

Drainage Letter/Report

for the

Manley Tract El Paso County, Colorado

April, 2022

Prepared for:

Ms. Nancy Manley
4645 North Curtis Road
Falcon, Colorado 80831

Prepared by:

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El Paso County Project Number _____

Job No: 2021-101

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Certifications and Approvals

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 had been prepared according to the criteria established by El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omission on my part in preparation this report

Signature _____ Seal
(Kenneth C. Harrison, P.E.)

Developer/Owner Statement

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

(Business Name)

By: _____
(Signature) (Date)

Print Name and Title _____

Address: _____

El Paso County

Filed in accordance with _____ of the code of the El Paso County, dated ____ as amended.

For El Paso County Engineer

(Signature) (Date)

(Print name)

Flood Plain Statement

See Section V of this report

I. **REPORT PURPOSE**

The purpose of this replat is to **only** modify the existing lot lines. No surface improvements are proposed. As a result, there will be **no changes** to the existing drainage patterns as described in the approved Drainage Report (September 2000) prepared by Law and Marriotti. This Letter/ Report is submitted as required by El Paso County for replats of previously platted parcels when there are to be **no** or only negligible changes to the drainage characteristics. This report will also address any criteria changes that have occurred since 2000. Included in the Appendix (*Exhibit 4*) is correspondence with El Paso County outlining the information that is to be addressed in this Letter/ Report.

The purpose of this project is to relocate lot lines only. **No** surface improvements are proposed. Therefore, there will be **no changes** to the current drainage conditions are

A Preliminary/ Final Drainage Report was prepared by Law and Marriotti Consultants Inc. The plat included four (4) lots and an out parcel labeled as Future Phase Two. The plat was recorded July 29, 2002. The report was filed by El Paso on September 20, 2000. Pertinent sections of this report are included in *Exhibit 5 of the Appendix*. The purpose of this Drainage Letter is to show that the replat will have **no impact** on the characteristics of the existing stormwater runoff as described in the approved Drainage Report. Greater detail for this report was required only to identify any impacts that the reduced flows from offsite areas (sub basin OS1) may have.

II. **GENERAL PROPERTY DESCRIPTION AND ACREAGE**

Manley Subdivision is located in the Southwest quarter of the Southwest quarter of Section 22, Township 13 south, Range 64 West, of the 6th PM in the County of El Paso, State of Colorado. More precisely , the parcel is located in the northeast corner of the Curtis Road/ Jones Road intersection (*Exhibit 1, Appendix*). The site is located in the Black Squirrel Creek Drainage Basin.

Manley Subdivision presently consists of four (4) lots and an “out-parcel” labelled as Future Phase 2. Several structures have been constructed on the property. These structures were there when the Law and Marriotti report was prepared (*Exhibits 2, Appendix*). The development is covered with native grasses and weeds. General site topography is characterized by a gentle slope from the northwest to the southeast at an average slope of approximately 2.5%.

Topography

The topographic map was obtained from GIS mapping obtained from El Paso County. The site is gently rolling from an elevation of 6610.0 at the northwest corner and 6566.0 at the southwest corner over 2,700 feet in length resulting in an average slope of 1.6%.

Structures

There are several single-family residential structures on the project site. They are located on Lots 2, 3, and 4 of the original plat. The approximate location is shown on *Exhibit 2 in the Appendix*. There are currently no plans to add additional structures as part of this replat.

III. DESIGN CRITERIA AND METHODOGY

El Paso County Drainage Criteria Manual, Volume I.

City of Colorado Springs Drainage Criteria Manual (where included with the El Paso County Drainage Criteria Manual).

Soil Survey of El Paso County Area, Colorado United States Department
Detention/ Water Quality

IV. FEMA FLOODPLAIN

The project site is located in FEMA map 080059 (eff 10/2020) (*Exhibit 2, Appendix*). The entire site is located outside the 100-year floodplain in Zone X which is an "Area of Minimal Disturbance" for which there are no special requirements for the construction of commercial or industrial structures.

V. HYDROLOGIC SOILS INFORMATION

A Custom Soil Resource Report (*Exhibit 3, Appendix*) was obtained that shows the approximate location as well as a description of the soil associated groups. All of the soils are classified as either hydraulic group A or B. The soils are identified as follows:

- Blakeland loamy sand (SCS No. 8)
- Blendon Sandy Loam (Blendon Sandy Loam (SCS No, 10)
- Ellicot Loamy coarse Sam (SCS No. 28)
- Stapleton Sandy loam (SCS No. 83)
- Tructon Loamy Sand (SCS No. 98)
- Ustic Torrifluents (SCS No. 101)

VI. OFFSITE DRAINAGE CONDITIONS

All areas for offsite and onsite sub basins were determined using GIMS mapping provided by El Paso County. This mapping was also used to compare the technical sections of the Law and Marriotti report with similar sections of this report (*Exhibit 10*).

Offsite Areas North of the subdivision

Storm water from areas north of the Manley subdivision is collected by swales #1 and #3. At no point does water from these swales enter the project site. Analysis of these swales is beyond the scope of this project.

Offsite Sub Basin OS-1 and Swale 4 (adjacent to Curtis Road)

This area is located directly west of the Manley tract. OS1 has an area of approximately 208.5 acres. It has an average slope of 1.6%, and is vegetated with long prairie grasses and an occasional bush. The storm water from the west sheet flows east and then is collected by a roadside swale (S4) which functions as a borrow ditch along the westerly side of Curtis Road. The water is then routed southerly to DP1 where a 24" CMP has been installed to carry the water under Curtis Road. The water discharges into a natural swale with no distinction features. The water then is routed through the subdivision via a small grass lined nondescript swale.

This area has been described in two (2) other drainage reports. Each report has different areas and storm water flows. The following summarizes the area, method used to determine storm flow rates, and resulting flow rates. The Design point is the same for all three (3) and is located at the upstream end of the existing 24" CMP culvert installed under Curtis Road approximately 200 feet north of the Curtis Road/ Jones Road intersection.

1. Law and Marriotti Report: Preliminary/ Final Drainage Report for Manly Subdivision,

Prepared by Law and Marriotti, approved by EPC September, 2000.

- Design Point: DP1
- Offsite area: 185 acres per the USGS mapping.
- Method: Rational. The current EPS design standard states that the upper limit for using the Report Rational Method is 110 acres
- Flow Rates at DP1
 - Q5: 78.7 cfs
 - Q100: 207 cfs

2 **Windmill Flats Final Drainage Report** ,

Prepared by Berge-Brewer, March 2002

- Design Point: DP3
- Offsite area: 43 = (plus or minus) acres per the EPC GIS mapping.
- Method: TR55
- Flow Rates at DP1
 - Q5: 20.4 cfs
 - Q100: 92.5 cfs

3 **Replat Report (this report): Preliminary/Final Drainage Letter/ report for the Manley Subdivision Replat:**

Prepared by KCH Engineering Solutions, April 2022, to be reviewed and recorded by EPC.

- Design Point: DP1
- Offsite area: 208.5 acres per the EPC GIS mapping.
- Method: TR55
- Flow Rates at DP1
 - Q5: 20.4 cfs
 - Q100: 92.5 cfs

Copies of pertinent pages of each of the existing drainage reports are included in *Exhibit 5* of the Appendix

VII. **ONSITE DRAINAGE CHARACTERISTICS**

It should be noted that the following hydrologic and hydraulic analyses were **only** done to determine the impact that the reduction in flows which is assume to be minimal.

This brief analysis was done only to note any impact that the reduction of the design flows would have on the existing drainage features. The **only** purpose for this replat is to change several lot lines and **not alter** or add to present drainage features. Therefore, there are no changes to any drainage facilities described in the Law and Marrioti report.

Onsite Drainage

The onsite subbasins shown on this Drainage Map are different than those shown on the Law and Marrioti Drainage Map. The Drainage Map developed for this report used the most up-to-date GIS Mapping to prepare a detailed and accurate location of hydrologic sub basins.

The following is a comparison of the stormwater generated by the **entire site** for both this report and the Law and Marrioti report;

Law and Marrioti Report (Exhibit 7, Appendix)

Contributing sub basins

Sub Basin OS-A (185 acres), sub basin A (23.4 acres) and subbasin B (16.5 acres)

Total Drainage Area: 224.90 acres

Q5 Design Flows at DP2 and DP3

Q5: discharge at DP2 = 88.9 cfs, discharge at DP3 = 5.6 cfs;

Total Discharge from Onsite and offsite basins: 94.5 cfs ;

Q100 Design Flows:

Q5: discharge at DP2 = 227 cfs, discharge at DP3 = 17.4 cfs;

Total Discharge from Onsite and offsite basins: 244.4 cfs: ,

KCH Engineering Solutions (Exhibit 7, Appendix)

The following summarizes the area and storm discharge at pertinent Design Points

Drainage Areas

Area draining to DP2:

Sub Basin OS1 (208.50 acres), Sub basins A (14.3 acres), D (6.63 acres), and E (2.23 acres).

Total Drainage Area draining to DP2 231.66 acres..

Area draining to DP3:

Sub basin B (13.82 acres)

Total Drainage Area draining from DP3: 13.82 acres

Total area draining from the entire site: 245.48 acres

Design storm summary

The following summarizes the total runoff from the site (*Exhibit 8, Appendix*)

Q5 Design Flows at DP2 and DP3 and Sub basin C

The following combines storm water runoff amounts where the Rational Method was used (B and C) and amounts where the TR55 method was used (OS1, A, D, and E) (*Exhibit 8, Appendix*). It is assumed that the runoff amounts are additive.

5-year storm

Sub basin B: 3.7 cfs (Rational)
 Sub basin C:0.5 cfs (Rational)
 Sub basins OS1, A, D, E (TR55)
 Q5: 20.44 cfs

Total Q5: 24.64 cfs

100-year storm

Sub basin B: 27.3 cfs (Rational)
 Sub basin C:3.5 cfs (Rational)
 Sub basins OS1, A, D, E (TR55): 92.5 cfs

Total Q100: runoff: 123.3 cfs

The following is a summary of the estimated design flows at each design point. Since the location of the design points are different in the Law and Marrioti report only the total outflow from the site was compared. It should be noted the TR55 Method was used for drainage areas greater than 110 acres instead of the Rational Method used in the Law and Marrioti report.

Design Point	Sub Basins	Total Acres	Existing Runoff		
			Q5	100	
		(acres)	cfs	cfs	
1	OS-A	208.56	20.4	88	TR55 Method
2	OS- A, A, D, E	231.69	23.8	119.1	TR55/Rational Methods
3	B	13.82	3.7	27.3	Rational Method
4	OS- A, A, D,	229.4	23.4	116.10	TR55/Rational Methods

Design Point 4

Design Point 4 is located along the southerly boundary of the site adjacent to Jones Road at the location where the private driveway enters the site.

Hydrological Characteristics:

Drainage Area: 208.53 (OS-A, A, D)

Design Flow: OS-A: Q5= 23.9 cfs, Q100= 92.5cfs

Swale 2 (onsite):

Drainage Area: OS-A, A, D

Design Flow: 5yr 23.9, 100yr: 92.5

Slope = 2.6%+/-

Depth of flow: 5yr= 0.6 ft, 100yr= 1.22 ft

Velocity: 5yr = 4.9 fps, 100yr = 7.3 fps

Design Point 5

DP 5 is located in a sump area located along the north side of Jones Road approximately 1,250 feet west of the southeast corner of the site.

Currently, stormwater ponds in this area and then overtops the embankment and is routed to the Jones and Curtis Road intersection.

Design Point 6

DP 6 is located at the northeasterly corner of the site. Runoff from Sub basin C sheet flows offsite to a natural field. No grading in this area is to be accomplished.

VIII. OFFSITE / ONSITE PROPOSED DRAINAGE CONDITIONS

The Proposed Conditions Map is the same as the Existing Conditions Map. Only one (1) map is required since the developed conditions is no different than the existing conditions.

IX. FULL SPECTRUM DETENTION POND

Criteria

El Paso County Engineering Criteria Manual, Appendix I, contains the policies and procedures for Stormwater Quality. Section I.7.1.B provides for exclusions to the requirements to provide Post Construction Stormwater Quality facilities. All areas of the **Manley Subdivision** project qualify for the allowed exemptions. No water quality or detention facilities are required for this site as discussed below.

The project consists of large single-family residential lots. No improvements are planned as part of this replat. There are no activities or improvements that require permanent water quality facilities for this project based on the exclusions found in Section I.7.1.5.B.2, Section I.7.1.5.B.3 and Section

The total area of the site is 23.776 acres. All of the property is comprised of 5-acre (minimum), and greater, single-family residential lots. The total lot imperviousness for 5-acre rural residential lots is less than 10%. The Manley Tract will not need a detention pond since there will be no changes are proposed..

X. FOUR STEP PROCESS

Since no physical changes are proposed from those described in the approved Law and Marrioti report. A discussion regarding the Four Step Process is not required.

XI. DRAINAGE/ BRIDGE FEE CALCULATIONS

Drainage Fees have already been paid and therefor none are due.

XII. SUMMARY

The initial Drainage Report for this site was prepared by Law and Marrioti and recorded by El Paso County in September of 2000. It was initially assumed that only a Drainage Letter would be required since the purpose of the replat was only to change a few the lot lines. However, since the runoff from the OS1 parcel was significantly lower than in the Law and Marrioti, a preliminary analysis of the downstream facilities was accomplished. Those changes are discussed in the above report.

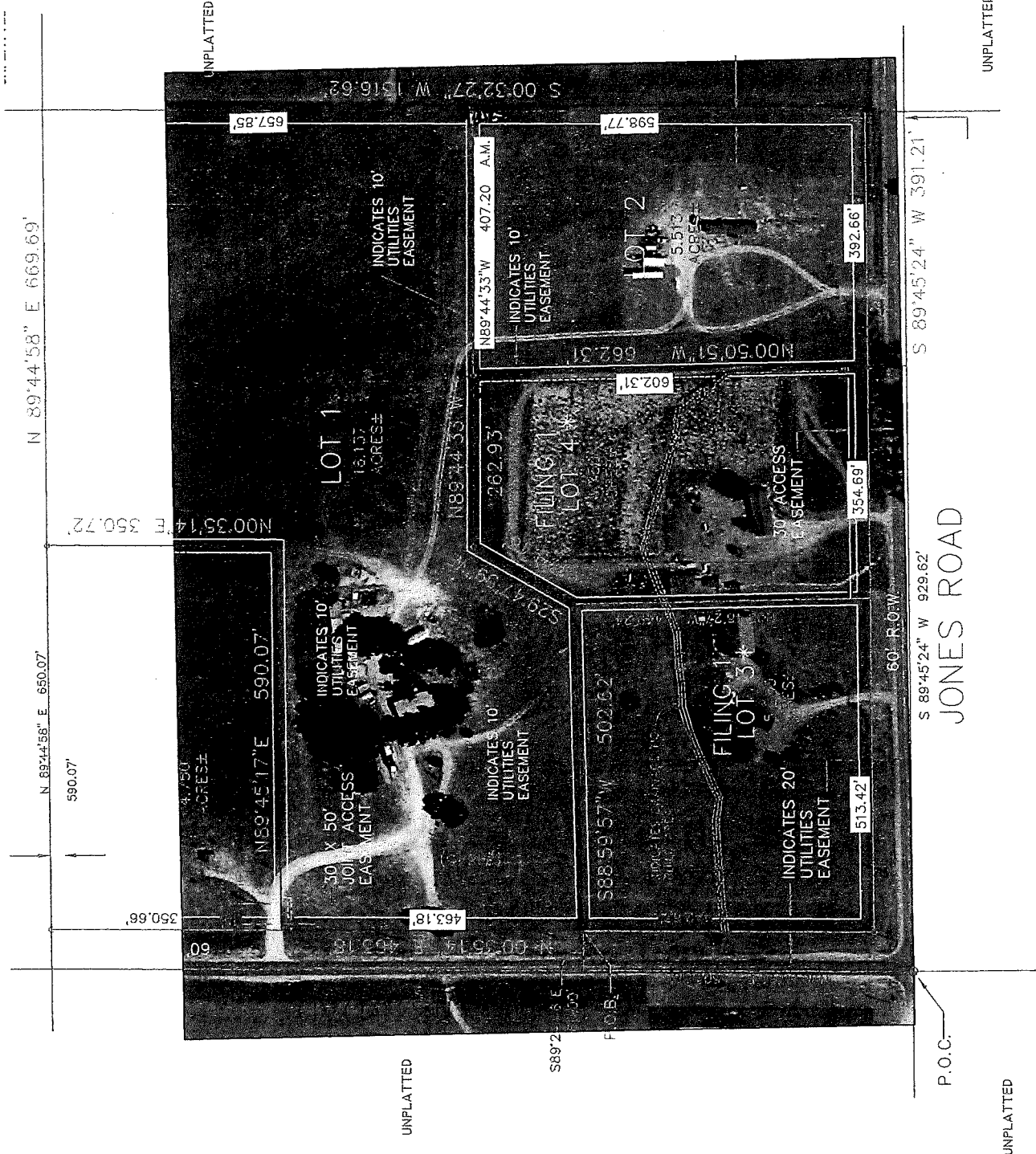
The following was accomplished in this report;

- a. Impacts due to changes in design flows and changes to the criteria.
- b. The requirement for a FSD pond was also evaluated.
- c. Additional preliminary analysis for the reduced offsite flow as it is routed through the Manley property. This routing is the same as the conditions when the Law and Marrioti report was approved.
- d. This Drainage Letter was prepared in accordance with the current criteria.

