



# **MERIDIAN SERVICE METROPOLITAN DISTRICT WATER TREATMENT PLANT EXPANSION DRAINAGE LETTER**

**(THE ESTATES AT ROLLING HILLS  
RANCH FILING NO. 2)**

**PCD FILE NO. PPR-22-12**



**PREPARED BY**

Rich Gallegos, P.E., CFM  
RESPEC  
121 S. Tejon St., Suite 1110  
Colorado Springs, CO 80903

**PREPARED FOR**

Meridian Service Metropolitan District  
11886 Stapleton Drive  
Falcon, CO 80831

**MARCH 2023**

## ENGINEER'S STATEMENT

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



Richard Gallegos, P.E., CFM  
Registered Professional Engineer State of Colorado No. 36247

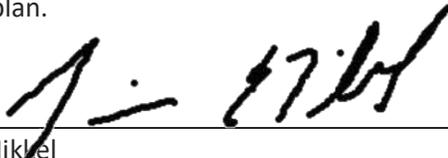
Date



03/21/2023

## DEVELOPER'S STATEMENT

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



3/21/2023

Jim Nikkel  
Meridian Service Metropolitan District  
11886 Stapleton Drive  
Falcon, CO 80831

Date

## EL PASO COUNTY

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

County Engineer/ECM Administrator



On behalf of the Meridian Service Metropolitan District, RESPEC Engineering is submitting this Small Subdivision Drainage Report to support the development of the Meridian Service Metropolitan Water Treatment Plant Expansion.

## 1. GENERAL PROPERTY DESCRIPTION WITH ACREAGE

The 3.3-acre site is located within the larger Meridian Ranch Master Planned Community east of Sunrise Ridge Drive and south of Palmer Peak Place. More specifically, the current water treatment facility is southeast of the intersection of Sunrise Ridge Drive and Palmer Peak Place.

Two County-approved Drainage Reports were found within the County's files that include the project site:

- *Preliminary Drainage Report for Estates at Rolling Hills Ranch Filing 2* by Tech Contractors, revised September 28, 2020, and approved on November 25, 2020, by the County.
- *Final Drainage Report for Estates at Rolling Hills Ranch Filing 2* by Tech Contractors, revised September 30, 2021 and approved on October 7, 2021, by the County.

Each report provides an existing and proposed conditions analysis. The reports also conform to requirements for Gieck Ranch Drainage Basin. Based upon the approval dates listed, the *Final Drainage Report for Estates at Rolling Hills Ranch Filing 2* has been used as the guiding document for this analysis.

Pertinent excerpts from the Estates at Rolling Hills Ranch FDR report are attached to this Small Subdivision Drainage Report.

## 2. GENERAL EXISTING DRAINAGE CHARACTERISTICS

The majority of the site drains to the south toward a channel. The site consists of slopes between 1% and 3%. Currently, underground storm sewer lines and swales exist on the site, shown in Appendix A – Estates at Rolling Hills Ranch Existing Drainage Map. The expansion of a water treatment facility, located on the central portion of the site (Appendix A – Proposed Drainage Conditions), warrants additional drainage considerations. The 5-year storm event and 100-year storm event were used in this analysis in order to compare flow values provided in the Final Drainage Report for Estates at Rolling Hills Ranch Filing 2.

The Estates at Rolling Hills Ranch FDR included the site as part of the existing conditions analysis within Drainage Area D01; see attached Estates at Rolling Hills Ranch Existing Drainage Map. D01 totals 9.6 acres with peak runoff rates of 14.0 cfs for the 5-year storm event and 31.0 cfs for the 100-year storm event. Flows travel overland and into a channel located on the southern portion of the drainage basin.

The site is located in an Unshaded Zone X (areas outside of the 100-year floodway) flood hazard area per the Federal Emergency Management Agency's Flood Insurance Rate Map panel 08041C0552G, effective date December 7, 2018. See attached floodplain exhibit.

### 3. GENERAL PROPOSED DRAINAGE CHARACTERISTICS

All of the improvements will be located in Drainage Area D01, per the Estates of the Rolling Hills Ranch FDR. Per the FDR, basin D01 totals 9.8-acres and generates peak runoff rates of 14.0 cfs for the 5-year storm event and 31.0 cfs for the 100-year storm event. Basin D01 has a calculated percent impervious cover of 43.3% and calculated composite runoff coefficients of 0.44 for the 5-year storm and 0.59 for the 100-year storm. The 3.3-acre proposed site is accounted for in the Drainage Area D01. According to the FDR, this portion of the drainage area is considered a commercial area, with an assumed percent impervious cover of 95.0%.

The site will be comprised of the existing water treatment plant, the proposed water treatment plant expansion, gravel driveway, and an easement for utilities. The site is divided into three proposed sub-basins (see Appendix A – Proposed Drainage Exhibit). Sub-basin PP1 and Sub-basin PP2 will drain to the southeasternmost portion of the site. Sub-basin PP1 will produce flows of 7.9 cfs for the 5-year storm and 14.5 cfs for the 100-year storm. Sub-basin PP1 will sheetflow to the east into a 2' deep swale with 3:1 side slope, which will then divert flows to the south towards the channel. Sub-basin PP2 will produce flows of 5.4 cfs for the 5-year storm and 9.9 cfs for the 100-year storm. Sub-basin PP2 will sheetflow to the south into a 2' deep swale with 3:1 side slopes, which will then divert flows east towards the southeasternmost portion of the site. A rock chute will carry flows from swales in both Sub-basin PP1 and Sub-basin PP2 into the channel located south of the site. Details on this rock chute are provided below in Appendix B - Rock Chute Design.

Sub-basin PP3 will flow to the northwest. This sub-basin will produce flows of 0.4 cfs for the 5-year storm and 0.8 cfs for the 100-year storm. These flows will sheetflow to the northwest.

Based upon the Estates of the Rolling Hills Ranch FDR, flows from both drainage areas will be collected in swales and conveyed into a proposed 18' wide rock chute in the southeast corner of the site. This location is deemed suitable according to the existing topography. These flows will continue towards the existing channel and onto Pond G downstream of the channel. Based on arial imagery from July of 2022, the channel has been stabilized with riprap according to the *Final Drainage Report for Estates at Rolling Hills Ranch Filing 2*. Offsite detention is provided by Pond G, where proposed flows are conveyed. Pond G requires no improvements.

Onsite water quality is provided by two grass swales located on the east and south ends of the property. These pervious areas reduce runoff by 33.0%, according to the UD-BMP spreadsheet version 3.07. This meets the MS4 Permit Section 4.a.iv.E requirement that at least 20% of the upstream imperviousness must be disconnected from the storm drainage system and drain through a receiving pervious area control measure. The two swales comprise of 17.6% of the footprint of the total upstream disconnected impervious area, exceeding the 10% required by the County's MS4 Permit. This information and calculations can be found below in Appendix A – Green Infrastructure Exhibit and Appendix B – UD-BMP spreadsheet.

