FINAL DRAINAGE REPORT FOR ZINDORF – MCDANIEL'S SUBDIVISION

PREPARED BY
Richard Gallegos, P.E.
RESPEC
121 S. Tejon St., Suite 1110
Colorado Springs, CO 80903

PREPARED FOR
Greg Zindorf
Z Investments LLC
PO Box 50005
Colorado Springs, CO

June 2022

ENGINEER'S STATEMENT

This report and plan for the drainage design of Zindorf - McDaniels Subdivision, was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the *El Paso County Drainage Criteria Manual* and is in conformity with the master plan of the drainage basin. I understand that El Paso County does not, and will not, assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

_____ _____

Richard Gallegos, P.E. Date

Registered Professional Engineer State of Colorado No. 36247

DEVELOPER'S STATEMENT

Greg Zindorf hereby certifies that the drainage facilities for the Zindorf – McDaniels Subdivision shall be constructed according to the design presented in this report. I understand that El Paso County does not, and will not, assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to El Paso County; and cannot, on behalf of the Zindorf – McDaniels Road guarantee that final drainage design review will absolve Greg Zindorf and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

_____ _____

Authorized Signature Date

Greg Zindorf

Printed Name

Owner Address: PO Box 50005

Title Colorado Springs, CO

EL PASO COUNTY STATEMENT

Filed in accordance with the *Drainage Criteria Manual of El Paso, Colorado,* 2018, as amended.

_____ _____

For the County Engineer Date

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1.0 PURPOSE

This drainage report is for the design of Zindorf – McDaniels Subdivision (McDaniels Tract). The site is located at 22755 McDaniels Road, Calhan CO in eastern El Paso County. See Vicinity Map in the Appendix below for reference. It is further described as the Northeast One-Quarter of the Northeast One-Quarter of Section 11, Township 14 South, Range 63 West of the 6th P.M.

This site is located in Haegler Ranch Drainage Basin. Work will include subdividing the 39.7-acre site into four residential lots. An existing home will remain, and the driveway will be reconstructed. On the other three lots, home pads and gravel driveways will be constructed.

2.0 SOIL CONDITIONS

According to the El Paso County Area Soil Survey, the soil on the site is classified as follows:

SOIL #	SOIL TYPE	HYDROLOGIC CLASSIFICATION
19	Columbine Gravelly Sandy Loam	A
28	Ellicot Loamy Coarse Sand	A
95	Truckton Loamy Sand	A

The Columbine soil can be described as having a very high permeability, very low surface runoff, and slight hazard of erosion. The Ellicot soil also can be described as very low surface runoff and slight erosion hazard. The Truckton soil includes a moderate hazard of erosion and low water surface runoff. The soil classification used for this study is 'A'. See Soils Map below in the Appendix for reference.

3.0 DRAINAGE CRITERIA

The methodology utilized for this report is in accordance with the *El Paso County Drainage Criteria Manual.* The Rational Method for computation of runoff was used.

$Q = cia$

Where

Q = maximum rate of runoff in cubic feet per second

c = runoff coefficient representing drainage area characteristics

i = average rainfall intensity, in inches per hour, for the duration required for the runoff to become established

a = drainage basin size in acres

4.0 EXISTING DRAINAGE CONDITIONS

The overall site consists of 39.7 acres, of this area only approximately 0.5 acres will be disturbed. An existing gravel driveway is located off of McDaniels Road within the site to service an existing home. The areas of the site not covered by gravel road or the residential home are covered with short grass pastures. These undeveloped areas include slopes that range from 0.5% to 2.4%. The overall existing site is approximately 2.1% impervious. See Existing Drainage Map in Appendix for reference.

Flows from Sub-basins EX1 through EX3 and OS1 through OS3 are tributary to the Haegler Ranch Drainage Basin.

Sub-basin OS1 contains 8.67 acres and drains southeast into Subbasin EX2. It produces flows of 1.1 cfs for the 5-year storm and 8.2 cfs for the 100-year storm. These flows will combine with flows from Sub-basin OS2 to produce total flows of 1.2 cfs for the 5-year storm and 8.9 cfs for the 100-year storm at Design Point 1. These flows continue towards the Haeglar Ranch floodway in the middle of the site.

