A ▪ C ▪ G

Austin Civil Group, Inc.

Land Planning ▪ Civil Engineering ▪ Development Services

October 25, 2023

City of Fruita Community Development
325 E. Aspen Avenue
Fruita, Colorado 81521

Re: Final Drainage Letter
Gear Estates
1156 18 Road

To Whom It May Concern:

The purpose of this letter is to provide the City of Fruita a drainage letter report for a new residential subdivision located at 1156 18 Road in Fruita, Colorado. As part of this letter Austin Civil Group, Inc (ACG) will review pre- and post-developed drainage conditions, design a water quality component for the project and identify the drainage fee in lieu of stormwater detention/retention. Shown below is an aerial photograph of the project area:

Project Site – 1156 18 Road

123 n 7th street ▪ suite 300 ▪ grand junction, colorado 81501 ▪ 970-242-7540 phone ▪ 970-255-1212 fax

Pre-Developed Drainage Characteristics

The project site is located along 18 Road and directly across from Wildwood Drive. The site currently contains a residential dwelling unit (mobile home) with several outbuildings. A fenced off livestock pen exists along the eastern end with landscaping (sparse grass/weeds) located throughout. Two (2) curb cuts exist along 18 Road that gives the property access to 18 Road. Shown below is street view of the property:

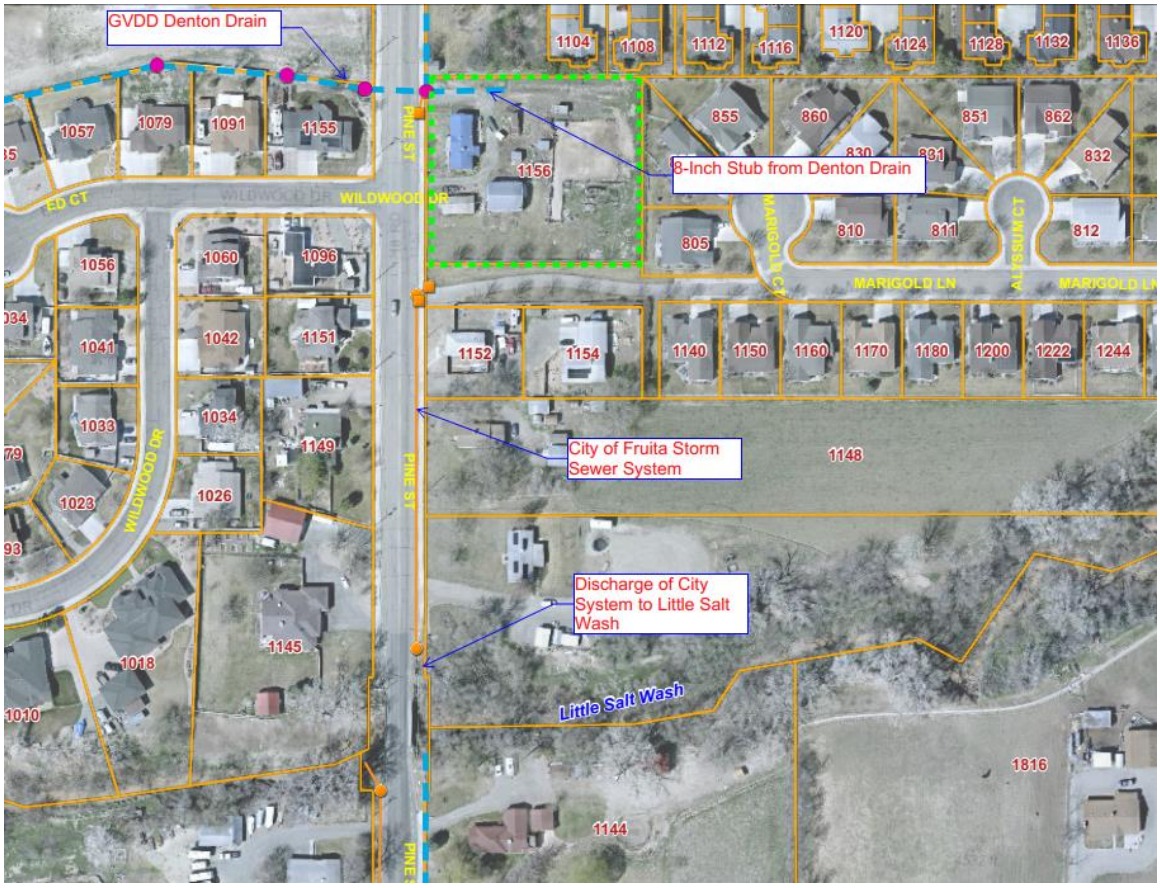
Street View of Property from 18 Road

According to USDA Web Soil Survey the property consists of two hydrologic soils groups. A Fruitland fine sandy loam (Rating A) and a Turley Clay Loam (Rating C). Soil Ratings A & C are different in infiltration rates and rate of water transmission where Rating A have high infiltration and water transmission rates while Ratings B have slow infiltration and water transmission rates. For the purpose of this study and to be conservative a Rating C has been selected in the calculation of runoff.

