



May 18, 2026

Town of Castle Rock
Castle Rock Water
175 Kellogg Court
Castle Rock, CO 80109

**RE: *Chick-fil-A #4027 Promenade at Castle Rock, Castle Rock, Colorado,
Drainage Conformance Letter***

To Whom it May Concern,

The purpose of this letter is to provide information that the Chick-fil-A #4027 in Castle Rock, Colorado conforms to the drainage patterns set forth in the approved Phase III Drainage Report, *Chick-fil-A Castle Rock Promenade* prepared by *Merrick & Company*, dated April 2018 ("Previous Drainage Report"). The Previous Drainage Report is assumed to be compliant to the "Overall Drainage Report", *Phase III Drainage Report for Promenade at Castle Filing No. 1 Castle Rock, CO*, prepared by *Bowman Consulting*, dated June 2015.

The Property limits are approximately 1.04 acres, located in the southeast quarter of Section 22, Township 7 South, Range 67 West of the 6th P.M., Town of Castle Rock, County of Douglas, State of Colorado (the "Property"). The existing site is bounded by private developments to the north, west, and south, and Promenade Parkway to the east. A Natural Resources Conservation Service (NRCS) soil study for the project area was obtained to determine the soil characteristics of the site. The results of this study show that the site primarily contains hydrologic soil group D. Refer to the NRCS soil study within Appendix C.

The proposed improvements include the installation of a walk-out door and an additional bypass lane in the drive-thru, located north of the existing building. Surrounding improvements include the sidewalk connecting to the right-of-way (the "Project"). According to FEMA Flood Insurance Map NO. 08035C0167G, effective March 16, 2016, this site is entirely Zone X, area of minimal flood hazard and outside of a floodplain. Refer to the FEMA map within **Appendix B**.

The Previous Drainage Report for the Property accounts for the existing conditions of the Chick-fil-A development, refer to **Appendix F**. The improvements for the Project will generally follow existing drainage patterns. To ensure compliance with the Previous Drainage Report, the existing versus proposed Basins studied are only the improvement areas that are disturbed by the Project. A proposed portion of sidewalk connecting to the right-of-way is not included in the proposed Basins as it is concrete to be replaced outside of the property line. The sidewalk is to match the existing condition and not change the existing drainage conditions. The Previous Drainage Report, Basin A-1, A-2, A-5, and B-1 shown in *Table 1*, contains the Projects proposed limits of disturbance. In the existing condition, flows in Basins A-1 and A-2 are captured by existing private Denver No. 16 Combination inlets, flows in Basin A-5 are directed offsite to an existing area inlet, and flows in Basin B-1 sheet flow offsite to follow existing drainage to the existing regional detention pond. The Previous Drainage Report included inlet calculation for the respective Basins.



Table 1- Existing Basins

Existing Basin	Area (Acres)	Existing Flows (CFS)		Impervious %
		5-yr	100-yr	
A-1	0.25	0.95	1.90	91%
A-2	0.11	0.42	0.84	91%
A-5	0.03	0.05	0.18	36%
B-1	0.10	0.06	0.47	11%
TOTAL:	0.49	1.48	3.39	80%*

*Previous Drainage Reports weighted imperviousness for all onsite areas

The proposed Project Basins are PA-1, PA-2, PA-5, and PB-1 are illustrated in the Proposed Drainage Map, provided within **Appendix A**. *Table 2* below summarizes the developed runoff during the 5-year and 100-year event, refer to **Appendix D** for complete calculations. Flows generated by the proposed conditions are not substantially significant in comparison to the existing conditions for the 5-year and 100-year events.

Table 2– Proposed Basins

Proposed Basin	Area (Acres)	Proposed Flows (CFS)		Impervious %
		5-yr	100-yr	
PA-1	0.26	0.98	1.94	92.6%
PA-2	0.12	0.47	0.89	98.4%
PA-5	0.03	0.03	0.14	23.6%
PB-1	0.08	0.03	0.34	7.3%
TOTAL:	0.49	1.51	3.31	76.5%

In comparison to the existing condition, total flows for the proposed condition are increasing for the minor storm and decreasing for the major storm. Minor modifications to the site from the Previous Drainage Report to the proposed Project explain the fluctuation in runoffs. A decrease in flow is expected as two canopies have been added to the site since the Previous Drainage Report. These canopies are located in Basins A-1 and A-2, and the roofs are equipped with downspouts designed to splash to grade. Roof area is weighted with an impervious of 90% whereas paved areas are calculated with an impervious of 100%. The proposed additional drive-thru lane increases the sites imperviousness and runoff captured onsite in Basins A-1 and A-2. Total flows conveyed to existing private Denver No. 16 Combination inlets (Design Points 1 and 5) increase when flows are compared between existing and proposed Basins. Inlet calculations were computed on Design Points 1 and 5 to ensure the existing private Denver No. 16 Combination inlets can convey runoff in the 5-year and 100-year storm event, see **Appendix E**. Existing storm pipes were evaluated to ensure they had capacity for the proposed increase in flow, **Appendix E**. Both existing private inlets and storm infrastructure are designed appropriately to convey the improvements in total Basin area. Thus, the drainage for the Project does not anticipate any negative impacts to the historical drainage patterns and structures.



The Overall Drainage Report captures the master developments drainage and water quality design for Promenade at Castle Rock. The existing development treats flows utilizing the existing regional detention pond east of US Highway 85, west of the overall development. The improved site Basins follow existing flow conditions to the regional detention ponds. In summary, the proposed improvements result in decreased flows in the 100-year condition. There are no negative impacts to the pipes or inlets with the change in Basin flows and in conclusion there are no projected negative impacts downstream.

The Project drainage is conveyed by existing private Denver No. 13 Combination inlets and private storm sewer infrastructure to the master detention/water quality regional pond as a part of the overall development. No drainage enhancements to the infrastructure of the detention/water quality pond are proposed. The project conforms to existing drainage patterns and designs outlined in the Previous Drainage Report. Existing infrastructure is sized to convey the proposed improvements. No storm infrastructure enhancements are needed.

Thank you,

KIMLEY-HORN AND ASSOCIATES, INC.



Emily Felton, P.E.

Colorado Registered Professional Engineer #0054609

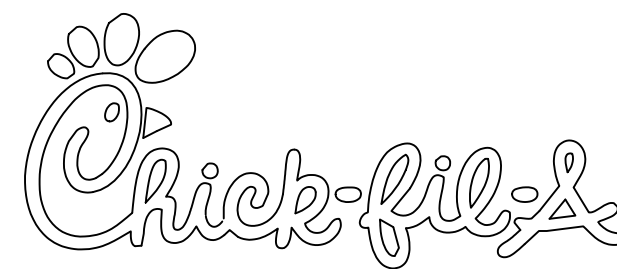


APPENDICES:

- Appendix A: Proposed Drainage Map
- Appendix B: FEMA Flood Map
- Appendix C: NRCS Soil Report
- Appendix D: Hydrologic Calculations
- Appendix E: Hydraulic Calculations
- Appendix F: Supporting Documentation



APPENDIX A: Proposed Drainage Map



Chick-fil-A
5200 Buffington Road
Atlanta, Georgia
30349-2998

Kimley»Horn

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PRELIMINARY

FOR REVIEW ONLY
NOT FOR
CONSTRUCTION

Kimley»Horn
Kimley-Horn and Associates, Inc.

CHICK-FIL-A
PROMENADE AT CASTLE ROCK
6353 PROMENADE PKWY
CASTLE ROCK, CO 80108

FSU# 04027

REVISION SCHEDULE

NO.	DATE	DESCRIPTION
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CONSULTANT PROJECT #	096203021
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PRINTED FOR	REVIEW
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DATE	05/18/2026
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DRAWN BY	BSF
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REVIEWED BY	HPC
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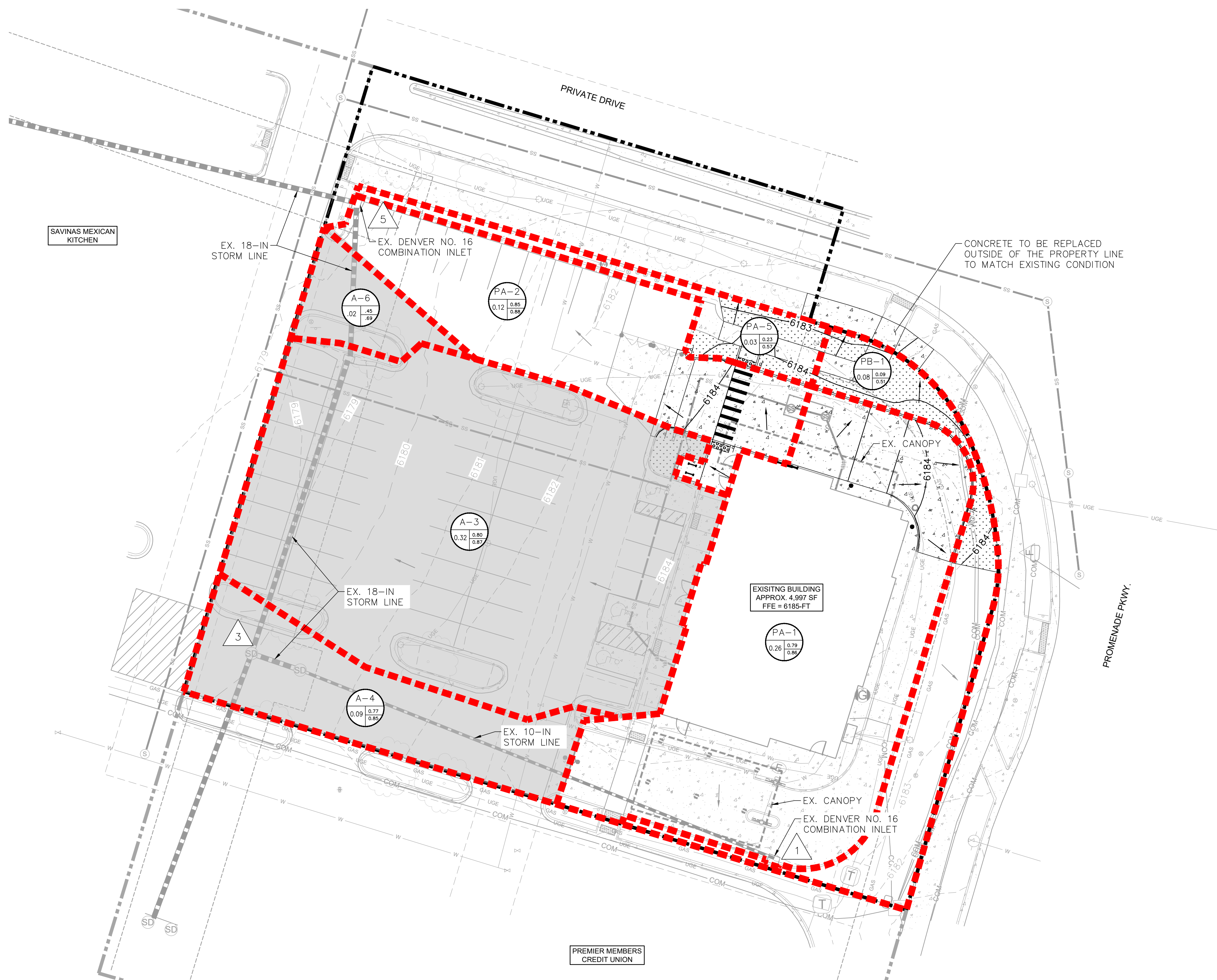
SHEET

PROPOSED DRAINAGE
EXHIBIT

PAGE NUMBER

LEGEND

- LEASE LINE
 - PROPOSED CURB
 - EXISTING EASEMENT
 - EXISTING STORM LINE
 - EXISTING MAJOR CONTOUR
 - EXISTING MINOR CONTOUR
 - PROPOSED MAJOR CONTOUR
 - PROPOSED MINOR CONTOUR
 - DRAINAGE PLAN BOUNDARY LINE
 - PROPOSED CONCRETE
 - PROPOSED LANDSCAPE
 - BASIN TO REMAIN AS EXISTING (NOT INCLUDED IN THIS STUDY)
- A = BASIN DESIGNATION
B = AREA (ACRES)
C = BASIN C5 VALUE
D = BASIN C100 VALUE
- PROPOSED FLOW DIRECTION
EXISTING FLOW DIRECTION
- # = DESIGN POINT

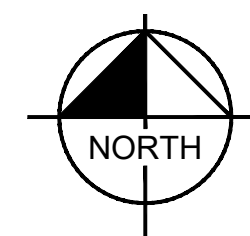


PROPOSED RATIONAL CALCULATIONS SUMMARY

DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	PEAK FLOWS (CFS)		RUNOFF COEFFICIENTS		PERCENT IMPERVIOUS
			Q5	Q100	5-YR	100-YR	
On-Site Subbasins							
1	PA-1	0.26	0.98	1.94	0.79	0.86	92.6%
5	PA-2	0.12	0.47	0.89	0.85	0.88	98.4%
OFFSITE	PA-5	0.03	0.03	0.14	0.23	0.57	23.6%
OFFSITE	PB-1	0.08	0.03	0.34	0.09	0.51	7.3%
TOTAL							
TOTAL		0.49	1.51	3.31	0.66	0.79	76.5%

DESIGN POINTS

NAME	INLET TYPE
DESIGN POINT 1 (104)	DENVER NO. 16 COMBINATION
DESIGN POINT 5 (100)	DENVER NO. 16 COMBINATION



GRAPHIC SCALE IN FEET
0 10 20 40



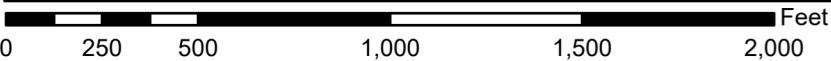
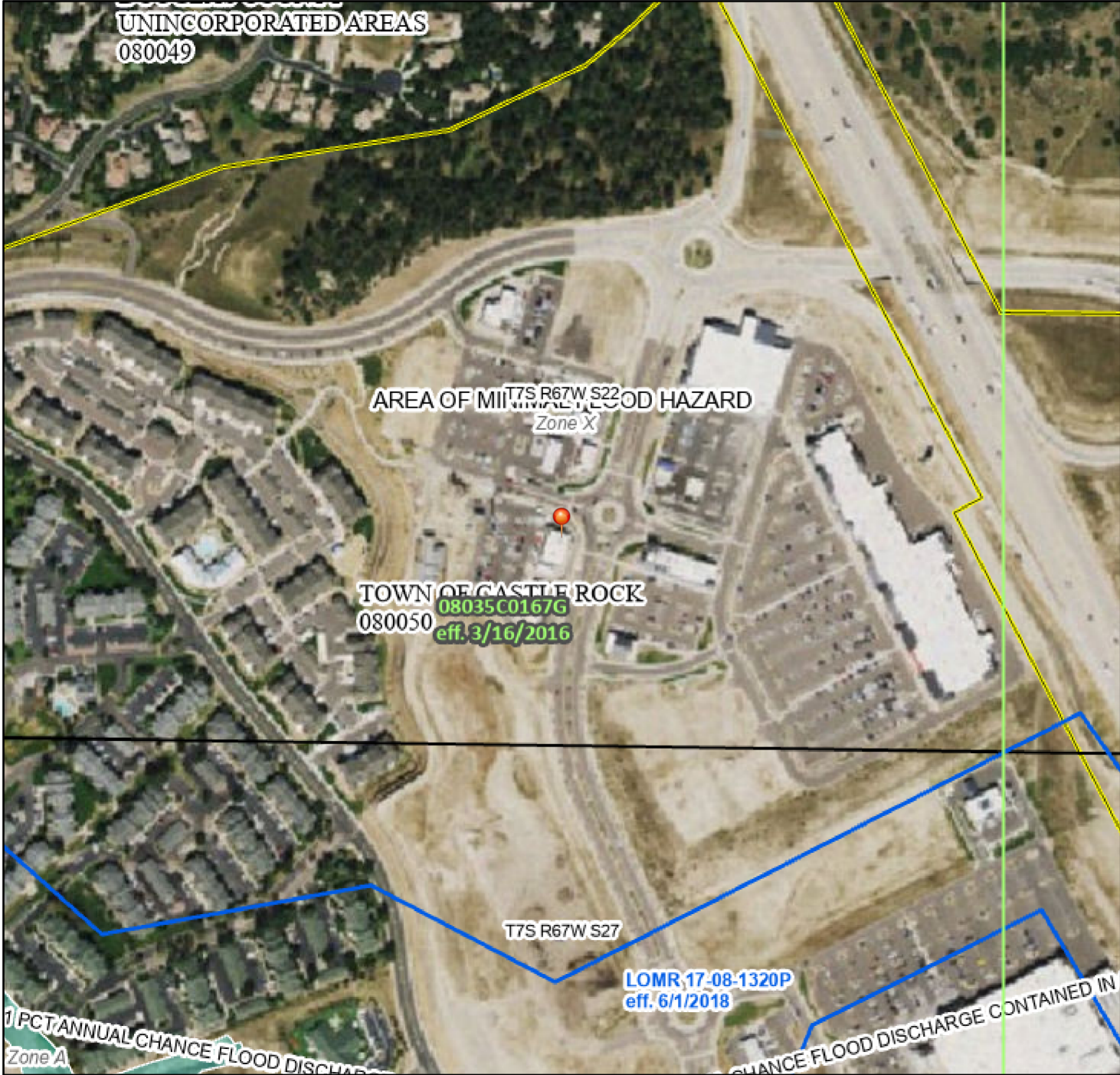