Sub-basin OS2 contains 0.49 acres and drain southwest into the Haegler Ranch floodway that runs through the middle of the site. It produces flows of 0.1 cfs for the 5-year storm and 1.0 cfs for the 100-year storm. These flows sheetflow to the southwest and will combine with flows from Design Point 1, described above.

Sub-basin OS3 contains 1.02 acres and drains the east along McDaniels Road. It contains half of McDaniels Road that drains south into the ditch. It produces flows of 0.5 cfs for the 5-year storm and 1.5 cfs for the 100-year storm. All flows north of the site are diverted into a drainage ditch that flows into a culvert under McDaniels Road. These flows bypass the development occurring on the site in a ditch along North Log Road. Flows overtopping the intersection of McDaniels Road and North Log Road sheetflow to the east.

Sub-basin EX1 contains 1.06 acres and drains due southwest. It produces flows of 0.2 cubic feet per second (cfs) for the 5-year storm and 1.4 cfs for the 100-year storm. These flows are diverted to the southerly direction.

Sub-basin EX2 contains 14.59 acres and drains southeast into the Haeglar Ranch floodway in the middle of the site. It produces flows of 1.8 cfs for the 5-year storm and 14.0 cfs for the 100-year storm. These flows sheetflow to the southeast.

Sub-basin EX3 contains 22.89 acres and sheetflows to the southwest into the Haegler Ranch floodway in the middle of the site. It produces flows of 3.5 cfs for the 5-year storm and 22.8 cfs for the 100-year storm. These flows will combine with flows from Design Point 1, Sub-basin EX2, Sub-basin EX3, and Sub-basin OS3 to produce total flows of 7.1 cfs for the 5-year storm and 48.0 cfs for the 100-year storm at Design Point 2.

The estimated runoff amounts produced for the project under Existing Conditions are shown in Table 1 below.

TABLE 1 – EXISTING CONDITIONS		
Sub-basin	Q_5 (CFS)	Q_{100} (CFS)
EX1	0.2	1.4
EX2	1.8	14.0
EX3	3.5	22.8
OS1	1.1	8.2
OS2	0.1	1.0
OS3	0.5	1.5
DP1 (OS1 + OS2)	1.2	8.9
DP2 (DP1 + EX2 + EX3 + OS3)	7.1	48.0

5.0 DEVELOPED DRAINAGE CONDITIONS

Although the overall site consists of 39.7 acre only approximately 0.5 acres will be disturbed. The site will be subdivided into four separate lots with three house and gravel driveway being constructed on the four lots. The existing house will remain and the gravel driveway will be reconstructed. See Proposed Conditions Map below in Appendix for reference.

The overall drainage pattern will remain the same as existing conditions with developed flows directed to the same locations as described in the Existing Conditions Section. Proposed site imperviousness is 2.8%, versus 2.1% in the existing conditions.

Sub-basin OS1 contains 8.67 acres and drains southeast into Subbasin PP2. It produces flows of 1.1 cfs for the 5-year storm and 8.2 cfs for the 100-year storm. These flows will combine with flows from Sub-basin OS2 to produce total flows of 1.2 cfs for the 5-year storm and 8.9 cfs for the 100-year storm at Design Point 1. These flows continue towards the Haeglar Ranch floodway in the middle of the site.

Sub-basin OS2 contains 0.49 acres and drain southwest into the Haegler Ranch floodway that runs through the middle of the site. It produces flows of 0.1 cfs for the 5-year storm and 1.0 cfs for the 100-year storm. These flows sheetflow to the southwest and will combine with flows from Design Point 1, described above.

Sub-basin OS3 contains 1.02 acres and drains the east along McDaniels Road. It contains half of McDaniels Road that drains south into the ditch. It produces flows of 0.5 cfs for the 5-year storm and 1.5 cfs for the 100-year storm. At each driveway location, a Public 18" RCP will be installed. Each cross culvert has the capacity to accommodate the full 100-year flow, as shown below in the Calculation section of the Appendix. Additionally, a 2' V-bottomed ditch will be constructed along McDaniels Road to accommodate the full 100-year flow. All flows north of the site are diverted into a drainage ditch that flows into a culvert under McDaniels Road. These flows bypass the development occurring on the site in a ditch along North Log Road. Flows overtopping the intersection of McDaniels Road and North Log Road sheetflow to the east.