A Geologic Review and Soils Engineering Report, prepared by Capstone Enterprises West, LLC, dated August 31, 2023 was prepared for the property. Five (5) test pits were dug on the property that encountered the same type of material consistent with the USGS and NRCS mapping, alluvium and colluvium sediment derived from sandstone and shale. On August 8th, 2023, groundwater was encountered in two (2) test pits (TP-1 and TP-2), at levels 8.0 and 6.0 feet below the surface, respectively. The water appeared to be associated with an unlined tailwater/stormwater ditch on the north side of the property.

The project site is very flat in nature. Elevation change across the property is 1-foot or less. Majority of stormwater runoff that does concentrate and flow would migrate to the northern boundary and be intercepted by the existing tailwater/stormwater ditch and the 8-inch Denton Drain stub pipe. The Denton Drain flows west and eventually discharges into the Little Salt Wash near the 17 ½ Road and Sabil Drive intersection. A small area of the property, southwest corner flows southwesterly and discharges directly into the 18 Road curb and gutter which conveys into a City of Fruita storm sewer system which discharges into the Little Salt Wash approximately 500-feet south of the property.

Near the northwest corner of the property the Grand Valley Drainage District maintains the Denton Drain. An 8-inch stub pipe out of the Denton Drain, which runs along the northern boundary of the property, collects some surface stormwater from the property and irrigation tailwater from properties to the east. The Denton Drain eventually discharges into the Little Salt Wash near the 17 ½ Road & Sabil Drive intersection. Shown on the following page is an aerial photo of these stormwater drainage facilities:



Existing Drainage Facilities

According to the National Flood Insurance Program (NFIP) Flood Insurance Rate Map (FIRM) for Mesa County, Colorado and Map Number 08077C0436F, the property is located in Zone X an area outside of the 0.2% Annual Chance Floodplain.

Offsite surface stormwater runoff from upgradient basins is considered minimal with the exception what the existing 8-inch stub Denton Drain collects. A short retaining wall along the eastern boundary limits off-site surface stormwater from draining onto the property.

While the Pre-Developed topographical drainage conditions show that the site could be delineated into two (2) drainage basins, one for the 18 Road storm sewer system and the second for the 8-inch stub Denton Drain, for the purpose of this drainage letter and the calculation of the water quality component and drainage fee only one Pre-Developed basin is considered and it consists of the entire property. Basin H-1 consists of approximately 1.23 acres and its longest flow path is considered from the eastern boundary to Denton Drain. Summarized below are the pre-developed drainage calculations for H-1:

Table 1: Pre-Developed Drainage Basin H-1 Runoff Calculations

Basin	Storm ID	Soil Type	Total Basin Size (ac)	Area of Roof (ac)	Area of Landscape (ac)	Area of Gravel (ac)	Composite "C"	Runoff "Q"
H-1	10-year	C	1.23	0.10	0.97	0.16	0.32	0.63
	100-year						0.54	2.30

Post-Developed Drainage Characteristics

Improvements proposed for the property is an 8-lot residential subdivision. Other proposed improvements are a residential local street, Sprocket Court, consisting of 28-feet of asphalt and curb, gutter and sidewalk on both sides, utility infrastructure and a water quality basin near the southwest corner of the property.

The Post-Developed site can be delineated into two (2) drainage basins. Basin D-1 consists of approximately 0.88 acres and majority of the residential lots and the new Sprocket Court. Runoff conveys either into Sprocket Court or the rear lot drainage system which both discharge directly into the water quality basin. Basin D-2 consists of approximately 0.35 acres and the rear half of Lots 1-5. Runoff is collected by their rear lot drainage system and discharges directly into the Denton Drain. Summarized below are the post-developed drainage calculations for Basin D-1 & D-2:

Table 2: Post-Developed Drainage Basin D-1 & D-2 Runoff Calculations

Basin	Storm ID	Soil Type	Basin Size (ac)	Area of Landscape (ac)	Area of Roof (ac)	Area of Imperv (ac)	Composite "C"	Runoff (cfs)
D-1	10	C	0.88	0.45	0.148	0.25	0.45	0.66
	100						0.60	1.86
D-2	10	C	0.35	0.27	0.08	0	0.35	0.19
	100						0.56	0.64

The site surface areas noted above were delineated into roof area, landscape area and concrete/asphalt area. For all the lots a 1,400-sf home, 20'x20' concrete driveway and remaining area landscaping were considered.

