# FINAL DRAINAGE REPORT FOR SOPRESSA EAST ADDITION FILING NO. 1

OCTOBER 2019

Prepared for:

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8605 EXPLORER DRIVE #250
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Prepared By:

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719-426-2124

JOB NUMBER:18-169

# FINAL DRAINAGE REPORT FOR
# SOPPRESSA EAST ADDITION FILING NO. 1

**Engineer's Statement:**

This report and plan for the drainage design of SOPRESSA EAST ADDITION FILING NO. 1 was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

_____ _____

David L. Mijares, Colorado PE #40510 Date

For and on behalf of Catamount Engineering

**Developer's Statement:**

CHALLENGER HOMES hereby certifies that the drainage facilities for SOPRESSA EAST ADDITION FILING NO. 1 shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of SOPRESSA EAST ADDITION FILING NO. 1 guarantee that final drainage design review will absolve CHALLENGER HOMES and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

CHALLENGER HOMES

Name of Developer

_____

Authorized Signature Date

_____

Printed Name

_____

Title

_____

_____

_____

Address

**City of Colorado Springs Only:**

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

_____ _____

For City Engineer Date

**CONDITIONS:**

# FINAL DRAINAGE REPORT FOR
# SOPPRESSA EAST ADDITION FILING NO. 1

## PURPOSE

The purpose of this drainage report is to identify existing drainage patterns and establish outfall scenarios from the proposed development. The site is contained within the Cottonwood Creek Drainage Basin and outfalls to the Sopressa Lane Storm Sewer System installed with the Cumbre Vista and Woodmen Vista Developments, and designed in the Sopressa Lane Storm Sewer report, by Matrix Design Group, Inc, dated July 2007. The parcel was previously studied in the "Final Drainage Report for Woodmen Vista Filing No. 1 & 2 and Amendment to the Master Development Drainage Report for Cumbre Vista Subdivision", by Matrix Design Group, Inc.", approved November 16, 2007. Development of Sopressa East Addition Filing No. 1 requires development of water quality and full spectrum detention.

## GENERAL LOCATION AND DESCRIPTION

The Sopressa East Addition development is located within the SE ¼ of Section 16 Township 13 South and Range 65 West of the 6$^{th}$ principal meridian. The proposed residential filing contains approximately 8.893 acres to be developed within the City of Colorado Springs and currently completing annexation. The proposed development is bounded to the north by a gravel portion of existing Sopressa Road and the Cumbre Vista subdivision, to the east by rural residential(unplatted) lots within El Paso County, to the South by the Lodge at Black Forest Subdivision (multi-family residential), and to the east by both the Woodmen Vistas residential subdivision Filing No. 2 and 3 unplatted rural residential lots within El Paso County.

The proposed residential development consists of 70 PUD residential lots, roadway infrastructure, and, greenspace. An existing residence within the southwest portion of the development within an unplatted County parcel will be demolished and included in the redevelopment area.

Existing soils on the site consist of Blakeland Loamy Sand (Hydrologic Group 'A') and Stapleton-Bernal sandy loams (Hydrologic Group 'B'). Soils have been identified as determined by the Natural Resources Conservation Service Web Soil Survey. Hydrologic Group 'B' soils have been used in hydrologic calculations. The easterly portion of the parcel sits on the physical boundary between the Cottonwood Creek and Sand Creek basins, while the parcel is located within the political boundary of the Cottonwood Creek basin. The parcel is divided by a predominant ridge with the southerly and westerly portions draining overland to the west and into rear yard swales constructed with development of the Woodmen Vista Filing No. 2 subdivision; and northerly portions of the site draining overland south to unimproved Sopressa Road.

No portion of the development is contained within a FEMA designated floodplain per FIRM panel 08041C0529 G, effective December 07, 2018.

## EXISTING DRAINAGE

The parcel was previously studied in the Final Drainage Report for Woodmen Vista Filing No. 1 & 2 and Amendment to the Master Development Drainage Report for Cumbre Vista Subdivision" and the analysis has been accepted for this report.

The report indicates 3 historic basins within the Sopressa East Addition Filing No. 1 development. Basin OS-1 (7.17 acres, $Q_5$=8.4 cfs, $Q_{100}$=18.7 cfs) contains the northern and eastern portion of the development and a portion of the rural residential lots east of the parcel. Basin OS-1 drains directly to existing gravel portions of Sopressa Lane. Runoff is collected within a 15' D10R inlet (catch basin #1/Woodmen Vista-FDR) located within Sopressa Lane.

Basin OS-2 (3.21 acres, $Q_5$=2.4 cfs, $Q_{100}$=5.1 cfs) contains the central westerly portion of the development and the 3 unplatted residential lots west of the development. Basin OS-2 drains into rear yards and is directed along lot line swales constructed with the development of the Cumbre Vista Subdivision to Crestone Peak Trail and then west along Sopressa Lane to Inlet #2/Woodmen Vista FDR.

Basin OS-3 (4.31 acres, $Q_5$=3.0 cfs, $Q_{100}$=6.3 cfs) contains the southerly portion of the parcel and drains into a rear yard swale constructed with the development of the Cumbre Vista Subdivision conveying flows to existing storm sewer facilities within Sopressa Lane. Basin OS-3 drains into rear yards and is directed along lot line swales constructed with the development of the Cumbre Vista Subdivision to Crestone Peak Trail and then west along Sopressa Lane to Inlet #2/Woodmen Vista FDR. A City Standard D-21 Curb inlet was installed coincident with the lot line between lots 10 and 11, Woodmen Vista Filing No. 2 to accept off-site flows from Basin OS-3.

The Woodmen Vista FDR/Cumbre Vista MDDP Amendment states that the 30" RCP constructed per the Sopressa Lane Storm Sewer Plans is designed to accommodate the developed flows from off-site sub-basins and that since future developed conditions are less than those under the interim developed conditions, design points within the Woodmen Vista subdivision will remain unchanged and assume that adjacent developments discharge flows onto Woodmen Vista.

## DEVELOPED DRAINAGE BASINS

The intent of the proposed development is to follow closely to historic drainage patterns while satisfying current City of Colorado Springs development and water quality criteria. The area of the site proposed for impervious development will be contained within the parking/private roadway section and private on-site storm sewer system conveying flows to through full spectrum detention basin and water quality facilities prior to outfall offsite.

Development of the site includes 70 residential lots, roadway and utility infrastructure to be constructed in 1 filing. Due to substantial grade within the site the parcel will drain to two private extended detention basins for water quality and full spectrum detention. EDB A will accept and detain flows from 'A' designated basins within the northerly and easterly portions of the development. EDB B will accept and detain flows from 'B' designated basins within the southwesterly portion of the development.

Generated storm runoff will be conveyed in on-site private crowned and curbed roadway sections. Flows will be collected in type 'R' inlets and conveyed in private HDPE storm sewer to outfall within proposed full-spectrum detention basins prior to release off-site. Due to the parcel being located on the physical ridge between Major drainage basins no off-site flows enter the site.

'A Basins'

| BASIN | AREA | $Q_2$ | $Q_5$ | $Q_{10}$ | $Q_{25}$ | $Q_{50}$ | $Q_{100}$ | Type R Inlet |
|---|---|---|---|---|---|---|---|---|
| A1 | 0.05 | 0.2 | 0.2 | 0.3 | 4.9 | 5.8 | 6.9 | 5' |
| A2 | 0.19 | 0.3 | 0.4 | 0.6 | 0.7 | 0.9 | 1.0 | 10' |
| A3 | 0.16 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 5' |
| A4 | 0.12 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 5' |
| A5 | 1.34 | 2.0 | 2.7 | 3.4 | 4.2 | 5.0 | 5.8 | 5' |
| A6 | 0.46 | 1.0 | 1.3 | 1.5 | 1.9 | 2.2 | 2.5 | 5' |
| A7 | 1.33 | 2.5 | 3.3 | 4.1 | 5.1 | 6.0 | 6.8 | 5' |
| A8 | 0.31 | 0.8 | 1.1 | 1.3 | 1.6 | 1.8 | 2.1 | 5' |
| A9 | 0.26 | 0.4 | 0.5 | 0.7 | 0.8 | 1.0 | 1.1 | FES |
| A10 | 0.74 | 2.4 | 3.1 | 3.7 | 4.4 | 5.0 | 5.7 | 10' |
| A11 | 0.39 | 0.1 | 0.3 | 0.5 | 0.8 | 0.9 | 1.2 | EDB A |

Flows collected within 'A' designated basin inlets will be conveyed in a private storm sewer system located predominantly within the street ROW which outfalls to private extended detention basin 'A'. Manning's equation calculations are provided in the appendix of this report. Hydraulic Grade Line Calculations will be developed upon initial review comments.

Basin A1 consists of the easterly portion of the northeasterly private roadway and will sheetflow to the roadway curb and gutter and be collected in a private 5' Type R at grade inlet. Flows will be conveyed in a private 12" HDPE storm sewer to Pipe Design Point 1.

Basin A2 consists of the westerly portion of the northeasterly private roadway, proposed parking, and landscape area. Runoff will sheetflow to the roadway curb and gutter and collected in a private 10' Type R at grade inlet. Pipe Design Point 1 ($Q_5$=0.7 cfs and $Q_{100}$=1.5) will be conveyed in a private 12" HDPE storm sewer to Pipe Design Point 2.

Basin A3 consists of the easterly portion of the central private roadway connection and landscape area. Runoff will sheetflow to the roadway curb and gutter and collected in a private 5' Type R at grade inlet. Pipe Design Point 2 ($Q_5$=0.8 cfs and $Q_{100}$=1.9) will be conveyed in a private 12" HDPE storm sewer to Pipe Design Point 3.

Basin A4 consists of the westerly portion of the central private roadway connection and easterly portion of Lot 3. Runoff will sheetflow to the roadway curb and gutter and collected in a private 5' Type R at grade inlet. Pipe Design Point 3 ($Q_5$=1.1 cfs and $Q_{100}$=2.5) will be conveyed in a private 15" HDPE storm sewer to extended detention basin A at Design Point A1.

Basin A5 consists of the easterly portion of the easterly private roadway and residential 'A' lots and will sheetflow to the roadway curb and gutter. Flows conveyed in the curb and gutter section will be collected in a private 5' Type R sump inlet. Flows will be conveyed in a private 15" HDPE storm sewer to Pipe Design Point 4.

Basin A6 consists of the westerly portion of the easterly private roadway and front yards of residential 'B' lots and will sheetflow to the roadway curb and gutter. Flows conveyed in the curb and gutter will be collected in a private 5' Type R sump inlet. Pipe Design Point 4 ($Q_5$=3.8 cfs and $Q_{100}$=8.0) will be conveyed in a private 15" HDPE storm sewer to Pipe Design Point 5.

Basin A7 consists of the roadways and residential lots within the central portion of the development and will sheetflow to the roadway curb and gutter. Flows conveyed in the curb and gutter will be collected in a private 5' Type R sump inlet. Pipe Design Point 5 ($Q_5$=6.8 cfs and $Q_{100}$=14.0) will be conveyed in a private 18" HDPE storm sewer to Pipe Design Point 6.

Basin A8 consists of the westerly portion of the westerly north-south private roadway and front yards of residential 'B' lots and will sheetflow to the roadway curb and gutter. Flows conveyed in the curb and gutter will be collected in a private 5' Type R sump inlet. Pipe Design Point 6 ($Q_5$=8.1 cfs and $Q_{100}$=16.6) will be conveyed in a private 18" HDPE storm sewer to Pipe Design Point 7.

Basin A9 consists of the easterly portion of residential 'B' lots 66-70. Runoff will sheetflow to a rear yard swale and be conveyed to a 10" FES and HDPE storm along the northerly lot line of Lot 70 and outfall to the proposed 5' sump inlet and Pipe Design Point 6.

Basin A10 consists of residential lots and roadway within the northern portion of the development. Generated runoff will sheetflow to the roadway curb and gutter. Flows conveyed in the curb and gutter will be collected in a private 10' Type R sump inlet. Pipe Design Point 7 ($Q_5$=10.5 cfs and $Q_{100}$=21.1) will be conveyed in a private 24" HDPE storm sewer to extended detention basin A at Design Point A1.

Basin A11 consists of landscaped area and a portion of residential lot 1 and will sheetflow directly to proposed private full spectrum extended detention basin A at Design Point A1.

Design Point A1 ($Q_2$=8.0 cfs, $Q_5$=10.7 cfs, $Q_{10}$=13.3 cfs, $Q_{25}$=16.4 cfs, $Q_{50}$=19.2 cfs, and $Q_{100}$=22.1 cfs) represents the site contribution to extended detention basin A.

'B Basins'

| BASIN | AREA | $Q_2$ | $Q_5$ | $Q_{10}$ | $Q_{25}$ | $Q_{50}$ | $Q_{100}$ | Type R Inlet |
|---|---|---|---|---|---|---|---|---|
| B1 | 1.56 | 2.4 | 3.1 | 3.7 | 4.4 | 5.0 | 5.7 | 10' |
| B2 | 1.26 | 2.1 | 2.9 | 3.6 | 4.4 | 5.2 | 5.9 | 10' |
| B3 | 0.39 | 0.2 | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 | EDB B |

Flows collected within 'B' designated basin inlets will be conveyed in a private storm sewer system located predominantly within the street ROW which outfalls westerly to private extended detention basin 'B'. Manning's equation calculations are provided in the appendix of this report. Hydraulic Grade Line Calculations will be developed upon initial review comments.

Basin B1 consisting of proposed private roadway and residential lots within the southwesterly portion of the development will sheetflow to the roadway curb and gutter and be collected in a private 10' Type R at grade inlet at design point 8. Flows will be conveyed in a private 15" to extended detention basin B at Design Point B1.

Basin B2 consisting of proposed private roadway and residential lots within the southwesterly portion of the development will sheetflow to the roadway curb and gutter and be collected in a private 10' Type R at grade inlet at design point 8. Flows will be conveyed in a private 15" to extended detention basin B at Design Point B1.

Basin B3 consists of landscaped area and a portion of residential lots 60-63 and will sheetflow directly to proposed private full spectrum extended detention basin B at Design Point B1.

Design Point B1 ($Q_2$=4.5 cfs, $Q_5$=6.1 cfs, $Q_{10}$=7.6 cfs, $Q_{25}$=9.5 cfs, $Q_{50}$=11.2 cfs, and $Q_{100}$=13.0 cfs) represents the site contribution to extended detention basin B.

'C Basins'

Basin C1 (0.19 Acres, $Q_2$=0.0 cfs, $Q_5$=0.1 cfs, $Q_{10}$=0.2 cfs, $Q_{25}$=0.4 cfs, $Q_{50}$=0.5 cfs, and $Q_{100}$=0.6 cfs) represents the westerly limits of the development. Basin C1 will contain landscaped area and walls and sheetflow westerly into the Woodmen Vistas subdivision.

## EXTENDED DETENTION BASINS

The parcel proposes to develop 8.893 acres within the Cottonwood Creek Drainage requiring development of water quality treatment and full-spectrum detention per the criteria of the City of Colorado Springs Drainage Criteria Manual Volume 2.

EDB A

The proposed Extended Detention Basin located in the northerly portion of the development has 4.83 tributary acres of development with an average imperviousness of 65.00%. Full spectrum pond development requires 0.120 acre-ft of water quality capture volume ponding to an elevation of 6975.71, an EURV volume of 0.265-acre ft, and a total volume of 0.566 acre-ft ponding to an elevation of 6979.52 providing full spectrum detention including the 100-YR event.

Runoff generated within the site will be conveyed to the pond through storm sewer systems or as direct sheetflow. The storm sewer systems will outfall directly to 6" concrete forebays with baffle providing adequate protection at discharge point. The concrete forebays require a total volume of 105 cubic feet of volume (2% of the design WQCV). The forebay will be constructed of a concrete slab with sides conforming to the pond slopes and 1' wall with a 2" rectangular notch which outfalls to the proposed trickle channel at the downstream end.

The pond will be constructed with 4:1 minimum side slopes to be vegetated per the final landscape plan. A 2' wide by 6" deep concrete trickle channel with a 0.5% longitudinal slope will convey low flows across the pond bottom to the micropool/outlet structure. The trickle channel will outfall to a 10' long by 4' wide by 2.5' deep concrete micropool. The micropool will provide a surface area of 40 square feet and an initial surcharge volume of 13.2 cubic feet utilizing a 4" initial surcharge depth.

The outlet structure will consist of a concrete box with orifice plate and screen providing water quality outlet and weir with trash rack for larger storm outfall. The pond will outfall through a private 12" HDPE pipe system to existing storm sewer within Sopressa Drive sized to accept developed flows from the parcel. The storm system conveys flows directly to Cottonwood Creek.

The emergency spillway will consist of a 20' weir along the northerly end of the pond at an elevation of 6980.00. The 20' weir will convey developed undetained flows a depth of 0.41' and consist of 12" depth of type VL soil riprap.

Outfall from the extended detention basin of $Q_2$=0.1 cfs, $Q_5$=0.1 cfs, $Q_{10}$=1.1 cfs, $Q_{25}$=3.6 cfs, $Q_{50}$=5.2 cfs, and $Q_{100}$=5.4 will be conveyed in a private 12" RCP.

EDB B

The proposed Extended Detention Basin located in the southwesterly portion of the development has 3.21 tributary acres of development with an average imperviousness of 65.00%. Full spectrum pond development requires 0.068 acre-ft of water quality capture volume ponding to an elevation of 6972.68, an EURV volume of 0.176-acre ft, and a total volume of 0.376 acre-ft ponding to an elevation of 6975.62 providing full spectrum detention including the 100-YR event.

Runoff generated within the site will be conveyed to the pond through storm sewer systems or as direct sheetflow. The storm sewer systems will outfall directly to 6” concrete forebays with baffle providing adequate protection at discharge point. The concrete forebays require a total volume of 60 cubic feet of volume (2% of the design WQCV). The forebay will be constructed of a concrete slab with sides conforming to the pond slopes and 1’ wall with a 2” rectangular notch which outfalls to the proposed trickle channel at the downstream end.

The pond will be constructed with 4:1 minimum side slopes to be vegetated per the final landscape plan. A 2’ wide by 6” deep concrete trickle channel with a 0.5% longitudinal slope will convey low flows across the pond bottom to the micropool/outlet structure. The trickle channel will outfall to a 10’ long by 4’ wide by 2.5’ deep concrete micropool. The micropool will provide a surface area of 40 square feet and an initial surcharge volume of 13.2 cubic feet utilizing a 4” initial surcharge depth.

The outlet structure will consist of a concrete box with orifice plate and screen providing water quality outlet and weir with trash rack for larger storm outfall. The pond will outfall through a private 12” HDPE pipe system to historic outfall point at the westerly limits of the subdivision. Outfall from the extended detention basin of $Q_2$=0.1 cfs, $Q_5$=0.1 cfs, $Q_{10}$=1.3 cfs, $Q_{25}$=3.4 cfs, $Q_{50}$=3.4 cfs, and $Q_{100}$=3.5 will be conveyed in a private 10” RCP.

The emergency spillway will consist of a 20’ weir along the northerly end of the pond at an elevation of 6975.62. The 20’ weir will convey developed undetained flows a depth of 0.31’ and consist of 12” depth of type VL soil riprap. Both the outlet pipe and emergency outfall will be directed to the historic low point between lots 10 and 11 within Woodmen Vista Filing No. 2. A City Standard D-21 Curb inlet was installed coincident with the lot line between lots 10 and 11, Woodmen Vista Filing No. 2 to accept off-site flows from Basin OS-3. A 4’ Concrete chase 0.67’ deep will need to be constructed along the lot line between lots 10 and 11 to convey emergency overflow from proposed extended detention basin B to the street system within Woodmen Vista Filing No. 2.The Woodmen Vista Subdivision anticipated flows from Basin OS-3 (4.31 acres, $Q_5$=3.0 cfs, $Q_{100}$=6.3 cfs) in this location. Proposed release from extended detention basin B is less than anticipated flows.

## 4-STEP PROCESS

*RUNOFF REDUCTION*

The development addresses Low Impact Development strategies primarily through the utilization of landscape swales within sides and rear of proposed residential lots and directing runoff from buildings and walkways through swales with minimal longitudinal grade prior to outfall to street collection and storm conveyance systems.

