



# FINAL DRAINAGE REPORT

## STRUTHERS ROAD IMPROVEMENTS

El Paso County, Colorado

---

PREPARED FOR:  
**GK Development, LLC**  
8605 Explorer Dr., Suite 260  
Colorado Springs, CO 80920

PREPARED BY:  
**Galloway & Company, Inc.**  
1155 Kelly Johnson Blvd., Suite 305  
Colorado Springs, CO 80920

DATE:  
**February 2020**



**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.*

\_\_\_\_\_  
Charlene Durham, PE 36727  
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: GK Development, LLC  
8605 Explorer Dr., Suite 260  
Colorado Springs, CO 80920

**DEVELOPER'S CERTIFICATION**

*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 add an acceleration lane on Struthers Road, at the intersection of Reagan Heights, just south of Baptist Road, in Monument, Colorado. Acceleration lane is in association with the development of the Monument Ridge Apartments, which is part of the overall Monument Ridge development. The purpose of this Final Drainage Report is to identify the changes in drainage patterns, locate and identify tributary or downstream drainage features and facilities that are impacted by the improvements.

## II. General Description

The site is located in Section 36, Township 11 S, Range 67W, of the Sixth Principal Meridian, County of El Paso, State of Colorado. The proposed improvements are located just south of the intersection of Struthers Road and Reagan Heights. The proposed improvements include the construction of an acceleration lane from Reagan Heights onto Struthers Road. Acceleration lane will require 650' of pavement, curb and gutter and concrete median to be removed and replaced with additional pavement, and new curb and gutter and concrete median. A Vicinity Map is included in Appendix A.

The existing soil type within the proposed site as determined by the NRCS Web Soil Survey for El Paso County Area consists of Peyton-Pring Complex and Tomah-Crowfoot Complex, both of which are defined as having a hydrologic soil group of B. See the soils map included in Appendix A.

## III. Previous Reports

The proposed site has been included in multiple drainage studies in the past. The following is a composite list of the existing reports pertaining to this site analysis.

1. *Preliminary Drainage Report, Monument Ridge*, by WestWorks Engineering, August 2007.
2. *Preliminary/Final Drainage Report Apartment Complex at Monument Ridge*, by Galloway & Company, Inc, December 2019.

## IV. Drainage 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.

## V. Existing Drainage Conditions

In the existing conditions, the basin (H-1, 2.09 acres) begins at the Baptist Road intersection, to the north, encompasses Struthers Road, to a high point in the road, approximately 900' south of the Reagan Heights intersection. Runoff generated from the west half of Struthers Road drains via curb and gutter to a low point approximately 350' south of the Reagan Heights intersection, Design Point A. An existing CDOT Type R inlet intercepts these flows. Flows for the basin are 7.3 cfs and 14.00 cfs for the 5 and 100-year events.

The existing Type R inlet is connected via an 18" RCP, to an existing 60" RCP, traversing Struthers Road, from the east to the west. This culvert also collects flows from an existing Type R inlet on the east side of Struthers Road and the outfall from an existing detention pond from the Monument Ridge Development. The existing 60" RCP releases flows on the west side of Struthers Road, where runoff is directed towards Jackson Creek.

## 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. Runoff continues through same path as under existing conditions.

### 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 project site is less than 1 acre and is not a sensitive or high-risk site, it is excluded from any water quality requirements.

### **3. Stabilize Drainageways**

This step implements stabilization to the channel to accommodate developed flows while protecting infrastructure and controlling sediment loading from erosion in the drainageways. Erosion protection in the form of existing riprap pads is located at outfall points.

### **4. Implement Site Specific and Other Source Control BMPs**

Since this project only includes roadway work, the potential use of source control BMP's is limited, but will be employed where practicable.

## **VII. Proposed Drainage Conditions**

In the proposed conditions, the historic drainage pattern is maintained in completely the same way. There are no increases to the basin flow, improvements to Struthers Road will remove impervious areas (concrete median) and replace with impervious areas (asphalt pavement & concrete median).

A drainage basin map has been prepared for this area. The map is included in Appendix C.

## **VIII. 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 and is not a sensitive or high-risk site, it is excluded from any water quality requirements.

## **IX. Maintenance**

There are no new facilities being constructed as part of this project. Existing storm appurtenances within public Right-Of-Way (Struthers Road) will continue to be owned and maintained by El Paso County.