Water Quality Component

A water quality capture volume (WQCV) feature will be implemented into the design of the site since the project site is greater than 1.0 acre in size. A water quality basin will be provided at the southwest end of the site. Collected runoff will be routed through an outlet structure and discharge into an existing storm inlet located just north of the pedestrian walkway corridor. A perforated drain plate will be installed in the outlet structure that will delay release over a 40-hr drain time. Procedures outlined in Section 1604 of the Mesa County/City of Grand Junction Stormwater Management Manual (SWMM) have been used to size the WQCV. Summarized in the table below are calculations identifying the required water quality volume for the site:

Table 3: Water Quality Capture Volume Calculation

K(1)	a(2)	I(3)	WQCV(4)	A(5)	Design Volume(6)
		decimal	inches	acres	cubic feet
0.65	1.00	0.41	0.12	1.23	637

(1) Adjustment to equation for Mesa County area = $d_6/0.43$; where $d_6 = 0.28$, therefore K = 0.6 per SWMM 1604.2
(2) Adjustment for BMPs drain time – per SWMM 1604.2
(3) Watershed impervious as a decimal
(4) Water Quality Capture Volume is in watershed inches = $K(a((0.91*I^3) - (1.19*I^2) + (0.78*I)))$ – per SWMM 1604.2
(5) Tributary watershed area in acres
(6) Design Volume is 120% of the WQCV = WQCV * A * 1.2 * (1/12) * 43,560

Note that the WQ Basin has been sized for the entire 1.23 acres even though Basin D-2 discharges into the Denton Drain.

The designed WQ basin has been provided with approximately 832 cubic feet of storage. This places the WQCV elevation at 4538.96 within the basin. Runoff that exceeds the WQCV will overtop the control plate and discharge directly through a proposed 15-inch storm pipe to the existing drain inlet. Calculation of the 15-inch storm pipe from outlet structure to existing drain inlet show that it has flow capacity of approximately 2.97 cfs which exceeds the 100-year runoff of Basin D-1.

Post-Construction Stormwater Control Operations and Maintenance

To insure the adequate maintenance, operation and repair of the site's water quality basin, in perpetuity, by the owners of the property, the following mutual covenants contained herein shall be followed:

- The Post-Construction Outlet Structure and its accompanying pipes/manholes shall be constructed by the Landowner in accordance with the plans and specifications and described in this report letter and Final Construction Plans.
- The Post-Construction Outlet Structure and its accompanying pipes/manholes shall operate and be maintained in good working order as reasonably determined by Mesa County Stormwater, Qualified Erosion Control Specialist (QECS) and this report letter.
- The Post-Construction Outlet Structure and its accompanying pipes/manholes shall be inspected quarterly and after any significant rainfall during the 1st (first) year of operation by the QECS. At any time during the inspections the QECS finds a significant collection of sediment and/or debris that inhibits the facility from functioning properly, appropriate means shall be selected by the QECS injunction with the Landowner to clean and maintain the facility to its original working order.
- After the 1st (first) year of operation, the QECS has the option to reduce the interval of inspections based on the 1st year's reports.
- The Post-Construction Stormwater Control Operations and Maintenance Agreement entered into by the Landowner and Mesa County Stormwater shall constitute a covenant running with the Property and shall be an equitable servitude binding on present and subsequent owners of the Property in whole or in part, and their administrators, executors, assigns, heirs and successors in interest.

Drainage Fee

Since the project is not providing stormwater detention/retention a drainage impact fee is proposed. The drainage fee calculation for the City of Fruita is specified in Section 17.47.150 of the Land Development Code and utilizes a "Base Value" amount of $18,815.00 and runoff coefficient (C) values utilizing the Rational Method procedures as specified in the Mesa County Stormwater Manual (SWMM). The drainage impact fee is therefore determined in accordance with the following formula:

Drainage Fee = Base Value x $(C_{100D} - C_{100H}) \times A^{0.7}$

= $18,815 x (0.58-0.54) x $1.23^{0.7}$ = $870

Conclusion

Gear Estates is proposed as an 8-lot residential subdivision that will construct Sprocket Court. A water quality basin is proposed at the southwest corner of the property that will provide the required water quality capture volume. Discharge from the water quality basin will be to an existing storm drain inlet located along the north side of the existing pedestrian pathway. Runoff exceeding the water quality level will overtop the control plate and discharge via a 15-inch storm pipe.

If you have any additional questions or concerns, please give me a call at 970-242-7540.

