EPC STORMWATER REVIEW COMMENTS
IN ORANGE BOXES WITH BLACK TEXT

# 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 P.E. 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:

10/05/2022

Printed Name: Arturo Acosta
Title: Manager

Date

please update the signatures

**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:

update to Joshua Palmer

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

# 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, Rage 66 West of the 6$^{th}$ 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 5-YEAR | C 100-YEAR | Overland Flow LENGTH (FT) | Overland Flow SLOPE (FT/FT) | Overland Flow Tco (1) (MIN) | Channel flow CHANNEL LENGTH (FT) | Channel flow CONVEYANCE COEFFICIENT C | Channel flow SLOPE (FT/FT) | Channel flow SCS (2) VELOCITY (FT/S) | Channel flow Tt (3) (MIN) | TOTAL Tc (4) (MIN) | TOTAL Tc (4) (MIN) | INTENSITY (5) 5-YR (IN/HR) | INTENSITY (5) 100-YR (IN/HR) | PEAK FLOW Q5 (6) (CFS) | PEAK FLOW 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 5-YEAR | C 100-YEAR | Overland Flow LENGTH (FT) | Overland Flow SLOPE (FT/FT) | Overland Flow Tco (1) (MIN) | Channel flow CHANNEL LENGTH (FT) | Channel flow CONVEYANCE COEFFICIENT C | Channel flow SLOPE (FT/FT) | Channel flow SCS (2) VELOCITY (FT/S) | Channel flow Tt (3) (MIN) | TOTAL Tc (4) (MIN) | TOTAL Tc (4) (MIN) | INTENSITY (5) 5-YR (IN/HR) | INTENSITY (5) 100-YR (IN/HR) | PEAK FLOW Q5 (6) (CFS) | PEAK FLOW 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 Tco = (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) Tc = Tco + Tt
*** 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(Tc) + 7.583
$I_{100}$ = -2.52 * ln(Tc) + 12.735
6) Q = CiA

**ARACO CONCRETE - 7470 SOUTHMOOR DRIVE**
**STORM INLET SIZING SUMMARY**

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

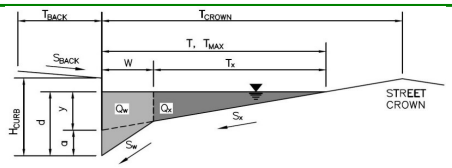
Version 4.05 Released March 2017

## 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)**

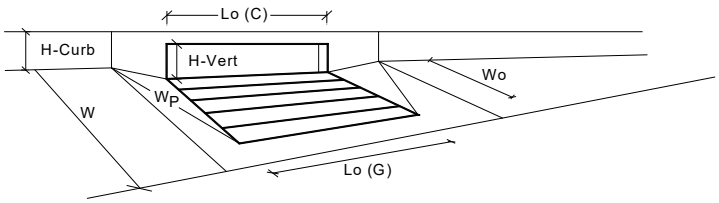
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 4.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 50.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.037 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 50.0 | 50.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 12.0 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Depth Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

