DRAINAGE LETTER REPORT

For

BENT GRASS COMMERCIAL FILING NO. 4

Bent Grass Market View
El Paso County, Colorado

October, 2026

PCD File No: PPR-2625

Prepared for:

Copestone General Contractors
555 Amelia Street, Suite 100
Colorado Springs, CO 80915
Contact: Nathan Derwick
(719) 578-6155

Prepared by:

Drexel, Barrell & Co.
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DRAINAGE LETTER REPORT
for
BENT GRASS COMMERCIAL FILING NO. 4

1.0 CERTIFICATION STATEMENTS

Engineer's Statement

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the city/county for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

SIGNATURE (Affix Seal): _____ 10-13-2026
For and on behalf of Drexel, Barrell & Co. Date
Katherine Varnum, P.E. #53459

COLORADO LICENSED
KATHERINE G. VARNUM
53459
PROFESSIONAL ENGINEER

Developer's Statement

I, the owner/developer have read and will comply with all of the requirements specified in this drainage report and plan.

_____ 10-13-2026
Nathan Derwick, President Date
Copestone General Contractors
555 Amelia Street, Suite 100
Colorado Springs, CO 80915

El Paso County

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

_____
Joshua J. Palmer, P.E. Date
County Engineer / ECM Administrator

Conditions:

DRAINAGE LETTER REPORT
for
BENT GRASS COMMERCIAL FILING NO. 4

2.0 PURPOSE

The purpose of this letter is to supplement the Final Drainage Report for Bent Grass East Commercial Filing No. 3 (approved November 2, 2021) with regards to the development Bent Grass Commercial Filing No. 4, a replat of Lots 4, 5, & 6 Bent Grass East Commercial Filing No. 3, in order to establish that the development is in conformance with the approved drainage design.

Runoff patterns, drainage facilities and the ability to safely pass developed runoff to historic downstream facilities shall be presented.

3.0 GENERAL SITE DESCRIPTION

Location

Bent Grass Commercial Filing No. 4 is located in Peyton, El Paso County, Colorado, within the Southeast Quarter of Section 1, Township 13 South, Range 65 West of the 6th P.M. El Paso County, Colorado. The property is bounded to the north by Bent Grass Market View, to the east is Meridian Park Drive, Tract A of Bent Grass East Commercial to the south, and Bent Grass Residential Filing No. 1 lots to the west.

Proposed Development

The proposed development is the construction of a child care facility on Lot 2, with associated parking and landscaping. The proposed disturbed area consists of 1.36 acres.

Soils

According to the Soil Survey of El Paso County Area, Colorado, prepared by the U.S. Department of Agriculture Soil Conservation Service, the site is underlain by the Columbine gravelly sandy loam (Soil No. 19), a hydrologic type A soils. See appendix for Soils map.

Climate

This area of El Paso County can be described as the foothills, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry, and summers relatively warm and dry. Precipitation ranges from 12 to 14 inches per year, with the majority of this moisture occurring in the spring and summer in the form of rainfall. Thunderstorms are common during the summer months.

Floodplain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate

Map (FIRM) Panel 08041C0553G (December 7, 2018), no portion of the site lies within a designated floodplain.

4.0 DRAINAGE CRITERIA

The drainage analysis has been prepared in accordance with the current El Paso County Drainage Criteria Manual. Calculations were performed to determine runoff quantities during the 5-year and 100-year frequency storms for existing and developed conditions using the Rational Method as required for basins containing less than 100 acres.

5.0 EXISTING CONDITION

The existing condition were initially described in the aforementioned approved Final Drainage Report for the Bent Grass East Commercial Filing No. 3 development and have been copied below. These existing conditions considered each lot to be already developed, so impervious and runoff calculations reflect these developed conditions. The proposed development will affect part of Basins B and C (see appendix for drainage report excerpts). Overlot grading has been completed, and an access roadway, detention facility and utility infrastructure have been installed. The site generally follows a 3%-5% grade from north to south and currently drains directly to the south towards the existing water quality detention facility.

Design Point 1 (Q_5=4 cfs and Q_{100}=8 cfs) represents developed flows from Basin A (lots 2 and 3 and north half of the private road). These flows will be routed towards Design Point 1 where a private 5' Type R Sump Inlet will completely collect both the 5 and 100 yr. developed flows.

Design Point 2 (Q_5=1 cfs and Q_{100}=3 cfs) represents developed flows from Basin B (portion of lots 4 and 5 and south half of the private road). These flows will be routed towards Design Point 2 where a private 5' Type R Sump Inlet will completely collect both the 5 and 100 yr. developed flows.

Design Point 3 (Q_5=7 cfs and Q_{100}=13 cfs) represents developed flows from Basin C (lots 4 and 6) and a portion of offsite Basin K (existing residential development to the west). These flows will be routed towards Design Point 3 where a private 24" RCP storm stub will collect both the 5 and 100 yr. developed flows. The individual site plans for each of these lots will show how curb and gutter will collect these developed flows and route them towards the provided 24" RCP private storm stub. These flows remain consistent with Basins L (Q_5=18 cfs and Q_{100}=35 cfs) and K (Q_5=2 cfs and Q_{100}=4 cfs) from the previous report.

Design Point 4 (Q_5=11 cfs and Q_{100}=22 cfs) represents the total developed flows that will enter the existing pond at this location (Basins A, B, C, and a portion of Basin K). A concrete forebay is proposed within the existing pond at this location with the following criteria: (See Appendix)
Per UD-BMP Spreadsheet – **Concrete Forebay sizing**
0.003 Ac-ft. or 131 SF min. Forebay with 12" high walls OR **88 SF min. with 18" high walls 4.5" wide notch at end of forebay**

Basin E (Q_5=0.3 cfs and Q_{100}=1.0 cfs) represents developed flows from Basin E (landscape/setback area within lots 1, 2, and 3) that will continue to sheet flow in a northeasterly direction and directly into Bent Grass Meadows Dr. This minor developed flow was accounted for and remains consistent with the previously approved report. Also, per ECM I.7.1.C.1.a this basin of 0.3 ac. is not practical to be captured and will not drain towards the downstream control measures.

Basin D (Q_5=3 cfs and Q_{100}=6 cfs) represents developed flows from Basin D (lots 1 and a portions of lot 5 and a portions of the private road). These flows will continue to sheet flow directly into Meridian Park Dr. They then travel as curb and gutter flows to the existing sump inlet within the cul-de-sac and then directly into the existing pond. These flows were accounted for in the previously approved drainage report and remain consistent with Basin M1 (Q_5=6 cfs and Q_{100}=11 cfs) from the previous report.

6.0 DEVELOPED CONDITION

The proposed development consists of a childcare facility and associated parking and landscaping. The proposed grading and storm system will route flows to the south where they will enter the existing private 24" RCP storm sewer and be directed towards the existing water quality detention facility, Pond 2. Which was approved as part of Bent Grass East Commercial Filing No. 2 (SF1412). The rest of the subdivision will remain undeveloped at this time.

The table below lists the developed basins and design points along with their developed flow rates. See further discussion at the end of this section for a comparison with existing flows.

DEVELOPED				
BASIN	**DP**	**Area (Ac.)**	**Q_5 (CFS)**	**Q_{100} (CFS)**
OS1	OS1	0.42	0.1	0.9
A	1	0.27	1.0	1.9
B	2	0.23	0.8	1.4
C	3	0.44	1.7	3.2
D	4	0.12	0.1	0.3
DP1+DP2+DP3+DP4	4A	1.06	3.2	6.3
E	5	0.02	0.1	0.2
F	6	0.07	0.1	0.3
G	7	0.04	0.01	0.1
H	8	0.57	2.1	3.9
I		0.84	2.7	5.3
DPOS1+I	9	1.27	2.2	4.9

Basin A is 0.27-acres of primarily parking area with some surrounding landscaping, located at the northern side of the site. The runoff generated within this basin is directed via curb and gutter as well as a concrete drainage chase towards a proposed, private, Type C area inlet located on the east side of the basin. The runoff entering the inlet, **Design Point 1**, has rates of Q_5=1.0 cfs and Q_{100}=1.9 cfs, and flows directly into the existing, private, 24" RCP storm sewer that bisects the site.

