FINAL DRAINAGE REPORT

For

TRAILS AT ASPEN RIDGE
FILING NO. 5

Prepared for:
EL PASO COUNTY
Engineering Development Review Team
2880 International Circle
Colorado Springs, CO 80910

On Behalf of:
COLA, LLC.
555 Middle Creek Parkway, Suite 380
Colorado Springs, CO 80921

Prepared by:

Matrix Design Group
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
(719) 575-0100
fax (719) 572-0208

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Project No. 21.886.048

PCD File No. SF-21-038

Engineer's Statement:
This report and plan for the drainage design of Trails at Aspen Ridge Filing No. 5 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 accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

_____ SEAL

Jesse Sullivan Date
Registered Professional Engineer
State of Colorado
No. 55600

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

COLA, LLC
Business Name

Per Plat, Owner has been changed to Viva Land Ventures LP. Revise documents to have consistent ownership

By: _____ _____
Tim Buschar Date

Title: Director of Land Acquisition and Development

Address: 555 Middle Creek Parkway, Suite 380
Colorado Springs, CO 80921

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

Change to Josh Palmer

_____ _____
Jennifer Irvine, P.E. Date
County Engineer / ECM Administrator

Conditions:

TABLE OF CONTENTS

I. INTRODUCTION

The Trails at Aspen Ridge Filing No. 5 development is within the Waterview East (Waterview II) Subdivision, which is within El Paso County jurisdiction and is comprised of a total of 22.351 acres of single-family residential, open space, and public right-of-way. The site is located within the 721.8-acre Waterview Development in the 419.8-acre portion of the development east of Powers. The Trails at Aspen Ridge development was referred to as Waterview East or Waterview II in the original Waterview Master Development Drainage Study (MDDP).

Figure 1 - Project Location

II. PURPOSE AND SCOPE OF STUDY

The purpose of this Final Drainage Report (FDR) is to identify and evaluate the offsite and onsite drainage patterns associated with Filing No. 5 of the Trails at Aspen Ridge development (22.351 acres, four tracts (Tract C & D are future developments) , 58 Lots) and to provide hydrologic and hydraulic analyses of this area to ensure compliance with the El Paso County Drainage Criteria Manual (DCM) and the most recent MDDP and PDR Amendments, as well as provide effective, safe routing to downstream outfalls.

III. GENERAL LOCATION AND DESCRIPTION

Trails at Aspen Ridge Filing No. 5 is within the Waterview subdivision, which extends from Grinnell Road on the west to approximately one-half mile east of the north-south portion of Powers Boulevard. The west portion of the subdivision (Waterview I) is bounded on the north by an east-west portion of Powers Boulevard and on the south by Bradley Road. The east portion of the subdivision (Waterview East/Waterview II) is bounded on the north by the Colorado Springs Airport and on the south, approximately 3,260 feet south of the Bradley and Powers intersection by property owned by the State of Colorado. The subject of this report, Trails at Aspen Ridge Filing No. 5, is in the Waterview East portion of the overall Waterview Subdivision and located southeast of the intersection of Powers Boulevard and Bradley Road. More specifically, the study area is located as follows:

A. General Location: The southwest ¼ and the northwest ¼ of Section 9, Township 15 South, Range 65 West of the 6th P.M. in the County of El Paso, State of Colorado.

B. Surrounding Streets and Developments:

a. North: Trails at Aspen Ridge PUDSP and Bradley Road.

b. East: Trails at Aspen Ridge Filing No. 1, 2, & 4.

c. South: Trails at Aspen Ridge Filing Nos. 1 & 3; Undeveloped property owned by the State of Colorado

d. West: Trails at Aspen Ridge Filing No. 3 & PUDSP, Undeveloped land; Powers Boulevard, Big Johnson Reservoir, and the Waterview I Subdivision (Filings 1 through 7).

C. Drainageway: This site is within the West Fork Jimmy Camp Creek Drainage Basin.

a. West Fork Jimmy Camp Creek: There appears to be a broad swale running through the middle of this portion of the project area. Flows are conveyed in a southeasterly direction. Total area of basin considered in this report is approximately 165.2 acres. This includes approximately 52.5 acres in Trails at Aspen Ridge Filing No. 1, 16.852 acres in Trails at Aspen Ridge Filing No. 2, 18.33 acres in Trails at Aspen Ridge Filing No. 3, 17.9 acres in Trails at Aspen Ridge Filing No. 4, **8.74** acres in Trails at Aspen Ridge Filing No. 5, 17.9 acres of the Trails at Aspen Ridge PUDSP, and 35.1 acres of offsite

b. Big Johnson Reservoir/Crews Gulch: The final major drainage basin in the studied area is on the west side and is within the Big Johnson Reservoir/Crews Gulch Drainage Basin. Total basin areas considered in this report includes 2.72 acres in Trails at Aspen Ridge Filing No. 1, 19.62 acres in Trails at Aspen Ridge Filing No. 3, **0.62** acres in Trails at Aspen Ridge Filing No. 5, and 12.5 acres of future Trails at Aspen Ridge Filings.

D. Irrigation Facilities

No known functioning irrigation facilities are within the project area.

E. Utilities and Encumbrances

a) Storm Sewer: At Design Points 1-C and 2-C at the south end of Drinking Horse Court just south of this filing are two existing at-grade inlets which will capture flows from this filing. See the FDR for Trails at Aspen Ridge Filing No. 3 for further analysis of capacities. This filing does not change capacities or analysis of the existing storm sewer which was completed in that report.

b) Sanitary Sewer: Sanitary sewer associated with Trails at Aspen Ridge Filing No. 1 has been stubbed out from Moose Meadow Street at the south boundary of this filing.

c) Gas: There is an existing petroleum line running just inside the Powers Boulevard easement west of the overall Trails at Aspen Ridge development. No known gas encumbrances on the project site.

d) Water: A water main associated with Trails at Aspen Ridge Filing No. 3 has been stubbed out from Moose Meadow Street at the south boundary of this filing.

e) Electric: There is an existing overhead electric easement parallel to the east side of the overall development with two sets of overhead lines. No electric encumbrances to this filing.

IV. Referenced Drainage Reports

This site is within the Waterview II or Waterview East portion of the Waterview Subdivision. This study looks at Trails at Aspen Ridge Filing No. 5, which takes up 22.351 acres of the Waterview East Subdivision. The reports below were used as references for this report.

"Amendment to Waterview Master Drainage Development Plan", completed by Springs Engineering, dated July 2014 *(MDDP-2014)*

"MDDP for Waterview East and PDR for Trails at Aspen Ridge", completed by Matrix Design Group, Dated September 2019. (MDDPA-Matrix)
Note: This report supersedes a previously approved PDR "Springs East at Waterview" by Stantec (SP-17-010).

"Final Drainage Report for Trails at Aspen Ridge Filing No. 1", completed by Matrix Design Group, Dated January 2020. (FDR-F1)

"Final Drainage Report for Trails at Aspen Ridge Filing No. 2", completed by Matrix Design Group, Dated February 2021. (FDR-F2)

"Final Drainage Report for Trails at Aspen Ridge Filing No. 3", completed by Matrix Design Group, Dated August 2021. (FDR-F3) (in review)

"PDR Amendment for Trails at Aspen Ridge", completed by Matrix Design Group, Dated April 2021. (PDRA-Matrix)

V. Land Uses

Land uses for the proposed development will be single family residential, public roads, and open space.

VI. SOIL CONDITIONS

Soils can be classified in four different hydrologic groups, A, B, C, or D to help predict stormwater runoff rates. Hydrologic group "A" is characterized by deep, well-drained coarse-grained soils with a rapid infiltration rate when thoroughly wet and having a low runoff potential. Group "D" typically has a clay layer at or near to the surface, or a very shallow depth to impervious bedrock and has a very slow infiltration rate and a high runoff potential. See Soils Map; Appendix C. Table 3.1 on the following page lists the soil types present in the development area:

Table 3.1 – NRCS Soil Survey for El Paso County

SOIL ID NUMBER	***SOIL***	***HYDROLOGIC CLASSIFICATION***	***PERMEABILITY***	***PERCENT ON SITE***
52	Manzanst clay loam, 0 to 3 percent slopes	C	Well Drained	45.3%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	B	Well Drained	54.7%

Predevelopment site conditions are undeveloped and ground cover consists of sparse natural vegetative land cover.

VII. Project Characteristics

a. Big Johnson Reservoir:

a. **Onsite Flows:** 2.7 acres of Filing No. 1, 19.62 acres of Filing No. 3 and 0.62 acres of Filing No. 5 (a small piece of Sub-basin N-6) are located within the Big Johnson Reservoir Basin. These are located at the east boundary of the Big Johnson Reservoir drainage basin. Runoff in sheet flows to the west at slopes ranging from 3 to 5 percent until reaching Powers Boulevard, eventually crossing Powers Boulevard via a 48-inch crossroad pipe south of the proposed development (approximately 3,440 feet south of Bradley Road) and a 60-inch crossroad pipe approximately 2,040 feet south of Bradley Road.

b. **Offsite Flows:** Under existing conditions and proposed conditions a portion of the Trails at Aspen Ridge PUDSP (Sub-basins N-3 to N-6) is upstream of the portion of Filing No. 3 and downstream of the portion of Filing No. 5 within the Big Johnson Reservoir drainage basin.

b. West Fork Jimmy Camp Creek:

c. **Onsite Flows:** Filing No. 5 adds 8.74 developed acres to the approximately 52.8 developed acres of Filing No. 1, 17.61 acres of Filing No. 2, and 18.33 acres of Filing No. 3 within the West Fork Jimmy Camp Creek Basin. Under predevelopment

conditions flows in this area generally flow south and to the east. After development flows will generally sheet flow to adjacent streets, where they will be conveyed via gutter flow towards sump or at-grade inlets which will capture the flows. Flows will then be conveyed to the proposed East Pond via storm sewer.

d. **Offsite Flows:** The first offsite basin upstream of Filing No. 5 is the commercial development along Bradley Road, approximately 14.5 acres of commercially zoned area in two lots just north of the PUD and south of Bradley Road. (Legacy Hill Drive runs between the two lots). The second, on the north side of Bradley Road, is approximately 19.6 acres (12.3 acres of the West Fork Jimmy Camp Creek Basin plus an additional 7.3 acres of Big Johnson Reservoir drainage area diverted into the West Fork Jimmy Camp Creek by CDOT construction of Powers Boulevard).

   Flows from the offsite sub-basin north of Bradley Road (OS-1) sheet flow to Bradley Road or Powers Boulevard where they are collected in the road ditch and conveyed across Bradley Road and onto the project via two existing 36-inch CMPs. Runoff south of Bradley Road under predevelopment conditions generally sheet flows to the south and slightly east within the West Fork Jimmy Camp Creek Drainage Basin (DBPS-WFJCC) at slopes ranging from 2 to 9 percent. There appeared to have been a broad swale running along the middle of this basin in a southeasterly direction in the predevelopment condition.

VIII. Regulatory Floodplain

Per the ***Flood Insurance Rate Map (FIRM)*** 08041C0768-G, effective date December 7, 2018, published by the Federal Emergency Management Agency (FEMA), no portion of Trails at Aspen Ridge (Waterview East) lies within any designated 100-year floodplain. This map can be found in Appendix C.

IX. Drainage Design Criteria

A. Design References

As required by El Paso County, Colorado, this report has been prepared in accordance to the criteria set forth in the ***City of Colorado Springs and El Paso County Drainage Criteria Manual Volume 1 & 2*** (Drainage Criteria Manual or DCM), the El Paso County Engineering Criteria Manual (ECM), and El Paso County Resolutions 15-042 and 19-245.

In addition to the DCM, the ***Urban Storm Drainage Criteria Manuals, Volumes 1-3*** (UDFCD), published by the Urban Drainage and Flood Control District, latest update, have been used to supplement the Drainage Criteria Manual for water quality capture volume (WQCV).

B. Design Frequency

Design frequency is based on the DCM. The 100-year storm event was used as the major storm for the project, and the 5-year storm event was used as the minor storm.

C. Design Discharge

a. Method of Analysis

The hydrology for this project uses the Rational Method as recommended by the Drainage Criteria Manual for the minor and major storms for drainage basins less than 100-acres in size. The Rational Method uses the following equation: $Q=C*i*A$

Where:

Q = Maximum runoff rate in cubic feet per second (cfs)
C = Runoff coefficient
i = Average rainfall intensity (inches per hour)
A = Area of drainage sub-basin (acres)

b. Runoff Coefficient

Rational Method coefficients from Table 6-6 of the Drainage Criteria Manual for developed land were utilized in the Rational Method calculations. See Appendix B for more information.

c. Time of Concentration

The time of concentration consists of the initial time of overland flow and the travel time in a channel to the inlet or point of interest. A minimum time of concentrations of 5 minutes is utilized for urban areas.

d. Rainfall Intensity

The hypothetical rainfall depths for the 1-hour storm duration were taken from Table 6-2 of the Drainage Criteria Manual. Table 5.1, below, lists the rainfall depth for the Major and Minor 1-hour storm events.

Table 5.1 – Project Area 1-Hour Rainfall Depth

Storm Recurrence Interval	Rainfall Depth (inches)
5-year	1.50
100-year	2.52

The rainfall intensity equation for the Rational Method was taken from Drainage Criteria Manual Volume 1 Figure 6-5.

e. StormCAD Analysis

1. Routing

Storm CAD was utilized to analyze the routing of runoff through the proposed storm sewer system. Catchments were created in the model and calibrated to match the values calculated in the Rational Method spreadsheet.

2. HGL Profiles

StormCAD was also used to determine the Hydraulic Grade Profiles for the major and minor storms. The standard method was used to calculate head loss in the system with K coefficients taken from Table 9-4 of the DCM.

Table 9-4. STORMCAD Standard Method Coefficients

Bend Loss		
Bend Angle	**K Coefficient**	
0°	0.05	
22.5°	0.10	
45°	0.40	
60°	0.64	
90°	1.32	
LATERAL LOSS		
One Lateral K Coefficient		
Bend Angle	Non-surcharged	Surcharged
45°	0.27	0.47
60°	0.52	0.90
90°	1.02	1.77
Two Laterals K Coefficient		
45°	0.96	
60°	1.16	
90°	1.52	

Note: No HGL or Routing calculations are included in this report since no new storm sewer is proposed in this filing.

X. Drainage Basins and Sub-basins

A. The ***predevelopment conditions*** for the site have been analyzed and are presented by design points (Table 6.2) and are described as follows:

a. Big Johnson Reservoir:
Under existing conditions, the westernmost drainage basin (Big Johnson Reservoir) of the study area runoff sheet flows west to the Powers Boulevard road ditch where flows are conveyed to an existing 60-inch CMP crossroad pipe at Design Point BJR-1 (Q_5 = 6.4 cfs, Q_{100} = 43.2 cfs). Flows in the south portion of this basin follow the same pattern and are conveyed to an existing 48-inch CMP crossroad pipe south of Design Point BJR-2 (Q_5 = 2.1 cfs, Q_{100} = 14.3 cfs). The total existing discharge from the study area to the Big Johnson Reservoir basin is approximately 8.6 cfs for the Q_5 event and 57.5 cfs for the Q_{100} event.

Existing conditions consider all of the areas as undeveloped. Sub-basins and Design points are summarized in the tables on the following page:

Table 6.1 **Trails at Aspen Ridge, Filing No. 1** **FDR** **Existing Conditions Sub-basin Summary Table**			
Area ID	**Area (Acres)**	**Q5 (cfs)**	**Q100 (cfs)**
Big Johnson Reservoir / BJR-1	39.94	6.4	43.2
Big Johnson Reservoir / BJR-2	8.85	2.13	14.32

Table 6.2 **Trails at Aspen Ridge, Filing No. 1** **FDR** **Existing Design Point Summary**				
Design Point	**Sub-Basins**	**Total Area (ac.)**	**Q(5) (cfs)**	**Q(100) (cfs)**
BJR-1	BJR-1	39.94	6.4	43.2
BJR-2	BJR-2	8.85	2.13	14.32
TO BIG JOHNSON RESERVOIR	BJR-1 & BJR-2	**48.79**	**8.6**	**57.5**

b. West Fork Jimmy Camp Creek

The middle portion of the studied area is within the West Fork tributary to Jimmy Camp Creek. A portion of this basin is upstream of Bradley Road. Flows in that sub-basin (OS-1: Q_5 = 5.0 cfs, Q_{100} = 25.3 cfs, SWMM Q_5 = 11.8 cfs, SWMM Q_{100} = 47.4 cfs) sheet flow to the road ditch and are conveyed to two 42-inch CMP crossroad pipes which direct the water across Bradley Road and on to the proposed development area.

The next downstream sub-basin is WF-1 (Q_5 = 17.2 cfs, Q_{100} = 115.2 cfs, SWMM Q_5 = 21.4 cfs, SWMM Q_{100} = 97.6 cfs) which includes 14.5 Acres of commercially zoned offsite area, 66.10 acres of offsite Trails at Aspen Ridge PUD (Originally 8.99), 32.09 Acres of Trails at Aspen Ridge Filing No. 1, 15.89 Acres of Trails at Aspen Ridge Filing No. 2 (PUD area reduced), and 5.00 Acres which are in both Filing No. 1 and the PUD. Flows in this sub-basin sheet flow towards the middle of the sub-basins where they join flows from OS-1 and are conveyed via a broad swale in a southeasterly direction and out of the study area.

The third sub-basin within the West Fork basin is sub-basin WF-2 (Q_5 = 5.4 cfs, Q_{100} = 36.5 cfs, SWMM Q_5 = 5.5 cfs, SWMM Q_{100} = 31.1 cfs) which includes 15.77 Acres of Filing No. 1 and 5.38 Acres of the PUD. Flows in this basin sheet flow in an easterly direction where they are captured by another broad swale at the south limit of the study area and conveyed in a southeasterly direction.

Total discharge to the West Fork Jimmy Camp Creek basin is approximately 37.0 cfs for the Q_5 event and 170.0 cfs for the Q_{100} event.

Existing conditions consider all of the areas as undeveloped. Sub-basins and Design points are summarized in the tables on the following page:

Table 6.1
Trails at Aspen Ridge, Filing No. 1
FDR
Existing Conditions Sub-basin Summary Table

Area ID	Area (Acres)	Q5 (cfs)	Q100 (cfs)
West Fork Jimmy Camp Creek / OS - 1	19.60	11.8*	47.4*
West Fork Jimmy Camp Creek / WF-1	119.08	21.4*	97.6*
West Fork Jimmy Camp Creek / WF-2	21.15	5.5*	31.1*

Table 6.2
Trails at Aspen Ridge, Filing No. 1
FDR
Existing Design Point Summary

Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
OS-1	OS-1 (7.3 Acres diverted by CDOT from Big Johnson)	19.60	11.8*	47.4*
WF-1	WF-1 & OS-1	138.69	33.2*	139.1*
WF-2	WF-2	21.15	5.5*	31.1*
TO WEST FORK JIMMY CAMP CREEK	WF-1, WF-2, & OS-1 (Basins are parallel, so this is a sum of WF-1 & WF-2.)	**159.84**	**37.0***	**170.0***

*Values from SWMM (See MDDP/PDR)

B. The fully developed conditions for the site are as follows:

a. Big Johnson Reservoir Drainage Basin:

Under proposed conditions, flows for this basin will be directed to a proposed detention pond (West Pond) near the west boundary of the proposed Trails at Aspen Ridge development. Sub-basins and Design Points for this major basin are summarized in hydrology Tables 6.3, 6.4, and 6.5 below and on the following pages. (Note that grey shading indicates sub-basins within the Big Johnson Reservoir basin that are covered in previous drainage reports and the values are for fully developed conditions for the PUDSP as well as the proposed development areas.)

Table 6.3
Trails at Aspen Ridge
Big Johnson Reservoir Drainage Basin
Proposed Conditions - Sub-basin Summary
(Gray shading: Covered in previous drainage report)

Basin	Area	Q5	Q100
	acres	cfs	cfs
N1	0.76	**1.5**	**3.4**
N2	2.57	**4.0**	**8.9**
N3	2.05	**3.8**	**8.4**
N4	1.13	**2.1**	**4.6**
N5	3.64	**6.3**	**13.8**
N6 (0.62 acres of this basin is developed by this Filing.)	3.40	**5.3**	**11.7**
O-1 (Filing No. 1)	1.63	**2.7**	**6.0**
O-2	2.97	**4.0**	**8.7**
O-2a	1.13	**1.8**	**4.0**
O-2b	0.57	**0.8**	**1.7**
O-2c	1.05	**1.1**	**2.5**
O-2d	0.60	**1.1**	**2.4**
O-2e	0.51	**0.7**	**1.6**
O-2f	0.65	**1.1**	**2.5**
O-2g	2.04	**2.7**	**6.0**
P1	6.39	**8.1**	**24.6**
P2	1.95	**0.5**	**3.2**

Table 6.4
Design Point Summary
(Gray shading: Covered in previous drainage report)

Design Point	Total Drainage Area	Storm Sewer		Downstream Design Point
		Q5 (cfs)	Q100 (cfs)	
1-N	4.62	4.62	7.25	15.97
2-N	1.13	1.13	2.10	4.62
3-N	5.75	5.75	9.03	19.89
4-N	3.64	3.64	6.26	13.79
5-N	4.17	4.38	6.38	14.06
6-N	13.55	13.76	21.52	47.40
1-O	1.63	4.60	6.32	13.93
O-2e	0.51	0.51	0.73	1.61
O-2f	0.65	0.65	1.11	2.44
O-2g	2.04	2.04	2.74	6.04
2-O	3.20	3.20	4.30	9.47
3-O	4.82	7.80	10.49	23.10
O-2c	1.05	1.05	1.10	2.42
O-2d	0.60	0.60	1.09	2.41
4-O	6.47	9.45	12.71	27.99
5-O	0.57	0.57	0.78	1.71

Table 6.4
Design Point Summary
(Gray shading: Covered in previous drainage report)

Design Point	Total Drainage Area	Storm Sewer		Downstream Design Point
		Q5 (cfs)	Q100 (cfs)	
6-O	10.01	13.74	30.27	7-O
O-2a	1.13	1.82	4.00	7-O
7-O	11.15	15.30	33.70	1-P
1-P	31.54	46.47	108.45	2-P
2-P	31.54	1.00	23.90	3-P
3-P	34.61	3.81	41.18	EX 60-inch Powers Blvd. Culvert (Public)

Table 6.5
DESIGN POINT DESCRIPTIONS
Big Johnson Reservoir Drainage Basin
(Gray shading: Covered in previous drainage report)

Design Point	Description	Downstream Design Point
1-N	Type R sump inlet (Public) capturing flows from sub-basins N2 and N3. Flows are conveyed downstream via 24-inch RCP (Public)	3-N
2-N	Type R sump inlet (Public) capturing flows from sub-basin N4. Flows are conveyed downstream via 18-inch RCP (Public)	3-N
3-N	Manhole (Public) combining flows from 2-N and 1-N. Flows are conveyed downstream via 24-inch RCP (Public).	5-N
4-N	Type R sump inlet (Public) capturing flows from sub-basin N5. Flows are conveyed downstream via 24-inch RCP (Public)	5-N
5-N	Manhole (Public) combining flows from DPs 4-N and 3-N. Flows are conveyed downstream via 36-inch RCP (Public).	6-N
6-N	Combination of flows with sub-basins N1 and N6 with flows from DP 5-N in proposed storm manhole (Public). Flows are conveyed downstream via 36-inch RCP (Public). Note: The storm sewer shows an additional 18-inch storm pipe tying into a manhole downstream of this manhole. This pipe will bring flows from supplementary inlets proposed in the adjacent filing to the north (To be called Trails at Aspen Ridge Filing #4 at the time of this report). The flows captured by this inlet are already included in this design point. UD-Inlet calculations indicate that the pair of supplementary inlets will each capture 7.9 cfs in the major storm event and 5.3 cfs in the minor storm event. A small portion (0.62 acres) of this sub-basin is developed by this filing. The West Pond will not require revisions.	1-P
Filing 1 ***1-O***	This design point is at an existing 10-foot Type R sump inlet (Trails at Aspen Ridge Filing No. 1). Flows are conveyed downstream via 30-inch x 19-inch HERCP	3-O
O-2e	Type R sump inlet (Public) capturing flows from portion of Turkey Flat Lane and West half of Sidewinder Drive (Sub-basin O-2e). Flows are conveyed downstream via	2-O

Table 6.5
DESIGN POINT DESCRIPTIONS
Big Johnson Reservoir Drainage Basin
(Gray shading: Covered in previous drainage report)

Design Point	Description	Downstream Design Point
	18-inch RCP (Public).	
O-2f	Type R sump inlet (Public) capturing flows from portion of Turkey Flat Lane and West half of Sidewinder Drive (Sub-basin O-2f). Flows are conveyed downstream via 18-inch RCP (Public).	2-O
O-2g	Type R sump inlet (Public) capturing flows from east half of Sidewinder Drive (Sub-basin O-2g). Flows are conveyed downstream via 18-inch RCP (Public).	2-O
2-O	Manhole (Public) combining flows from DP O-2e, O-2f, and O-2g. Flows are conveyed downstream via 18-inch RCP (Public).	3-O
3-O	Manhole (Public) combining flows from DP O-2c, O-2d, and 2-O. Flows are conveyed downstream via 38-inch x 24-inch HERCP (Public).	4-O
O-2c	Type R at-grade inlet (Public) capturing flows from sub-basin O-2c. Flows are conveyed downstream via 18-inch RCP (Public).	4-O
O-2d	Type R at-grade inlet (Public) capturing flows from sub-basin O-2d. Flows are conveyed downstream via 18-inch RCP (Public).	4-O
4-O	Manhole (Public) combining flows from DP O-2c, O-2d, and 3-O. Flows are conveyed downstream via 38-inch x 24-inch HERCP (Public).	6-O
5-O	Type R at-grade inlet (Public) capturing flows from sub-basin O-2b. Flows are conveyed downstream via 18-inch RCP (Public).	6-O
6-O	Combination of flows from DP 5-O and 4-O in storm manhole. (Public). Flows are conveyed downstream via 38-inch x 24-inch HERCP (Public).	7-O
O-2a	Type R at-grade Inlet (Public) capturing flows from Sub-basin O-2a.	7-O
7-O	Combination of flows with sub-basin O-2a with flows from DP 6-O in Type R curb inlet (Public). Flows are conveyed downstream via 45-inch x 29-inch HERCP (Public).	1-P
1-P	Combined flows into the West Pond (Private).	2-P
2-P	West Pond Discharge (Full spectrum detention) (Private)	3-P
3-P	Combination of Sub-basins OS-2, Q-2 and P2 with West Pond Discharge	EX 60-inch Powers Blvd. Culvert (Public)

- Generally, flows will sheet flow off developed lots towards adjacent streets which will capture flows and direct them downstream to the nearest inlets. After capture in inlets the flows will be conveyed onwards towards the downstream detention basin via storm sewer.

b. <u>West Fork Jimmy Camp Creek:</u>

Under proposed conditions, flows for this basin will be directed to a proposed detention pond (East Pond) near the southeast corner of the proposed Trails at Aspen Ridge development. Sub-basins and Design Points for this major basin are summarized in hydrology Tables 6.6, 6.7, and 6.8 below and on the following pages. (Note that grey shading indicates sub-basins within the West Fork Jimmy Camp Creek basin that are covered in previous drainage reports. Sub-basins C1, C2, and C3 and Design Points 1-C and 2-C were covered in previous reports, but make up the areas being developed by this filing and are thus not shaded.) (Similarly to the approved MDDP and MDDPA, design point routing was performed in StormCAD and therefore no rational routing tables were included.)

Table 6.6
<u>Trails at Aspen Ridge</u>
West Fork - Jimmy Camp Creek
Proposed Conditions - Sub-basin Summary
(Gray shading: Covered in previous drainage report)

Basin	Area	Q5	Q100
	acres	cfs	cfs
OS-1	19.67	4.0	26.8
A-1	12.34	4.4	18.9
A-2	1.09	2.7	5.2
A-3	4.98	2.2	9.0
A-4	0.12	0.6	1.0
B-1	1.06	1.8	4.1
C-1	3.17	5.7	12.5
C-2	1.31	2.7	5.9
C-3	4.48	8.2	18.0
C-4	0.36	1.6	3.0
C-5	3.13	5.7	12.5
C-6	0.07	0.3	0.6
C-7+8 (MDDPA Sub-basins C7 and C8 combined)	2.25	4.2	9.2
D-1	1.27	1.3	3.6
E-1a	3.53	0.8	3.1
E-1b	3.85	4.4	9.8
E-2	2.14	3.9	8.7
F-1	1.44	2.6	5.8
F-2	0.58	1.1	2.4
F-3	1.29	2.3	5.1
F-4	0.58	1.1	2.5
F-5	2.27	3.5	7.8
F-6	1.00	1.7	3.9
F-7	5.06	7.5	16.5
F-8	0.84	1.5	3.3
G-1	1.11	2.1	4.6
H-1	3.60	5.3	11.7
H-2	1.16	1.9	4.2
H-3	2.97	4.7	10.3
H-4	0.92	1.6	3.6
H-5	2.42	4.0	8.9
H-6	2.46	4.1	9.1
H-7	2.03	3.0	6.6
H-8	0.97	1.7	3.8
H-9a	1.95	2.3	5.8

Table 6.6
Trails at Aspen Ridge
West Fork - Jimmy Camp Creek
Proposed Conditions - Sub-basin Summary
(Gray shading: Covered in previous drainage report)

Basin	Area	Q5	Q100
	acres	cfs	cfs
H-9b	0.38	0.6	1.3
H-10	1.33	2.5	5.5
H-11	3.42	5.0	11.0
I-1	3.13	5.6	12.4
I-2	0.59	1.9	3.8
I-3	4.18	7.1	15.6
K-OS (Fully Developed) (See TAR Filing 4 analysis for breakdown of this area)	37.74	44.9	95.7
K-OS (Undeveloped)	46.76	10.0	67.5
OS-EAST SIDE	4.15	2.6	17.6
M	10.28	6.4	23.1

Table 6.7
Design Point Summary - StormCAD
(Gray shading: Covered in previous/future drainage report)

Design Point	Total Drainage Area	Surface		Storm Sewer		Downstream Design Point
		Q5 (cfs)	Q100 (cfs)	Q5 (cfs)	Q100 (cfs)	
1-OS	19.67	4.0	26.8	-	-	A
1-A	12.34	3.5	17.6	-	-	A
2-A	1.09	2.7	5.2	-	-	A
3-A	4.98	2.2	8.9	-	-	A
4-A	0.12	0.6	1.0	-	-	A
A	38.20	-	-	12.0	55.6	B
1-B	1.06	1.8	4.1	-	-	B
B	39.26	-	-	12.7	57.1	C
1-C	3.27	5.7	12.5	-	-	C
2-C	1.19	2.7	5.9	-	-	C
3-C	4.60	8.2	18.0	-	-	C
4-C	0.36	1.6	3.0	-	-	C
5-C	3.13	5.7	12.5	-	-	C
6-C	0.07	0.3	0.6	-	-	C
7-C	2.20	4.0	8.8	-	-	C
8-C	0.06	0.3	0.5	-	-	C
C	54.13	-	-	27.6	90.2	D
1-D	4.80	1.3	3.6	-	-	D
D	58.93	-	-	24.8	84.9	E
E-1a	3.53	1.2	4.7			D
E-1b	3.85	4.5	9.9	-	-	E
2-E	2.14	3.9	8.7	-	-	E

Table 6.7
Design Point Summary - StormCAD
(Gray shading: Covered in previous/future drainage report)

Design Point	Total Drainage Area	Surface		Storm Sewer		Downstream Design Point
		Q5 (cfs)	Q100 (cfs)	Q5 (cfs)	Q100 (cfs)	
E	64.92	-	-	30.0	95.7	F
1-F	2.07	2.7	6.0	-	-	3-F
2-F	0.58	1.1	2.5	-	-	3-F
3-F	3.32	2.3	5.1	5.8	12.9	4-F
4-F	3.89	1.1	2.5	6.8	15.1	5-F
5-F	6.16	3.5	7.8	8.3	18.2	6-F
6-F	7.16	1.7	3.9	9.6	21.0	8-F
7-F	5.06	7.5	16.5	7.5	16.5	8-F
8-F	13.07	1.5	3.3	16.2	35.8	F
F	77.98	-	-	39.1	117.1	G
1-G	1.11	2.1	4.6	-	-	G
G	79.09	-	-	39.7	118.6	M
1-H	3.60	5.3	11.7	-	-	1-2 H
2-H	1.16	1.9	4.2	-	-	1-2 H
1-2 H	4.76	-	-	7.4	15.5	1-4 H
3-H	2.97	4.7	10.3	-	-	1-4 H
4-H	0.92	1.6	3.6	-	-	1-4 H
1-4 H	8.65	-	-	14.7	31.1	1-6 H
5-H	2.42	4.0	8.9	-	-	1-6 H
6-H	2.46	3.9	8.6	-	-	1-6 H
1-6 H	13.53	-	-	18.6	39.6	1-8 H
7-H	2.03	2.9	6.4	-	-	1-8 H
8-H	0.97	1.7	3.7	-	-	1-8 H
1-8 H	16.52	-	-	21.7	46.0	1-10 H
9a-H	1.95	2.3	5.7	-	-	
9b-H	0.38	0.6	1.4	2.8	6.5	10-H
10-H	1.33	2.4	5.2	-	-	1-10 H
1-10 H	20.17	-	-	25.3	59.6	11-H
11-H	3.42	5.0	11.0	-	-	H
H	23.59			32.4	76.2	M
1-I	3.13	5.6	12.4	-	-	K
2-I	0.59	1.9	3.8	-	-	K
K-OS	37.74			57.3	122.1	K
K	41.46	-	-	62.2	133.3	3-I
3-I	4.18	7.8	17.2	7.8	17.2	M
I	45.64	-	-	66.5	143.4	M
M	162.88	-	-	158.2	426.5	East Pond Discharge

