PCD-ENGINEERING REVIEW COMMENTS
IN BLUE BOXES WITH BLUE TEXT

Engineering Review
03/18/2021 3:31:40 PM
dsdrice
JeffRice@elpasoco.com
(719) 520-7877
EPC Planning & Community
Development Department

FALCON FIELD
PRELIMINARY DRAINAGE REPORT
EL PASO COUNTY, COLORADO

January 2021

PREPARED FOR:

Falcon Field, LLC
3230 Electra Dr
Colorado Springs, CO 80906

PREPARED BY:

Dakota Springs Engineering
31 N. Tejon Street, Suite 514
Colorado Springs, CO 80903
719.227.7388

Please add PCD File No.
SP21-001

CERTIFICATIONS

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

_____
Charles K. Cothern, P.E. 24997

Owner/Developer's Statement:
I, the owner/developer have read and will comply with all the requirements specified in this drainage report and plan.

By (signature): _____ Date: _____

Title: _____

Address: _____

_____

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

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

Table of Contents

List of Figures

Appendix

Per the County GIS it appears that the site is located within the Falcon (CHWS1400) drainage basin. Please revise.

GENERAL LOCATION & DESCRIPTION

The Commons at Falcon Field is approximately 57.7 acres of proposed commercial development. The site will include the construction of 3 public roads, 10 commercial lots and 4 tracts. The project is bounded by Highway 24 along the northwest, open space to the west, school to the south and residential development to the east and northeast. The project is in the east half of Section 7, Township 13 South, Range 64 West of the 6th PM. Tax ID numbers are 4307000001 & 4307200015

The Commons at Falcon Field development site is located within the Jimmy Camp Creek Drainage Basin (FOFO2000).

Design, phasing, responsibility for and maintenance of any proposed improvements will be discussed in the final drainage report(s) ad development of the site proceeds. Fees will be assessed and paid according to the current rates at the time of platting for each filing. All easements for utilities and drainage features will be provided with the final plat process.

Description of Property

The project site is 57.7 acres of vegetation, consisting of short grasses and weeds. The slopes in the site are between 0 and 9%.

The site is composed of two soil types. From the NRCS report in Appendix A, the site falls into the following soil type:

8 – Blaketon loamy sand (1-9%) – Type A Soil
19 – Columbine gravelly sandy loam (0-3%) – Type A Soil

Type A soil is defined by: 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.

All runoff computations for this report are based on soil type A.

Climate

The climate of the site is typical of a sub-humid to semiarid climate with mild summers and winters. The average temperature is 31 degrees F in the winter and 68.4 degrees in the summer. Total annual precipitation is 15.21 inches.

Floodplain Statement

The Flood Insurance Rate Maps (FIRM No. 08041C0553-G & 08041C0561-G both dated 12/7/18) indicates that there are no designated regulatory floodplains in the vicinity of the proposed site. There is a Zone A area that covers the "Falcon Creek East Tributary" that bisects the site. This reach of the channel is the subject of a FEMA floodplain study being completed by others.

Utilities & Other Encumbrances

The site is currently open grass land with one single family residence and barn. The residence is supported by a well and individual septic system. There are no known utilities on site.

DRAINAGE DESIGN CRITERIA

Development Criteria Reference

Resolution No. 15-042, Adoption for portions of the City of Colorado Springs Drainage Criteria Manual (DCM), El Paso County Engineering Criteria Manual (ECM) and Urban Storm Drainage Criteria Manual (USDCM) by Mile High Flood District, (MHFD) was used in preparation of this report. Additional preliminary and final drainage plans, master development drainage plans, and drainage basin planning studies used in the preparation of the report are listed in the References Section.

Hydrologic Criteria

Rational Method

The rational method was used to determine onsite flows, as required by the current City of Colorado Springs Drainage Criteria Manual (DCM). Both the 5-year and 100-year storm events were considered in this analysis. Runoff coefficients appropriate to the existing and proposed land uses were selected for an SCS hydrologic soul group "A" soil from Table 6-6 of the DCM. The time of concentration was calculated per DCM requirements. Rational Method results are shown in the Appendix B & C. MHFD spreadsheets were used to develop preliminary sizing the detention and water quality pond facilities.

Storm Sewer Design

Storm Sewer systems will be designed to accommodate the 100-year storm and checked for the 5-year storm. Inlets will be placed where street flows exceed allowable street capacity. The MHFD Inlet spreadsheet is used to determine the size of all on-grade and sump inlets. Onsite developed flow captured by the storm system will be conveyed to one of the four proposed full spectrum detention/water quality facilities. Final design of these facilities will be included in the Final Drainage Report(s) for the development.

Detention Storage Criteria

This report addresses the preliminary design stage of the 4 detention/water quality facilities within the proposed development. Water quality requirements were determined from the MHFD Volume 3 spreadsheet for an Extended Detention Basin. All facilities will provide full spectrum detention.

Preliminary storage volumes and outflows have been calculated for all detention facilities. A copy of these designs has been included in the appendix. Final calculations for these facilities will be completed at the time of final plat(s).

Waivers

drainage

No variances or waivers are being requested for this development.

DRAINAGE BASINS

Please address/discuss runoff from Hwy 24 that may be entering the site. Any flows from Hwy 24 should be accounted for in your analysis.

Offsite Basins

There is one off site basin contributing flows to the site. Runoff from the basin enters the site at the most northerly corner through a box culvert under highway 24. A majority of the flow entering the site through the box culver is from Detention Pond No. 4 located in Tract A Woodman Hills Filing No. 7. The outlet structure currently consists of three 36-inch CMP pipes with CMP risers. Wilson & Company

Please indicate the three alternatives.

completed Stormwater Assessment for Pond 4 to analyze and propose improved outlet facilities for the pond. The study proposed three alternatives. None of the alternatives have been implemented. This report also speaks to "Current Apparent Issues Downstream of U.S Highway 24. These issues will be discussed later in this report. Peak outflow rates for Pond 4 are summarized as follows and compares the Wilson report and the Woodman Hills Filing No. 7 Final Drainage Report (WH7-FDR). Flows are in CFS,

Event	Wilson	WH7-FDR
2yr	30	11
5yr	55	34
100yr	182	270

In general, please also provide discussion of the Falcon DBPS. Please discuss the problems/issues identified for this site and discuss the solutions indicated in the DBPS.

The issues do not appear to have been discussed. Please provide.

Existing Drainage Analysis

Historic drainage patterns and quantities were determined by analyzing runoff quantities and patterns for the site in its current conditions. The site was divided into 9 basins for this analysis.

- Basin E-1 (2.16 acres) (Q_5 = 0.61 cfs & Q_{100} = 3.42 cfs) is the easterly most basin. It is bounded on the North by Rio Lane. The southerly half of Rio Lane drains through this basing in the form of sheet flow. Runoff from this basin leaves the site to the Southeast as sheet flow.

- Basin E-2 (8.06 acres) (Q_5 = 1.92 cfs & Q_{100} = 10.81 cfs) is located west of Basin E-1. It is bounded on the North by Rio Lane. The southerly half of Rio Lane drains through this basing in the form of sheet flow. A portion of the existing home and driveway lie in this basin. Runoff from this basin travels as sheet flow to the southeast conce[illegible] along the easterly boundary of the site. The swale exits the [illegible] running westerly in the northly side of Pinto Pony Rd.

There appears to be runoff from the property to the north that enters this basin. Please be sure to account for it in your design. See comment in the existing drainage plan

- Basin E-3 (7.46 acres) (Q_5 = 2.87 cfs & Q_{100} = 12.54 cfs) i[illegible] basin has the remainder of the exiting home together with [illegible] basin travels southeasterly as sheet flow. Runoff from this basin leaves the site as sheet flow.

- Basin E-4 (13.89 acres) (Q_5 = 2.90 cfs & Q_{100} = 19.48 cfs) is located to west of Basin E-3. This basin is bounded on the north by Rio Lane and on the northwest by State Highway 24. This basin contains a major unimproved channel that runs from north to south through the basin. Flows in this channel come from the box culvert under Highway 24. Flows entering the site from the box culvert are 34 cfs for the 5-year event and 270 cfs for the 100-year event. All runoff from within this basin travels as sheet flow to the channel. All runoff from this basin leaves the site to the south in the existing channel.

- Basin E-5 (13.41 acres) (Q_5 = 2.60 cfs & Q_{100} = 17.44 cfs) is located to the southwest of basin E-4. The basin is bounded on the west by basins E-6 & E-9. No runoff from these basins enters this basin. Runoff from this basin leaves site to the south as mildly concentrated flow.

Address the spring on the north side of proposed Lot 6.

- Basin E-6 (8.09 acres) (Q_5 = 1.95 cfs & Q_{100} = 13.08 cfs) is located to the west of Basin E-5. It is bounded on the west by Basins E-7 & E-8. The basin slopes to the south. Runoff from this basin leaves the site as sheet flow.

- Basin E-7 (0.55 acres) (Q_5 = 0.18 cfs & Q_{100} = 1.19 cfs) is located to the west of Basin E-6 and south of Basin E-8. Runoff from this basin leaves the site to the south as sheet flow.

- Basin E-8 (0.40 acres) (Q_5 = 0.15 cfs & Q_{100} = 1.00 cfs) is located to the west of basins E-6 & E-7. Runoff from this basin leaves the site to the west as sheet flow.

- Basin E-9 (5.07 acres) (Q_5 = 1.18 cfs & Q_{100} = 7.90 cfs) is located along the westerly boundary of the site. It is bounded on the north and east by basin E-5 and on the south by basin E-6. Runoff leaves this basin to the west as mildly concentrated flow.

Design Points

- There were no design points identified

Not all runoff from the site is sheet flow. Regardless of sheet flow or concentrated flow, design points should be provided in the appropriate locations indicating the "Q" for the minor and major storm events. Please provide the appropriate design points in your report and drainage plan.

Proposed Drainage Analysis

The site is being developed as a commercial project. Proposed zoning is Commercial Regional (CR). No maximum lot coverage is specified in the Land Development code. Maximum lot coverage is then limited by setbacks, landscaping and parking requirements. Several Allowed Uses in the CR district are subject to Specific Use Standards. Runoff computations for the developed condition reflect the high imperviousness associated with commercial developments. Thirty percent (30%) lot coverage by a building was assumed for purposes of calculating runoff for the development. As each pad site is developed the drainage from the developed pad will need to be conveyed to the facilities presented in this report. Individual pad sites may need to construct storm water facilities, inlets & pipes to convey the runoff to the appropriate outfall. Once to the outfall the runoff will be conveyed to the extended detention basin by the facilities identified in this report. The extended detention facilities identified in this report will provide water quality and detention of the individual pad sites.

The proposed development consists of 14 developed basins. The developed basins include the adjacent roadways that contribute runoff to the site. The runoff from the site will be collected via curb & gutter, inlets and pipes and conveyed to one of extended detention basins “EDB’s”. The ponds will then release into the existing drainage channel that bisects the site or to other suitable outfall locations.

- Basin D-1 (8.26 acres) (Q_5 = 24.16 cfs & Q_{100} = 47.06 cfs) is the most northeasterly developed basin. The southerly half of the existing Rio Lane R-O-W adjacent to the basin is included. This basin contains proposed lots 6, 7, 8, and a portion of lot 5. The northerly half of the Retail Street R-O-W is also included in the basin. Runoff from this basin will be directed to the easterly end of Retail Street and collected in a storm sewer. The collected runoff from this basin will be conveyed to Extended Detention Basin B.

Please discuss the suitable outfall locations of each of the ponds. Is the downstream adequate to handle this developments runoff? Discuss any downstream improvements needed.

It appears there is a typo on the 5yr flow. Revise accordingly.

- Basin D-2 (7.58 acres) (Q_5 = 220.27 cfs & Q_{100} = 39.37 cfs) lies to the south of basin D-1. The basin contains portions of lots 4 & 5 and all of lots 1, 2 & 3. A portion of the Retail Street R-O-W is also included in the basin. Runoff will be directed to Extended Detention Basin B by overland flow and private storm sewer system(s) to be designed as the lots are developed.

- Basin D-3 (1.22 acres) (Q_5 = 3.00 cfs & Q_{100} = 6.16 cfs) is located to the south of basin D-2. The basin contains portions of lots 4 & 5 and Extended Detention Basin A. Extended Detention Basin A will be located in an appropriately sized easement. Runoff from this basin will be directed to Extended Detention Basin A by sheet flow and private storm sewer system(s) to be designed as the lots are developed.

Per the contours shown, the portions of lots 4 & 5 are conveyed to EDB-A. It appears that this portion of the basin should be split into its own basin. Revise accordingly.

- Basin D-4 (1.13 acres) (Q_5 = 3.87 cfs & Q_{100} = 7.55 cfs) is to the East of the existing channel that bisects the site and south of Highway 24. The basin is bounded on the East and South of Rio Lane. The basin contains proposed lot 11. Runoff from this basin will be conveyed to the proposed Rio Lane R-O-W. Runoff from this basin will be conveyed to Extended Detention Basin B.

Per the contours shown, the runoff appears to go to the channel. Revise accordingly.

- Basin D-5 (1.54 acres) (Q_5 = 5.54 cfs & Q_{100} = 10.76 cfs) is located to the west of basin D-1. The basin is bounded on the west by the proposed new alignment of Rio Lane and on the south by Retail Street. The basin contains proposed lots 9 & 10 and a portion of lot 8. The southerly half of the existing Rio Lane R-O-W adjacent to the basin is also included. Runoff from this basin will be directed to a low point in Retail Street to be located just to the east of new Rio Lane. Runoff from this basin will be conveyed to Extended Detention Basin B.

- Basin D-6 (0.84 acres) (Q_5 = 5.54 cfs & Q_{100} = 10.76 cfs) is the R-O-W of the proposed new Rio Lane alignment. Runoff from the street will travel as street flow to the south to the intersection with Retail Street. Then to the East as street flow to the low point in Retail Street. Runoff from this basin will be conveyed to Extended Detention Basin B.

- Basin D-7 (7.76 acres) (Q_5 = 27.56 cfs & Q_{100} = 53.68 cfs) is Located to the East of Woodman Rd., South of Highway 24 and West of the existing channel that bisects the site. The basin is bounded on the South by proposed Retail Street. The basin contains lots 12 through 16. A small portion of the southerly R-O-W of Highway 24 is included in this basin. Runoff from this basin will be directed to south easterly corner of the basin by sheet flow and private storm sewer system(s) to be designed as the lots are developed. Runoff from this basin will be conveyed to Extended Detention Basin C.

- Basin D-8 (1.67 acres) (Q_5 = 4.85 cfs & Q_{100} = 9.71 cfs) is the northeast half of Retail Street and the East half of Woodman Road. Runoff is directed to the low point in Retail Street located to the east of the channel. Runoff from this basin will be conveyed to Extended Detention Basin B.

- Basin D-9 (0.78 acres) (Q_5 = 2.17 cfs & Q_{100} = 4.34 cfs) is the Southeasterly half of the Retail Street R-O-W. Runoff is directed to the low point in. Retail Street located to the east of the channel. Runoff from this basin will be conveyed to Extended Detention Basin B.

- Basin D-10 (1.77) (Q_5 = 0.62 cfs & Q_{100} = 4.18 cfs) is located in the south center of the site. It is bounded on the Northwest by the proposed Retail Street and in the east by the existing channel

that bisects the site. This basin contains Tract B and is the location of Extended Detention Basin C.

- Basin D-11 (4.39 acres) (Q_5 = 14.49 cfs & Q_{100} = 28.23 cfs) is located to the northwest of Woodman Rd and to the Northeast of proposed Retail Street. It is bounded on North by Highway 24 The basin contains proposed lots 17, 18 & 19. Runoff from this basin will be directed to the east to the south center of the site. Runoff in the basin will be conveyed by sheet flow and private storm sewer system(s) to be designed as the lots are developed. Runoff from this basin will be conveyed to extended Detention Basin C.

- Basin D-12 (1.35 acres) (Q_5 = 4.14 cfs & Q_{100} = 8.28 cfs) is the northeast half of proposed Retail Street and the Southwesterly portion of Woodman Road. Runoff from this basin will be conveyed as street flow to a low point located at the westerly area of the proposed traffic circle. Runoff from this basin will be conveyed to Extended Detention Basin C.

- Basin D-13 (13.73) (Q_5 = 35.05 cfs & Q_{100} = 71.54 cfs) is the basin that takes up most of the southerly leg of the development. It is bounded on the North by proposed Retail Street, on the East by the extension of Woodman Road and on the South by the extension of Pinto Pony Rd. The basin contains lot 20. Runoff from this basin will be conveyed to the Southeast by sheet flow and private storm sewer system(s) to be designed as the lot is developed. Extended Detention Basin D will be in the Southeasterly corner of the basin.

- Basin D-14 (2.20 acres) (Q_5 = 6.39 cfs & Q_{100} = 12.26 cfs) includes the Southerly half of Retail Street, the Westerly half of extended Woodman Rd and the Northerly half of extended Pinto Pony Rd. Runoff from this basin will be conveyed as street flow to the intersection of Woodman Rd and Pinto Pony Rd. Runoff from this basin will be conveyed to Extended Detention Basin D.

- Basin D-15 (1.59 acres) (Q_5 = 5.23 cfs & Q_{100} = 10.04 cfs) includes the Easterly half of Extended Woodman Rd and the Southerly Half of Extended Pinto Pony Rod. Runoff from this basin will be conveyed as street flow to the intersection of Woodman Rd and Pinto Pony Rd. Runoff from this basin will be conveyed to Extended Detention Basin D.

The flows shown do not match what is on the table on the proposed drainage map. Revise accordingly. Also, is DP B intended to be the outfall location of the pond? if so then please include that information in the text.

Basin A has not been identified on the plan. Revise accordingly.

Design Points

- Design Point A (Q_5=24.16, Q_{100}=47.06) consists of flow from Basin D-1. A storm inlet will be located at this design point to capture the runoff from proposed Retail Street. The remainder of the runoff reaching this design point will come from facilities constructed within Basin A. Runoff reaching this deign point will be conveyed to Extended Detention Basin B. by a 36" RCP.

- Design Point B (Q_5=7.58, Q_{100}=20.27) consists of flow from Basin D-2. Flows reaching this design point will be conveyed through the tributary basin via sheet flow and private storm sewer system(s). Flows will be conveyed to Extended Detention Basin B.

- Design Point C (Q_5=3.00, Q_{100}=6.16) consists of flow from Basin D-3. Flows reaching this design point will be conveyed through the tributary basin via sheet flow and private storm sewer system(s). Flows will be conveyed to Extended Detention Basin A.

Please see comment on Basin D-2 and adjust accordingly. Also, please state if DP C is intended to be the outfall of EDB-A

Basin D-8 above indicates that it will flow to this design point. Please include basin D-8 flow and revise accordingly

- Design Point D (Q_5=18.82, Q_{100}=35.70) consists of flow from Basin D-4, 5 &6. Design point D is located at a low point in proposed Retail Street. An Sump inlet will be constructed to capture the flow from basins 5 & 6. Flows from basin 5 will be conveyed to this design point be onsite storm sewer. Runoff from this design point will be conveyed to Extended Detention Basin B by a 27" RCP to design Point E, then to the basin.

- Design Point E (Q_5=0.78, Q_{100}=2.17) consists of flow from Basin D-9 and Design Point D. A sump inlet will be installed on the South side of proposed Retail Street intercept the street flow. The intercepted flow together with the pipe flow from Design Point D will be conveyed to Extended Detention Basin B by a 30" RCP.

- Design Point F (Q_5=27.56, Q_{100}=53.68) consists of flow from Basins D-7. Runoff reaching this design point will be conveyed by sheet flow and onsite storm sewer(s). Runoff reaching this deign point will be conveyed to Extended Detention Basin C by a 36" RCP that will cross under Proposed Retail Street.

- Design Point G (Q_5=0.62, Q_{100}=4.18) consists of flow from Basin D-10. Runoff will sheet flow into Extended Detention Basin C.

