



DRAINAGE LETTER

Woodmen Frontage Road Turn Lane

Bent Grass Meadows Drive & East Woodmen
Road

PREPARED FOR:
Challenger Communities, LLC
8605 Explorer Dr., Suite 250
Colorado Springs, CO 80920

PREPARED BY:
Galloway & Company, Inc.
6162 S. Willow Drive, Suite 320
Greenwood Village, CO 80111

DATE:
January 10, 2022

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 Drainage Criteria Manual for the City of Colorado Springs and El Paso County. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Scott Brown, PE 45900
For and on behalf of Galloway & Company, Inc.

Date

DEVELOPER'S CERTIFICATION

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

By: _____

Date

Address: Challenger Communities, LLC
8605 Explorer Dr., Suite 250
Colorado Springs, CO 80920

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.

Jennifer Irvine, P.E.
County Engineer/ECM Administrator

Date

Conditions:

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I. Purpose

The intent of the developer is to make improvements to the Woodmen Frontage Road by expanding pavement to provide a left turn lane. The purpose of this Drainage Letter is to identify drainage patterns, locate and identify tributary drainage features and to determine impacts due to the added imperviousness.

II. General Description

The site is located in the west half of Section 1, Township 13S, Range 65 West, of the 6th Principal Meridian, Colorado Springs, El Paso County, State of Colorado. The proposed improvements are located approximately at the intersection of the north side of Woodmen Frontage Road ROW and Bent Grass Meadows Drive. The proposed improvements include asphalt widening of the existing roadway to accommodate the construction of a left turn lane along Woodmen Frontage Road traveling eastbound while providing a lane to continue westbound.

Please include surrounding developments

The existing soil type within the proposed site as determined by the NRCS web soil survey for El Paso County Area consists of Columbine gravelly sandy loam which is defined as having a hydrologic soil group of A. See soils map included in Appendix A.

III. Previous Reports

The proposed site has been included in other drainage studies in the past. Below is the list of the existing reports pertaining to this site and adjacent sites.

1. *Final Drainage Report Latigo Business Center Filing No. 2*, by Kiowa Engineering Corporation, July 15, 2008.
2. *Final Drainage Report Falcon Meadows at Bent Grass Filing No. 1*, by Galloway & Company, Inc., September 2021 (review in progress)

IV. Design Criteria

Hydrology 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.

The drainage calculations were based on the criteria manual Figure 6-5 and IDF equations to determine the intensity and are listed in Table 1 below.

Table 1 - Precipitation Data

Return Period	One Hour Depth (in)	Intensity (in/hr)
5-year	1.50	5.17
100-year	2.52	8.68

The rational method was used to calculate peak flows as the tributary areas are less than 100 acres. The rational method has been proven to be accurate for basins of this size and is based on the following formula:

$$Q = CIA$$

Where:

- Q = Peak Discharge (cfs)
- C = Runoff Coefficient
- I = Runoff intensity (inches/hour)
- A = Drainage area (acres)

The runoff coefficients are calculated based on land use, percent imperviousness, and design storm for each basin, as shown in the drainage criteria manual (Table 6-6). Composite percent impervious and C values were calculated using the residential, streets, roofs, and lawns coefficients found in Table 6-6 of the manual.

The 100-year event was used as the major storm event and the 5-year event was used as the minor event.

Include existing drainage map in appendix

V. Existing Drainage Conditions

Address how flows are conveyed across driveways and discuss any existing infrastructure utilized.

Design Point 1 (0.66 AC, $Q_5 = 1.7$ cfs, $Q_{100} = 3.6$ cfs): is located on Woodmen Frontage Road. The flows shown are from the northern portion of the Woodmen Frontage Road which includes pavement and grass area. Flows infiltrate the grassed buffer in the minor events and will flow east in the major storm event into the proposed channel along Woodmen Frontage Road.

VI. Four Step Process

The Four Step Process is used to minimize the adverse impacts of urbanization and is a vital component of developing a balanced, sustainable project. Below identifies the approach to the four-step process:

1. Employ Runoff Reduction Practices

The proposed roadway improvements use Low Impact Development (LID) practices to reduce runoff at the source. All runoff is routed through the pervious areas along side the roadway.