Table 6.7
Design Point Summary - StormCAD
(Gray shading: Covered in previous/future drainage report)

Design Point	Total Drainage Area	Surface		Storm Sewer		Downstream Design Point
		Q5 (cfs)	Q100 (cfs)	Q5 (cfs)	Q100 (cfs)	
East Pond Discharge SWMM Discharge (MDDPA-Matrix)	**162.88**	-	-	8.5	127.4	Existing Swale

Table 6.5
DESIGN POINT DESCRIPTIONS
(Gray shading: Covered in previous drainage report)

Design Point	Description	Downstream Design Point
1-OS	- This design point is at the downstream end of the offsite sub-basin (OS-1) north of Bradley Road. Flows in Sub-basin OS-1 will sheet flow to the road ditch running along Bradley and Powers Boulevard. Once channelized in the ditch flows will be directed to a proposed 24-inch RCP storm pipe sleeved into one of the existing 42-inch CMP crossroad pipes to minimize disturbance to Bradley Road and avoid conflicts with existing utilities along the north side of Bradley Road. From there flows will be conveyed on to design point A. The second existing 42" CMP will be plugged. - Please note that approximately 7.3 acres of the area tributary to this design point have been diverted from the Big Johnson Reservoir by CDOT construction of Powers Boulevard. Future development of that portion of the tributary sub-basin must redirect these flows to the Big Johnson Reservoir to maintain compliance with the two relevant DBPS reports. - Development of the OS-1 Sub-basin will require onsite detention and an FDR.	A
Filing 1 1-A	-This design point is located at a sump inlet on the north side of Frontside Drive and just west of the Legacy Hill Drive Roundabout. -Please note that the commercial lot to within Sub-basin A-1 will be treated as undeveloped for the purposes of this report. Per MDDPA-Matrix, future development of this lot will require on-site detention as described in the referenced MDDP. -Development of this basin will require onsite detention and an FDR.	A
Filing 1 2-A	-This design point is located at a sump inlet on the south side of Frontside Drive and just west of the Legacy Hill Drive Roundabout. -Flow to This design point is primarily from street drainage along Frontside Drive.	A

Table 6.5
DESIGN POINT DESCRIPTIONS
(Gray shading: Covered in previous drainage report)

Design Point	Description	Downstream Design Point
Filing 1 3-A	-This design point is located at a sump inlet on the north side of Frontside Drive and just east of the Legacy Hill Drive Roundabout. -Please note that the commercial lot to within Sub-basin A-3 will be treated as undeveloped for the purposes of this report. Per MDDPA-Matrix, future development of this lot will require on-site detention as described in the referenced MDDP. -Development of this basin will require onsite detention and an FDR.	A
Filing 1 4-A	-This design point is located at a sump inlet on the south side of Frontside Drive and just east of the Legacy Hill Drive Roundabout. -Flow to This design point is almost exclusively from street drainage along Frontside Drive.	A
Filing 1 A	-This design point represents the manhole combining drainage from Design points OS-1 and 1-A through 4-A.	B
Filing 1 1-B	-This design point represents the on-grade inlet south of Frontside Drive.	B
Filing 1 B	-This design point represents the manhole on Legacy Hill Drive combining the flows from design point A with design point 1-B.	C
Filing 5 1-C	- This is located at an existing at-grade inlet on the west side of Drinking Horse Drive constructed as part of Filing No. 3.	C
Filing 5 2-C	- This is located at an at-grade inlet on the east side of Drinking Horse Drive constructed as part of Filing No. 3.	C
Filing 3 3-C	-This design point is at a sump inlet just west of Legacy Hill Drive on the north side of Moose Meadow Street. -Much of the tributary area is developed as a part this filing. -Q100 flows will equalize across Moose Meadow between Inlets 3-C and 4-C.	C
Filing 3 4-C	-This design point is at a sump inlet just west of Legacy Hill Drive on the south side of Moose Meadow Street.	C
Filing 1 5-C	-This design point is at a sump inlet just east of Legacy Hill Drive on the north side of Moose Meadow Street.	C
Filing 1 6-C	-This design point is at a sump inlet just east of Legacy Hill Drive on the south side of Moose Meadow Street.	C
Filing 2 7+8-C	- This design point is located at a sump inlet on the south side of Moose Meadow Street between Roundhouse Drive and Beartrack Point. Sub-basins C-	C

Table 6.5
DESIGN POINT DESCRIPTIONS
(Gray shading: Covered in previous drainage report)

Design Point	Description	Downstream Design Point
	7+8 is tributary to this location.	
C	-This design point is at an existing manhole in Legacy Hill Drive at its intersection with Moose Meadow Street. It reflects the combination of flows from design points 1-C through 8-C with flows from design point B.	D
Filing 3 E-1a	-This design point/sub-basin is at a proposed CDOT Type C inlet proposed to capture runoff from the park area. - Flows will sheet flow off of the park area towards the area inlet.	1-D
Filing 1 1-D	-This design point is an on-grade inlet on Legacy Hill Drive northwest of its intersection with Sunday Gulch. -Sub-basin D flows will be combined with flows from Sub-basin E-1a	D
Filing 1 D	-This design point combines flows from design point 1-D with flows from design point C at a manhole in Legacy Hill Drive northwest of its intersection with Sunday Gulch Drive.	E
Filing 1 1-E	-This design point is located at a sump inlet on Falling Rock Drive just west of Sunday Gulch Drive which captures flows from Sub-basin E-1b and flow bypass from design point 1-D.	E
Filing 1 2-E	-This is a sump inlet across the street from design point 1-E. -During lower probability events flows to design point 1-E may equalize across the street to this design point.	E
Filing 1 E	This design point is at a manhole at the intersection of Sunday Gulch Drive and Falling Rock Drive. Flows from Design points 1-E, 2-E, and D are combined at this design point.	F
Filing 3 1-F	-This design point is at a 10-foot at-grade inlet on the west side of Lazy Ridge Drive.	3-F
Filing 3 2-F	-This design point is at a 10-foot at-grade inlet on the east side of Lazy Ridge Drive.	3-F
Filing 3 3-F	-This design point is at a 10-foot at-grade inlet on the west side of Lazy Ridge Drive. -Flows from Sub-basin F-3 are combined with storm sewer flows from design points 1-F and 2-F in a proposed storm sewer manhole immediately south of the proposed inlet.	4-F
Filing 3 4-F	-This design point is at a 10-foot at-grade inlet on the east side of Lazy Ridge Drive. -Flows from sub-basin F-4 are combined with flows from Design Point 3-F.	5-F
Filing 1 5-F	-This design point is at an at-grade inlet on the west side of Wagon Hammer Drive. -Flows from Sub-basin F-5 are combined with storm sewer flows from design	6-F

Table 6.5
DESIGN POINT DESCRIPTIONS
(Gray shading: Covered in previous drainage report)

Design Point	Description	Downstream Design Point
	points 1-F, 2-F, 3-F, and 4-F	
Filing 1 6-F	-This design point is at an at-grade inlet on the east side of Wagon Hammer Drive. -Flows from Sub-basin F-6 are combined with storm sewer flows from design points 1-F, 2-F, 3-F, 4-F, and 5-F	8-F
Filing 1 7-F	-This design point is at a sump inlet located on the north side of Lookout Court just west of its intersection with Sunday Gulch Drive. -This inlet captures flows from Sub-basin F-7	8-F
Filing 1 8-F	-This design point is at a sump inlet and manhole on the south side of Lookout Court just west of its intersection with Sunday Gulch Drive. -Flows from Sub-basin F-8 are combined with flows from design points 1-F, 2-F, 3-F, 4-F, 5-F, 6-F, and 7-F.	F
Filing 1 F	-This design point combines flows from design points 1-F through 8-F with flows from design point E. -Variance Drop Manhole	G
Filing 1 1-G	-This design point is at an at-grade inlet capturing flows from Sub-basin G.	G
Filing 1 G	-This design point reflects the combination of surface flows from design point 1-G with storm sewer flows from design point F	M
Filing 1 1-H	-This design point is at an existing sump inlet on the west side of Lazy Ridge Drive capturing flows from Sub-basin H-1.	1-2 H
Filing 1 2-H	-This design point is at an existing sump inlet on the east side of Lazy Ridge Drive capturing flows from Sub-basin H-2.	1-2 H
Filing 1 1-2 H	-Flows from design points 1-H and 2-H are combined at this manhole on the south side of Buffalo Horn Drive at its intersection with Lazy Ridge Drive.	1-4 H
Filing 1 3-H	-This design point is at a sump inlet on the west side of Wagon Hammer Drive capturing flows from Sub-basin H-3	1-4 H
Filing 1 4-H	-This design point is at a sump inlet on the east side of Wagon Hammer Drive capturing flows from Sub-basin H-5	1-4 H
Filing 1 1-4 H	-Flows from design point 1-2 H are combined with flows from 3-H and 4-H at this manhole on the south side of Buffalo Horn Drive at its intersection with Wagon Hammer Drive.	1-6 H
Filing 1 5-H	-This is an at-grade inlet on the north side of Buffalo Horn Drive just west of its intersection with Windy Pass Court.	1-6 H

Table 6.5
DESIGN POINT DESCRIPTIONS
(Gray shading: Covered in previous drainage report)

Design Point	Description	Downstream Design Point
Filing 1 6-H	-This is an at-grade inlet on the south side of Buffalo Horn Drive just west of its intersection with Windy Pass Court.	1-6 H
Filing 1 1-6 H	-Flows from design point 1-4 H are combined with flows from 5-H and 6-H at this manhole on the south side of Buffalo Horn Drive west of its intersection with Windy Pass Court.	1-8 H
Filing 1 7-H	-This design point is at an on-grade inlet on the west side of Sunday Gulch Drive just north of its intersection with Buffalo Horn Drive. -This inlet captures flows from Sub-basin H-7	1-8 H
Filing 1 8-H	-This design point is at an on-grade inlet on the east side of Sunday Gulch Drive just north of its intersection with Buffalo Horn Drive. -This inlet captures flows from Sub-basin H-8	1-8 H
Filing 1 1-8 H	-Flows from design point 1-6 H are combined with flows from 7-H and 8-H at this manhole on the south side of Buffalo Horn Drive west of its intersection with Sunday Gulch Drive.	1-10 H
Filing 1 9a-H	-This design point is near the south boundary of Filing No. 1 where a flared end section captures flows from a swale running along this southern boundary of the study area. -This design point captures flows from Sub-basin H-9a.	9b-H
Filing 1 9b-H	-This design point is near the south boundary of Filing No. 1 where a Type C Inlet captures flows within Sub-basin H-9b. -This design point combines flows from Sub-basins H-9a and H-9b.	10-H
Filing 1 10-H	-This design point is at a sump inlet on the south side of the cul-de-sac at the east end of Buffalo Horn Drive. Surface flows from Sub-basin H-10 are combined with storm sewer flows from design point 9-H.	1-10 H
Filing 1 1-10 H	-Flows from design points 10-H and 1-8 H are combined at a manhole towards the north side of the cul-de-sac at the east end of Buffalo Horn Drive.	11-H
Filing 1 11-H	-This design point is at a sump inlet on the north side of the cul-de-sac at the east end of Buffalo Horn Drive. -This inlet captures flows from Sub-basin H-11	H
Filing 1 H	-This design point combines storm sewer flows from design point 11-H and 1-10 H	M
Filing 4 & Future K-OS	-This design point is at the storm sewer stub out from Filing No. 2. Future filings in Trails at Aspen Ridge will extend the storm sewer to the north along Big Johnson Drive. -See analysis in TAR Filing 4 FDR for a detailed breakdown of the area tributary to this DP.	OS-2-K

Table 6.5
DESIGN POINT DESCRIPTIONS
(Gray shading: Covered in previous drainage report)

Design Point	Description	Downstream Design Point
OS-E	-Type C inlet capturing flows from sub-basin OS-East Side. Flows will be conveyed to Design Point 14-K via 18-inch storm pipe.	K
K	-This design point combines storm sewer flows from design points 1-14-K, 2-I, and 1-I in a manhole located at the intersection of Big Johnson Drive and Legacy Hill Drive.	3-I
Filing 1 1-I	-This design point is at a sump inlet on the north side of Legacy Hill Drive just west of its intersection with Big Johnson Drive. -Flows from Sub-basin I-1 are captured at this inlet.	K
Filing 1 2-I	-This design point is at a sump inlet on the south side of Legacy Hill Drive just west of its intersection with Big Johnson Drive. -Flows from Sub-basin I-2 are captured at this inlet.	K
Filing 1 3-I	-This design point is at a sump inlet at the south side of the cul-de-sac at the east end of Falling Rock Drive. -Flows from Sub-basin I-3 are captured by this inlet	M
Filing 1 I	-This design point represents the combination of storm sewer flows from design point K with flows captured by the inlet at design point 3-I	M
Filing 1 M	-This design point represents the combinate of all of the flows directed to the East Pond. -Included Sub-basins: OS-1, A-1 to A-4, B-1, C-1 to C-8, D-1, E-1a, E1b, E-2, F-1 to F-8, H-1 to H-11, I-1 to I-3, K-1+2 to K-14, K-OS, OS-East Side, and M	East Pond Discharge
East Pond Discharge	-This design point is at the discharge structure from the East Pond. -Developed flows from the proposed improvements will be metered out by this structure at predevelopment levels as determined by a combination of UD-Detention and SWMM modeling of the Full Spectrum Extended Detention Basin	Existing Swale

XI. Drainage Facility Design

A. Street Capacity

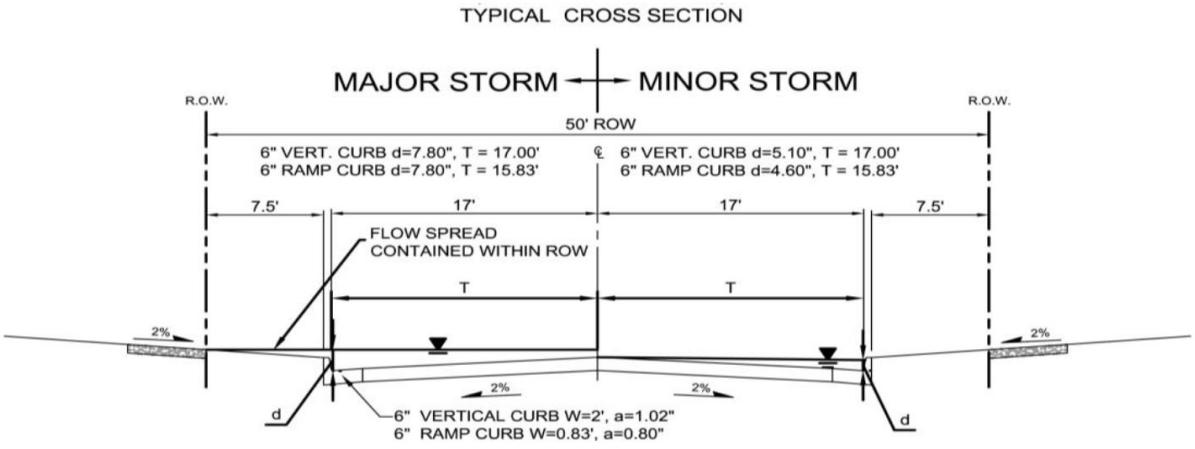
The width of the typical section for streets within this filing will be 35 feet from back of curb to back of curb. Curb heights will be 6-inch. These streets will generally utilize EPC Optional Type C curb and gutter with EPC Type A curb and gutter used for the curb radii through intersections. The following table (Table 6.1) lists streets and capacities by Design Point:

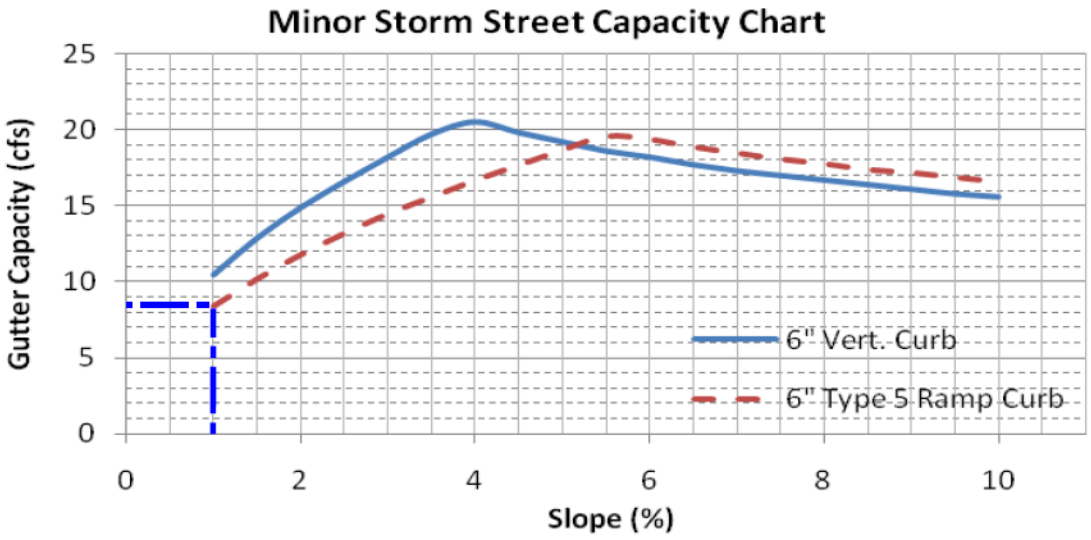
TRAILS AT ASPEN RIDGE FILING NO. 3 STREET CAPACITIES								
Street	***Sub-basin***	***BYPASS SOURCE (Design Point)***	***Slope %***	***ROAD CAPACITY MINOR STORM (cfs)***	***Q(5) TOTAL FLOW***	***Q(100) BYPASS FLOWS RECEIVED (cfs)***	***ROAD CAPACITY MAJOR STORM (cfs)***	***Q(100) TOTAL FLOW (cfs)***
Little Boulder Loop	C-3	N/A	3.3	16	8.4	-	36	18.5
Drinking Horse Court (Worst Case)	C-1, C-2	N/A	5.7	18.0	8.3	-	32	19.2
Moose Meadow Street	C-3	N/A	4.5	18.0	8.2	-	34	18.0
Moose Meadow Street	C-3, C4	N/A	3.4	18.0	10.0	-	34	21.5

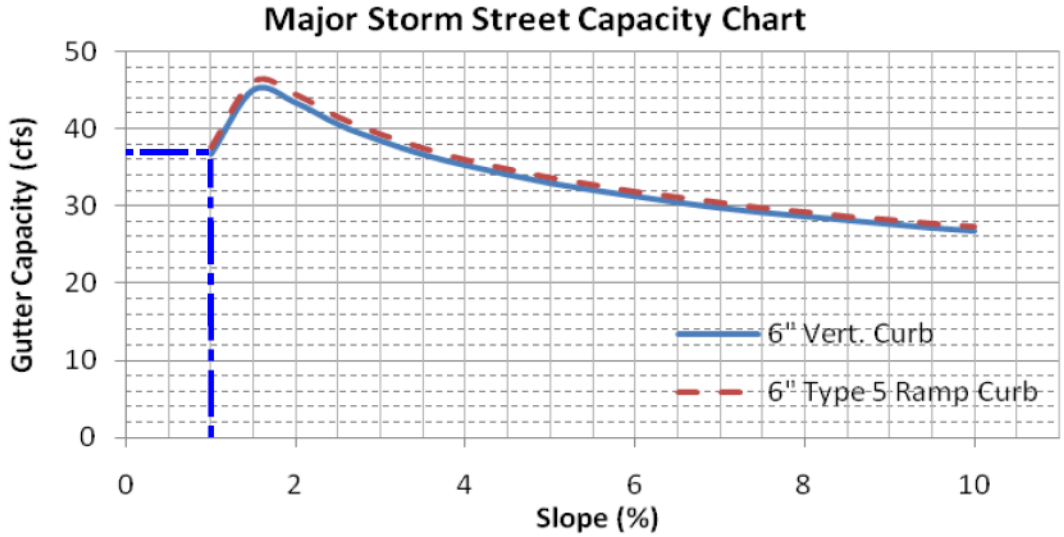
Note: Road design has added a warp to Drinking Horse Court which may direct flows to the east side of the road. The analysis above considers the road as if all flows have been diverted to that side of the road as a worst-case analysis of the proposed infrastructure.

Nomograph 7-7 from the DCM is shown below and on the following page:

Figure 7-7. Street Capacity Charts Residential (Detached Sidewalk)







Notes:

- 1% is shown as the flattest potential slope.
- EPC Optional Type C curb and gutter was used for all streets.
- The nomograph (Figure 7-7) above was used to calculate capacities for the EPC Type C (Local/Residential) streets within the project area. Compared to requirements in the El Paso DCM this nomograph is slightly more conservative for the major storm (7.8-inch depth versus 12-inch depth in Table 6-1 of the El Paso County DCM) and identical for the minor/initial storm.

B. Inlet Capacity

In accordance with the DCM, this project will use Type R inlets. On-grade inlet capacities were determined utilizing UD-Inlet (Included in Trails at Aspen Ridge Filing 3 FDR). Sump inlet capacities were determined utilizing DCM Nomograph 8-11 shown below. The following Table 6.2 lists inlets by design point and corresponding capacity. Please note that all inlets described in this filing are existing and analysis is included in the referenced filing's FDR.

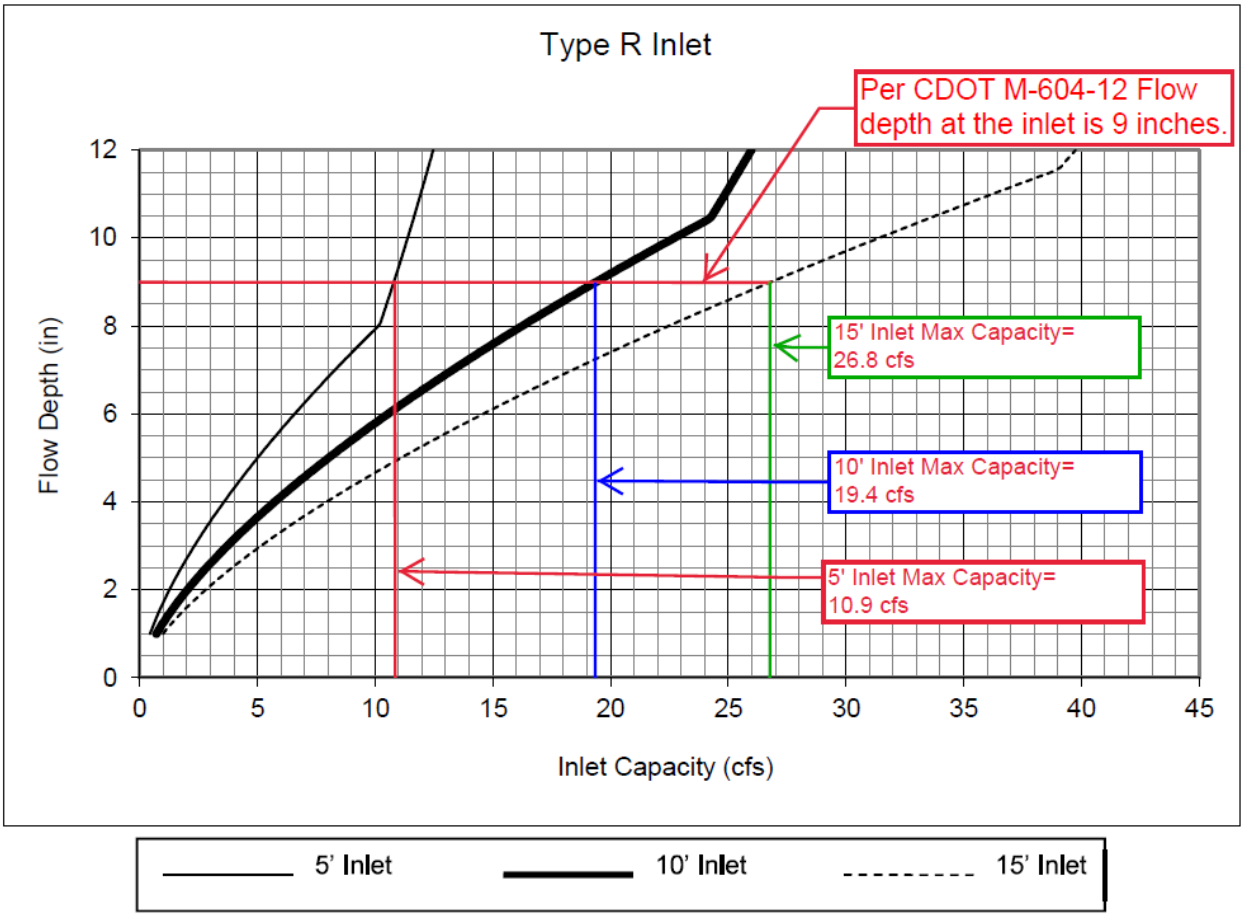


Figure 2-Inlet Capacity - Sump Conditions (DCM Figure 8-11)

Trails at Aspen Ridge
Filing No. 5
INLET SUMMARY

DESIGN POINT (#-Letter) or SUB-BASIN (Letter#)	*SUB-BASINS*	*TOTAL AREA (AC)*	*INLET*			*Q(5) BYPASS FLOWS (cfs)*	*Q(5) TOTAL INFLOW*	*Q5 INLET CAPACTIY*	*Q(100) BYPASS FLOWS (cfs)*	*Q(100) TOTAL INFLOW (cfs)*	*MAX INLET CAPACITY*	*NOTES:*
			SIZE (Ft.)	*TYPE*	*CONDITION*							
1-C	C-1	3.17	10	R	**AT-GRADE**	2.1	5.67	**3.6**	11.4	19.2	**5.3**	*Existing Inlet (Filing No. 3)*
2-C	C-2	1.31	5	R	**AT-GRADE**	0.3	2.66	**2.4**	1.1	5.86	**4.8**	*Existing Inlet (Filing No. 3)*
3-C	C-3	4.48	10	R	**SUMP**		9.02	**13**		19.2	**21**	*East Pond Existing inlet (Filing No. 1) 9.5" sump depth*
4-C	C-4	0.36	10	R	**SUMP**		10.0	**13**		21.5	**21**	*Existing inlet (Filing No. 1) Tributary to East Pond Q100 equalizes with Inlet 4-C*

Note: Road design has added a warp to Drinking Horse Court which may direct flows to the east side of the road. The analysis above considers the road as if all flows have been diverted to that side of the road as a worst-case analysis of the proposed infrastructure.

C. Storm Sewer Capacities

No new or modified storm sewer is part of this filing. (See Trails at Aspen Ridge Filing 3 for storm design information)

D. Detention

Summary information for the East and West Ponds is listed below. Supporting UD-Detention spreadsheets are included in Appendix A. The East and West Ponds will be privately owned and maintained by the Waterview II Metropolitan District.

Table 7.5
Pond Summary Table

Major Basin	Pond ID	Analysis Method	Contributing Basins	Approximate Detention Volumes			EX 5 Year	Proposed 5 Year	EX 100 Year	Proposed 100 Year
				WQCV	EURV	Q100				
				Ac.-Ft.	Ac.-Ft.	Ac.-Ft.	(CFS)	(CFS)	(CFS)	(CFS)
West Fork Jimmy Camp Creek	East Pond	UD-Detention	OS-1, A, B, C, D, E, F, G, J, K, I, H, M, & OS-East Side	**F5**: 2.204 **FB**: 4.833	5.654 6.581	17.242 17.921	37.0	**8.5** **5.8**	170.0	**127.4** **139.5**
Big Johnson Reservoir	West Pond	UD-Detention	O-1 to O-2g, N1 to N6, & P1	**F5**: 0.375 **FB**: 0.544	0.986 1.845	3.394 3.718	8.6	**0.4** **0.7**	57.5	**10.6** **22.1**

Trails at Aspen Ridge, Filing No. 5 = **F5**, Trails at Aspen Ridge, Full Buildout = **FB**

Emergency Overflows

Table 7.6
Emergency Overflow Weirs

Major Basin	Pond ID	Description of Emergency Overflow Weir
West Fork - Jimmy Camp Creek	East Pond	The emergency overflow weir for this pond will release emergency overflows to a proposed swale along the edge of the development boundary and direct the flows south to an existing swale flowing to the southeast. Flows will then follow historic patterns.
Big Johnson Reservoir	West Pond	The emergency overflow weir for this pond will discharge emergency flows to the Powers Boulevard road ditch. Flows will then follow historic paths.

Outfall Analysis

East Pond

The outfall for the East Pond was analyzed in ***MDDP-Matrix*** to confirm that the receiving swale should remain stable after construction of the pond. Hydraflow Express was utilized to check the

velocity of the anticipated Full Buildout Q100 Discharge and calculated a velocity in the 48" outfall pipe of 12.9 feet per second. A second Hydraflow calculation was performed at the narrowest point in the swale receiving the discharge. The results of this calculation indicated that the anticipated velocity of a Q100 discharge from the pond is around 3.7 feet per second which is well below the maximum 100-year velocity and barely above the maximum low flow velocity indicated for erosive soils in Table 12-3 (shown on the following page) of the DCM regarding Hydraulic Design Criteria for natural unlined channels. Additionally, the outfall will discharge to a rip rap lined low tailwater basin designed in accordance with UDFCD criteria.

Table 12-3. Hydraulic Design Criteria for Natural Unlined Channels

Design Parameter	Erosive Soils or Poor Vegetation	Erosion Resistant Soils and Vegetation
Maximum Low-flow Velocity (ft/sec)	3.5 ft/sec	5.0 ft/sec
Maximum 100-year Velocity (ft/sec)	5.0 ft/sec	7.0 ft/sec
Froude No., Low-flow	0.5	0.7
Froude No., 100-year	0.6	0.8
Maximum Tractive Force, 100-year	0.60 lb/sf	1.0 lb/sf

[1] Velocities, Froude numbers and tractive force values listed are average values for the cross section.
[2] "Erosion resistant" soils are those with 30% or greater clay content. Soils with less than 30% clay content shall be considered "erosive soils."

The Web Soil Survey for the site indicates that the Soils for the receiving swale are are classified as Stoneham sandy loam which is likely an erosive soil.

After receiving the East Pond Discharge, the existing swale will convey the stormwater to an existing detention feature on an adjacent property. According to the West Fork – Jimmy Camp Creek DBPS (See DPBS plan Sheet 6 in Appendix C of ***MDDP-Matrix***) this existing detention feature is expected to receive up to 380 cfs for a Q100 event. The tributary drainage area treated by the East Pond makes up approximately 70 percent of the area tributary to the existing offsite pond. As the anticipated discharge from the East Pond is less than half (Filing No. 5: 127.4 cfs, Full Buildout: 139.5 cfs) of the the flow listed in the DBPS, the existing detention feature should not be adversely affected.

West Pond

The outfall for the West Pond is located upstream of an existing 60-inch CMP across Powers Boulevard. The predevelopment discharge to this location from the project area is estimated to be 43.2 cfs for the major storm and 6.4 cfs for the minor storm. Under proposed conditions the highest anticipated discharges according to UD-Detention are 10.6 cfs (FB: 22.1 cfs) for the major storm and 0.4 cfs (FB: 0.7 cfs) for the minor storm. Worst case post development total flows to the Powers Boulevard Ditch is approximately 41.2 cfs which is lower than the predevelopment values and will have an approximate depth of 4 inches in the Powers Boulevard Ditch. This includes the discharge from OS-2 for the major storm of 11.7 cfs (***MDDPA-Matrix***) and the undetained flows from Sub-basin Q-2. The receiving 60-inch culvert has been modeled in Hydraflow Express and has a capacity of approximately 291 cfs under channel flow conditions which far exceeds the anticipated

flows. The above items indicate that the outfall location is suitable and in compliance with DCM requirements.

SWMM Analysis: West Fork – Jimmy Camp Creek

Please note that the ***MDDPA-Matrix*** report analyzed the full buildout of the area tributary to the East Pond using pond inflow hydrographs generated in SWMM and input to UD-Detention because full build out of the basin will include detention ponds for the commercial areas along Bradley Road in series with the East Pond. However, as these commercial areas are not anticipated to be developed prior to Trails at Aspen Ridge Filing No. 5, analysis of the East Pond for this filing utilized only the UD-Detention spreadsheet and considered all the upstream areas as undeveloped in order to confirm that the East Pond outlet structure for Filing No. 5 will conform to detention requirements in the DCM.

East Pond Phasing:

The East Pond was constructed as part of Trails at Aspen Ridge Filing No. 1. The pond was built to the size required for full development of the upstream basin, so expansion of the pond volume is not required for this development. (This volume does **not** include developed flows from the commercial areas or OS-East Side. These areas will be required to construct full spectrum detention when developed.) The Filing No. 1 orifice plate for the East Pond outlet structure has been evaluated and found **adequate** to discharge the combined Filings No. 1 through No. 5 developed flows in compliance with DCM Criteria. Future filings will require additional evaluations and, possibly, redesigns of the orifice plate or upgrade to the full buildout plate indicated in ***MDDPA-Matrix/PDRA Matrix*** to ensure compliance with the DCM and ***MDDPA-Matrix/PDRA-Matrix*** criteria.

