

FINAL DRAINAGE REPORT – ADDENDUM NO. 1

for

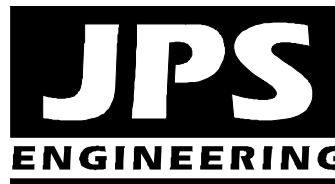
ARACO ENTERPRISES LLC - BUILDING ADDITION 7470 SOUTHMOOR DRIVE, FOUNTAIN, CO

Prepared for:

Araco Enterprises LLC
7470 Southmoor Drive
Fountain, CO 80817

May 1, 2024

Prepared by:



**19 E. Willamette Ave.
Colorado Springs, CO 80903
(719)-477-9429
www.jpsengr.com**

**JPS Project No. 111705
PPR-1950**

ARACO ENTERPRISES LLC - BUILDING ADDITION
7470 SOUTHMOOR DRIVE, FOUNTAIN, CO
DRAINAGE REPORT STATEMENTS

1. Engineer's Statement:

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

11/3/22

John P. Schwab, Colorado, No. 29891

2. Developer's Statement:

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

By: _____

Printed Name: Arturo Acosta
Title: Manager

10/05/2022

Date

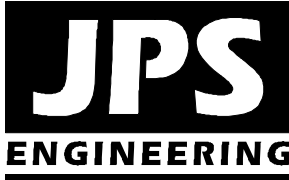
3. El Paso County Statement:

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

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

Date

Conditions:



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ARACO ENTERPRISES LLC – FINAL DRAINAGE REPORT ADDENDUM NO. 1

I. GENERAL

A. Background

Araco Enterprises LLC is constructing a building addition along with parking and related site improvements on the developed property at 7470 Southmoor Drive in Fountain, Colorado. The project site (El Paso County Assessor's No. 65244-00-085) is an unplatted 4.2-acre developed parcel described as a tract in the Southeast Quarter of Section 24, Township 15 South, Range 66 West of the 6th P.M. The property is located along the southwest side of Southmoor Drive. The property is zoned M (Industrial).

B. Scope

JPS Engineering prepared the "Final Drainage Report (FDR) for Araco Enterprises LLC – Building Addition" dated June 10, 2022 (approved by El Paso County on 1/5/23; PPR-1950). This report serves as an Addendum to the previously approved FDR. The purpose of this Addendum is to provide updated drainage calculations in support of consolidating the on-site stormwater detention facilities into a single basin at the northwest corner of the property.

II. DEVELOPED DRAINAGE CONDITIONS

The developed drainage basins and projected flows are shown on the attached Figure D1 (Appendix C). The previously depicted Detention Basin A2 (near the southeast corner of the site) has been eliminated, and the proposed Detention Basin A1 at the northwest corner of the site has been enlarged to meet all of the required on-site stormwater detention and water quality requirements.

Appendix A of this Addendum includes updated hydrologic calculations along with updated hydraulic calculations for the proposed Storm Sewer A2 (24" HDPE) conveying the developed drainage from the southerly Basin A2 into Detention Basin A1.

Appendix B includes updated detention pond design calculations, and the revised outlet structure design details are provided on Sh. C3.1.

III. SUMMARY

This Addendum No. 1 to the “Final Drainage Report for Araco Enterprises LLC – Building Addition” provides revised drainage calculations for the consolidation of on-site stormwater detention facilities in Detention Basin A1 at the northwest corner of the property. The proposed detention pond has been designed to provide stormwater detention and water quality to mitigate developed drainage impacts for this site. Proper construction and maintenance of the proposed drainage and erosion control facilities will ensure that this development has no significant adverse drainage impact on downstream or surrounding areas.

