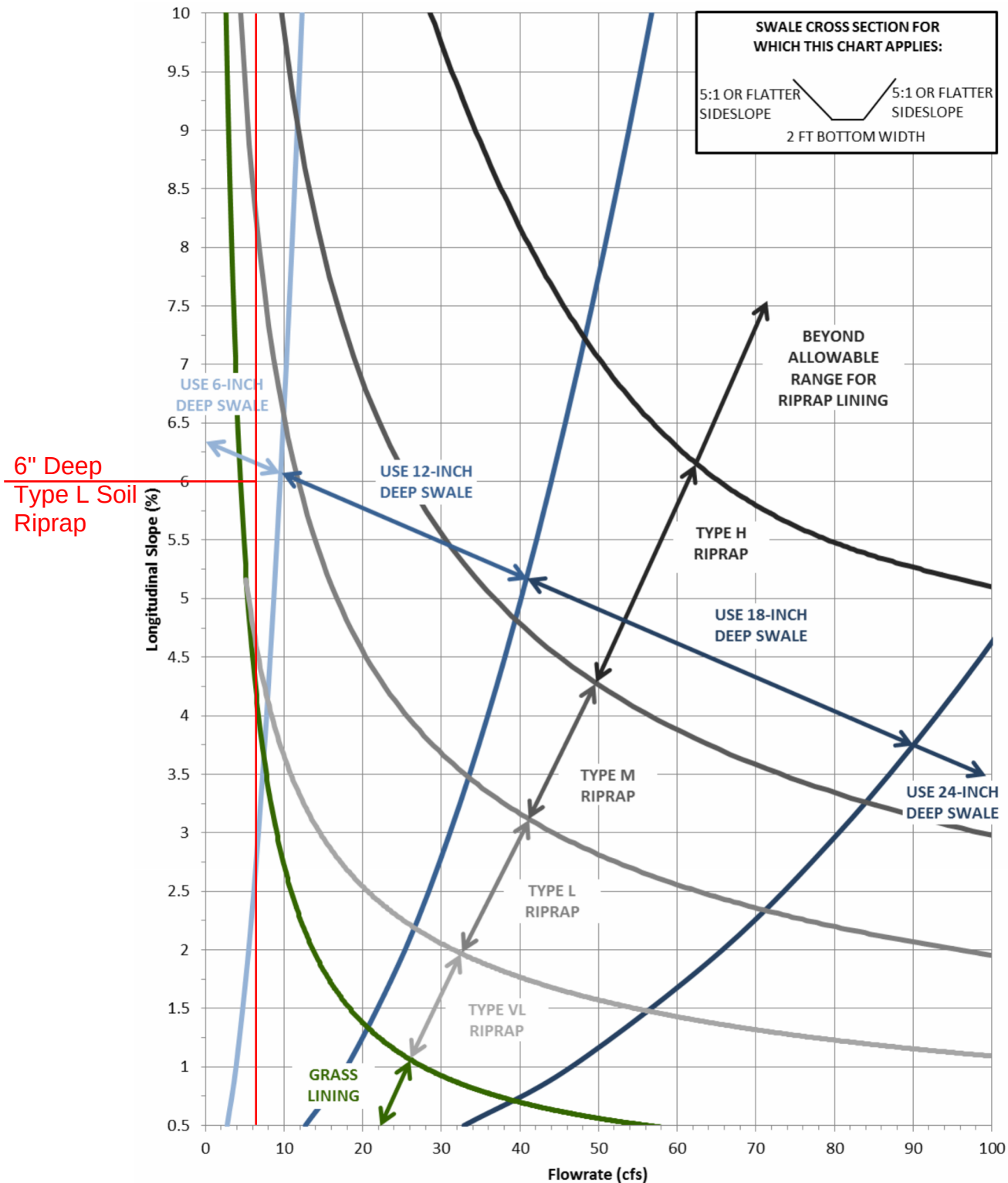


Figure 8-22. Swale stability chart; 2- to 4-foot bottom width and side slopes between 5:1 and 10:1

(Note: Riprap classifications refer to gradation for riprap used in soil riprap or void-filled riprap. See Figure 8-34 for gradations.) (Source: Muller Engineering Company)

Weir Report

East Detention Pond - Emergency Spillway

Trapezoidal Weir

Crest = Sharp
Bottom Length (ft) = 20.00
Total Depth (ft) = 1.50
Side Slope (z:1) = 4.00

Highlighted

Depth (ft) = 0.50
Q (cfs) = 23.06
Area (sqft) = 11.00
Velocity (ft/s) = 2.10
Top Width (ft) = 24.00

Calculations

Weir Coeff. Cw = 3.10
Compute by: Known Q
Known Q (cfs) = 23.06



APPENDIX D

Reference Materials

TABLE 6-1
1-HOUR POINT RAINFALL VALUES FOR
THE TOWN OF CASTLE ROCK (INCHES)

2- YR	5-YR	10-YR	50-YR	100-YR
1.06	1.43	1.66	2.26	2.60

The one-hour rainfall depths are the basis of the Town's intensity-duration rainfall curves and are used to formulate design storm distributions.

6.1.2 Intensity-Duration Curves. Rainfall intensity based on storm duration for a variety of storm return periods can be found on Figure 6-1 at the end of this chapter. These curves were developed using distribution factors provided in the NOAA Atlas and also provided in Table RA-4 of the *UDFCD Manual*. These Intensity-Duration curves are based on Equation RA-3 in the Rainfall Section of the *UDFCD Manual*.

6.1.3 Six-hour Rainfall. In order to use the Colorado Urban Hydrograph Procedure (CUHP), 2-, 3- or 6-hour rainfall distributions are required, depending on watershed area. Table RA-1 in the *UDFCD Manual* summarizes storm durations, area adjustments, and incremental rainfall depths to be used in CUHP based on watershed area. The UD-Raincurve Spreadsheet included in the *UDFCD Manual* shall be used to generate the rainfall distribution curves necessary for a CUHP model. In order to generate these distribution curves, the 1-hour and 6-hour rainfall depths for the design return periods are necessary. Since the Town of Castle Rock is not located within UDFCD boundaries, the rainfall depth-duration-frequency curves provided in the *UDFCD Manual* do not provide rainfall values for the entire Town. Therefore these values are provided in these *Criteria*. The 1-hour point values can be found in Table 6-1 of this chapter. The 6-hour point values are as follows:

TABLE 6-2
6-HOUR POINT RAINFALL VALUES FOR
THE TOWN OF CASTLE ROCK (INCHES)

2- YR	5-YR	10-YR	50-YR	100-YR
1.5	2.0	2.2	3.0	3.4

The UD-Raincurve spreadsheet shall be used for all portions of the Town. Once the rainfall distribution curves are generated using the UDFCD UD-Raincurve Spreadsheet, the CUHP model is to be set up following the procedures provided in the Runoff chapter in Volume 1 of the *UDFCD Manual*.

6.2 Selecting a Method to Estimate Runoff

Two primary methods for estimating storm runoff, peak flow rates and total volumes are used in the Town.

- Rational Method

**NOAA Atlas 14, Volume 8, Version 2 CASTLE
ROCK**


Station ID: 05-1401
Location name: Castle Rock, Colorado, USA*
Latitude: 39.4106°, Longitude: -104.9058°
Elevation:
Elevation (station metadata): 6185 ft**



* source: ESRI Maps
 ** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aeriels](#)

PF tabular

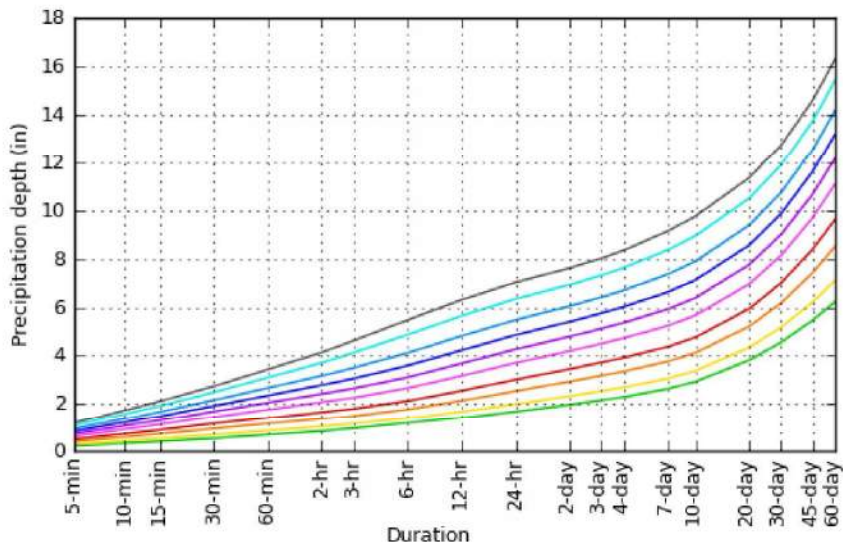
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.232 (0.192-0.283)	0.297 (0.246-0.363)	0.404 (0.334-0.496)	0.496 (0.407-0.611)	0.623 (0.492-0.797)	0.724 (0.556-0.938)	0.826 (0.610-1.10)	0.931 (0.656-1.27)	1.07 (0.724-1.51)	1.18 (0.775-1.69)
10-min	0.339 (0.282-0.415)	0.434 (0.360-0.531)	0.592 (0.489-0.727)	0.726 (0.596-0.894)	0.913 (0.720-1.17)	1.06 (0.814-1.37)	1.21 (0.894-1.61)	1.36 (0.961-1.86)	1.57 (1.06-2.21)	1.73 (1.14-2.47)
15-min	0.414 (0.344-0.506)	0.530 (0.439-0.648)	0.722 (0.597-0.886)	0.885 (0.726-1.09)	1.11 (0.878-1.42)	1.29 (0.993-1.68)	1.48 (1.09-1.96)	1.66 (1.17-2.27)	1.92 (1.29-2.69)	2.11 (1.38-3.01)
30-min	0.536 (0.445-0.655)	0.688 (0.571-0.842)	0.941 (0.777-1.15)	1.15 (0.946-1.42)	1.45 (1.14-1.85)	1.68 (1.29-2.18)	1.92 (1.42-2.55)	2.16 (1.52-2.95)	2.48 (1.68-3.49)	2.73 (1.79-3.90)
60-min	0.687 (0.570-0.839)	0.858 (0.712-1.05)	1.15 (0.949-1.41)	1.40 (1.15-1.73)	1.76 (1.39-2.26)	2.05 (1.58-2.67)	2.35 (1.74-3.13)	2.66 (1.88-3.65)	3.10 (2.09-4.36)	3.43 (2.25-4.90)
2-hr	0.838 (0.700-1.02)	1.03 (0.858-1.25)	1.36 (1.13-1.65)	1.65 (1.36-2.02)	2.07 (1.66-2.65)	2.42 (1.88-3.13)	2.78 (2.08-3.69)	3.17 (2.26-4.32)	3.71 (2.53-5.19)	4.14 (2.73-5.85)
3-hr	0.956 (0.802-1.16)	1.15 (0.962-1.39)	1.49 (1.24-1.81)	1.80 (1.49-2.19)	2.26 (1.82-2.89)	2.64 (2.07-3.42)	3.05 (2.29-4.04)	3.50 (2.50-4.75)	4.12 (2.82-5.75)	4.62 (3.07-6.51)
6-hr	1.18 (0.991-1.41)	1.39 (1.17-1.67)	1.77 (1.49-2.13)	2.12 (1.77-2.56)	2.65 (2.15-3.37)	3.10 (2.44-3.99)	3.59 (2.72-4.72)	4.11 (2.97-5.56)	4.86 (3.36-7.65)	5.47 (3.66-7.65)
12-hr	1.41 (1.20-1.68)	1.67 (1.42-1.99)	2.13 (1.80-2.55)	2.55 (2.14-3.06)	3.17 (2.58-3.98)	3.68 (2.91-4.68)	4.22 (3.22-5.50)	4.81 (3.50-6.44)	5.64 (3.93-7.75)	6.31 (4.25-8.75)
24-hr	1.68 (1.43-1.98)	1.99 (1.70-2.36)	2.54 (2.15-3.01)	3.01 (2.54-3.59)	3.70 (3.03-4.60)	4.27 (3.39-5.36)	4.85 (3.72-6.25)	5.48 (4.00-7.25)	6.34 (4.44-8.63)	7.03 (4.77-9.67)
2-day	1.97 (1.70-2.31)	2.33 (2.00-2.73)	2.93 (2.51-3.45)	3.45 (2.93-4.08)	4.19 (3.44-5.15)	4.79 (3.83-5.95)	5.40 (4.16-6.89)	6.05 (4.45-7.92)	6.93 (4.88-9.34)	7.62 (5.21-10.4)
3-day	2.15 (1.86-2.52)	2.54 (2.18-2.96)	3.17 (2.72-3.72)	3.72 (3.17-4.38)	4.50 (3.70-5.49)	5.11 (4.10-6.32)	5.75 (4.44-7.29)	6.41 (4.74-8.36)	7.31 (5.18-9.80)	8.01 (5.51-10.9)
4-day	2.29 (1.98-2.67)	2.69 (2.32-3.13)	3.35 (2.89-3.92)	3.92 (3.35-4.60)	4.72 (3.90-5.74)	5.36 (4.32-6.61)	6.02 (4.67-7.60)	6.70 (4.96-8.70)	7.63 (5.42-10.2)	8.35 (5.76-11.3)
7-day	2.63 (2.28-3.04)	3.05 (2.65-3.53)	3.76 (3.25-4.36)	4.37 (3.75-5.09)	5.23 (4.34-6.31)	5.92 (4.79-7.24)	6.62 (5.16-8.31)	7.35 (5.48-9.49)	8.35 (5.97-11.1)	9.13 (6.34-12.3)
10-day	2.93 (2.55-3.37)	3.37 (2.94-3.89)	4.12 (3.57-4.76)	4.75 (4.10-5.52)	5.66 (4.72-6.80)	6.38 (5.18-7.78)	7.12 (5.57-8.90)	7.89 (5.91-10.1)	8.94 (6.42-11.8)	9.75 (6.80-13.1)
20-day	3.82 (3.35-4.36)	4.34 (3.81-4.97)	5.21 (4.55-5.98)	5.94 (5.16-6.84)	6.96 (5.83-8.27)	7.76 (6.34-9.36)	8.56 (6.75-10.6)	9.39 (7.08-11.9)	10.5 (7.59-13.7)	11.3 (7.98-15.1)
30-day	4.55 (4.01-5.18)	5.17 (4.55-5.88)	6.17 (5.41-7.04)	7.00 (6.10-8.02)	8.13 (6.83-9.59)	9.00 (7.38-10.8)	9.86 (7.79-12.1)	10.7 (8.11-13.6)	11.9 (8.61-15.4)	12.7 (8.99-16.9)
45-day	5.46 (4.83-6.18)	6.22 (5.49-7.04)	7.42 (6.53-8.43)	8.39 (7.34-9.57)	9.69 (8.15-11.3)	10.7 (8.77-12.7)	11.6 (9.20-14.2)	12.5 (9.51-15.7)	13.7 (10.00-17.7)	14.6 (10.4-19.2)
60-day	6.22 (5.52-7.02)	7.11 (6.30-8.02)	8.50 (7.51-9.63)	9.62 (8.44-10.9)	11.1 (9.33-12.9)	12.2 (10.0-14.4)	13.2 (10.5-16.0)	14.2 (10.8-17.7)	15.4 (11.3-19.8)	16.3 (11.6-21.4)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
 Please refer to NOAA Atlas 14 document for more information.