*TREAT AND SLOW RELEASE*

On-site flow is directed to the on-site private proposed full spectrum extended detention basins constructed with development of the project which outfall to outfalls specified in the MDDP amendment. The extended detention basin provides Water Quality Capture Volume required and attenuates release of flows to approximate historic runoff.

*CHANNEL STABILIZATION*

The ultimate recipient of runoff from the site is Cottonwood Creek. Flows generated within the site are tributary to proposed full spectrum extended detention basins constructed on site.

*SOURCE CONTROLS*

A Grading, Erosion Control, and Stormwater Quality Plan and narrative will be approved by City of Colorado Springs prior to any soil disturbance. The erosion control plan will include specific source control BMP's as well as defined overall site management practices for the construction period. The grading narrative will address materials storage and spill containment during construction operations.

## COST ESTIMATE

Private Improvements Non-reimbursable

| | | | | | | |
|---|---|---|---|---|---|---|
| 5' Type R Inlet | 7 | EA | @$ | 3,800/EA | $ | 26,600 |
| 10' Type R Inlet | 3 | EA | @$ | 5,500/EA | $ | 16,500 |
| 12" HDPE | 161 | LF | @$ | 25/LF | $ | 4,025 |
| 15" RCP | 345 | LF | @$ | 30/LF | $ | 10,350 |
| 18" RCP | 81 | LF | @$ | 38/LF | $ | 3,078 |
| 24" RCP | 18 | LF | @$ | 50/LF | $ | 900 |
| WATER QUALITY POND | 2 | EA | @$ | 25,000/EA | $ | 50,000 |
| | | | **SUBTOTAL** | | **$** | **111,453** |
| | | | *10% CONTINGENCY* | | *$* | *11,145* |
| | | | **TOTAL** | | **$** | **122,598** |

## DRAINAGE FEE CALCULATION

Sopressa East Addition Filing No. 1 contains Riverbend Crossing Filing No. 1 contains 8.893 acres to be platted within the Cottonwood Creek Drainage Basin. (2019 FEES)

COTTONWOOD CREEK

| | | |
|---|---|---|
| 8.893 Acres X $ | 13,923/Acre = | $ 123,817.24 (Drainage Fee) |
| 8.893 Acres X $ | 1,130/Acre = | $ 10,049.09 (Bridge Fee) |
| 8.893 Acres X $ | 723/Acre = | $ 6,429.64 (Surcharge) |

## DRAINAGE METHODOLOGY

This drainage report was prepared in accordance to the criteria established in the City of Colorado Springs/El Paso County Drainage Criteria Manual Volumes 1 and 2, as revised May 2014.

The rational method for drainage basin study areas of less than 100 acres was utilized in the analysis. For the Rational Method, flows were calculated for the 2, 5, 10, 25, 50, and 100-year recurrence intervals. The average runoff coefficients, 'C' values, are taken from Table 6-6 and the Intensity-Duration-Frequency curves are taken from Figure 6-5 of the City Drainage Criteria Manual. Time of concentration for overland flow and storm drain or gutter flow are calculated per Section 3.2 of the City Drainage Criteria Manual. Calculations for the Rational Method are shown in the Appendix of this report.

Urban Drainage and Flood Control District methodology was utilized for determination of street capacity, inlet sizing, and extended detention basin design. UD-Inlet Version 4.05 was utilized in street capacity and inlet sizing calculations. UD-Culvert Version 3.05 was utilized in developing preliminary pipe sizing. Details and analysis of final storm drain conveyance and collection system will be developed in an addendum to the final drainage report submitted with Private Storm Sewer Plans for Sopressa East Addition Filing No. 1 Subdivision. Preliminary sizing calculations were provided in the appendix of this report. UD-Detention version 3.07 was utilized in development of extended detention basin and outfall. Calculations are included in the appendix of this report.

## SUMMARY

Development of Sopressa East Addition Filing No. 1 will require that flows be treated for water quality and be detained to historic levels prior to release from the site. Site runoff and storm drain and appurtenances will not adversely affect the downstream and surrounding developments. This report is in general conformance with all previously approved reports which included this site. Facilities will be owned or maintained by the Home Owner's Association.

## REFERENCES:

City of Colorado Springs Engineering Division Drainage Criteria Manual Volumes 1 and 2, revised May 2014

"Cottonwood Creek Drainage Basin Planning Study" prepared by Ayers and Associates, Inc. dated June 2000.

"Cottonwood Creek Drainage Basin Planning Study" prepared by URS Consultants, Inc. dated June 9, 1994.

"Master Development Drainage Report for Cumbre Vista Subdivision & Preliminary/Final Drainage Report for Cumbre Vista Filing No. 1" prepared by Matrix Design Group, Inc. dated July 2005.

"Final Drainage Report for Woodmen Vista Filing No. 1 and 2 & Amendment to the Master Development Drainage Report for Cumbre Vista Subdivision", by Matrix Design Group, Inc. dated November 2007.

Natural Resources Conservation Service Web Soil Survey

# APPENDIX

# National Flood Hazard Layer FIRMette

FEMA

38°56'56.77"N

104°42'47.10"W


104°42'9.64"W

38°56'28.79"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

**SPECIAL FLOOD HAZARD AREAS**
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

**OTHER AREAS**
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

**GENERAL STRUCTURES**
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**
- Digital Data Available
- No Digital Data Available
- Unmapped

N

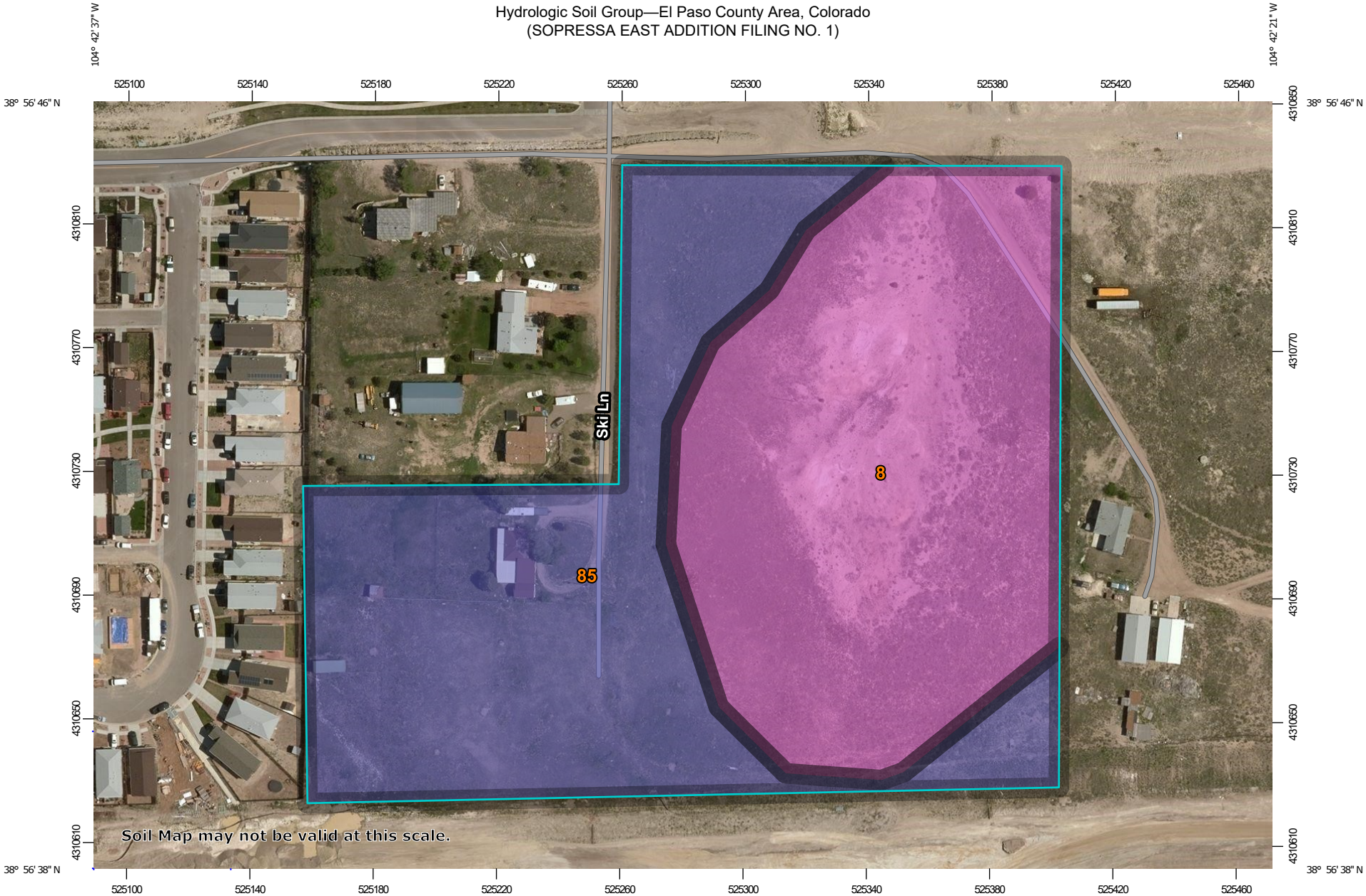
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/6/2019 at 12:11:42 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Hydrologic Soil Group—El Paso County Area, Colorado
(SOPRESSA EAST ADDITION FILING NO. 1)




Map Scale: 1:1,750 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Soil Rating Lines**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Soil Rating Points**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Water Features**

Streams and Canals

**Transportation**

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Hydrologic Soil Group

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| 8 | Blakeland loamy sand, 1 to 9 percent slopes | A | 5.1 | 52.0% |
| 85 | Stapleton-Bernal sandy loams, 3 to 20 percent slopes | B | 4.7 | 48.0% |
| **Totals for Area of Interest** | | | **9.8** | **100.0%** |

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Higher

# HYDROLOGIC AND HYDRAULIC CALCULATIONS

PROPOSED DRAINAGE DESIGN - RATIONAL ANALYSIS

| | | | | | | | | | | | CONVEYANCE TC | | | | | | TT | INTENSITY | | | | | | TOTAL FLOWS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BASIN** | **AREA TOTAL (Acres)** | **$C_2$** | **$C_5$** | **$C_{10}$** | **$C_{25}$** | **$C_{50}$** | **$C_{100}$** | **Length (ft)** | **Height (ft)** | **TI (min)** | **Length (ft)** | **Height (ft)** | **$C_V$** | **Slope (%)** | **Velocity (fps)** | **TC (min)** | **TOTAL (min)** | **$I_2$ (in/hr)** | **$I_5$ (in/hr)** | **$I_{10}$ (in/hr)** | **$I_{25}$ (in/hr)** | **$I_{50}$ (in/hr)** | **$I_{100}$ (in/hr)** | **$Q_2$ (c.f.s.)** | **$Q_5$ (c.f.s.)** | **$Q_{10}$ (c.f.s.)** | **$Q_{25}$ (c.f.s.)** | **$Q_{50}$ (c.f.s.)** | **$Q_{100}$ (c.f.s.)** |
| **A1** | 0.05 | **0.89** | **0.90** | **0.92** | **0.94** | **0.95** | **0.96** | 15 | 1 | 0.7 | 50 | 4 | 20 | 8.0% | 5.7 | 0.1 | 5.0 | 4.1 | 5.2 | 6.0 | 6.9 | 7.8 | 8.7 | **0.2** | **0.2** | **0.3** | **0.3** | **0.4** | **0.4** |
| *Residential 1/8 acre* | *0.00* | *0.41* | *0.45* | *0.49* | *0.54* | *0.57* | *0.59* | | | | | | | | | | *MIN* | | | | | | | | | | | | |
| *Pavement* | *0.05* | *0.89* | *0.90* | *0.92* | *0.94* | *0.95* | *0.96* | | | | | | | | | | | | | | | | | | | | | | |
| **A2** | 0.19 | **0.40** | **0.45** | **0.50** | **0.57** | **0.60** | **0.63** | 52 | 3 | 4.8 | 71 | 3 | 20 | 4.2% | 4.1 | 0.3 | 5.0 | 4.1 | 5.2 | 6.0 | 6.9 | 7.7 | 8.7 | **0.3** | **0.4** | **0.6** | **0.7** | **0.9** | **1.0** |
| *Landscape* | *0.11* | *0.05* | *0.12* | *0.20* | *0.30* | *0.34* | *0.39* | | | | | | | | | | *MIN* | | | | | | | | | | | | |
| *Pavement* | *0.08* | *0.89* | *0.90* | *0.92* | *0.94* | *0.95* | *0.96* | | | | | | | | | | | | | | | | | | | | | | |
| **A3** | 0.16 | **0.26** | **0.32** | **0.38** | **0.46** | **0.49** | **0.53** | 91 | 4 | 8.3 | 15 | 0.67 | 20 | 4.5% | 4.2 | 0.1 | 8.4 | 3.5 | 4.4 | 5.1 | 5.9 | 6.6 | 7.4 | **0.1** | **0.2** | **0.3** | **0.4** | **0.5** | **0.6** |
| *Landscape* | *0.12* | *0.05* | *0.12* | *0.20* | *0.30* | *0.34* | *0.39* | | | | | | | | | | | | | | | | | | | | | | |
| *Pavement* | *0.04* | *0.89* | *0.90* | *0.92* | *0.94* | *0.95* | *0.96* | | | | | | | | | | | | | | | | | | | | | | |
| | | *0.05* | *0.12* | *0.20* | *0.30* | *0.34* | *0.39* | | | | | | | | | | | | | | | | | | | | | | |
| **A4** | 0.12 | **0.57** | **0.60** | **0.63** | **0.67** | **0.70** | **0.71** | 45 | 1.5 | 4.1 | 57 | 2.3 | 20 | 4.0% | 4.0 | 0.2 | 5.0 | 4.1 | 5.2 | 6.0 | 6.9 | 7.8 | 8.7 | **0.3** | **0.4** | **0.5** | **0.6** | **0.6** | **0.7** |
| *Residential 1/8 acre* | *0.08* | *0.41* | *0.45* | *0.49* | *0.54* | *0.57* | *0.59* | | | | | | | | | | *MIN* | | | | | | | | | | | | |
| *Pavement* | *0.04* | *0.89* | *0.90* | *0.92* | *0.94* | *0.95* | *0.96* | | | | | | | | | | | | | | | | | | | | | | |
| **A5** | 1.34 | **0.47** | **0.51** | **0.54** | **0.59** | **0.62** | **0.64** | 100 | 2 | 8.5 | 435 | 11 | 20 | 2.5% | 3.2 | 2.3 | 10.8 | 3.2 | 4.0 | 4.7 | 5.4 | 6.0 | 6.7 | **2.0** | **2.7** | **3.4** | **4.2** | **5.0** | **5.8** |
| *Residential 1/8 acre* | *1.17* | *0.41* | *0.45* | *0.49* | *0.54* | *0.57* | *0.59* | | | | | | | | | | | | | | | | | | | | | | |
| *Pavement* | *0.17* | *0.89* | *0.90* | *0.92* | *0.94* | *0.95* | *0.96* | | | | | | | | | | | | | | | | | | | | | | |
| **A6** | 0.46 | **0.57** | **0.60** | **0.63** | **0.67** | **0.69** | **0.71** | 50 | 1 | 5.1 | 435 | 11 | 20 | 2.5% | 3.2 | 2.3 | 7.4 | 3.7 | 4.6 | 5.3 | 6.1 | 6.9 | 7.7 | **1.0** | **1.3** | **1.5** | **1.9** | **2.2** | **2.5** |
| *Residential 1/8 acre* | *0.31* | *0.41* | *0.45* | *0.49* | *0.54* | *0.57* | *0.59* | | | | | | | | | | | | | | | | | | | | | | |
| *Pavement* | *0.15* | *0.89* | *0.90* | *0.92* | *0.94* | *0.95* | *0.96* | | | | | | | | | | | | | | | | | | | | | | |
| **A7** | 1.33 | **0.52** | **0.55** | **0.59** | **0.63** | **0.66** | **0.67** | 100 | 5 | 5.8 | 229 | 2.8 | 20 | 1.2% | 2.2 | 1.7 | 7.5 | 3.6 | 4.6 | 5.3 | 6.1 | 6.8 | 7.6 | **2.5** | **3.3** | **4.1** | **5.1** | **6.0** | **6.8** |
| *Residential 1/8 acre* | *1.03* | *0.41* | *0.45* | *0.49* | *0.54* | *0.57* | *0.59* | | | | | | | | | | | | | | | | | | | | | | |
| *Pavement* | *0.30* | *0.89* | *0.90* | *0.92* | *0.94* | *0.95* | *0.96* | | | | | | | | | | | | | | | | | | | | | | |
| **A8** | 0.31 | **0.64** | **0.67** | **0.70** | **0.73** | **0.75** | **0.77** | 36 | 0.8 | 3.6 | 230 | 4.1 | 20 | 1.8% | 2.7 | 1.4 | 5.0 | 4.1 | 5.2 | 6.0 | 6.9 | 7.7 | 8.7 | **0.8** | **1.1** | **1.3** | **1.6** | **1.8** | **2.1** |
| *Residential 1/8 acre* | *0.16* | *0.41* | *0.45* | *0.49* | *0.54* | *0.57* | *0.59* | | | | | | | | | | *MIN* | | | | | | | | | | | | |
| *Pavement* | *0.15* | *0.89* | *0.90* | *0.92* | *0.94* | *0.95* | *0.96* | | | | | | | | | | | | | | | | | | | | | | |
| **A9** | 0.26 | **0.41** | **0.45** | **0.49** | **0.54** | **0.57** | **0.59** | 55 | 2 | 5.7 | 223 | 5 | 10 | 2.2% | 1.5 | 2.5 | 8.2 | 3.5 | 4.4 | 5.2 | 5.9 | 6.6 | 7.4 | **0.4** | **0.5** | **0.7** | **0.8** | **1.0** | **1.1** |
| *Residential 1/8 acre* | *0.26* | *0.41* | *0.45* | *0.49* | *0.54* | *0.57* | *0.59* | | | | | | | | | | | | | | | | | | | | | | |
| *Pavement* | *0.00* | *0.89* | *0.90* | *0.92* | *0.94* | *0.95* | *0.96* | | | | | | | | | | | | | | | | | | | | | | |