APPENDIX A
DRAINAGE CALCULATIONS

**ARACO CONCRETE
COMPOSITE RUNOFF COEFFICIENTS**

DEVELOPED CONDITIONS											
5-YEAR C VALUES											
BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A1	1.46	1.293	ASPHALT	0.9	0.167	LANDSCAPED	0.08				0.806
A2	2.30	1.340	BUILDING / ASPHALT	0.9	0.550	GRAVEL	0.59	0.41	LANDSCAPED	0.08	0.665
A1,A2	3.76										0.720
100-YEAR C VALUES											
BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A1	1.46	1.293	ASPHALT	0.96	0.167	LANDSCAPED	0.35				0.890
A2	2.30	1.340	BUILDING / ASPHALT	0.96	0.550	GRAVEL	0.7	0.41	LANDSCAPED	0.35	0.727
A1,A2	3.76										0.790

ARACO CONCRETE
RATIONAL METHOD

HISTORIC FLOWS

BASIN	DESIGN POINT	AREA (AC)	C		Overland Flow			Channel flow					TOTAL T _c ⁽⁴⁾ (MIN)	TOTAL T _c ⁽⁴⁾ (MIN)	INTENSITY ⁽⁵⁾		PEAK FLOW	
			5-YEAR	100-YEAR	LENGTH (FT)	SLOPE (FT/FT)	T _{co} ⁽¹⁾ (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT C	SLOPE (FT/FT)	SCS ⁽²⁾ VELOCITY (FT/S)	T _t ⁽³⁾ (MIN)			5-YR (IN/HR)	100-YR (IN/HR)	Q5 ⁽⁶⁾ (CFS)	Q100 ⁽⁶⁾ (CFS)
A	1	3.76	0.113	0.374	300	0.01	31.3	70	15	0.014	1.77	0.7	32.0	32.0	2.39	4.01	1.01	5.63
B	2	0.44	0.080	0.350	60	0.17	5.7	130	15	0.015	1.84	1.2	6.8	6.8	4.70	7.89	0.17	1.21

DEVELOPED FLOWS

BASIN	DESIGN POINT	AREA (AC)	C		Overland Flow			Channel flow					TOTAL T _c ⁽⁴⁾ (MIN)	TOTAL T _c ⁽⁴⁾ (MIN)	INTENSITY ⁽⁵⁾		PEAK FLOW	
			5-YEAR	100-YEAR	LENGTH (FT)	SLOPE (FT/FT)	T _{co} ⁽¹⁾ (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT C	SLOPE (FT/FT)	SCS ⁽²⁾ VELOCITY (FT/S)	T _t ⁽³⁾ (MIN)			5-YR (IN/HR)	100-YR (IN/HR)	Q5 ⁽⁶⁾ (CFS)	Q100 ⁽⁶⁾ (CFS)
DEVELOPED FLOW:																		
A1	A1	1.46	0.806	0.890	100	0.01	5.4	200	20	0.015	2.45	1.4	6.7	6.7	4.72	7.93	5.55	10.30
A2	A2	2.30	0.665	0.727	100	0.03	5.5	500	20	0.01	2.00	4.2	9.7	9.7	4.18	7.01	6.39	11.72
Tt A2 to DP1								485	20	0.008	1.79	4.5						
A1,A2	1	3.76	0.720	0.790									14.2	14.2	3.60	6.05	9.75	17.96
DETAINED FLOW:																		
POND A1 DISCHARGE			1	3.76													0.10	1.00
B	2	0.44	0.080	0.350	60	0.17	5.7	130	15	0.015	1.84	1.2	6.8	6.8	4.70	7.89	0.17	1.21

1) OVERLAND FLOW T_{co} = (0.395*(1.1-RUNOFF COEFFICIENT))*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333)))

2) SCS VELOCITY = C * ((SLOPE(FT/FT)^0.5)

C = 2.5 FOR HEAVY MEADOW

C = 5 FOR TILLAGE/FIELD

C = 7 FOR SHORT PASTURE AND LAWNS

C = 10 FOR NEARLY BARE GROUND

C = 15 FOR GRASSED WATERWAY

C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES

3) MANNING'S CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)

4) T_c = T_{co} + T_t

*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED

5) INTENSITY BASED ON I-D-F EQUATIONS IN CITY OF COLORADO SPRINGS DRAINAGE CRITERIA MANUAL

$$I_5 = -1.5 * \ln(T_c) + 7.583$$

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

6) Q = CIA

ARACO CONCRETE - 7470 SOUTHMOOR DRIVE
STORM INLET SIZING SUMMARY

INLET	BASIN FLOW			INLET FLOW			INLET CONDITION / TYPE	INLET SIZE	INLET CAPACITY (CFS)
	DP	Q5 FLOW (CFS)	Q100 FLOW (CFS)	INLET FLOW % OF BASIN	Q5 FLOW (CFS)	Q100 FLOW (CFS)			
A2	A2	6.4	11.7	100	6.4	11.7	SUMP TYPE 16	DOUBLE	20.1