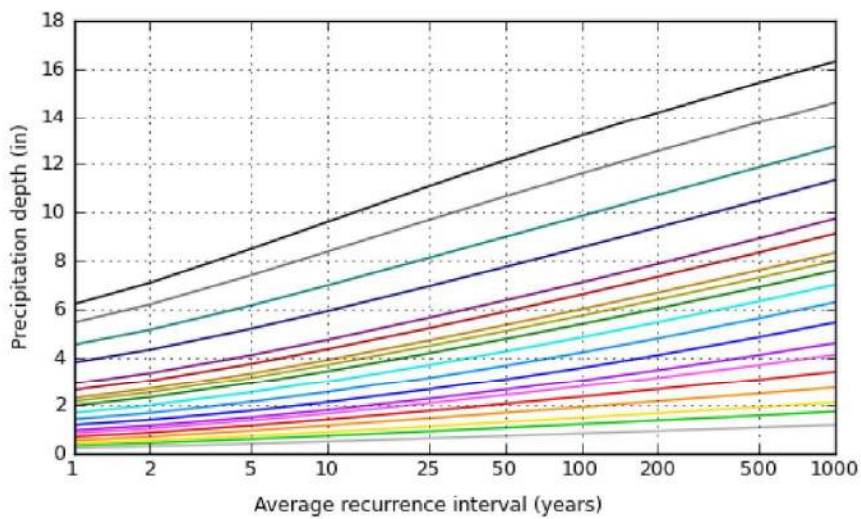
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PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 39.4106°, Longitude: -104.9058°



Average recurrence interval (years)
1
2
5
10
25
50
100
200
500
1000



Duration	
5-min	2-day
10-min	3-day
15-min	4-day
30-min	7-day
60-min	10-day
2-hr	20-day
3-hr	30-day
6-hr	45-day
12-hr	60-day
24-hr	

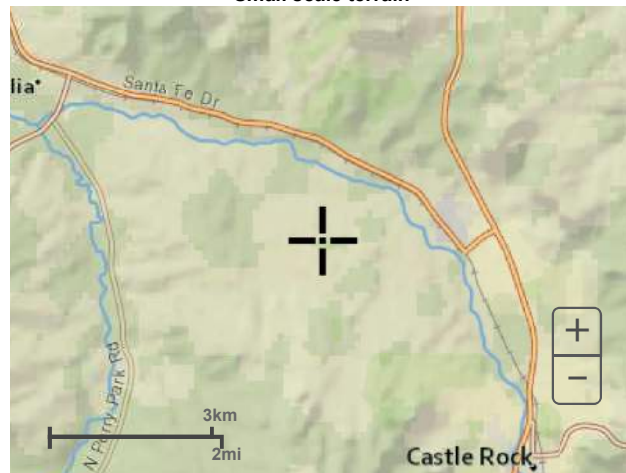
NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Sun Dec 2 17:02:16 2018

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Maps & aerals

Small scale terrain



Large scale terrain



Large scale map





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[National Weather Service](#)
[National Water Center](#)
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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Table 6-3. Recommended percentage imperviousness values

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

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A =$ $0.84i^{1.302}$	$C_A =$ $0.86i^{1.276}$	$C_A =$ $0.87i^{1.232}$	$C_A =$ $0.88i^{1.124}$	$C_A =$ $0.85i+0.025$	$C_A =$ $0.78i+0.110$	$C_A =$ $0.65i+0.254$
B	$C_B =$ $0.84i^{1.169}$	$C_B =$ $0.86i^{1.088}$	$C_B =$ $0.81i+0.057$	$C_B =$ $0.63i+0.249$	$C_B =$ $0.56i+0.328$	$C_B =$ $0.47i+0.426$	$C_B =$ $0.37i+0.536$
C/D	$C_{C/D} =$ $0.83i^{1.122}$	$C_{C/D} =$ $0.82i+0.035$	$C_{C/D} =$ $0.74i+0.132$	$C_{C/D} =$ $0.56i+0.319$	$C_{C/D} =$ $0.49i+0.393$	$C_{C/D} =$ $0.41i+0.484$	$C_{C/D} =$ $0.32i+0.588$

Where:

i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

The values for various catchment imperviousness and storm return periods are presented graphically in Figures 6-1 through 6-3, and are tabulated in Table 6-5. These coefficients were developed for the Denver region to work in conjunction with the time of concentration recommendations in Section 2.4. Use of these coefficients and this procedure outside of the semi-arid climate found in the Denver region may not be valid. The UD-Rational Excel workbook performs all the needed calculations to find the runoff coefficient given the soil type and imperviousness and the reader may want to take advantage of this macro-enabled Excel workbook that is available for download from the UDFCD's website www.udfcd.org.

See Examples 7.1 and 7.2 that illustrate the Rational Method.

Table 6-5. Runoff coefficients, *c*

Total or Effective % Impervious	NRCS Hydrologic Soil Group A						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.01	0.01	0.01	0.04	0.13	0.27
5%	0.02	0.02	0.02	0.03	0.07	0.15	0.29
10%	0.04	0.05	0.05	0.07	0.11	0.19	0.32
15%	0.07	0.08	0.08	0.1	0.15	0.23	0.35
20%	0.1	0.11	0.12	0.14	0.2	0.27	0.38
25%	0.14	0.15	0.16	0.19	0.24	0.3	0.42
30%	0.18	0.19	0.2	0.23	0.28	0.34	0.45
35%	0.21	0.23	0.24	0.27	0.32	0.38	0.48
40%	0.25	0.27	0.28	0.32	0.37	0.42	0.51
45%	0.3	0.31	0.33	0.36	0.41	0.46	0.54
50%	0.34	0.36	0.37	0.41	0.45	0.5	0.58
55%	0.39	0.4	0.42	0.45	0.49	0.54	0.61
60%	0.43	0.45	0.47	0.5	0.54	0.58	0.64
65%	0.48	0.5	0.51	0.54	0.58	0.62	0.67
70%	0.53	0.55	0.56	0.59	0.62	0.65	0.71
75%	0.58	0.6	0.61	0.64	0.66	0.69	0.74
80%	0.63	0.65	0.66	0.69	0.71	0.73	0.77
85%	0.68	0.7	0.71	0.74	0.75	0.77	0.8
90%	0.73	0.75	0.77	0.79	0.79	0.81	0.84
95%	0.79	0.81	0.82	0.83	0.84	0.85	0.87
100%	0.84	0.86	0.87	0.88	0.88	0.89	0.9
Total or Effective % Impervious	NRCS Hydrologic Soil Group B						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.01	0.07	0.26	0.34	0.44	0.54
5%	0.03	0.03	0.1	0.28	0.36	0.45	0.55
10%	0.06	0.07	0.14	0.31	0.38	0.47	0.57
15%	0.09	0.11	0.18	0.34	0.41	0.5	0.59
20%	0.13	0.15	0.22	0.38	0.44	0.52	0.61
25%	0.17	0.19	0.26	0.41	0.47	0.54	0.63
30%	0.2	0.23	0.3	0.44	0.49	0.57	0.65
35%	0.24	0.27	0.34	0.47	0.52	0.59	0.66
40%	0.29	0.32	0.38	0.5	0.55	0.61	0.68
45%	0.33	0.36	0.42	0.53	0.58	0.64	0.7
50%	0.37	0.4	0.46	0.56	0.61	0.66	0.72
55%	0.42	0.45	0.5	0.6	0.63	0.68	0.74
60%	0.46	0.49	0.54	0.63	0.66	0.71	0.76
65%	0.5	0.54	0.58	0.66	0.69	0.73	0.77
70%	0.55	0.58	0.62	0.69	0.72	0.75	0.79
75%	0.6	0.63	0.66	0.72	0.75	0.78	0.81
80%	0.64	0.67	0.7	0.75	0.77	0.8	0.83
85%	0.69	0.72	0.74	0.78	0.8	0.82	0.85
90%	0.74	0.76	0.78	0.81	0.83	0.84	0.87
95%	0.79	0.81	0.82	0.85	0.86	0.87	0.88
100%	0.84	0.86	0.86	0.88	0.89	0.89	0.9

Table 6-5. Runoff coefficients, *c* (continued)

Total or Effective % Impervious	NRCS Hydrologic Soil Group C						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.05	0.15	0.33	0.40	0.49	0.59
5%	0.03	0.08	0.17	0.35	0.42	0.5	0.6
10%	0.06	0.12	0.21	0.37	0.44	0.52	0.62
15%	0.1	0.16	0.24	0.4	0.47	0.55	0.64
20%	0.14	0.2	0.28	0.43	0.49	0.57	0.65
25%	0.18	0.24	0.32	0.46	0.52	0.59	0.67
30%	0.22	0.28	0.35	0.49	0.54	0.61	0.68
35%	0.26	0.32	0.39	0.51	0.57	0.63	0.7
40%	0.3	0.36	0.43	0.54	0.59	0.65	0.71
45%	0.34	0.4	0.46	0.57	0.62	0.67	0.73
50%	0.38	0.44	0.5	0.6	0.64	0.69	0.75
55%	0.43	0.48	0.54	0.63	0.66	0.71	0.76
60%	0.47	0.52	0.57	0.65	0.69	0.73	0.78
65%	0.51	0.56	0.61	0.68	0.71	0.75	0.79
70%	0.56	0.61	0.65	0.71	0.74	0.77	0.81
75%	0.6	0.65	0.68	0.74	0.76	0.79	0.82
80%	0.65	0.69	0.72	0.77	0.79	0.81	0.84
85%	0.7	0.73	0.76	0.79	0.81	0.83	0.86
90%	0.74	0.77	0.79	0.82	0.84	0.85	0.87
95%	0.79	0.81	0.83	0.85	0.86	0.87	0.89
100%	0.83	0.85	0.87	0.88	0.89	0.89	0.9

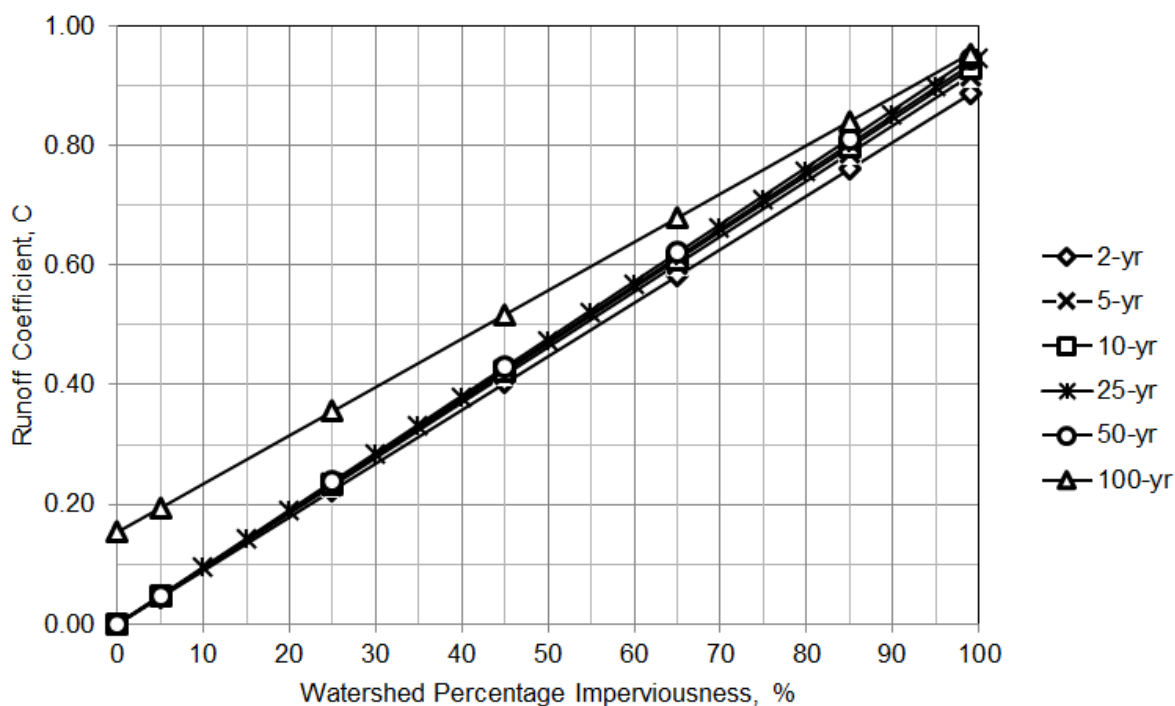


Figure 6-1. Runoff coefficient vs. watershed imperviousness NRCS HSG A

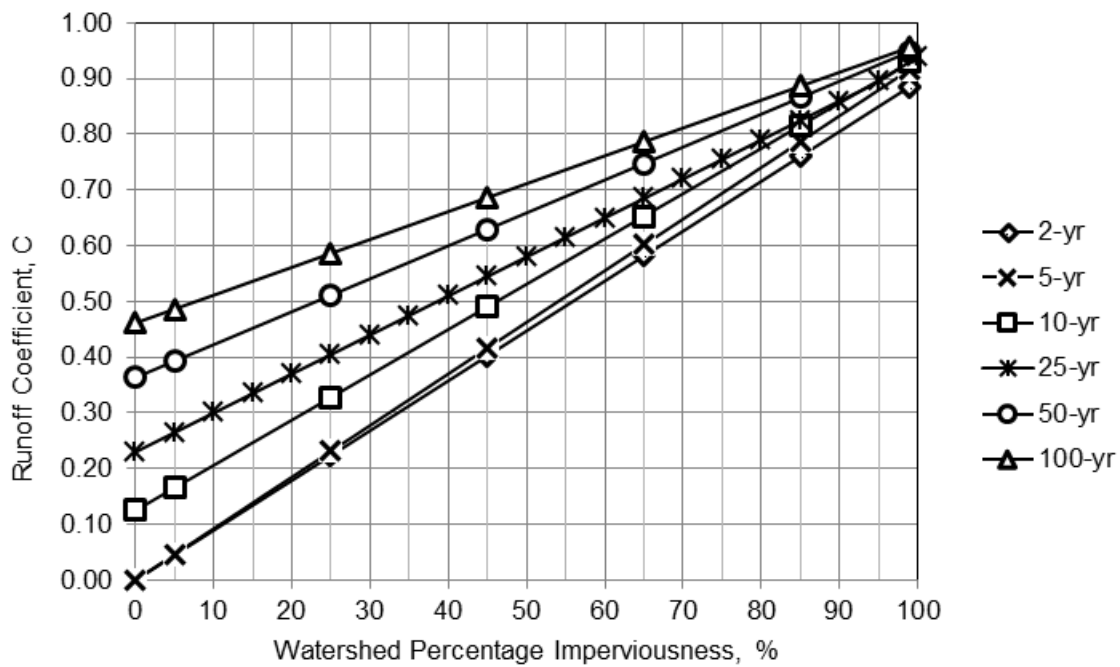


Figure 6-2. Runoff coefficient vs. watershed imperviousness NRCS HSG B

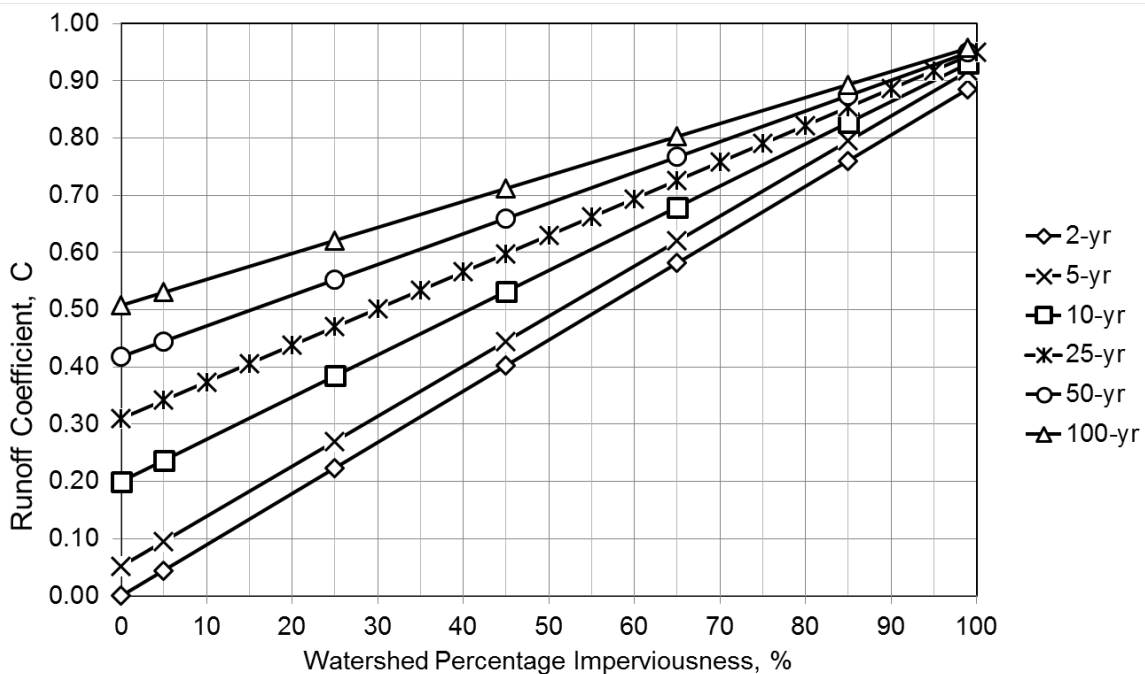
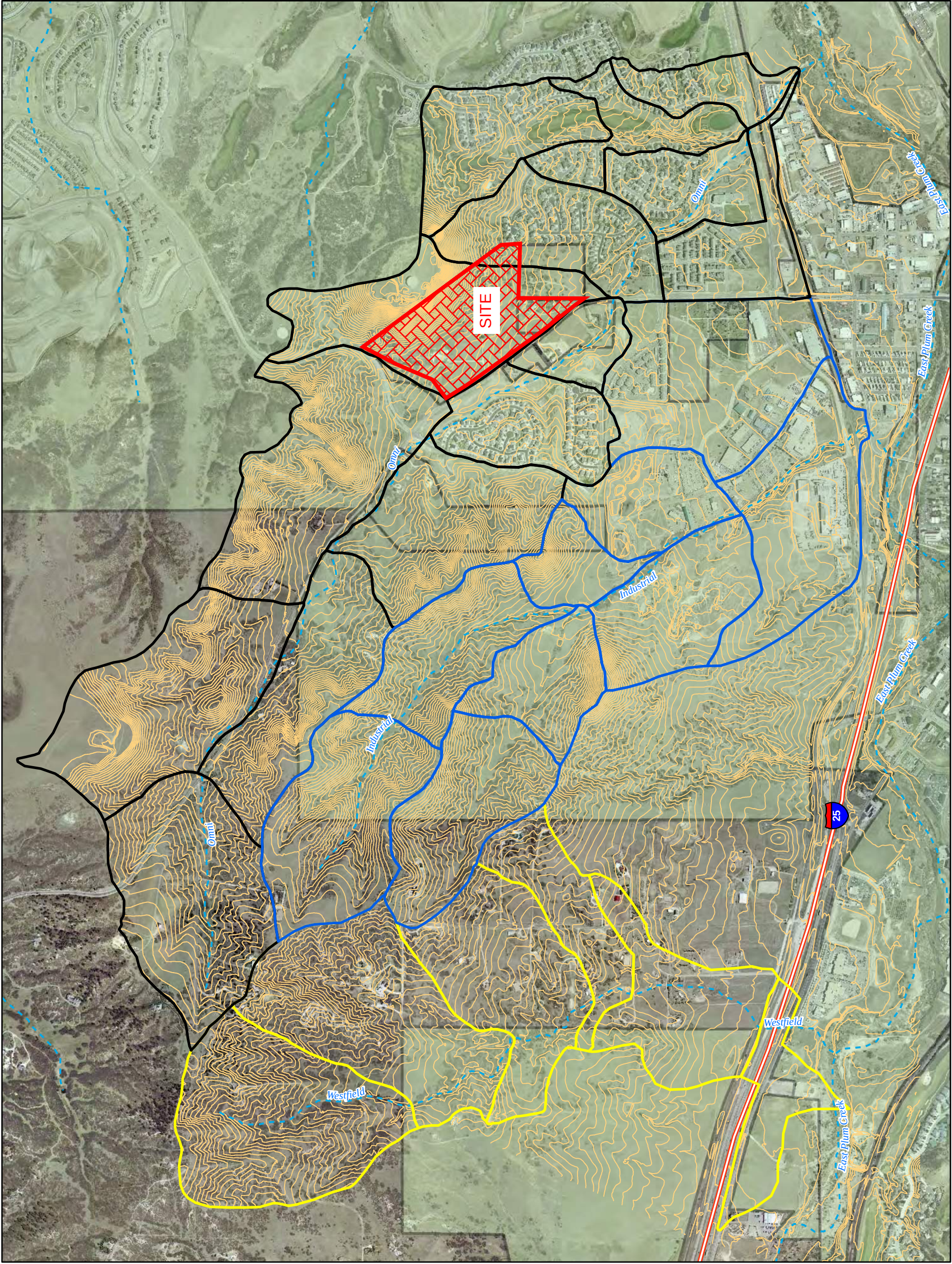
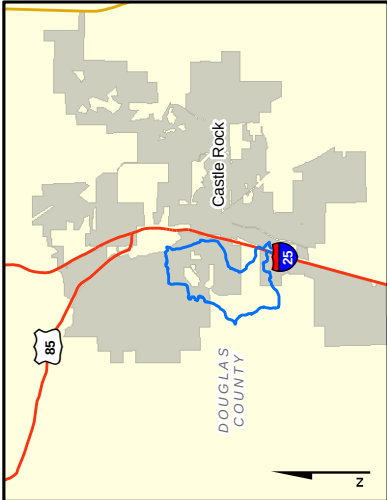