**Version 4.05 Released March 2017**




| **Design Information (Input)** | Denver No. 16 Combination | | MINOR | MAJOR | |
|---|---|---|---|---|---|
| Type of Inlet | | Type = | Denver No. 16 Combination | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | | $a_{local}$ = | 2.00 | 2.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | | No = | 2 | 2 | |
| Water Depth at Flowline (outside of local depression) | | Ponding Depth = | 6.0 | 12.0 | inches |
| **Grate Information** | | | MINOR | MAJOR | ☐ Override Depths |
| Length of a Unit Grate | | $L_o$ (G) = | 3.00 | 3.00 | feet |
| Width of a Unit Grate | | $W_o$ = | 1.73 | 1.73 | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | | $A_{ratio}$ = | 0.31 | 0.31 | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | | $C_f$ (G) = | 0.50 | 0.50 | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | | $C_w$ (G) = | 3.60 | 3.60 | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | | $C_o$ (G) = | 0.60 | 0.60 | |
| **Curb Opening Information** | | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | | $L_o$ (C) = | 3.00 | 3.00 | feet |
| Height of Vertical Curb Opening in Inches | | $H_{vert}$ = | 6.50 | 6.50 | inches |
| Height of Curb Orifice Throat in Inches | | $H_{throat}$ = | 5.25 | 5.25 | inches |
| Angle of Throat (see USDCM Figure ST-5) | | Theta = | 0.00 | 0.00 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | | $C_w$ (C) = | 3.70 | 3.70 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | | $C_o$ (C) = | 0.66 | 0.66 | |
| **Low Head Performance Reduction (Calculated)** | | | MINOR | MAJOR | |
| Depth for Grate Midwidth | | $d_{Grate}$ = | 0.523 | 1.023 | ft |
| Depth for Curb Opening Weir Equation | | $d_{Curb}$ = | 0.33 | 0.83 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | | $RF_{Combination}$ = | 0.71 | 1.00 | |
| Curb Opening Performance Reduction Factor for Long Inlets | | $RF_{Curb}$ = | 1.00 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | | $RF_{Grate}$ = | 0.71 | 1.00 | |
| | | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | | **$Q_a$ =** | **6.2** | **20.1** | **cfs** |
| **WARNING: Inlet Capacity less than Q Peak for Minor Storm** | | $Q_{PEAK\ REQUIRED}$ = | 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 ft^2

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/ft^2

Calculated Avg Shear Stress: 0.1560 lb/ft^2

# 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 |
| | | | | | | | | | | | |

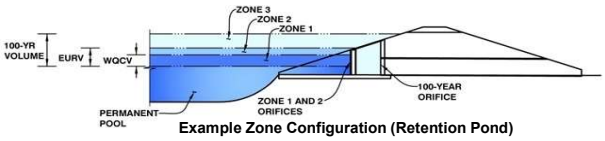
Provide updated forebay, weir notch, and trickle channel calculations

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.04 (February 2021)*

**Project: ARACO CONCRETE**

**Basin ID: A1**



**Example Zone Configuration (Retention Pond)**

Watershed Information

Selected BMP Type = **EDB**
Watershed Area = 3.76 acres
Watershed Length = 835 ft
Watershed Length to Centroid = 415 ft
Watershed Slope = 0.013 ft/ft
Watershed Imperviousness = 76.00% percent
Percentage Hydrologic Soil Group A = 100.0% percent
Percentage Hydrologic Soil Group B = 0.0% percent
Percentage Hydrologic Soil Groups C/D = 0.0% percent
Target WQCV Drain Time = 40.0 hours
Location for 1-hr Rainfall Depths = User Input

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

| | | | Optional User Overrides | |
|---|---|---|---|---|
| Water Quality Capture Volume (WQCV) = | 0.096 | acre-feet | | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.370 | acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.264 | acre-feet | 1.19 | inches |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.343 | acre-feet | 1.50 | inches |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.406 | acre-feet | 1.75 | inches |
| 25-yr Runoff Volume (P1 = 2 in.) = | 0.483 | acre-feet | 2.00 | inches |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 0.557 | acre-feet | 2.25 | inches |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 0.645 | acre-feet | 2.52 | inches |
| 500-yr Runoff Volume (P1 = 3.14 in.) = | 0.838 | acre-feet | 3.14 | inches |
| Approximate 2-yr Detention Volume = | 0.243 | acre-feet | | |
| Approximate 5-yr Detention Volume = | 0.316 | acre-feet | | |
| Approximate 10-yr Detention Volume = | 0.378 | acre-feet | | |
| Approximate 25-yr Detention Volume = | 0.451 | acre-feet | | |
| Approximate 50-yr Detention Volume = | 0.493 | acre-feet | | |
| Approximate 100-yr Detention Volume = | 0.534 | acre-feet | | |

