

**DRAINAGE LETTER**  
for  
**FALCON SHERIFF SUBSTATION**

Tract B of Tract 36 Woodmen Hills Filing No. 11  
10262 Royal County Down Road  
Falcon, Colorado

**October 5, 2023**

**PCD File No: PPR-22-059**

Prepared for:

**El Paso County**

Prepared by:

**Drexel, Barrell & Co.**  
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Contact: Tim McConnell, P.E.  
(719) 260-0887

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SOILS MAP  
FLOODPLAIN MAP  
HYDROLOGY CALCULATIONS  
REPORT EXCERPTS  
DRAINAGE MAP

**DRAINAGE LETTER**  
for  
**FALCON SHERIFF SUBSTATION**

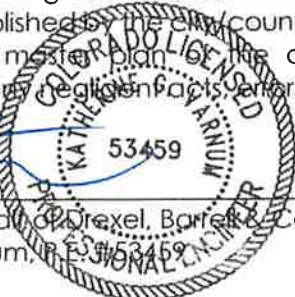
**1.0 CERTIFICATION STATEMENTS**

**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 facts, errors or omissions on my part in preparing this report.

SIGNATURE (Affix Seal):

  
For and on behalf of Drexel, Barrett & Co.  
Katherine Varnum, P.E.



10/5/23  
Date

**Developer's Statement**

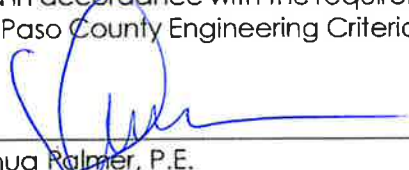
I, the owner/developer have read and will comply with all of the requirements specified in this drainage report and plan.

  
Authorized Signature  
El Paso County

6/4/24  
Date

**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.  
County Engineer / ECM Administrator

6/4/24  
Date

Conditions:

**DRAINAGE LETTER**  
for  
**FALCON SHERIFF SUBSTATION**

## **2.0 PURPOSE**

The purpose of this letter is to supplement the Preliminary and Final Drainage Report for Woodmen Hills Fire Station, by Land Development Consultants, Inc. (June 23, 2009) with regards to the development of Tract B of Tract 36, Woodmen Hills Filing No. 11, 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

The Falcon Sheriff Substation is located at Tract B, Tract 36 Woodmen Hills Filing No. 11 in Falcon, El Paso County, Colorado. The property is bounded by to the north by Stapleton Drive, to the west by tract 1 of Woodmen Hills Filing No. 11, to the south by Royal County Down Road, and to the east by Tract A, Tract 36 Woodmen Hills Filing No. 11, which serves as the Falcon Fire Station District 1.

The site was previously studied as part of the Preliminary and Final Drainage Report for Woodmen Hills Fire Station, by Land Development Consultants, Inc. (June 23, 2009)

### Existing Site & Proposed Development

Tract B is currently undeveloped, with the exception of the drive aisle, along the eastern boundary. Overlot rough grading was completed at some point in the past, with the overall development of Woodmen Hills Filing No. 11. The western boundary is the top of an adjacent drainage channel, identified as Tract 1, Woodmen Hills Filing No. 11. Vegetation consists of sparse growth of native grasses.

The proposed development is the development of a sheriff substation, along with associated parking, drive aisles and landscaping. The proposed area of disturbance is roughly 1.32 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 soil. 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), and 08041C0551G (December 7, 2018) no portion of the site lies within any flood zones.

## **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 Preliminary and Final Drainage Report for Woodmen Hills Fire Station, by Land Development Consultants, (approved July 6, 2009), and referenced by the drainage map excerpt in the appendix.

Basins A and B represent Tract B and the following table lists basin data:

<b>BASIN</b>	<b>AREA (AC)</b>	<b>C5</b>	<b>C100</b>	<b>Q5 (cfs)</b>	<b>Q100 (cfs)</b>
A	0.52	0.20	0.20	0.4	0.7
B	1.81	0.15	0.20	1.0	2.2

Basin A, located along the western boundary drains westerly directly into the existing drainage way.

Flows from Basin B currently sheet flow to the southwest ultimately overtopping the curb and becoming gutter flow easterly along Royal County Down Road, towards an existing 10' sump inlet at the intersection with Meridian Ranch Road.

Flows generated by the offsite flow off Stapleton Road (Basin OS-1), and the fire station (Basins C) are captured and treated for water quality in a porous landscape detention facility, that then discharged into the existing public storm system in Royal County Down Road. Flows reach the existing golf course channel and ultimately reach Woodmen Hills Regional Pond 1.

Basin D discharges directly out to Meridian Ranch Road, where it is captured by the existing storm system at the intersection with Royal County Down Road.

## 6.0 DEVELOPED CONDITION

The proposed development consists of the sheriff substation and associated parking and landscaping. The proposed grading will primarily route flows to the southeast where they will be directed towards the existing porous landscape detention (PLD) water quality facility. This existing facility is functioning as intended.

See below for basin/design point table and description:

RUNOFF & DESIGN POINT SUMMARY				
BASIN	DP	AREA (AC)	Q5	Q100
OS1	1	0.47	0.5	1.2
A		0.35	1.6	2.9
	2	0.83	1.8	3.4
B	3	0.09	0.3	0.6
C		0.24	1.1	2.0
	4	0.33	1.1	2.0
D	5	0.30	1.4	2.5
E	6	0.26	1.0	1.8
F		0.05	0.1	0.2
	7	1.77	4.8	8.9
OS-EX		0.20	0.2	0.4
C-EX		2.30	6.9	12.5
	8	4.28	10.9	20.0
OS2	9	0.86	1.0	2.5

**Basin OS-1** is located in the open space to the north of the proposed site improvements. This area will remain undisturbed. Flows of  $Q_5 = 0.5$  cfs and  $Q_{100} = 1.2$  cfs generally travel to the south as overland flow towards **Design Point 1**.

The proposed northern parking lot additions make up the entirety of **Basin A** and will direct flows to the southeast of the basin at rates of  $Q_5 = 1.6$  cfs and  $Q_{100} = 2.9$  cfs. These flows combine with DP1 flows and are captured by the existing parking lot chase to the southeast at **Design Point 2**.

**Basin B** is located on the westerly side of the proposed building. This outdoor patio and landscaped area will drain directly into the adjacent drive aisle at rates of  $Q_5 = 0.3$  cfs and  $Q_{100} = 0.6$  cfs and travel to the southeast towards **Design Point 3**.

**Basin C** consists of the drive aisle and parking along the western side of the building. This area drains ( $Q_5 = 1.1$  cfs and  $Q_{100} = 2.0$  cfs) to the south and combines with DP3 at a low point (**Design Point 4**) where a proposed private Type 16 combo sump inlet will capture flows in their entirety. Flows continue to the southeast via private 12" RCP storm sewer.

**Basin D** covers the building. Roof drains are anticipated to connect directly to the proposed storm sewer at **Design Point 5**, directing all flow to the east towards the existing water quality facility. A 5'x5' Type VL riprap pad will be provided at the storm sewer

outfall to aid in energy dissipation, without impeding existing swale flows from the fire station chase.

**Basin E** consists of the southern portion of the site. Flows generated by this basin ( $Q_5=1.0\text{cfs}$  and  $Q_{100}=1.8\text{cfs}$ ) will travel as overland and curb and gutter flow to the east and north towards **Design Point 6** and an existing low point in the access drive.

**Basin F** covers the landscaped area on the east side of the proposed building. Flow rates of  $Q_5=0.1\text{cfs}$  and  $Q_{100}=0.2\text{cfs}$  will travel directly to the east towards the access drive.

**Design Point 7** represents all flows associated with this project site development that will reach the existing water quality facility. These flows of  $Q_5=4.8\text{cfs}$  and  $Q_{100}=8.9\text{cfs}$ , are understandably greater when compared to the existing rates established by the previous report ( $Q_5=1.0\text{cfs}$  and  $Q_{100}=2.2\text{cfs}$ ) given the developed condition.

**Basin OS-EX** represents that portion of the offsite OS-1 basin considered in the existing condition, generating flows of  $Q_5=0.2\text{cfs}$  and  $Q_{100}=0.4\text{cfs}$  that currently flow onsite into existing basin C-EX.

**Basin C-EX** represents the existing fire station, and associated improvements. Flows generated by this basin travel via curb and concrete chase towards the existing PLD facility, and **Design Point 8**.

**Offsite basin OS2**, runs the entire length of the western boundary of the site alongside the existing open drainage channel, and will remain unchanged generating flows of  $Q_5=1.0\text{cfs}$  and  $Q_{100}=2.5\text{cfs}$

The existing PLD facility - while not technically oversized to accommodate the development of this adjacent site – was sized assuming 100% imperviousness for the entirety of the fire station site. Once the impervious ratio is corrected, and the tributary area adjusted to include this development, the PLD facility is still within capacity to accommodate these additional flows. Minor grading will occur on the westerly edge to safely receive the proposed storm sewer flows. The facility sizing and underdrain will remain the same with the current outlet structure accommodating the additional flows.

Flows reaching the existing PLD facility at **Design Point 8** ( $Q_5=10.9\text{cfs}$  and  $Q_{100}=20.0\text{cfs}$ ) are less than those anticipated by the original Woodmen Hills Filing No. 11 Design basin AA10 ( $Q_5=12.1\text{cfs}$  and  $Q_{100}=22.6\text{cfs}$ ). Therefore, the existing 24" RCP outfall is assumed to be sufficiently sized to accommodate these developed flows.