Figure 6-3. Runoff coefficient vs. watershed imperviousness NRCS HSG C and D



Watershed Location

Legend

- Industrial
- Omni
- Westfield
- Castle Rock Town Boundary
- Perennial Streams and Creeks
- 10ft Contours

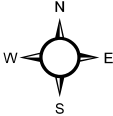
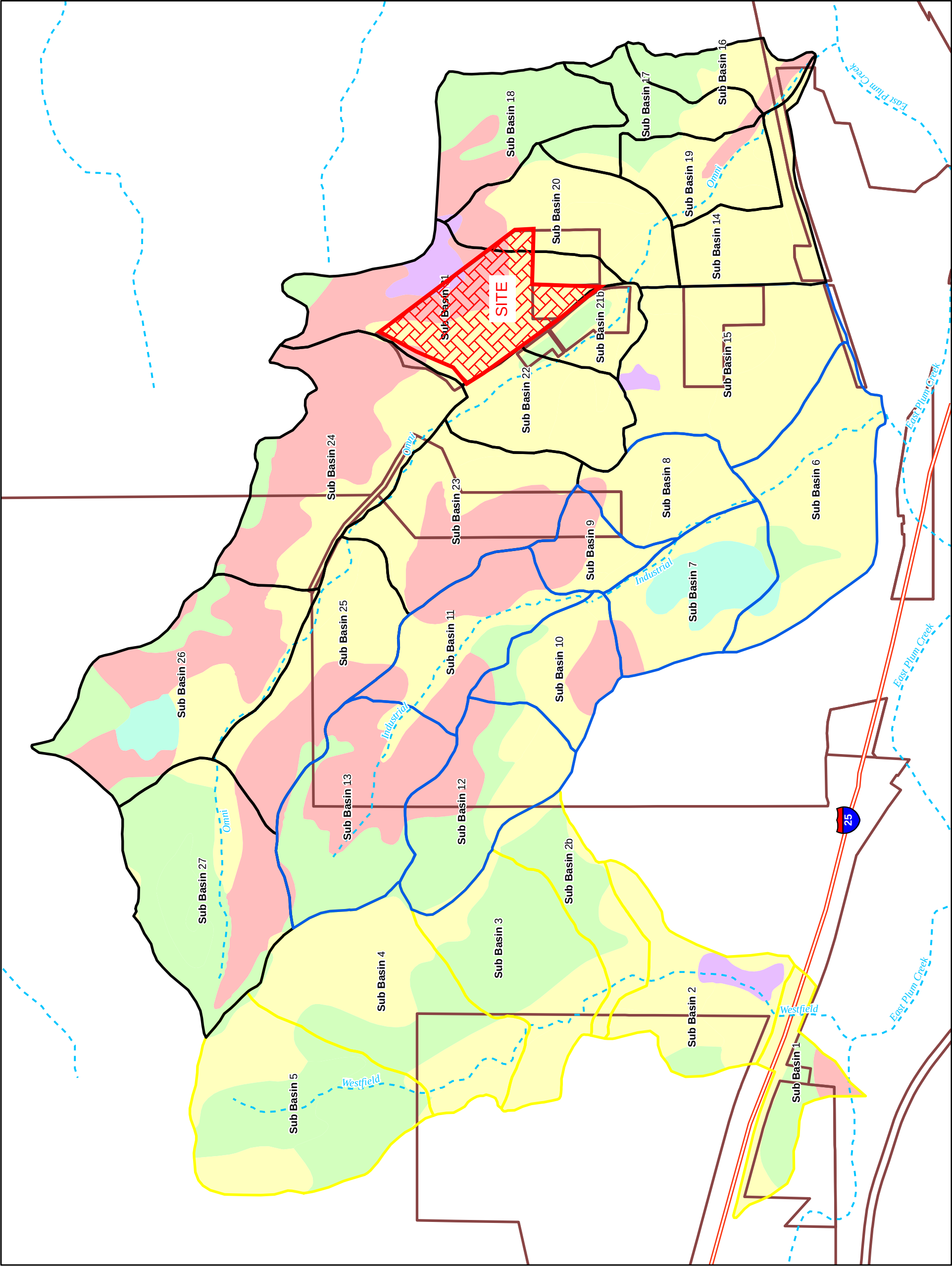
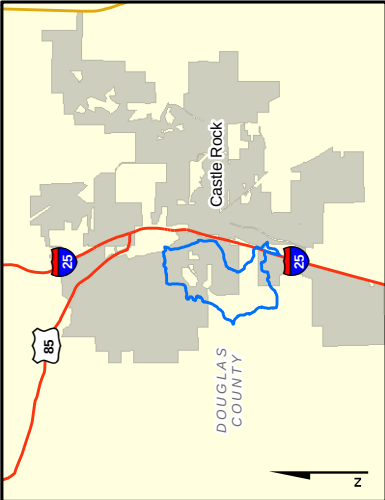


Figure III-2
Omni/Industrial/Westfield
Flood Hazard Area Delineation
Drainage Basins



Legend

- Perennial Streams and Creeks
- Industrial
- Omni
- Westfield
- Castle Rock Town Boundary

Hydrologic Soil Group

- A
- B
- C
- D
- No Data

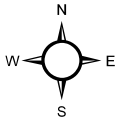
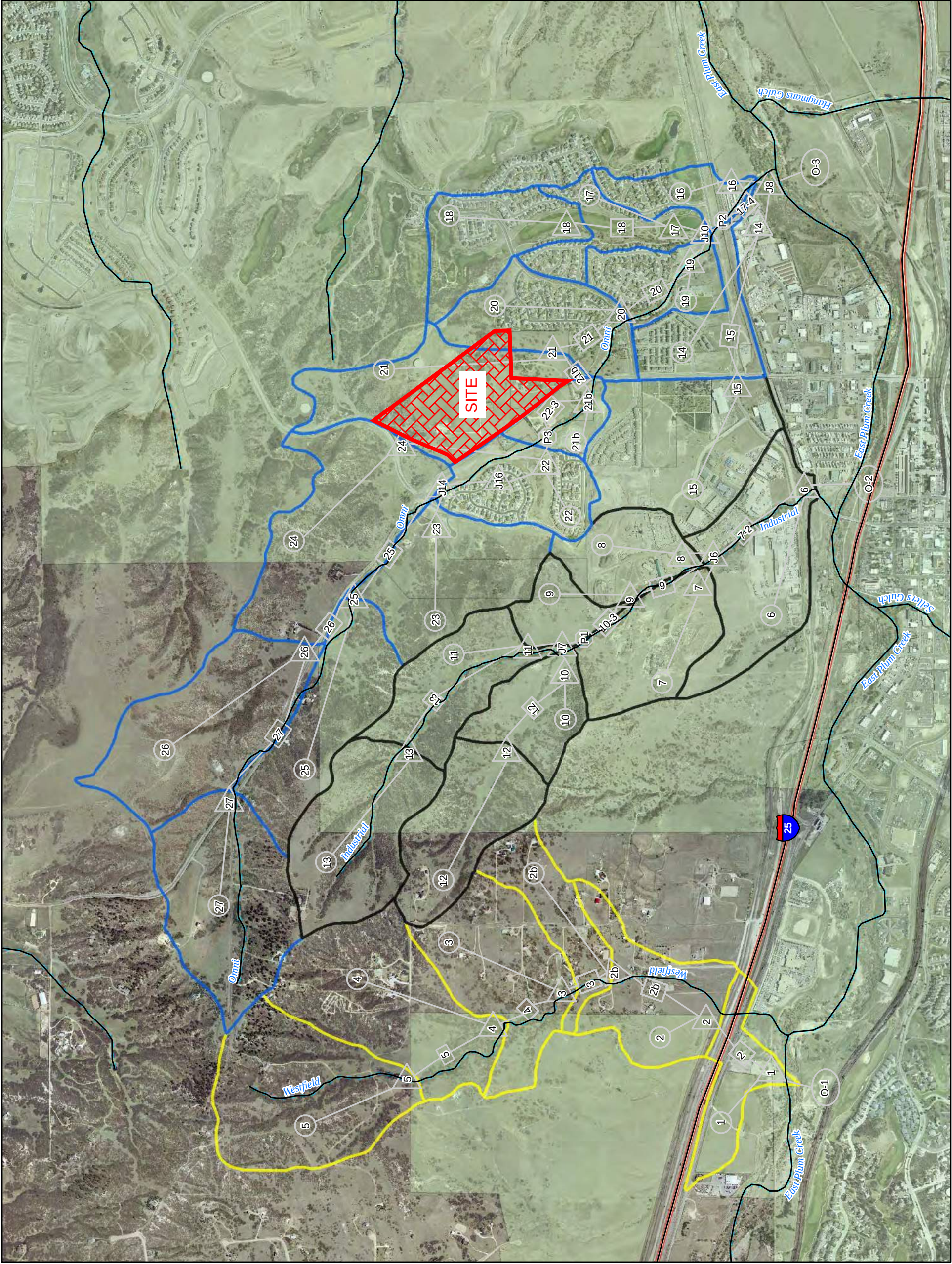
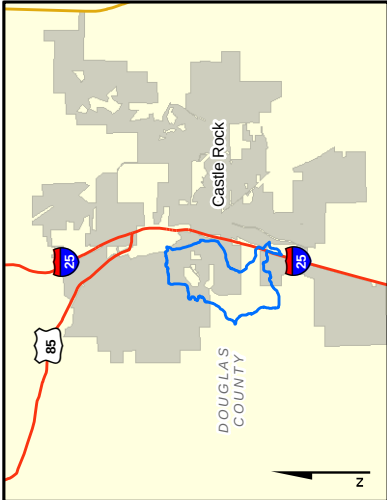


Figure III-3
Omni/Industrial/Westfield
Flood Hazard Area Delineation
Hydrologic Soils Classification



Watershed Location

Legend

- Perennial Streams and Creeks
- Industrial
- Omni
- Westfield
- Castle Rock Town Boundary
- Outfall Identification
- Conveyance Element
- Sub Basin Identification
- Storage Element
- Design Point or Junction

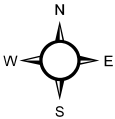
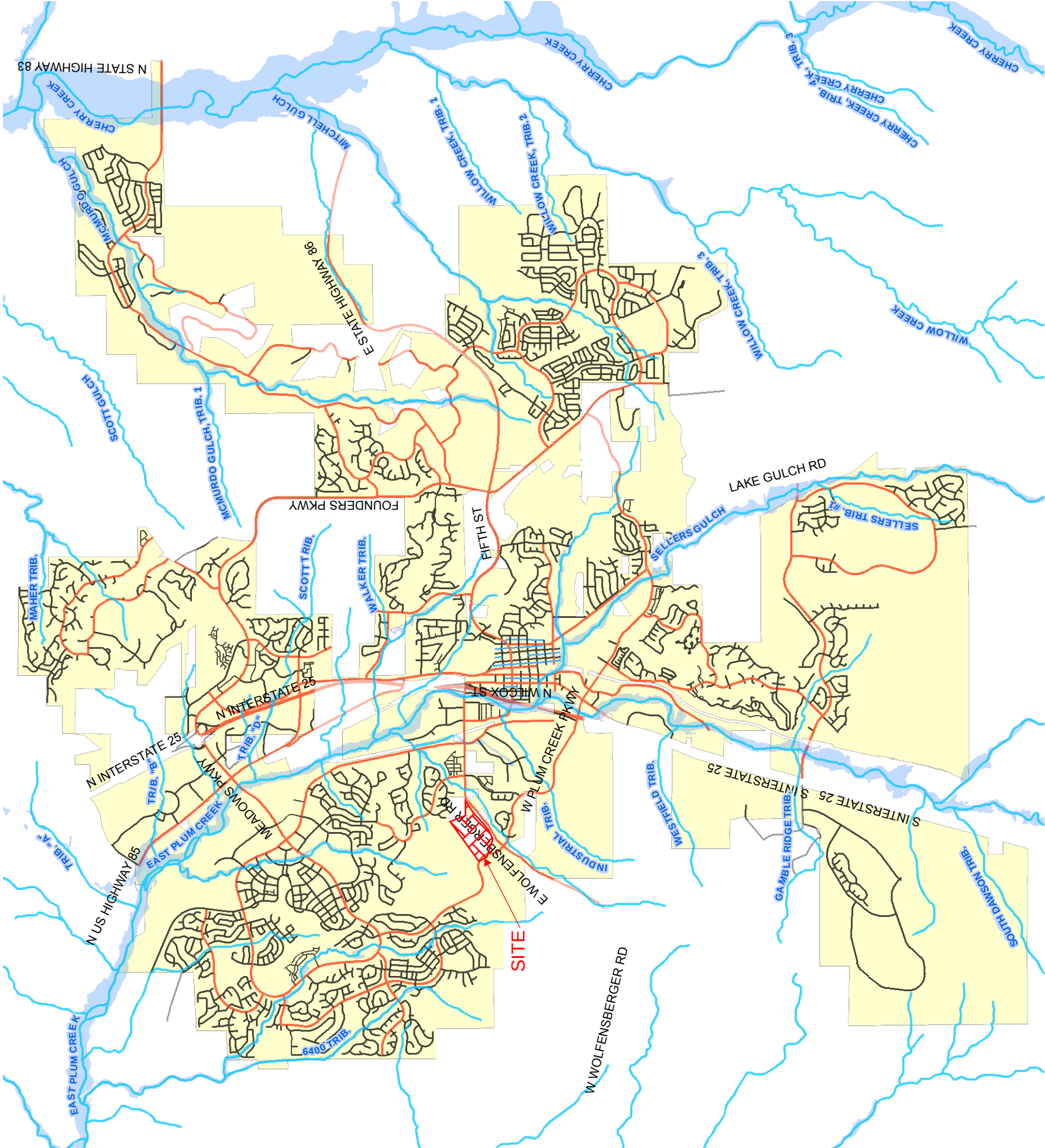


Figure III-6
Omni/Industrial/Westfield
Flood Hazard Area Delineation
Watershed Connectivity



- Legend**
- Drainages
 - FEMA Floodplain Areas
 - Castle Rock Boundary



Plot Info: J:\GIS\Master Plan Maps\Stormwater\FEMA.mxd Printer: 11-10-10

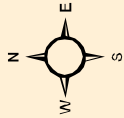


Figure 3-1
FEMA Regulated
Floodplains

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 makes no warranty, expressed or implied, for the accuracy or completeness of the data. The user assumes all responsibility for any errors, omissions, corrections, and/or updates, should be directed to the Utilities Department, Town of Castle Rock, (720) 733-0087. Copyright 2010, Town of Castle Rock, Utilities Mapping.



2010 Stormwater Master Plan Update



Prepared by
Castle Rock Water Engineering
March 2011

Capital Improvement Projects



Omni Tributary—Before



Omni Tributary—After

Table 2-13 summarizes capital improvement projects completed since 2004.