Basin B represents the 10,000 s.f. proposed single-story building, located in the middle of the site. The runoff captured on the buildings roof is directed towards the roof drains at rates of Q_5=0.8 cfs and Q_{100}=1.4 cfs before being discharged directly into the same existing, private, 24" RCP storm sewer as previously mentioned for **Basin A.**

Basin C is 0.44-acres and consists of the western parking area for the site, as well as some surrounding sidewalks and landscaping. The runoff generated within this basin has rates of Q_5=1.7 cfs and Q_{100}=3.2 cfs and is directed south via a combination of curb and gutters as well as a concrete drainage chase. Eventually the runoff is captured by a proposed, private, 5' Type R curb inlet located at the southern end of the site, **Design Point 3**. After being captured at **DP3** the runoff is directed east via a proposed, private, 18" RCP storm sewer before joining the same existing, private, 24" RCP storm sewer mentioned for the previous basins.

Basin D consists of 0.12-acres of playground and patio area directly south of **Basin B**. The runoff from this basin will sheet flow south, where it is captured by a proposed, private 6" PVC trench drain along the southern edge of the playground. The runoff, with rates of Q_5=0.1 cfs and Q_{100}=0.3 cfs, is then directed east joining the same existing, private, 24" RCP storm sewer mentioned for the previous basins.

Design Point 4A represents all the runoff from the site that will be entering the existing storm sewer system that runs north to south through the site. The runoff from the site that combines at **DP4A** has rates of Q_5=3.2 cfs and Q_{100}=6.3 cfs and continues south within the private 30" RCP storm sewer before being discharged into Pond 2 (SP-20-010).

Basin E consists of a proposed 5' sidewalk that will run along the southern side of Bent Grass Market View. This 0.02-acre basin directs runoff with rates of Q_5=0.1 cfs and Q_{100}=0.2 cfs, directly into Bent Grass Market View, where it will travel east via curb and gutter towards an existing, private, 5' Type R sump inlet. This runoff from the site was already accounted for in the original Bent Grass East Commercial Filing No. 3 Drainage Report. See Appendix for inlet calculations.

Basin F is a relatively small, 0.07-acre, basin that runs down the east side of the proposed building and playground, **Basin B** and **Basin D**. This basin creates runoff with rates of Q_5=0.1 cfs and Q_{100}=0.3 cfs, that will be directed east and south. Eventually this runoff will be directly discharged into the existing, private, detention pond.

Basin G is 0.04-acres located along the southern side of the site and is made up of landscaped area. This basin creates runoff rates of Q_5=0.01 cfs and Q_{100}=0.1 cfs, this runoff sheet flows to the south before being directly discharged into the existing, private, detention pond directly south of the site.

Basin H represents the eastern portion of the site which will remain undisturbed for this development. This 0.57-acre basin produces runoff with rates of Q_5=2.1 cfs and Q_{100}=3.9 cfs, whose drainage pattern will remain unchanged from the previous report. Runoff sheet flows into Lot 3B of Bent Grass East Commercial Filing No. 2B.

Basin OS1 is a 0.42-acre offsite basin that is located along the western boundary of the site, containing the backyards of a number of residential lots from the Bent Grass

Residential Filing No. 1 development. This basin creates runoff with rates of Q_5=0.1 cfs and Q_{100}=0.9 cfs that are directed southeast, sheet flowing into **Basin I** through **Design Point OS1 (DPOS1)**.

Basin I represents the western portion of the site which will remain largely undisturbed for the development, aside from a concrete pad being added to the southeast corner of the basin to act as a vehicle turnaround. This 0.84-acre basin creates runoff with rates of Q_5=2.7 cfs and Q_{100}=5.3 cfs that follows the same drainage pattern as described in the

previous drainage report, flowing south and discharging directly into the detention pond south of the site.

Flow Comparison

Comparison Flows					
Existing	**Q5**	**Q100**	**Developed**	**Q5**	**Q100**
DP3	7.0	13.0	DP4A+DP6-7+DP9	5.5	11.6
Basin D	3.0	6.0	DP8	2.1	3.9

The above table shows the comparison of existing vs. proposed flows leaving the site. As indicated, developed flows are less than those calculated in the existing conditions.

7.0 FOUR STEP PROCESS

This project conforms to the El Paso County Four Step Process. The process for this site focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

1. ***Employ Runoff Reduction Practices*:** Proposed impervious areas on this site (roofs, asphalt/sidewalk) will sheet flow across landscaped ground as much as possible to slow runoff and increase time of concentration prior to being conveyed to the proposed public streets and storm sewer system. This will minimize directly connected impervious areas within the project site.

2. ***Implement BMP's that provide a Water Quality Capture Volume with slow release*:** Runoff from this project will be routed through onsite storm sewer to an existing detention basin, Pond 2 (SP-20-010), to the south This will allow for the runoff to be treated for water quality before discharging into the offsite storm system.

3. ***Stabilize Drainage Ways*:** No drainage ways exist within the project boundaries. Runoff will enter the storm sewer system, and be directed towards the existing detention basin, Pond 2 (SP-20-010), to the south, this will allow for flow rate reduction and protection of downstream facilities.

4. ***Implement Site Specific and Other Source Control BMP's*:** Standard commercial source control will be utilized in order to minimize potential pollutants entering the storm system. Example source control measures consist of: indoor storage of chemicals; and trash receptacles in common areas.

8.0 DRAINAGE & BRIDGE FEES

All Basin and Bridge fees were paid with the Final Plat for Bent Grass East Commercial Filing No. 3 "R15062". No additional Basin nor Bridge fees are required.

Based on the developments associated with this drainage report, the total runoff reaching the existing detention basin, Pond 2 (SP-20-010), as well as the overall imperviousness of the site will be slightly reduced. Due to these reductions, there are no updates nor upgrades that are necessary for the existing Pond 2. See appendix for Pond and Forebay calculations.

9.0 SUMMARY

Development of Bent Grass Commercial Filing No. 4 will not adversely affect surrounding or downstream developments. All the of the developed flows being generated on, and subsequently leaving the site are less than those anticipated in the initial Final Drainage Report and analysis of the existing storm system that conveys the flows to the south has determined that the storm system adequately sized to accommodate the flows from the site. Therefore, it is acceptable to state that the drainage design for Bent Grass Commercial Filing No. 4 is in conformance with the Final Drainage Report from the original Bent Grass East Commercial Filing No. 3.

The downstream existing detention facility is functioning as intended and was designed to treat flows generated by this property.