Onsite detention for this development is not required as the site was included in the drainage design for Woodmen Hills Filing No. 11 and accounted for in the sizing of the downstream Woodmen Hills Pond #1. See appendix for drainage report and map excerpts.

## 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 water quality basin located at the southeast corner of the adjacent property. 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 water quality basin located at the southeast corner of the adjacent property, 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 household 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 TR B Tract 36 Woodmen Hills Filing No. 11 will not adversely affect surrounding or downstream developments. Downstream Woodmen Hills Pond #1 was sized to accommodate this area in the developed condition for both water quality and detention and appears to be functioning as intended. The onsite PLD facility, and downstream storm system are functioning as designed and are adequate to accommodate the additional flow generated by the development without downstream impact.



## 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. Final Drainage Report for Woodmen Hills Filing No. 11 (URS) 11-27-2002.
3. Final Drainage Report for Woodmen Hills Filing No. 10 (URS) 04-03-2001
4. Final Drainage Report for Woodmen Hills Filing No. 6 (URS Greiner, Inc.) 09-27-1998
5. Final Drainage Report for Woodmen Hills Fire Station (Land Development Consultants) 07-06-2009

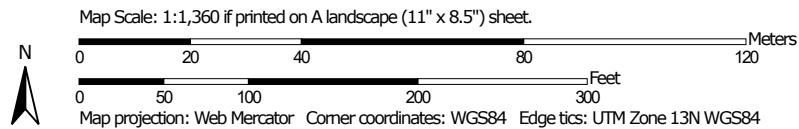
## Appendix



# Custom Soil Resource Report Soil Map



Soil Map may not be valid at this scale.



# Custom Soil Resource Report


## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

### Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

### Water Features

 Streams and Canals

### Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

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

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.

## 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	4.9	100.0%
<b>Totals for Area of Interest</b>		<b>4.9</b>	<b>100.0%</b>

## Map Unit Descriptions

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

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

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

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

## Custom Soil Resource Report

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

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

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

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

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

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

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

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

## 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:* Flood plains, fan terraces, fans  
*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



## Custom Soil Resource Report

### **Other soils**

*Percent of map unit:* 1 percent

*Hydric soil rating:* No

### **Pleasant**

*Percent of map unit:* 1 percent

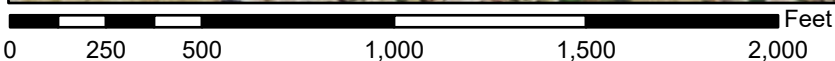
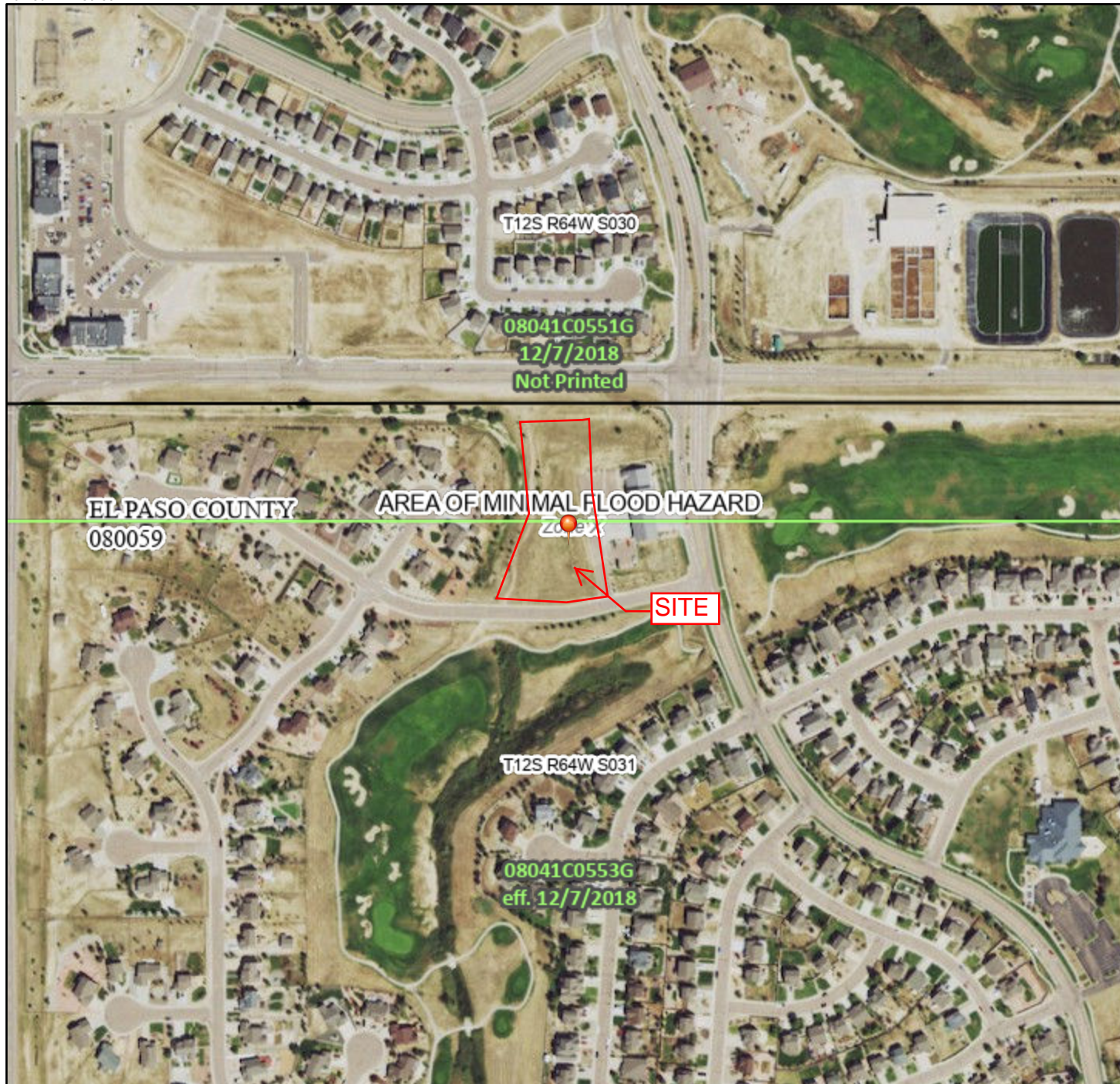
*Landform:* Depressions

*Hydric soil rating:* Yes

# National Flood Hazard Layer FIRMette



104°36'27"W 38°58'21"N



1:6,000

104°35'50"W 38°57'53"N

Basemap Imagery Source: USGS National Map 2023

## Legend

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
OTHER FEATURES		Levee, Dike, or Floodwall
		Cross Sections with 1% Annual Chance Water Surface Elevation
OTHER FEATURES		Coastal Transect
		Base Flood Elevation Line (BFE)
OTHER FEATURES		Limit of Study
		Jurisdiction Boundary
OTHER FEATURES		Coastal Transect Baseline
		Profile Baseline
OTHER FEATURES		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 **8/22/2023 at 12:41 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: Falcon Sheriff Substation  
 PROJECT NO: 21653-00  
 DESIGN BY: KGV  
 REV. BY: TDM  
 AGENCY: El Paso County  
 REPORT TYPE: Letter  
 DATE: 8/22/2023



Drexel, Barrell & Co.

	C2*	C5*	C10*	C100*	% IMPERV
Native Vegetation		0.25		0.35	0
Roof		0.90		0.95	90
Concrete Drives and Walks		0.90		0.95	100
Streets: Paved		0.90		0.95	100
Streets: Gravel		0.80		0.85	80

\*C-Values and Basin Imperviousness based on Table 5-1, El Paso County Drainage Criteria Manual

### DEVELOPED CONIDTION

SUB-BASIN	SURFACE DESIGNATION	AREA ACRE	COMPOSITE RUNOFF COEFFICIENTS				% IMPERV
			C2	C5	C10	C100	
A	Native Vegetation	0.00		0.25		0.35	0
	Roof	0.00		0.90		0.95	90
	Concrete Drives and Walks	0.00		0.90		0.95	100
	Streets: Paved	0.35		0.90		0.95	100
	Streets: Gravel	0.00		0.80		0.85	80
	WEIGHTED AVERAGE			0.90		0.95	100%
	TOTAL A	0.35					
B	Native Vegetation	0.02		0.25		0.35	0
	Roof	0.00		0.90		0.95	90
	Concrete Drives and Walks	0.07		0.90		0.95	100
	Streets: Paved	0.00		0.90		0.95	100
	Streets: Gravel	0.00		0.80		0.85	80
	WEIGHTED AVERAGE			0.76		0.82	78%
	TOTAL B	0.09					
C	Native Vegetation	0.00		0.25		0.35	0
	Roof	0.00		0.90		0.95	90
	Concrete Drives and Walks	0.00		0.90		0.95	100
	Streets: Paved	0.24		0.90		0.95	100
	Streets: Gravel	0.00		0.80		0.85	80
	WEIGHTED AVERAGE			0.90		0.95	100%
	TOTAL C	0.24					



## PROJECT INFORMATION

PROJECT: Falcon Sheriff Substation  
 PROJECT NO: 21653-00  
 DESIGN BY: KGV  
 REV. BY: TDM  
 AGENCY: El Paso County  
 REPORT TYPE: Letter  
 DATE: 8/22/2023



Drexel, Barrell & Co.