APPENDIX B: FEMA Flood Map

National Flood Hazard Layer FIRMMette



104°53'4"W 39°25'34"N



1:6,000

104°52'26"W 39°25'6"N

Basemap Imagery Source: USGS National Map 2023

Legend

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
		Profile Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/19/2026 at 10:55 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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



Appendix C: NRCS Soil Report



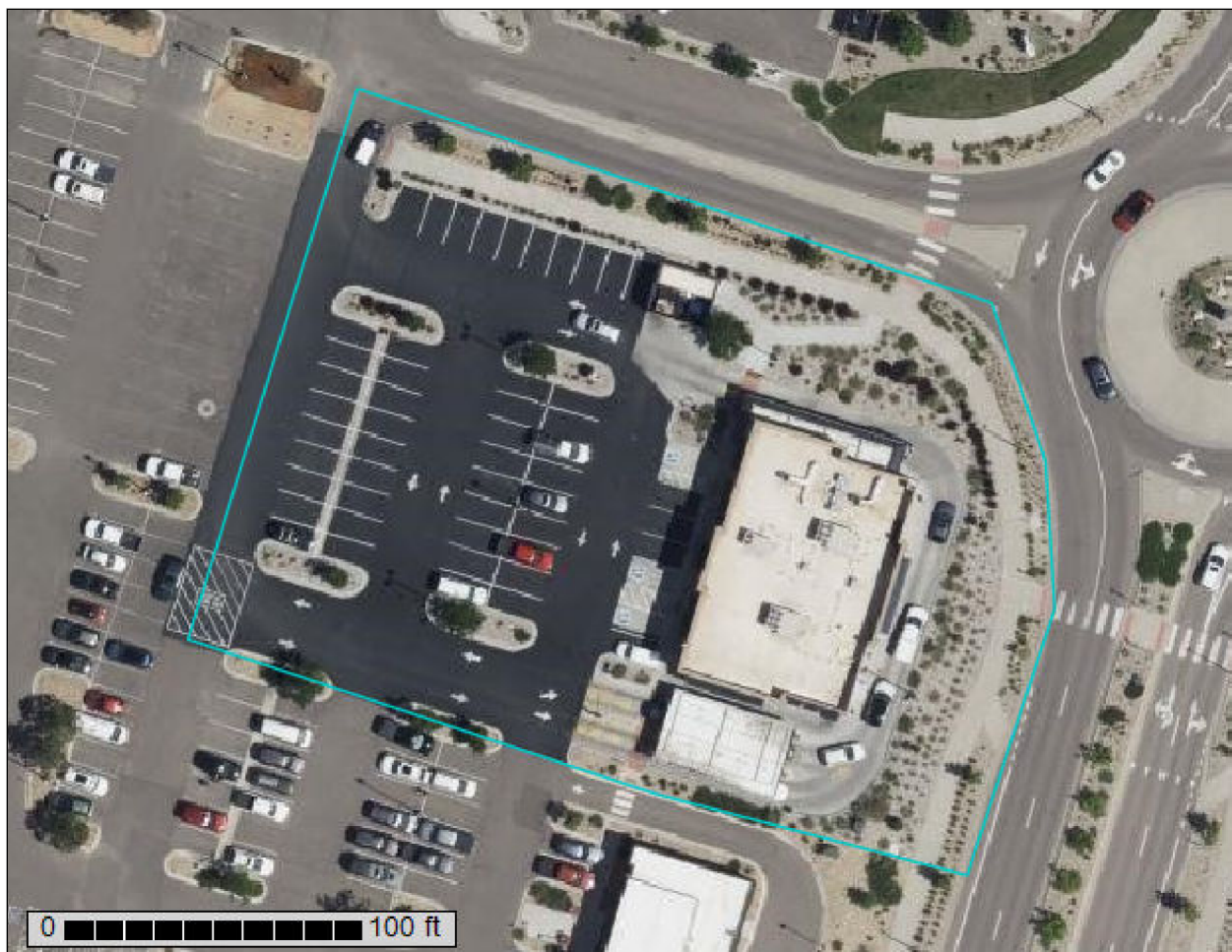
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

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

Custom Soil Resource Report for **Castle Rock Area, Colorado**



February 19, 2026

Preface

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

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

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

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

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

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

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How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

Custom Soil Resource Report

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

Soil Map

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

Custom Soil Resource Report Soil Map



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 18, Aug 29, 2025

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Su	Stony rough land	1.2	100.0%
Totals for Area of Interest		1.2	100.0%

Map Unit Descriptions

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

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

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

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

Custom Soil Resource Report

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

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

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

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

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

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

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

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

Castle Rock Area, Colorado

Su—Stony rough land

Map Unit Setting

National map unit symbol: jr0b
Elevation: 5,500 to 6,600 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 49 to 51 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Stony rough land: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stony Rough Land

Setting

Landform: Hills, Side slopes of mesas, Knobs
Landform position (three-dimensional): Side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

H1 - 0 to 6 inches: flaggy loam
H2 - 6 to 30 inches: flaggy clay loam
H3 - 30 to 34 inches: unweathered bedrock

Properties and qualities

Slope: 5 to 40 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: R048AY237CO - Stony Loam
Hydric soil rating: No

Minor Components

Fondis

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

Crowfoot

Percent of map unit: 5 percent

Custom Soil Resource Report

Hydric soil rating: No

Peyton

Percent of map unit: 5 percent

Hydric soil rating: No

Pring

Percent of map unit: 5 percent

Hydric soil rating: No

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Custom Soil Resource Report

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APPENDIX D: Hydrologic Calculations



STANDARD FORM SF-1

PROPOSED RUNOFF COEFFICIENTS - IMPERVIOUS CALCULATION

PROJECT NAME: Chick-fil-A #4027 Promenade at Castle Rock
PROJECT NUMBER: 096203021
CALCULATED BY: LAO
CHECKED BY: HPC

SOIL: D

Paved Area Roof Area Landscaping

LAND USE:

5-YEAR COEFF.	0.86	0.77	0.05
100-YEAR COEFF.	0.89	0.85	0.49
IMPERVIOUS %	100%	90%	2%

DESIGN BASIN	DESIGN POINT	Paved Area (AC)	Roof Area (AC)	Landscaping (AC)	TOTAL AREA (AC)	C(5)	C(100)	Imp %
On-Site Subbasins								
PA-1	1	0.09	0.17	0.00	0.26	0.79	0.86	92.6%
PA-2	5	0.11	0.01	0.00	0.12	0.85	0.88	98.4%
PA-5	OFFSITE	0.00	0.01	0.02	0.03	0.23	0.57	23.6%
PB-1	OFFSITE	0.00	0.00	0.07	0.08	0.09	0.51	7.3%
TOTAL		0.19	0.19	0.09	0.49	0.66	0.79	76.5%



STANDARD FORM SF-2 PROPOSED TIME OF CONCENTRATION

PROJECT NAME: Chick-fil-A #4027 Promenade at Castle Rock
 PROJECT NUMBER: 096203021
 CALCULATED BY: LAO
 CHECKED BY: HPC

SUB-BASIN DATA			INITIAL TIME (T _i)			TRAVEL TIME (T _t)					T _c CHECK (URBANIZED BASINS)			FINAL T _c
DESIGN BASIN (1)	AREA A _c (2)	C _s (3)	LENGTH Ft (4)	SLOPE ft/ft (5)	T _i Min. (6)	LENGTH Ft. (7)	SLOPE ft/ft (8)	C _v (9)	VEL fps (11)	T _t Min. (12)	COMP. t _c (13)	TOTAL LENGTH (14)	T _c Min. (17)	Min.

On-Site Subbasins

PA-1	0.26	0.79	47	0.04	2.5	220	0.00	20	1.3	2.9	5.4	267	11.5	5.4
PA-2	0.12	0.85	150	0.02	4.5	175	0.01	20	2.0	1.5	6.0	325	11.8	6.0
PA-5	0.03	0.23	40	0.06	5.6				0.0	0.0	5.6	40	10.2	5.6
PB-1	0.08	0.09	20	0.10	3.8				0.0	0.0	3.8	20	10.1	5.0

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L_i}}{S_o^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

$$t_c = \frac{L'}{180} + 10$$

PROPOSED STORM DRAINAGE DESIGN - RATIONAL METHOD 5 YEAR EVENT

PROJECT NAME: Chick-fil-A #4027 Promenade at Castle Rock

PROJECT NUMBER: 096203021

P₁ (1-Hour Rainfall) = 1.43

CALCULATED BY: LAO

CHECKED BY: HPC

	DIRECT RUNOFF						
DESIGN POINT	DESIGN BASIN	AREA (AC)	RUNOFF COEFF	t _c (min)	C*A(ac)	I (in/hr)	Q 5-yr (cfs)
(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	PA-1	0.26	0.79	5.43	0.21	4.74	0.98
5	PA-2	0.12	0.85	5.99	0.10	4.61	0.47
OFFSITE	PA-5	0.03	0.23	5.64	0.01	4.69	0.03
OFFSITE	PB-1	0.08	0.09	5.00	0.01	4.85	0.03

$$I = \frac{28.5 P_1}{(10 + T_d)^{0.786}}$$

PROPOSED STORM DRAINAGE DESIGN - RATIONAL METHOD 100 YEAR EVENT

PROJECT NAME: Chick-fil-A #4027 Promenade at Castle Rock

PROJECT NUMBER: 096203021

CALCULATED BY: LAO

P_1 (1-Hour Rainfall) = 2.61

CHECKED BY: HPC

	DIRECT RUNOFF						
DESIGN POINT	DESIGN BASIN	AREA (AC)	RUNOFF COEFF	t_c (min)	$C*A$ (ac)	I (in/hr)	Q 100-yr (cfs)
(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	PA-1	0.26	0.86	5.43	0.22	8.66	1.94
5	PA-2	0.12	0.88	5.99	0.11	8.42	0.89
OFFSITE	PA-5	0.03	0.57	5.64	0.02	8.57	0.14
OFFSITE	PB-1	0.08	0.51	5.00	0.04	8.85	0.34

$$I = \frac{28.5 P_1}{(10 + T_d)^{0.786}}$$



PROJECT NAME: Chick-fil-A #4027 Promenade at Castle Rock
PROJECT NUMBER: 096203021
CALCULATED BY: LAO
CHECKED BY: HPC

PROPOSED RATIONAL CALCULATIONS SUMMARY

DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	PEAK FLOWS (CFS)		RUNOFF COEFFICIENTS		PERCENT IMPERVIOUS
			Q5	Q100	5-YR	100-YR	
On-Site Subbasins							
1	PA-1	0.26	0.98	1.94	0.79	0.86	92.6%
5	PA-2	0.12	0.47	0.89	0.85	0.88	98.4%
OFFSITE	PA-5	0.03	0.03	0.14	0.23	0.57	23.6%
OFFSITE	PB-1	0.08	0.03	0.34	0.09	0.51	7.3%
TOTAL							
TOTAL		0.49	1.51	3.31	0.66	0.79	76.5%



APPENDIX E: Hydraulic Calculations

INLET MANAGEMENT

Project: CFA #4027 Promenade at Castle Rock

Minor: 5-year

Major: 100-year

Worksheet Protected

INLET NAME	100 (Design Point 5)	104 (Design Point 1)
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	In Sump	In Sump
Inlet Type	Denver No. 16 Combination	Denver No. 16 Combination
Number of Inlet Units	1	1

USER-DEFINED INPUT

User-Defined Peak Flows

Minor Peak Flow, Q (cfs)	0.47	0.98
Major Peak Flow, Q (cfs)	0.89	1.94

Bypass (Carry-Over) Flow from Upstream

Inlets must be organized from upstream (left) to downstream (right) in order for bypass

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received
Bypass Flow Description (Optional):	N/A	N/A
Minor Bypass Flow Received, Q_b (cfs)	0.00	0.00
Major Bypass Flow Received, Q_b (cfs)	0.00	0.00

CALCULATED OUTPUT

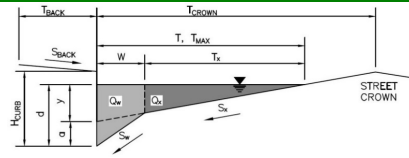
Minor Total Design Peak Flow, Q (cfs)	0.47	0.98
Major Total Design Peak Flow, Q (cfs)	0.89	1.94
Minor Inlet Interception Capacity, Q_a (cfs)	4.24	5.56
Major Inlet Interception Capacity, Q_a (cfs)	4.24	5.56
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A
Minor Flow Capture Percentage, C%	100%	100%
Major Flow Capture Percentage, C%	100%	100%

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

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

Project: CFA #4027 Promenade at Castle Rock

Inlet ID: 100 (Design Point 5)

**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}	=	9.0	ft
S_{BACK}	=	0.000	ft/ft
n_{BACK}	=	0.012	

H_{CURB}	=	6.00	inches
T_{CROWN}	=	40.0	ft
W	=	2.00	ft
S_x	=	0.040	ft/ft
S_y	=	0.083	ft/ft
S_o	=	0.000	ft/ft
n_{STREET}	=	0.012	

Max. Allowable Spread for Minor & Major Storm

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

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T_{MAX}	9.0	9.0	ft
d_{MAX}	6.0	6.0	inches

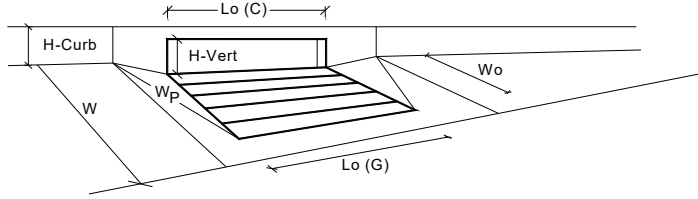
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow}	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



Design Information (Input)

Type of Inlet Denver No. 16 Combination
 Local Depression (additional to continuous gutter depression 'a' from above)
 Number of Unit Inlets (Grate or Curb Opening)
 Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate
 Width of a Unit Grate
 Open Area Ratio for a Grate (typical values 0.15-0.90)
 Clogging Factor for a Single Grate (typical value 0.50 - 0.70)
 Grate Weir Coefficient (typical value 2.15 - 3.60)
 Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening
 Height of Vertical Curb Opening in Inches
 Height of Curb Orifice Throat in Inches
 Angle of Throat
 Side Width for Depression Pan (typically the gutter width of 2 feet)
 Clogging Factor for a Single Curb Opening (typical value 0.10)
 Curb Opening Weir Coefficient (typical value 2.3-3.7)
 Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth
 Depth for Curb Opening Weir Equation
 Grated Inlet Performance Reduction Factor for Long Inlets
 Curb Opening Performance Reduction Factor for Long Inlets
 Combination Inlet Performance Reduction Factor for Long Inlets

Total Inlet Interception Capacity (assumes clogged condition)

Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)

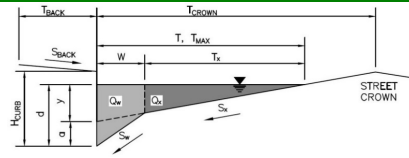
	MINOR	MAJOR	
Type =	Denver No. 16 Combination		
a _{local} =	2.00	2.00	inches
No =	1	1	
Ponding Depth =	5.4	5.4	inches
	MINOR	MAJOR	☐ Override Depths
L _o (G) =	3.00	3.00	feet
W _o =	1.73	1.73	feet
A _{ratio} =	0.31	0.31	
C _f (G) =	0.50	0.50	
C _w (G) =	3.60	3.60	
C _o (G) =	0.60	0.60	
	MINOR	MAJOR	
L _o (C) =	3.00	3.00	feet
H _{vert} =	6.50	6.50	inches
H _{throat} =	5.25	5.25	inches
Theta =	0.00	0.00	degrees
W _p =	2.00	2.00	feet
C _f (C) =	0.10	0.10	
C _w (C) =	3.70	3.70	
C _o (C) =	0.66	0.66	
	MINOR	MAJOR	
d _{Grate} =	0.47	0.47	ft
d _{Curb} =	0.28	0.28	ft
RF _{Grate} =	0.84	0.84	
RF _{Curb} =	N/A	N/A	
RF _{Combination} =	0.84	0.84	
	MINOR	MAJOR	
Q _s =	4.2	4.2	cfs
Q _{PEAK REQUIRED} =	0.5	0.9	cfs

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

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

Project: CFA #4027 Promenade at Castle Rock

Inlet ID: 104 (Design Point 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)

$T_{BACK} =$	0.0	ft
$S_{BACK} =$	0.000	ft/ft
$n_{BACK} =$	0.012	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	26.0	ft
$W =$	2.00	ft
$S_x =$	0.037	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.000	ft/ft
$n_{STREET} =$	0.012	

Max. Allowable Spread for Minor & Major Storm

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

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	13.0	13.0	ft
$d_{MAX} =$	6.0	6.0	inches

☐ ☐

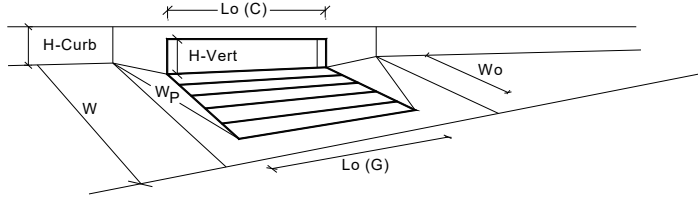
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



Design Information (Input)