Calculated by: DLM

Date: 10/5/2019

PROPOSED DRAINAGE DESIGN - RATIONAL ANALYSIS

| | | | | | | | | | | | CONVEYANCE TC | | | | | | TT | INTENSITY | | | | | | TOTAL FLOWS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BASIN** | **AREA TOTAL (Acres)** | **$C_2$** | **$C_5$** | **$C_{10}$** | **$C_{25}$** | **$C_{50}$** | **$C_{100}$** | **Length (ft)** | **Height (ft)** | **TI (min)** | **Length (ft)** | **Height (ft)** | **$C_V$** | **Slope (%)** | **Velocity (fps)** | **TC (min)** | **TOTAL (min)** | **$I_2$ (in/hr)** | **$I_5$ (in/hr)** | **$I_{10}$ (in/hr)** | **$I_{25}$ (in/hr)** | **$I_{50}$ (in/hr)** | **$I_{100}$ (in/hr)** | **$Q_2$ (c.f.s.)** | **$Q_5$ (c.f.s.)** | **$Q_{10}$ (c.f.s.)** | **$Q_{25}$ (c.f.s.)** | **$Q_{50}$ (c.f.s.)** | **$Q_{100}$ (c.f.s.)** |
| **A10** | 0.74 | **0.78** | **0.80** | **0.83** | **0.86** | **0.87** | **0.89** | 45 | 1 | 2.8 | 302 | 4.5 | 20 | 1.5% | 2.4 | 2.1 | 5.0 | 4.1 | 5.2 | 6.0 | 6.9 | 7.8 | 8.7 | **2.4** | **3.1** | **3.7** | **4.4** | **5.0** | **5.7** |
| *Residential 1/8 acre* | *0.04* | *0.41* | *0.45* | *0.49* | *0.54* | *0.57* | *0.59* | | | | | | | | | | *MIN* | | | | | | | | | | | | |
| *Pavement* | *0.63* | *0.89* | *0.90* | *0.92* | *0.94* | *0.95* | *0.96* | | | | | | | | | | | | | | | | | | | | | | |
| *Landscape* | *0.07* | *0.05* | *0.12* | *0.20* | *0.30* | *0.34* | *0.39* | | | | | | | | | | | | | | | | | | | | | | |
| **A11** | 0.39 | **0.09** | **0.15** | **0.23** | **0.32** | **0.36** | **0.41** | 64 | 8 | 5.9 | 73 | 0.5 | 7 | 0.7% | 0.6 | 2.1 | 8.0 | 3.6 | 4.5 | 5.2 | 5.9 | 6.7 | 7.5 | **0.1** | **0.3** | **0.5** | **0.8** | **0.9** | **1.2** |
| *Residential 1/8 acre* | *0.04* | *0.41* | *0.45* | *0.49* | *0.54* | *0.57* | *0.59* | | | | | | | | | | | | | | | | | | | | | | |
| *Landscape* | *0.35* | *0.05* | *0.12* | *0.20* | *0.30* | *0.34* | *0.39* | | | | | | | | | | | | | | | | | | | | | | |
| **B1** | 1.56 | **0.54** | **0.57** | **0.61** | **0.65** | **0.67** | **0.69** | 100 | 2 | 7.6 | 746 | 12.5 | 20 | 1.7% | 2.6 | 4.8 | 12.4 | 3.0 | 3.8 | 4.4 | 5.1 | 5.7 | 6.4 | **2.6** | **3.4** | **4.2** | **5.1** | **6.0** | **6.9** |
| *Residential 1/8 acre* | *1.14* | *0.41* | *0.45* | *0.49* | *0.54* | *0.57* | *0.59* | | | | | | | | | | | | | | | | | | | | | | |
| *Pavement* | *0.42* | *0.89* | *0.90* | *0.92* | *0.94* | *0.95* | *0.96* | | | | | | | | | | | | | | | | | | | | | | |
| **B2** | 1.26 | **0.50** | **0.53** | **0.57** | **0.61** | **0.64** | **0.66** | 76 | 1.5 | 7.1 | 324 | 6 | 20 | 1.9% | 2.7 | 2.0 | 9.1 | 3.4 | 4.3 | 5.0 | 5.7 | 6.4 | 7.2 | **2.1** | **2.9** | **3.6** | **4.4** | **5.2** | **5.9** |
| *Residential 1/8 acre* | *1.03* | *0.41* | *0.45* | *0.49* | *0.54* | *0.57* | *0.59* | | | | | | | | | | | | | | | | | | | | | | |
| *Pavement* | *0.23* | *0.89* | *0.90* | *0.92* | *0.94* | *0.95* | *0.96* | | | | | | | | | | | | | | | | | | | | | | |
| **B3** | 0.39 | **0.18** | **0.24** | **0.30** | **0.39** | **0.42** | **0.46** | 43 | 1.2 | 7.3 | 258 | 12.5 | 7 | 4.8% | 1.5 | 2.8 | 10.1 | 3.3 | 4.1 | 4.8 | 5.5 | 6.2 | 6.9 | **0.2** | **0.4** | **0.6** | **0.8** | **1.0** | **1.2** |
| *Residential 1/8 acre* | *0.14* | *0.41* | *0.45* | *0.49* | *0.54* | *0.57* | *0.59* | | | | | | | | | | | | | | | | | | | | | | |
| *Landscape* | *0.25* | *0.05* | *0.12* | *0.20* | *0.30* | *0.34* | *0.39* | | | | | | | | | | | | | | | | | | | | | | |
| **C1** | 0.19 | **0.05** | **0.12** | **0.20** | **0.30** | **0.34** | **0.39** | 30 | 5 | 3.8 | 71 | 1 | 7 | 1.4% | 0.8 | 1.4 | 5.3 | 4.1 | 5.1 | 5.9 | 6.8 | 7.6 | 8.6 | **0.0** | **0.1** | **0.2** | **0.4** | **0.5** | **0.6** |
| *Landscape* | *0.19* | *0.05* | *0.12* | *0.20* | *0.30* | *0.34* | *0.39* | | | | | | | | | | | | | | | | | | | | | | |

Calculated by: DLM

Date: 10/5/2019

| | | WEIGHTED | | | | | | TT | INTENSITY | | | | | | TOTAL FLOWS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DESIGN POINT** | **AREA TOTAL (Acres)** | **$C_2$** | **$C_5$** | **$C_{10}$** | **$C_{25}$** | **$C_{50}$** | **$C_{100}$** | **TOTAL (min)** | **$I_2$ (in/hr)** | **$I_5$ (in/hr)** | **$I_{10}$ (in/hr)** | **$I_{25}$ (in/hr)** | **$I_{50}$ (in/hr)** | **$I_{100}$ (in/hr)** | **$Q_2$ (c.f.s.)** | **$Q_5$ (c.f.s.)** | **$Q_{10}$ (c.f.s.)** | **$Q_{25}$ (c.f.s.)** | **$Q_{50}$ (c.f.s.)** | **$Q_{100}$ (c.f.s.)** |
| **1** | **0.24** | **0.51** | **0.54** | **0.59** | **0.65** | **0.67** | **0.70** | **5.0** | 4.1 | 5.2 | 6.0 | 6.9 | 7.8 | 8.7 | **0.5** | **0.7** | **0.9** | **1.1** | **1.2** | **1.5** |
| BASIN A1 | 0.05 | 0.89 | 0.90 | 0.92 | 0.94 | 0.95 | 0.96 | 5.0 | | | | | | | | | | | | |
| BASIN A2 | 0.19 | 0.40 | 0.45 | 0.50 | 0.57 | 0.60 | 0.63 | 5.0 | | | | | | | | | | | | |
| **2** | **0.40** | **0.41** | **0.45** | **0.51** | **0.57** | **0.60** | **0.63** | **8.4** | 3.5 | 4.4 | 5.1 | 5.9 | 6.6 | 7.4 | **0.6** | **0.8** | **1.0** | **1.3** | **1.6** | **1.9** |
| BASIN A3 | 0.16 | 0.26 | 0.32 | 0.38 | 0.46 | 0.49 | 0.53 | 8.4 | | | | | | | | | | | | |
| DP-1 | 0.24 | 0.51 | 0.54 | 0.59 | 0.65 | 0.67 | 0.70 | 5.0 | | | | | | | | | | | | |
| **3** | **0.52** | **0.44** | **0.49** | **0.54** | **0.60** | **0.62** | **0.65** | **8.4** | 3.5 | 4.4 | 5.1 | 5.9 | 6.6 | 7.4 | **0.8** | **1.1** | **1.4** | **1.8** | **2.1** | **2.5** |
| BASIN A4 | 0.12 | 0.57 | 0.60 | 0.63 | 0.67 | 0.70 | 0.71 | 5.0 | | | | | | | | | | | | |
| DP-2 | 0.40 | 0.41 | 0.45 | 0.51 | 0.57 | 0.60 | 0.63 | 8.4 | | | | | | | | | | | | |
| **4** | **1.80** | **0.50** | **0.53** | **0.57** | **0.61** | **0.64** | **0.66** | **10.8** | 3.2 | 4.0 | 4.7 | 5.4 | 6.0 | 6.7 | **2.9** | **3.8** | **4.8** | **5.9** | **6.9** | **8.0** |
| BASIN A5 | 1.34 | 0.47 | 0.51 | 0.54 | 0.59 | 0.62 | 0.64 | 10.8 | | | | | | | | | | | | |
| BASIN A6 | 0.46 | 0.57 | 0.60 | 0.63 | 0.67 | 0.69 | 0.71 | 7.4 | | | | | | | | | | | | |
| **5** | **3.13** | **0.51** | **0.54** | **0.58** | **0.62** | **0.65** | **0.66** | **10.8** | 3.2 | 4.0 | 4.7 | 5.4 | 6.0 | 6.7 | **5.1** | **6.8** | **8.4** | **10.4** | **12.2** | **14.0** |
| BASIN A7 | 1.33 | 0.52 | 0.55 | 0.59 | 0.63 | 0.66 | 0.67 | 7.5 | | | | | | | | | | | | |
| DP-4 | 1.80 | 0.50 | 0.53 | 0.57 | 0.61 | 0.64 | 0.66 | 10.8 | | | | | | | | | | | | |
| **6** | **3.70** | **0.51** | **0.54** | **0.58** | **0.62** | **0.65** | **0.67** | **10.8** | 3.2 | 4.0 | 4.7 | 5.4 | 6.0 | 6.7 | **6.0** | **8.1** | **10.0** | **12.3** | **14.5** | **16.6** |
| BASIN A8 | 0.31 | 0.64 | 0.67 | 0.70 | 0.73 | 0.75 | 0.77 | 5.0 | | | | | | | | | | | | |
| BASIN A9 | 0.26 | 0.41 | 0.45 | 0.49 | 0.54 | 0.57 | 0.59 | 8.2 | | | | | | | | | | | | |
| DP-5 | 3.13 | 0.51 | 0.54 | 0.58 | 0.62 | 0.65 | 0.66 | 10.8 | | | | | | | | | | | | |
| **7** | **4.44** | **0.56** | **0.59** | **0.62** | **0.66** | **0.69** | **0.70** | **10.8** | 3.2 | 4.0 | 4.7 | 5.4 | 6.0 | 6.7 | **7.9** | **10.5** | **12.9** | **15.7** | **18.3** | **21.1** |
| BASIN A10 | 0.74 | 0.78 | 0.80 | 0.83 | 0.86 | 0.87 | 0.89 | 5.0 | | | | | | | | | | | | |
| DP-6 | 3.70 | 0.51 | 0.54 | 0.58 | 0.62 | 0.65 | 0.67 | 10.8 | | | | | | | | | | | | |
| **A1** | **4.83** | **0.52** | **0.55** | **0.59** | **0.64** | **0.66** | **0.68** | **10.8** | 3.2 | 4.0 | 4.7 | 5.4 | 6.0 | 6.7 | **8.0** | **10.7** | **13.3** | **16.4** | **19.2** | **22.1** |
| BASIN A11 | 0.39 | 0.09 | 0.15 | 0.23 | 0.32 | 0.36 | 0.41 | 8.0 | | | | | | | | | | | | |
| DP-7 | 4.44 | 0.56 | 0.59 | 0.62 | 0.66 | 0.69 | 0.70 | 10.8 | | | | | | | | | | | | |
| **8** | **2.82** | **0.50** | **0.53** | **0.57** | **0.61** | **0.64** | **0.66** | **12.4** | 3.0 | 3.8 | 4.4 | 5.1 | 5.7 | 6.4 | **4.3** | **5.7** | **7.1** | **8.8** | **10.3** | **11.9** |
| BASIN B1 | 1.56 | 0.54 | 0.57 | 0.61 | 0.65 | 0.67 | 0.69 | 12.4 | | | | | | | | | | | | |
| BASIN B2 | 1.26 | 0.50 | 0.53 | 0.57 | 0.61 | 0.64 | 0.66 | 9.1 | | | | | | | | | | | | |
| **B1** | **3.21** | **0.46** | **0.50** | **0.54** | **0.59** | **0.61** | **0.63** | **12.4** | 3.0 | 3.8 | 4.4 | 5.1 | 5.7 | 6.4 | **4.5** | **6.1** | **7.6** | **9.5** | **11.2** | **13.0** |
| BASIN B3 | 0.39 | 0.18 | 0.24 | 0.30 | 0.39 | 0.42 | 0.46 | 10.1 | | | | | | | | | | | | |
| DP-8 | 2.82 | 0.50 | 0.53 | 0.57 | 0.61 | 0.64 | 0.66 | 12.4 | | | | | | | | | | | | |
| **9** | **4.83** | | | | | | | | **POND ROUTED** | | | | | | **0.1** | **0.1** | **1.1** | **3.6** | **5.2** | **5.4** |
| POND A OUTLET | | | | | | | | | SEE UD DENTENTION | | | | | | | | | | | |
| **10** | **3.21** | | | | | | | | **POND ROUTED** | | | | | | **0.1** | **0.1** | **1.3** | **3.4** | **3.4** | **3.5** |
| POND B OUTLET | | | | | | | | | SEE UD DENTENTION | | | | | | | | | | | |
| **B2** | **3.40** | | | | | | | | **POND ROUTED** | | | | | | **0.1** | **0.2** | **1.5** | **3.8** | **3.9** | **4.1** |
| BASIN C1 | 0.19 | | | | | | | | SEE UD DENTENTION | | | | | | | | | | | |
| DP-10 | 3.21 | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |

Calculated by: DLM

Date: 10/5/2019

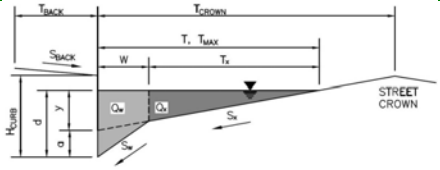
Version 4.05 Released March 2017

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

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

**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**

**Inlet ID:** **BASIN A1**




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

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | 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) | $n_{BACK}$ = | 0.012 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 8.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 12.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | 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 | $S_O$ = | 0.040 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.012 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 12.0 | 12.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 5.0 | 8.0 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☐ | check = yes |

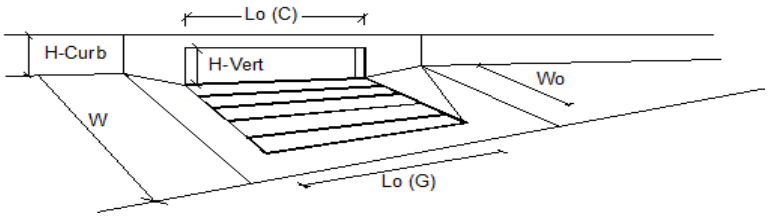
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Spread Criterion** | **$Q_{allow}$ =** | **12.6** | **12.6** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

**Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 1.0 | 1.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$-G = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$-C = | 0.10 | 0.10 | |
| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity** | **Q =** | **0.2** | **0.4** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.0** | **0.0** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **100** | **100** | **%** |

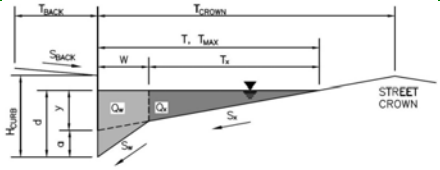
Version 4.05 Released March 2017

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

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

**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**

**Inlet ID:** **BASIN A2**




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

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | 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 | $H_{CURB}$ = | 8.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 12.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | 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 | $S_O$ = | 0.040 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.012 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 12.0 | 12.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☑ | check = yes |

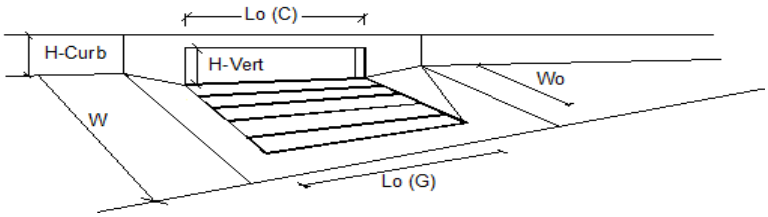
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | **$Q_{allow}$ =** | **12.6** | **36.0** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

**Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 1.0 | 1.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 10.00 | 10.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$-G = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$-C = | 0.10 | 0.10 | |
| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity** | **Q =** | **0.4** | **1.0** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.0** | **0.0** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **100** | **100** | **%** |

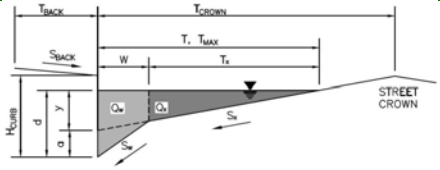
Version 4.05 Released March 2017

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

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

**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**

**Inlet ID:** **BASIN A3**




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

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | 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 | $H_{CURB}$ = | 8.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 12.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | 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 | $S_O$ = | 0.030 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.020 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 12.0 | 12.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☑ | check = yes |

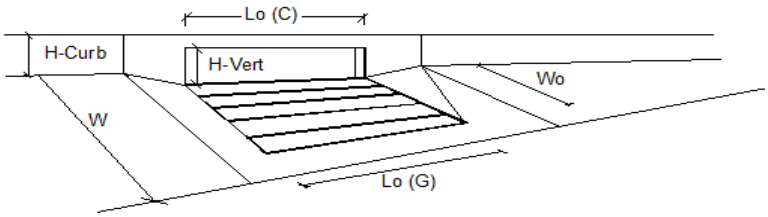
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | **$Q_{allow}$ =** | **6.5** | **23.6** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

**Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 1.0 | 1.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$-G = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$-C = | 0.10 | 0.10 | |
| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity** | **Q =** | **0.2** | **0.6** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.0** | **0.0** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **100** | **100** | **%** |

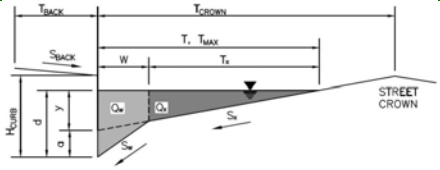
Version 4.05 Released March 2017

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

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

**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**

**Inlet ID:** **BASIN A4**




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

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | 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 | $H_{CURB}$ = | 8.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 12.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | 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 | $S_O$ = | 0.030 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.020 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 12.0 | 12.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☑ | check = yes |

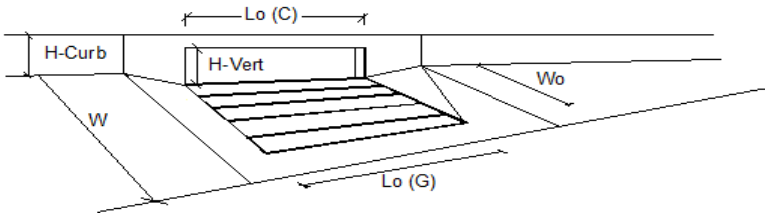
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | **$Q_{allow}$ =** | **6.5** | **23.6** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

**Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 1.0 | 1.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$-G = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$-C = | 0.10 | 0.10 | |
| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity** | **Q =** | **0.4** | **0.8** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.0** | **0.0** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **100** | **100** | **%** |

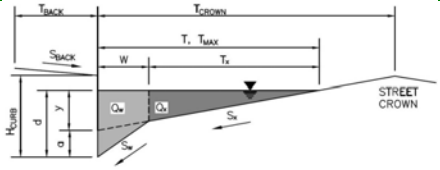
Version 4.05 Released March 2017

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

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

**Project:** **Riverbend Crossing**

**Inlet ID:** **BASIN A5**




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

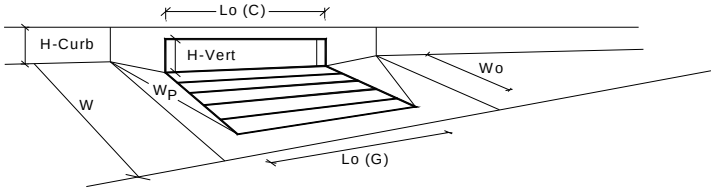
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 8.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 12.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | 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) | $n_{STREET}$ = | 0.012 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 12.0 | 12.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 8.0 | 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)** | CDOT Type R Curb Opening | | MINOR | MAJOR | |
|---|---|---|---|---|---|
| Type of Inlet | | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | | $a_{local}$ = | 1.00 | 1.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | | Ponding Depth = | 5.0 | 8.0 | inches |
| **Grate Information** | | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | | $L_o$ (C) = | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | | Theta = | 63.40 | 63.40 | 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) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | | $C_o$ (C) = | 0.67 | 0.67 | |
| **Low Head Performance Reduction (Calculated)** | | | MINOR | MAJOR | |
| Depth for Grate Midwidth | | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | | $d_{Curb}$ = | 0.25 | 0.50 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | | $RF_{Combination}$ = | 0.64 | 1.00 | |
| Curb Opening Performance Reduction Factor for Long Inlets | | $RF_{Curb}$ = | 1.00 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | | $RF_{Grate}$ = | N/A | N/A | |
| | | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | | **$Q_a$ =** | **3.5** | **8.7** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | | $Q_{PEAK\ REQUIRED}$ = | 2.7 | 5.8 | cfs |