Sub-basin PP1 contains 1.06 acres and drains due southwest. It produces flows of 0.2 cfs for the 5-year storm and 1.4 cfs for the 100-year storm. These flows are diverted to the southerly direction.

Sub-basin PP2 contains 14.59 acres and drains southeast into the Haeglar Ranch floodway in the middle of the site. It produces flows of 1.8 cfs for the 5-year storm and 14.0 cfs for the 100-year storm. These flows sheetflow to the southeast.

Sub-basin PP3 contains 22.89 acres and sheetflows to the southwest into the Haegler Ranch floodway in the middle of the site. It produces flows of 3.9 cfs for the 5-year storm and 22.9 cfs for the 100-year storm. These flows will combine with flows from Design Point 1, Sub-basin PP2, Sub-basin PP3, and Sub-basin OS3 to produce total flows of 7.5 cfs for the 5-year storm and 48.0 cfs for the 100-year storm at Design Point 2.

All flows north of the site are diverted into a drainage ditch that flows into a culvert under McDaniels Road. These flows bypass the development occurring on the site in a ditch along North Log Road. Flows overtopping the intersection of McDaniels Road and North Log Road sheetflow to the east.

The estimated runoff amounts produced for the project for Developed Conditions are shown in Table 2 below.

TABLE 2 – DEVELOPED CONDITIONS		
Sub-basin	Q_5 (CFS)	Q_{100} (CFS)
PP1	0.2	1.4
PP2	1.8	14.0
PP3	3.9	22.9
OS1	1.1	8.2
OS2	0.1	1.0
OS3	0.5	1.5
DP1 (OS1 + OS2)	1.2	8.9
DP2 (DP1 + EX2 + EX3 + OS3)	7.5	48.0

6.0 WATER QUALITY

The total disturbance for this development will be 0.50 acres. Since the overall disturbance will be less than one acre and since it is not part of a larger common plan of development, an Erosion and Stormwater Quality Control Permit is not required.

7.0 EROSION CONTROL PLAN

The site construction consists of constructing a new building and associated parking. The disturbance is under one acre, and therefore, does not require an Erosion and Stormwater Quality Control Permit. The Grading and Erosion Control Plan will be submitted in separate Construction Plans.

8.0 FLOODPLAIN STATEMENT

Portions of the site are within the designated FEMA 100-year floodplain and designated FEMA 100-year floodway as designated on Map No. 08041C0810G and Map No. 08041C0807G, both dated December 7th, 2018. No development will incur within the FEMA 100-year floodplain and the FEMA 100-year floodway.

9.0 DRAINAGE BASIN FEES

The proposed development is located within the Haegler Ranch Drainage Basin.

2022 Haegler Ranch Drainage Fees
Impervious Coverage = 2.83%
Area Subject to Fees = 0.0283 x 39.67 = 1.12 Acres
Haegler Ranch Fee = $11,891/Acre
Drainage Basin Fee = $11,891x 1.12 = $13,318

2022 Haegler Ranch Bridge Fees
Impervious Coverage = 2.83%
Area Subject to Fees = 0.0283 x 39.67 = 1.12 Acres
Haegler Ranch Fee = $1,755/Acre
Drainage Basin Fee = $1,755 x 1.12 = $1,966

10.0 CONSTRUCTION COST OPINION

The public drainage facility costs are as follows:

Description	Quantity	Unit Cost	Amount
18" RCP	100 LF	$90.00	$ 9,000
		Sub-Total	$ 9,000
		Engineering & Contingencies 10%	$ 900
		TOTAL	**$ 9,900**

11.0 CONCLUSIONS

For this 39.7-acre site, the site will be divided into four separate lots. The existing gravel driveway will be removed and reconstructed the 1850 sf house will remain. Three additional home pads and gravel driveway will be constructed on the other lots. The total anticipated disturbance of the site will be 0.5 acres. Construction will occur with drainage sub-basin PP3. The development increases flows from 3.5cfs to 3.9cfs for the 5-year storm and 22.8cfs to 22.9cfs for the 100-year storm. This is a 11.4% increase in flow for the 5-year storm and a 0.4% increase for the 100-year storm. Total routed flows at