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) = 0.096 acre-feet
Zone 2 Volume (EURV - Zone 1) = 0.275 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) = 0.163 acre-feet
Total Detention Basin Volume = 0.534 acre-feet

Depth Increment = 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 | -- | -- | -- | 10 | 0.000 | | |
| **Bot EL-5632.0** | -- | 1.50 | -- | -- | -- | 2,962 | 0.068 | 2,229 | 0.051 |
| | -- | 3.50 | -- | -- | -- | 3,410 | 0.078 | 8,601 | 0.197 |
| | -- | 5.50 | -- | -- | -- | 3,874 | 0.089 | 15,885 | 0.365 |
| **Spillway=5638.0** | -- | 7.50 | -- | -- | -- | 4,329 | 0.099 | 24,088 | 0.553 |
| **Top EL=5640.0** | -- | 9.50 | -- | -- | -- | 4,780 | 0.110 | 33,197 | 0.762 |
| | -- | | -- | -- | -- | | | | |
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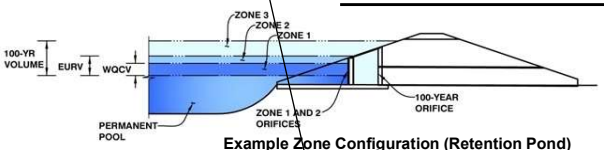
15/16" diameter will result in an Orifice Area of 0.69 sq. inches. Update spreadsheet, or increase the diameter to 1" (0.79 sq. inches) and update spreadsheet and GEC Plans

# 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 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 = | 5.208E-03 | $ft^2$ |
| Depth at top of Zone using Orifice Plate = | 5.57 | ft (relative to basin bottom at Stage = 0 ft) | Elliptical Half-Width = | N/A | feet |
| Orifice Plate: Orifice Vertical Spacing = | 14.60 | inches | Elliptical Slot Centroid = | N/A | feet |
| Orifice Plate: Orifice Area per Row = | 0.75 | sq. inches (diameter = 15/16 inch) | 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 | 1.86 | 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, Ho = | 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, $H_t$ = | 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).*

| 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) = | N/A | N/A | 1.19 | 1.50 | 1.75 | 2.00 | 2.25 | 2.52 | 3.14 |
| 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 | 0.264 | 0.343 | 0.406 | 0.483 | 0.557 | 0.645 | 0.838 |
| CUHP Predevelopment Peak Q (cfs) = | N/A | N/A | 0.0 | 0.0 | 0.1 | 0.5 | 0.9 | 1.5 | 2.8 |
| 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 |

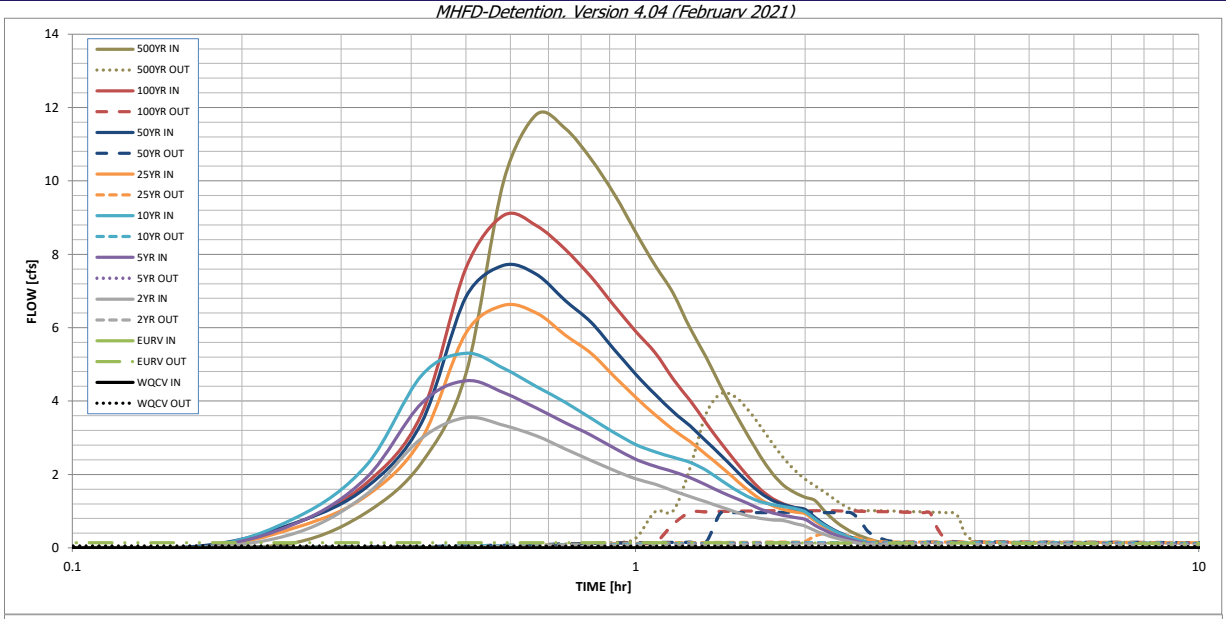
Add similar note from approved drainage report