Type of Inlet Denver No. 16 Combination
 Local Depression (additional to continuous gutter depression 'a' from above)
 Number of Unit Inlets (Grate or Curb Opening)
 Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate
 Width of a Unit Grate
 Open Area Ratio for a Grate (typical values 0.15-0.90)
 Clogging Factor for a Single Grate (typical value 0.50 - 0.70)
 Grate Weir Coefficient (typical value 2.15 - 3.60)
 Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening
 Height of Vertical Curb Opening in Inches
 Height of Curb Orifice Throat in Inches
 Angle of Throat
 Side Width for Depression Pan (typically the gutter width of 2 feet)
 Clogging Factor for a Single Curb Opening (typical value 0.10)
 Curb Opening Weir Coefficient (typical value 2.3-3.7)
 Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth
 Depth for Curb Opening Weir Equation
 Grated Inlet Performance Reduction Factor for Long Inlets
 Curb Opening Performance Reduction Factor for Long Inlets
 Combination Inlet Performance Reduction Factor for Long Inlets

Total Inlet Interception Capacity (assumes clogged condition)

Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)

	MINOR	MAJOR	
Type =	Denver No. 16 Combination		
a _{local} =	2.00	2.00	inches
No =	1	1	
Ponding Depth =	6.0	6.0	inches
	MINOR	MAJOR	☐ Override Depths
L _o (G) =	3.00	3.00	feet
W _o =	1.73	1.73	feet
A _{ratio} =	0.31	0.31	
C _f (G) =	0.50	0.50	
C _w (G) =	3.60	3.60	
C _o (G) =	0.60	0.60	
	MINOR	MAJOR	
L _o (C) =	3.00	3.00	feet
H _{vert} =	6.50	6.50	inches
H _{throat} =	5.25	5.25	inches
Theta =	0.00	0.00	degrees
W _p =	2.00	2.00	feet
C _f (C) =	0.10	0.10	
C _w (C) =	3.70	3.70	
C _o (C) =	0.66	0.66	
	MINOR	MAJOR	
d _{Grate} =	0.52	0.52	ft
d _{Curb} =	0.33	0.33	ft
RF _{Grate} =	0.94	0.94	
RF _{Curb} =	N/A	N/A	
RF _{Combination} =	0.94	0.94	
	MINOR	MAJOR	
Q _s =	5.6	5.6	cfs
Q _{PEAK REQUIRED} =	1.0	1.9	cfs

Worksheet for Existing 10-in

Project Description	
Friction Method	Manning
Solve For	Formula Discharge
Input Data	
Roughness Coefficient	0.013
Channel Slope	0.028 ft/ft
Normal Depth	10.0 in
Diameter	10.0 in
Results	
Discharge	3.68 cfs
Flow Area	0.5 ft ²
Wetted Perimeter	2.6 ft
Hydraulic Radius	2.5 in
Top Width	0.00 ft
Critical Depth	9.5 in
Percent Full	100.0 %
Critical Slope	0.024 ft/ft
Velocity	6.75 ft/s
Velocity Head	0.71 ft
Specific Energy	1.54 ft
Froude Number	(N/A)
Maximum Discharge	3.96 cfs
Discharge Full	3.68 cfs
Slope Full	0.028 ft/ft
Flow Type	Undefined
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	100.0 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	10.0 in
Critical Depth	9.5 in
Channel Slope	0.028 ft/ft
Critical Slope	0.024 ft/ft

Worksheet for Existing 18-in

Project Description	
Friction Method	Manning
Solve For	Formula Discharge
Input Data	
Roughness Coefficient	0.013
Channel Slope	0.002 ft/ft
Normal Depth	18.0 in
Diameter	18.0 in
Results	
Discharge	5.22 cfs
Flow Area	1.8 ft ²
Wetted Perimeter	4.7 ft
Hydraulic Radius	4.5 in
Top Width	0.00 ft
Critical Depth	10.6 in
Percent Full	100.0 %
Critical Slope	0.006 ft/ft
Velocity	2.95 ft/s
Velocity Head	0.14 ft
Specific Energy	1.64 ft
Froude Number	(N/A)
Maximum Discharge	5.62 cfs
Discharge Full	5.22 cfs
Slope Full	0.002 ft/ft
Flow Type	Undefined
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	0.0 %
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	18.0 in
Critical Depth	10.6 in
Channel Slope	0.002 ft/ft
Critical Slope	0.006 ft/ft



Appendix F: Supporting Documentations

**PHASE III DRAINAGE REPORT
FOR
CHICK-FIL-A CASTLE ROCK PROMENADE**

**FOR LOT 1A-6A, BLOCK 2
PROMENADE AT CASTLE ROCK, FILING NO. 1, AMENDMENT NO. 13
CD17-0048**

CASTLE ROCK, COLORADO

Prepared For:

Chick-fil-A, Inc.
5200 Buffington Road
Atlanta, Georgia 30349

Contact: Don Ikeler
Phone: 404-305-4407

Prepared By:

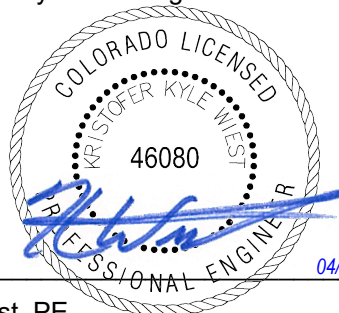


Merrick & Company
5970 Greenwood Plaza Blvd.
Greenwood Village, CO 80111
Contact: Kristofer K. Wiest, PE
Phone: 303-353-3695
Project No. 65119391

April 2018

ENGINEER'S CERTIFICATION STATEMENT

"I affirm that this report and plan for the Phase III drainage design of the Chick-fil-A Castle Rock at Promenade 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: _____

04/04/2018

Kristofer K. Wiest, PE

Registered Professional Engineer State of Colorado #40733

For and on Behalf of Merrick & Company

DEVELOPER'S CERTIFICATION STATEMENT

"Chick-fil-A hereby certifies that the drainage facilities for Chick-fil-A Castle Rock at Promenade shall be constructed according to the design presented in this report. I understand that the Town of Castle Rock does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that the Town of Castle Rock reviews drainage plans pursuant to the Municipal Code; but cannot, on behalf of Chick-fil-A Castle Rock at Promenade, guarantee that final drainage design review will absolve Chick-fil-A and/or their successors and/or assigns of future liability for improper design."

DON IKELER

Name of Developer

Authorized Signature



DEVELOPMENT SERVICES
APPROVED

By tkucewesky
on 04/10/2018
Approved CD17-0048 Ph III Drn Rpt.pdf
Record Document on File



MERRICK®

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APPENDIX

Appendix A - Supporting Documentation

Appendix B - Hydrologic Calculations

Appendix C – Hydraulic Calculations

Appendix D – Site Maps

I. GENERAL LOCATION AND DESCRIPTION

A. SITE LOCATION

This Phase III Drainage Report is being prepared for the proposed Chick-fil-A Quick Serve Restaurant located southwest of the intersection of Castle Gate Drive North and Promenade Parkway. The project site consists of Lot 1A-6A, Block 2, of Promenade at Castle Rock Filing No. 1, Amendment No. 13 located in the southwest quarter of Section 22 Township 7 South, Range 67 West of the sixth Principal Meridian, Town of Castle Rock, County of Douglas, State of Colorado. The site is situated in the north portion of the Promenade at Castle Rock overall development. At the time of this report, the site is surrounded by vacant land proposed to be retail developments. Both the site and adjacent properties are zoned PD.

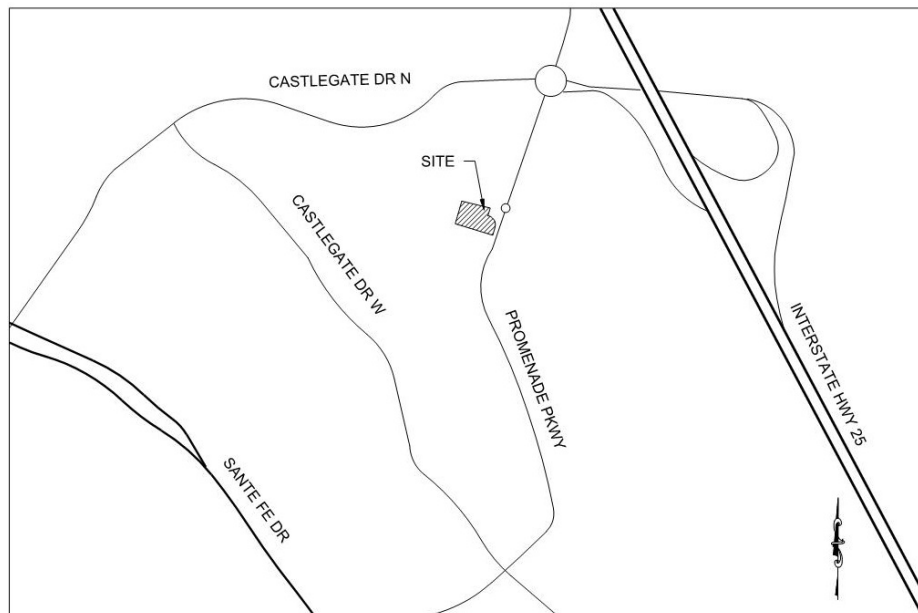


FIGURE 1 – VICINITY MAP

This report will analyze developed runoff from the site, for both the anticipated conditions per the previously approved drainage study, and proposed conditions.

B. DESCRIPTION OF PROPERTY

The proposed site is 1.04 acres, and is bounded by a proposed shared private access street to the north, Promenade Parkway to the east, and undeveloped commercial lots to the south and west. The portion of the private drive that is a part of this property has been analyzed and accounted for in the Block 2 Phase III Drainage Report by Bowman Consulting. The site is a portion of the overall Promenade at Castle Rock

development, and proposes to construct a quick serve restaurant with associated curb and gutter, drive aisles, parking, drive thru, and landscaping.

The site is situated within the East Plum Creek Tributary B watershed and is currently vacant and undeveloped with minimal ground cover. Developed site runoff will be accommodated by a storm drainage system including offsite conveyance pipes, underground detention, and regional detention basin by others. There is approximately four feet of fall across the site, with existing slopes on site on average of 3%, sloping generally to the west. Per the NRCS Castle Rock Area Web Soil Survey for the site, the hydrologic soil group for the site is Type C/D.

The site is located within FEMA delineated floodplain zone x (area of minimal flood hazard) as determined by Flood Insurance Rate Map No. 08035C0167G, dated March 16, 2016. No known major or minor drainageways, existing irrigation canals or ditches, nor significant geologic features exist on the site.

II. DRAINAGE BASINS AND SUB-BASINS

A. MAJOR DRAINAGE BASINS

The site is located in the East Plum Creek Tributary B watershed and has previously been studied as a part of “Phase III Drainage Report for Block 2, Phase I Promenade at Castle Rock” (hereinafter referred to as “Block 2 Drainage Report”) and “Phase III Drainage Report for Promenade at Castle Filing No. 1 Castle Rock, CO” (hereinafter referred to as “Overall Drainage Report”). The site consists of a portion of Basins C1, and C14 from the *Block 2 Drainage Report*. With the exclusion of Basin C14 that is proposed to flow southeast, the site is expected to flow west with a maximum 85% imperviousness. Per the *Block 2 Drainage Report*, a storm sewer stub has been proposed to convey all of Basin C1 to Design Point 1. However, after the site develops, a portion of Basin C1 will be captured by the area inlet at Design Point 2 of the Block 2 Drainage Report.

The Northern property line of Lot 1A-6A is located along the crown of the private drive that is proposed by the overall developer. The developer has analyzed the flow from this area and accounted for it in the Block 2 – Phase III Drainage Report by Bowman Consulting.

The inlet at Design Point 2, located on lot 5A, has been designed to accommodate 0.3 acres of offsite flow from lots 1A-6A and 1A-7A. This is shown in the “La Loma Castle Rock Restaurant, Promenade at Castle Rock Drainage Letter of Compliance” prepared by Kimley-Horn, dated December 1, 2017. See appendix A for the relevant pages from the letter.

The site will be treated by a master detention/water quality pond (Regional Pond) located in the western portion of the overall development. Please refer to the *Overall Drainage Report* and *Block 2 Drainage Report* for further information on the master drainage analysis for the Promenade at Castle Rock development.

B. MINOR DRAINAGE BASINS

The proposed development of the site will consist of a 5,122-square foot quick serve restaurant, a trash enclosure, associated drives, parking areas and landscaping. The proposed drainage conditions generally follow the existing drainage patterns shown in the *Block 2 Phase 1 – Phase III Drainage Report*. A majority of the site will be captured by 3 proposed inlets on the site, a portion will sheet flow west of the site to the offsite area inlet to be installed with Bowman's plans, and a portion of the site will runoff southeast into Promenade Parkway. The entire property area, with the exclusion of Basin B-1, approximately 0.10 acres, will be treated and detained by the Regional Pond, located in the western portion of the overall development (as shown on the Master Drainage Maps in Appendix C).

The site is divided into nine (9) sub-basins, which are further described as follows:

BASIN A-1 (Q5=0.95cfs, Q100=1.90cfs)

Basin A-1 is approximately 0.25 acres and consists of the proposed Chick-fil-A building, the drive through lane, as well as a small part of landscaping and sidewalk. Runoff from the building will exit the roof via downspouts and over flow scuppers on the rear of the building into the drive through lane. The flow from the drive through lane will flow via curb and gutter to the curb inlet at design point 1. From there it will join the storm system for the rest of Block 2. If this inlet is clogged, the water will pond around the inlet to a depth of approximately 6" until reaching the high point at the drive through entrance and then it will sheet flow into Basin A-4.

BASIN A-2 (Q5=0.42cfs, Q100=0.84cfs)

Basin A-2 is approximately 0.11 acres and consists of around one-quarter of the parking lot, the trash enclosure and a small portion of the drive through including the crosswalk. Developed runoff for this basin will sheet and gutter flow westerly into the curb inlet at design point 5. From this point, it will join the storm system for the rest of Block 2, ultimately ending up in the planned detention facility. If this inlet is clogged the flow will pond in the corner until reaching a depth of 5" and will then flow westerly towards the area inlet at design point 6.

BASIN A-3 (Q5=1.25cfs, Q100=2.46cfs)

Basin A-3 is approximately 0.32 acres and consists of a majority of the parking lot, the store front sidewalk, and landscape islands. Runoff from this basin will sheet flow into the inlet at design point 4 via overland flow and the crossspan located in the western portion of the basin that feeds into the inlet at design point 4. From this point it will join the storm system for the rest of Block 2. If this inlet is clogged the flow will pond around the inlet to a depth of approximately 3" and then continue flowing westerly to the area inlet at design point 6.

BASIN A-4 (Q5=0.33cfs, Q100=0.68cfs)

Basin A-4 is approximately 0.09 acres and consists of the south west quarter of the parking lot and portions of 2 landscape islands. Developed runoff from this basin will sheet flow offsite to the neighboring property and into the area inlet at design point 6. This inlet will take the flow into the drainage system for Block 2. This flow is accounted for in the *Lot 1A-5A Drainage Letter*, which assumes a combined 0.3 acres of runoff from lots 6A and 7A going to the inlet at design point 6.

BASIN A-5 (Q5=0.05cfs, Q100=0.18cfs)

Basin A-5 is approximately 0.03 acres and consists of landscaped area, and small sections of sidewalk accessing the private drive sidewalk and trash area. Developed runoff from this basin will sheet flow into the Private Drive and enter the existing area inlet at design point 8. According to "Phase III Drainage Report For Block 2, Phase I Promenade at Castle Rock" dated 10/21/2016 the Type-R inlet has a capacity of 5.4 cfs, and will receive a major storm flow of 3.2 cfs. With the addition of 0.18 cfs from basin A-5 the inlet will continue to have adequate capacity.

BASIN A-6 (Q5=0.04cfs, Q100=0.12cfs)

Basin A-6 is approximately 0.02 acres and consists of a small amount of parking area in the Northwest corner of the lot and a portion of a landscape island. Developed runoff from this basin will sheet flow offsite to the neighboring property and into the area inlet at design point 6. This inlet will take the flow into the drainage system for Block 2. This flow is accounted for in the *Lot 5A Drainage Letter*, which assumes a combined 0.3 acres of runoff from lots 6A and 7A going to the inlet at design point 6.

BASIN B-1 (Q5=0.06cfs, Q100=0.47cfs)

Basin B-1 is approximately 0.10 acres and consists of only landscaped area. Developed runoff from this basin will sheet flow offsite to Promenade Parkway at design point 7. Runoff from this area will ultimately end up in the regional detention pond further described by the "Promenade Roadway Infrastructure Phase III Drainage Report" Dated June 5, 2015 by others. This report assumed 1.8 cfs would leave the site during the 100 year storm event, with Basin B1 contributing only 0.47 cfs it is in compliance with the report.

BASIN C1-A (Q5=2.30cfs, Q100=4.60cfs)

Basin C1-A is approximately 0.60 acres and consists of basins C1-B, C1-C and C1-D of the Phase II Drainage Report for Premier Members Credit Union prepared by Elevation Consulting. Developed runoff from this basin will be routed into the Type C inlet provided for lot 1A-7A.

BASIN C2-A (Q5=0.57cfs, Q100=1.04cfs)

Basin C2-A is approximately 0.15 acres and consists of the portion of basin C2 from the master drainage report that is proposed to drain into the inlet per the *Lot 5A-1A Drainage Letter*. Developed runoff from this

basin will route into the Type C inlet provided for lot 1A-7A. The flow value for this lot was found in the *Lot 5A Drainage Letter*.

C. DRAINAGE DESIGN CRITERIA

A. REGULATIONS

The “Town of Castle Rock Storm Drainage Design and Technical Criteria Manual” dated September 2007, revised October 2012 and the Urban Storm Drainage Criteria Manual” Volumes 1, 2, and 3 revised March 2017 are the primary design criteria for this study. These documents shall be referred to as the “Manual”.