### 4. HYDROLOGICAL CALCULATIONS

For this drainage analysis, we have completed two evaluations. The first is to compute the overall percent of impervious cover to verify that the proposed land use complies with the assumptions outlined in the Estates of the Rolling Hills Ranch FDR. The second is to size the proposed swales on the eastern and southern portions of the property, as well as the outlet pipe that will drain into the existing channel.

Compliance with the Estates of the Rolling Hills Ranch FDR:

As part of the analysis of the proposed conditions completed for the Estates of the Rolling Hill Ranch, the assumptions for the one drainage area (D01) were reviewed. The FDR assumes the 3.3-acre proposed site, a portion of drainage area D01, is a commercial site. The area assumes a hydrologic soil type “B” and a maximum percent impervious of 95.0%. The overall percent impervious calculation for the Meridian Service Metropolitan District Water Treatment District as designed was completed to verify that the proposed development complies with the FDR analysis.

- Total Acreage: 3.3-acres
  - Total area of pavement/building: 0.15-acres @ 100% Impervious
  - Total area of Gravel Drive/Rock Landscaping: 0.65-acres @ 80% Impervious
  - Total area of vegetated area: 2.50-ac @ 0% Impervious
- Computed Site Percent Impervious: 20.3%
- Maximum Allowable Percent Impervious: 95%

The site as designed has an overall percent impervious of 20.3%, which is less than the maximum allowed by the Meridian Service Metropolitan District of 95%; **therefore, the land use design complies with the approved master drainage plan.** Sufficient stormwater mitigation capacity and water quality exist within Pond G downstream.

Swale and Outlet Pipe Calculations:

Two drainage areas were delineated to compute flows directed to two proposed swales. Each area considers the proposed grades for the Meridian Service Metropolitan District Water Treatment Plant Expansion. The Rational Method was used to determine the peak 5-year and 100-year flows and utilize the same assumptions given within the Estates at the Rolling Hills FDR.

The 5-year,  $C(5) = 0.80$ , and 100-year,  $C(100) = 0.88$ , runoff coefficients for commercial areas given in the *El Paso County Drainage Criteria Manual*. Runoff coefficients were compared to those in the Estates at Rolling Hills Ranch Filing No. 2 Final Drainage Report. See Appendix D for the referenced runoff coefficients. The drainage areas delineated specifically for this analysis also are contained within the larger FDR drainage delineations given within the County approved report.

Computed peak flow rates of  $Q(5) = 7.9$  cfs and  $Q(100) = 14.5$  cfs from Sub-basin PP1 will sheetflow east to a proposed swale. Given a minimum 1.9% slope across this proposed swale on the eastern portion of the site, Manning’s normal depth calculation was used to size the proposed swale. A Manning’s  $n$  value of 0.025 was used for grass lined channels. According to these calculations, a minimum 2.0 foot deep triangular channel is required to accommodate the 100-year flow. This minimum value accounts for 1’ of freeboard above the water surface. A value of 2’ was selected for this channel. This calculation is shown below in Appendix B – East Swale Calculation.

Computed peak flow rates of  $Q(5) = 5.4$  cfs and  $Q(100) = 9.9$  cfs from Sub-basin PP2 will sheetflow south to a proposed swale. Given a minimum 1.4% slope across this proposed swale on the eastern portion of the site, a Manning’s normal depth calculation was used to size the proposed swale. A Manning’s  $n$  value of 0.025 was used for grass lined channels. According to these calculations, a minimum 1.8 foot deep triangular channel is required to accommodate the 100-year flow. This minimum value accounts for 1’ of freeboard above the water surface. A value of 2’ was selected for this channel for simplicity. This calculation is shown below in Appendix B – South Swale Calculation.



Flows from Sub-basin PP1 and Sub-basin PP2 combine in the southeasternmost portion of the site. This produces combined flows of approximately 13.3 cfs for the 5-year storm and 24.4 cfs for the 100-year storm.

## 5. DRAINAGE FEES

The proposed development falls in the Gieck Ranch Drainage Basin. The entire development occupies 3.3 acres of land. The calculated percent impervious for this site is 20.3%. This calculation is shown above in the Hydrologic Calculations section of this report.

Gieck Ranch Fees:

Drainage Fees: There are currently no drainage fees for this basin.

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Bridge Fees: There are no bridge fees for this basin.

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# APPENDIX A

## MAPS

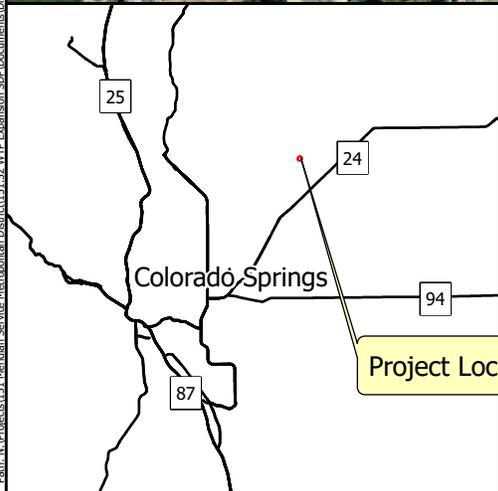




Project Location

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

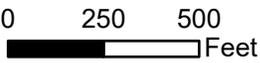
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Project Location



1"=500'



Prepared by:



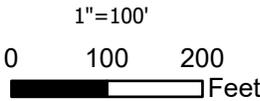
121 S. TEJON ST., SUITE 1110  
 COLORADO SPRINGS, CO 80903  
 WWW.RESPEC.COM (719) 266-5212

Meridian Service Metropolitan  
 District Water Treatment Plant Expansion

**VICINITY MAP**



Maxar, Microsoft



Map Unit Symbol	Map Unit Name	Rating	Percent of Site, %
83	Stapleton sandy loam, 3 to 8 percent slopes	B	100.0

Prepared by:



**RESPEC**

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Meridian Service Metropolitan  
 District Water Treatment Plant Expansion

**SOILS MAP**



Project Location

Zone A (100-year studied floodplain)

Zone AE (100-year studied floodplain)



1" = 1000'  
0 500 1,000 Feet

**NATIONAL FLOOD INSURANCE PROGRAM**

**PANEL 0552G**

**FIRM**  
FLOOD INSURANCE RATE MAP  
EL PASO COUNTY,  
COLORADO  
AND INCORPORATED AREAS

**PANEL 552 OF 1300**  
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS	COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY		0552G	552	G

Notice to User: The Map Number shown below is subject to change in the printing process. The Community Number shown above shall be used for insurance purposes unless the reverse is indicated.