Table 2-13 – Capital Improvement Projects Completed Since 2004

PROJECT	TYPE	YEAR COMPLETED	COST
Craig & Gould Storm Sewer & Centennial Park Flume	Storm Drainage Conveyance	2006	\$1,200,000
Omni Drainageway Stabilization	Stream Stabilization	2005	\$540,000
Sellars Gulch Stream Stabilization Phase I	Stream Stabilization	2007	\$480,000
South Gilbert Street Storm Sewer System/ Glovers Area Storm Sewer	Storm Drainage Conveyance	2006	\$450,000
Mitchell Street Storm Sewer System	Storm Drainage Conveyance	2008	\$315,000
Sellars Gulch Stream Stabilization Phase II	Stream Stabilization	2010	\$250,000
			\$3,235,000

APPENDIX E

Operations and Maintenance Procedures

Stormwater Management Facility Operation and Maintenance (O&M) General Guidelines

Castle Rock Water
Stormwater Division

**175 Kellogg Court
Castle Rock, CO 80109
720-733-2235**

Reference:

This manual is adapted from the following documents:

Douglas County, Colorado, STORMWATER MANAGEMENT FACILITY OPERATION AND MAINTENANCE MANUAL, October 2010

Town of Parker, Colorado, STORMWATER PERMANENT BEST MANAGEMENT PRACTICES (PBMP) LONG-TERM OPERATION AND MAINTENANCE MANUAL, October 2004

Urban Drainage and Flood Control District, URBAN STORM DRAINAGE CRITERIA MANUAL, VOLUME 3, November 2010

Stormwater Management Facility Operation and Maintenance (O&M) Standard Guidelines

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 - 2. Minor Work
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Stormwater Management Facility Operation and Maintenance (O&M) Standard Guidelines

I. Background

This document provides General Guidelines and Standard Operating Procedures (SOPs) for Operation and Maintenance (O&M) of stormwater facilities. Additional information regarding O&M of site specific features may be found on approved Construction Drawings and in the Phase III Drainage Report.

A. Compliance with the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual

Owners or managers of developed property located within the incorporated limits of Castle Rock are required to comply with the Town's Storm Drainage Design and Technical Criteria Manual (Storm Manual) adopted by reference in accordance with Ordinance 2019-13 of the Municipal Code. The purpose of the ordinance is to ensure property owners follow proper operation and maintenance procedures for stormwater management facilities located on their sites. Requirements for inspection and maintenance are located in these O&M Standard Guidelines. Additional information can be obtained by contacting the Town's Stormwater Division at 720-733-2235.

B. Preventive and Prompt Maintenance Activities Reduce Overall Maintenance Costs

The most effective way to maintain your stormwater facility is to prevent pollutants from entering the facility in the first place. Common pollutants include sediment, trash and debris, chemicals, pet wastes, runoff from stored materials, illicit discharges into the storm drainage system and many others. A thorough maintenance program will include measures to address these potential contaminants, and will save money and time in the long run. Key points to consider in your maintenance program include:

- Educate employees/residents on how their actions impact water quality and how they can help reduce maintenance costs.
- Keep properties, streets, curb & gutters and parking lots free of trash, debris and lawn clippings.
- Ensure the proper disposal of hazardous wastes and chemicals.
- Plan lawn care to minimize the use of chemicals and pesticides.
- Sweep or blow grass clippings from paved surfaces and put the clippings in a compost pile or back on the lawn.
- Be aware of automobiles leaking fluids. Use absorbents such as clay cat litter to soak up drippings and dispose of properly.

- Re-vegetate disturbed and bare areas to maintain vegetative stabilization.
- Clean out the upstream components of the storm drainage system, including inlets, storm sewers and outfalls.
- Do not store materials outdoors (including landscaping materials) unless they are properly protected from stormwater runoff.

II. General Description of Stormwater Management Facilities

The following are brief descriptions of commonly used stormwater management facilities. For more detailed information refer to the Town's Storm Manual.

A. Volume Reduction Facilities (Filtration Control Measures)

1. Grass Buffers and Swales – Grass buffers are densely vegetated strips of grass designed to provide filtration, infiltration and settling to reduce runoff pollutants through sheet flow over the grass. Grass swales are densely vegetated trapezoidal or triangular channels designed to slow runoff, promote infiltration and facilitate sedimentation while limiting erosion. Buffers differ from swales in that they are designed to accommodate overland sheet flow rather than concentrated or channelized flow.
2. Permeable Pavement Systems – Permeable pavement consists of a permeable pavement layer, usually underlain by gravel and sand layers, designed to promote volume reduction, provide treatment and slow release of water quality capture volume (WQCV). Uses include parking lots and low traffic areas to accommodate vehicles while facilitating stormwater infiltration near its source.

B. Water Quality and Flood Control Facilities

1. Extended Detention Basins (EDBs) – EDBs are sedimentation basins with forebays, micropools and a slow release outlet designed to detain stormwater for many hours after storm runoff ends. The basins are considered to be “dry” because the majority of the basin is designed not to have a significant permanent pool of water remaining between runoff events.
2. Porous Landscape Detention (Rain Gardens or Bioretention) – Porous landscape detention (PLD) is depressed landscaped areas designed to capture and filter or infiltrate the WQCV through an engineered granular filtration layer. PLDs are often landscaped with ornamental grasses and shrubs.
3. Sand Filter Basins – Sand filter basins consist of a surcharge zone underlain by a sand bed with an underdrain system. Stormwater runoff accumulates in the surcharge zone and gradually infiltrates into the underlying sand bed. The underdrain system gradually dewater the sand bed and discharges the runoff.

4. Retention Ponds and Constructed Wetland Ponds – Retention ponds, “wet ponds”, have a permanent pool of water with additional capacity designed to capture and slowly release the WQCV. Constructed wetland ponds are shallow retention ponds designed to permit the growth of wetland plants such as rushes, willows and cattails, and slow runoff allowing time for sedimentation, filtering and biological uptake.
5. Underground Control Measures and Storage – Underground stormwater control measures include proprietary and non-proprietary devices installed below ground that provide water quality treatment via sedimentation, screening, filtration, hydrodynamic separation and other physical and chemical processes. These may be in the form of a vault, storm drain insert and/or pipe galleries.

C. Open Channels

1. Stabilized Channels – Stabilized channels utilize grade control structures as a means of establishing a mild slope for the baseflow channel and arresting stream degradation. Severe bends or cut banks may also need to be stabilized. Stabilized Channels may be grass-lined, riprap, concrete or a combination thereof.
2. Constructed Wetland Channels – Constructed wetlands channels have wetland bottoms which use dense natural vegetation to slow runoff and promote biological uptake and settling of sediment.

III. Ownership and Easements

Maintenance responsibility lies with the owner of the land, except as modified by specific agreement. Maintenance responsibility shall be defined on Final Plats and Final Development Plans. The property owner or designee shall be responsible for the maintenance of all drainage facilities including inlets, pipes, culverts, channels, ditches, hydraulic structures, and detention basins located on their land unless modified by specific agreement. Maintenance access for all facilities must be adequate for the anticipated maintenance vehicles and equipment and should be shown on the Final Plats and Final Development Plans. The Operation and Maintenance Manual, as described in Section 4.6 of the Town’s Storm Manual, shall define those entities responsible for the maintenance and management of stormwater facilities. If the property owner fails to maintain a facility, the Town will complete maintenance and charge the owner at 1.25 times the cost of maintenance.

Drainage easements are required in order to ensure for the proper construction, maintenance and access to drainage improvements that have the potential to affect the public drainage system and other properties. Drainage easements shall be granted to the Town for inspection and maintenance purposes and shall be shown on the Drainage Plan, Final Plat and Site Improvement Plan, as applicable. The drainage easement shall state that the Town has the right of access on the easements for inspection and maintenance purposes. In general,

easements are required for detention or retention ponds, water quality enhancement ponds and other Best Management Practice facilities, storm sewers, swales, channels, parking lot areas that convey runoff from adjacent properties (blanket type easements), major drainageways and floodplains. Easement requirements are specific to the type of stormwater management facility and are discussed in more detail in later chapters.

Refer to Section 4.6 of the Storm Manual for more information on maintenance responsibility (ownership) and easements, respectively.

IV. Access

Refer to approved Plat, Drainage Plan and/or Site Plan for location of designated maintenance access. Contact Castle Rock Water at 720-733-6000 with any questions regarding access to a facility.

V. Safety

Keep safety considerations at the forefront of inspection and maintenance procedures at all times. Likely hazards should be anticipated and avoided. Never enter a confined space (outlet structure, manhole, etc) without proper training or equipment. A confined space should never be entered without at least one additional person present.

If a highly toxic or flammable substance is discovered, the inspector(s) should leave the immediate area and contact the **Town's Fire Department** at **911**. If there is any question about a substance, leave the area immediately and contact the **Town's Fire Department** at **303-660-1066**. Also, never open a sealed container to check the contents.

Potentially dangerous (e.g., fuel, chemicals, hazardous materials) substances found in the areas **must be** referred to the **Town's Fire Department** immediately for response by the Hazardous Materials Unit. The emergency contact number is **303-660-1066** (or 911).

Vertical drops may be encountered in areas located within and around the facility. Avoid walking on top of retaining walls or other structures that have a significant vertical drop. If a vertical drop is identified within the stormwater management facility that is greater than 48" in height, make the appropriate note/comment on the maintenance inspection form.

If any hazard is found within the facility area that poses an immediate threat to public safety, contact the Town's Fire Department immediately!

VI. Field Inspection Equipment

It is imperative that the appropriate equipment is taken to the field with the inspector(s). This is to ensure the safety of the inspector and allow the inspections to be performed as efficiently as possible. Below is a list of the equipment that may be necessary to perform the inspections of a Stormwater Management Facilities:

- Town Approved Drainage Report and Construction Drawings
- Typical Inspection & Maintenance Requirements (See Appendix B)
- Protective clothing and boots
- Safety equipment (vest, hard hat, confined space entry equipment)
- Communication equipment
- Clipboard
- Manhole Lid Remover
- Shovel
- First Aid Kit

Some of the items identified above need not be carried by the inspector (manhole lid remover, shovel, and confined space entry equipment). However, this equipment should be available in the vehicle driven to the site.

VII. Inspecting and Maintaining Stormwater Management Facilities

The quality of stormwater discharging to waterways relies heavily on the proper operation and maintenance of permanent Control Measures.

This section contains a general overview of stormwater management facility inspection, operation and maintenance guidelines. Appendix A contains Standard Operating Procedures (SOPs) for the facilities identified in Section II. Refer to the approved Drainage Report and Construction Drawings prior to performing inspections and/or maintenance.

A. Inspection Procedures

All stormwater management facilities shall be inspected by a qualified individual at a minimum of one time per year. Inspections should follow the inspection guidance found in the SOPs located in Appendix A of this manual.

B. Maintenance Procedures

Stormwater Management Facility Maintenance Programs are separated into three broad categories of work. These categories were based largely on the Urban Drainage and Flood Control District's Maintenance Program for regional drainage facilities. The categories are separated based upon the magnitude and type of the maintenance activities performed. A description of each category follows:

1. Routine Work

The majority of this work consists of regularly scheduled mowing and trash and debris pickups for stormwater management facilities during the growing season. This work also includes items such as the removal of debris/material that may be clogging the outlet structure well screens and trash racks. It may also include activities such as weed control, mosquito treatment and algae treatment. These activities normally will be performed numerous times during the year. These items can be completed without any prior notification to the Town.

2. Minor Work

This work consists of a variety of isolated or small-scale maintenance/operational problems. Most of this work can be completed by a small crew, hand tools, and small equipment. **These items require notification, at least 7 days prior to the start of work, to Castle Rock Water at 720-733-6000.**

3. Major Work

This work consists of larger maintenance/operational problems and failures within the stormwater management facilities. **All of this work requires notification, at least 14 days prior to the start of work, to Castle Rock Water at 720-733-6000 to ensure the proper maintenance is performed.** Some of this work requires that the engineering staff review the original design and construction drawings to assess the situation and assign the necessary maintenance. This work may also require more specialized maintenance equipment, design/details, surveying, or assistance through private contractors and consultants.

C. Maintenance Personnel

Maintenance personnel must be qualified to properly maintain stormwater management facilities. Inadequately trained personnel can cause additional problems resulting in additional maintenance costs.

VIII. References

CONTECH Stormwater Solutions. 2007. *StormFilter Inspection and Maintenance Procedures*. www.contech-cpi.org.

Koski, T. and Skinner, V. 2003. Colorado State University Extension. Fact Sheet no.7.202, Lawn Care. <http://www.ext.colostate.edu/pubs/garden/07202.html>.

Law, N.L., K. DiBlasi, and U. Ghosh. 2008. *Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout Programs in the Chesapeake Bay Basin*. Center for Watershed Protection. Prepared for U.S.

EPA Chesapeake Bay Program Grant CB-973222-01: Ellicott City, MD.
www.cpw.org.

Wright Water Engineers, Inc., Wenk Associates, Muller Engineering Company, Inc.,
Matrix Design Group, and Smith Environmental. 2004. *City and County of
Denver Water Quality Management Plan*. Denver, CO

IX. Appendices

Appendix A – Standard Operating Procedures

Extended Detention Basins (EDBs)

EDBs have low to moderate maintenance requirements on a routine basis, but may require significant maintenance once every 15 to 25 years. Maintenance frequency depends on the amount of construction activity within the tributary watershed, the erosion control measures implemented, the size of the watershed, and the design of the facility.

Inspection

Inspect the EDB at least twice annually, observing the amount of sediment in the forebay and checking for debris at the outlet structure.

Debris and Litter Removal

Remove debris and litter from the detention area as required to minimize clogging of the outlet.

Mowing and Plant Care

When starting from seed, mow native/drought tolerant grasses only when required to deter weeds during the first three years. Following this period, mowing of native/drought tolerant grass may stop or be reduced to maintain a height of no less than 6 inches (higher mowing heights are associated with deeper roots and greater drought tolerance). In general, mowing should be done as needed to maintain appropriate height and control weeds. Mowing of manicured grasses may vary from as frequently as weekly during the summer, to no mowing during the winter. See Section 4 of this chapter for additional recommendations from the CSU Extension.

Aeration

For EDBs with manicured grass, aeration will supply the soil and roots with air and increase infiltration. It reduces soil compaction and helps control thatch while helping water move into the root zone. Aeration is done by punching holes in the ground using an aerator with hollow punches that pull the soil cores or "plugs" from the ground. Holes should be at least 2 inches deep and no more than 4 inches apart.

Aeration should be performed at least once per year when the ground is not frozen. Water the turf thoroughly prior to aeration. Mark sprinkler heads and shallow utilities such as irrigation lines and cable TV lines to ensure those lines will not be damaged. Avoid aerating in extremely hot and dry conditions. Heavy traffic areas may require aeration more frequently.

Mosquito Control

Although the design provided in this manual implements practices specifically developed to deter mosquito breeding, some level of mosquito control may be necessary if the BMP is located in close proximity to outdoor amenities.

The Town provides annual mosquito control for all public and private facilities. This program includes larvae control only. Mosquitos are more difficult to control when they are adults. This typically requires neighborhood fogging with an insecticide. Therefore, no adult mosquito

Facts on Mosquito Breeding

Although mosquitoes prefer shallow, stagnant water, they can breed within the top 6 to 8 inches of deeper pools.

Mosquitoes need nutrients and prefer shelter from direct sunlight.

Mosquitoes can go from egg to adult within 72 hours.

The most common mosquitoes in Colorado include the *Aedes Vexans* and the *Culex Tarsalis*. Both have similar needs for breeding and development.

control is provided. For questions regarding the Town's mosquito control program, please contact the Utilities Department Stormwater Division at 720-733-6011.

Irrigation Scheduling and Maintenance

Adjust irrigation throughout the growing season to provide the proper irrigation application rate to maintain healthy vegetation. Less irrigation is typically needed in early summer and fall, with more irrigation needed during July and August. Native grass and other drought tolerant plantings should not require irrigation after establishment.

Check for broken sprinkler heads and repair them, as needed. Completely drain the irrigation system before the first winter freeze each year. Upon reactivation of the irrigation system in the spring, inspect all components and replace damaged parts, as needed.

Sediment Removal from the Forebay, Trickle Channel, and Micropool

Remove sediment from the forebay and trickle channel annually. If portions of the watershed are not developed or if roadway or landscaping projects are taking place in the watershed, the required frequency of sediment removal in the forebay may be as often as after each storm event. The forebay should be maintained in such a way that it does not provide a significant source of resuspended sediment in the stormwater runoff.

Sediment removal from the micropool is required about once every one to four years, and should occur when the depth of the pool has been reduced to approximately 18 inches. Small micropools may be vacuumed and larger pools may need to be pumped in order to remove all sediment from the micropool bottom. Removing sediment from the micropool will benefit mosquito control. Ensure that the sediment is disposed of properly and not placed elsewhere in the basin.

Sediment Removal from the Basin Bottom

Remove sediment from the bottom of the basin when accumulated sediment occupies about 20% of the water quality design volume or when sediment accumulation results in poor drainage within the basin. The required frequency may be every 15 to 25 years or more frequently in basins where construction activities are occurring.

Erosion and Structural Repairs

Repair basin inlets, outlets, trickle channels, and all other structural components required for the basin to operate as intended. Repair and vegetate eroded areas as needed following inspection.