10.0 REFERENCES

The sources of information used in the development of this study are listed below:

1. El Paso County Drainage Criteria Manual, 10-31-2018.

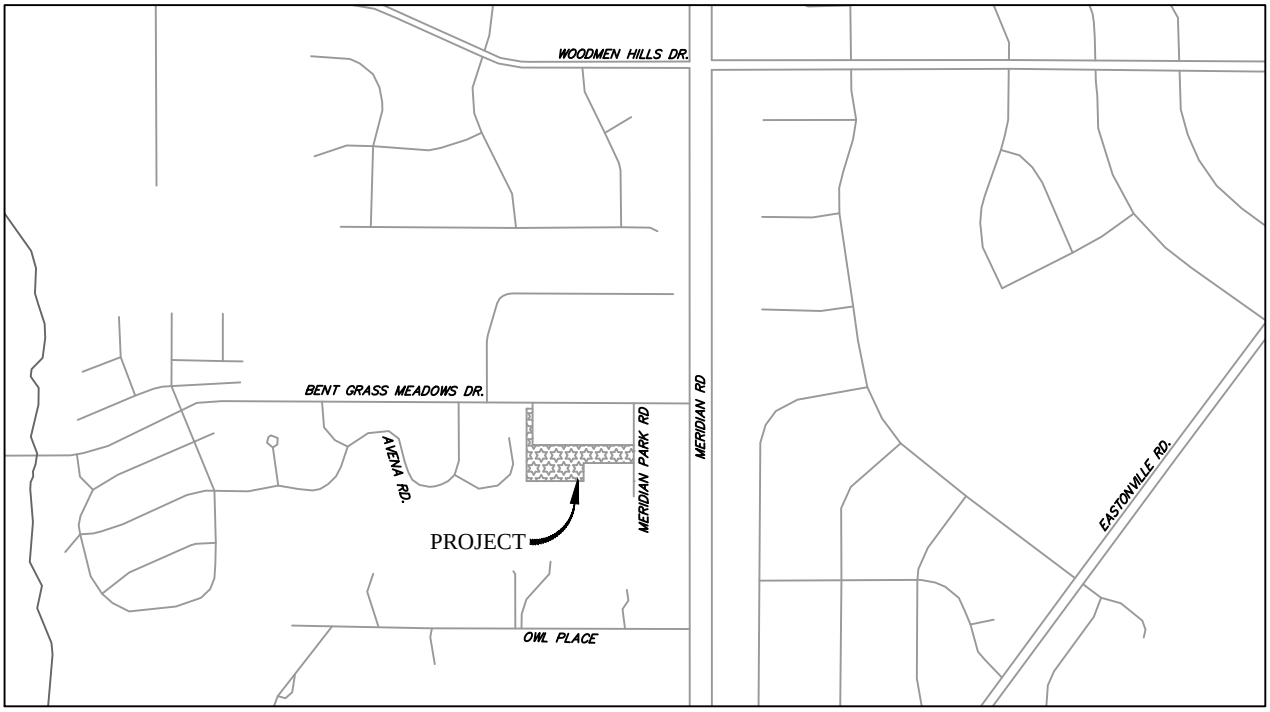
2. El Paso County Land Development Code, 5-25-2023.

3. Final Drainage Report for Bent Grass East Commercial Filing No. 3 (Classic Consulting) 11-02-2021. Amended 4-21-2022

4. United States Department of Agriculture – National Resources Conservation Service. Web Soil Survey.

5. Federal Emergency Management Agency (FEMA) Flood Map Service Center.

Appendix



Vicinity Map

Not to scale

BENT GRASS COMMERCIAL
EL PASO COUNTY, CO
VICINITY MAP

Drexel, Barrell & Co.
Engineers • Surveyors

DATE:

JOB NO: 21814–01CSCV

DWG. NO. VMAP

SHEET 1 OF 1

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for

El Paso County Area, Colorado

August 12, 2026

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,220 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 23, 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: Jul 23, 2024—Aug 4, 2024

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
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	2.5	100.0%
Totals for Area of Interest		**2.5**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Columbine

Setting

Landform: Fans, Fan terraces, Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

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

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

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

National Flood Hazard Layer FIRMette

FEMA

104°36'56"W 38°57'10"N

104°36'19"W 38°56'42"N

Feet

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

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

SPECIAL FLOOD HAZARD AREAS

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

OTHER AREAS OF FLOOD HAZARD

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

OTHER AREAS

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

GENERAL STRUCTURES

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

OTHER FEATURES

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

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/12/2026 at 8:55 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.

EXISTING RUNOFF CALCULATIONS FROM BENT GRASS EAST COMMERCIAL FILING NO. 3 (SF2147)

JOB NAME: *BENT GRASS EAST COMMERCIAL FILING NO. 3*
JOB NUMBER: *2177.64*
DATE: *11/04/20*
CALCULATED BY: *MAW*

FINAL DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS AREA / STREETS				LANDSCAPE/UNDEVELOPED AREAS				WEIGHTED			WEIGHTED CA		
		AREA (AC)	C(2)	C(5)	C(100)	AREA (AC)	C(2)	C(5)	C(100)	C(2)	C(5)	C(100)	**CA(2)**	**CA(5)**	**CA(100)**
A	1.4	1.10	0.89	0.90	0.96	0.30	0.02	0.08	0.35	0.70	0.72	0.83	**0.99**	**1.01**	**1.16**
B	0.4	0.30	0.89	0.90	0.96	0.10	0.02	0.08	0.35	0.67	0.70	0.81	**0.27**	**0.28**	**0.32**
C	2.0	1.60	0.89	0.90	0.96	0.40	0.02	0.08	0.35	0.72	0.74	0.84	**1.43**	**1.47**	**1.68**
D	0.9	0.75	0.89	0.90	0.96	0.15	0.02	0.08	0.35	0.75	0.76	0.86	**0.67**	**0.69**	**0.77**
E	0.3	0.05	0.89	0.90	0.96	0.25	0.02	0.08	0.35	0.17	0.22	0.45	**0.05**	**0.07**	**0.14**
K	1.0	0.35	0.89	0.90	0.96	0.65	0.02	0.08	0.35	0.32	0.37	0.56	**0.32**	**0.37**	**0.56**

JOB NAME:	*BENT GRASS EAST COMMERCIAL FILING NO. 3*
JOB NUMBER:	*2177.64*
DATE:	*11/04/20*
CALC'D BY:	*MAW*

EXISTING RUNOFF CALCULATIONS FROM BENT GRASS EAST COMMERCIAL FILING NO. 3 (SF2147)

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}}$$

$$V = C_v S_w^{0.5}$$

Tc=L/V

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

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

*For buried riprap, select C_v value based on type of vegetative cover.

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	TOTAL AREA (AC)	WEIGHTED CA(2)	CA(5)	CA(100)	OVERLAND C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(2) (in/hr)	I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(2) (cfs)	Q(5) (cfs)	Q(100) (cfs)
A	1.4	0.99	1.01	1.16	0.08	30	2	5.4	250	2.0%	1.0	4.2	9.6	3.34	4.19	7.03	3	**4**	**8**
B	0.4	0.27	0.28	0.32	0.08	10	0.2	4.6	100	1.5%	0.9	1.9	6.6	3.79	4.76	7.99	1	**1**	**3**
C	2.0	1.43	1.47	1.68	0.08	30	1.5	5.9	400	2.0%	1.0	6.7	12.7	3.01	3.77	6.34	4	**6**	**11**
D	0.9	0.67	0.69	0.77	0.08	10	0.2	4.6	200	2.0%	1.4	2.4	7.0	3.72	4.67	7.83	2	**3**	**6**
E	0.3	0.05	0.07	0.14	0.08	25	0.5	7.3					7.3	3.67	4.60	7.72	0.2	**0.3**	**1.0**
K	1.0	0.32	0.37	0.56	0.08	65	3	9.0					9.0	3.43	4.29	7.21	1	**2**	**4**

EXISTING RUNOFF CALCULATIONS FROM BENT GRASS EAST COMMERCIAL FILING NO. 3 (SF2147)

JOB NAME: *BENT GRASS EAST COMMERCIAL FILING NO. 3*
JOB NUMBER: *2177.64*
DATE: *11/04/20*
CALCULATED BY: *MAW*

FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Outfall / Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
1	A	1.01	1.16	9.6	4.19	7.03	4	8	5' Type R Sump Inlet
2	B	0.28	0.32	6.6	4.76	7.99	1	3	5' Type R Sump Inlet
3	C, 70% K	1.73	2.07	12.7	3.77	6.34	7	13	24" RCP Stub
4	A, B, C, 70% K	3.02	3.55	12.8	3.76	6.32	11	22	Concrete Forebay

PROJECT INFORMATION

PROJECT:	Bent Grass Commerci
PROJECT NO:	21814-01CSCV
DESIGN BY:	CGH
REV. BY:	KGV
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	10/13/2026

Drexel, Barrell & Co.