It appears that DP G should include the flow from DP-F. Also state if this design point is the outfall of EDB-C

- Design Point H (Q_5=17.92, Q_{100}=35.12) combines flow from Basins D-11 and D-12 at the Woodman Rd and Retail Street in the traffic circle. A sump inlet will be constructed to intercept the street flows. The basin 11 flows will reach the location by sheet flow and on-site storm sewers. Runoff reaching this design point will be conveyed to Extended Detention Basin C by a 30" RCP which will cross under the traffic circle to the east.

- Design Point I (Q_5=13.73, Q_{100}=35.05) consists of flow from Basin D-13. Runoff will reach this deign point via sheet flow and onsite storm sewer(s). This design point is located at Extended Detention Basin D.

- Design Point J (Q_5=6.39, Q_{100}=12.26) consists of flow from Basin D-14 and DP-K. Runoff from this basin will be intercepted by on grade inlets and conveyed to Extended Detention Basin D by a 24" RCP.

- Design Point K (Q_5=5.23, Q_{100}=10.04) consists of flow from Basin D-15. Runoff from this basin will be intercepted by on grade inlets and conveyed to Extended Detention Basin D by a 18" RCP through DP-J.

DRAINAGE FACILITY DESIGN

General Concept

Falcon Field is located in the Falcon Drainage Basin. How development of the individual lots in the project is unknown at the writing of this report. Storm sewers are proposed to extend into the low point of a basin at an identified design point. When development in a particular basin occurs runoff will need to be directed to the stubbed storm sewer. Systems intercepting street flows and conveying basin runoff have been identified in this report. Street systems consist of on grade and sump inlets.

Storm Sewer System

All development is anticipated to be urban and will [illegible] collect storm water runoff and convey the runoff t[illegible] outfalls.

Final Plat submittals will include details concernin[illegible] part of the Final Drainage Report for each submitta[illegible]

Please indicate what improvements are indicated in the Falcon DPBS. How does your proposed improvements compare to what is indicated in the DBPS? Does it match what is recommended in the DBPS? Please address. Additionally, discuss the estimated cost of the improvements and how that compares to the costs listed in the DPBS. Please address whether the developer will be seeking reimbursement for the channel improvements. Address estimated drainage basin fees and any potential dainage fee offsets/credits in general.

Existing Channel Improvements

The existing channel will be realigned and shaped as a part of the development of this site. Preliminary sizing is a 20-foot bottom width with 3:1 side slopes. The 100-yr flow from the Woodman Hills Filing No. 7 Drainage Report (270 cfs) results in a flow depth of 1.63 feet and a Froude Number of 0.92 for the proposed channel section. The channel will have a longitudinal slope (0.05%) that results in a non-erosive flow velocity in the 100-year event. The channel will have riffle drops to facilitate the design grade and the total drop of the channel through the site. Channel side slopes will be lined as appropriate to provide stability and prevent erosion.

Detention / Water Quality Ponds

Discuss temporary sediment basins.

There are four (4) proposed water quality/detention ponds on site that will provide water quality for the proposed improvements. The proposed facilities are Full Spectrum Extended Detention Basins (EDB). Flows will pass through the outlet structures of one of the four proposed ponds regulating release rates to at or below historic levels. There are no existing storm drainage systems on the site except the natural drainage channel that bisects the site. The four water quality / extended detention basins have been sized using the MHFD pond spreadsheet. The ponds will have appropriate design elements including, forebays, trickle channels, micropools, outlet structures, 4:1 side slopes, maintenance access and overflow spillways. The computations for each pond are contained in the appendix. Complete design details for the ponds will be included in the Final Drainage Report for the development. A geotechnical investigation may be required for the design of pond elements including embankments.

The WQCV is treated through four proposed extended detention basins, Ponds A-D. There is a major drainageway bisecting the site that will need to be stabilized. Some site-specific source control BMPs that will be implemented include, but are not limited to, silt fencing placed around downstream areas of disturbance, construction vehicle tracking pads at the entrances, designated concrete truck washout basin, designated vehicle fueling areas, covered storage areas, spill containment and control, etc.

Four Step Process

Revise section to represent the Four-Step Process outline in the EPC ECM Section I.7.2. Steps 2 & 3 should switched and Step 4 should be revised.

In accordance with the El Paso County Engineering Criteria Manual, Appendix I, this site has implemented the four-step process to minimize adverse impacts of urbanization and helps with the management of smaller, frequently occurring events. The four step process includes reducing runoff volumes, treating and slowly releasing the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls.

Please discuss how the impervious areas of the site will be minimized.

Reduce Runoff

To reduce runoff volume, the new impervious areas for the development will be minimized. Existing features will be preserved as all the offsite basins which are undeveloped open space will continue to be

so, and runoff from developable areas will be conveyed to common ponds handle detention and water quality needs. Existing drainage paths have been maintained as much as possible to also help reduce overall impacts from the site.

Treat & Release WQCV

The WQCV is treated through 4 separate extended detention basins. The outlet structures for the ponds have been designed according to the FSD spreadsheet by MHFD to ensure the release times of the facilities meet requirements.

Stabilize Stream Channels

There is one major drainageway bisecting the site that will require stabilization. Downstream of the project, the channel will continue in its unimproved natural state. Runoff exiting this development will remain as close to existing levels as possible. Channel stabilization will assure that the downstream facility is not adversely impacted by the upstream channelization. Therefore, those downstream channel/facilities would also, not see any increase or adverse effects to their functionality.

Implement Source Controls

Some site-specific source control BMPs that will be implemented include, but are not limited to, silt fencing placed around downstream areas of disturbance, construction vehicle tracking pads at the entrances, sediment ponds, designated concrete truck washout basin, designated vehicle fueling areas, covered storage areas, spill containment and control, etc. Based on site specific development there may be site/use specific source control facilities.

Maintenance

The water quality extended detention basins will be maintained by Falcon Field Metropolitan District. Facilities located within the project boundary will be private facilities and will also be maintained by Falcon Field Metropolitan District. All facilities located outside of the project boundary and within public right-of-way, will be maintained by the county. A BMP maintenance agreement and easement will be provided for the ponds, as well as an Operations and Maintenance manual.

All easements will be provided as part of the Final Plat process or by separate instrument as appropriate.

SUMMARY

Development within the site is to be commercial pad sites with internal roads. The proposed storm sewer(s) will connect to the new water quality facilities, allowing flow rates to continue as they currently are.

Make a statement regarding the design causing no adverse impacts to downstream properties. Address downstream conveyances.

REFERENCE MATERIALS

1. "City of Colorado Springs Drainage Criteria Manual, Volume 1" May 2014.
2. "City of Colorado Springs Drainage Criteria Manual, Volume 2" May 2014.
3. Pond 4 of the Falcon Area Stormwater Assessment, March 2011, Wilson & Company, Inc.
4. Soils Survey of El Paso County Area, Natural Resources Conservation Services of Colorado.
5. Flood Insurance Rate Maps for El Paso County, Colorado and Incorporated Areas. Federal Emergency Management Agency, December 7, 2018
6. "Engineering Criteria Manual El Paso County" January 9, 2006, Revised December 2016.
7. "Urban Storm Drainage Criteria Manual, Volume 1: Management, Hydrology & Hydraulics" Original September 1969, Updated January 2016.
8. "Urban Storm Drainage Criteria Manual, Volume 2: Structures, Storage & Recreation" Original September 1969, Updated January 2016.
9. "Urban Storm Drainage Criteria Manual, Volume 3: Stormwater Quality" Original September 1992, Updated November 2010.
10. "Falcon DBPS" December 2005. Matrix Design Group

Add EPC DCM Update

Correct the highlighted dates for latest revisions.

Figure 1: Vicinity Map

Please provide the title pages for the appendix and figures in the appropriate location in the report.

Appendix A: NRCS Soil Report

Appendix B: Flood Hazard Map

Appendix C: Existing Hydrology Calculations

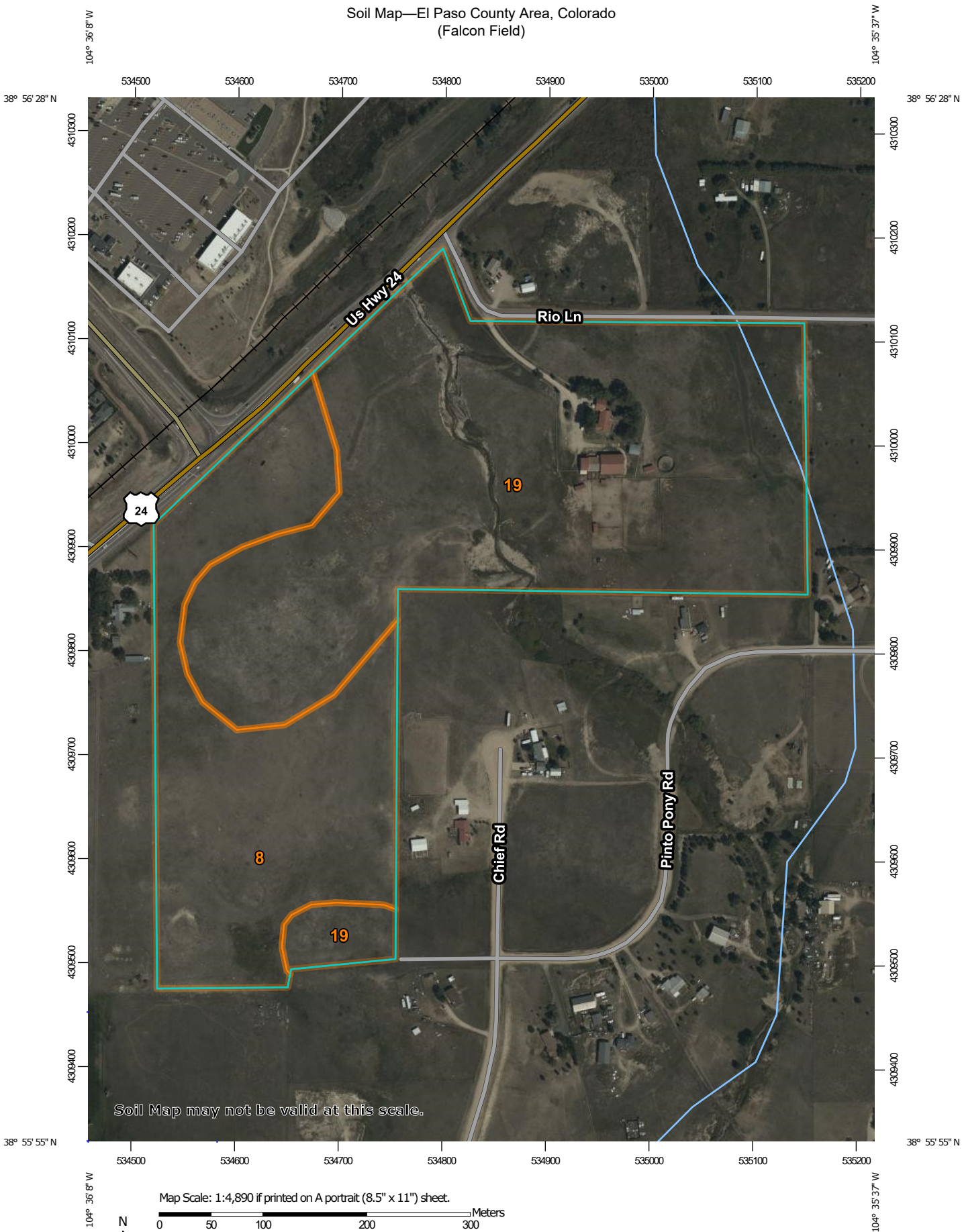
Appendix D: Proposed Hydrology Calculations

Appendix E: Proposed Facilities Calculations

Figure 2: Existing Drainage Map

Figure 3: Proposed Drainage Map

Soil Map—El Paso County Area, Colorado
(Falcon Field)



Map Scale: 1:4,890 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 18, Jun 5, 2020

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

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 2018

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	19.3	33.3%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	38.6	66.7%
Totals for Area of Interest		**57.8**	**100.0%**

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Pleasant
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Other soils
Percent of map unit: 1 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 18, Jun 5, 2020

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Columbine

Setting

Landform: Fans, flood plains, fan terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB215CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit: 1 percent

Landform: Depressions
Hydric soil rating: Yes

Other soils
Percent of map unit: 1 percent
Hydric soil rating: No

Fluvaquentic haplaquolls
Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 18, Jun 5, 2020

National Flood Hazard Layer FIRMette

FEMA

104°36'14"W 38°56'28"N

104°35'36"W 38°56'N

Feet

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

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
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- 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 8/24/2020 at 11:22 AM 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.

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

Weighted Imperviousness Calculations

SUB-BASIN	AREA (SF)	AREA (Acres)	ROOF AREA	ROOF IMPERVIOUSNESS	ROOF C2	ROOF C5	ROOF C10	ROOF C100	PASTURE AREA	PASTURE IMPERVIOUSNESS	LANDSCAPE C2	LANDSCAPE C5	LANDSCAPE C10	LANDSCAPE C100	PAVEMENT AREA	PAVEMENT IMPERVIOUSNESS	PAVEMENT C2	PAVEMENT C5	PAVEMENT C10	PAVEMENT C100	WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS C2	WEIGHTED COEFFICIENTS C5	WEIGHTED COEFFICIENTS C10	WEIGHTED COEFFICIENTS C100
E-1	94,264	2.16	0	90%	0.71	0.73	0.75	0.81	91,564	0%	0.02	0.09	0.15	0.36	2,700	100%	0.89	0.90	0.92	0.96	2.9%	0.04	0.11	0.17	0.38
E-2	351,247	8.06	2,253	90%	0.71	0.73	0.75	0.81	341,194	0%	0.02	0.09	0.15	0.36	7,800	100%	0.89	0.90	0.92	0.96	2.8%	0.04	0.11	0.17	0.38
E-3	324,969	7.46	11,058	90%	0.71	0.73	0.75	0.81	295,587	0%	0.02	0.09	0.15	0.36	18,324	100%	0.89	0.90	0.92	0.96	8.7%	0.09	0.16	0.21	0.41
E-4	604,916	13.89	0	90%	0.71	0.73	0.75	0.81	604,916	0%	0.02	0.09	0.15	0.36	0	100%	0.89	0.90	0.92	0.96	0.0%	0.02	0.09	0.15	0.36
E-5	584,122	13.41	0	90%	0.71	0.73	0.75	0.81	584,122	0%	0.02	0.09	0.15	0.36	0	100%	0.89	0.90	0.92	0.96	0.0%	0.02	0.09	0.15	0.36
E-6	352,525	8.09	0	90%	0.71	0.73	0.75	0.81	352,525	0%	0.02	0.09	0.15	0.36	0	100%	0.89	0.90	0.92	0.96	0.0%	0.02	0.09	0.15	0.36
E-7	23,808	0.55	0	90%	0.71	0.73	0.75	0.81	23,808	0%	0.02	0.09	0.15	0.36	0	100%	0.89	0.90	0.92	0.96	0.0%	0.02	0.09	0.15	0.36
E-8	17,466	0.40	0	90%	0.71	0.73	0.75	0.81	17,466	0%	0.02	0.09	0.15	0.36	0	100%	0.89	0.90	0.92	0.96	0.0%	0.02	0.09	0.15	0.36
E-9	220,884	5.07	0	90%	0.71	0.73	0.75	0.81	220,884	0%	0.02	0.09	0.15	0.36	0	100%	0.89	0.90	0.92	0.96	0.0%	0.02	0.09	0.15	0.36
TOTAL	2,574,201	59.10	13,311	90%	0.71	0.73	0.75	0.81	2,532,066	0%	0.02	0.09	0.15	0.36	28,824	0%	0.89	0.90	0.92	0.96	0.5%	0.03	0.10	0.16	0.37

Please identify the design points on the existing drainage plan

Falcon Field
Existing Runoff Calculations
Time of Concentration

Watercourse Coefficient

					Forest & Meadow	2.50	Short Grass Pasture & Lawns	7.00			Grassed Waterway	15.00				
					Fallow or Cultivation	5.00	Nearly Bare Ground	10.00			Paved Area & Shallow Gutter	20.00				
	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)			FINAL T(c)
DESIGN POINT	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	min.
A	E-1	94,264	2.16	0.11	200	1.7%	21.4	453	1.7%	7.00	0.9	8.3	29.7	653	13.6	29.7
B	E-2	351,247	8.06	0.11	200	1.8%	21.0	964	1.8%	7.00	0.9	17.1	38.1	1164	16.5	38.1
C	E-3	324,969	7.46	0.16	200	2.0%	19.4	670	2.0%	7.00	1.0	11.3	30.7	870	14.8	30.7
D	E-4	604,916	13.89	0.09	200	2.4%	19.5	901	2.4%	7.00	1.1	13.8	33.3	1101	16.1	33.3
E	E-5	584,122	13.41	0.09	200	3.3%	17.6	1505	3.3%	7.00	1.3	19.7	37.3	1705	19.5	37.3
F	E-6	352,525	8.09	0.09	200	2.0%	20.8	534	5.2%	7.00	1.6	5.6	26.4	734	14.1	26.4
G	E-7	23,808	0.55	0.09	200	6.5%	14.0	42	11.9%	7.00	2.4	0.3	14.3	242	11.3	14.3
H	E-8	17,466	0.40	0.09	90	5.6%	9.9	0	0.0%	7.00	0.0	0.0	9.9	90	10.5	9.9
I	E-9	220,884	5.07	0.09	200	2.5%	19.3	630	2.9%	7.00	1.2	8.8	28.1	830	14.6	28.1

Falcon Field
Existing Runoff Calculations ***Design Storm*** ***5 Year***
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
A	E-1	2.16	0.11	29.7	0.24	2.50	0.61					easterly most basin. It is bounded on the North by Rio Lane.
B	E-2	8.06	0.11	38.1	0.90	2.12	1.92					Located west of Basin E-1. It is bounded on the North by Rio Lane. A portion of the existing home and driveway lie in this basin.
	E-3	7.46	0.16	30.7	1.17	2.45	2.87					Located to the west of basin E-2. This basin has the remainder of the exiting home together with all the outbuildings.
	E-4	13.89	0.09	33.3	1.25	2.32	2.90					Located to west of Basin E-3. This basin is bounded on the north by Rio Lane and on the northwest by State Highway 24.
	E-5	13.41	0.09	37.3	1.21	2.15	2.60					Located to the southwest of basin E-4. The basin is bounded on the west by basins E-6 & E-9.
	E-6	8.09	0.09	26.4	0.73	2.67	1.95					Located to the west of Basin E-5. It is bounded on the west by Basins E-7 & E-8
	E-7	0.55	0.09	14.3	0.05	3.59	0.18					Located to the west of Basin E-6 and south of Basin E-8.
	E-8	0.40	0.09	9.9	0.04	4.14	0.15					Located to the west of basins E-6 & E-7.
	E-9	5.07	0.09	28.1	0.46	2.58	1.18					Located along the westerly boundary of the site. It is bounded on the north and east by basin E-5 and on the south by basin E-6

Falcon Field
Existing Runoff Calculations ***Design Storm*** ***100 Year***
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
	E-1	2.16	0.38	29.7	0.82	4.19	3.42					easterly most basin. It is bounded on the North by Rio Lane.
	E-2	8.06	0.38	38.1	3.03	3.56	10.81					Located west of Basin E-1. It is bounded on the North by Rio Lane. A portion of the existing home and driveway lie in this basin.
	E-3	7.46	0.41	30.7	3.05	4.11	12.54					Located to the west of basin E-2. This basin has the remainder of the exiting home together with all the outbuildings.
	E-4	13.89	0.36	33.3	5.00	3.90	19.48					Located to west of Basin E-3. This basin is bounded on the north by Rio Lane and on the northwest by State Highway 24.
	E-5	13.41	0.36	37.3	4.83	3.61	17.44					Located to the southwest of basin E-4. The basin is bounded on the west by basins E-6 & E-9.
	E-6	8.09	0.36	26.4	2.91	4.49	13.08					Located to the west of Basin E-5. It is bounded on the west by Basins E-7 & E-8
	E-7	0.55	0.36	14.3	0.20	6.03	1.19					Located to the west of Basin E-6 and south of Basin E-8.
	E-8	0.40	0.36	9.9	0.14	6.96	1.00					Located to the west of basins E-6 & E-7.
	E-9	5.07	0.36	28.1	1.83	4.33	7.90					Located along the westerly boundary of the site. It is bounded on the north and east by basin E-5 and on the south by basin E-6