Appendix B – Stormwater Facility Maintenance Inspection Forms

Typical Inspection & Maintenance Requirements

Grass Buffers and Swales

Features	Sediment Removal	Mowing/ Weed Control	Trash & Debris Removal	Erosion	Overgrown Vegetation Removal	Standing Water (mosquito/algae control)	Structure Repair
Low-flow channel							
Upper Stage							

Extended Detention Basins (EDBs)

EDB Features	Sediment Removal	Mowing/ Weed Control	Trash & Debris Removal	Erosion	Overgrown Vegetation Removal	Standing Water (mosquito/algae control)	Structure Repair
Inflow Points (outfalls)							
Forebay							
Low-flow channel							
Bottom Stage							
Micropool							
Outlet Works							
Emergency Spillway							
Upper Stage							
Embankment							

Rain Gardens and Porous Landscape Detention (PLDs)

PLD Features	Sediment Removal	Mowing Weed control	Trash & Debris Removal	Erosion	Overgrown Vegetation Removal	Removal/ Replacement	Structure Repair
Inflow Points							
Landscaping							
Filter Media							
Underdrain System							
Overflow Outlet Works							
Embankment							

APPENDIX F

Drainage Worksheets: Attachments D & E

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

Project:	Questions	Project#	Check those that apply	Applicant: Instructions
Section 1	Non-applicable Sites			
1.1	Will the project result in a temporary disturbance of greater than one acre?	No	☐	Proceed to section 1.2.
		Yes	☒	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	☐	Proceed to section 1.3.
		Yes	☐	Proceed to section 2.
1.3	Is the project within the Cherry Creek Watershed?	Yes	☐	Permanent water quality control measures may be required. Refer to Water Quality Control Regulation 72.7 for details and allowable exclusions.
		No	☐	Permanent water quality control measures are not required.
Section 2	Applicable Site Types and Exclusions by Variance			
2.1	Does the project have more than 35% impervious area on the existing site?	No	☒	Project is an applicable Development Site. Proceed to section 3.
		Yes	☐	Proceed to 2.2.
2.2	Does the project have greater than 75% impervious area on the existing site?	No	☐	Project is an applicable Redevelopment Site. Proceed to section 3.
		Yes	☐	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 further action required.
		No	☐	Proceed to 2.4.
2.4	Do any other water quality exclusions apply to the site?	No	☐	Portions of the project are excluded. Proceed with design in accordance with Constrained Redevelopment standards and apply for <u>variance</u> for <u>Constrained Redevelopment Sites</u> .
		Yes	☐	Proceed to section 3. Following approval of other exclusions, design remaining site in accordance with Constrained Redevelopment standards and apply for <u>variance</u> for <u>Constrained Redevelopment Sites</u> .
Section 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	☒	Proceed to next line.
		No	☒	Proceed to 3.1.2.
	Is the trail for a roadway?	Yes	☐	Proceed to 3.1.2.
		No	☐	Project is excluded. Submit <u>variance</u> 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	☐	This exclusion does not apply. Permanent water quality is required.
		No	☒	Proceed to 3.1.3.
3.1.3	Does the project add impervious area?	No	☐	Project is excluded. Submit <u>variance</u> for <u>Pavement Management Sites Excluded from Permanent Water Quality Requirements</u> .
		Yes	☒	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 ☐	☒	Project is excluded. Submit variance for <u>Roadway Redevelopment Sites Excluded</u> from Permanent Water Quality Requirements. Proceed to next line.
	Does the project add more than one acre of paved area per mile to an existing roadway?	No ☐	☒	Project is excluded. Submit variance for <u>Roadway Redevelopment Sites Excluded</u> from Permanent Water Quality Requirements. Proceed to next line.
	Does the project increase the width by two times or more, on average, of the original roadway area?	No ☐	☒	Existing areas of site are excluded only. Submit variance for <u>Existing Roadway Surfaces Only Excluded</u> from Permanent Water Quality Requirements. 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 ☐	☐	Project is excluded. Submit variance for <u>Oil and Gas Exploration Sites Excluded</u> from Permanent Water Quality Requirements.
3.2.2	Is the project for stream stabilization?	No ☒	☒	Proceed to 3.2.2. Project is excluded. Submit variance for <u>Stream Stabilization Sites Excluded</u> from Permanent Water Quality Requirements. 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 ☐	☒	Project is excluded. Submit variance for <u>Aboveground and Underground Utilities Excluded</u> from Permanent Water Quality Requirements.
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?	No ☒	☒	Proceed to 3.2.4. Project is excluded. Submit variance for <u>Sites with Land Disturbances to Undeveloped Land that will Remain Undeveloped Excluded</u> from Permanent Water Quality Requirements. 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 ☐	☒	Project is excluded. Submit study along with variance for <u>Non-residential and Non-commercial Infiltration Conditions Excluded</u> from Permanent Water Quality Requirements. 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 ☐	☒	Proceed to next line. Project is excluded. Submit variance for <u>Large Lot Single Family Sites Excluded</u> from Permanent Water Quality Requirements. Proceed to next line.
	Is the project site greater than 10% impervious?	No ☐	☒	Project is excluded. Submit variance for <u>Large Lot Single Family Sites Excluded</u> from Permanent Water Quality Requirements. Proceed to next line.
	Is the project site greater than 20% impervious?	Yes ☐	☒	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 ☐	☒	Project is excluded. Submit study along with variance for <u>Large Lot Single Family Sites Excluded</u> from Permanent Water Quality Requirements. This exclusion does not apply. Permanent water quality is required.

Attachment D

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 No	☐ ☒	This exclusion does not apply. Permanent water quality is required. Proceed to next line.
	Is all or a portion of the site undeveloped or will it remain undeveloped after construction?	Yes No	☐ ☒	This portion of the project is excluded. Submit <u>variance for Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped Excluded from Permanent Water Quality Requirements</u> . Proceed to next line. Proceed to next line.
	Is the remaining untreated impervious area greater than 20% of the site?	Yes No	☐ ☒	This exclusion does not apply. Permanent water quality is required. Proceed to next line.
	Is the remaining untreated impervious area greater than one acre?	Yes No	☐ ☒	This exclusion does not apply. Permanent water quality is required. Proceed to next line.
	Is it practicable to capture runoff from portions of the site that will not drain to a control measure?	No Yes	☒ ☐	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. This exclusion does not apply. Permanent water quality is required.



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 Hillside at Castle Rock - Phase 3 & 4

Project Owner BLVD Way Communities

Project Location NEC of Wolfsenberger Rd & Coachline Rd

ToCR Project Number Forthcoming

Total Site Area 5.67 acres

Total Size of Common Plan of Development 5.67 acres

Check all that apply:

☒ Project within Plum Creek Basin

☐ Project within Cherry Creek Basin

Estimated construction completion date 08/2024

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

APPENDIX G

Drainage Maps

1.	THIS OVERALL DRAINAGE MAP IS TO PROVIDE GENERAL LOCATIONS AND INFORMATION FOR STORM CONVEYANCE AND STORAGE FACILITIES, RETAINING WALLS, AS WELL AS CONSTRUCTION PHASING ONLY. FOR MORE DETAILS REFER TO PROPOSED DRAINAGE PLAN 1 & 2 AND CONSTRUCTION PLANS.
TO	
2.	ALL TRICKLE AND DRAINAGE/ROCK MITIGATION CHANNELS' DETAILS ARE DESIGNED AND SHOWN IN CONSTRUCTION PLANS.
3.	FOR LOT TYPE CONFIGURATIONS REFER TO CONSTRUCTION PLANS FOR LOT DRAINAGE DETAILS.
4.	PROPOSED GRADING CONTOURS SHOWN ARE OVERLOT GRADING WITH FINISHED STREET GRADING. FOR FINAL AREA GRADING FOR LOT, REFER TO LOT TYPE CONFIGURATION IN CONSTRUCTION PLANS.
5.	PHASE LINES ARE FOR INFORMATION ONLY.
6.	ALL STORM CONVEYANCE AND STORAGE FACILITIES WITHIN THE PROJECT BOUNDARY ARE PRIVATE UNLESS OTHERWISE NOTED.

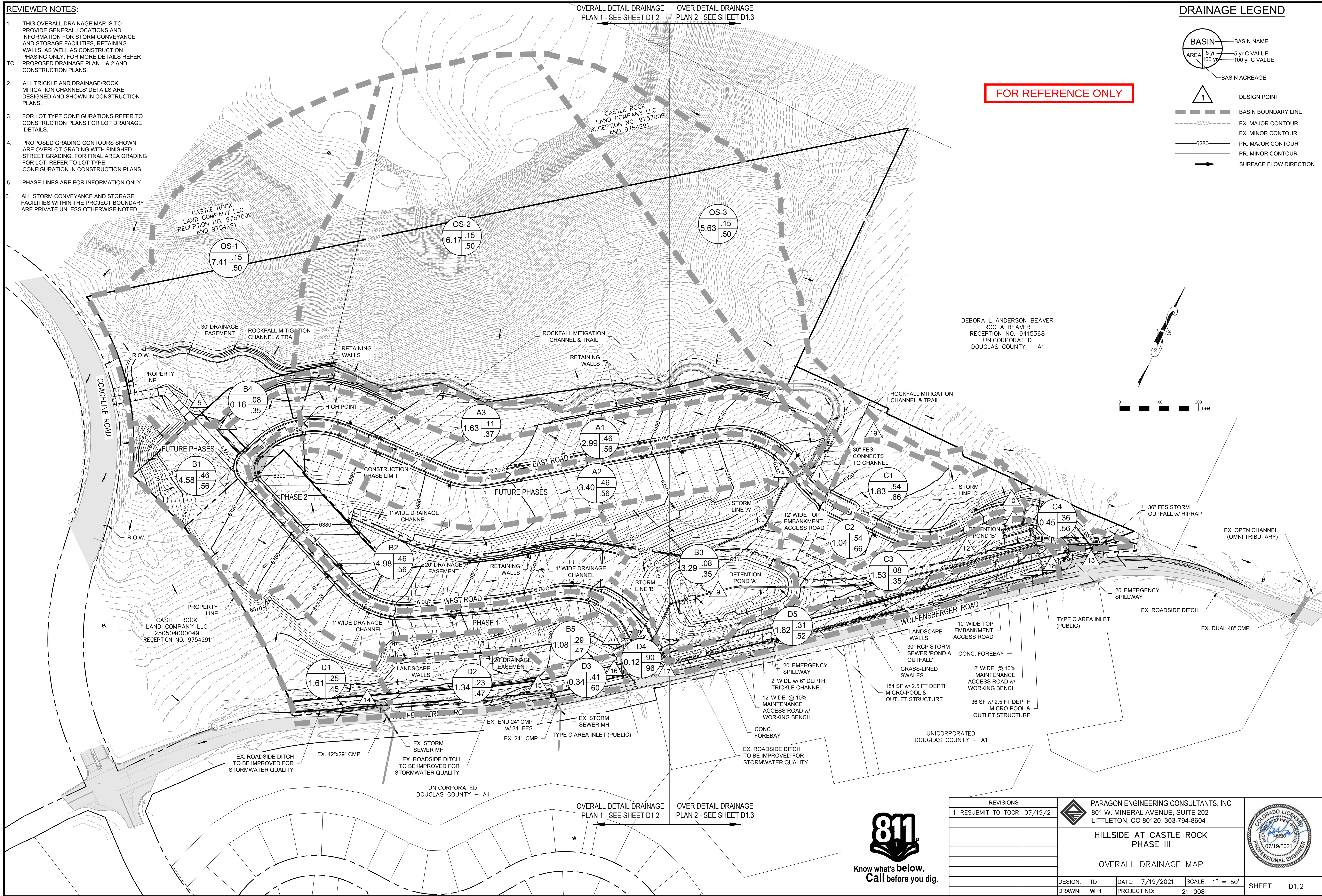
BASIN — BASIN NAME
AREA — 5 yr C VALUE
 — 100 yr C VALUE
100 yr — 100 yr C VALUE
BASIN ACREAGE

1 — DESIGN POINT

BASIN BOUNDARY LINE

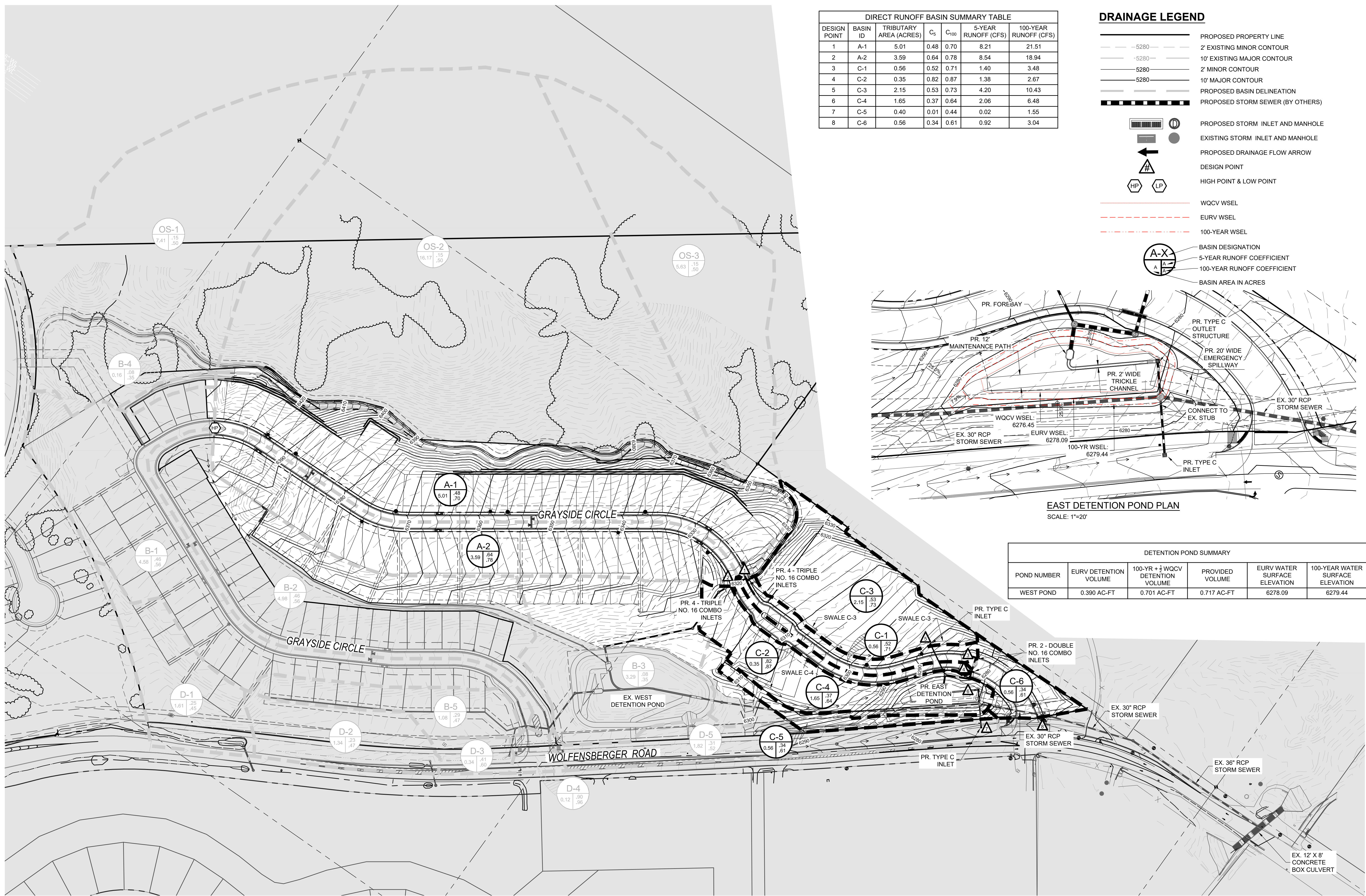
-6280- — EX. MAJOR CONTOUR
- - - - - — EX. MINOR CONTOUR
6280 — PR. MAJOR CONTOUR
————— — PR. MINOR CONTOUR

→ — SURFACE FLOW DIRECTION



Know what's below.
Call before you dig.