	C2*	C5*	C10*	C100*	% IMPERV
<b>Native Vegetation</b>		0.25		0.35	0
<b>Roof</b>		0.90		0.95	90
<b>Concrete Drives and Walks</b>		0.90		0.95	100
<b>Streets: Paved</b>		0.90		0.95	100
<b>Streets: Gravel</b>		0.80		0.85	80

\*C-Values and Basin Imperviousness based on Table 5-1, El Paso County Drainage Criteria Manual

<b>D</b>	Native Vegetation	0.00		0.25		0.35	0
	Roof	0.25		0.90		0.95	90
	Concrete Drives and Walks	0.06		0.90		0.95	100
	Streets: Paved	0.00		0.90		0.95	100
	Streets: Gravel	0.00		0.80		0.85	80
	WEIGHTED AVERAGE			0.90		0.95	92%
<b>TOTAL D</b>		0.30					
<b>E</b>	Native Vegetation	0.07		0.25		0.35	0
	Roof	0.00		0.90		0.95	90
	Concrete Drives and Walks	0.19		0.90		0.95	100
	Streets: Paved	0.00		0.90		0.95	100
	Streets: Gravel	0.00		0.80		0.85	80
	WEIGHTED AVERAGE			0.73		0.79	73%
<b>TOTAL E</b>		0.26					
<b>F</b>	Native Vegetation	0.04		0.25		0.35	0
	Roof	0.00		0.90		0.95	90
	Concrete Drives and Walks	0.01		0.90		0.95	100
	Streets: Paved	0.00		0.90		0.95	100
	Streets: Gravel	0.00		0.80		0.85	80
	WEIGHTED AVERAGE			0.38		0.47	20%
<b>TOTAL F</b>		0.05					
<b>OS1</b>	Native Vegetation	0.47		0.25		0.35	0
	Roof	0.00		0.90		0.95	90
	Concrete Drives and Walks	0.00		0.90		0.95	100
	Streets: Paved	0.00		0.90		0.95	100
	Streets: Gravel	0.00		0.80		0.85	80
	WEIGHTED AVERAGE			0.25		0.35	0%
<b>TOTAL OS1</b>		0.47					

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	C2*	C5*	C10*	C100*	% IMPERV
Native Vegetation		0.25		0.35	0
Roof		0.90		0.95	90
Concrete Drives and Walks		0.90		0.95	100
Streets: Paved		0.90		0.95	100
Streets: Gravel		0.80		0.85	80

\*C-Values and Basin Imperviousness based on Table 5-1, El Paso County Drainage Criteria Manual

<b>OS2</b>	Native Vegetation	0.86		0.25		0.35	0
	Roof	0.00		0.90		0.95	90
	Concrete Drives and Walks	0.00		0.90		0.95	100
	Streets: Paved	0.00		0.90		0.95	100
	Streets: Gravel	0.00		0.80		0.85	80
	WEIGHTED AVERAGE			0.25		0.35	0%
<b>TOTAL OS2</b>		0.86					
<b>OS-EX</b>	Native Vegetation	0.20		0.20		0.25	0
<b>FIRE STATION</b>	Roof	0.00		0.90		0.95	90
	Concrete Drives and Walks	0.00		0.90		0.95	100
	Streets: Paved	0.00		0.90		0.95	100
	Streets: Gravel	0.00		0.80		0.85	80
	WEIGHTED AVERAGE			0.20		0.25	0%
<b>TOTAL OS-EX</b>		0.20					
<b>C-EX</b>	Native Vegetation	0.90		0.20		0.25	0
<b>FIRE STATION</b>	Roof	0.00		0.90		0.95	90
	Concrete Drives and Walks	0.00		0.90		0.95	100
	Streets: Paved	1.40		0.90		0.95	100
	Streets: Gravel	0.00		0.80		0.85	80
	WEIGHTED AVERAGE			0.63		0.68	61%
<b>TOTAL C-EX</b>		2.30					

Tributary to Existing PLD      4.28      0.63      0.68      59%

## PROJECT INFORMATION

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 DATE: 8/22/2023



## RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF DEVELOPED TIME OF CONCENTRATION

SUB-BASIN DATA							INITIAL/OVERLAND TIME (t <sub>i</sub> )			TRAVEL TIME (t <sub>t</sub> )				TIME OF CONCENTRATION		FINAL t <sub>c</sub>
BASIN	DESIGN PT:	C <sub>5</sub>	C <sub>100</sub>	AREA	COMP		LENGTH	SLOPE	t <sub>i</sub>	LENGTH	SLOPE	VEL.	t <sub>t</sub>	COMP.	MINIMUM	
				Ac			Ft	%	Min	Ft	%	FPS	Min	t <sub>c</sub>	t <sub>c</sub>	Min
OS1	1	0.25	0.35	0.47	0.12	0.16	70	4.8	7.9	167	5.2	8.3	0.3	8.2	5.0	8.2
A		0.90	0.95	0.35	0.32	0.34	50	1.0	2.6	144	1.9	5.2	0.5	3.1	5.0	5.0
DP1+A	2	0.50	0.57	0.83	0.42	0.47	From DP1			144	1.9	5.2	0.5	8.7	5.0	8.7
B	3	0.76	0.82	0.09	0.07	0.07	50	0.5	5.7					5.7	5.0	5.7
C		0.90	0.95	0.24	0.21	0.23	35	0.5	2.8	140	1.4	4.8	0.5	3.3	5.0	5.0
DP3+C	4	0.72	0.76	0.33	0.24	0.25	From DP3			140	1.4	4.8	0.5	6.2	5.0	6.2
D	5	0.90	0.95	0.30	0.27	0.29	55	1.2	2.6					2.6	5.0	5.0
E	6	0.73	0.79	0.26	0.19	0.21	75	2.1	4.7	171	1.8	5.2	0.5	5.3	5.0	5.3
F		0.38	0.47	0.05	0.02	0.03	50	1.1	9.3					9.3	5.0	9.3
DP2+DP4+DP5+DP6+F	7	0.64	0.70	1.77	1.14	1.24	From Basin F							9.3	5.0	9.3
OS-EX		0.20	0.25	0.20	0.04	0.05	40	2.0	8.4					8.4	6.0	8.4
C-EX		0.63	0.68	2.30	1.44	1.56	100	5.0	5.2	600	5.0	8.3	1.2	6.4	6.0	6.4
DP7+OS-EX+C-EX	8	0.61	0.67	4.28			From OS-EX			600	5.0	8.3	1.2	9.7	5.0	9.7
OS2	9	0.25	0.35	0.86	0.21	0.30	40	15.2	4.1	200	10.5	8.7	0.4	4.4	6.0	6.0

## PROJECT INFORMATION

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 DESIGN BY: KGV  
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 REPORT TYPE: Letter  
 DATE: 8/22/2023



## RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF DEVELOPED TIME OF CONCENTRATION

SUB-BASIN DATA							INITIAL/OVERLAND TIME (t <sub>i</sub> )			TRAVEL TIME (t <sub>t</sub> )				TIME OF CONCENTRATION		FINAL t <sub>c</sub>
BASIN	DESIGN PT:	C <sub>5</sub>	C <sub>100</sub>	AREA	COMP		LENGTH	SLOPE	t <sub>i</sub>	LENGTH	SLOPE	VEL.	t <sub>t</sub>	COMP.	MINIMUM	
				Ac			Ft	%	Min	Ft	%	FPS	Min	t <sub>c</sub>	t <sub>c</sub>	Min
OS1	1	0.25	0.35	0.47	0.12	0.16	70	4.8	7.9	167	5.2	8.3	0.3	8.2	5.0	8.2
A		0.90	0.95	0.35	0.32	0.34	50	1.0	2.6	144	1.9	5.2	0.5	3.1	5.0	5.0
DP1+A	2	0.50	0.57	0.83	0.42	0.47	From DP1			144	1.9	5.2	0.5	8.7	5.0	8.7
B	3	0.76	0.82	0.09	0.07	0.07	50	0.5	5.7					5.7	5.0	5.7
C		0.90	0.95	0.24	0.21	0.23	35	0.5	2.8	140	1.4	4.8	0.5	3.3	5.0	5.0
DP3+C	4	0.72	0.76	0.33	0.24	0.25	From DP3			140	1.4	4.8	0.5	6.2	5.0	6.2
D		0.90	0.95	0.30	0.27	0.29	55	1.2	2.6					2.6	5.0	5.0
DP4+D	5	0.67	0.71	0.63	0.42	0.45	From DP4			45	0.1	4.2	0.2	6.4	5.0	6.4
E	6	0.73	0.79	0.26	0.19	0.21	75	2.1	4.7	171	1.8	5.2	0.5	5.3	5.0	5.3
F		0.38	0.47	0.05	0.02	0.03	50	20.0	3.5					3.5	5.0	5.0
DP2+DP5+DP6+F	7	0.59	0.65	1.77	1.05	1.15	From DP2			210	1.9	5.2	0.7	9.4	5.0	9.4
OS-EX		0.20	0.25	0.20	0.04	0.05	40	2.0	8.4					8.4	6.0	8.4
C-EX		0.63	0.68	2.30	1.44	1.56	100	5.0	5.2	600	5.0	8.3	1.2	6.4	6.0	6.4
DP7+OS-EX+C-EX	8	0.59	0.64	4.28			From OS-EX			600	5.0	8.3	1.2	9.7	5.0	9.7
OS2	9	0.25	0.35	0.86	0.21	0.30	40	15.2	4.1	200	10.5	8.7	0.4	4.4	6.0	6.0