Even though this report was prepared in greater detail in order to meet current El Paso County Drainage criteria, **no drainage improvements** are required.

APPENDIX

Exhibit 1: Location Maps



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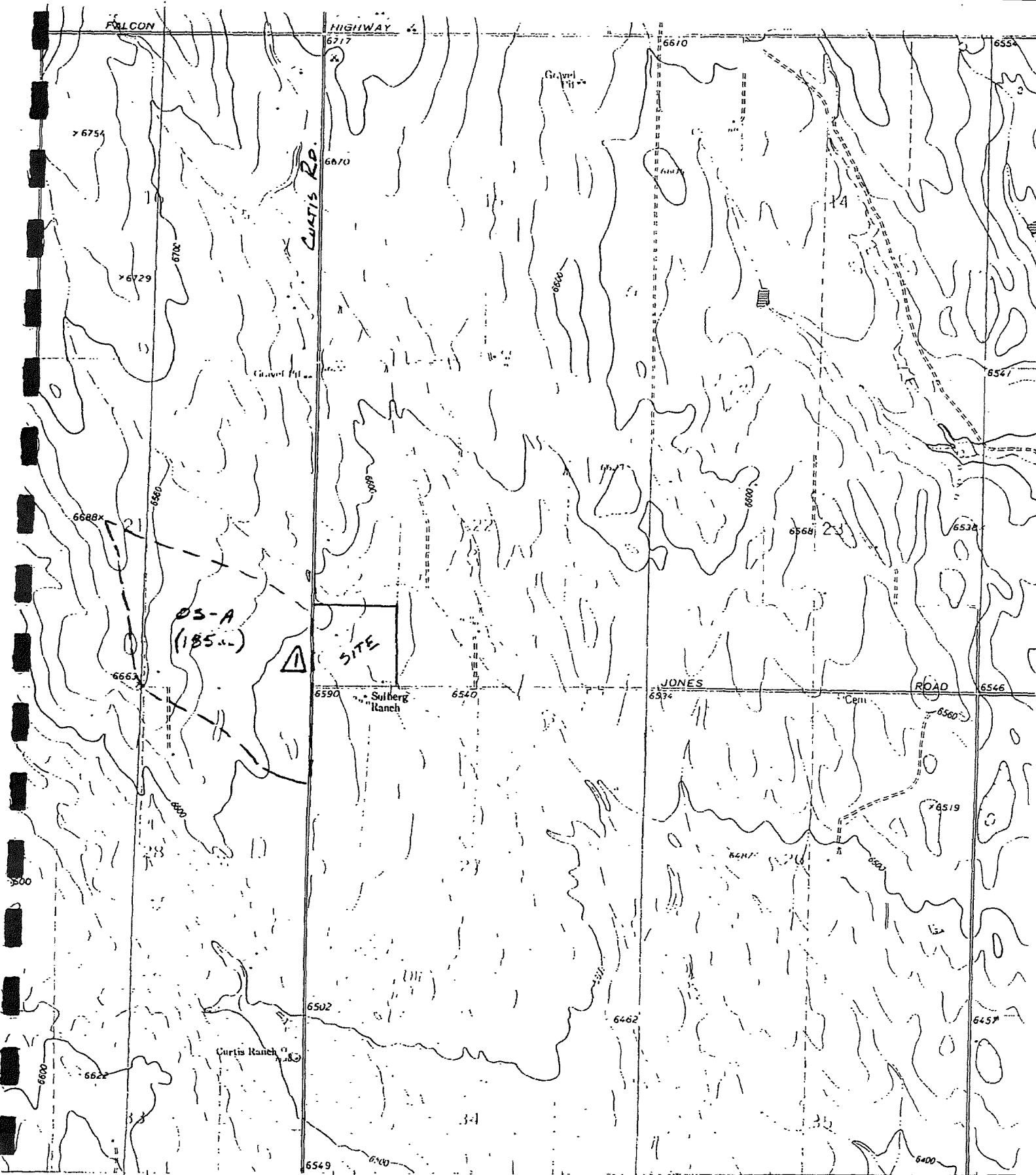
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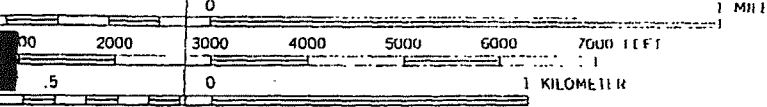
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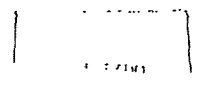


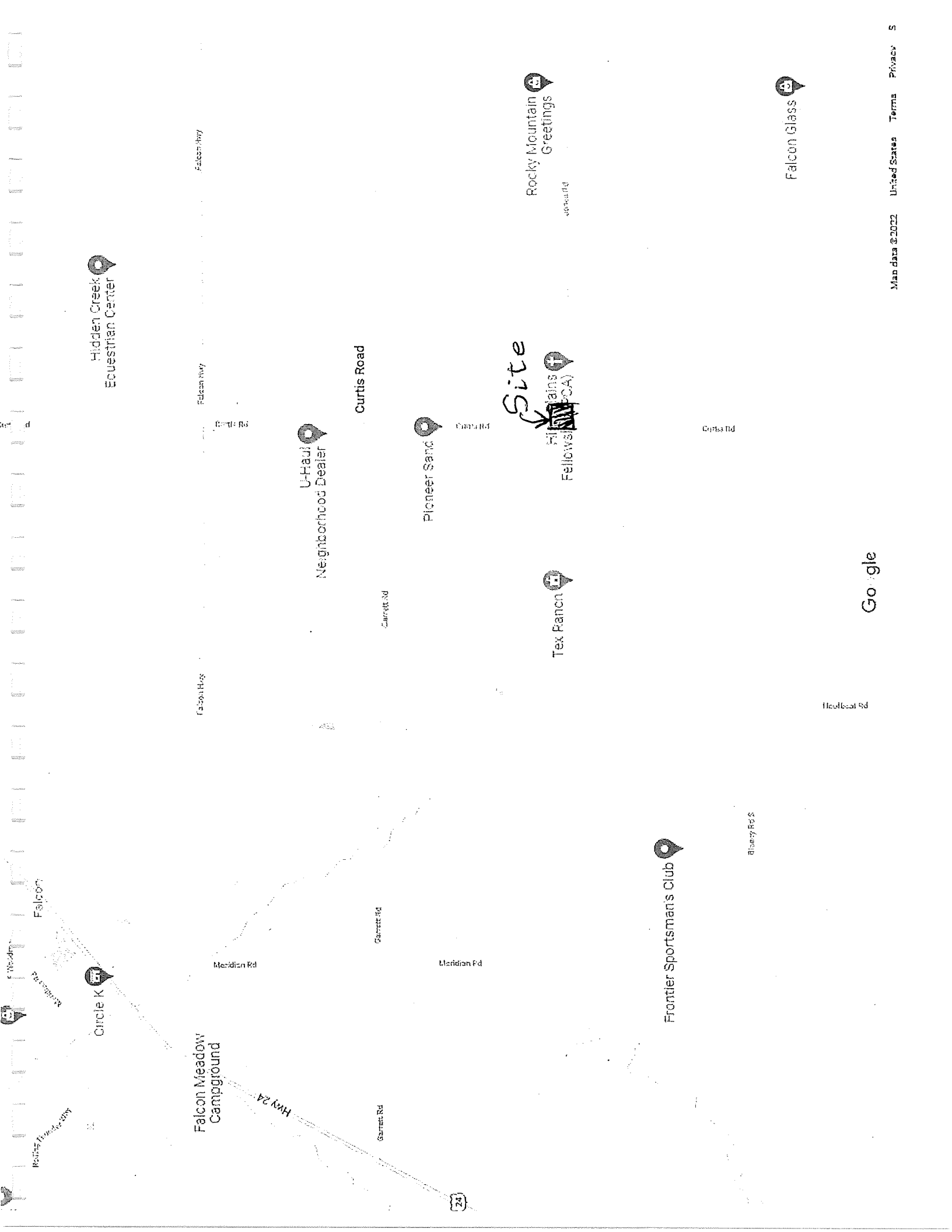
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ROJ
Heavy-duty
Unim
U.S.R





Hidden Creek
Equestrian Center

U-Haul
Neighborhood Dealer

Pioneer Sand

Tex Ranch

Rocky Mountain
Greetings

Falcon Glass

Site

Hill Plains
Fellowship (PCA)

Falcon Meadow
Campground

Frontier Sportsman's Club

Google

Exhibit 2: FEMA FIRM Map

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

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

PANEL 575 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

<u>COMMUNITY</u>	<u>NUMBER</u>	<u>PANEL</u>	<u>SUFFIX</u>
COLORADO SPRINGS, CITY OF	080080	0575	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0575	F

**MAP NUMBER
08041C0575 F**

**EFFECTIVE DATE:
MARCH 17, 1997**



Federal Emergency Management Agency

FALCON HIGHWAY

CESSNA DRIVE

ZONE X
15

16

17

20

ZONE A

21

22

ZONE A

SITE

JONES ROAD

ZONE X

29

ZONE X

28

27

ZONE A

ROAD

HOOFBEAT ROAD

32

33

CURTIS ROAD

34

ZONE



38°54'4"N



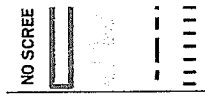
Legend

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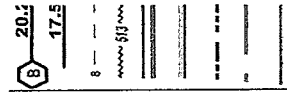
SPECIAL FLOOD HAZARD AREAS



OTHER AREAS OF FLOOD HAZARD



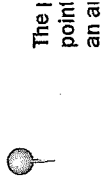
OTHER AREAS
GENERAL STRUCTURES



OTHER FEATURES



MAP PANELS



The point an a

This map complies with digital flood maps if it is. The basemap shown cc accuracy standards. The flood hazard inform

Exhibit 3: SCS Soils Map and Data



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for **El Paso County Area, Colorado**

Manley Subdivision



February 7, 2022

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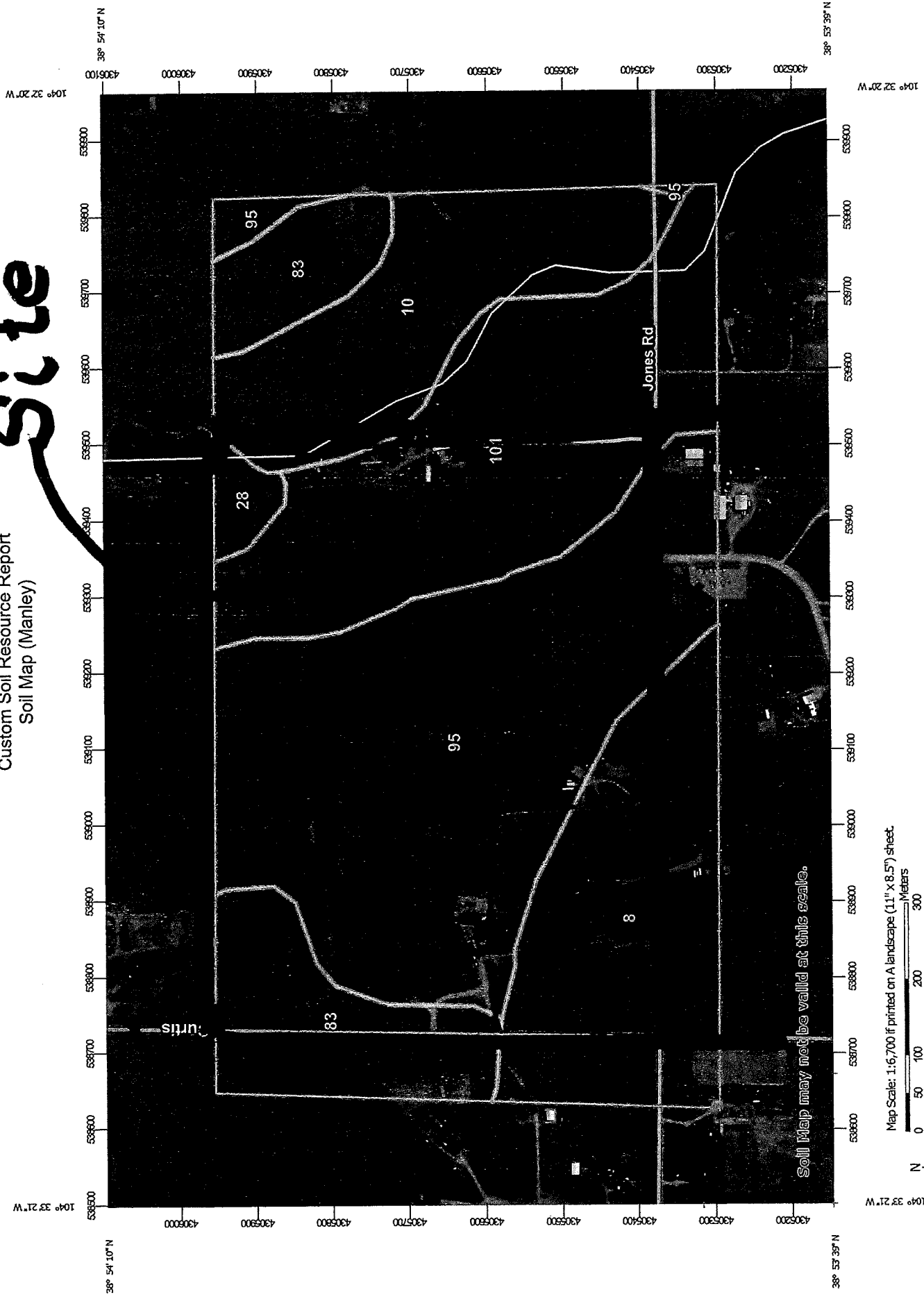
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Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Site

Custom Soil Resource Report Soil Map (Manley)



Map Scale: 1:6,700 if printed on A landscape (11" x 8.5") 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
- Water Features
 - Streams and Canals
- Transportation
 - Rails
 - Interstate Highways
 - US Routes
 - Major Roads
 - Local Roads
- Background
 - Aerial Photography
- Other
 - Spoil Area
 - Stony Spot
 - Very Stony Spot
 - Wet Spot
 - Other
 - Special Line Features

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 (Manley)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	31.9	16.3%
10	Blendon sandy loam, 0 to 3 percent slopes	25.9	13.3%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	2.5	1.3%
83	Stapleton sandy loam, 3 to 8 percent slopes	23.8	12.2%
95	Truckton loamy sand, 1 to 9 percent slopes	67.8	34.7%
101	Ustic Torrifluvents, loamy	43.5	22.3%
Totals for Area of Interest		195.4	100.0%

Map Unit Descriptions (Manley)

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

Custom Soil Resource Report

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits
derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: 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
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent

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Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent

Landform: Depressions

Hydric soil rating: Yes

10—Blendon sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3671

Elevation: 6,000 to 6,800 feet

Mean annual precipitation: 14 to 16 inches

Mean annual air temperature: 46 to 48 degrees F

Frost-free period: 125 to 145 days

Farmland classification: Not prime farmland

Map Unit Composition

Blendon and similar soils: 98 percent

Minor components: 2 percent

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

Description of Blendon

Setting

Landform: Terraces, alluvial fans

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 10 inches: sandy loam

Bw - 10 to 36 inches: sandy loam

C - 36 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

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

Calcium carbonate, maximum content: 2 percent

Available water supply, 0 to 60 inches: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