2. Implement BMPs That Provide a Water Quality Capture Volume with Slow Release

This step utilizes formalized water quality capture volume to slow the release of runoff from the site. There is no water quality being proposed with the associated roadway improvements. Per Section 1.7.1.B of the El Paso County *Stormwater Quality Policy & Procedures*, since the site is less than 1 acre, is not a sensitive or high-risk site, and does not directly discharge into State Waters, it is excluded from any water quality requirements.

3. Stabilize Drainageways

The surrounding drainageways will not undergo any stabilization for the development of this project.

4. Implement Site Specific and Other Source Control BMPs

Since this project only includes roadway work with no curb and gutter, the potential use of source control BMP's is limited. All runoff however, will be conveyed through native grass buffers and an existing native grass channel to promote infiltration and pollutant removal.

VII. Proposed Drainage Conditions

Drainage patterns shall remain as the existing drainage patterns

Design Point 1 (0.66 AC, $Q_5 = 3.0$ cfs, $Q_{100} = 5.7$ cfs): is located on the northside of Woodmen Frontage Road near the northwestern corner of the intersection of the Woodmen Frontage Road and Bent Grass Meadows Drive. The flows shown are from the northern portion of the Woodmen Frontage Road which include the proposed turn lane and the additional pavement. Flows from the proposed improvements runoff in an eastward direction, onto the existing grass buffer, to the intersection where flows enter into the existing curb and gutter and are routed downstream via this curb and gutter to the existing 10-foot type 'R' inlet located on the west side of Bent Grass Meadows Drive. Flows are captured by the existing 10-foot type 'R' inlet. Emergency overflow will overtop the centerline of Bent Grass Meadows Drive and to the existing 5-foot type 'R' inlet located on the east side of Bent Grass Meadows Drive. Should both inlets become clogged, emergency overflow will be conveyed downstream and around the end of the existing curb and gutter, into the existing channel along the north side of Woodmen Frontage Road.

VIII. Proposed Channel Improvements

No channel improvements are anticipated.

If swale is being used to convey flows between driveways, include discussion of it here.

IX. Proposed Water Quality

There is no water quality being proposed with the associated roadway improvements. Per Section 1.7.1.B of the El Paso County *Stormwater Quality Policy & Procedures*, since the site is less than 1 acre, is not a sensitive or high-risk site, and does not directly discharge into State Waters, it is excluded from any water quality requirements.

IX. Maintenance

It is recommended to maintain the existing grass buffer with regular mowing when necessary along Woodmen Frontage Road.

X. Wetland mitigation

No wetlands are located on the site

XI. Floodplain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map number 08041C0553G, effective December 7, 2018, there is no floodplain in the project area. A copy of the FIRM Panel is included in Appendix A.

XII. Drainage/Bridge Fees and Credits/Reimbursements

Since there is no land being platted with this development, drainage and bridge fees are not required.

XIV. Conclusions

This report for the proposed roadway improvements to Woodmen Frontage Road between Bent Grass Meadows Drive and Falcon Meadows Blvd has been prepared using the criteria and methods as described in the El Paso County Drainage Criteria Manual. Although the roadway improvements will result in slightly higher runoff and an added 0.13 acres of imperviousness area to the roadside grass buffer and downstream channel, there will be minimal impact on the downstream infrastructure.

VI. References

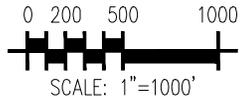
1. *City of Colorado Springs/County of El Paso Drainage Criteria Manual*, October 1991.
2. *Drainage Criteria Manual, Volume 2*, City of Colorado Springs, November 2002.
3. *Urban Storm Drainage Criteria Manual*, Urban Drainage and Flood Control District, January 2016 (with current revisions).
4. *Final Drainage Report Latigo Business Center Filing No. 2*, by Kiowa Engineering Corporation, July 15, 2008.
5. *Final Drainage Report Falcon Meadows at Bent Grass Filing No. 1*, by Galloway & Company, Inc., September 2021 (review in progress)