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

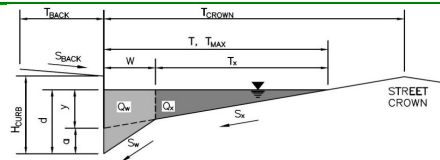
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Araco Enterprises - Inlet A2 (Sump Condition)

Inlet ID:

Inlet A2

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

$T_{BACK} = 4.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 50.0$ ft
 $W = 2.00$ ft
 $S_x = 0.037$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.000$ ft/ft
 $n_{STREET} = 0.016$

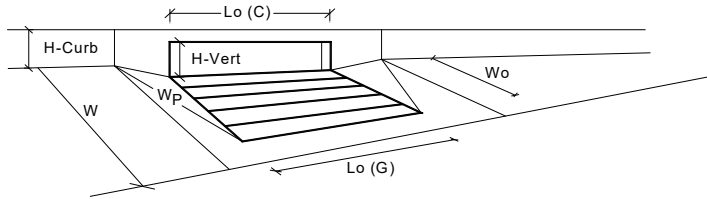
	Minor Storm	Major Storm	
$I_{MAX} =$	50.0	50.0	ft
$d_{MAX} =$	6.0	12.0	inches

$Q_{allow} =$

Minor Storm	Major Storm	
SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)

Type of Inlet Denver No. 16 Combination
 Local Depression (additional to continuous gutter depression 'a' from above)
 Number of Unit Inlets (Grate or Curb Opening)
 Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate
 Width of a Unit Grate
 Area Opening Ratio for a Grate (typical values 0.15-0.90)
 Clogging Factor for a Single Grate (typical value 0.50 - 0.70)
 Grate Weir Coefficient (typical value 2.15 - 3.60)
 Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening
 Height of Vertical Curb Opening in Inches
 Height of Curb Orifice Throat in Inches
 Angle of Throat (see USDCM Figure ST-5)
 Side Width for Depression Pan (typically the gutter width of 2 feet)
 Clogging Factor for a Single Curb Opening (typical value 0.10)
 Curb Opening Weir Coefficient (typical value 2.3-3.7)
 Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth
 Depth for Curb Opening Weir Equation
 Combination Inlet Performance Reduction Factor for Long Inlets
 Curb Opening Performance Reduction Factor for Long Inlets
 Grated Inlet Performance Reduction Factor for Long Inlets

Total Inlet Interception Capacity (assumes clogged condition)

WARNING: Inlet Capacity less than Q Peak for Minor Storm

	MINOR	MAJOR	
Type =	Denver No. 16 Combination		
a_{local} =	2.00	2.00	inches
No =	2	2	
Ponding Depth =	6.0	12.0	inches
	MINOR	MAJOR	<input type="checkbox"/> Override Depths
$L_o (G)$ =	3.00	3.00	feet
W_o =	1.73	1.73	feet
A_{ratio} =	0.31	0.31	
$C_r (G)$ =	0.50	0.50	
$C_w (G)$ =	3.60	3.60	
$C_o (G)$ =	0.60	0.60	
	MINOR	MAJOR	
$L_o (C)$ =	3.00	3.00	feet
H_{vert} =	6.50	6.50	inches
H_{throat} =	5.25	5.25	inches
Theta =	0.00	0.00	degrees
W_p =	2.00	2.00	feet
$C_r (C)$ =	0.10	0.10	
$C_w (C)$ =	3.70	3.70	
$C_o (C)$ =	0.66	0.66	
	MINOR	MAJOR	
d_{Grate} =	0.523	1.023	ft
d_{Curb} =	0.33	0.83	ft
$RF_{Combination}$ =	0.71	1.00	
RF_{Curb} =	1.00	1.00	
RF_{Grate} =	0.71	1.00	
	MINOR	MAJOR	
Q_a =	6.2	20.1	cfs
$Q_{PEAK REQUIRED}$ =	6.4	11.7	cfs