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Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

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

28—Ellicott loamy coarse sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 3680
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Ellicott and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellicott

Setting

Landform: Flood plains, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile

A - 0 to 4 inches: loamy coarse sand
C - 4 to 60 inches: stratified coarse sand to sandy loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively 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

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Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: R069XY031CO - Sandy Bottomland LRU's A and B
Other vegetative classification: SANDY BOTTOMLAND (069AY031CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquoll

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

83—Stapleton sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369z
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Stapleton and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stapleton

Setting

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

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Typical profile

A - 0 to 11 inches: sandy loam
Bw - 11 to 17 inches: gravelly sandy loam
C - 17 to 60 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
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 supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

95—Truckton loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2yvrn
Elevation: 5,800 to 7,100 feet
Mean annual precipitation: 12 to 19 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 90 to 155 days
Farmland classification: Not prime farmland

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Map Unit Composition

Truckton and similar soils: 87 percent

Minor components: 13 percent

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

Description of Truckton

Setting

Landform: Fan remnants, interfluves

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Wind re-worked alluvium derived from arkose

Typical profile

A - 0 to 4 inches: loamy sand

Bt1 - 4 to 12 inches: sandy loam

Bt2 - 12 to 19 inches: sandy loam

C - 19 to 80 inches: sandy loam

Properties and qualities

Slope: 1 to 9 percent

Depth to restrictive feature: More than 80 inches

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

Calcium carbonate, maximum content: 1 percent

Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): 6e

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Ecological site: R049XB210CO - Sandy Foothill

Hydric soil rating: No

Minor Components

Blakeland

Percent of map unit: 5 percent

Landform: Hills, interfluves

Landform position (two-dimensional): Shoulder, backslope, summit

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

Down-slope shape: Convex, linear

Across-slope shape: Convex, linear

Ecological site: R049XB210CO - Sandy Foothill

Hydric soil rating: No

Bresser

Percent of map unit: 5 percent

Landform: Terraces, interfluves

Landform position (three-dimensional): Tread

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Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Urban land

Percent of map unit: 2 percent
Hydric soil rating: No

Ellicott, occasionally flooded

Percent of map unit: 1 percent
Landform: Drainageways, flood plains
Down-slope shape: Linear
Across-slope shape: Concave, linear
Ecological site: R067BY031CO - Sandy Bottomland
Hydric soil rating: No

101—Ustic Torrfluents, loamy

Map Unit Setting

National map unit symbol: 3673
Elevation: 5,500 to 7,000 feet
Mean annual precipitation: 13 to 16 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 125 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Ustic torrfluents and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ustic Torrfluents

Setting

Landform: Flood plains, stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy, clayey, stratified loamy

Typical profile

A - 0 to 6 inches: variable
C - 6 to 60 inches: stratified loamy sand to clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.20 to 2.00 in/hr)

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Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 10 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): 2e

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B

Ecological site: R069XY037CO - Saline Overflow LRU's A and B

Other vegetative classification: OVERFLOW (069BY036CO)

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent

Landform: Depressions

Hydric soil rating: Yes

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Exhibit 4: Charts, Tables and Correspondence

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	0.08	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.

$$t_c = t_i + t_t \quad (\text{Eq. 6-7})$$

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min)

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i , may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L}}{S^{0.33}} \quad (\text{Eq. 6-8})$$

Where:

t_i = overland (initial) flow time (min)

C_s = runoff coefficient for 5-year frequency (see Table 6-6)

L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)

S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t , which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t , can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad (\text{Eq. 6-9})$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

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_o) 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.

$$t_c = \frac{L}{180} + 10 \quad (\text{Eq. 6-10})$$

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

Table 6-10. NRCS Curve Numbers for Frontal Storms & Thunderstorms for Developed Conditions (ARCI)

Fully Developed Urban Areas (vegetation established) ¹	Treatment	Hydrologic Condition	% I	Pre-Development CN			
				HSG A	HSG B	HSG C	HSG D
Open space (lawns, parks, golf courses, cemeteries, etc.):							
Poor condition (grass cover < 50%)	----	----	---	68	79	86	89
Fair condition (grass cover 50% to 75%)	----	----	---	49	69	79	84
Good condition (grass cover > 75%)	----	----	---	39	61	74	80
Impervious areas:							
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	----	----	---	98	98	98	98
Streets and roads:							
Paved; curbs and storm sewers (excluding right-of-way)	----	----	---	98	98	98	98
Paved; open ditches (including right-of-way)	----	----	---	83	89	92	93
Gravel (including right-of-way)	----	----	---	76	85	89	91
Dirt (including right-of-way)	----	----	---	72	82	87	89
Western desert urban areas:							
Natural desert landscaping (pervious areas only)	----	----	---	63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)	----	----	---	96	96	96	96
Urban districts:							
Commercial and business	----	----	85	89	92	94	95
Industrial	----	----	72	81	88	91	93
Residential districts by average lot size:							
1/8 acre or less (town houses)	----	----	65	77	85	90	92
1/4 acre	----	----	38	61	75	83	87
1/3 acre	----	----	30	57	72	81	86
1/2 acre	----	----	25	54	70	80	85
1 acre	----	----	20	51	68	79	84
2 acres	----	----	12	46	65	77	82
Developing Urban Areas ¹							
Newly graded areas (pervious areas only, no vegetation)	----	----	---	77	86	91	94
Cultivated Agricultural Lands ¹							
Fallow							
Bare soil	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Crop residue cover (CR)	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Good	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Straight row (SR)	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Good	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
SR + CR	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Good	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Contoured (C)	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Good	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
C + CR	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Good	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Contoured & terraced (C&T)	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Good	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
C&T+ CR	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Good	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
SR	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Good	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
SR + CR	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Good	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
C	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Good	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
C + CR Poor	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Good	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
C&T	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Good	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
C&T+ CR	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D
Good	Treatment ²	Hydrologic Condition ³	% I	HSG A	HSG B	HSG C	HSG D

Most Conservation Case Lower for Slope

Table 4B-6 Values of the roughness coefficient, "n."

Type of Channel and Description	Manning's "n" (Normal)	Type of Channel and Description	Manning's "n" (Normal)
A. Constructed Channels		6. Sluggish reaches, weedy deep pools	0.070
a. <i>Earth, straight and uniform</i>		7. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.100
1. Clean, recently completed	0.018		
2. Gravel, uniform selection, clean	0.025		
3. With short grass, few weeds	0.027		
b. <i>Earth, winding and sluggish</i>		b. <i>Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages</i>	
1. No vegetation	0.025	1. Bottom: gravel, cobbles, and few boulders	0.040
2. Grass, some weeds	0.030	2. Bottom: cobbles with large boulders	0.050
3. Dense weeds or aquatic plants in deep channels	0.035		
4. Earth bottom and rubble sides	0.030	B-2 Flood plains	
5. Stony bottom and weedy banks	0.035	a. <i>Pasture, no brush</i>	
6. Cobble bottom and clean sides	0.040	1. Short grass	0.030
		2. High grass	0.035
c. <i>Rock-lined</i>		b. <i>Cultivated areas</i>	
1. Smooth and uniform	0.035	1. No crop	0.030
2. Jagged and irregular	0.040	2. Mature row crops	0.035
d. <i>Channels not maintained, weeds and brush uncut</i>		3. Mature field crops	0.040
1. Dense weeds, high as flow depth	0.080	c. <i>Brush</i>	
2. Clean bottom, brush on sides	0.050	1. Scattered brush, heavy weeds	0.050
3. Same, highest stage of flow	0.070	2. Light brush and trees	0.060
4. Dense brush, high stage	0.100	3. Medium to dense brush	0.070
B. Natural Streams		4. Heavy, dense brush	0.100
B-1 Minor streams (top width at flood stage < 100 ft.)		d. <i>Trees</i>	
a. <i>Streams on plain</i>		1. Dense willows, straight	0.150
1. Clean, straight, full stage, no rifts or deep pools	0.030	2. Cleared land with tree stumps, no sprouts	0.040
2. Same as above, but more stones and weeds	0.035	3. Same as above, but with heavy growth of sprouts	0.060
3. Clean, winding, some pools and shoals	0.040	4. Heavy stand of timber, a few downed trees, little undergrowth, flood stage below branches	0.100
4. Same as above, but some weeds	0.040	5. Same as above, but with flood stage reaching branches	0.120
5. Same as 4, but more stones	0.050		

*Note: These "n" values are "normal" values for use in analysis of channels. For conservative design for channel capacity, the maximum values listed in other references should be considered. For channel bank stability, the minimum values should be considered.

From: Daniel Torres
Sent: Thursday, March 18, 2021 8:22 AM
To: 'KEN HARRISON'
Subject: RE: Rural Road Construction Document examples

Hi Ken,

I have provided answers to your questions below in blue:

Does the Drainage Letter need to address the updated criteria? Yes. The drainage letter should be done per the current criteria. **There are also several mistakes in the report. It uses the Rational Method for 185 acres which is currently limited to less than 100 acres. Does this need to be addressed in the Drainage Letter?** Any previous errors should be noted/addressed in the report. **Nothing was stated in the report about a FSD pond either. Will this have to be addressed even though the Drainage Report was approved?** Yes. Detention should be addressed for the site in question. Whether detention is needed depends on your analysis of the site and development proposed. **Also does El Paso County have similar requirements for Drainage Letters since they have adopted the majority of the C/CS Drainage Criteria Manuals?** Our drainage criteria manual can be found on the County website ([Engineering - El Paso County Planning Development](#)). DCM vol. 1 Chapter 4 has the requirements for drainage letters and reports.

If this is for a specific project that you have submitted for review in the County, I can get you in touch with the review engineer that has been assigned the project to better answer any of your questions. Additionally, the review engineer would know the specifics of the project and can tell you what you will need to provide. My answers above are for most projects in general.

Respectfully,

Daniel Torres, P.E.
Engineer II
El Paso County
Planning and Community Development
[2880 International Circle, Suite 110](#)
[Colorado Springs, CO 80910](#)
[\(719\) 520-6300 \(Main\)](#)
[\(719\) 520-6305 \(Direct\)](#)
www.elpasoco.com

PERSONAL WORK SCHEDULE

Monday - Thursday, 7:00 am to 5:30 pm

DEPARTMENT HOURS

Monday - Friday, 7:30 am to 4:30 pm

NOTE: In an effort to be respectful of the health of our employees, family, and all citizens in El Paso County, we are limiting our face-to-face public interactions. During this timeframe we will be making every effort to operate "business as usual". All phone calls and emails will be returned, projects reviewed, and necessary meetings held via conference call. Thank you for your patience. Be safe!

WE NEED YOUR HELP! The Planning and Community Development Department has been working on revising the Master Plan for El Paso County. Once adopted, this plan will help guide development for the next 20 years. The draft version of this plan is now available for public review and we are seeking public comments on the draft plan until April 9, 2021. You may do so here: <https://elpaso.hlplanning.com/pages/draft-plan-outreach> Thank you in advance for your feedback!

From: KEN HARRISON <ksharrison5228@msn.com>
Sent: Friday, March 12, 2021 4:18 PM
To: Daniel Torres <DanielTorres@elpasoco.com>
Subject: RE: Rural Road Construction Document examples

CAUTION: This email originated from outside the El Paso County technology network. Do not click links or open attachments unless you recognize the sender and know the content is safe. Please call IT Customer Support at 520-6355 if you are unsure of the integrity of this message.

Thanks Daniel. I have another issue that I would like to discuss with you. An existing tract was platted in 2001 with a Drainage Report submitted and approved. The owners wish to replat the property and need a Drainage Letter. The purpose of the replat is only to reconfigure lots and not change anything about the development. The proposed development will stay the same. However, the current approved report was prepared using the 2001 criteria. The current criteria has a significant revisions. Does the Drainage Letter need to address the updated criteria? There are also several mistakes in the report. It uses the Rational Method for 185 acres which is currently limited to less than 100 acres. Does this need to be addressed in the Drainage Letter? Nothing was stated in the report about a FSD pond either. Will this have to be addressed even though the Drainage Report was approved? Also does El Paso County have similar requirements for Drainage Letters since they have adopted the majority of the C/CS Drainage Criteria Manuals?

Thanks for you time!

Kenneth Harrison
KCH Engineering Solutions, LLC
719-246-4471
ksharrison5228@msn.com

From: Daniel Torres
Sent: Tuesday, March 9, 2021 1:20 PM
To: KEN HARRISON
Subject: Rural Road Construction Document examples

Hi Ken,

I have provided a few projects that have a rural local roadways within their construction documents. They can be found on EDARP by searching the following file numbers or clicking on the link provided.

SF207: Project Details - EDARP (epcdevplanreview.com)

SF1911: Project Details - EDARP (epcdevplanreview.com)

SF1824: Project Details - EDARP (epcdevplanreview.com)

Respectfully,

Daniel Torres, P.E.
Engineer II
El Paso County
Planning and Community Development
2880 International Circle, Suite 110
Colorado Springs, CO 80910
(719) 520-6300 (Main)
(719) 520-6305 (Direct)
www.elpasoco.com

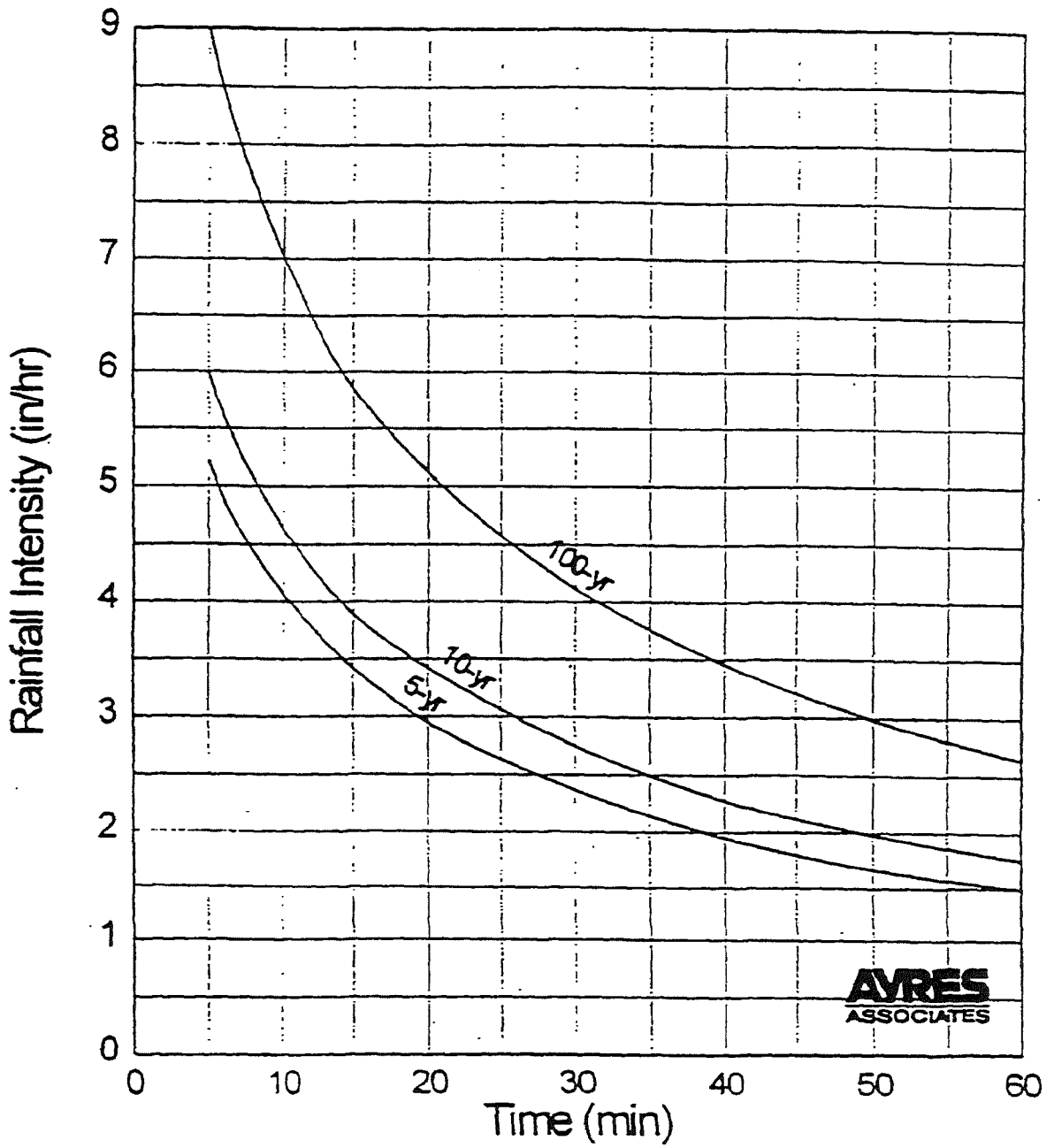
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Interim Release October 12, 1994 , Rainfall Intensity Curves
 City Of Colorado Springs Drainage Criteria Manual