Design Point 2 (DP2) are 7.1 cfs for the 5-year storm and 48.0 cfs for the 100-year storm compared to the 7.5 cfs for the 5-year storm and 48.0 cfs for the 100-year storm under developed conditions. There is 0.4 cfs increase for the 5-year storm and no change in the 100-year storm discharge rate. These increases do not warrant the need for detention. All developed flows will continue to flow along existing drainage patterns. All areas disturbed by construction will be repaired, and erosion control measures will be installed during construction of the proposed site.

12.0 REFERENCES

Municipal Code Corporation (2018). *Drainage Criteria Manual of El Paso County, Colorado (DPM)*

USDA, NRCS. Soil Survey of El Paso County Area, Colorado.

Haegler Ranch Drainage Basin Planning Study, URS Corporation, Dated May 2009.

APPENDIX A

MAPS

Prepared by:

RESPEC

121 S. TEJON ST., SUITE 1110
COLORADO SPRINGS, CO 80903
WWW.RESPEC.COM (719) 266-5212

22755 McDaniels Road

VICINITY MAP

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Path: N:\Projects\W0008 - Gunnan & Associates\#### 22755 McDaniels Road\8. GIS\McDaniels\McDaniels.aprx

N

0 100 200 Feet

Map Unit Symbol	Map Unit Name	Rating
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A
28	Ellicot loamy coarse sand, 0 to 5 percent slopes	A
95	Truckton loamy sand, 1 to 9 percent slopes	A

Prepared by:

RESPEC

121 S. TEJON ST., SUITE 1110
COLORADO SPRINGS, CO 80903
WWW.RESPEC.COM (719) 266-5212

22755 McDaniels Road

SOILS MAP

Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Maxar

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PANEL 0810G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 810 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0810	G

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

MAP NUMBER
08041C0810G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

11

Prepared by:

RESPEC

121 S. TEJON ST., SUITE 1110
COLORADO SPRINGS, CO 80903
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22755 McDaniels Road

FIRM MAP

Path: N:\Projects\W0008 - Gurman & Associates\#### 22755 McDaniels Road\8. GIS\McDaniels\McDaniels.aprx

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 807 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0807	G

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

MAP NUMBER
08041C0807G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

Prepared by:

RESPEC

121 S. TEJON ST., SUITE 1110
COLORADO SPRINGS, CO 80903
WWW.RESPEC.COM (719) 266-5212

22755 McDaniels Road

FIRM MAP

Path: N:\Projects\W0008 - Guman & Associates\#### 22755 McDaniels Road\8. GIS\McDaniels\McDaniels.aprx

ALL ELEVATIONS IN NAVD88

EXISTING CONDITIONS			
AREA DESIGNATION	ACRES	Q5 (CFS)	Q100 (CFS)
EX1	1.06	0.2	1.4
EX2	14.59	1.8	14.0
EX3	22.86	3.5	22.8
OS1	8.67	1.1	8.2
OS2	0.49	0.1	1.0
OS3	1.02	0.5	1.5
DP1 (OS1 + OS2)	9.16	1.2	8.9
DP2 (DP1 + EX2 + EX3 + OS3)	47.63	7.1	48.0

SYMBOL LEGEND

- A1A / XX — BASIN DESIGNATION / BASIN AREA (ACRE) — BASIN CALLOUT
- XX / XX — 5 YEAR STORM, CFS / 100 YEAR STORM, CFS — BASIN INFORMATION
- DESIGN POINT: XX / XX.X / XX.X — 5 YEAR ACCUMULATED FLOW, CFS / 100 YEAR ACCUMULATED FLOW, CFS
- FEMA 100-YEAR FLOODPLAIN
- FEMA 100-YEAR FLOODWAY
- EXISTING SUB-BASIN BOUNDARY
- 7290 — EXISTING MAJOR CONTOUR
- 7291 — EXISTING MINOR CONTOUR

DESIGNED Coleton Deitz
DRAWN Coleton Deitz
CHECKED Richard Gallegos
DATE 6.15.2022

REVISION

RESPEC
COMMUNITY DESIGN SOLUTIONS
121 SOUTH TEJON STREET SUITE 1110
COLORADO SPRINGS, CO 80903
WWW.RESPEC.COM PHONE: (719)266-5212

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NOT FOR CONSTRUCTION
6/2022

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811 Know what's below. Call before you dig.

