J·R ENGINEERING

November 29, 2022

El Paso County
Engineering Division
2880 International Circle, Suite 110
Colorado Springs, Colorado 80910

Re: Lewis Palmer SD38 Trail System – PCD Filing No. PPR2240
Drainage Letter

This drainage letter will address the impact the Lewis Palmer SD38 Trail System project will have within the Dirty Woman Creek drainage basin. The Dirty Woman Creek and Crystal Creek Drainage Basin Planning Study was prepared in September 1993 by Kiowa Engineering Corporation. This letter will address the impacts within Basins CC153, CC157, DWC79, DWC117, LFDW105, LFDW107, LFDW109, and LFDW111 of the approved study. The purpose of this letter is to determine impacts to the drainage conditions within these basins due to the placement of a 4 foot wide asphalt milling trail.

General Location

The site is located in El Paso County, adjacent to Monument, and the Woodmoor Improvement Association. See Appendix A for the Vicinity Map. The proposed project is comprised of a 4 foot wide trail, with varying width dirt shoulders to blend into the existing grades, and is approximately 2.5 miles long within existing roadway right-of-way, easements, maintenance roads, and open space tracts. The trail will be installed along Woodmoor Drive, Willow Park Way, below Lake Woodmoor on maintenance access paths, Lake Woodmoor Drive, through open tracts owned by the Woodmoor Improvement Association, and along Deer Creek Drive; within School District, and Woodmoor Improvement Association property, or on properties where easements have been obtained. The total disturbed area associated with the project will be 1.34 acres. Only 1.7 miles of the trail will cause disturbance. The remaining 0.8 miles will be on existing sidewalks or gravel maintenance roads. See Appendix C for the Basin map from the Dirty Woman Creek and Crystal Creek Drainage Basin Planning Study.

Soil Conditions

Soil characteristics are comprised of various soils throughout the project limits of the trail. Soils are comprised of Pring coarse sandy loam (Group B)(31.9% of trail), Tomah-Crowfoot loamy sands (Group B)(29.7% of trail), Kettle gravelly loamy sand (Group B)(20.4% of trail), and Alamosa loam (Group D)(18.0% of trail). Group B soils exhibit a moderate infiltration rate when thoroughly wet and consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission. Group D soils exhibit a very slow infiltration rate when thoroughly wet and consist chiefly of clays that have a high shrink-swell potential, have a high water table, have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission. Refer to the soil survey mapping in Appendix B.

Drainage Design Criteria

Storm drainage analysis and design criteria for the project were taken from the "City of Colorado Springs/El Paso County Drainage Criteria Manual", Volumes 1 and 2 (EPCDCM), dated October 12, 1994, and Chapter 6 of the "Colorado Springs Drainage Criteria Manual (CCSDCM)", dated May 2014, as adopted by El Paso County.

Will any outlet protection be needed downstream of these culverts? Indicate max flow 18" culvert can convey. Show whether flow in ditches is above or below those flows.

Existing and Proposed Drainage Characteristics

The proposed trail will be constructed within existing righ open space tracts. The existing drainage patterns within these areas will be maintained once the trail is constructed. In areas where the trail will potentially impact a drainage path (i.e. roadside ditch), the project's contractor will install 18" culvert pipe (minimum) to allow for the continued flow of runoff. The trail will be constructed at grade, therefore, historic sheet flows will not be impeded by the placement of the trail material. As a result, drainage plans have not been developed, but information in the construction documents related to the installation of drainage culverts has been included.

According to CCSDCM, Table 6-10, the Curve Number for gravel streets is 85, and 82 for dirt. The Curve Numbers associated with the impacted basins is shown in Table 1 below. The table also shows the area of each basin, the disturbed area in each basin as a result of this project, and the overall basin disturbance as a percentage. As shown in the table, the trail disturbs between 0.02% and 0.65% of the overall basin areas.

Are roadside ditches adequate? Any erosion, overtopping, etc?