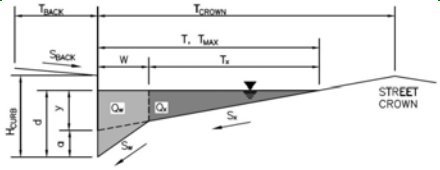
Version 4.05 Released March 2017

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

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

**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**

**Inlet ID:** **BASIN A6**




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

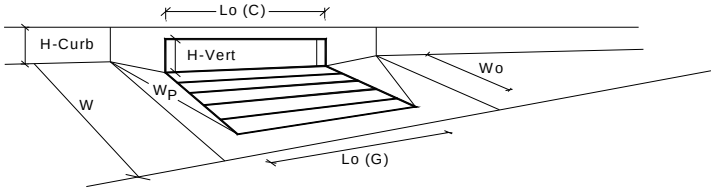
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 8.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 12.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | 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) | $n_{STREET}$ = | 0.012 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 12.0 | 12.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 5.0 | 8.0 | 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)** | CDOT Type R Curb Opening | | MINOR | MAJOR | |
|---|---|---|---|---|---|
| Type of Inlet | | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | | $a_{local}$ = | 1.00 | 1.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | | Ponding Depth = | 5.0 | 8.0 | inches |
| **Grate Information** | | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | | $L_o$ (C) = | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | | Theta = | 63.40 | 63.40 | 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) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | | $C_o$ (C) = | 0.67 | 0.67 | |
| **Low Head Performance Reduction (Calculated)** | | | MINOR | MAJOR | |
| Depth for Grate Midwidth | | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | | $d_{Curb}$ = | 0.25 | 0.50 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | | $RF_{Combination}$ = | 0.64 | 1.00 | |
| Curb Opening Performance Reduction Factor for Long Inlets | | $RF_{Curb}$ = | 1.00 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | | $RF_{Grate}$ = | N/A | N/A | |
| | | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | | **$Q_a$ =** | **3.5** | **8.7** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | | $Q_{PEAK\ REQUIRED}$ = | 1.3 | 2.5 | cfs |

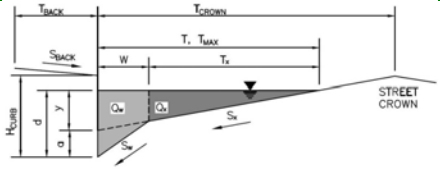
Version 4.05 Released March 2017

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

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

**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**

**Inlet ID:** **BASIN A7**




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

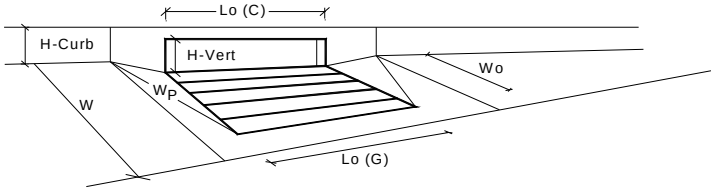
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.012 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 8.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 12.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | 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) | $n_{STREET}$ = | 0.012 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 12.0 | 12.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 5.0 | 5.0 | 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)** | CDOT Type R Curb Opening | | MINOR | MAJOR | |
|---|---|---|---|---|---|
| Type of Inlet | | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | | $a_{local}$ = | 1.00 | 1.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | | Ponding Depth = | 5.0 | 8.0 | inches |
| **Grate Information** | | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | | $L_o$ (C) = | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | | Theta = | 63.40 | 63.40 | 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) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | | $C_o$ (C) = | 0.67 | 0.67 | |
| **Low Head Performance Reduction (Calculated)** | | | MINOR | MAJOR | |
| Depth for Grate Midwidth | | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | | $d_{Curb}$ = | 0.25 | 0.50 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | | $RF_{Combination}$ = | 0.64 | 1.00 | |
| Curb Opening Performance Reduction Factor for Long Inlets | | $RF_{Curb}$ = | 1.00 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | | $RF_{Grate}$ = | N/A | N/A | |
| | | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | | **$Q_a$ =** | **3.5** | **8.7** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | | $Q_{PEAK\ REQUIRED}$ = | 3.3 | 6.8 | cfs |

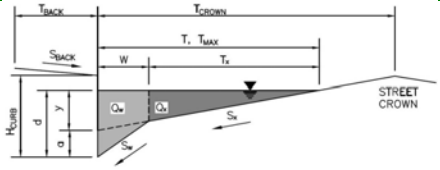
Version 4.05 Released March 2017

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

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

**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**

**Inlet ID:** **BASIN A8**




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

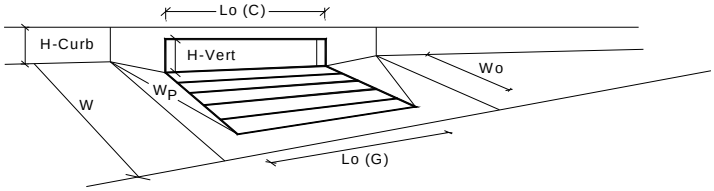
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.012 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 8.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 12.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | 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) | $n_{STREET}$ = | 0.012 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 12.0 | 12.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 5.0 | 8.0 | 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)** | CDOT Type R Curb Opening | | MINOR | MAJOR | |
|---|---|---|---|---|---|
| Type of Inlet | | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | | $a_{local}$ = | 1.00 | 1.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | | Ponding Depth = | 5.0 | 8.0 | inches |
| **Grate Information** | | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | | $L_o$ (C) = | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | | Theta = | 63.40 | 63.40 | 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) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | | $C_o$ (C) = | 0.67 | 0.67 | |
| **Low Head Performance Reduction (Calculated)** | | | MINOR | MAJOR | |
| Depth for Grate Midwidth | | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | | $d_{Curb}$ = | 0.25 | 0.50 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | | $RF_{Combination}$ = | 0.64 | 1.00 | |
| Curb Opening Performance Reduction Factor for Long Inlets | | $RF_{Curb}$ = | 1.00 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | | $RF_{Grate}$ = | N/A | N/A | |
| | | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | | **$Q_a$ =** | **3.5** | **8.7** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | | $Q_{PEAK\ REQUIRED}$ = | 1.1 | 2.1 | cfs |

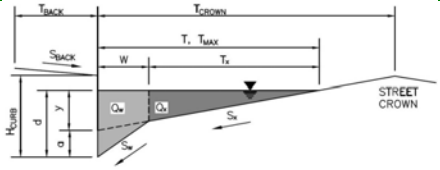
Version 4.05 Released March 2017

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

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

**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**

**Inlet ID:** **BASIN A10**




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

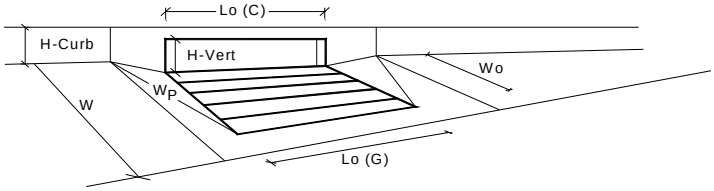
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.012 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 8.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 12.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | 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) | $n_{STREET}$ = | 0.012 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 12.0 | 12.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 5.0 | 8.0 | 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)** | CDOT Type R Curb Opening | | MINOR | MAJOR | |
|---|---|---|---|---|---|
| Type of Inlet | | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | | $a_{local}$ = | 1.00 | 1.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | | Ponding Depth = | 5.0 | 8.0 | inches |
| **Grate Information** | | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | | $L_o$ (C) = | 10.00 | 10.00 | feet |
| Height of Vertical Curb Opening in Inches | | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | | Theta = | 63.40 | 63.40 | 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) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | | $C_o$ (C) = | 0.67 | 0.67 | |
| **Low Head Performance Reduction (Calculated)** | | | MINOR | MAJOR | |
| Depth for Grate Midwidth | | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | | $d_{Curb}$ = | 0.25 | 0.50 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | | $RF_{Combination}$ = | 0.47 | 0.75 | |
| Curb Opening Performance Reduction Factor for Long Inlets | | $RF_{Curb}$ = | 0.87 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | | $RF_{Grate}$ = | N/A | N/A | |
| | | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | | **$Q_a$ =** | **5.0** | **16.0** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | | $Q_{PEAK\ REQUIRED}$ = | 3.1 | 5.7 | cfs |

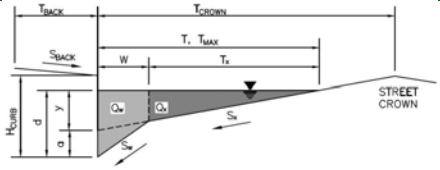
Version 4.05 Released March 2017

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

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

**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**

**Inlet ID:** **DP 8**




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

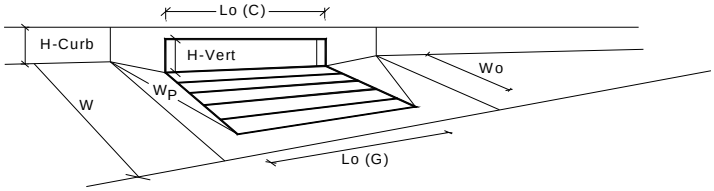
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 5.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.012 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 8.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 30.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | 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) | $n_{STREET}$ = | 0.012 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 30.0 | 30.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 5.5 | 8.0 | 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

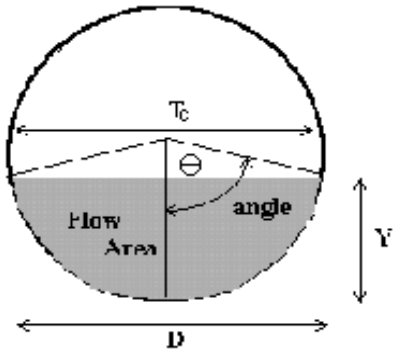
**Version 4.05 Released March 2017**




| **Design Information (Input)** | CDOT Type R Curb Opening | | MINOR | MAJOR | |
|---|---|---|---|---|---|
| Type of Inlet | | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | | $a_{local}$ = | 1.00 | 1.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | | Ponding Depth = | 5.5 | 8.0 | inches |
| **Grate Information** | | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | | $L_o$ (C) = | 10.00 | 10.00 | feet |
| Height of Vertical Curb Opening in Inches | | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | | Theta = | 63.40 | 63.40 | 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) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | | $C_o$ (C) = | 0.67 | 0.67 | |
| **Low Head Performance Reduction (Calculated)** | | | MINOR | MAJOR | |
| Depth for Grate Midwidth | | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | | $d_{Curb}$ = | 0.29 | 0.50 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | | $RF_{Combination}$ = | 0.52 | 0.75 | |
| Curb Opening Performance Reduction Factor for Long Inlets | | $RF_{Curb}$ = | 0.90 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | | $RF_{Grate}$ = | N/A | N/A | |
| | | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | | **$Q_a$ =** | **6.6** | **16.0** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | | $Q_{PEAK\ REQUIRED}$ = | 5.7 | 11.9 | cfs |

# CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

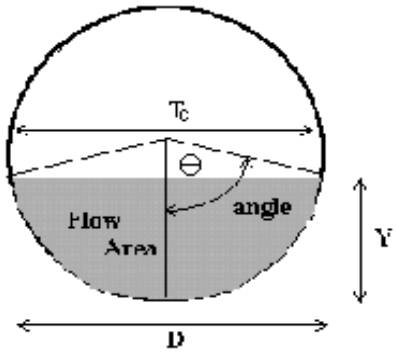
**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**
**Pipe ID:** **Pipe Design Point 1**




| | | | |
|---|---|---|---|
| **Design Information (Input)** | | | |
| Pipe Invert Slope | So = | 0.0050 | ft/ft |
| Pipe Manning's n-value | n = | 0.0130 | |
| Pipe Diameter | D = | 12.00 | inches |
| **Design discharge** | **Q =** | **1.50** | **cfs** |
| **Full-flow Capacity (Calculated)** | | | |
| Full-flow area | Af = | 0.79 | sq ft |
| Full-flow wetted perimeter | Pf = | 3.14 | ft |
| Half Central Angle | Theta = | 3.14 | radians |
| Full-flow capacity | Qf = | 2.53 | cfs |
| **Calculation of Normal Flow Condition** | | | |
| Half Central Angle (0<Theta<3.14) | Theta = | 1.68 | radians |
| Flow area | An = | 0.45 | sq ft |
| Top width | Tn = | 0.99 | ft |
| Wetted perimeter | Pn = | 1.68 | ft |
| Flow depth | Yn = | 0.55 | ft |
| Flow velocity | Vn = | 3.35 | fps |
| Discharge | Qn = | 1.50 | cfs |
| Percent Full Flow | Flow = | 59.3% | of full flow |
| Normal Depth Froude Number | $Fr_n$ = | 0.88 | subcritical |
| **Calculation of Critical Flow Condition** | | | |
| Half Central Angle (0<Theta-c<3.14) | Theta-c = | 1.61 | radians |
| Critical flow area | Ac = | 0.41 | sq ft |
| Critical top width | Tc = | 1.00 | ft |
| Critical flow depth | Yc = | 0.52 | ft |
| Critical flow velocity | Vc = | 3.64 | fps |
| Critical Depth Froude Number | $Fr_c$ = | 1.00 | |

# CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

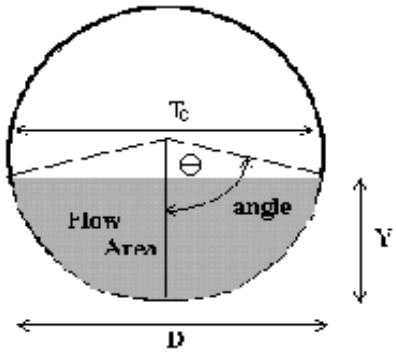
**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**
**Pipe ID:** **Pipe Design Point 2**




| | | | |
|---|---|---|---|
| **Design Information (Input)** | | | |
| Pipe Invert Slope | So = | 0.0050 | ft/ft |
| Pipe Manning's n-value | n = | 0.0130 | |
| Pipe Diameter | D = | 12.00 | inches |
| **Design discharge** | **Q =** | **1.90** | **cfs** |
| **Full-flow Capacity (Calculated)** | | | |
| Full-flow area | Af = | 0.79 | sq ft |
| Full-flow wetted perimeter | Pf = | 3.14 | ft |
| Half Central Angle | Theta = | 3.14 | radians |
| Full-flow capacity | Qf = | 2.53 | cfs |
| **Calculation of Normal Flow Condition** | | | |
| Half Central Angle (0<Theta<3.14) | Theta = | 1.87 | radians |
| Flow area | An = | 0.54 | sq ft |
| Top width | Tn = | 0.96 | ft |
| Wetted perimeter | Pn = | 1.87 | ft |
| Flow depth | Yn = | 0.65 | ft |
| Flow velocity | Vn = | 3.53 | fps |
| Discharge | Qn = | 1.90 | cfs |
| Percent Full Flow | Flow = | 75.1% | of full flow |
| Normal Depth Froude Number | $Fr_n$ = | 0.83 | subcritical |
| **Calculation of Critical Flow Condition** | | | |
| Half Central Angle (0<Theta-c<3.14) | Theta-c = | 1.75 | radians |
| Critical flow area | Ac = | 0.48 | sq ft |
| Critical top width | Tc = | 0.98 | ft |
| Critical flow depth | Yc = | 0.59 | ft |
| Critical flow velocity | Vc = | 3.96 | fps |
| Critical Depth Froude Number | $Fr_c$ = | 1.00 | |

# CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

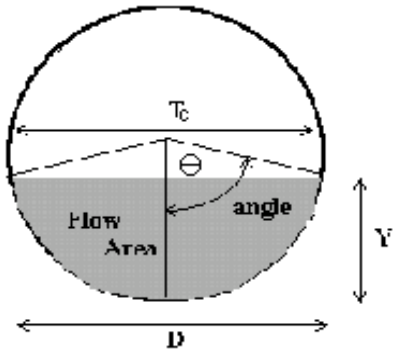
**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**
**Pipe ID:** **Pipe Design Point 3**




| | | | |
|---|---|---|---|
| **Design Information (Input)** | | | |
| Pipe Invert Slope | So = | 0.0050 | ft/ft |
| Pipe Manning's n-value | n = | 0.0130 | |
| Pipe Diameter | D = | 15.00 | inches |
| **Design discharge** | **Q =** | **2.50** | **cfs** |
| **Full-flow Capacity (Calculated)** | | | |
| Full-flow area | Af = | 1.23 | sq ft |
| Full-flow wetted perimeter | Pf = | 3.93 | ft |
| Half Central Angle | Theta = | 3.14 | radians |
| Full-flow capacity | Qf = | 4.58 | cfs |
| **Calculation of Normal Flow Condition** | | | |
| Half Central Angle (0<Theta<3.14) | Theta = | 1.62 | radians |
| Flow area | An = | 0.66 | sq ft |
| Top width | Tn = | 1.25 | ft |
| Wetted perimeter | Pn = | 2.03 | ft |
| Flow depth | Yn = | 0.66 | ft |
| Flow velocity | Vn = | 3.81 | fps |
| Discharge | Qn = | 2.50 | cfs |
| Percent Full Flow | Flow = | 54.6% | of full flow |
| Normal Depth Froude Number | $Fr_n$ = | 0.93 | subcritical |
| **Calculation of Critical Flow Condition** | | | |
| Half Central Angle (0<Theta-c<3.14) | Theta-c = | 1.58 | radians |
| Critical flow area | Ac = | 0.62 | sq ft |
| Critical top width | Tc = | 1.25 | ft |
| Critical flow depth | Yc = | 0.63 | ft |
| Critical flow velocity | Vc = | 4.01 | fps |
| Critical Depth Froude Number | $Fr_c$ = | 1.00 | |

# CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

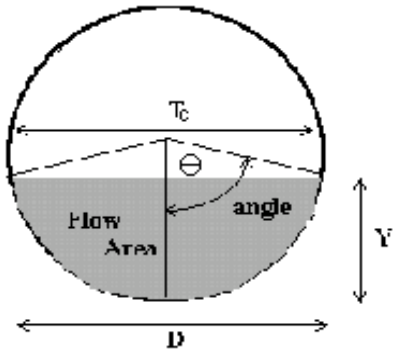
**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**
**Pipe ID:** **Pipe Design Point 4**




| | | | |
|---|---|---|---|
| **Design Information (Input)** | | | |
| Pipe Invert Slope | So = | 0.0200 | ft/ft |
| Pipe Manning's n-value | n = | 0.0130 | |
| Pipe Diameter | D = | 15.00 | inches |
| **Design discharge** | **Q =** | **8.00** | **cfs** |
| **Full-flow Capacity (Calculated)** | | | |
| Full-flow area | Af = | 1.23 | sq ft |
| Full-flow wetted perimeter | Pf = | 3.93 | ft |
| Half Central Angle | Theta = | 3.14 | radians |
| Full-flow capacity | Qf = | 9.16 | cfs |
| **Calculation of Normal Flow Condition** | | | |
| Half Central Angle (0<Theta<3.14) | Theta = | 2.03 | radians |
| Flow area | An = | 0.95 | sq ft |
| Top width | Tn = | 1.12 | ft |
| Wetted perimeter | Pn = | 2.54 | ft |
| Flow depth | Yn = | 0.90 | ft |
| Flow velocity | Vn = | 8.41 | fps |
| Discharge | Qn = | 8.00 | cfs |
| Percent Full Flow | Flow = | 87.3% | of full flow |
| Normal Depth Froude Number | $Fr_n$ = | 1.61 | supercritical |
| **Calculation of Critical Flow Condition** | | | |
| Half Central Angle (0<Theta-c<3.14) | Theta-c = | 2.47 | radians |
| Critical flow area | Ac = | 1.16 | sq ft |
| Critical top width | Tc = | 0.78 | ft |
| Critical flow depth | Yc = | 1.11 | ft |
| Critical flow velocity | Vc = | 6.92 | fps |
| Critical Depth Froude Number | $Fr_c$ = | 1.00 | |

# CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

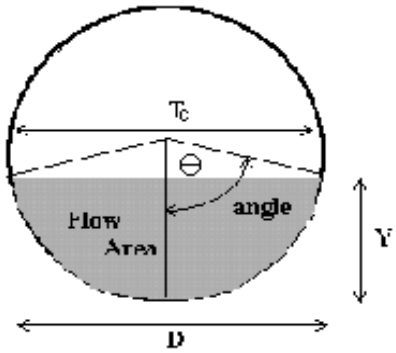
**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**
**Pipe ID:** **Pipe Design Point 5**




| | | | |
|---|---|---|---|
| **Design Information (Input)** | | | |
| Pipe Invert Slope | So = | 0.0200 | ft/ft |
| Pipe Manning's n-value | n = | 0.0130 | |
| Pipe Diameter | D = | 18.00 | inches |
| **Design discharge** | **Q =** | **14.00** | **cfs** |
| **Full-flow Capacity (Calculated)** | | | |
| Full-flow area | Af = | 1.77 | sq ft |
| Full-flow wetted perimeter | Pf = | 4.71 | ft |
| Half Central Angle | Theta = | 3.14 | radians |
| Full-flow capacity | Qf = | 14.90 | cfs |
| **Calculation of Normal Flow Condition** | | | |
| Half Central Angle (0<Theta<3.14) | Theta = | 2.14 | radians |
| Flow area | An = | 1.46 | sq ft |
| Top width | Tn = | 1.26 | ft |
| Wetted perimeter | Pn = | 3.21 | ft |
| Flow depth | Yn = | 1.16 | ft |
| Flow velocity | Vn = | 9.58 | fps |
| Discharge | Qn = | 14.00 | cfs |
| Percent Full Flow | Flow = | 94.0% | of full flow |
| Normal Depth Froude Number | $Fr_n$ = | 1.57 | supercritical |
| **Calculation of Critical Flow Condition** | | | |
| Half Central Angle (0<Theta-c<3.14) | Theta-c = | 2.57 | radians |
| Critical flow area | Ac = | 1.70 | sq ft |
| Critical top width | Tc = | 0.81 | ft |
| Critical flow depth | Yc = | 1.38 | ft |
| Critical flow velocity | Vc = | 8.23 | fps |
| Critical Depth Froude Number | $Fr_c$ = | 1.00 | |

# CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

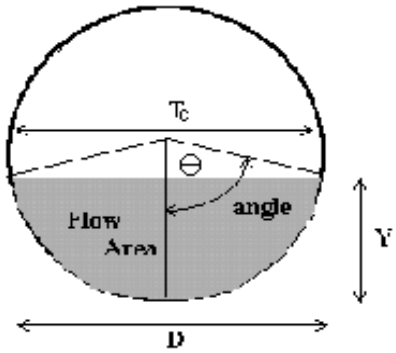
**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**
**Pipe ID:** **Pipe Design Point 6**




| | | | |
|---|---|---|---|
| **Design Information (Input)** | | | |
| Pipe Invert Slope | So = | 0.0250 | ft/ft |
| Pipe Manning's n-value | n = | 0.0130 | |
| Pipe Diameter | D = | 18.00 | inches |
| **Design discharge** | **Q =** | **16.60** | **cfs** |
| **Full-flow Capacity (Calculated)** | | | |
| Full-flow area | Af = | 1.77 | sq ft |
| Full-flow wetted perimeter | Pf = | 4.71 | ft |
| Half Central Angle | Theta = | 3.14 | radians |
| Full-flow capacity | Qf = | 16.65 | cfs |
| **Calculation of Normal Flow Condition** | | | |
| Half Central Angle (0<Theta<3.14) | Theta = | 2.26 | radians |
| Flow area | An = | 1.55 | sq ft |
| Top width | Tn = | 1.16 | ft |
| Wetted perimeter | Pn = | 3.39 | ft |
| Flow depth | Yn = | 1.23 | ft |
| Flow velocity | Vn = | 10.74 | fps |
| Discharge | Qn = | 16.60 | cfs |
| Percent Full Flow | Flow = | 99.7% | of full flow |
| Normal Depth Froude Number | $Fr_n$ = | 1.64 | supercritical |
| **Calculation of Critical Flow Condition** | | | |
| Half Central Angle (0<Theta-c<3.14) | Theta-c = | 2.72 | radians |
| Critical flow area | Ac = | 1.74 | sq ft |
| Critical top width | Tc = | 0.62 | ft |
| Critical flow depth | Yc = | 1.43 | ft |
| Critical flow velocity | Vc = | 9.54 | fps |
| Critical Depth Froude Number | $Fr_c$ = | 1.00 | |

# CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

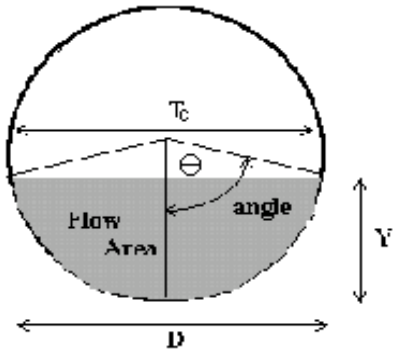
**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**
**Pipe ID:** **Pipe Design Point 7**




| | | | |
|---|---|---|---|
| **Design Information (Input)** | | | |
| Pipe Invert Slope | So = | 0.0300 | ft/ft |
| Pipe Manning's n-value | n = | 0.0130 | |
| Pipe Diameter | D = | 24.00 | inches |
| **Design discharge** | **Q =** | **21.10** | **cfs** |
| **Full-flow Capacity (Calculated)** | | | |
| Full-flow area | Af = | 3.14 | sq ft |
| Full-flow wetted perimeter | Pf = | 6.28 | ft |
| Half Central Angle | Theta = | 3.14 | radians |
| Full-flow capacity | Qf = | 39.29 | cfs |
| **Calculation of Normal Flow Condition** | | | |
| Half Central Angle (0<Theta<3.14) | Theta = | 1.61 | radians |
| Flow area | An = | 1.66 | sq ft |
| Top width | Tn = | 2.00 | ft |
| Wetted perimeter | Pn = | 3.23 | ft |
| Flow depth | Yn = | 1.04 | ft |
| Flow velocity | Vn = | 12.73 | fps |
| Discharge | Qn = | 21.10 | cfs |
| Percent Full Flow | Flow = | 53.7% | of full flow |
| Normal Depth Froude Number | $Fr_n$ = | 2.46 | supercritical |
| **Calculation of Critical Flow Condition** | | | |
| Half Central Angle (0<Theta-c<3.14) | Theta-c = | 2.27 | radians |
| Critical flow area | Ac = | 2.76 | sq ft |
| Critical top width | Tc = | 1.53 | ft |
| Critical flow depth | Yc = | 1.65 | ft |
| Critical flow velocity | Vc = | 7.63 | fps |
| Critical Depth Froude Number | $Fr_c$ = | 1.00 | |

# CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

**Project:** **SOPRESSA EAST ADDITION FILING NO. 1**
**Pipe ID:** **Pipe Design Point 8**




| | | | |
|---|---|---|---|
| **Design Information (Input)** | | | |
| Pipe Invert Slope | So = | 0.0400 | ft/ft |
| Pipe Manning's n-value | n = | 0.0130 | |
| Pipe Diameter | D = | 15.00 | inches |
| **Design discharge** | **Q =** | **11.90** | **cfs** |
| **Full-flow Capacity (Calculated)** | | | |
| Full-flow area | Af = | 1.23 | sq ft |
| Full-flow wetted perimeter | Pf = | 3.93 | ft |
| Half Central Angle | Theta = | 3.14 | radians |
| Full-flow capacity | Qf = | 12.95 | cfs |
| **Calculation of Normal Flow Condition** | | | |
| Half Central Angle (0<Theta<3.14) | Theta = | 2.11 | radians |
| Flow area | An = | 0.99 | sq ft |
| Top width | Tn = | 1.08 | ft |
| Wetted perimeter | Pn = | 2.63 | ft |
| Flow depth | Yn = | 0.94 | ft |
| Flow velocity | Vn = | 11.97 | fps |
| Discharge | Qn = | 11.90 | cfs |
| Percent Full Flow | Flow = | 91.9% | of full flow |
| Normal Depth Froude Number | $Fr_n$ = | 2.20 | supercritical |
| **Calculation of Critical Flow Condition** | | | |
| Half Central Angle (0<Theta-c<3.14) | Theta-c = | 2.81 | radians |
| Critical flow area | Ac = | 1.22 | sq ft |
| Critical top width | Tc = | 0.41 | ft |
| Critical flow depth | Yc = | 1.22 | ft |
| Critical flow velocity | Vc = | 9.77 | fps |
| Critical Depth Froude Number | $Fr_c$ = | 1.00 | |

# Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Sunday, Oct 6 2019

## <Name>

**Rectangular**

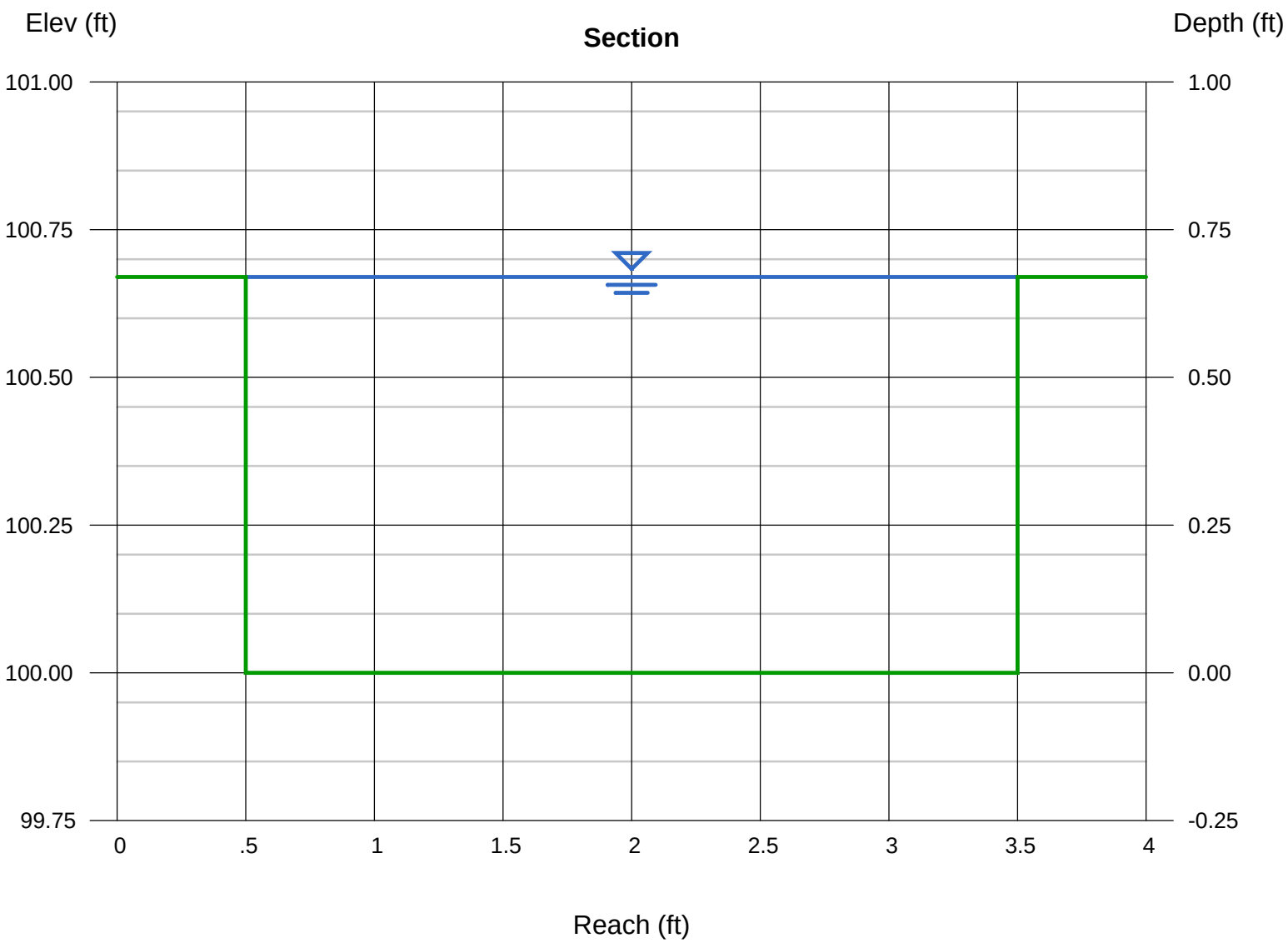
| | | |
|---|---|---|
| Bottom Width (ft) | = | 3.00 |
| Total Depth (ft) | = | 0.67 |
| Invert Elev (ft) | = | 100.00 |
| Slope (%) | = | 2.00 |
| N-Value | = | 0.012 |

**Calculations**

| | | |
|---|---|---|
| Compute by: | | Known Depth |
| Known Depth (ft) | = | 0.67 |

**Highlighted**

| | | |
|---|---|---|
| Depth (ft) | = | 0.67 |
| Q (cfs) | = | 21.07 |
| Area (sqft) | = | 2.01 |
| Velocity (ft/s) | = | 10.48 |
| Wetted Perim (ft) | = | 4.34 |
| Crit Depth, Yc (ft) | = | 0.67 |
| Top Width (ft) | = | 3.00 |
| EGL (ft) | = | 2.38 |

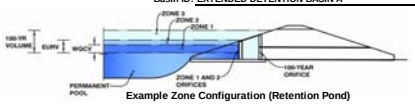


# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**

**Project:** SORPRESSA EAAST ADDITION FILING NO. 1

**Basin ID:** EXTENDED DETENTION BASIN A




**Example Zone Configuration (Retention Pond)**

**Required Volume Calculation**

| | | |
|---|---|---|
| Selected BMP Type = | **EDB** | |
| Watershed Area = | 4.83 | acres |
| Watershed Length = | 515 | ft |
| Watershed Slope = | 0.050 | ft/ft |
| Watershed Imperviousness = | 65.00% | percent |
| Percentage Hydrologic Soil Group A = | 52.0% | percent |
| Percentage Hydrologic Soil Group B = | 48.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Desired WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | Denver - Capitol Building | |
| Water Quality Capture Volume (WQCV) = | 0.102 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.367 | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.275 | acre-feet |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.364 | acre-feet |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.455 | acre-feet |
| 25-yr Runoff Volume (P1 = 2 in.) = | 0.569 | acre-feet |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 0.670 | acre-feet |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 0.794 | acre-feet |
| 500-yr Runoff Volume (P1 = 3.14 in.) = | 1.066 | acre-feet |
| Approximate 2-yr Detention Volume = | 0.259 | acre-feet |
| Approximate 5-yr Detention Volume = | 0.343 | acre-feet |
| Approximate 10-yr Detention Volume = | 0.426 | acre-feet |
| Approximate 25-yr Detention Volume = | 0.485 | acre-feet |
| Approximate 50-yr Detention Volume = | 0.520 | acre-feet |
| Approximate 100-yr Detention Volume = | 0.566 | acre-feet |

Optional User Override 1-hr Precipitation

| | |
|---|---|
| 1.19 | inches |
| 1.50 | inches |
| 1.75 | inches |
| 2.00 | inches |
| 2.25 | inches |
| 2.52 | inches |
| | inches |

**Stage-Storage Calculation**

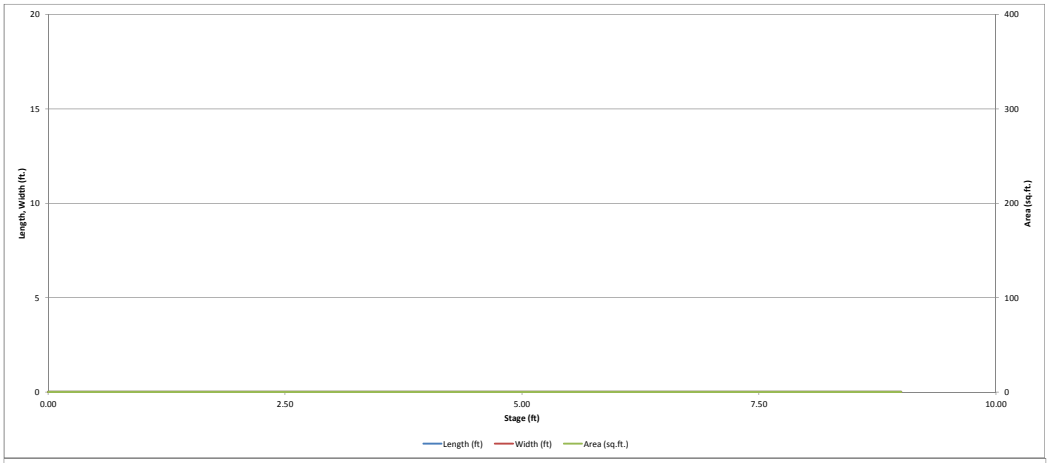
| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.102 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.265 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.199 | acre-feet |
| Total Detention Basin Volume = | 0.566 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | ft^3 |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | ft^2 |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | ft^2 |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | ft^3 |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | ft^2 |
| Volume of Main Basin ($V_{MAIN}$) = | user | ft^3 |
| Calculated Total Basin Volume ($V_{total}$) = | **user** | acre-feet |

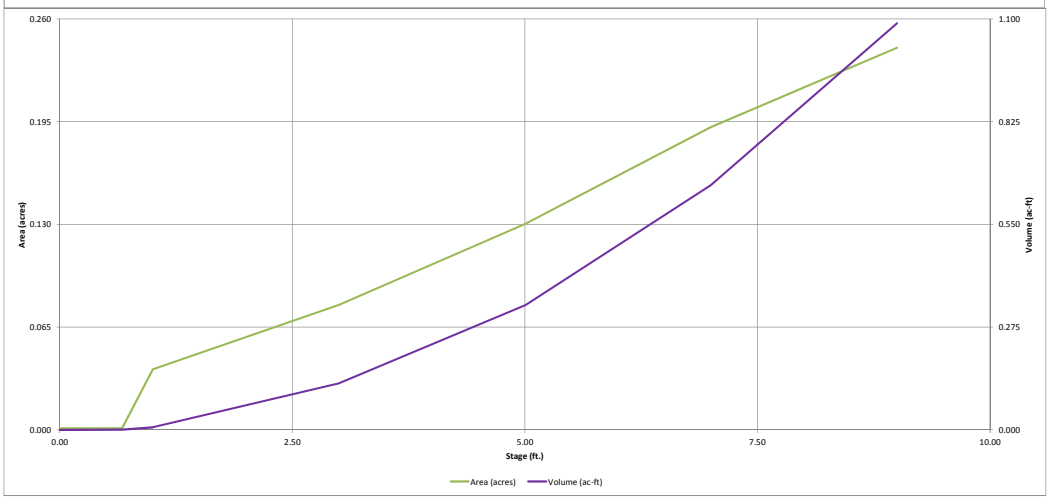
Depth Increment = 1 ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area (ft^2) | Optional Override Area (ft^2) | Area (acre) | Volume (ft^3) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| **Top of Micropool** | -- | 0.00 | -- | -- | -- | 40 | 0.001 | | |
| **ISV** | -- | 0.67 | -- | -- | -- | 40 | 0.001 | 26 | 0.001 |
| **6974** | -- | 1.00 | -- | -- | -- | 1,670 | 0.038 | 292 | 0.007 |
| **6976** | -- | 3.00 | -- | -- | -- | 3,439 | 0.079 | 5,418 | 0.124 |
| **6978** | -- | 5.00 | -- | -- | -- | 5,671 | 0.130 | 14,528 | 0.334 |
| **6980** | -- | 7.00 | -- | -- | -- | 8,343 | 0.192 | 28,542 | 0.655 |
| **6982** | -- | 9.00 | -- | -- | -- | 10,531 | 0.242 | 47,416 | 1.089 |

## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



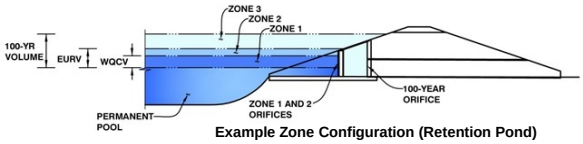



# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

**Project:** SORPRESSA EAST ADDITION FILING NO. 1

**Basin ID:** EXTENDED DETENTION BASIN A




Example Zone Configuration (Retention Pond)

| | Stage (ft) | Zone Volume (ac-ft) | Outlet Type |
|---|---|---|---|
| Zone 1 (WQCV) | 2.71 | 0.102 | Orifice Plate |
| Zone 2 (EURV) | 5.26 | 0.265 | Orifice Plate |
| Zone 3 (100-year) | 6.52 | 0.199 | Weir&Pipe (Restrict) |
| | | 0.566 | Total |