## **X. Wetlands Mitigation**

No wetlands are located on site.

## **XI. Floodplain Statement**

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map number 08041C0286G, effective December 7, 2018, the project site is located within Zone X. Zone X is areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance-flood. 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.

## **XIII. Conclusion**

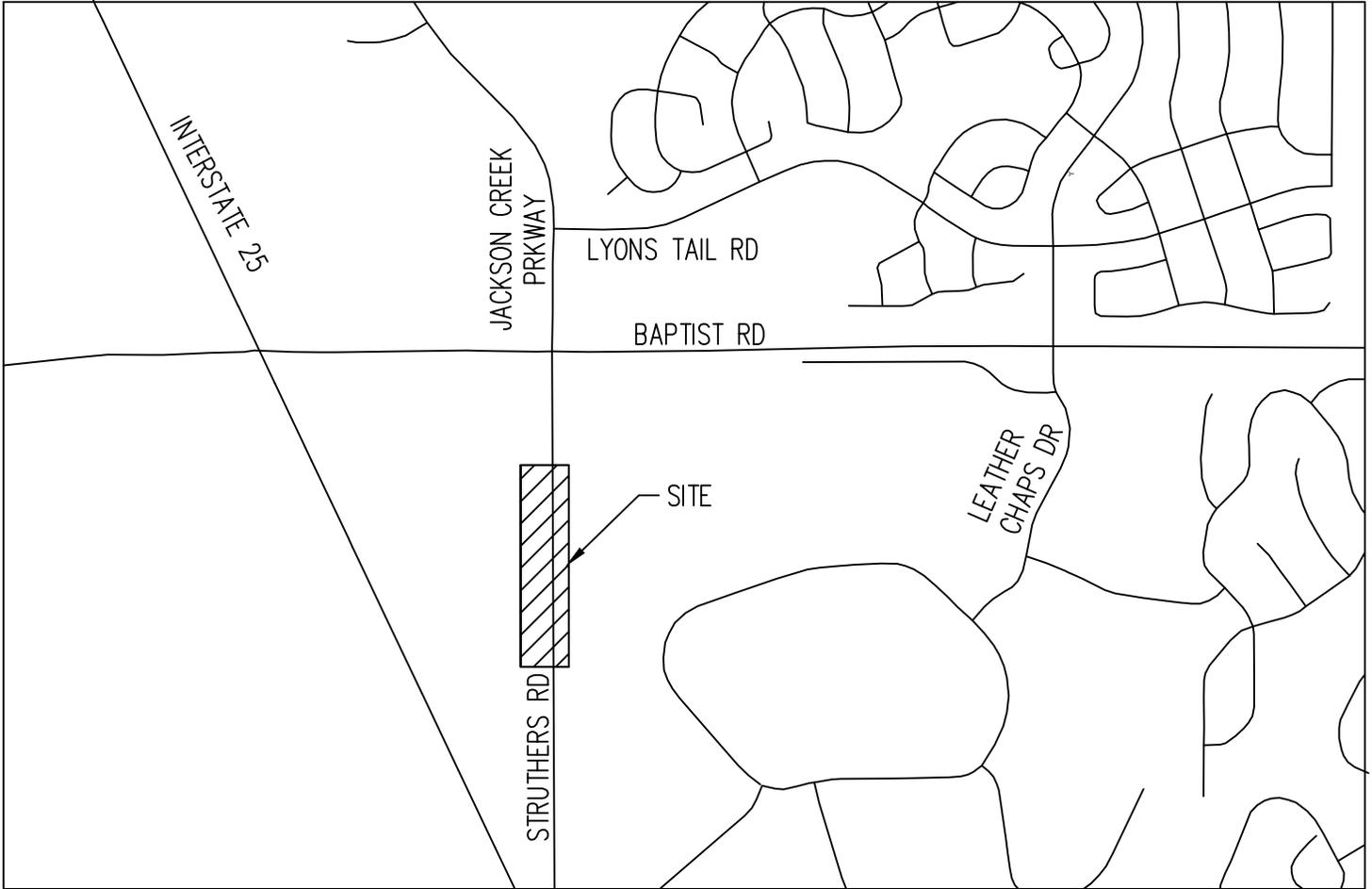
This report for the proposed roadway improvements to Struthers Road, at the intersection of Reagan Heights, has been prepared using the criteria and methods as described in the El Paso County Drainage

Criteria Manual. Roadway improvements will result in no changes to runoff generated, there will be no impact on the downstream infrastructure.