West Pond Phasing:

The West Pond was originally constructed as a part of Trails at Aspen Ridge Filing No. 1 as a sand filter due to the small area tributary to the pond in Filing No. 1. The outlet structure was designed to be modifiable to accommodate updating the pond to a Full Spectrum Extend Detention Basin (EDB). The Filing 3 development within the West Pond tributary area triggered upgrading the sand filter to an EDB. This modification entailed removing the sand filter, and grading in and constructing new forebays, trickle channels, and a micropool at the existing outlet structure. The orifice plate installed in Filing No. 1 was removed and replaced. The proposed orifice plate for Filing No. 3 matched full buildout design with the exception of the low WQCV orifice at the micropool elevation. This orifice was installed as a 4-inch orifice in the main plate and, to accommodate Filing No. 3 conditions, a 3-inch orifice plate was bolted across the 4-inch orifice to provide DCM compliant discharge of the water quality event. Another Filing No. 3 modification to the detention pond was raising the emergency spillway to be 5.93 feet above the low orifice. This was required to accommodate the county's requirement to match the discharge for all events in the UD-Detention model for Full Buildout Conditions. The two forebays for the West Pond have been designed for full buildout conditions to prevent the need for retrofitting in a future filing.

The Orifice Plate as designed in Filing No. 3 was determined to be **adequate** for this filing.

Exclusions from Detention:

No additional exclusions from detention or water quality are requested for this filing.

XII. Environmental Evaluations

A. WETLAND IMPACTS

There are no designated wetland or riparian areas on site, and no anticipated impacts.

B. STORMWATER QUALITY

All on-site detention facilities shall be designed to accommodate water quality requirements. As the development of each parcel progresses, the detention guidelines outlined in this report are to be upheld. Per Chapter 4, Section 4.1, of the El Paso County DCM, Volume 2, the DCM requires a Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls.

FOUR STEP PROCESS

Step 1: Employ Runoff Reduction Practices

- Site specific landscaping will be done on each lot to decrease the connectivity of impervious areas. Grass lined swales will be used where possible to allow ground infiltration.

Step 2: Stabilize Drainageways.

- The site is in the West Fork – Jimmy Camp Creek and Big Johnson basins. Drainage fees, to be paid by the relevant Trails at Aspen Ridge (Waterview East) developers at the time of platting, will help fund future channel improvements. Specific information on future improvements to the two basins was unavailable for this report. There are no defined drainage ways through or adjacent to the site which would require stabilization as part of this development.

Step 3: Provide Water Quality Capture Volume

- Both the West Pond and the East Pond meet the DCM standards for the release rates of Full Spectrum Detention Ponds for Water Quality Capture Volumes.

Step 4: Consider Need for Industrial and Commercial BMPs

- There are no commercial or industrial components of this development, therefore no BMPs of this nature are required. The Full Spectrum Detention BMP is provided for the proposed development by the East and West Ponds.

XIII. PERMITTING REQUIREMENTS

No additional permitting requirements are expected at this time.

XIV. Erosion Control Plan

A grading and erosion control plan (GEC) for Trails at Aspen Ridge Filing No. 5 will be completed. The GEC incorporates straw wattles, straw bale check dams, silt fence, vehicle tracking control, inlet & outlet control, sedimentation basins and other best management practices (BMPs) identified in

the DCM Volume 2. Please refer to the GEC for phasing and procedural information for adaptations between the Filing No. 5 GEC and the overall GEC.

XV. Drainage Fees

(Tract D drainage fees shall be paid with future platting)

Impervious Area Calculations

Land Use Type	% Impervious	Area (Acres)	Impervious Acres
West Fork Jimmy Camp Creek			
Residential (1/8 acre or less)	65%	7.805	5.073
Park	7%	1.341	0.094
	Total	9.146	5.167

Big Johnson Reservoir

Residential (1/8 acre or less)	65%	0.645	0.419
Park/Detention/Open Space	7%	0.100	0.007
	Total	0.745	0.426

Double Counted Area F1 & F5	0.314
F5 Area	9.365

TRAILS AT ASPEN RIDGE FILING NO. 5 Final Drainage Report 2021 Drainage and Bridge Fees						
	Impervious Area (ac.)	Fee/ Imp. Acre	Fee Due	Reimbursable Const. Costs	Fee Due at Platting	Drainage Fee Credit
Big Johnson Reservoir						
Drainage Fee	0.426	$19,752.00	$8,414.35	$0.00	$8,414.35	$0.00
Bridge Fee	0.426	$2,551.00	$1,086.73	$0.00	$1,086.73	$0.00
Sub-Total					$9,501.08	
West Fork Jimmy Camp Creek						
Drainage Fee	5.167	$13,524.00	$69,878.51	$0.00	$69,878.51	$0.00
Bridge Fee	5.167	$4,001.00	$20,673.17	$0.00	$20,673.17	$0.00
Sub-Total					$90,551.68	
Overall Total					***$100,052.76***	

XVI. Construction Cost Opinion

No new drainage infrastructure or modifications to the existing detention ponds are proposed by this filing. All storm sewers that facilitate this filing's flows have been built in previous filings.

XVII. Summary

The above report has demonstrated that the proposed development will comply with the governing DCM, ECM, previous drainage reports, and the El Paso County MS4 permit. No adverse effect on downstream infrastructure is anticipated. Therefore, we recommend approval of the proposed development.

XVIII. References

1. ***El Paso County and City of Colorado Springs Drainage Criteria Manual, Volume 1 & 2***, El Paso County, May 2014
2. ***El Paso County Engineering Criteria Manual,*** El Paso County, Rev. December 2016
3. ***Web Soil Survey of El Paso County Area, Colorado. Unites States Department of Agriculture Soil Conservation Service***.
4. ***Flood Insurance Rate Maps for El Paso County, Colorado and Incorporated Areas, Panel 768 of 1300, Federal Emergency Management Agency***, Effective Date December 7, 2018.
5. ***Urban Storm Drainage Criteria Manual, Vol. 1-3*** by Urban Drainage and Flood Control District (UDFCD), January 2016
6. ***West Fork Jimmy Camp Creek Drainage Basin Planning Study*** by Kiowa Engineering, revised October 2003
7. ***Jimmy Camp Creek Drainage Basin Planning Study, Development of Alternatives & Design of Selected Plan, Report*** by Kiowa Engineering, March 2015
8. **Big Johnson Reservoir/Crews Gulch Drainage Basin Planning Study,** by Kiowa Engineering, September 1991.
9. **"Amendment to Waterview Master Drainage Development Plan"**, completed by Springs Engineering, dated July 2014 *(MDDP-2014)*
10. **"Master Drainage Development Plan Amendment for Waterview East & Preliminary Drainage Plan for Trails at Aspen Ridge",** Completed by Matrix Design Group, Dated August 2019 (MDDPA-Matrix) (Approval Pending)
11. ***"Final Drainage Report for Trails at Aspen Ridge Filing No. 1",*** completed by Matrix Design Group, Dated January 2020. (FDR-F1)
12. **"PDR Amendment for Trails at Aspen Ridge",** completed by Matrix Design Group, Dated January 2021. (PDRA-Matrix) Awaiting Signatures.
13. ***"Final Drainage Report for Trails at Aspen Ridge Filing No. 2",*** completed by Matrix Design Group, Dated February 2021. (FDR-F2)
14. ***"Final Drainage Report for Trails at Aspen Ridge Filing No. 3",*** completed by Matrix Design Group, Dated February 2021. (FDR-F3) (in review)

XIX. Appendices

APPENDIX A

HYDROLOGIC AND HYDRAULIC CALCULATIONS

Project Name:	TRAILS AT ASPEN RIDGE FILING NO. 5
Project Location:	EL PASO COUNTY
Designer	KZ & JTS
Notes:	Existing Condition

Average Channel Velocity	5	ft/s
Average Slope for Initial Flow	0.04	ft/ft

Channel Flow Type Key

Heavy Meadow	2
Tillage/Field	3
Short Pasture and Lawns	4
Nearly Bare Ground	5
Grassed Waterway	6
Paved Areas	7

		Area		Rational 'C' Values								Flow Lengths				Initial Flow		Channel Flow				Tc	Rainfall Intensity & Rational Flow Rate					SWMM Values	
				Surface Type 2 (Impervious)			Surface Type 3 (Undeveloped)			Composite								Average (%)	Channel Flow Type (See Key above)	Velocity										
Major Basin / Sub-basin	**Comments**	sf	acres	C5	C100	Area (SF)	C5	C100	Area	C5	C100	Initial ft	True Initial Length ft	Channel ft	True Channe Length ft	Average Slope	Initial Tc (min)	Slope	Ground Type	(ft/s)	Channel Tc (min)	Total (min)	i5 in/hr	Q5 cfs	i100 in/hr	Q100 cfs	Q5 cfs	Q100 cfs
Big Johnson Reservoir / BJR-1	***Offsite for Filing No. 1***	1,739,574.1	39.94	0.90	0.96		0.09	0.36	1,739,574	0.09	0.36	709.00	300.00	2094.00	2503.00	0.052	27.91	3.599	5.000	1.9	22.3	50.2	1.8	**6.4**	3.0	**43.2**		
Big Johnson Reservoir / BJR-2	***-Located at south end of study area. -A portion of this area is in Filing No. 1***	385,700.5	8.85	0.90	0.96		0.09	0.36	385,701	0.09	0.36	300.00	300.00	760.00	760.00	0.040	19.84	5.014	5.000	2.2	5.7	25.5	2.7	**2.1**	4.5	**14.3**		
West Fork Jimmy Camp Creek / OS - 1	***- The most northwestern portion of this basin (7.268 Acres) outside of the proposed Trails at Aspen Ridge development was rerouted out of the Big Johnson Reservoir basin by CDOT construction of Powers Boulevard and Bradley Road. Future development of the rerouted area will require routing the flows back to the Big Johnson Reservoir to return the area to compliance with the relevant DBPS studies.***	853,953.7	19.60	0.90	0.96	42031.00	0.09	0.36	811,923	0.13	0.39	621.00	300.00	2146.00	2467.00	0.106	19.79	2.470	5.000	1.5	26.5	46.3	1.9	**4.8**	3.1	**24.1**	**11.8**	**47.4**
West Fork Jimmy Camp Creek / WF-1		5,187,332.2	119.08	0.90	0.96		0.09	0.36	5,187,332	0.09	0.36	530.00	300.00	3811.00	4041.00	0.089	20.22	2.940	5.000	1.7	39.5	59.8	1.6	**17.1**	2.7	**115.2**	**21.4**	**97.6**
West Fork Jimmy Camp Creek / WF-2	***Located at south end of study area.***	921,440.7	21.15	0.90	0.96		0.09	0.36	921,441	0.09	0.36	300.00	300.00	1014.00	1014.00	0.080	15.74	6.114	5.000	2.5	6.8	22.6	2.8	**5.4**	4.8	**36.5**	**5.5**	**31.1**
Marksheffel Tributary to Jimmy Camp Creek / MKT-1	***-Offsite for Filing No. 1 -Located at northeast corner of Trails at Aspen Ridge PUD***	314,083.1	7.21	0.90	0.96		0.09	0.36	314,083	0.09	0.36	300.00	300.00	1125.00	1125.00	0.056	17.74	3.000	5.000	1.7	10.8	28.6	2.5	**1.6**	4.2	**10.9**		
EXISTING CONDITIONS - DESIGN POINTS	***INCLUDED SUB-BASINS***																											
BJR-1	***BJR-1***	1,739,574.1	39.94	0.90	0.96	0.00	0.09	0.36	1,739,574	0.09	0.36	709.00	300.00	2094.00	2503.00	0.052	27.91	3.599	5.000	1.9	22.3	50.2	1.8	**6.4**	3.0	**43.2**		
BJR-2	***BJR-2***	385,700.5	8.85	0.90	0.96		0.09	0.36	385,701	0.09	0.36	300.00	300.00	760.00	760.00	0.040	19.84	5.014	5.000	2.2	5.7	25.5	2.7	**2.1**	4.5	**14.3**		
TO BIG JOHNSON RESERVOIR	***BJR-1 & BJR-2 (Basins are parallel so this is a sum of BJR-1 & BJR-2.)***	2,125,274.6	48.79	0.90	0.96	0.00	0.09	0.36	2,125,275	0.09	0.36	709.00	300.00	2854.00	3263.00	0.052	27.91	5.014	5.000					**8.6**		**57.5**		
OS-1	***OS-1 (Note: 7.3 Acres diverted by CDOT from Big Johnson)***	853,953.7	19.60	0.90	0.96	42031.00	0.09	0.36	811,923	0.13	0.39	621.00	300.00	2146.00	2467.00	0.106	19.79	2.470	5.000	1.5	26.5	46.3	1.9	**4.8**	3.1	**24.1**	**11.8**	**47.4**
WF-1	***WF-1 & OS-1***	6,041,285.9	138.69	0.90	0.96	42031.00	0.09	0.36	5,999,255	0.10	0.36	621.00	300.00	5957.00	6278.00	0.106	20.49	2.771	5.000	1.6	63.7	84.2	1.3	**16.9**	2.1	**108.1**	**33.2**	**139.1**
WF-2	***WF-2***	921,440.7	21.15	0.90	0.96	0.00	0.09	0.36	921,441	0.09	0.36	300.00	300.00	1014.00	1014.00	0.080	15.74	6.114	5.000	2.5	6.8	22.6	2.8	**5.4**	4.8	**36.5**	**5.5**	**31.1**
TO WEST FORK JIMMY CAMP CREEK	***WF-1, WF-2, & OS-1 (Basins are parallel so this is a sum of WF-1 & WF-2.)***	6,962,726.5	159.84	0.90	0.96	42031.00	0.09	0.36	6,920,696	0.09	0.36		0.00		0.00		#DIV/0!		5.000					**22.3**		**144.6**	**37.0**	**170.0**
MKT-1 TO MARKSHEFFEL TRIBUTARY TO JIMMY CAMP CREEK	***MKT-1***	314,083.1	7.21	0.90	0.96	0.00	0.09	0.36	314,083	0.09	0.36	300.00	300.00	1125.00	1125.00	0.056	17.74	3.000	5.000	1.7	10.8	28.6	2.5	**1.6**	4.2	**10.9**		

Note: Q2, Q5 & Q10 are based on C5; Q25, Q50 & Q100 are based on C100

Project Name:	TRAILS AT ASPEN RIDGE FILING NO. 5
Project Location:	EL PASO COUNTY
Designer	KZ & JTS
Notes:	Proposed Condition

OS-1 Previous/future filing

Average Channel Velocity 4 ft/s (If specific channel vel is used, this will be ignored)
Average Slope for Initial Flow 0.04 ft/ft (If Elevations are used, this will be ignored)

Channel Flow Type Key

Heavy Meadow	2
Tillage/Field	3
Short Pasture and Lawns	4
Nearly Bare Ground	5
Grassed Waterway	6
Paved Areas	7

	Area		Rational 'C' Values														Flow Lengths				Initial Flow		Channel Flow				Tc	Rainfall Intensity & Rational Flow Rate						SWMM Values	
			Surface Type 1 Residential 1/8 or less (65% Imp.)			Surface Type 2 Pavement (100% Imp.)			Surface Type 3 Park (7% Imp.)			Surface Type 4 Undeveloped (2% Imp.)			Composite		Initial	True Initial	Channel	True Channel	Average (decimal)	Initial	Average (%)	Channel Flow Type (See Key above)	Velocity	Channel	Total	i2	Q2	i5	Q5	i100	Q100		
Basin	sf	acres	C5	C100	Area (SF)	C5	C100	Area (SF)	C5	C100	Area	C5	C100	Area	C5	C100	ft	Length ft	ft	Length ft	Slope	Tc (min)	Slope	Ground Type	(ft/s)	Tc (min)	(min)	in/hr	cfs	in/hr	cfs	in/hr	cfs	Q5 cfs	Q100 cfs
OS-1	857,033	19.67	0.45	0.59		0.90	0.96		0.12	0.39		0.09	0.36	857033	0.09	0.36	780.00	300.00	300.00	780.00	0.10	23.57	1.40	5	1.2	11.0	34.6	1.8	3.2	2.2	**3.98**	3.7	**26.77**	1.1	16.2
A-1	537,354	12.34	0.45	0.59		0.90	0.96	47144	0.12	0.39		0.09	0.36	490210	0.16	0.41	861.00	300.00	869.00	1430.00	0.09	24.30	1.10	7	2.1	11.4	35.7	1.7	3.5	2.2	**4.39**	3.7	**18.88**		
A-2	47,525	1.09	0.45	0.59	22315	0.90	0.96	25,211	0.12	0.39		0.09	0.36		0.69	0.79	116.00	116.00	819.00	819.00	0.01	7.50	1.10	7	2.1	6.5	14.0	2.8	2.1	3.6	**2.70**	6.0	**5.19**		
A-3	216,948	4.98	0.45	0.59		0.90	0.96	22990	0.12	0.39		0.09	0.36	193958	0.18	0.42	441.00	300.00	562.00	703.00	0.04	22.01	1.00	7	2.0	5.9	27.9	2.0	1.8	2.5	**2.23**	4.2	**9.02**		
A-4	5,198	0.12	0.45	0.59		0.90	0.96	5,198	0.12	0.39		0.09	0.36		0.90	0.96	0.00	0.00	132.00	132.00	0.01	0.00	1.00	7	2.0	1.1	5.0	4.0	0.4	5.1	**0.55**	8.6	**0.99**		
B-1	46,101	1.06	0.45	0.59	46101	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	185.00	185.00	400.00	400.00	0.04	10.03	3.40	7	3.7	1.8	11.8	3.0	1.5	3.8	**1.84**	6.4	**4.06**		
C-1	137,909	3.17	0.45	0.59	137909	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	192.00	192.00	519.00	519.00	0.06	8.92	4.20	7	4.1	2.1	11.0	3.1	4.5	3.9	**5.67**	6.6	**12.49**		
C-2	57,149	1.31	0.45	0.59	57149	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	74.00	74.00	519.00	519.00	0.05	5.89	4.80	7	4.4	2.0	7.9	3.5	2.1	4.5	**2.66**	7.5	**5.86**		
C-3	195,039	4.48	0.45	0.59	195039	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	162.00	162.00	710.00	710.00	0.09	7.16	3.25	7	3.6	3.3	10.5	3.2	6.5	4.0	**8.19**	6.8	**18.04**		
C-4 (Filing 3)	15,505	0.36	0.45	0.59		0.90	0.96	15505	0.12	0.39		0.09	0.36		0.90	0.96	0.00	0.00	630.00	630.00	0.01	0.00	5.00	7	4.5	2.3	5.0	4.0	1.3	5.1	**1.65**	8.6	**2.95**		
C-5	136,286	3.13	0.45	0.59	136286	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	95.00	95.00	822.00	822.00	0.04	7.18	3.80	7	3.9	3.5	10.7	3.2	4.5	4.0	**5.67**	6.7	**12.50**		
C-6	3,110	0.07	0.45	0.59		0.90	0.96	3110	0.12	0.39		0.09	0.36		0.90	0.96	0.00	0.00	100.00	100.00	0.01	0.00	1.90	7	2.8	0.6	5.0	4.0	0.3	5.1	**0.33**	8.6	**0.59**		
C-7+8	98,093	2.25	0.45	0.59	95674	0.90	0.96	2,419	0.12	0.39		0.09	0.36		0.46	0.60	110.00	110.00	800.00	800.00	0.05	7.20	3.90	7	3.9	3.4	10.6	3.2	3.3	4.0	**4.20**	6.7	**9.17**		
D-1	55,297	1.27	0.45	0.59		0.90	0.96	14,978	0.12	0.39	40319	0.09	0.36		0.33	0.54	473.00	300.00	555.00	728.00	0.06	16.56	4.00	7	4.0	3.0	19.6	2.4	1.0	3.0	**1.29**	5.1	**3.56**		
E-1a (Filing 3)	153,676	3.53	0.45	0.59	33837	0.90	0.96		0.12	0.39	119839	0.09	0.36		0.19	0.43	40.00	40.00	1450.00	1450.00	0.05	6.04	5.00	2	0.6	43.2	49.3	1.4	1.0	1.8	**1.23**	3.0	**4.66**		
E-1b	167,490	3.85	0.45	0.59	167490	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	860.00	300.00	1451.00	2011.00	0.06	18.99	4.50	7	4.2	7.9	26.9	2.0	3.6	2.6	**4.49**	4.3	**9.90**		
E-2	93,093	2.14	0.45	0.59	93093	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	193.00	193.00	503.00	503.00	0.08	8.13	3.90	7	3.9	2.1	10.2	3.2	3.1	4.1	**3.94**	6.8	**8.68**		
F-1 (Filing 3)	62,934	1.44	0.45	0.59	62934	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	180.00	180.00	630.00	630.00	0.09	7.55	3.00	7	3.5	3.0	10.6	3.2	2.1	4.0	**2.63**	6.7	**5.80**		
F-2 (Filing 3)	25,121	0.58	0.45	0.59	25121	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	60.00	60.00	354.00	354.00	0.04	5.71	0.70	7	1.7	3.5	9.2	3.4	0.9	4.2	**1.11**	7.1	**2.44**		
F-3 (Filing 3)	56,286	1.29	0.45	0.59	56286	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	180.00	180.00	322.00	322.00	0.09	7.55	0.70	7	1.7	3.2	10.8	3.2	1.9	4.0	**2.34**	6.7	**5.15**		
F-4 (Filing 3)	25,282	0.58	0.45	0.59	25282	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	60.00	60.00	322.00	322.00	0.04	5.71	0.70	7	1.7	3.2	8.9	3.4	0.9	4.3	**1.13**	7.2	**2.48**		
F-5	98,690	2.27	0.45	0.59	98690	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	187.00	187.00	550.00	550.00	0.04	10.08	0.80	7	1.8	5.1	15.2	2.7	2.8	3.4	**3.54**	5.8	**7.79**		
F-6	43,725	1.00	0.45	0.59	43725	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	68.00	68.00	550.00	550.00	0.03	6.69	0.80	7	1.8	5.1	11.8	3.0	1.4	3.8	**1.75**	6.5	**3.85**		
F-7	220,319	5.06	0.45	0.59	220319	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	332.00	300.00	868.00	900.00	0.05	12.47	2.75	7	3.3	4.6	17.0	2.6	5.9	3.3	**7.49**	5.5	**16.49**		
F-8	36,790	0.84	0.45	0.59	36790	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	137.00	137.00	297.00	297.00	0.03	9.50	3.00	7	3.5	1.4	10.9	3.1	1.2	4.0	**1.52**	6.7	**3.35**		
G-1	48,375	1.11	0.45	0.59	48375	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	80.00	80.00	667.00	667.00	0.05	6.12	2.45	7	3.1	3.6	9.7	3.3	1.7	4.1	**2.09**	7.0	**4.60**		
H-1 (Filing 3)	156,776	3.60	0.45	0.59	156776	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	180.00	180.00	667.00	667.00	0.03	10.88	0.80	7	1.8	6.2	17.1	2.6	4.2	3.3	**5.32**	5.5	**11.71**		
H-2 (Filing 3)	50,742	1.16	0.45	0.59	50742	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	84.00	84.00	667.00	667.00	0.03	7.44	0.80	7	1.8	6.2	13.6	2.9	1.5	3.6	**1.91**	6.1	**4.20**		
H-3	129,347	2.97	0.45	0.59	129347	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	192.00	192.00	517.00	517.00	0.04	10.21	0.80	7	1.8	4.8	15.0	2.7	3.7	3.5	**4.66**	5.8	**10.27**		
H-4	39,883	0.92	0.45	0.59	39883	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	57.00	57.00	517.00	517.00	0.03	6.12	0.80	7	1.8	4.8	10.9	3.1	1.3	4.0	**1.65**	6.7	**3.62**		
H-5	105,275	2.42	0.45	0.59	105275	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	175.00	175.00	493.00	493.00	0.03	10.73	2.83	7	3.3	2.5	13.2	2.9	3.2	3.7	**4.02**	6.2	**8.85**		
H-6	107,181	2.46	0.45	0.59	107181	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	156.00	156.00	1028.00	1028.00	0.05	8.55	3.75	7	3.8	4.5	13.0	2.9	3.3	3.7	**4.12**	6.2	**9.07**		
H-7	88,272	2.03	0.45	0.59	88272	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	258.00	258.00	506.00	506.00	0.03	13.03	1.20	7	2.2	3.8	16.9	2.6	2.4	3.3	**3.01**	5.5	**6.64**		
H-8	42,304	0.97	0.45	0.59	42304	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	60.50	60.50	506.00	506.00	0.02	7.22	1.20	7	2.2	3.8	11.1	3.1	1.4	3.9	**1.74**	6.6	**3.83**		
H-9a	84,792	1.95	0.45	0.59	64592	0.90	0.96		0.12	0.39	20200	0.09	0.36		0.37	0.54	246.00	246.00	649.00	649.00	0.05	12.28	1.90	6	2.1	5.2	17.5	2.6	1.9	3.2	**2.35**	5.4	**5.76**		
H-9b	16,350	0.38	0.45	0.59	12615	0.90	0.96		0.12	0.39	3735	0.09	0.36		0.37	0.54	129.00	129.00	137.00	137.00	0.03	10.06	1.10	6	1.6	1.5	11.5	3.1	0.4	3.9	**0.55**	6.5	**1.34**		
H-10	57,758	1.33	0.45	0.59	57758	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	60.00	60.00	640.00	640.00	0.03	6.28	2.20	7	3.0	3.6	9.9	3.3	2.0	4.1	**2.48**	6.9	**5.46**		
H-11	148,966	3.42	0.45	0.59	148966	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	237.00	237.00	864.00	864.00	0.03	12.49	2.00	7	2.8	5.1	17.6	2.5	4.0	3.2	**4.99**	5.4	**10.98**		
I-1	136,188	3.13	0.45	0.59	136188	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	120.00	120.00	1104.00	1104.00	0.09	6.28	3.80	7	3.9	4.7	11.0	3.1	4.4	4.0	**5.61**	6.6	**12.35**		
I-2	25,770	0.59	0.45	0.59		0.90	0.96	18039	0.12	0.39	7731	0.09	0.36		0.67	0.79	43.00	43.00	352.00	352.00	0.02	4.07	2.00	7	2.8	2.1	6.1	3.8	1.5	4.8	**1.92**	8.1	**3.82**		
I-3	182,282	4.18	0.45	0.59	182282	0.90	0.96		0.12	0.39		0.09	0.36		0.45	0.59	153.00	153.00	718.00	718.00	0.04	9.12	2.80	7	3.3	3.6	12.7	3.0	5.6	3.7	**7.07**	6.3	**15.58**		
OS-EAST SIDE	180,740	4.15	0.45	0.59		0.90	0.96		0.12	0.39		0.09	0.36	180740	0.09	0.36	165.00	165.00	1421.00	1421.00	0.07	12.21	1.00	2	0.3	94.7	106.9	0.9	0.3	1.1	**0.10**	1.8	**3.40**		
M	447,971	10.28	0.45	0.59	115721	0.90	0.96		0.12	0.39	332250	0.09	0.36		0.21	0.44	437.00	300.00	10.00	147.00	0.06	18.53	1.00	6	1.5	1.6	20.2	2.4	5.1	3.0	**6.39**	5.0	**23.09**		
R-1	81,300	1.87	0.45	0.59	29098	0.90	0.96		0.12	0.39	52202	0.09	0.36		0.24	0.46	21.00	21.00	220.00	220.00	0.33	2.22	10.00	4	2.2	1.7	5.0	4.0	1.8	5.1	**2.29**	8.6	**7.45**		

Note: Q2, Q5 & Q10 are based on C5; Q25, Q50 & Q100 are based on C100
Note: grey shading indicates sub-basins within the West Fork Jimmy Camp Creek basin that are covered in previous drainage reports. Sub-basins C1, C2, and C3 and Design Points 1-C and 2-C were covered in previous reports, but make up the areas being developed by this filing and are thus not shaded.

Rational Method - Proposed Conditions

Project Location:	TRAILS AT ASPEN RIDGE FILING NO. 5
	EL PASO COUNTY
Designer	JTS
Notes:	Proposed Condition

Average Channel Velocity 4.00 ft/s (If specific channel vel is used, this will be ignored)
Average Slope for Initial Flow 0.04 ft/ft (If Elevations are used, this will be ignored)

Channel Flow Type Key
Heavy Meadow 2.00
Tillage/Field 3.00
Short Pasture and Lawns 4.00
Nearly Bare Ground 5.00
Grassed Waterway 6.00
Paved Areas 7.00