SUMMARY - EXISTING RUNOFF TABLE						
DESIGN POINT	**BASIN DESIGNATION**	**BASIN AREA (ACRES)**	**DIRECT 5-YR RUNOFF (CFS)**	**DIRECT 100-YR RUNOFF (CFS)**	**CUMULATIVE 5-YR RUNOFF (CFS)**	**CUMULATIVE 100-YR RUNOFF (CFS)**
	E-1	2.16	0.61	3.42	0.61	3.42
	E-2	8.06	1.92	10.81	1.92	10.81
	E-3	7.46	2.87	12.54	2.87	12.54
	E-4	13.89	2.90	19.48	2.90	19.48
	E-5	13.41	2.60	17.44	2.60	17.44
	E-6	8.09	1.95	13.08	1.95	13.08
	E-7	0.55	0.18	1.19	0.18	1.19
	E-8	0.40	0.15	1.00	0.15	1.00
	E-9	5.07	1.18	7.90	1.18	7.90

Weighted Imperviousness Calculations

SUB-BASIN	AREA (SF)	AREA (Acres)	ROOF AREA	ROOF IMPERVIOUSNESS	ROOF C2	ROOF C5	ROOF C10	ROOF C100	LANDSCAPE AREA	LANDSCAPE IMPERVIOUSNESS	LANDSCAPE C2	LANDSCAPE C5	LANDSCAPE C10	LANDSCAPE C100	PAVEMENT AREA	PAVEMENT IMPERVIOUSNESS	PAVEMENT C2	PAVEMENT C5	PAVEMENT C10	PAVEMENT C100	WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS C2	WEIGHTED COEFFICIENTS C5	WEIGHTED COEFFICIENTS C10	WEIGHTED COEFFICIENTS C100
D-1	359,773	8.26	106,706	90%	0.71	0.73	0.75	0.81	71,955	0%	0.02	0.09	0.15	0.36	181,112	100%	0.89	0.90	0.92	0.96	77.0%	0.66	0.69	0.72	0.80
D-2	330,154	7.58	82,539	90%	0.71	0.73	0.75	0.81	66,031	0%	0.02	0.09	0.15	0.36	181,585	100%	0.89	0.90	0.92	0.96	77.5%	0.67	0.70	0.72	0.80
D-3	53,165	1.22	0	90%	0.71	0.73	0.75	0.81	18,608	0%	0.02	0.09	0.15	0.36	34,557	100%	0.89	0.90	0.92	0.96	65.0%	0.58	0.62	0.65	0.75
D-4	49,397	1.13	14,819	90%	0.71	0.73	0.75	0.81	9,879	0%	0.02	0.09	0.15	0.36	24,699	100%	0.89	0.90	0.92	0.96	77.0%	0.66	0.69	0.72	0.80
D-5	67,118	1.54	16,780	90%	0.71	0.73	0.75	0.81	13,424	0%	0.02	0.09	0.15	0.36	36,915	100%	0.89	0.90	0.92	0.96	77.5%	0.67	0.70	0.72	0.80
D-6	36,430	0.84	0	90%	0.71	0.73	0.75	0.81	10,929	0%	0.02	0.09	0.15	0.36	25,501	100%	0.89	0.90	0.92	0.96	70.0%	0.63	0.66	0.69	0.78
D-7	338,056	7.76	101,417	90%	0.71	0.73	0.75	0.81	67,611	0%	0.02	0.09	0.15	0.36	169,028	100%	0.89	0.90	0.92	0.96	77.0%	0.66	0.69	0.72	0.80
D-8	72,560	1.67	0	90%	0.71	0.73	0.75	0.81	21,768	0%	0.02	0.09	0.15	0.36	50,792	100%	0.89	0.90	0.92	0.96	70.0%	0.63	0.66	0.69	0.78
D-9	33,820	0.78	0	90%	0.71	0.73	0.75	0.81	10,146	0%	0.02	0.09	0.15	0.36	23,674	100%	0.89	0.90	0.92	0.96	70.0%	0.63	0.66	0.69	0.78
D-10	77,199	1.77	0	90%	0.71	0.73	0.75	0.81	77,199	0%	0.02	0.09	0.15	0.36	0	100%	0.89	0.90	0.92	0.96	0.0%	0.02	0.09	0.15	0.36
D-11	191,223	4.39	57,367	90%	0.71	0.73	0.75	0.81	38,245	0%	0.02	0.09	0.15	0.36	95,612	100%	0.89	0.90	0.92	0.96	77.0%	0.66	0.69	0.72	0.80
D-12	58,905	1.35	0	90%	0.71	0.73	0.75	0.81	17,672	0%	0.02	0.09	0.15	0.36	41,234	100%	0.89	0.90	0.92	0.96	70.0%	0.63	0.66	0.69	0.78
D-13	598,137	13.73	179,441	90%	0.71	0.73	0.75	0.81	179,441	0%	0.02	0.09	0.15	0.36	239,255	100%	0.89	0.90	0.92	0.96	67.0%	0.57	0.61	0.64	0.74
D-14	95,800	2.20	0	90%	0.71	0.73	0.75	0.81	19,160	0%	0.02	0.09	0.15	0.36	76,640	100%	0.89	0.90	0.92	0.96	80.0%	0.72	0.74	0.77	0.84
D-15	69,424	1.59	0	90%	0.71	0.73	0.75	0.81	13,885	0%	0.02	0.09	0.15	0.36	55,539	100%	0.89	0.90	0.92	0.96	80.0%	0.72	0.74	0.77	0.84
D-16																									
D-17																									
TOTAL	2,431,161	55.81	559,068	90%	0.71	0.73	0.75	0.81	635,951	0%	0.02	0.09	0.15	0.36	1,236,142	0%	0.89	0.90	0.92	0.96	20.7%	0.62	0.65	0.68	0.77

Falcon Field
Proposed Runoff Calculations
Time of Concentration

Watercourse Coefficient

					Forest & Meadow	2.50		Short Grass Pasture & Lawns	7.00				Grassed Waterway	15.00		
					Fallow or Cultivation	5.00		Nearly Bare Ground	10.00				Paved Area & Shallow Gutter	20.00		
	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)			FINAL T(c)
DESIGN POINT	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	min.
A	D-1	359,773	8.26	0.69	100	1.7%	6.3	453	1.7%	20.00	2.6	2.9	9.2	553	13.1	9.2
B	D-2	330,154	7.58	0.70	100	1.8%	6.1	964	1.8%	20.00	2.7	6.0	12.1	1064	15.9	12.1
C	D-3	53,165	1.22	0.62	100	2.0%	7.0	670	2.0%	20.00	2.8	3.9	10.9	770	14.3	10.9
D	D-4	49,397	1.13	0.69	50	2.4%	4.0	315	2.4%	20.00	3.1	1.7	5.7	365	12.0	5.7
E	D-5	67,118	1.54	0.70	100	3.3%	5.0	468-	3.3%	20.00	3.6	0.0	5.0	100	10.6	5.0
F	D-6	36,430	0.84	0.66	50	2.0%	4.6	408	5.2%	20.00	4.6	1.5	6.1	458	12.5	6.1
G	D-7	338,056	7.76	0.69	50	6.5%	2.9	633-	11.9%	20.00	6.9	0.0	5.0	50	10.3	5.0
H	D-8	72,560	1.67	0.66	50	5.6%	3.2	940	2.5%	20.00	3.2	5.0	8.2	990	15.5	8.2
I	D-9	33,820	0.78	0.66	100	2.5%	6.0	660	2.9%	20.00	3.4	3.2	9.2	760	14.2	9.2
J	D-10	77,199	1.77	0.09	50	2.0%	10.4	240	2.5%	20.00	3.2	1.3	11.7	290	11.6	11.7
K	D-11	191,223	4.39	0.69	50	2.5%	3.9	425	2.1%	20.00	2.9	2.5	6.4	475	12.6	6.4
L	D-12	58,905	1.35	0.66	50	2.5%	4.2	534	2.5%	20.00	3.2	2.8	7.0	584	13.2	7.0
M	D-13	598,137	13.73	0.61	50	2.5%	4.7	903	2.5%	20.00	3.2	4.8	9.5	953	15.3	9.5
N	D-14	95,800	2.20	0.74	50	2.5%	3.5	1636	3.0%	20.00	3.5	7.9	11.4	1686	19.4	11.4
O	D-15	69,424	1.59	0.74	50	2.5%	3.5	950	3.0%	20.00	3.5	4.6	8.1	1000	15.6	8.1

Falcon Field
Proposed Runoff Calculations ***Design Storm*** ***5 Year***
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
A	D-1	8.26	0.69	9.2	5.68	4.25	24.16					The northerly of the two undeveloped basins on the site
B	D-2	7.58	0.70	12.1	5.27	3.84	20.27					The southerly of the two undeveloped basins on the site
C	D-3	1.22	0.62	10.9	0.75	3.99	3.00					
DESIGN	D-4	1.13	0.69	5.7	0.78	4.97	3.87					
E	D-5	1.54	0.70	5.0	1.07	5.17	5.54					
F	D-6	0.84	0.66	6.1	0.55	4.87	2.68					
G	D-7	7.76	0.69	5.0	5.33	5.17	27.56					
H	D-8	1.67	0.66	8.2	1.09	4.44	4.85					
I	D-9	0.78	0.66	9.2	0.51	4.25	2.17					
J	D-10	1.77	0.09	11.7	0.16	3.90	0.62					
K	D-11	4.39	0.69	6.4	3.02	4.80	14.49					
L	D-12	1.35	0.66	7.0	0.89	4.66	4.14					
M	D-13	13.73	0.61	9.5	8.32	4.21	35.05					
N	D-14	2.20	0.74	11.4	1.62	3.94	6.39					
O	D-15	1.59	0.74	8.1	1.18	4.45	5.23					

Falcon Field
Proposed Runoff Calculations ***Design Storm 100 Year***
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
	D-1	8.26	0.80	9.2	6.59	7.14	47.06					The northerly of the two undeveloped basins on the site
	D-2	7.58	0.80	12.1	6.10	6.45	39.37					The southerly of the two undeveloped basins on the site
	D-3	1.22	0.75	10.9	0.92	6.70	6.16					
	D-4	1.13	0.80	5.7	0.90	8.35	7.55					
	D-5	1.54	0.80	5.0	1.24	8.68	10.76					
	D-6	0.84	0.78	6.1	0.65	8.18	5.36					
	D-7	7.76	0.80	5.0	6.19	8.68	53.68					
	D-8	1.67	0.78	8.2	1.30	7.45	9.71					
	D-9	0.78	0.78	9.2	0.61	7.13	4.34					
	D-10	1.77	0.36	11.7	0.64	6.54	4.18					
	D-11	4.39	0.80	6.4	3.50	8.07	28.23					
	D-12	1.35	0.78	7.0	1.06	7.83	8.28					
	D-13	13.73	0.74	9.5	10.11	7.07	71.54					
	D-14	2.20	0.84	11.4	1.85	6.61	12.26					
	D-15	1.59	0.84	8.1	1.34	7.47	10.04					

SUMMARY - PROPOSED RUNOFF TABLE

DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
	D-1	8.26	24.16	47.06	24.16	47.06
	D-2	7.58	20.27	39.37	20.27	39.37
	D-3	1.22	3.00	6.16	3.00	6.16
	D-4	1.13	3.87	7.55	3.87	7.55
	D-5	1.54	5.54	10.76	5.54	10.76
	D-6	0.84	2.68	5.36	2.68	5.36
	D-7	7.76	27.56	53.68	27.56	53.68
	D-8	1.67	4.85	9.71	4.85	9.71
	D-9	0.78	2.17	4.34	2.17	4.34
	D-10	1.77	0.62	4.18	0.62	4.18
	D-11	4.39	14.49	28.23	14.49	28.23
	D-12	1.35	4.14	8.28	4.14	8.28
	D-13	13.73	35.05	71.54	35.05	71.54
	D-14	2.20	6.39	12.26	6.39	12.26
	D-15	1.59	5.23	10.04	5.23	10.04

Weighted Imperviousness Calculations

DP	AREA (SF)	AREA (Acres)	ROOF AREA	ROOF IMPERVIOUSNESS	ROOF C2	ROOF C5	ROOF C10	ROOF C100	LANDSCAPE AREA	LANDSCAPE IMPERVIOUSNESS	LANDSCAPE C2	LANDSCAPE C5	LANDSCAPE C10	LANDSCAPE C100	PAVEMENT AREA	PAVEMENT IMPERVIOUSNESS	PAVEMENT C2	PAVEMENT C5	PAVEMENT C10	PAVEMENT C100	WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS C2	WEIGHTED COEFFICIENTS C5	WEIGHTED COEFFICIENTS C10	WEIGHTED COEFFICIENTS C100
A	359,773	8.26	106,706	90%	0.71	0.73	0.75	0.81	71,955	0%	0.02	0.09	0.15	0.36	181,112	100%	0.89	0.90	0.92	0.96	77.0%	0.66	0.69	0.72	0.80
B	330,154	7.58	82,539	90%	0.71	0.73	0.75	0.81	66,031	0%	0.02	0.09	0.15	0.36	181,585	100%	0.89	0.90	0.92	0.96	77.5%	0.67	0.70	0.72	0.80
C	53,165	1.22	0	90%	0.71	0.73	0.75	0.81	18,608	0%	0.02	0.09	0.15	0.36	34,557	100%	0.89	0.90	0.92	0.96	65.0%	0.58	0.62	0.65	0.75
D	225,505	5.18	31,599	90%	0.71	0.73	0.75	0.81	34,232	0%	0.02	0.09	0.15	0.36	159,674	100%	0.89	0.90	0.92	0.96	83.4%	0.73	0.75	0.78	0.85
E	33,820	0.78	0	90%	0.71	0.73	0.75	0.81	10,146	0%	0.02	0.09	0.15	0.36	23,674	100%	0.89	0.90	0.92	0.96	70.0%	0.63	0.66	0.69	0.78
F	338,056	7.76	101,417	90%	0.71	0.73	0.75	0.81	67,611	0%	0.02	0.09	0.15	0.36	169,028	100%	0.89	0.90	0.92	0.96	77.0%	0.66	0.69	0.72	0.80
G	77,199	1.77	0	90%	0.71	0.73	0.75	0.81	77,199	0%	0.02	0.09	0.15	0.36	0	100%	0.89	0.90	0.92	0.96	0.0%	0.02	0.09	0.15	0.36
H	250,128	5.74	57,367	90%	0.71	0.73	0.75	0.81	55,917	0%	0.02	0.09	0.15	0.36	136,844	100%	0.89	0.90	0.92	0.96	75.4%	0.65	0.68	0.71	0.79
I	598,137	13.73	179,441	90%	0.71	0.73	0.75	0.81	179,441	0%	0.02	0.09	0.15	0.36	239,255	100%	0.89	0.90	0.92	0.96	67.0%	0.57	0.61	0.64	0.74
J	95,800	2.20	0	90%	0.71	0.73	0.75	0.81	19,160	0%	0.02	0.09	0.15	0.36	76,640	100%	0.89	0.90	0.92	0.96	80.0%	0.72	0.74	0.77	0.84
K	69,424	1.59	0	90%	0.71	0.73	0.75	0.81	13,885	0%	0.02	0.09	0.15	0.36	55,539	100%	0.89	0.90	0.92	0.96	80.0%	0.72	0.74	0.77	0.84
TOTAL	2,431,161	55.81	559,068	90%	0.71	0.73	0.75	0.81	614,184	0%	0.02	0.09	0.15	0.36	1,257,908	0%	0.89	0.90	0.92	0.96	20.7%	0.63	0.66	0.69	0.78

Falcon Field
Proposed Runoff Calculations
Time of Concentration

Watercourse Coefficient

					Forest & Meadow	2.50	Short Grass Pasture & Lawns	7.00			Grassed Waterway	15.00				
					Fallow or Cultivation	5.00	Nearly Bare Ground	10.00			Paved Area & Shallow Gutter	20.00				
	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)			FINAL T(c)
DESIGN POINT	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	min.
A	D-1	359,773	8.26	0.69	100	1.7%	6.3	453	1.7%	20.00	2.6	2.9	9.2	553	13.1	9.2
B	D-2	330,154	7.58	0.70	100	1.8%	6.1	964	1.8%	20.00	2.7	6.0	12.1	1064	15.9	12.1
C	D-3	53,165	1.22	0.62	100	2.0%	7.0	670	2.0%	20.00	2.8	3.9	10.9	770	14.3	10.9
D	D-4, 5, 6	225,505	5.18	0.75	100	3.3%	4.3	368	2.4%	20.00	3.1	2.0	6.3	468	12.6	6.3
E	D-9	33,820	0.78	0.66	100	2.5%	6.0	660	2.9%	20.00	3.4	3.2	9.2	760	14.2	9.2
F	D-7	338,056	7.76	0.69	50	6.5%	2.9	633	11.9%	20.00	6.9	1.5	5.0	683	13.8	5.0
G	D-10	77,199	1.77	0.09	50	2.0%	10.4	240	2.5%	20.00	3.2	1.3	11.7	290	11.6	11.7
H	D-11, 12	250,128	5.74	0.68	50	2.5%	4.0	584	2.1%	20.00	2.9	3.4	7.4	634	13.5	7.4
I	D-13	598,137	13.73	0.61	50	2.5%	4.7	903	2.5%	20.00	3.2	4.8	9.5	953	15.3	9.5
J	D-14	95,800	2.20	0.74	50	2.5%	3.5	1636	3.0%	20.00	3.5	7.9	11.4	1686	19.4	11.4
K	D-15	69,424	1.59	0.74	50	2.5%	3.5	950	3.0%	20.00	3.5	4.6	8.1	1000	15.6	8.1

Falcon Field
Proposed Runoff Calculations ***Design Storm*** ***5 Year***
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
A	D-1	8.26	0.69	9.2	5.68	4.25	24.16					Runoff from basin D-1 at the the street
B	D-2	7.58	0.70	12.1	5.27	3.84	20.27					Runoff from Basin D-2 at detention pond B
C	D-3	1.22	0.62	10.9	0.75	3.99	3.00					Runoff from Basin D-3 at detention pond A
D	D-4, 5, 6	5.18	0.75	6.3	3.90	4.83	18.82					Runiff from Basins D-4, 5,& 6
E	D-9	0.78	0.66	9.2	0.51	4.25	2.17					Runoff from Basin D-9
F	D-7	7.76	0.69	5.0	5.33	5.17	27.56					Runoff from Basin D-5
G	D-10	1.77	0.09	11.7	0.16	3.90	0.62					Runoff from Basin D-10
H	D-11, 12	5.74	0.68	7.4	3.90	4.59	17.92					Runoff from Basin D-11 & 12
I	D-13	13.73	0.61	9.5	8.32	4.21	35.05					Runoff from Basin D-13
J	D-14	2.20	0.74	11.4	1.62	3.94	6.39					Runoff from Basin D-14
K	D-15	1.59	0.74	8.1	1.18	4.45	5.23					Runoff from Basin D-15

Falcon Field
Proposed Runoff Calculations ***Design Storm*** ***100 Year***
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
A	D-1	8.26	0.80	9.2	6.59	7.14	47.06					Runoff from basin D-1 at the the street
B	D-2	7.58	0.80	12.1	6.10	6.45	39.37					Runoff from Basin D-2 at detention pond B
C	D-3	1.22	0.75	10.9	0.92	6.70	6.16					
D	D-4, 5, 6	5.18	0.85	6.3	4.40	8.11	35.70					
E	D-9	0.78	0.78	9.2	0.61	7.13	4.34					
F	D-7	7.76	0.80	5.0	6.19	8.68	53.68					
G	D-10	1.77	0.36	11.7	0.64	6.54	4.18					
H	D-11, 12	5.74	0.79	7.4	4.56	7.71	35.12					
I	D-13	13.73	0.74	9.5	10.11	7.07	71.54					
J	D-14	2.20	0.84	11.4	1.85	6.61	12.26					
K	D-15	1.59	0.84	8.1	1.34	7.47	10.04					