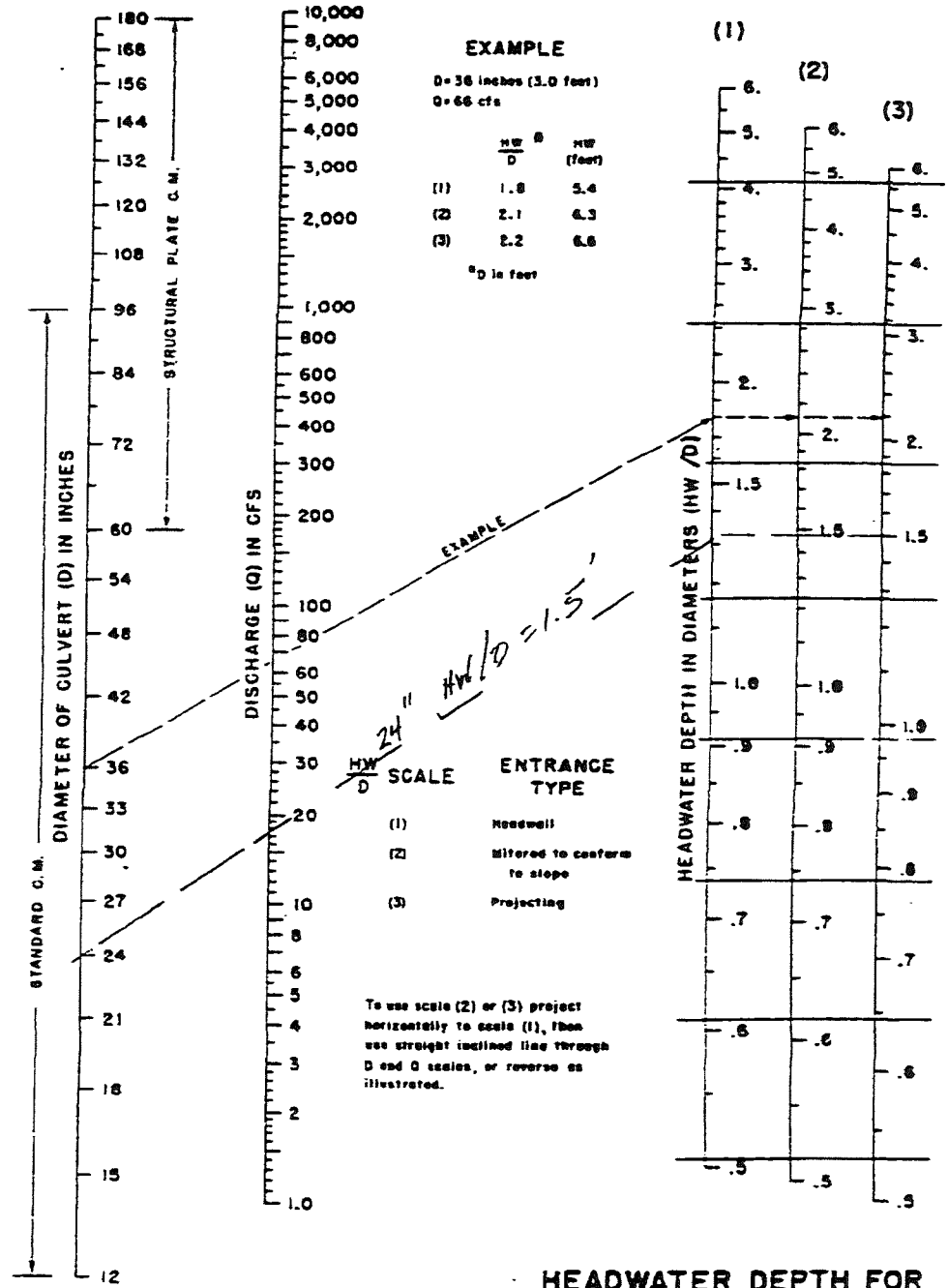
TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY			
		10		100	
		A&B*	C&D*	A&B*	C&D*
Business					
Commercial Areas	95	0.90	0.90	0.90	0.90
Neighborhood Areas	70	0.75	0.75	0.80	0.80
Residential					
1/8 Acre or less	65	0.60	0.70	0.70	0.80
1/4 Acre	40	0.50	0.60	0.60	0.70
1/3 Acre	30	0.40	0.50	0.55	0.60
1/2 Acre	25	0.35	0.45	0.45	0.55
1 Acre	20	0.30	0.40	0.40	0.50
Industrial					
Light Areas	80	0.70	0.70	0.80	0.80
Heavy Areas	90	0.80	0.80	0.90	0.90
Parks and Cemeteries					
Playgrounds	13	0.30	0.35	0.60	0.65
Railroad Yard Areas	40	0.50	0.55	0.60	0.65
Undeveloped Areas					
Historic Flow Analysis- Greenbelts, Agricultural	2	0.15	0.25	0.20	0.30
Pasture/Meadow	0	0.25	0.30	0.35	0.45
Forest	0	0.10	0.15	0.15	0.20
Exposed Rock	100	0.90	0.90	0.95	0.95
Offsite Flow Analysis (when land use not defined)	45	0.55	0.60	0.65	0.70
Streets					
Paved	100	0.90	0.90	0.95	0.95
Gravel	80	0.80	0.80	0.85	0.85
Drive and Walks					
Roofs	90	0.90	0.90	0.95	0.95
Lawns	0	0.25	0.30	0.35	0.45

* Hydrologic Soil Group

9/30/90



**HEADWATER DEPTH FOR
 C. M. PIPE CULVERTS
 WITH INLET CONTROL**

BUREAU OF PUBLIC ROADS JAN. 1963



HDR Infrastructure, Inc.
 A Centerra Company

The City of Colorado Springs / El Paso County
 Drainage Criteria Manual

Date
 OCT. 1987

Figure

9-37

Exhibit 5: Drainage Basin Planning Study Exhibits

El Paso County Drainage Basin Fees

Resolution No. 21-468

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2022 Drainage Fee (per Impervious Acre)	2022 Bridge Fee (per Impervious Acre)
--------------	------------------	--------------	---------------------	--	--

Drainage Basins with DBPS's:

CHMS0200	Chico Creek	2013	Haegler Ranch	\$11,891	\$1,755
CHWS1200	Chico Creek	2001	Bennett Ranch	\$13,312	\$5,106
CHWS1400	Chico Creek	2013	Falcon	\$34,117	\$4,687
FOFO2000	Fountain Creek	2001	West Fork Jimmy Camp Creek	\$14,470	\$4,281
FOFO2600	Fountain Creek	1991*	Big Johnson / Crews Gulch	\$21,134	\$2,729
FOFO2800	Fountain Creek	1988*	Widefield	\$21,134	\$0
FOFO2900	Fountain Creek	1988*	Security	\$21,134	\$0
FOFO3000	Fountain Creek	1991*	Windmill Gulch	\$21,134	\$317
FOFO3100 / FOFO3200	Fountain Creek	1988*	Carson Street / Little Johnson	\$12,891	\$0
FOFO3400	Fountain Creek	1984*	Peterson Field	\$15,243	\$1,156
FOFO3600	Fountain Creek	1991*	Fisher's Canyon	\$21,134	\$0
FOFO4000	Fountain Creek	1996	Sand Creek	\$21,814	\$8,923
FOFO4200	Fountain Creek	1977	Spring Creek	\$10,961	\$0
FOFO4600	Fountain Creek	1984*	Southwest Area	\$21,134	\$0
FOFO4800	Fountain Creek	1991	Bear Creek	\$21,134	\$1,156
FOFO5800	Fountain Creek	1964	Camp Creek	\$2,342	\$0
FOMO1000	Monument Creek	1981	Douglas Creek	\$13,291	\$294
FOMO1200	Monument Creek	1977	Templeton Gap	\$13,644	\$317
FOMO2000	Monument Creek	1971	Pulpit Rock	\$7,008	\$0
FOMO2200	Monument Creek	1994	Cottonwood Creek / S. Pine	\$21,134	\$1,156
FOMO2400	Monument Creek	1966	Dry Creek	\$16,684	\$604
FOMO3600	Monument Creek	1989*	Black Squirrel Creek	\$9,595	\$604
FOMO3700	Monument Creek	1987*	Middle Tributary	\$17,636	\$0
FOMO3800	Monument Creek	1987*	Monument Branch	\$21,134	\$0
FOMO4000	Monument Creek	1996	Smith Creek	\$8,616	\$1,156
FOMO4200	Monument Creek	1989*	Black Forest	\$21,134	\$575
FOMO5200	Monument Creek	1993*	Dirty Woman Creek	\$21,134	\$1,156
FOMO5300	Fountain Creek	1993*	Crystal Creek	\$21,134	\$1,156

Miscellaneous Drainage Basins: ¹

CHBS0800	Chico Creek		Book Ranch	\$19,830	\$2,871
CHEC0400	Chico Creek		Upper East Chico	\$10,803	\$313
CHWS0200	Chico Creek		Telephone Exchange	\$11,870	\$278
CHWS0400	Chico Creek		Livestock Company	\$19,552	\$233
CHWS0600	Chico Creek		West Squirrel	\$10,192	\$4,229
CHWS0800	Chico Creek		Solberg Ranch	\$21,134	\$0
FOFO1200	Fountain Creek		Crooked Canyon	\$6,381	\$0
FOFO1400	Fountain Creek		Calhan Reservoir	\$5,327	\$310
FOFO1600	Fountain Creek		Sand Canyon	\$3,849	\$0
FOFO2000	Fountain Creek		Jimmy Camp Creek ³	\$21,134	\$989
FOFO2200	Fountain Creek		Fort Carson	\$16,684	\$604
FOFO2700	Fountain Creek		West Little Johnson	\$1,392	\$0
FOFO3800	Fountain Creek		Stratton	\$10,137	\$453
FOFO5000	Fountain Creek		Midland	\$16,684	\$604
FOFO6000	Fountain Creek		Palmer Trail	\$16,684	\$604
FOFO6800	Fountain Creek		Black Canyon	\$16,684	\$604
FOMO4600	Monument Creek		Beaver Creek	\$12,635	\$0
FOMO3000	Monument Creek		Kettle Creek	\$11,413	\$0
FOMO3400	Monument Creek		Elkhorn	\$1,917	\$0
FOMO5000	Monument Creek		Monument Rock	\$9,160	\$0
FOMO5400	Monument Creek		Palmer Lake	\$14,647	\$0
FOMO5600	Monument Creek		Raspberry Mountain	\$4,927	\$0
PLPL0200	Monument Creek		Bald Mountain	\$10,500	\$0

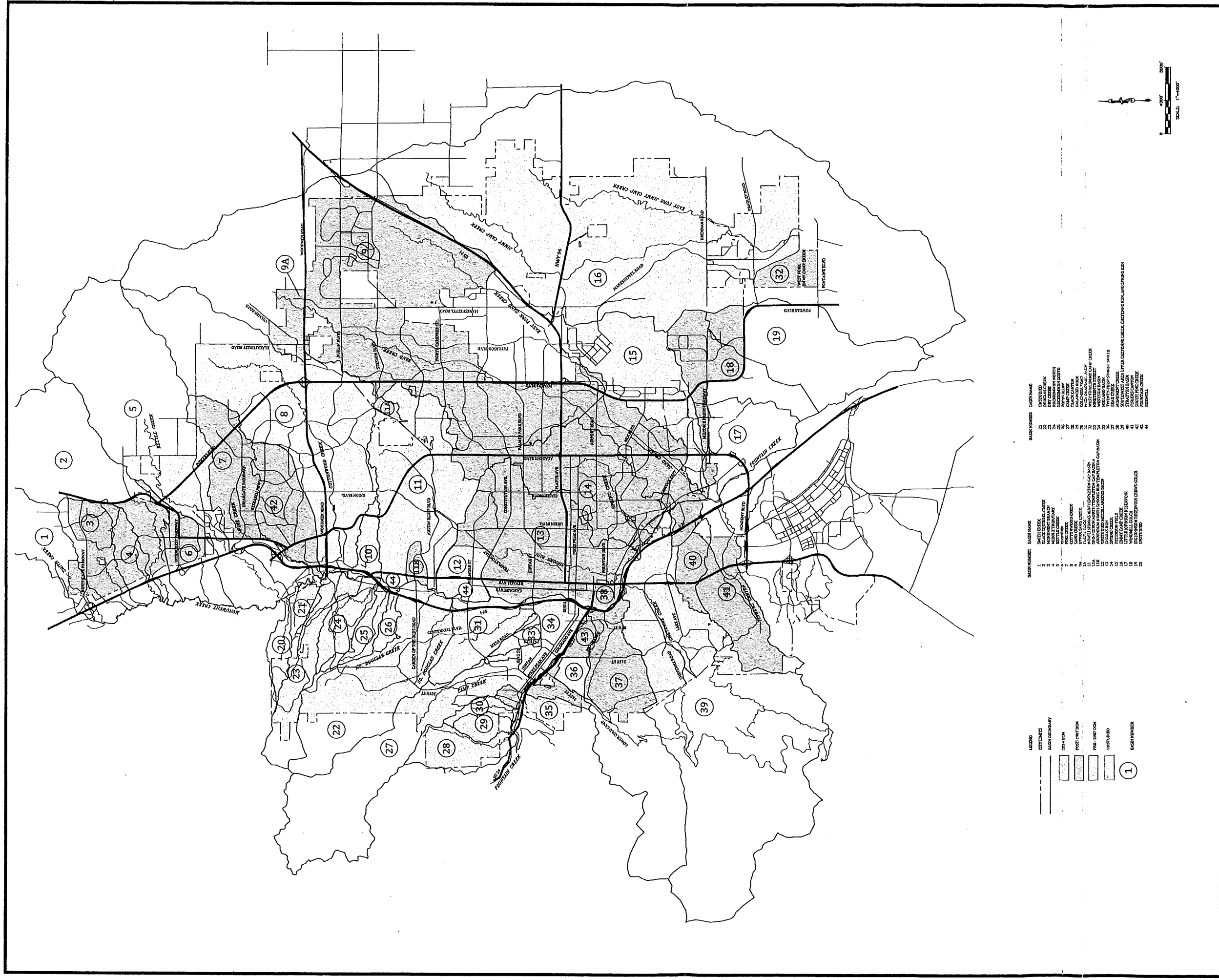
Interim Drainage Basins: ²

FOFO1800	Fountain Creek		Little Fountain Creek	\$2,702	\$0
FOMO4400	Monument Creek		Jackson Creek	\$8,365	\$0
FOMO4800	Monument Creek		Teachout Creek	\$5,809	\$873

1. The miscellaneous drainage fee previous to September 1999 resolution was the average of all drainage fees for basins with Basin Planning Studies performed within the last 14 years.

2. Interim Drainage Fees are based upon draft Drainage Basin Planning Studies or the Drainage Basin Identification and Fee Estimation Report. (Best available information suitable for setting a fee.)

3. This is an interim fee and will be adjusted when a DBPS is completed. In addition to the Drainage Fee a surety in the amount of \$7,285 per impervious acre shall be provided to secure payment of additional fees in the event that the DBPS results in a fee greater than the current fee. Fees paid in excess of the future revised fee will be reimbursed. See Resolution 06-326 (9/14/06) and Resolution 16-320 (9/07/16).