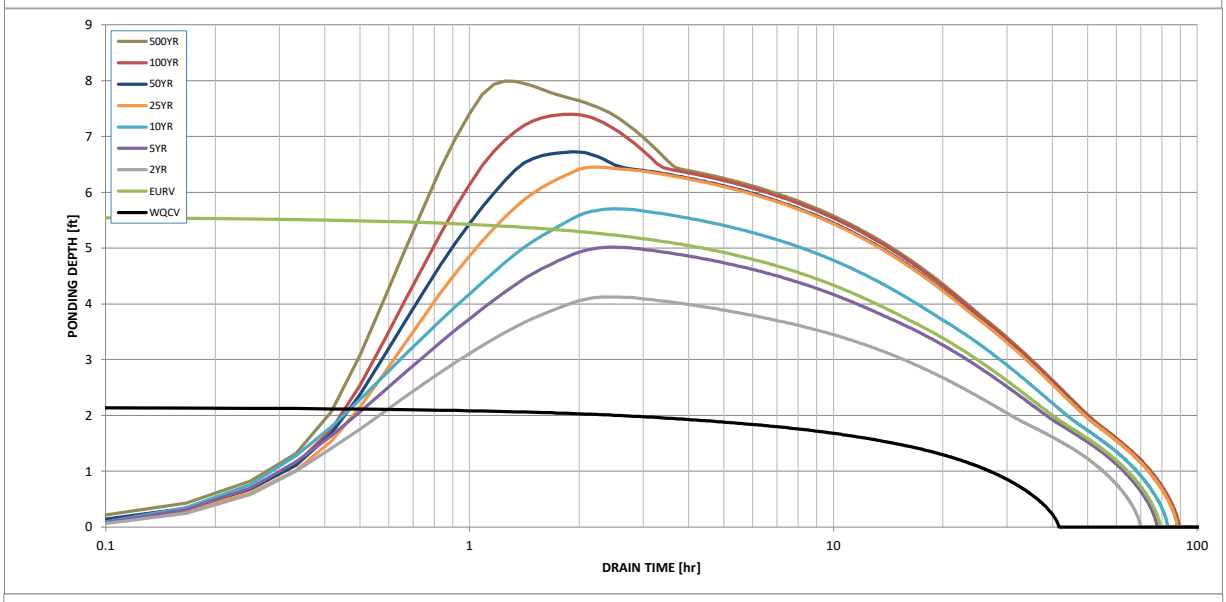
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Unit Peak Flow, q (cfs/acre) = | N/A | N/A | 0.01 | 0.02 | 0.02 | 0.20 | 0.40 | 0.66 |
| Peak Inflow Q (cfs) = | N/A | N/A | 2.3 | 2.8 | 3.4 | 4.0 | 4.6 | 5.2 |
| Peak Outflow Q (cfs) = | 0.0 | 0.3 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 |
| Outflow to Predevelopment Q = | N/A | N/A | N/A | 7.2 | 6.8 | 0.9 | 0.6 | 0.4 |
| Structure Controlling Flow = | Plate | Plate | Plate | Plate | Plate | Plate | Outlet Plate 1 | Outlet Plate 1 |
| Velocity through Grate 1 (fps) = | N/A | N/A | N/A | N/A | N/A | N/A | 0.0 | 0.0 |
| Velocity through Grate 2 (fps) = | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 7% of Inflow Volume (hours) = | 38 | 63 | 63 | 64 | 64 | 64 | 64 | 64 |
| 9% of Inflow Volume (hours) = | 39 | 67 | 66 | 67 | 68 | 69 | 69 | 70 |
| Maximum Ponding Depth (ft) = | 1.72 | 3.64 | 2.64 | 3.00 | 3.31 | 3.67 | 3.95 | 4.35 |
| imum Ponding Depth (acres) = | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| mum Volume Stored (acre-ft) = | 0.047 | 0.175 | 0.106 | 0.131 | 0.152 | 0.177 | 0.197 | 0.226 |