ARACO CONCRETE - 7470 SOUTHMOOR DRIVE
STORM SEWER SIZING SUMMARY

PIPE FLOW				PIPE CAPACITY		
PIPE	BASINS	Q5 FLOW (CFS)	Q100 FLOW (CFS)	PIPE SIZE (IN)	MIN. PIPE SLOPE	FULL PIPE CAPACITY (CFS)
A2	A2	6.4	11.7	24	0.5%	16.0

ASSUMPTIONS:
1. STORM DRAIN PIPE ASSUMED TO BE RCP OR HDPE

Hydraulic Analysis Report

Project Data

Project Title: Project - Araco
Designer: JPS
Project Date: Wednesday, October 23, 2019
Project Units: U.S. Customary Units
Notes:

Channel Analysis: SD-A2

Notes:

Input Parameters

Channel Type: Circular
Pipe Diameter: 2.0000 ft
Longitudinal Slope: 0.0050 ft/ft
Manning's n: 0.0130
Depth: 2.0000 ft

Result Parameters

Flow: 15.9965 cfs
Area of Flow: 3.1416 ft²
Wetted Perimeter: 6.2832 ft
Hydraulic Radius: 0.5000 ft
Average Velocity: 5.0918 ft/s
Top Width: 0.0000 ft
Froude Number: 0.0000
Critical Depth: 1.4414 ft
Critical Velocity: 6.5991 ft/s
Critical Slope: 0.0066 ft/ft
Critical Top Width: 1.79 ft
Calculated Max Shear Stress: 0.6240 lb/ft²
Calculated Avg Shear Stress: 0.1560 lb/ft²

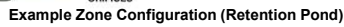
APPENDIX B

STORMWATER DETENTION CALCULATIONS

ARACO CONCRETE
COMPOSITE RUNOFF COEFFICIENTS

IMPERVIOUS AREAS - EXISTING CONDITIONS											
BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
A	3.76	0.15	BUILDING / PAVEMENT	100	3.61	MEADOW	0				3.989
IMPERVIOUS AREAS - DEVELOPED CONDITIONS											
BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
A1	1.46	1.293	ASPHALT	100	0.167	LANDSCAPED	0				88.562
A2	2.30	1.340	BUILDING / ASPHALT	100	0.550	NATIVE GRAVEL	40	0.41	LANDSCAPE	0	67.826
A1,A2	3.76										75.878

MHFD-Detention, Version 4.04 (February 2021)

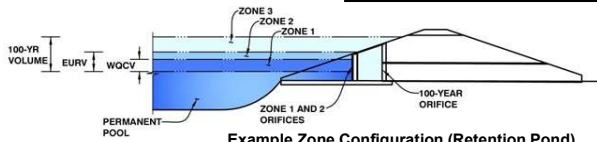
Basin ID: A1[illegible]

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **ARACO CONCRETE**

Basin ID: **A1**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.14	0.096	Orifice Plate
Zone 2 (EURV)	5.57	0.275	Orifice Plate
Zone 3 (100-year)	7.31	0.163	Weir&Pipe (Restrict)
Total (all zones)		0.534	

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 Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft ²
Underdrain Orifice Centroid =	N/A	feet

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)
Depth at top of Zone using Orifice Plate =	5.57	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	14.60	inches
Orifice Plate: Orifice Area per Row =	0.75	sq. inches (diameter = 15/16 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	5.208E-03	ft ²
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft ²

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	1.86	3.71					
Orifice Area (sq. inches)	0.75	0.75	0.75					

	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	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft ²
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe).

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, H _o =	6.40	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.50	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H _u =	6.40	N/A	feet
Overflow Weir Slope Length =	2.50	N/A	feet
Grate Open Area / 100-yr Orifice Area =	89.98	N/A	
Overflow Grate Open Area w/o Debris =	6.96	N/A	ft ²
Overflow Grate Open Area w/ Debris =	3.48	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 =	0.10	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	1.60		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.08	N/A	ft ²
Outlet Orifice Centroid =	0.08	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.61	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	7.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	3.00	feet
Spillway End Slopes =	0.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =	1.00	feet
Stage at Top of Freeboard =	9.50	feet
Basin Area at Top of Freeboard =	0.11	acres
Basin Volume at Top of Freeboard =	0.76	acre-ft