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

| | | |
|---|---|---|
| Underdrain Orifice Invert Depth = | N/A | ft (distance below the filtration media surface) |
| Underdrain Orifice 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 = | 5.26 | ft (relative to basin bottom at Stage = 0 ft) |
| Orifice Plate: Orifice Vertical Spacing = | 21.00 | inches |
| Orifice Plate: Orifice Area per Row = | N/A | inches |

**Calculated Parameters for Plate**

| | | |
|---|---|---|
| WQ Orifice Area per Row = | N/A | $ft^2$ |
| 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 | 1.75 | 3.51 | | | | | |
| Orifice Area (sq. inches) | 0.59 | 0.59 | 1.23 | | | | | |

| | 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) and Grate (Flat or Sloped)**

| | Zone 3 Weir | Not Selected | |
|---|---|---|---|
| Overflow Weir Front Edge Height, Ho = | 5.26 | N/A | ft (relative to basin bottom at Stage = 0 ft) |
| Overflow Weir Front Edge Length = | 4.00 | N/A | feet |
| Overflow Weir Slope = | 4.00 | N/A | H:V (enter zero for flat grate) |
| Horiz. Length of Weir Sides = | 4.00 | N/A | feet |
| Overflow Grate Open Area % = | 70% | N/A | %, grate open area/total area |
| Debris Clogging % = | 50% | N/A | % |

**Calculated Parameters for Overflow Weir**

| | Zone 3 Weir | Not Selected | |
|---|---|---|---|
| Height of Grate Upper Edge, $H_t$ = | 6.26 | N/A | feet |
| Over Flow Weir Slope Length = | 4.12 | N/A | feet |
| Grate Open Area / 100-yr Orifice Area = | 29.40 | N/A | should be $\geq$ 4 |
| Overflow Grate Open Area w/o Debris = | 11.54 | N/A | $ft^2$ |
| Overflow Grate Open Area w/ Debris = | 5.77 | 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 = | 2.00 | N/A | ft (distance below basin bottom at Stage = 0 ft) |
| Outlet Pipe Diameter = | 12.00 | N/A | inches |
| Restrictor Plate Height Above Pipe Invert = | 6.00 | | inches |

**Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate**

| | Zone 3 Restrictor | Not Selected | |
|---|---|---|---|
| Outlet Orifice Area = | 0.39 | N/A | $ft^2$ |
| Outlet Orifice Centroid = | 0.29 | N/A | feet |
| Half-Central Angle of Restrictor Plate on Pipe = | 1.57 | N/A | radians |

**User Input: Emergency Spillway (Rectangular or Trapezoidal)**

| | | |
|---|---|---|
| Spillway Invert Stage= | 6.52 | ft (relative to basin bottom at Stage = 0 ft) |
| Spillway Crest Length = | 20.00 | feet |
| Spillway End Slopes = | 4.00 | H:V |
| Freeboard above Max Water Surface = | 1.00 | feet |

**Calculated Parameters for Spillway**

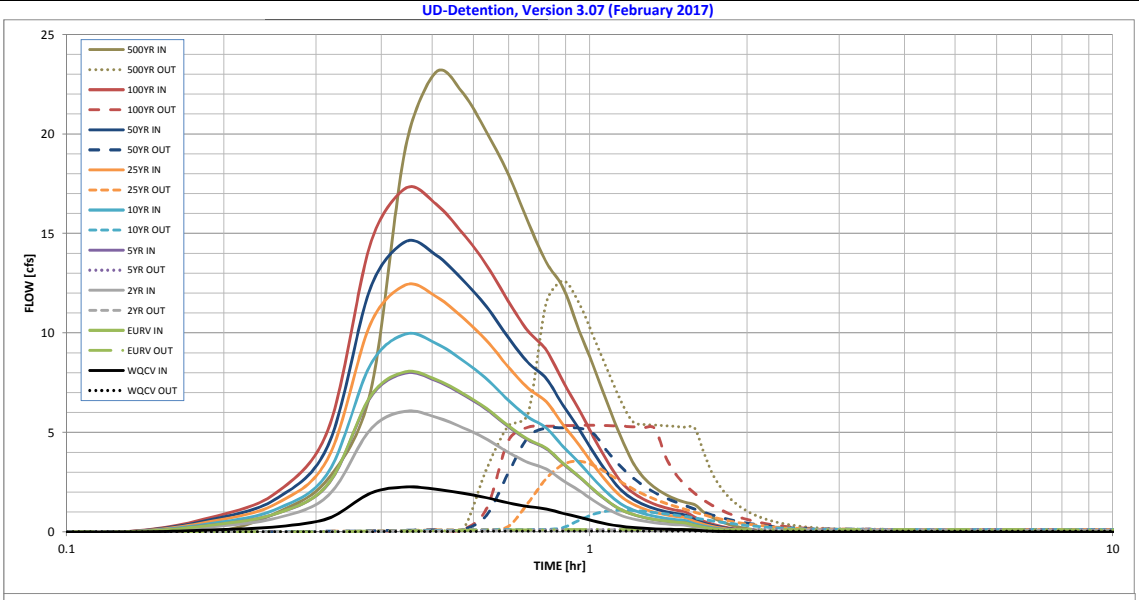
| | | |
|---|---|---|
| Spillway Design Flow Depth= | 0.41 | feet |
| Stage at Top of Freeboard = | 7.93 | feet |
| Basin Area at Top of Freeboard = | 0.21 | acres |

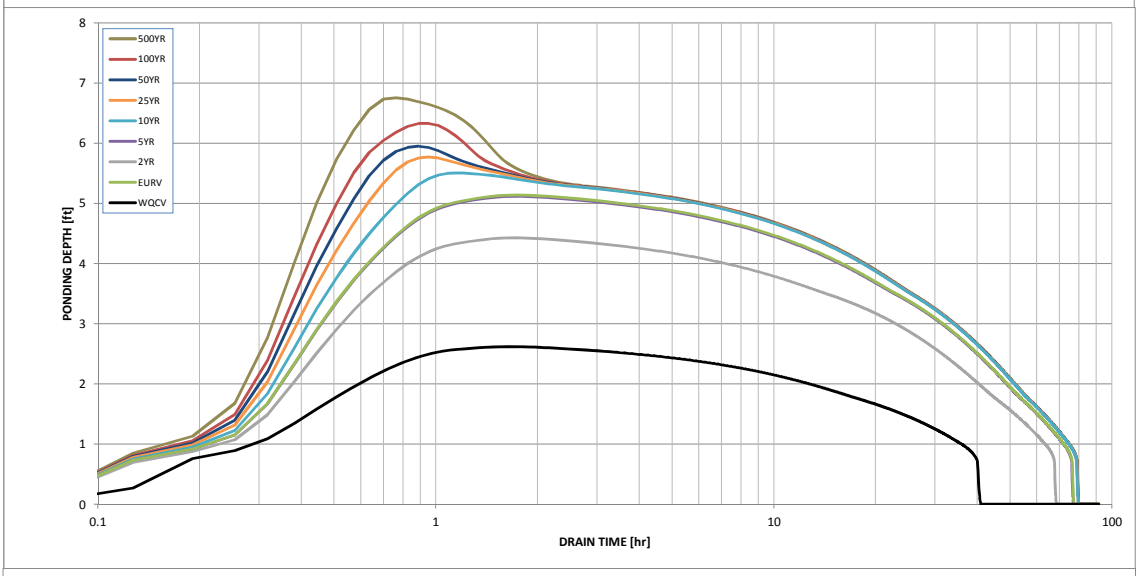
**Routed Hydrograph Results**

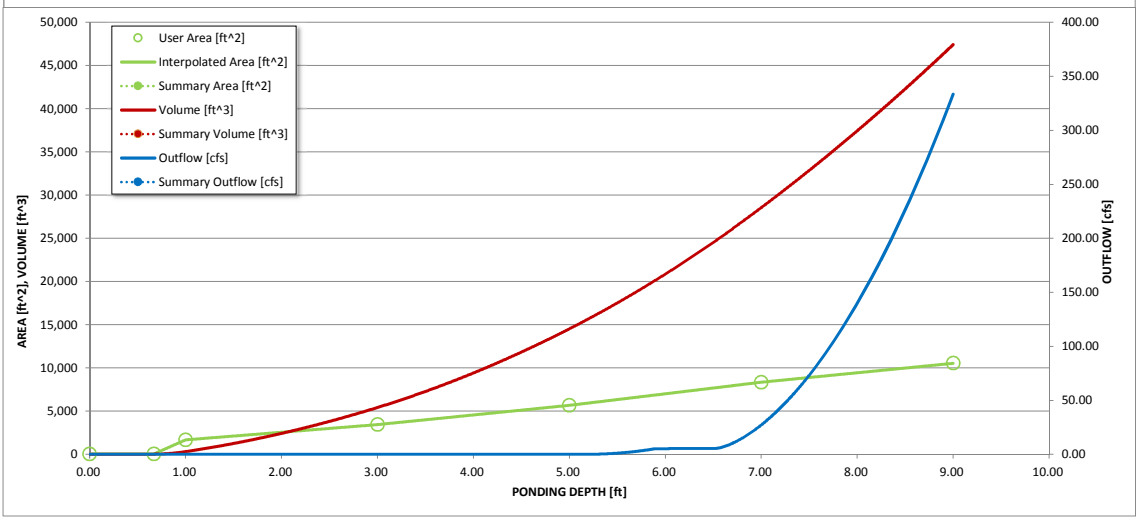
| Design Storm Return Period = | WQCV | EURV | 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year | 500 Year |
|---|---|---|---|---|---|---|---|---|---|
| One-Hour Rainfall Depth (in) = | 0.53 | 1.07 | 1.19 | 1.50 | 1.75 | 2.00 | 2.25 | 2.52 | 3.14 |
| Calculated Runoff Volume (acre-ft) = | 0.102 | 0.367 | 0.275 | 0.364 | 0.455 | 0.569 | 0.670 | 0.794 | 1.066 |
| OPTIONAL Override Runoff Volume (acre-ft) = | | | | | | | | | |
| Inflow Hydrograph Volume (acre-ft) = | 0.101 | 0.367 | 0.275 | 0.364 | 0.455 | 0.569 | 0.670 | 0.794 | 1.066 |
| Predevelopment Unit Peak Flow, q (cfs/acre) = | 0.00 | 0.00 | 0.01 | 0.02 | 0.15 | 0.45 | 0.74 | 1.13 | 1.92 |
| Predevelopment Peak Q (cfs) = | 0.0 | 0.0 | 0.0 | 0.1 | 0.7 | 2.2 | 3.6 | 5.5 | 9.3 |
| Peak Inflow Q (cfs) = | 2.3 | 8.0 | 6.1 | 8.0 | 9.9 | 12.4 | 14.6 | 17.3 | 23.1 |
| Peak Outflow Q (cfs) = | 0.1 | 0.1 | 0.1 | 0.1 | 1.1 | 3.6 | 5.2 | 5.4 | 12.6 |
| Ratio Peak Outflow to Predevelopment Q = | N/A | N/A | N/A | 1.6 | 1.6 | 1.6 | 1.5 | 1.0 | 1.4 |
| Structure Controlling Flow = | Plate | Plate | Plate | Plate | Overflow Grate 1 | Overflow Grate 1 | Outlet Plate 1 | Outlet Plate 1 | Spillway |
| Max Velocity through Grate 1 (fps) = | N/A | N/A | N/A | N/A | 0.1 | 0.3 | 0.4 | 0.5 | 0.5 |
| 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 | 70 | 63 | 70 | 71 | 69 | 67 | 66 | 62 |
| Time to Drain 99% of Inflow Volume (hours) = | **40** | 74 | 66 | 74 | 76 | 76 | 75 | 74 | 73 |
| Maximum Ponding Depth (ft) = | 2.62 | 5.14 | 4.43 | 5.12 | 5.50 | 5.77 | 5.95 | 6.33 | 6.76 |
| Area at Maximum Ponding Depth (acres) = | 0.07 | 0.13 | 0.12 | 0.13 | 0.15 | 0.15 | 0.16 | 0.17 | 0.18 |
| Maximum Volume Stored (acre-ft) = | 0.095 | 0.351 | 0.262 | 0.348 | 0.402 | 0.443 | 0.469 | 0.534 | 0.608 |

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)




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

# Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

| | SOURCE | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK |
|---|---|---|---|---|---|---|---|---|---|---|
| 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] |
| 3.81 min | 0:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 0:03:49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hydrograph | 0:07:37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Constant | 0:11:26 | 0.10 | 0.36 | 0.27 | 0.36 | 0.44 | 0.55 | 0.65 | 0.76 | 1.01 |
| 1.313 | 0:15:14 | 0.28 | 0.97 | 0.73 | 0.96 | 1.19 | 1.48 | 1.74 | 2.06 | 2.74 |
| | 0:19:03 | 0.71 | 2.48 | 1.88 | 2.47 | 3.06 | 3.81 | 4.47 | 5.28 | 7.04 |
| | 0:22:52 | 1.95 | 6.83 | 5.17 | 6.78 | 8.42 | 10.48 | 12.29 | 14.51 | 19.33 |
| | 0:26:40 | 2.27 | 8.05 | 6.07 | 7.99 | 9.95 | 12.42 | 14.59 | 17.27 | 23.10 |
| | 0:30:29 | 2.15 | 7.67 | 5.77 | 7.61 | 9.49 | 11.84 | 13.93 | 16.49 | 22.08 |
| | 0:34:17 | 1.95 | 6.98 | 5.25 | 6.92 | 8.63 | 10.78 | 12.68 | 15.02 | 20.10 |
| | 0:38:06 | 1.73 | 6.21 | 4.67 | 6.17 | 7.70 | 9.62 | 11.33 | 13.43 | 18.00 |
| | 0:41:55 | 1.47 | 5.35 | 4.01 | 5.30 | 6.63 | 8.30 | 9.78 | 11.61 | 15.59 |
| | 0:45:43 | 1.29 | 4.66 | 3.50 | 4.63 | 5.78 | 7.24 | 8.52 | 10.11 | 13.56 |
| | 0:49:32 | 1.16 | 4.22 | 3.17 | 4.19 | 5.24 | 6.56 | 7.72 | 9.16 | 12.29 |
| | 0:53:20 | 0.94 | 3.46 | 2.59 | 3.44 | 4.31 | 5.40 | 6.37 | 7.57 | 10.19 |
| | 0:57:09 | 0.75 | 2.82 | 2.10 | 2.79 | 3.51 | 4.41 | 5.21 | 6.20 | 8.36 |
| | 1:00:58 | 0.56 | 2.15 | 1.59 | 2.13 | 2.68 | 3.39 | 4.01 | 4.79 | 6.49 |
| | 1:04:46 | 0.40 | 1.58 | 1.17 | 1.57 | 1.99 | 2.52 | 2.99 | 3.58 | 4.88 |
| | 1:08:35 | 0.30 | 1.15 | 0.85 | 1.14 | 1.44 | 1.83 | 2.16 | 2.59 | 3.54 |
| | 1:12:23 | 0.24 | 0.90 | 0.67 | 0.89 | 1.12 | 1.42 | 1.68 | 2.00 | 2.72 |
| | 1:16:12 | 0.20 | 0.74 | 0.55 | 0.73 | 0.92 | 1.17 | 1.38 | 1.64 | 2.23 |
| | 1:20:01 | 0.17 | 0.63 | 0.47 | 0.63 | 0.79 | 0.99 | 1.17 | 1.39 | 1.89 |
| | 1:23:49 | 0.15 | 0.55 | 0.41 | 0.55 | 0.69 | 0.87 | 1.03 | 1.22 | 1.66 |
| | 1:27:38 | 0.13 | 0.50 | 0.37 | 0.50 | 0.62 | 0.78 | 0.93 | 1.10 | 1.49 |
| | 1:31:26 | 0.13 | 0.46 | 0.35 | 0.46 | 0.58 | 0.72 | 0.85 | 1.02 | 1.37 |
| | 1:35:15 | 0.09 | 0.34 | 0.25 | 0.34 | 0.42 | 0.53 | 0.63 | 0.74 | 1.01 |
| | 1:39:04 | 0.07 | 0.25 | 0.19 | 0.25 | 0.31 | 0.39 | 0.46 | 0.55 | 0.74 |
| | 1:42:52 | 0.05 | 0.18 | 0.14 | 0.18 | 0.23 | 0.28 | 0.34 | 0.40 | 0.54 |
| | 1:46:41 | 0.04 | 0.13 | 0.10 | 0.13 | 0.17 | 0.21 | 0.25 | 0.30 | 0.40 |
| | 1:50:29 | 0.02 | 0.09 | 0.07 | 0.09 | 0.12 | 0.15 | 0.18 | 0.21 | 0.29 |
| | 1:54:18 | 0.02 | 0.07 | 0.05 | 0.07 | 0.08 | 0.11 | 0.13 | 0.15 | 0.20 |
| | 1:58:07 | 0.01 | 0.05 | 0.03 | 0.05 | 0.06 | 0.07 | 0.09 | 0.11 | 0.15 |
| | 2:01:55 | 0.01 | 0.03 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.10 |
| | 2:05:44 | 0.00 | 0.02 | 0.01 | 0.02 | 0.02 | 0.03 | 0.03 | 0.04 | 0.06 |
| | 2:09:32 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.03 |
| | 2:13:21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 |
| | 2:17:10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:20:58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:24:47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:28:35 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:32:24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:36:13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:40:01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:43:50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:47:38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:51:27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:55:16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:59:04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:02:53 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:06:41 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:10:30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:14:19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:18:07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:21:56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:25:44 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:29:33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:33:22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:37:10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:40:59 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:44:47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:48:36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:52:25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:56:13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:00:02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:03:50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:07:39 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:11:28 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:15:16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:19:05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:22:53 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:26:42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:30:31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:34:19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# Detention Basin Outlet Structure Design

**UD-Detention, Version 3.07 (February 2017)**

**Summary Stage-Area-Volume-Discharge Relationships**

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

| Stage - Storage Description | Stage [ft] | Area [ft^2] | Area [acres] | Volume [ft^3] | Volume [ac-ft] | Total Outflow [cfs] |
|---|---|---|---|---|---|---|
| | | | | | | |

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

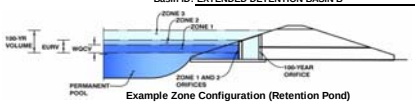
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**

**Project:** SORPRESSA EAAST ADDITION FILING NO. 1

**Basin ID:** EXTENDED DETENTION BASIN B




**Example Zone Configuration (Retention Pond)**

**Required Volume Calculation**

| | | |
|---|---|---|
| Selected BMP Type = | **EDB** | |
| Watershed Area = | 3.21 | acres |
| Watershed Length = | 450 | ft |
| Watershed Slope = | 0.062 | ft/ft |
| Watershed Imperviousness = | 65.00% | percent |
| Percentage Hydrologic Soil Group A = | 52.0% | percent |
| Percentage Hydrologic Soil Group B = | 48.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Desired WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | Denver - Capitol Building | |
| Water Quality Capture Volume (WQCV) = | 0.068 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.244 | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.183 | acre-feet |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.242 | acre-feet |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.303 | acre-feet |
| 25-yr Runoff Volume (P1 = 2 in.) = | 0.378 | acre-feet |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 0.445 | acre-feet |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 0.528 | acre-feet |
| 500-yr Runoff Volume (P1 = 3.14 in.) = | 0.709 | acre-feet |
| Approximate 2-yr Detention Volume = | 0.172 | acre-feet |
| Approximate 5-yr Detention Volume = | 0.228 | acre-feet |
| Approximate 10-yr Detention Volume = | 0.283 | acre-feet |
| Approximate 25-yr Detention Volume = | 0.322 | acre-feet |
| Approximate 50-yr Detention Volume = | 0.346 | acre-feet |
| Approximate 100-yr Detention Volume = | 0.376 | acre-feet |