## PROJECT INFORMATION

PROJECT: Falcon Sheriff Substation  
 PROJECT NO: 21653-00  
 DESIGN BY: KGV  
 REV. BY: TDM  
 AGENCY: El Paso County  
 REPORT TYPE: Letter  
 DATE: 8/22/2023



## RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

DEVELOPED	RUNOFF		5 YR		STORM	P1=	1.50
			DIRECT RUNOFF				
BASIN (S)	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t <sub>c</sub> (MIN)	C * A	I (IN/HR)	Q (CFS)
OS1	1	0.47	0.25	8.2	0.12	4.42	0.5
A		0.35	0.90	5.0	0.32	5.17	1.6
	2	0.83	0.50	8.7	0.42	4.34	1.8
B	3	0.09	0.76	5.7	0.07	4.96	0.3
C		0.24	0.90	5.0	0.21	5.17	1.1
	4	0.33	0.72	6.2	0.24	4.84	1.1
D		0.30	0.90	5.0	0.27	5.17	1.4
	5	0.63	0.67	6.4	0.42	4.80	2.0
E	6	0.26	0.73	5.3	0.19	5.09	1.0
F		0.05	0.38	5.0	0.02	5.17	0.1
	7	1.77	0.59	9.4	1.05	4.23	4.4
OS-EX		0.20	0.20	8.4	0.04	4.38	0.2
C-EX		2.30	0.63	6.4	1.44	4.80	6.9
	8	4.28	0.59	9.7	2.53	4.18	10.6
OS2	9	0.86	0.25	6.0	0.21	4.90	1.0



## PROJECT INFORMATION

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 PROJECT NO: 21653-00  
 DESIGN BY: KGV  
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 AGENCY: El Paso County  
 REPORT TYPE: Letter  
 DATE: 8/22/2023

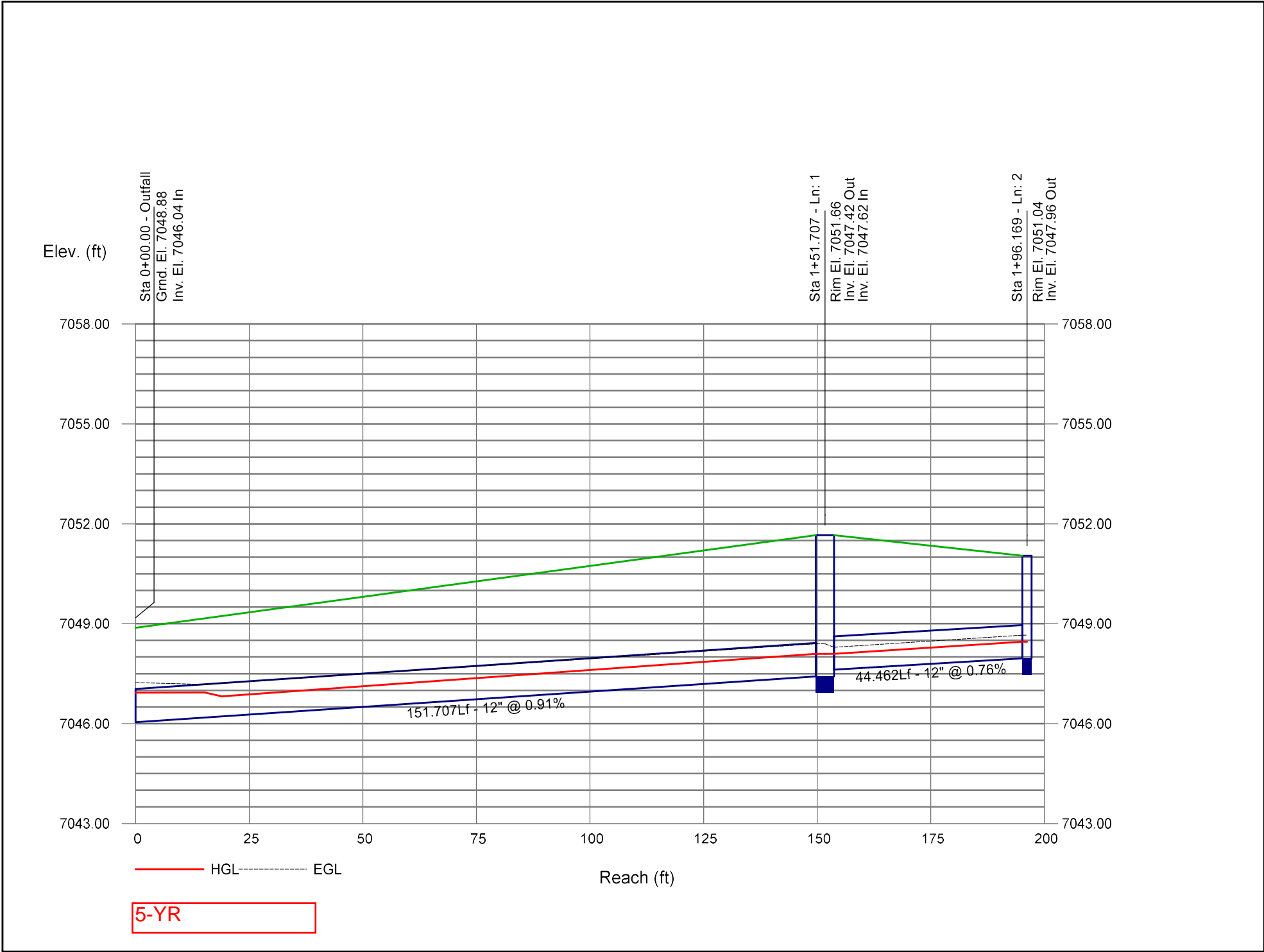


Drexel, Barrell & Co.

## RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

DEVELOPED	RUNOFF		100 YR		STORM	P1=	2.52
			DIRECT RUNOFF				
BASIN (S)	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t <sub>c</sub> (MIN)	C * A	I (IN/HR)	Q (CFS)
OS1	1	0.47	0.35	8.2	0.16	7.43	1.2
A		0.35	0.95	5.0	0.34	8.68	2.9
	2	0.83	0.57	8.7	0.47	7.29	3.4
B	3	0.09	0.82	5.7	0.07	8.33	0.6
C		0.24	0.95	5.0	0.23	8.68	2.0
	4	0.33	0.76	6.2	0.25	8.13	2.0
D		0.30	0.95	5.0	0.29	8.68	2.5
	5	0.63	0.71	6.4	0.45	8.06	3.6
E	6	0.26	0.79	5.3	0.21	8.55	1.8
F		0.05	0.47	5.0	0.03	8.68	0.2
	7	1.77	0.65	9.4	1.15	7.10	8.2
OS-EX		0.20	0.25	8.4	0.05	7.36	0.4
C-EX		2.30	0.68	6.4	1.56	8.06	12.5
	8	4.28	0.64	9.7	2.76	7.02	19.4
OS2	9	0.86	0.35	6.0	0.30	8.22	2.5