SUMMARY - PROPOSED DESIGN POINTS

DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
A	D-1	8.26	24.16	47.06	24.16	47.06
B	D-2	7.58	20.27	39.37	20.27	39.37
C	D-3	1.22	3.00	6.16	3.00	6.16
D	D-4, 5, 6	5.18	18.82	35.70	18.82	35.70
E	D-9	0.78	2.17	4.34	2.17	4.34
F	D-7	7.76	27.56	53.68	27.56	53.68
G	D-10	1.77	0.62	4.18	0.62	4.18
H	D-11, 12	5.74	17.92	35.12	17.92	35.12
I	D-13	13.73	35.05	71.54	35.05	71.54
J	D-14	2.20	6.39	12.26	6.39	12.26
K	D-15	1.59	5.23	10.04	5.23	10.04

Version 4.05 Released March 2017

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Design Point A	Design Point D	Design Point E	Design Point H	Design Point J	Design Point K
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump	In Sump	In Sump	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	5.0	6.6	2.2	4.1	6.4	5.2
Major Q_{Known} (cfs)	10.0	12.9	4.3	8.3	12.3	10.0

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)						
Percent Impervious						
NRCS Soil Type						

Watershed Profile

Overland Slope (ft/ft)						
Overland Length (ft)						
Channel Slope (ft/ft)						
Channel Length (ft)						

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						
C_1						
C_2						
C_3						
User-defined C						
User-defined 5-yr C_5						
User-defined T_c						

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						
C_1						
C_2						
C_3						
User-defined C						
User-defined 5-yr C_5						
User-defined T_c						

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**5.0**	**6.6**	**2.2**	**4.1**	**6.4**	**5.2**
Major Total Design Peak Flow, Q (cfs)	**10.0**	**12.9**	**4.3**	**8.3**	**12.3**	**10.0**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A	N/A	N/A	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A	N/A	N/A	0.0

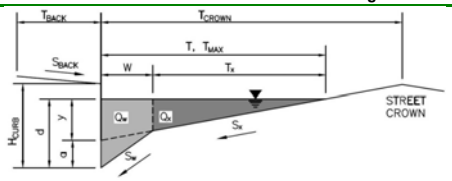
Version 4.05 Released March 2017

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

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

Project: FALCON FIELD

Inlet ID: Design Point A



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	3.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.040	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	ft
Gutter Width	W =	1.00	ft
Street Transverse Slope	S_X =	0.015	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} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	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		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	4.68	4.68	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	1.0	1.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	0.82	0.82	inches
Water Depth at Gutter Flowline	d =	5.50	5.50	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	25.0	25.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.113	0.113	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	28.8	39.9	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	27.8	38.9	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.101	0.071	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	0.0	0.0	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		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

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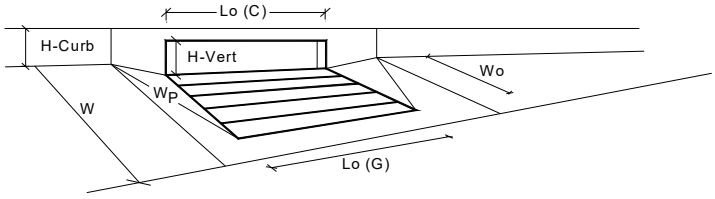


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.5	5.5	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) =	15.00	15.00	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 =	1.00	1.00	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} =	0.38	0.38	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.52	0.52	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.75	0.75	
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 =**	**10.0**	**10.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.0	10.0	cfs

Warning 5: The width of unit is greater than the gutter width.

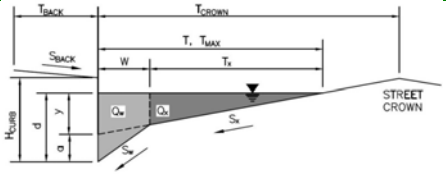
Version 4.05 Released March 2017

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

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

Project: FALCON FIELD

Inlet ID: Design Point D



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	3.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.400	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	ft
Gutter Width	W =	1.00	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} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	6.24	6.24	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	1.0	1.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	0.76	0.76	inches
Water Depth at Gutter Flowline	d =	7.00	7.00	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	25.0	25.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.109	0.109	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

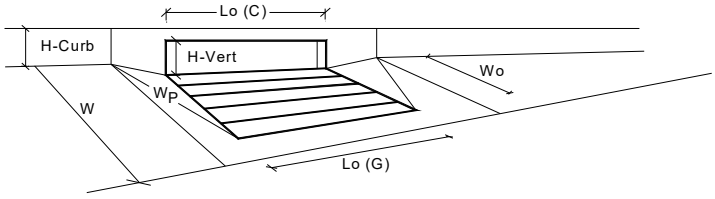
Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	21.9	21.9	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	20.9	20.9	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.130	0.130	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	0.0	0.0	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		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} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	6.0	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) =	20.00	20.00	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 =	1.00	1.00	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} =	0.42	0.42	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.57	0.57	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.79	0.79	
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 =**	**16.1**	**16.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	6.6	12.9	cfs

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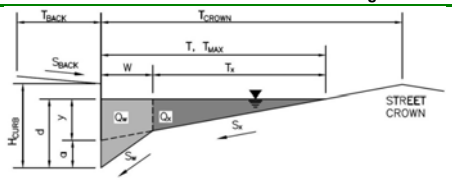
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: FALCON FIELD

Inlet ID: Design Point E



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	3.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.400	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	ft
Gutter Width	W =	1.00	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} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	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		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	6.24	6.24	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	1.0	1.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	0.76	0.76	inches
Water Depth at Gutter Flowline	d =	7.00	7.00	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	25.0	25.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.109	0.109	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	21.9	30.2	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	20.9	29.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.130	0.093	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	0.0	0.0	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		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

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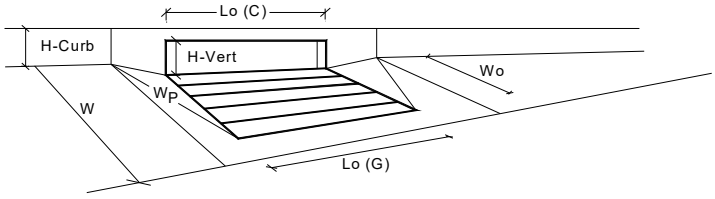


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	7.0	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 =	1.00	1.00	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} =	0.42	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.77	0.90	
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 =**	**5.9**	**7.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.2	4.3	cfs

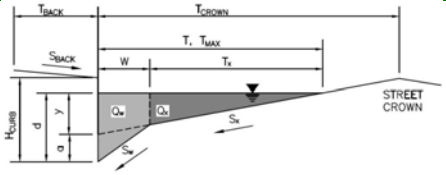
Version 4.05 Released March 2017

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

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

Project: FALCON FIELD

Inlet ID: Design Point H



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	3.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.400	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	ft
Gutter Width	W =	1.00	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} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	6.24	6.24	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	1.0	1.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	0.76	0.76	inches
Water Depth at Gutter Flowline	d =	7.00	7.00	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	25.0	25.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.109	0.109	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

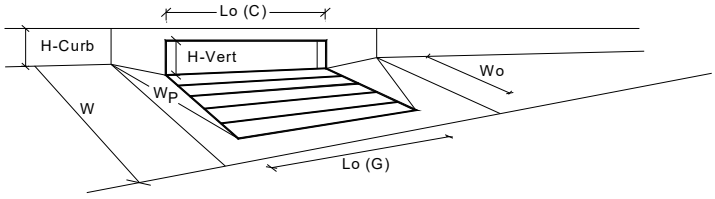
Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	21.9	21.9	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	20.9	20.9	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.130	0.130	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	0.0	0.0	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		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} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	6.0	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 =	1.00	1.00	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} =	0.42	0.42	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.57	0.57	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.93	0.93	
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 =**	**10.0**	**10.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	4.1	8.3	cfs

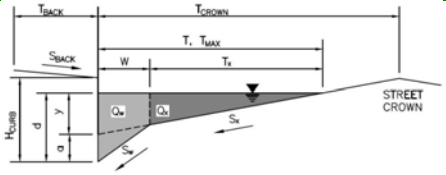
Version 4.05 Released March 2017

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

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

Project: FALCON FIELD

Inlet ID: Design Point J



Gutter Geometry (Enter data in the blue cells)

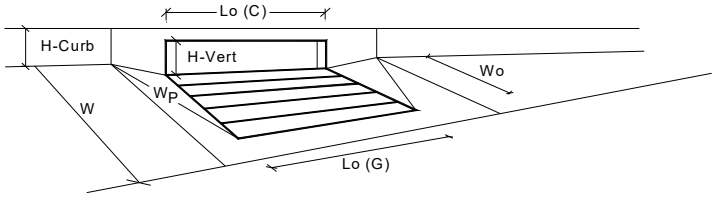
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	3.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.040	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	ft
Gutter Width	W =	1.00	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} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	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)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	7.0	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 =	1.00	1.00	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} =	0.42	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.66	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	0.99	
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 =**	**10.0**	**13.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	6.4	12.3	cfs

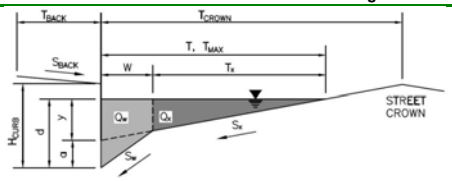
Version 4.05 Released March 2017

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

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

Project: FALCON FIELD

Inlet ID: Design Point K



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	3.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.040	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	ft
Gutter Width	W =	1.00	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 =	3.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	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

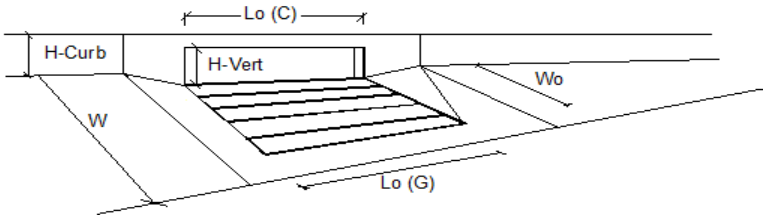
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.8**	**12.9**	**cfs**

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} =	3.0	3.0	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 =	20.00	20.00	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	

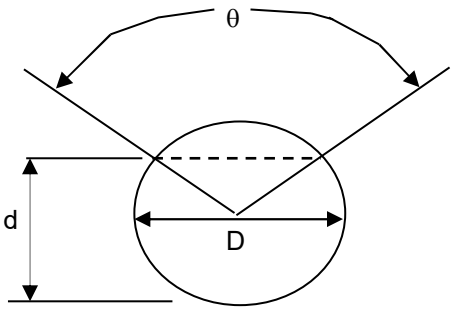
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.2**	**10.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

MANNING'S EQUATION FOR PIPE FLOW

Project:	Falcon Field	Location:	Design Point A outflow pipe
By:	DW	Date:	1/22/2021
Chk. By:	CC	Date:	1/22/2021

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	36	inches
d=	36	inches
n=	0.013	mannings coeff
θ=	0.0	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
7.07	9.42	0.75	6.67	47.16

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

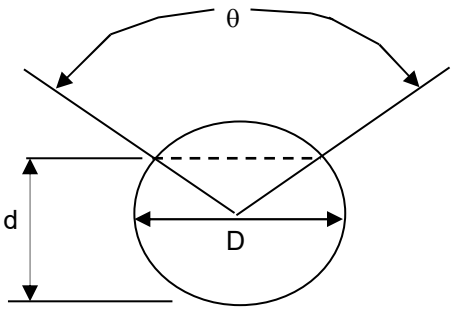
Project: Falcon Field Location: Design Point D outfall pipe

By: DW Date: 1/22/2021

Chk. By: CC Date: 1/22/2021

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	27	inches
d=	27	inches
n=	0.013	mannings coeff
θ=	0.0	degrees
S=	0.015	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
3.98	7.07	0.56	9.54	37.93

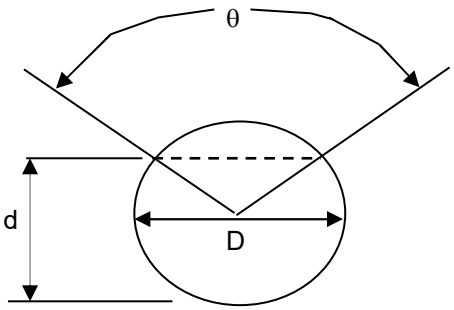
Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project:	Falcon Field	Location:	Design Point E outfall pipe	
By:	DW	Date:	1/22/2021	
Chk. By:	CC	Date:	1/22/2021	mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	30	inches
d=	30	inches
n=	0.013	mannings coeff
θ=	0.0	degrees
S=	0.01	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
4.91	7.85	0.63	8.36	41.02

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

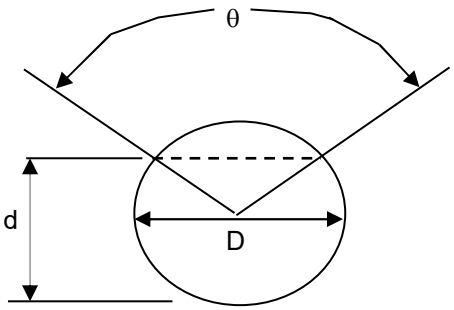
Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project:	Falcon Field	Location:	Design Point F outfall pipe
By:	DW	Date:	1/22/2021
Chk. By:	CC	Date:	1/22/2021

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	36	inches
d=	36	inches
n=	0.013	mannings coeff
θ=	0.0	degrees
S=	0.01	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
7.07	9.42	0.75	9.44	66.70

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

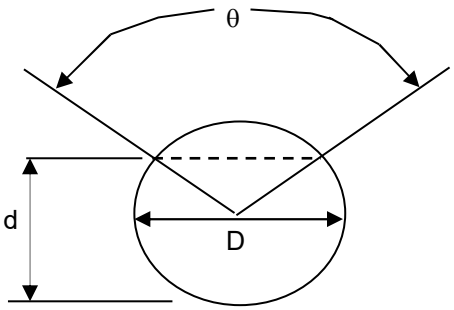
Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project:	Falcon Field	Location:	Design Point H outfall pipe
By:	DW	Date:	1/22/2021
Chk. By:	CC	Date:	1/22/2021

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	30	inches
d=	30	inches
n=	0.013	mannings coeff
θ=	0.0	degrees
S=	0.01	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
4.91	7.85	0.63	8.36	41.02

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

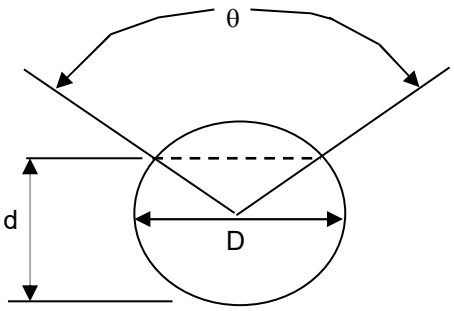
Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project:	Falcon Field	Location:	Design Point J outfall pipe
By:	DW	Date:	1/22/2021
Chk. By:	CC	Date:	1/22/2021

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	24	inches
d=	24	inches
n=	0.013	mannings coeff
θ=	0.0	degrees
S=	0.01	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
3.14	6.28	0.50	7.20	22.62

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

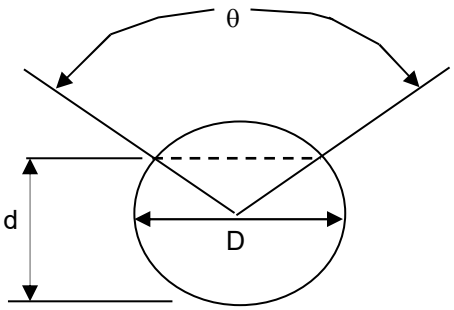
Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project:	Falcon Field	Location:	Design Point K outfall pipe
By:	DW	Date:	1/22/2021
Chk. By:	CC	Date:	1/22/2021

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	18	inches
d=	18	inches
n=	0.013	mannings coeff
θ=	0.0	degrees
S=	0.01	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
1.77	4.71	0.38	5.94	10.50

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

Created by: Mike O'Shea

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project:	**Falcon Field**	Location:	Major Channel	
By:	DW	Date:	1/20/2021	
Chk By:	CC	Date:	1/25/2021	version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

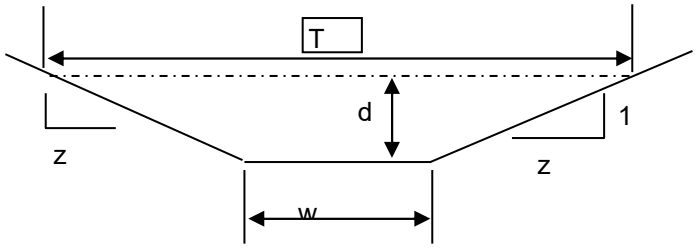
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

INPUT	
z (sideslope)=	3
z (sideslope)=	3
b (btm width, ft)=	20
d (depth, ft)=	1.63
S (slope, ft/ft)	0.0055
n_{low} =	0.02
n_{high} =	0.02

Clear Data Entry Cells

				Low N		High N			
Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
1.63	40.57	30.31	1.34	6.69270067	271.528	6.692701	271.528	T =	29.78
								Dm =	1.362
				Sc low =	0.0054	Sc high =	0.0054		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0038	0.0070	0.0038	0.0070		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

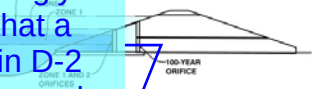
Created by: Mike O'Shea

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Falcon Field

Update accordingly as it appears that a portion of Basin D-2 will flow to this pond.