		Area		Rational 'C' Values																			Flow Lengths									Tc	Rainfall Intensity & Rational Flow Rate				
				Surface Type 1 Commercial Areas (95% Impervious)			Surface Type 2 Residential (1/8 or less) (65% Impervious)			Surface Type 3 Streets - Paved (100% Impervious)			Surface Type 4 Neighborhoods/Multi-Family (70% Impervious)			Surface Type 5 Parks and Cemetaries (7% Impervious)			Surface Type 6 Undeveloped-Historic Flow Analysis (2% Impervious)			Composite		Percent Impervious	Initial	True Initial	Channel	True Channel	Average (decimal)	Initial	Average (%)	Channel Flow Type (See Key above)	Velocity	Channel	Total	i5	Q5	i100	Q100
Sub-basin	Comments	sf	acres	C5	C100	Area	C5	C100	Area (SF)	C5	C100	Area (SF)	C5	C100	Area	C5	C100	Area	C5	C100	Area	C5	C100		ft	Length ft	ft	Length ft	Slope	Tc (min)	Slope	Ground Type	(ft/s)	Tc (min)	(min)	in/hr	cfs	in/hr	cfs
N1	***NATURE BRIDGE TRAIL***	21148	0.49	0.82	0.89		0.45	0.59	21148.00	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	40	40	400	400	0.05	4.33	0.80	7	1.79	3.73	8.05	4.43	**1.0**	7.45	**2.2**
N2	***SIDEWINDER DRIVE***	111768	2.57	0.82	0.89		0.45	0.59	111768.00	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	100	100	980	980	0.05	6.84	1.00	7	2.00	8.17	15.00	3.46	**4.0**	5.82	**8.9**
N3	***GOLDEN ROUT STREET***	89385	2.05	0.82	0.89		0.45	0.59	89385.00	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	100	100	667	667	0.05	6.84	2.90	7	3.41	3.26	10.10	4.09	**3.8**	6.87	**8.4**
N4	***GOLDEN ROUT STREET***	49322	1.13	0.82	0.89		0.45	0.59	49322.00	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	100	100	667	667	0.05	6.84	2.90	7	3.41	3.26	10.10	4.09	**2.1**	6.87	**4.6**
N5	***BLUE MINER STREET***	158389	3.64	0.82	0.89		0.45	0.59	158389.00	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	100	100	900	900	0.05	6.84	2.00	7	2.83	5.30	12.14	3.80	**6.3**	6.38	**13.8**
N6	***BLUE MINER STREET***	160590	3.89	0.82	0.89		0.45	0.59	160590.00	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	100	100	1821	1821	0.05	6.84	2.00	7	2.83	10.73	17.57	3.21	**5.7**	5.40	**12.5**
O-1 (Filing No. 1)	***BUFFALO HORN DRIVE***	70840	1.63	0.82	0.89		0.45	0.59	70840.00	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	138	138	1230	1230	0.03	9.24	1.00	7	2.00	10.25	19.49	3.05	**2.3**	5.13	**5.0**
O-2	***TURKEY FLAT AND TRIPLE TREE***	129552	2.97	0.82	0.89		0.45	0.59	129552.00	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	331	300	515	546	0.03	15.60	0.75	7	1.67	5.44	21.03	2.94	**4.0**	4.94	**8.7**
O-2a	***RAINY CREEK TRAIL***	49413	1.13	0.82	0.89		0.45	0.59	49413.00	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	71	71	719	719	0.03	7.22	0.75	7	1.67	7.16	14.38	3.53	**1.8**	5.93	**4.0**
O-2b	***RAINY CREEK TRAIL***	24683	0.57	0.82	0.89		0.45	0.59	24683.00	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	71	71	1269	1269	0.03	7.22	0.75	7	1.67	12.64	19.86	3.02	**0.8**	5.08	**1.7**
O-2c	***TRIPLE TREE***	45777	1.05	0.82	0.89		0.45	0.59	45777.00	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	328	300	1270	1298	0.02	17.75	0.70	7	1.67	12.93	30.68	2.39	**1.1**	4.02	**2.5**
O-2d	***TRIPLE TREE***	26083	0.60	0.82	0.89		0.45	0.59	26083.40	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	70	70	278	278	0.02	8.20	1.00	7	2.00	2.32	10.51	4.02	**1.1**	6.76	**2.4**
O-2e	***SIDEWINDER DRIVE***	22115	0.51	0.82	0.89		0.45	0.59	22115.00	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	138	138	182	182	0.01	16.30	1.00	7	2.00	1.52	17.81	3.19	**0.7**	5.36	**1.6**
O-2f	***SIDEWINDER DRIVE***	28444	0.65	0.82	0.89		0.45	0.59	28444.00	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	189	189	240	240	0.03	10.80	2.40	7	3.10	1.29	12.09	3.80	**1.1**	6.39	**2.5**
O-2g	***SIDEWINDER DRIVE***	88754	2.04	0.82	0.89		0.45	0.59	88754.00	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36		0.45	0.59	65.00	75	75	1038	1038	0.01	12.01	1.00	7	2.00	8.65	20.66	2.96	**2.7**	4.98	**6.0**
P1	***POND & DIRECT DRAINAGE TO POND***	288793	6.63	0.82	0.89		0.45	0.59	123353.00	0.90	0.96		0.53	0.68		0.19	0.52	165439.90	0.09	0.36		0.30	0.55	31.77	70	70	340	340	0.05	7.04	1.00	7	2.00	2.83	9.86	4.12	**8.3**	6.93	**25.5**
P2	***UNDEVELOPED***	74272	1.71	0.82	0.89		0.45	0.59		0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36	74272.00	0.09	0.36	2.00	70	70	340	340	0.05	8.90	2.00	2	0.35	16.03	24.92	2.69	**0.4**	4.51	**2.8**
Q-2	***UNDETAINABLE***	59121	1.36	0.82	0.89		0.45	0.59	13503.60	0.90	0.96		0.53	0.68		0.19	0.52		0.09	0.36	45617.40	0.17	0.41	16.39	50	50	471	471	0.06	6.50	4.70	2	0.54	14.48	20.98	2.94	**0.7**	4.94	**2.8**
DESIGN POINTS																																							
1-N	***N2 & N3***	201153	4.62	0.82	0.89	0	0.45	0.59	201153	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	100	100	980	980	0.05	6.84	1.00	7	2.00	8.17	15.00	3.46	**7.3**	5.82	**16.0**
2-N	***N4***	49322	1.13	0.82	0.89	0	0.45	0.59	49322	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	100	100	667	667	0.05	6.84	2.90	7	3.41	3.26	10.10	4.09	**2.1**	6.87	**4.6**
3-N	***N2-N4***	250475	5.75	0.82	0.89	0	0.45	0.59	250475	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	100	100	980	980	0.05	6.84	1.00	7	2.00	8.17	15.00	3.46	**9.0**	5.82	**19.9**
4-N	***N5***	158389	3.64	0.82	0.89	0	0.45	0.59	158389	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	100	100	900	900	0.05	6.84	2.00	7	2.83	5.30	12.14	3.80	**6.3**	6.38	**13.8**
5-N	***N6 & N1***	190738	4.38	0.82	0.89	0	0.45	0.59	190738	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	100	100	1821	1821	0.05	6.84	2.00	7	2.83	10.73	17.57	3.21	**6.4**	5.40	**14.1**
6-N	***N1-N6***	599602	13.76	0.82	0.89	0	0.45	0.59	599602	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	100	100	1410	1410	0.05	6.84	2.00	7	2.83	8.31	15.15	3.45	**21.5**	5.79	**47.4**
1-O	***O-1***	200392	4.60	0.82	0.89	0	0.45	0.59	200392	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	138	100	1230	1268	0.03	9.24	1.00	7	2.00	10.57	19.80	3.03	**6.3**	5.09	**13.9**
O-2e	***O-2e***	22115	0.51	0.82	0.89	0	0.45	0.59	22115	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	138	100	182	220	0.01	16.30	1.00	7	2.00	1.83	18.12	3.17	**0.7**	5.32	**1.6**
O-2f	***O-2f***	28444	0.65	0.82	0.89	0	0.45	0.59	28444	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	189	100	240	329	0.03	10.80	2.40	7	3.10	1.77	12.57	3.74	**1.1**	6.29	**2.4**
O-2g	***O-2g***	88754	2.04	0.82	0.89	0	0.45	0.59	88754	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	75	75	1038	1038	0.01	12.01	1.00	7	2.00	8.65	20.66	2.96	**2.7**	4.98	**6.0**
2-O	***O-2e, O-2f, O-2g***	139313	3.20	0.82	0.89	0	0.45	0.59	139313	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	75	75	1038	1038	0.01	12.01	1.00	7	2.00	8.65	20.66	2.96	**4.3**	4.98	**9.5**
3-O	***O-1, O-2e, O-2f, O-2g***	339705	7.80	0.82	0.89	0	0.45	0.59	339705	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	75	75	1038	1038	0.01	12.01	1.00	7	2.00	8.65	20.66	2.96	**10.5**	4.98	**23.1**
O-2c	***O-2c***	45777	1.05	0.82	0.89	0	0.45	0.59	45777	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	328	100	1270	1498	0.02	17.75	0.70	7	1.67	14.92	32.67	2.31	**1.1**	3.87	**2.4**
O-2d	***O-2d***	26083	0.60	0.82	0.89	0	0.45	0.59	26083	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	70	70	278	278	0.02	8.20	1.00	7	2.00	2.32	10.51	4.02	**1.1**	6.76	**2.4**
4-O	***O-1, O-2c, O-2d, O-2e, O-2f, O-2g***	411565	9.45	0.82	0.89	0	0.45	0.59	411565	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	75	75	1038	1038	0.01	12.01	1.00	7	2.00	8.65	20.66	2.96	**12.7**	4.98	**28.0**
5-O	***O-2b***	24683	0.57	0.82	0.89	0	0.45	0.59	24683	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	71	71	1269	1269	0.03	7.22	0.75	7	1.67	12.64	19.86	3.02	**0.8**	5.08	**1.7**
6-O	***O-1, O-2b, O-2c, O-2d, O-2e, O-2f, O-2g***	436248	10.01	0.82	0.89	0	0.45	0.59	436248	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	71	71	1269	1269	0.03	7.22	0.75	7	1.67	12.64	19.86	3.02	**13.7**	5.08	**30.3**
O-2a	***O-2a***	49413	1.13	0.82	0.89	0	0.45	0.59	49413	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	71	71	719	719	0.03	7.22	0.75	7	1.67	7.16	14.38	3.53	**1.8**	5.93	**4.0**
7-O	***O-1, O-2a, O-2b, O-2c, O-2d, O-2e, O-2f, O-2g***	485661	11.15	0.82	0.89	0	0.45	0.59	485661	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	0	0.45	0.59	65.00	71	71	1269	1269	0.03	7.22	0.75	7	1.67	12.64	19.86	3.02	**15.3**	5.08	**33.7**
1-P	***N1, O-1, O-2a, O-2b, O-2c, O-2d, O-2e, O-2f, O-2g, P1***	1374056	31.54	0.82	0.89	0	0.45	0.59	1208616	0.90	0.96	0	0.53	0.68	0	0.19	0.52	165440	0.09	0.36	0	0.42	0.58	58.02	71	71	719	719	0.03	7.57	0.75	7	1.67	7.16	14.73	3.49	**46.5**	5.86	**108.4**
2-P	***N1, O-1, O-2a, O-2b, O-2c, O-2d, O-2e, O-2f, O-2g, P1***	1374056	31.54	0.82	0.89	0	0.45	0.59	0	0.90	0.96	0	0.53	0.68	0	0.19	0.52	0	0.09	0.36	1374056	0.09	0.36	2.00	71	71	719	719	0	11.23	1	7	1.67	7.16	18.38	3.14	**1.0**	5.28	**23.9**
3-P	***N1, O-1, O-2a, O-2b, O-2c, O-2d, O-2e, O-2f, O-2g, P1, P2***	1507449	34.61	0.82	0.89	0	0.45	0.59	123353	0.90	0.96	0	0.53	0.68	0	0.19	0.52	165440	0.09	0.36	1374056	0.14	0.43	7.91	71	71	719	719	0.03	10.67	0.75	7	1.67	7.16	17.83	3.19	**3.8**	5.36	**41.2**

Design Point Routing
West Fork Jimmy Camp Creek

StormCAD						
Design Point	Total Drainage Area	Surface		Storm Sewer		Downstream Design Point
		Q5	Q100	Q5	Q100	
1-OS	19.67	4.0	26.8	-	-	A
1-A	12.34	3.5	17.6	-	-	A
2-A	1.09	2.7	5.2	-	-	A
3-A	4.98	2.2	8.9	-	-	A
4-A	0.12	0.6	1.0	-	-	A
A	38.20	-	-	12.0	55.6	B
1-B	1.06	1.8	4.1	-	-	B
B	39.26	-	-	12.7	57.1	C
1-C	3.27	5.7	12.5	-	-	C
2-C	1.19	2.7	5.9	-	-	C
3-C	4.60	8.2	18.0	-	-	C
4-C	0.36	1.6	3.0	-	-	C
5-C	3.13	5.7	12.5	-	-	C
6-C	0.07	0.3	0.6	-	-	C
7-C	2.20	4.0	8.8	-	-	C
8-C	0.06	0.3	0.5	-	-	C
C	54.13	-	-	27.6	90.2	D
1-D	4.80	1.3	3.6	-	-	D
D	58.93			24.8	84.9	E
E-1a	3.53	1.2	4.7			D
E-1b	3.85	4.5	9.9	-	-	E
2-E	2.14	3.9	8.7	-	-	E
E	64.92	-	-	30.0	95.7	F
1-F	2.07	2.7	6.0			3-F
2-F	0.58	1.1	2.5			3-F
3-F	3.32	2.3	5.1	5.8	12.9	4-F
4-F	3.89	1.1	2.5	6.8	15.1	5-F
5-F	6.16	3.5	7.8	8.3	18.2	6-F
6-F	7.16	1.7	3.9	9.6	21.0	8-F
7-F	5.06	7.5	16.5	7.5	16.5	8-F
8-F	13.07	1.5	3.3	16.2	35.8	F
F	77.98	-	-	39.1	117.1	G
1-G	1.11	2.1	4.6	-	-	G
G	79.09	-	-	39.7	118.6	M
1-H	3.60	5.3	11.7	-	-	1-2 H
2-H	1.16	1.9	4.2	-	-	1-2 H
1-2 H	4.76	-	-	7.4	15.5	1-4 H
3-H	2.97	4.7	10.3	-	-	1-4 H
4-H	0.92	1.6	3.6	-	-	1-4 H
1-4 H	8.65	-	-	14.7	31.1	1-6 H
5-H	2.42	4.0	8.9	-	-	1-6 H
6-H	2.46	3.9	8.6	-	-	1-6 H
1-6 H	13.53	-	-	18.6	39.6	1-8 H
7-H	2.03	2.9	6.4	-	-	1-8 H
8-H	0.97	1.7	3.7	-	-	1-8 H
1-8 H	16.52	-	-	21.7	46.0	1-10 H
9a-H	1.95	2.3	5.7	-	-	
9b-H	0.38	0.6	1.4	2.8	6.5	10-H
10-H	1.33	2.4	5.2	-	-	1-10 H
1-10 H	20.17	-	-	25.3	59.6	11-H
11-H	3.42	5.0	11.0	-	-	H
H	23.59			32.4	76.2	M
1-I	3.13	5.6	12.4	-	-	K
2-I	0.59	1.9	3.8	-	-	K
K-OS	37.74			57.3	122.1	K
K	41.46	-	-	62.2	133.3	3-I
3-I	4.18	7.8	17.2	7.8	17.2	M
I	45.64	-	-	66.5	143.4	M
M	162.88	-	-	158.2	426.5	East Pond Discharge
East Pond Discharge SWMM Discharge (MDDPA-Matrix)	162.88	-	-	5.0	111.8	Existing Swale

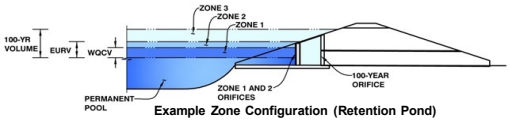
Note: Similarly to the approved MDDP and MDDPA, design point routing was performed in StormCAD and therefore no additional routing tables were included

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Trails at Aspen Ridge - Filing No. 5

Basin ID: East Pond: West Fork of Jimmy Camp Creek



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	162.88	acres	
Watershed Length =	3,742	ft	
Watershed Slope =	0.030	ft/ft	
Watershed Imperviousness =	37.10%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	87.0%	percent	
Percentage Hydrologic Soil Groups C/D =	13.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	2.335	acre-feet	
Excess Urban Runoff Volume (EURV) =	6.213	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	4.968	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	7.072	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	10.140	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	15.576	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	19.249	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	24.034	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.55 in.) =	38.026	acre-feet	3.55 inches
Approximate 2-yr Detention Volume =	4.644	acre-feet	
Approximate 5-yr Detention Volume =	6.643	acre-feet	
Approximate 10-yr Detention Volume =	9.023	acre-feet	
Approximate 25-yr Detention Volume =	10.151	acre-feet	
Approximate 50-yr Detention Volume =	10.654	acre-feet	
Approximate 100-yr Detention Volume =	12.355	acre-feet	

Optional User Override 1-hr Precipitation

Stage-Storage Calculation

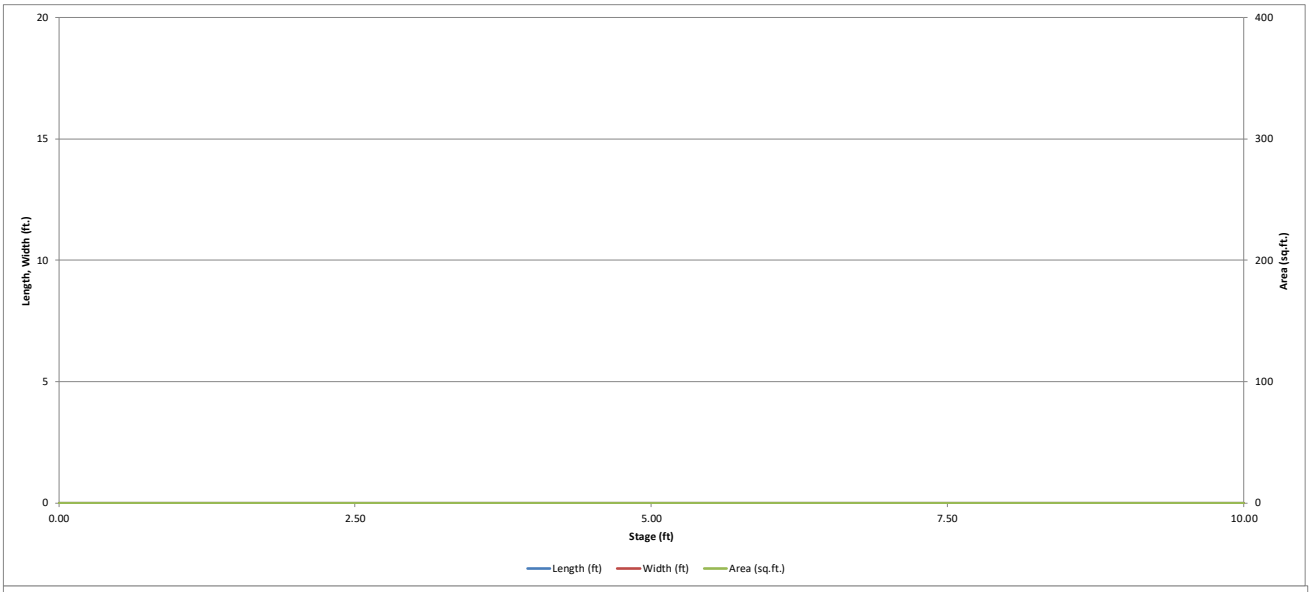
Zone 1 Volume (WQCV) =	2.335	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.878	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	6.141	acre-feet
Total Detention Basin Volume =	12.355	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

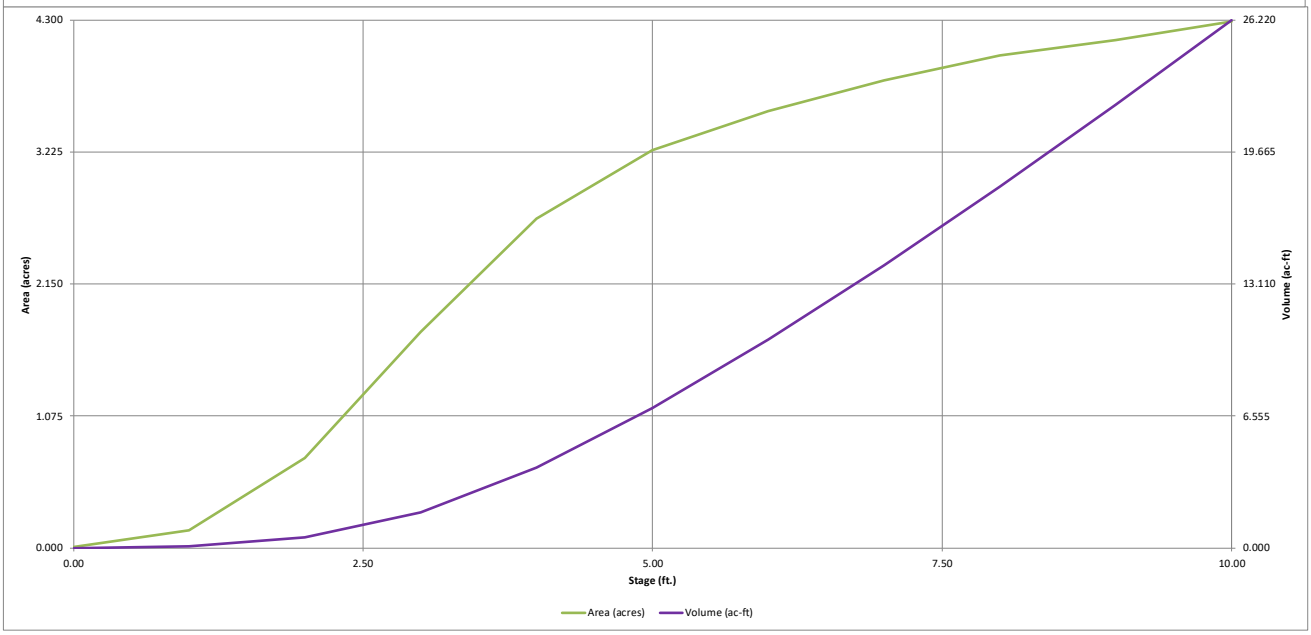
Depth Increment = 1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	443	0.010		
5817	--	1.00	--	--	--	6,211	0.143	3,265	0.075
5818	--	2.00	--	--	--	31,782	0.730	22,007	0.505
5819	--	3.00	--	--	--	76,551	1.757	76,490	1.756
5820	--	4.00	--	--	--	116,770	2.681	173,150	3.975
5821	--	5.00	--	--	--	141,034	3.238	302,052	6.934
5822	--	6.00	--	--	--	154,951	3.557	450,045	10.332
5823	--	7.00	--	--	--	165,754	3.805	610,397	14.013
5824	--	8.00	--	--	--	174,708	4.011	780,628	17.921
5825	--	9.00	--	--	--	180,233	4.138	958,098	21.995
5826	--	10.00	--	--	--	186,799	4.288	1,141,614	26.208

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



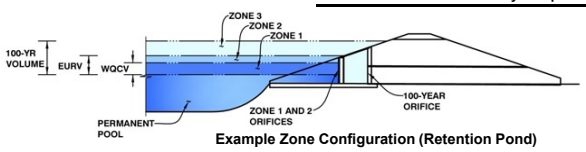


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Trails at Aspen Ridge - Filing No. 5

Basin ID: East Pond: West Fork of Jimmy Camp Creek



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.31	2.335	Orifice Plate
Zone 2 (EURV)	4.78	3.878	Rectangular Orifice
Zone 3 (100-year)	6.56	6.141	Weir&Pipe (Restrict)
		12.355	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area CHECK CELLS AB84:BE84	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.33	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.70	1.40	2.10	2.80			
Orifice Area (sq. inches)	4.10	4.20	4.20	4.20	4.30			

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	3.73	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	6.95	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	15.00	N/A	inches
Vertical Orifice Width =	24.00		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	2.50	N/A	ft^2
Vertical Orifice Centroid =	0.63	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.94	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	14.50	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	9.50	N/A	feet
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area
Debris Clogging % =	45%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.94	N/A	feet
Over Flow Weir Slope Length =	9.50	N/A	feet
Grate Open Area / 100-yr Orifice Area =	9.23	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	103.31	N/A	ft^2
Overflow Grate Open Area w/ Debris =	56.82	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	48.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	40.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	11.19	N/A	ft^2
Outlet Orifice Centroid =	1.80	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.30	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.08	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	136.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

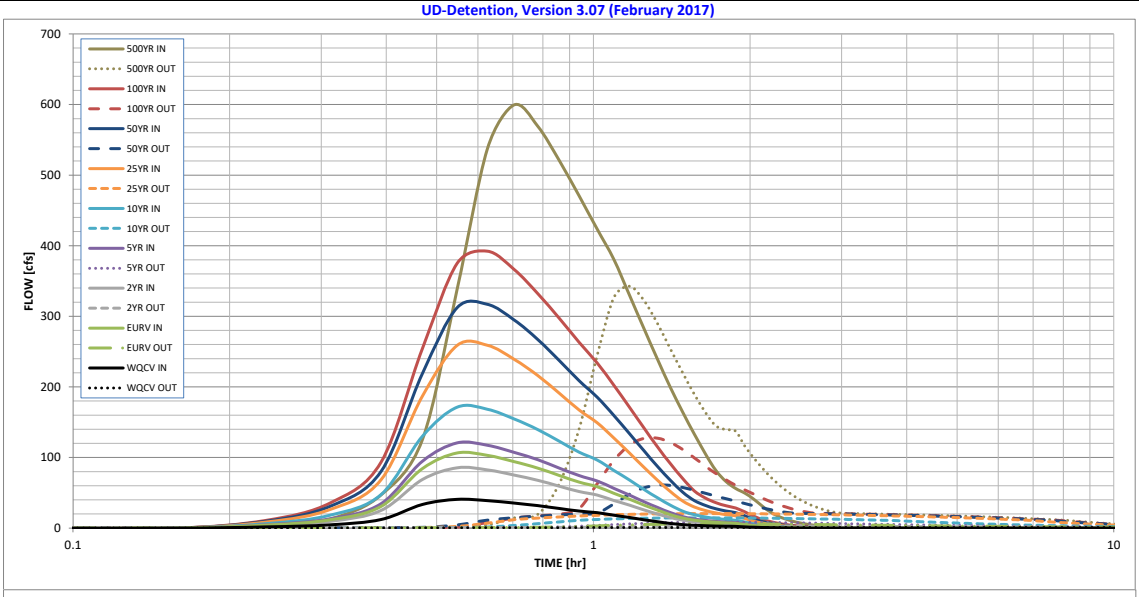
Spillway Design Flow Depth=	1.02	feet
Stage at Top of Freeboard =	10.10	feet
Basin Area at Top of Freeboard =	4.29	acres

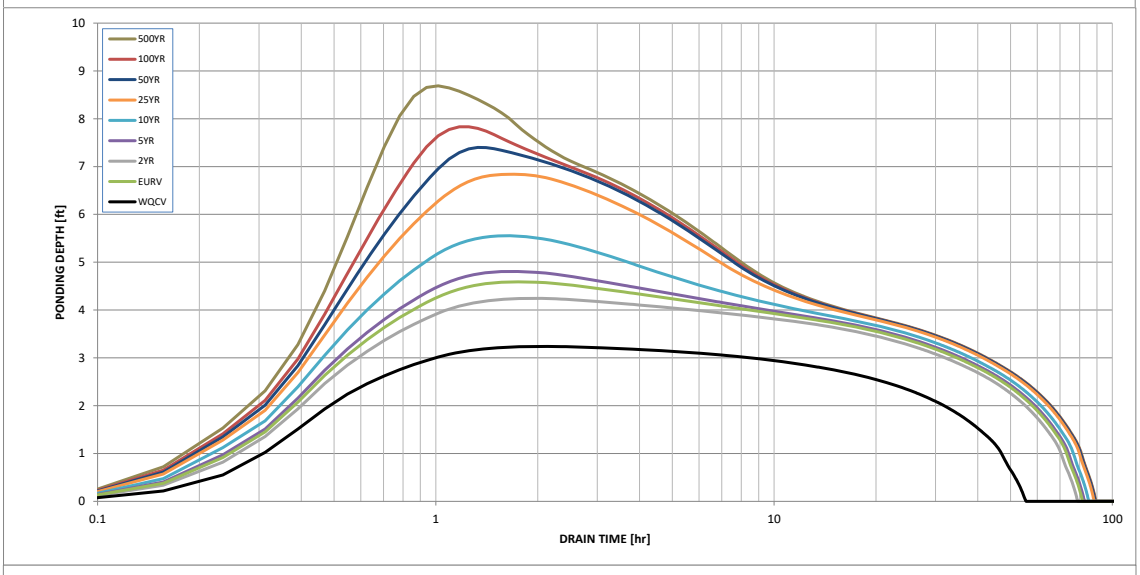
Routed Hydrograph Results

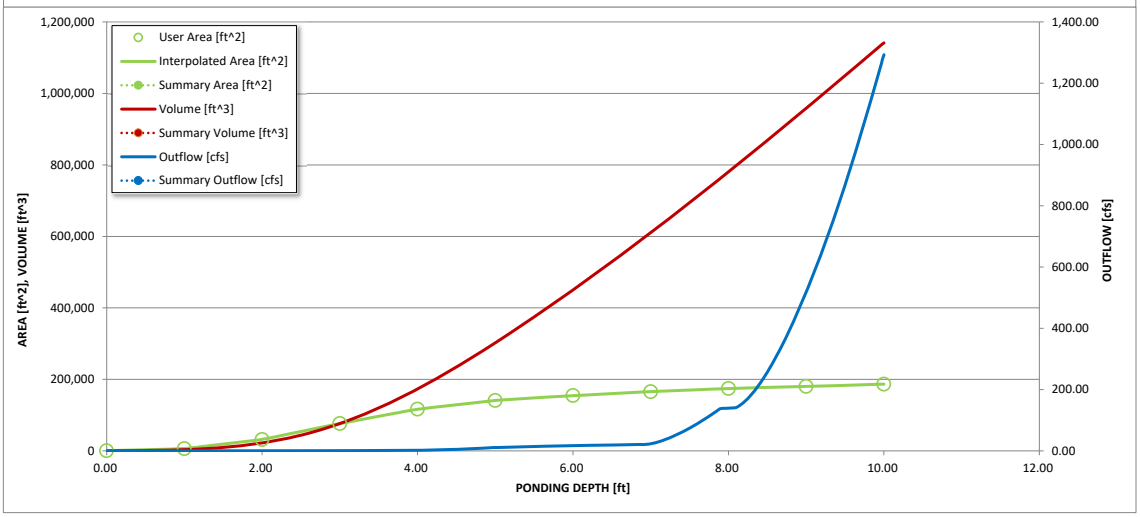
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.55
Calculated Runoff Volume (acre-ft) =	2.335	6.213	4.968	7.072	10.140	15.576	19.249	24.034	38.026
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	2.337	6.218	4.972	7.078	10.148	15.583	19.262	24.055	38.054
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.04	0.24	0.73	1.01	1.35	2.24
Predevelopment Peak Q (cfs) =	0.0	0.0	2.2	6.0	38.9	119.5	164.1	219.2	364.7
Peak Inflow Q (cfs) =	40.7	106.4	85.6	120.8	171.3	259.1	317.1	392.3	599.5
Peak Outflow Q (cfs) =	0.9	6.1	3.1	8.5	14.6	20.6	60.9	127.4	342.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.4	0.4	0.2	0.4	0.6	0.9
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	0.4	1.0	1.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	47	68	67	68	67	66	64	61	53
Time to Drain 99% of Inflow Volume (hours) =	**51**	74	72	75	75	76	75	74	69
Maximum Ponding Depth (ft) =	3.24	4.59	4.25	4.81	5.55	6.84	7.40	7.83	8.69
Area at Maximum Ponding Depth (acres) =	1.98	3.01	2.81	3.13	3.41	3.77	3.89	3.98	4.10
Maximum Volume Stored (acre-ft) =	2.204	5.654	4.634	6.298	8.763	13.407	15.551	17.242	20.677

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)





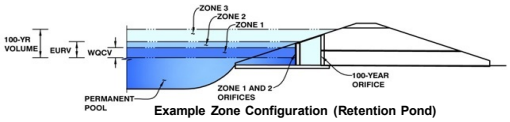


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Trails at Aspen Ridge

Basin ID: West Fork of Jimmy Camp Creek-East Pond. (Full Buildout with SWMM Hydrographs-PDR Amendment)



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	162.87	acres	
Watershed Length =	3,742	ft	
Watershed Slope =	0.030	ft/ft	
Watershed Imperviousness =	44.95%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	87.0%	percent	
Percentage Hydrologic Soil Groups C/D =	13.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	2.617	acre-feet	
Excess Urban Runoff Volume (EURV) =	7.644	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	6.222	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	8.686	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	11.929	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	17.163	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	20.779	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	25.490	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.55 in.) =	39.629	acre-feet	3.55 inches
Approximate 2-yr Detention Volume =	5.821	acre-feet	
Approximate 5-yr Detention Volume =	8.161	acre-feet	
Approximate 10-yr Detention Volume =	10.755	acre-feet	
Approximate 25-yr Detention Volume =	11.861	acre-feet	
Approximate 50-yr Detention Volume =	12.409	acre-feet	
Approximate 100-yr Detention Volume =	14.066	acre-feet	

Optional User Override 1-hr Precipitation

Stage-Storage Calculation

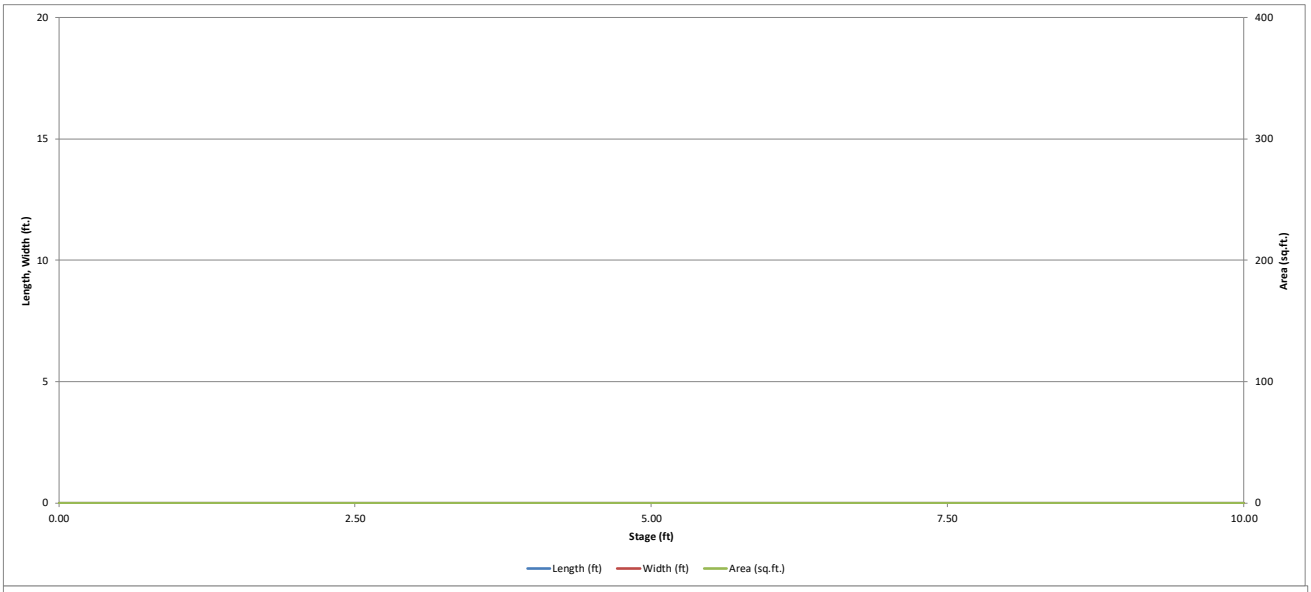
Zone 1 Volume (WQCV) =	2.617	acre-feet
Zone 2 Volume (EURV - Zone 1) =	5.027	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	6.422	acre-feet
Total Detention Basin Volume =	14.066	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