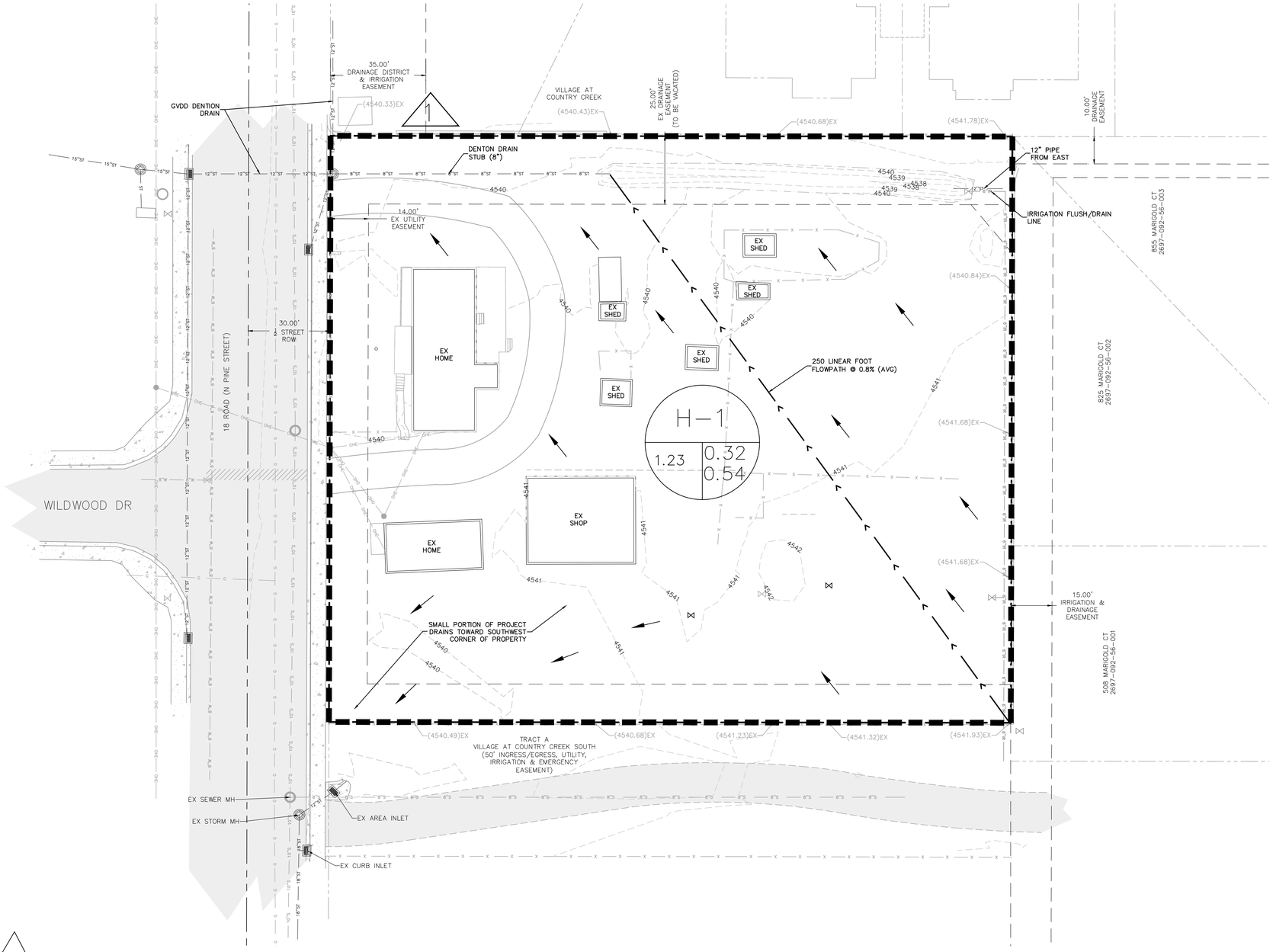
Sincerely,
Austin Civil Group, Inc.

Scott Sorensen, P.E.
Project Engineer

Attachments:
- Appendix A – Pre-Developed Drainage Conditions Map, D1
- Appendix B – Post-Developed Drainage Conditions Map, D2
- Appendix C – Rational Method & WQCV Calculations Spreadsheets
- Appendix D – Outlet Structure Detail

APPENDIX A

PRE-DEVELOPED DRAINAGE CONDITIONS MAP, D1



A
B | C.1 / C.2

D=DESIGN POINT DESIGNATION

A=BASIN DESIGNATION
B=AREA IN ACRE
C.1=10-YR COMPOSITE RUNOFF COEFFICIENT
C.2=100-YR COMPOSITE RUNOFF COEFFICIENT

DESIGN POINT	AREA (AC.)	10-YR (CFS)	100-YR (CFS)
1	1.23	0.63	2.30

UTILITY CONTACTS

UTE WATER DISTRICT	242-7491
CITY OF FRUITA PUBLIC WORKS	858-9558
GRAND VALLEY IRRIGATION CO.	242-2762
GRAND VALLEY DRAINAGE DISTRICT	242-4343
XCEL ENERGY	244-2781
QWEST	244-4333
CHARTER	245-8750