B. DRAINAGE STUDIES, MASTER PLANS SITE CONSTRAINTS

The following Drainage Reports involving the project site were considered in this study:

1. “Phase III Drainage Report for Block 2, Phase I Promenade at Castle Rock” prepared by Bowman Consulting, dated October 19, 2017. (*Block 2 Drainage Report*)
2. “Phase III Drainage Report for Promenade at Castle Filing No. 1 Castle Rock, CO” prepared by Bowman Consulting, dated June 5, 2015. (*Overall Drainage Report*)
3. “La Loma Castle Rock Restaurant Promenade at Castle Rock Drainage Letter of Compliance” prepared by Kimley-Horn Consulting, dated December 1, 2017. (*Lot 1A-5A Drainage Letter*)
4. “Phase II Drainage Report For Premier Members Credit Union” prepared by Elevation Consulting, dated March, 2018. (*Lot 1A-7A Drainage Letter*)

C. HYDROLOGIC CRITERIA

Storm runoff rates for all onsite basins are calculated based on the following criteria found in the Manual. The initial storm (5-year event) and the major storm (100-year event) are considered to size drainage facilities and verify conformance with drainage criteria and previously approved drainage reports. Runoff rates are calculated using the Rational Method Equation. The values for the runoff coefficient are taken from “Runoff Coefficient Equations based on NRCS soil group and storm return period” found in Table 6-4 of the Urban Drainage Manual. Rainfall intensities “I” are taken from the Intensity-Duration-Frequency found in Figure 6-1 of the Castle Rock Manual. Time of concentration is calculated as the sum of the overland flow time and travel time. Overland flow time is calculated over a maximum 300 foot distance using the FAA equation $T_i = 0.395(1.1 - C_5) L^{0.5} S^{-0.33}$ where:

- C_5 = basin composite runoff coefficient for the five-year storm event
- L = length of overland flow in feet
- S = slope of flow path in percent
- T_i = travel time in minutes

Travel time is calculated as the flow time through a length of street gutter or channel by multiplying the average flow velocity by the travel length. Flow velocity is obtained through Manning's equation based on the allowed flow depth for the initial and major storms.

D. HYDRAULIC CRITERIA

Hydraulic calculations in compliance with the Manual for street capacity, inlet calculations, pipe sizes, etc. will be included as part of the Phase III drainage report. AutoCAD® Hydraflow Storm Sewers Extension will be used to analyze the hydraulic grade line of the stormwater conveyances. The Urban Drainage Inlet Sizing spreadsheet will be used to size proposed site inlets.

E. STORAGE AND WATER QUALITY ENHANCEMENT

Per the *Overall Drainage Report*, a Regional Detention Pond was designed for the Excess Urban Runoff Volume (EURV) and 100-year detention plus Water Quality Capture Volume (WQCV). An anticipated imperviousness of 85% was assumed for the site. The proposed imperviousness for the site will be less than 85%, therefore, required storage and water quality for this project has been accounted for in the existing Regional Pond.

D. STORMWATER MANAGEMENT FACILITY DESIGN

A. STORMWATER CONVEYANCE FACILITIES

The proposed development will generally runoff to the west and will include both public and private underground storm sewer systems. This system will connect to the proposed storm sewer system located offsite and eventually be routed to the Regional Detention Pond. Small, landscaped portions of the site's runoff will be released directly offsite to the storm sewer infrastructure in Promenade Parkway and the Private Access Drive.

B. STORMWATER STORAGE FACILITIES

Per the *Overall* and *Block 2 Drainage Reports*, the Regional Detention Pond is designed to provide EURV and 100-year plus WQCV detention for the development. The Chick-fil-A Site consists of portions of Basin C14, C1 and C2 per the *Block 2 Drainage Report* Drainage Map provided in the Appendices. The *Block 2 Drainage Report* anticipated 85% impervious for Basins C1 and C2 and 6% for Basins C14. The site was anticipated to consist of approximately 0.054 acres of Basin C14, creating a composite anticipated site imperviousness of 84.1%. The proposed site development is in compliance with the previously approved drainage reports, with a developed site imperviousness of 80%.

C. WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES

Per the *Block 2 Drainage Report*, the Regional Detention Pond to Tributary B will provide permanent water quality for the site. Temporary erosion control measures will be installed during construction to mitigate sediment leaving the site.

D. GENERAL

The site has previously been studied as a part of the *Block 2 Drainage Report* and the *Overall Drainage Report*. The site's existing drainage patterns are described in the Proposed Drainage Maps of the previously approved study. Site runoff generally overland flows west and is captured and conveyed by a series of storm sewer infrastructure to the existing Regional Pond where the runoff is treated, detained, and released. The overall developed site runoff flows are less than the anticipated flows per the *Block 2 Drainage Report*.

E. CONCLUSIONS

A. COMPLIANCE WITH STANDARDS

The proposed drainage concept complies with the current Town of Castle Rock Drainage Criteria as well as all existing approved Promenade at Castle Rock drainage reports referenced previously.

B. VARIANCES

No variances were necessary for this report.

C. DRAINAGE CONCEPT

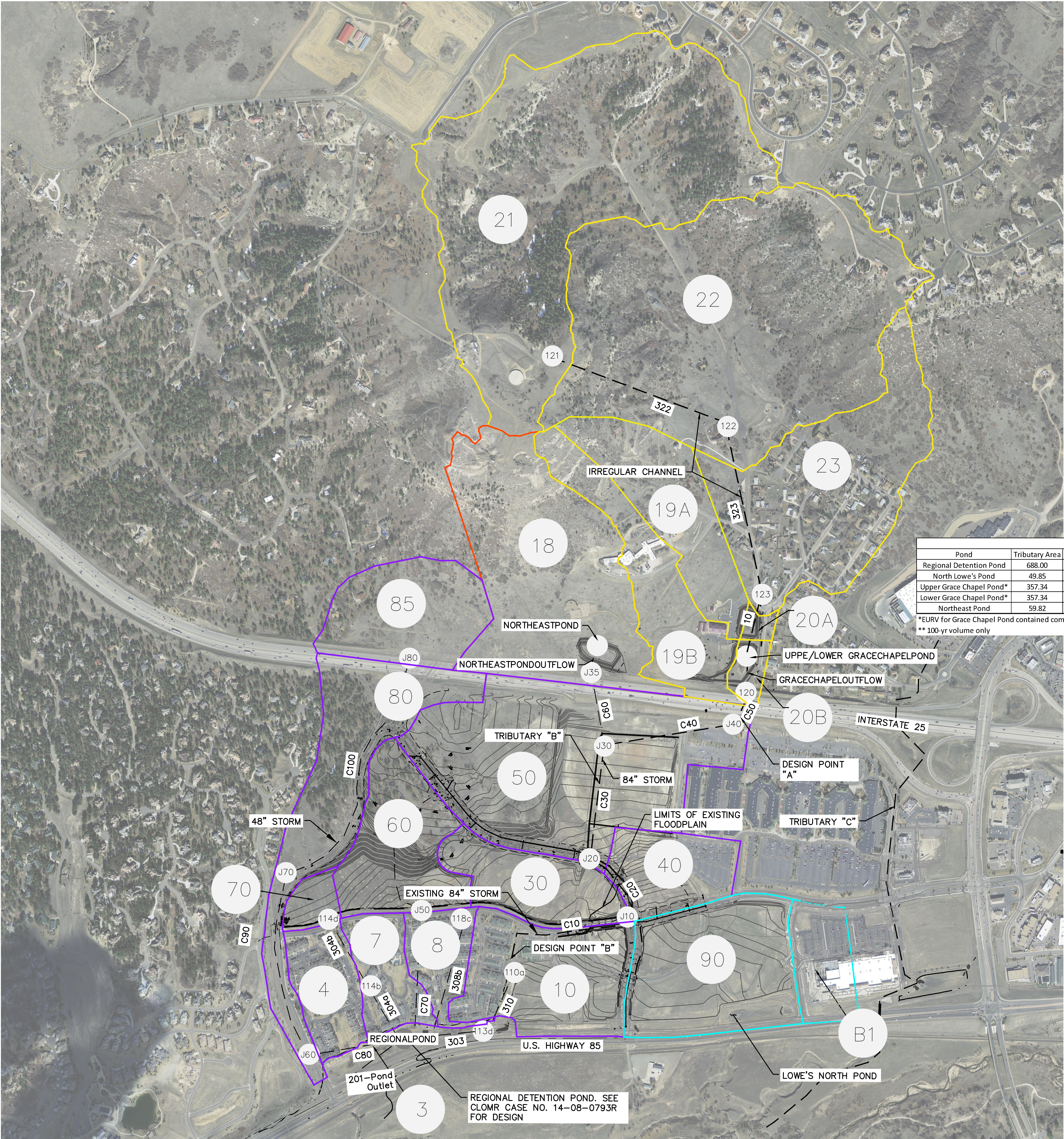
Development of the proposed site will not adversely affect surrounding developments. A majority of the developed site runoff will be captured by proposed inlets. The proposed storm sewer infrastructure will convey developed site runoff to the Regional Pond, where it will be treated and detained.

F. REFERENCES

1. "Phase III Drainage Report for Block 2, Phase I Promenade at Castle Rock" prepared by Bowman Consulting, dated October 19, 2017.
2. "Phase III Drainage Report for Promenade at Castle Filing No. 1 Castle Rock, CO" prepared by Bowman Consulting, dated June 5, 2015.
3. Phase III Drainage Report for Promenade Roadway Infrastructure" prepared by Bowman Consulting, dated June 5, 2015.
4. "Town of Castle Rock Storm Drainage Design and Technical Criteria Manual" dated September 2007, revised October 2012
5. "Urban Storm Drainage Criteria Manual" Volumes 1, 2, and 3, revised March 2017
6. "La Loma Castle Rock Restaurant Promenade at Castle Rock Drainage Letter of Compliance" prepared by Kimley-Horn Consulting, December 1, 2017.
7. "Phase II Drainage Report For Premier Members Credit Union" prepared by Elevation Consulting, dated March, 2018. (Lot 1A-7A Drainage Letter)

Appendix A

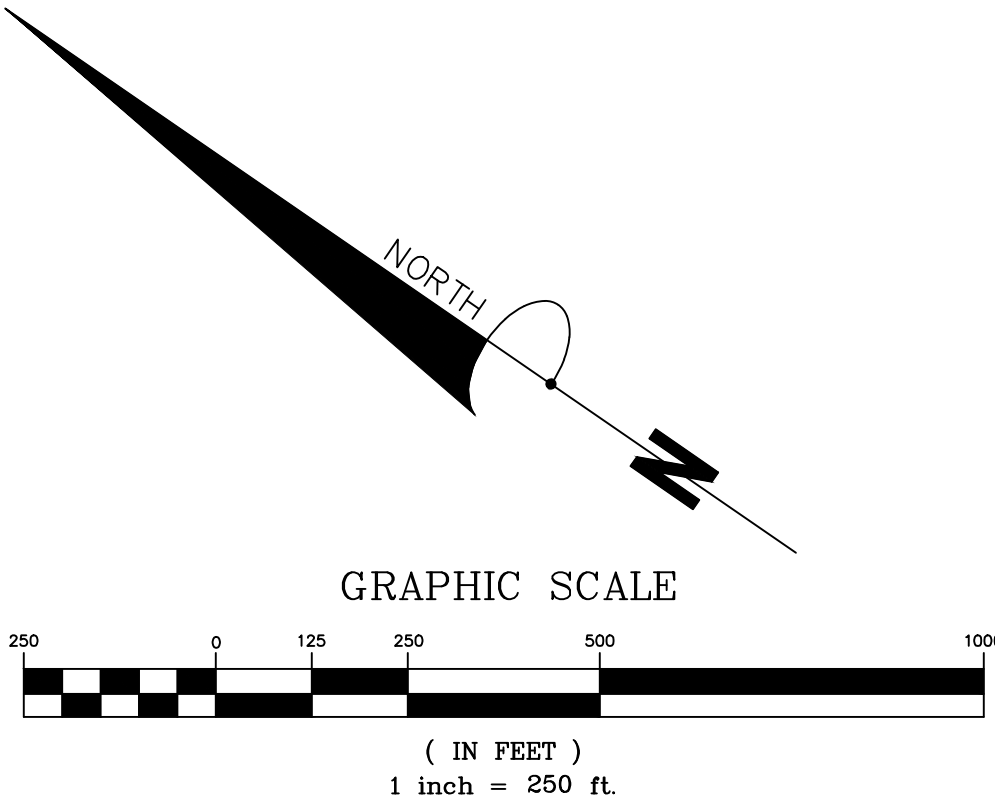
(Supporting Documentation)



Basin	Areas (Ac)	Junction Load	Imperviousness (%)	100-Yr Flow (cfs)
3	10.75	RegionalPond	11	9
4	15.13	114b	70	68
7	11.13	RegionalPond	70	49
8	9.15	118c	70	38
10	30.3	113d	59	128
18	59.79	Northeast Pond	25	156
19A	26.02	UpperGraceChapelPond	23	52
19B	25.95	LowerGraceChapelPond	35	99
20A	1.5	UpperGraceChapelPond	9	3
20B	3.35	LowerGraceChapelPond	17	7
21	122.37	121	16	225
22	123.16	122	5	220
23	54.99	123	25	91
30	18.74	J10	75	78
40	15.54	J10	68	75
50	73.91	J20	67	415
60	25.08	J60	74	122
70	4.26	114d	80	27
80	32.8	J60	37	62
85	24.22	J80	17	59
90	35.65	LowesNorthPond	75	162

Detention Pond Summary								
Pond	Tributary Area	EURV (ac-ft)	WQCV (ac-ft)	Pond Bottom Elevation	EURV/WQCV WSEL (ft)	100-yr Inflow (cfs)	100-yr outflow (cfs)	100-yr + WQCV ac-ft
Regional Detention Pond	688.00	15.27	n/a	6018.00	6027.35	1115.50	812.01	23.80
North Lowe's Pond	49.85	n/a	1.55	6046.00	6048.35	231.10	102.00	9.18
Upper Grace Chapel Pond*	357.34	n/a	n/a	6175.00	n/a	589.71	519.09	4.74**
Lower Grace Chapel Pond*	357.34	4.48	n/a	6162.00	6167.34	568.18	532.02	9.56
Northeast Pond	59.82	1.23	n/a	6177.00	6182.10	174.63	9.00	6.23

*EURV for Grace Chapel Pond contained completely in Lower Grace Chapel Pond
** 100-yr volume only



NOTE:
1. THE BENCHMARK USED FOR THE SITE WAS A (KK1334) BRASS DISK IN THE CENTER OF THE EAST END OF A 10' BY 15' EXPOSED AREA OF OUTCROPPING BEDROCK, 149.9' EAST OF THE NEAR RAIL, 50.9' WEST OF THE CENTERLINE OF COUNTY ROAD 25, 0.7' WEST OF THE EAST EDGE OF THE OUTCROP, AND EAST OF THE EXTENDED CENTER OF INTERSTATE 25 EXIT 182, 10' BELOW THE ROAD, AND 1 FT NORTH OF A FIBERGLASS WITNESS POST. THE BENCHMARK ELEVATION IS 6222.12' AND BASED ON NAVD88.

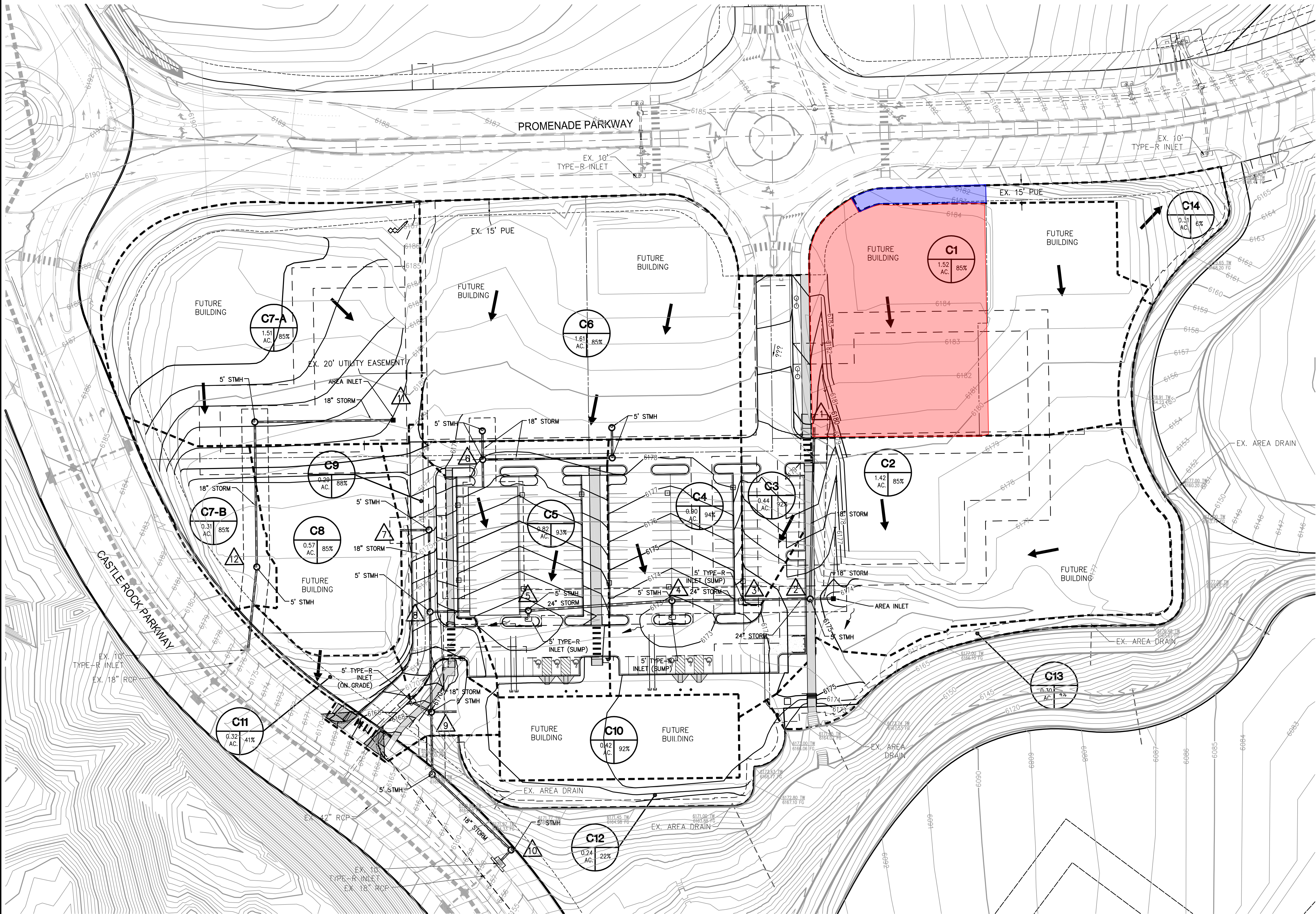
PROMENADE AT CASTLE ROCK
PHASE III DRAINAGE MAP

CASTLE ROCK, COLORADO

Bowman Consulting Group, Ltd.
603 Park Point Drive
Suite 100
Golden, CO 80401
Phone: (303) 801-2900
www.bowmanconsulting.com
© Bowman Consulting Group, Ltd.