Basin Number	Basin Name	Basin Number	Basin Name
1	Point Creek	21	East Fork Juntura Creek
2	Blackfoot Creek	22	Blackfoot Creek
3	North Juntura Creek	23	North Juntura Creek
4	North Juntura Creek	24	North Juntura Creek
5	North Juntura Creek	25	North Juntura Creek
6	North Juntura Creek	26	North Juntura Creek
7	North Juntura Creek	27	North Juntura Creek
8	North Juntura Creek	28	North Juntura Creek
9	North Juntura Creek	29	North Juntura Creek
10	North Juntura Creek	30	North Juntura Creek
11	North Juntura Creek	31	North Juntura Creek
12	North Juntura Creek	32	North Juntura Creek
13	North Juntura Creek	33	North Juntura Creek
14	North Juntura Creek	34	North Juntura Creek
15	North Juntura Creek	35	North Juntura Creek
16	North Juntura Creek	36	North Juntura Creek
17	North Juntura Creek	37	North Juntura Creek
18	North Juntura Creek	38	North Juntura Creek
19	North Juntura Creek	39	North Juntura Creek
20	North Juntura Creek	40	North Juntura Creek
21	North Juntura Creek	41	North Juntura Creek
22	North Juntura Creek	42	North Juntura Creek
23	North Juntura Creek	43	North Juntura Creek
24	North Juntura Creek	44	North Juntura Creek

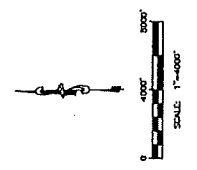
- LEGEND**
- CITY LIMITS
 - BASIN BOUNDARY
 - 2014 ICM
 - POST-2017 ICM
 - PRE-2017 ICM
 - UNDEVELOPED
 - BASIN NUMBER

Project No.:	17012
Date:	7/31/17
Design:	ROW
Drawn:	DAK
Check:	BNV
Reviewed:	

DRAINAGE BASIN PLANNING STUDY INVENTORY

CITY OF COLORADO SPRINGS, COLORADO

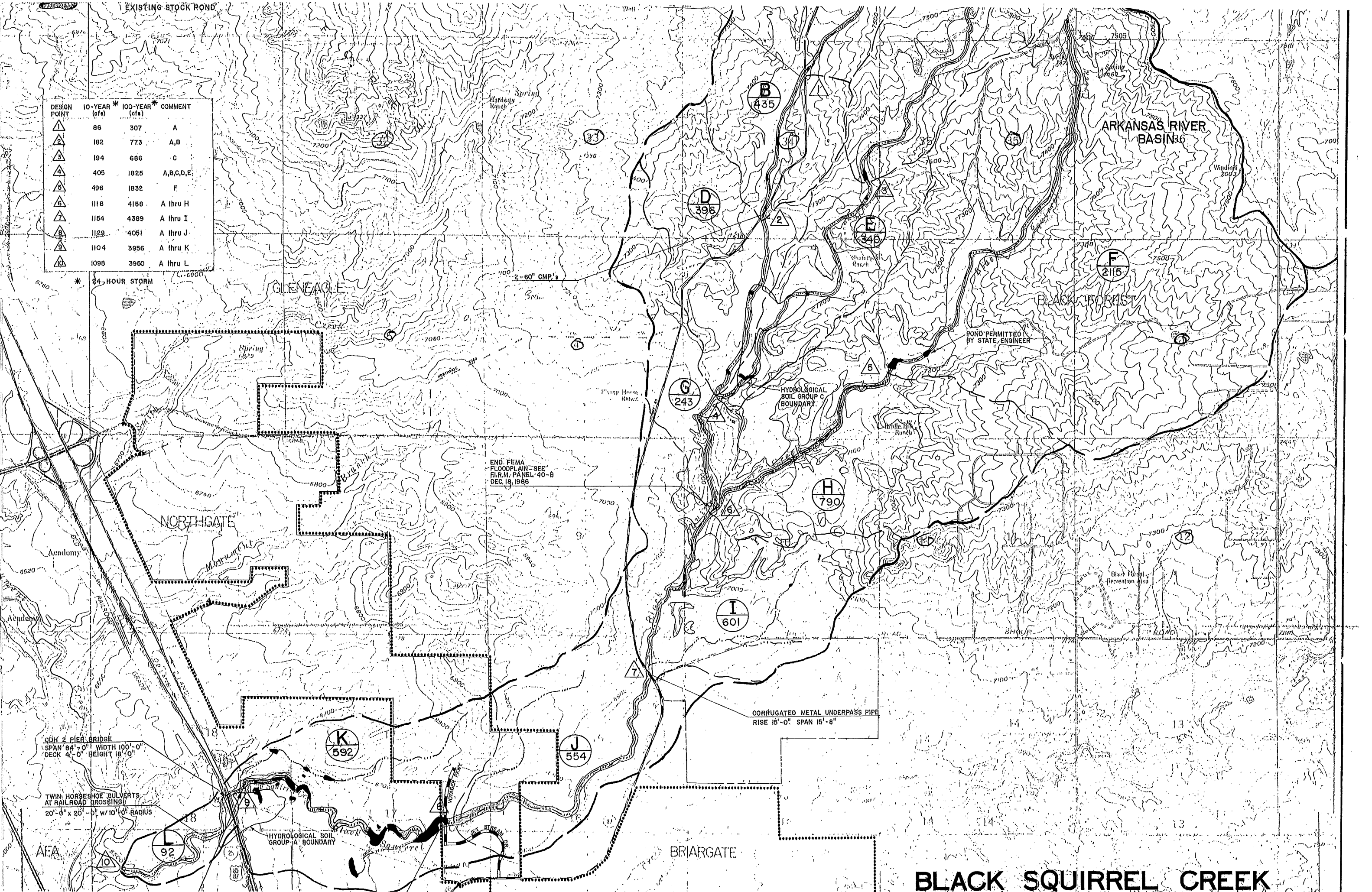
Kiowa
Engineering Corporation
1624 Sarah 21st Street
Colorado Springs, Colorado 80904
(719) 530-7342



EXISTING STOCK ROAD

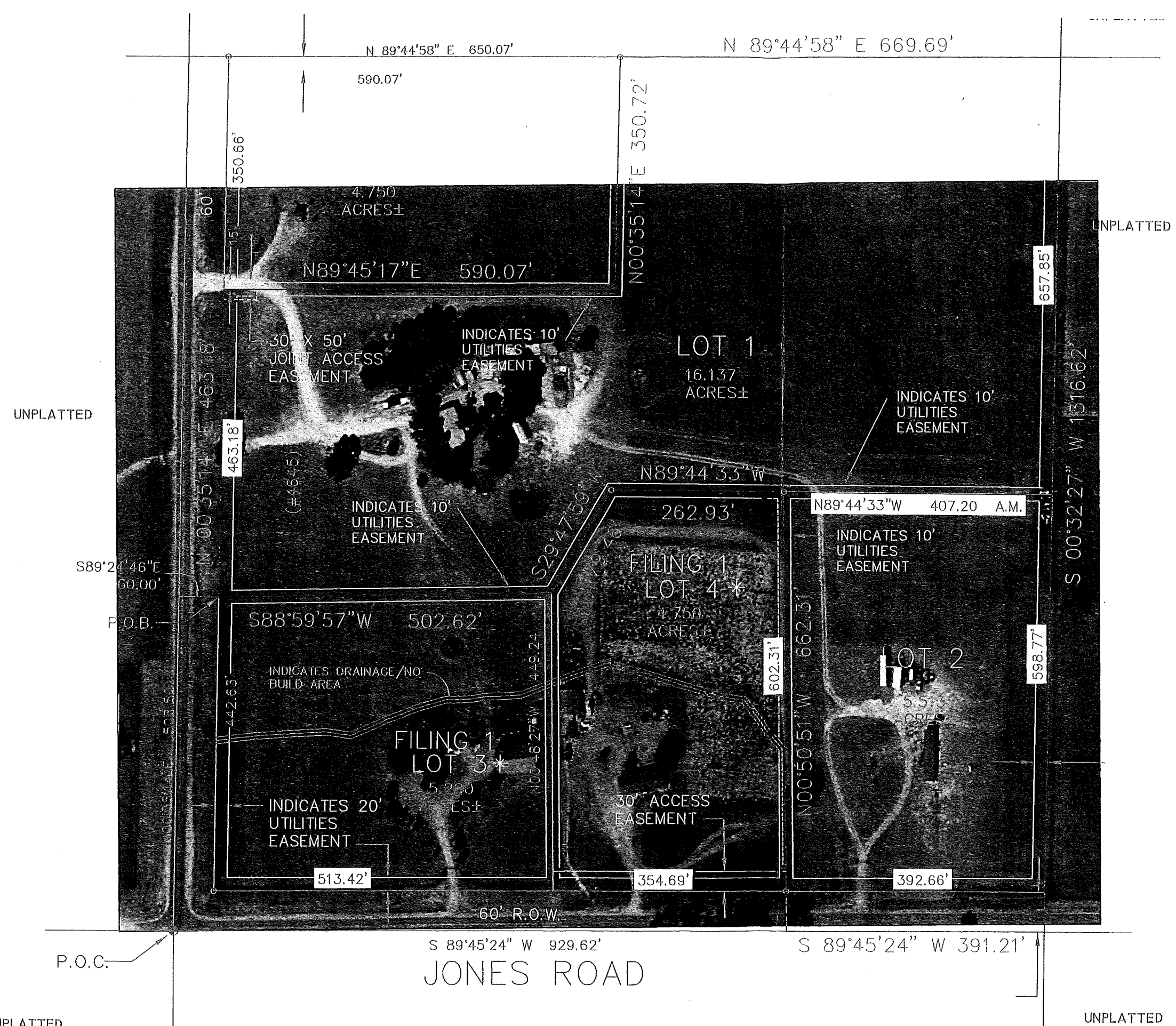
DESIGN POINT	10-YEAR (cfs)	100-YEAR (cfs)	COMMENT
△	86	307	A
△	182	773	A,B
△	194	686	C
△	405	1825	A,B,C,D,E
△	496	1832	F
△	1118	4158	A thru H
△	1154	4389	A thru I
△	1129	4051	A thru J
△	1104	3956	A thru K
△	1098	3950	A thru L

* 24-HOUR STORM



BLACK SQUIRREL CREEK

Exhibit 6: Existing Plat and Replat



N 89°44'58" E 650.07'

N 89°44'58" E 669.69'

590.07'

350.66'

N00°35'14"E 350.72'

N89°45'17"E 590.07'

4.750 ACRES±

UNPLATTED

657.85'

30' X 50' JOINT ACCESS EASEMENT

INDICATES 10' UTILITIES EASEMENT

LOT 1
16.137 ACRES±

INDICATES 10' UTILITIES EASEMENT

UNPLATTED

N 00°35'14" E 463.18'

463.18'

INDICATES 10' UTILITIES EASEMENT

N89°44'33"W

262.93'

N89°44'33"W 407.20 A.M.

INDICATES 10' UTILITIES EASEMENT

S89°24'46"E 60.00'

P.O.B.

S88°59'57"W 502.62'

INDICATES DRAINAGE/NO BUILD AREA

FILING 1 LOT 4*
4.750 ACRES±

LOT 2
5.513 ACRES±

S 00°32'27" W 1516.62'

598.77'

442.65'

INDICATES 20' UTILITIES EASEMENT

FILING 1 LOT 3*
5.260 ACRES±

30' ACCESS EASEMENT

N00°50'51" W 662.31'

602.31'

513.42'

354.69'

392.66'

60' R.O.W.

S 89°45'24" W 929.62'

S 89°45'24" W 391.21'

JONES ROAD

P.O.C.

UNPLATTED

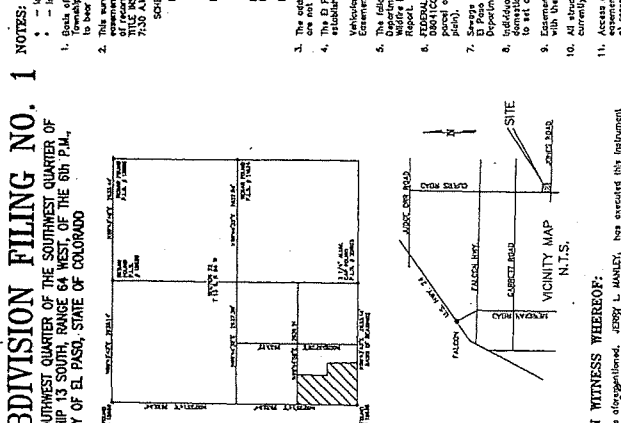
UNPLATTED

Replat

11223

MANLEY SUBDIVISION FILING NO. 1

A PORTION OF THE SOUTHWEST QUARTER OF SECTION 22, TOWNSHIP 13 SOUTH, RANGE 64 WEST, OF THE 8TH P.M., COUNTY OF EL PASO, STATE OF COLORADO



IN WITNESS WHEREOF, I, JERRY L. MANLEY, Notary Public for the State of Colorado, do hereby certify that the above and foregoing was acknowledged before me this 28th day of June, 2002, A.D.

NOTARIAL: MARY MANLEY, Notary Public for the State of Colorado, do hereby certify that the above and foregoing was acknowledged before me this 28th day of June, 2002, A.D.

IN WITNESS WHEREOF, I, JERRY L. MANLEY, Notary Public for the State of Colorado, do hereby certify that the above and foregoing was acknowledged before me this 28th day of June, 2002, A.D.

APPROVALS: This subdivision was approved by the El Paso County Planning Department this 28th day of June, 2002. Approved by the Board of County Commissioners of El Paso County, Colorado, this 28th day of June, 2002.

NOTES: 1. Indicates survey monument set with a 1/4 nail with Surveyor's Copy, P.L.S. 118465. 2. Indicates recovered survey monument as noted.

- 3. The address established on the plat (4845) are for informational purposes only. They are not the legal description and are subject to change. 4. The El Paso County Department of Transportation must be contacted prior to the establishment of any driveway.

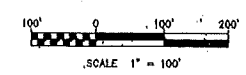
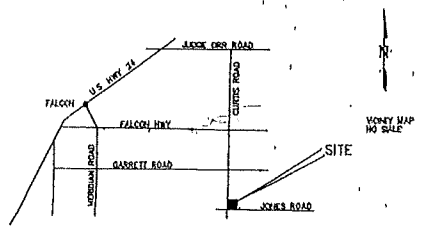
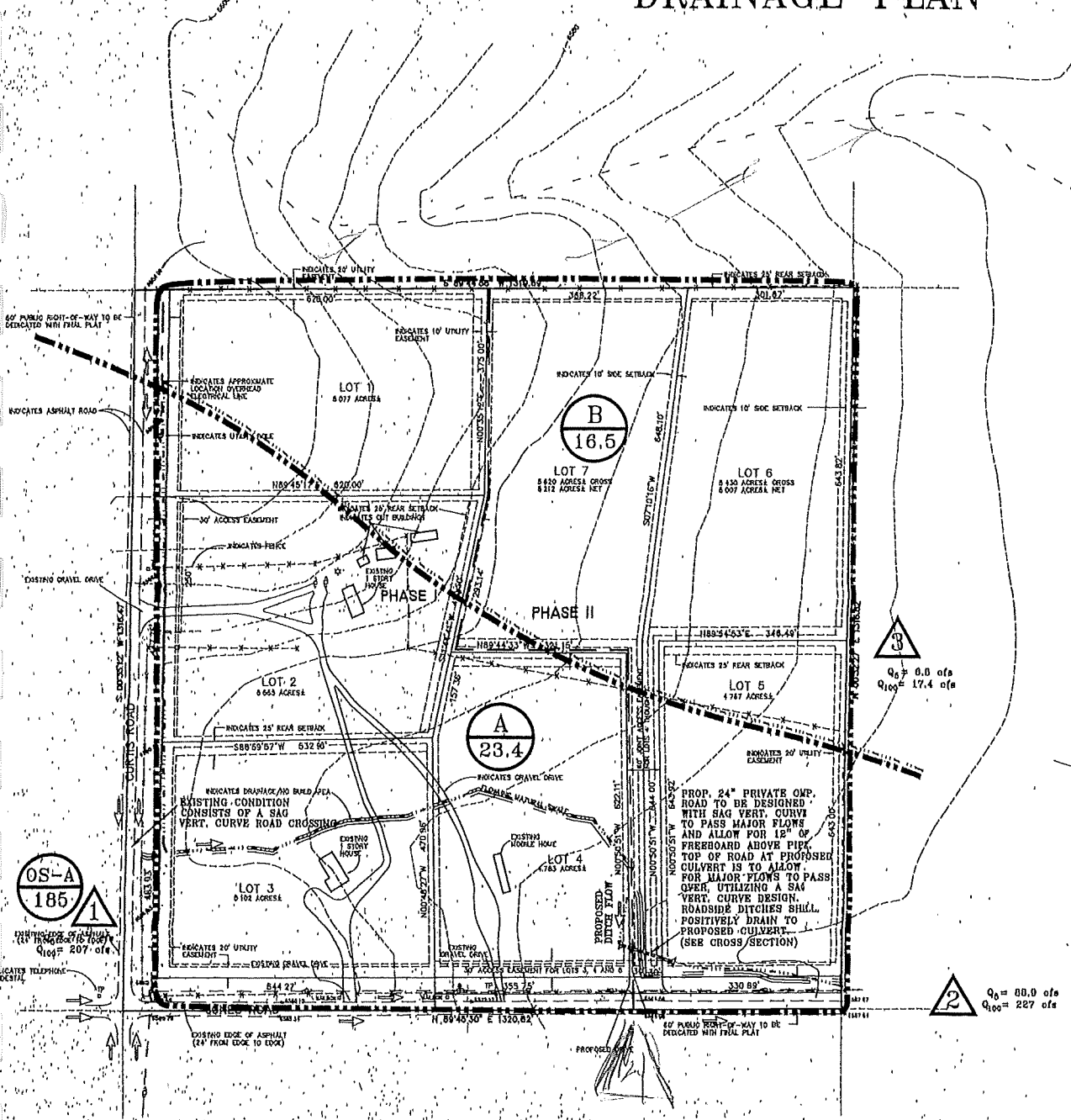
- 15. The property owner, its successors and assigns, and all future owners in this development are hereby notified that they may be required to comply with applicable rules, if any, of the Metropolitan District which components may result in a reduction of said applicant's utility, and thus a reduction in water availability.