Storm Sewer Profile

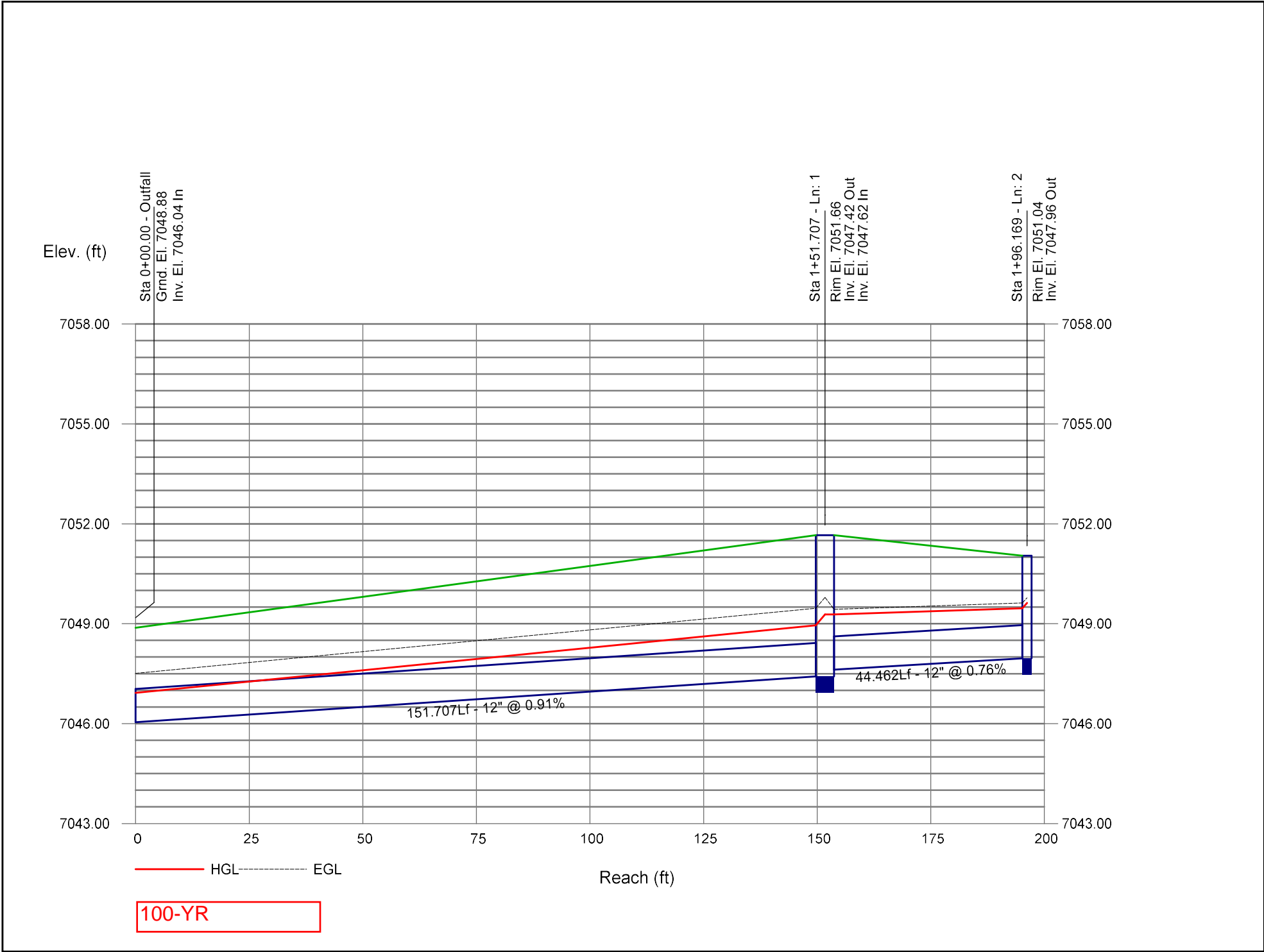


Line No.	Line ID	Flow Rate (cfs)	Line Size (in)	Line Type	Line Length (ft)	Invert Dn (ft)	Invert Up (ft)	Line Slope (%)	HGL Up (ft)	HGL Dn (ft)	Minor Loss (ft)	HGL Jnct (ft)	Vel Ave (ft/s)	Line No.	Energy Loss (ft)	
1	1	2.50	12	Cir	151.707	7046.04	7047.42	0.91	7048.10	7046.93	n/a	7048.10	3.90	1	0.000	
2	2	1.40	12	Cir	44.462	7047.62	7047.96	0.76	7048.46	7048.10	0.20	7048.46	3.68	2	0.000	
<div> <div>Project File: New.stm</div> <div>5-YR</div> <div>Number of lines: 2</div> <div>Date: 8/22/2023</div> </div> <div>NOTES: ** Critical depth</div>																

# Hydraulic Grade Line Computations

Line	Size  (in)	Q  (cfs)	Downstream								Len  (ft)	Upstream										Check		JL coeff  (K)	Minor loss  (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)				
1	12	2.50	7046.04	7046.93	0.89	0.57	3.39	0.30	7047.23	0.000	151.70	7047.42	7048.10	j 0.68**	0.57	4.42	0.30	7048.40	0.000	0.000	n/a	0.64	0.19		
2	12	1.40	7047.62	7048.10	0.48	0.37	3.79	0.20	7048.29	0.000	44.46	7047.96	7048.46	0.50**	0.39	3.56	0.20	7048.66	0.000	0.000	n/a	1.00	0.20		

Storm Sewer Profile



Line No.	Line ID	Flow Rate (cfs)	Line Size (in)	Line Type	Line Length (ft)	Invert Dn (ft)	Invert Up (ft)	Line Slope (%)	HGL Up (ft)	HGL Dn (ft)	Minor Loss (ft)	HGL Jnct (ft)	Vel Ave (ft/s)	Line No.	Energy Loss (ft)	
1	1	4.50	12	Cir	151.707	7046.04	7047.42	0.91	7048.95	7046.93	0.33	7049.28	5.92	1	1.954	
2	2	2.50	12	Cir	44.462	7047.62	7047.96	0.76	7049.46	7049.28	0.16	7049.62	3.18	2	0.187	
<div> <div>Project File: New.stm</div> <div>5-YR</div> <div>Number of lines: 2</div> <div>Date: 8/22/2023</div> </div> <div>NOTES: ** Critical depth</div>																

# Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	12	4.50	7046.04	7046.93	0.89	0.74	6.11	0.58	7047.51	1.215	151.70	7047.42	7048.95	1.00	0.79	5.73	0.51	7049.46	1.361	1.288	1.954	0.64	0.33
2	12	2.50	7047.62	7049.28	1.00	0.79	3.18	0.16	7049.44	0.420	44.462	7047.96	7049.46	1.00	0.79	3.18	0.16	7049.62	0.420	0.420	0.187	1.00	0.16

# Design Procedure Form: Porous Landscape Detention (PLD)

Designer: Ewald  
 Company: LDC  
 Date: May 13, 2009  
 Project: Woodland Hills Fire Station  
 Location: Stapleton Dr and Meridian Ranch Blvd

**EXCERPT FROM WOODMEN HILLS  
 FIRE STATION DRAINAGE REPORT.  
 USES INCORRECT IMPERVIOUS  
 RATIO (OVERSIZES PLD FACILITY)**

<p>1. Basin Storage Volume                  ( <math>I_a = 100\%</math> if all paved and roofed areas u/s of PLD)                  A) Tributary Area's Imperviousness Ratio (<math>i = I_a / 100</math>)                  B) Contributing Watershed Area Including the PLD (Area)                  C) Water Quality Capture Volume (WQCV)                  (WQCV = <math>0.8 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I)</math>)                  D) Design Volume: Vol<sub>PLD</sub> = (WQCV / 12) * Area</p>	<p><math>I_a =</math> <u>100.00</u> %  <math>i =</math> <u>1.00</u>                  Area = <u>100,080</u> square feet                  WQCV = <u>0.40</u> watershed inches                  Vol = <u>3,336.0</u> cubic feet</p>
<p>2. PLD Surface Area (<math>A_{PLD}</math>) and Average Depth (<math>d_{av}</math>)                  (<math>d_{av} = (Vol / A_{PLD})</math>, Min=0.5', Max=1.0')</p>	<p><math>A_{PLD} =</math> <u>3,340</u> square feet  <math>d_{av} =</math> <u>1.00</u> feet</p>
<p>3. Base Course (See Figure PLD-1)</p>	<p><u>6" (Min.) Sandy Loam Turf Layer, Plus 18" (Min.) Layer of 25% Peat and 75% Sand Mix, Plus 9" (Min.) Layer of ASSHTO #8 Coarse Aggregate (CDOT Section 703 Specification).</u>                  Other: _____</p>
<p>5. Draining of porous pavement (Check a, or b, or c, <b>answer d</b>)                  Based on answers to 5a through 5d, check the appropriate method</p> <p>a) Check box if subgrade is heavy or expansive clay <input type="checkbox"/>                  b) Check box if subgrade is silty or clayey sands <input type="checkbox"/>                  c) Check box if subgrade is well-draining soils <input checked="" type="checkbox"/> <b>X</b></p> <p>d) Does tributary catchment contain land uses that may have petroleum products, greases, or other chemicals present, such as gas station, hardware store, restaurant, etc.?                  yes <input type="checkbox"/> no <input checked="" type="checkbox"/> <b>x</b></p>	<p><b>X</b> Infiltration to Subgrade with Permeable Membrane: 5(c) checked <b>and</b> 5(d) = no                  Underdrain with Impermeable Membrane: 5(a) checked <b>or</b> 5(d) = yes                  Underdrain with Permeable Membrane: 5(b) checked <b>and</b> 5(d) = no                  Other: _____</p>

Notes:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



## PROJECT INFORMATION

PROJECT: Falcon Sheriff Substation  
PROJECT NO: 21653-00  
DESIGN BY: KGV  
REV. BY: TDM  
AGENCY: El Paso County  
REPORT TYPE: Letter  
DATE: 12/7/2022



## WATER QUALITY CAPTURE VOLUME

Effective Imperviousness of Tributary Area,  $I_a$  58 %

Tributary Area's Imperviousness Ratio ( $i=I_a/100$ ) 0.58

Contributing Watershed Area 187,744 sf  
4.31 ac

Drain Time 12 hrs

Water Quality Capture Volume (WQCV) 0.18 watershed in  
 $WQCV = 0.8 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i)$

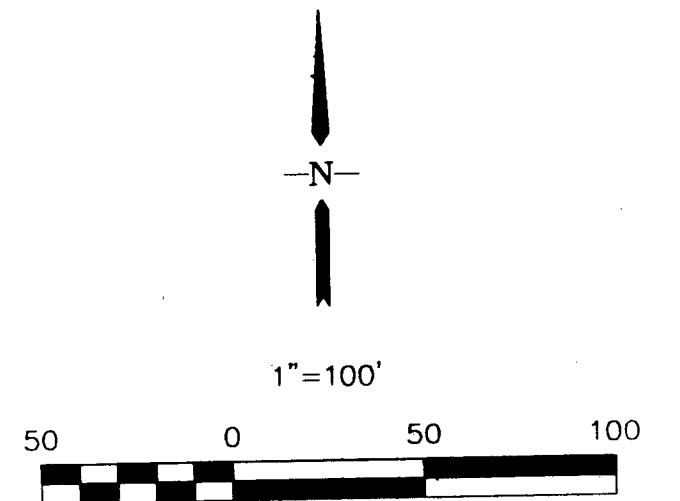
Water Quality Capture Volume (WQCV) Design Volume 2874 cf  
 $V_{WQCV} = WQCV / 12 * \text{Area}$

Existing facility designed for **3,336 cf**

REVISED FOR NEW WATERSHED  
AREA AND UPDATED IMPERVIOUS  
RATIO. WQCV IS LESS THAN  
ORIGINALLY DESIGNED FOR. PLD  
IS ADEQUATE TO ACCOMMODATE  
ADDITIONAL FLOW.