Table 1 – Basin Summary

Basin	Area (acres)**	Curve Number**	Trail Length (ft) in Basin	Area (acres) Disturbed	Basin Disturbance (%)
CC153	34.0	85	406	0.096	0.28
CC157	56.5	88	1,375	0.179	0.32
DWC79	78.1	84	1,625	0.227	0.29
DWC117	79.2	88	1,078	0.153	0.19
LFDW105	51.7	87	1,991	0.336	0.65
LFDW107	26.8	85	37	0.005	0.02
LFDW109	55.9	87	1,421	0.217	0.39
LFDW111	122.0	88	1,041	0.126	0.10

Include what flows are for these basins

** - Information taken from the Dirty Woman Creek and Crystal Creek DBPS. See Appendix C (Appendix Table 1 from the Study).

Table 2 – Revised Curve Numbers

	Existing		Proposed	
Basin	Disturbance Area (acres)	Curve Number*	Curve Number**	Revised Basin Curve Number***
CC153	0.096	85	83.17	84.995
CC157	0.179	88	84.12	87.988
DWC79	0.227	84	83.97	84.000
DWC117	0.153	88	83.94	87.992
LFDW105	0.336	87	83.63	86.978
LFDW107	0.005	85	83.98	85.000
LFDW109	0.217	87	83.81	86.988
LFDW111	0.126	88	84.27	87.996

* - Information taken from the Dirty Woman Creek and Crystal Creek DBPS. This number represents the entire basin, but is used for the disturbance area comparison. Some areas of disturbance area are dirt, gravel, or vegetated.

** - Composite Curve Number calculated based on a Curve Number of 85 for gravel streets (4' wide), and 82 for dirt (varying width to tie into existing grades alongside the trail).

*** - Revised Basin Curve Number is a composite number calculated from the overall basin Curve Number and the proposed Curve Number resulting from the trail installation.

Calculating a composite Curve Number for each of these basins as a result of adding a 4' trail, results in a reduction to all of the basin's Curve Numbers, as shown in the table above.

Drainage Fees

The site is located within the Dirty Woman Creek drainage basin. The drainage fee associated with the Dirty Woman Creek Drainage Basin is $21,134 per impervious acre, and the bridge fee is $1,156 per impervious acre. This project is not associated with any land development efforts, and therefore, no fee is required at this time.

Conclusion

The proposed changes resulting from the trail will have minimal to no effect on the overall runoff conditions within each of the basins identified in Table 2, therefore no additional drainage improvements are needed other than the localized improvements associated with roadside ditches.

Please provide a cover sheet and then this will be the second page of the memo.

Design Engineer's Statement:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

_____
Glenn Ellis, Colorado P.E. # 38861
For and On Behalf of JR Engineering, LLC

Owner/Developer's Statement:

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

_____ _____
Business Name Date
By: _____

Title: _____

Address: _____

_____

El Paso County:

Filed Code,
Drai amended.