	C2*	C5*	C10*	C100*	% IMPERV
Roofs		0.73		0.81	90
Lawns/Landscaping		0.08		0.35	0
Business-Commercial Areas		0.81		0.88	95
Drive and Walks		0.90		0.96	100

*C-Values and Basin Imperviousness based on Table 6-6, City of Colorado Springs Drainage Criteria Manual

SUB-BASIN	SURFACE DESIGNATION	AREA ACRE	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	% IMPERV
DEVELOPED							
OS1	Roofs	*0.00*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.42*		*0.08*		*0.35*	*0*
	Business-Commercial Areas	*0.00*		*0.81*		*0.88*	*95*
	Drive and Walks	*0.00*		*0.90*		*0.96*	*100*
OS1 TOTAL	*WEIGHTED AVERAGE*	0.42		0.08		0.35	0
A	Roofs	*0.00*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.07*		*0.08*		*0.35*	*0*
	Business-Commercial Areas	*0.00*		*0.81*		*0.88*	*95*
	Drive and Walks	*0.21*		*0.90*		*0.96*	*100*
A TOTAL	*WEIGHTED AVERAGE*	0.27		0.70		0.81	75
B	Roofs	*0.23*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.00*		*0.08*		*0.35*	*0*
	Business-Commercial Areas	*0.00*		*0.81*		*0.88*	*95*
	Drive and Walks	*0.00*		*0.90*		*0.96*	*100*
B TOTAL	*WEIGHTED AVERAGE*	0.23		0.73		0.81	90
C	Roofs	*0.00*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.08*		*0.08*		*0.35*	*0*
	Business-Commercial Areas	*0.00*		*0.81*		*0.88*	*95*
	Drive and Walks	*0.36*		*0.90*		*0.96*	*100*
C TOTAL	*WEIGHTED AVERAGE*	0.44		0.76		0.86	83
D	Roofs	*0.00*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.10*		*0.08*		*0.35*	*0*
	Business-Commercial Areas	*0.00*		*0.81*		*0.88*	*95*
	Drive and Walks	*0.02*		*0.90*		*0.96*	*100*
D TOTAL	*WEIGHTED AVERAGE*	0.12		0.20		0.44	15
E	Roofs	*0.00*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.00*		*0.08*		*0.35*	*0*

PROJECT INFORMATION

PROJECT:	Bent Grass Commerci
PROJECT NO:	21814-01CSCV
DESIGN BY:	CGH
REV. BY:	KGV
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	10/13/2026

Drexel, Barrell & Co.

	C2*	C5*	C10*	C100*	% IMPERV
Roofs		0.73		0.81	90
Lawns/Landscaping		0.08		0.35	0
Business-Commercial Areas		0.81		0.88	95
Drive and Walks		0.90		0.96	100

*C-Values and Basin Imperviousness based on Table 6-6, City of Colorado Springs Drainage Criteria Manual

SUB-BASIN	SURFACE DESIGNATION	AREA ACRE	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	% IMPERV
DEVELOPED							
	Business-Commercial Areas	*0.00*		*0.81*		*0.88*	*95*
	Drive and Walks	*0.02*		*0.90*		*0.96*	*100*
E TOTAL	*WEIGHTED AVERAGE*	0.02		0.90		0.96	100
F	Roofs	*0.00*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.05*		*0.08*		*0.35*	*0*
	Business-Commercial Areas	*0.00*		*0.81*		*0.88*	*95*
	Drive and Walks	*0.02*		*0.90*		*0.96*	*100*
F TOTAL	*WEIGHTED AVERAGE*	0.07		0.29		0.51	26
G	Roofs	*0.00*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.04*		*0.08*		*0.35*	*0*
	Business-Commercial Areas	*0.00*		*0.81*		*0.88*	*95*
	Drive and Walks	*0.00*		*0.90*		*0.96*	*100*
G TOTAL	*WEIGHTED AVERAGE*	0.04		0.08		0.35	0
H	Roofs	*0.00*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.07*		*0.08*		*0.35*	*0*
	Business-Commercial Areas	*0.49*		*0.81*		*0.88*	*95*
	Drive and Walks	*0.00*		*0.90*		*0.96*	*100*
H TOTAL	*WEIGHTED AVERAGE*	0.57		0.71		0.81	83
I	Roofs	*0.00*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.17*		*0.08*		*0.35*	*0*
	Business-Commercial Areas	*0.67*		*0.81*		*0.88*	*95*
	Drive and Walks	*0.01*		*0.90*		*0.96*	*100*
I TOTAL	*WEIGHTED AVERAGE*	0.84		0.67		0.78	76
TOTALS (A-I)		2.60		0.66		0.78	74.9

PROJECT INFORMATION

PROJECT:	Bent Grass Commercial
PROJECT NO:	21814-01CSCV
DESIGN BY:	CGH
REV. BY:	KGV
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	10/13/2026

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

DEVELOPED **TIME OF CONCENTRATION STANDARD FORM SF-2**

SUB-BASIN DATA					CA		INITIAL/OVERLAND TIME (t_i)			TRAVEL TIME (t_t)				TIME OF CONC. t_c		FINAL t_c
BASIN	DESIGN PT:	C_5	C_{100}	AREA	*5*	*100*	LENGTH	SLOPE	t_i	LENGTH	SLOPE	VEL.	t_t	COMP.	*MINIMUM*	
				Ac			Ft	%	Min	Ft	%	FPS	Min	t_c	t_c	Min
DEVELOPED																
OS1	**OS1**	0.08	0.35	0.42	*0.03*	*0.15*	100	3.7	12.3	256	2.7	8.5	0.5	12.8	*5.0*	**12.8**
A	**1**	0.70	0.81	0.27	*0.19*	*0.22*	50	4.4	3.2	180	2.4	9.0	0.3	3.6	*5.0*	**5.0**
B	**2**	0.73	0.81	0.23	*0.17*	*0.19*	70	0.5	7.3	70	0.5	5.5	0.2	7.5	*5.0*	**7.5**
C	**3**	0.76	0.86	0.44	*0.33*	*0.38*	50	3.8	2.9	290	2.2	8.6	0.6	3.5	*5.0*	**5.0**
D	**4**	0.20	0.44	0.12	*0.02*	*0.05*	55	2.0	9.9	55	1.4	5.6	0.2	10.1	*5.0*	**10.1**
DP1+DP2+DP3+DP4	**4A**	0.68	0.79	1.06	*0.71*	*0.83*	From DP-2			65	1.0	7.2	0.2	7.7	*5.0*	**7.7**
E	**5**	0.90	0.96	0.02	*0.02*	*0.02*	20	2.0	1.3	20	3.0	13.5	0.0	1.4	*5.0*	**5.0**
F	**6**	0.29	0.51	0.07	*0.02*	*0.04*	25	2.0	6.0	75	4.4	12.2	0.1	6.1	*5.0*	**6.1**
G	**7**	0.08	0.35	0.04	*0.00*	*0.01*	31	1.8	8.8	31	11.6	16.0	0.0	8.8	*5.0*	**8.8**
H	**8**	0.71	0.81	0.57	*0.40*	*0.46*	100	7.6	3.7	105	2.7	7.0	0.3	3.9	*5.0*	**5.0**
I		0.67	0.78	0.84	*0.56*	*0.66*	100	5.0	4.7	508	2.7	7.0	1.2	5.9	*5.0*	**5.9**
DPOS1+I	**9**	0.47	0.63	1.27	*0.60*	*0.80*	From Basin H			45	6.9	7.0	0.1	12.9	*5.0*	**12.9**