**MAP NUMBER**  
08041C0552G

**MAP REVISED**  
DECEMBER 7, 2018

Federal Emergency Management Agency

Prepared by:

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COLORADO SPRINGS, CO 80903  
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Meridian Service Metropolitan  
District Water Treatment Plant Expansion

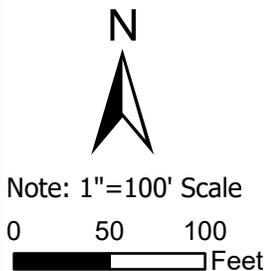
**FIRM MAP**

Path: N:\Projects\151\_Meridian Service Metropolitan District\151.02 WTP Expansion\SDP\Documents\Drainage4\_GIS\Meridian\_WTPE.aprx



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<b>MERIDIAN RANCH WTP EXPANSION</b>	
Total Site Area, ac	3.3
Total Impervious Area, ac	0.65
Total Site Percent Impervious, %	20.3
Upstream Impervious Area (in blue), ac	0.65
PIA (in green), ac	0.10
WQCV, cf	1180
Stormwater Volume Reduction, cf	385
Stormwater Volume Reduction as % of WQCV	33



Prepared by:



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MERIDIAN RANCH SERVICE METROPOLITAN DISTRICT  
WATER TREATMENT EXPANSION

**Green Infrastructure Exhibit**



# APPENDIX B

## CALCULATIONS



PROJECT: Meridian Service Metropolitan District Water Treatment Plant Expansion

PREPARED BY: CTD

DATE: SEPTEMBER 2022

COMPOSITE RUNOFF COEFFICIENTS						
SUBBASIN	AREA (AC)	LAND USE IMPERVIOUS, %	HYDROLOGIC SOIL GROUP	LAND USE	5-YEAR RUNOFF COEFFICIENT	100-YEAR RUNOFF COEFFICIENT
COMPOSITE	9.6	43.1	B	COMMERCIAL AREAS; RESIDENTIAL AREAS - 1/2 ACRE; HISTORIC FLOW ANALYSIS - GREENBELTS	0.44	0.59

\*Note that above calculation was provided by the Estates at Rolling Hills Ranch Filing No. 2 Final Drainage Report



PROJECT Meridian Service Metropolitan District Water Treatment Plant Expansion

PREPARED BY CTD

DATE SEPTEMBER 2022

PROPOSED CONDITIONS - RATIONAL METHOD CALCULATIONS										
STREET	DESIGN POINT	DIRECT RUNOFF								REMARKS
		AREA DESIGN	AREA (A)	RUNOFF COEFF (C)	$t_c$	CA	$I_5$	$I_{100}$	Q	
			ac	10yr	min		in/hr	in/hr	cfs	
<b>5-Year Runoff Calculations</b>										
	PP1	Commercial	1.9	0.80	5.0	1.52	5.2	-	7.9	
	PP2	Commercial	1.3	0.80	5.0	1.04	5.2	-	5.4	
	PP3	Commercial	0.1	0.80	5.0	0.1	5.2	-	0.4	
	DP1	Commercial	3.2	0.80	5.0	2.56	5.2	-	13.2	
<b>100-Year Runoff Calculations</b>										
	PP1	Commercial	1.9	0.88	5.0	1.672	-	8.7	14.5	
	PP2	Commercial	1.3	0.88	5.0	1.144	-	8.7	9.9	
	PP3	Commercial	0.1	0.88	5.0	0.088	-	8.7	0.8	
	DP1	Commercial	3.2	0.88	5.0	2.82	-	8.7	24.4	

# Rock Chute Design Data

(Version WI-July-2010, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

**Project:** Meridian Service Metro District WTP Exp.  
**Designer:** CTD  
**Date:** August 1, 2022

**County:** El Paso, Colorado  
**Checked by:** RGG  
**Date:** \_\_\_\_\_

**Input Geometry:**

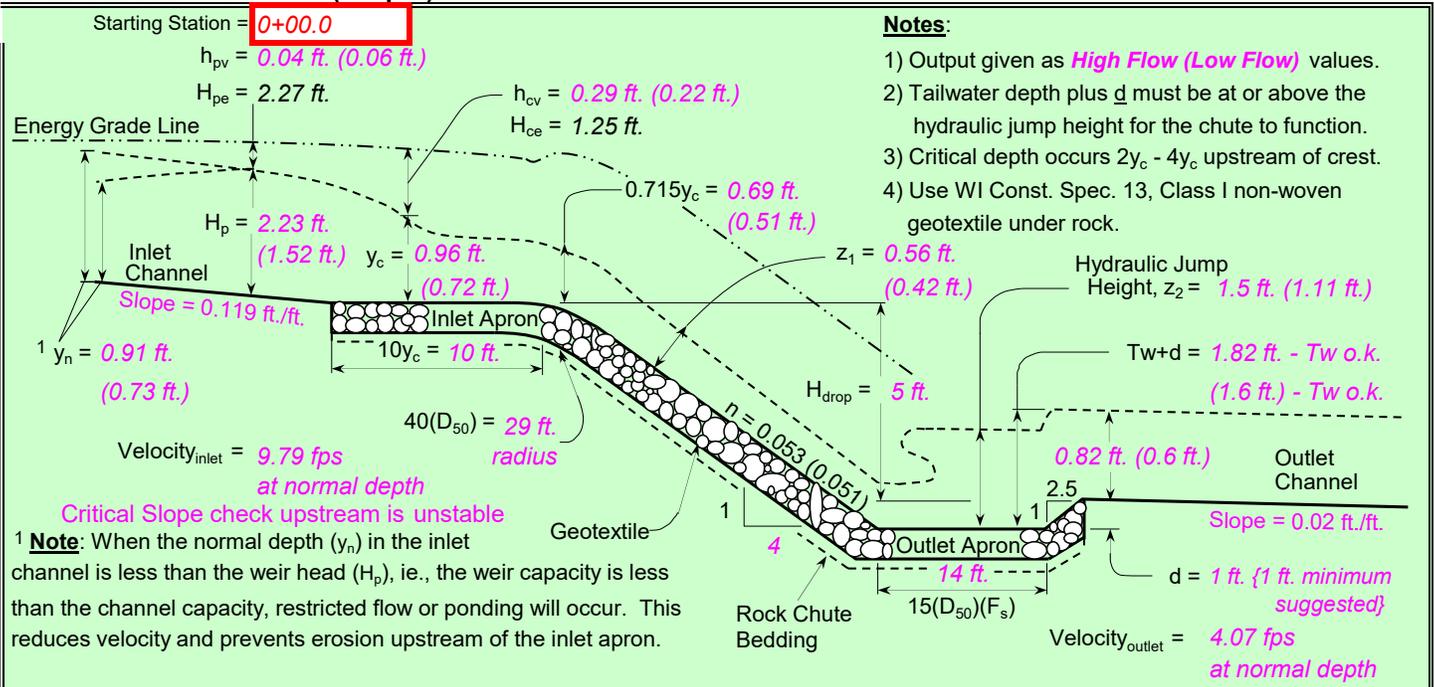
→ <u>Upstream Channel</u>	→ <u>Chute</u>	→ <u>Downstream Channel</u>
Bw = 0.0 ft.	Bw = 2.0 ft.	Bw = 4.0 ft.
Side slopes = 3.0 (m:1)	Factor of safety = 1.30 (F <sub>s</sub> ) <b>1.2 Min</b>	Side slopes = 4.0 (m:1)
Velocity n-value = 0.030	Side slopes = 4.0 (m:1) → <b>2.0:1 max.</b>	Velocity n-value = 0.035
Bed slope = 0.1190 ft./ft.	Bed slope (4:1) = 0.250 ft./ft. → <b>3.0:1 max.</b>	Bed slope = 0.0200 ft./ft.
Freeboard = 1.0 ft. →	Freeboard = 1.0 ft. →	Base flow = 0.0 cfs
Outlet apron depth, d = 1.0 ft.		

