DRAINAGE LETTER REPORT

For

BENT GRASS PLAZA

A replat of

LOT 1, 2, & 3, BENT GRASS EAST COMMERCIAL

Bent Grass Meadows Drive

Peyton, Colorado

September 20, 2023

PCD File No: PPR-#####

PPR2342

Prepared for:

Land First, LLC
1378 Promontory Bluff VW
Colorado Springs, CO 80921

Prepared by:

Drexel, Barrell & Co.
101 Sahwatch St, Suite 100
Colorado Springs, CO 80903
Contact: Tim McConnell, P.E.
(719) 260-0887

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APPENDICES

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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):_____

For and on behalf of Drexel, Barrell & Co. Date
Katherine Varnum, P.E. #53459

Developer's Statement

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

_____

Authorized Signature Date
LAND FIRST, LLC
1378 Promontory Bluff VW
Colorado Springs, CO 80921

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 Palmer, P.E. Date
County Engineer / ECM Administrator

Conditions:

DRAINAGE LETTER REPORT

for

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A replat of

LOT 1, 2, & 3, BENT GRASS EAST COMMERCIAL

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 Plaza, a replat of Lots 1, 2, & 3 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 Plaza, a replat of Lots 1, 2, & 3 of Bent Grass East Commercial 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 Meadows Drive, to the east is Meridian Park Drive, Lot 4 and 5 to the south, and Bent Grass Residential Filing No. 1 lots to the west.

Proposed Development

The proposed development of Lot 1, 2, & 3 is the construction of a commercial center, with associated parking and landscaping. The proposed disturbed area consists of 1.86 acres. The property is proposed to be replatted as Bent Grass Plaza with two lots.

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 is as described in the aforementioned approved Final Drainage Report for the Bent Grass East Commercial Filing No. 3 development, as part of Basins A, D, and E (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.

6.0 DEVELOPED CONDITION

The proposed development consists of a commercial center 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.

Add text to the affect of: "Pond 2 approved as part of Bent Grass East Commercial Filing No. 2 (SF1412)"

The table below lists the basins and design points along with their developed flow rates.

DEVELOPED				
BASIN	**DP**	**Area (Ac.)**	**Q_5 (CFS)**	**Q_{100} (CFS)**
A	1	0.15	0.3	0.8
B	2	0.22	0.6	1.2
	3	0.37	0.9	2.0
C		0.12	0.5	0.9
	4	0.49	1.4	2.9
D	5	0.26	0.9	1.7
E	6	0.40	1.7	3.1
F		0.30	1.3	2.3
	7	1.45	5.2	9.9
G	8	0.05	0.1	0.2
H	9	0.11	0.5	0.9
I		0.04	0.0	0.2
J		0.24	1.1	2.0
	10	1.89	6.5	12.4
K	11	0.11	0.2	0.5
L	12	0.09	0.2	0.4

Basin A covers 0.15-acres and represents the northern half of the westerly proposed building as well as the proposed sidewalk and swale to the north. Roof drains will lead runoff generated by the roof of the building, down and into the swale. Once there the runoff will be directed east, towards a proposed private Type C Area Inlet at **Design-Point 1** and discharge to the east via proposed private 18" RCP storm sewer.

Basin B covers 0.22-acres and represents the northern half of the easterly proposed building as well as the proposed sidewalk and swale to the north. Roof drains will lead runoff generated by the roof of the building, down and into the swale. Once there the runoff will be directed west towards a proposed private Type C Area Inlet at **Design-Point 2** and discharge to the west via proposed private 18" RCP storm sewer.

Design Point 3 is located at a proposed private 4' storm manhole where flows from DP1 and DP2 combine and discharge to the south via proposed private 18" RCP storm sewer.

Basin C represents the northern half of the central parking lot which separates the 2 proposed buildings. This 0.12-acres of parking area will direct its runoff to a low point at the southeast corner of the parking area, where it will be picked up by a proposed private 5' Type R inlet at **Design-Point 4**. Piped flows will continue to the southeast via proposed private 18" RCP storm sewer.

Basin D represents the southern half of the westerly proposed building, as well as a portion of parking lot directly south of the building. The building roof drains will output into the parking lot, and the 0.26-acre area will direct runoff towards a low point and a proposed private 5' Type R inlet at **Design-Point 5** at the southeast corner of the basin. Piped flows will continue to the east via proposed private 18" RCP storm sewer.

Basin E represents the south-easterly half of the eastern proposed building, as well as a portion of parking lot directly south of the building. The building roof drains will output into the parking lot, and the 0.40-acre area will direct runoff towards a low point and a proposed private 5' Type R inlet at **Design-Point 6** to the south of the basin. Piped flows will continue to the west via proposed private 18" RCP storm sewer.

Basin F represents the south-westerly half of the eastern proposed building, as well as a portion of parking lot directly south of the building. The building roof drains will output into the parking lot, and the 0.30-acre area will direct runoff towards a low point and a proposed private 5' Type R inlet at **Design-Point 7** to the south of the basin.

Design Point 7 is located at the proposed private 5' Type R curb inlet mentioned above where piped flows from DP4, DP5, DP6 and surface flow from Basin F combine and discharge to the south via proposed private 18" RCP storm sewer.

Basin G is 0.05-acres of landscaping and sidewalk located at the southwestern corner of the site. Runoff will sheet flow directly into the adjacent Bent Grass Market View at **Design Point 8** and continue to the east as curb and gutter flow.

Basin H covers 0.11-acres of the central drive aisle. Runoff will sheet flow directly into the adjacent Bent Grass Market View at **Design Point 9** and continue to the east as curb and

For Basins G, H, I, K, and L that do not discharge directly into a inlet that conveys flows to Pond 2, discuss how WQ treatment will be achieved for areas of proposed disturbances (with this project). Or if WQ for these basins is accounted for in the previous drainage report design, please state that (for example: there is a previously approved WQ exclusion or the flows are conveyed through the streets and eventually end up in Pond 2).

gutter flow.

Basin I is 0.04-acres of landscaping and sidewalk located along the southern boundary of the site. Runoff will sheet flow directly into the adjacent Bent Grass Market View and continue to the west as curb and gutter flow.

Basin J covers 0.24-acres of Bent Grass Market View along the west and south boundary of the site. Runoff currently travels to the south and west as curb and gutter flow towards the existing low point and private 5' Type R curb inlet at **Design Point 10.**

Design Point 10 is located at the existing private 5' Type R inlet mentioned above. Piped flows from DP7, DP8, DP9 and surface flows from Basins I and J combine at this point and discharge to the south via existing private 24" RCP storm sewer.