PROJECT INFORMATION

PROJECT:	Bent Grass Commercial
PROJECT NO:	21814-01CSCV
DESIGN BY:	CGH
REV. BY:	KGV
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	10/13/2026

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

DEVELOPED RUNOFF 5 YR STORM P1= 1.50

BASIN (S)	DIRECT RUNOFF						
	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)
DEVELOPED							
OS1	OS1	0.42	0.08	12.8	0.03	3.66	**0.1**
A	1	0.27	0.70	5.0	0.19	5.09	**1.0**
B	2	0.23	0.73	7.5	0.17	4.51	**0.8**
C	3	0.44	0.76	5.0	0.33	5.09	**1.7**
D	4	0.12	0.20	10.1	0.02	4.05	**0.1**
DP1+DP2+DP3+DP4	4A	1.06	0.68	7.7	0.71	4.48	**3.2**
E	5	0.02	0.90	5.0	0.02	5.09	**0.1**
F	6	0.07	0.29	6.1	0.02	4.81	**0.1**
G	7	0.04	0.08	8.8	0.00	4.26	**0.01**
H	8	0.57	0.71	5.0	0.40	5.09	**2.1**
I		0.84	0.67	5.9	0.56	4.85	**2.7**
DPOS1+I	9	1.27	0.47	12.9	0.60	3.65	**2.2**

PROJECT INFORMATION

PROJECT:	Bent Grass Commercial
PROJECT NO:	21814-01CSCV
DESIGN BY:	CGH
REV. BY:	KGV
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	10/13/2026

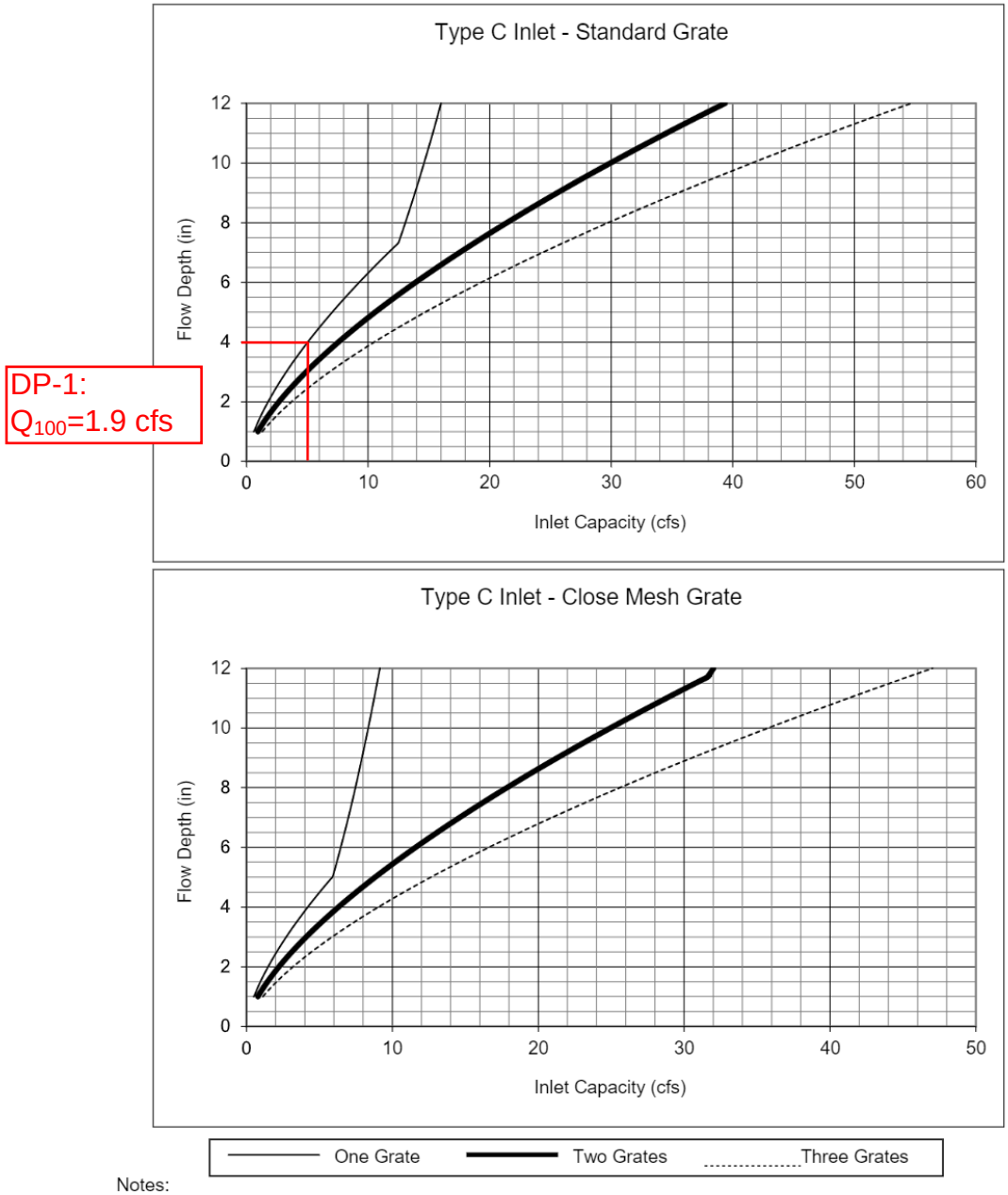
Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