_____
Dire

Cond
_____
_____
_____
_____
_____

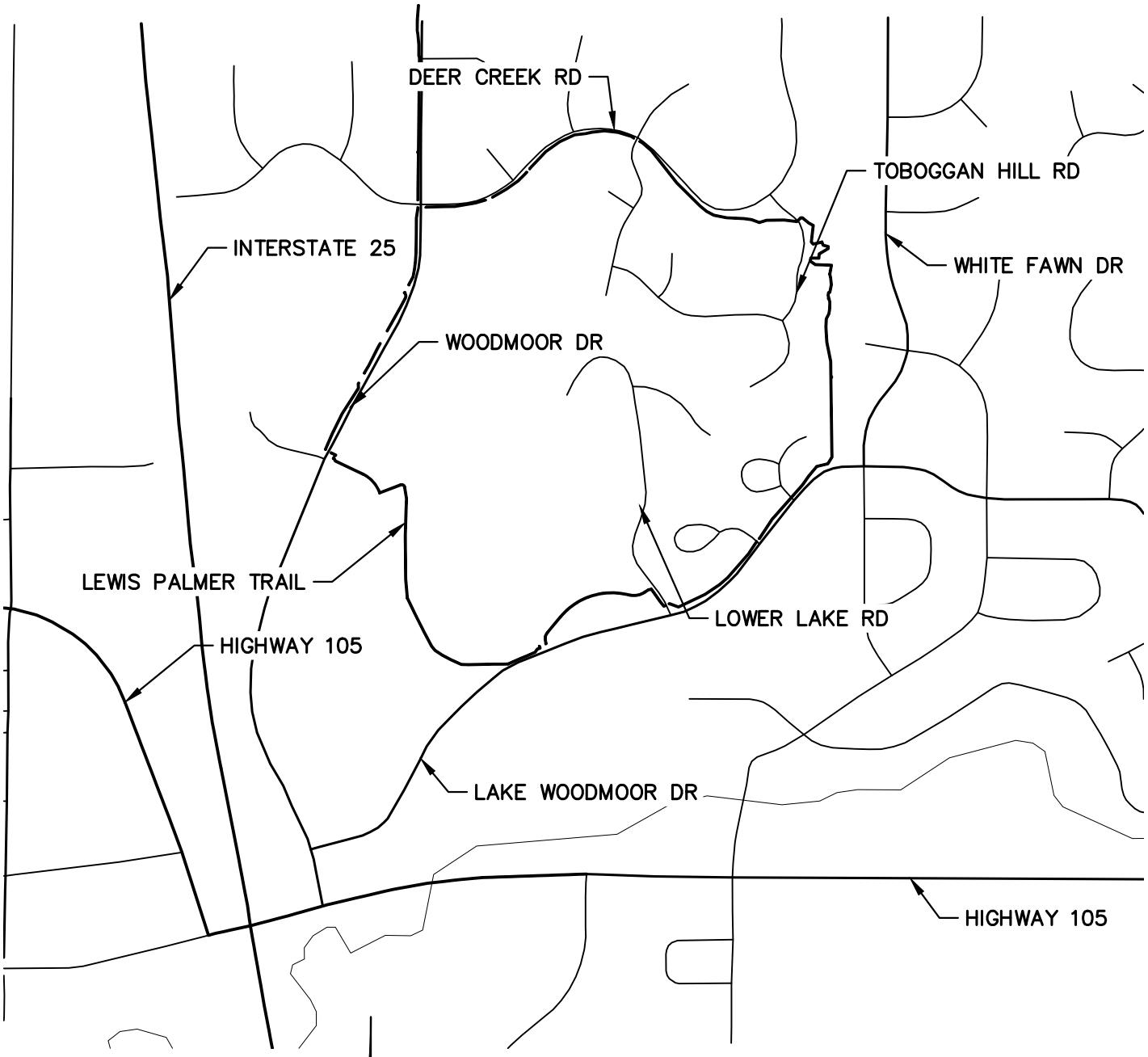
El Paso County:

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

_____ _____
Joshua Palmer, P.E. Date
County Engineer / ECM Administrator

Conditions:

Appendix A



1000 500 0 1000 2000

ORIGINAL SCALE: 1" = 1000'