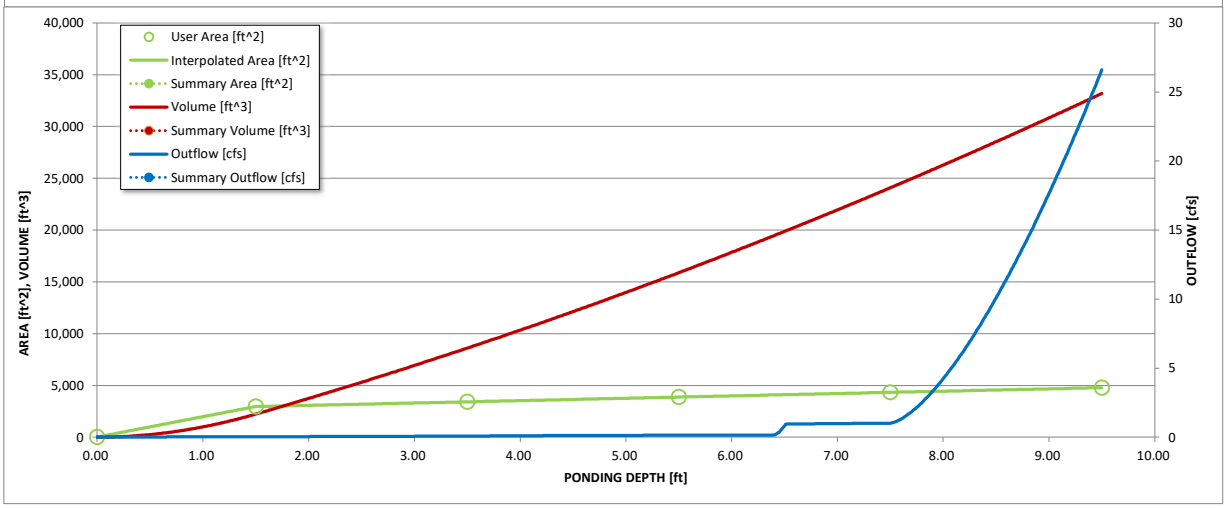
Note that while the indicated ratios of Peak Outflow to Predevelopment Q appear higher than the recommended range for the 5-year through 25-year storms, the