Table with columns: NO., REVISIONS, DATE. Includes LDC, INC. and PLANING SERVICES, LAND SERVICES.

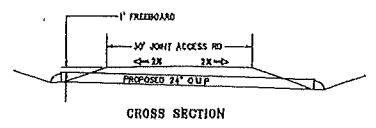
Exhibit 7: Hydrologic Summary per Existing Plat

Exhibit 7: Hydrologic Summary per Existing Plat

DRAINAGE PLAN



- OS-A 16.5 = DRAINAGE BASIN = ACREAGE
- 1 = DESIGN POINT
- = BASIN BOUNDARY
- = DITCH FLOW DIRECTION
- = TC PATH



SUBJECT
LOCAL
3335 NORTH BLAKE PARKWAY
COLORADO SPRING, CO. 80918

DATA
EXISTING ZONE A-33
PROPOSED ZONE R-1

OWNER
JERRY L. & NANCY MANLEY
1414 N. CURTIS ROAD
FALCON, CO. 80421

LEGAL DESCRIPTION
THE SOUTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 22, TOWNSHIP 13 SOUTH, RANGE 61 WEST, OF THE 6TH PM, CONTAINING 34.600 ACRES MORE OR LESS

NOTE: INTERMITTENT DRAINAGE TO NORTH AND CONTIGUOUS FROM 1525 QUAD.

NOTE: JONES ROAD MAY BE WIDENED IN THE FUTURE, WHICH MAY AFFECT DRAINAGE FACILITIES

Revised September 21, 2000

HYDROLOGIC COMPUTATIONS - RATIONAL METHOD

* $T_c = 1.487 (1 - C_1) L^{0.5} C_2^{0.23}$

POINT OF CONCENTRATION	SUBAREA(S) CONTRIBUTING	AREA		FLOW PATH CHARACTERISTICS				Tc MIN.	C	C x A	I	Q	Q FLOW (CFS)		REMARKS	
		ACRE	SQ. MI.	FLOW DESCRIPTION	LENGTH (FT)	HEIGHT (FT)	AVG. V (FPS)						TOTAL	PIPE		STREET
DP 1	05-A	185		O.L.	1000	20	-	49/35*								
				CHANNEL	2500	35	7	8								
		185				5 YR			48	0.25	40.3	1.7	78.7			
DP 2	05-H + A	209		O.L.	1000	20	-	40/35*								
				Channel	5000	55	7	12								
						5 YR			52	0.25	52.3	1.7	88.9			
DP 3	B	14		O.L.	1000	30	-	51/45*								
					500	10	5	2								
						5 YR			53	0.25	4.0	1.7	U.8			
						100 YR										
								47	0.35	5.6	3.1	17.4				

Exhibit 8: Hydrologic Summary per Re-plat

KCH Engineering Solutions

5228 Cracker Barrel Circle
Colorado Springs, CO 80917
(719) 246-4471

JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

Time of Concentration

Calc scale of each map

A. Main Top map

Distance along Northerly P.L. $650.07 - 669.69 = 139.7$

Distance (rule) $6\frac{5}{16} \text{ in} = 6.3125$

Scale $1" = 213.3$ use $1" = 200'$

11x17 map

Distance along northerly P.L. 1320

Distance $= 6\frac{5}{16} \text{ in} = 6.3125$

Scale $= 209$ - use $210'$ $1" = 210'$

B. OS-A

- $300'$ @ $10'$ Fall (Overland)

- $1/2$ in. fall to Culvert under Curbie

Distance along Northerly P.L. $1320'$

Linear inches

Scale $2.9'$

Scale $1320 / 2.9 = 455.2'$ $\therefore 1" = 455'$

C. OS-A

1. Overland

$$L = \frac{1''}{455 \text{ ft}} \times \frac{200'}{200} = 200' / 455 = 0.44 \text{ in.}$$

Fall = $6'$

2. Shallow Swale (to culvert under Curbie)

Actual on Paper = 10.2

Scaled distance $455 \text{ ft} \times 10.2 = 4614'$

Van, Fall: $6700 - 6590 = 110'$

Scale $110 / 4614 = 2.6$

3. Shallow to Easterly P.L.

$1'$ = another 1200 ft = total

$4614 + 1200 = 5800$, $D_{500} = 6700 - 6554 = 146'$, $3 = 146 / 5800 = 2.5'$

Chris

KCH Engineering Solutions

5228 Cracker Barrel Circle
Colorado Springs, CO 80917
(719) 246-4471

JOB _____
SHEET NO. _____ OF _____
CALCULATED BY K. Harrison DATE 1/18/22
CHECKED BY _____ DATE _____
SCALE _____

T_c (Cont)

D. Subbasin A

- Shallow Sheet - 100 ft
- Fall = 3' Slope = 3%

- Shallow Swale to Eastern PL

Length = 1050

Vent Drop = 6580 - 6554 =

Slope = 26/1050 = 2.5% 9009

E. Subbasin B

- Shallow Sheet Flow = 100 ft V = 6" S = 6/100 = 6%

- Shallow Channel Flow

Distance to East PL = 850'

V = (6592 - 6554) = 38'

S = 38/850 = 4.47%

F. Subbasin C

- Shallow Sheet = (0.6") * 210'/inch = 126'

- Shallow Swale

6592 - 6568 = 24'; S = 24'

Distance: 4.3" (paper) * 210'/inch = 903'

Slope = 24/903 = 2.7%

G. Subbasin D (53)

- Shallow Sheet = L=200, Vent Drop = 20' S = 20/200 = 10%

- Shallow Channel Flow

Distance to East PL = 2100'

Vent Drop: 6588 - 6562 = 26'; S =

Slope: 2.4%

**Manley Subdivision
Drainage Calculations
Developed Conditions
(Area Runoff Coefficient Summary)**

BASIN	TOTAL AREA (Acres)	Gravel Road			Buildings			NATURAL			RUNOFF COEFFICIENT	
		AREA (Acres)	C ₅	C ₁₀₀	AREA (Acres)	C ₅	C ₁₀₀	AREA (Acres)	C ₅	C ₁₀₀	C ₅	C ₁₀₀
A	14.30	0.13	0.59	0.70	0.09	0.73	0.81	14.08	0.08	0.35	0.09	0.36
B	13.82	0.00	0.59	0.70	0.00	0.73	0.81	13.82	0.08	0.35	0.08	0.35
C	2.19	0.00	0.59	0.70	0.00	0.73	0.81	2.19	0.08	0.35	0.08	0.35
D	6.63	0.05	0.59	0.70	0.07	0.73	0.81	6.51	0.08	0.35	0.09	0.36
E	2.23	0.00	0.59	0.70	0.00	0.73	0.81	2.23	0.08	0.35	0.08	0.35
F	1.50	0.60	0.59	0.70	0.00	0.73	0.81	0.90	0.08	0.35	0.28	0.49
OS-A	208.53	0.00	0.59	0.70	0.00	0.73	0.81	208.53	0.08	0.35	0.08	0.35

Manley Subdivision
FINAL DRAINAGE REPORT
Existing and Developed conditions
(Area Drainage Summary)

BASIN	From Area Runoff Coefficient Summary		OVERLAND				SHALLOW CHANNEL FLOW				Time of Travel (T _t)				INTENSITY *			TOTAL FLOWS	
	AREA TOTAL (Acres)	C _s	C ₁₀₀	C _s	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (cfs)	Q ₁₀₀ (cfs)	
A	14.30	0.09	0.36	0.09	100	3	12.7	1050	2.5%	0.8	22.1	34.8	2.3	3.8	2.9	3.8	2.9	19.3	19.3
B	13.82	0.08	0.35	0.08	100	2	14.7	126	4.5%	1.1	2.0	16.6	3.4	5.6	3.7	5.6	3.7	27.3	27.3
C	2.19	0.08	0.35	0.08	100	14	7.7	903	2.7%	0.8	18.3	26.0	2.7	4.5	2.7	4.5	0.5	3.5	3.5
D	5.63	0.09	0.36	0.09	200	20	12.1	1100	2.4%	0.8	23.7	35.7	2.2	3.7	2.2	3.7	1.3	8.8	8.8
E	2.23	0.08	0.35	0.08	200	2	26.0	400	3.0%	0.9	7.7	33.7	2.3	3.9	2.3	3.9	0.4	3.0	3.0
OS-A	208.53	0.08	0.35	0.08	100	10	8.6	5800	2.6%	0.8	119.9	128.5	0.3	0.5	0.3	0.5	5.0	36.3	36.3

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: Ken H

Date: 1/20/2022

Checked by:

Manley

Harrison

Manley

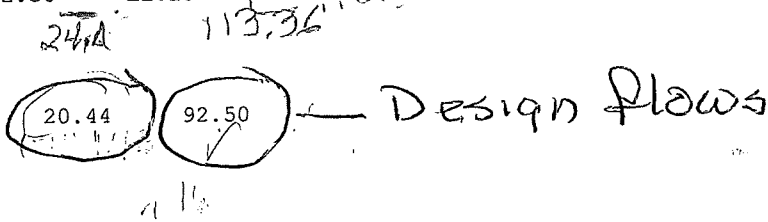
El Paso County, Colorado

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier Peak Flow and Peak Time (hr) by Rainfall Return Period
 5-Yr (cfs) (hr) 100-Yr (cfs) (hr)

Sub-Area or Reach Identifier	5-Yr Peak Flow (cfs)	5-Yr Peak Time (hr)	100-Yr Peak Flow (cfs)	100-Yr Peak Time (hr)
SUBAREAS OS A	19.18	13.46	87.99 ✓	13.36
A	3.23	12.31	15.78	12.24
D	1.45	12.34	7.11	12.27
E	0.51	12.30	2.48	12.25

REACHES
OUTLET



Areas

Sub-Area	Area (Acres)	Flow (cfs)
OS-A	208.5	0.326
A	13.8	0.326 0.33284
B	2.2	0.01386 0.01036
C	6.6	0.663
D	2.2	
E		

~~1 mile * Area~~ 1 mile²
640 A
640 Acres
1 mile²

✓

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 TR20.inp

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 Manley
 no project subtitle provided

SUB-AREA:
 OS A Outlet .32583 66. 2.1
 A Outlet .02234 66. .57
 D Outlet .01036 66. .595
 E Outlet .00348 66. .56

STREAM REACH:

STORM ANALYSIS:
 5-Yr 2.7 Type II 2
 100-Yr 4.6 Type II 2

STRUCTURE RATING:

GLOBAL OUTPUT:
 2 0.05 YYYYN YYYYNN

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STORM 5-Yr

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Elevation (ft)	Peak Flow Time (hr)	Rate (cfs)	Rate (csm)
OS A	0.326		0.409		13.46	19.18	58.87

Line Start Time (hr)	Flow (cfs)	Values @ time (cfs)	increment (cfs)	of 0.133 hr (cfs)	Rate (cfs)	Rate (cfs)
11.868	0.10	0.57	1.51	2.84	4.70	10.06
12.797	12.79	15.12	16.91	18.17	18.97	19.08
13.725	18.64	17.80	16.66	15.59	14.67	13.00
14.654	12.30	11.63	11.00	10.42	9.91	9.02
15.582	8.63	8.28	7.95	7.65	7.38	6.89
16.510	6.66	6.45	6.25	6.06	5.88	5.57
17.439	5.44	5.31	5.20	5.09	4.98	4.79
18.367	4.70	4.61	4.54	4.47	4.39	4.26
19.296	4.19	4.12	4.06	3.99	3.93	3.79
20.224	3.73	3.66	3.60	3.53	3.47	3.36
21.152	3.31	3.26	3.22	3.18	3.14	3.08
22.081	3.06	3.04	3.01	3.00	2.98	2.94
23.009	2.93	2.92	2.90	2.89	2.87	2.85
23.938	2.84	2.82	2.80	2.75	2.69	2.47
24.866	2.31	2.13	1.93	1.72	1.51	1.13
25.795	0.96	0.81	0.68	0.58	0.49	0.35
26.723	0.30	0.26	0.22	0.18	0.16	0.11
27.651	0.09	0.08	0.07	0.06		

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0 0 0.05

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Y
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STORM 5-Yr

SUB-AREA:

OS A	Outlet	.32583	66.	2.1
A	Outlet	.02234	66.	.57
D	Outlet	.01036	66.	.595

no project subtitle provided

Line Start Time (hr)	Flow (cfs)	Values (cfs)	@ time (cfs)	increment (cfs)	of 0.035 hr (cfs)	Peak Flow (cfs)	Rate (cfs)
27.899	0.07	0.07	0.06	0.06	0.06	0.05	0.05

STORM 100-Yr

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Elevation (ft)	Time (hr)	Peak Flow Rate (cfs)	Rate (csm)
OS A	0.326		1.461		13.36	87.99	270.06

Line Start Time (hr)	Flow (cfs)	Values (cfs)	@ time (cfs)	increment (cfs)	of 0.133 hr (cfs)	Peak Flow Rate (cfs)	Rate (cfs)
11.370	0.08	0.18	0.42	1.10	3.16	7.48	13.98
12.298	22.71	34.00	47.29	60.49	71.60	79.88	85.16
13.226	87.87	87.99	85.98	82.56	77.59	71.27	64.80
14.155	59.24	54.45	50.16	46.42	43.08	39.96	37.13
15.083	34.65	32.45	30.46	28.69	27.11	25.67	24.38
16.012	23.24	22.19	21.23	20.35	19.53	18.77	18.06
16.940	17.41	16.82	16.26	15.77	15.32	14.91	14.52
17.869	14.15	13.81	13.47	13.16	12.86	12.59	12.36
18.797	12.14	11.92	11.71	11.51	11.31	11.11	10.92
19.725	10.72	10.53	10.34	10.15	9.96	9.77	9.58
20.654	9.40	9.23	9.06	8.91	8.76	8.63	8.51
21.582	8.40	8.30	8.21	8.13	8.06	7.99	7.93
22.511	7.87	7.82	7.77	7.72	7.68	7.63	7.59
23.439	7.55	7.51	7.47	7.43	7.39	7.34	7.26
24.367	7.13	6.95	6.69	6.34	5.90	5.40	4.87
25.296	4.33	3.79	3.29	2.82	2.39	2.01	1.70
26.224	1.44	1.22	1.04	0.88	0.75	0.63	0.54
27.153	0.46	0.39	0.33	0.28	0.23	0.20	0.17
28.081	0.14	0.12	0.10	0.08	0.07	0.06	

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Elevation (ft)	Time (hr)	Peak Flow Rate (cfs)	Rate (csm)
A	0.022		1.460		12.24	15.78	706.47

Line Start Time (hr)	Flow (cfs)	Values (cfs)	@ time (cfs)	increment (cfs)	of 0.036 hr (cfs)	Peak Flow Rate (cfs)	Rate (cfs)
11.271	0.05	0.07	0.09	0.11	0.13	0.16	0.19
11.523	0.22	0.26	0.31	0.38	0.47	0.60	0.79
11.775	1.06	1.44	1.99	2.76	3.78	5.07	6.64
12.027	8.42	10.27	12.05	13.59	14.78	15.51	15.78