Note: n value = a) velocity n from waterway program  
 or b) computed manning's n for channel

**Design Storm Data (Table 2, FOTG, WI-NRCS Grade Stabilization Structure No. 410):**

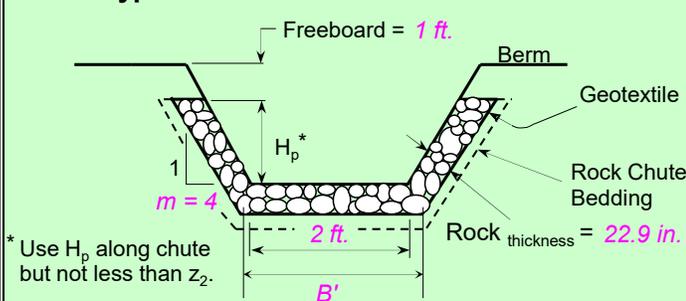
Apron elev. --- Inlet = 7072.0 ft. ----- Outlet = 7066.0 ft. --- (H <sub>drop</sub> = 5 ft.)		<b>Note:</b> The total required capacity is routed through the chute (principal spillway) or in combination with an auxiliary spillway.
Q <sub>high</sub> = Runoff from design storm capacity from Table 2, FOTG Standard 410		<b>Input tailwater (Tw):</b> 0.25 1.30
Q <sub>5</sub> = Runoff from a 5-year, 24-hour storm.		
Q <sub>high</sub> = 24.4 cfs	High flow storm through chute	Tw (ft.) = Program
Q <sub>5</sub> = 13.3 cfs	Low flow storm through chute	Tw (ft.) = Program

**Profile and Cross Section (Output):**



**Profile Along Centerline of Chute**

**Typical Cross Section**



5.37 cfs/ft.	Equivalent unit discharge
F <sub>s</sub> = 1.30	Factor of safety (multiplier)
z <sub>1</sub> = 0.56 ft.	Normal depth in chute
n-value = 0.053	Manning's roughness coefficient
D <sub>50</sub> (F <sub>s</sub> ) = 11.5 in.	Minimum Design D50*
2(D <sub>50</sub> )(F <sub>s</sub> ) = 22.9 in.	Rock chute thickness
Tw + d = 1.82 ft.	Tailwater above outlet apron
z <sub>2</sub> = 1.5 ft.	Hydraulic jump height
<b>*** The outlet will function adequately</b>	

**High Flow Storm Information**

**Design Procedure Form: Runoff Reduction**

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 1

**Designer:** RICHARD GALLEGOS  
**Company:** REPSEC  
**Date:** March 16, 2023  
**Project:** MERIDIAN RANCH METRO DISTRICT WTP EXPANSION  
**Location:** 12855 SUNSET RIDGE DRIVE

**SITE INFORMATION (User Input in Blue Cells)**

WQCV Rainfall Depth = 0.60 inches  
 Depth of Average Runoff Producing Storm,  $d_6$  = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA																			
Area ID	1																			
Downstream Design Point ID	DP1																			
Downstream BMP Type	None																			
DCIA (ft <sup>2</sup> )	--																			
UIA (ft <sup>2</sup> )	28,314																			
RPA (ft <sup>2</sup> )	4,284																			
SPA (ft <sup>2</sup> )	--																			
HSG A (%)	0%																			
HSG B (%)	100%																			
HSG C/D (%)	0%																			
Average Slope of RPA (ft/ft)	0.330																			
UIA:RPA Interface Width (ft)	714.00																			

**CALCULATED RUNOFF RESULTS**

Area ID	1																			
UIA:RPA Area (ft <sup>2</sup> )	32,598																			
L / W Ratio	0.06																			
UIA / Area	0.8686																			
Runoff (in)	0.29																			
Runoff (ft <sup>3</sup> )	794																			
Runoff Reduction (ft <sup>3</sup> )	385																			

**CALCULATED WQCV RESULTS**

Area ID	1																			
WQCV (ft <sup>3</sup> )	1180																			
WQCV Reduction (ft <sup>3</sup> )	385																			
WQCV Reduction (%)	33%																			
Untreated WQCV (ft <sup>3</sup> )	794																			

**CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)**

Downstream Design Point ID	DP1																			
DCIA (ft <sup>2</sup> )	0																			
UIA (ft <sup>2</sup> )	28,314																			
RPA (ft <sup>2</sup> )	4,284																			
SPA (ft <sup>2</sup> )	0																			
Total Area (ft <sup>2</sup> )	32,598																			
Total Impervious Area (ft <sup>2</sup> )	28,314																			
WQCV (ft <sup>3</sup> )	1,180																			
WQCV Reduction (ft <sup>3</sup> )	385																			
WQCV Reduction (%)	33%																			
Untreated WQCV (ft <sup>3</sup> )	794																			

**CALCULATED SITE RESULTS (sums results from all columns in worksheet)**

Total Area (ft <sup>2</sup> )	32,598
Total Impervious Area (ft <sup>2</sup> )	28,314
WQCV (ft <sup>3</sup> )	1,180
WQCV Reduction (ft <sup>3</sup> )	385
WQCV Reduction (%)	33%
Untreated WQCV (ft <sup>3</sup> )	794

# Manning Formula: East Swales

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## Irregular Section

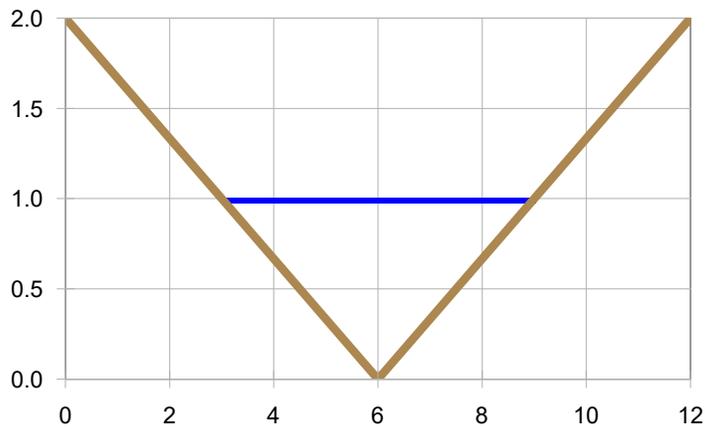
### Input

Flow 14.5 cfs  
Slope 0.019 ft/ft

Sta	Elev	n	Sta	Elev	n	Sta	Elev	n	Sta	Elev	n
0	2	0.025	6	0	0.025	12	2	0.025			

### Output

WSElev 0.989 ft  
Flow Area 2.93 sf  
Velocity 4.95 fps  
Velocity Head 0.380 ft  
Top Width 5.93 ft  
Froude Number 1.24  
Critical WSElev 1.077 ft  
Critical Slope ft/ft