Conceptual Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	1.22	acres
Watershed Length =	232	ft
Watershed Length to Centroid =	116	ft
Watershed Slope =	0.022	ft/ft
Watershed Imperviousness =	85.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.037	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.139	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.089	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.115	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.136	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.160	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.183	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.209	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.29 in.) =	0.282	acre-feet	3.29	inches
Approximate 2-yr Detention Volume =	0.091	acre-feet		
Approximate 5-yr Detention Volume =	0.119	acre-feet		
Approximate 10-yr Detention Volume =	0.141	acre-feet		
Approximate 25-yr Detention Volume =	0.167	acre-feet		
Approximate 50-yr Detention Volume =	0.182	acre-feet		
Approximate 100-yr Detention Volume =	0.195	acre-feet		

Define Zones and Basin Geometry

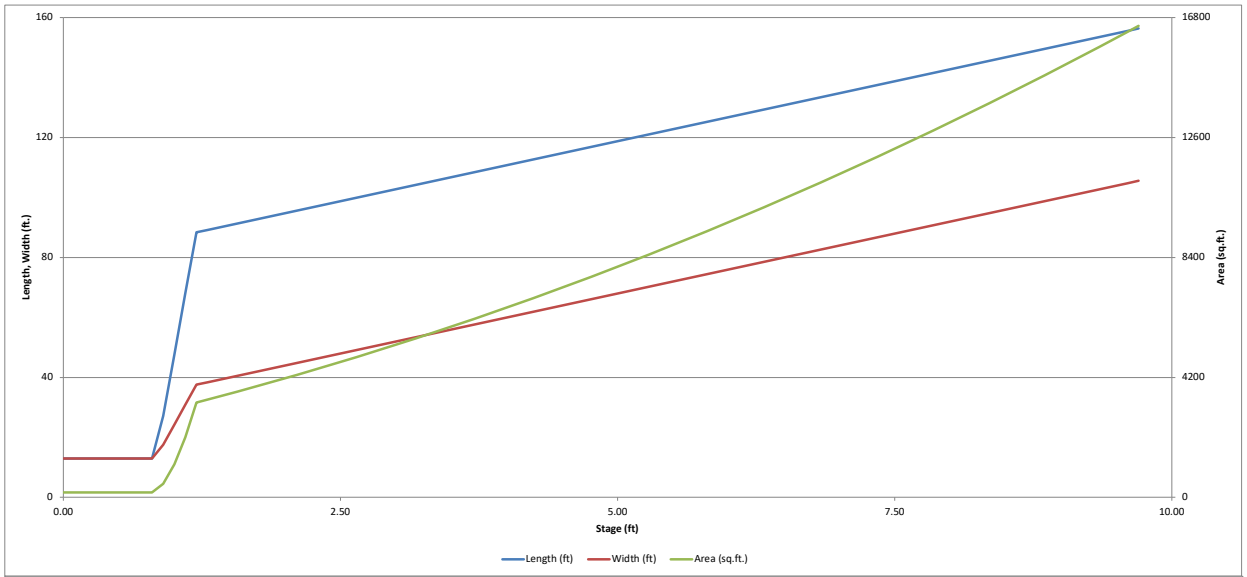
Zone 1 Volume (WQCV) =	0.037	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.102	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.057	acre-feet
Total Detention Basin Volume =	0.195	acre-feet
Initial Surcharge Volume (ISV) =	55	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	3.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	3	
Initial Surcharge Area (A_{ISV}) =	167	ft^2
Surcharge Volume Length (L_{ISV}) =	12.9	ft
Surcharge Volume Width (W_{ISV}) =	12.9	ft
Depth of Basin Floor (H_{FLOOR}) =	0.37	ft
Length of Basin Floor (L_{FLOOR}) =	88.4	ft
Width of Basin Floor (W_{FLOOR}) =	37.6	ft
Area of Basin Floor (A_{FLOOR}) =	3,321	ft^2
Volume of Basin Floor (V_{FLOOR}) =	522	ft^3
Depth of Main Basin (H_{MAIN}) =	1.80	ft
Length of Main Basin (L_{MAIN}) =	102.8	ft
Width of Main Basin (W_{MAIN}) =	52.0	ft
Area of Main Basin (A_{MAIN}) =	5,343	ft^2
Volume of Main Basin (V_{MAIN}) =	7,726	ft^3
Calculated Total Basin Volume (V_{total}) =	**0.193**	acre-feet

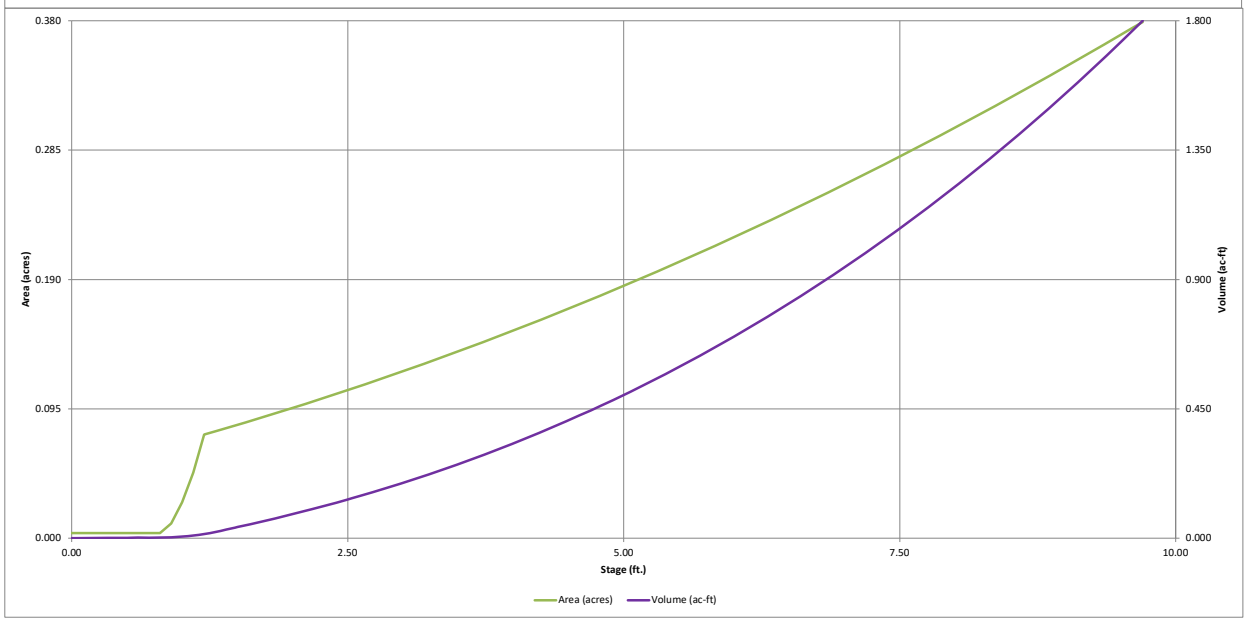
Depth Increment = 0.10 ft

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		12.9	12.9	167		0.004		
ISV	0.33		12.9	12.9	167		0.004	55	0.001
	0.40		12.9	12.9	167		0.004	67	0.002
	0.50		12.9	12.9	167		0.004	83	0.002
	0.60		12.9	12.9	167		0.004	100	0.002
	0.70		12.9	12.9	167		0.004	117	0.003
	0.80		12.9	12.9	167		0.004	133	0.003
	0.90		27.2	17.6	478		0.011	160	0.004
	1.00		47.6	24.2	1,154		0.026	239	0.005
	1.10		68.0	30.9	2,102		0.048	400	0.009
Floor	1.20		88.4	37.6	3,321		0.076	669	0.015
	1.30		89.2	38.4	3,423		0.079	1,006	0.023
	1.40		90.0	39.2	3,526		0.081	1,353	0.031
Zone 1 (WQCV)	1.48		90.6	39.8	3,609		0.083	1,639	0.038
	1.50		90.8	40.0	3,629		0.083	1,711	0.039
	1.60		91.6	40.8	3,735		0.086	2,079	0.048
	1.70		92.4	41.6	3,841		0.088	2,458	0.056
	1.80		93.2	42.4	3,949		0.091	2,848	0.065
	1.90		94.0	43.2	4,058		0.093	3,248	0.075
	2.00		94.8	44.0	4,169		0.096	3,659	0.084
	2.10		95.6	44.8	4,280		0.098	4,082	0.094
	2.20		96.4	45.6	4,393		0.101	4,515	0.104
	2.30		97.2	46.4	4,507		0.103	4,960	0.114
	2.40		98.0	47.2	4,623		0.106	5,417	0.124
	2.50		98.8	48.0	4,740		0.109	5,885	0.135
Zone 2 (EURV)	2.54		99.1	48.3	4,787		0.110	6,076	0.139
	2.60		99.6	48.8	4,858		0.112	6,365	0.146
	2.70		100.4	49.6	4,977		0.114	6,857	0.157
	2.80		101.2	50.4	5,098		0.117	7,360	0.169
	2.90		102.0	51.2	5,219		0.120	7,876	0.181
	3.00		102.8	52.0	5,343		0.123	8,404	0.193
Zone 3 (100-year)	3.03		103.0	52.2	5,380		0.124	8,565	0.197
	3.10		103.6	52.8	5,467		0.126	8,945	0.205
	3.20		104.4	53.6	5,593		0.128	9,498	0.218
	3.30		105.2	54.4	5,720		0.131	10,063	0.231
	3.40		106.0	55.2	5,848		0.134	10,642	0.244
	3.50		106.8	56.0	5,978		0.137	11,233	0.258
	3.60		107.6	56.8	6,109		0.140	11,837	0.272
	3.70		108.4	57.6	6,241		0.143	12,455	0.286
	3.80		109.2	58.4	6,374		0.146	13,086	0.300
	3.90		110.0	59.2	6,509		0.149	13,730	0.315
	4.00		110.8	60.0	6,645		0.153	14,387	0.330
	4.10		111.6	60.8	6,782		0.156	15,059	0.346
	4.20		112.4	61.6	6,921		0.159	15,744	0.361
	4.30		113.2	62.4	7,060		0.162	16,443	0.377
	4.40		114.0	63.2	7,201		0.165	17,156	0.394
	4.50		114.8	64.0	7,344		0.169	17,883	0.411
	4.60		115.6	64.8	7,488		0.172	18,625	0.428
	4.70		116.4	65.6	7,632		0.175	19,381	0.445
	4.80		117.2	66.4	7,779		0.179	20,151	0.463
	4.90		118.0	67.2	7,926		0.182	20,936	0.481
	5.00		118.8	68.0	8,075		0.185	21,737	0.499
	5.10		119.6	68.8	8,225		0.189	22,552	0.518
	5.20		120.4	69.6	8,376		0.192	23,382	0.537
	5.30		121.2	70.4	8,529		0.196	24,227	0.556
	5.40		122.0	71.2	8,683		0.199	25,087	0.576
	5.50		122.8	72.0	8,838		0.203	25,963	0.596
	5.60		123.6	72.8	8,994		0.206	26,855	0.617
	5.70		124.4	73.6	9,152		0.210	27,762	0.637
	5.80		125.2	74.4	9,311		0.214	28,686	0.659
	5.90		126.0	75.2	9,471		0.217	29,625	0.680
	6.00		126.8	76.0	9,633		0.221	30,580	0.702
	6.10		127.6	76.8	9,796		0.225	31,551	0.724
	6.20		128.4	77.6	9,960		0.229	32,539	0.747
	6.30		129.2	78.4	10,125		0.232	33,543	0.770
	6.40		130.0	79.2	10,292		0.236	34,564	0.793
	6.50		130.8	80.0	10,460		0.240	35,602	0.817
	6.60		131.6	80.8	10,629		0.244	36,656	0.842
	6.70		132.4	81.6	10,800		0.248	37,728	0.866
	6.80		133.2	82.4	10,972		0.252	38,816	0.891
	6.90		134.0	83.2	11,145		0.256	39,922	0.916
	7.00		134.8	84.0	11,319		0.260	41,045	0.942
	7.10		135.6	84.8	11,495		0.264	42,186	0.968
	7.20		136.4	85.6	11,672		0.268	43,344	0.995
	7.30		137.2	86.4	11,850		0.272	44,520	1.022
	7.40		138.0	87.2	12,029		0.276	45,714	1.049
	7.50		138.8	88.0	12,210		0.280	46,926	1.077
	7.60		139.6	88.8	12,392		0.284	48,156	1.106
	7.70		140.4	89.6	12,576		0.289	49,405	1.134
	7.80		141.2	90.4	12,760		0.293	50,672	1.163
	7.90		142.0	91.2	12,946		0.297	51,957	1.193
	8.00		142.8	92.0	13,133		0.301	53,261	1.223
	8.10		143.6	92.8	13,322		0.306	54,584	1.253
	8.20		144.4	93.6	13,512		0.310	55,925	1.284
	8.30		145.2	94.4	13,703		0.315	57,286	1.315
	8.40		146.0	95.2	13,895		0.319	58,666	1.347
	8.50		146.8	96.0	14,088		0.323	60,065	1.379
	8.60		147.6	96.8	14,283		0.328	61,484	1.411
	8.70		148.4	97.6	14,479		0.332	62,922	1.444
	8.80		149.2	98.4	14,677		0.337	64,380	1.478
	8.90		150.0	99.2	14,875		0.341	65,857	1.512
	9.00		150.8	100.0	15,075		0.346	67,355	1.546
	9.10		151.6	100.8	15,277		0.351	68,872	1.581
	9.20		152.4	101.6	15,479		0.355	70,410	1.616
	9.30		153.2	102.4	15,683		0.360	71,968	1.652
	9.40		154.0	103.2	15,888		0.365	73,547	1.688
	9.50		154.8	104.0	16,095		0.369	75,146	1.725
	9.60		155.6	104.8	16,302		0.374	76,766	1.762
	9.70		156.4	105.6	16,511		0.379	78,406	1.800

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



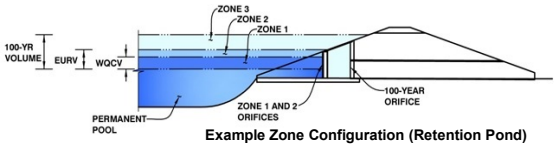


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Falcon Field

Basin ID: POND A



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.48	0.037	Orifice Plate
Zone 2 (EURV)	2.54	0.102	Orifice Plate
Zone 3 (100-year)	3.03	0.057	Weir&Pipe (Restrict)
Total (all zones)		0.195	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =	2.54	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	10.20	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.85	1.69					
Orifice Area (sq. inches)	0.20	0.25	1.00					

	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			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft²
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.54	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.29	N/A	feet
Overflow Weir Front Edge Length =	2.00	N/A	feet	Overflow Weir Slope Length =	3.09	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	40.34	N/A	
Horiz. Length of Weir Sides =	3.00	N/A	feet	Overflow Grate Open Area w/o Debris =	4.33	N/A	ft²
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	4.33	N/A	ft²
Debris Clogging % =	0%	N/A	%				

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.11	N/A	ft²
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.10	N/A	feet
Restrictor Plate Height Above Pipe Invert =	2.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	0.68	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	2.80	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.55	feet
Spillway Crest Length =	2.00	feet	Stage at Top of Freeboard =	4.35	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.16	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.39	acre-ft

Calculated Parameters for Spillway

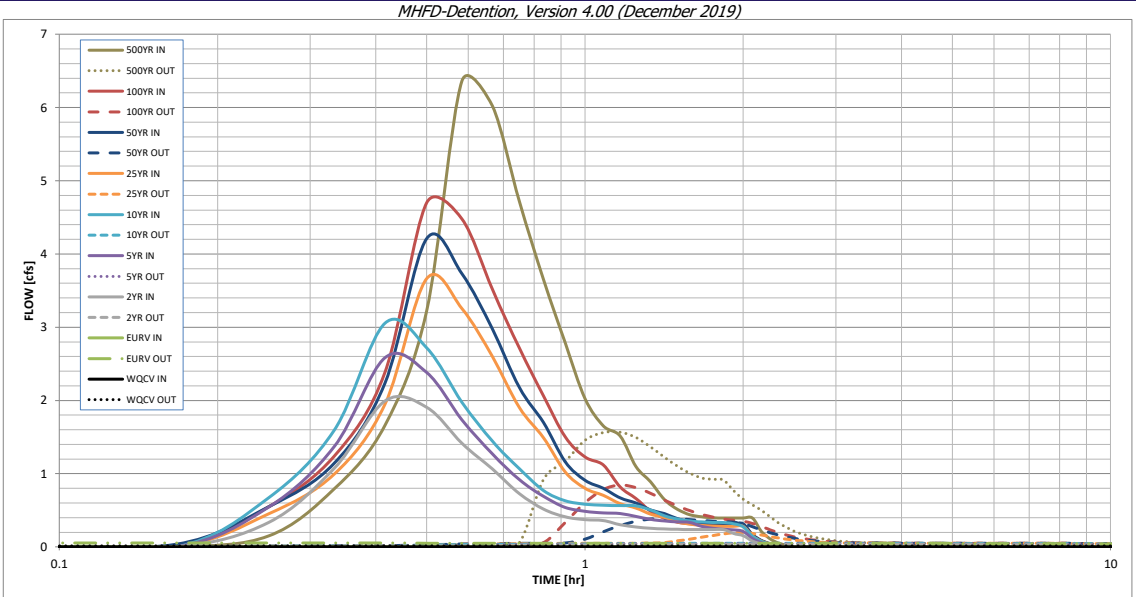
Routed Hydrograph Results

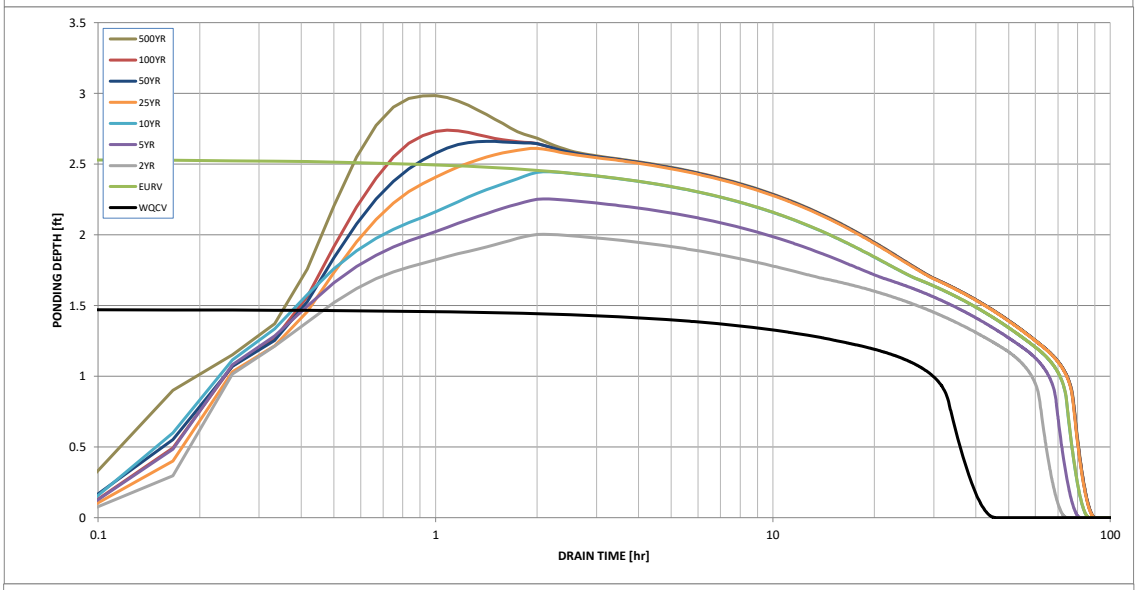
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

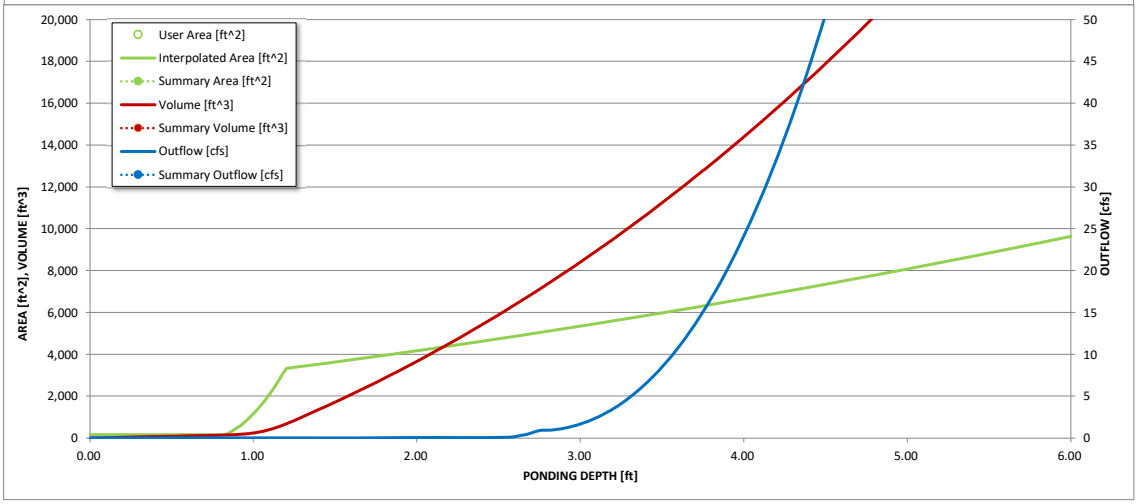
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.29
CUHP Runoff Volume (acre-ft) =	0.037	0.139	0.089	0.115	0.136	0.160	0.183	0.209	0.282
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.089	0.115	0.136	0.160	0.183	0.209	0.282
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.0	0.3	0.6	1.0	2.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.26	0.50	0.81	1.61
Peak Inflow Q (cfs) =	N/A	N/A	2.0	2.6	3.1	3.7	4.2	4.7	6.4
Peak Outflow Q (cfs) =	0.0	0.1	0.0	0.0	0.1	0.2	0.4	0.8	1.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.7	1.4	0.6	0.6	0.9	0.8
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.0	0.1	0.2	0.2
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) =	38	73	63	69	73	75	75	74	71
Time to Drain 99% of Inflow Volume (hours) =	**41**	79	68	74	79	81	81	80	79
Maximum Ponding Depth (ft) =	1.48	2.54	2.00	2.25	2.45	2.61	2.66	2.74	2.98
Area at Maximum Ponding Depth (acres) =	0.08	0.11	0.10	0.10	0.11	0.11	0.11	0.12	0.12
Maximum Volume Stored (acre-ft) =	0.038	0.139	0.084	0.109	0.129	0.147	0.153	0.162	0.190

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.15
	0:15:00	0.00	0.00	0.33	0.54	0.67	0.45	0.55	0.55	0.79
	0:20:00	0.00	0.00	1.07	1.37	1.59	0.99	1.14	1.24	1.66
	0:25:00	0.00	0.00	1.99	2.59	3.06	1.95	2.24	2.39	3.22
	0:30:00	0.00	0.00	1.91	2.38	2.72	3.66	4.21	4.70	6.36
	0:35:00	0.00	0.00	1.42	1.74	1.98	3.26	3.73	4.48	6.02
	0:40:00	0.00	0.00	1.06	1.27	1.44	2.60	2.97	3.51	4.72
	0:45:00	0.00	0.00	0.73	0.92	1.07	1.90	2.18	2.71	3.65
	0:50:00	0.00	0.00	0.52	0.69	0.77	1.49	1.70	2.07	2.79
	0:55:00	0.00	0.00	0.41	0.54	0.63	1.03	1.17	1.51	2.03
	1:00:00	0.00	0.00	0.37	0.49	0.58	0.80	0.91	1.23	1.65
	1:05:00	0.00	0.00	0.36	0.47	0.57	0.70	0.80	1.12	1.51
	1:10:00	0.00	0.00	0.30	0.46	0.56	0.59	0.67	0.82	1.10
	1:15:00	0.00	0.00	0.27	0.42	0.56	0.53	0.60	0.66	0.89
	1:20:00	0.00	0.00	0.26	0.38	0.50	0.45	0.51	0.49	0.65
	1:25:00	0.00	0.00	0.25	0.35	0.42	0.40	0.46	0.39	0.51
	1:30:00	0.00	0.00	0.24	0.34	0.38	0.34	0.38	0.34	0.44
	1:35:00	0.00	0.00	0.24	0.33	0.36	0.31	0.35	0.31	0.41
	1:40:00	0.00	0.00	0.24	0.28	0.34	0.29	0.33	0.31	0.40
	1:45:00	0.00	0.00	0.24	0.26	0.33	0.29	0.32	0.30	0.40
	1:50:00	0.00	0.00	0.24	0.24	0.33	0.28	0.32	0.30	0.40
	1:55:00	0.00	0.00	0.18	0.23	0.32	0.28	0.32	0.30	0.40
	2:00:00	0.00	0.00	0.15	0.21	0.28	0.28	0.32	0.30	0.40
	2:05:00	0.00	0.00	0.08	0.11	0.15	0.15	0.17	0.16	0.21
	2:10:00	0.00	0.00	0.04	0.06	0.08	0.08	0.09	0.09	0.11
	2:15:00	0.00	0.00	0.02	0.03	0.04	0.04	0.04	0.04	0.05
	2:20:00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.02
	2:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

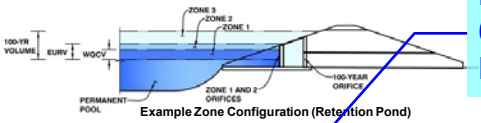
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Falcon Field

Basin ID: Pond B

Per your narrative Basins D1, 2, 4, 5, 6, 8 & 9 are tributary to this pond. Revise the area accordingly.