#### **XIV. References**

1. *City of Colorado Springs/County of El Paso Drainage Criteria Manual*, October 1991.
2. *El Paso County Ordinance 15-042*, May 2014.
3. *Drainage Criteria Manual, Volume 2*, City of Colorado Springs, November 2002.
4. *Urban Storm Drainage Criteria Manual*, Urban Drainage and Flood Control District, January 2016 (with current revisions).
5. *Preliminary Drainage Report, Monument Ridge*, by WestWorks Engineering, August 2007.
6. *Preliminary/Final Drainage Report Apartment Complex at Monument Ridge*, by Galloway & Company, Inc, December 2019.

**APPENDIX A**  
**Exhibits and Figures**



STRUTHERS ROAD IMPROVEMENTS

STRUTHERS ROAD  
SCALE: N.T.S  
VICINITY MAP

Project No:	GNK000020.20
Drawn By:	CMD
Checked By:	RGD
Date:	03/02/2020



1755 Telstar Drive, Suite 107  
Colorado Springs, CO 80920  
719.900.7220 • [GallowayUS.com](http://GallowayUS.com)

**NOTES TO USERS**

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov/> or contact the National Geodetic Survey at the following address:

NGS Information Services  
 NOAA, NINGS12  
 National Geodetic Survey  
 SSMC-3, #9202  
 1315 East-West Highway  
 Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at <http://www.ngs.noaa.gov/>.

**Base Map** information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

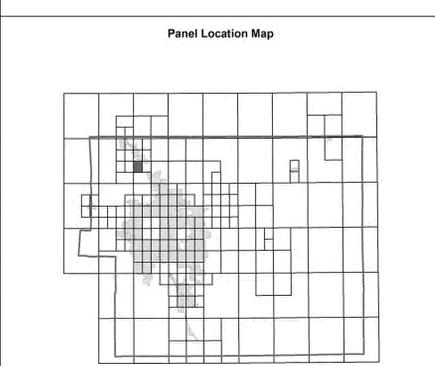
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center (MSC)** via the FEMA Map Information eXchange (FIMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at <http://www.msc.fema.gov/>.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfp>.

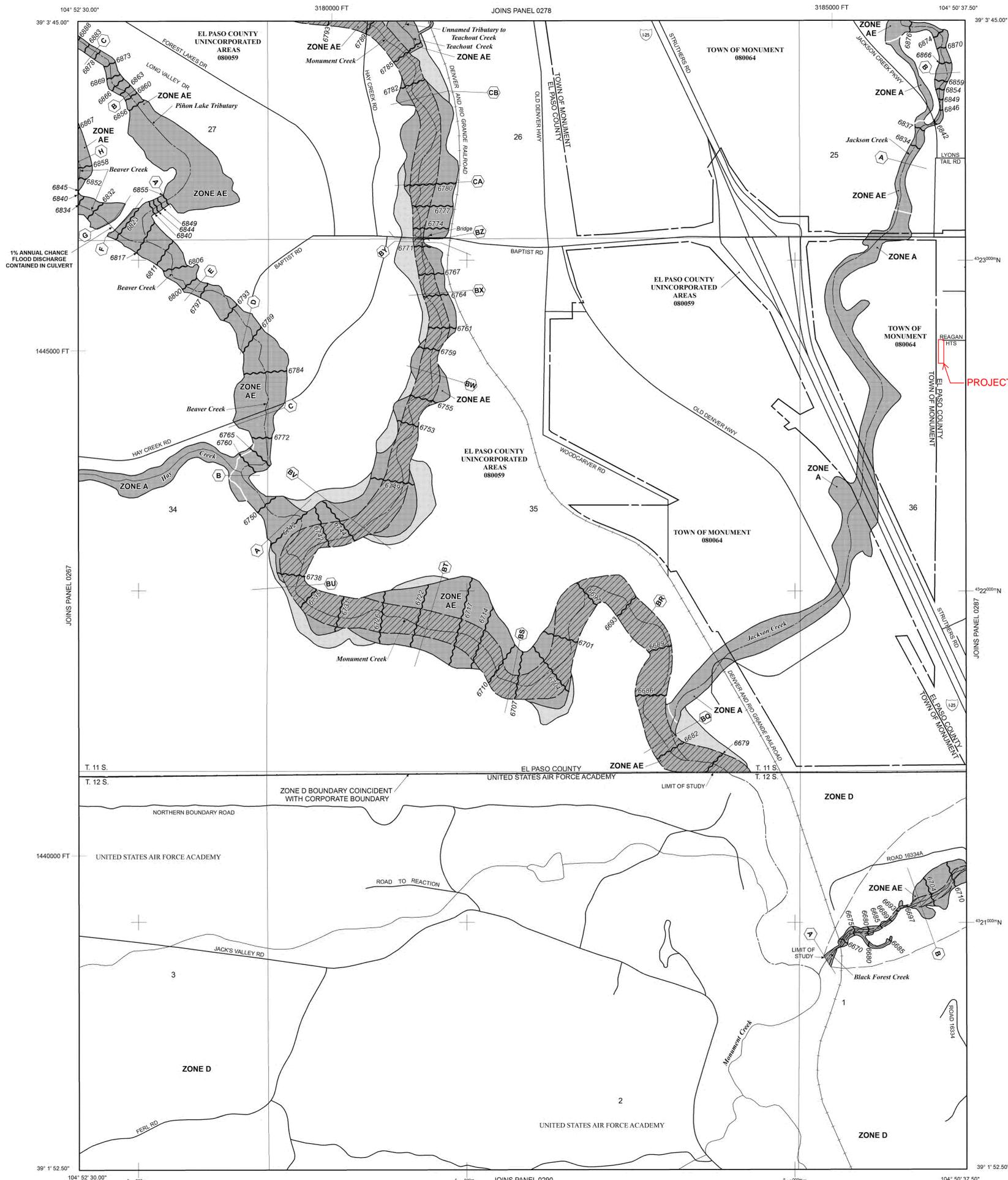
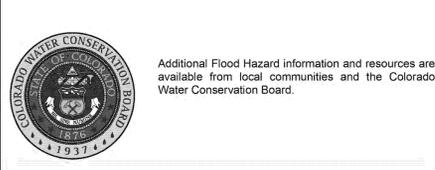
El Paso County Vertical Datum Offset Table	
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