PROJECT NAME: Zindorf - McDaniels Subdivision

SHEET TITLE: EXISTING CONDITIONS

SUBMITTED FOR: Greg Zindorf

SHEET NUMBER: 1 OF 2

NAME: N:\Projects\W0008 - Gurman & Associates\##### 22755 McDaniels Road\4. DWG\5. Sheets\Sheet Set\1 Existing Conditions.dwg PLOT DATE: Jun 15, 2022 12:05pm

PROPOSED CONDITIONS			
AREA DESIGNATION	ACRES	Q5 (CFS)	Q100 (CFS)
PP1	1.06	0.2	1.4
PP2	14.59	1.8	14.0
PP3	22.86	3.9	22.9
OS1	8.67	1.1	8.2
OS2	0.49	0.1	1.0
OS3	1.02	0.5	1.5
DP1 (OS1 + OS2)	9.16	1.2	8.9
DP2 (DP1 + EX2 + EX3 + OS3)	47.63	7.5	48.0

ALL ELEVATIONS IN NAVD88

22550 McDaniels Road
Calhan CO, 80808
REC. No. 3400000280

1550 North Log Road
Calhan CO, 80808
REC. No. 3400000237

22545 McDaniels Road
Calhan CO, 80808
REC. No. 3400000328

22755 McDaniels Road
Calhan CO, 80808
REC. No. 3400000295

23155 McDaniels Road
Calhan CO, 80808
REC. No. 3412000022

1210 Log Road
Calhan CO, 80808
REC. No. 3400000329

1215 Log Road
Calhan CO, 80808
REC. No. 3412000023

McDaniels Road

North Log Road

FEMA Flood Zone 'A'
100-Year Floodplain

Existing
Public 48" CMP

1' Tall Berm

Proposed Public 18" RCP

Existing Public 24" CMP

2' Deep Proposed
Ditch With 3:1
Side Slopes

Proposed Gravel
Driveway

Proposed House

Remove Existing
Gravel Driveway

Existing House

FEMA Flood Zone 'AE'
100-Year Floodway

FEMA Flood Zone 'AE'
100-Year Floodplain

Property Line

Proposed Lot Line

OS1
8.67
1.1
8.2

OS2
0.49
0.1
1.0

OS3
1.02
0.5
1.5

PP1
1.06
0.2
1.4

PP2
14.59
1.8
14.0

PP3
22.86
3.9
22.9

DP1
9.16
1.2
8.9

DP2
47.63
7.5
48.0

SYMBOL LEGEND

A1A — BASIN DESIGNATION
XX — BASIN AREA (ACRE)
BASIN CALLOUT

XX — 5 YEAR STORM, CFS
XX — 100 YEAR STORM, CFS
BASIN INFORMATION

DESIGN POINT
XX — XX.X 5 YEAR ACCUMULATED FLOW, CFS
XX.X 100 YEAR ACCUMULATED FLOW, CFS

FEMA 100-YEAR FLOODPLAIN
FEMA 100-YEAR FLOODWAY
PROPOSED SUB-BASIN BOUNDARY
7290 — PROPOSED MAJOR CONTOUR
7291 — PROPOSED MINOR CONTOUR

0 100 200
SCALE: 1" = 100'

DESIGNED Coleton Deitz
DRAWN Coleton Deitz
CHECKED Richard Gallegos
DATE 6.15.2022

REVISION

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811 Know what's below. Call before you dig.