Example Zone Configuration (Retention Pond)

Depth Increment = 0.10 ft

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	18.90	acres
Watershed Length =	1,182	ft
Watershed Length to Centroid =	850	ft
Watershed Slope =	0.007	ft/ft
Watershed Imperviousness =	85.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.570	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.149	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.541	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.992	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.354	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.763	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.162	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.618	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.29 in.) =	4.883	acre-feet	3.29	inches
Approximate 2-yr Detention Volume =	1.415	acre-feet		
Approximate 5-yr Detention Volume =	1.837	acre-feet		
Approximate 10-yr Detention Volume =	2.186	acre-feet		
Approximate 25-yr Detention Volume =	2.587	acre-feet		
Approximate 50-yr Detention Volume =	2.820	acre-feet		
Approximate 100-yr Detention Volume =	3.028	acre-feet		

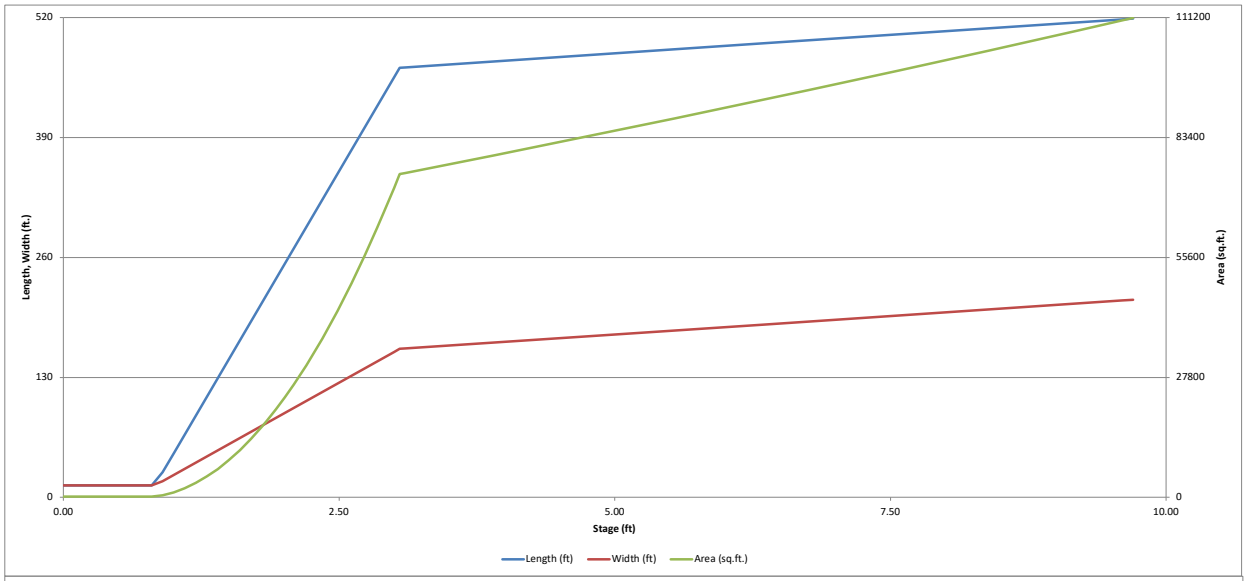
Define Zones and Basin Geometry

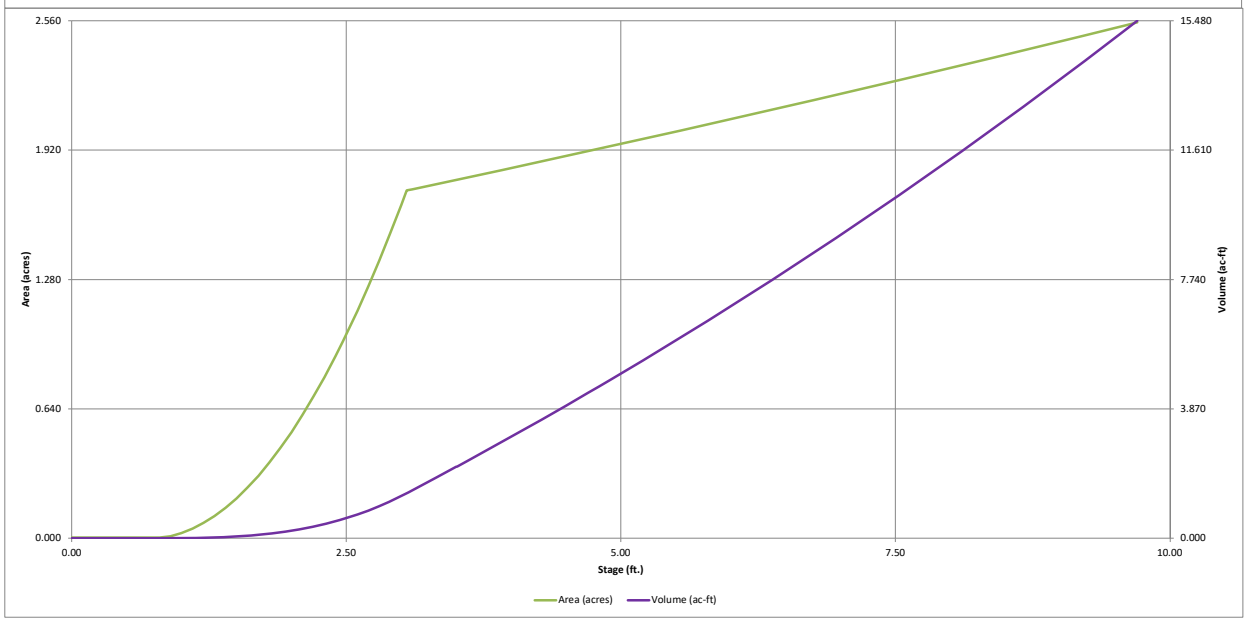
Zone 1 Volume (WQCV) =	0.570	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.579	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.879	acre-feet
Total Detention Basin Volume =	3.028	acre-feet
Initial Surcharge Volume (ISV) =	55	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	4.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	3	
Initial Surcharge Area (A_{ISV}) =	167	ft^2
Surcharge Volume Length (L_{ISV}) =	12.9	ft
Surcharge Volume Width (W_{ISV}) =	12.9	ft
Depth of Basin Floor (H_{FLOOR}) =	2.22	ft
Length of Basin Floor (L_{FLOOR}) =	465.8	ft
Width of Basin Floor (W_{FLOOR}) =	160.9	ft
Area of Basin Floor (A_{FLOOR}) =	74,950	ft^2
Volume of Basin Floor (V_{FLOOR}) =	58,202	ft^3
Depth of Main Basin (H_{MAIN}) =	0.95	ft
Length of Main Basin (L_{MAIN}) =	473.4	ft
Width of Main Basin (W_{MAIN}) =	168.5	ft
Area of Main Basin (A_{MAIN}) =	79,771	ft^2
Volume of Main Basin (V_{MAIN}) =	73,481	ft^3
Calculated Total Basin Volume (V_{total}) =	**3.026**	acre-feet

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		12.9	12.9	167		0.004		
ISV	0.33		12.9	12.9	167		0.004	55	0.001
	0.40		12.9	12.9	167		0.004	67	0.002
	0.50		12.9	12.9	167		0.004	83	0.002
	0.60		12.9	12.9	167		0.004	100	0.002
	0.70		12.9	12.9	167		0.004	117	0.003
	0.80		12.9	12.9	167		0.004	133	0.003
	0.90		27.2	17.6	478		0.011	160	0.004
	1.00		47.6	24.2	1,154		0.026	239	0.005
	1.10		68.0	30.9	2,102		0.048	400	0.009
	1.20		88.4	37.6	3,321		0.076	669	0.015
	1.30		108.8	44.2	4,813		0.110	1,073	0.025
	1.40		129.2	50.9	6,577		0.151	1,641	0.038
	1.50		149.6	57.6	8,613		0.198	2,398	0.055
	1.60		170.0	64.2	10,921		0.251	3,372	0.077
	1.70		190.4	70.9	13,501		0.310	4,591	0.105
	1.80		210.8	77.6	16,352		0.375	6,081	0.140
	1.90		231.2	84.2	19,476		0.447	7,870	0.181
	2.00		251.6	90.9	22,872		0.525	9,986	0.229
	2.10		272.0	97.6	26,540		0.609	12,454	0.286
	2.20		292.4	104.2	30,480		0.700	15,303	0.351
	2.30		312.8	110.9	34,692		0.796	18,559	0.426
	2.40		333.2	117.6	39,175		0.899	22,250	0.511
Zone 1 (WQCV)	2.47		347.5	122.2	42,476		0.975	25,107	0.576
	2.50		353.6	124.2	43,931		1.009	26,403	0.606
	2.60		374.0	130.9	48,959		1.124	31,045	0.713
	2.70		394.4	137.6	54,259		1.246	36,204	0.831
	2.80		414.8	144.2	59,831		1.374	41,906	0.962
	2.90		435.2	150.9	65,674		1.508	48,179	1.106
	3.00		455.6	157.6	71,790		1.648	55,050	1.264
Floor	3.05		465.8	160.9	74,950		1.721	58,718	1.348
	3.10		466.2	161.3	75,201		1.726	62,472	1.434
	3.20		467.0	162.1	75,704		1.738	70,017	1.607
	3.30		467.8	162.9	76,208		1.749	77,613	1.782
	3.40		468.6	163.7	76,713		1.761	85,259	1.957
	3.50		469.4	164.5	77,219		1.773	92,956	2.134
Zone 2 (EURV)	3.51		469.5	164.6	77,270		1.774	93,728	2.152
	3.60		470.2	165.3	77,727		1.784	100,703	2.312
	3.70		471.0	166.1	78,236		1.796	108,501	2.491
	3.80		471.8	166.9	78,746		1.808	116,350	2.671
	3.90		472.6	167.7	79,258		1.820	124,250	2.852
Zone 3 (100-year)	4.00		473.4	168.5	79,771		1.831	132,202	3.035
	4.10		474.2	169.3	80,285		1.843	140,205	3.219
	4.20		475.0	170.1	80,801		1.855	148,259	3.404
	4.30		475.8	170.9	81,317		1.867	156,365	3.590
	4.40		476.6	171.7	81,835		1.879	164,522	3.777
	4.50		477.4	172.5	82,355		1.891	172,732	3.965
	4.60		478.2	173.3	82,875		1.903	180,993	4.155
	4.70		479.0	174.1	83,397		1.915	189,307	4.346
	4.80		479.8	174.9	83,920		1.927	197,673	4.538
	4.90		480.6	175.7	84,444		1.939	206,091	4.731
	5.00		481.4	176.5	84,970		1.951	214,562	4.926
	5.10		482.2	177.3	85,497		1.963	223,085	5.121
	5.20		483.0	178.1	86,025		1.975	231,661	5.318
	5.30		483.8	178.9	86,555		1.987	240,290	5.516
	5.40		484.6	179.7	87,086		1.999	248,972	5.716
	5.50		485.4	180.5	87,618		2.011	257,707	5.916
	5.60		486.2	181.3	88,151		2.024	266,496	6.118
	5.70		487.0	182.1	88,686		2.036	275,338	6.321
	5.80		487.8	182.9	89,222		2.048	284,233	6.525
	5.90		488.6	183.7	89,759		2.061	293,182	6.731
	6.00		489.4	184.5	90,297		2.073	302,185	6.937
	6.10		490.2	185.3	90,837		2.085	311,241	7.145
	6.20		491.0	186.1	91,378		2.098	320,352	7.354
	6.30		491.8	186.9	91,920		2.110	329,517	7.565
	6.40		492.6	187.7	92,464		2.123	338,736	7.776
	6.50		493.4	188.5	93,009		2.135	348,010	7.989
	6.60		494.2	189.3	93,555		2.148	357,338	8.203
	6.70		495.0	190.1	94,103		2.160	366,721	8.419
	6.80		495.8	190.9	94,651		2.173	376,159	8.635
	6.90		496.6	191.7	95,201		2.186	385,651	8.853
	7.00		497.4	192.5	95,753		2.198	395,199	9.073
	7.10		498.2	193.3	96,305		2.211	404,802	9.293
	7.20		499.0	194.1	96,859		2.224	414,460	9.515
	7.30		499.8	194.9	97,414		2.236	424,174	9.738
	7.40		500.6	195.7	97,970		2.249	433,943	9.962
	7.50		501.4	196.5	98,528		2.262	443,768	10.188
	7.60		502.2	197.3	99,087		2.275	453,648	10.414
	7.70		503.0	198.1	99,647		2.288	463,585	10.642
	7.80		503.8	198.9	100,209		2.300	473,578	10.872
	7.90		504.6	199.7	100,772		2.313	483,627	11.103
	8.00		505.4	200.5	101,336		2.326	493,732	11.335
	8.10		506.2	201.3	101,901		2.339	503,894	11.568
	8.20		507.0	202.1	102,468		2.352	514,113	11.802
	8.30		507.8	202.9	103,036		2.365	524,388	12.038
	8.40		508.6	203.7	103,605		2.378	534,720	12.275
	8.50		509.4	204.5	104,175		2.392	545,109	12.514
	8.60		510.2	205.3	104,747		2.405	555,555	12.754
	8.70		511.0	206.1	105,320		2.418	566,058	12.995
	8.80		511.8	206.9	105,894		2.431	576,619	13.237
	8.90		512.6	207.7	106,470		2.444	587,237	13.481
	9.00		513.4	208.5	107,047		2.457	597,913	13.726
	9.10		514.2	209.3	107,625		2.471	608,647	13.973
	9.20		515.0	210.1	108,205		2.484	619,438	14.220
	9.30		515.8	210.9	108,785		2.497	630,288	14.469
	9.40		516.6	211.7	109,367		2.511	641,195	14.720
	9.50		517.4	212.5	109,951		2.524	652,161	14.972
	9.60		518.2	213.3	110,535		2.538	663,185	15.225
	9.70		519.0	214.1	111,121		2.551	674,268	15.479

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



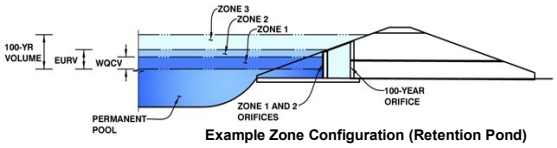


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Falcon Field

Basin ID: Pond B



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.47	0.570	Orifice Plate
Zone 2 (EURV)	3.51	1.579	Orifice Plate
Zone 3 (100-year)	4.00	0.879	Weir&Pipe (Restrict)
Total (all zones)		3.028	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =	3.51	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.17	2.50					
Orifice Area (sq. inches)	2.25	2.25	13.00					

	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		Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A ft²
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A feet
Vertical Orifice Diameter =	N/A	N/A	inches			

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.51	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.26	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	3.09	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	13.81	N/A	
Horiz. Length of Weir Sides =	3.00	N/A	feet	Overflow Grate Open Area w/o Debris =	10.82	N/A	ft²
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	10.82	N/A	ft²
Debris Clogging % =	0%	N/A	%				

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.78	N/A	ft²
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.40	N/A	feet
Restrictor Plate Height Above Pipe Invert =	8.20		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.48	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.91 feet
Spillway Crest Length =	18.00	feet	Stage at Top of Freeboard =	5.91 feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	2.06 acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	6.75 acre-ft

Calculated Parameters for Spillway

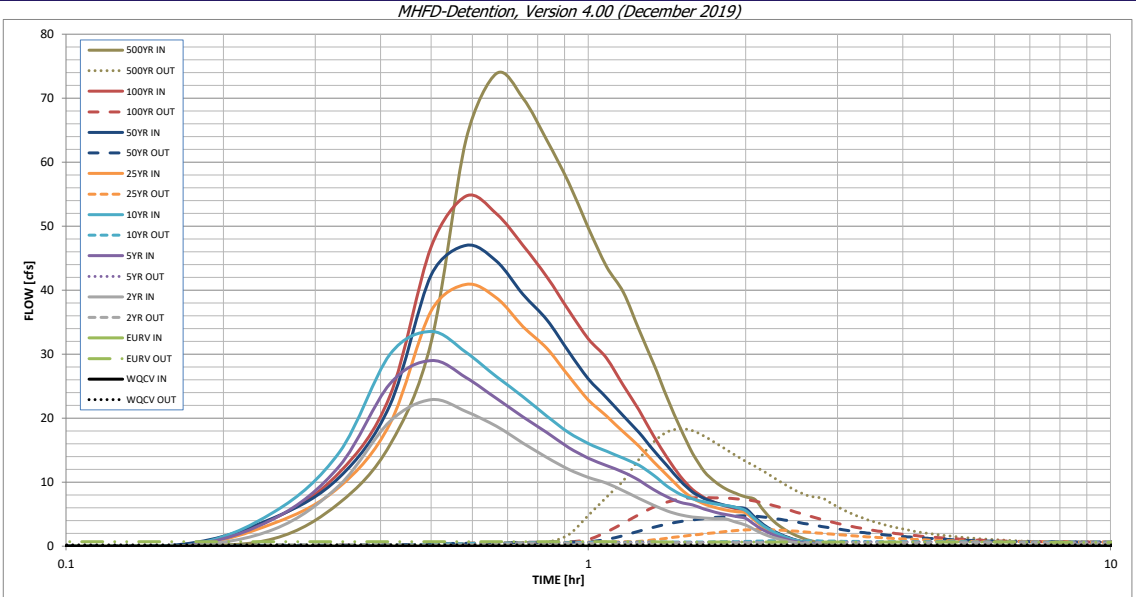
Routed Hydrograph Results

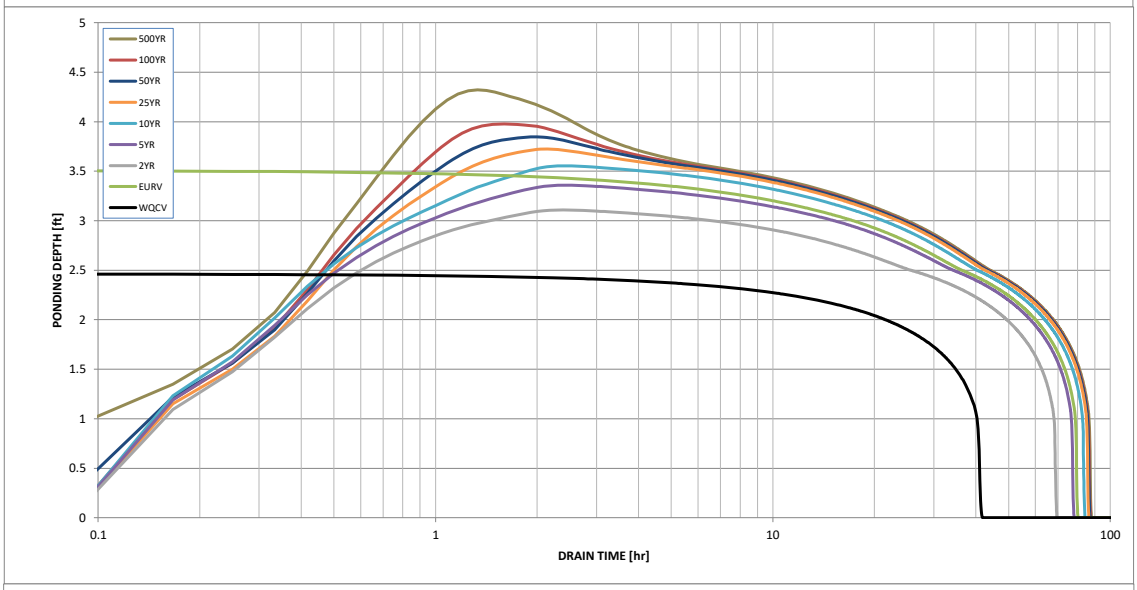
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