**Panel Location Map**



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



**LEGEND**

- SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD
- The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AD, AH, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.
- ZONE A** No Base Flood Elevations determined. Base Flood Elevations determined.
- ZONE AE** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AD** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decremented. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.
- FLOODWAY AREAS IN ZONE AE
- The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.
- OTHER FLOOD AREAS**
- ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot, or with drainage areas less than 1 square mile, and areas protected by levees from 1% annual chance flood.
- OTHER AREAS**
- ZONE D** Areas determined to be outside the 0.2% annual chance floodplain.
- ZONE D** Areas in which flood hazards are undetermined, but possible.
- COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS
- OTHERWISE PROTECTED AREAS (OPAs)
- CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
- Floodplain boundary
- Floodway boundary
- Zone D Boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- Base Flood Elevation line and value; elevation in feet\* (EL 987)
- Cross section line
- Transsect line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 5000-foot grid ticks; Colorado State Plane coordinate system, central zone (FIPSZONE 0902), Lambert Conformal Conic Projection
- Bench mark (see explanation in Notes to Users section of this FIRM panel)
- River Mile
- MAP REPOSITORIES**  
 Refer to Map Repository list on Map Index
- EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP**  
 MARCH 17, 1997
- EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**  
 DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.
- For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.
- To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.



**NFP**

**PANEL 0286G**

**FIRM**

**FLOOD INSURANCE RATE MAP**

**EL PASO COUNTY, COLORADO AND INCORPORATED AREAS**

**PANEL 286 OF 1300**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:	COMMUNITY	NUMBER	PANEL	SUFFIX
	EL PASO COUNTY	080059	0286	G
	MONUMENT, TOWNSHIP OF	080064	0286	G

Notice to User: The Map Number shown below should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject community.

**MAP NUMBER**  
08041C0286G

**MAP REVISED**  
DECEMBER 7, 2018

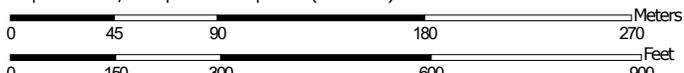
**Federal Emergency Management Agency**

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 11 SOUTH, RANGE 67 WEST, AND TOWNSHIP 12 SOUTH, RANGE 67 WEST.

# Custom Soil Resource Report Soil Map



Map Scale: 1:3,270 if printed on a portrait (8.5" x 11") sheet.