Optional User Override 1-hr Precipitation

| | |
|---|---|
| 1.19 | inches |
| 1.50 | inches |
| 1.75 | inches |
| 2.00 | inches |
| 2.25 | inches |
| 2.52 | inches |
| | inches |

**Stage-Storage Calculation**

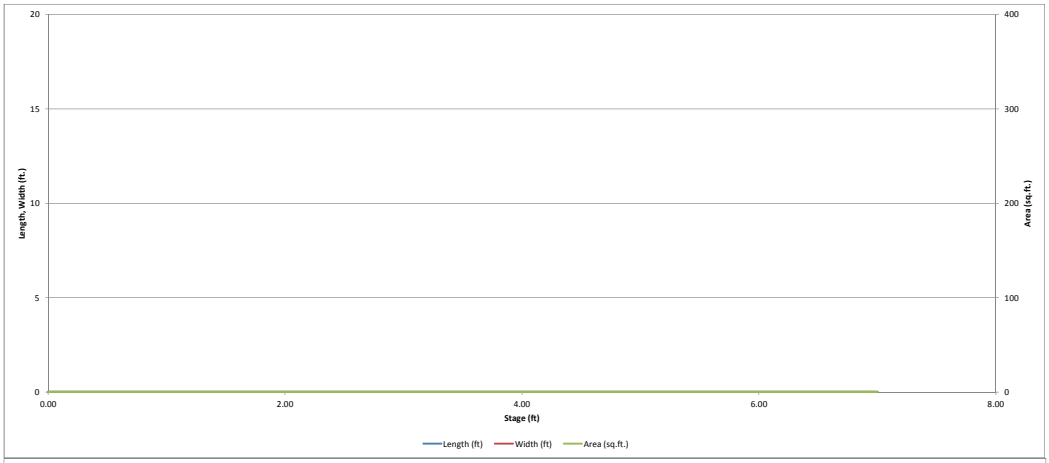
| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.068 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.176 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.132 | acre-feet |
| Total Detention Basin Volume = | 0.376 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | ft^3 |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | ft^2 |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | ft^2 |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | ft^3 |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | ft^2 |
| Volume of Main Basin ($V_{MAIN}$) = | user | ft^3 |
| Calculated Total Basin Volume ($V_{total}$) = | **user** | acre-feet |

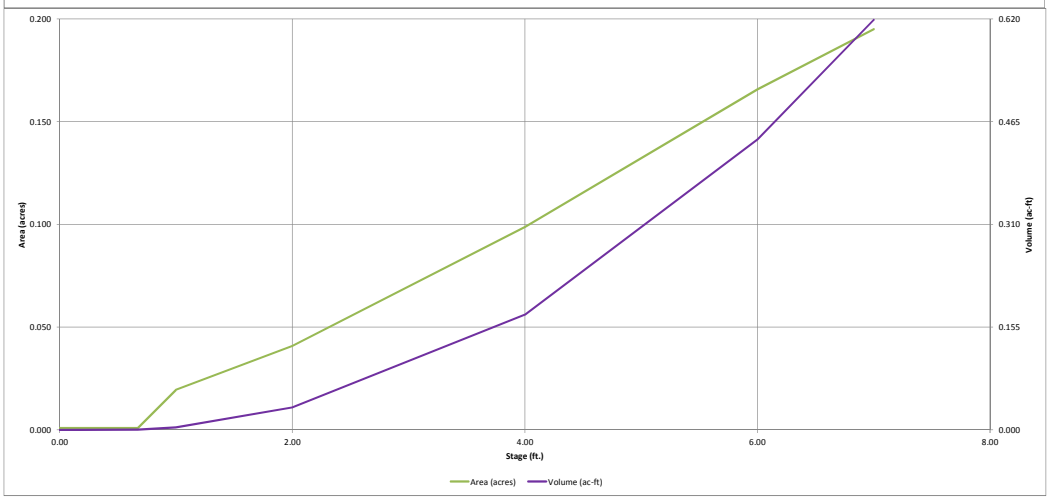
Depth Increment = 1 ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area (ft^2) | Optional Override Area (ft^2) | Area (acre) | Volume (ft^3) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| **Top of Micropool** | -- | 0.00 | -- | -- | -- | 40 | 0.001 | | |
| **ISV** | -- | 0.67 | -- | -- | -- | 40 | 0.001 | 26 | 0.001 |
| **6971** | -- | 1.00 | -- | -- | -- | 845 | 0.019 | 164 | 0.004 |
| **6972** | -- | 2.00 | -- | -- | -- | 1,777 | 0.041 | 1,466 | 0.034 |
| **6974** | -- | 4.00 | -- | -- | -- | 4,302 | 0.099 | 7,563 | 0.174 |
| **6976** | -- | 6.00 | -- | -- | -- | 7,220 | 0.166 | 19,085 | 0.438 |
| **6977** | -- | 7.00 | -- | -- | -- | 8,495 | 0.195 | 26,942 | 0.619 |

## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



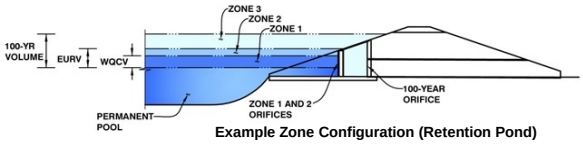



# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

**Project:** SORPRESSA EAST ADDITION FILING NO. 1

**Basin ID:** EXTENDED DETENTION BASIN B




Example Zone Configuration (Retention Pond)

| | Stage (ft) | Zone Volume (ac-ft) | Outlet Type |
|---|---|---|---|
| Zone 1 (WQCV) | 2.68 | 0.068 | Orifice Plate |
| Zone 2 (EURV) | 4.65 | 0.176 | Orifice Plate |
| Zone 3 (100-year) | 5.62 | 0.132 | Weir&Pipe (Restrict) |
| | | 0.376 | Total |

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

| | | |
|---|---|---|
| Underdrain Orifice Invert Depth = | N/A | ft (distance below the filtration media surface) |
| Underdrain Orifice 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 = | 4.65 | ft (relative to basin bottom at Stage = 0 ft) |
| Orifice Plate: Orifice Vertical Spacing = | 18.60 | inches |
| Orifice Plate: Orifice Area per Row = | N/A | inches |

**Calculated Parameters for Plate**

| | | |
|---|---|---|
| WQ Orifice Area per Row = | N/A | $ft^2$ |
| 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 | 1.55 | 3.10 | | | | | |
| Orifice Area (sq. inches) | 0.35 | 0.35 | 1.23 | | | | | |

| | 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) and Grate (Flat or Sloped)**

| | Zone 3 Weir | Not Selected | |
|---|---|---|---|
| Overflow Weir Front Edge Height, Ho = | 4.65 | N/A | ft (relative to basin bottom at Stage = 0 ft) |
| Overflow Weir Front Edge Length = | 4.00 | N/A | feet |
| Overflow Weir Slope = | 0.00 | N/A | H:V (enter zero for flat grate) |
| Horiz. Length of Weir Sides = | 4.00 | N/A | feet |
| Overflow Grate Open Area % = | 70% | N/A | %, grate open area/total area |
| Debris Clogging % = | 50% | N/A | % |

**Calculated Parameters for Overflow Weir**

| | Zone 3 Weir | Not Selected | |
|---|---|---|---|
| Height of Grate Upper Edge, $H_t$ = | 4.65 | N/A | feet |
| Over Flow Weir Slope Length = | 4.00 | N/A | feet |
| Grate Open Area / 100-yr Orifice Area = | 41.07 | N/A | should be $\geq$ 4 |
| Overflow Grate Open Area w/o Debris = | 11.20 | N/A | $ft^2$ |
| Overflow Grate Open Area w/ Debris = | 5.60 | 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 = | 2.00 | N/A | ft (distance below basin bottom at Stage = 0 ft) |
| Outlet Pipe Diameter = | 10.00 | N/A | inches |
| Restrictor Plate Height Above Pipe Invert = | 5.00 | | inches |

**Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate**

| | Zone 3 Restrictor | Not Selected | |
|---|---|---|---|
| Outlet Orifice Area = | 0.27 | N/A | $ft^2$ |
| Outlet Orifice Centroid = | 0.24 | N/A | feet |
| Half-Central Angle of Restrictor Plate on Pipe = | 1.57 | N/A | radians |

**User Input: Emergency Spillway (Rectangular or Trapezoidal)**

| | | |
|---|---|---|
| Spillway Invert Stage= | 5.62 | ft (relative to basin bottom at Stage = 0 ft) |
| Spillway Crest Length = | 20.00 | feet |
| Spillway End Slopes = | 4.00 | H:V |
| Freeboard above Max Water Surface = | 1.00 | feet |

**Calculated Parameters for Spillway**

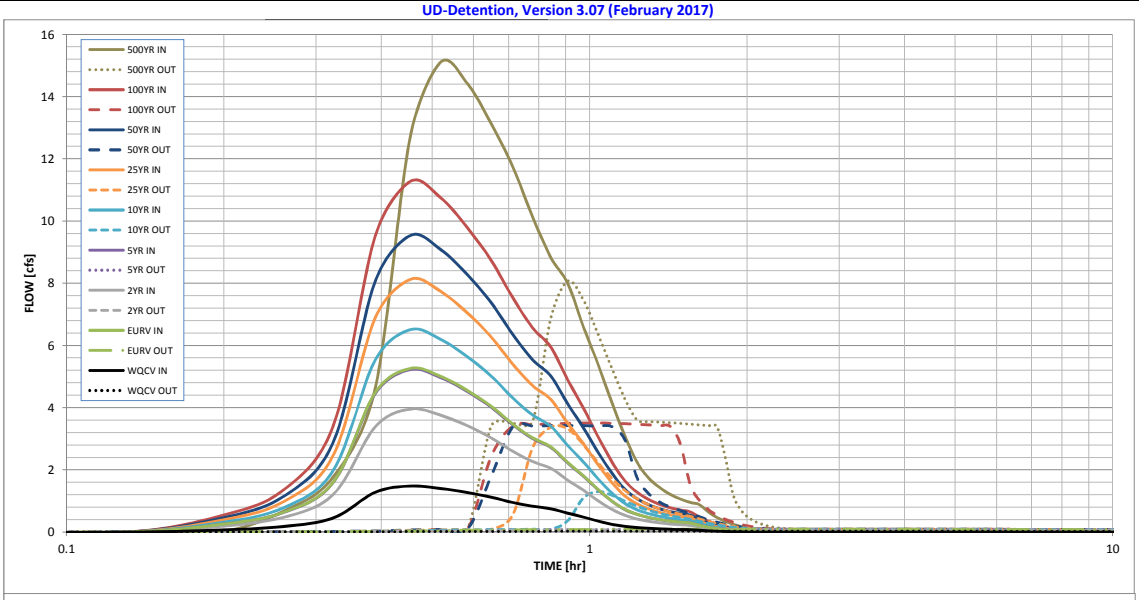
| | | |
|---|---|---|
| Spillway Design Flow Depth= | 0.31 | feet |
| Stage at Top of Freeboard = | 6.93 | feet |
| Basin Area at Top of Freeboard = | 0.19 | acres |

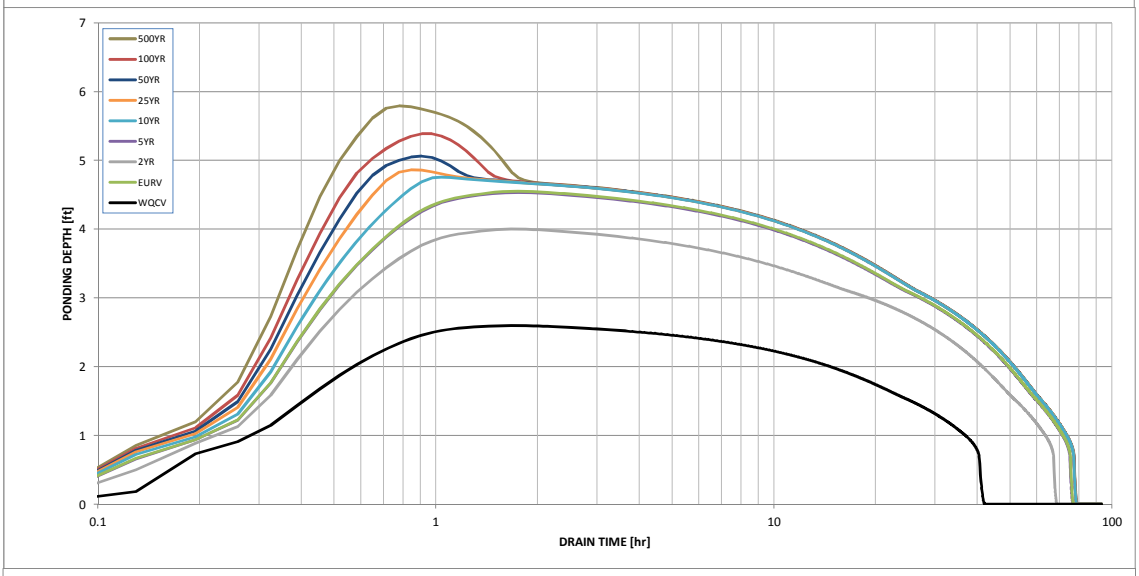
**Routed Hydrograph Results**

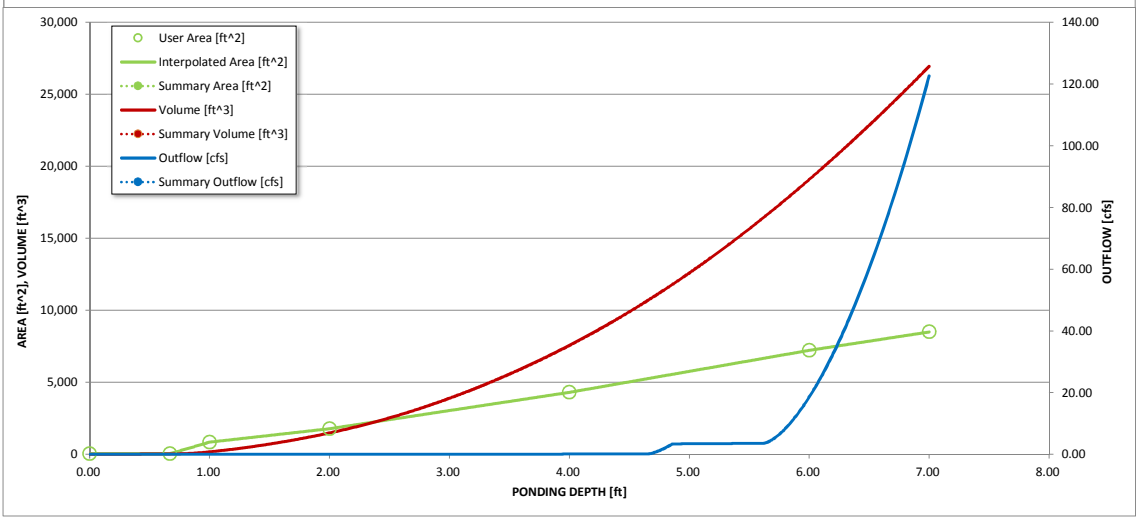
| Design Storm Return Period = | WQCV | EURV | 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year | 500 Year |
|---|---|---|---|---|---|---|---|---|---|
| One-Hour Rainfall Depth (in) = | 0.53 | 1.07 | 1.19 | 1.50 | 1.75 | 2.00 | 2.25 | 2.52 | 3.14 |
| Calculated Runoff Volume (acre-ft) = | 0.068 | 0.244 | 0.183 | 0.242 | 0.303 | 0.378 | 0.445 | 0.528 | 0.709 |
| OPTIONAL Override Runoff Volume (acre-ft) = | | | | | | | | | |
| Inflow Hydrograph Volume (acre-ft) = | 0.067 | 0.244 | 0.182 | 0.242 | 0.302 | 0.378 | 0.445 | 0.527 | 0.709 |
| Predevelopment Unit Peak Flow, q (cfs/acre) = | 0.00 | 0.00 | 0.01 | 0.02 | 0.14 | 0.43 | 0.70 | 1.08 | 1.82 |
| Predevelopment Peak Q (cfs) = | 0.0 | 0.0 | 0.0 | 0.1 | 0.4 | 1.4 | 2.2 | 3.5 | 5.9 |
| Peak Inflow Q (cfs) = | 1.5 | 5.3 | 4.0 | 5.2 | 6.5 | 8.1 | 9.5 | 11.3 | 15.1 |
| Peak Outflow Q (cfs) = | 0.0 | 0.1 | 0.1 | 0.1 | 1.3 | 3.4 | 3.4 | 3.5 | 8.1 |
| Ratio Peak Outflow to Predevelopment Q = | N/A | N/A | N/A | 1.8 | 3.0 | 2.5 | 1.5 | 1.0 | 1.4 |
| Structure Controlling Flow = | Plate | Plate | Plate | Plate | Overflow Grate 1 | Outlet Plate 1 | Outlet Plate 1 | Outlet Plate 1 | Spillway |
| Max Velocity through Grate 1 (fps) = | N/A | N/A | N/A | N/A | 0.1 | 0.3 | 0.3 | 0.3 | 0.3 |
| 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 | 69 | 62 | 68 | 69 | 67 | 65 | 63 | 59 |
| Time to Drain 99% of Inflow Volume (hours) = | **41** | 74 | 66 | 73 | 75 | 74 | 73 | 72 | 71 |
| Maximum Ponding Depth (ft) = | 2.60 | 4.55 | 4.00 | 4.53 | 4.76 | 4.86 | 5.06 | 5.39 | 5.79 |
| Area at Maximum Ponding Depth (acres) = | 0.06 | 0.12 | 0.10 | 0.12 | 0.12 | 0.13 | 0.13 | 0.14 | 0.16 |
| Maximum Volume Stored (acre-ft) = | 0.063 | 0.232 | 0.174 | 0.231 | 0.257 | 0.271 | 0.297 | 0.342 | 0.404 |

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)