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

SCALE VERIFICATION
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET
ADJUST SCALES ACCORDINGLY

REVISIONS

NO.	DESCRIPTION	DATE	BY

A • C • G
AUSTIN CIVIL GROUP, INC
Land Planning ▪ Civil Engineering ▪ Development Services
123 N. 7th Street, Suite 300 ▪ Grand Junction, Colorado 81501
(970) 242-7540

GEAR ESTATES
description
HISTORIC DRAINAGE
1156 18 ROAD
FRUITA, CO
prepared for
TREYTYN PROPERTIES LLC

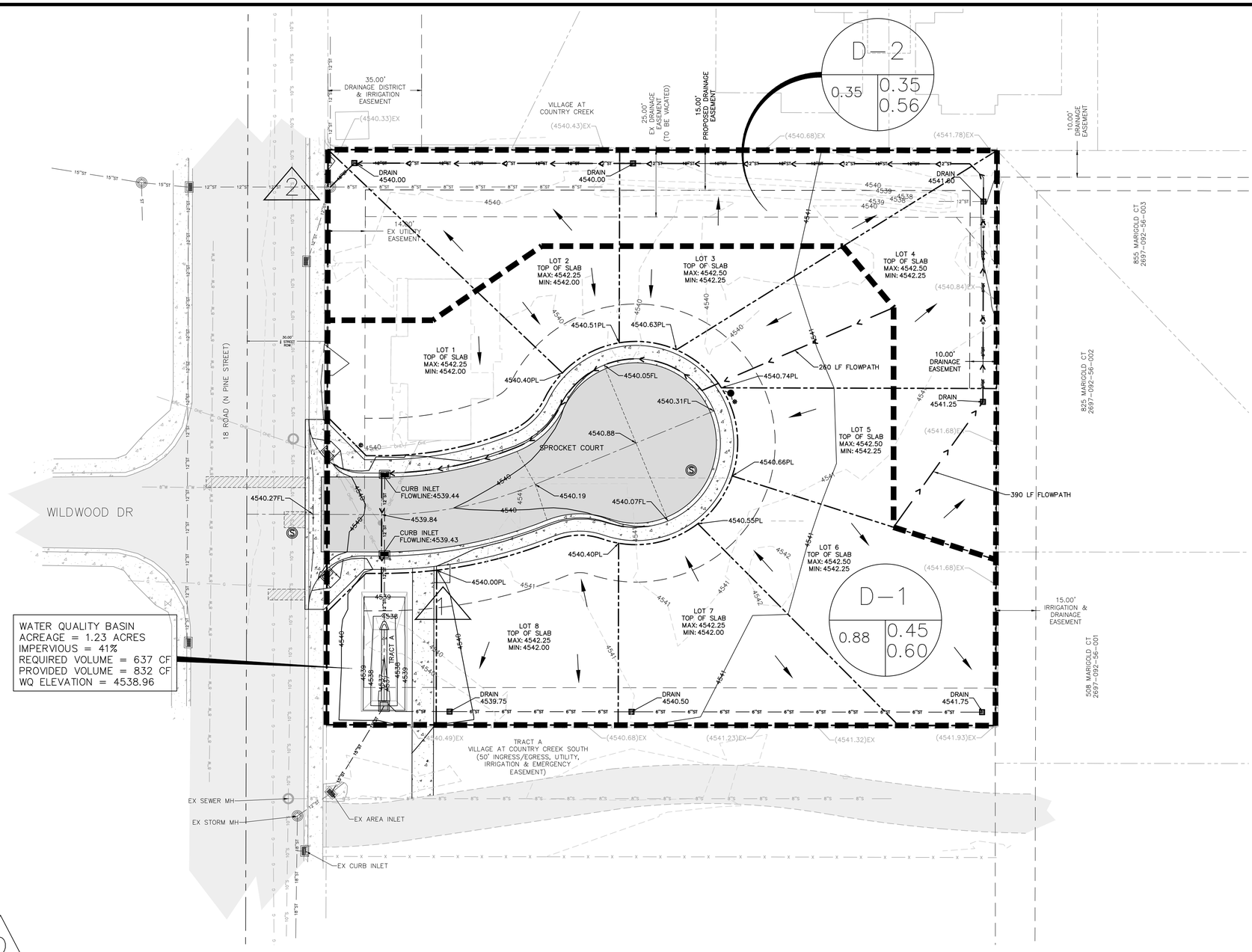
DRAWN BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:
STS	STS		STS