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Beginning of Input Data List

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0.05

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Y
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STORM 100-Yr

SUB-AREA:

OS A	Outlet	.32583	66.	2.1
A	Outlet	.02234	66.	.57
D	Outlet	.01036	66.	.595

Exhibit 9: Hydraulic Summary for Re-plat

Manley Subdivision

Swale Summary

Swale #	Contributing Subbasins	Location	Slope %	Design Flow		Depth of Flow		Velocity		Froude #	
				Q5 cfs	Q100 cfs	Q5 ft	Q100 ft	Q5 fps	Q100 fps	5 year	100 year
1 at DP1	OS 1	along west side of curbtis	2.4	19.2	88.0	0.6	1.3	4.5	6.6	1.24	1.36
2	OS 1, A, D	see map	3.0	20.4	92.5	0.6	1.2	4.9	7.3	1.38	1.52
3	OS1	for reference									
4	Swale north of site										
5	B	inside SB	3.5	3.7	27.3	0.3	0.7	3.2	5.6	1.29	1.49
6	Borrow ditch along no. side of Jones from SW corner to DP4										
7	Borrow ditch along west. side of Jones										
8	OS1,A,D,E	DP4 to DP2	3.5	20.4	92.5	0.6	1.3	5.2	7.7	1.47	1.63

Design Point Summary

Design Point	Sub Basins	Total Acres	Existing Runoff		
			Q5	Q100	
		(acres)	cfs	cfs	
1	OS-A	208.53	19.2	88	TR55 Method
2	OS- A, A, D, E	231.69	20.4	92.5	TR55Rational and Method
3	B	13.82	3.7	19.3	Rational Method
4	OS- A, A, D, E	231.5	20.4	92.5	TR55 and Rational Method

Task 1 @ DPL

The open channel flow calculator

5 year
Along center R

Select Channel Type: **Trapezoid** ▼

Rectangle Trapezoid Triangle Circle

Depth from Q ▼ Select unit system: **Feet(ft)** ▼

Channel slope: <input type="text" value="0.024"/> ft/ft	Water depth(y): <input type="text" value="0.63"/> ft	Bottom width(b): <input type="text" value="3"/> ft
Flow velocity: <input type="text" value="4.472"/> ft/s	LeftSlope (Z1): <input type="text" value="6"/> to 1 (H:V)	RightSlope (Z2): <input type="text" value="6"/> to 1 (H:V)
Flow discharge: <input type="text" value="19.2"/> ft ³ /s	Input n value <input type="text" value="0.028"/> or select n	
Calculate!	Status: <input type="text" value="Calculation finished"/>	Reset
Wetted perimeter: <input type="text" value="10.69"/> ft	Flow area: <input type="text" value="4.29"/> ft ²	Top width(T): <input type="text" value="10.59"/> ft
Specific energy: <input type="text" value="0.94"/> ft	Froude number: <input type="text" value="1.24"/>	Flow status: <input type="text" value="Supercritical flow"/>
Critical depth: <input type="text" value="0.71"/> ft	Critical slope: <input type="text" value="0.015"/> ft/ft	Velocity head: <input type="text" value="0.31"/> ft

Sample 1
@ DPA

The open channel flow calculator

100%
Along Portus

Select Channel Type: **Trapezoid** ▼

Rectangle
Trapezoid
Triangle
Circle

Depth from Q ▼ Select unit system: **Feet(ft)** ▼

Channel slope: **0.024** **ft/ft**

Water depth(y): **1.26** **ft**

Bottom width(b): **3** **ft**

Flow velocity: **6.62** **ft/s**

Left Slope (Z1): **6** to 1 (H:V)

Right Slope (Z2): **6** to 1 (H:V)

Flow discharge: **88** **ft³/s**

Input n value: **0.028** or select n

Calculate!

Status: **Calculation finished**

Reset

Wetted perimeter: **18.32** **ft**

Flow area: **13.29** **ft²**

Top width(T): **18.11** **ft**

Specific energy: **1.94** **ft**

Froude number: **1.36**

Flow status: **Supercritical flow**

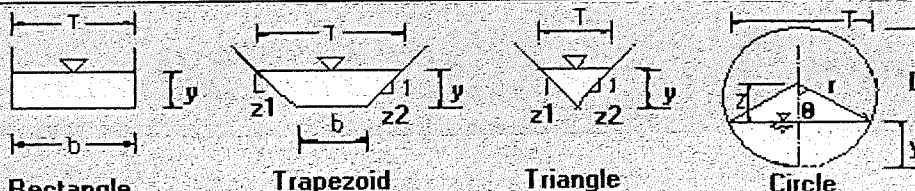
Critical depth: **1.46** **ft**

Critical slope: **0.0122** **ft/ft**

Velocity head: **0.68** **ft**

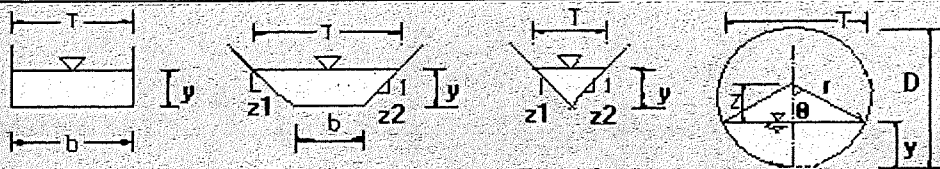
Swale 2@DP4
~~100 y.R. 5.11.11~~
 5

The open channel flow calculator

Select Channel Type: <input type="text" value="Trapezoid"/>			
Depth from Q <input type="text" value="0.030"/>	Select unit system: <input type="text" value="Feet(ft)"/>		
Channel slope: <input type="text" value="0.030"/> <input type="text" value="ft/ft"/>	Water depth(y): <input type="text" value="0.62"/> <input type="text" value="ft"/>	Bottom width(b) <input type="text" value="3"/> <input type="text" value="ft"/>	
Flow velocity <input type="text" value="4.928"/> <input type="text" value="ft/s"/>	Left Slope (Z1): <input type="text" value="6"/> to 1 (H:V)	Right Slope (Z2): <input type="text" value="6"/> to 1 (H:V)	
Flow discharge <input type="text" value="20.4"/> <input type="text" value="ft^3/s"/>	Input n value <input type="text" value="0.028"/> or select n		
<input type="button" value="Calculate!"/>	Status: <input type="text" value="Calculation finished"/>	<input type="button" value="Reset"/>	
Wetted perimeter <input type="text" value="10.51"/> <input type="text" value="ft"/>	Flow area <input type="text" value="4.14"/> <input type="text" value="ft^2"/>	Top width(T) <input type="text" value="10.41"/> <input type="text" value="ft"/>	
Specific energy <input type="text" value="0.99"/> <input type="text" value="ft"/>	Froude number <input type="text" value="1.38"/>	Flow status <input type="text" value="Supercritical flow"/>	
Critical depth <input type="text" value="0.73"/> <input type="text" value="ft"/>	Critical slope <input type="text" value="0.015"/> <input type="text" value="ft/ft"/>	Velocity head <input type="text" value="0.38"/> <input type="text" value="ft"/>	

Swale Z @ DP4
100 yr storm

The open channel flow calculator

Select Channel Type: Trapezoid ▾			
Depth from Q ▾	Select unit system: Feet(ft) ▾		
Channel slope: 0.030 ft/ft	Water depth(y): 1.22 ft	Bottom width(b): 3 ft	
Flow velocity: 7.296 ft/s	LeftSlope (Z1): 6 to 1 (H:V)	RightSlope (Z2): 6 to 1 (H:V)	
Flow discharge: 92.5 ft ³ /s	Input n value: 0.028 or select n		
<input type="button" value="Calculate!"/>	Status: Calculation finished	<input type="button" value="Reset"/>	
Wetted perimeter: 17.9 ft	Flow area: 12.68 ft ²	Top width(T): 17.7 ft	
Specific energy: 2.05 ft	Froude number: 1.52	Flow status: Supercritical flow	
Critical depth: 1.49 ft	Critical slope: 0.0121 ft/ft	Velocity head: 0.83 ft	

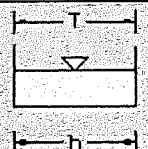
Swale 5

The open channel flow calculator

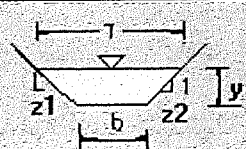
@DP3

5/10/14

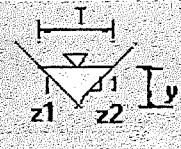
Select Channel Type: **Trapezoid** ▼



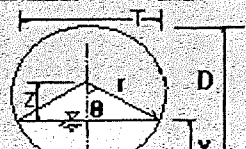
Rectangle



Trapezoid



Triangle



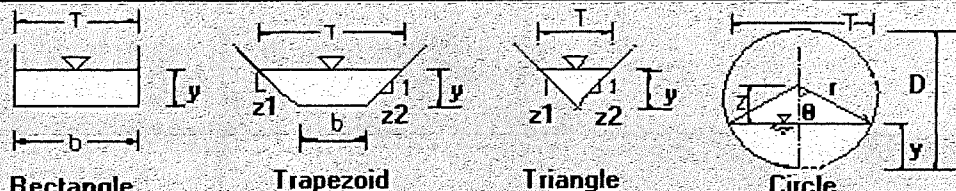
Circle

Depth from Q ▼ Select unit system: **Feet(ft)** ▼

Channel slope: <input type="text" value=".035"/> ft/ft	Water depth(y): <input type="text" value="0.25"/> ft	Bottom width(b): <input type="text" value="3"/> ft
Flow velocity: <input type="text" value="3.206411"/> ft/s	LeftSlope (Z1): <input type="text" value="6"/> to 1 (H:V)	RightSlope (Z2): <input type="text" value="6"/> to 1 (H:V)
Flow discharge: <input type="text" value="3.7"/> ft ³ /s	Input n value: <input type="text" value="0.028"/> or select n	
Calculate!	Status: <input type="text" value="Calculation finished"/>	Reset
Wetted perimeter: <input type="text" value="6.1"/> ft	Flow area: <input type="text" value="1.15"/> ft ²	Top width(T): <input type="text" value="6.06"/> ft
Specific energy: <input type="text" value="0.41"/> ft	Froude number: <input type="text" value="1.29"/>	Flow status: <input type="text" value="Supercritical flow"/>
Critical depth: <input type="text" value="0.3"/> ft	Critical slope: <input type="text" value="0.0183"/> ft/ft	Velocity head: <input type="text" value="0.16"/> ft

Swak 5
~~DP-3~~ DP-3
 100

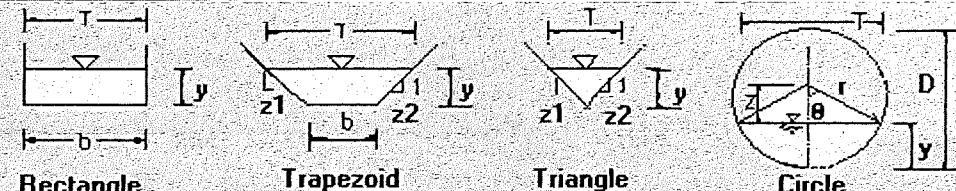
The open channel flow calculator

Select Channel Type: <input type="text" value="Trapezoid"/>			
Depth from Q <input type="text" value=""/>	Select unit system: <input type="text" value="Feet(ft)"/>		
Channel slope: <input type="text" value=".035"/> <input type="text" value="ft/ft"/>	Water depth(y): <input type="text" value="0.69"/> <input type="text" value="ft"/>	Bottom width(b): <input type="text" value="3"/> <input type="text" value="ft"/>	
Flow velocity <input type="text" value="5.592"/> <input type="text" value="ft/s"/>	LeftSlope (Z1): <input type="text" value="6"/> to 1 (H:V)	RightSlope (Z2): <input type="text" value="6"/> to 1 (H:V)	
Flow discharge <input type="text" value="27.3"/> <input type="text" value="ft^3/s"/>	Input n value <input type="text" value="0.028"/> or select n		
<input type="button" value="Calculate!"/>	Status: <input type="text" value="Calculation finished"/>	<input type="button" value="Reset"/>	
Wetted perimeter <input type="text" value="11.35"/> <input type="text" value="ft"/>	Flow area <input type="text" value="4.88"/> <input type="text" value="ft^2"/>	Top width(T) <input type="text" value="11.23"/> <input type="text" value="ft"/>	
Specific energy <input type="text" value="1.17"/> <input type="text" value="ft"/>	Froude number <input type="text" value="1.49"/>	Flow status <input type="text" value="Supercritical flow"/>	
Critical depth <input type="text" value="0.84"/> <input type="text" value="ft"/>	Critical slope <input type="text" value="0.0144"/> <input type="text" value="ft/ft"/>	Velocity head <input type="text" value="0.49"/> <input type="text" value="ft"/>	

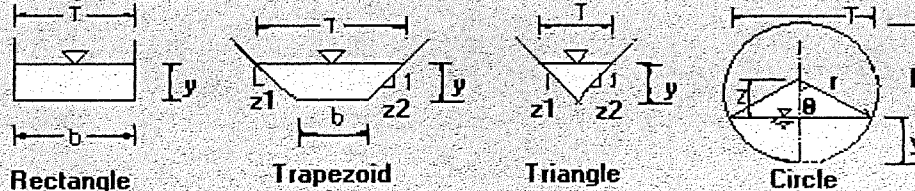
sware e
ckng no. side of Jones

The open channel flow calculator

100y
DP 4 to DP 2

Select Channel Type: Trapezoid ▾			
Depth from Q ▾	Select unit system: Feet(ft) ▾		
Channel slope: .035 ft/ft	Water depth(y): 1.25 ft	Bottom width(b): 2 ft	
Flow velocity: 7.741 ft/s	LeftSlope (Z1): 6 to 1 (H:V)	RightSlope (Z2): 6 to 1 (H:V)	
Flow discharge: 92.5 ft ³ /s	Input n value: 0.028 or select n		
<input type="button" value="Calculate!"/>	Status: Calculation finished	<input type="button" value="Reset"/>	
Wetted perimeter: 17.26 ft	Flow area: 11.95 ft ²	Top width(T): 17.05 ft	
Specific energy: 2.18 ft	Froude number: 1.63	Flow status: Supercritical flow	
Critical depth: 1.56 ft	Critical slope: 0.0122 ft/ft	Velocity head: 0.93 ft	

The open channel flow calculator

Select Channel Type: Trapezoid ▾			
Depth from Q ▾	Select unit system: Feet(ft) ▾		
Channel slope: <input type="text" value=".035"/> ft/ft	Water depth(y): <input type="text" value="0.6"/> ft	Bottom width(b) <input type="text" value="3"/> ft	
Flow velocity <input type="text" value="5.181"/> ft/s	LeftSlope (Z1): <input type="text" value="6"/> to 1 (H:V)	RightSlope (Z2): <input type="text" value="6"/> to 1 (H:V)	
Flow discharge <input type="text" value="20.4"/> ft ³ /s	Input n value <input type="text" value=".028"/> or select n		
<input type="button" value="Calculate!"/>	Status: <input type="text" value="Calculation finished"/>	<input type="button" value="Reset"/>	
Wetted perimeter <input type="text" value="10.27"/> ft	Flow area <input type="text" value="3.94"/> ft ²	Top width(T) <input type="text" value="10.17"/> ft	
Specific energy <input type="text" value="1.01"/> ft	Froude number <input type="text" value="1.47"/>	Flow status <input type="text" value="Supercritical flow"/>	
Critical depth <input type="text" value="0.73"/> ft	Critical slope <input type="text" value="0.015"/> ft/ft	Velocity head <input type="text" value="0.42"/> ft	