VICINITY MAP
LEWIS PALMER TRAIL
JOB NO. 25203.00
11/23/22
SHEET 1 OF 1

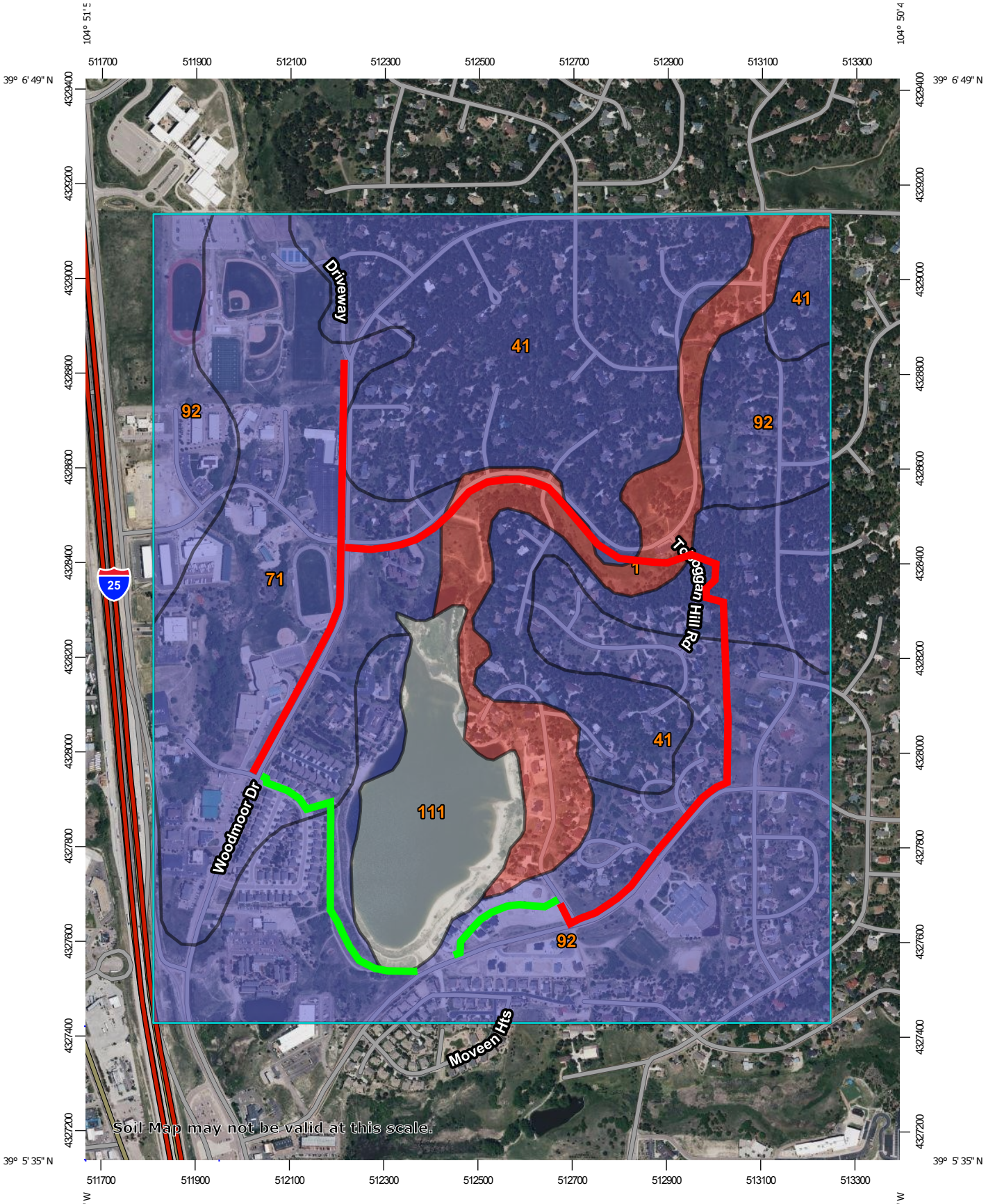
J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

Appendix B

TRAIL DISTURBANCE

TRAIL ON EXISTING CONCRETE OR MAINTENANCE ACCESS ROAD (NO DISTURBANCE)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 20, Sep 2, 2022

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Alamosa loam, 1 to 3 percent slopes	D	49.5	8.1%
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	B	172.3	28.3%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	130.6	21.5%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	B	216.4	35.5%
111	Water		40.0	6.6%
Totals for Area of Interest			**608.9**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

