EPC STORMWATER REVIEW COMMENTS ARE SHOWN IN ORANGE BOXES WITH BLACK TEXT

FINAL DRAINAGE REPORT
FOR
FLYING HORSE NORTH FILING NO. 2

JANUARY 2022

Prepared for:
PRI #2
2138 FLYING HORSE CLUB DRIVE
COLORADO SPRINGS, CO 80921
Contact: Joe Loidolt

Prepared by:
CLASSIC CONSULTING
619 N. CASCADE AVE., SUITE 200
COLORADO SPRINGS, CO 80903
(719) 785-0790

PCD File No. SP-22-xxx SF-22-008
Job no. 1306.00

FINAL DRAINAGE REPORT FOR FLYING HORSE NORTH FILING NO. 2

DRAINAGE REPORT STATEMENT

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 County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

____ ____________________

Marc A. Whorton, Colorado P.E. #37155 Date

OWNER’S/DEVELOPER'S STATEMENT:

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

Business Name: PRI #2

____

Title: __________________________________

Address: 2138 Flying Horse Club Drive

Colorado Springs, CO 80921

EL PASO COUNTY:

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

________________________________ ____________________

Jennifer Irvine, P.E. Date

County Engineer, / ECM Administrator

Conditions:

FINAL DRAINAGE REPORT FOR FLYING HORSE NORTH FILING NO. 2

TABLE OF CONTENTS:

APPENDICES

FINAL DRAINAGE REPORT FOR FLYING HORSE NORTH FILING NO. 2

PURPOSE

This portion of the Flying Horse North development was previously studied in the Preliminary Drainage Report for Flying Horse North Preliminary Plan and Final Drainage Report for Flying Horse North Filing No. 1 approved September 2018. The previous drainage basins BS-22, BS-23 and BS-23A encompass the proposed single lot development and final plat. The purpose of this report is to document any drainage improvements required with the development of this single large lot rural residential plat.

GENERAL DESCRIPTION

Flying Horse North Filing No. 2 is a single large lot rural residential lot shown as lot 220 within the Flying Horse North PUD Plan approved in March 2017. The total acreage of the proposed lot is 2.898 acres and located in section 36, township 11 south, range 66 west of the sixth principal meridian. The site is bounded on the north the existing Flying Horse North Golf Course platted as Tract J and to the west, east and south by the future Flying Horse North development that is currently unplatted. The site is within the Black Squirrel Creek Drainage Basin.

The average soil condition reflects Hydrologic Group “B” (Elbeth Sandy Loam) as determined by the “Soil Survey of El Paso County Area,” prepared by the Soil Conservation Service (see map in Appendix).

EXISTING DRAINAGE CONDITIONS

The proposed lot contains an existing highpoint along a ridge line adjacent to the existing golf course. The majority of the lot is heavily forested with existing slopes ranging 4% to 25%. No significant disturbance exists on-site other than the natural trails crossing the property. The highpoint is near the middle of the lot with existing drainage patterns traveling in all directions. The north portion of the lot currently is tributary to the natural channel within the adjacent golf course. The western portion of the lot is tributary to a smaller natural ravine within the adjacent golf course and the tee boxes for hole #15. The south and eastern portions of the lot are tributary to the unplatted future Flying Horse North development. As mentioned above, this lot falls within the previous drainage basins BS-22, BS-23 and BS-23A as found on the Drainage Map excerpt from the previous report. (See Appendix) All three of these basins, and thus this development, are tributary to the existing Flying Horse North Detention Pond 8. This facility is fully constructed and owned and maintained by the Flying Horse North HOA.

DEVELOPED DRAINAGE CONDITIONS

The proposed basins established are based on the existing high point and ridge within the lot along with the proposed placement of driveway and multiple structures. The site plan for the lot proposes a main residence with detached garage and a separate detached barn/garage structure with associated hard surface driveway access. The following are the proposed basin descriptions for this lot.

Design Point 1 (Q_5 = 0.4 cfs and Q_{100} = 1.3 cfs) represents developed flows from Basin A. This basin consists of a portion of the barn roof and driveway and sheet flows in a southwesterly direction across a natural receiving pervious area on-site and then through future residential development property and ultimately into the existing Flying Horse North Pond 8 where formal stormwater quality/detention takes place. This downstream facility design accounted for this developed residential flow.

Design Point 2 (Q_5 = 0.4 cfs and Q_{100} = 1.7 cfs) represents developed flows from Basin B. This basin consists of a portion of the driveway that sheet flows in a northeasterly direction across a natural receiving pervious area on-site and then through future residential development property and ultimately into the existing Flying Horse North Pond 8 where formal stormwater quality/detention takes place. This downstream facility design accounted for this developed residential flow even though per the UD-BMP ver. 3.7 (Design Procedure: Runoff Reduction spreadsheet) this basin’s unconnected impervious areas and receiving pervious areas show 100% WQCV reduction with 0% untreated WQCV. (See Appendix)

Design Point 3 (Q_5 = 0.3 cfs and Q_{100} = 1.3 cfs) represents developed flows from Basin C. This basin consists of a portion of the barn roof and garage roof that sheet flows in a northwesterly direction across a natural receiving pervious area on-site and then through the golf course property and ultimately into the existing Flying Horse North Pond 8 where formal stormwater quality/detention takes place. This downstream facility design accounted for this developed residential flow.