Culvert #1 - 24" C.M.D (Existing)
 $Q_5 = 19.2$ cfs $Q_{100} = 88$ cfs

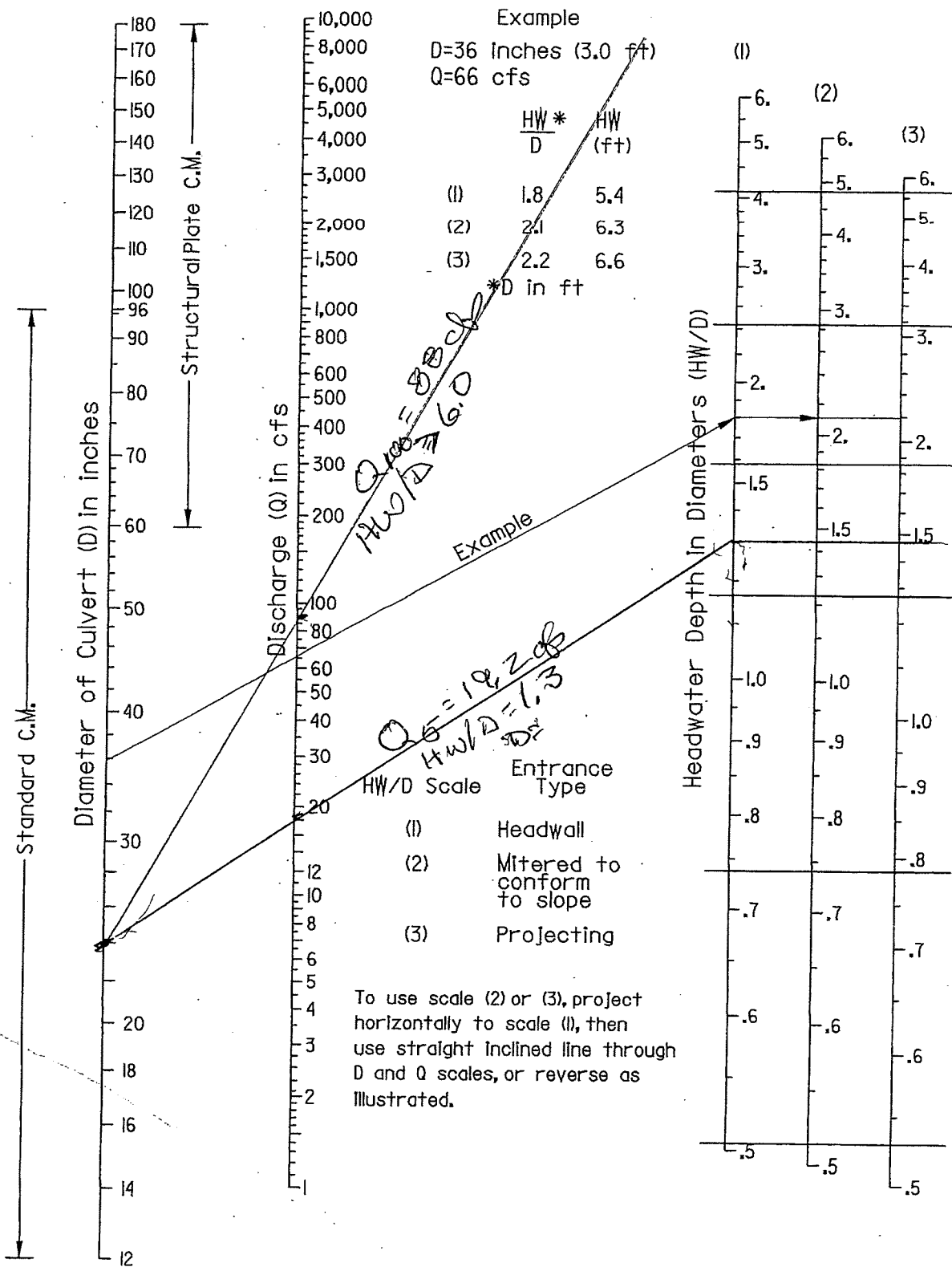


Exhibit F.2 Headwater Depth for CMP Culverts with Inlet Control
 (Source: Reference F.1)

Culvert Structure #2
 Use values DP #2 & #3

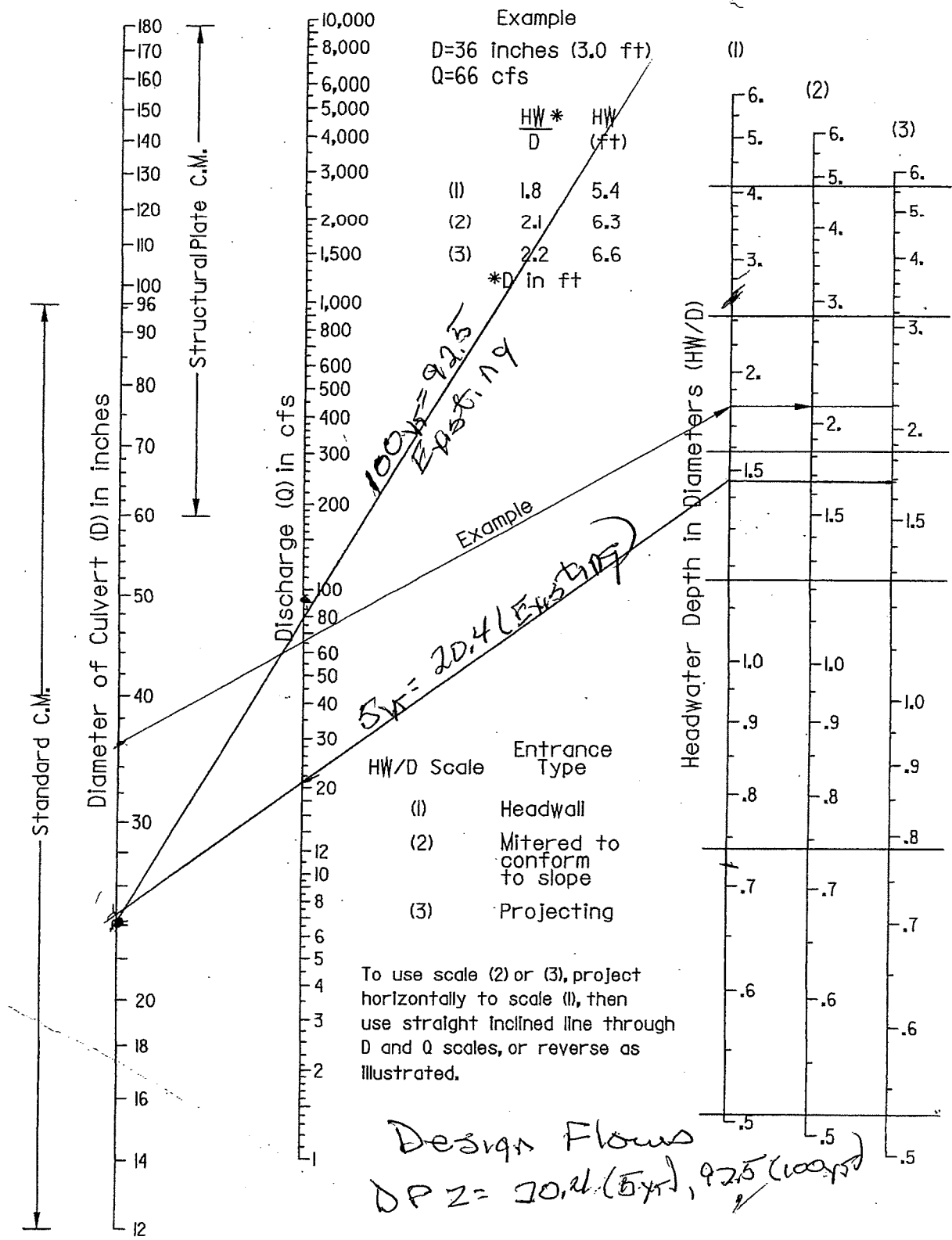


Exhibit F.2 Headwater Depth for CMP Culverts with Inlet Control
 (Source: Reference F.1)

Exhibit 10: Drainage Conditions (map pocket)

Exhibit 10

Drainage Conditions (map pocket)

MANLEY SUBDIVISION FILING NO. 2

A PORTION OF THE SOUTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 22, TOWNSHIP 13 SOUTH, RANGE 64 WEST, OF THE 6th P.M., COUNTY OF EL PASO, STATE OF COLORADO

DESIGN POINT SUMMARY

DESIGN POINT	CONTRIB SUB BASINS	TOTAL AREA (acres)	EXISTING RUNOFF		COMMENTS
			Q5 (cfs)	Q100 (cfs)	
1	OSA	208.53	19.2	88.0	TR55 Method
2	OS-A, A, D, E	231.69	20.4	92.5	TR55 and Rational Method
3	B	13.82	3.7	19.3	Rational Method
4	OS-A, A, D, E	231.50	20.4	92.5	TR55 and Rational Method

SWALE SUMMARY

SWALE #	CONTRIBUTING SUBBASINS	LOCATION	SLOPE %	DESIGN FLOW		DEPTH OF FLOW		VELOCITY		FROUDE #	
				Q5 cfs	Q100 cfs	Q5 ft	Q100 ft	Q5 fps	Q100 fps	5 year	100 year
1 AT DP1	OS 1	W. SIDE OF CURTIS RD.	2.4	19.2	88.0	0.6	1.3	4.5	6.6	1.24	1.36
2	OS 1, A, D	SEE MAP	3.0	3.0	92.5	0.6	1.2	4.9	7.3	1.38	1.52
3	OS 1										
4	SWALE NORTH OF SITE										
5	B	INSIDE SB	3.5	3.5	27.3	0.3	0.7	3.2	5.6	1.29	1.49
6	BORROW DITCH ALONG N. SIDE OF JONES RD. FROM S.W. CORNER TO DP4										
7	BORROW DITCH ALONG WEST SIDE OF CURTIS RD.										
8	OS 1, A, D, E	DP4 TO DP2	3.5	20.4	92.5	0.6	1.3	5.2	7.7	1.47	1.63

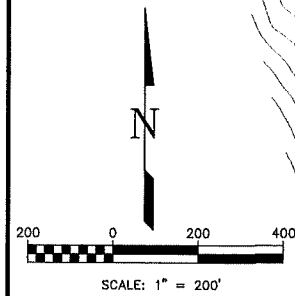
SUB BASIN HYDROLOGIC SUMMARY

BASIN I.D.	AREA (acres)	RUNOFF COEFFICIENTS		RUNOFF		COMMENTS
		5 yr	100 yr	5 yr	100 yr	
A	14.3	0.08	0.35	2.9	19.3	
B	13.8	0.08	0.35	3.7	27.8	
C	2.19	0.08	0.35	0.5	3.5	
D	6.63	0.08	0.35	1.3	8.8	
E	2.23	0.08	0.35	0.4	3.0	
OS 1	208.5	0.08	0.35	19.2	88.0	The TR55 method is used since the total acreage is greater than 130 acres.

NOTES:

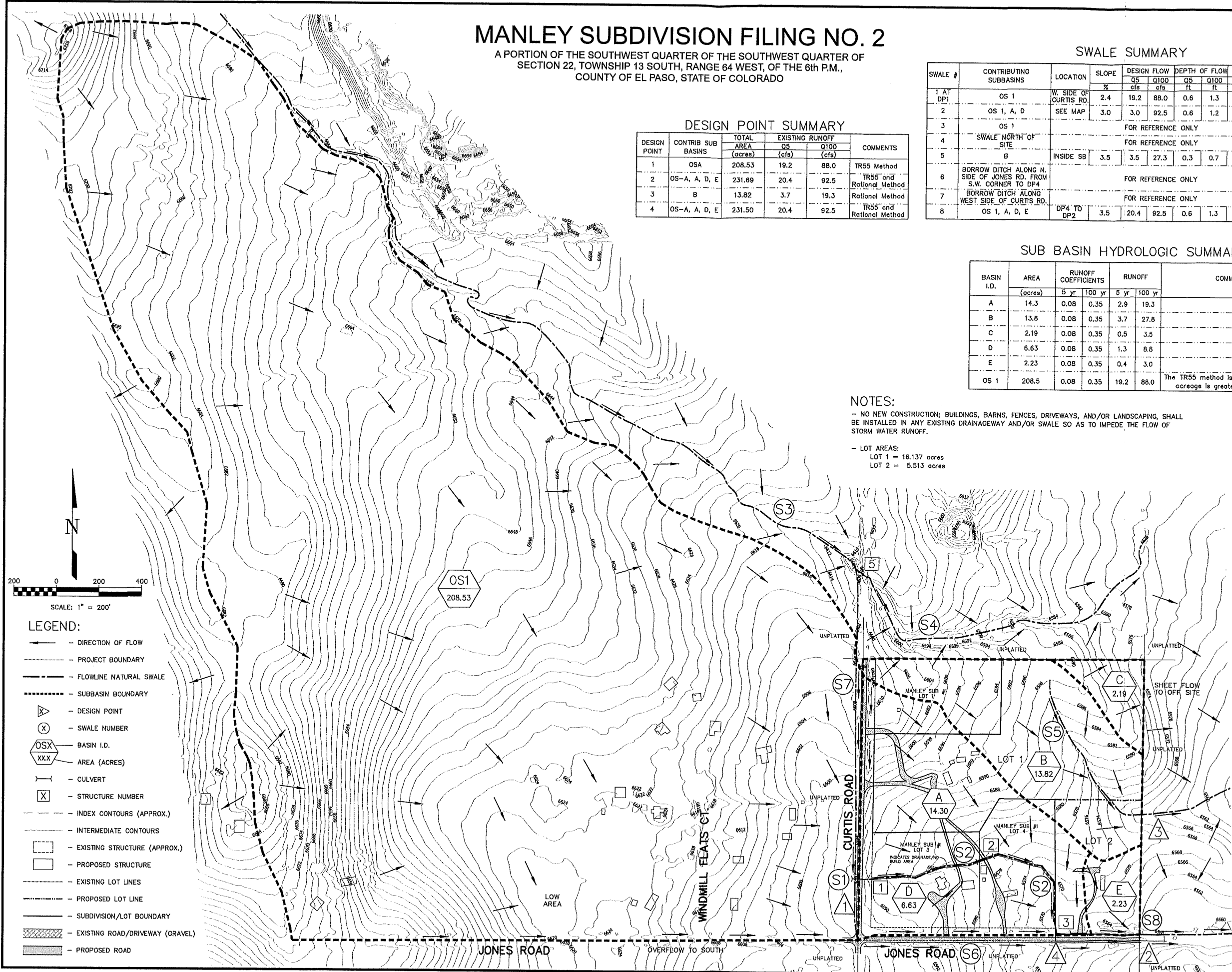
- NO NEW CONSTRUCTION; BUILDINGS, BARNs, FENCES, DRIVEWAYS, AND/OR LANDSCAPING, SHALL BE INSTALLED IN ANY EXISTING DRAINAGEWAY AND/OR SWALE SO AS TO IMPEDE THE FLOW OF STORM WATER RUNOFF.

- LOT AREAS:
LOT 1 = 16.137 acres
LOT 2 = 5.513 acres



LEGEND:

- DIRECTION OF FLOW
- - - - - PROJECT BOUNDARY
- - - - - FLOWLINE NATURAL SWALE
- - - - - SUBBASIN BOUNDARY
- △ DESIGN POINT
- ⊗ SWALE NUMBER
- OSX BASIN I.D.
- XXX AREA (ACRES)
- CULVERT
- X STRUCTURE NUMBER
- - - - - INDEX CONTOURS (APPROX.)
- - - - - INTERMEDIATE CONTOURS
- EXISTING STRUCTURE (APPROX.)
- PROPOSED STRUCTURE
- - - - - EXISTING LOT LINES
- - - - - PROPOSED LOT LINE
- - - - - SUBDIVISION/LOT BOUNDARY
- ▨ EXISTING ROAD/DRIVEWAY (GRAVEL)
- ▨ PROPOSED ROAD



According to Colorado law, legal action cannot be taken against any person for any defect in this survey until the first anniversary of the date of the survey. In no event, may any action be taken against any person for a defect in this survey more than ten years from the date of the certification shown hereon.

CALL BEFORE YOU DIG ...

811

DIAL 811

48 HOURS BEFORE YOU DIG, CALL 811 TO LOCATE UTILITIES FOR LOCATING AND MARKING GAS, ELECTRIC, WATER AND FIBER OPTIC.

No.	REVISIONS	By	Date
	Description		

H Scale: 1" = 200'

V Scale: N/A

Designed By: KCH

Drawn By: DAS

Checked By: KCH

DWG#: 02152022

Land Development Consultants, Inc.

PLANNING • SURVEYING

www.ldc-inc.com • TEL: (719) 528-6133 • FAX: (719) 528-6848

3808 MADEIRA ROAD • COLORADO SPRINGS, CO 80909

MANLEY SUBDIVISION FILING NO. 2

DRAINAGE PLAN OF EXISTING CONDITIONS

Project No.: 99158

Sheet: 1 of 1