JOB NUMBER: 1503.0001
DATE: 10-25-23
SCALE: 1"=20'
SHEET NO: D-1

P:\1503.0001 - Key Subdivision\Drawings\CSD\Production Drawings\PASD-HISTORIC.dwg, 10/17/2023 3:18:3 PM, DWG To PDF.pc3

APPENDIX B

POST-DEVELOPED DRAINAGE CONDITIONS MAP, D-2



A
B C.1 C.2

D

D=DESIGN POINT DESIGNATION

A=BASIN DESIGNATION
B=AREA IN ACRE
C.1=10-YR COMPOSITE RUNOFF COEFFICIENT
C.2=100-YR COMPOSITE RUNOFF COEFFICIENT

DESIGN POINT	AREA (AC.)	10-YR (CFS)	100-YR (CFS)
1	0.88	0.66	1.86
2	0.35	0.19	0.64

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UTE WATER DISTRICT	242-7491
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GEAR ESTATES
description
DEVELOPED DRAINAGE CONDITIONS
1156 18 ROAD
FRUITA, CO
prepared for
TREYTYN PROPERTIES LLC

DRAWN BY: STS
DESIGNED BY: STS
CHECKED BY:
APPROVED BY: STS

JOB NUMBER: 1503.0001
DATE: 10-25-23
SCALE: 1"=10'
SHEET NO: D-2

APPENDIX C

RATIONAL METHOD & WQCV CALCULATIONS SPREADSHEETS

Gear Estates
1156 18 Road
Fruita, CO

AREA + RUNOFF CURVE NUMBER CALCULATIONS

TIME OF CONCENTRATION & RATE OF RUNOFF

BASIN	STORM EVENT	SOIL	Total Basin Area [1]	Agriculture		Roof		Gravel		Impervious		Landscape		Residential		Composite i[3]	Composite C[4]	Composite CN[5]	K[6]	Intitial Overland Flow			Travel Time- Channel Flow					Totals			
				i[2]	A[1]	i[2]	A[1]	i[2]	A[1]	i[2]	A[1]	i[2]	A[1]	i[2]	A[1]					Length	Slope	t_i[7]	Length	S_w	Cv[8]	Vel[9]	t_t[10]	Average Slope[11]	T_c[12]	Intensity, I[13]	Runoff, Q[14]
																				feet	%	min.	feet	ft/ft		ft/sec	min.		min.	in./hr.	cfs
H-1	10-YEAR	C	1.23	0.02		0.9	0.10	0.35	0.16	1.00		0.02	0.97			0.13	0.32	77	0.23	280	0.008	11.56						0.01	11.56	1.63	0.63
	100-YEAR	C	1.23	0.02		0.9	0.10	0.35	0.16	1.00		0.02	0.97			0.13	0.54	77	0.23	280	0.008	11.56						0.01	11.56	3.47	2.30
D-1	10-YEAR	C	0.88	0.02		0.9	0.18	0.30		1.00	0.25	0.02	0.45	0.35		0.48	0.45	86	0.39	80	2	9.13	180	0.007	20	1.6	1.86	1.07	10.99	1.66	0.66
	100-YEAR	C	0.88	0.02		0.9	0.18	0.30		1.00	0.25	0.02	0.45	0.35		0.48	0.60	86	0.39	80	2	9.13	180	0.007	20	1.6	1.86	1.07	10.99	3.54	1.86
D-2	10-YEAR	C	0.35	0.02		0.9	0.08	0.30		1.00		0.02	0.27	0.35		0.22	0.35	79	0.27	60	2	9.21	330	0.005	20	1.4	3.89	0.73	13.10	1.54	0.19
	100-YEAR	C	0.35	0.02		0.9	0.08	0.30		1.00		0.02	0.27	0.35		0.22	0.56	79	0.27	60	2	9.21	330	0.005	20	1.4	3.89	0.73	13.10	3.28	0.64
WQ	10-YEAR	C	1.23	0.02		0.9	0.26	0.30		1.00	0.25	0.02	0.72	0.35		0.41	0.42	84	0.35												
	100-YEAR	C	1.23	0.02		0.9	0.26	0.30		1.00	0.25	0.02	0.72	0.35		0.41	0.58	84	0.35												

(1) Area in acres

(2) Imperviousness Value from Table 701 of SWMM as a decimal

(3) Composite Impervious Value as a decimal - ((i1*A1)+(i2*A2)+(i3*A3)+(i4*A4)+(i5*A5)+(i6*A6))/(A1+A2+A3+A4+A5+A6)

(4) Runoff Coefficient from Table 702 in SWMM

(5) SCS Curve Number (CN) - SWMM Equation 708

(6) Flow Resistance Coefficients = Table 702 of SWMM with $C_{5\text{-}yr}$ Value Based on Soil Type and Imperviousness Value in (4)