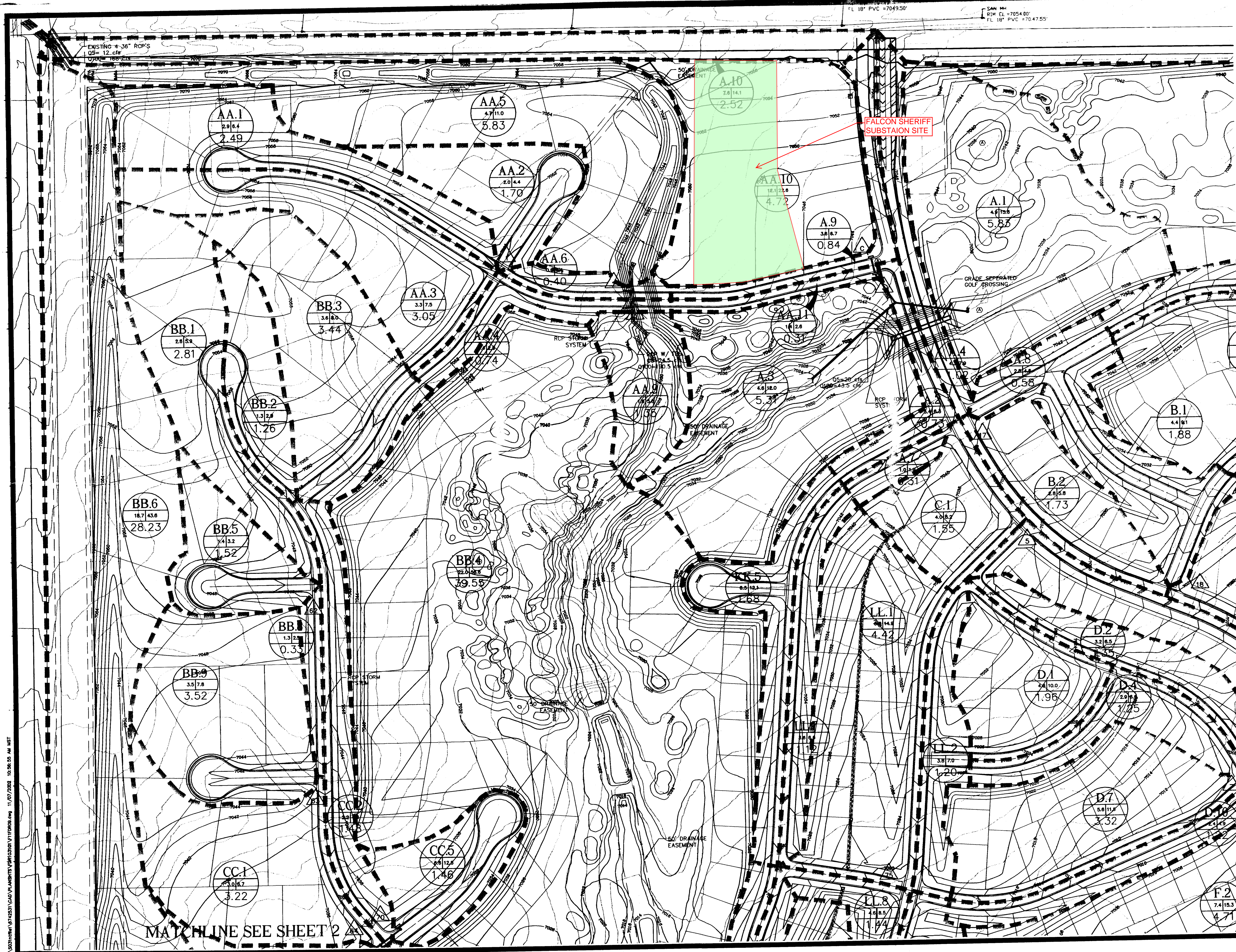
# FINAL DRAINAGE PLAN WOODMEN HILLS FILING NO. 11



## LEGEND

- BASIN LABEL  
(Q5=5 YEAR STORM)  
(Q100=100 YEAR STORM)
- RATIONAL DESIGN POINT  
INTERCEPTED INLET FLOW
- HEC-1 DESIGN  
POINT
- DESIGN PT.  
PIPE ROUTING
- STORM  
INLET
- STREET  
SLOPE
- FLOW  
ARROW
- MAJOR BASIN  
BOUNDARY
- SUB-BASIN  
BOUNDARY
- HIGH POINT/  
LOW POINT
- CURB  
FLOW
- RCP STORM  
SYSTEM

MATCHLINE SEE SHEET 3



MATCHLINE SEE SHEET 2

**URS**  
9960 FEDERAL DRIVE #300  
COLORADO SPRINGS, COLORADO 80921  
PHONE: (719) 531-0001  
FAX: (719) 531-0007

**FIGURE 9  
SHEET 1 OF 5**



### *Haegler Ranch Basin*

As mentioned before, there will be no development in the Haegler Ranch Basin due to plat restrictions. This area, with any proposed development will need to be studied and a new drainage report produced. Also, Eastonville Road and the crossing at Eastonville Road for the Haegler Ranch Basin will need to be further studied when any proposed development occurs.

### ***Detention***

The Woodmen Hills detention pond system will be the source of detention for the Falcon Basin and was approved as part of Woodmen Hills Filings No. 5, 6, 7, 8 and 9. Please refer to the comparison and changes necessary above on the difference between these reports. Also the Bennett Ranch Basin Regional Detention Pond was designed and approved as part of Woodmen Hills Filing No. 10. Please refer to comparison above on the difference between these reports.

The combination of these existing ponds makes it possible to release flows out of the Woodmen Hills subdivision at or below historical levels.

### ***Developed Condition Channel Characteristics***

See Figure 13 Construction/River Stationing for the North and South Channels and Figure 14 Construction/River Stationing for the Golf Course Channels for information on station equivalency between HEC-RAS river stationing and Construction stationing.

### ***Falcon Basin***

#### **Golf Course Channel**

The Falcon DBPS proposed a major channel to be located on the Falcon Basin section of Woodmen Hills Filing No. 11. This major channel is to route flows from offsite basin flows entering Woodmen Hills Filing No. 11 from Falcon Hills via the quadruple 36" RCPs, towards the floodplain located on the border of Woodmen Hills Filing No. 11 and Filing No. 6 (design point EA). This channel has a more natural varying cross-section through the golf course with a minimum depth of 4.7 feet, side slopes of 4:1, minimum bottom width of 5 feet, and a minimum slope of 0.5%. It is designed to carry a maximum flow of 281 cfs, in a 50' drainage easement. Also, a smaller channel, not specified in the Falcon DBPS, is to be located on the southern section of the golf course. It is designed to carry flows from residential basins towards the major golf course channel (see Proposed Design Drainage Characteristics for Falcon Basin for more details on basin areas draining to this channel). This smaller channel also has a "natural" look to it and it is designed to handle 78 cfs. It has a trapezoidal cross-section with a minimum bottom width of 5 feet, minimum depth of 2.71 feet, side slopes of 4:1 in a 30' drainage easement. Please see Appendix E: Channel Calculations.

The golf course channel will start at design point MD (Incoming flows  $Q_{5\text{-year}} = 12$  cfs and  $Q_{100\text{-year}} = 168$  cfs). The channel will continue east along the proposed Stapleton Drive to

the natural low point where it will turn south towards a 72" RCP under Royal County Road. At this point, the channel will carry flows from Falcon Hills and from basin A.5 in Woodmen Hills Filing No. 11.

The channel will cross under Royal County Road via a 72" RCP. From this point, the channel will enter the golf course area. The channel will have a more "natural" look to it, with varying trapezoidal dimensions. The channel will be a major feature for the golf course design. The channel will continue south towards the beginning of the existing floodplain. At this point, the channel will carry flows from Falcon Hills and Woodmen Hills Filing No. 11.

The channel will enter the floodplain area and will cross under Sand Hills Road via a 4-42" RCPs. At this point, the channel will pick up flows draining towards sump inlets located at the low point of Sand Hills Road (see Proposed Drainage Design Characteristics for Falcon Basin for more details on basin areas draining to this point). The channel will then become part of the floodplain and will continue south, towards design point EA.

At design point EA, the channel will exit Woodmen Hills Filing No. 11 and enter Woodmen Hills Filing No. 6 (Exiting flows  $Q_{5\text{-year}} = 69$  cfs and  $Q_{100\text{-year}} = 282$  cfs). The channel will continue through Filing No. 6 towards Pond 1 (see Woodmen Hills Filing No. 6 FDR for more details on Pond 1).

The smaller channel will route flows from the residential basins (see Proposed Drainage Design Characteristics for Falcon Basin for more details on basin areas draining to this channel) towards the crossing of the major channel under Sand Hills Road. At this point, the flows from the major channel will combine with flows from the smaller channel and enter the floodplain channel area.