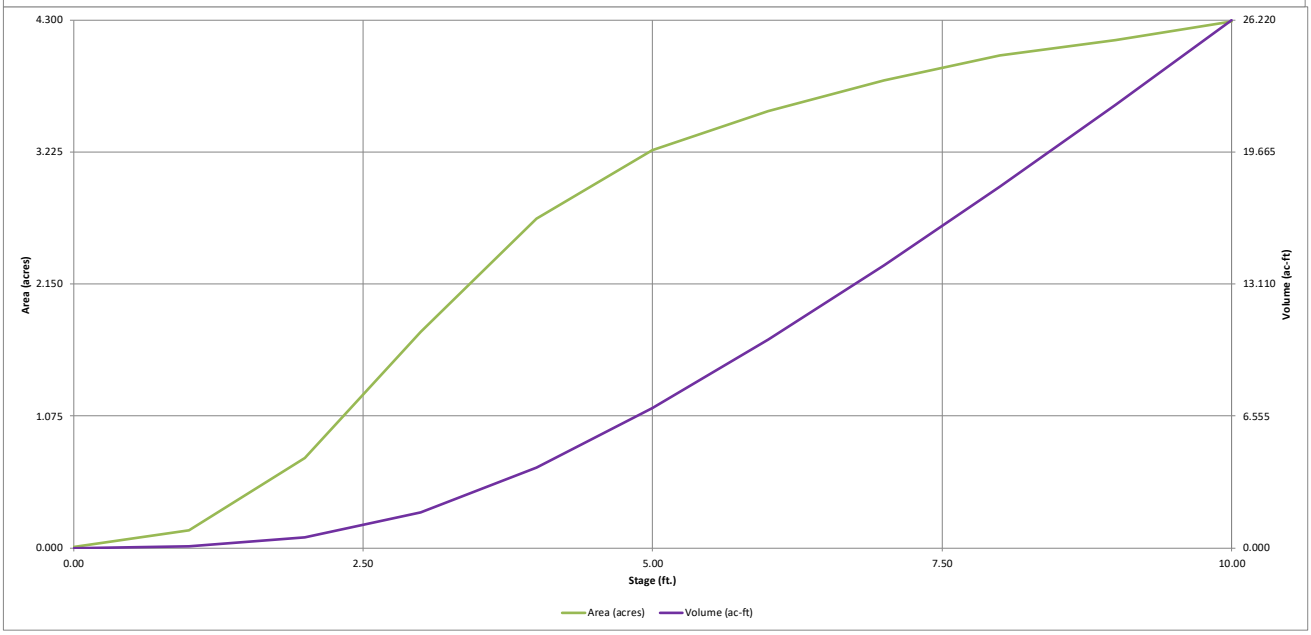
Depth Increment = 1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	443	0.010		
5817	--	1.00	--	--	--	6,211	0.143	3,265	0.075
5818	--	2.00	--	--	--	31,782	0.730	22,007	0.505
5819	--	3.00	--	--	--	76,551	1.757	76,490	1.756
5820	--	4.00	--	--	--	116,770	2.681	173,150	3.975
5821	--	5.00	--	--	--	141,034	3.238	302,052	6.934
5822	--	6.00	--	--	--	154,951	3.557	450,045	10.332
5823	--	7.00	--	--	--	165,754	3.805	610,397	14.013
5824	--	8.00	--	--	--	174,708	4.011	780,628	17.921
5825	--	9.00	--	--	--	180,233	4.138	958,098	21.995
5826	--	10.00	--	--	--	186,799	4.288	1,141,614	26.208

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



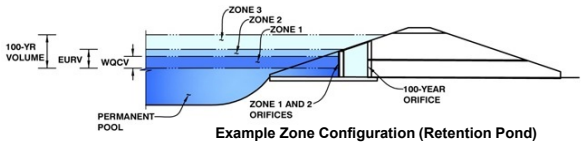


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Trails at Aspen Ridge

Basin ID: West Fork of Jimmy Camp Creek-East Pond. (Full Buildout with SWMM Hydrographs-PDR Amendment)



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.44	2.617	Orifice Plate
Zone 2 (EURV)	5.22	5.027	Rectangular Orifice
Zone 3 (100-year)	7.02	6.422	Weir&Pipe (Restrict)
		14.066	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area CHECK CELLS AB84:BE84	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.33	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00							
Orifice Area (sq. inches)	32.50							

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	5.22	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	6.95	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	14.00	N/A	inches
Vertical Orifice Width =	24.00		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	2.33	N/A	ft^2
Vertical Orifice Centroid =	0.58	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.94	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	14.50	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	9.50	N/A	feet
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area
Debris Clogging % =	45%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.94	N/A	feet
Over Flow Weir Slope Length =	9.50	N/A	feet
Grate Open Area / 100-yr Orifice Area =	9.23	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	103.31	N/A	ft^2
Overflow Grate Open Area w/ Debris =	56.82	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	48.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	40.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	11.19	N/A	ft^2
Outlet Orifice Centroid =	1.80	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.30	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.02	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	136.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

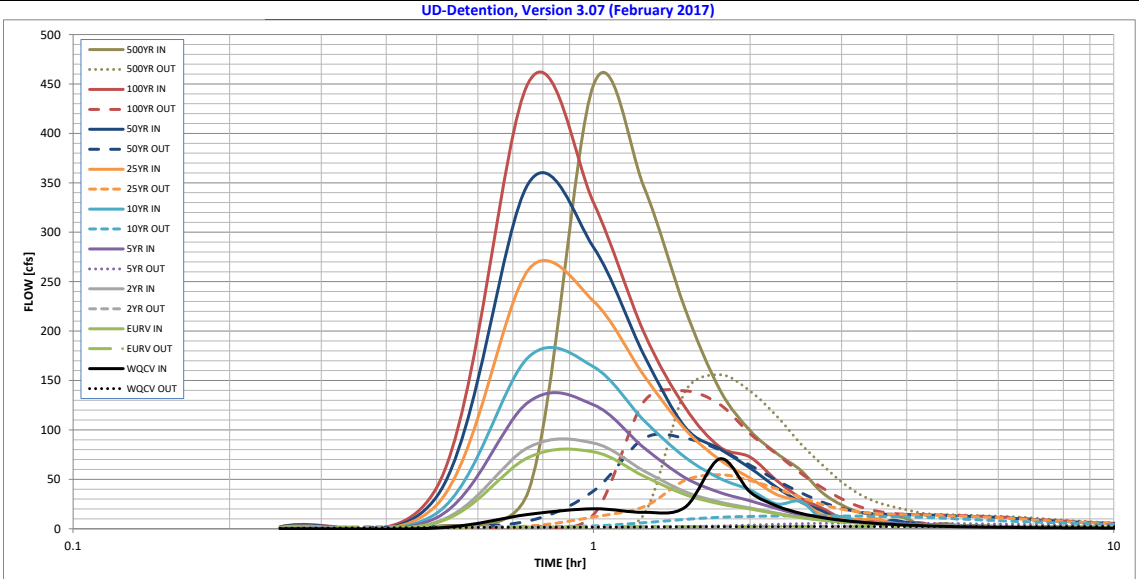
Spillway Design Flow Depth=	1.02	feet
Stage at Top of Freeboard =	10.04	feet
Basin Area at Top of Freeboard =	4.29	acres

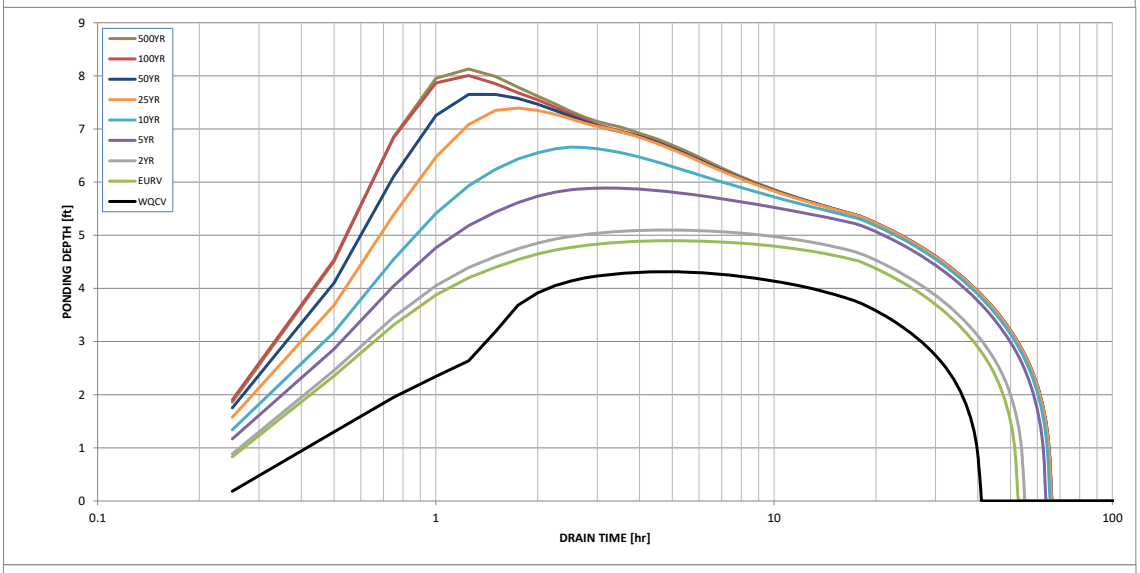
Routed Hydrograph Results

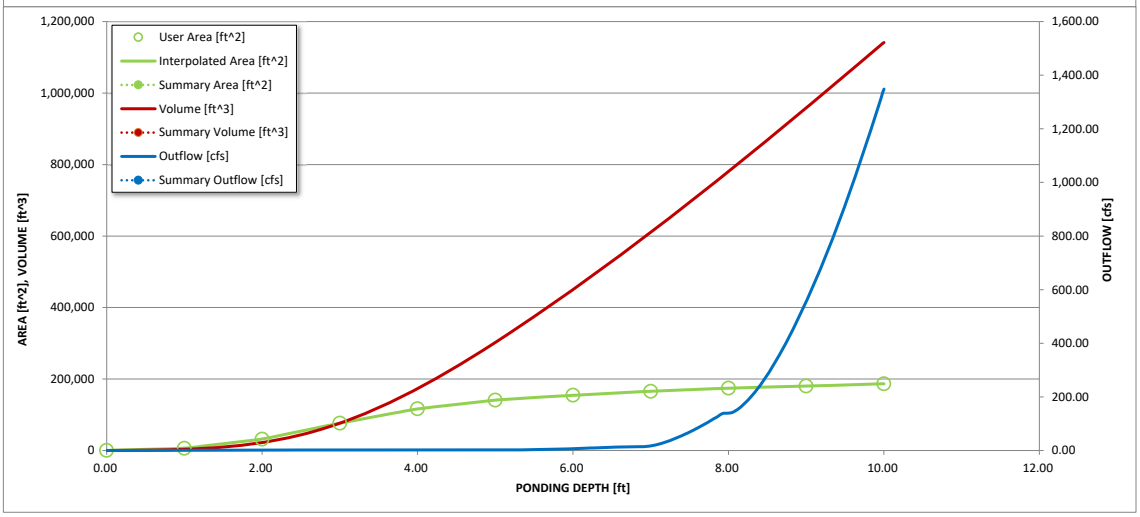
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.55
Calculated Runoff Volume (acre-ft) =	2.617	7.644	6.222	8.686	11.929	17.163	20.779	25.490	39.629
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	6.426	8.837	9.369	12.837	16.730	22.692	26.955	31.615	33.910
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.04	0.24	0.73	1.01	1.35	2.24
Predevelopment Peak Q (cfs) =	0.0	0.0	2.2	6.0	38.9	119.5	164.1	219.2	364.7
Peak Inflow Q (cfs) =	70.8	77.8	86.7	128.3	173.8	262.1	349.6	451.5	448.9
Peak Outflow Q (cfs) =	2.3	2.4	2.5	5.8	13.2	54.8	91.7	139.5	155.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.3	0.5	0.6	0.6	0.4
Structure Controlling Flow =	Plate	Plate	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.4	0.7	1.2	1.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	50	52	60	61	60	59	58	58
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	54	62	63	64	63	63	63
Maximum Ponding Depth (ft) =	4.32	4.90	5.10	5.89	6.66	7.40	7.65	8.01	8.13
Area at Maximum Ponding Depth (acres) =	2.85	3.18	3.27	3.52	3.72	3.89	3.94	4.01	4.03
Maximum Volume Stored (acre-ft) =	4.833	6.581	7.227	9.907	12.733	15.512	16.530	17.921	18.443

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

User-Defined	SOURCE	USER	USER	USER	USER	USER	USER	USER	USER	USER
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
15.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:15:00	0.05	0.16	0.20	0.50	0.84	1.46	1.96	1.98	2.59
Hydrograph	0:30:00	0.86	6.19	6.90	11.37	15.89	24.35	32.72	41.96	38.17
Constant	0:45:00	14.59	72.22	82.41	128.26	173.76	262.12	349.57	451.53	448.91
1.067	1:00:00	20.26	77.83	86.71	125.47	164.01	230.42	284.89	330.27	346.20
	1:15:00	16.66	53.21	58.69	82.08	109.73	155.23	176.00	198.88	222.45
	1:30:00	21.81	34.61	37.49	51.69	72.34	100.66	102.80	122.84	140.70
	1:45:00	70.78	25.32	27.05	36.78	50.97	69.72	80.85	82.80	99.35
	2:00:00	37.20	20.01	21.02	28.35	39.21	51.27	61.54	72.60	76.35
	2:15:00	23.23	15.22	15.91	20.49	25.16	34.72	41.92	48.89	59.38
	2:30:00	15.71	11.27	11.69	14.20	27.85	27.48	27.15	31.29	36.74
	2:45:00	11.39	8.76	9.00	11.68	10.26	14.46	18.19	20.89	24.07
	3:00:00	8.61	7.04	7.18	7.32	12.43	11.79	8.43	10.54	16.48
	3:15:00	6.74	5.83	5.91	6.76	6.67	9.19	9.45	6.82	14.94
	3:30:00	5.43	4.94	4.97	5.63	6.37	10.11	5.00	9.65	13.91
	3:45:00	4.47	4.28	4.28	4.80	5.66	5.64	8.57	4.66	10.21
	4:00:00	3.76	3.76	3.73	4.18	4.47	3.31	6.50	5.93	3.86
	4:15:00	3.21	3.35	3.31	3.69	3.92	4.26	4.80	6.20	4.43
	4:30:00	2.78	3.02	2.97	3.31	3.49	3.69	3.85	3.32	5.36
	4:45:00	2.44	2.76	2.70	3.00	3.14	3.30	3.41	3.48	3.59
	5:00:00	2.16	2.54	2.48	2.75	2.87	3.00	3.08	3.16	3.26
	5:15:00	1.94	2.36	2.29	2.55	2.65	2.75	2.82	2.88	2.96
	5:30:00	1.76	2.21	2.13	2.37	2.46	2.55	2.61	2.66	2.71
	5:45:00	1.60	2.08	1.93	2.23	2.31	2.38	2.43	2.48	2.50
	6:00:00	1.46	1.99	1.85	2.06	2.13	2.24	2.28	2.32	2.33
	6:15:00	1.44	1.98	2.27	1.97	2.04	2.09	2.24	2.33	2.32
	6:30:00	1.26	1.62	1.81	1.90	1.85	2.10	1.97	2.12	1.98
	6:45:00	1.20	2.07	1.45	1.86	1.56	1.94	2.21	1.58	1.95
	7:00:00	1.09	1.47	1.55	1.65	2.02	1.87	1.80	2.37	1.80
	7:15:00	1.05	1.79	1.45	1.80	1.76	1.81	1.72	1.59	1.71
	7:30:00	0.99	1.55	1.32	1.91	1.97	1.75	1.72	1.39	1.94
	7:45:00	0.95	1.50	1.35	1.34	1.83	1.48	1.66	1.65	1.63
	8:00:00	0.90	1.43	1.38	1.37	1.61	1.64	1.46	1.63	1.32
	8:15:00	0.86	1.54	1.37	1.42	1.41	1.56	1.87	1.32	1.43
	8:30:00	0.83	1.54	1.33	1.60	1.51	1.34	1.75	1.29	1.45
	8:45:00	0.80	1.32	1.14	1.61	1.36	1.51	1.64	1.47	1.45
	9:00:00	0.77	1.34	1.21	1.73	1.35	1.46	1.37	1.51	1.31
	9:15:00	0.75	1.36	1.02	1.35	1.46	1.59	1.66	1.65	1.50
	9:30:00	0.73	1.28	1.20	1.35	1.47	1.42	1.27	1.28	1.38
	9:45:00	0.71	1.23	1.15	1.16	1.41	1.34	1.47	1.33	1.35
	10:00:00	0.69	1.23	1.12	1.31	1.24	1.31	1.52	1.35	1.29
	10:15:00	0.67	1.21	1.10	1.27	1.13	1.24	1.39	1.47	1.37
	10:30:00	0.66	1.20	1.08	1.29	1.20	1.33	1.39	1.34	1.45
	10:45:00	0.64	1.18	1.06	1.15	1.29	1.23	1.44	1.25	1.17
	11:00:00	0.63	1.16	1.05	1.23	1.26	1.29	1.30	1.15	1.15
	11:15:00	0.61	1.14	1.03	1.19	1.24	1.24	1.29	1.30	1.10
	11:30:00	0.60	1.13	1.02	1.20	1.22	1.24	1.24	1.25	1.16
	11:45:00	0.59	1.12	1.00	1.18	1.21	1.23	1.23	1.23	1.16
	12:00:00	0.58	1.10	0.98	1.16	1.20	1.21	1.22	1.22	1.15
	12:15:00	0.57	1.09	0.97	1.15	1.18	1.20	1.20	1.21	1.13
	12:30:00	0.56	1.08	0.96	1.14	1.17	1.19	1.19	1.19	1.12
	12:45:00	0.56	1.07	0.94	1.13	1.16	1.17	1.18	1.18	1.11
	13:00:00	0.55	1.05	0.93	1.11	1.15	1.16	1.16	1.17	1.09
	13:15:00	0.54	1.04	0.92	1.10	1.13	1.15	1.15	1.16	1.08
	13:30:00	0.53	1.03	0.91	1.09	1.12	1.14	1.14	1.15	1.07
	13:45:00	0.53	1.02	0.89	1.08	1.11	1.13	1.13	1.14	1.06
	14:00:00	0.52	1.01	0.88	1.07	1.10	1.12	1.12	1.13	1.05
	14:15:00	0.52	1.00	0.87	1.06	1.09	1.11	1.11	1.12	1.04
	14:30:00	0.51	0.99	0.86	1.05	1.08	1.10	1.10	1.10	1.03
	14:45:00	0.51	0.98	0.85	1.04	1.07	1.09	1.09	1.09	1.02
	15:00:00	0.50	0.97	0.84	1.03	1.06	1.08	1.08	1.08	1.01
	15:15:00	0.50	0.96	0.83	1.02	1.06	1.07	1.07	1.07	1.00
	15:30:00	0.49	0.95	0.82	1.01	1.05	1.06	1.06	1.06	0.99
	15:45:00	0.49	0.95	0.82	1.01	1.04	1.05	1.06	1.05	0.98
	16:00:00	0.48	0.93	0.81	1.00	1.03	1.05	1.05	1.05	0.98
	16:15:00	0.48	0.92	0.80	0.99	1.02	1.04	1.04	1.04	0.97
	16:30:00	0.48	0.92	0.79	0.98	1.01	1.03	1.03	1.03	0.96
	16:45:00	0.47	0.91	0.78	0.97	1.01	1.02	1.02	1.02	0.95
	17:00:00	0.47	0.90	0.77	0.96	1.00	1.01	1.02	1.02	0.94
	17:15:00	0.47	0.89	0.76	0.96	0.99	1.01	1.01	1.01	0.94
	17:30:00	0.46	0.88	0.75	0.95	0.98	1.00	1.00	1.00	0.93
	17:45:00	0.46	0.88	0.74	0.94	0.97	0.99	0.99	0.99	0.92
	18:00:00	0.46	0.86	0.73	0.93	0.97	0.98	0.98	0.99	0.91

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

Designer: Jesse Sullivan
Company: Matrix Design Group
Date: March 17, 2022
Project: FDR: Trails at Aspen Ridge Filing No. 5 - East Pond
Location: El Paso County, CO

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.60	inches
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event	2.52	
Max Intensity for Optional User Defined Storm	2.51496		

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	Filing No. 1	Filing No. 2	Filing No. 3	Filing No. 4	Filing No. 5	TAR Future	Offsite							
Receiving Pervious Area Soil Type	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Clay Loam	Sandy Loam	Sandy Loam
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	49.763	17.614	18.328	9.090	9.000	17.919	41.161							
Directly Connected Impervious Area (DCIA, acres)	28.168	10.645	9.799	5.368	5.294	0.358	0.823							
Unconnected Impervious Area (UIA, acres)	0.000	0.000	0.000	0.000	0.000	0.000	0.000							
Receiving Pervious Area (RPA, acres)	0.000	0.000	0.000	0.000	0.000	0.000	0.000							
Separate Pervious Area (SPA, acres)	21.595	6.969	8.529	3.722	3.706	17.561	40.338							
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C	C	C	C	C	C	C	C	C	C	C	C	C
								MISSING INPUT	MISSING INPUT	MISSING INPUT	MISSING INPUT	MISSING INPUT	MISSING INPUT	MISSING INPUT

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	49.763	17.614	18.328	9.090	9.000	17.919	41.161							
Directly Connected Impervious Area (DCIA, %)	56.6%	60.4%	53.5%	59.1%	58.8%	2.0%	2.0%							
Unconnected Impervious Area (UIA, %)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%							
Receiving Pervious Area (RPA, %)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%							
Separate Pervious Area (SPA, %)	43.4%	39.6%	46.5%	41.0%	41.2%	98.0%	98.0%							
A_R (RPA / UIA)	0.000	0.000	0.000	0.000	0.000	0.000	0.000							
I_a Check	1.000	1.000	1.000	1.000	1.000	1.000	1.000							
f / I for WQCV Event:	1.7	1.7	1.7	1.7	1.7	1.7	1.7							
f / I for 5-Year Event:	0.5	0.5	0.5	0.5	0.5	0.5	0.5							
f / I for 100-Year Event:	0.3	0.3	0.3	0.3	0.3	0.3	0.3							
f / I for Optional User Defined Storm CUHP:	0.31	0.31	0.31	0.31	0.31	0.31	0.31							
IRF for WQCV Event:	1.00	1.00	1.00	1.00	1.00	1.00	1.00							
IRF for 5-Year Event:	1.00	1.00	1.00	1.00	1.00	1.00	1.00							
IRF for 100-Year Event:	1.00	1.00	1.00	1.00	1.00	1.00	1.00							
IRF for Optional User Defined Storm CUHP:	1.00	1.00	1.00	1.00	1.00	1.00	1.00							
Total Site Imperviousness: I_{total}	56.6%	60.4%	53.5%	59.1%	58.8%	2.0%	2.0%							
Effective Imperviousness for WQCV Event:	56.6%	60.4%	53.5%	59.1%	58.8%	2.0%	2.0%							
Effective Imperviousness for 5-Year Event:	56.6%	60.4%	53.5%	59.1%	58.8%	2.0%	2.0%							
Effective Imperviousness for 100-Year Event:	56.6%	60.4%	53.5%	59.1%	58.8%	2.0%	2.0%							
Effective Imperviousness for Optional User Defined Storm CUHP:	56.6%	60.4%	53.5%	59.1%	58.8%	2.0%	2.0%							

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%							
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A							
100-Year Event CREDIT**: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.0%	-22.4%	-9.7%							
User Defined CUHP CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%							

Total Site Imperviousness:	**37.1%**
Total Site Effective Imperviousness for WQCV Event:	**37.1%**
Total Site Effective Imperviousness for 5-Year Event:	**37.1%**
Total Site Effective Imperviousness for 100-Year Event:	**37.1%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	**37.1%**

Notes:

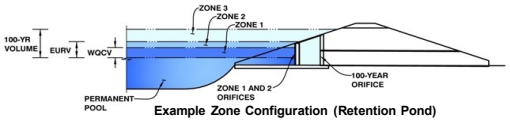
* Use Green-Ampt average infiltration rate values from Table 3-3.
** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Trails at Aspen Ridge - Filing No. 5

Basin ID: West Pond: Big Johnson Reservoir Basin



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	31.54	acres	
Watershed Length =	2,691	ft	
Watershed Slope =	0.020	ft/ft	
Watershed Imperviousness =	32.90%	percent	
Percentage Hydrologic Soil Group A =	8.6%	percent	
Percentage Hydrologic Soil Group B =	81.2%	percent	
Percentage Hydrologic Soil Groups C/D =	10.2%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.421	acre-feet	
Excess Urban Runoff Volume (EURV) =	1.059	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.825	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.179	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.724	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	2.736	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.438	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.352	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.55 in.) =	7.006	acre-feet	3.55 inches
Approximate 2-yr Detention Volume =	0.771	acre-feet	
Approximate 5-yr Detention Volume =	1.107	acre-feet	
Approximate 10-yr Detention Volume =	1.531	acre-feet	
Approximate 25-yr Detention Volume =	1.759	acre-feet	
Approximate 50-yr Detention Volume =	1.861	acre-feet	
Approximate 100-yr Detention Volume =	2.190	acre-feet	

Optional User Override 1-hr Precipitation

Stage-Storage Calculation

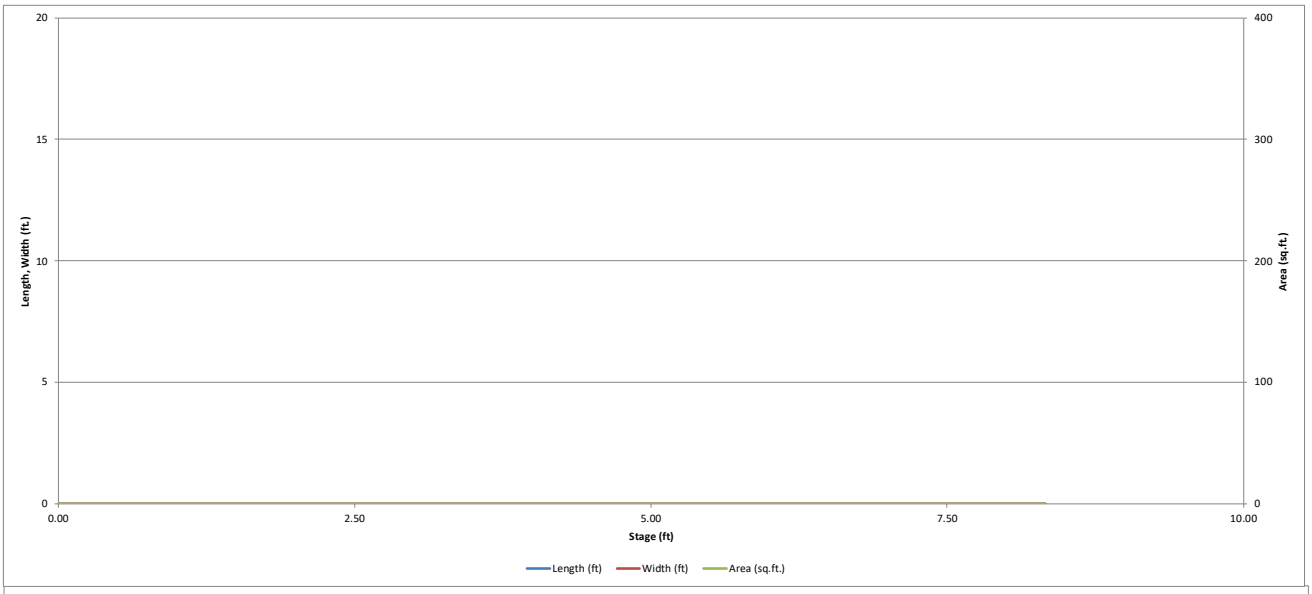
Zone 1 Volume (WQCV) =	0.421	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.638	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.130	acre-feet
Total Detention Basin Volume =	2.190	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

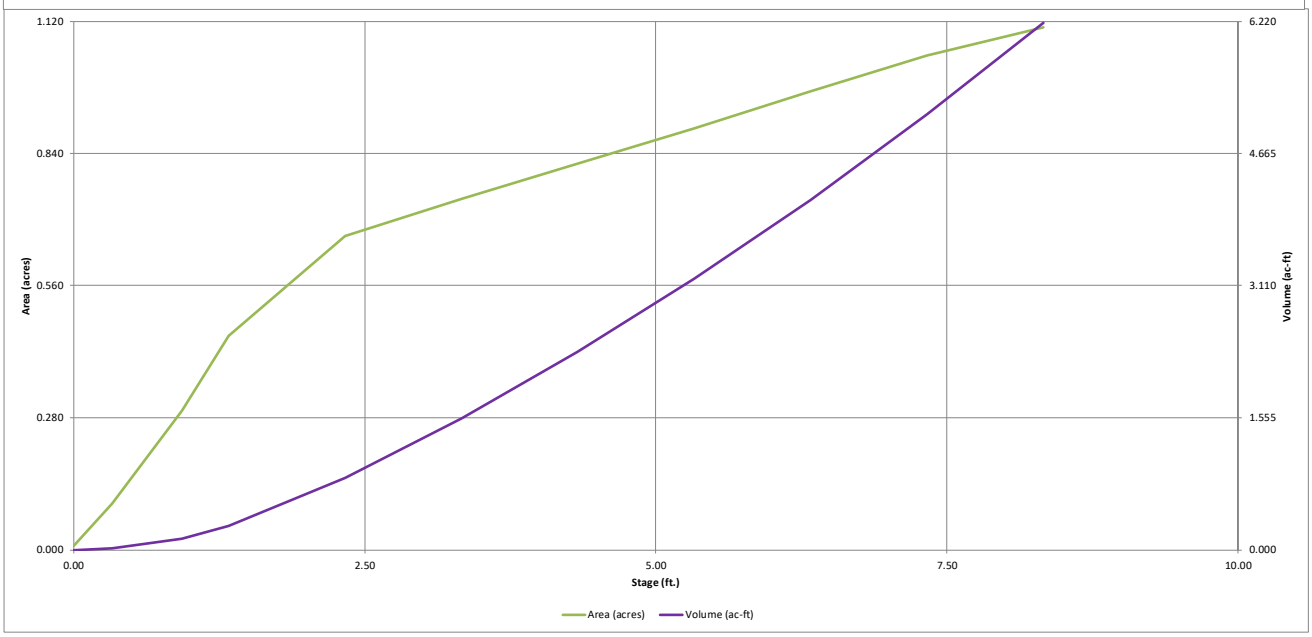
Depth Increment = 0.5 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	408	0.009		
5868	--	0.33	--	--	--	4,269	0.098	729	0.017
5868.6	--	0.93	--	--	--	12,845	0.295	5,778	0.133
5869	--	1.33	--	--	--	19,776	0.454	12,233	0.281
5870	--	2.33	--	--	--	28,956	0.665	36,796	0.845
5871	--	3.33	--	--	--	32,409	0.744	67,478	1.549
5872	--	4.33	--	--	--	35,683	0.819	101,524	2.331
5873	--	5.33	--	--	--	38,914	0.893	138,823	3.187
5874	--	6.33	--	--	--	42,330	0.972	179,445	4.119
5875	--	7.33	--	--	--	45,627	1.047	223,423	5.129
5876	--	8.33	--	--	--	48,281	1.108	270,377	6.207

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



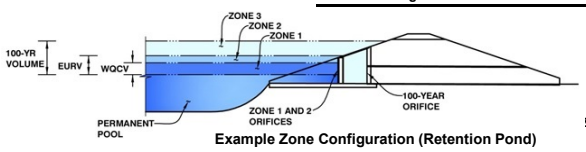


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Trails at Aspen Ridge - Filing No. 5

Basin ID: West Pond: Big Johnson Reservoir Basin



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.62	0.421	Orifice Plate
Zone 2 (EURV)	2.65	0.638	Orifice Plate
Zone 3 (100-year)	4.16	1.130	Weir&Pipe (Restrict)
		2.190	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.15	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	2.53	3.00	4.10			
Orifice Area (sq. inches)	3.00	4.01	2.50	2.50	181.00			

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.36	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.36	N/A	feet
Overflow Weir Front Edge Length =	6.00	N/A	feet	Over Flow Weir Slope Length =	4.12	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	6.69	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	21.03	N/A	ft^2
Overflow Grate Open Area % =	85%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	21.03	N/A	ft^2
Debris Clogging % =	0%	N/A	%				

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.14	N/A	ft^2
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	1.00	N/A	feet
Restrictor Plate Height Above Pipe Invert =	24.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.93	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.66	feet
Spillway Crest Length =	30.00	feet	Stage at Top of Freeboard =	7.59	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.06	acres
Freeboard above Max Water Surface =	1.00	feet			