Developed flows at Design Point 10 (Q_5=6.5 cfs and Q_{100}=12.4 cfs) are higher than those anticipated by the previously approved report (see appendix for excerpts) (Q_5=4.0 cfs and Q_{100}=8.0 cfs). Analysis of the existing storm system that conveys the flows to the south has been completed and the piping determined to be adequately sized to accommodate the additional flows.

Basin K covers 0.11-acres of landscaping and sidewalk along the northern boundary of the site. Runoff from this basin will discharge directly into Bent Grass Meadows Drive and continue to the east as curb and gutter flow.

Basin L covers 0.09-acres of landscaping and sidewalk along the eastern boundary of the site. Runoff from this basin will discharge directly into Meridian Park Drive and continue to the south as curb and gutter flow.

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 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 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

Drainage and bridge fees are not required as the site has been previously platted.

9.0 SUMMARY

Development of Bent Grass Plaza, a replat of Lots 1, 2, & 3 of Bent Grass East Commercial Filing No. 3 will not adversely affect surrounding or downstream developments. Developed flows at Design Point 10 (Q_5=6.5 cfs and Q_{100}=12.4 cfs) are higher than those anticipated by the previously approved report (Q_5=4.0 cfs and Q_{100}=8.0 cfs), however analysis of the existing storm system that conveys the flows to the south has determined that the storm system adequately sized to accommodate the additional flows. Therefore, it is acceptable to state that the drainage design for Lots 1, 2, & 3 (Bent Grass Plaza replat) 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

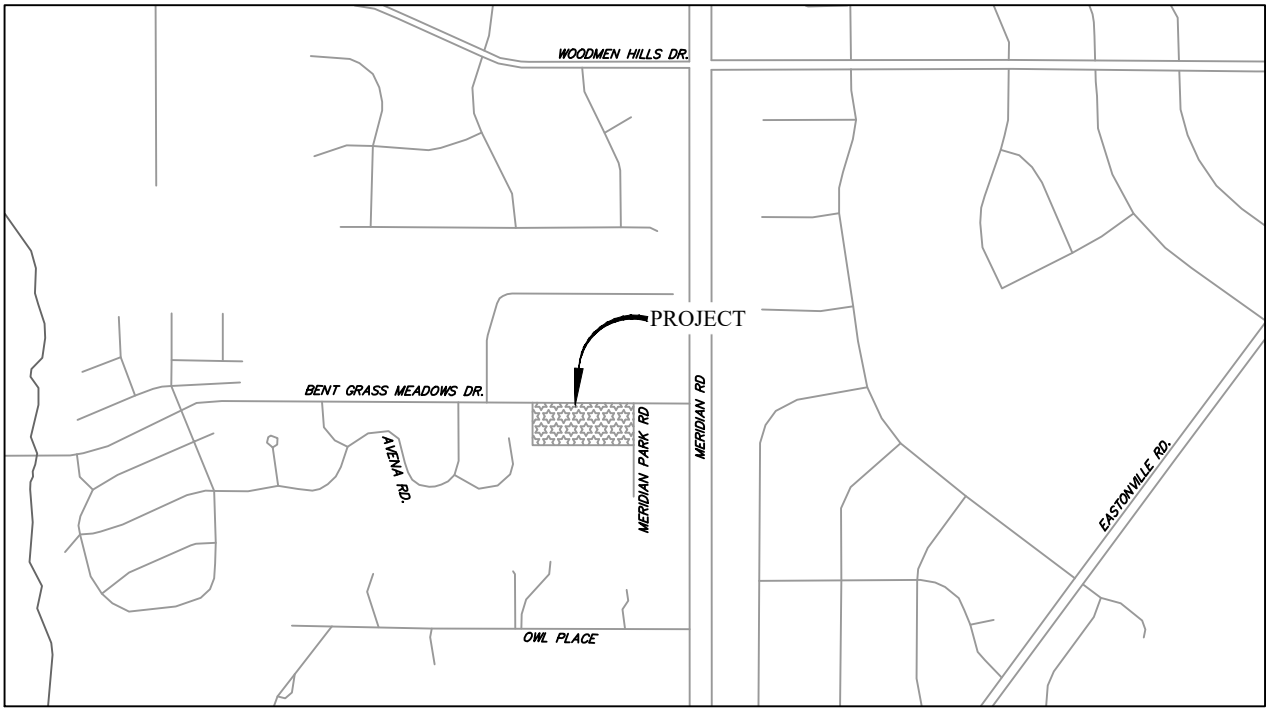
The sources of information used in the development of this study are listed below:

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

Appendix



Vicinity Map

Not to scale

-N-

BENT GRASS PLAZA
PEYTON, CO
VICINITY MAP

Drexel, Barrell & Co.
Engineers • Surveyors

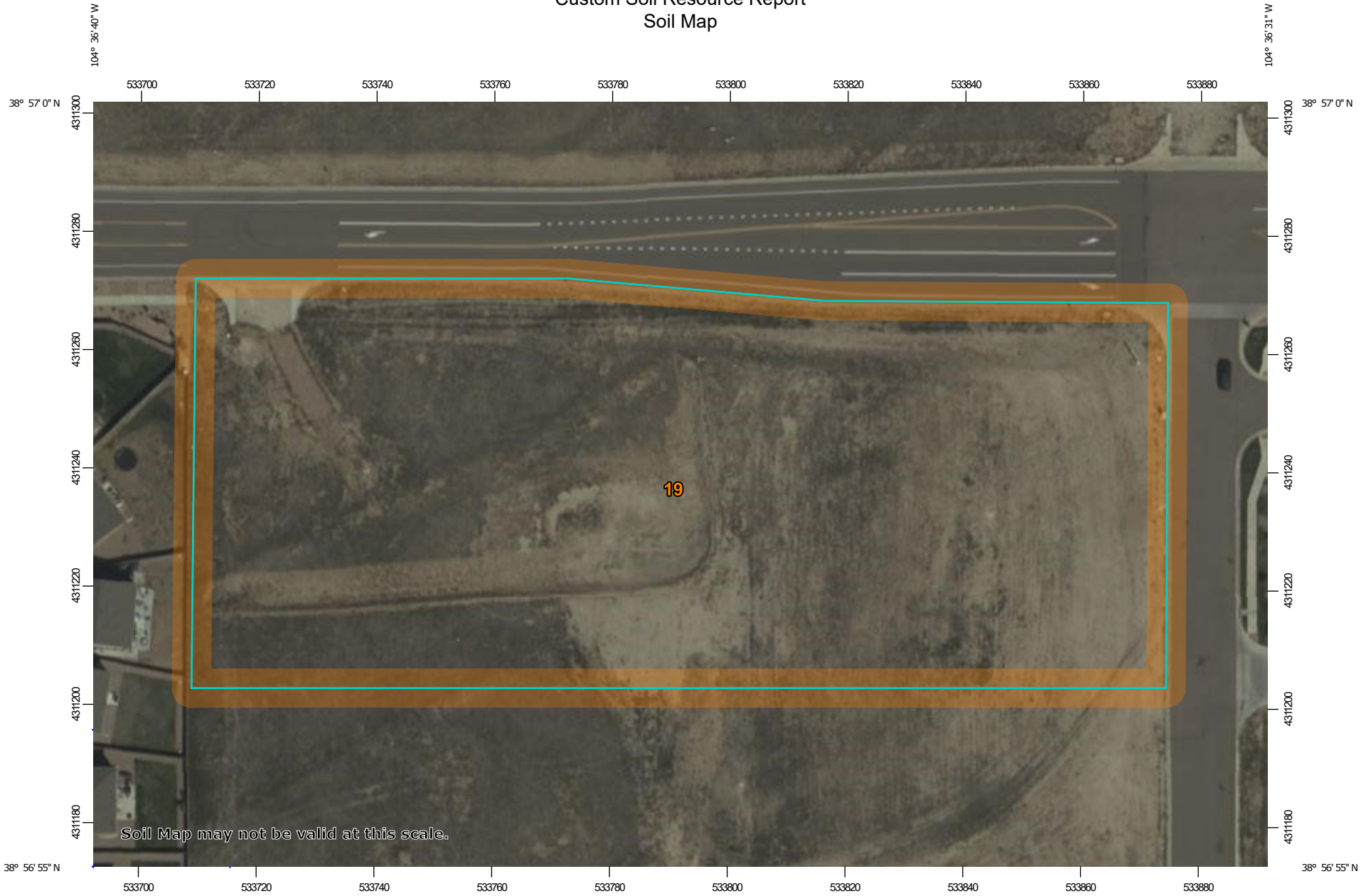
DATE:

JOB NO: 21814-00CSCV

DWG. NO. VMAP

SHEET 1 OF 1

Custom Soil Resource Report
Soil Map



Map Scale: 1:912 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 40 80 160 240

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 20, Sep 2, 2022

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

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 2018

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	2.8	100.0%
Totals for Area of Interest		**2.8**	**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°36'54"W 38°57'12"N

104°36'17"W 38°56'44"N

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

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
- 20.2 / 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
- 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 9/18/2023 at 5:23 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.

PROJECT INFORMATION

PROJECT:	Bent Grass Plaza
PROJECT NO:	21814-00CSCV
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	10/10/2023

Drexel, Barrell & Co.

	C2*	C5*	C10*	C100*	% IMPERV
Roofs		0.73		0.81	90
Lawns/Landscaping		0.08		0.35	0
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							
A	Roofs	*0.09*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.06*		*0.08*		*0.35*	*0*
	Drive and Walks	*0.00*		*0.90*		*0.96*	*100*
A TOTAL	*WEIGHTED AVERAGE*	0.15		0.46		0.62	53
B	Roofs	*0.15*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.07*		*0.08*		*0.35*	*0*
	Drive and Walks	*0.00*		*0.90*		*0.96*	*100*
B TOTAL	*WEIGHTED AVERAGE*	0.22		0.52		0.66	62
C	Roofs	*0.00*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.01*		*0.08*		*0.35*	*0*
	Drive and Walks	*0.11*		*0.90*		*0.96*	*100*
C TOTAL	*WEIGHTED AVERAGE*	0.12		0.84		0.92	93
D	Roofs	*0.09*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.05*		*0.08*		*0.35*	*0*
	Drive and Walks	*0.11*		*0.90*		*0.96*	*100*
D TOTAL	*WEIGHTED AVERAGE*	0.26		0.67		0.78	76
E	Roofs	*0.07*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.02*		*0.08*		*0.35*	*0*
	Drive and Walks	*0.31*		*0.90*		*0.96*	*100*
E TOTAL	*WEIGHTED AVERAGE*	0.40		0.83		0.90	94
F	Roofs	*0.10*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.01*		*0.08*		*0.35*	*0*
	Drive and Walks	*0.19*		*0.90*		*0.96*	*100*
F TOTAL	*WEIGHTED AVERAGE*	0.30		0.82		0.89	94
G	Roofs			*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.05*		*0.08*		*0.35*	*0*
	Drive and Walks	*0.01*		*0.90*		*0.96*	*100*
G TOTAL	*WEIGHTED AVERAGE*	0.05		0.28		0.56	22

PROJECT INFORMATION

PROJECT:	Bent Grass Plaza
PROJECT NO:	21814-00CSCV
DESIGN BY:	KGV
REV. BY:	TDM
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Drexel, Barrell & Co.

	C2*	C5*	C10*	C100*	% IMPERV
Roofs		0.73		0.81	90
Lawns/Landscaping		0.08		0.35	0
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

H	Roofs	*0.01*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.00*		*0.08*		*0.35*	*0*
	Drive and Walks	*0.10*		*0.90*		*0.96*	*100*
H TOTAL	*WEIGHTED AVERAGE*	0.11		0.89		0.95	99
I	Roofs	*0.01*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.03*		*0.08*		*0.35*	*0*
	Drive and Walks	*0.00*		*0.90*		*0.96*	*100*
I TOTAL	*WEIGHTED AVERAGE*	0.04		0.23		0.46	21
J	Roofs	*0.00*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.00*		*0.08*		*0.35*	*0*
	Drive and Walks	*0.24*		*0.90*		*0.96*	*100*
J TOTAL	*WEIGHTED AVERAGE*	0.24		0.90		0.96	100
K	Roofs	*0.00*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.07*		*0.08*		*0.35*	*0*
	Drive and Walks	*0.04*		*0.90*		*0.96*	*100*
K TOTAL	*WEIGHTED AVERAGE*	0.11		0.38		0.57	36
L	Roofs	*0.00*		*0.73*		*0.81*	*90*
	Lawns/Landscaping	*0.05*		*0.08*		*0.35*	*0*
	Drive and Walks	*0.04*		*0.90*		*0.96*	*100*
L TOTAL	*WEIGHTED AVERAGE*	0.09		0.44		0.62	44

PROJECT INFORMATION

PROJECT: Bent Grass Plaza
PROJECT NO: 21814-00CSCV
DESIGN BY: KGV
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Final
DATE: 10/10/2023