Bowman
VISION LAND

PLAN STATUS		
DATE	DESCRIPTION	
DESIGN	DRAWN	LJT
SCALE	H:	CHKD
	V:	
JOB No.	020029	
DATE :	10/07/2014	
FILE No.		
SHEET		



LEGEND:

- DESIGN POINT
- PROPOSED BASIN BOUNDARY
- FLOW DIRECTION
- EMERGENCY OVERFLOW PATH FOR SUMP INLETS

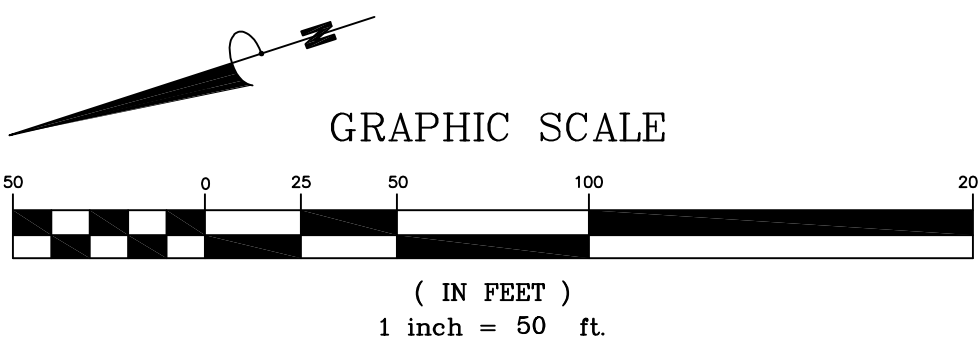
BASIN DESIGNATION

BASIN AREA

PERCENT IMPERVIOUS

DESIGN POINT SUMMARY TABLE				
Design Point	Contributing Basins	Area (acres)	5-Year (cfs)	100-Year (cfs)
1	C1	1.52	4.8	10.5
2	C1-C2	2.94	7.6	16.3
3	C1-C3	3.38	8.6	18.9
4	C1-C4	4.28	11.2	24.1
5	C1-C5	5.10	13.3	28.2
6	C6	1.61	5.0	9.9
7	C8	0.57	2.0	4.4
8	C1-C6, C8	7.28	18.9	16.3
9	C1-C6, C8-C10	7.99	20.1	21.6
10	C1-C6, C8-C10, C12	8.23	20.4	22.5
11	C7-A	1.51	4.8	10.3
12	C7-A&B	1.82	5.5	12.2

BASIN SUMMARY TABLE			
Basin	Area (acres)	5-Year (cfs)	100-Year (cfs)
C1	1.52	4.8	10.5
C2	1.42	3.6	7.8
C3	0.44	1.4	3.2
C4	0.90	3.4	7.0
C5	0.82	3.4	6.2
C6	1.61	5.0	9.9
C7-A	1.51	4.8	10.3
C7-B	0.31	1.0	2.6
C8	0.57	2.0	4.4
C9	0.29	1.0	1.8
C10	0.42	1.5	3.5
C11	0.32	0.5	1.8
C12	0.24	0.5	0.9
C13	0.30	0.5	1.8
C14	0.31	0.5	1.8



BENCHMARK:
(KK1334) BRASS DISK IN THE CENTER OF THE EAST END OF A 10' BY 15' EXPOSED AREA OF OUTCROPPING BEDROCK, 149.9' EAST OF THE NEAR RAIL, 50.9' WEST OF THE CENTERLINE OF COUNTY ROAD 25, 0.7' WEST OF THE EAST EDGE OF OUTCROP, AND EAST OF THE EXTENDED CENTER OF INTERSTATE 25 EXIT 162, 10' BELOW THE ROAD, AND 1 FT NORTH OF A FIBERGLASS WITNESS POST.
DATUM=NAVD88
ELEVATION=6222.12

REVISIONS		DATE	DESCRIPTION
REVISION			

DRAINAGE MAP

BLOCK 2 PROMENADE AT CASTLE ROCK

COLORADO

CASTLE ROCK

SEAL		
DESIGN	DRAWN	CHKD LJT
SCALE	H: 1" = 50' V: NA	
JOB No.	020029-01-009	
DATE :	09/22/2017	
SHEET		
DM1		

Hydrologic Soil Group—Castle Rock Area, Colorado



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 9, Sep 22, 2016

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

Date(s) aerial images were photographed: Mar 16, 2012—Apr 13, 2012

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

Hydrologic Soil Group— Summary by Map Unit — Castle Rock Area, Colorado (CO622)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BwD	Buick-Satanta loams, 3 to 9 percent slopes	C	2.8	8.3%
KwF	Kutch-Newlin-Stapleton complex, 8 to 40 percent slopes	D	10.8	31.5%
Su	Stony rough land	D	20.6	60.2%
Totals for Area of Interest			34.2	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.

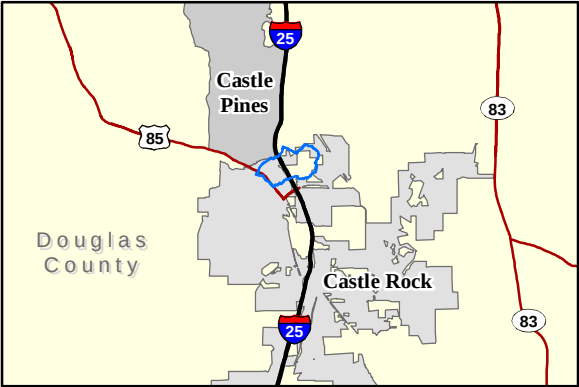
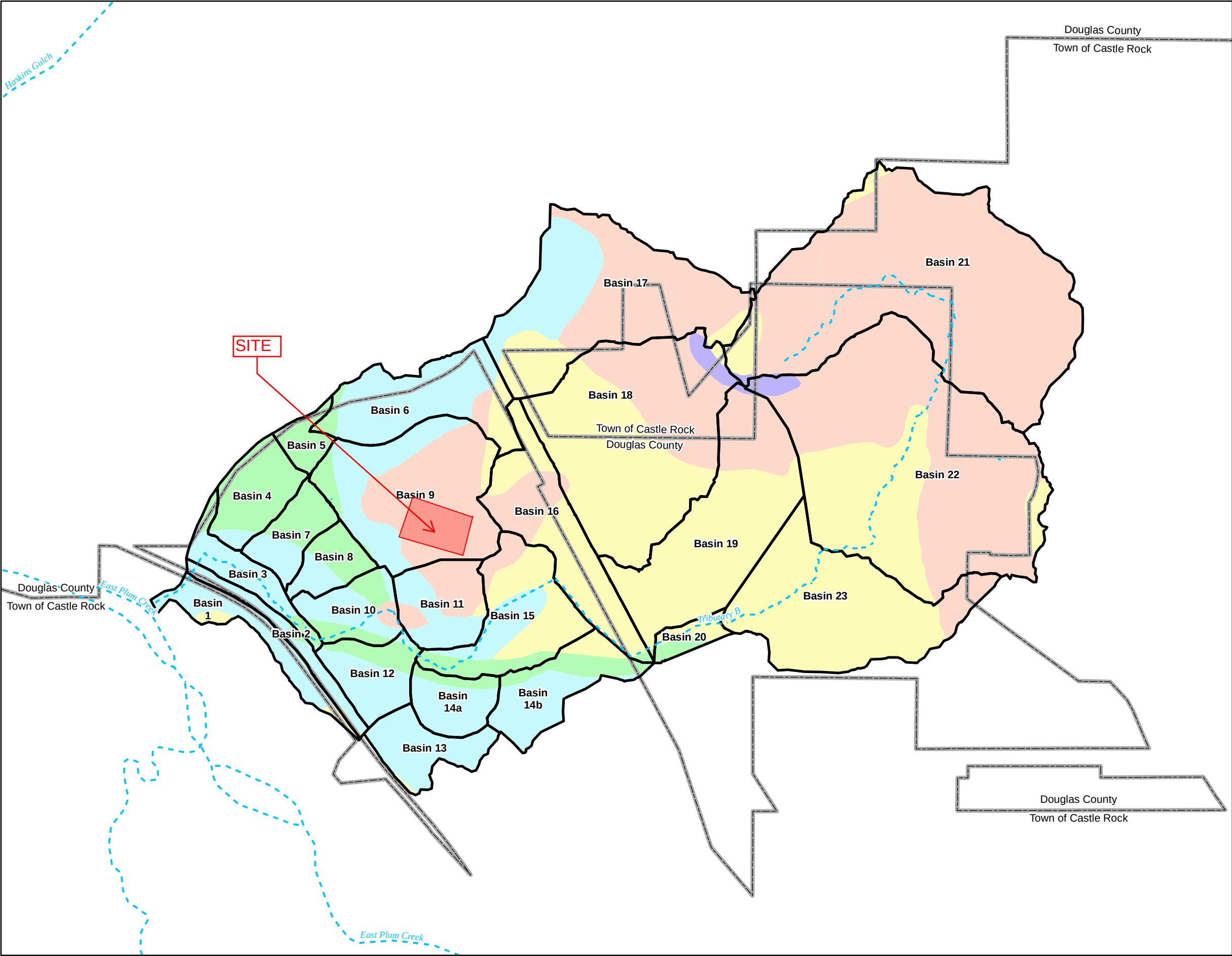
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



LEGEND

- Perennial Streams and Creeks
- Town of Castle Rock Boundary
- Basins

Hydrologic Soil Group

- A
- B
- C
- D
- Not Rated

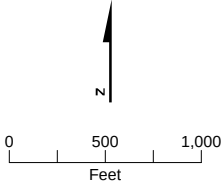


FIGURE A-2
NRCS Soil Data
Tributary B Watershed Master Plan
Castle Rock, Colorado

- o Minor Storm: 5-year Storm Event
- o Major Storm: 100-year Storm Event

Tables and profiles are provided in **Appendix D**.

PROPOSED DRAINAGE SYSTEM DESIGN

GENERAL CONCEPT

Drainage facilities associated with the previously identified site improvements for the Project consist of standard sheet and conveyed flow patterns through the use of concrete curbing or channels and private onsite underground storm sewer piping that outfall into the existing storm sewer and detention facility designed as part of the Drainage Report.

SPECIFIC DETAILS

Runoff conditions for the Project were developed utilizing the previously referenced Hydrological Criteria. The Project can be divided into ten (10) design points and thirteen (13) sub-basins. Sub-basins were determined based on on-site runoff and off-site run-on. On-site runoff will be captured and conveyed to the private underground storm sewer system. On-site drainage facilities designed as part of the Project are capturing some off-site run-on, which are denoted as Sub-basin C2*. An overview of the Project's post-development sub-basins is provided in further detail below.

SUB-BASIN DESCRIPTIONS

Sub-basin A1

Sub-Basin A1 is approximately 0.84 acre and includes on-site run-off from the majority of the site's parking, surrounding landscape islands, and drive aisles. Runoff from the area will surface flow to the northwest corner of the parking lot and captured by Design Point A1.

$$\begin{array}{ll} C_5 = 0.75 & Q_5 = 2.51 \\ C_{100} = 0.84 & Q_{100} = 5.05 \end{array}$$

Sub-basin A2

Sub-Basin A2 is approximately 0.30 acres and includes on-site run-off from the parking and landscape along the north and northwest side of the site, surrounding landscape islands, and northern drive aisle. Runoff from the area will surface flow to an existing catch basin located to the north of the site at Design Point A2.

$$\begin{array}{ll} C_5 = 0.68 & Q_5 = 0.87 \\ C_{100} = 0.81 & Q_{100} = 1.80 \end{array}$$

**Sub-basin B1**

Sub-Basin B1 is approximately .06 acres and includes on-site run-off from a portion of landscaping along the northwest border of the site. Runoff from the area will surface flow offsite to the west towards the existing stairwell at Design Point B1.

$$\begin{array}{ll} C_5 = 0.07 & Q_5 = 0.02 \\ C_{100} = 0.47 & Q_{100} = 0.19 \end{array}$$

Sub-basin B2

Sub-Basin B2 is approximately .12 acres and includes on-site run-off from a portion of landscaping along the western border of the site. Runoff from the area will surface flow to the center of the sub-basin and captured by Design Point B2.

$$\begin{array}{ll} C_5 = 0.07 & Q_5 = 0.03 \\ C_{100} = 0.50 & Q_{100} = 0.43 \end{array}$$

Sub-basin B3

Sub-Basin B3 is approximately .01 acres and includes on-site run-off from a portion of patio hardscape along the western border of the site. Runoff from the area will surface flow to the center of the sub-basin and captured by the trench drain represented by Design Point B3.

$$\begin{array}{ll} C_5 = 0.76 & Q_5 = 0.05 \\ C_{100} = 0.84 & Q_{100} = 0.09 \end{array}$$

Sub-basin B4

Sub-Basin B4 is approximately .05 acres and includes on-site run-off from a portion of landscaping and patio hardscape along the western border of the site. Runoff from the area will surface flow to the center of the sub-basin and captured by the trench drain represented by Design Point B4.

$$\begin{array}{ll} C_5 = 0.76 & Q_5 = 0.18 \\ C_{100} = 0.84 & Q_{100} = 0.34 \end{array}$$

Sub-basin B5

Sub-Basin B5 is approximately .04 acres and includes on-site run-off from a portion of landscaping and patio hardscape along the southwestern and southern border of the site. Runoff from the area will surface flow to the center of the sub-basin and captured by the trench drain represented by Design Point B5.

$$\begin{array}{ll} C_5 = 0.76 & Q_5 = 0.14 \\ C_{100} = 0.84 & Q_{100} = 0.26 \end{array}$$

**Sub-basin B6**

Sub-Basin B6 is approximately .05 acres and includes on-site run-off from a large portion of landscaping and a small portion of patio hardscape along the retaining wall on the southwestern and southern border of the site. Runoff from the area will surface flow to the center of the sub-basin and flow offsite at Design Point B6.

$$\begin{array}{ll} C_5 = 0.20 & Q_5 = 0.04 \\ C_{100} = 0.56 & Q_{100} = 0.20 \end{array}$$

Sub-basin B7

Sub-Basin B7 is approximately .03 acres and includes on-site run-off from a portion of landscaping, patio hardscape, and concrete sidewalk along the southern border of the site. Runoff from the area will surface flow to the center of the sub-basin and captured by Design Point B7.

$$\begin{array}{ll} C_5 = 0.09 & Q_5 = 0.01 \\ C_{100} = 0.48 & Q_{100} = 0.12 \end{array}$$

Sub-basin R1

Sub-Basin R1 is approximately .16 acres and includes on-site run-off from the northern half of the proposed building and patio roof. Runoff from the area will surface flow from the roof, splash-on-grade via storm drain downspouts, and flow into the trench drain in sub-basin "B3" and follow the drainage pattern as described in Sub-Basin "B3" above.

$$\begin{array}{ll} C_5 = 0.76 & Q_5 = 0.56 \\ C_{100} = 0.84 & Q_{100} = 1.05 \end{array}$$

Sub-basin R2

Sub-Basin R2 is approximately .16 acres and includes on-site run-off from the southern half of the proposed building and patio roof. Runoff from the area will surface flow from the roof, splash-on-grade via storm drain downspouts, and flow into the trench drain in sub-basin "B4" and follow the drainage pattern as described in Sub-Basin "B4" above.

$$\begin{array}{ll} C_5 = 0.77 & Q_5 = 0.57 \\ C_{100} = 0.85 & Q_{100} = 1.06 \end{array}$$

Sub-basin C1

Sub-basin "C1*" is approximately 0.15 acres and includes the on-site run-off from the parking, drive aisles, landscaping, and sidewalk located on the southeast portion Site. Runoff from this sub-basin will surface flow southeast and be captured by Design Point C1.

$$\begin{array}{ll} C_5 = 0.80 & Q_5 = 0.57 \\ C_{100} = 0.87 & Q_{100} = 1.04 \end{array}$$

Sub-basin C2*

Sub-basin "C2*" is approximately 0.30 acres and includes the off-site run-on from the parking, drive aisles, and landscaping located on the adjacent property to the east of the Site. Runoff from this sub-basin will surface flow towards and into sub-basin "A1" and follow the drainage pattern as described in Sub-Basin "A1" above.

$$C_5 = 0.72$$

$$C_{100} = 0.83$$

$$Q_5 = 1.01$$

$$Q_{100} = 1.95$$

The Drainage Map outlining the sub-basins is provided in **Appendix E**.