DEVELOPED RUNOFF 100 YR STORM P1= 2.52

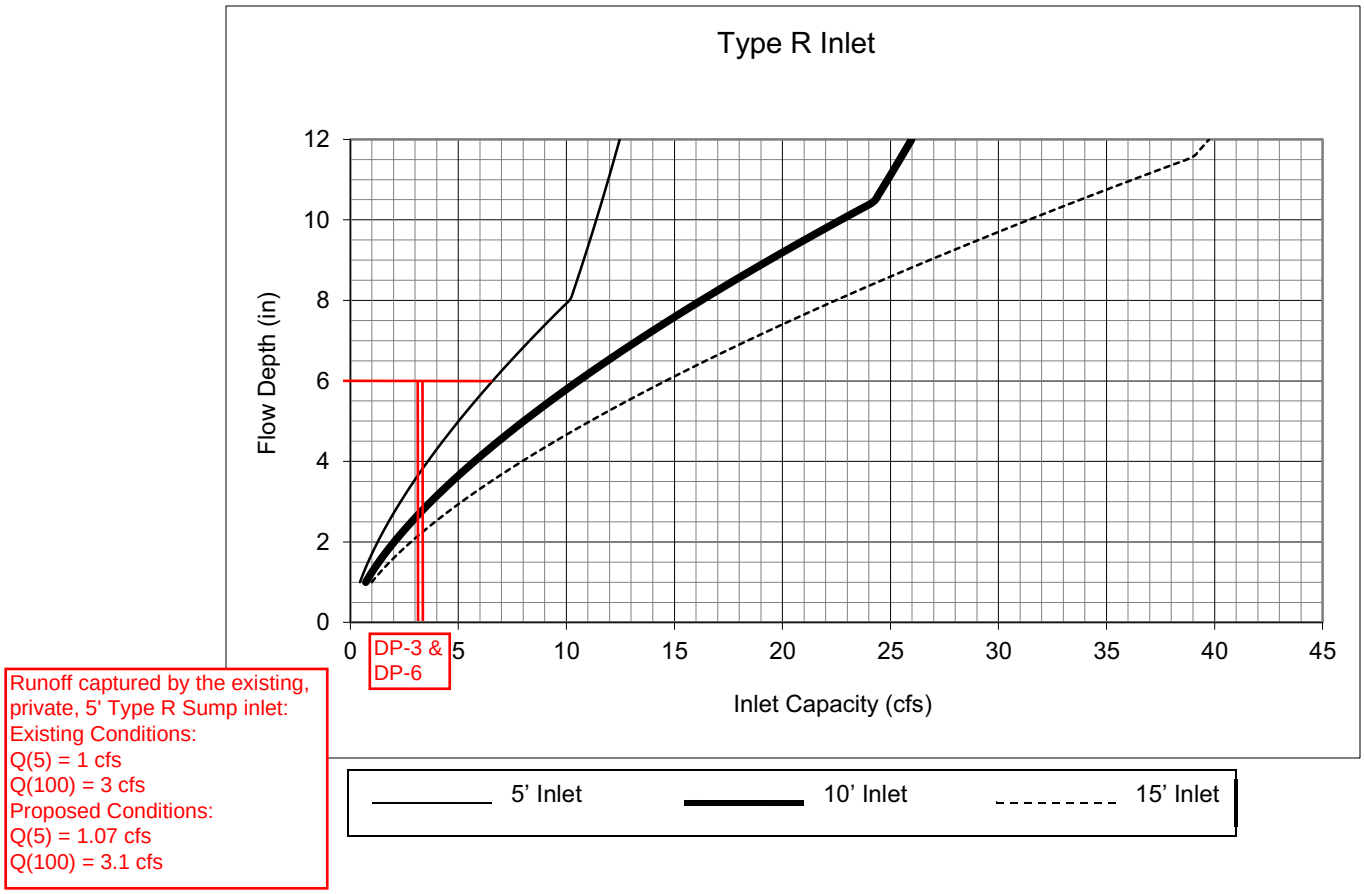
BASIN (S)	DIRECT RUNOFF						
	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)
DEVELOPED							
OS1	OS1	0.42	0.35	12.8	0.15	6.15	**0.9**
A	1	0.27	0.81	5.0	0.22	8.55	**1.9**
B	2	0.23	0.81	7.5	0.19	7.57	**1.4**
C	3	0.44	0.86	5.0	0.38	8.55	**3.2**
D	4	0.12	0.44	10.1	0.05	6.80	**0.3**
DP1+DP2+DP3+DP4	4A	1.06	0.79	7.7	0.83	7.52	**6.3**
E	5	0.02	0.96	5.0	0.02	8.55	**0.2**
F	6	0.07	0.51	6.1	0.04	8.09	**0.3**
G	7	0.04	0.35	8.8	0.01	7.15	**0.1**
H	8	0.57	0.81	5.0	0.46	8.55	**3.9**
I		0.84	0.78	5.9	0.66	8.15	**5.3**
DPOS1+I	9	1.27	0.63	12.9	0.80	6.13	**4.9**

Figure 8-10. Inlet Capacity Chart Sump Conditions, Area (Type C) Inlet



Notes:
1. The standard inlet parameters must apply to use these charts.

Figure 8-11. Inlet Capacity Chart Sump Conditions , Curb Opening (Type R) Inlet



Notes:

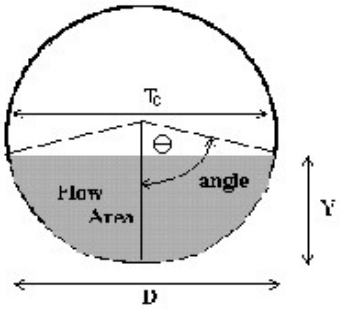
1. The standard inlet parameters must apply to use this chart.

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: BENT GRASS EAST COMMERCIAL FILING NO. 3

Pipe ID: 24" RCP (DP-1 & DP-2)



Design Information (Input)			
Pipe Invert Slope	So =	0.0100	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	24.00	inches
Design discharge	Q =	10.00	cfs

Full-Flow Capacity (Calculated)			
Full-flow area	Af =	3.14	sq ft
Full-flow wetted perimeter	Pf =	6.28	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	22.68	cfs

Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.50	radians
Flow area	An =	1.43	sq ft
Top width	Tn =	2.00	ft
Wetted perimeter	Pn =	3.00	ft
Flow depth	Yn =	0.93	ft
Flow velocity	Vn =	6.99	fps
Discharge	Qn =	10.00	cfs
Percent of Full Flow	Flow =	44.1%	of full flow
Normal Depth Froude Number	Fr_n =	1.46	supercritical

Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.70	radians
Critical flow area	Ac =	1.83	sq ft
Critical top width	Tc =	1.98	ft
Critical flow depth	Yc =	1.13	ft
Critical flow velocity	Vc =	5.46	fps
Critical Depth Froude Number	Fr_c =	1.00	

New Runoff Rates from site with this development will be:
Q(5) = 5.1 cfs
Q(100) = 10.2 cfs

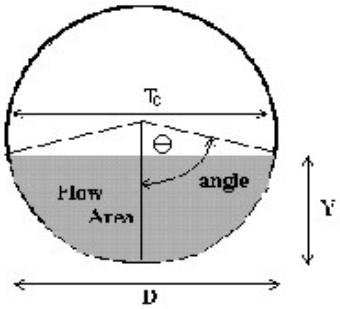
Existing Designed runoff rates are 10 cfs, with the modification of flows from the site (DP6), pipe capacity will still be well below the maximum capacity of 22.68 cfs

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: BENT GRASS EAST COMMERCIAL FILING NO. 3

Pipe ID: 24" RCP (DP-3)



Design Information (Input)			
Pipe Invert Slope	So =	0.0100	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	24.00	inches
Design discharge	Q =	13.00	cfs

Full-Flow Capacity (Calculated)			
Full-flow area	Af =	3.14	sq ft
Full-flow wetted perimeter	Pf =	6.28	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	22.68	cfs

Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.66	radians
Flow area	An =	1.74	sq ft
Top width	Tn =	1.99	ft
Wetted perimeter	Pn =	3.31	ft
Flow depth	Yn =	1.09	ft
Flow velocity	Vn =	7.47	fps
Discharge	Qn =	13.00	cfs
Percent of Full Flow	Flow =	57.3%	of full flow
Normal Depth Froude Number	Fr_n =	1.41	supercritical

Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.87	radians
Critical flow area	Ac =	2.16	sq ft
Critical top width	Tc =	1.91	ft
Critical flow depth	Yc =	1.30	ft
Critical flow velocity	Vc =	6.03	fps
Critical Depth Froude Number	Fr_c =	1.00	

New Runoff Rates from site with this development will be:
Q(5) = 6.9 cfs
Q(100) = 13.5 cfs

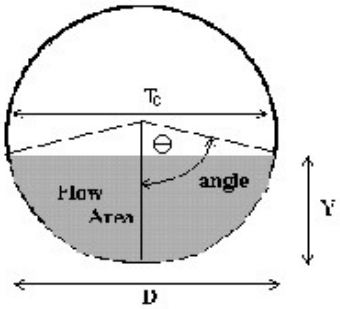
Existing Designed runoff rates are 13 cfs, with the modification of flows from the site (DP1 & DP2), pipe capacity will still be well below the maximum capacity of 22.68 cfs

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: BENT GRASS EAST COMMERCIAL FILING NO. 3

Pipe ID: 30" RCP (DP-4)



Design Information (Input)			
Pipe Invert Slope	So =	0.0100	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	30.00	inches
Design discharge	Q =	22.00	cfs

Full-Flow Capacity (Calculated)			
Full-flow area	Af =	4.91	sq ft
Full-flow wetted perimeter	Pf =	7.85	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	41.13	cfs

Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.61	radians
Flow area	An =	2.58	sq ft
Top width	Tn =	2.50	ft
Wetted perimeter	Pn =	4.03	ft
Flow depth	Yn =	1.30	ft
Flow velocity	Vn =	8.52	fps
Discharge	Qn =	22.00	cfs
Percent of Full Flow	Flow =	53.5%	of full flow
Normal Depth Froude Number	Fr_n =	1.48	supercritical

Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.85	radians
Critical flow area	Ac =	3.31	sq ft
Critical top width	Tc =	2.40	ft
Critical flow depth	Yc =	1.59	ft
Critical flow velocity	Vc =	6.66	fps
Critical Depth Froude Number	Fr_c =	1.00	

New Runoff Rates from site with this development will be:
Q(5) = 8.3 cfs
Q(100) = 16.5 cfs

Existing Designed runoff rates are 22 cfs, with the modification of flows from the site (DP3A), pipe capacity will still be well below the maximum capacity of 41.13 cfs

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**Marc A. Whorton, P.E.**
Company:	**Classic Consulting**
Date:	**November 4, 2020**
Project:	**Bent Grass East Commercial Filing No. 3**
Location:	**Exist. Pond - Proposed Forebay for Commercial Development**

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 90.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.900

C) Contributing Watershed Area — Area = 4.500 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.42 in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- ○ Water Quality Capture Volume (WQCV)
- ◉ Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$) — V_{DESIGN}= ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$= 0.147 ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$= ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
- i) Percentage of Watershed consisting of Type A Soils — HSG_A = 0 %
- ii) Percentage of Watershed consisting of Type B Soils — HSG_B = 100 %
- iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = 0 %

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.455 ac-f t

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired) — $EURV_{DESIGN\ USER}$= ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 4.00 ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 2% of the WQCV) — V_{FMIN} = 0.003 ac-ft

B) Actual Forebay Volume — V_F = 0.003 ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 22.00 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 0.44 cfs

E) Forebay Discharge Design

Choose One
- ○ Berm With Pipe
- ◉ Wall with Rect. Notch
- ○ Wall with V-Notch Weir

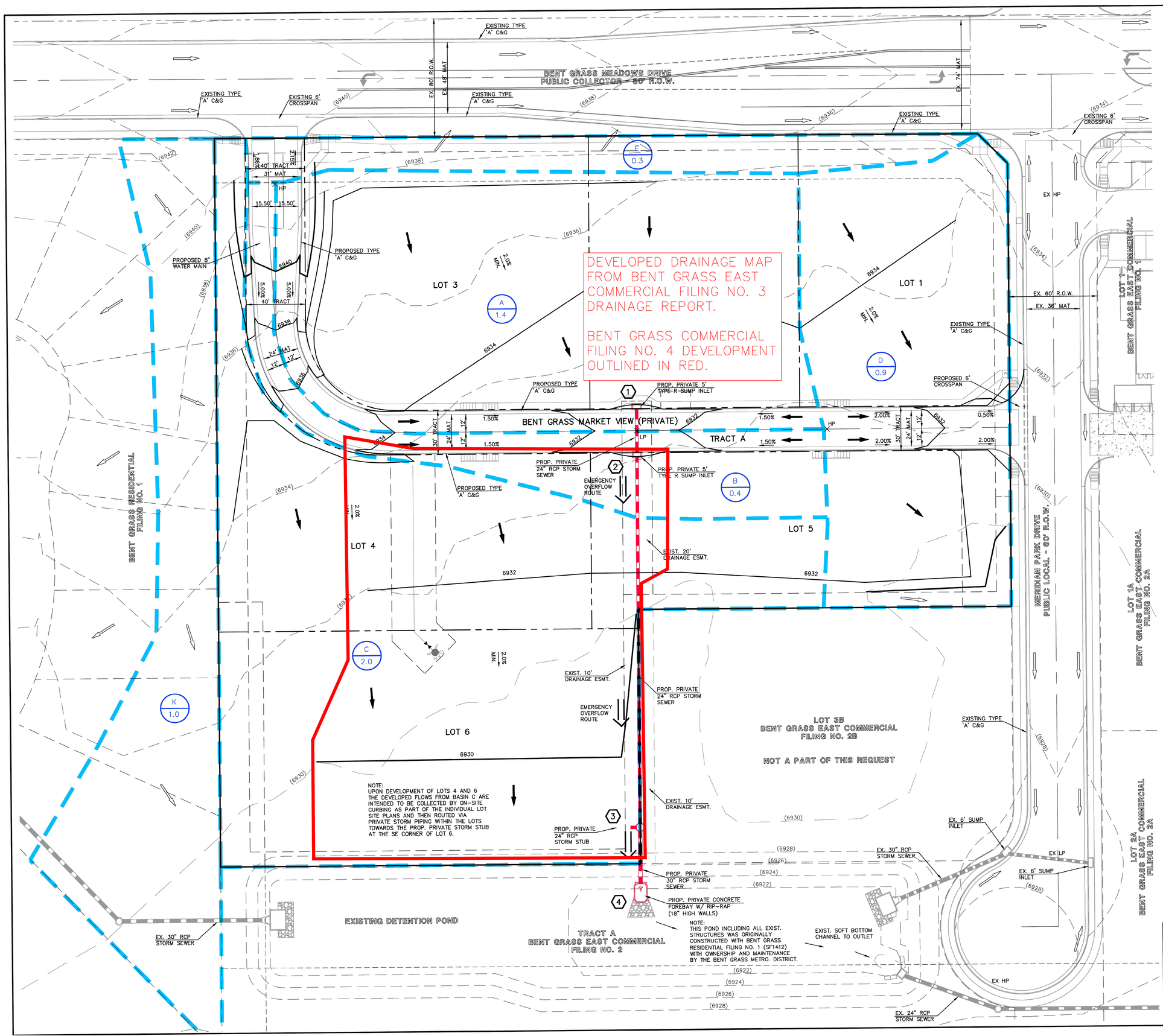
Flow too small for berm w/ pipe

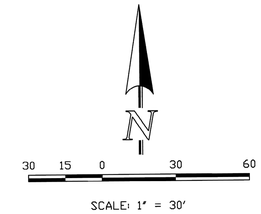
F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = in

G) Rectangular Notch Width — Calculated W_N = 4.5 in

New Runoff Rates from site with this development will be:
Q(5) = 8.3 cfs
Q(100) = 16.5 cfs

Existing Designed runoff rates are 22 cfs, with the modification of flows from the site (DP3A), pond capacity will be well below the current rates of 22 cfs





LEGEND

DESCRIPTION	SYMBOL
PROPOSED CONTOUR-10	7090
PROPOSED CONTOUR-2	
EXISTING CONTOUR-10	(7090)
EXISTING CONTOUR-2	
PROPERTY LINE	
BOUNDARY LINE	
PROPOSED PRIVATE STORM SEWER	
PROPOSED PRIVATE STORM INLET	
EXISTING STORM SEWER	
EXISTING STORM INLET	
EXISTING FLOW DIRECTION	
PROPOSED FLOW	
HIGH POINT	HP
LOW POINT	LP
OVERFLOW ROUTE	
BASIN IDENTIFIER / AREA IN ACRES	B 0.4
DESIGN POINT	1
DRAINAGE BASIN	

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	TOTAL AREA (AC)	WEIGHTED CA(2)	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	STREET / CHANNEL FLOW Slope (%)	STREET / CHANNEL FLOW Velocity (fps)	STREET / CHANNEL FLOW Tc (min)	Tc TOTAL (min)	INTENSITY I(2) (in/hr)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(2) (cfs)	TOTAL FLOWS Q(5) (cfs)	TOTAL FLOWS Q(100) (cfs)
A	1.4	0.99	1.01	1.16	0.08	30	2	5.4	250	2.0%	1.0	4.2	9.6	3.34	4.19	7.03	3	4	8
B	0.4	0.27	0.28	0.32	0.08	10	0.2	4.6	100	1.5%	0.9	1.9	6.6	3.79	4.76	7.99	1	1	3
C	2.0	1.43	1.47	1.68	0.08	30	1.5	5.9	400	2.0%	1.0	6.7	12.7	3.01	3.77	6.34	4	6	11
D	0.9	0.67	0.69	0.77	0.08	10	0.2	4.6	200	2.0%	1.4	2.4	7.0	3.72	4.67	7.83	2	3	6
E	0.3	0.05	0.07	0.14	0.08	25	0.5	7.3					7.3	3.67	4.60	7.72	0.2	0.3	1.0
K	1.0	0.32	0.37	0.50	0.08	65	3	9.0					9.0	3.43	4.29	7.21	1	2	4