**Manning Formula:** South Swale

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**Irregular Section**

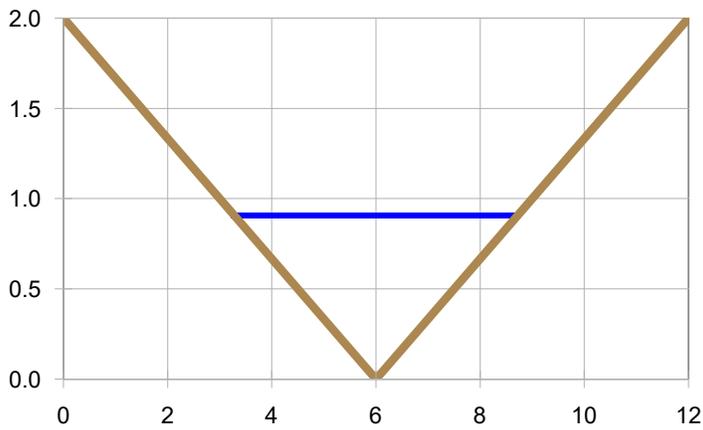
**Input**

Flow 9.9 cfs  
Slope 0.014 ft/ft

Sta	Elev	n	Sta	Elev	n	Sta	Elev	n	Sta	Elev	n
0	2	0.025	6	0	0.025	12	2	0.025			

**Output**

WSElev 0.907 ft  
Flow Area 2.47 sf  
Velocity 4.01 fps  
Velocity Head 0.250 ft  
Top Width 5.44 ft  
Froude Number 1.05  
Critical WSElev 0.925 ft  
Critical Slope ft/ft





# APPENDIX C

## DESIGN CHARTS



3.1. - Rational Method Runoff Coefficient (C)

The runoff coefficient represents the integrated effects of infiltration, detention storage, evaporation, retention, flow routing, and interception, all of which affect the time distribution and peak rate of runoff. Runoff coefficients are based on the imperviousness of a particular land use and the hydrologic soil type of the area and are to be selected in accordance with Table 6-6.

The procedure for determining the runoff coefficient includes these steps:

1. Categorize the site area into one or more similar land uses, each with a representative imperviousness, according to the information in Table 6-6.
2. Based on the dominant hydrologic soil type in the area, use Table 6-6 to estimate the runoff coefficient for the particular land use category for the design storms of interest.
3. Calculate an area-weighted average runoff coefficient for the site based on the runoff coefficients from individual land use areas of the site.

When analyzing an area for design purposes, urbanization of the full watershed, including both on-site and off-site areas, shall be assumed.

Gravel parking areas, storage areas, and access drives proposed on Site Improvement Plans shall be analyzed based on an imperviousness of 80%. This is due to the potential for gravel areas being paved over time by property owners and the resulting adverse impacts on the stormwater management facilities and adjacent properties.

There are some circumstances where the selection of impervious percentage values may require additional investigation due to unique land characteristics (e.g., recent burn areas). When these circumstances arise, it is the designer's responsibility to verify that the correct land use assumptions are made.

When multiple sub-basins are delineated, the composite C value calculation is:

$$C_c = (C_1 A_1 + C_2 A_2 + C_3 A_3 + \dots + C_i A_i) / A_t \quad (\text{Eq. 6-6})$$

Where:

$C_c$  = composite runoff coefficient for total area

$C_i$  = runoff coefficient for subarea corresponding to surface type or land use

$A_i$  = area of surface type corresponding to  $C_i$  (units must be the same as those used for total area)

$A_t$  = total area of all subareas for which composite runoff coefficient applies

$i$  = number of surface types in the drainage area

**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										
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													



# APPENDIX D

## REPORT EXCERPTS



**COMPOSITE 'C' FACTORS**

PROJECT: **Estates at Rolling Hills Ranch Filing 2**

9/16/2020

BASIN DESIGNATION	AREA (AC.)											COMPOSITE FACTOR		Percent Impervious
	UNDEV	2.5 AC	1 DU/AC	2 DU/AC	3 DU/AC	GRADED	TANK SITE	STREETS	OPEN SPACE PARKS/GC LAWNS	COMM	TOTAL	5-year	100-year	
<b>OS7c</b>	5.9	4.1									10.0	0.12	0.38	4.6%
<b>A01</b>	4.7		1.4								6.1	0.11	0.38	4.4%
<b>OS8</b>	1.7	23.5									25.2	0.16	0.40	10.3%
<b>B01</b>	9.0		2.3								11.3	0.11	0.38	4.0%
<b>B02</b>	0.4		4.1	3.8							8.3	0.20	0.45	21.5%
<b>B03</b>	7.8		1.0				1.7				10.5	0.16	0.41	13.2%
<b>B04</b>	0.1		3.9	6.3			0.3				10.6	0.22	0.46	24.1%
<b>B05</b>	1.8		1.5	1.0			1.3				5.6	0.23	0.46	25.9%
<b>B06</b>				1.5							1.5	0.22	0.46	25.0%
<b>B07</b>			3.5	3.6					0.4		7.4	0.21	0.45	21.5%
<b>B08</b>				9.4							9.4	0.22	0.46	25.0%
<b>B09</b>				6.1							6.1	0.22	0.46	25.0%
<b>B10</b>				12.2							12.2	0.22	0.46	25.0%
<b>B11</b>				0.4							0.4	0.22	0.46	25.0%
<b>B12</b>				3.3							3.3	0.22	0.46	25.0%
<b>C01</b>						8.5		1.1	2.4		12.0	0.27	0.45	9.6%
<b>D01</b>				3.8					2.5	3.3	9.5	0.44	0.59	43.3%
<b>E01</b>	2.0					1.8		0.6	2.0		6.4	0.24	0.44	9.3%
<b>E02</b>	0.3							0.2	0.1		0.6	0.40	0.58	35.1%
<b>E03</b>	1.5			0.2				0.5	0.3		2.6	0.29	0.50	23.7%
											158.8	<b>Composite:</b>		17.3%
<b>TOTAL</b>	35.2	27.6	17.6	51.4	0.0	10.3	3.3	2.4	7.6	3.3	158.8	0.21	0.44	17.3%
<b>FB11</b>				0.4							0.4	0.22	0.46	25.0%
<b>FB12</b>				3.8				1.4	1.1		6.2	0.38	0.56	38.0%
<b>FC01</b>					3.7			1.0	1.5		6.2	0.35	0.53	34.0%
											146.3	<b>Composite:</b>		21.1%
<b>TOTAL</b>	31.4	27.6	17.6	51.7	3.7	0.0	3.3	2.4	5.4	6.6	149.6	0.22	0.45	21.1%
<b>A01</b>	4.7		1.4								6.1	0.12	0.38	4.6%
<b>C01</b>						8.5		1.1	2.4		12.0	0.27	0.45	9.6%