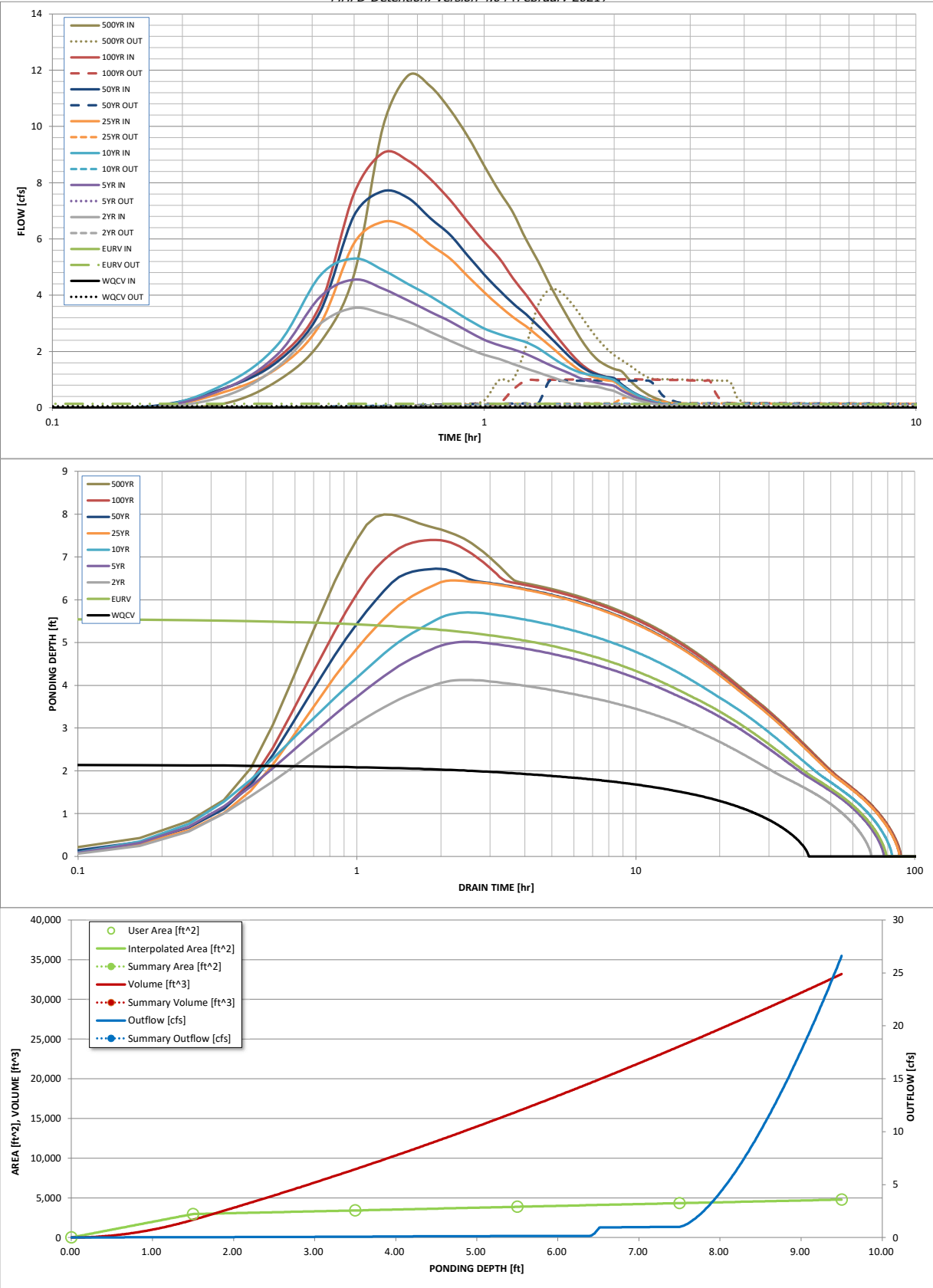
Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
One-Hour Rainfall Depth (in) =	N/A	N/A	0.264	0.343	0.406	0.483	0.557	0.645	0.838
CUHP Runoff Volume (acre-ft) =	0.096	0.370	0.264	0.343	0.406	0.483	0.557	0.645	0.838
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.0	0.0	0.1	0.5	0.9	1.5	2.8
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.01	0.12	0.25	0.41	0.76
Peak Inflow Q (cfs) =	N/A	N/A	3.5	4.6	5.3	6.6	7.7	9.1	11.8
Peak Outflow Q (cfs) =	0.0	0.1	0.1	0.1	0.1	0.4	1.0	1.0	4.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.6	2.9	0.8	1.0	0.7	1.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.0	0.1	0.1	0.1
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	71	63	70	74	78	77	76	74
Time to Drain 99% of Inflow Volume (hours) =	40	75	67	74	79	84	83	83	82
Maximum Ponding Depth (ft) =	2.15	5.56	4.12	5.02	5.70	6.45	6.72	7.40	8.00
Area at Maximum Ponding Depth (acres) =	0.07	0.09	0.08	0.09	0.09	0.09	0.10	0.10	0.10
Maximum Volume Stored (acre-ft) =	0.096	0.370	0.247	0.322	0.383	0.452	0.477	0.542	0.602