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 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 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
68	Peyton-Pring complex, 3 to 8 percent slopes	3.0	29.2%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	7.3	70.8%
<b>Totals for Area of Interest</b>		<b>10.3</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,

## Custom Soil Resource Report

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

### 68—Peyton-Pring complex, 3 to 8 percent slopes

#### Map Unit Setting

*National map unit symbol:* 369f

*Elevation:* 6,800 to 7,600 feet

*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Peyton and similar soils:* 40 percent

*Pring and similar soils:* 30 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Peyton

##### Setting

*Landform:* Hills

*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

##### Typical profile

*A - 0 to 12 inches:* sandy loam

*Bt - 12 to 25 inches:* sandy clay loam

*BC - 25 to 35 inches:* sandy loam

*C - 35 to 60 inches:* sandy loam

##### Properties and qualities

*Slope:* 3 to 5 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Well drained

*Runoff class:* Low

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Moderate (about 7.3 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4c

*Hydrologic Soil Group:* B

*Ecological site:* Sandy Divide (R049BY216CO)

*Hydric soil rating:* No

#### Description of Pring

##### Setting

*Landform:* Hills

*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Linear

*Across-slope shape:* Linear

## Custom Soil Resource Report

*Parent material:* Arkosic alluvium derived from sedimentary rock

### Typical profile

*A - 0 to 14 inches:* coarse sandy loam

*C - 14 to 60 inches:* gravelly sandy loam

### Properties and qualities

*Slope:* 3 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Well drained

*Runoff class:* Low

*Capacity of the most limiting layer to transmit water (Ksat):* High (2.00 to 6.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Low (about 6.0 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 3e

*Hydrologic Soil Group:* B

*Ecological site:* Loamy Park (R048AY222CO)

*Hydric soil rating:* No

### Minor Components

#### Other soils

*Percent of map unit:*

*Hydric soil rating:* No

#### Pleasant

*Percent of map unit:*

*Landform:* Depressions

*Hydric soil rating:* Yes

## 93—Tomah-Crowfoot complex, 8 to 15 percent slopes

### Map Unit Setting

*National map unit symbol:* 36bb

*Elevation:* 7,300 to 7,600 feet

*Farmland classification:* Not prime farmland

### Map Unit Composition

*Tomah and similar soils:* 50 percent

*Crowfoot and similar soils:* 30 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

## Description of Tomah

### Setting

*Landform:* Alluvial fans, hills

*Landform position (three-dimensional):* Side slope, crest

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Alluvium derived from arkose and/or residuum weathered from arkose

### Typical profile

*A - 0 to 10 inches:* loamy sand

*E - 10 to 22 inches:* coarse sand

*C - 48 to 60 inches:* coarse sand

### Properties and qualities

*Slope:* 8 to 15 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Well drained

*Runoff class:* Medium

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Very low (about 2.0 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 6e

*Hydrologic Soil Group:* B

*Ecological site:* Sandy Divide (R049BY216CO)

*Hydric soil rating:* No

## Description of Crowfoot

### Setting

*Landform:* Alluvial fans, hills

*Landform position (three-dimensional):* Side slope, crest

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Alluvium

### Typical profile

*A - 0 to 12 inches:* loamy sand

*E - 12 to 23 inches:* sand

*Bt - 23 to 36 inches:* sandy clay loam

*C - 36 to 60 inches:* coarse sand

### Properties and qualities

*Slope:* 8 to 15 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Well drained

*Runoff class:* Medium

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)

*Depth to water table:* More than 80 inches

## Custom Soil Resource Report

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Low (about 4.7 inches)

### **Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 6e

*Hydrologic Soil Group:* B

*Ecological site:* Sandy Divide (R049BY216CO)

*Hydric soil rating:* No

### **Minor Components**

#### **Other soils**

*Percent of map unit:*

*Hydric soil rating:* No

#### **Pleasant**

*Percent of map unit:*

*Landform:* Depressions

*Hydric soil rating:* Yes

**APPENDIX B**  
**Hydrologic Computations**

# COMPOSITE % IMPERVIOUS CALCULATIONS: PROPOSED

**Subdivision:** Monument  
**Location:** CO, El Paso County

**Project Name:** Struthers Road Improvements  
**Project No.:** GNK000002.20  
**Calculated By:** CMD  
**Checked By:** SMB  
**Date:** 2/26/20