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

# Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

| | SOURCE | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK |
|---|---|---|---|---|---|---|---|---|---|---|
| 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] |
| 3.89 min | 0:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 0:03:53 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hydrograph | 0:07:47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Constant | 0:11:40 | 0.07 | 0.24 | 0.18 | 0.24 | 0.29 | 0.36 | 0.43 | 0.50 | 0.67 |
| 1.286 | 0:15:34 | 0.18 | 0.64 | 0.48 | 0.63 | 0.78 | 0.98 | 1.14 | 1.35 | 1.80 |
| | 0:19:27 | 0.47 | 1.63 | 1.23 | 1.62 | 2.01 | 2.51 | 2.94 | 3.47 | 4.63 |
| | 0:23:20 | 1.28 | 4.49 | 3.39 | 4.46 | 5.54 | 6.89 | 8.08 | 9.53 | 12.71 |
| | 0:27:14 | 1.49 | 5.27 | 3.96 | 5.22 | 6.51 | 8.13 | 9.54 | 11.28 | 15.11 |
| | 0:31:07 | 1.41 | 5.01 | 3.76 | 4.97 | 6.20 | 7.74 | 9.09 | 10.76 | 14.42 |
| | 0:35:01 | 1.28 | 4.56 | 3.42 | 4.52 | 5.64 | 7.05 | 8.28 | 9.79 | 13.13 |
| | 0:38:54 | 1.12 | 4.05 | 3.03 | 4.02 | 5.02 | 6.28 | 7.38 | 8.74 | 11.73 |
| | 0:42:47 | 0.95 | 3.47 | 2.60 | 3.45 | 4.31 | 5.40 | 6.35 | 7.53 | 10.14 |
| | 0:46:41 | 0.84 | 3.03 | 2.27 | 3.01 | 3.76 | 4.71 | 5.54 | 6.57 | 8.83 |
| | 0:50:34 | 0.76 | 2.74 | 2.05 | 2.72 | 3.41 | 4.27 | 5.02 | 5.95 | 8.00 |
| | 0:54:28 | 0.61 | 2.24 | 1.67 | 2.22 | 2.79 | 3.50 | 4.13 | 4.90 | 6.61 |
| | 0:58:21 | 0.48 | 1.81 | 1.35 | 1.80 | 2.26 | 2.85 | 3.36 | 3.99 | 5.40 |
| | 1:02:14 | 0.36 | 1.37 | 1.02 | 1.36 | 1.72 | 2.17 | 2.57 | 3.07 | 4.17 |
| | 1:06:08 | 0.25 | 1.01 | 0.74 | 1.00 | 1.26 | 1.60 | 1.90 | 2.28 | 3.11 |
| | 1:10:01 | 0.19 | 0.74 | 0.54 | 0.73 | 0.92 | 1.17 | 1.38 | 1.65 | 2.25 |
| | 1:13:55 | 0.15 | 0.58 | 0.43 | 0.57 | 0.72 | 0.91 | 1.08 | 1.28 | 1.74 |
| | 1:17:48 | 0.12 | 0.48 | 0.35 | 0.47 | 0.59 | 0.75 | 0.89 | 1.05 | 1.43 |
| | 1:21:41 | 0.11 | 0.41 | 0.30 | 0.40 | 0.51 | 0.64 | 0.75 | 0.90 | 1.21 |
| | 1:25:35 | 0.09 | 0.36 | 0.26 | 0.35 | 0.45 | 0.56 | 0.66 | 0.79 | 1.07 |
| | 1:29:28 | 0.09 | 0.32 | 0.24 | 0.32 | 0.40 | 0.51 | 0.60 | 0.71 | 0.96 |
| | 1:33:22 | 0.08 | 0.30 | 0.22 | 0.30 | 0.37 | 0.47 | 0.55 | 0.66 | 0.89 |
| | 1:37:15 | 0.06 | 0.22 | 0.16 | 0.22 | 0.27 | 0.34 | 0.40 | 0.48 | 0.65 |
| | 1:41:08 | 0.04 | 0.16 | 0.12 | 0.16 | 0.20 | 0.25 | 0.30 | 0.35 | 0.48 |
| | 1:45:02 | 0.03 | 0.12 | 0.09 | 0.12 | 0.15 | 0.18 | 0.22 | 0.26 | 0.35 |
| | 1:48:55 | 0.02 | 0.09 | 0.06 | 0.08 | 0.11 | 0.13 | 0.16 | 0.19 | 0.26 |
| | 1:52:49 | 0.02 | 0.06 | 0.04 | 0.06 | 0.08 | 0.10 | 0.11 | 0.14 | 0.18 |
| | 1:56:42 | 0.01 | 0.04 | 0.03 | 0.04 | 0.05 | 0.07 | 0.08 | 0.10 | 0.13 |
| | 2:00:35 | 0.01 | 0.03 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.09 |
| | 2:04:29 | 0.00 | 0.02 | 0.01 | 0.02 | 0.02 | 0.03 | 0.04 | 0.04 | 0.06 |
| | 2:08:22 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.03 | 0.04 |
| | 2:12:16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 |
| | 2:16:09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| | 2:20:02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:23:56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:27:49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:31:43 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:35:36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:39:29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:43:23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:47:16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:51:10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:55:03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2:58:56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:02:50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:06:43 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:10:37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:14:30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:18:23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:22:17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:26:10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:30:04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:33:57 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:37:50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:41:44 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:45:37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:49:31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:53:24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:57:17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:01:11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:05:04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:08:58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:12:51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:16:44 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:20:38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:24:31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:28:25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:32:18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:36:11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:40:05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# Detention Basin Outlet Structure Design

**UD-Detention, Version 3.07 (February 2017)**

**Summary Stage-Area-Volume-Discharge Relationships**

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

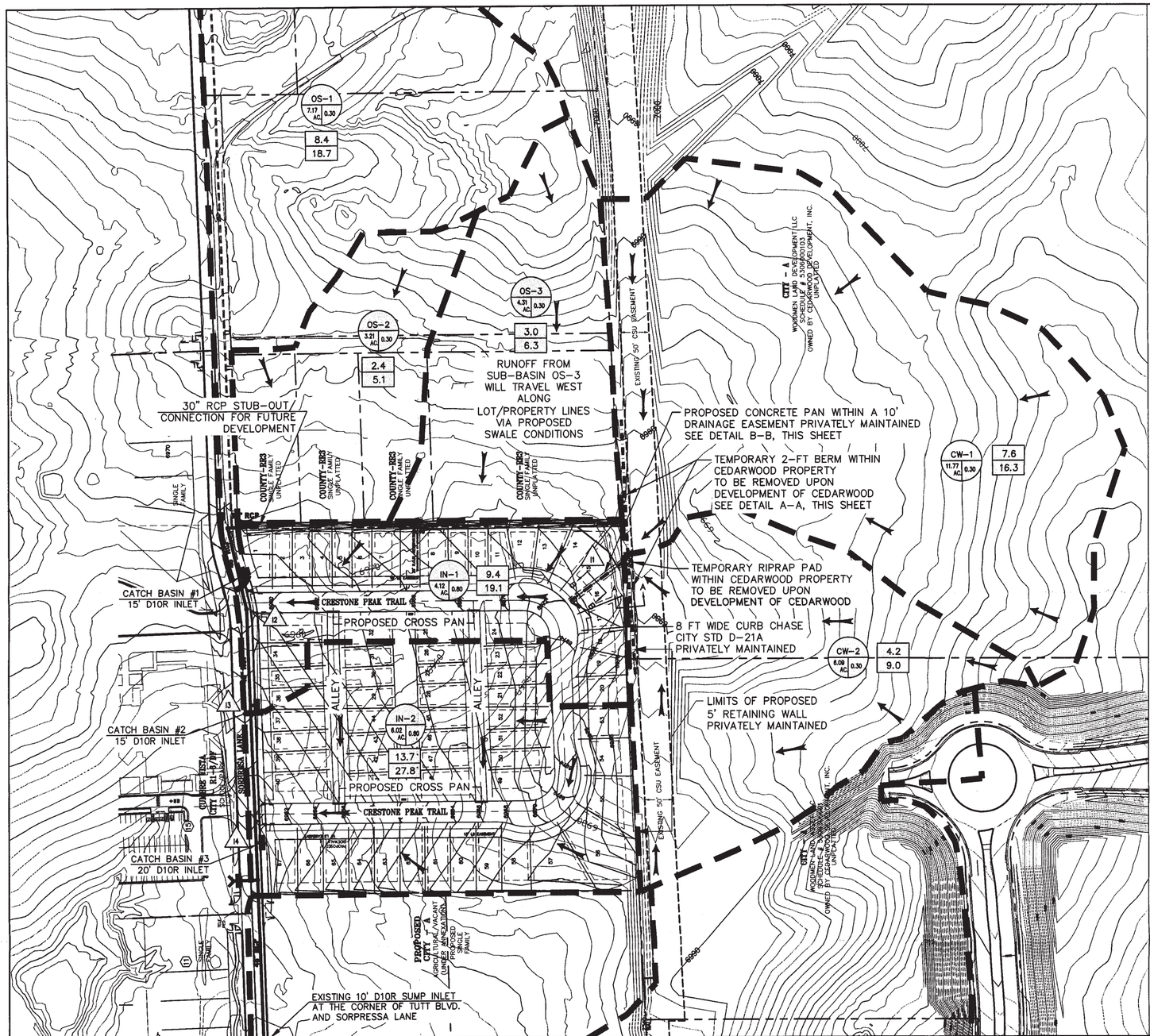
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

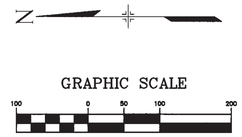
| Stage - Storage Description | Stage [ft] | Area [ft^2] | Area [acres] | Volume [ft^3] | Volume [ac-ft] | Total Outflow [cfs] |
|---|---|---|---|---|---|---|
| | | | | | | |

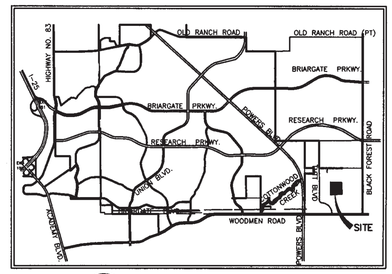
For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

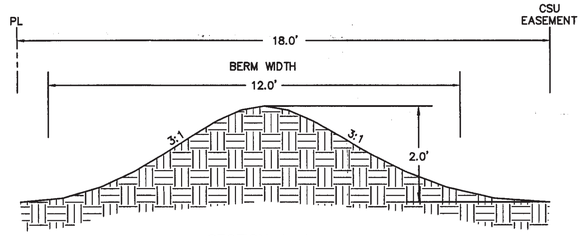
# DRAINAGE MAP



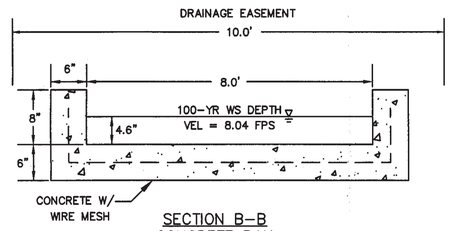

VICINITY MAP




SECTION A-A
TWO FOOT BERM
NTS

## LEGEND

- PROPERTY LINE
- EASEMENT LINE
- DRAINAGE BASIN BOUNDARY
- PROPOSED BERM
- PROPOSED DIVERSION SWALE
- 6520 PROPOSED CONTOUR
- 6520 EXISTING CONTOUR
- PROPOSED FLOW DIRECTION ARROW
- DP DESIGN POINT
- XX-1 BASIN DESIGNATION
- 99.99 / AC 99.99 "C" COEFFICIENT (100 YR)
- BASIN AREA (ACRES)
- 99.99 5-YEAR FLOWRATE
- 99.99 100-YEAR FLOWRATE




SECTION B-B
CONCRETE PAN
NTS

NOTES:
1)STORM SEWER SYSTEM CONSTRUCTED PER SORPRESSA LANE STORM SEWER PLANS, DATED MAY 2006 REVISED JULY 2007

ROUTED SURFACE FLOWS
DESIGN POINT SUMMARY

| DESIGN POINT | TRIBUTARY SUB-BASINS | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|---|
| I1 | CW1, CW2 | 11.6 | 24.7 |
| I2 | DP I1, IN1 | 18.2 | 38.1 |
| I3 | OS1(fb), DP I2 | 19.0 | 43.5 |
| I4 | DP I2(fb), IN2 | 18.5 | 47.5 |

REFERENCE DRAWINGS

| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|

REVISIONS

NAME: S:\05.206.001\dwg\DRAINAGE\DR01.dwg
PCP: Matrix.ctb
PLOT DATE: Thu Nov 15, 2007 3:33pm
By: gerrit_slotter

BENCHMARK DATA(ELEV.) 6901.818'
(DATUM) FIMS
(DESCRIPTION/LOCATION) SEE RIGHT

BENCHMARK:

FIMS 2" DIAMETER ALUMINUM CAP STAMPED "CSU FIMS CONTROL BG16" ON THE NORTHEAST CORNER OF THE CONCRETE BASE FOR ELECTRIC VAULT #FBBX-1, 260 FEET NORTH OF THE NORTH EDGE OF WOODMEN ROAD.

ELEV: 6901.818'

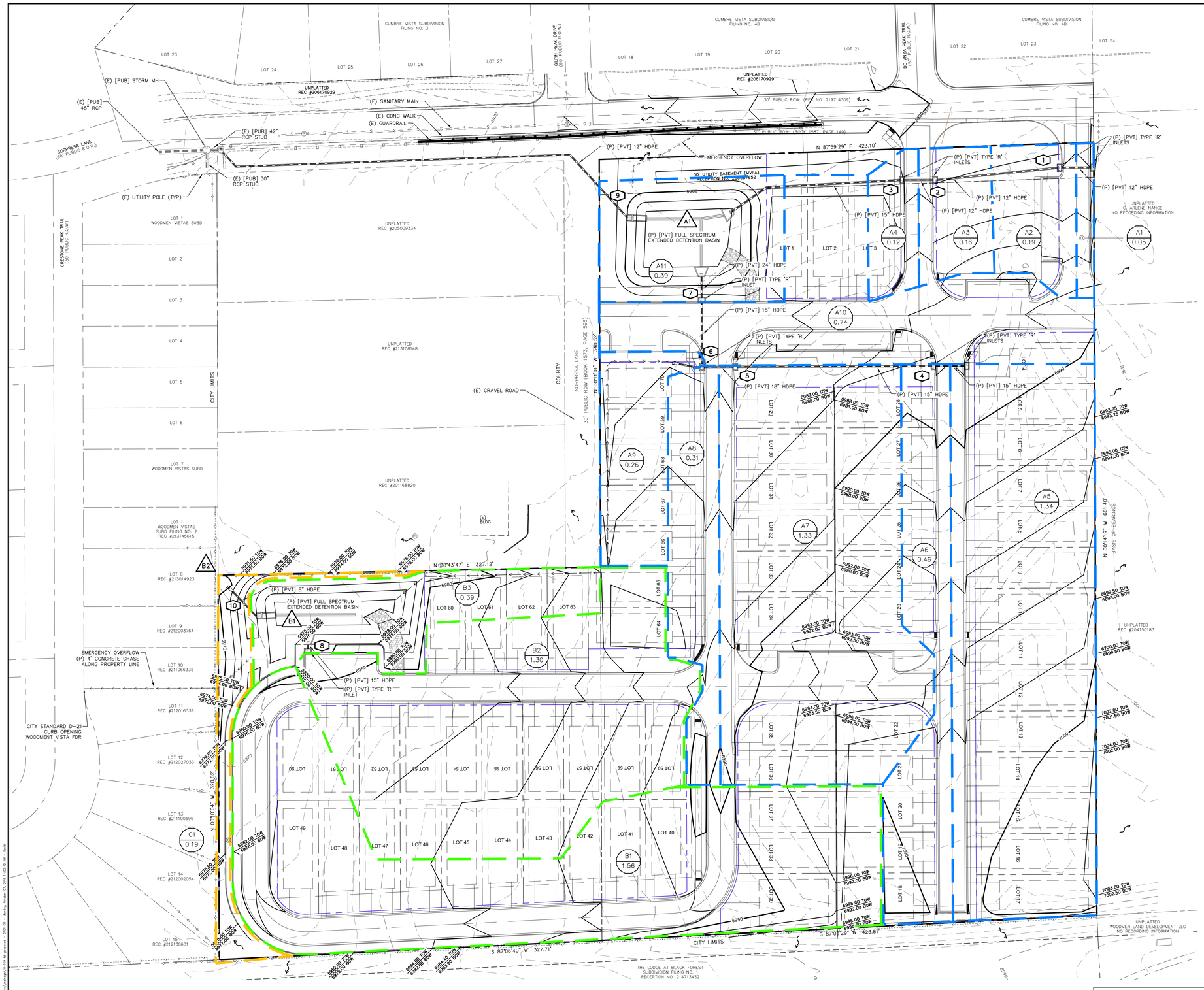
Matrix Design Group, Inc.
Integrated Design Solutions
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
Phone 719-575-0100
Fax 719-575-0208

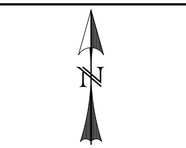
# WOODMEN VISTA FILING NO. 1 & 2

## FINAL DRAINAGE REPORT

## INTERIM DEVELOPED CONDITIONS DRAINAGE MAP

DESIGNED BY: ZDH
DRAWN BY: ZDH
CHECKED BY: GES
SCALE HORIZ: 1"=100' VERT: N/A
DATE ISSUED: JULY 2007
SHEET NO. 1 OF 2 SHEETS
DR01



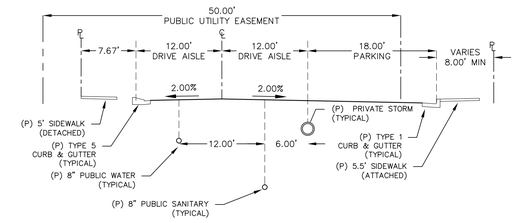




## PROPOSED DRAINAGE BASINS

| BASIN | AREA (ACRES) | Q2 (CFS) | Q5 (CFS) | Q10 (CFS) | Q25 (CFS) | Q50 (CFS) | Q100 (CFS) |
|---|---|---|---|---|---|---|---|
| A1 | 0.05 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 |
| A2 | 0.19 | 0.3 | 0.4 | 0.6 | 0.7 | 0.9 | 1.0 |
| A3 | 0.16 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 |
| A4 | 0.12 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 |
| A5 | 1.34 | 2.0 | 2.7 | 3.4 | 4.2 | 5.0 | 5.8 |
| A6 | 0.46 | 1.0 | 1.3 | 1.5 | 1.9 | 2.2 | 2.5 |
| A7 | 1.33 | 2.5 | 3.3 | 4.1 | 5.1 | 6.0 | 6.8 |
| A8 | 0.31 | 0.8 | 1.1 | 1.3 | 1.6 | 1.8 | 2.1 |
| A9 | 0.26 | 0.4 | 0.5 | 0.7 | 0.8 | 1.0 | 1.1 |
| A10 | 0.74 | 2.4 | 3.1 | 3.7 | 4.4 | 5.0 | 5.7 |
| B1 | 1.56 | 2.6 | 3.4 | 4.2 | 5.1 | 6.0 | 6.9 |
| B2 | 1.26 | 2.1 | 2.9 | 3.6 | 4.4 | 5.2 | 5.9 |
| B3 | 0.39 | 0.2 | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 |
| C1 | 0.19 | 0.0 | 0.1 | 0.2 | 0.4 | 0.5 | 0.6 |

## PROPOSED DESIGN POINTS

| DESIGN POINT | Q2 (CFS) | Q5 (CFS) | Q10 (CFS) | Q25 (CFS) | Q50 (CFS) | Q100 (CFS) |
|---|---|---|---|---|---|---|
| 1 | 0.5 | 0.7 | 0.9 | 1.1 | 1.2 | 1.5 |
| 2 | 0.6 | 0.8 | 1.0 | 1.3 | 1.6 | 1.9 |
| 3 | 0.8 | 1.1 | 1.4 | 1.8 | 2.1 | 2.5 |
| 4 | 2.9 | 3.8 | 4.8 | 5.9 | 6.9 | 8.0 |
| 5 | 5.1 | 6.8 | 8.4 | 10.4 | 12.2 | 14.0 |
| 6 | 6.0 | 8.1 | 10.0 | 12.3 | 14.5 | 16.6 |
| 7 | 7.9 | 10.5 | 12.9 | 15.7 | 18.3 | 21.1 |
| 8 | 4.3 | 5.7 | 7.1 | 8.8 | 10.3 | 11.9 |
| 9 | 0.1 | 0.1 | 1.1 | 3.6 | 5.2 | 5.4 |
| 10 | 0.1 | 0.1 | 1.3 | 3.4 | 3.4 | 3.5 |
| A1 | 8.0 | 10.7 | 13.3 | 16.4 | 19.2 | 22.1 |
| B1 | 4.5 | 6.1 | 7.6 | 9.5 | 11.2 | 13.0 |
| B2 | 0.1 | 0.2 | 1.5 | 3.8 | 3.9 | 4.1 |




**TYPICAL DRIVE AISLE**
N.T.S.

## LEGEND

| | |
|---|---|
| EXISTING | (E) |
| FUTURE | (F) |
| PROPOSED | (P) |
| CURB AND GUTTER | C&G |
| EASEMENT | ESMT |
| BOUNDARY | |
| RIGHT-OF-WAY | |
| LOT LINE | |
| EASEMENT | |
| SETBACK | |
| (E) CONTOUR, INDEX | 5970 |
| (E) CONTOUR | |
| (E) STORM SEWER, INLET, MH | |
| (P) CONTOUR, INDEX | 5970 |
| (P) CONTOUR | |
| (P) FENCE | |
| (P) STORM SEWER, INLET, MH | |
| BASIN BOUNDARY | |

PREPARED FOR:
CHALLENGER HOMES
8605 EXPLORER DRIVE
#250
COLORADO SPRINGS, CO 80920
(719) 598-5192

CATAMOUNT ENGINEERING
321 W. HENRIETTA AVE
PO BOX 221
WOODLAND PARK, CO 80866
(719)426-2124

SOPRESSA EAST ADDITION FILING NO. 1

PROPOSED DRAINAGE CONDITIONS

| CHECKED BY: DLM | DRAWN BY: DBM |
|---|---|
| SCALE: 1"=40' | DATE: 10/01/19 |
| JOB NUMBER | SHEET |
| 18-169 | 1 OF 1 |