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)



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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

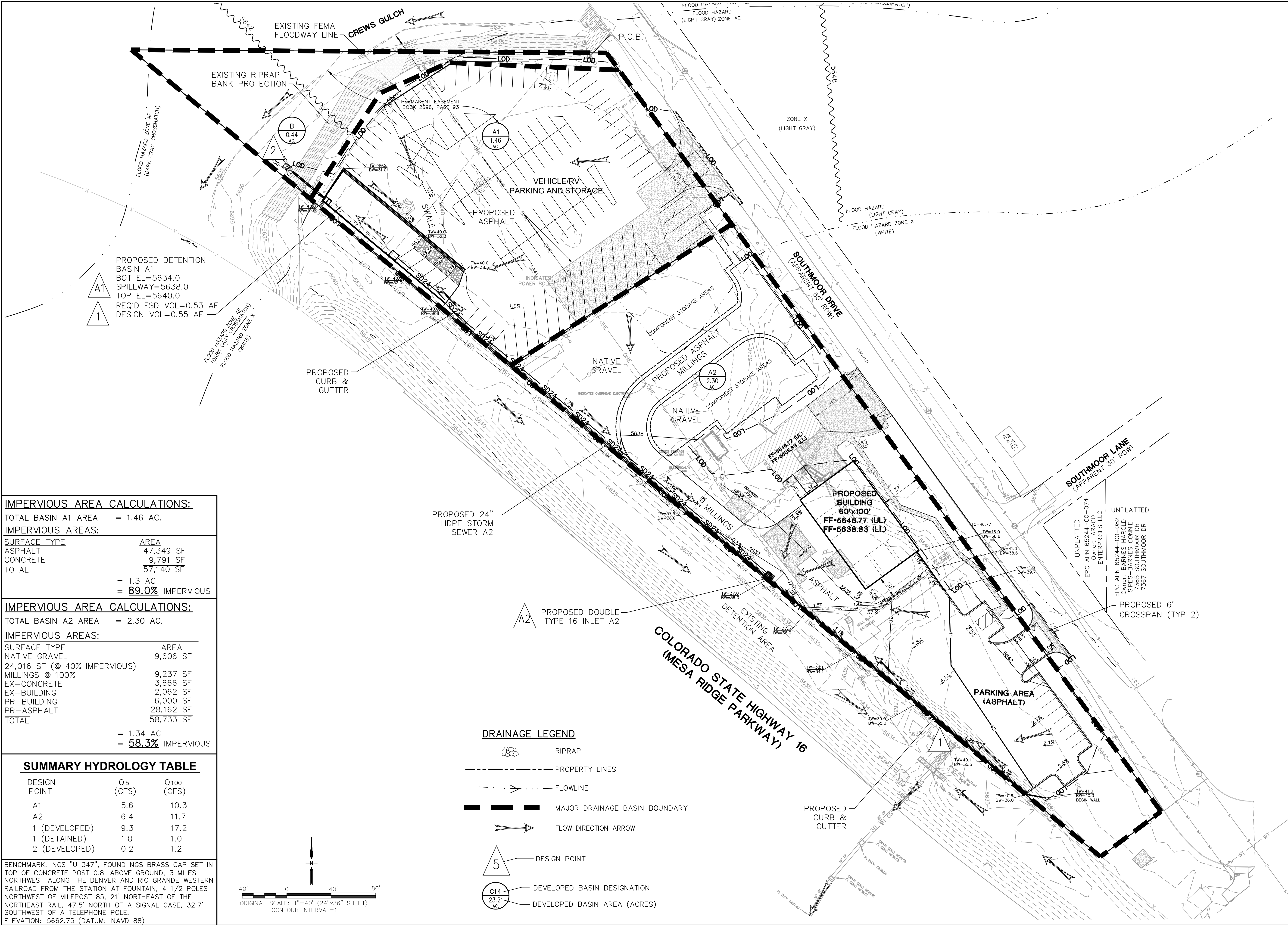
Inflow Hydrographs

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

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	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]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.15
	0:15:00	0.00	0.00	0.41	0.67	0.83	0.56	0.69	0.68	0.97
	0:20:00	0.00	0.00	1.47	1.92	2.26	1.42	1.66	1.78	2.31
	0:25:00	0.00	0.00	2.99	3.94	4.69	2.95	3.40	3.63	4.74
	0:30:00	0.00	0.00	3.55	4.55	5.30	5.85	6.84	7.62	10.00
	0:35:00	0.00	0.00	3.34	4.23	4.89	6.61	7.70	9.06	11.81
	0:40:00	0.00	0.00	3.05	3.81	4.40	6.40	7.45	8.78	11.43
	0:45:00	0.00	0.00	2.70	3.41	3.96	5.80	6.74	8.13	10.60
	0:50:00	0.00	0.00	2.38	3.07	3.53	5.30	6.15	7.39	9.64
	0:55:00	0.00	0.00	2.11	2.72	3.14	4.67	5.41	6.60	8.61
	1:00:00	0.00	0.00	1.88	2.42	2.82	4.11	4.74	5.91	7.70
	1:05:00	0.00	0.00	1.73	2.22	2.62	3.63	4.18	5.32	6.94
	1:10:00	0.00	0.00	1.56	2.08	2.47	3.22	3.70	4.60	5.98
	1:15:00	0.00	0.00	1.40	1.91	2.33	2.89	3.32	4.02	5.21