ADDITIONAL PERMITTING REQUIREMENTS

The Site will disturb more than 1 acre and will require a Colorado Discharge Permit System (CDPS) General Permit for Stormwater Discharge Associated with Construction Activities from the Colorado Department of Public Health and Environment (CDPHE).

The Project will also require approval of public improvement plans and Grading, Erosion and Sediment Control Plans (GESCP) by Town of Castle Rock.

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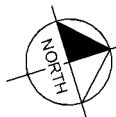
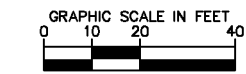
K:\DEN_Civil\096547001_La Loma Castle Rock\CA00_Drainage Plan\547001DM.dwg, Simpson, Tanner 12/1/2017 9:52 AM
THIS DOCUMENT, TOGETHER WITH THE CONCEPTS & DESIGN PRESENTED HEREIN, AS AN INSTRUMENT OF SERVICE, IS INTENDED ONLY FOR THE SPECIFIC PURPOSE AND CLIENT FOR WHICH IT WAS PREPARED. REUSE OF ANY PORTION OF THIS DOCUMENT WITHOUT WRITTEN AUTHORIZATION & ADAPTATION BY MFCU & ASSOCIATES, INC. SHALL BE WITHOUT LIABILITY TO MFCU & ASSOCIATES, INC.

Basin Summary									
DESIGN POINT	DRAIN BASIN	AREA (AC)	% of Site (%)	I (%)	WEIGHTED (%)	C ₂	C ₅	C ₁₀	C ₁₀₀
A1	A1	0.84	43%	88%	37.4%	0.73	0.75	0.78	0.84
A2	A2	0.30	15%	79%	12.0%	0.86	0.88	0.71	0.81
B1	B1	0.06	3%	9%	0.3%	0.07	0.07	0.13	0.47
B2	B2	0.12	6%	4%	0.2%	0.03	0.07	0.16	0.50
B3	B3	0.01	1%	90%	0.6%	0.74	0.76	0.78	0.84
B4	B4	0.05	3%	90%	2.4%	0.74	0.76	0.78	0.84
B5	B5	0.04	2%	90%	1.6%	0.74	0.76	0.78	0.84
B6	B6	0.05	2%	20%	0.6%	0.16	0.20	0.28	0.56
B7	B7	0.03	2%	11%	0.2%	0.08	0.09	0.14	0.48
R1	R1	0.16	8%	90%	7.3%	0.74	0.76	0.78	0.84
R2	R2	0.16	8%	90%	7.3%	0.74	0.77	0.80	0.85
C1	C1	0.15	8%	93%	7.3%	0.78	0.80	0.82	0.87
C2*	C2*	0.30	-	83%	-	0.70	0.72	0.75	0.83
TOTAL SITE		2.28	92%		70.0%	0.64	0.66	0.70	0.80

LA LOMA CASTLE ROCK

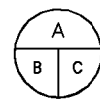
PROMENADE AT CASTLE ROCK FILING NO.1, AMENDMENT NC 13, LOT 1-5A, BLOCK 2
A PARCEL LOCATED IN THE SOUTHWEST QUARTER OF SECTION 22,
TOWNSHIP 7 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
TOWN OF CASTLE ROCK, COUNTY OF DOUGLAS, STATE OF COLORADO

Design Point Summary						
DESIGN POINT	DRAIN BASIN	AREA (AC)	Q ₂ (CFS)	Q ₅ (CFS)	Q ₁₀ (CFS)	Q ₁₀₀ (CFS)
A1	A1	0.84	1.82	2.51	3.00	5.05
A2	A2	0.30	0.64	0.87	1.05	1.80
B1	B1	0.06	0.01	0.02	0.03	0.19
B2	B2	0.12	0.01	0.03	0.09	0.43
B3	B3	0.01	0.04	0.05	0.06	0.09
B4	B4	0.05	0.14	0.18	0.21	0.34
B5	B5	0.04	0.11	0.14	0.16	0.26
B6	B6	0.05	0.03	0.04	0.07	0.20
B7	B7	0.03	0.01	0.01	0.02	0.12
R1	R1	0.16	0.43	0.56	0.66	1.05
R2	R2	0.16	0.43	0.57	0.67	1.06
C1	C1	0.15	0.43	0.57	0.66	1.04
C2*	C2*	0.30	0.76	1.01	1.19	1.95
TOTAL SITE		2.28	4.86	6.66	7.67	13.58
		1.98	4.10	5.55	6.68	11.83



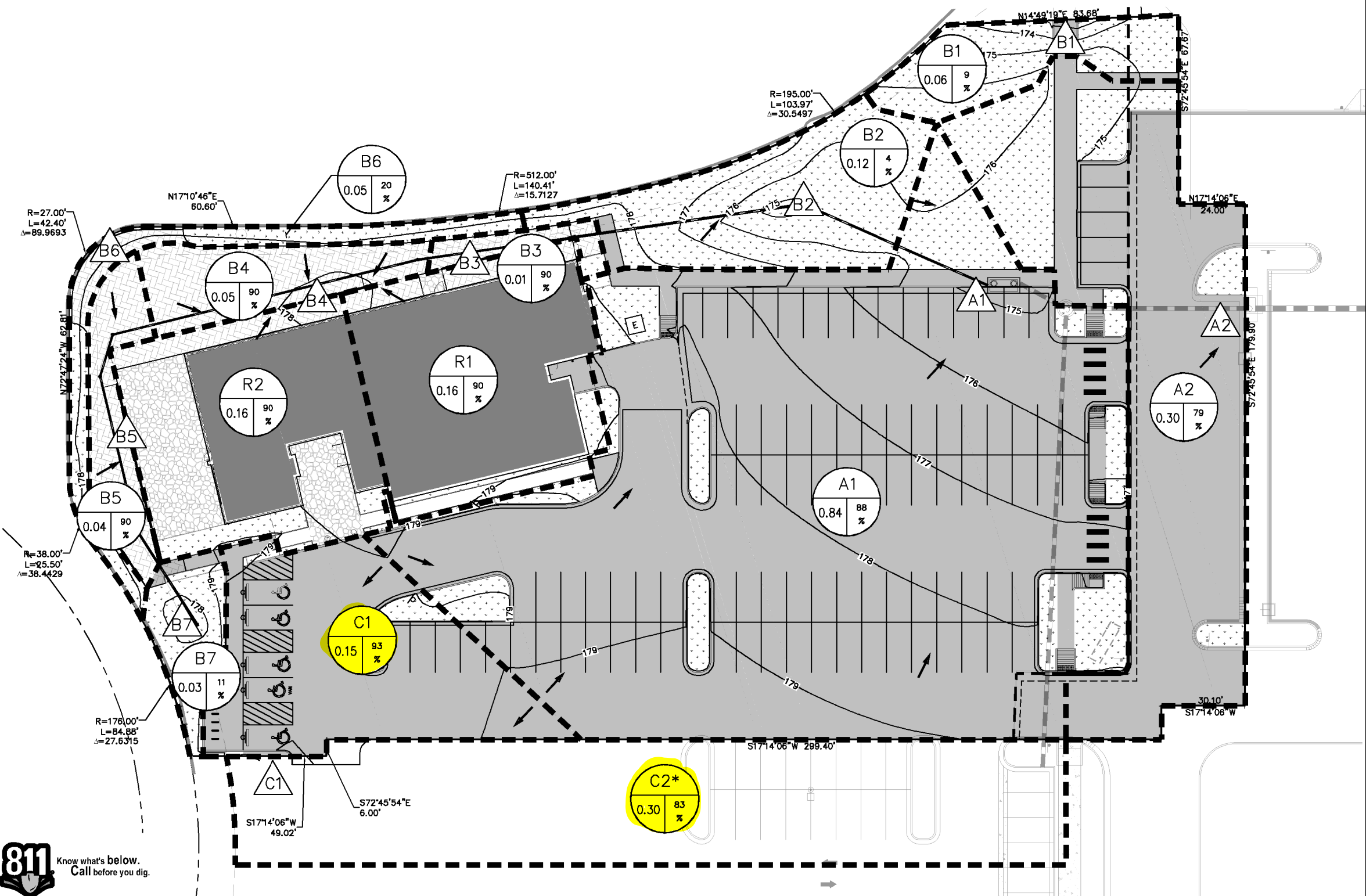
LEGEND

- XXXX ----- EX. MAJOR CONTOUR
- XXXX ----- EX. MINOR CONTOUR
- XXXX ----- PROP. MAJOR CONTOUR
- XXXX ----- PROP. MINOR CONTOUR
- GRADING LIMITS
- PROPOSED STORM LINE
- ST ----- PROPOSED ROOF DRAIN
- DRAINAGE BASIN BOUNDARY



DESIGN POINT

FLOW DIRECTION



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

PROFESSIONAL ENGINEER CERTIFICATION

I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS 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.

ERIN L. GRIFFIN, P.E. 42894

DATE

Kimley»Horn

2017 KIMLEY-HORN AND ASSOCIATES, INC.
4582 South Ulster Street, Suite 1500
Denver, Colorado 80237 (303) 228-2300

DESIGNED BY: AJH
DRAWN BY: TGS
CHECKED BY: ELG
DATE: 12/01/17

LA LOMA CASTLE ROCK
CASTLE ROCK, COLORADO
CONSTRUCTION DOCUMENTS
PROPOSED DRAINAGE MAP

PRELIMINARY
FOR REVIEW ONLY
NOT FOR
CONSTRUCTION
Kimley»Horn
Kimley-Horn and Associates, Inc.

PROJECT NO.
096547001

DRAWING NAME
547001DM

1 OF 1



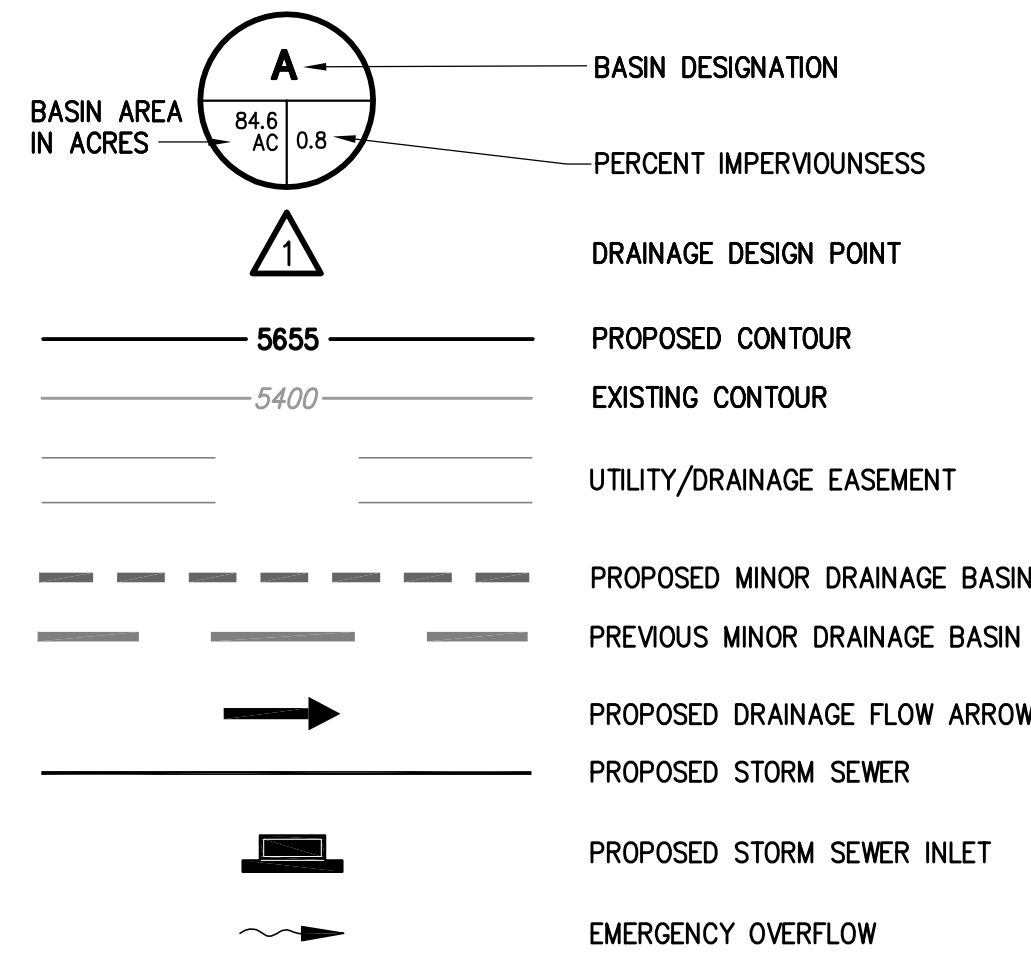


**STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)**

CALCULATED BY: LJT P1= 2.60 in
DATE: 1/31/18
CHECKED BY: LJT

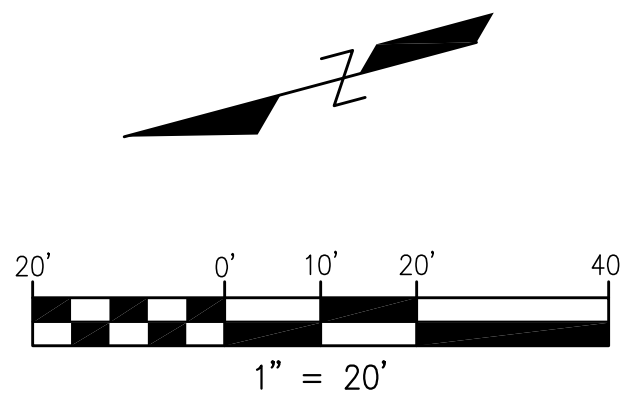
JOB NO: 2018002
PROJECT: Block 2 Lot 1A-7A
DESIGN STORM: 100-Year

[illegible]



Basin Summary Table			
Basin	Area	5yr Q	100yr Q
C1-B	0.10	0.5	0.9
C1-C	0.19	0.6	1.3
C1-D	0.17	0.7	1.3
C1-E	0.28	1.0	2.0
C13-A	0.03	0.0	0.1
C14-A	0.19	0.0	0.8
EX 1	0.15	0.6	1.2

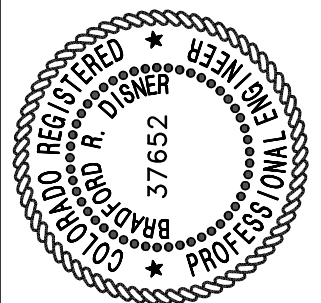
Design Point	Contributing Basins	5yr Q	100yr Q
1	C1-B & C1-C	1.0	2.0
2	C1-B, C1-C, EX 1	2.0	4.1
3	C1-B-C1-E, EX 1	2.9	5.9
4	C1-B-C1-E, EX 1	2.9	5.8



BENCHMARK:

(K11334) BRASS DISK IN THE CENTER OF THE EAST END OF A 10' BY 15' EXPOSED AREA OF OUTCROPPING BEDROCK, 149.9' EAST OF THE NEAR RAIL, 50.9' WEST OF THE CENTERLINE OF COUNTY ROAD 25, 0.7' WEST OF THE EAST EDGE OF OUTCROP, AND EAST OF THE EXTENDED CENTER OF INTERSTATE 25 EXIT 182, 10' BELOW THE ROAD, AND 1 FT NORTH OF A FIBERGLASS WITNESS POST.
DATUM=NAVD88
ELEVATION=6222.12

	P.O. BOX 280869 LAKEWOOD, CO 80226 PHONE:(303)204-5065	
	 Elevation Consulting	
SHEET	Premier Members Credit Union DRAINAGE MAP CASTLE ROCK, COLORADO	BY _____ DATE 2/27/18 JOB NO. 2018002 CHECKED BY LJT
DM01		



P.O. BOX 280869
LAKEWOOD, CO 80226
PHONE:(303)204-5065

Elevation
Consulting

PREMIER MEMBERS CREDIT UNION

DRAINAGE MAP

CASTLE ROCK, COLORADO

SHEET

DM01

Appendix B

(Hydrologic Calculations)



MERRICK & COMPANY
Developed Composite C-Factor and Impervious Analysis

Chick-fil-A @ Promenade

Calculated by: LDV
 Checked by: KW
 Date: 10/31/17

UDFCD - TABLE 6-4, SOIL GROUP C/D							
Basin	Land Use	Area (acres)	I value	C2	C5	C10	C100
A-1	PROPOSED LANDSCAPE	0.01	0.02		0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.13	0.90		0.77	0.80	0.85
	PROPOSED PAVEMENT	0.11	1.00		0.86	0.87	0.89
		0.25	0.91	0.00	0.78	0.80	0.86
A-2	PROPOSED LANDSCAPE	0.01	0.02		0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.01	0.90		0.77	0.80	0.85
	PROPOSED PAVEMENT	0.09	1.00		0.86	0.87	0.89
		0.11	0.91	0.00	0.78	0.81	0.86
A-3	PROPOSED LANDSCAPE	0.02	0.02		0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.01	0.90		0.77	0.80	0.85
	PROPOSED PAVEMENT	0.29	1.00		0.86	0.87	0.89
		0.32	0.94	0.00	0.80	0.82	0.87
A-4	PROPOSED LANDSCAPE	0.01	0.02		0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.00	0.90		0.77	0.80	0.85
	PROPOSED PAVEMENT	0.08	1.00		0.86	0.87	0.89
		0.09	0.89	0.00	0.77	0.79	0.85
A-5	PROPOSED LANDSCAPE	0.02	0.02		0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.01	0.90		0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00		0.86	0.87	0.89
		0.03	0.36	0.00	0.33	0.40	0.63
A-6	PROPOSED LANDSCAPE	0.01	0.02		0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.00	0.90		0.77	0.80	0.85
	PROPOSED PAVEMENT	0.01	1.00		0.86	0.87	0.89
		0.02	0.51	0.00	0.45	0.51	0.69
B1	PROPOSED LANDSCAPE	0.09	0.02		0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.01	0.90		0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00		0.86	0.87	0.89
		0.10	0.11	0.00	0.12	0.21	0.53
ON-SITE TOTALS	PROPOSED LANDSCAPE	0.17	0.02		0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.17	0.90		0.77	0.80	0.85
	PROPOSED PAVEMENT	0.58	1.00		0.86	0.87	0.89
		0.92	0.80	0.00	0.69	0.73	0.81