Design Point 4 (Q_5 = 1.4 cfs and Q_{100} = 4.7 cfs) represents developed flows from Basin D. This basin consists of a portion of all the barn and garage roof, driveway and the entire main house structure. This basin sheet flows in a northerly direction across a large natural receiving pervious area on-site and then directly onto golf course property and ultimately into the existing Flying Horse North Pond 8 where formal stormwater quality/detention takes place. This downstream facility design also accounted for this developed residential flow.

Even though all these basins are tributary to a downstream SWQ facility, per the UD-BMP ver. 3.7 (Design Procedure: Runoff Reduction spreadsheet) these basin's unconnected impervious areas and receiving pervious areas show 100% WQCV reduction with 0% untreated WQCV. (See Appendix)

DRAINAGE CRITERIA

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014 along with the El Paso County Engineering Criteria Manual, updated October 2020. Individual on-site developed basin design was calculated using the Rational Method. Runoff Coefficients are based on the imperviousness of the particular land use and the hydrologic soil type in accordance with Table 6-6. The average rainfall intensity, by recurrence interval found in the Intensity-Duration-Frequency (IDF) curves in Figure 6-5. (See Appendix)

The City of Colorado Springs/El Paso County DCM requires the Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls. The Four Step Process pertains to management of smaller, frequently occurring storm events, as opposed to larger storms for which drainage and flood control infrastructure are sized. Implementation of these four steps helps to achieve storm water permit requirements.

This site adheres to this **Four Step Process** as follows:

1. **Employ Runoff Reduction Practices:** Proposed developed rural large lot impervious areas (roof tops, patios and driveways) will to the extent possible, sheet flow across on-site natural receiving pervious areas to slow runoff and increase time of concentration prior to being conveyed to the existing downstream stormwater quality facility. This site does not contain any directly connected impervious areas.

2. **Stabilize Drainageways:** After developed flows utilize the runoff reduction practices through natural receiving pervious areas, developed flows will travel via stabilized natural channels and routed directly to the existing stormwater quality facility, Pond 8 that was originally constructed with Flying Horse North Filing No. 1.

3. **Provide Water Quality Capture Volume (WQCV):** Runoff from this development will be treated through capture and slow release of the WQCV in the existing stormwater quality facility (Pond 8).

4. **Consider need for Industrial and Commercial BMPs**: No industrial uses are proposed within this development. However, a site-specific storm water quality and erosion control plan and narrative will be submitted along with the individual site plan. Details such as site-specific sediment and erosion control construction BMP's as well as temporary and permanent BMP's will be detailed in this plan and narrative to protect

receiving waters. BMP's will be constructed and maintained as the development has been graded and erosion control methods employed.

FLOODPLAIN STATEMENT

No portion of this site is located within a FEMA floodplain as determined by the Flood Insurance Rate Map (F.I.R.M.) Map Number 08041C0315G, with effective date of December, 7 2018. (See Appendix)

DRAINAGE AND BRIDGE FEES

This site lies entirely within the Black Squirrel Creek Drainage Basin boundaries.

The fees are calculated using the following impervious acreage method approved by El Paso County. Flying Horse North Filing No. 1 has a total area of 2.898 acres with a rural, large lot residential land use designation.

The percent imperviousness for this subdivision is calculated as follows:

Fees for 2.5 Ac. lot residential Land Use

(Per El Paso County Percent Impervious Chart: 11%)

2.898 Ac. x 11% = 0.319 **Impervious Ac.**

The following calculations are based on the 2022 Black Squirrel Creek Drainage/Bridge fees:

ESTIMATED FEES:

Bridge Fees

$ 604.00 x 0.319 Impervious Ac. = **$ 192.68**

Drainage Fees

$ 9,595.00 x 0.319 Impervious Ac. = **$ 3,060.81**

Per ECM 3.10.2a a 25% reduction in fees apply to large lots. Please include a statement explaining the reduction and apply to drainage basin fee.

SUMMARY

The proposed single residential lot development, drainage patterns and quantities remain consistent with the previously approved final drainage report for Flying Horse North Filing No. 1. The proposed development was previously accounted for with SWQ treatment/detention provided in the existing downstream facility (Pond 8) and thus, will not adversely impact surrounding properties.

Pond 8 was sized for full development, but at the time, the orifice plate was sized for pre-development flow only (SF181). Engineer to confirm sizing of existing orifice plate at Pond 8 and design upgrades, as necessary. In the event a new orifice plate is required, a revised SDI Form will be necessary to update the State database.

PREPARED BY:

Classic Consulting Engineers & Surveyors, LLC

Marc A. Whorton, P.E.
Project Manager

mw/130600/Reports/130600FDR.doc

REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual, as revised in November 1991 and 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.

2. "Master Development Drainage Plan for Flying Horse North", Classic Consulting, dated September 2016.

3. "Preliminary Drainage Report for Flying Horse North (Golf Course Grading and Private Access Roads)", Classic Consulting, dated September 2016.

4. "Final Drainage Report and Plan for Cathedral Pines Subdivision Filing No. 2," Leigh Whitehead & Associates, dated March 2005.