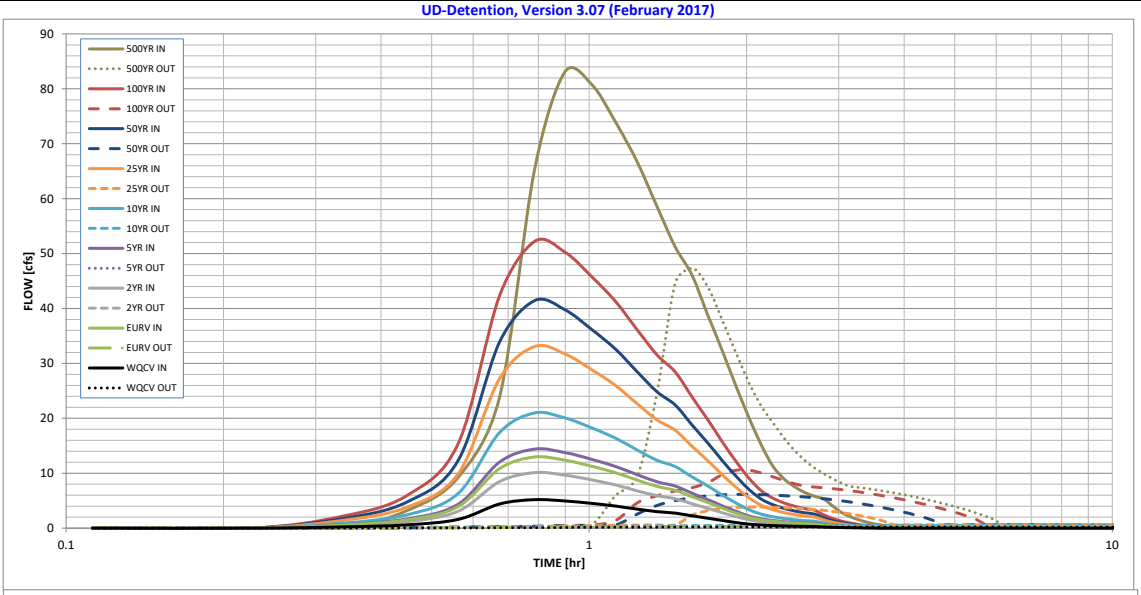
Calculated Parameters for Spillway

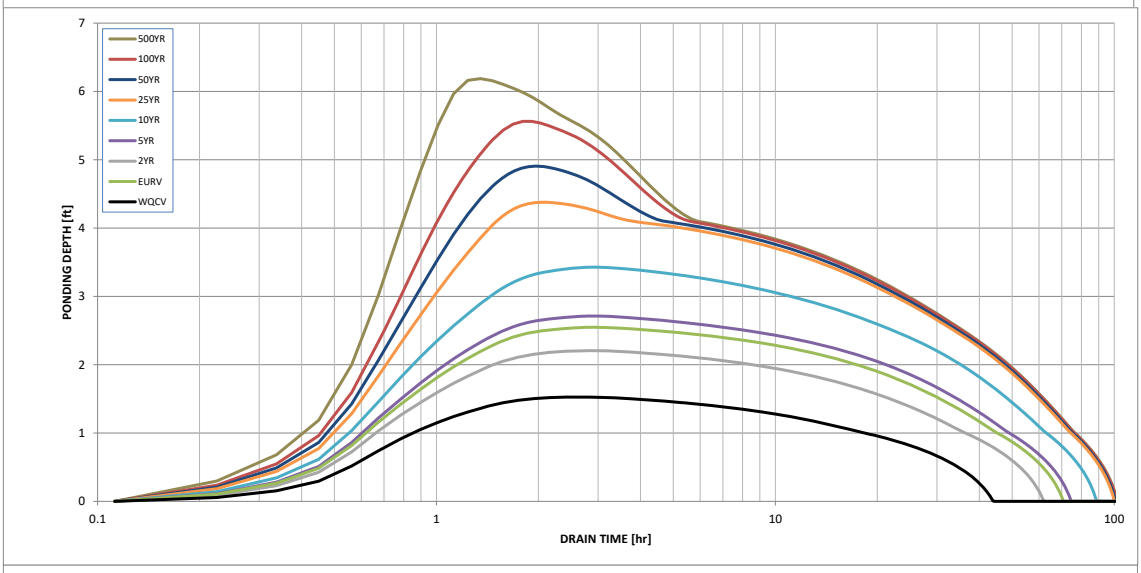
Routed Hydrograph Results

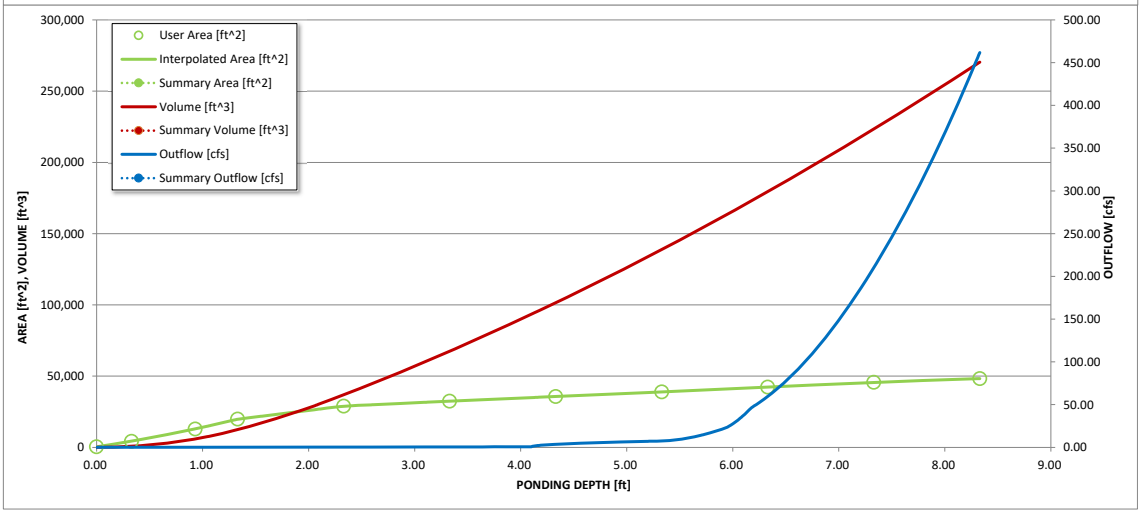
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.55
Calculated Runoff Volume (acre-ft) =	0.421	1.059	0.825	1.179	1.724	2.736	3.438	4.352	7.006
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.420	1.058	0.824	1.178	1.722	2.735	3.436	4.349	6.998
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.13	0.43	0.61	0.84	1.43
Predevelopment Peak Q (cfs) =	0.0	0.0	0.2	0.6	4.1	13.7	19.2	26.4	45.2
Peak Inflow Q (cfs) =	5.2	13.0	10.1	14.4	21.0	33.1	41.4	52.2	83.1
Peak Outflow Q (cfs) =	0.2	0.3	0.3	0.4	0.5	3.9	6.2	10.6	47.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.1	0.3	0.3	0.4	1.0
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Overflow Grate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1	1.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	40	63	55	66	77	84	82	80	72
Time to Drain 99% of Inflow Volume (hours) =	**42**	67	59	71	84	93	93	92	88
Maximum Ponding Depth (ft) =	1.53	2.55	2.21	2.71	3.43	4.38	4.90	5.56	6.19
Area at Maximum Ponding Depth (acres) =	0.49	0.68	0.64	0.69	0.75	0.82	0.86	0.91	0.96
Maximum Volume Stored (acre-ft) =	0.375	0.986	0.760	1.103	1.616	2.364	2.810	3.394	3.975

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)





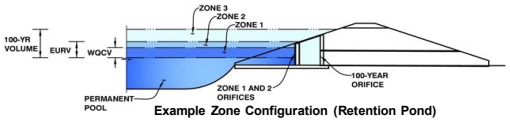


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Trails at Aspen Ridge - MDDPA and PDR (FULL BUILDOUT)

Basin ID: West Pond: Big Johnson Reservoir Basin



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	31.54	acres	
Watershed Length =	2,691	ft	
Watershed Slope =	0.020	ft/ft	
Watershed Imperviousness =	58.02%	percent	
Percentage Hydrologic Soil Group A =	8.6%	percent	
Percentage Hydrologic Soil Group B =	81.2%	percent	
Percentage Hydrologic Soil Groups C/D =	10.2%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.604	acre-feet	
Excess Urban Runoff Volume (EURV) =	1.975	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	1.614	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.189	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.844	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	3.758	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	4.436	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	5.311	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.55 in.) =	8.072	acre-feet	3.55 inches
Approximate 2-yr Detention Volume =	1.513	acre-feet	
Approximate 5-yr Detention Volume =	2.058	acre-feet	
Approximate 10-yr Detention Volume =	2.616	acre-feet	
Approximate 25-yr Detention Volume =	2.857	acre-feet	
Approximate 50-yr Detention Volume =	2.992	acre-feet	
Approximate 100-yr Detention Volume =	3.288	acre-feet	

Optional User Override 1-hr Precipitation

Stage-Storage Calculation

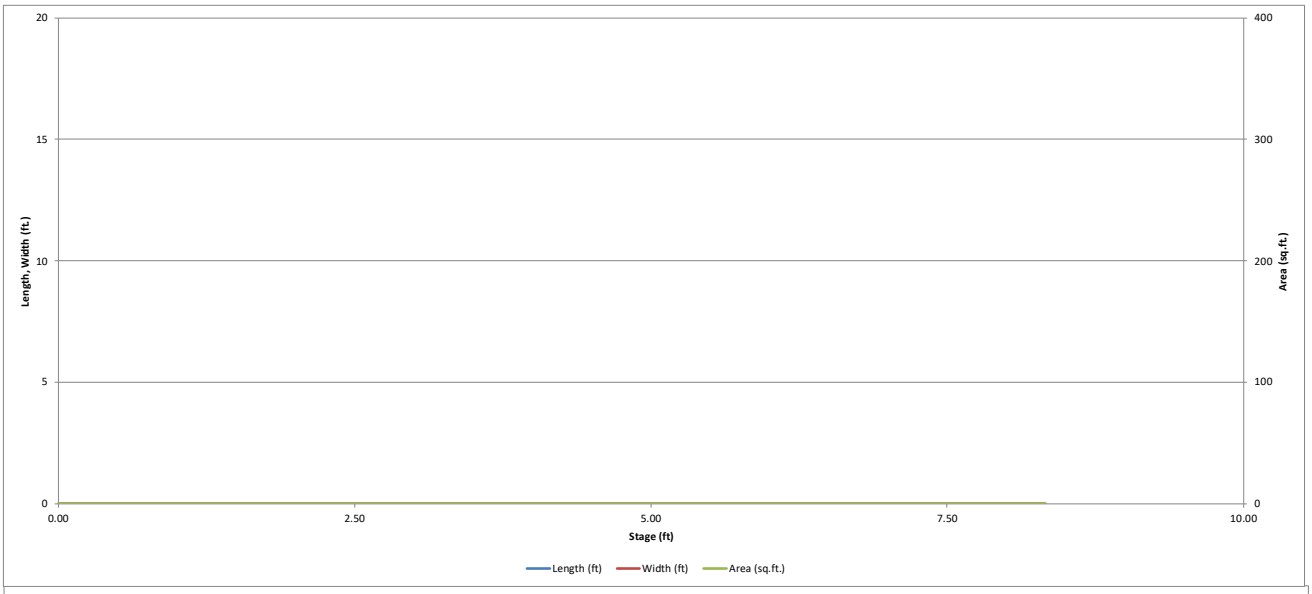
Zone 1 Volume (WQCV) =	0.604	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.372	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.312	acre-feet
Total Detention Basin Volume =	3.288	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

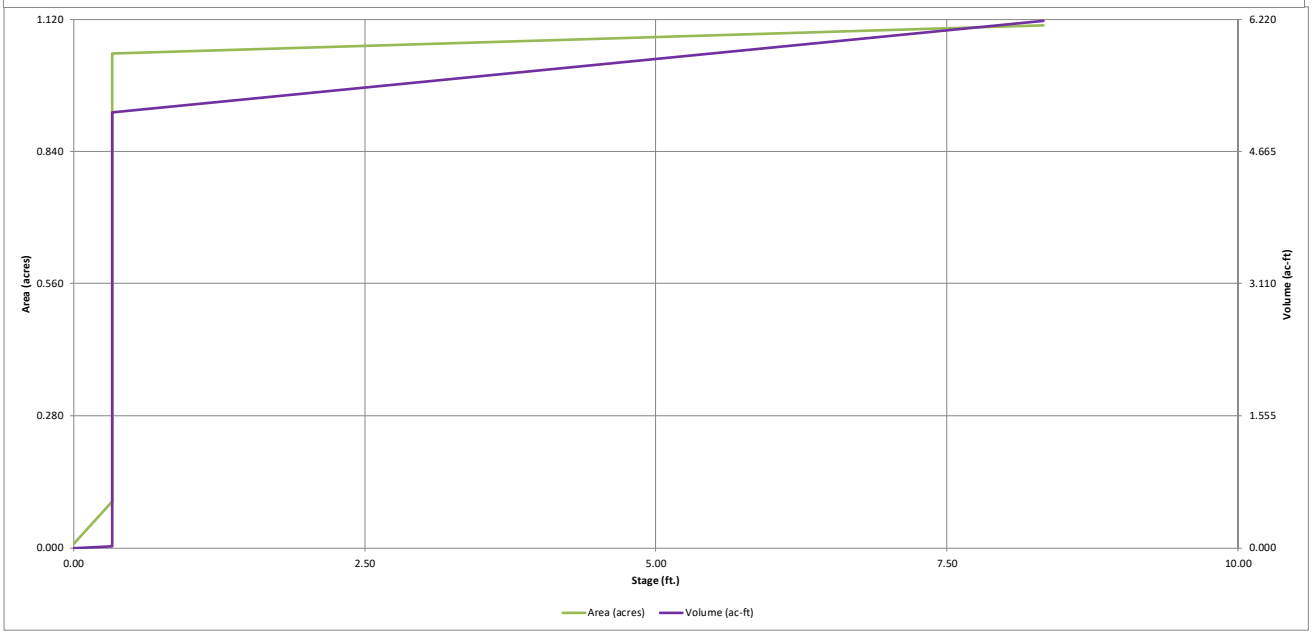
Depth Increment = 0.5 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	408	0.009		
5868	--	0.33	--	--	--	4,269	0.098	729	0.017
5868.6	--	0.93	--	--	--	12,845	0.295	5,906	0.136
5869	--	1.33	--	--	--	19,776	0.454	12,233	0.281
5870	--	2.33	--	--	--	28,956	0.665	36,796	0.845
5871	--	3.33	--	--	--	32,409	0.744	67,478	1.549
5872	--	4.33	--	--	--	35,683	0.819	101,525	2.331
5873	--	5.33	--	--	--	38,914	0.893	138,823	3.187
5874	--	6.33	--	--	--	42,330	0.972	179,445	4.119
5875	--	7.33	--	--	--	45,627	1.047	223,424	5.129
5876	--	8.33	--	--	--	48,281	1.108	270,378	6.207

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



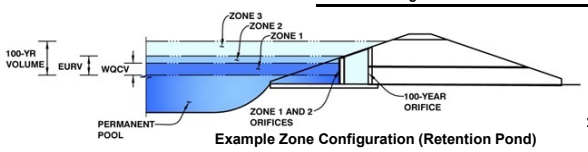


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Trails at Aspen Ridge - MDDPA and PDR (FULL BUILDOUT)

Basin ID: West Pond: Big Johnson Reservoir Basin



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.95	0.604	Orifice Plate
Zone 2 (EURV)	3.89	1.372	Orifice Plate
Zone 3 (100-year)	5.45	1.312	Weir&Pipe (Restrict)
		3.288	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.15	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	2.53	3.00	4.10			
Orifice Area (sq. inches)	4.00	4.01	2.50	2.50	181.00			

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected		Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected		Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.36	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.36	N/A	feet
Overflow Weir Front Edge Length =	6.00	N/A	feet	Over Flow Weir Slope Length =	4.12	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	6.69	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	21.03	N/A	ft^2
Overflow Grate Open Area % =	85%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	21.03	N/A	ft^2
Debris Clogging % =	0%	N/A	%				

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected		Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.14	N/A	ft^2
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	1.00	N/A	feet
Restrictor Plate Height Above Pipe Invert =	24.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.93	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.93	feet
Spillway Crest Length =	30.00	feet	Stage at Top of Freeboard =	7.86	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.08	acres
Freeboard above Max Water Surface =	1.00	feet			

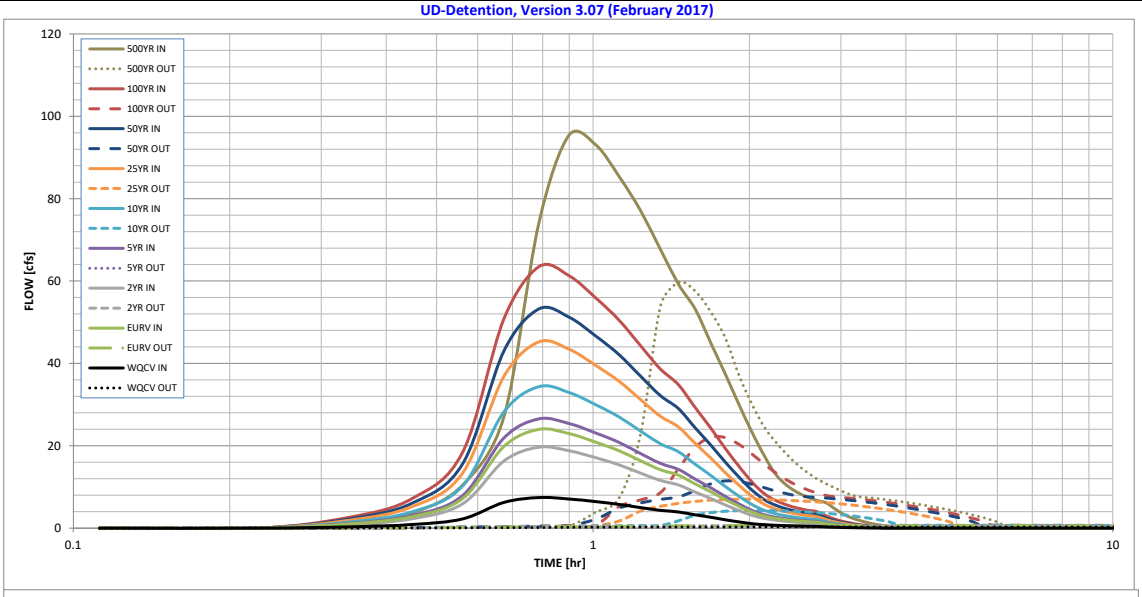
Calculated Parameters for Spillway

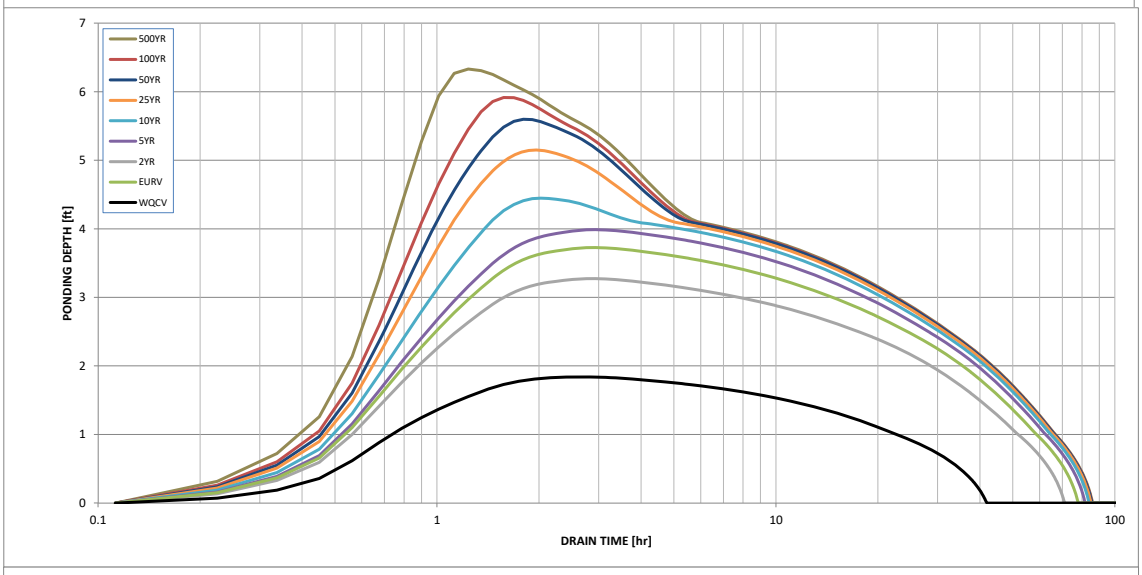
Routed Hydrograph Results

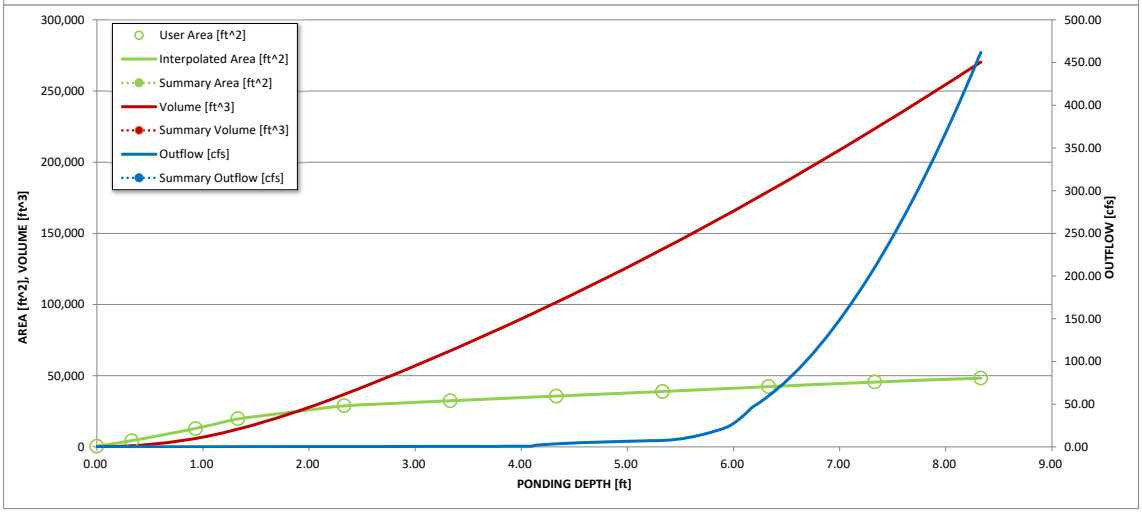
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.55
Calculated Runoff Volume (acre-ft) =	0.604	1.975	1.614	2.189	2.844	3.758	4.436	5.311	8.072
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.603	1.974	1.614	2.187	2.842	3.756	4.434	5.309	8.065
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.13	0.43	0.61	0.84	1.43
Predevelopment Peak Q (cfs) =	0.000	0.000	0.244	0.634	4.098	13.681	19.153	26.432	45.2
Peak Inflow Q (cfs) =	7.436	23.992	19.665	26.547	34.374	45.239	53.219	63.476	95.4
Peak Outflow Q (cfs) =	0.305	0.642	0.560	0.683	4.322	7.032	11.487	22.082	59.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.077	1.055	0.514	0.600	0.835	1.3
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	0.2	0.6	1.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	69	63	72	72	70	69	66	61
Time to Drain 99% of Inflow Volume (hours) =	**40**	74	67	77	78	78	78	77	74
Maximum Ponding Depth (ft) =	1.84	3.73	3.27	3.99	4.45	5.15	5.60	5.92	6.33
Area at Maximum Ponding Depth (acres) =	0.56	0.77	0.74	0.79	0.83	0.88	0.91	0.94	0.97
Maximum Volume Stored (acre-ft) =	0.544	1.845	1.505	2.049	2.421	3.019	3.422	3.718	4.119

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

Designer: Jesse Sullivan
Company: Matrix Design Group
Date: March 17, 2022
Project: FDR: Trails at Aspen Ridge Filing No. 3-West Pond
Location: El Paso County, CO

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.60	inches
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event	2.52	
Max Intensity for Optional User Defined Storm	2.51496		

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	O-1	O-2	O-2a	O-2b	O-2c	O-2d	O-2e	O-2f	O-2g	N-1	N-2 to N-6	P1		
Receiving Pervious Area Soil Type	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Clay Loam	Clay Loam	Sandy Loam	Sandy Loam	Sandy Loam
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	1.626	2.974	1.134	0.567	1.051	0.599	0.508	0.653	2.038	0.761	13.004	6.630		
Directly Connected Impervious Area (DCIA, acres)	1.057	1.933	0.737	0.368	0.683	0.389	0.330	0.424	1.324	0.495	0.523	2.107		
Unconnected Impervious Area (UIA, acres)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
Receiving Pervious Area (RPA, acres)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
Separate Pervious Area (SPA, acres)	0.569	1.041	0.397	0.198	0.368	0.210	0.178	0.229	0.713	0.266	12.482	4.523		
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C	C	C	C	C	C	C	C	C	C	C	C	C
													MISSING INPUT	MISSING INPUT

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	1.626	2.974	1.134	0.567	1.051	0.599	0.508	0.653	2.038	0.761	13.004	6.630		
Directly Connected Impervious Area (DCIA, %)	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	4.0%	31.8%		
Unconnected Impervious Area (UIA, %)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
Receiving Pervious Area (RPA, %)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
Separate Pervious Area (SPA, %)	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%	96.0%	68.2%		
A_R (RPA / UIA)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
I_a Check	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		
f / I for WQCV Event:	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	0.4	0.4	1.7		
f / I for 5-Year Event:	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2	0.2	0.5		
f / I for 100-Year Event:	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.3		
f / I for Optional User Defined Storm CUHP:	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.12	0.12	0.31		
IRF for WQCV Event:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
IRF for 5-Year Event:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
IRF for 100-Year Event:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
IRF for Optional User Defined Storm CUHP:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Total Site Imperviousness: I_{total}	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	4.0%	31.8%		
Effective Imperviousness for WQCV Event:	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	4.0%	31.8%		
Effective Imperviousness for 5-Year Event:	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	4.0%	31.8%		
Effective Imperviousness for 100-Year Event:	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	4.0%	31.8%		
Effective Imperviousness for Optional User Defined Storm CUHP:	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	4.0%	31.8%		

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
100-Year Event CREDIT**: Reduce Detention By:	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%		
User Defined CUHP CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		

Total Site Imperviousness:	**32.9%**
Total Site Effective Imperviousness for WQCV Event:	**32.9%**
Total Site Effective Imperviousness for 5-Year Event:	**32.9%**
Total Site Effective Imperviousness for 100-Year Event:	**32.9%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	**32.9%**

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.
** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

APPENDIX B

STANDARD DESIGN CHARTS AND TABLES

El Paso County Drainage Basin Fees

Resolution No. 20-424

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2021 Drainage Fee (per Impervious Acre)	2021 Bridge Fee (per Impervious Acre)
Drainage Basins with DBPS's:					
CHMS0200	Chico Creek	2013	Haegler Ranch	$11,113	$1,640
CHWS1200	Chico Creek	2001	Bennett Ranch	$12,441	$4,772
CHWS1400	Chico Creek	2013	Falcon	$31,885	$4,380
FOFO2000	Fountain Creek	2001	West Fork Jimmy Camp Creek	$13,524	$4,001
FOFO2600	Fountain Creek	1991*	Big Johnson / Crews Gulch	$19,752	$2,551
FOFO2800	Fountain Creek	1988*	Widefield	$19,752	$0
FOFO2900	Fountain Creek	1988*	Security	$19,752	$0
FOFO3000	Fountain Creek	1991*	Windmill Gulch	$19,752	$296
FOFO3100 / FOFO3200	Fountain Creek	1988*	Carson Street / Little Johnson	$12,048	$0
FOFO3400	Fountain Creek	1984*	Peterson Field	$14,246	$1,080
FOFO3600	Fountain Creek	1991*	Fisher's Canyon	$19,752	$0
FOFO4000	Fountain Creek	1996	Sand Creek	$20,387	$8,339
FOFO4200	Fountain Creek	1977	Spring Creek	$10,244	$0
FOFO4600	Fountain Creek	1984*	Southwest Area	$19,752	$0
FOFO4800	Fountain Creek	1991	Bear Creek	$19,752	$1,080
FOFO5400	Fountain Creek	1977	21st Street	$5,942	$0
FOFO5600	Fountain Creek	1964	19th Street	$3,887	$0
FOFO5800	Fountain Creek	1964	Camp Creek	$2,189	$0
FOMO0400	Monument Creek	1986*	Mesa	$10,331	$0
FOMO1000	Monument Creek	1981	Douglas Creek	$12,421	$274
FOMO1200	Monument Creek	1977	Templeton Gap	$12,752	$296
FOMO1400	Monument Creek	1976	Pope's Bluff	$3,956	$675
FOMO1600	Monument Creek	1976	South Rockrimmon	$4,643	$0
FOMO1800	Monument Creek	1973	North Rockrimmon	$5,942	$0
FOMO2000	Monument Creek	1971	Pulpit Rock	$6,549	$0
FOMO2200	Monument Creek	1994	Cottonwood Creek / S. Pine	$19,752	$1,080
FOMO2400	Monument Creek	1966	Dry Creek	$15,592	$565
FOMO3600	Monument Creek	1989*	Black Squirrel Creek	$8,968	$565
FOMO3700	Monument Creek	1987*	Middle Tributary	$16,482	$0
FOMO3800	Monument Creek	1987*	Monument Branch	$19,752	$0
FOMO4000	Monument Creek	1996	Smith Creek	$8,052	$1,080
FOMO4200	Monument Creek	1989*	Black Forest	$19,752	$538
FOMO5200	Monument Creek	1993*	Dirty Woman Creek	$19,752	$1,080
FOMO5300	Fountain Creek	1993*	Crystal Creek	$19,752	$1,080
Miscellaneous Drainage Basins: [1]					
CHBS0800	Chico Creek		Book Ranch	$18,533	$2,683
CHEC0400	Chico Creek		Upper East Chico	$10,097	$293
CHWS0200	Chico Creek		Telephone Exchange	$11,093	$260
CHWS0400	Chico Creek		Livestock Company	$18,273	$217
CHWS0600	Chico Creek		West Squirrel	$9,525	$3,953
CHWS0800	Chico Creek		Solberg Ranch	$19,752	$0
FOFO1200	Fountain Creek		Crooked Canyon	$5,963	$0
FOFO1400	Fountain Creek		Calhan Reservoir	$4,979	$290
FOFO1600	Fountain Creek		Sand Canyon	$3,597	$0
FOFO2000	Fountain Creek		Jimmy Camp Creek[3]	$19,752	$924
FOFO2200	Fountain Creek		Fort Carson	$15,592	$565
FOFO2700	Fountain Creek		West Little Johnson	$1,301	$0
FOFO3800	Fountain Creek		Stratton	$9,474	$424
FOFO5000	Fountain Creek		Midland	$15,592	$565
FOFO6000	Fountain Creek		Palmer Trail	$15,592	$565
FOFO6800	Fountain Creek		Black Canyon	$15,592	$565
FOMO4600	Monument Creek		Beaver Creek	$11,808	$0
FOMO3000	Monument Creek		Kettle Creek	$10,666	$0
FOMO3400	Monument Creek		Elkhorn	$1,792	$0
FOMO5000	Monument Creek		Monument Rock	$8,561	$0
FOMO5400	Monument Creek		Palmer Lake	$13,689	$0
FOMO5600	Monument Creek		Raspberry Mountain	$4,605	$0
PLPL0200	Monument Creek		Bald Mountain	$9,813	$0
Interim Drainage Basins: [2]					
FOFO1800	Fountain Creek		Little Fountain Creek	$2,525	$0
FOMO4400	Monument Creek		Jackson Creek	$7,818	$0
FOMO4800	Monument Creek		Teachout Creek	$5,429	$816

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).

EPC Stormwater Management *Jennifer Irvine, P.E.*

depths over the duration of the storm as a fraction of the 1-hour depth and is also shown in Figure 6-19. By applying the 1-hour depths shown in Table 6-2 to the values shown in Table 6-3, a short-duration project design storm can be developed for any return period storm from a 2-year up to 100-year frequency. By applying the appropriate 1-hour depth for other project locations, a project design storm can be created for any location.

Table 6-3. 2-Hour Design Storm Distribution, ≤ 1 mi^2

Time (minutes)	Fraction of 1-Hour Rainfall Depth	Time (minutes)	Fraction of 1-Hour Rainfall Depth
5	0.014	65	1.004
10	0.046	70	1.018
15	0.079	75	1.030
20	0.120	80	1.041
25	0.179	85	1.052
30	0.258	90	1.063
35	0.421	95	1.072
40	0.712	100	1.082
45	0.824	105	1.091
50	0.892	110	1.100
55	0.935	115	1.109
60	0.972	120	1.119

- **Frontal Storms**: The characteristics of longer-duration "frontal storms" (general) is less well understood than the shorter duration thunderstorms and should be studied further. However, some events of this nature have been observed, such as the April 1999 storm which produced flooding on Fountain Creek, showing that these types of events do occur and tend to produce hazardous flood flows. In addition, modeling of the Jimmy Camp Creek drainage basin using the 24-hour, Type II distribution shows that it produces results reasonably comparably to recorded flow data. Therefore, the NRCS 24-hour Type II distribution has replaced the Type IIa distribution as the standard, long-duration design storm. This distribution can be applied to drainage basins up to 10 square miles without a DARF correction and is shown in Table 6-4. This distribution is included as a standard storm option in the HEC-HMS program.