#### Western Channel

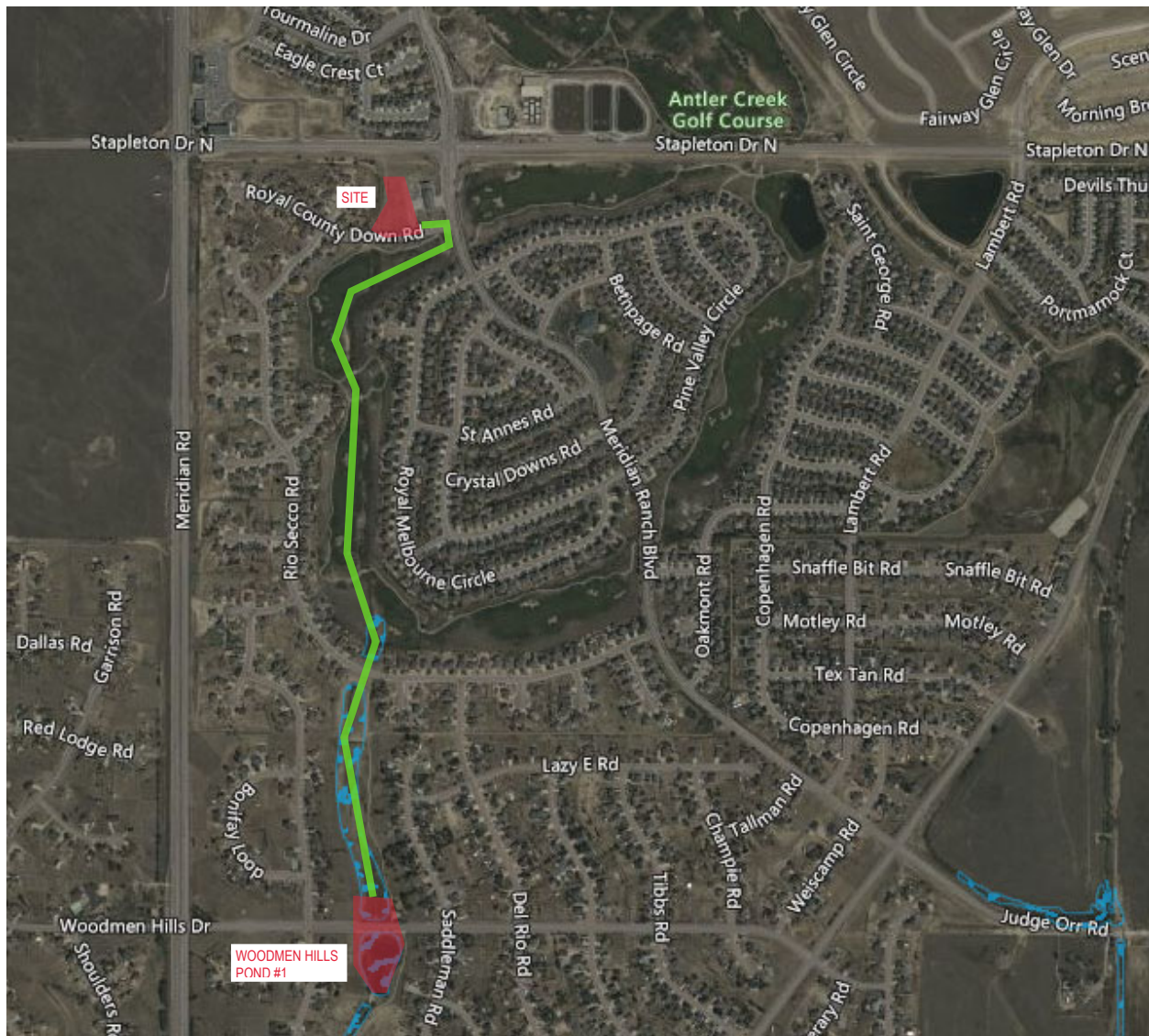
The Meridian Road Channel conveys flow from Basin BB.6 south adjacent to Meridian Road (not including Meridian Road r.o.w. flow) to the boundary with Woodmen Hills Filing No. 5 where it turns east and conveys flow to a proposed 42-inch culvert. This culvert conveys flow under Tompkins Road to the existing FEMA floodplain drainage located between Woodmen Hills Filing No. 5 and No. 6. The design flow (100-year) for this channel is 43.6 cfs. The cross section will be a grass lined trapezoidal channel with 6 to 1 side slopes, maximum depth of 4 feet (flow depth range of 0.5-1.0 feet), bottom width of 9 feet, slope ranging from 0.65% to 6.0% with velocities ranging from 7.0 to 3.2 fps See Appendix E for channel calculations.

#### *Bennett Ranch Basin*

The approved design of the Bennett Regional Detention Pond in the Woodmen Hills Filing No. 10 included a design of two channels within the Bennett Ranch Basin: the

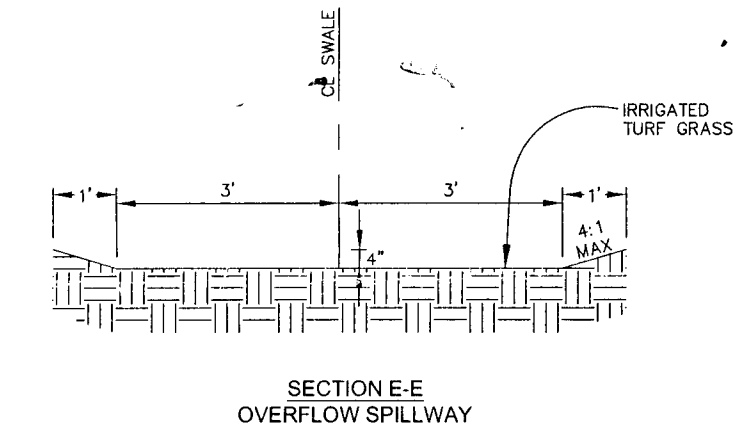
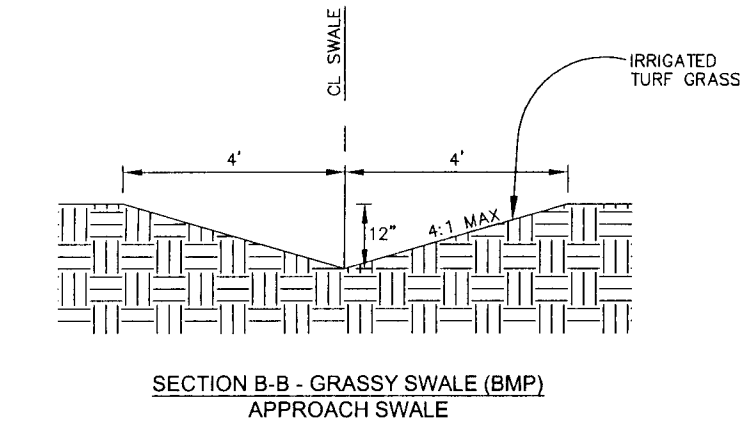
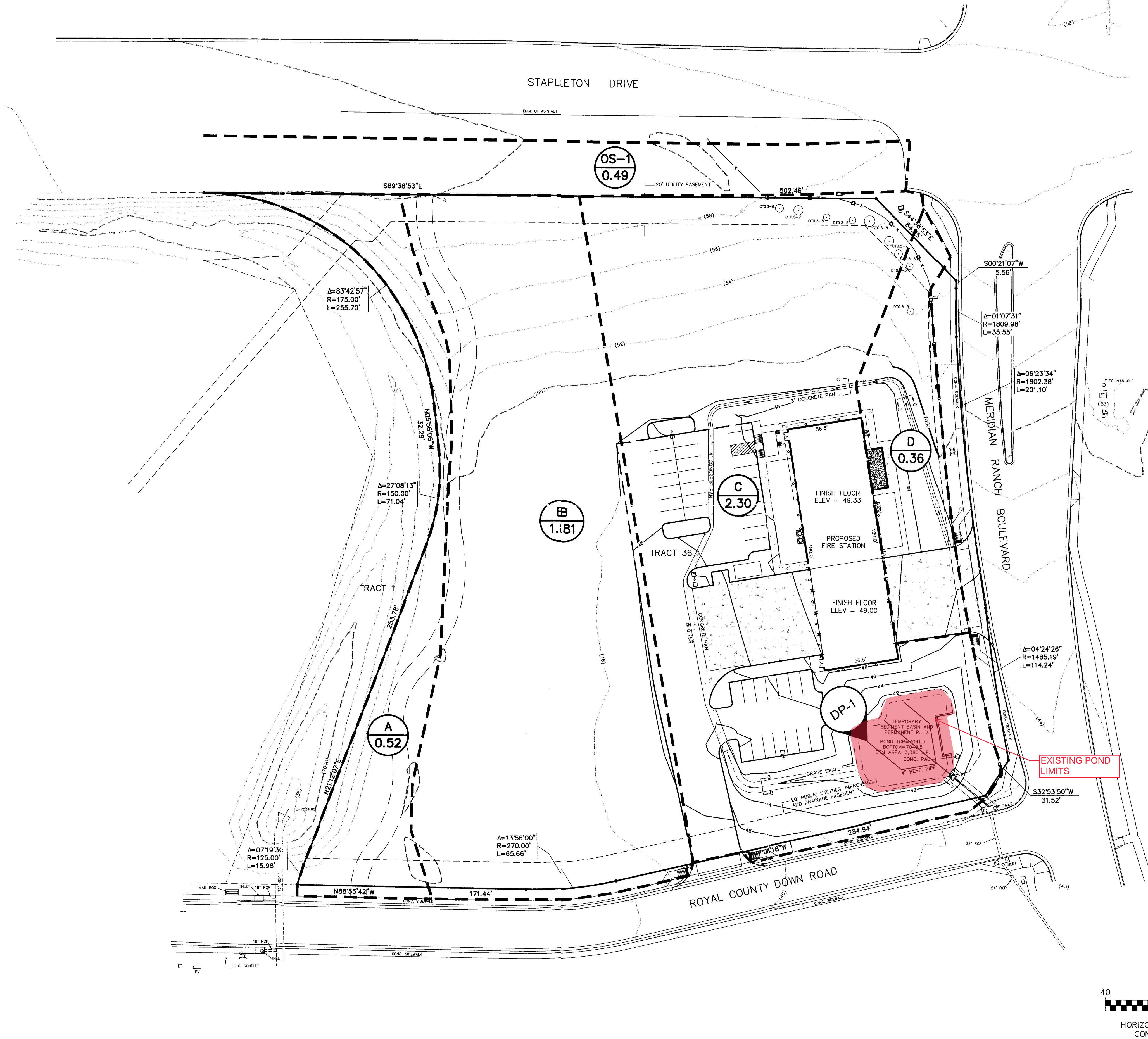
- **Basin AA.10** (4.72 acres) contains the area for a future Police/Fire Station near Stapleton Drive and Meridian Ranch Boulevard. This basin generates 12.1 cfs for the 5-year storm event and 22.6 cfs for the 100-year event. This flow is conveyed to an inlet at Pipe Design Point A. This flow will be carried through an 18" RCP to the inlet at Design Point 4.
- **Basin A.10** (2.52 acres) contains a portion of Stapleton Drive. This basin generates 7.6 cfs for the 5-year storm event and 14.1 cfs for the 100-year event. This flow is routed through basin A.9 to an inlet at Design Point C.
- **Basin A.9** (0.84 acres) contains a portion of Royal County Down Road and Meridian Ranch Blvd. This basin generates 3.6 cfs for the 5-year storm event and 6.7 cfs for the 100-year event. This flow is conveyed to an inlet at Design Point C.
- **Design Point C** ( $Q_5=9$  cfs and  $Q_{100}=17$  cfs) contains Basin A.9 and AA.10. A 10' sump inlet will intercept 9 cfs for the 5-year storm and 17 cfs for the 100-year storm. This inlet will connect to proposed 24" RCP and release into the proposed golf course channel in Basin A.3.
- **Basin AA.11** (0.31 acres) contains a portion of Royal County Down Road. This basin generates 1.4 cfs for the 5-year storm event and 2.6 cfs for the 100-year event. This flow is conveyed to an inlet at Design Point 4.
- **Design Point 4** ( $Q_5=1$  cfs and  $Q_{100}=3$  cfs) contains Basin AA.11. A 10' on-grade inlet will intercept 1 cfs for the 5-year storm and 2 cfs for the 100-year storm. This inlet will connect to proposed 24" RCP and release into the proposed golf course channel in Basin A.3.
- **Basin A.3** (5.31 acres) contains a portion of the proposed golf course between Royal County Down Road and Royal Melbourne Circle. This basin generates 4.6 cfs for the 5-year storm event and 12.0 cfs for the 100-year event. This flow is conveyed as channel flow to the confluence of the main golf channel with Basin AA.9.
- **Basin BB.4** (39.55 acres) contains a portion of the majority of the golf course channel. This basin generates 22.0 cfs for the 5-year storm event and 56.6 cfs for the 100-year event. This flow is conveyed as channel flow to the proposed set of 48" RCP's under Sand Hills Road to Basin DD.7. See the appendix for channel calculations.
- **Basin DD.7** (8.84 acres) contains  $\frac{1}{2}$  acre lots and the golf channel outlet. This basin generates 7.4 cfs for the 5-year storm event and 17.3 cfs for the 100-year event. This flow is conveyed as channel flow to the south into the channel in Woodmen Hills Filing No. 6.