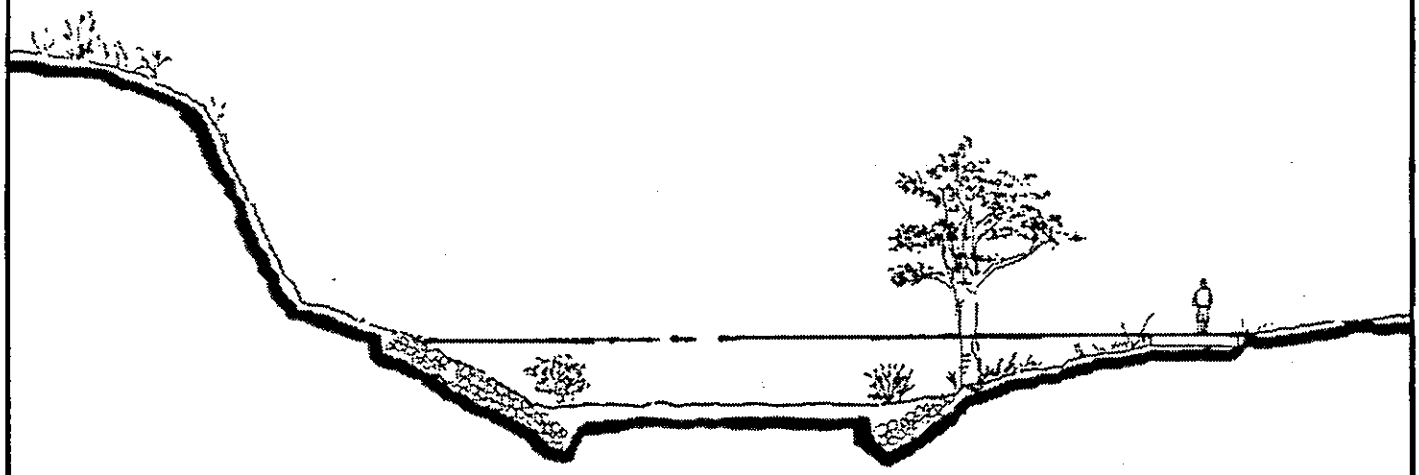
Tie-break Rule: Higher

Appendix C

Include excerpts from any other reports, which may show flows, roadside ditch sizing, etc

Drainage Basin Planning Study

Dirty Woman Creek and Crystal Creek
El Paso County, Colorado



Prepared for:

El Paso County Department of Public Works
3105 North Stone
Colorado Springs, Colorado 80907

Prepared by:

Kiowa Engineering Corporation
419 West Bijou
Colorado Springs, Colorado 80905

September, 1993

APPENDIX TABLE 1
Summary of Sub-basin Hydrologic Data

Basin Designation	Area (Acres)	Curve Number	Tc (min)	Basin Designation	Area (Acres)	Curve Number	Tc (min)	Basin Designation	Area (Acres)	Curve Number	Tc (min)
SDW01	119.6	82	39.2	DWC79	78.1	84	32.9	CC157	56.5	88	29.9
SDW03	60.0	83	28.6	LDW81	54.6	86	12.9	CC159	7.8	88	11.6
SDW05	69.7	82	17.5	LDW83	40.5	85	23.8	CC161	47.2	88	12.0
SDW07	37.7	88	18.3	LDW85	24.2	86	24.0	CC163	47.5	86	9.7
UDW09	61.2	82	19.3	LDW87	65.3	86	31.7	CC165	43.2	88	12.0
UDW11	27.2	83	12.6	LDW89	61.8	85	35.8	CC167	45.9	88	16.8
UDW13	18.6	84	23.4	LDW91	11.6	86	16.5	CC169	67.6	80	9.4
UDW15	62.0	82	39.7	LDW93	21.1	86	17.8	CC171	27.3	88	5.5
UDW17	19.6	82	33.3	LDW95	28.7	85	22.9	CC173	20.1	88	11.5
UDW19	23.0	83	32.7	LDW97	17.8	85	6.5	CC175	22.4	82	9.5
UDW21	21.1	83	9.3	LDW99	21.1	88	14.5	CC177	45.6	84	17.2
UDW23	11.9	83	13.8	LDW101	79.9	86	19.7	CC179	37.2	80	37.9
UDW25	33.6	83	39.6	LDW103	81.2	85	29.1	CC181	24.1	80	5.5
UDW27	42.4	84	19.5	LDW105	51.7	87	30.2	CC183	54.3	84	8.2
UDW29	51.1	83	26.8	LDW107	26.8	85	26.7	CC185	53.0	82	8.9
UDW31	30.5	88	14.6	LDW109	55.9	87	17.1	CC187	47.6	86	22.1
MDW33	90.8	84	35.5	LDW111	122.0	88	37.3	CC189	30.6	83	12.2
MDW35	18.1	83	18.6	DWC113	19.6	83	9.0				
MDW37	56.1	84	36.2	DWC115	27.7	88	7.7				
MDW39	58.6	87	26.8	DWC117	79.2	88	17.1				
NDW41	61.8	85	11.0	DWC119	28.2	88	16.6				
NDW43	37.1	85	30.7	DWC121	98.4	88	24.2				
NDW45	56.4	86	39.8	DWC123	21.5	88	3.8				
NDW47	31.2	85	20.4	DWC125	30.2	88	18.6				
NDW49	7.1	85	18.8	DWC127	57.6	81	13.8				
NDW51	23.8	84	40.5	DWC129	58.7	88	20.8				
NDW53	7.5	85	14.7	DWC131	33.7	80	11.8				
NDW55	6.4	85	6.1	DWC133	48.5	85	16.5				
NDW57	89.0	85	27.8	DWC135	54.5	82	26.3				
NDW59	69.2	86	26.9	DWC137	33.9	86	25.2				
DWC61	43.4	86	29.6	DWC139	50.6	87	17.4				
DWC63	81.7	86	36.4	DWC141	29.3	87	10.9				
DWC65	34.4	86	31.7	DWC143	40.2	85	9.7				
DWC67	26.2	85	33.3	CC145	54.8	85	32.0				
DWC69	13.1	87	7.2	CC147	68.8	83	28.8				
DWC71	31.9	87	19.3	CC149	52.1	81	29.1				
DWC73	48.5	85	29.7	CC151	87.6	82	35.0				
DWC75	60.5	86	10.8	CC153	34.0	85	14.2				
DWC77	30.1	85	29.7	CC155	15.5	88	11.3				