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

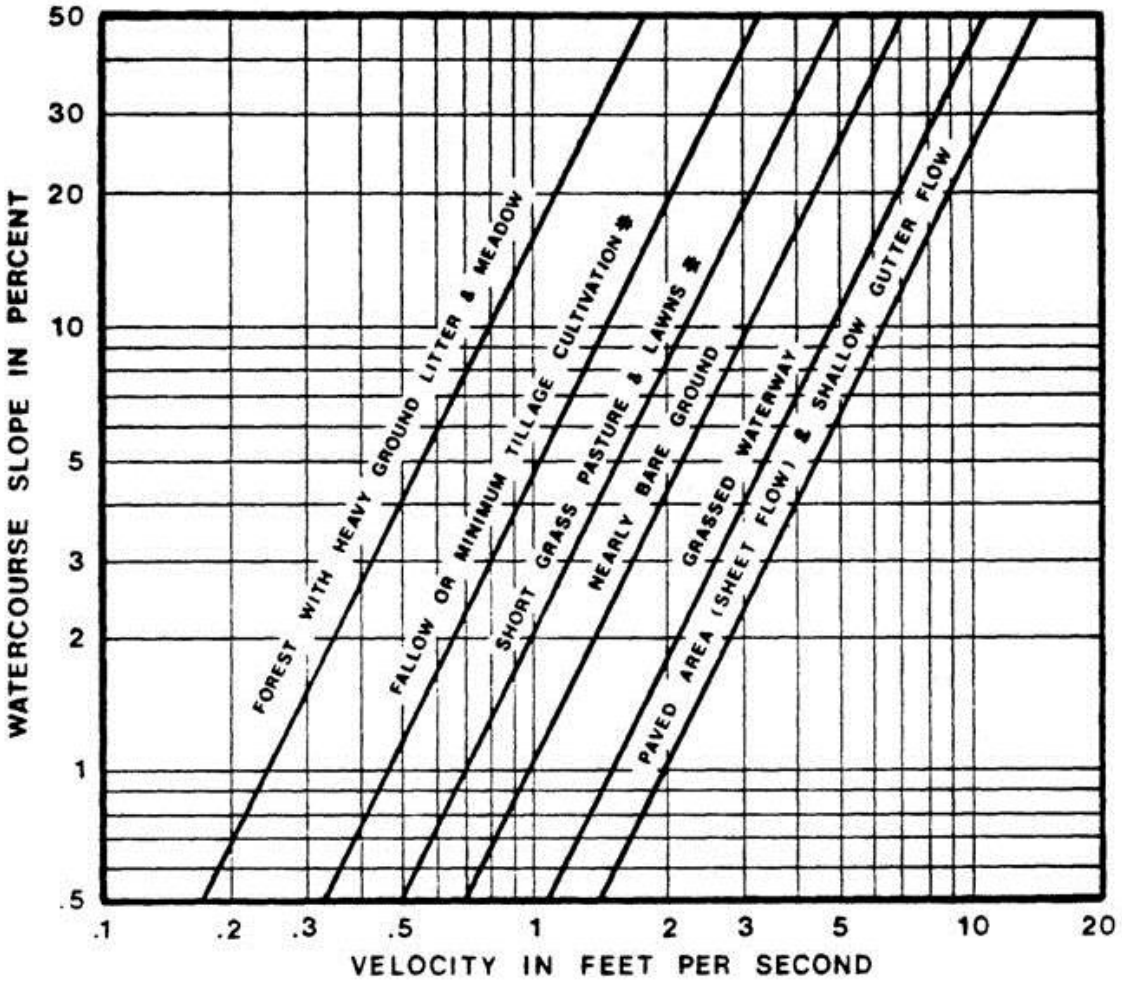
Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82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

3.2 Time of Concentration

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

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

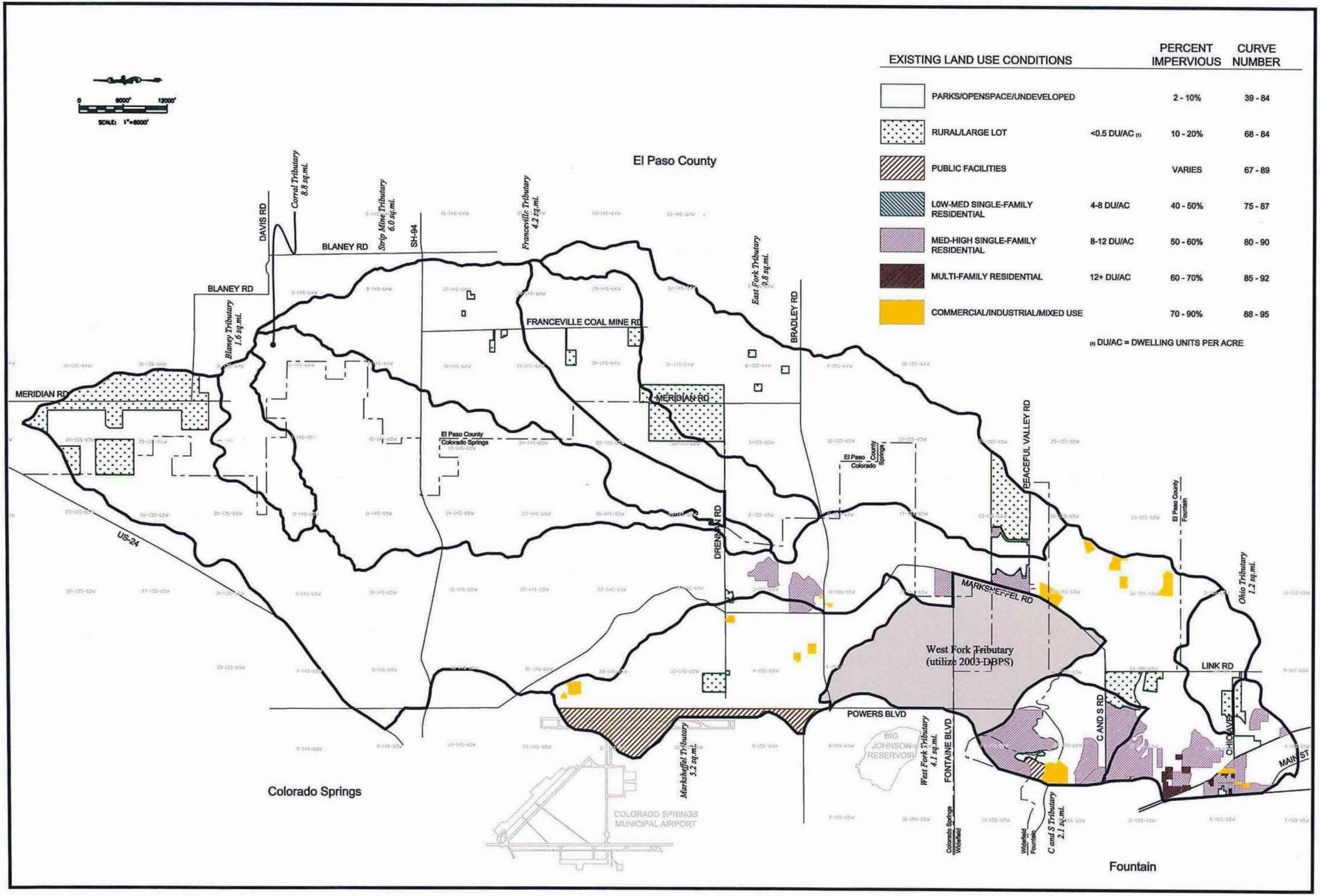
Figure 6-25. Estimate of Average Concentrated Shallow Flow



APPENDIX C

REPORT REFERENCES

EXCERPTS FROM DBPS
WEST FORK JIMMY CAMP CREEK
&
BIG JOHNSON RESERVOIR BASIN



EXISTING LAND USE CONDITIONS		PERCENT IMPERVIOUS	CURVE NUMBER
PARKS/OPENSPACE/UNDEVELOPED		2 - 10%	39 - 84
RURAL/LARGE LOT	<0.5 DU/AC (1)	10 - 20%	68 - 84
PUBLIC FACILITIES		VARIES	67 - 89
LOW-MED SINGLE-FAMILY RESIDENTIAL	4-8 DU/AC	40 - 50%	75 - 87
MED-HIGH SINGLE-FAMILY RESIDENTIAL	8-12 DU/AC	50 - 60%	80 - 90
MULTI-FAMILY RESIDENTIAL	12+ DU/AC	60 - 70%	85 - 92
COMMERCIAL/INDUSTRIAL/MIXED USE		70 - 90%	88 - 95

(1) DU/AC = DWELLING UNITS PER ACRE

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

JIMMY CAMP CREEK WATERSHED
DRAINAGE BASIN PLANNING STUDY
EXISTING CONDITIONS LAND USE MAP
CITY OF COLORADO SPRINGS

Project No.:	14008
Date:	OCT 2014
Design:	
Drawn:	BJW
Check:	
Revisions:	

II-1

VII. IMPLEMENTATION OF SELECTED PLAN

7.1 General

The results of the analyses summarized in Chapter 6 represent a concept level design process. The selected plan improvements shown on the conceptual design drawings will be subject to refinement as the development of the land within the Jimmy Camp Creek Basin commences. The size and location of the channel conveyances will have to be determined based upon a higher level of engineering analysis that is typically carried out during the preparation of the master development drainage and final drainage planning reports. It is an underlying intent of the selected to plan to preserve to the greatest extent practical the existing condition 100-year floodplain and environmental resources that exist therein. It will be important that the major drainageway channel conveyances that have been identified in this DBPS be followed and major deviations from the concepts presented herein should be discouraged when land development applications are made to the City of Colorado Springs.

With respect to FSD as presented in this DBPS, the location of future FSD basins will be refined during the land development process. Guidelines for locating FSD's have been provided in previous sections of the DBPS. If implemented, FSD will result in the limitation of peak discharges released from developing areas to pre-development conditions. As such, the future major drainageway conveyances and road crossings need only to be designed to be able to carry the pre-development condition discharges. Consolidation of FSD sites should be encouraged in order to limit long-term maintenance costs so long as the intent of the FSD system is achieved. Implementation of the concepts in this DBPS will reduce the level of planning and engineering that will be required during later drainage planning phases associated with the land development process.

7.2 Cost Estimates

Presented on Table VII-1 are the costs estimates for the major drainageway conveyances for Jimmy Camp Creek and its major sub-tributaries within the City of Colorado Springs. Presented on Table VII-2 are conveyance costs for sub-drainageways for the City of Colorado Springs. There has been no cost estimate made for local storm sewer systems. An estimate for the cost to replace roadway crossings found to be deficient when the hydraulic analysis was prepared has also not been made in this DBPS. Unit costs applied when calculating the conveyance costs are prepared on the tables. Engineering design costs have been estimated at 10 percent of the construction. A contingency allowance of 10 percent off the construction has been assumed. No allowance for the relocation of utilities has been assumed when developing the conveyance cost estimates.

Presented on tables within the DBPS are costs estimates for the major drainageway conveyances for Jimmy Camp Creek and its major sub-tributaries within the City of Colorado Springs. There has been no cost estimate made for local storm sewer systems. An estimate for the cost to replace roadway crossings found to be deficient when the hydraulic analysis was prepared has also not been made in this DBPS. Unit costs applied when calculating the conveyance costs are prepared on the tables. The estimated cost of the FSD basins was presented in Chapter 5 of the DBPS. The cost and acreage data associated with FSD has been provided in the DBPS and used in the development of a storage fee. Since the effect of implementing the FSD alternative is to maintain rates of runoff to be conveyed by the receiving drainageways to pre-development conditions it is has been concluded to be reasonable to spread only the cost of the major drainage conveyances in amongst all un-platted property within Colorado Springs.

The total cost for future roadway culverts and bridges has not been made in this DBPS. This is primarily because the number and location of the future roadway crossing cannot be accurately determined at this time. All future roadway crossings should be sized to convey the pre-development condition discharge. Because runoff will be controlled to existing peak discharges, there is no additional costs for culverts and bridges associated with providing capacity because of increased runoff due to development.

7.3 Unplatted Acreage

Presented on Figure VII-1 are the jurisdictional limits and corresponding acreage of the three governmental entities in the Jimmy Camp Creek watershed. Presented on Figure VII-2 are the un-plattable acreage that lies within the City of Colorado Springs, City of Fountain and El Paso County. Using El Paso County Tax Assessor maps, plats and ownership records the amount of un-platted and developable acreage was estimated. From these records the following total un-platted acreages were determined:

City of Colorado Spring outside BLR	**148 acres**
City of Colorado Spring inside BLR	**13,341acres**
City of Colorado Springs Total	**13,489 acres**
El Paso County	**14,018 acres**
City of Fountain	**664 acres**

The unplatted acreage shown on Figure VII-2 excludes the existing 100-year floodplains, large regional parks, school sites and public utility easement corridors Land that is already platted has not been accounted for in the estimate of the plattable acreage unless the platted parcel exceeded 15 acres in size. Most of these large acreage platted parcels occur within the County. The un-platted acreage listed in the report is the land that is considered developable and would be subject to drainage and storage fees.

The weighted percent imperviousness was estimated for the entire watershed. Based upon the land use planning information accumulated and applied in this DBPS, the weighted percent imperviousness for the watershed was determined to be 57.5 percent.

7.4 Unit Drainage Costs

Presented on Table VII-3 of the DBPS and this Executive Summary are the unit major drainageway and FSD storage fee calculations for the City of Colorado Springs. All of the improvements that were used in the calculation of the unit drainage costs are considered public facilities subject to maintenance by the Colorado Springs in accordance with this DBPS and applicable drainage criteria. The unit drainage costs can

be used to structure a fee system for the Jimmy Camp Creek watershed to replace the present fee system that has been established using the 1987 Wilson DBPS. It is recommended that a drainage fee be established within each of the jurisdictions to cover the capital improvement costs associated with the stabilization of the major and sub-drainageways identified in this DBPS. Since FSD is the selected storage option for the watershed, it may be possible to have the fees associated with the unit drainage costs accumulate during the initial phases of land development until such time that major drainageway or sub-drainageway stabilization is needed. Having the drainage fund accumulate by not requiring a developer to install major drainageway improvements during the initial phase of the land development process will help the keep the drainage fund from becoming immediately in debt. It will also give the City time and some greater flexibility in focusing the capital improvement funds generated by the fee system. Managing the fees system in this way may also help the land development process by not front-end loading the very initial phases of development with the costs of major and sub-drainageway improvements that could very well be offsite from the land development activity itself.

The FSD storage cost can be used to develop a FSD storage fee. The unit storage fee can be assessed at the time of platting if the parcel subject to platting is so limited in size as to not to be feasible to site a regional FSD. In developing the FSD unit storage fee 15 percent has been added to the unit acre-foot construction cost presented on Table V-4 of the DBPS to bring the unit storage cost to 2014 dollars. Fees that accumulate in the FSD storage fund could later be used to reimburse a property owner that would be required because of its size to construct and FSD. It is however preferable to construct the regional FSD's at the earliest possible time during the development of a sub-watershed so that the impact of develop runoff on the receiving drainageway is mitigated.

Because the land area within the watershed and the land that is within the City is controlled by one major land owner it may be feasible to "close" the basin to fees. This would then end the need to collect drainage and FSD fees at the time of platting land. Accordingly, no reimbursement for any public major drainageway or FSD facilities would occur.

A bridge fee has not been calculated for this watershed. This is primarily because the number and location of bridges cannot be accurately determined, and the fact that any bridge or major roadway crossing would only have to be sized to convey pre-development condition discharges. In this regard, the cost of a bridge or culvert associated with a future road is based on the need for transportation and not storm water conveyance. It may be necessary to establish some form of interim fee to cover the cost of reimbursements already established under the present Jimmy Camp Creek bridge fee system.

on the design plans. The purpose of the detention basins is to limit peak discharges at the basin's outfall to Jimmy Camp Creek to the existing hydrologic condition. The regional basins have also been sited within each of the major land developments to more locally control runoff to existing levels. Wherever practical, the regional detention basins should be designed so as to take advantage of the adjacent roadway embankments. It is not anticipated that any of the regional detention basins will be subject to State Engineer's regulations. Stormwater quality measures should be designed into the regional stormwater detention basins. These measures would include the provision of a water quality and sediment pool area in addition to the volume required for stormwater detention.

Right-of-Way

For the most part the main channels within the basin which pass through undeveloped areas and the right-of-way can be dedicated as part of the land development process. For those segments of the drainageway where floodplain preservation is the recommended plan, a combination of open space dedication (such as park-land and greenbelts), in combination with a more narrow dedicated right-of-way along the low flow area of the drainageway should be obtained through the land development process. Land acquisition will be required for the regional detention basins. The dedication of easements and right-of-way for the drainageways and detention basins would be accomplished at the time of development planning and platting of the parcels that lie adjacent to or upstream of the stormwater facility.

Cost Estimates and Drainage Basin Fees

Cost estimates have been prepared and are contained within the DBPS. The cost of the major drainageway facilities has been determined for each jurisdiction. The facility cost estimate will be used in the determination of the drainage and bridge fees for this basin. Bridge crossing costs have been determined as well for the basin.

Presented on Table 17 through 19 is the cost and plattable acreage (i.e., that area available for platting into subdivisions), data associated with the determination of drainage and bridge fees for the basin. The plattable acreage has been determined using a combination of assessor's maps, aerial photographs and topographic mapping that covering the watershed. As presented on Table 17, the reductions in the area available for platting have been listed. The reductions are mostly attributable to areas that are already platted, known roadway or planned road right-of-ways for minor and major arterials, and the area underlying the proposed detention basins.

Drainage basin fees have been determined for those areas that are within the City of Colorado Springs and El Paso County. The City of Fountain does not have a drainage basin fee system and therefore no fees have been calculated for the areas within the City of Fountain. The area of the basin within the City of Colorado Springs lies within the Colorado Centre development and the Banning-Lewis Ranch Flood Conservancy District (District). It is the intent of the City of Colorado Springs that the District will be responsible for all drainage, detention and bridge improvement construction and maintenance. Prior to any development within the City, specific agreements will have to be finalized between the City and the District. The drainage and bridge fees calculated for the County areas have been determined in accordance with Resolution No. 99-383. The percent impervious values listed on Exhibit 3 of this resolution where applied when calculating the weighted percent impervious value for the sub-basins within the County.

THE COLORADO CENTRE DEVELOPMENT

City of Colorado Springs

LAND USES:
Light Industrial
Office/commercial

CURVE NUMBER RANGE:

85-95

UNDEVELOPED LAND

LAND USES:
Light Industrial
Office/commercial

CURVE NUMBER RANGE:

85-95

CRESCENT HEIGHTS DEVELOPMENT

City of Fountain

LAND USES:
Medium/high density residential
Office/commercial

CURVE NUMBER RANGE:

79-93

THE GLEN AT WIDEFIELD DEVELOPMENT

LAND USES:
Low/medium/high density residential
Office/commercial
School
Park and open space

CURVE NUMBER RANGE:

68-95

CROSS CREEK AT MESA RIDGE

LAND USES:
Office/commercial
Industrial

CURVE NUMBER RANGE:

85-95

LEGEND

MAJOR LAND DEVELOPMENT BOUNDARY

0' 1000' 2000'

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904
(719) 630-7342

West Fork Jimmy Camp Creek Drainage Basin Planning Study

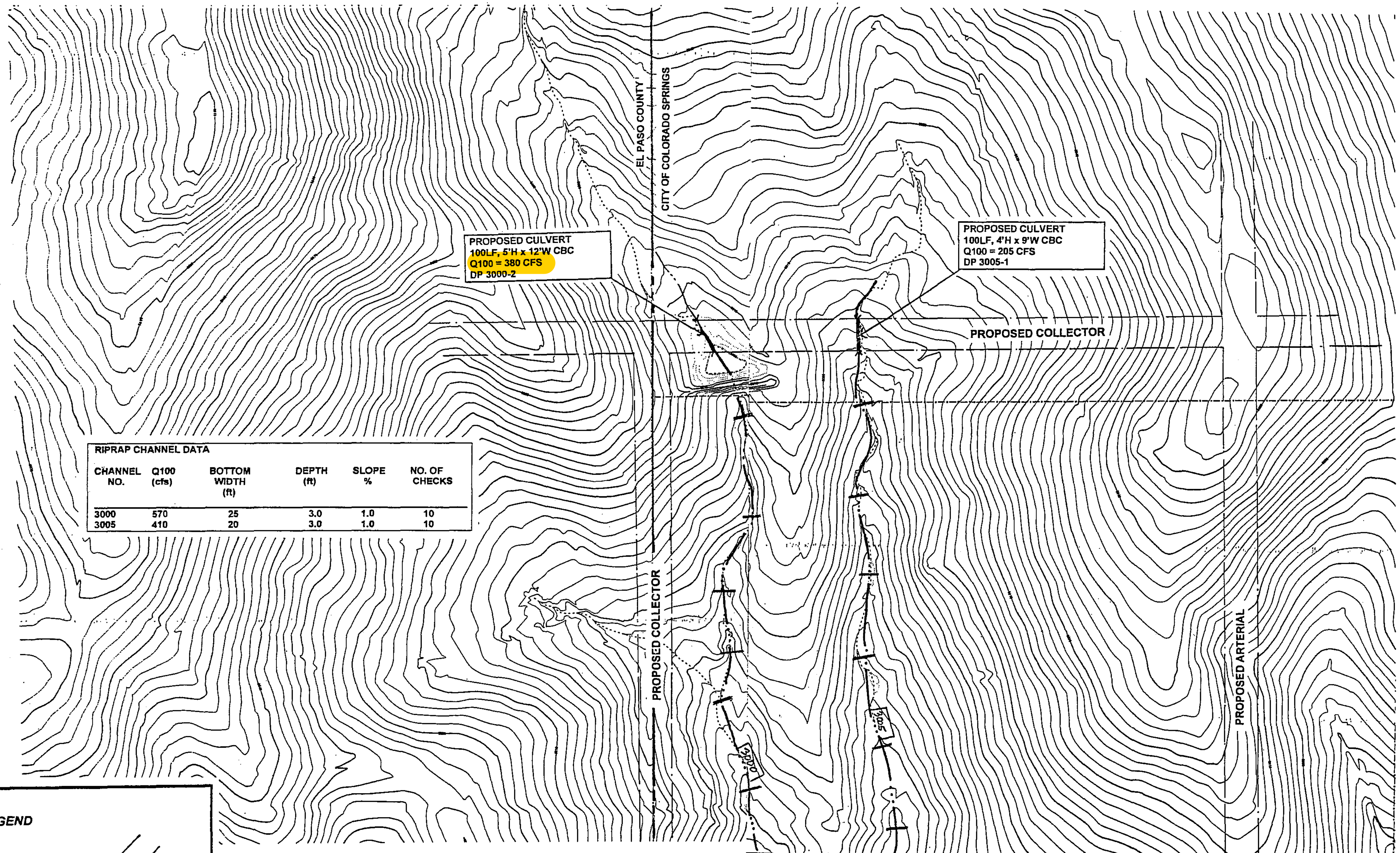
MAJOR DEVELOPMENT & LAND USE MAP

EL PASO COUNTY, COLORADO

Project No.:	9893
Date:	6/99
Design:	RNW
Drawn:	CAD
Check:	RNW
Revisions:	

FIGURE 2

THIS DRAWING IS A MASTER PLANNING SHEET REPRESENTING PRELIMINARY AND CONCEPTUAL ENGINEERING. IT SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.



RIPRAP CHANNEL DATA

CHANNEL NO.	Q100 (cfs)	BOTTOM WIDTH (ft)	DEPTH (ft)	SLOPE %	NO. OF CHECKS
3000	570	25	3.0	1.0	10
3005	410	20	3.0	1.0	10

LEGEND

ROADWAY CROSSING

DRAINAGEWAY AND ROUTING ELEMENT NUMBER

DRAINAGEWAY GRADE CONTROL STRUCTURE

DESIGN POINT NUMBER

0' 200' 400'

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904
(719) 630-7342

WEST FORK JIMMY CAMP CREEK
DRAINAGE BASIN PLANNING STUDY

PRELIMINARY PLAN
EL PASO COUNTY, COLORADO

Project No.: 9893
Date: 2/00
Design: RNW
Drawn: CAD
Check: RNW
Revisions:

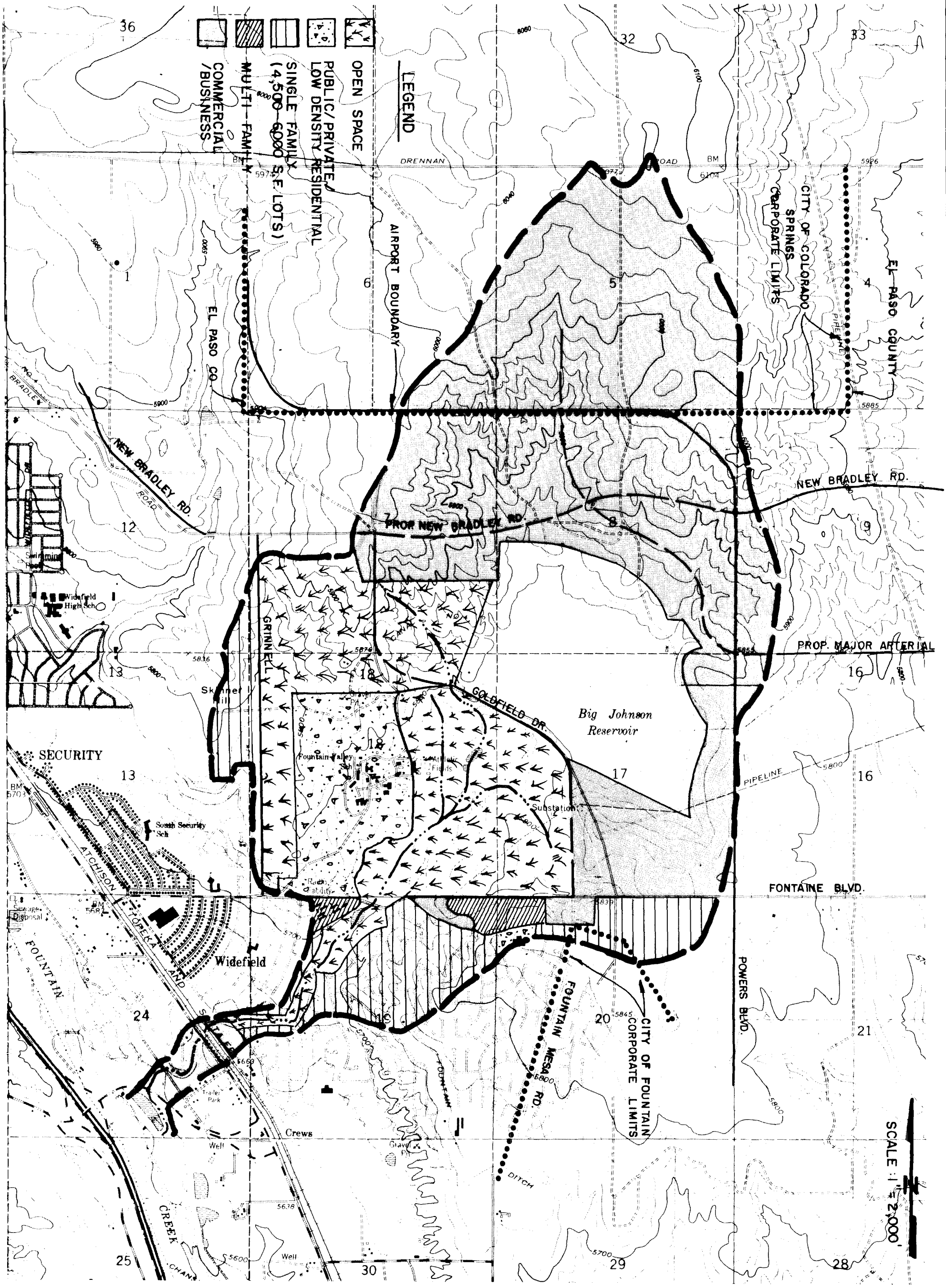


FIGURE 5

BIG JOHNSON RESERVOIR / CREWS GULCH DRAINAGE BASIN PLANNING STUDY

LAND USE MAP

Project No. 88-05-05
Date: 6-88
Design: RNW
Drawn: EAK
Check: RNW
Revisions:

Kiowa Engineering Corporation
419 W. Bijou St.
Colorado Springs, CO 80905

TABLE 15

BIG JOHNSON RESERVOIR/CREWS GULCH DRAINAGE PLANNING STUDY DRAINAGEWAY COSTS
PRELIMINARY DESIGN COST ESTIMATE

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL	NON-REIMBURSABLE COSTS	REIMBURSABLE COSTS
REACH 4 BOULDER LOW FLOW STA 96+00 TO 102+20	4180	LF	$58	$242,440	$0	$242,44
ST 92+85 GRADE CONTROL STRUCTURES (2 TOTAL)	100	LF	$88	$8,800	$0	$8,8
- 94+15 DROP STRUCTURES STA 109+25, 112+25, 117+25	120	LF	$336	$40,320	$0	$40,320
ENERGY DISSAPATOR STA 82+85	1	LS	$80,000	$80,000	$40,000	$40,000
3.5'xB' CBC, STA 106+75	50	LF	$380	$19,000	$19,000	$
36" PCCP AND HEADWALL	520	LF	$150	$78,000	$0	$78,000
PRESSURE MANHOLE	1	LS	$5,000	$5,000	$0	$5,00
MC RAE RESERVOIR IMPROVEMENTS						
SHEET PILE WALL	27900	SF	$20	$558,000	$279,000	$279,00
OUTLET RECONSTRUCTION (18"CSP)	1	LS	$8,000	$8,000	$8,000	$
TWIN 48"INCH REHABILITATION	1	LS	$10,000	$10,000	$0	$10,00
20' MAINTENANCE BENCH	970	LF	$30	$26,100	$0	$26,10
RIPRAP EMBANKMENT PROTECT. FONTAINE BLVD	920	CY	$24	$19,680	$0	$19,68
EARTHWORK	2000	CY	$3	$6,000	$0	$6,00
BIG JOHNSON RESERVOIR IMPROVEMENTS						
WATER QUALITY PONDS	67.0	AC-FT	$10,000	$670,000	$0	$670,00
EMBANKMENT ROAD RECONSTRUCTION	1500	LF	$25	$37,500	$0	$37,50
RIPRAP SPILLWAY CREST PROTECTION	1960	CY	$24	$47,040	$0	$47,04
DROP INLET AND TRASH RACK	1	LS	$7,000	$7,000	$0	$7,00
3' FOOT HIGH CONTOUR BERMS	4400	LF	$15	$66,000	$0	$66,00
SUBTOTAL REACH 4				$1,926,880	$346,00	$1,582,88

correcting existing deficiencies within the basin (non-reimbursable costs). Construction funding for these facilities will have to be provided through other funding mechanisms. A suggested allocation of the non-reimbursable cost has been presented on Table 18. The construction of initial systems within the basin will not be reimbursable, and shall be the responsibility of the property owner or developer.

Table 19 presents the fee calculation for the Big Johnson/Crews Gulch Basin. Drainage fees have been calculated using the reimbursable costs shown on Table 15. Reimbursable road crossing replacement costs at locations where there is an existing inadequacy have been calculated using the bridge cost-sharing formula, as per Resolution number 89-31. The land fee has been estimated without the acreage associated with channel right-of-ways, McRae Reservoir, and the detention/water quality ponds above Powers Boulevard. Easements establishing long-term construction and maintenance access for the channels crossing the Fountain Valley School property and for the water quality ponds at Big Johnson Reservoir, as well as for all public facilities, will be needed.

Implementation

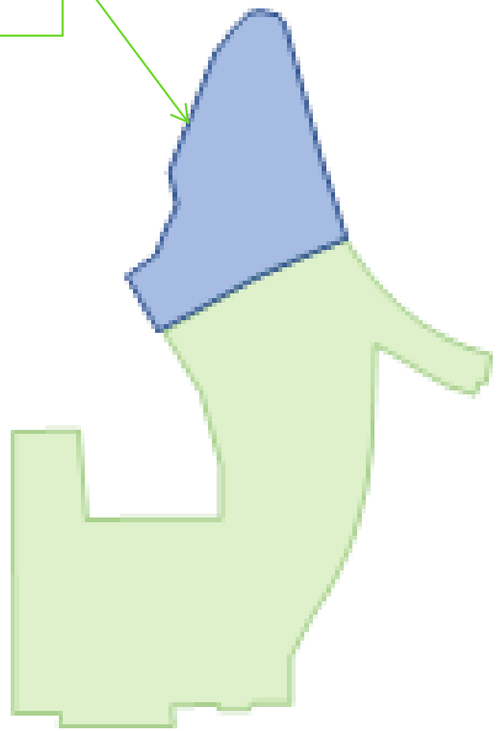
The proposed plan separates the basin into three distinct systems, namely, the Crews Gulch system (Reaches 1 through 4), the Big Johnson system (Reach 5), and the Fountain Mesa Tributary system (Reach 3A). These systems will be impacted differently by land development, and therefore, the prioritization of improvements is dependent upon differing factors in each of these basins. A discussion of implementation follows:

Crews Gulch: Of primary importance in this basin are the improvements to McRae Reservoir. Substantial park improvements exist downstream of McRae Reservoir, and more are proposed at Fountain Creek Regional Park. Adjacent to Harvard Street the potential for flood damages to residences exists for the 100-year event. McRae Reservoir's flood history is well documented, and

FIRMETTE

Unresolved review 1 comment:
- Replace project label to "Filing 5 area".