# 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:* _____

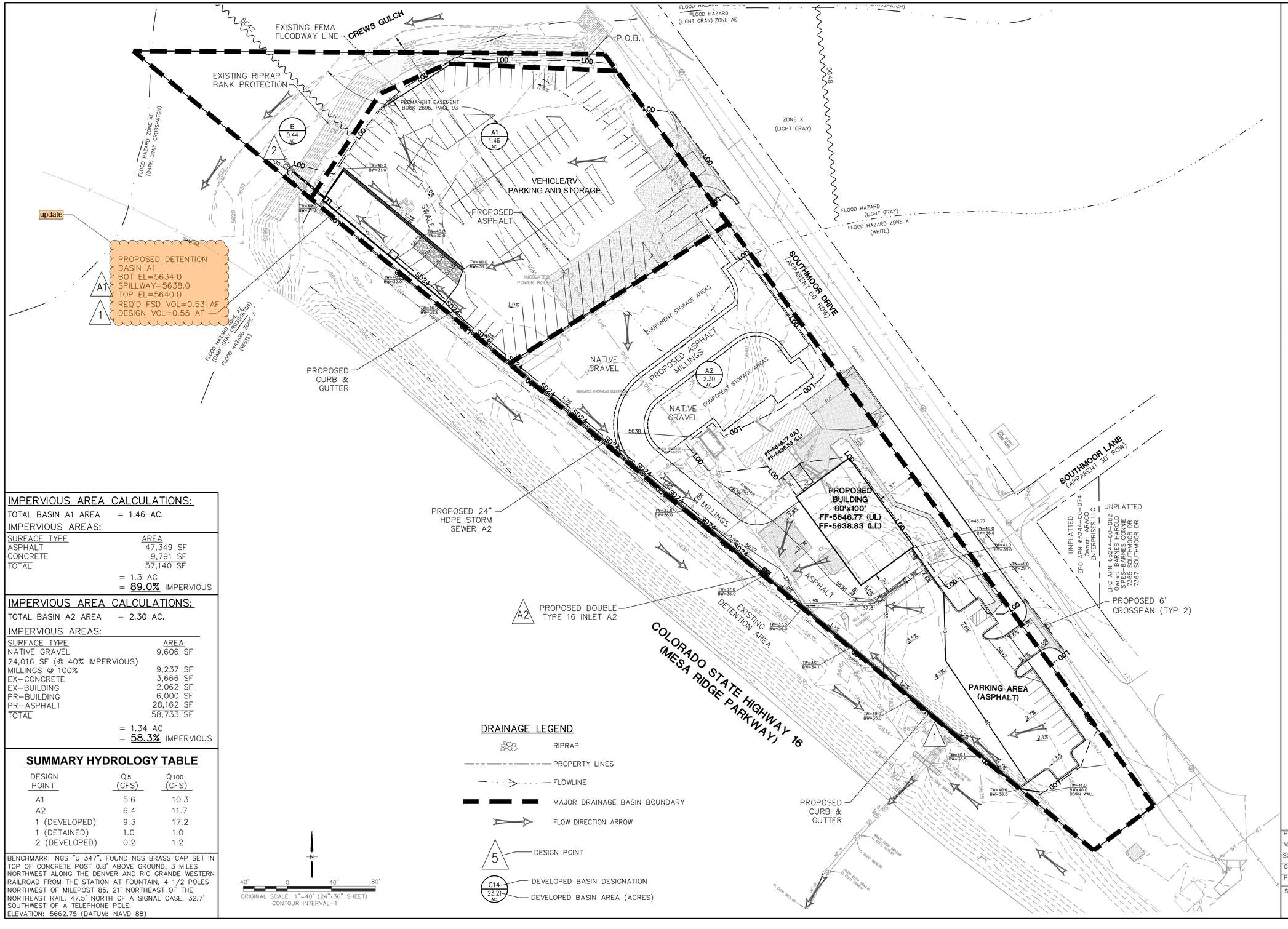
Inflow Hydrographs

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

| | SOURCE | CUHP | CUHP | CUHP | CUHP | CUHP | CUHP | CUHP | CUHP | CUHP |
|---|---|---|---|---|---|---|---|---|---|---|
| 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] |
| 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 NORTHWEST 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)


JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com


CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

# ARACO CONCRETE
## 7470 SOUTHMOOR DR., COLORADO SPRINGS, COLORADO 80915

| 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