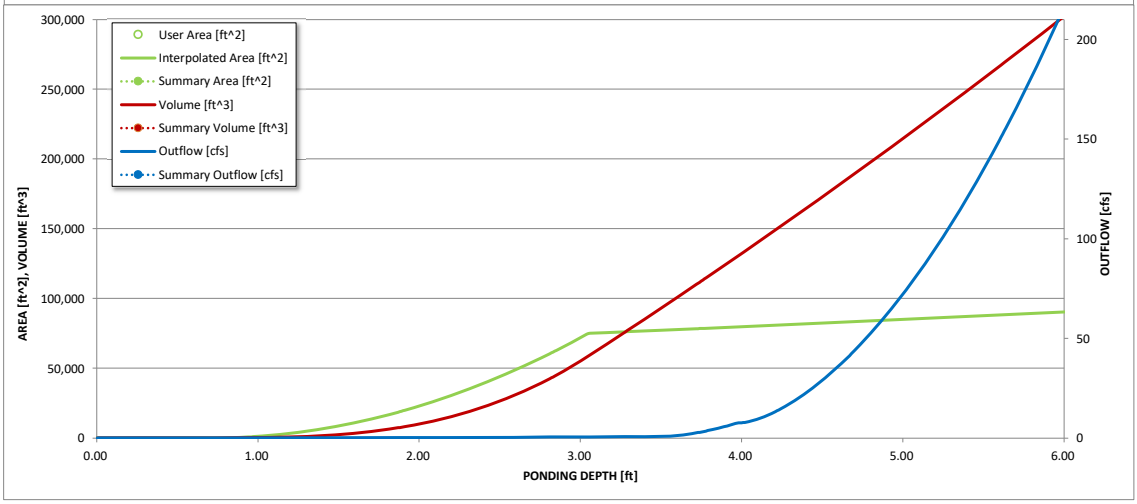
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.29
CUHP Runoff Volume (acre-ft) =	0.570	2.149	1.541	1.992	2.354	2.763	3.162	3.618	4.883
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.541	1.992	2.354	2.763	3.162	3.618	4.883
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.3	2.5	5.0	8.4	17.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.01	0.13	0.26	0.44	0.91
Peak Inflow Q (cfs) =	N/A	N/A	22.9	29.0	33.5	40.9	47.0	54.7	73.9
Peak Outflow Q (cfs) =	0.2	0.7	0.6	0.7	0.9	2.6	4.7	7.6	18.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.3	3.2	1.0	1.0	0.9	1.1
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.2	0.4	0.6	0.7
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	73	64	71	76	77	77	76	74
Time to Drain 99% of Inflow Volume (hours) =	**40**	77	67	75	80	82	83	82	82
Maximum Ponding Depth (ft) =	2.47	3.51	3.11	3.36	3.55	3.72	3.85	3.98	4.32
Area at Maximum Ponding Depth (acres) =	0.98	1.77	1.73	1.76	1.78	1.80	1.81	1.83	1.87
Maximum Volume Stored (acre-ft) =	0.576	2.152	1.434	1.869	2.223	2.527	2.743	2.980	3.627

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

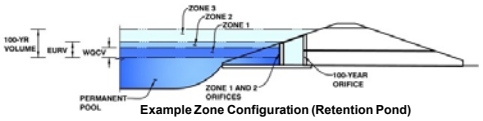
	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.03	1.18
	0:15:00	0.00	0.00	2.66	4.32	5.34	3.58	4.47	4.36	6.74
	0:20:00	0.00	0.00	9.51	12.48	14.65	9.24	10.75	11.50	15.81
	0:25:00	0.00	0.00	19.49	25.35	29.95	19.08	22.01	23.44	31.86
	0:30:00	0.00	0.00	22.89	29.03	33.55	36.77	42.34	46.76	63.49
	0:35:00	0.00	0.00	21.07	26.36	30.29	40.93	47.02	54.72	73.88
	0:40:00	0.00	0.00	18.73	23.08	26.50	38.80	44.54	51.95	70.03
	0:45:00	0.00	0.00	16.12	20.20	23.36	34.32	39.35	46.99	63.39
	0:50:00	0.00	0.00	13.86	17.77	20.32	30.89	35.37	42.07	56.83
	0:55:00	0.00	0.00	12.02	15.42	17.75	26.59	30.41	36.87	49.76
	1:00:00	0.00	0.00	10.77	13.77	16.05	22.88	26.15	32.42	43.73
	1:05:00	0.00	0.00	9.87	12.61	14.84	20.34	23.23	29.38	39.66
	1:10:00	0.00	0.00	8.65	11.58	13.74	17.84	20.34	25.11	33.82
	1:15:00	0.00	0.00	7.48	10.28	12.63	15.63	17.78	21.27	28.58
	1:20:00	0.00	0.00	6.42	8.87	11.09	13.21	14.99	17.26	23.14
	1:25:00	0.00	0.00	5.52	7.68	9.36	11.08	12.56	13.80	18.44
	1:30:00	0.00	0.00	4.90	6.88	8.11	9.02	10.20	10.92	14.53
	1:35:00	0.00	0.00	4.58	6.46	7.40	7.51	8.48	8.83	11.72
	1:40:00	0.00	0.00	4.42	5.83	6.94	6.62	7.47	7.60	10.06
	1:45:00	0.00	0.00	4.32	5.32	6.61	6.05	6.81	6.81	8.98
	1:50:00	0.00	0.00	4.26	4.95	6.37	5.66	6.38	6.27	8.23
	1:55:00	0.00	0.00	3.76	4.67	6.07	5.39	6.07	5.88	7.71
	2:00:00	0.00	0.00	3.32	4.34	5.55	5.21	5.86	5.60	7.33
	2:05:00	0.00	0.00	2.55	3.34	4.27	4.02	4.53	4.28	5.59
	2:10:00	0.00	0.00	1.91	2.48	3.17	2.98	3.35	3.15	4.11
	2:15:00	0.00	0.00	1.43	1.85	2.35	2.21	2.49	2.34	3.05
	2:20:00	0.00	0.00	1.06	1.37	1.73	1.64	1.85	1.75	2.28
	2:25:00	0.00	0.00	0.77	0.98	1.26	1.19	1.34	1.28	1.67
	2:30:00	0.00	0.00	0.55	0.69	0.91	0.85	0.96	0.92	1.20
	2:35:00	0.00	0.00	0.39	0.49	0.65	0.62	0.70	0.67	0.87
	2:40:00	0.00	0.00	0.26	0.33	0.44	0.43	0.49	0.47	0.61
	2:45:00	0.00	0.00	0.15	0.21	0.28	0.28	0.31	0.30	0.39
	2:50:00	0.00	0.00	0.08	0.12	0.15	0.16	0.18	0.17	0.22
	2:55:00	0.00	0.00	0.03	0.06	0.07	0.07	0.08	0.08	0.10
	3:00:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.03
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Falcon Field

Basin ID: POND C



Example Zone Configuration (Retention Pond)

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (acre)	Volume (ft³)	Volume (ac-ft)
Top of Micropool	0.00		12.9	12.9	167		0.004		
ISV	0.33		12.9	12.9	167		0.004	55	0.001
	0.40		12.9	12.9	167		0.004	67	0.002
	0.50		12.9	12.9	167		0.004	83	0.002
	0.60		12.9	12.9	167		0.004	100	0.002
	0.70		12.9	12.9	167		0.004	117	0.003
	0.80		12.9	12.9	167		0.004	133	0.003
	0.90		27.2	17.6	478		0.011	160	0.004
	1.00		47.6	24.2	1,154		0.026	239	0.005
	1.10		68.0	30.9	2,102		0.048	400	0.009
	1.20		88.4	37.6	3,321		0.076	669	0.015
	1.30		108.8	44.2	4,813		0.110	1,073	0.025
	1.40		129.2	50.9	6,577		0.151	1,641	0.038
	1.50		149.6	57.6	8,613		0.198	2,398	0.055
	1.60		170.0	64.2	10,921		0.251	3,372	0.077
	1.70		190.4	70.9	13,501		0.310	4,591	0.105
	1.80		210.8	77.6	16,352		0.375	6,081	0.140
	1.90		231.2	84.2	19,476		0.447	7,870	0.181
	2.00		251.6	90.9	22,872		0.525	9,986	0.229
	2.10		272.0	97.6	26,540		0.609	12,454	0.286
Floor	2.14		280.1	100.2	28,083		0.645	13,546	0.311
	2.20		280.6	100.7	28,266		0.649	15,237	0.350
	2.30		281.4	101.5	28,572		0.656	18,079	0.415
Zone 1 (WQCV)	2.38		282.1	102.2	28,817		0.662	20,374	0.468
	2.40		282.2	102.3	28,879		0.663	20,951	0.481
	2.50		283.0	103.1	29,187		0.670	23,854	0.548
	2.60		283.8	103.9	29,497		0.677	26,789	0.615
	2.70		284.6	104.7	29,807		0.684	29,754	0.683
	2.80		285.4	105.5	30,120		0.691	32,750	0.752
	2.90		286.2	106.3	30,433		0.699	35,778	0.821
	3.00		287.0	107.1	30,748		0.706	38,837	0.892
	3.10		287.8	107.9	31,064		0.713	41,927	0.963
	3.20		288.6	108.7	31,381		0.720	45,049	1.034
	3.30		289.4	109.5	31,699		0.728	48,203	1.107
	3.40		290.2	110.3	32,019		0.735	51,389	1.180
	3.50		291.0	111.1	32,340		0.742	54,607	1.254
	3.60		291.8	111.9	32,663		0.750	57,857	1.328
	3.70		292.6	112.7	32,986		0.757	61,140	1.404
	3.80		293.4	113.5	33,311		0.765	64,455	1.480
	3.90		294.2	114.3	33,637		0.772	67,802	1.557
	4.00		295.0	115.1	33,965		0.780	71,182	1.634
	4.10		295.8	115.9	34,294		0.787	74,595	1.712
Zone 2 (EURV)	4.15		296.2	116.3	34,458		0.791	76,314	1.752
	4.20		296.6	116.7	34,624		0.795	78,041	1.792
	4.30		297.4	117.5	34,955		0.802	81,520	1.871
	4.40		298.2	118.3	35,288		0.810	85,032	1.952
	4.50		299.0	119.1	35,621		0.818	88,577	2.033
	4.60		299.8	119.9	35,957		0.825	92,156	2.116
	4.70		300.6	120.7	36,293		0.833	95,769	2.199
	4.80		301.4	121.5	36,631		0.841	99,415	2.282
	4.90		302.2	122.3	36,970		0.849	103,095	2.367
	5.00		303.0	123.1	37,310		0.857	106,809	2.452
Zone 3 (100-year)	5.01		303.1	123.2	37,344		0.857	107,182	2.461
	5.10		303.8	123.9	37,652		0.864	110,557	2.538
	5.20		304.6	124.7	37,994		0.872	114,339	2.625
	5.30		305.4	125.5	38,339		0.880	118,156	2.712
	5.40		306.2	126.3	38,684		0.888	122,007	2.801
	5.50		307.0	127.1	39,031		0.896	125,893	2.890
	5.60		307.8	127.9	39,379		0.904	129,813	2.980
	5.70		308.6	128.7	39,728		0.912	133,769	3.071
	5.80		309.4	129.5	40,078		0.920	137,759	3.163
	5.90		310.2	130.3	40,430		0.928	141,784	3.255
	6.00		311.0	131.1	40,783		0.936	145,845	3.348
	6.10		311.8	131.9	41,138		0.944	149,941	3.442
	6.20		312.6	132.7	41,493		0.953	154,073	3.537
	6.30		313.4	133.5	41,850		0.961	158,240	3.633
	6.40		314.2	134.3	42,208		0.969	162,443	3.729
	6.50		315.0	135.1	42,568		0.977	166,681	3.826
	6.60		315.8	135.9	42,929		0.986	170,956	3.925
	6.70		316.6	136.7	43,291		0.994	175,267	4.024
	6.80		317.4	137.5	43,654		1.002	179,614	4.123
	6.90		318.2	138.3	44,019		1.011	183,998	4.224
	7.00		319.0	139.1	44,384		1.019	188,418	4.325
	7.10		319.8	139.9	44,752		1.027	192,875	4.428
	7.20		320.6	140.7	45,120		1.036	197,369	4.531
	7.30		321.4	141.5	45,490		1.044	201,899	4.635
	7.40		322.2	142.3	45,861		1.053	206,467	4.740
	7.50		323.0	143.1	46,233		1.061	211,071	4.846
	7.60		323.8	143.9	46,607		1.070	215,713	4.952
	7.70		324.6	144.7	46,982		1.079	220,393	5.060
	7.80		325.4	145.5	47,358		1.087	225,110	5.168
	7.90		326.2	146.3	47,735		1.096	229,864	5.277
	8.00		327.0	147.1	48,114		1.105	234,657	5.387
	8.10		327.8	147.9	48,494		1.113	239,487	5.498
	8.20		328.6	148.7	48,875		1.122	244,355	5.610
	8.30		329.4	149.5	49,257		1.131	249,262	5.722
	8.40		330.2	150.3	49,641		1.140	254,207	5.836
	8.50		331.0	151.1	50,026		1.148	259,190	5.950
	8.60		331.8	151.9	50,413		1.157	264,212	6.065
	8.70		332.6	152.7	50,800		1.166	269,273	6.182
	8.80		333.4	153.5	51,189		1.175	274,372	6.299
	8.90		334.2	154.3	51,579		1.184	279,511	6.417
	9.00		335.0	155.1	51,971		1.193	284,688	6.536
	9.10		335.8	155.9	52,364		1.202	289,905	6.655
	9.20		336.6	156.7	52,758		1.211	295,161	6.776
	9.30		337.4	157.5	53,153		1.220	300,457	6.898
	9.40		338.2	158.3	53,550		1.229	305,792	7.020
	9.50		339.0	159.1	53,948		1.238	311,167	7.143
	9.60		339.8	159.9	54,347		1.248	316,581	7.268

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	15.35	acres
Watershed Length =	1,035	ft
Watershed Length to Centroid =	517	ft
Watershed Slope =	0.026	ft/ft
Watershed Imperviousness =	85.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

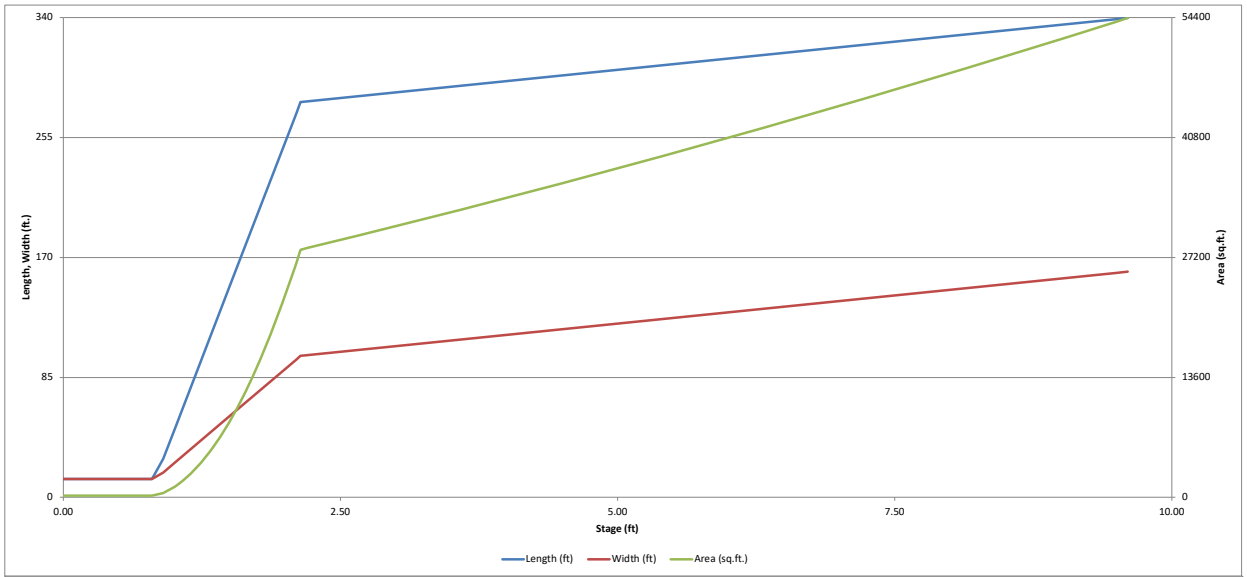
			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.463	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	1.745	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.204	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.556	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.839	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	2.158	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.470	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.826	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.29 in.) =	3.814	acre-feet	3.29 inches
Approximate 2-yr Detention Volume =	1.149	acre-feet	
Approximate 5-yr Detention Volume =	1.492	acre-feet	
Approximate 10-yr Detention Volume =	1.776	acre-feet	
Approximate 25-yr Detention Volume =	2.101	acre-feet	
Approximate 50-yr Detention Volume =	2.290	acre-feet	
Approximate 100-yr Detention Volume =	2.459	acre-feet	