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																
A	**1**	0.46	0.62	0.15	*0.07*	*0.09*	50	10.0	3.9	135	0.5	3.0	0.8	4.7	*5.0*	**5.0**
B	**2**	0.52	0.66	0.22	*0.12*	*0.15*	50	4.5	4.6	160	0.5	3.0	0.9	5.5	*5.0*	**5.5**
DP1+DP2	**3**	0.50	0.65	0.37	*0.19*	*0.24*	From DP2			25	1.0	11.3	0.0	5.5	*5.0*	**5.5**
C		0.84	0.92	0.12	*0.10*	*0.11*	25	1.0	2.4	60	2.0	5.3	0.2	2.6	*5.0*	**5.0**
DP3+C	**4**	0.58	0.71	0.49	*0.29*	*0.35*	From DP3			90	1.0	11.3	0.1	5.7	*5.0*	**5.7**
D	**5**	0.67	0.78	0.26	*0.17*	*0.20*	50	10.0	2.7	170	2.0	5.3	0.5	3.2	*5.0*	**5.0**
E	**6**	0.83	0.90	0.40	*0.33*	*0.36*	50	2.0	2.8	120	1.6	4.2	0.5	3.3	*5.0*	**5.0**
F		0.82	0.89	0.30	*0.25*	*0.27*	50	2.0	2.9	170	3.0	6.3	0.4	3.4	*5.0*	**5.0**
DP4+DP5+DP6+F	**7**	0.72	0.81	1.45	*1.04*	*1.18*	From DP6			180	1.0	11.3	0.3	5.3	*5.0*	**5.3**
G	**8**	0.28	0.56	0.05	*0.01*	*0.03*	25	2.0	6.1	15	2.0	5.3	0.0	6.2	*5.0*	**6.2**
H	**9**	0.89	0.95	0.11	*0.10*	*0.10*	20	2.0	1.4	60	4.0	6.8	0.1	1.6	*5.0*	**5.0**
I		0.23	0.46	0.04	*0.01*	*0.02*	25	2.0	6.5	15	2.0	5.3	0.0	6.5	*5.0*	**6.5**
J		0.90	0.96	0.24	*0.21*	*0.23*	25	2.0	1.5	365	1.0	3.8	1.6	3.1	*5.0*	**5.0**
DP7+DP8+DP9+I+J	**10**	0.73	0.83	1.89	*1.37*	*1.56*	From DP8			75	1.0	3.8	0.3	6.5	*5.0*	**6.5**
K	**11**	0.38	0.57	0.11	*0.04*	*0.06*	25	2.0	5.4	25	2.0	5.3	0.1	5.4	*5.0*	**5.4**
L	**12**	0.44	0.62	0.09	*0.04*	*0.06*	45	2.0	6.5	25	2.0	5.3	0.1	6.6	*5.0*	**6.6**

PROJECT INFORMATION

PROJECT:	Bent Grass Plaza
PROJECT NO:	21814-00CSCV
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	10/10/2023

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							
A	1	0.15	0.46	5.0	0.07	5.09	**0.3**
B	2	0.22	0.52	5.5	0.12	4.96	**0.6**
DP1+DP2	3	0.37	0.50	5.5	0.19	4.95	**0.9**
C		0.12	0.84	5.0	0.10	5.09	**0.5**
DP3+C	4	0.49	0.58	5.7	0.29	4.91	**1.4**
D	5	0.26	0.67	5.0	0.17	5.09	**0.9**
E	6	0.40	0.83	5.0	0.33	5.09	**1.7**
F		0.30	0.82	5.0	0.25	5.09	**1.3**
DP4+DP5+DP6+F	7	1.45	0.72	5.3	1.04	5.02	**5.2**
G	8	0.05	0.28	6.2	0.01	4.80	**0.1**
H	9	0.11	0.89	5.0	0.10	5.09	**0.5**
I		0.04	0.23	6.5	0.01	4.72	**0.0**
J		0.24	0.90	5.0	0.21	5.09	**1.1**
DP7+DP8+DP9+I+J	10	1.89	0.73	6.5	1.37	4.72	**6.5**
K	11	0.11	0.38	5.4	0.04	4.97	**0.2**
L	12	0.09	0.44	6.6	0.04	4.69	**0.2**

PROJECT INFORMATION

PROJECT:	Bent Grass Plaza
PROJECT NO:	21814-00CSCV
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	10/10/2023

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							
A	1	0.15	0.62	5.0	0.09	8.55	**0.8**
B	2	0.22	0.66	5.5	0.15	8.33	**1.2**
DP1+DP2	3	0.37	0.65	5.5	0.24	8.31	**2.0**
C		0.12	0.92	5.0	0.11	8.55	**0.9**
DP3+C	4	0.49	0.71	5.7	0.35	8.26	**2.9**
D	5	0.26	0.78	5.0	0.20	8.55	**1.7**
E	6	0.40	0.90	5.0	0.36	8.55	**3.1**
F		0.30	0.89	5.0	0.27	8.55	**2.3**
DP4+DP5+DP6+F	7	1.45	0.81	5.3	1.18	8.43	**9.9**
G	8	0.05	0.56	6.2	0.03	8.06	**0.2**
H	9	0.11	0.95	5.0	0.10	8.55	**0.9**
I		0.04	0.46	6.5	0.02	7.93	**0.2**
J		0.24	0.96	5.0	0.23	8.55	**2.0**
DP7+DP8+DP9+I+J	10	1.89	0.83	6.5	1.56	7.94	**12.4**
K	11	0.11	0.57	5.4	0.06	8.36	**0.5**
L	12	0.09	0.62	6.6	0.06	7.88	**0.4**

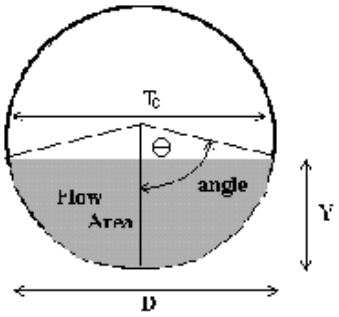
CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: BENT GRASS PLAZA - UPDATED

Pipe ID: 24" RCP (DP-1)

UPDATED WITH REVISED FLOW RATES. REFERENCE ORIGINAL CALCULATIONS LATER IN THIS REPORT



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 =	12.40	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 =	1.63	radians
Flow area	An =	1.68	sq ft
Top width	Tn =	2.00	ft
Wetted perimeter	Pn =	3.25	ft
Flow depth	Yn =	1.05	ft
Flow velocity	Vn =	7.38	fps
Discharge	Qn =	12.40	cfs
Percent of Full Flow	Flow =	54.7%	of full flow
Normal Depth Froude Number	Fr_n =	1.42	supercritical

Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.84	radians
Critical flow area	Ac =	2.10	sq ft
Critical top width	Tc =	1.93	ft
Critical flow depth	Yc =	1.27	ft
Critical flow velocity	Vc =	5.92	fps
Critical Depth Froude Number	Fr_c =	1.00	