APPENDIX A

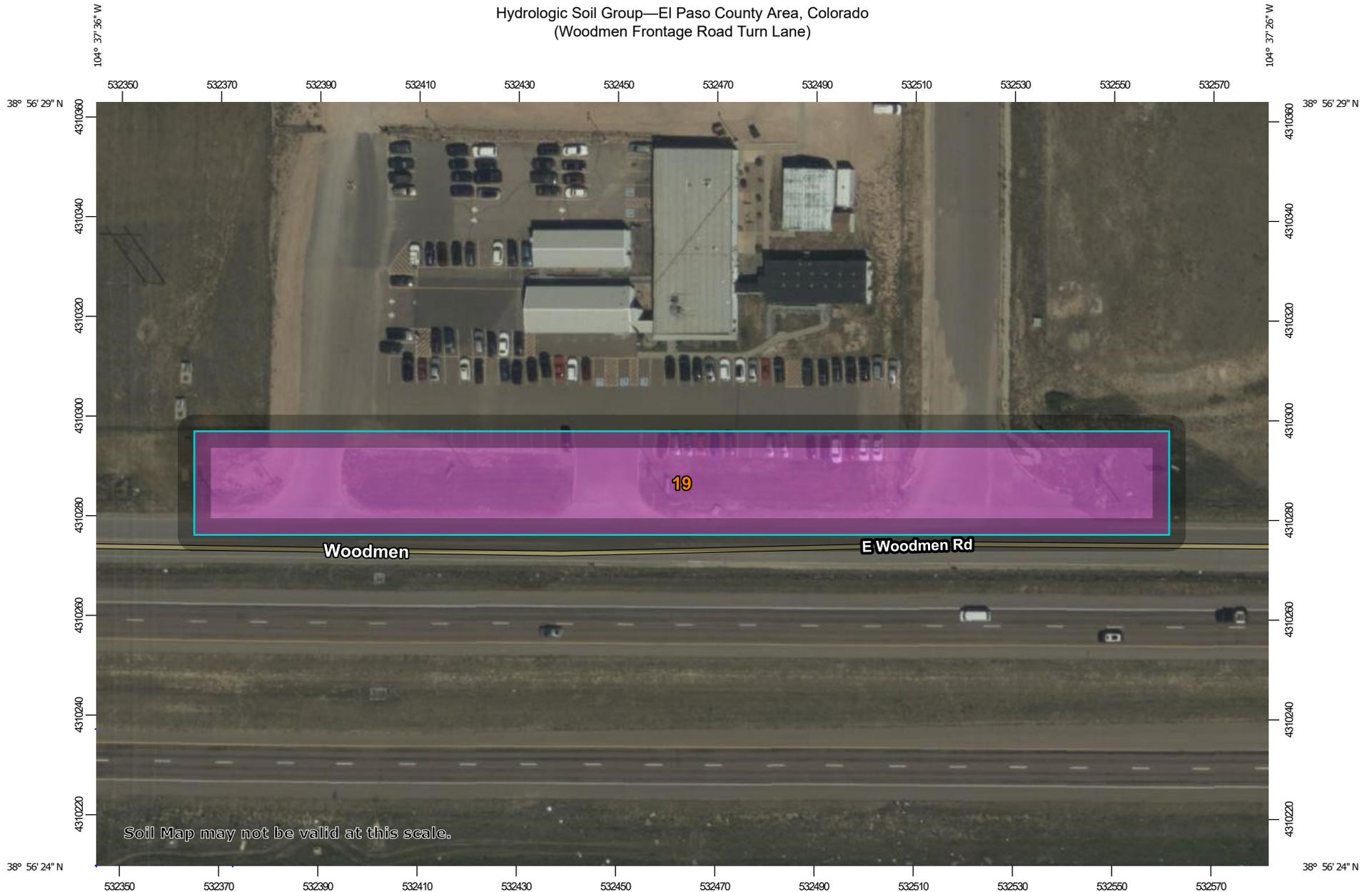
Exhibits and Figures



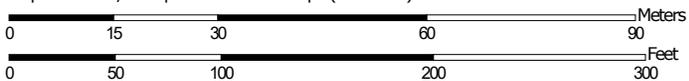
VICINITY MAP



Hydrologic Soil Group—El Paso County Area, Colorado
(Woodmen Frontage Road Turn Lane)



Map Scale: 1:1,080 if printed on A landscape (11" x 8.5") sheet.