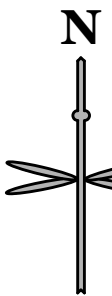
REVISIONS			 PARAGON ENGINEERING CONSULTANTS, INC. 801 W. MINERAL AVENUE, SUITE 202 LITTLETON, CO 80120 303-794-8604					
1	RESUBMIT TO TOCR	07/19/21						
			HILLSIDE AT CASTLE ROCK PHASE III OVERALL DRAINAGE MAP					
DESIGN: TD			DATE: 7/19/2021			SCALE: 1" = 50'		
DRAWN: WLB			PROJECT NO:			21-008		
						SHEET D1.2		



DIRECT RUNOFF BASIN SUMMARY TABLE						
DESIGN POINT	BASIN ID	TRIBUTARY AREA (ACRES)	C _s	C ₁₀₀	5-YEAR RUNOFF (CFS)	100-YEAR RUNOFF (CFS)
1	A-1	5.01	0.48	0.70	8.21	21.51
2	A-2	3.59	0.64	0.78	8.54	18.94
3	C-1	0.56	0.52	0.71	1.40	3.48
4	C-2	0.35	0.82	0.87	1.38	2.67
5	C-3	2.15	0.53	0.73	4.20	10.43
6	C-4	1.65	0.37	0.64	2.06	6.48
7	C-5	0.40	0.01	0.44	0.02	1.55
8	C-6	0.56	0.34	0.61	0.92	3.04

DRAINAGE LEGEND

- PROPOSED PROPERTY LINE
- 2' EXISTING MINOR CONTOUR
- 10' EXISTING MAJOR CONTOUR
- 2' MINOR CONTOUR
- 10' MAJOR CONTOUR
- PROPOSED BASIN DELINEATION
- PROPOSED STORM SEWER (BY OTHERS)
- PROPOSED STORM INLET AND MANHOLE
- EXISTING STORM INLET AND MANHOLE
- PROPOSED DRAINAGE FLOW ARROW
- DESIGN POINT
- HIGH POINT & LOW POINT
- WQCV WSEL
- EURV WSEL
- 100-YEAR WSEL
- BASIN DESIGNATION
- 5-YEAR RUNOFF COEFFICIENT
- 100-YEAR RUNOFF COEFFICIENT
- BASIN AREA IN ACRES



SCALE IN FEET
0 100 200

IF BAR DOES NOT MEASURE
1 INCH THEN DRAWING IS
NOT TO SCALE

TOWN APPROVAL BLOCK

TOWN OF CASTLE ROCK APPROVAL
PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM
DATE OF DEVELOPMENT SERVICES APPROVAL

APPROVED BY: _____

DEVELOPMENT SERVICES _____ DATE _____

CONSTRUCTION DOCUMENTS

HILLSIDE AT CASTLE ROCK - PHASES 3-4

NEC WOLFENBERGER ROAD AND COACHLINE ROAD

PROPOSED DRAINAGE MAP

BLVD BUILDERS

EES ENTITLEMENT AND ENGINEERING SOLUTIONS, INC.
3801 E. Florida Avenue, Suite 425
Denver, CO 80210
303-572-1597
www.ees.us.com

PRELIMINARY NOT FOR CONSTRUCTION

DATE: 2023/08/02

2

SHEET 2 OF 2

APPENDIX H

Site Grading Plans

P:\BLVDWAY BUILDERS\HILLSIDE AT CASTLE ROCK\08 CAD\SETUP SETS\PH 3-4 CDR\01 COVER SHEET.DWG 8/23/2023 11:50 AM Owen Sanford

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TOWN OF CASTLE ROCK GENERAL NOTES:

1.

ALL MATERIALS, WORKMANSHIP, AND CONSTRUCTION OF PUBLIC IMPROVEMENTS SHALL MEET OR EXCEED THE STANDARDS AND SPECIFICATIONS SET FORTH IN THE TOWN OF CASTLE ROCK (TCR) MUNICIPAL CODE, TCR TECHNICAL MANUALS, AND APPLICABLE STATE AND FEDERAL REGULATIONS. WHERE THERE IS CONFLICT BETWEEN THESE PLANS AND THE TECHNICAL MANUAL OR ANY APPLICABLE STANDARDS, THE MORE STRINGENT STANDARD SHALL APPLY. ALL WORK SHALL BE INSPECTED AND APPROVED BY THE TCR CONSTRUCTION INSPECTOR.
2.

THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED UPON AS BEING EXACT OR COMPLETE.
3.

THE CONTRACTOR MUST CALL THE LOCAL UTILITY LOCATION CENTER AT LEAST 72 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATIONS OF THE UTILITIES. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL VERIFY PERTINENT LOCATIONS AND ELEVATIONS, ESPECIALLY AT CONNECTION POINTS AND AT POTENTIAL UTILITY CONFLICTS. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES THAT CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THESE PLANS.
4.

THE CONTRACTOR SHALL COORDINATE AND COOPERATE WITH THE TOWN AND ALL UTILITY COMPANIES INVOLVED WITH REGARD TO RELOCATIONS OR ADJUSTMENTS OF EXISTING UTILITIES DURING CONSTRUCTION AND TO ASSURE THAT THE WORK IS ACCOMPLISHED IN A TIMELY FASHION AND WITH A MINIMUM DISRUPTION OF SERVICE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING ALL PARTIES AFFECTED BY ANY DISRUPTION OF ANY UTILITY SERVICE.
5.

CONTRACTOR SHALL PROVIDE A MINIMUM SEVENTY-TWO (72) HOURS NOTICE TO THE ON-SITE TCR CONSTRUCTION INSPECTOR, (720) 733-2200, PRIOR TO MAKING ANY CONNECTIONS/TIE-INS TO EXISTING WATER, SANITARY SEWER, AND/OR STORM SEWER SYSTEMS PROVIDED THAT THE UTILITY TIE-IN DOES NOT DISRUPT SERVICE TO EXISTING CR WATER CUSTOMERS. IF THE TIE-IN WILL DISRUPT UTILITY SERVICE, THEN CONTRACTOR SHALL PROVIDE A MINIMUM OF THREE (3) WEEKS NOTICE TO THE TCR CONSTRUCTION INSPECTOR TO ALLOW TIME FOR CR WATER TO PROVIDE WRITTEN NOTIFICATION TO EXISTING CUSTOMERS AFFECTED BY THE TIE-IN. ALL TOWN UTILITY TIE-INS MUST BE APPROVED BY CR WATER PRIOR TO COMMENCING WORK.
6.

THE CONTRACTOR SHALL HAVE ONE (1) SIGNED COPY OF THE APPROVED PLANS, ONE (1) COPY OF THE APPROPRIATE CRITERIA AND SPECIFICATIONS, AND A COPY OF ANY PERMITS AND EXTENSION AGREEMENTS NEEDED FOR THE JOB ONSITE AT ALL TIMES.
7.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL ASPECTS OF SAFETY INCLUDING, BUT NOT LIMITED TO, EXCAVATION, TRENCHING, SHORING, TRAFFIC CONTROL, AND SECURITY.
8.

IF DURING THE CONSTRUCTION PROCESS CONDITIONS ARE ENCOUNTERED WHICH COULD INDICATE A SITUATION THAT IS NOT IDENTIFIED IN THE PLANS OR SPECIFICATIONS, THE CONTRACTOR SHALL CONTACT THE TCR CONSTRUCTION INSPECTOR IMMEDIATELY.
9.

ALL REFERENCES TO ANY PUBLISHED STANDARDS SHALL REFER TO THE LATEST REVISION OF SAID STANDARD UNLESS SPECIFICALLY STATED OTHERWISE.
10.

THE CONTRACTOR SHALL SUBMIT A TRAFFIC CONTROL PLAN IN ACCORDANCE WITH MUTCD TO THE APPROPRIATE RIGHT-OF-WAY AUTHORITY (TOWN, COUNTY OR STATE) FOR APPROVAL PRIOR TO ANY CONSTRUCTION ACTIVITIES WITHIN OR AFFECTING THE RIGHT-OF-WAY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ANY AND ALL TRAFFIC CONTROL DEVICES AS MAY BE REQUIRED BY THE CONSTRUCTION ACTIVITIES.
11.

THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL LABOR AND MATERIALS NECESSARY FOR THE COMPLETION OF THE INTENDED IMPROVEMENTS SHOWN ON THESE DRAWINGS OR AS DESIGNATED TO BE PROVIDED, INSTALLED, OR CONSTRUCTED UNLESS SPECIFICALLY NOTED OTHERWISE.
12.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR RECORDING AS-BUILT INFORMATION ON A SET OF RECORD DRAWINGS KEPT ON THE CONSTRUCTION SITE AND AVAILABLE TO THE TCR CONSTRUCTION INSPECTOR AT ALL TIMES.
13.

DIMENSIONS FOR LAYOUT AND CONSTRUCTION ARE NOT TO BE SCALED FROM ANY DRAWING. IF PERTINENT DIMENSIONS ARE NOT SHOWN, CONTACT THE CONSULTANT ENGINEER FOR CLARIFICATION AND ANNOTATE THE DIMENSION ON THE AS-BUILT RECORD DRAWINGS.
14.

ALL INITIAL SEDIMENT CONTROL MEASURES SHALL BE INSTALLED PER THE TEMPORARY EROSION & SEDIMENT CONTROL (TESO) PLAN PRIOR TO ANY EARTH-DISTURBING ACTIVITY. ALL EROSION AND SEDIMENT CONTROL PRACTICES MUST BE MAINTAINED IN EFFECTIVE OPERATING CONDITION AT ALL TIMES. REMOVAL OF CONTROL MEASURES SHALL NOT OCCUR WITHOUT THE APPROVAL OF THE STORMWATER INSPECTOR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR KEEPING ROADWAYS FREE AND CLEAR OF ALL CONSTRUCTION DEBRIS AND DIRT TRACKED FROM THE SITE. THE CONTRACTOR SHALL ALSO COMPLY WITH ALL TERMS AND CONDITIONS OF THE COLORADO CONSTRUCTION GENERAL PERMIT FOR STORMWATER DISCHARGES.
15.

THE CONTRACTOR SHALL PROVIDE AN ACTION PLAN IMMEDIATELY FOLLOWING THE PRE-CONSTRUCTION MEETING DETAILING SUFFICIENT MEANS TO MITIGATE DUST ON SITE DURING OVERLOT GRADING, ROCK CRUSHING OR OTHER EARTHWORK ACTIVITIES. IF THE CONTRACTOR FAILS TO CONTROL DUST, ALL EARTH DISTURBING ACTIVITIES SHALL BE STOPPED UNTIL SUFFICIENT MEASURES ARE TAKEN TO THE TOWN'S SATISFACTION. THE CONTRACTOR SHALL ALSO COMPLY WITH ALL TERMS AND CONDITIONS OF THE COLORADO AIR QUALITY REGULATIONS FOR LAND DEVELOPMENT, AS REQUIRED.
16.

THE CONTRACTOR SHALL SEQUENCE INSTALLATION OF UTILITIES IN SUCH A MANNER AS TO MINIMIZE POTENTIAL UTILITY CONFLICTS. IN GENERAL, STORM SEWER AND SANITARY SEWER SHOULD BE CONSTRUCTED PRIOR TO INSTALLATION OF THE WATER LINES AND DRY UTILITIES.
17.

THERE SHALL BE NO SITE CONSTRUCTION ACTIVITIES ON SATURDAYS UNLESS SPECIFICALLY APPROVED BY THE TCR CONSTRUCTION INSPECTOR AND NO SITE CONSTRUCTION ACTIVITIES ON SUNDAYS OR HOLIDAYS UNLESS THERE IS PRIOR WRITTEN APPROVAL BY THE PUBLIC WORKS DIRECTOR.
18.

NO SOLID OBJECT (EXCLUDING FIRE HYDRANTS AND TRAFFIC CONTROL DEVICES AND TRAFFIC SIGNS) EXCEEDING THIRTY (30) INCHES IN HEIGHT ABOVE THE FLOWLINE ELEVATION OF THE ADJACENT STREET, INCLUDING BUT NOT LIMITED TO BUILDINGS, UTILITY CABINETS, WALLS, FENCES, LANDSCAPE PLANTINGS, CROPS, CUT SLOPES, AND BERMS, SHALL BE PLACED WITHIN SIGHT DISTANCE LINES AND SIGHT DISTANCE EASEMENTS.
19.

THIS PROPERTY IS LOCATED WITHIN ZONE X AS PER FEMA FIRM PANEL NO. 0169G DATED MARCH 16, 2016.
20.

BENCHMARK: NGS STATION "N 393". A BRASS DISK IN THE CENTER OF THE EAST END OF A 10 FT (3.0 M) BY 15 FT (4.6 M) EXPOSED AREA OF OUTCROPPING BEDROCK, 149.9 FT (45.7 M) EAST OF THE NEAR RAIL, 50.9 FT (15.5 M) WEST OF THE CENTERLINE OF COUNTY ROAD 25, 0.7 FT (0.2 M) WEST OF THE EAST EDGE OF THE OUTCROP, AND EAST OF THE EXTENDED CENTER OF INTERSTATE 25 EXIT 182, 10 FT (3.0 M) BELOW THE ROAD, AND 1 FT (0.3 M) NORTH OF A FIBERGLASS WITNESS POST. ELEVATION = 6222.12 (NAVD 88)

PROJECT BENCHMARK:

THE SOUTHWEST 1/16TH CORNER OF SECTION 3, TOWNSHIP 8 SOUTH, RANGE 67 WEST, BEING A 3" ALUMINUM CAP STAMPED "PLS 25629 1995".

ELEVATION = 6352.83 (NAVD 88).

ELEVATION BASED ON NGS STATION "N 393" AS DESCRIBED ABOVE.
21.

BASIS OF BEARINGS:
BEARINGS ARE BASED ON THE SOUTH LINE OF THE SOUTHEAST 1/4 OF THE SOUTHEAST 1/4 OF SECTION 4, TOWNSHIP 8 SOUTH, RANGE 67 WEST OF THE 6TH PRINCIPAL MERIDIAN AND ASSUMED TO BEAR N89°26'32"W.

CONTACTS:

OWNER/DEVELOPER:
BLVD HILLSIDE, LLC.
600 GRANT STREET, SUITE 404
DENVER, COLORADO 80203
PHONE: 303-200-0742
CONTACT: AARON FOY
AARON@BLVDBUILDERS.COM

ENGINEER / PLAN PREPARER:
ENTITLEMENT & ENGINEERING SOLUTIONS, INC.
3801 E. FLORIDA AVE., SUITE 425
GLENDALE, COLORADO 80210
PHONE: 303-572-7997
CONTACT: LUKE BREEDLOVE
LUKE.BREEDLOVE@EES.US.COM

LAND SURVEYOR:
FARNSWORTH GROUP
223 WILLOW STREET
FORT COLLINS, COLORADO 80524
PHONE: 970-484-7477
CONTACT: JOHN MCGEEHEE
EMAIL: J.MCGEEHEE@F-W.COM

LANDSCAPE PLANNER:
PCS GROUP, INC.
1007 16TH STREET #3, B-180
DENVER, COLORADO 80265
PHONE: 303-531-4908
CONTACT: PAUL SHOUKAS
PAUL@PCSGROUPCO.COM

TOWN OF CASTLE ROCK PUBLIC WORKS DEPARTMENT:
4175 NORTH CASTLETON COURT
CASTLE ROCK, CO 80104
PHONE: (720) 733-2462
CONTACT: BOB GOEBEL, DIRECTOR

CASTLE ROCK WATER DEPARTMENT:
175 KELLOGG COURT
BUILDING 171
CASTLE ROCK, CO 80109
PHONE: (720) 733-6000
EMAIL: WATER@CRGOV.COM

DRY UTILITY COMPANIES:

(ELECTRICAL)
CORE
5496 NORTH U.S. HWY. 85
SEDALIA, CO 80135
BROOKS KAUFMAN
(720) 733-5493

(GAS)
BLACK HILLS ENERGY
1769 PARK STREET
CASTLE ROCK, CO 80109
CONTACT: RON ZUROFF
(303) 217-7811

(COMMUNICATION)
CENTURY LINK
9750 E. COSTILLA AVE.
ENGLEWOOD, CO 80112
CONTACT : CHARLES PLACE
(720) 578-5132

(COMMUNICATION)
COMCAST CABLE
6850 S. TUCSON WAY
ENGLEWOOD, CO 80112
CONTACT: SCOTT MOORE
(303) 603-5665

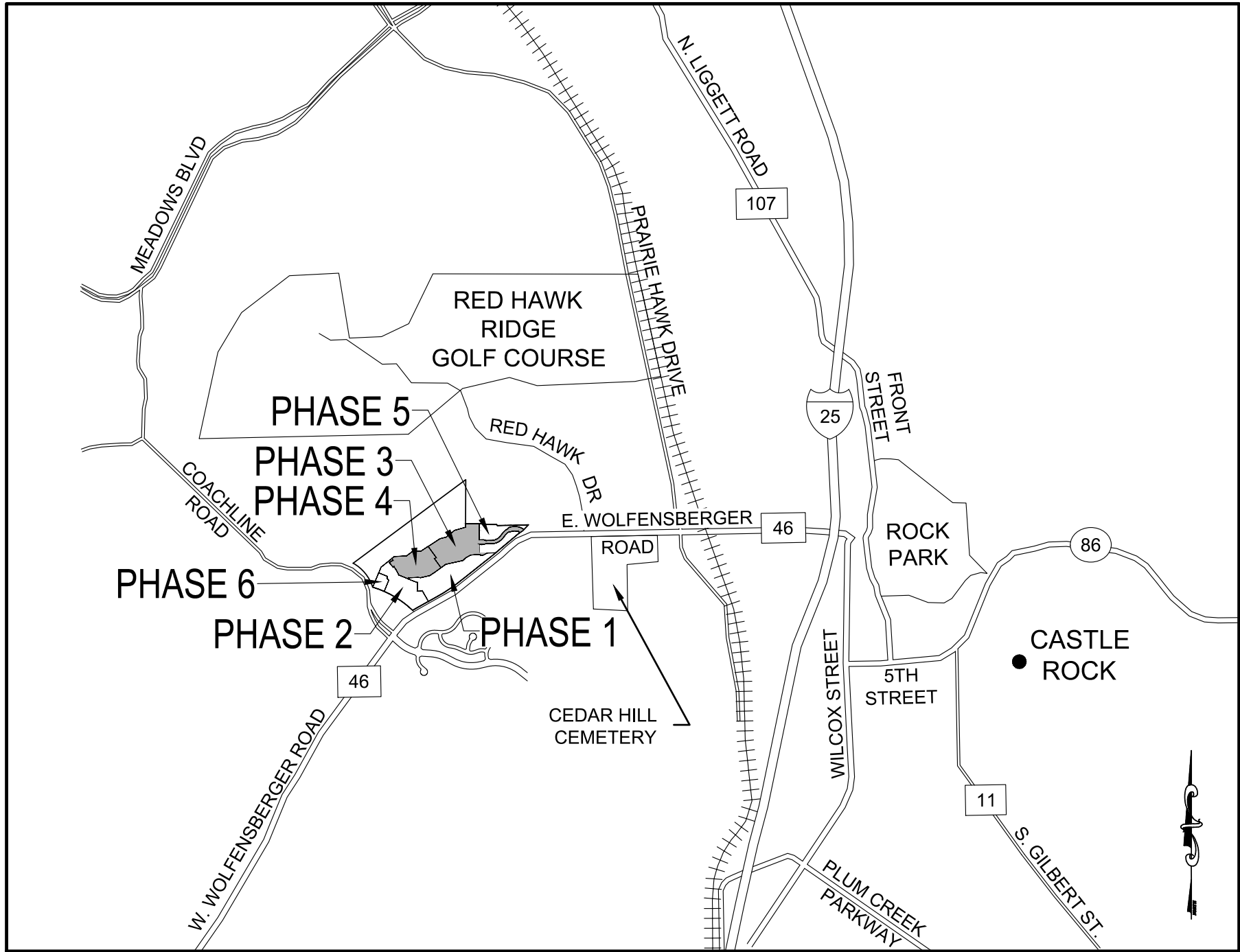
FIELD CHANGE ORDER			
FCO No.	Submittal Date	Description	Approval Date
FCO23-00			