PROJECT NAME: Zindorf - McDaniels Subdivision

SHEET TITLE: Proposed Conditions

SUBMITTED FOR: Greg Zindorf

SHEET NUMBER: 2 OF 2

NAME: N:\Projects\W0008 - Guman & Associates\##### 22755 McDaniels Road\4. DWG\5. Sheets\Sheet Set\2 Proposed Conditions.dwg PLOT DATE: Jun 15, 2022 12:06pm

APPENDIX B

CALCULATIONS

McDaniels Subdivision

C FACTOR CALCULATION SHEET

EXISTING CONDITIONS

RUNOFF COEFICIENT

TYPE A/B SOILS

LAND USE		**Imperv %**	**5 YR**	**100 YR**
UNDEV		0	0.08	0.35
GRAVEL ROAD		80	0.59	0.7
ASPHALT ROAD		100	0.9	0.96
ROOFS		90	0.73	0.81

EXISTING CONDITIONS

	TOTAL	SURFACE CONDITION AREAS				CALCULATED C			
AREA	AREA	UNDEV	GRAVEL	ASPHALT	ROOFS	5	100	% IMPERVIOUS	
DESIG.	(acre)		ROAD	ROAD		YR	YR		
EX1	1.06	1.06	0.00	0.00	0.00	**0.08**	**0.35**		**0.00**
EX2	14.59	14.59	0.00	0.00	0.00	**0.08**	**0.35**		**0.00**
EX3	22.86	21.83	0.98	0.00	0.05	**0.10**	**0.37**		**3.63**
OS1	8.67	8.67	0.00	0.00	0.00	**0.08**	**0.35**		**0.00**
OS2	0.49	0.49	0.00	0.00	0.00	**0.08**	**0.35**		**0.00**
OS3	1.02	0.60	0.42	0.00	0.00	**0.29**	**0.49**		**32.94**
Site Percent Impervious		2.11							

DEVELOPED CONDITIONS									
RUNOFF COEFICIENT									
TYPE A/B SOILS									
LAND USE		**Imperv %**	**5 YR**	**100 YR**					
UNDEV		0	0.08	0.35					
GRAVEL ROAD		80	0.59	0.7					
ASPHALT ROAD		100	0.9	0.96					
ROOFS		90	0.73	0.81					
Developed Conditions									
	TOTAL	SURFACE CONDITION AREAS				CALCULATED C			
AREA	AREA	UNDEV	GRAVEL	ASPHALT	ROOFS	5	100	% IMPERVIOUS	
DESIG.	(acre)		ROAD	ROAD		YR	YR		
EX1	1.06	1.06	0.00	0.00	0.00	**0.08**	**0.35**		**0.00**
EX2	14.59	14.59	0.00	0.00	0.00	**0.08**	**0.35**		**0.00**
EX3	22.86	21.49	1.16	0.00	0.21	**0.11**	**0.37**		**4.89**
Total	38.51	37.14	1.16	0.00	0.21	**TOTAL SITE IMPERVIOUSNESS**			**2.90**
OS1	8.67	8.67	0.00	0.00	0.00	**0.08**	**0.35**		**0.00**
OS2	0.49	0.49	0.00	0.00	0.00	**0.08**	**0.35**		**0.00**
OS3	1.02	0.60	0.42	0.00	0.00	**0.29**	**0.49**		**32.94**
Site Percent Impervious		2.83							

McDaniels Subdivision
PROJ.W008
DRAINAGE CALCULATION SHEET
file:McDaniels Rd.xlsx
06/14/22