(7) Initial or Overland Flow Time (minutes): $t_i = (1.8 * (1.1\text{-}K) * L_o^{1/2}) / S^{1/3}$ - Limited to 300-ft max = Per SWMM, Equation 702; t_{imin} = 5 minutes; t_{imax} = (L/180) + 10 (urbanized watersheds) Equation 704

(8) Travel Time Conveyance Coefficient per Table 703 of SWMM

(9) $V = C_v * S_w^{1/2}$ -- per SWMM Equation 703

(10) Travel Time in Concentrated Flow: $t_t = L/(V*60)$

(11) Average Slope as a Percentage

(12) Total $T_c = t_i + t_t$

(13) Average Intensity (in./hr.); $I_{10yr} = (28.9 * 0.63)/(10 + T_c)^{0.786}$; $I_{100yr} = (28.9 * 1.34)/(10 + T_c)^{0.786}$ -- per SWMM 604

(14) Storm Runoff: $Q_{cfs} = C * I_{(in/hr)} * A_{(acres)}$ -- per SWMM Equation 710

WATER QUALITY CAPTURE VOLUME (WQCV)

LOCATION	K[(1)]	a[(2)]	I[(3)]	WQCV[(4)]	A[(5)]	Design Volume[(6)]
			decimal	inches	acres	cubic feet
POND	0.65	1.00	0.41	0.12	1.23	637

(1) Adjustment to equation for Mesa County area = $d_6/0.43$; where d_6 =0.28, therefore K = 0.65 --- per SWMM 1604.2

(2) Adjustment for BMPs drain time --- per SWMM 1604.2

(3) Watershed impervious as a decimal

(4) Water Quality Capture Volume is in watershed inches = $K(a((0.91*I^3) - (1.19*I^2) + (0.78*I)))$ ---- per SWMM 1604.2