GENERAL LEGEND:

— — — 5530 — — —	PROPERTY LINE
— X —	EXIST. CONTOUR
— E —	EXIST. FENCE
— G —	EXIST. BURIED ELECTRIC LINE
— CTV —	EXIST. GAS MAIN
— COM —	EXIST. CATV LINE
— S —	EXIST. COMMUNICATION LINE
— S —	EXIST. SANITARY SEWER
— S —	EXIST. STORM SEWER
— W —	EXIST. WATER MAIN
⊗	EXIST. SANITARY SEWER MH
⊕	EXIST. STORM MANHOLE
⊙	EXIST. FIRE HYDRANT
⊕	EXIST. WATER VALVE
⊕	EXIST. UTILITY RISER
⊕	EXIST. STREET SIGN
☁	EXIST. VEGETATION
■	EXIST. ASPHALT PAVEMENT

x 5537.30 2%	PROPOSED SPOT ELEVATION
— — — 5530 — — —	PROPOSED SLOPE
— S —	PROPOSED PHASING LINE
— W —	PROPOSED CONTOUR
→	PROPOSED SANITARY SEWER
→	PROPOSED WATER MAIN
→	PROPOSED C.L. SWALE
→	PROPOSED 100-YR EGL
→	PROPOSED 100-YR HGL
→	PROPOSED STORM SEWER
→	PROPOSED AREA INLET
→	PROPOSED WATER VALVE
→	PROPOSED FIRE HYDRANT
→	PROPOSED SIGN
→	PROPOSED STREET LIGHT
→	PROPOSED ROADWAY STRIPING
→	PROPOSED ASPHALT PAVEMENT
→	PROPOSED CONCRETE PAVEMENT
→	PROPOSED LOT NUMBER
→	PROPOSED BLOCK NUMBER
→	PROPOSED DRAINAGE FLOW ARROW
→	PROPOSED CLEANOUT
→	PROPOSED 12"x8" REDUCER

PUBLIC IMPROVEMENT CONSTRUCTION PLANS FOR:
HILLSIDE AT CASTLE ROCK
PHASES 3 - 4
LOCATED IN THE SW 1/4 OF SECTION 3 AND THE SE 1/4 OF SECTION 4,
TOWNSHIP 8 SOUTH, RANGE 67 WEST, 6th P.M., TOWN OF CASTLE ROCK,
COUNTY OF DOUGLAS, STATE OF COLORADO
TOWN OF CASTLE ROCK PROJECT NO. CD 23-00 _____



VICINITY MAP

SCALE: 1" = 2,000'

APPROVED VARIANCES:

1.

VARIANCE NO. 15-0036
DESCRIPTION: A 1% VARIANCE IN THE MAXIMUM STREET GRADE FOR AN APPROXIMATE 500 FT. SEGMENT OF LOCAL ROAD.

APPROVAL DATE: 7/1/15
2.

VARIANCE NO. 16-0047
DESCRIPTION: CROSS PANS AT ENTRY STREETS.

APPROVAL DATE: 8/3/16
3.

VARIANCE NO. 16-0048
DESCRIPTION: 10% OF SITE RUNOFF NOT REQUIRED TO RUN THROUGH A WATER QUALITY FEATURE.

APPROVAL DATE: 8/10/16
4.

VARIANCE NO. 19-0020
DESCRIPTION: OFFSITE PERVIOUS AREAS AND 0.49 ACRES OF DEVELOPED IMPERVIOUS AREA ARE NOTE CAPTURED AND TREATED.

APPROVAL DATE: 5/2/19
5.

VARIANCE NO. 19-0021
DESCRIPTION: ROCK FALL MITIGATION CHANNEL FREEBOARD.

APPROVAL DATE: 5/2/19
6.

VARIANCE NO. 19-0022
DESCRIPTION: CONCRETE CHANNEL FREEBOARD

APPROVAL DATE: 5/2/19

Sheet List Table		
Sheet Number	Sheet Title	
1	C0.1	COVER SHEET
2	C0.2	STANDARD NOTES
3	C0.3	TYPICAL ROADWAY SECTIONS
4	C1.1	EXISTING CONDITIONS PLAN 1
5	C1.2	EXISTING CONDITIONS PLAN 2
6	C1.3	OVERALL UTILITY PHASING PLAN
7	C1.4	OVERALL ROADWAY PHASING PLAN
8	C2.1	OVERLOT GRADING TEMPLATES
9	C2.2	OVERLOT GRADING PLAN 1
10	C2.3	OVERLOT GRADING PLAN 2
11	C5.1	STORM SEWER A P&P
12	C5.2	STORM SEWER B, C & D P&P
13	C5.3	STORM SEWER DETAILS
14	C6.1	PHASE 3 WATER PLAN & PROFILE 1
15	C6.2	PHASE 3 WATER PLAN & PROFILE 2
16	C6.3	PHASE 3 WATER PLAN & PROFILE 3
17	C6.4	PHASE 3 WATER PLAN & PROFILE 4
18	C6.5	PHASE 3 WATER PLAN & PROFILE 5
19	C6.6	PHASE 4 WATER PLAN & PROFILE
20	C6.7	WATER DETAILS 1
21	C6.8	WATER DETAILS 2
22	C6.9	WATER DETAILS 3
23	C6.10	WATER DETAILS 3
24	C6.11	WATER DETAILS 4
25	C7.1	PHASE 3 SANITARY SEWER PLAN & PROFILE 1
26	C7.2	PHASE 3 SANITARY SEWER PLAN & PROFILE 2
27	C7.3	PHASE 3 SANITARY SEWER PLAN & PROFILE 3
28	C7.4	PHASE 3 SANITARY SEWER PLAN & PROFILE 4
29	C7.5	PHASE 4 SANITARY SEWER PLAN & PROFILE 1
30	C7.6	SANITARY SEWER DETAILS 1
31	C7.7	SANITARY SEWER DETAILS 2
32	C8.1	ROCK FALL MITIGATION CHANNEL PLAN & PROFILE STA. 10+00 - 15+50
33	C8.2	ROCK FALL MITIGATION CHANNEL PLAN & PROFILE STA. 15+50 - 22+00
34	C8.3	ROCK FALL MITIGATION CHANNEL PLAN & PROFILE STA. 22+00 - 26+30
35	C9.1	PHASE 3 GRAYSIDE CIRCLE SIGNAGE, STRIPING & LIGHTING PLAN 1
36	C9.2	PHASE 3 GRAYSIDE CIRCLE SIGNAGE, STRIPING & LIGHTING PLAN 2
37	C9.3	PHASE 4 GRAYSIDE CIRCLE SIGNAGE, STRIPING, & LIGHTING PLAN
38	C9.4	WOLFENSBERGER ROAD SIGNAGE, STRIPING & LIGHTING PLAN
39	C10.1	PHASE 3 GRAYSIDE CIRCLE PLAN & PROFILE 1
40	C10.2	PHASE 3 GRAYSIDE CIRCLE PLAN & PROFILE 2
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48	C11.1	DETENTION POND PLAN
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50	C11.3	POND DETAILS
51	LP0.1	MASTER PLANTING PLAN
52	LP0.2	NOTES, CHARTS AND PLANTING DETAILS
53	LP0.3	GESC PLAN, NOTES AND DETAILS
54-59	LP1.1-LP1.6	PLANTING PLANS
60	IR 0.1	IRRIGATION SCHEDULE AND NOTES
61-66	IR 1.1-IR1.6	IRRIGATION PLANS
67-69	IR 2.1-IR2.3	IRRIGATION DETAILS
70	IR 2.4	IRRIGATION DETAILS AND CHARTS

INDEMNIFICATION AND ADHERENCE TO STANDARDS STATEMENTS:

THESE PLANS HAVE BEEN REVIEWED BY THE TOWN OF CASTLE ROCK FOR CONCEPT ONLY. THE REVIEW DOES NOT IMPLY RESPONSIBILITY BY THE REVIEWING DEPARTMENT, THE TOWN ENGINEER, OR THE TOWN OF CASTLE ROCK FOR ACCURACY AND CORRECTNESS OF THE CALCULATIONS. FURTHERMORE, THE REVIEW DOES NOT IMPLY THAT QUANTITIES OF ITEMS ON THE PLANS ARE THE FINAL QUANTITIES REQUIRED. THE REVIEW SHALL NOT BE CONSTRUED FOR ANY REASON AS ACCEPTANCE OF FINANCIAL RESPONSIBILITY BY THE TOWN FOR ADDITIONAL QUANTITIES OF ITEMS SHOWN THAT MAY BE REQUIRED DURING THE CONSTRUCTION PHASE. ALL WORK SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE TOWN OF CASTLE ROCK MUNICIPAL CODE, TECHNICAL MANUALS AND/OR OTHER TOWN-APPROVED APPLICABLE STANDARDS.

PROFESSIONAL ENGINEER CERTIFICATION:

I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS FOR HILLSIDE AT CASTLE ROCK PHASES 3-4 WERE PREPARED UNDER MY DIRECT SUPERVISION, IN ACCORDANCE WITH ALL APPLICABLE TOWN OF CASTLE ROCK AND STATE OF COLORADO STANDARDS AND STATUTES, RESPECTIVELY; AND THAT I AM FULLY RESPONSIBLE FOR ALL DESIGN AND REVISIONS RELATIVE TO SAID PLANS.

MICHAEL S. GOODHUE
REGISTERED PROFESSIONAL
ENGINEER COLORADO NO. 48230

TOWN APPROVAL BLOCK

TOWN OF CASTLE ROCK APPROVAL
PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM
DATE OF DEVELOPMENT SERVICES APPROVAL

APPROVED BY:

DEVELOPMENT SERVICES

DATE



CALL UTILITY NOTIFICATION
CENTER OF COLORADO

1-800-922-1987 or 811

CALL 3-BUSINESS DAYS (NOT INCLUDING INITIAL
DAY OF CONTACT) IN ADVANCE BEFORE YOU DIG,
GRADE, OR EXCAVATE FOR THE MARKING OF
UNDERGROUND MEMBER UTILITIES.

DATE		BY		REVISION		No.	

PRELIMINARY
NOT FOR
CONSTRUCTION



3801 E. Florida Avenue, Suite 425
Denver, CO 80210
303-572-1987 www.ees.us.com



CONSTRUCTION PLANS
HILLSIDE AT CASTLE ROCK - PHASES 3-4

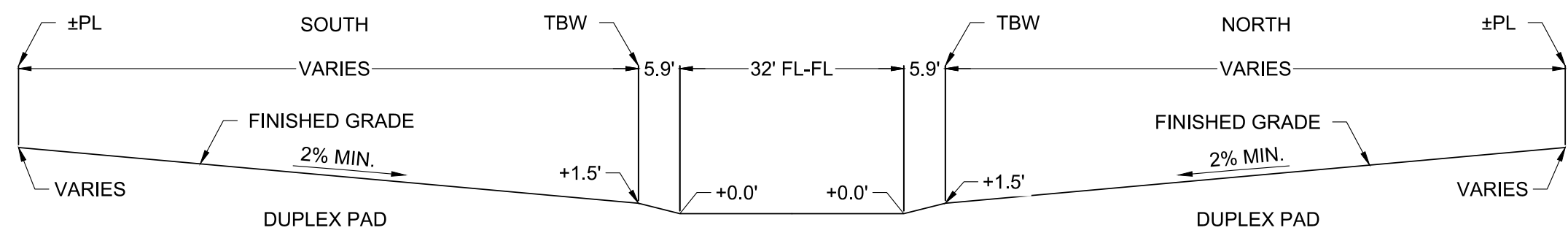
CASTLE ROCK, COLORADO

COVER SHEET

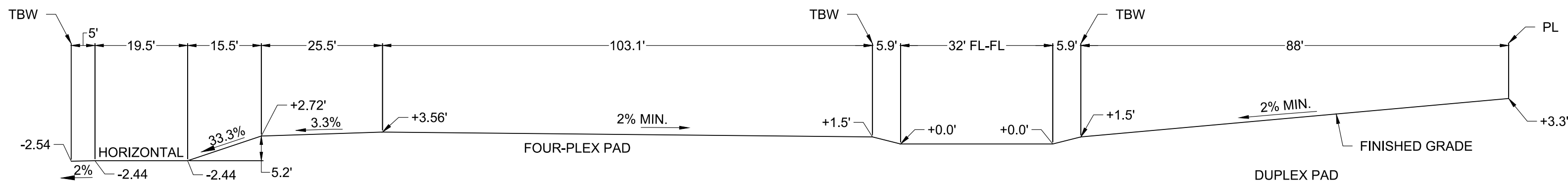
PROJECT NO.: BLV001.02
DESIGNED BY: WLB
DRAWN BY: WLB
DATE: 8/23/2023

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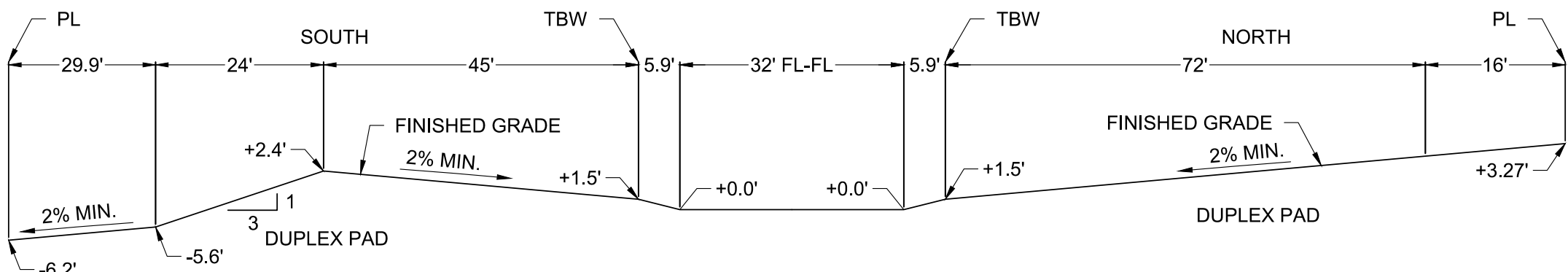
SHEET 01 OF 70



GRAYSIDE CIRCLE OVERLOT GRADING SECTION
(THE ARBORS)
STA: 14+75 TO STA: 19+14



GRAYSIDE CIRCLE OVERLOT GRADING SECTION
STA: 19+62 TO STA: 30.52



GRAYSIDE CIRCLE OVERLOT GRADING SECTION
STA: 30+52 TO STA: 32+15

TOWN APPROVAL BLOCK	
TOWN OF CASTLE ROCK APPROVAL	
PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM DATE OF DEVELOPMENT SERVICES APPROVAL	
APPROVED BY:	
DEVELOPMENT SERVICES	DATE

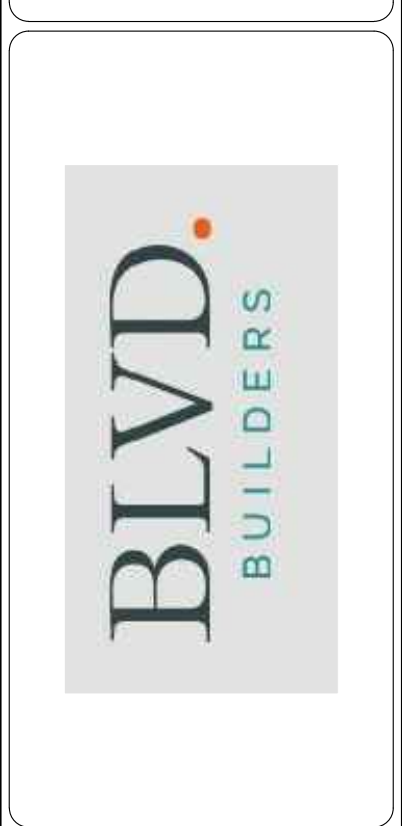
No.	REVISION	BY	DATE

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ENGINEERING
SOLUTIONS, INC.