	1:20:00	0.00	0.00	1.26	1.72	2.12	2.54	2.91	3.41	4.40
	1:25:00	0.00	0.00	1.12	1.53	1.85	2.22	2.53	2.87	3.69
	1:30:00	0.00	0.00	0.99	1.36	1.60	1.88	2.14	2.39	3.06
	1:35:00	0.00	0.00	0.88	1.22	1.40	1.58	1.79	1.96	2.50
	1:40:00	0.00	0.00	0.80	1.06	1.26	1.32	1.50	1.59	2.03
	1:45:00	0.00	0.00	0.76	0.95	1.18	1.15	1.30	1.35	1.70
	1:50:00	0.00	0.00	0.74	0.89	1.13	1.04	1.18	1.20	1.51
	1:55:00	0.00	0.00	0.66	0.83	1.07	0.98	1.10	1.10	1.38
	2:00:00	0.00	0.00	0.59	0.78	0.99	0.93	1.05	1.03	1.29
	2:05:00	0.00	0.00	0.47	0.61	0.78	0.74	0.83	0.80	1.00
	2:10:00	0.00	0.00	0.37	0.48	0.61	0.57	0.64	0.61	0.76
	2:15:00	0.00	0.00	0.28	0.37	0.47	0.44	0.49	0.46	0.58
	2:20:00	0.00	0.00	0.22	0.28	0.36	0.34	0.38	0.35	0.44
	2:25:00	0.00	0.00	0.17	0.22	0.27	0.26	0.29	0.27	0.33
	2:30:00	0.00	0.00	0.13	0.16	0.20	0.19	0.21	0.20	0.25
	2:35:00	0.00	0.00	0.09	0.12	0.15	0.14	0.16	0.15	0.19
	2:40:00	0.00	0.00	0.07	0.09	0.11	0.11	0.12	0.12	0.14
	2:45:00	0.00	0.00	0.05	0.06	0.08	0.08	0.09	0.08	0.11
	2:50:00	0.00	0.00	0.03	0.04	0.06	0.05	0.06	0.06	0.07
	2:55:00	0.00	0.00	0.02	0.03	0.04	0.04	0.04	0.04	0.05
	3:00:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	3:05:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX C