							Initial Tci			Travel Time								
AREA DESIG.	AREA (acre)	C5 (5 yr)	C100 (100 yr)	C5 X A	C100 X A	L (ft)	Slope (%)	ti (min)	L (ft)	Slope (%)	V (fps)	Tt (min)	TC (min)	I5 (in/hr)	I100 (in/hr)	Q5 (cfs)	Q100 (cfs)	AREA DESIG.
EXISTING CONDITIONS																		
EX1	1.06	0.08	0.35	0.08	0.37	300	1.70	27.73	350	1.70	0.90	6.48	34.21	2.14	3.74	0.2	1.4	EX1
EX2	14.59	0.08	0.35	1.17	5.11	300	2.00	26.28	1400	1.40	0.80	29.17	55.45	1.57	2.75	1.8	14.0	EX2
EX3	22.86	0.10	0.37	2.29	8.46	300	2.00	25.77	1500	1.40	0.80	31.25	57.02	1.54	2.69	3.5	22.8	EX3
OS1	8.67	0.08	0.35	0.69	3.03	300	1.00	33.04	1000	1.10	0.70	23.81	56.85	1.55	2.70	1.1	8.2	OS1
OS2	0.49	0.08	0.35	0.04	0.17	115	2.40	15.32	115	2.40	1.20	1.60	16.92	3.18	5.55	0.1	1.0	OS2
OS3	1.02	0.29	0.49	0.30	0.50	300	0.50	32.98	1150	0.50	1.10	17.42	50.40	1.67	2.93	0.5	1.5	OS3
DP1 (OS1 + OS2)	9.16	0.08	0.35	0.73	3.21	300	1.00	33.04	900	1.10	0.70	21.43	54.47	1.59	2.78	1.2	8.9	DP1 (OS1 + OS2)
DP2 (DP1 + EX2 + EX3 + OS3)	47.63	0.09	0.36	4.48	17.27	300	1.00	33.04	2600	1.10	5.00	8.67	54.47	1.59	2.78	7.1	48.0	DP2 (DP1 + EX2 + EX3 + OS3)
DEVELOPED CONDITIONS																		
PP1	1.06	0.08	0.35	0.08	0.37	300	1.70	27.73	350	1.70	0.90	6.48	34.21	2.14	3.74	0.2	1.4	PP1
PP2	14.59	0.08	0.35	1.17	5.11	300	2.00	26.28	1400	1.40	0.80	29.17	55.45	1.57	2.75	1.8	14.0	PP2
PP3	22.86	0.11	0.37	2.51	8.46	300	2.00	25.51	1500	1.40	0.80	31.25	56.76	1.55	2.70	3.9	22.9	PP3
OS1	8.67	0.08	0.35	0.69	3.03	300	1.00	33.04	1000	1.10	0.70	23.81	56.85	1.55	2.70	1.1	8.2	OS1
OS2	0.49	0.08	0.35	0.04	0.17	115	2.40	15.32	115	2.40	1.20	1.60	16.92	3.18	5.55	0.1	1.0	OS2
OS3	1.02	0.29	0.49	0.30	0.50	300	0.50	32.98	1150	0.50	1.10	17.42	50.40	1.67	2.93	0.5	1.5	OS3
DP1 (OS1 + OS2)	9.16	0.08	0.35	0.73	3.21	300	1.00	33.04	900	1.10	0.70	21.43	54.47	1.59	2.78	1.2	8.9	DP1 (OS1 + OS2)
DP2 (DP1 + PP2 + PP3 + OS3)	47.63	0.10	0.36	4.71	17.27	300	1.00	33.04	2600	1.10	5.00	8.67	54.47	1.59	2.78	7.5	48.0	DP2 (DP1 + PP2 + PP3 + OS3)

Manning Formula:

Circular Channel

Input

Flow	1.5 cfs
Slope	0.013 ft/ft
Manning's n	0.01
Diameter	18 in

Output

Depth	0.315 ft
Flow Area	0.269 sf
Velocity	5.57 fps
Velocity Head	0.483 ft
Top Width	1.22 ft
Froude Number	2.09
Critical Depth	0.460 ft
Critical Slope	0.00290 ft/ft

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Manning Formula:

Irregular Section

Input

Flow	1.5 cfs
Slope	0.01 ft/ft

Sta	Elev	n	Sta	Elev	n	Sta	Elev	n	Sta	Elev	n
0	2	0.03	6	0	0.03	12	2	0.03			

Output

WSElev	0.510 ft
Flow Area	0.780 sf
Velocity	1.92 fps
Velocity Head	0.0575 ft
Top Width	3.06 ft
Froude Number	0.671
Critical WSElev	0.435 ft
Critical Slope	ft/ft

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APPENDIX C

DESIGN CHARTS

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

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

Figure 6-25. Estimate of Average Concentrated Shallow Flow

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency

IDF Equations

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

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

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

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

$I_5 = -1.50 \ln(D) + 7.583$

$I_2 = -1.19 \ln(D) + 6.035$

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