Falcon Sheriff Substation – Runoff Routing to Woodmen Hills Pond #1





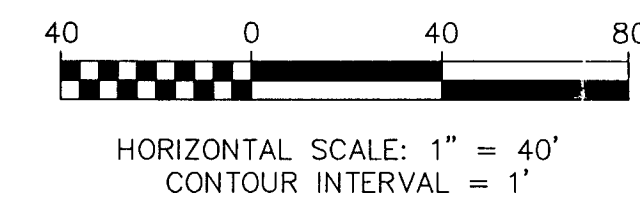
MAP UTILIZED FOR EXISTING CONDITION



CONTOUR LEGEND	
(6840)	MAJOR CONTOUR
(41)	MINOR CONTOUR
6840	MAJOR CONTOUR
41	MINOR CONTOUR

DRAINAGE PLAN LEGEND	
	BASIS BOUNDARY
	CONCENTRATED FLOW PATH
	BASIN NAME ACREAGE
	DRAINAGE BASIN TAG
	DESIGN POINT TAG DESIGN POINT DESIGNATION

DRAINAGE BASIN SUMMARY PROPOSED BASINS		
BASIN	MINOR FLOW (cfs) (5 YR)	MAJOR FLOW (cfs) (100 YR)
OS-1	0.50	0.80
A	0.40	0.70
B	1.00	2.20
C	—	—
D	0.20	0.30
DP-1	3.80	8.00



48 HOURS  
BEFORE YOU  
DIG...  
CALL  
BEFORE  
YOU  
DIG...  
1-800-922-1987

REVISIONS	
No.	Description
1	COUNTY COMMENTS

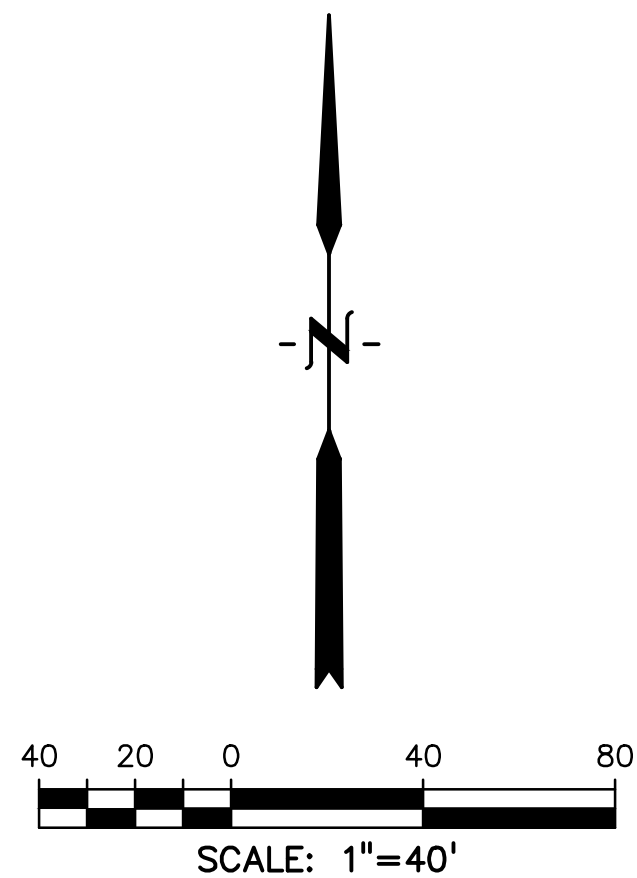
H Scale:	1" = 40'
V Scale:	N/A
Designed By:	DCE
Drawn By:	KLV
Checked By:	DCE
Date:	05/21/09

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2850 Serendipity Circle West · Colorado Springs, CO 80917

# WOODMEN HILLS FIRE STATION PROPOSED DRAINAGE PLAN

Project No.: 08055  
Sheet: 2 of 2





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  
 FIRE STATION BASIN BOUNDARY (FOR REFERENCE)  
 FLOW DIRECTION  
 DESIGN POINT  
 BASIN  
AREA (ACRE) C5  
C100

RUNOFF & DESIGN POINT SUMMARY					
BASIN	DP	AREA (AC)	Q5	Q100	
OS1	1	0.47	0.5	1.2	
A	2	0.35	1.6	2.9	
	2	0.83	1.8	3.4	
B	3	0.09	0.3	0.6	
C		0.24	1.1	2.0	
	4	0.33	1.1	2.0	
D		0.30	1.4	2.5	
	5	0.63	2.0	3.6	
E	6	0.26	1.0	1.8	
F		0.05	0.1	0.2	
	7	1.77	4.4	8.2	
OS-EX		0.20	0.2	0.4	
C-EX		2.30	6.9	12.5	
	8	4.28	10.6	19.4	
OS2	9	0.86	1.0	2.5	

PREPARED BY:  
  
DREXEL, BARRELL & CO.  
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COLORADO SPGS, COLORADO 80905  
CONTACT: TIM D. McCONNELL, P.E.  
(719)260-0887  
BOULDER • COLORADO SPRINGS • GREELEY

CLIENT:  
  
EL PASO COUNTY

DRAINAGE MAPPING PLANS FOR:  
**WOODMEN HILLS  
SHERIFF SUBSTATION**  
EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	9-13-2022
RESUBMITTAL	10-5-2023
DESIGNED BY:	KGV
DRAWN BY:	CGH
CHECKED BY:	TDM
FILE NAME:	21653-00-DRN

PREPARED UNDER MY DIRECT  
SUPERVISION FOR AND ON BEHALF  
OF DREXEL, BARRELL & CO.  
DRAWING SCALE:  
HORIZONTAL: 1" = 40'  
VERTICAL: N/A

PROPOSED  
DRAINAGE  
PLAN

PROJECT NO. 21653-00CSCV  
DRAWING NO.

**DRN**

SHEET: 1 OF 1