**TIME OF CONCENTRATION**

PROJECT: **Estates at Rolling Hills Ranch Filing 2**

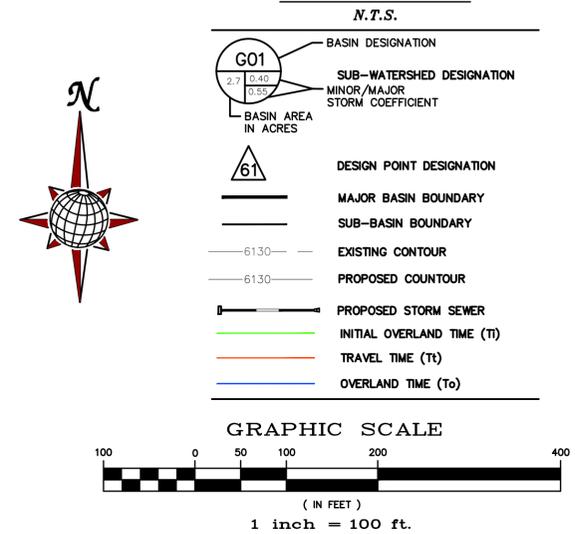
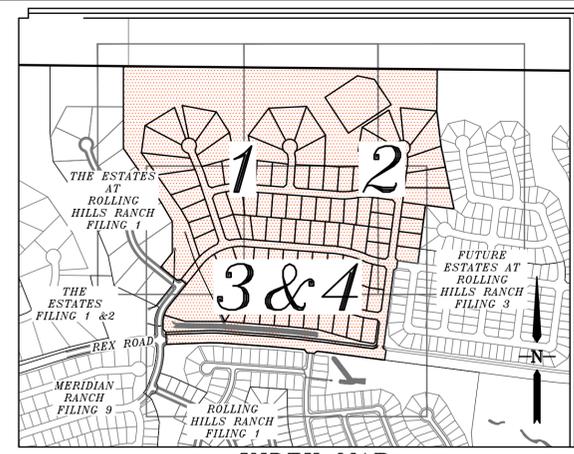
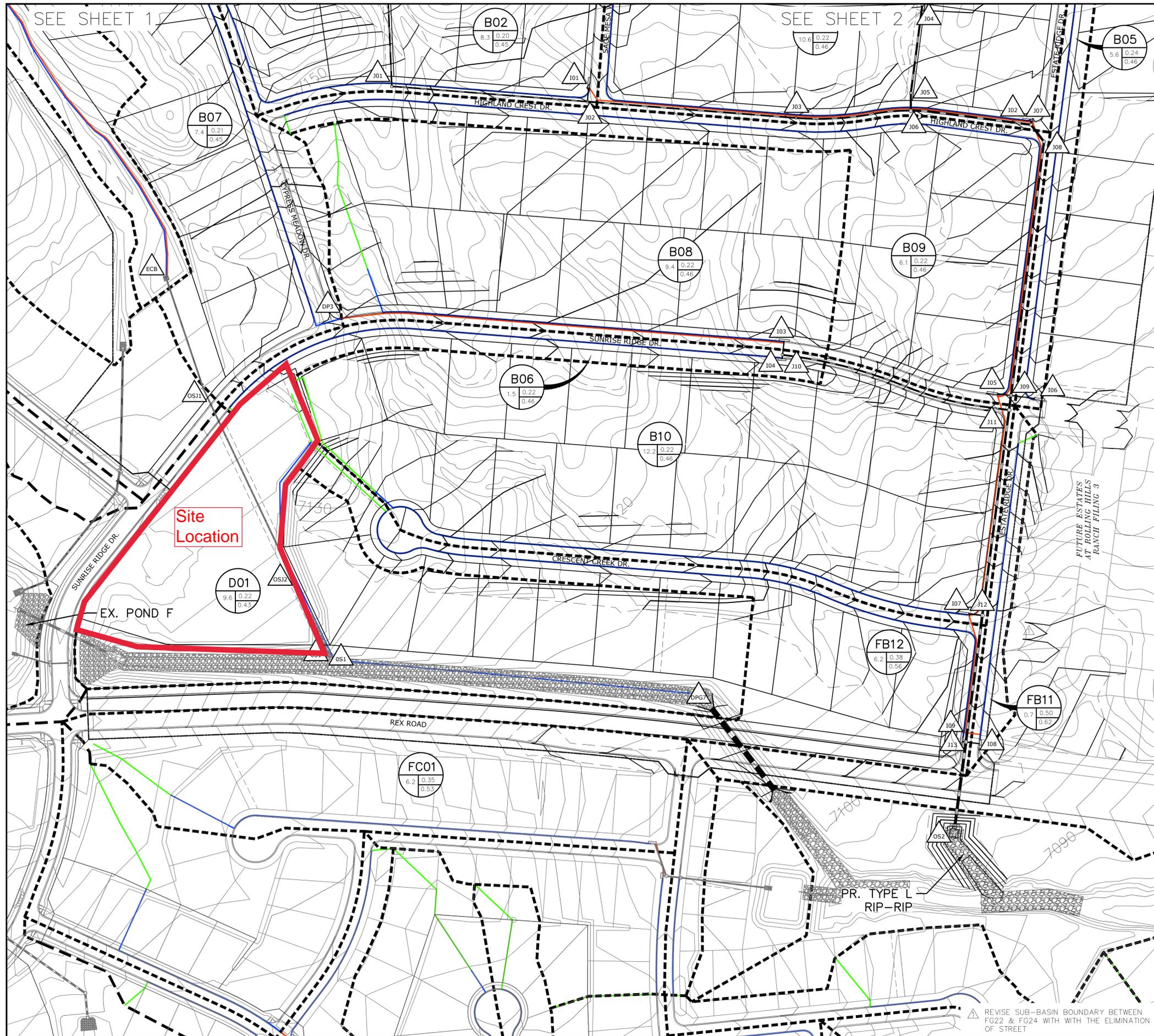
DATE: 9/16/2020