FIGURES



IMPERVIOUS AREA CALCULATIONS:
TOTAL BASIN A1 AREA = 1.46 AC.
IMPERVIOUS AREAS:

SURFACE TYPE	AREA
ASPHALT	47,349 SF
CONCRETE	9,791 SF
TOTAL	57,140 SF

= 1.3 AC
= **89.0%** IMPERVIOUS

IMPERVIOUS AREA CALCULATIONS:
TOTAL BASIN A2 AREA = 2.30 AC.
IMPERVIOUS AREAS:

SURFACE TYPE	AREA
NATIVE GRAVEL	9,606 SF
24,016 SF (@ 40% IMPERVIOUS)	
MILLINGS @ 100%	9,237 SF
EX-CONCRETE	3,666 SF
EX-BUILDING	2,062 SF
PR-BUILDING	6,000 SF
PR-ASPHALT	28,162 SF
TOTAL	58,733 SF

= 1.34 AC
= **58.3%** IMPERVIOUS

SUMMARY HYDROLOGY TABLE

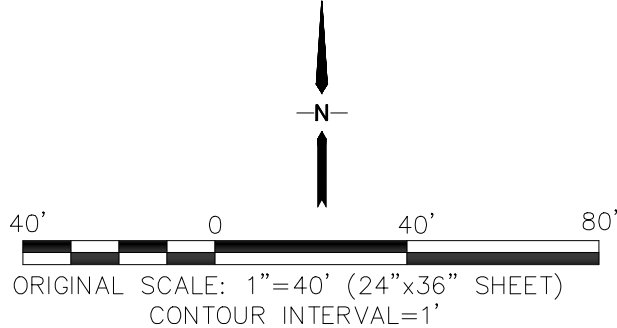
DESIGN POINT	Q5 (CFS)	Q100 (CFS)
A1	5.6	10.3
A2	6.4	11.7
1 (DEVELOPED)	9.3	17.2
1 (DETAINED)	1.0	1.0
2 (DEVELOPED)	0.2	1.2

BENCHMARK: NGS "U 347", FOUND NGS BRASS CAP SET IN TOP OF CONCRETE POST 0.8' ABOVE GROUND, 3 MILES NORTHWEST ALONG THE DENVER AND RIO GRANDE WESTERN RAILROAD FROM THE STATION AT FOUNTAIN, 4 1/2 POLES NORTHEAST OF MILEPOST 85, 21' NORTHEAST OF THE NORTHEAST RAIL, 47.5' NORTH OF A SIGNAL CASE, 32.7' SOUTHWEST OF A TELEPHONE POLE.

ELEVATION: 5662.75 (DATUM: NAVD 88)

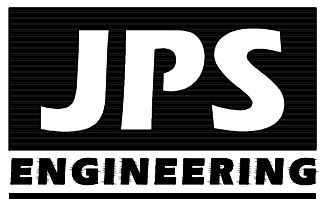
DRAINAGE LEGEND

- RIPRAP
- - - - - PROPERTY LINES
- - - - - FLOWLINE
- — — — — MAJOR DRAINAGE BASIN BOUNDARY
- FLOW DIRECTION ARROW
- 5 — DESIGN POINT
- C14 — DEVELOPED BASIN DESIGNATION
- 23.21 AC — DEVELOPED BASIN AREA (ACRES)



ARACO CONCRETE

7470 SOUTHMOOR DR., COLORADO SPRINGS, COLORADO 80915



19 E. Willamette Ave.
Colorado Springs, CO
80903
PH: 719-477-9429
FAX: 719-471-0766
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NO.	REVISION	BY	DATE

DEVELOPED DRAINAGE PLAN

HORZ. SCALE: 1"=40'	DRAWN: BJJ
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: LDC	CHECKED: JPS
CREATED: 6/21/19	LAST MODIFIED: 04/23/24
PROJECT NO: 111705	MODIFIED BY: PV

SHEET: D1