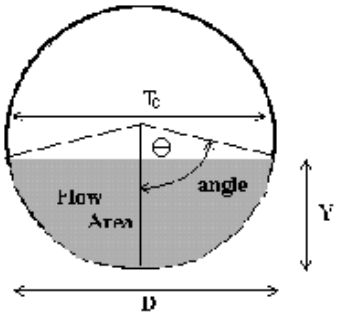
CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: BENT GRASS PLAZA - UPDATED

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

UPDATED WITH REVISED FLOW RATES. REFERENCE ORIGINAL CALCULATIONS LATER IN THIS REPORT



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 =	14.40	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 =	1.73	radians
Flow area	An =	1.88	sq ft
Top width	Tn =	1.98	ft
Wetted perimeter	Pn =	3.46	ft
Flow depth	Yn =	1.16	ft
Flow velocity	Vn =	7.65	fps
Discharge	Qn =	14.40	cfs
Percent of Full Flow	Flow =	63.5%	of full flow
Normal Depth Froude Number	Fr_n =	1.38	supercritical

Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.95	radians
Critical flow area	Ac =	2.29	sq ft
Critical top width	Tc =	1.86	ft
Critical flow depth	Yc =	1.37	ft
Critical flow velocity	Vc =	6.29	fps
Critical Depth Froude Number	Fr_c =	1.00	

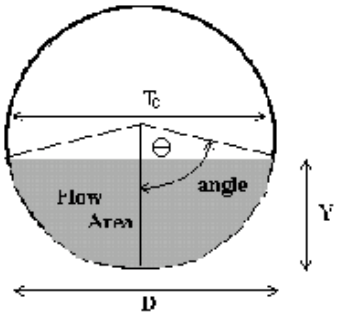
CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: BENT GRASS PLAZA - UPDATED

Pipe ID: 24" RCP (DP-3)

UPDATED WITH REVISED FLOW RATES. REFERENCE ORIGINAL CALCULATIONS LATER IN THIS REPORT



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 =	17.40	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 =	1.89	radians
Flow area	An =	2.19	sq ft
Top width	Tn =	1.90	ft
Wetted perimeter	Pn =	3.78	ft
Flow depth	Yn =	1.31	ft
Flow velocity	Vn =	7.96	fps
Discharge	Qn =	17.40	cfs
Percent of Full Flow	Flow =	76.7%	of full flow
Normal Depth Froude Number	Fr_n =	1.31	supercritical

Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.10	radians
Critical flow area	Ac =	2.53	sq ft
Critical top width	Tc =	1.73	ft
Critical flow depth	Yc =	1.50	ft
Critical flow velocity	Vc =	6.87	fps
Critical Depth Froude Number	Fr_c =	1.00	

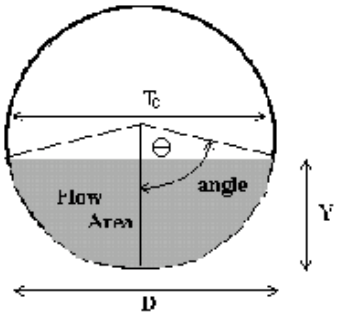
CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: BENT GRASS PLAZA - UPDATED

Pipe ID: 30" RCP (DP-4)

UPDATED WITH REVISED FLOW RATES. REFERENCE ORIGINAL CALCULATIONS LATER IN THIS REPORT

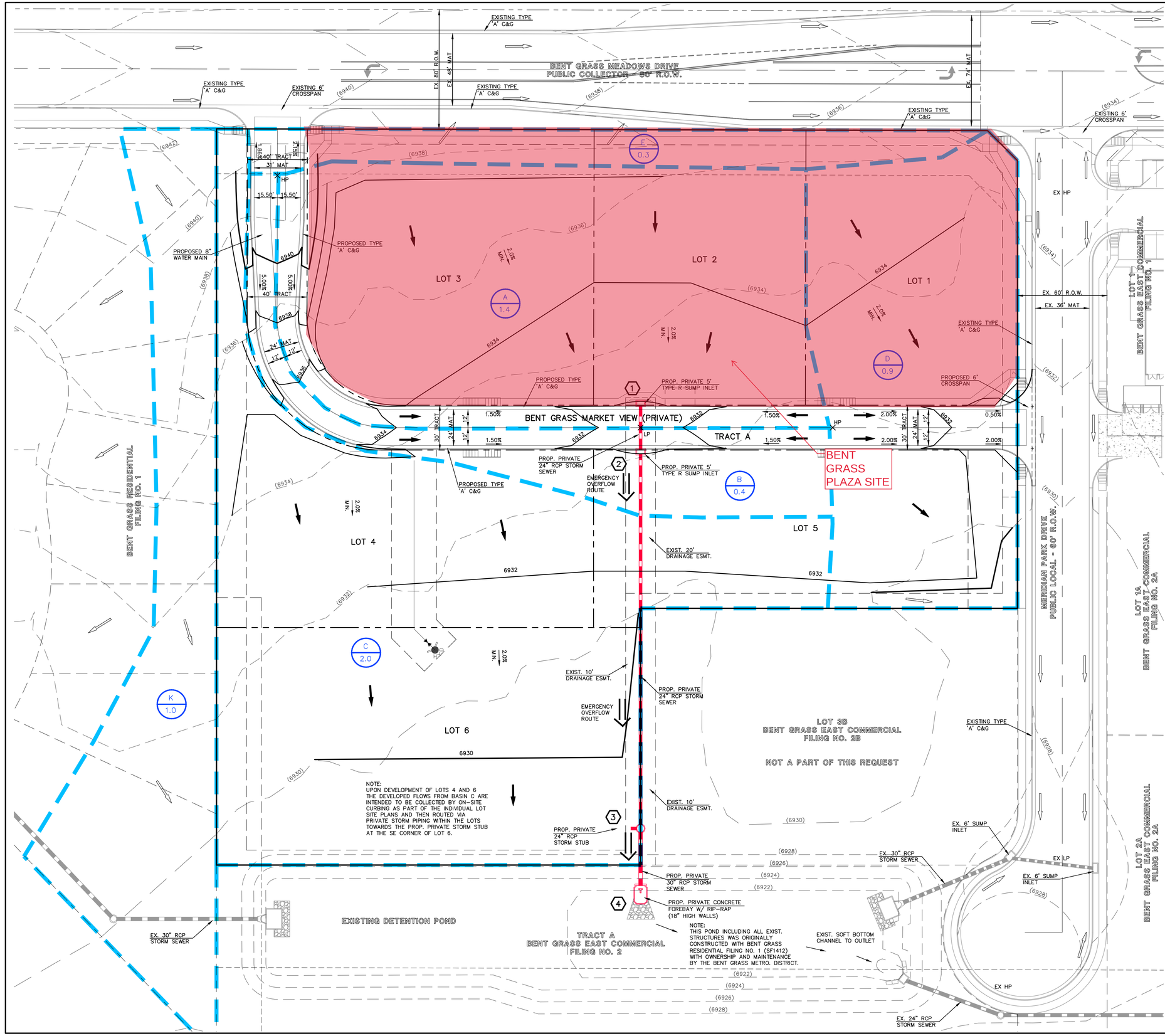


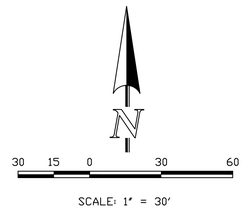
Design Information (Input)			
Pipe Invert Slope	So =	0.0100	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	30.00	inches
Design discharge	Q =	26.40	cfs