TIME OF CONCENTRATION																	
SUBBASIN DATA			INIT./OVERLAND TIME (T <sub>i</sub> )				TRAVEL TIME (T <sub>t</sub> )							TOTAL	T <sub>c</sub> Check (Urbanized Basins)		FINAL
BASIN DESIGNATION	C <sub>s</sub>	AREA (AC)	LENGTH (FT)	ΔH	SLOPE %	T <sub>i</sub> (Min.)*	LENGTH (FT)	ΔH	SLOPE %	CONVEYANCE		VEL. (FPS)	T <sub>t</sub> (Min.)**	T <sub>i</sub> +T <sub>t</sub> (Min.)	L (FT)	T <sub>c</sub> = (L/180) + 10	T <sub>c</sub> (min)
										TYPE	COEF.						
<b>OS7c</b>	0.12	10.0	190	11.0	5.8%	13.8	890	50	5.6%	G	15	3.6	4.2	18.0	1080.00	16.0	<b>16.0</b>
<b>A01</b>	0.11	6.1	185	6.0	3.2%	16.6	1275	34	2.7%	L	7	1.1	18.6	35.2	1460.00	18.1	<b>18.1</b>
<b>OS8</b>	0.16	25.2	FROM APPROVED MERIDIAN RANCH FILING MDDP, JAN 2018														<b>26.6</b>
<b>B01</b>	0.11	11.3	230	9.0	3.9%	17.4	1050	31	3.0%	L	7	1.2	14.5	32.0	1280.00	17.1	<b>17.1</b>
<b>B02</b>	0.20	8.3	290	15.0	5.2%	16.2	1135	21	1.9%	P	20	2.7	7.0	23.1	1425.00	17.9	<b>17.9</b>
<b>B03</b>	0.16	10.5	300	7.0	2.3%	22.4	1120	37	3.3%	G	15	2.7	6.8	29.2	1420.00	17.9	<b>17.9</b>
<b>B04</b>	0.22	10.6	260	23.0	8.8%	12.6	1270	23	1.8%	P	20	2.7	7.9	20.5	1530.00	18.5	<b>18.5</b>
<b>B05</b>	0.23	5.6	300	20.0	6.7%	14.6	1500	42	2.8%	P	20	3.3	7.5	22.1	1800.00	20.0	<b>20.0</b>
<b>B06</b>	0.22	1.5	30	0.6	2.0%	7.0	1150	14	1.2%	P	20	2.2	8.7	15.7	1180.00	16.6	<b>15.7</b>
<b>B07</b>	0.21	7.4	300	12.0	4.0%	17.8	1080	25	2.3%	P	20	3.0	5.9	23.7	1380.00	17.7	<b>17.7</b>
<b>B08</b>	0.22	9.4	300	11.0	3.7%	18.1	890	8	0.9%	P	20	1.9	7.8	25.9	1190.00	16.6	<b>16.6</b>
<b>B09</b>	0.22	6.1	30	0.6	2.0%	7.0	2030	32	1.6%	P	20	2.5	13.5	20.5	2060.00	21.4	<b>20.5</b>
<b>B10</b>	0.22	12.2	300	14.0	4.7%	16.7	1230	25	2.0%	P	20	2.9	7.2	23.9	1530.00	18.5	<b>18.5</b>
<b>B11</b>	0.22	0.4	30	0.6	2.0%	7.0	170	4	2.4%	P	20	3.1	0.9	7.9	200.00	11.1	<b>7.9</b>
<b>B12</b>	0.22	3.3	195	13.0	6.7%	12.0	1480	29	2.0%	P	20	2.8	8.8	20.8	1675.00	19.3	<b>19.3</b>
<b>C01</b>	0.27	12.0	185	9.0	4.9%	12.2	1310	35	2.7%	B	10	1.6	13.4	25.5	1495.00	18.3	<b>18.3</b>
<b>D01</b>	0.44	9.5	100	2.0	2.0%	9.7	1200	37	3.1%	L	7	1.2	16.3	25.9	1300.00	17.2	<b>17.2</b>
<b>E01</b>	0.24	6.4	125	4.0	3.2%	12.0	375	6	1.6%	L	7	0.9	7.1	19.0	500.00		<b>19.0</b>
<b>E02</b>	0.40	0.6	45	2.0	4.4%	5.2	375	12	3.2%	P	20	3.6	1.7	7.0	420.00	12.3	<b>7.0</b>
<b>E03</b>	0.29	2.6	125	4.0	3.2%	11.3	595	13	2.2%	P	20	3.0	3.4	14.6	720.00	14.0	<b>14.0</b>
<b>FB11</b>	0.22	0.4	30	0.6	2.0%	7.0	170	4	2.4%	P	20	3.1	0.9	7.9	200.00	11.1	<b>7.9</b>
<b>FB12</b>	0.38	6.2	195	13.0	6.7%	9.8	1480	29	2.0%	P	20	2.8	8.8	18.7	1675.00	19.3	<b>18.7</b>
<b>FC01</b>	0.35	6.2	185	9.0	4.9%	11.0	985	25	2.5%	P	20	3.2	5.2	16.2	1170.00	16.5	<b>16.2</b>

Notes:	* T <sub>i</sub> = $\frac{0.395 (1.1 - C_5) L^{0.5}}{S^{0.33}}$
	V = C <sub>v</sub> S <sub>w</sub> <sup>0.5</sup> ** T <sub>t</sub> = L x V

TYPE OF SURFACE		C <sub>v</sub>
HEAVY MEADOW	H	2.5
TILLAGE/FIELD	T	5
RIPRAP (not buried)	R	6.5
SHORT PASTURE AND LAWNS	L	7
NEARLY BARE GROUND	B	10
GRASSED WATERWAY	G	15
PAVED AREAS	P	20





DP	BASIN	AREA (AC)	Q(5) (CFS)	Q(100) (CFS)	INLET	Q(5) (CFS)	Q(100) (CFS)	PIPE
DP1	OS7c	10.0	4.1	22	EX 30" CULVERT	4.1	22	24" RCP
ECB	A01	6.1	5.0	27	EX TYPE C INLET	5.0	27	24" RCP
OS101						5.0	27	24" RCP
OS102						5.0	27	24" RCP
CB01	B01	11.3	4.2	24	PR TYPE C INLET	4.2	24	24" RCP
J01						4.2	24	24" RCP
I01	B02	8.3	5.5	20	PR 20' FORCED SUMP	5.5	17	18" RCP
J02						9.5	40	30" RCP
J03						9.5	40	30" RCP
DP2	OS8	25.2	10	45	EX 30" CULVERT	10	45	36" RCP
CB02	B03	10.5	14	57	PR TYPE D INLET	14	57	36" RCP
J04						13	57	36" RCP
J05						13	57	36" RCP
I02	B04	10.6	7.4	26	PR 20' FORCED SUMP	7	17	24" RCP
J06						20	86	42" RCP
J07						26	98	42" RCP
J08						26	98	42" RCP
I05	B09	6.1	4.1	22	PR 20' SUMP	4.1	17	18" RCP
I06	B05	5.6	4.0	13	PR 20' FLOW-BY	3.6	10	18" RCP
J09						31	118	42" RCP
DP3	B07	7.4	5.1	18				
I03	B08	9.4	10	35	PR 20' SUMP	10.0	17	18" RCP
I04	B06	1.5	1.1	21	PR 15' SUMP	1.1	21	18" RCP
J10						11	38	30" RCP
J11						41	151	42" RCP
I07	B10	12.2	8.6	31	PR 20' FORCED SUMP	8.6	17	24" RCP
J12						47	164	48" RCP
I08	B11	1.0	1.7	5	PR 10' SUMP	1.7	5.1	18" RCP
I09	B12	3.3	2.3	20	PR 20' SUMP	2.3	17	18" RCP
J13						51	182	54" RCP
I08	FB11	0.7	1.6	14	PR 10' SUMP	1.6	14	18" RCP
I09	FB12	6.2	7.5	29	PR 20' SUMP	7.5	17	18" RCP
J13						55	189	54" RCP