¹SITE AREA DOES NOT INCLUDE THE HALF OF THE PRIVATE DRIVE THAT IS ON LOT 1A-6A, WHICH HAS BEEN ANALYZED AND ACCOUNT FOR AS PART OF THE BLOCK 2 PHASE III DRAINAGE REPORT

PREVIOUSLY APPROVED REPORT BY MERRICK & COMPANY

tc1



STANDARD FORM SF-2 TIME OF CONCENTRATION

03/16/18

CALCULATED BY: LDV
CHECKED BY: KW

PROJECT: Chick-fil-A @ Promenade
BASIN:

JOB NO: 65119391
LOCATION: CASTLE ROCK, CO

SUB-BASIN DATA				INITIAL/OVERLAND TIME (Tc)			TRAVEL TIME (Tt)						Tc CHECK (Urbanized Basins)			FINAL Tc	CONVEYANCE REMARKS	
DESIGNATION	AREA (acres)	I value	Cs	LENGTH (ft)	SLOPE (%)	Ti (min)	LENGTH (ft)	AVG. SLOPE ΔY (%)		Conv. Type*	VEL (fps)	Tt (min)	COMP Tc (min)	TOTAL LENGTH (ft)	Tc=(26-17i)+L/(60*(14+i9)*sqrt(S)) (min)	(min)**		
A-1	0.25	0.91	0.78														5.0	Roof
A-2	0.11	0.91	0.78	150	4.6	4.3	13	0.5	3.8	6	3.9	0.1	4.3	163	10.7		5.0	Paved Gutter
A-3	0.32	0.94	0.80	126	4.6	3.6	48	0.5	1.0	6	2.0	0.4	4.0	174	10.3		5.0	Paved Gutter
A-4	0.09	0.89	0.77										0.0	0			5.0	#VALUE!
A-5	0.03	0.36	0.33										0.0	0			5.0	N/A
A-6	0.02	0.51	0.45														5.0	
B-1	0.10	0.11	0.12										0.0	0			5.0	N/A

Q:\DEN\Projects\9391-00 CFA Promenade at Castle Rock\Design\Drainage\Hydrology\Rational\9391_Rational Calculations Drainage Calculations.xls\tc1

Merrick & Company

* Note: Conveyance Coefficients - Type 1-Heavy Meadow, Type 2-Tillage/Field, Type 3-Short Pasture and lawns, Type 4-Nearly Bare Soil, Type 5-Grassed Waterway, Type 6-Paved areas and shallow paved swales. The maximum initial/overland length shall not exceed 300 feet.

** Based on Assumption that Building roofs will take 5 min to fully contribute to storm system



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

CALCULATED BY: LDV
DATE: 03/16/18
CHECKED BY: KW

JOB NO: 65119391
PROJECT: Chick-fil-A @ Promenade
DESIGN STORM: 5 Year

DESIGN POINT	AREA DESIG.	DIRECT RUNOFF						TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME		
		AREA (Acres)	RUNOFF COEFF	T _c (min)	C A (Acres)	I (in/hour)	Q (cfs)	T _c (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	T _t (min)
1	A-1	0.25	0.78	5.0	0.20	4.85	0.95												
5	A-2	0.11	0.78	5.0	0.09	4.85	0.42												
4	A-3	0.32	0.80	5.0	0.26	4.85	1.25												
6	A-4	0.09	0.77	5.0	0.07	4.85	0.33												
8	A-5	0.03	0.33	5.0	0.01	4.85	0.05												
6	A-6	0.02	0.45	5.0	0.01	4.85	0.04												
7	B1	0.10	0.12	5.0	0.01	4.85	0.06												
2	C1-A*	0.60	0.65		0.39		2.30												
2	C2-A*	0.15	0.80		0.12		0.60												

5-YEAR RAINFALL = 1.43 IN/HR., 100-YEAR RAINFALL = 2.61 IN/HR.
*value known from Block 2 Phase III Drainage Report

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

CALCULATED BY: LDV
DATE: 03/16/18
CHECKED BY: KW

JOB NO: 65119391
PROJECT: Chick-fil-A @ Promenade
DESIGN STORM: 100 Year

DESIGN POINT	AREA DESIG.	DIRECT RUNOFF						TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME		
		AREA (Acres)	RUNOFF COEFF	T _c (min)	C A (Acres)	I (in/hour)	Q (cfs)	T _c (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	T _t (min)
1	A-1	0.25	0.86	5.0	0.21	8.853	1.90												
5	A-2	0.11	0.86	5.0	0.10	8.853	0.84												
4	A-3	0.32	0.87	5.0	0.28	8.853	2.46												
6	A-4	0.09	0.85	5.0	0.08	8.853	0.68												
8	A-5	0.03	0.63	5.0	0.02	8.853	0.18												
6	A-6	0.02	0.69	5.0	0.01	8.853	0.12												
7	B1	0.10	0.53	5.0	0.05	8.853	0.47												
2	C1-A*	0.60	0.82		0.49		4.60												
2	C2-A*	0.15	0.87		0.13		1.20												

5-YEAR RAINFALL = 1.43 IN/HR., 100-YEAR RAINFALL = 2.61 IN/HR.

*value known from report by others

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Appendix C

(Hydraulic Calculations)



Merrick & Company
5970 Greenwood Plaza Blvd.
Greenwood Village, CO 80111
Ph: (303) 751-0741

Job Name: CFA Promenade @ Castle
Job Number: 9391
Date: 1/21/2018
By: LV

FLOW CALCULATIONS - GRATE INLET SUMP CONDITION

(Reference: Urban Drainage and Flood Control District Drainage Criteria Manual, 2016, V.1, Chapter 7)
(Note: Spreadsheet assumes orifice condition for fully developed flow.)

INLET TYPE: Type C Inlet - Standard

BASIN: C1-A + C2-A

Orifice Equation:

$$Q = C_d \cdot A_o \cdot (2gH)^{0.5}$$

K = Clogging Coefficient value
for multiple inlets

N	Grate
1	1
2	1.5
3	1.75
4	1.88
5	1.94
6	1.97
7	1.98
8	1.99

Adjust A_o (open area) due to clogging as follows:

Effective Area Opening $A_e = (1-C) A_o$, where:

$$C = K \cdot C_o / N$$

N = Number of Inlets

C_o = Single Inlet Clogging Factor:

$$C_o(\text{grate}) = \frac{0.5}{1} \quad (50\% \text{ clogging})$$

Number of inlets:

N = 1

Inlet Dimensions and Effective Open Area:

Grate Opening:

$$A_o(g) = 5.75 \quad \text{ft}^2$$

$$\text{Total } A_o(g) = 5.75 \quad \text{ft}^2$$

$$K = 1.00$$

$$C = K \cdot C_o / N = 0.50$$

$$A_e(g) = (1-C)A_o = 2.88 \quad \text{ft}^2$$

Allowable depth:

$$H = 2.0 \quad \text{in} = 0.1666667 \quad \text{ft}$$

Constants:

$$g = 32.20 \quad \text{ft/s}^2$$

$$C_d = 0.67$$

Flow Calculations:

Grate Flow:

$$Q = C_d \cdot A_e(g) \cdot (2gH)^{0.5}$$

$$Q_g = 6.31 \quad \text{CFS}$$

**Total Intercepted Flow with
an allowable depth of**

1 inlet(s) and
2 inches is

6.3 cfs

Required Flow (Q Major) = **5.51** cfs

Required Flow (Q Minor) = **4.51** cfs

Bypass = 0.0 cfs

Bypass = 0.0 cfs

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INLET MANAGEMENT

Worksheet Protected

INLET NAME	104	100	101
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
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)	1.0	0.4	1.3
Major Q_{known} (cfs)	1.9	0.8	2.5

Bypass (Carry-Over) Flow from Upstream

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

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	1.0	0.4	1.3
Major Total Design Peak Flow, Q (cfs)	1.9	0.8	2.5
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A

Minor Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A
C_s	N/A	N/A	N/A
Overland Flow Velocity, V_i	N/A	N/A	N/A
Channel Flow Velocity, V_t	N/A	N/A	N/A
Overland Flow Time, T_i	N/A	N/A	N/A
Channel Travel Time, T_t	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A

Major Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A
C_s	N/A	N/A	N/A
Overland Flow Velocity, V_i	N/A	N/A	N/A
Channel Flow Velocity, V_t	N/A	N/A	N/A
Overland Flow Time, T_i	N/A	N/A	N/A
Channel Travel Time, T_t	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A

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

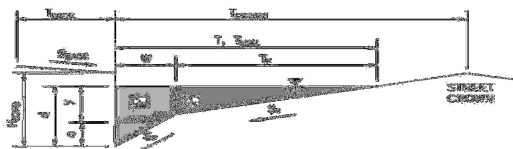
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Enter Your Project Name Here

Inlet ID:

104



Gutter Geometry (Enter data in the blue cells)

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)

$T_{BACK} =$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} =$ 0.012

$H_{CURB} =$ 6.00 inches
 $T_{CROWN} =$ 26.0 ft
 $W =$ 2.00 ft
 $S_X =$ 0.037 ft/ft
 $S_W =$ 0.083 ft/ft
 $S_O =$ 0.000 ft/ft
 $n_{STREET} =$ 0.012

Max. Allowable Spread for Minor & Major Storm

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

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	13.0	13.0	ft
$d_{MAX} =$	6.0	6.0	inches
	☐	☐	

MINOR STORM Allowable Capacity is based on Depth Criterion

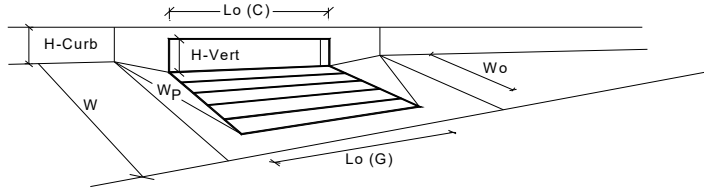
MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

Minor Storm	Major Storm	
SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



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' from above)		a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	6.0	inches
Grate Information			MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		$L_o (G)$ =	3.00	3.00	feet
Width of a Unit Grate		W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_r (G)$ =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w (G)$ =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o (G)$ =	0.60	0.60	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		$L_o (C)$ =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_r (C)$ =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w (C)$ =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o (C)$ =	0.66	0.66	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	0.523	0.523	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.33	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.94	0.94	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	0.94	0.94	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
		Q_a =	3.9	3.9	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK REQUIRED}$ =	1.0	1.9	cfs

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

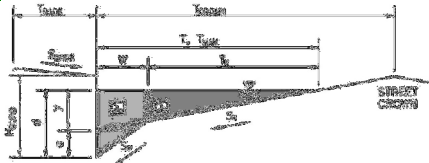
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Enter Your Project Name Here

Inlet ID:

100



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

$T_{BACK} = 9.0$ ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

$S_{BACK} = 0.000$ ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$n_{BACK} = 0.012$

Height of Curb at Gutter Flow Line

$H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown

$T_{CROWN} = 40.0$ ft

Gutter Width

$W = 2.00$ ft

Street Transverse Slope

$S_X = 0.040$ ft/ft

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

$S_W = 0.083$ ft/ft

Street Longitudinal Slope - Enter 0 for sump condition

$S_O = 0.000$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$n_{STREET} = 0.012$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	9.0	9.0	ft

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

	Minor Storm	Major Storm	
$d_{MAX} =$	6.0	6.0	inches

Check boxes are not applicable in SUMP conditions

☐

☐

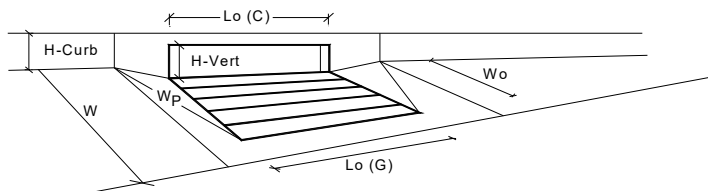
MINOR STORM Allowable Capacity is based on Depth Criterion

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

MAJOR STORM Allowable Capacity is based on Depth Criterion

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)

Denver No. 16 Combination

Type of Inlet

Local Depression (additional to continuous gutter depression 'a' from above)

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth

Depth for Curb Opening Weir Equation

Combination Inlet Performance Reduction Factor for Long Inlets

Curb Opening Performance Reduction Factor for Long Inlets

Grated Inlet Performance Reduction Factor for Long Inlets

Total Inlet Interception Capacity (assumes clogged condition)

Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)

	MINOR	MAJOR	
Type =	Denver No. 16 Combination		
a_{local} =	2.00	2.00	inches
No =	1	1	
Ponding Depth =	5.4	5.4	inches
	MINOR	MAJOR	Override Depths
$L_o (G)$ =	3.00	3.00	feet
W_o =	1.73	1.73	feet
A_{ratio} =	0.31	0.31	
$C_r (G)$ =	0.50	0.50	
$C_w (G)$ =	3.60	3.60	
$C_o (G)$ =	0.60	0.60	
	MINOR	MAJOR	
$L_o (C)$ =	3.00	3.00	feet
H_{vert} =	6.50	6.50	inches
H_{throat} =	5.25	5.25	inches
Theta =	0.00	0.00	degrees
W_p =	2.00	2.00	feet
$C_r (C)$ =	0.10	0.10	
$C_w (C)$ =	3.70	3.70	
$C_o (C)$ =	0.66	0.66	
	MINOR	MAJOR	
d_{Grate} =	0.469	0.469	ft
d_{Curb} =	0.28	0.28	ft
$RF_{Combination}$ =	0.84	0.84	
RF_{Curb} =	1.00	1.00	
RF_{Grate} =	0.84	0.84	
	MINOR	MAJOR	
Q_a =	3.0	3.0	cfs
$Q_{PEAK REQUIRED}$ =	0.4	0.8	cfs

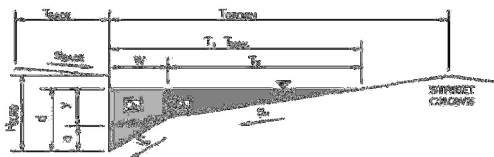
Version 4.05 Released March 2017

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

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

Project: Enter Your Project Name Here

Inlet ID: 101



Gutter Geometry (Enter data in the blue cells)

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)

Max. Allowable Spread for Minor & Major Storm

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

Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

T_{BACK} = 4.0 ft
S_{BACK} = 0.100 ft/ft
n_{BACK} = 0.013

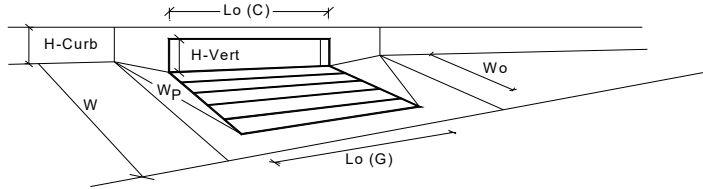
H_{CURB} = 6.00 inches
T_{CROWN} = 40.0 ft
W = 2.00 ft
S_X = 0.050 ft/ft
S_W = 0.083 ft/ft
S_O = 0.000 ft/ft
n_{STREET} = 0.012

	Minor Storm	Major Storm	
T _{MAX}	9.0	9.0	ft
d _{MAX}	6.0	6.0	inches
	☐	☐	

	Minor Storm	Major Storm	
Q _{allow}	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