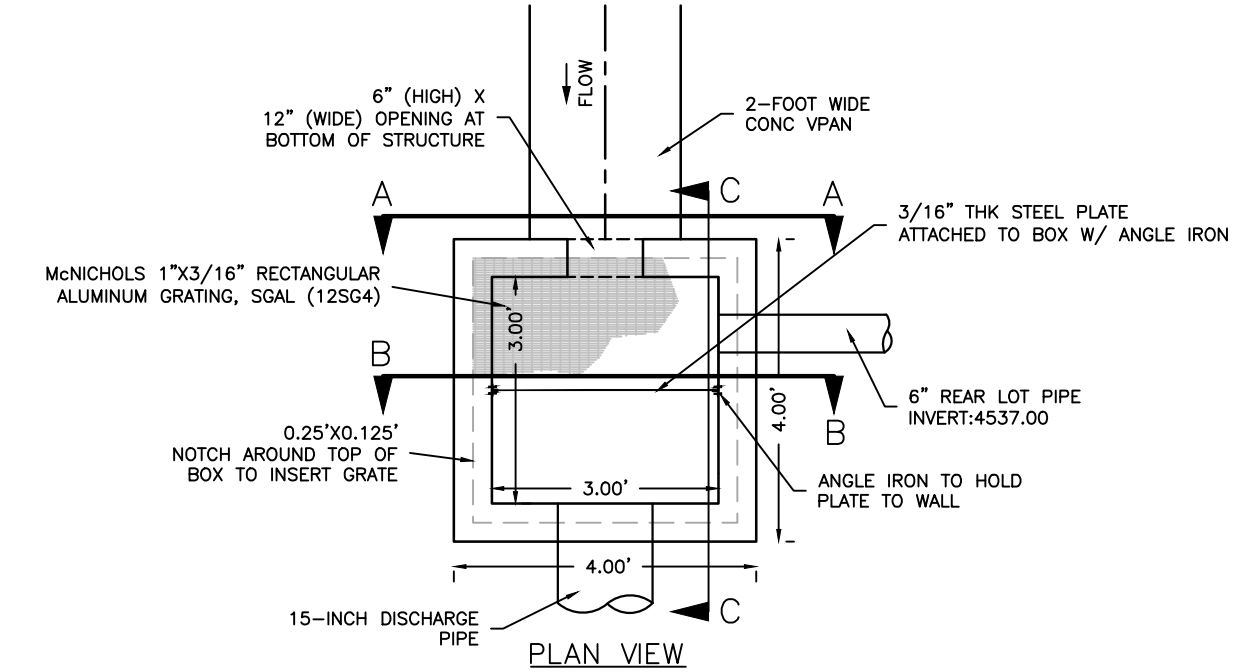
(5) Tributary watershed area in acres

(6) Design Volume is 120% of the WQCV = WQCV * A * 1.2 * (1/12) * 43,560

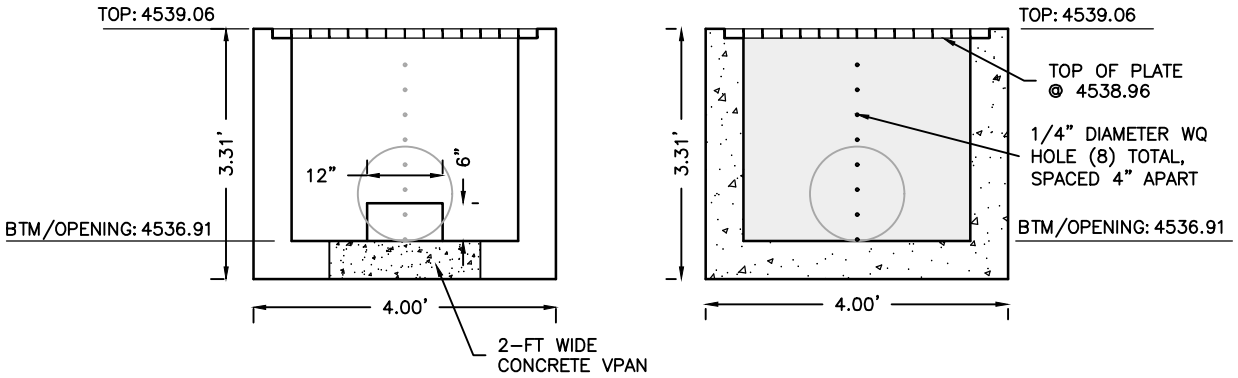
VOLUME AVAILABLE IN WQ POND					
ELEVATION	AREA	AVERAGE AREA	DEPTH	VOLUME END AREA	TOTAL VOLUME
feet	ft^2		feet	ft^3	
4536.91	1.0	1			
4537.00	40	21	0.1	2	2
4538.00	308	174	1.0	174	176
4539.00	650	479	1.0	479	655
4539.25	765	708	0.3	177	832
VOLUME=V=((AREA1+AREA2)/2)*Depth; SWMM FIGURE 1406					

APPENDIX D

OUTLET STRUCTURE DETAIL

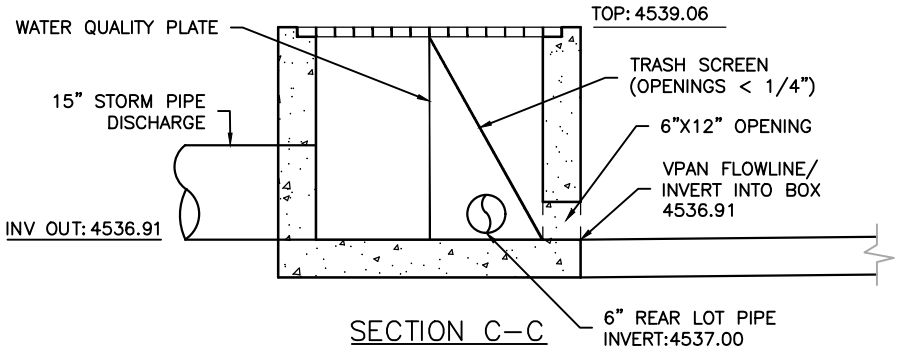


PLAN VIEW



SECTION A-A

SECTION B-B



SECTION C-C

WQ OUTLET STRUCTURE

Title: GEAR ESTATES *WQ OUTLET STRUCTURE*	A · C · G AUSTIN CIVIL GROUP, INC Land Planning ▪ Civil Engineering ▪ Development Services 123 N. 7th Street, Suite 300 ▪ Grand Junction, Colorado 81501 (970) 242-7540
By: STS	
Date: 10-25-23 **Scale:** NTS	

Gear Estates
Water Quality Control Plate
Job #: 1503.0001
10/25/2023

Given:

WQCV =	637	cubic feet
Box Invert Elevation=	4536.91	ft
WQCV elevation =	4538.96	ft
10_{yr} Elevation=	-	ft
100_{yr} Elevation=	-	ft

Urban Drainage & Flood Control District Equation EDB-3 for 40-hr Drain Time, 4" Hole Spacing

A = (88*(WQCV^(0.95/H^0.085)))/(Td*S^0.09*H^(2.6*S^0.3))

A = Hole Area in Square Inches for holes at 4" On Center
WQCV = Water Quality Capture Volume in Acre-Feet
H = Depth of Volume in feet (WQCV - Box Invert Elevation)
Td = Time to Drain the WQCV Volume in hours
S = Slope in feet vertical / feet horiziontal

Solving for A:

WQCV =	0.01	Acre-Ft
H =	2.05	ft
Td =	40.000	
S =	0.020	ft/ft
A =	0.040	Area of Hole In Square inches

Hole Diameter In Inches = 0.226352 = Approx. 1/4"