APPROXIMATE PROJECT VICINITY



8

9

17

16

EL PASO COUNTY
UNINCORPORATED AREAS
080059

CITY OF COLORADO SPRINGS

EL PASO COUNTY

FOREIG

COLO

MAP SCALE 1" = 500'

250 0 500 1000 FEET

50 0 150 300 ME

PANEL 0768G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 768 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0768	G
EL PASO COUNTY	080059	0768	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
08041C0768G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

1335000 FT

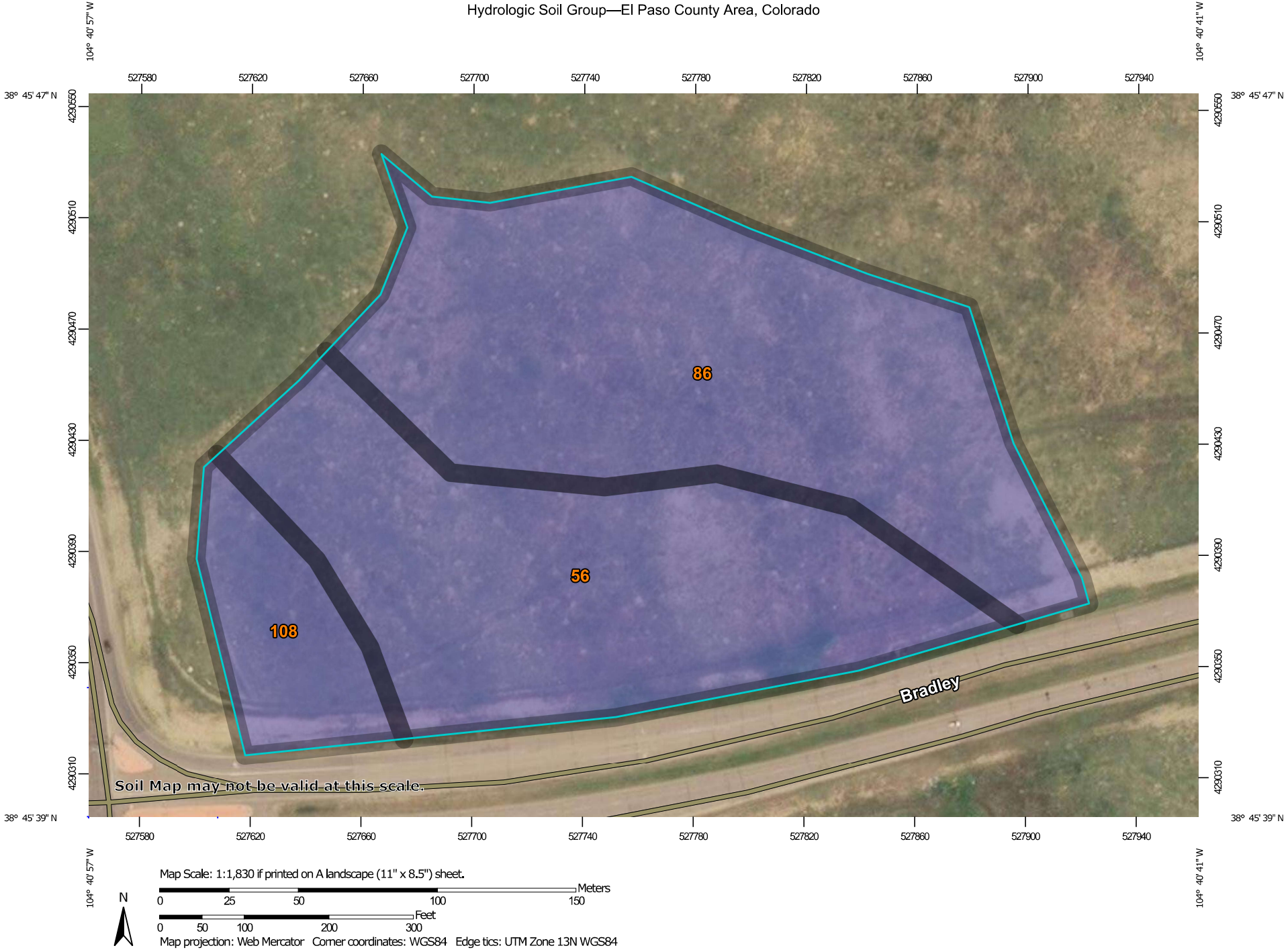
38° 45' 0.00"

104° 41' 15.00"

5 28 000m E

JOINS PANEL 0956

USDA NRCS WEB SOIL SURVEY REPORT



Map Scale: 1:1,830 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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 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 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Apr 12, 2017—Nov 17, 2017

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
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	B	4.8	41.2%
86	Stoneham sandy loam, 3 to 8 percent slopes	B	5.7	49.2%
108	Wiley silt loam, 3 to 9 percent slopes	B	1.1	9.6%
Totals for Area of Interest			**11.6**	**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

Map Scale: 1:6,790 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 300 600 1200 1800

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 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.

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

Date(s) aerial images were photographed: Apr 12, 2017—Nov 17, 2017

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
8	Blakeland loamy sand, 1 to 9 percent slopes	A	17.8	8.6%
31	Fort Collins loam, 3 to 8 percent slopes	B	0.0	0.0%
52	Manzanst clay loam, 0 to 3 percent slopes	C	21.0	10.2%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	B	137.7	66.8%
86	Stoneham sandy loam, 3 to 8 percent slopes	B	5.3	2.6%
108	Wiley silt loam, 3 to 9 percent slopes	B	24.3	11.8%
Totals for Area of Interest			**206.0**	**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 D

MAPS

Trails at Aspen Ridge Vicinity Map

Know what's below. Call before you dig.

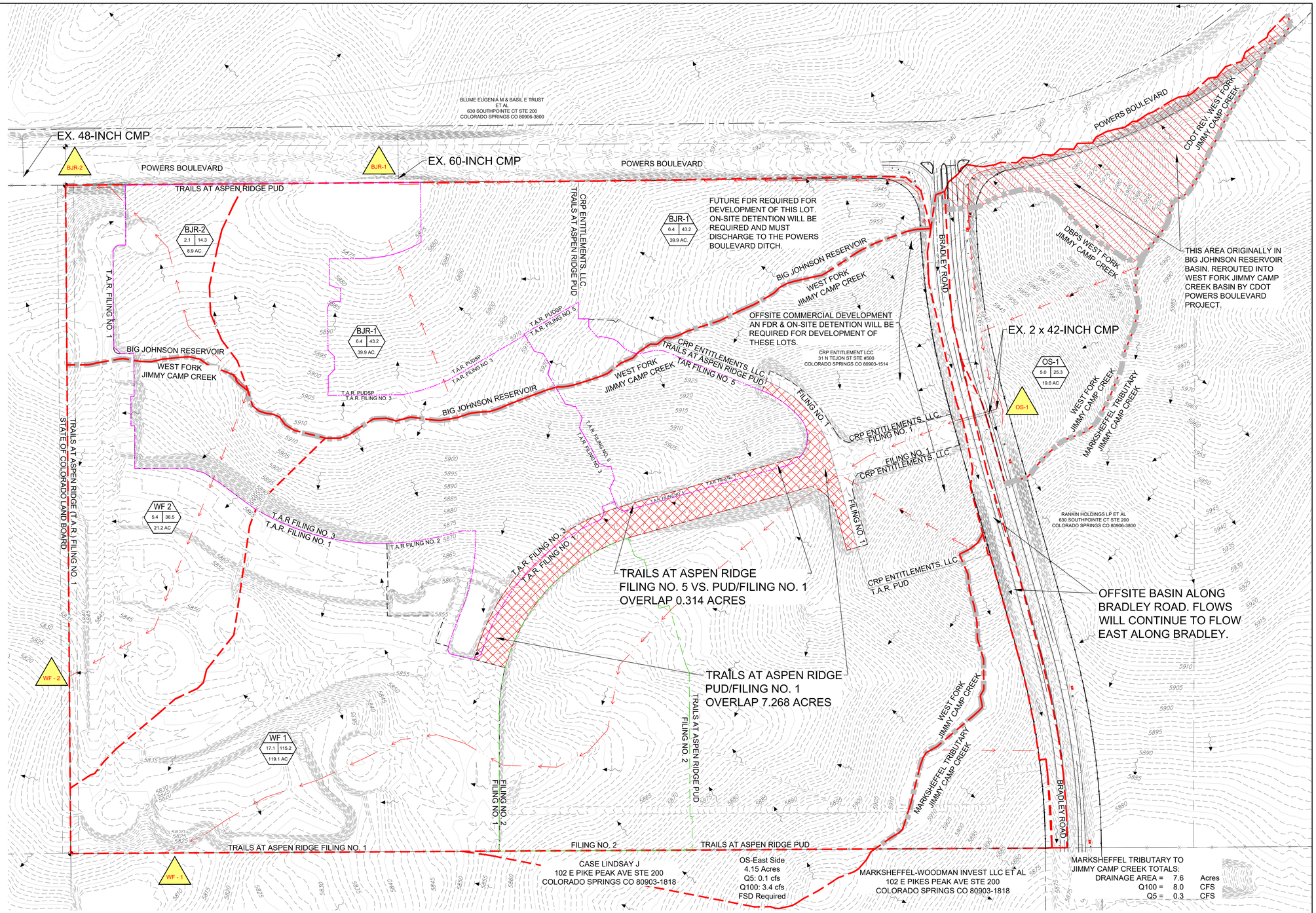
Trails at Aspen Ridge
Final Drainage Report
Existing Design Point Summary

Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
BJR-1	BJR-1	39.94	6.43	43.22
BJR-2	BJR-2	8.85	2.13	14.32
TO BIG JOHNSON RESERVOIR	BJR-1 & BJR-2 (Basins are parallel so this is a sum of BJR-1 & BJR-2.)	**48.79**	**8.56**	**57.54**
OS-1	OS-1 (Note: 7.3 Acres diverted by CDOT from Big Johnson)	19.60	11.8*	47.4*
WF-1	WF-1 & OS-1	138.69	33.2*	139.1*
WF-2	WF-2	21.15	5.5*	31.1*
TO WEST FORK JIMMY CAMP CREEK	WF-1, WF-2, & OS-1 (Basins are parallel so this is a sum of WF-1 & WF-2.)	**159.84**	**37.0***	**170.0***

Trails at Aspen Ridge
Final Drainage Report
Existing Conditions Basin Summary Table

Area ID	Area (Acres)	Q5 (cfs)	Q100 (cfs)
Big Johnson Reservoir / BJR-1	39.94	6.43	43.22
Big Johnson Reservoir / BJR-2	8.85	2.13	14.32
West Fork Jimmy Camp Creek / OS - 1	19.60	11.8*	47.4*
West Fork Jimmy Camp Creek / WF-1	119.08	21.4*	97.6*
West Fork Jimmy Camp Creek / WF-2	21.15	5.5*	31.1*

*Values from SWMM (See MDDP/PDR)



LEGEND

- DESIGN POINT IDENTIFIER
- BASIN IDENTIFICATION
- BASIN FLOWS (Q5 / Q100)
- BASIN AREA
- BASIN BOUNDARY
- DBPS BASIN BOUNDARY
- EXISTING CONTOURS

GRAPHIC SCALE
150' 0' 150' 300'
(IN FEET)
1 inch = 150 ft.

REFERENCE DRAWINGS
X-886-PR SITE_F1
X-886-PR SITE
10415-Storm Base-2017
886-PR Legacy Drive
X-886-EX SURVEY
X-Title(Drainage)

NO.	DATE	DESCRIPTION	BY

REVISIONS

NAME: S:\21.886.048 (Trails at Aspen Ridge - F5)\200 Drainage\201 Drainage Reports\FDR\DWG\PRELIM FDR F5.dwg
PCP: Matrix.ctb
PLOT DATE: Thu Mar 17, 2022 11:24am

BENCHMARK DATA(ELEV.) _____
(DATUM) _____
(DESCRIPTION/LOCATION) _____

VERTICAL BENCHMARK:

BASIS OF BEARING:

PREPARED UNDER MY DIRECT SUPERVISION, FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

Matrix DESIGN GROUP
2435 Research Parkway, Suite
300 Colorado Springs, CO 80920
Phone 719-575-0100
Fax 719-575-0208

COLA, LLC.

TRAILS AT ASPEN RIDGE FILING NO. 5
FINAL DRAINAGE REPORT
PREDEVELOPMENT CONDITIONS

DESIGNED BY: JTS	SCALE:	DATE ISSUED:	OCTOBER 2021
DRAWN BY: JTS	HORIZ:	SHEET NO.	1 OF 3 SHEETS
CHECKED BY:	VERT:		DR-01

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

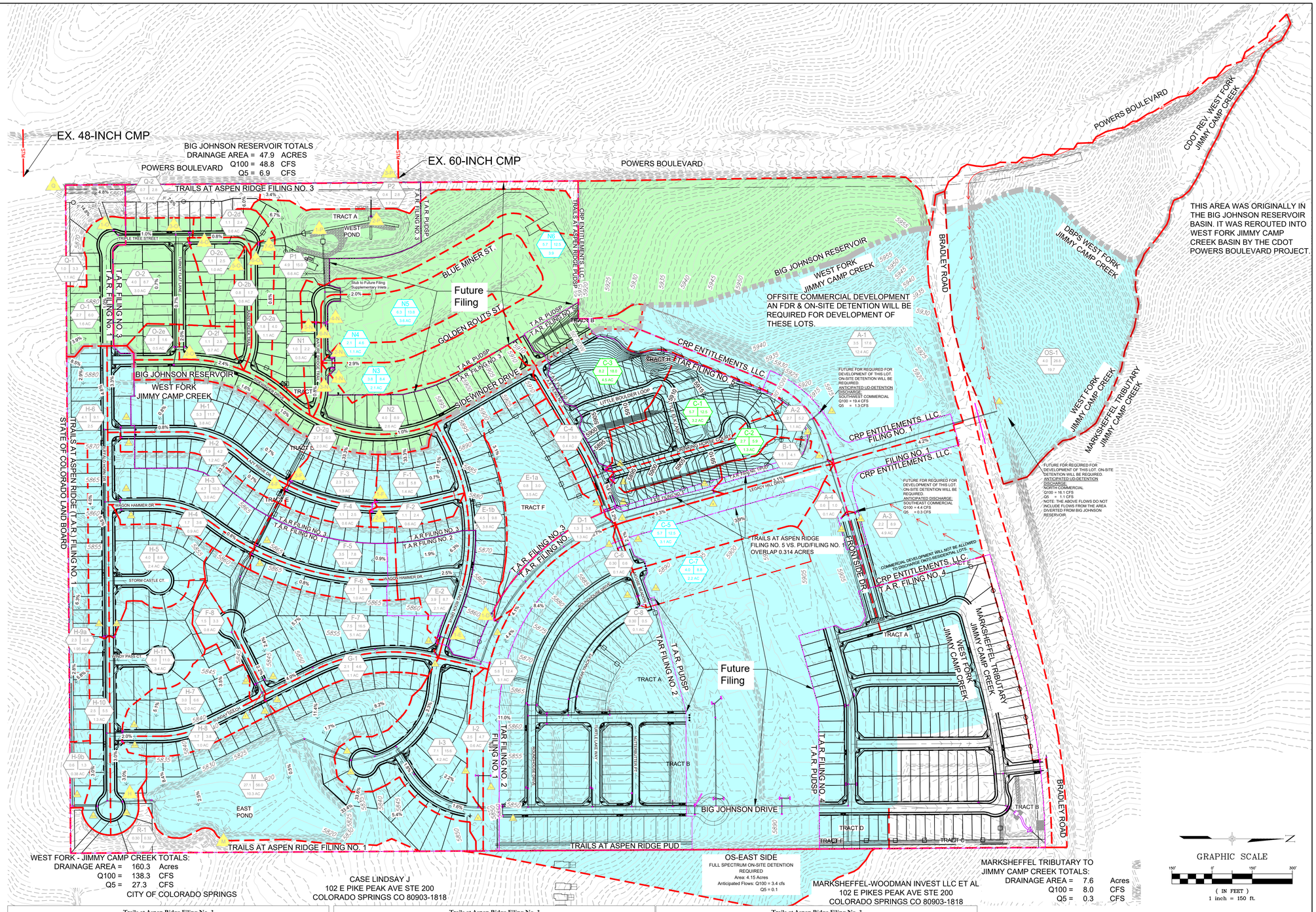
Trails at Aspen Ridge Proposed Conditions Sub-basin Summary			
Basin	**Area**	Q5	Q100
	acres	cfs	cfs
West Fork - Jimmy Camp Creek			
OS-1	19.67	4.0	26.8
A-1	12.34	4.4	18.9
A-2	1.09	2.7	5.2
A-3	4.98	2.2	9.0
A-4	0.12	0.6	1.0
B-1	1.06	1.8	4.1
C-1 (Filing 5)	3.17	5.7	12.5
C-2 (Filing 5)	1.31	2.7	5.9
C-3 (Filing 5)	4.48	8.2	18.0
C-4 (Filing 3)	0.36	1.6	3.0
C-5	3.13	5.7	12.5
C-6	0.07	0.3	0.6
C-7+8	2.25	4.2	9.2
D-1	1.27	1.3	3.6
E-1a (Filing 3)	3.53	1.2	4.7
E-1b	3.85	4.5	9.9
E-2	2.14	3.9	8.7
F-1 (Filing 3)	1.44	2.6	5.8
F-2 (Filing 3)	0.58	1.1	2.4
F-3 (Filing 3)	1.29	2.3	5.1
F-4 (Filing 3)	0.58	1.1	2.5
F-5	2.27	3.5	7.8
F-6	1.00	1.7	3.9
F-7	5.06	7.5	16.5
F-8	0.84	1.5	3.3
G-1	1.11	2.1	4.6
H-1 (Filing 3)	3.60	5.3	11.7
H-2 (Filing 3)	1.16	1.9	4.2
H-3	2.97	4.7	10.3
H-4	0.92	1.6	3.6
H-5	2.42	4.0	8.9
H-6	2.46	4.1	9.1
H-7	2.03	3.0	6.6
H-8	0.97	1.7	3.8
H-9a	1.95	2.3	5.8
H-9b	0.38	0.6	1.3
H-10	1.33	2.5	5.3
H-11	3.42	5.0	11.0
I-1	3.13	5.6	12.4
I-2	0.59	1.9	3.8
I-3	4.18	7.1	15.6
K-OS (Fully Developed)	37.74	44.9	95.7
K-OS (Undeveloped)	46.76	10.0	67.5
OS-EAST SIDE	4.15	0.1	3.4
M	10.28	6.4	23.1

Trails at Aspen Ridge - Filing No. 3 Proposed Conditions Sub-basin Summary			
Basin	**Area**	Q5	Q100
	acres	cfs	cfs
Big Johnson Reservoir			
N1	0.49	1.0	2.2
N2	2.57	4.0	8.9
N3	2.05	3.8	8.4
N4	1.13	2.1	4.6
N5	3.64	6.3	13.8
N6	3.89	5.7	12.5
O-1 (Filing No. 1)	1.63	2.3	5.0
O-2	2.97	4.0	8.7
O-2a	1.13	1.8	4.0
O-2b	0.57	0.8	1.7
O-2c	1.05	1.1	2.5
O-2d	0.60	1.1	2.4
O-2e	0.51	0.7	1.6
O-2f	0.65	1.1	2.5
O-2g	2.04	2.7	6.0
P1	6.63	4.9	15.0
P1a	2.05	1.3	4.5
P2	1.71	0.4	2.8
Q-2	1.36	0.7	2.8

Design Point Routing
West Fork Jimmy Camp Creek

Design Point	Total Drainage Area	StormCAD Surface Q5	Surface Q100	Storm Sewer Q5	Storm Sewer Q100	Downstream Design Point
1-OS	**19.67**	4.0	26.8	-	-	A
1-A	**12.34**	3.5	17.6	-	-	A
2-A	**1.09**	2.7	5.2	-	-	A
3-A	**4.98**	2.2	8.9	-	-	A
4-A	**0.12**	0.6	1.0	-	-	A
A	**38.20**	-	-	12.0	55.6	B
1-B	**1.06**	1.8	4.1	-	-	B
B	**39.26**	-	-	12.7	57.1	C
1-C	**3.27**	5.7	12.5	-	-	C
2-C	**1.19**	2.7	5.9	-	-	C
3-C	**4.60**	8.2	18.0	-	-	C
4-C	**0.36**	1.6	3.0	-	-	C
5-C	**3.13**	5.7	12.5	-	-	C
6-C	**0.07**	0.3	0.6	-	-	C
7-C	**2.20**	4.0	8.8	-	-	C
8-C	**0.06**	0.3	0.5	-	-	C
C	**54.13**	-	-	27.6	90.2	D
1-D	**4.80**	1.3	3.6	-	-	D
D	**58.93**			24.8	84.9	E
E-1a	**3.53**	1.2	4.7			D
E-1b	**3.85**	4.5	9.9	-	-	E
2-E	**2.14**	3.9	8.7	-	-	E
E	**64.92**	-	-	30.0	95.7	F
1-F	**2.07**	2.7	6.0			3-F
2-F	**0.58**	1.1	2.5			3-F
3-F	**3.32**	2.3	5.1	5.8	12.9	4-F
4-F	**3.89**	1.1	2.5	6.8	15.1	5-F
5-F	**6.16**	3.5	7.8	8.3	18.2	6-F
6-F	**7.16**	1.7	3.9	9.6	21.0	8-F
7-F	**5.06**	7.5	16.5	7.5	16.5	8-F
8-F	**13.07**	1.5	3.3	16.2	35.8	F
F	**77.98**	-	-	39.1	117.1	G
1-G	**1.11**	2.1	4.6	-	-	G
G	**79.09**	-	-	39.7	118.6	M
1-H	**3.60**	5.3	11.7	-	-	1-2 H
2-H	**1.16**	1.9	4.2	-	-	1-2 H
1-2 H	**4.76**	-	-	7.4	15.5	1-4 H
3-H	**2.97**	4.7	10.3	-	-	1-4 H
4-H	**0.92**	1.6	3.6	-	-	1-4 H
1-4 H	**8.65**	-	-	14.7	31.1	1-6 H
5-H	**2.42**	4.0	8.9	-	-	1-6 H
6-H	**2.46**	3.9	8.6	-	-	1-6 H
1-6 H	**13.53**	-	-	18.6	39.6	1-8 H
7-H	**2.03**	2.9	6.4	-	-	1-8 H
8-H	**0.97**	1.7	3.7	-	-	1-8 H
1-8 H	**16.52**	-	-	21.7	46.0	1-10 H
9a-H	**1.95**	2.3	5.7	-	-	
9b-H	**0.38**	0.6	1.4	2.8	6.5	10-H
10-H	**1.33**	2.4	5.2	-	-	1-10 H
1-10 H	**20.17**	-	-	25.3	59.6	11-H
11-H	**3.42**	5.0	11.0	-	-	H
H	**23.59**			32.4	76.2	M
1-I	**3.13**	5.6	12.4	-	-	K
2-I	**0.59**	1.9	3.8	-	-	K
K	**41.46**	-	-	62.2	133.3	3-I
3-I	**4.18**	7.8	17.2	7.8	17.2	M
I	**45.64**	-	-	66.5	143.4	M
M	**162.88**	-	-	**158.2**	**426.5**	East Pond Discharge
East Pond Discharge SWMM Discharge (MDDPA-Matrix)	**162.88**	-	-	5.0	111.8	Existing Swale

NOTE: SIMILARLY TO THE APPROVED MDDP AND MDDPA, DESIGN POINT ROUTING WAS PERFORMED IN STORMCAD AND THEREFORE NO ADDITIONAL ROUTING TABLES WERE INCLUDED.



WEST FORK - JIMMY CAMP CREEK TOTALS:
DRAINAGE AREA = 160.3 Acres
Q100 = 138.3 CFS
Q5 = 27.3 CFS
CITY OF COLORADO SPRINGS

CASE LINDSAY J
102 E PIKE PEAK AVE STE 200
COLORADO SPRINGS CO 80903-1818

OS-EAST SIDE
FULL SPECTRUM ON-SITE DETENTION REQUIRED
Area: 4.15 Acres
Anticipated Flows: Q100 = 3.4 cfs
Q5 = 0.1

MARKSHEFFEL-WOODMAN INVEST LLC ET AL
102 E PIKES PEAK AVE STE 200
COLORADO SPRINGS CO 80903-1818

MARKSHEFFEL TRIBUTARY TO JIMMY CAMP CREEK TOTALS:
DRAINAGE AREA = 7.6 Acres
Q100 = 8.0 CFS
Q5 = 0.3 CFS

GRAPHIC SCALE
150' 0' 150' 300'
(IN FEET)
1 inch = 150 ft.

LEGEND
FILING #5 PREV. FILING FUT. FILING
DESIGN POINT IDENTIFIER
BASIN IDENTIFICATION
BASIN FLOWS Q5 Q100
BASIN AREA
BASIN BOUNDARY
DBPS BASIN BOUNDARY
BASINS DRAINING TOWARDS WEST POND
BASINS DRAINING TOWARDS EAST POND
EXISTING CONTOURS 5890
PROPOSED CONTOURS 5900

Trails at Aspen Ridge Filing No. 3
Big Johnson Reservoir
Proposed Design Point Summary

Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
1-N	N2 & N3	4.62	7.25	15.97
2-N	N4	1.13	2.10	4.62
3-N	N2-N4	5.75	9.03	19.89
4-N	N5	3.64	6.26	13.79
5-N	N6 & N1	4.38	6.38	14.06
6-N	N1-N6	13.76	21.52	47.40
1-O	O-1	4.60	6.32	13.93
O-2c	O-2c	0.51	0.73	1.61
O-2f	O-2f	0.65	1.11	2.44
O-2g	O-2g	2.04	2.74	6.04
2-O	O-2c, O-2f, O-2g	3.20	4.30	9.47
3-O	O-1, O-2c, O-2f, O-2g	7.80	10.49	23.10
O-2c	O-2c	1.05	1.10	2.42
O-2d	O-2d	0.60	1.09	2.41

Trails at Aspen Ridge Filing No. 3
Big Johnson Reservoir
Proposed Design Point Summary

Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
4-O	O-1, O-2c, O-2d, O-2e, O-2f, O-2g	9.45	12.71	27.99
5-O	O-2b	0.57	0.78	1.71
6-O	O-1, O-2b, O-2c, O-2d, O-2e, O-2f, O-2g,	10.01	13.74	30.27
O-2a	O-2a	1.13	1.82	4.00
7-O	O-1, O-2a, O-2b, O-2c, O-2d, O-2e, O-2f, O-2g,	11.15	15.30	33.70
1-P	N1, O-1, O-2a, O-2b, O-2c, O-2d, O-2e, O-2f, O-2g, P1	31.54	46.47	108.45
2-P	N1, O-1, O-2a, O-2b, O-2c, O-2d, O-2e, O-2f, O-2g, P1	31.54	0.40	13.50

Trails at Aspen Ridge Filing No. 3
Big Johnson Reservoir
Proposed Design Point Summary

Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
3-P	N1, O-1, O-2a, O-2b, O-2c, O-2d, O-2e, O-2f, O-2g, P1, P2	34.61	3.21	30.78

NOTE:
1. FILING NO. 3 FLOW CALCULATIONS USED BECAUSE NO RELEVANT FLOW CHANGES ARE INDICATED FOR THIS FILING.
2. ALL STORM STRUCTURES ARE DESIGNED IN PREVIOUS FILINGS. REFER TO FILING 3 FDR FOR STORM WATER INFORMATION.

REFERENCE DRAWINGS
X-886-PR SITE_F1
X-Title(Drainage)
X-886-PR STORM_F1
X-886-PR SITE-F2
X-886-PR-SITE - F5
X-886-PR-SITE - F3
X-886-PR-SITE - F4

NO.	DATE	DESCRIPTION	BY

REVISIONS

NAME: S:\21.886.048 (Trails at Aspen Ridge - F5)\200 Drainage\201 Drainage Reports\FDR\DWG\DR02\Filing 5 Basins DR02.dwg
PCP: Matrix.ctb
PLOT DATE: Thu Mar 17, 2022 3:42pm

BENCHMARK DATA(ELEV.)
(DATUM)
(DESCRIPTION/LOCATION)

VERTICAL BENCHMARK:

BASIS OF BEARING:

PREPARED UNDER MY DIRECT SUPERVISION, FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

Matrix
2435 Research Parkway, Suite
300 Colorado Springs, CO 80920
Phone 719-575-0100
Fax 719-575-0208

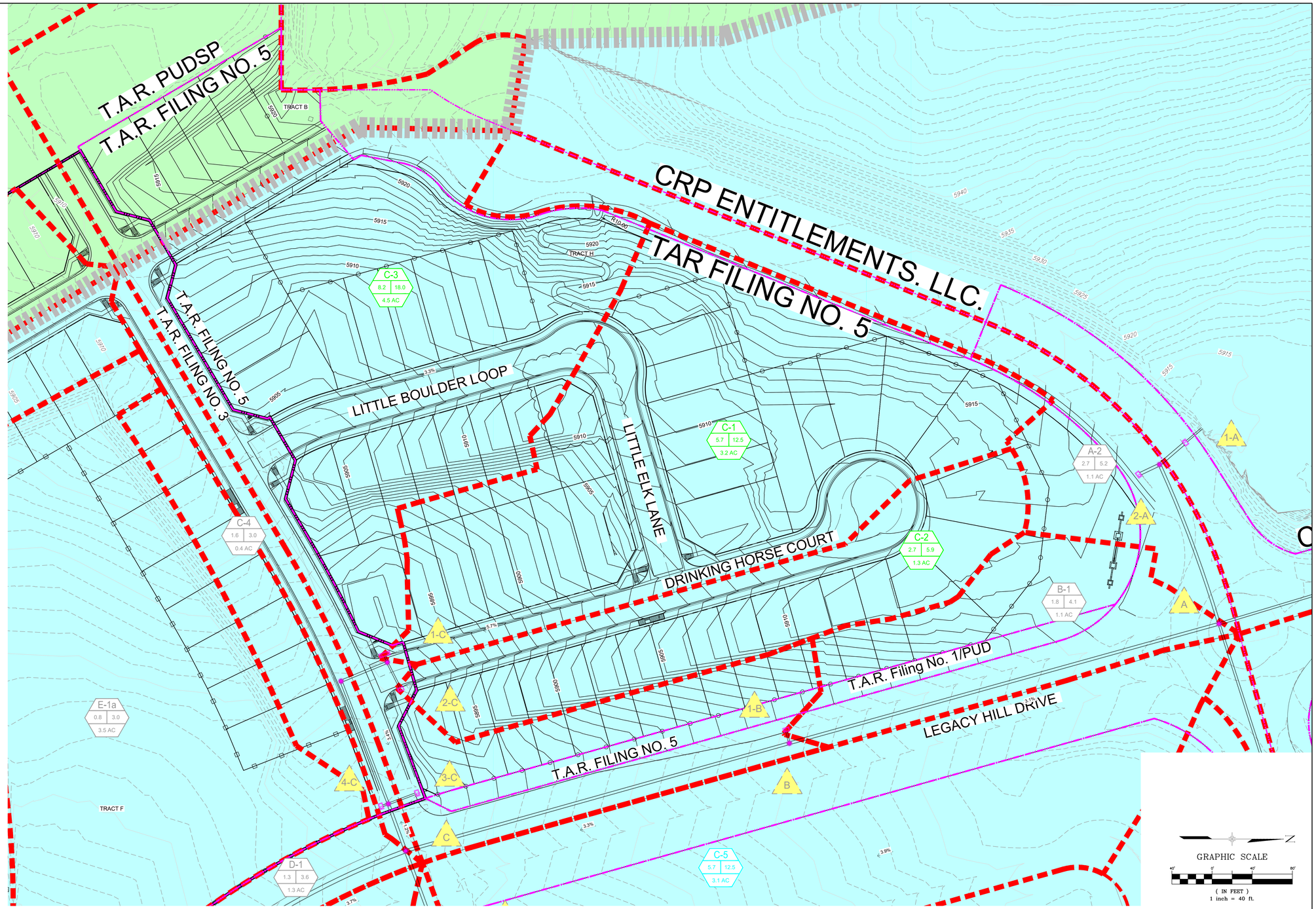
COLA, LLC.

TRAILS AT ASPEN RIDGE FILING #5
FINAL DRAINAGE REPORT
PROPOSED DRAINAGE BASINS

DESIGNED BY: JTS
DRAWN BY: JTS
CHECKED BY:
SCALE
HORIZ:
VERT:
DATE ISSUED: OCTOBER 2021
SHEET NO. 2 OF 3 SHEETS

DR-02

Know what's below. Call before you dig.



GRAPHIC SCALE

40' 0' 40' 80'

(IN FEET)
1 inch = 40 ft.

NOTE:
1. FILING NO. 3 FLOW CALCULATIONS USED BECAUSE NO RELEVANT FLOW CHANGES ARE INDICATED FOR THIS FILING.
2. ALL STORM STRUCTURES ARE DESIGNED IN PREVIOUS FILINGS. REFER TO FILING 3 FDR FOR STORM WATER INFORMATION.

LEGEND

FILING #5 | PREV. FILING | FUT. FILING

DESIGN POINT IDENTIFIER

BASIN IDENTIFICATION

BASIN FLOWS Q5 Q100

BASIN AREA

BASIN BOUNDARY

DBPS BASIN BOUNDARY

BASINS DRAINING TOWARDS WEST POND

BASINS DRAINING TOWARDS EAST POND

EXISTING CONTOURS 5890

PROPOSED CONTOURS 5915

NOTE: SIMILARLY TO THE APPROVED MDDP AND MDDPA, DESIGN POINT ROUTING WAS PERFORMED IN STORMCAD AND THEREFORE NO ADDITIONAL ROUTING TABLES WERE INCLUDED.

REFERENCE DRAWINGS
X-886-PR SITE_F1
X-Title(Drainage)
X-886-PR STORM_F1
X-886-PR SITE-F2
X-886-PR-SITE - F5
X-886-PR-SITE - F3
X-886-PR-SITE - F4

NO.	DATE	DESCRIPTION	BY

REVISIONS

NAME: S:\21.886.048 (Trails at Aspen Ridge - F5)\200 Drainage\201 Drainage Reports\FDR\DWG\DR02-Filing 5 Basins DR03.dwg
PCP: Matrix.ctb
PLOT DATE: Thu Mar 17, 2022 3:45pm

BENCHMARK DATA(ELEV.)
(DATUM)
(DESCRIPTION/LOCATION)

VERTICAL BENCHMARK:

BASIS OF BEARING:

PREPARED UNDER MY DIRECT SUPERVISION, FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

Matrix
2435 Research Parkway, Suite
300 Colorado Springs, CO 80920
Phone 719-575-0100
Fax 719-575-0208

COLA, LLC.

TRAILS AT ASPEN RIDGE FILING #5

FINAL DRAINAGE REPORT

PROPOSED DRAINAGE BASINS

DESIGNED BY: JTS
DRAWN BY: JTS
CHECKED BY:

SCALE
HORIZ:
VERT:

DATE ISSUED: OCTOBER 2021

SHEET NO. 3 OF 3 SHEETS

DR-03