BENCH MARK:  
 INTERSECTION OF WOODMEN RD AND MERIDIAN ROAD AT SW CORNER (BRASS CAP W/ NO. GF-9)  
 ELEVATION = 6874.00

NOTE:  
 COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

TECH CONTRACTORS  
 11886 STAPLETON DRIVE  
 FALCON, CO 80831  
 TELEPHONE: 719.495.7444  
 FAX: 719.495.3349

**MERIDIAN RANCH**

FUTURE RATIONAL DRAINAGE MAP  
 FINAL DRAINAGE REPORT  
 THE ESTATES AT  
 ROLLING HILLS RANCH FILING 2

Scale: 1" = 100'  
 4 of 4

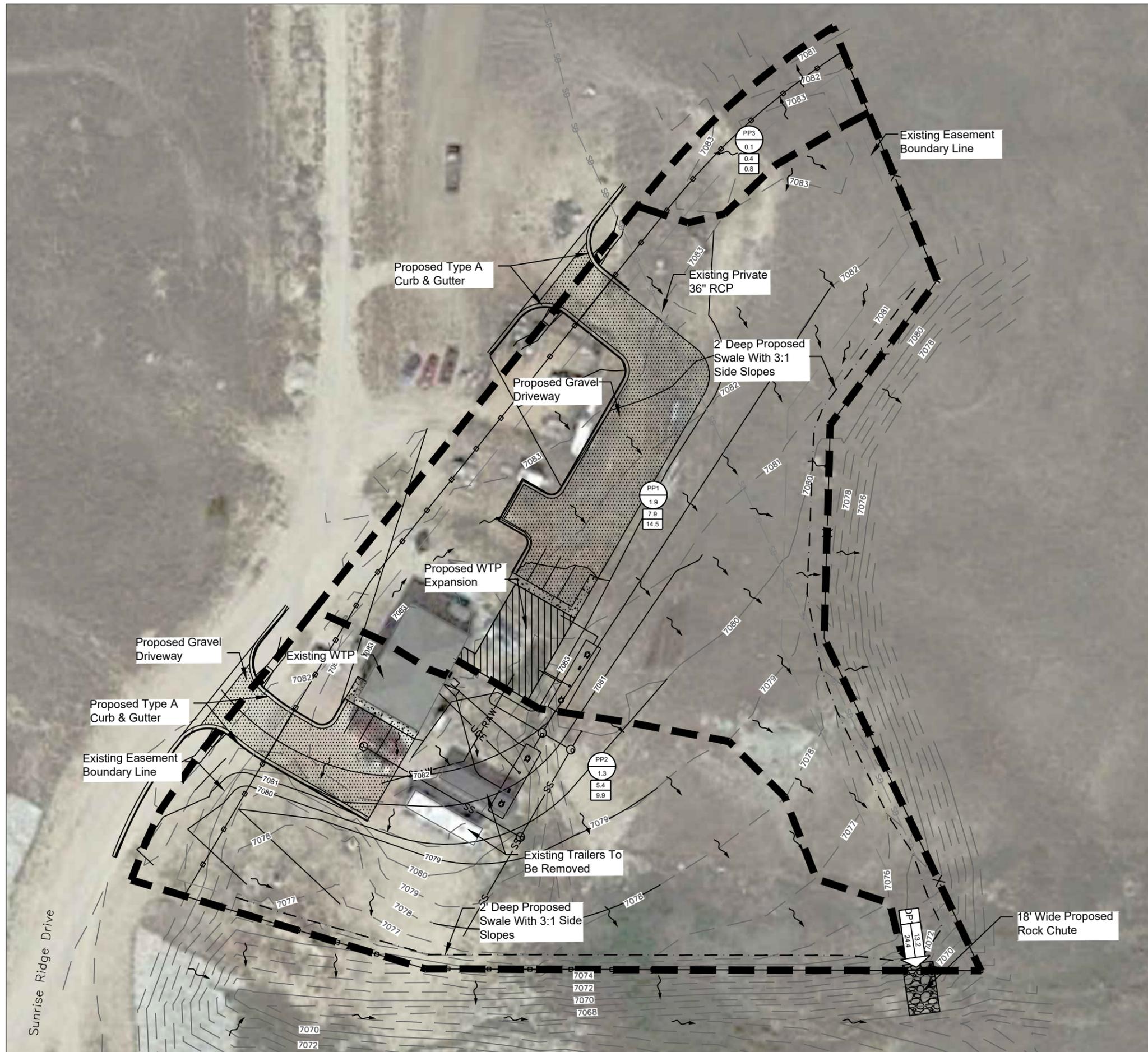
Drawn by	Checked by	Date
TAK	-	SEPT 2020

No.	Revisions	Date	Instr.	Appr.	Date



# BACK POCKET

2023/03/16 2:10 PM By: Coleton Deltz N:\Projects\151 Meridian Service Metropolitan District\151.52 WTP Expansion SDR\Documents\Drainage\2\_Drainage Plans\1\_Proposed Conditions.dwg



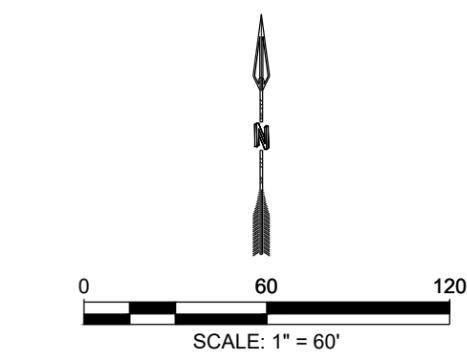
**BENCHMARK**

- SURVEY CONTROL POINT AS SHOWN HERON. ELEVATIONS ARE BASED ON COLORADO SPRINGS "FIMS" VERTICAL DATUM, FIMS MONUMENT "ELPASOW" ELEVATION = 7106.2' (NGVD 29). "FIMS" BRASS CAP SET ABOUT 3 MILES NORTH AND 1 MILE EAST OF FALCON, CO.

**LEGEND**

- PROPOSED GRAVEL
- PROPOSED CONCRETE
- PROPOSED RIPRAP
- PROPOSED WROUGHT IRON FENCE
- PROPOSED WOOD FENCE
- PROPOSED SWALE
- EXISTING STORM PIPE
- BASIN DESIGNATION
- BASIN CALLOUT
- BASIN INFORMATION
- DESIGN POINT
- DIRECTION OF DRAINAGE FLOW
- PROPOSED SUB-BASIN BOUNDARY
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR

PROPOSED CONDITIONS			
SUB-BASIN	AREA (AC)	Q5 (CFS)	Q100 (CFS)
PP1	1.9	7.9	14.5
PP2	1.3	5.4	9.9
PP3	0.1	0.4	0.8



NO.	DESCRIPTION	BY	APP.	DATE
1				
2				
3				
4				
5				
6				
7				