5. "Final Drainage Report and Plan for Cathedral Pines Subdivision Filing No. 3," Stillwater Engineering, dated July 2006.

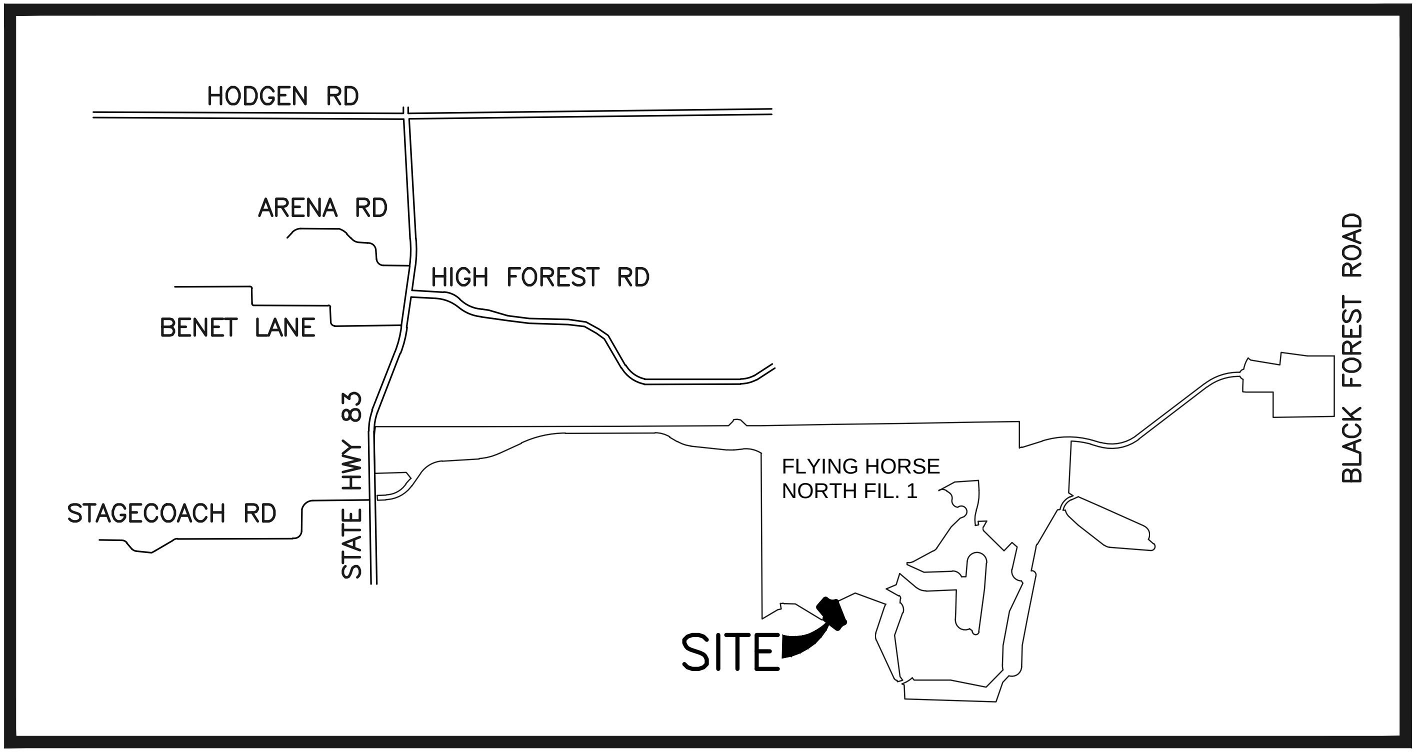
6. "Black Squirrel Creek Drainage Basin Planning Study," URS Corporation, dated August 1987.

7. "Urban Storm Drainage Criteria Manual Volume 1, 2 & 3" Urban Drainage and Flood Control District, dated January 2016.

8. "Preliminary Drainage Report for Flying Horse North Preliminary Plan and Final Drainage Report for Flying Horse North Filing No. 1", Classic Consulting, dated September 2018.