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 =	1.74	radians
Flow area	An =	2.97	sq ft
Top width	Tn =	2.47	ft
Wetted perimeter	Pn =	4.34	ft
Flow depth	Yn =	1.46	ft
Flow velocity	Vn =	8.89	fps
Discharge	Qn =	26.40	cfs
Percent of Full Flow	Flow =	64.2%	of full flow
Normal Depth Froude Number	Fr_n =	1.43	supercritical

Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.98	radians
Critical flow area	Ac =	3.67	sq ft
Critical top width	Tc =	2.29	ft
Critical flow depth	Yc =	1.75	ft
Critical flow velocity	Vc =	7.19	fps
Critical Depth Froude Number	Fr_c =	1.00	





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	0.56	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	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

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

The proposed development plans to construct a private roadway in order to provide vehicular access to the 6 lots. This private road will connect to both Bent Grass Meadows Dr. to the north and Meridian Park Dr. to the east. High points are planned at each of these two connection points with a low point near the middle of the property. (See Developed Drainage Map in Appendix)

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 off-site 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. (See Appendix)

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 portion of 5 and a portion 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. (See Appendix)

DRAINAGE CRITERIA

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014 along with the El Paso County Engineering Criteria Manual, updated October 2020. Individual on-site developed basin design used for detention/SWQ basin sizing, inlet sizing and storm system routing was calculated using the Rational Method. Runoff Coefficients are based on the imperviousness of the particular land

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**

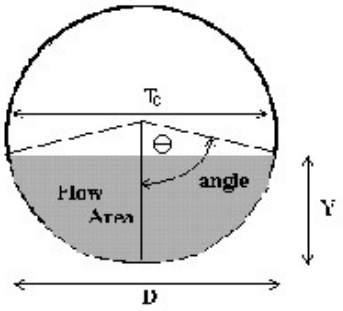
CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: BENT GRASS EAST COMMERCIAL FILING NO. 3

Pipe ID: 24" RCP (DP-1)

ORIGINAL CALCULATIONS



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 =	8.00	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 =	1.39	radians
Flow area	An =	1.21	sq ft
Top width	Tn =	1.97	ft
Wetted perimeter	Pn =	2.78	ft
Flow depth	Yn =	0.82	ft
Flow velocity	Vn =	6.59	fps
Discharge	Qn =	8.00	cfs
Percent of Full Flow	Flow =	35.3%	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 =	1.58	radians
Critical flow area	Ac =	1.58	sq ft
Critical top width	Tc =	2.00	ft
Critical flow depth	Yc =	1.01	ft
Critical flow velocity	Vc =	5.05	fps
Critical Depth Froude Number	Fr_c =	1.00	

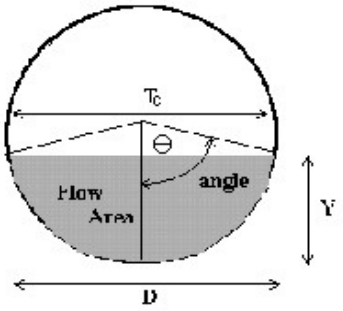
CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: BENT GRASS EAST COMMERCIAL FILING NO. 3

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

ORIGINAL CALCULATIONS



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	

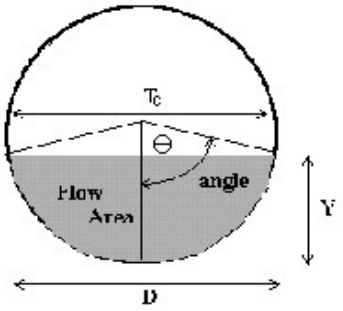
CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: BENT GRASS EAST COMMERCIAL FILING NO. 3

Pipe ID: 24" RCP (DP-3)

ORIGINAL CALCULATIONS



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	

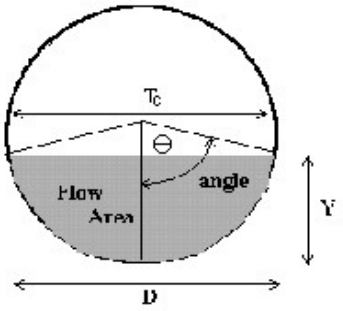
CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: BENT GRASS EAST COMMERCIAL FILING NO. 3

Pipe ID: 30" RCP (DP-4)

ORIGINAL CALCULATIONS



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

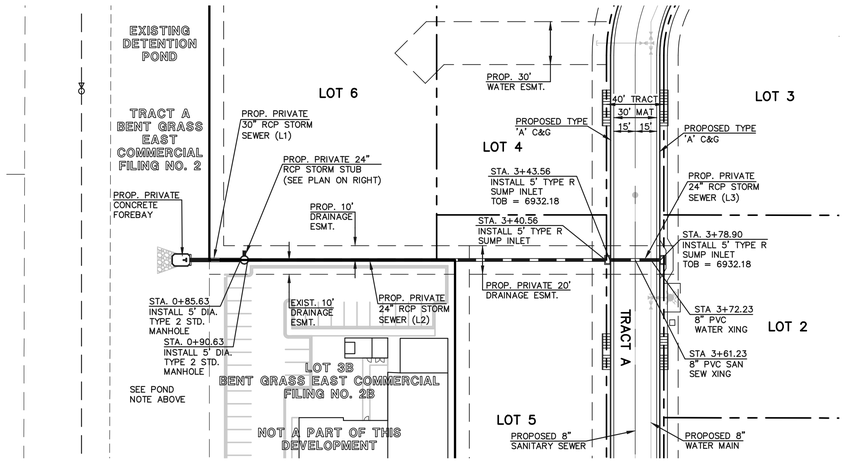
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	4.91	sq ft
Full-flow wetted perimeter	Pf =	7.85	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	41.13	cfs

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

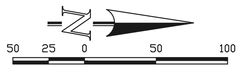
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.85	radians
Critical flow area	Ac =	3.31	sq ft
Critical top width	Tc =	2.40	ft
Critical flow depth	Yc =	1.59	ft
Critical flow velocity	Vc =	6.66	fps
Critical Depth Froude Number	Fr_c =	1.00	

POND NOTE:
THIS POND INCLUDING ALL EXIST. STRUCTURES WAS ORIGINALLY CONSTRUCTED WITH BENT GRASS RESIDENTIAL FILING NO. 1 (SF1412) WITH OWNERSHIP AND MAINTENANCE BY THE BENT GRASS METRO. DISTRICT.