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



Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	1.0	100.0%
Totals for Area of Interest			1.0	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Hydrologic Soil Group—El Paso County Area, Colorado
(Woodmen Frontage Road Turn Lane)

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

-  A
-  A/D
-  B
-  B/D

-  C
-  C/D
-  D
-  Not rated or not available

Water Features

 Streams and Canals

Transportation

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

Background

 Aerial Photography

MAP INFORMATION

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

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 19, Aug 31, 2021

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.

National Flood Hazard Layer FIRMette



104°38'3"W 38°56'40"N



Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

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 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 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



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 **11/10/2021 at 6:13 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

APPENDIX B

Hydrologic Computations

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	C ₅	C ₁₀₀	t _c (min)	Q ₅ (cfs)	Q ₁₀₀ (cfs)
Existing Condition						
X-1	0.66	0.57	0.66	7.53	1.7	3.6
Proposed Condition						
A-1	0.66	0.90	0.96	5.00	3.0	5.7

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: _____
Location: CO, El Paso County

Project Name: Woodmen Frontage RT Lane
Project No.: CNL024
Calculated By: MJP
Checked By: SMB
Date: 11/12/21

Basin ID	Total Area (ac)	Paved Roads			Lawns			Roofs			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
Existing Condition											
X-1	0.66	100	0.53	80.3	2	0.13	0.4	100	0.00	0.00	80.7
Proposed Condition											
A-1	0.66	100	0.66	100.0	2	0.00	0.0	100	0.00	0.00	100.0

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

Subdivision: _____
Location: CO, El Paso County

Project Name: Woodmen Frontage RT Lane
Project No.: CNL024
Calculated By: MJP
Checked By: SMB
Date: 11/12/21

SUB-BASIN DATA						INITIAL/OVERLAND (T _i)			TRAVEL TIME (T _t)					T _c CHECK (URBANIZED BASINS)			FINAL T _c (MIN)
BASIN ID	D.A. (AC)	Hydrologic Soils Group	Impervious (%)	C ₁₀₀	C ₅	L (FT)	S (%)	T _i (MIN)	L (FT)	S (%)	C _v	VEL. (FPS)	T _t (MIN)	COMP. T _c (MIN)	TOTAL LENGTH (FT)	Urbanized T _c (MIN)	T _c (MIN)
X-1	0.66	A	80.7	0.66	0.57	30	1.5	4.6	425	1.5	20.0	2.4	2.9	7.5	455.0	12.5	7.5
A-1	0.66	A	100.0	0.96	0.90	30	1.5	1.8	425	1.5	20.0	2.4	2.9	4.6	455.0	12.5	5.0

NOTES:

$T_i = (0.395 * (1.1 - C_5) * L^{0.5}) / (S^{0.33})$, S in ft/ft

$T_t = L / 60V$ (Velocity From Fig. 501)

Velocity $V = C_v * S^{0.5}$, S in ft/ft

$T_c \text{ Check} = 10 + L / 180$

For Urbanized basins a minimum T_c of 5.0 minutes is required.

For non-urbanized basins a minimum T_c of 10.0 minutes is required

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

Subdivision: _____
Location: CO, El Paso County
Design Storm: 5-Year

Project Name: Woodmen Frontage RT Lane
Project No.: CNL024
Calculated By: MJP
Checked By: SMB
Date: 11/12/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
Existing	1	X-1	0.66	0.57	7.5	0.38	4.53	1.7													
Proposed	1	A-1	0.66	0.90	5.0	0.59	5.10	3.0													

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

Subdivision: _____
Location: CO, El Paso County
Design Storm: 100-Year

Project Name: Woodmen Frontage RT Lane
Project No.: CNL024
Calculated By: MJP
Checked By: SMB
Date: 11/12/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coef.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
Existing	1	X-1	0.66	0.66	7.5	0.44	8.07	3.6													
Proposed	1	A-1	0.66	0.96	5.0	0.63	9.09	5.7													

APPENDIX C

Drainage Map