APPENDIX

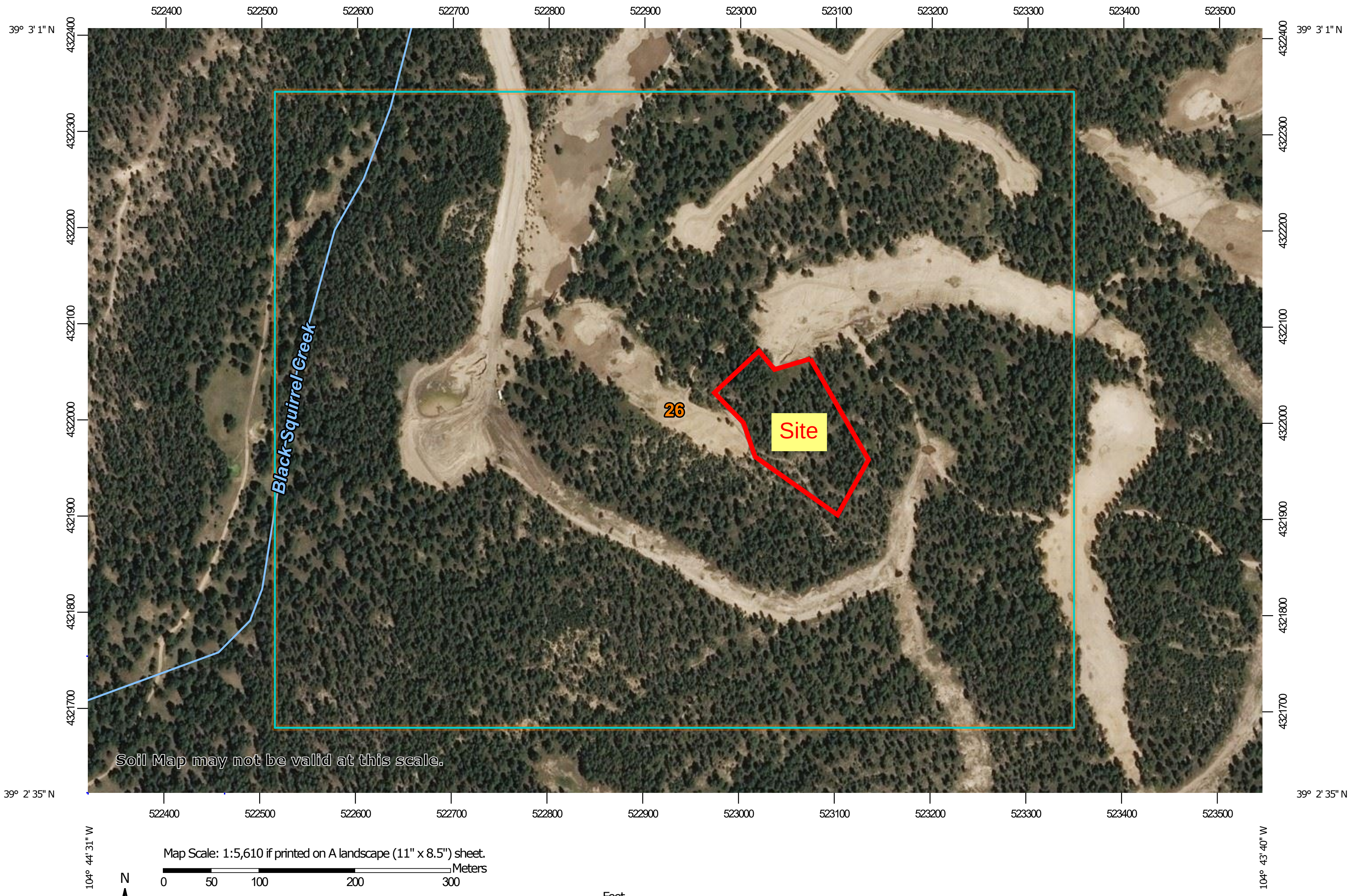
VICINITY MAP



VICINITY MAP

SOILS MAP (S.C.S. SURVEY)

Soil Map—El Paso County Area, Colorado
(Flying Horse North Filing No. 2)



Map Scale: 1:5,610 if printed on A landscape (11" x 8.5") sheet.

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

El Paso County Area, Colorado

26—Elbeth sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 367y
Elevation: 7,300 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Elbeth and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Elbeth

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkose

Typical profile

A - 0 to 3 inches: sandy loam
E - 3 to 23 inches: loamy sand
Bt - 23 to 68 inches: sandy clay loam
C - 68 to 74 inches: sandy clay loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
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 supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:

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
Λ Lava Flow
ψ 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
ψ 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 8, 2018—May 26, 2019

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
26	Elbeth sandy loam, 8 to 15 percent slopes	137.0	100.0%
Totals for Area of Interest		**137.0**	**100.0%**

Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

F.E.M.A MAP

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 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, N/NGS12
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.

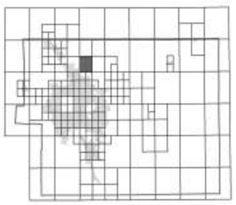
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this 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/nfip.