1	2	3	4	5	6	7	8	9	10	11	12
Basin ID	Total Area (ac)	Paved/Gravel Roads			Lawns/Undeveloped			Roofs			Basins Total
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	Weighted % Imp.
H-1	2.09	100	2.09	100.0	2	0.00	0.0	90	0.00	0.0	100.0
P-1	2.09	100	2.09	100.0	2	0.00	0.0	90	0.00	0.0	100.0

**NOTES:**

*% Impervious values are taken directly from Table 6-6 in the Colorado Springs DCM Vol. 1. CH. 6 (Referencing UDFCD 2001)*

# COMPOSITE RUNOFF COEFFICIENT CALCULATIONS: PROPOSED

**Subdivision:** Monument  
**Location:** CO, El Paso County

**Project Name:** Struthers Road Improvements  
**Project No.:** GNK000002.20  
**Calculated By:** CMD  
**Checked By:** SMB  
**Date:** 2/26/20

	1	2	3	4	5	6	7	8	9	10	11	12	13
Basin ID	Total Area (ac)	Paved/Gravel Roads			Lawns/Undeveloped			Roofs			Composite C <sub>5</sub>	Composite C <sub>100</sub>	
		C <sub>5</sub>	C <sub>100</sub>	Area (ac)	C <sub>5</sub>	C <sub>100</sub>	Area (ac)	C <sub>5</sub>	C <sub>100</sub>	Area (ac)			
H-1	2.09	0.90	0.96	2.09	0.09	0.36	0.00	0.73	0.81	0.00	0.90	0.96	
P-1	2.09	0.90	0.96	2.09	0.09	0.36	0.00	0.73	0.81	0.00	0.90	0.96	

**NOTES:**

*C values are taken directly from Table 6-6 in the Colorado Springs DCM Vol. 1. CH. 6 (Referencing UDFCD 2001)  
 Coefficients use HSG A&B soils - Refer to "Appendix A: Exhibits and Figures" for soil map*

# STANDARD FORM SF-2: PROPOSED TIME OF CONCENTRATION

**Subdivision:** Monument  
**Location:** CO, El Paso County

**Project Name:** Struthers Road Improvements  
**Project No.:** GNK000002.20  
**Calculated By:** CMD  
**Checked By:** SMB  
**Date:** 2/26/20

1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18	
SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME						Tc CHECK			FINAL																	
DATA						(T <sub>i</sub> )			(T <sub>t</sub> )						(URBANIZED BASINS)																				
BASIN ID	D.A. (AC)	Hydrologic Soils Group	Impervious (%)	C <sub>5</sub>	C <sub>100</sub>	L (FT)	S (%)	T <sub>i</sub> (MIN)	L (FT)	S (%)	C <sub>v</sub>	VEL. (FPS)	T <sub>t</sub> (MIN)	COMP. T <sub>c</sub> (MIN)	TOTAL LENGTH(FT)	Urbanized T <sub>c</sub> (MIN)	T <sub>c</sub> (MIN)																		
H-1	2.09	B	100.0	0.90	0.96	35	1.0	2.2	1350	1.5	20	2.4	9.19	11.4	1385.0	17.7	11.4																		
P-1	2.09	B	100.0	0.90	0.96	35	1.0	2.2	1350	1.5	20	2.4	9.19	11.4	1385.0	17.7	11.4																		

**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<sub>c</sub> of 5.0 minutes is required.

For non-urbanized basins a minimum T<sub>c</sub> of 10.0 minutes is required

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

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

**Project Name:** Struthers Road Improvements  
**Project No.:** GNK000002.20  
**Calculated By:** CMD  
**Checked By:** SMB  
**Date:** 2/26/20

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)
	A	H-1	2.09	0.90	11.4	1.88	3.90	7.3													Existing flow into ex inlet at DP A
	A	P-1	2.09	0.90	11.4	1.88	3.90	7.3													Proposed flow into ex inlet at DP A

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

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

**Project Name:** Struthers Road Improvements  
**Project No.:** GNK000002.20  
**Calculated By:** CMD  
**Checked By:** SMB  
**Date:** 2/26/20

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)	
		H-1	2.09	0.96	11.4	2.01	6.95	14.0													Existing flow into ex inlet at DP A
		P-1	2.09	0.96	11.4	2.01	6.95	14.0													Proposed flow into ex inlet at DP A

**APPENDIX C**  
**Drainage Map**