Impacted Basins

TRAIL DISTURBANCE

TRAIL ON EXISTING CONCRETE OR MAINTENANCE ACCESS ROAD (NO DISTURBANCE)

PROJECT AREA

LEGEND

- MAJOR BASIN BOUNDARY
- MAJOR TRIBUTARY BOUNDARY
- SUB-BASIN BOUNDARY
- DRAINAGEWAY
- CC 169 — BASIN DESIGNATION
- 55 — DESIGN POINT

N

0' 250' 500' 750' 1,000' 1,250' 1,500'
SCALE IN FEET

PROJECT No. 91.07.17

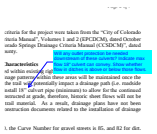
DIRTY WOMAN/CRYSTAL CREEK DRAINAGE BASIN PLANNING STUDY EL PASO COUNTY, COLORADO

HYDROLOGIC BASIN MAP

Kiowa Engineering Corporation

v2_Drainage Report - Final.pdf Markup Summary

Callout (1)



Subject: Callout
Page Label: 2
Author: CDurham
Date: 12/21/2022 7:39:47 AM
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Will any outlet protection be needed downstream of these culverts? Indicate max flow 18" culvert can convey. Show whether flow in ditches is above or below those flows.

Drainage Report - County (1)

Subject: Drainage Report - County
Page Label: 4
Author: CDurham
Date: 12/19/2022 10:43:42 AM
Status:
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El Paso County:

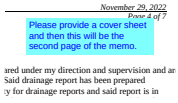
Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

_____

_ _____
Joshua Palmer, P.E.
Date
County Engineer / ECM Administrator

Conditions:

Text Box (4)



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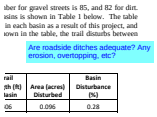
Please provide a cover sheet and then this will be the second page of the memo.



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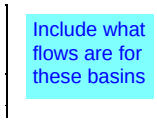
Are roadside ditches adequate? Any erosion, overtopping, etc?



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Include what flows are for these basins

Aspen

Include excerpts from any other reports, which may show flows, roadside ditch sizing, etc

Subject: Text Box
Page Label: 12
Author: CDurham
Date: 12/21/2022 7:41:21 AM
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Include excerpts from any other reports, which may show flows, roadside ditch sizing, etc