El Paso County Vertical Datum Offset Table

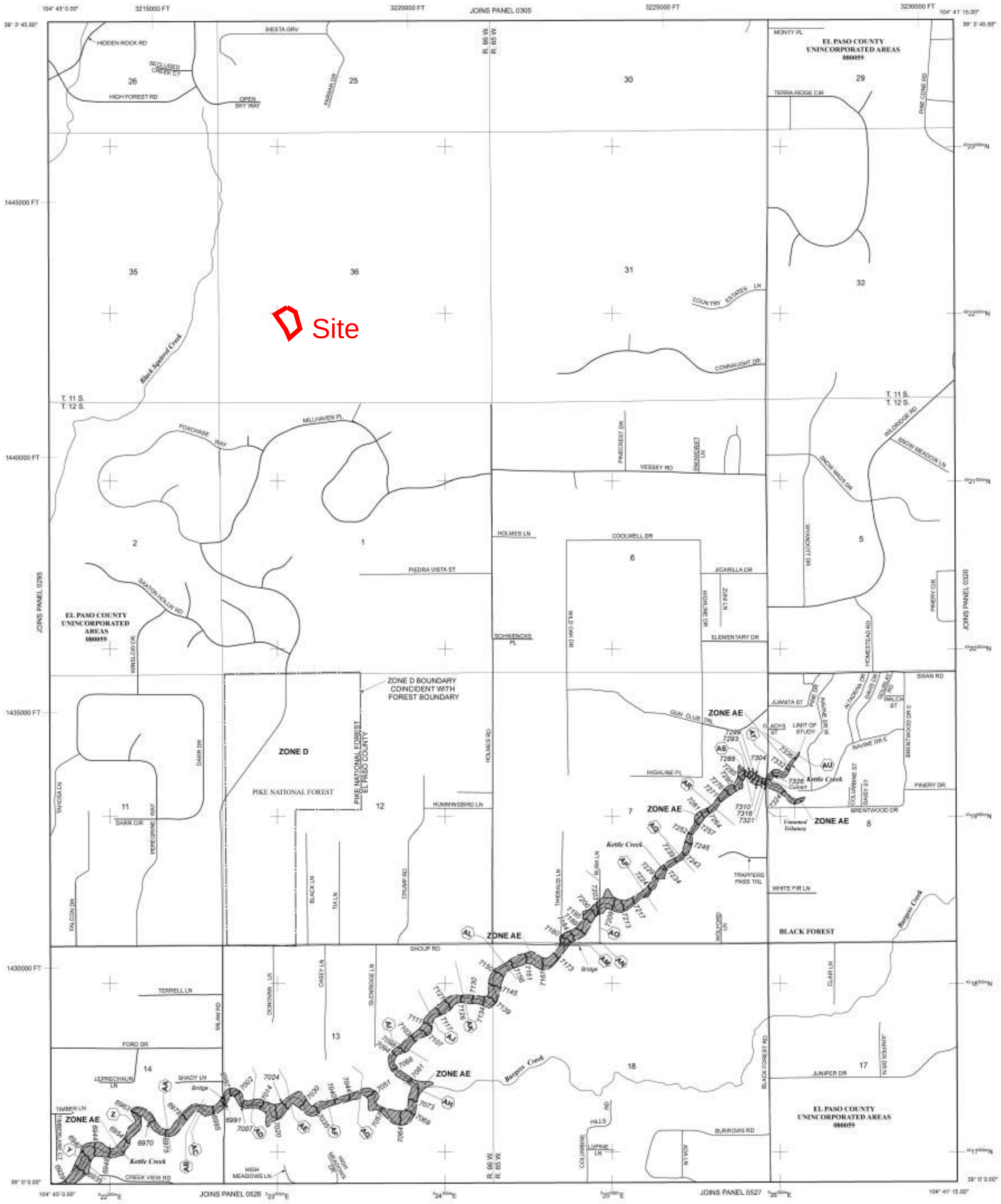
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

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, AO, AR, 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.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	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 decertified. 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 X	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.
~~ 513 ~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

(A)———(A)	Cross section line
(23)- - - - -(23)	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories 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.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP

PANEL 0315G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 315 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0315	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
08041C0315G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

CALCULATIONS

For Colorado Springs and much of the Fountain Creek watershed, the 1-hour depths are fairly uniform and are summarized in Table 6-2. Depending on the location of the project, rainfall depths may be calculated using the described method and the NOAA Atlas maps shown in Figures 6-6 through 6-17.

Table 6-2. Rainfall Depths for Colorado Springs

Return Period	1-Hour Depth	6-Hour Depth	24-Hour Depth
2	1.19	1.70	2.10
5	1.50	2.10	2.70
10	1.75	2.40	3.20
25	2.00	2.90	3.60
50	2.25	3.20	4.20
100	2.52	3.50	4.60

Where Z= 6,840 ft/100

These depths can be applied to the design storms or converted to intensities (inches/hour) for the Rational Method as described below. However, as the basin area increases, it is unlikely that the reported point rainfalls will occur uniformly over the entire basin. To account for this characteristic of rain storms an adjustment factor, the Depth Area Reduction Factor (DARF) is applied. This adjustment to rainfall depth and its effect on design storms is also described below. The UDFCD UD-Rain spreadsheet, available on UDFCD's website, also provides tools to calculate point rainfall depths and Intensity-Duration-Frequency curves[2] and should produce similar depth calculation results.

2.2 Design Storms

Design storms are used as input into rainfall/runoff models and provide a representation of the typical temporal distribution of rainfall events when the creation or routing of runoff hydrographs is required. It has long been observed that rainstorms in the Front Range of Colorado tend to occur as either short-duration, high-intensity, localized, convective thunderstorms (cloud bursts) or longer-duration, lower-intensity, broader, frontal (general) storms. The significance of these two types of events is primarily determined by the size of the drainage basin being studied. Thunderstorms can create high rates of runoff within a relatively small area, quickly, but their influence may not be significant very far downstream. Frontal storms may not create high rates of runoff within smaller drainage basins due to their lower intensity, but tend to produce larger flood flows that can be hazardous over a broader area and extend further downstream.

- **Thunderstorms**: Based on the extensive evaluation of rain storms completed in the Carlton study (Carlton 2011), it was determined that typical thunderstorms have a duration of about 2 hours. The study evaluated over 300,000 storm cells using gage-adjusted NEXRAD data, collected over a 14-year period (1994 to 2008). Storms lasting longer than 3 hours were rarely found. Therefore, the results of the Carlton study have been used to define the shorter duration design storms.