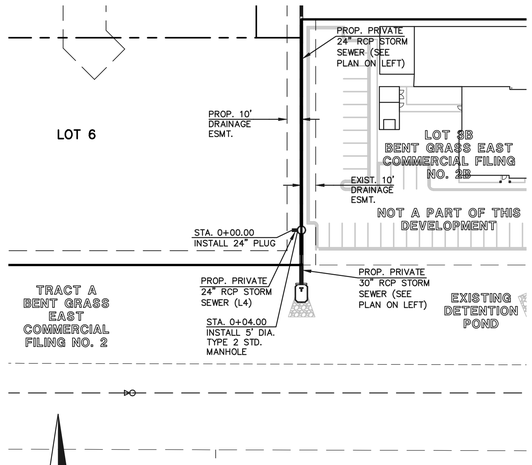
STORM SEWER LINE TABLE		
LINE	LENGTH	BEARING
L1	35.63'	N00°00'03"E
L2	249.93'	N00°00'03"E
L3	35.34'	N00°00'03"E
L4	4.00'	N89°59'57"W



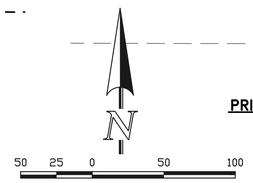
PRIVATE STORM SEWER RUN-1



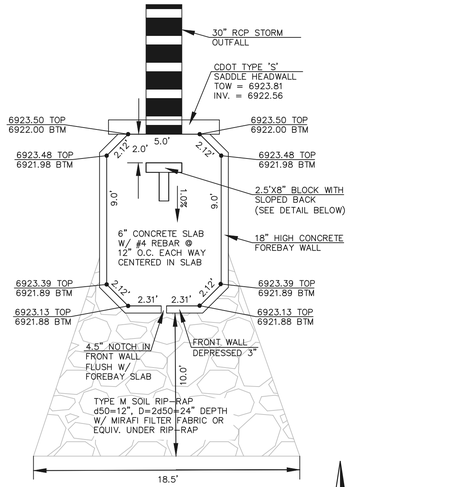
SCALE: 1" = 50'



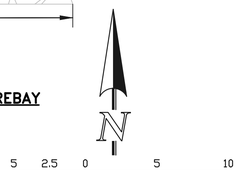
PRIVATE STORM SEWER RUN-2



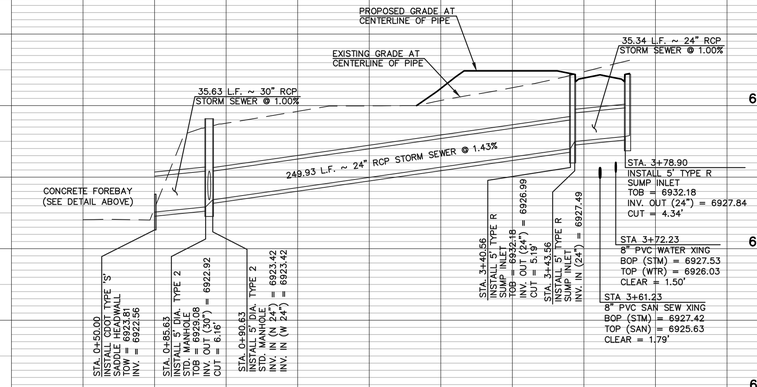
SCALE: 1" = 50'



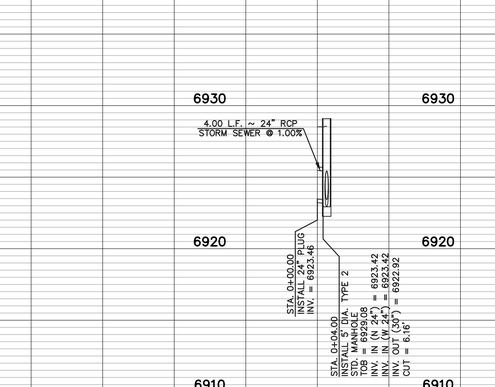
CONCRETE FOREBAY



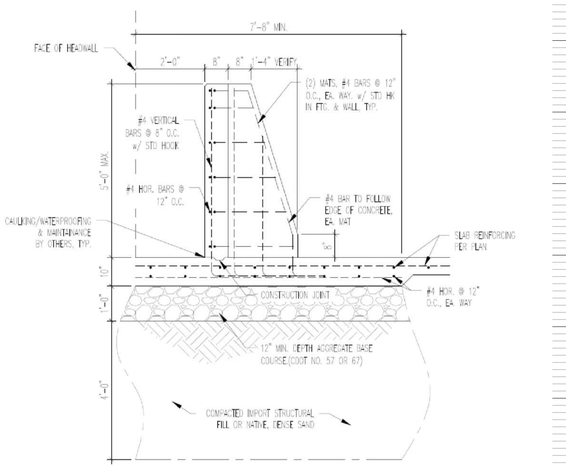
SCALE: 1" = 5'



PRIVATE STORM SEWER RUN-1



PRIVATE STORM SEWER RUN-2



1 BAFFLE STRUCTURE

SCALE: 3/8 = 1'-0"

EPC 4/21/22

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
811
UTILITY NOTIFICATION CENTER OF COLORADO
IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NO.	REVISION	DATE
1	REVISED PER COUNTY COMMENTS	11-30-21
2	REVISED PER COUNTY COMMENTS	2-16-22

REVIEW:

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

COLORADO REGISTERED PROFESSIONAL ENGINEER MARC ALAN WHORTON 37155

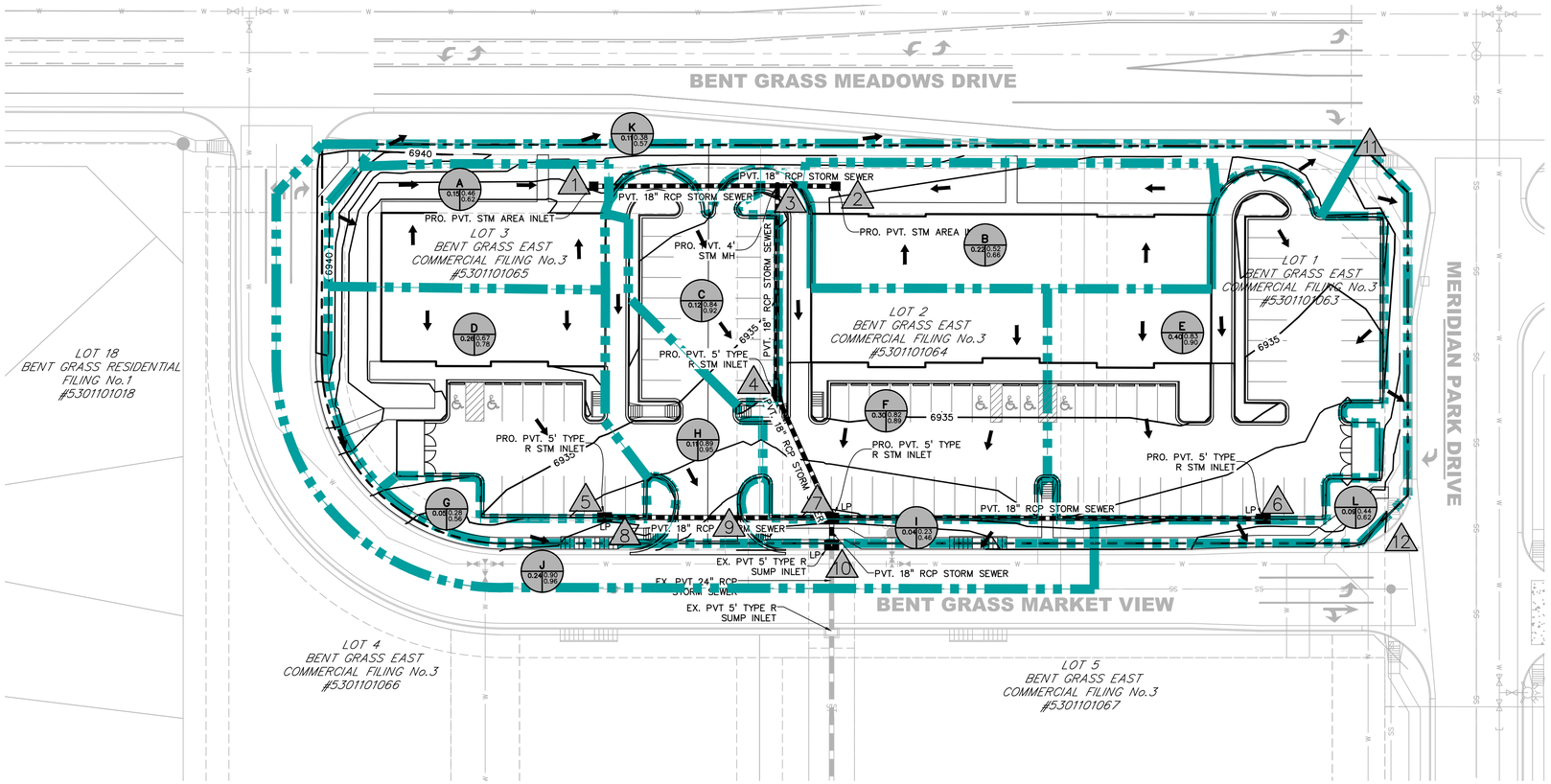
MARC A. WHORTON, COLORADO P.E. #37155 — 4/4/2022 DATE

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

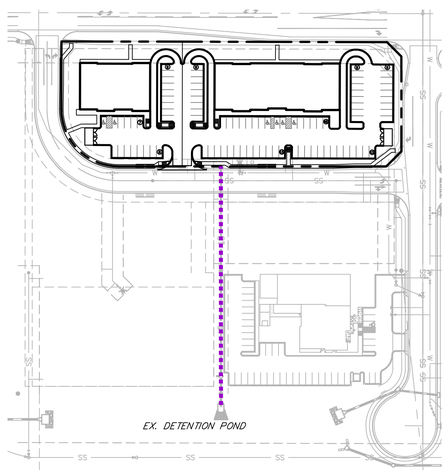
BENT GRASS EAST COMMERCIAL FILING NO. 3
PRIVATE STORM SEWER PLAN

DESIGNED BY	PRA	SCALE		DATE	04-21-21
DRAWN BY	PRA	(H) 1"=	50'	SHEET	7 OF 10
CHECKED BY		(V) 1"=	5'	JOB NO.	2177.64

N:\2177#A\DRAWINGS\CONSTRUCTION\07-217764-STRM-01.dwg, 2/16/2022 4:58:15 PM, 1:1



SITE DRAINAGE PLAN



FLOW ROUTING
SCALE: 1"=100'

Please create a basic WQ treatment summary table (example provided below) on this map. For proposed disturbances that are not tributary to the pond, provide applicable exclusions. As stated above on PDF pg 6, the table should clarify how WQ is achieved for Basins G, H, I, K, and L (as all other Basins flows are explained in the text as being conveyed to Pond 2 via stormwater piping).

PBMP SUMMARY TABLE

BASINS	PBMP TRIBUTARY AREA (AC)	PBMP
A1.1	1.43	RG-A1.1
A3.1	1.87	RG-A3.1
B1,B2	8.60	EDB-B
OA2,A2	0.95	EXCLUDED*

* EXCLUDED BASED ON < 1-ACRE OF DEVELOPED ROADWAY AREA PER ECM APP. 17.C.1.a

DEVELOPED				
BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
A	1	0.15	0.3	0.8
B	2	0.22	0.6	1.2
	3	0.37	0.9	2.0
C		0.12	0.5	0.9
	4	0.49	1.4	2.9
D	5	0.26	0.9	1.7
E	6	0.40	1.7	3.1
F		0.30	1.3	2.3
	7	1.45	5.2	9.9
G	8	0.05	0.1	0.2
H	9	0.11	0.5	0.9
I		0.04	0.0	0.2
J		0.24	1.1	2.0
	10	1.89	6.5	12.4
K	11	0.11	0.2	0.5
L	12	0.09	0.2	0.4

LEGEND

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

30 15 0 30 60
SCALE: 1"=30'

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:
LAND FIRST, LLC
154 DEL ORO CIRCLE
COLORADO SPRINGS, CO 80919
MR. RON WALDTHAUSEN
(719) 491-0801

DRAINAGE PLANS FOR:
BENT GRASS EAST
COMMERCIAL FILING No. 3
BENT GRASS MARKET DR.
EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	9-25-2023

DESIGNED BY:	KGV
DRAWN BY:	CGH
CHECKED BY:	TDM
FILE NAME:	21814-00-DRN-PP

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. 21814-00CSCV
DRAWING NO.
DRN