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Denver, CO 80210
303-572-1997 www.ees.us.com



CONSTRUCTION PLANS

HILLSIDE AT CASTLE ROCK - PHASES 3-4

CASTLE ROCK, COLORADO

OVERLOT GRADING
TEMPLATES

PROJECT NO: BLV001.02

DESIGNED BY: WLB

DRAWN BY: WLB

DATE: 8/23/2023

C2.1

SHEET 8 OF 70

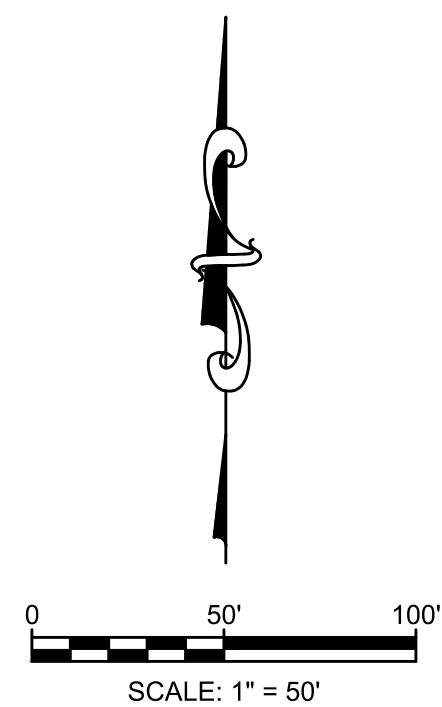
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P:\BLVDWAY BUILDERS\HILLSIDE AT CASTLE ROCK\8 CAD\SET\PH 3-4 CDS\OVERLOT GRADING PLANS.DWG 8/23/2023 11:51 AM Owen Sanitized



LEGEND

- EX. SIGNAGE & STRIPING
- EX. C&G W/ ATTACHED WALK
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- PR. MAJOR CONTOUR
- PR. MINOR CONTOUR
- EX. FENCE
- EX. 8" WATER LINE
- EX. 12" WATER LINE
- EX. STREET LIGHT
- EX. SANITARY SEWER
- EX. STORM SEWER
- EX. ELECTRIC
- EX. GAS LINE
- EX. FIBER OPTIC LINE
- EX. COMMUNICATIONS LINE
- EX. WATER LINE, VALVE &, HYDRANT
- EX. SANITARY SEWER W/ MANHOLE
- RIGHT-OF-WAY
- CENTERLINE RIGHT-OF-WAY
- PR. EASEMENT
- SITE BOUNDARY
- SLOPE ARROW & PERCENT GRADE
- FLOW DIRECTION
- LOT NUMBER
- DIVERSION DITCH PLASTIC LINER
- PR. STORM SEWER & MANHOLE
- PR. SWALE FLOWLINE
- PHASE LINE
- LIMITS OF GRADING
- DUPLEX UNITS
- QUADPLEX UNITS
- QUADPLEX WITH WALKOUT UNITS
- WALKOUT



TOWN APPROVAL BLOCK

TOWN OF CASTLE ROCK APPROVAL
PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM
DATE OF DEVELOPMENT SERVICES APPROVAL

APPROVED BY: _____
DEVELOPMENT SERVICES DATE

NOTES:

- THE HAUL ROUTE MUST BE APPROVED BY THE TOCR TRANSPORTATION PLANNING AND TRAFFIC ENGINEERING DIVISION.
- STRUCTURAL WALL DESIGN AND MATERIAL BY OTHERS.
- "RETAINING WALLS, SECTIONS OF RETAINING WALLS 4-FEET IN HEIGHT OR HIGHER OR TIERED WALLS MUST BE DESIGNED BY A STRUCTURAL ENGINEER LICENSED IN THE STATE OF COLORADO AND MUST RECEIVE A BUILDING PERMIT FROM THE TOWN OF CASTLE ROCK PRIOR TO THE ISSUANCE OF THE PUBLIC WORKS PERMIT"

TEMPORARY EROSION CONTROL NOTES:

- TEMPORARY EROSION CONTROL SHALL BE PROVIDED IN ACCORDANCE WITH THE TOWN'S GRADING, EROSION, AND SEDIMENT CONTROL CRITERIA.
- TEMPORARY EROSION CONTROL IS REQUIRED AT THE ENDS OF ALL ROADWAYS THAT ARE NOT COMPLETED DUE TO PROJECT PHASING, SUBDIVISION BOUNDARIES, ETC. SUCH EROSION CONTROL MEASURES SHALL BE MAINTAINED BY THE PROPERTY OWNER IN GOOD WORKING CONDITION.

PROJECT BENCHMARK:

TOP OF THE SW 1/16 CORNER OF SECTION 3, TOWNSHIP 8 SOUTH, RANGE 67 WEST, BEING A 3" ALUMINUM CAP STAMPED "PLS 25629 1995" WITH AN ELEVATION OF 6352.83 FEET NAVD 88. THIS ELEVATION IS BASED UPON NGS STATION "N 393" WITH A PUBLISHED ELEVATION OF 6222.12 FEET NAVD 88.



CALL UTILITY NOTIFICATION
CENTER OF COLORADO
1-800-922-1987 or 811

CALL 3-BUSINESS DAYS (NOT INCLUDING INITIAL DAY OF CONTACT) IN ADVANCE BEFORE ANY DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

PRELIMINARY
NOT FOR
CONSTRUCTION



CONSTRUCTION PLANS
HILLSIDE AT CASTLE ROCK - PHASES 3-4

CASTLE ROCK, COLORADO
OVERLOT GRADING PLAN 1

PROJECT NO: BLV001.02
DESIGNED BY: WLB
DRAWN BY: WLB
DATE: 8/23/2023
C2.2
SHEET 09 OF 70

PROJECT BENCHMARK:

TOP OF THE SW 1/16 CORNER OF SECTION 3, TOWNSHIP 8 SOUTH, RANGE 67 WEST, BEING A 3" ALUMINUM CAP STAMPED "PLS 25629 1995" WITH AN ELEVATION OF 6352.83 FEET NAVD 88. THIS ELEVATION IS BASED UPON NGS STATION "N 393" WITH A PUBLISHED ELEVATION OF 6222.12 FEET NAVD 88.



Know what's below.
Call before you dig.

CALL UTILITY NOTIFICATION
CENTER OF COLORADO
1-800-922-1987 or 811

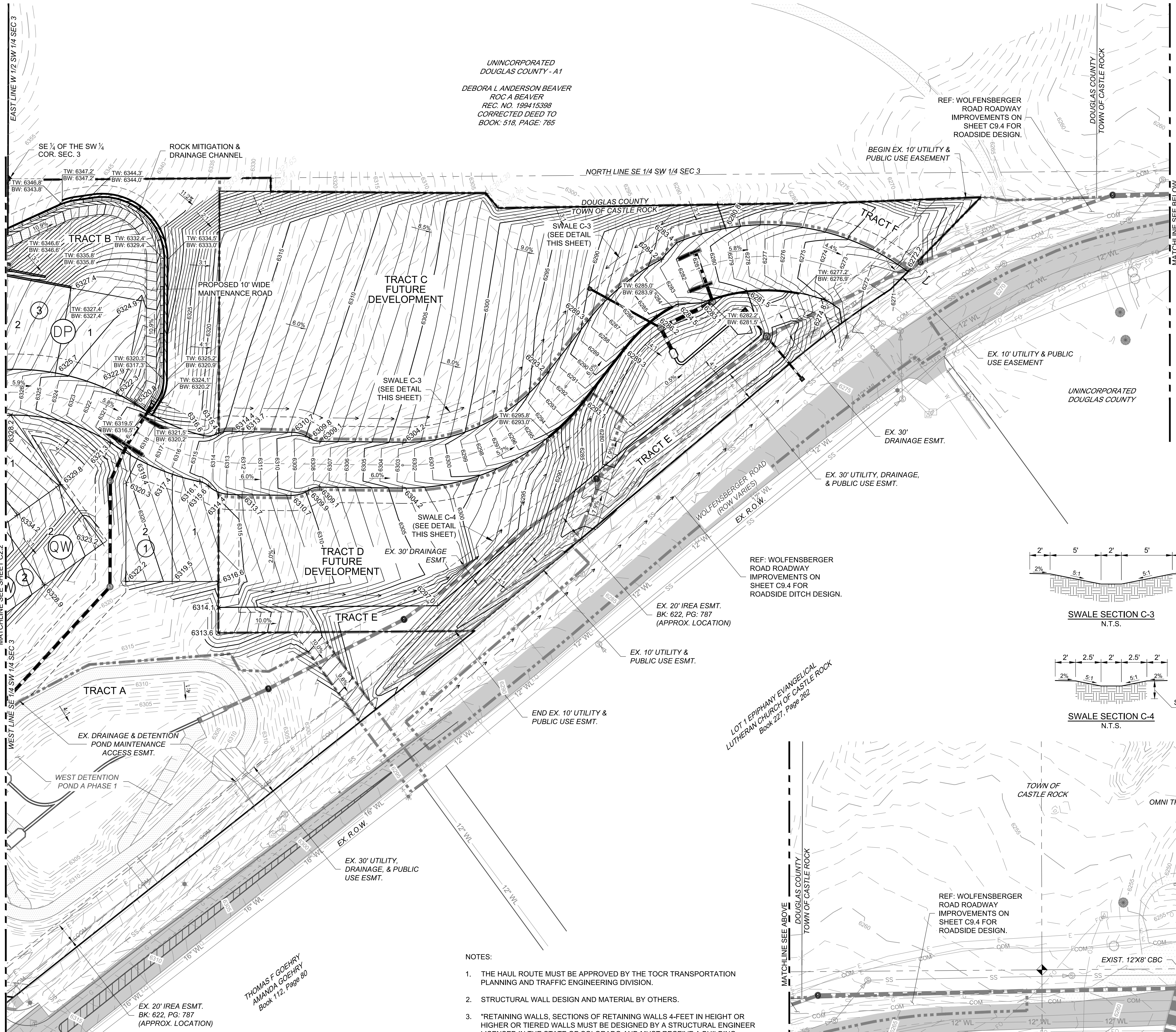
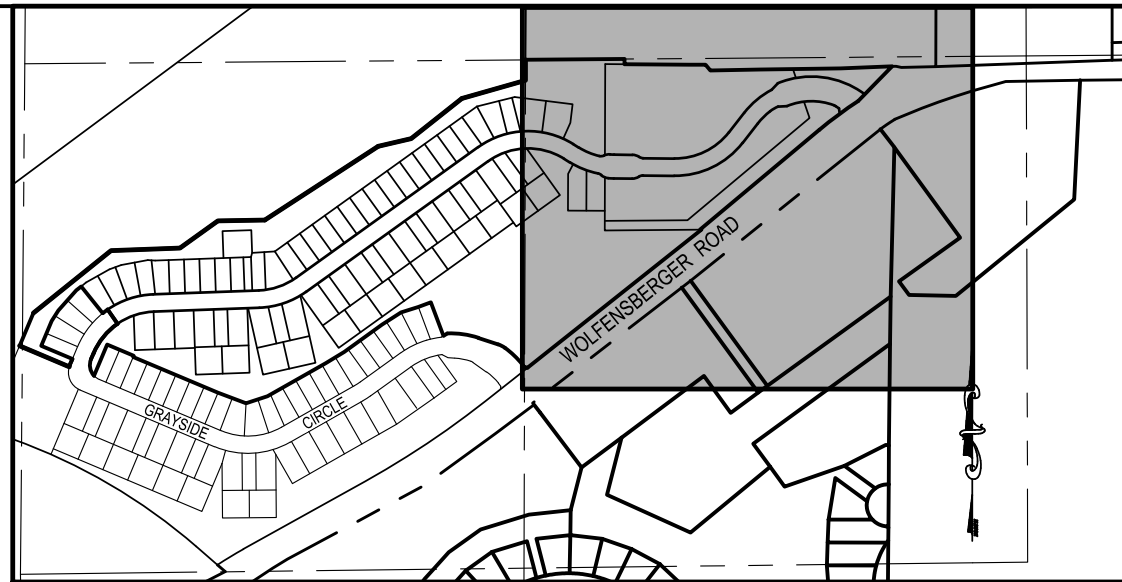
THOMAS F GOEHRY
AMANDA GOEHRY
Book 112, Page 80

NOTES:

- THE HAUL ROUTE MUST BE APPROVED BY THE TCCR TRANSPORTATION PLANNING AND TRAFFIC ENGINEERING DIVISION.
- STRUCTURAL WALL DESIGN AND MATERIAL BY OTHERS.
- "RETAINING WALLS, SECTIONS OF RETAINING WALLS 4-FEET IN HEIGHT OR HIGHER OR TIERED WALLS MUST BE DESIGNED BY A STRUCTURAL ENGINEER LICENSED IN THE STATE OF COLORADO AND MUST RECEIVE A BUILDING PERMIT FROM THE TOWN OF CASTLE ROCK PRIOR TO THE ISSUANCE OF THE PUBLIC WORKS PERMIT"

TEMPORARY EROSION CONTROL NOTES:

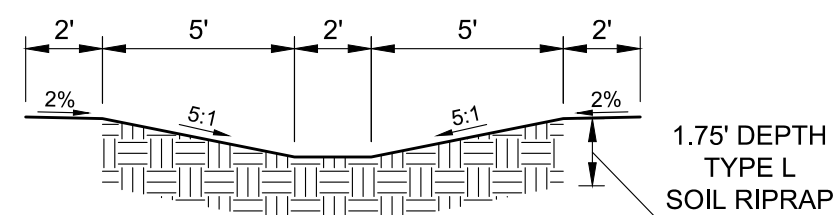
- TEMPORARY EROSION CONTROL SHALL BE PROVIDED IN ACCORDANCE WITH THE TOWN'S GRADING, EROSION, AND SEDIMENT CONTROL CRITERIA.
- TEMPORARY EROSION CONTROL IS REQUIRED AT THE ENDS OF ALL ROADWAYS THAT ARE NOT COMPLETED DUE TO PROJECT PHASING, SUBDIVISION BOUNDARIES, ETC. SUCH EROSION CONTROL MEASURES SHALL BE MAINTAINED BY THE PROPERTY OWNER IN GOOD WORKING CONDITION..



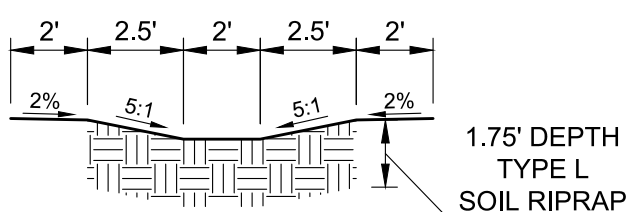
KEYMAP
SCALE: 1"=500'

LEGEND

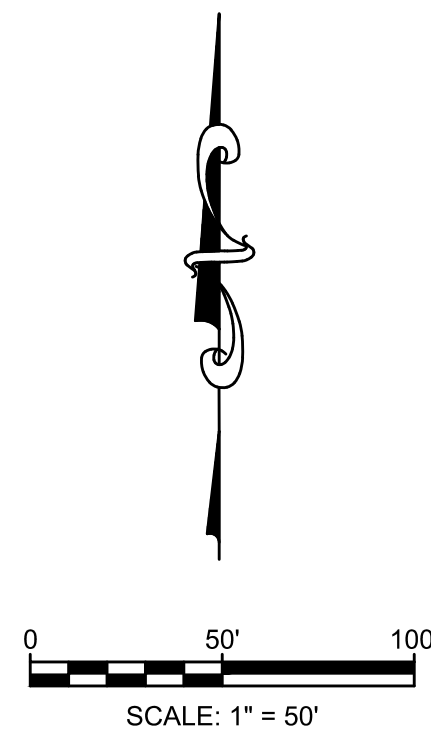
- EX. SIGNAGE & STRIPING
- EX. C&G W/ ATTACHED WALK
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- PR. MAJOR CONTOUR
- PR. MINOR CONTOUR
- EX. FENCE
- EX. 8" WATER LINE
- EX. 12" WATER LINE
- EX. STREET LIGHT
- EX. SANITARY SEWER
- EX. STORM SEWER
- EX. ELECTRIC
- EX. GAS LINE
- EX. FIBER OPTIC LINE
- EX. COMMUNICATIONS LINE
- EX. WATER LINE, VALVE &, HYDRANT
- EX. SANITARY SEWER W/ MANHOLE
- RIGHT-OF-WAY
- PR. EASEMENT
- SITE BOUNDARY
- SLOPE ARROW & PERCENT GRADE
- FLOW DIRECTION
- LOT NUMBER
- DIVERSION DITCH PLASTIC LINER
- PR. STORM SEWER & MANHOLE
- PR. SWALE FLOWLINE
- PHASE LINE
- LIMITS OF GRADING
- DUPLEX UNITS
- QUADPLEX UNITS
- QUADPLEX WITH WALKOUT UNITS
- WALKOUT



SWALE SECTION C-3
N.T.S.



SWALE SECTION C-4
N.T.S.



TOWN APPROVAL BLOCK

TOWN OF CASTLE ROCK APPROVAL
PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM
DATE OF DEVELOPMENT SERVICES APPROVAL

APPROVED BY:

DEVELOPMENT SERVICES DATE

PRELIMINARY
NOT FOR
CONSTRUCTION



CONSTRUCTION PLANS
HILLSIDE AT CASTLE ROCK - PHASES 3-4

CASTLE ROCK, COLORADO

OVERLOT GRADING PLAN 2

PROJECT NO: BLV001.02

DESIGNED BY: WLB

DRAWN BY: WLB

DATE: 8/23/2023

C2.3

SHEET 10 OF 70