  To determine the temporal distribution of thunderstorms, 22 gage-adjusted NEXRAD storm cells were studied in detail. Through a process described in a technical memorandum prepared by the City of Colorado Springs (City of Colorado Springs 2012), the results of this analysis were interpreted and normalized to the 1-hour rainfall depth to create the distribution shown in Table 6-3 with a 5 minute time interval for drainage basins up to 1 square mile in size. This distribution represents the rainfall

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis-- Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

Table 6-7. Conveyance Coefficient, C_v

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

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

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \tag{Eq. 6-10}$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional "calibration" of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

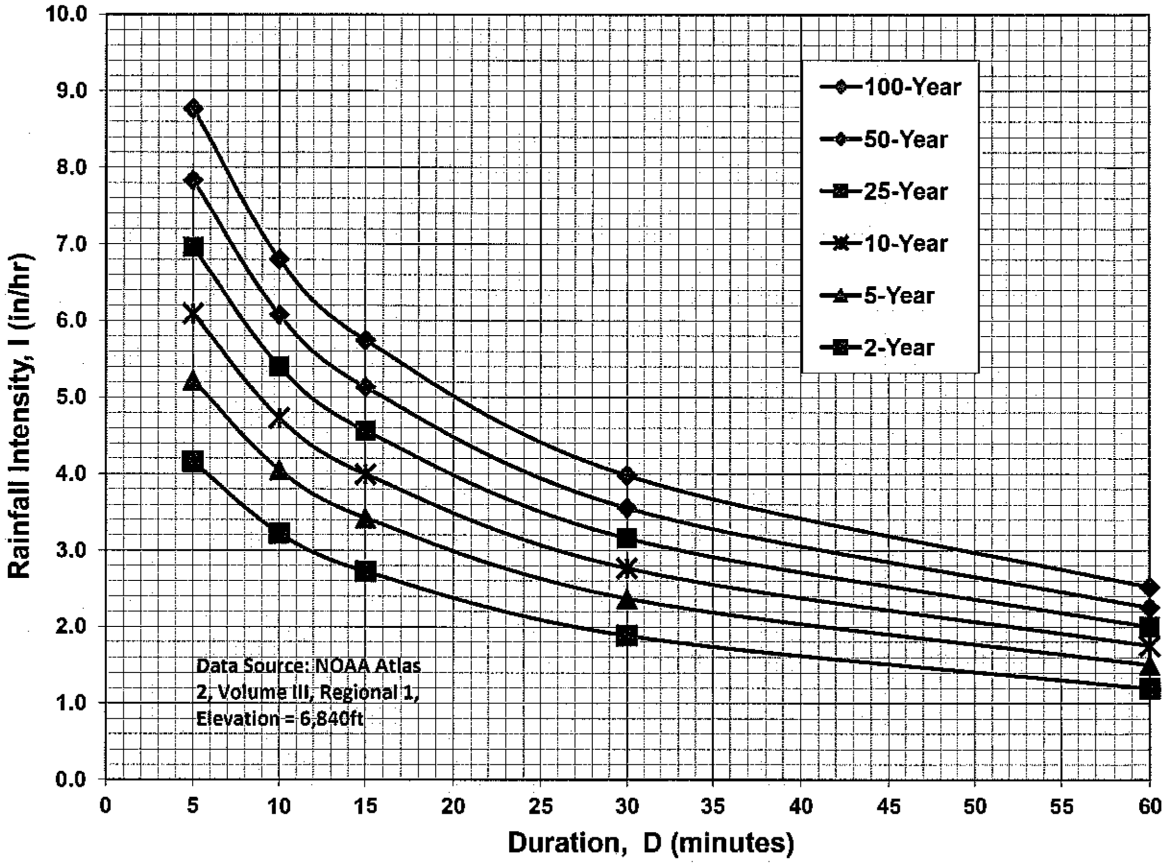
3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



Data Source: NOAA Atlas 2, Volume III, Regional 1, Elevation = 6,840ft

IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

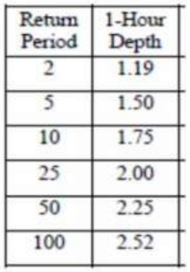
Note: Values calculated by equations may not precisely duplicate values read from figure.

JOB NAME: ***FLYING HORSE NORTH FILING NO. 2***
JOB NUMBER: ***1306.00***
DATE: ***01/22/22***
CALCULATED BY: ***MAW***

FINAL DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY

		DEVELOPED AREA/IMPERVIOUS AREA				**LANDSCAPE/UNDEVELOPED AREAS**				**WEIGHTED**			**WEIGHTED CA**			**IMPERVIOUSNESS**
BASIN	TOTAL AREA (AC)	AREA (AC)	C(2)	C(5)	C(100)	AREA (AC)	C(2)	C(5)	C(100)	C(2)	C(5)	C(100)	**CA(2)**	**CA(5)**	**CA(100)**	**%**
A	0.34	0.08	0.79	0.81	0.88	0.26	0.02	0.08	0.35	0.20	0.25	0.47	**0.07**	**0.09**	**0.16**	22%
B	0.62	0.08	0.79	0.81	0.88	0.54	0.02	0.08	0.35	0.12	0.17	0.42	**0.07**	**0.11**	**0.26**	12%
C	0.48	0.03	0.79	0.81	0.88	0.45	0.02	0.08	0.35	0.07	0.13	0.38	**0.03**	**0.06**	**0.18**	6%
D	1.46	0.28	0.79	0.81	0.88	1.18	0.02	0.08	0.35	0.17	0.22	0.45	**0.24**	**0.32**	**0.66**	18%
Total	**2.90**															**15%**