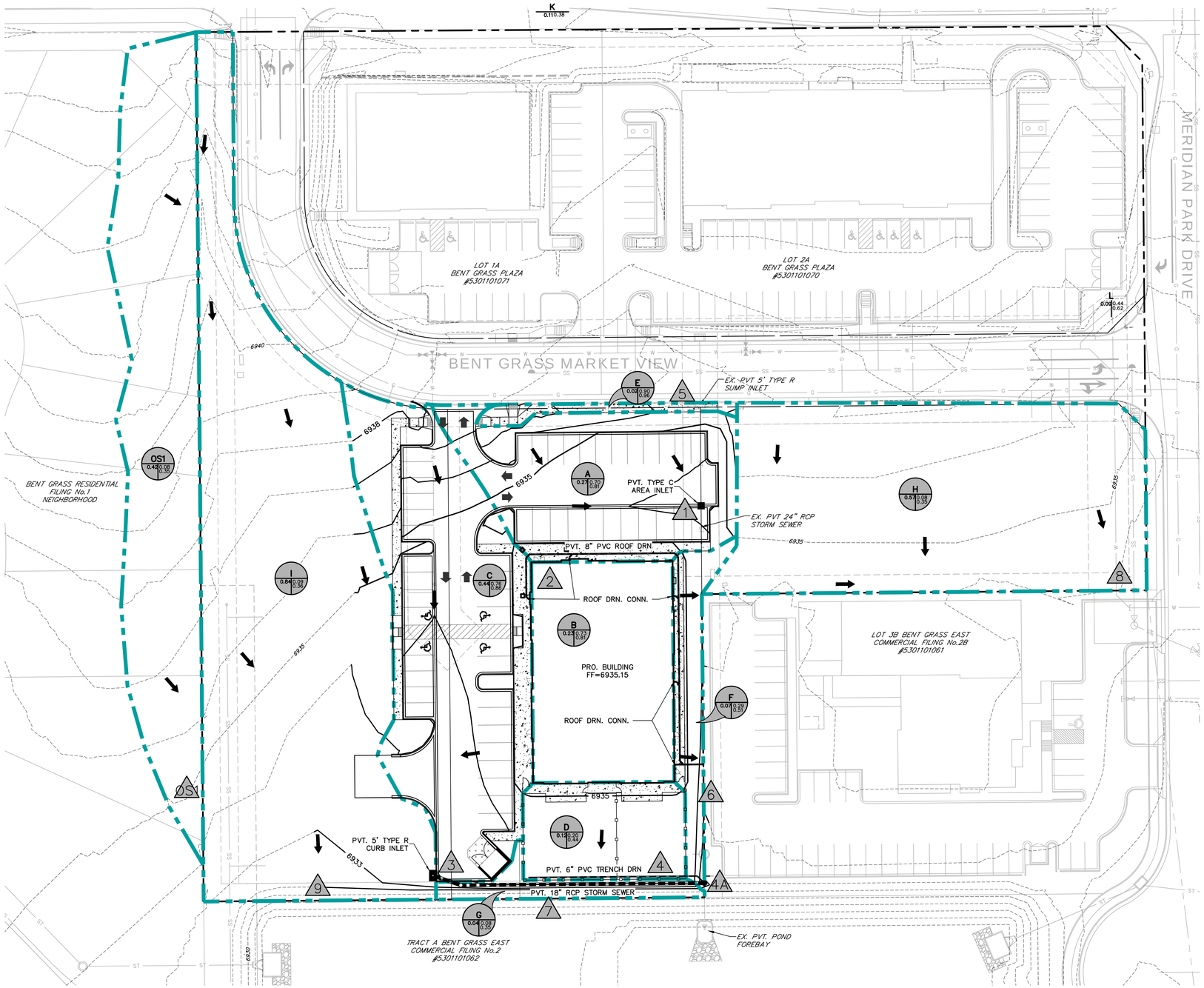
FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Outfall / Inlet Size
1	A	1.01	1.16	9.6	4.19	7.03	4	8	9' Type R Sump Inlet
2	B	0.28	0.32	6.6	4.76	7.99	1	3	9' Type R Sump Inlet
3	C, 70% K	1.73	2.07	12.7	3.77	6.34	7	13	24" RCP Stub
4	A, B, C, 70% K	3.02	3.55	12.8	3.76	6.32	11	22	Concrete Forebay

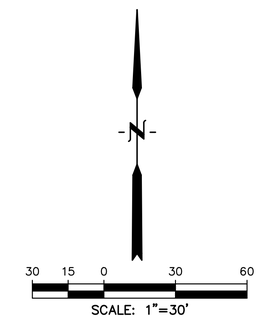
CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

BENT GRASS EAST
COMMERCIAL FILING NO. 3
DEVELOPED DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	10-27-20
DRAWN BY	MAW	(H) 1"= 30'		SHEET	1 OF 1
CHECKED BY		(V) 1"= N/A		JOB NO.	2177.64



SITE DRAINAGE PLAN



LEGEND

PROPOSED INTERMEDIATE CONTOUR 5522
PROPOSED INDEX CONTOUR 5520
EX. INTERMEDIATE CONTOUR 5364
EX. INDEX CONTOUR 5365
HIGH POINT ..... HP
LOW POINT ..... LP
PROPOSED INLET
PROPOSED MANHOLE
BASIN BOUNDARY
FLOW DIRECTION
DESIGN POINT
BASIN
AREA (ACRE)
C5
C100

DEVELOPED				
BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
OS1	OS1	0.42	0.1	0.9
A	1	0.27	1.0	1.9
B	2	0.23	0.8	1.4
C	3	0.44	1.7	3.2
D	4	0.12	0.1	0.3
DP1+DP2+DP3+DP4	4A	1.06	3.2	6.3
E	5	0.02	0.1	0.2
F	6	0.07	0.1	0.3
G	7	0.04	0.01	0.1
H	8	0.57	2.1	3.9
I		0.84	2.7	5.3
DPOS1+I	9	1.27	2.2	4.9

PREPARED BY:

DREXEL, BARRELL & CO.
Engineers • Surveyors
101 SAHWATCH ST, SUITE 100
COLORADO SPGS, COLORADO 80903
CONTACT: TIM D. McCONNELL, P.E.
(719)260-0887
COLORADO SPRINGS • LAFAYETTE

CLIENT:

THE LEARNING EXPERIENCE
210 HILLSBORO TECHNOLOGY DR.
DEERFIELD BEACH, FL 33441

DRAINAGE PLANS FOR:
THE LEARNING EXPERIENCE
11659 BENT GRASS MARKET VIEW
FALCON, COLORADO

ISSUE	DATE
INITIAL ISSUE	08/14/2026
RESUBMITTAL	10/13/2026

DESIGNED BY:	KGV
DRAWN BY:	CGH
CHECKED BY:	KGV
FILE NAME:	21814-01-DRN-PP

COLORADO LICENSED
KATHERINE G. VARNER
53459
10/13/2026
PROFESSIONAL ENGINEER

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1" = 30"
VERTICAL: N/A

PROPOSED DRAINAGE PLAN

PROJECT NO. 21814-01CSCV

DRAWING NO.

DRN

SHEET: 1 OF 1