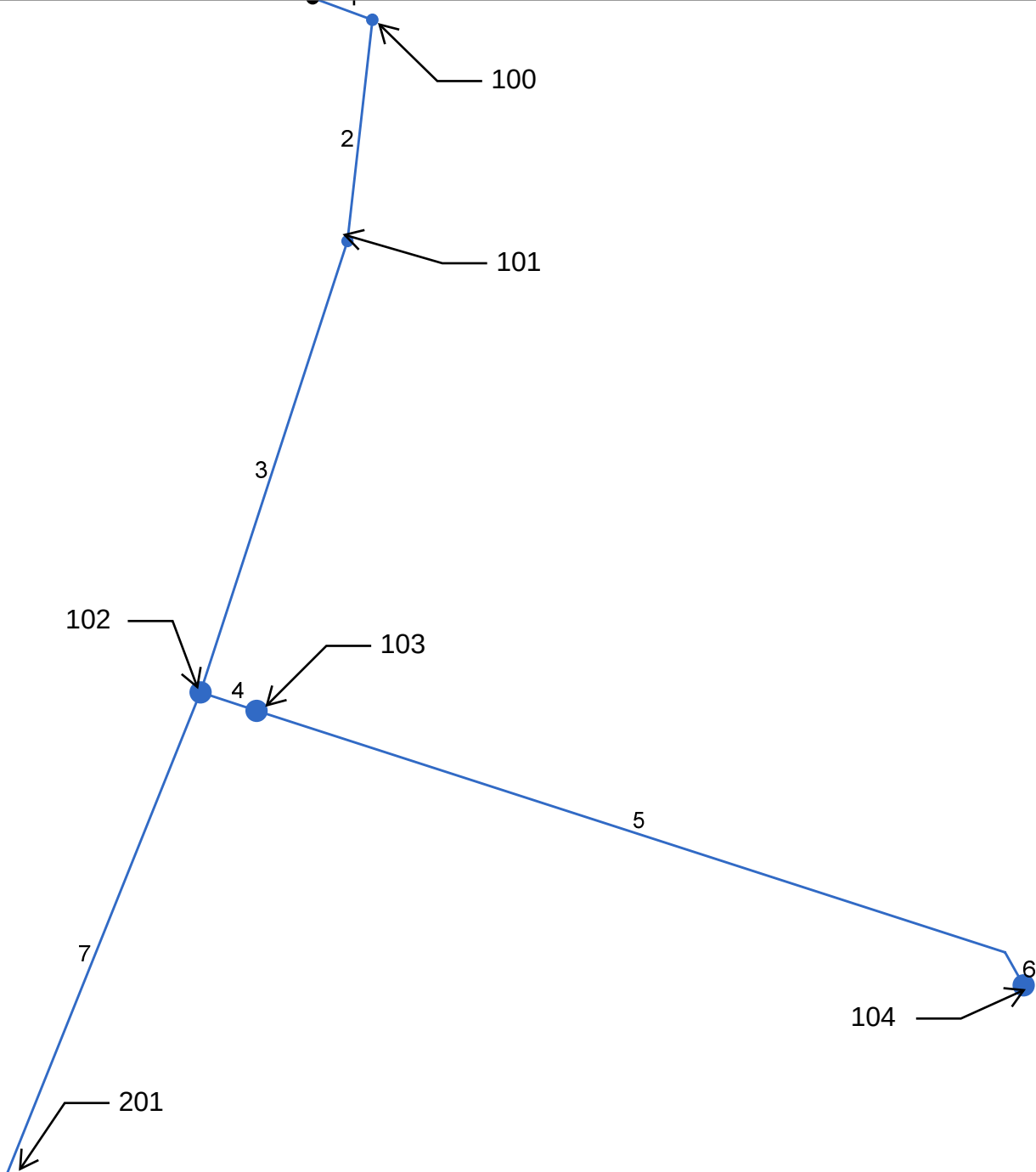
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Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Denver No. 16 Combination	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	6.0	inches
Grate Information			MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		$L_o (G)$ =	3.00	3.00	feet
Width of a Unit Grate		W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_r (G)$ =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w (G)$ =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o (G)$ =	0.60	0.60	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		$L_o (C)$ =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_r (C)$ =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w (C)$ =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o (C)$ =	0.66	0.66	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	0.523	0.523	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.33	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.94	0.94	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	0.94	0.94	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
		Q_a =	3.9	3.9	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK REQUIRED}$ =	1.3	2.5	cfs

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

PREVIOUSLY APPROVED REPORT BY MERRICK & COMPANY

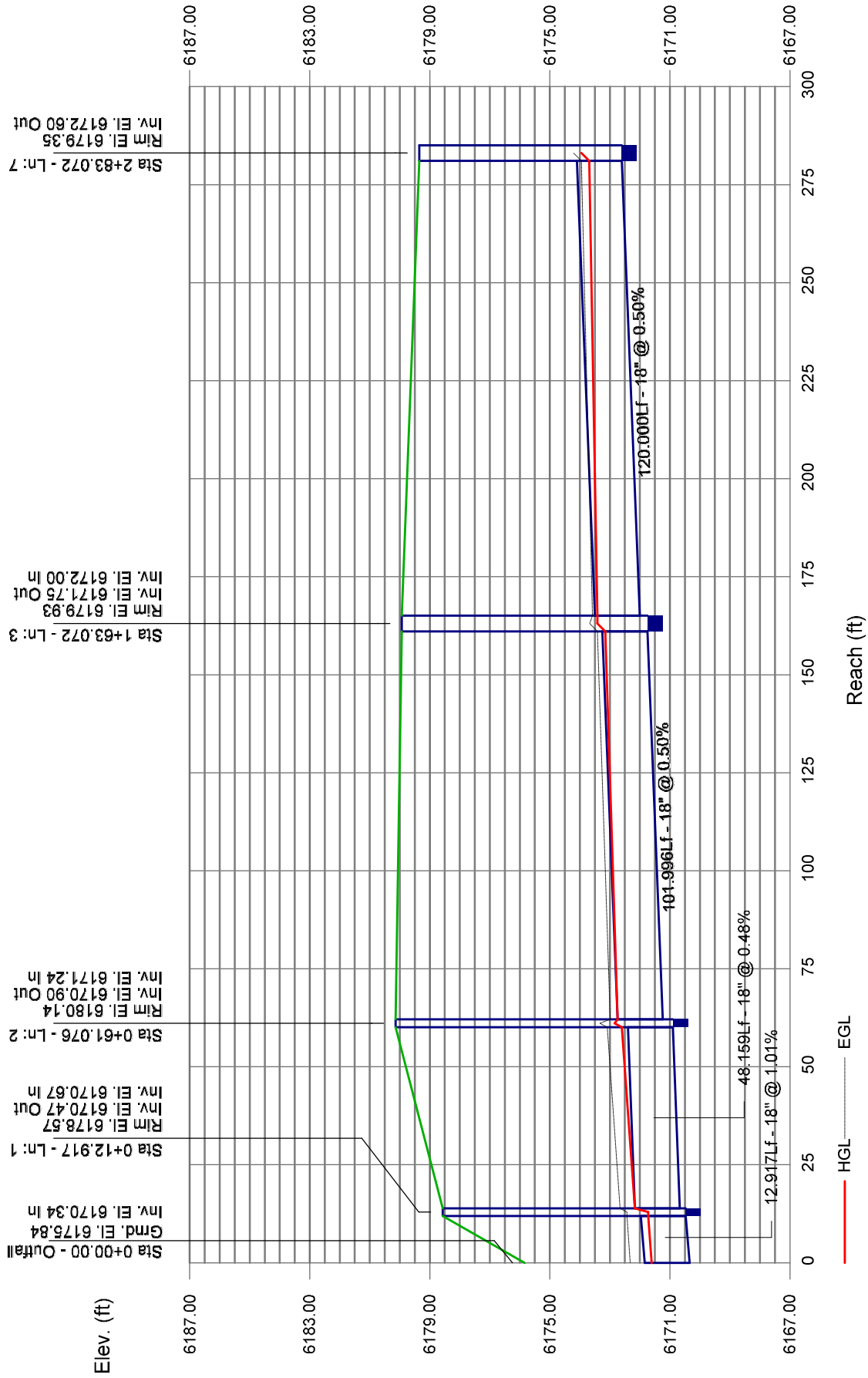


Line No.	DnStm Ln No	Flow Rate (cfs)	Line Size (in)	Line Type	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Line Slope (%)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)	HGL Up (ft)	HGL Dn (ft)	Vel Ave (ft/s)	Defl Ang (Deg)	n-val Pipe	
1	Outfall	10.65	18	Cir	12.917	6170.47	6170.34	1.01	6178.57	0.00	6171.72	6171.61	6.71	21.773	0.013	
2	1	9.91	18	Cir	48.159	6170.90	6170.67	0.48	6180.14	6178.57	6172.60	6172.17	5.61	74.380	0.013	
3	2	7.68	18	Cir	101.996	6171.75	6171.24	0.50	6179.93	6180.14	6173.15	6172.74	4.03	10.602	0.013	
4	3	1.89	18	Cir	12.000	6173.18	6172.71	3.92	6181.43	6179.93	6173.68	6173.41	2.81	-86.988	0.013	
5	4	1.89	12	Cir	159.000	6179.61	6176.42	2.01	6180.77	6181.43	6180.19	6176.82	5.09	-0.620	0.012	
6	5	1.89	12	Cir	8.000	6179.78	6179.61	2.12	6182.79	6180.77	6180.36	6180.19	3.91	43.125	0.012	
7	3	5.80	18	Cir	120.000	6172.60	6172.00	0.50	6179.35	6179.93	6173.69	6173.41	3.68	3.719	0.013	
Project File: 2018-0308_STORM SEWER.stm											Number of lines: 7				Date: 03/16/18	
NOTES: ** Critical depth																

Storm Sewer Profile

PREVIOUSLY APPROVED REPORT BY MERRICK & COMPANY

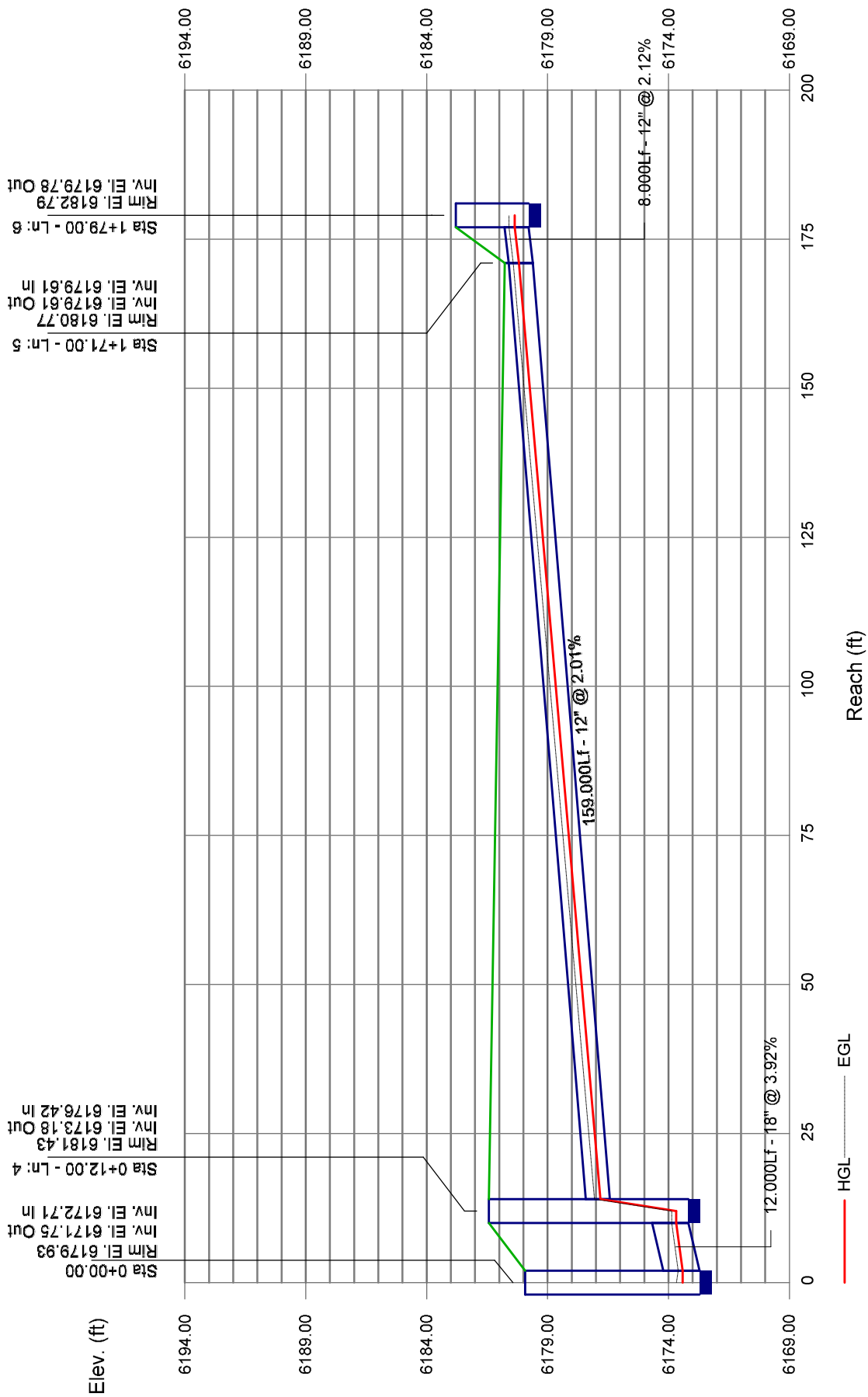
R.stm



Storm Sewer Profile

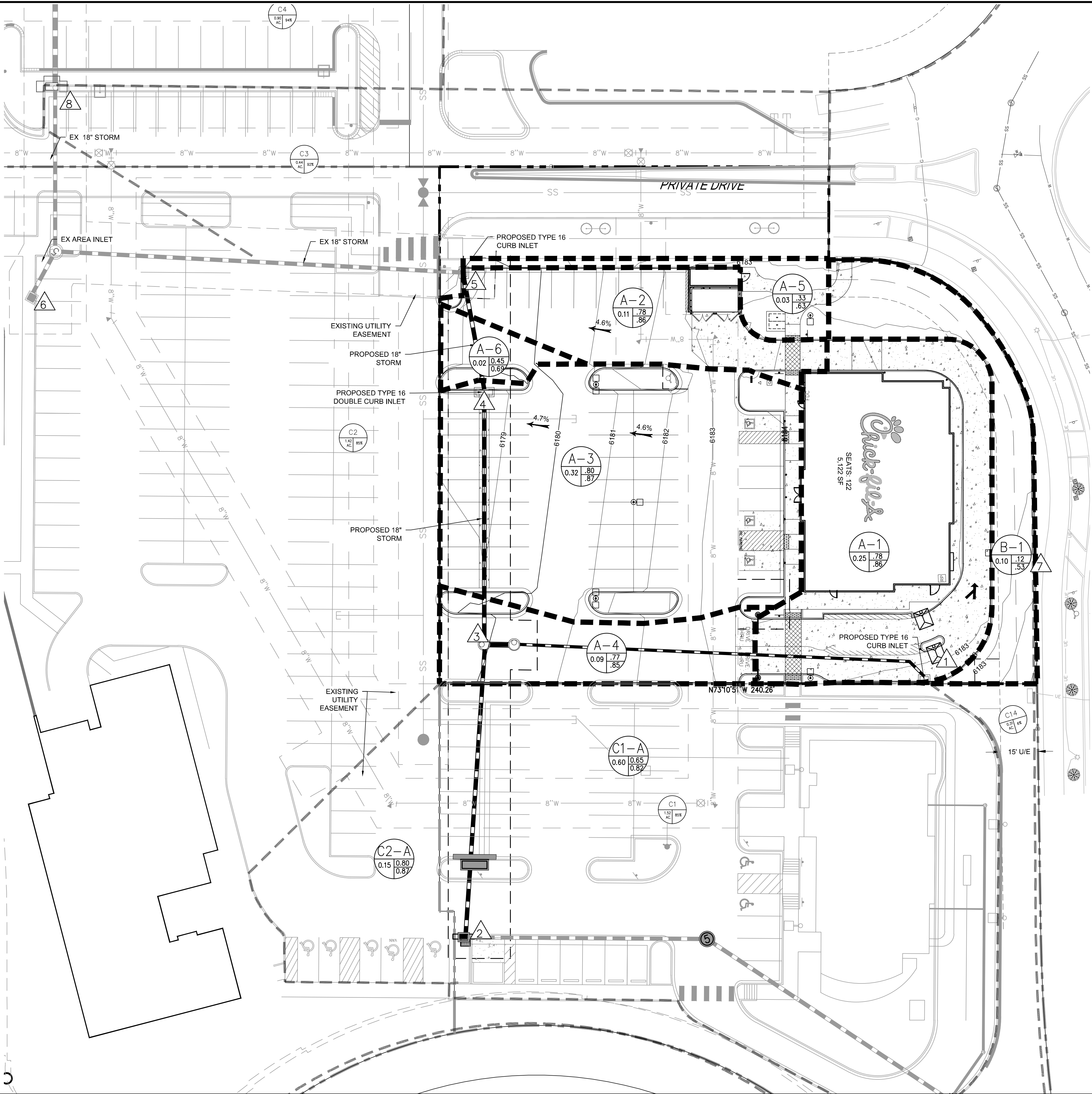
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Appendix D

(Drainage Map)



LEGEND:

- LEASE LINE
- 5555 PROPOSED MAJOR CONTOUR
- 5555 PROPOSED MINOR CONTOUR
- 5555 - EXISTING MAJOR CONTOUR
- 5555 - EXISTING MINOR CONTOUR
- DRAINAGE BASIN BOUNDARY
- △ DESIGN POINT
- FLOW ARROWS
- OFFSITE FLOW ARROWS
- STORM SEWER
- STORM INLET
- STORM MANHOLE
- ☆ EX LIGHT POLE
- EX SANITARY MANHOLE
- EX STORM MANHOLE
- EX STORM SERVICE
- EX TREE
- EX STORM INLET
- EX DRAINAGE BASIN

BASIN IDENTIFICATION

BASIN C5 VALUE

BASIN C100 VALUE

BASIN AREA (ACRES)

SUMMARY RUNOFF TABLE

BASIN	5 YEAR RUNOFF	100 YEAR RUNOFF
A1	0.95 CFS	1.90 CFS
A2	0.42 CFS	0.84 CFS
A3	1.25 CFS	2.46 CFS
A4	0.33 CFS	0.68 CFS
A5	0.05 CFS	0.18 CFS
A6	0.04 CFS	0.12 CFS
B1	0.06 CFS	0.47 CFS
C1-A	2.30 CFS	4.60 CFS
C2-A	0.60 CFS	1.20 CFS

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30349-2998

Revisions:

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MERRICK & COMPANY

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303-751-0741

STORE
CHICK-FIL-A
FSU #04027
CASTLE ROCK

CASTLE ROCK
PROMENADE,
CASTLE ROCK, CO

SHEET TITLE

DWG EDITION ---

Job No. : 65119391
Store : 04027
Date : 11/06/17
Drawn By : LV
Checked By: KW

Sheet