JOB NAME:	*FLYING HORSE NORTH FILING NO. 2*
JOB NUMBER:	*1306.00*
DATE:	*01/22/22*
CALC'D BY:	*MAW*



Return Period	1-Hour Depth
2	1.19
5	1.50
10	1.75
25	2.00
50	2.25
100	2.52

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

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

Tc=L/V

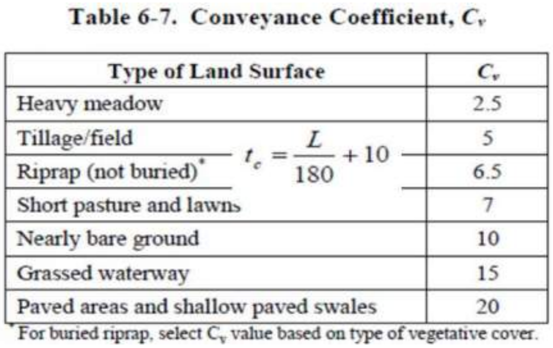


Table 6-7. Conveyance Coefficient, C_v

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

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

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

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

	WEIGHTED			OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY			TOTAL FLOWS		
BASIN	CA(2)	CA(5)	CA(100)	C(5)	Length *(ft)*	Height *(ft)*	Tc *(min)*	Length *(ft)*	Slope *(%)*	Velocity *(fps)*	Tc *(min)*	TOTAL *(min)*	I(2) *(in/hr)*	I(5) *(in/hr)*	I(100) *(in/hr)*	Q(2) *(cfs)*	Q(5) *(cfs)*	Q(100) *(cfs)*
A	0.07	0.09	0.16	0.08	60	8	6.1					6.1	3.89	4.88	8.19	0.3	**0.4**	**1.3**
B	0.07	0.11	0.26	0.08	100	6	10.2	100	6.0%	1.2	1.4	11.6	3.12	3.91	6.57	0.2	**0.4**	**1.7**
C	0.03	0.06	0.18	0.08	100	12	8.1	150	13.0%	1.8	1.4	9.5	3.36	4.21	7.06	0.1	**0.3**	**1.3**
D	0.24	0.32	0.66	0.08	100	9	8.9	80	25.0%	2.5	0.5	9.5	3.36	4.21	7.07	0.8	**1.4**	**4.7**

JOB NAME: *FLYING HORSE NORTH FILING NO. 2*
JOB NUMBER: *1306.00*
DATE: *01/22/22*
CALCULATED BY: *MAW*

FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow	
					I(5)	I(100)	Q(5)	Q(100)
1	BASIN A	0.09	0.16	6.1	4.88	8.19	0.4	1.3
2	BASIN B	0.11	0.26	11.6	3.91	6.57	0.4	1.7
3	BASIN C	0.06	0.18	9.5	4.21	7.06	0.3	1.3
4	BASIN D	0.32	0.66	9.5	4.21	7.07	1.4	4.7

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 1

Designer: **Marc A. Whorton, P.E.**
Company: **Classic Consulting**
Date: **January 21, 2022**
Project: **Flying Horse North Filing No. 2**
Location: **Lot 1 - 2.898 ac.**

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.53 inches
Depth of Average Runoff Producing Storm, d_6 = 0.42 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	UIA:RPA		UIA:RPA		UIA:RPA		UIA:RPA	UIA:RPA			
Area ID	Roof (A)	Dwy (A)		Dwy (B)		Roof (C)		Roof (D)	Dwy (D)			
Downstream Design Point ID	DP1	DP1		DP2		DP3		DP4	DP4			
Downstream BMP Type	None	None		None		None		None	None			
DCIA (ft^2)	--	--		--		--		--	--			
UIA (ft^2)	1,164	2,285		3,510		706		3,920	6,346			
RPA (ft^2)	2,026	5,090		7,120		1,420		4,100	3,206			
SPA (ft^2)	--	--		--		--		--	--			
HSG A (%)	0%	0%		0%		0%		0%	0%			
HSG B (%)	100%	100%		100%		100%		100%	100%			
HSG C/D (%)	0%	0%		0%		0%		0%	0%			
Average Slope of RPA (ft/ft)	0.200	0.200		0.200		0.100		0.090	0.150			
UIA:RPA Interface Width (ft)	65.00	100.00		150.00		40.00		70.00	75.00			

CALCULATED RUNOFF RESULTS

Area ID	Roof (A)	Dwy (A)		Dwy (B)		Roof (C)		Roof (D)	Dwy (D)			
UIA:RPA Area (ft^2)	3,190	7,375		10,630		2,126		8,020	9,552			
L / W Ratio	0.76	0.74		0.47		1.33		1.64	1.70			
UIA / Area	0.3649	0.3098		0.3302		0.3321		0.4888	0.6644			
Runoff (in)	0.00	0.00		0.00		0.00		0.00	0.00			
Runoff (ft^3)	0	0		0		0		0	0			
Runoff Reduction (ft^3)	42	82		126		25		140	227			

CALCULATED WQCV RESULTS

Area ID	Roof (A)	Dwy (A)		Dwy (B)		Roof (C)		Roof (D)	Dwy (D)			
WQCV (ft^3)	47	93		143		29		160	258			
WQCV Reduction (ft^3)	47	93		143		29		160	258			
WQCV Reduction (%)	100%	100%		100%		100%		100%	100%			
Untreated WQCV (ft^3)	0	0		0		0		0	0			

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	DP1	DP2	DP3	DP4								
DCIA (ft^2)	0	0	0	0								
UIA (ft^2)	3,449	3,510	706	10,266								
RPA (ft^2)	7,116	7,120	1,420	7,306								
SPA (ft^2)	0	0	0	0								
Total Area (ft^2)	10,565	10,630	2,126	17,572								
Total Impervious Area (ft^2)	3,449	3,510	706	10,266								
WQCV (ft^3)	140	143	29	418								
WQCV Reduction (ft^3)	140	143	29	418								
WQCV Reduction (%)	100%	100%	100%	100%								
Untreated WQCV (ft^3)	0	0	0	0								

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	40,893
Total Impervious Area (ft^2)	17,931
WQCV (ft^3)	730
WQCV Reduction (ft^3)	730
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

DRAINAGE MAPS

CLASSIC CONSULTING ENGINEERS & SURVEYORS

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

	WEIGHTED			OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY			TOTAL FLOWS		
BASIN	CA(2)	CA(5)	CA(100)	C(5)	Length *(ft)*	Height *(ft)*	Tc *(min)*	Length *(ft)*	Slope *(%)*	Velocity *(fps)*	Tc *(min)*	TOTAL *(min)*	I(2) *(in/hr)*	I(5) *(in/hr)*	I(100) *(in/hr)*	Q(2) *(cfs)*	Q(5) *(cfs)*	Q(100) *(cfs)*
A	0.07	0.09	0.16	0.08	60	8	6.1					6.1	3.89	4.88	8.19	0.3	**0.4**	**1.3**
B	0.07	0.11	0.26	0.08	100	6	10.2	100	6.0%	1.2	1.4	11.6	3.12	3.91	6.57	0.2	**0.4**	**1.7**
C	0.03	0.06	0.18	0.08	100	12	8.1	150	13.0%	1.8	1.4	9.5	3.36	4.21	7.06	0.1	**0.3**	**1.3**
D	0.24	0.32	0.66	0.08	100	9	8.9	80	25.0%	2.5	0.5	9.5	3.36	4.21	7.07	0.8	**1.4**	**4.7**

FINAL DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY

		DEVELOPED AREA/IMPERVIOUS AREA				LANDSCAPE/UNDEVELOPED AREAS				WEIGHTED			WEIGHTED CA			IMPERVIOUSNESS
BASIN	TOTAL AREA (AC)	AREA (AC)	C(2)	C(5)	C(100)	AREA (AC)	C(2)	C(5)	C(100)	C(2)	C(5)	C(100)	**CA(2)**	**CA(5)**	**CA(100)**	%
A	0.34	0.08	0.79	0.81	0.88	0.26	0.02	0.08	0.35	0.20	0.25	0.47	**0.07**	**0.09**	**0.16**	22%
B	0.62	0.08	0.79	0.81	0.88	0.54	0.02	0.08	0.35	0.12	0.17	0.42	**0.07**	**0.11**	**0.26**	12%
C	0.48	0.03	0.79	0.81	0.88	0.45	0.02	0.08	0.35	0.07	0.13	0.38	**0.03**	**0.06**	**0.18**	6%
D	1.46	0.28	0.79	0.81	0.88	1.18	0.02	0.08	0.35	0.17	0.22	0.45	**0.24**	**0.32**	**0.66**	18%
Total	**2.90**															**15%**

FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

					Intensity		Flow	
Design Point(s)	**Contributing Basins**	**Equivalent CA(5)**	**Equivalent CA(100)**	**Maximum Tc**	**I(5)**	**I(100)**	**Q(5)**	**Q(100)**
1	BASIN A	0.09	0.16	6.1	4.88	8.19	0.4	1.3
2	BASIN B	0.11	0.26	11.6	3.91	6.57	0.4	1.7
3	BASIN C	0.06	0.18	9.5	4.21	7.06	0.3	1.3
4	BASIN D	0.32	0.66	9.5	4.21	7.07	1.4	4.7

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

FLYING HORSE NORTH FILING NO. 2
FINAL DRAINAGE REPORT
DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	1-11-22
DRAWN BY	MAW	(H) 1"= 40'		SHEET 2 OF 2	
CHECKED BY		(V) 1"= N/A		JOB NO.	1306.00

CLASSIC℠ CONSULTING ENGINEERS & SURVEYORS