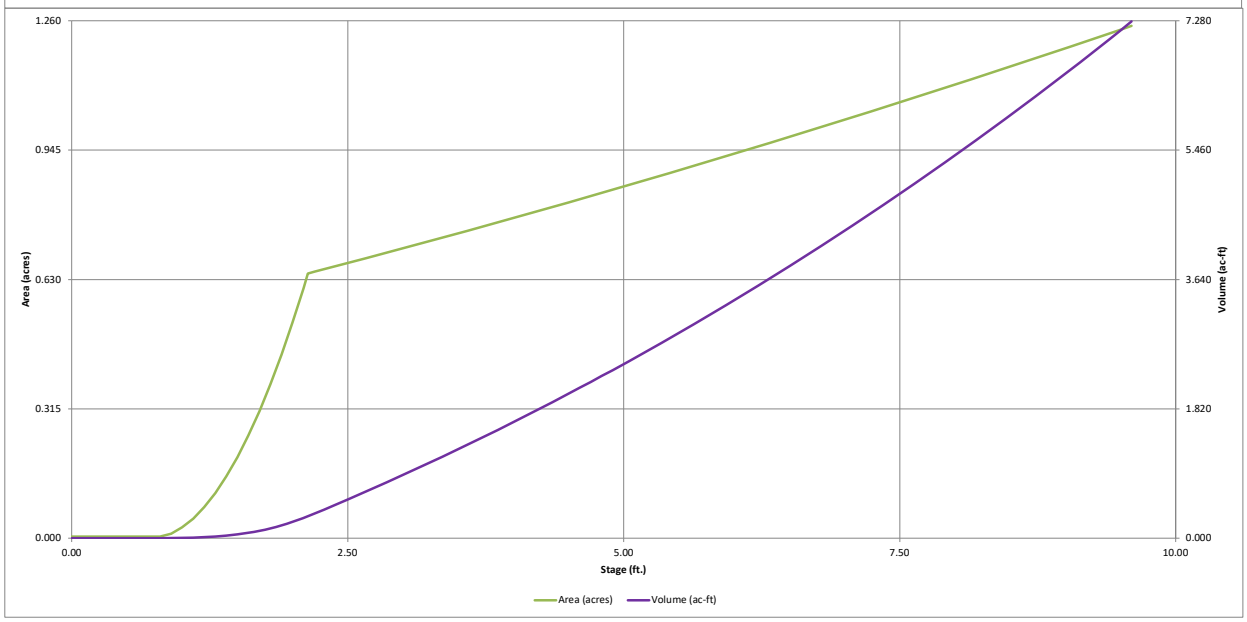
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.463	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.282	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.714	acre-feet
Total Detention Basin Volume =	2.459	acre-feet
Initial Surcharge Volume (ISV) =	55	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	5.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	3	
Initial Surcharge Area (A_{ISV}) =	167	ft^2
Surcharge Volume Length (L_{ISV}) =	12.9	ft
Surcharge Volume Width (W_{ISV}) =	12.9	ft
Depth of Basin Floor (H_{FLOOR}) =	1.31	ft
Length of Basin Floor (L_{FLOOR}) =	280.1	ft
Width of Basin Floor (W_{FLOOR}) =	100.2	ft
Area of Basin Floor (A_{FLOOR}) =	28,083	ft^2
Volume of Basin Floor (V_{FLOOR}) =	13,280	ft^3
Depth of Main Basin (H_{MAIN}) =	2.86	ft
Length of Main Basin (L_{MAIN}) =	303.0	ft
Width of Main Basin (W_{MAIN}) =	123.1	ft
Area of Main Basin (A_{MAIN}) =	37,310	ft^2
Volume of Main Basin (V_{MAIN}) =	93,200	ft^3
Calculated Total Basin Volume (V_{total}) =	**2.448**	acre-feet

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



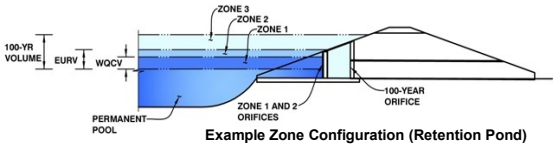


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Falcon Field

Basin ID: POND C



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.38	0.463	Orifice Plate
Zone 2 (EURV)	4.15	1.282	Orifice Plate
Zone 3 (100-year)	5.01	0.714	Weir&Pipe (Restrict)
Total (all zones)		2.459	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.15	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	16.60	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.38	2.77					
Orifice Area (sq. inches)	2.08	2.08	14.00					

	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			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.30	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.35	N/A	feet
Overflow Weir Front Edge Length =	32.00	N/A	feet	Overflow Weir Slope Length =	0.21	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	4.95	N/A	
Horiz. Length of Weir Sides =	0.20	N/A	feet	Overflow Grate Open Area w/o Debris =	4.62	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	4.62	N/A	ft^2
Debris Clogging % =	0%	N/A	%				

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.93	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.45	N/A	feet
Restrictor Plate Height Above Pipe Invert =	9.40		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.62	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.70	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.89	feet
Spillway Crest Length =	19.00	feet	Stage at Top of Freeboard =	6.59	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.98	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.91	acre-ft

Calculated Parameters for Spillway

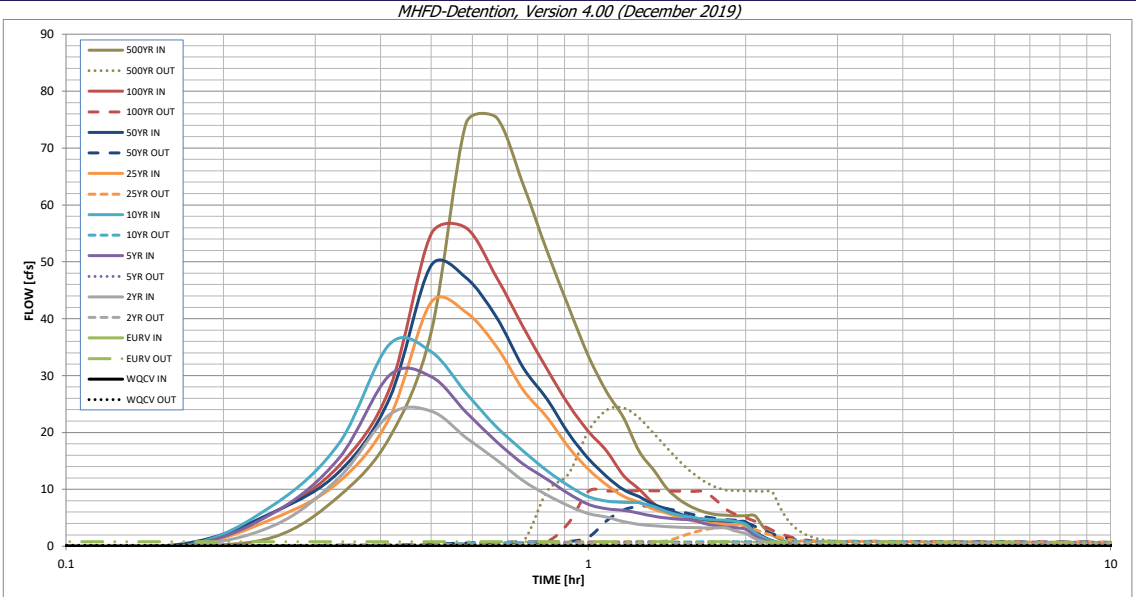
Routed Hydrograph Results

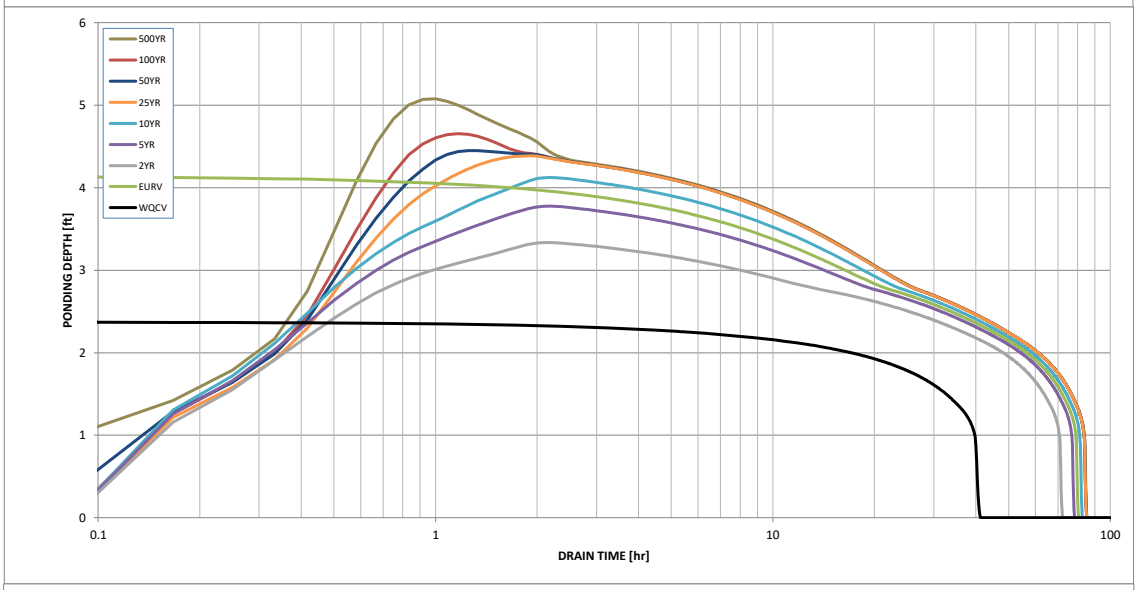
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

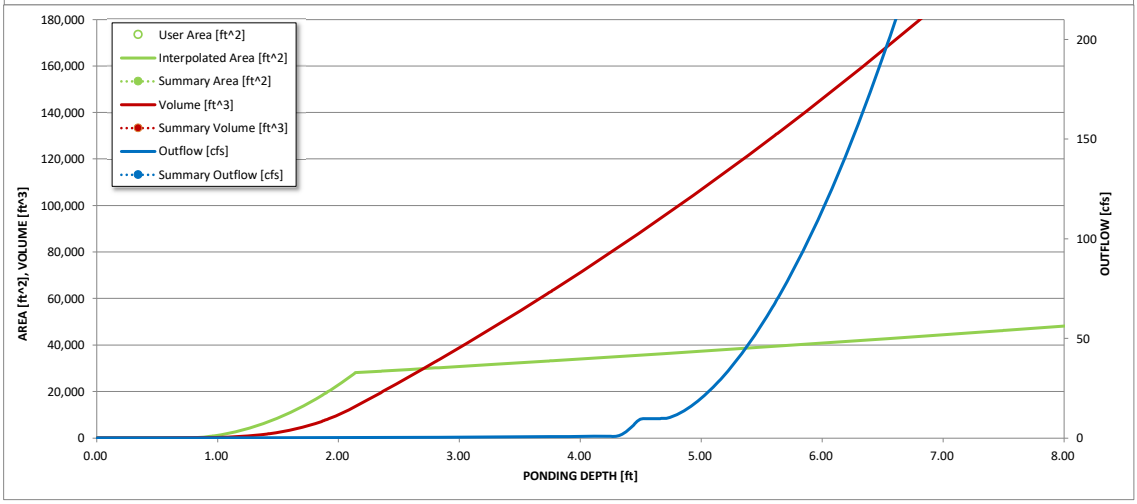
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.29
CUHP Runoff Volume (acre-ft) =	0.463	1.745	1.204	1.556	1.839	2.158	2.470	2.826	3.814
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.204	1.556	1.839	2.158	2.470	2.826	3.814
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.3	0.4	3.3	6.5	10.7	21.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.02	0.21	0.43	0.70	1.39
Peak Inflow Q (cfs) =	N/A	N/A	23.8	30.1	35.6	42.9	49.3	56.0	75.4
Peak Outflow Q (cfs) =	0.2	0.8	0.6	0.7	0.8	3.6	7.0	9.8	24.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.7	2.2	1.1	1.1	0.9	1.1
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.6	1.3	1.9	2.0
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) =	38	72	66	71	74	76	75	74	71
Time to Drain 99% of Inflow Volume (hours) =	**40**	77	70	75	79	81	81	80	79
Maximum Ponding Depth (ft) =	2.38	4.15	3.34	3.78	4.12	4.39	4.45	4.66	5.08
Area at Maximum Ponding Depth (acres) =	0.66	0.79	0.73	0.76	0.79	0.81	0.81	0.83	0.86
Maximum Volume Stored (acre-ft) =	0.468	1.752	1.128	1.457	1.728	1.936	1.985	2.157	2.512

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

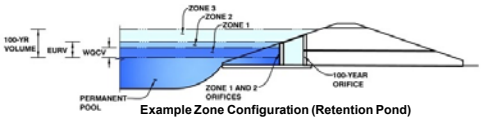
	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.04	1.62
	0:15:00	0.00	0.00	3.65	5.93	7.34	4.92	6.03	5.98	8.81
	0:20:00	0.00	0.00	12.07	15.53	18.13	11.34	13.09	14.16	19.16
	0:25:00	0.00	0.00	23.17	30.09	35.58	22.70	26.10	27.81	37.61
	0:30:00	0.00	0.00	23.77	29.82	34.18	42.90	49.33	54.87	74.34
	0:35:00	0.00	0.00	19.08	23.60	26.98	41.14	47.18	56.01	75.38
	0:40:00	0.00	0.00	15.20	18.40	21.00	35.13	40.28	47.34	63.67
	0:45:00	0.00	0.00	11.52	14.48	16.78	27.51	31.46	38.60	51.93
	0:50:00	0.00	0.00	9.03	11.78	13.30	22.67	25.88	31.16	42.02
	0:55:00	0.00	0.00	7.10	9.21	10.63	17.40	19.83	24.84	33.48
	1:00:00	0.00	0.00	5.73	7.38	8.70	13.55	15.43	20.19	27.19
	1:05:00	0.00	0.00	5.13	6.58	7.95	10.81	12.29	16.78	22.63
	1:10:00	0.00	0.00	4.32	6.31	7.73	8.77	9.94	12.43	16.71
	1:15:00	0.00	0.00	3.85	5.81	7.64	7.70	8.71	10.02	13.44
	1:20:00	0.00	0.00	3.59	5.28	6.98	6.51	7.35	7.55	10.05
	1:25:00	0.00	0.00	3.44	4.95	6.04	5.79	6.53	6.09	8.06
	1:30:00	0.00	0.00	3.34	4.75	5.43	4.98	5.61	5.19	6.84
	1:35:00	0.00	0.00	3.27	4.63	5.05	4.47	5.03	4.62	6.05
	1:40:00	0.00	0.00	3.23	4.01	4.80	4.15	4.67	4.28	5.60
	1:45:00	0.00	0.00	3.23	3.62	4.64	3.98	4.47	4.16	5.44
	1:50:00	0.00	0.00	3.23	3.38	4.55	3.87	4.36	4.11	5.36
	1:55:00	0.00	0.00	2.62	3.24	4.34	3.83	4.30	4.10	5.36
	2:00:00	0.00	0.00	2.23	3.00	3.86	3.80	4.28	4.10	5.36
	2:05:00	0.00	0.00	1.37	1.84	2.39	2.37	2.66	2.55	3.33
	2:10:00	0.00	0.00	0.82	1.11	1.45	1.45	1.63	1.56	2.03
	2:15:00	0.00	0.00	0.47	0.65	0.84	0.85	0.95	0.91	1.19
	2:20:00	0.00	0.00	0.24	0.37	0.47	0.48	0.54	0.52	0.68
	2:25:00	0.00	0.00	0.11	0.18	0.22	0.25	0.27	0.26	0.34
	2:30:00	0.00	0.00	0.04	0.06	0.07	0.09	0.10	0.09	0.12
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Falcon Field

Basin ID: POND D



Example Zone Configuration (Retention Pond)

Depth Increment = 0.10 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		12.9	12.9	167		0.004		
ISV	0.33		12.9	12.9	167		0.004	55	0.001
	0.40		12.9	12.9	167		0.004	67	0.002
	0.50		12.9	12.9	167		0.004	83	0.002
	0.60		12.9	12.9	167		0.004	100	0.002
	0.70		12.9	12.9	167		0.004	117	0.003
	0.80		12.9	12.9	167		0.004	133	0.003
	0.90		27.2	17.6	478		0.011	160	0.004
	1.00		47.6	24.2	1,154		0.026	239	0.005
	1.10		68.0	30.9	2,102		0.048	400	0.009
	1.20		88.4	37.6	3,321		0.076	669	0.015
	1.30		108.8	44.2	4,813		0.110	1,073	0.025
	1.40		129.2	50.9	6,577		0.151	1,641	0.038
	1.50		149.6	57.6	8,613		0.198	2,398	0.055
	1.60		170.0	64.2	10,921		0.251	3,372	0.077
	1.70		190.4	70.9	13,501		0.310	4,591	0.105
	1.80		210.8	77.6	16,352		0.375	6,081	0.140
	1.90		231.2	84.2	19,476		0.447	7,870	0.181
	2.00		251.6	90.9	22,872		0.525	9,986	0.229
	2.10		272.0	97.6	26,540		0.609	12,454	0.286
	2.20		292.4	104.2	30,480		0.700	15,303	0.351
	2.30		312.8	110.9	34,692		0.796	18,559	0.426
Zone 1 (WQCV)	2.38		329.1	116.2	38,257		0.878	21,476	0.493
	2.40		333.2	117.6	39,175		0.899	22,250	0.511
	2.50		353.6	124.2	43,931		1.009	26,403	0.606
	2.60		374.0	130.9	48,959		1.124	31,045	0.713
	2.70		394.4	137.6	54,259		1.246	36,204	0.831
Floor	2.75		404.6	140.9	57,011		1.309	38,985	0.895
	2.80		405.0	141.3	57,229		1.314	41,841	0.961
	2.90		405.8	142.1	57,667		1.324	47,586	1.092
	3.00		406.6	142.9	58,106		1.334	53,375	1.225
	3.10		407.4	143.7	58,546		1.344	59,207	1.359
	3.20		408.2	144.5	58,988		1.354	65,084	1.494
	3.30		409.0	145.3	59,430		1.364	71,005	1.630
	3.40		409.8	146.1	59,874		1.375	76,970	1.767
Zone 2 (EURV)	3.46		410.3	146.6	60,141		1.381	80,571	1.850
	3.50		410.6	146.9	60,320		1.385	82,980	1.905
	3.60		411.4	147.7	60,766		1.395	89,034	2.044
	3.70		412.2	148.5	61,214		1.405	95,133	2.184
	3.80		413.0	149.3	61,664		1.416	101,277	2.325
	3.90		413.8	150.1	62,114		1.426	107,466	2.467
Zone 3 (100-year)	4.00		414.6	150.9	62,566		1.436	113,700	2.610
	4.10		415.4	151.7	63,019		1.447	119,979	2.754
	4.20		416.2	152.5	63,473		1.457	126,304	2.900
	4.30		417.0	153.3	63,929		1.468	132,674	3.046
	4.40		417.8	154.1	64,386		1.478	139,089	3.193
	4.50		418.6	154.9	64,844		1.489	145,551	3.341
	4.60		419.4	155.7	65,303		1.499	152,058	3.491
	4.70		420.2	156.5	65,764		1.510	158,612	3.641
	4.80		421.0	157.3	66,226		1.520	165,211	3.793
	4.90		421.8	158.1	66,689		1.531	171,857	3.945
	5.00		422.6	158.9	67,154		1.542	178,549	4.099
	5.10		423.4	159.7	67,620		1.552	185,288	4.254
	5.20		424.2	160.5	68,087		1.563	192,073	4.409
	5.30		425.0	161.3	68,555		1.574	198,905	4.566
	5.40		425.8	162.1	69,025		1.585	205,784	4.724
	5.50		426.6	162.9	69,496		1.595	212,710	4.883
	5.60		427.4	163.7	69,968		1.606	219,683	5.043
	5.70		428.2	164.5	70,442		1.617	226,704	5.204
	5.80		429.0	165.3	70,916		1.628	233,772	5.367
	5.90		429.8	166.1	71,392		1.639	240,887	5.530
	6.00		430.6	166.9	71,870		1.650	248,050	5.694
	6.10		431.4	167.7	72,348		1.661	255,261	5.860
	6.20		432.2	168.5	72,828		1.672	262,520	6.027
	6.30		433.0	169.3	73,310		1.683	269,827	6.194
	6.40		433.8	170.1	73,792		1.694	277,182	6.363
	6.50		434.6	170.9	74,276		1.705	284,585	6.533
	6.60		435.4	171.7	74,761		1.716	292,037	6.704
	6.70		436.2	172.5	75,247		1.727	299,537	6.876
	6.80		437.0	173.3	75,735		1.739	307,086	7.050
	6.90		437.8	174.1	76,224		1.750	314,684	7.224
	7.00		438.6	174.9	76,714		1.761	322,331	7.400
	7.10		439.4	175.7	77,205		1.772	330,027	7.576
	7.20		440.2	176.5	77,698		1.784	337,772	7.754
	7.30		441.0	177.3	78,192		1.795	345,567	7.933
	7.40		441.8	178.1	78,687		1.806	353,411	8.113
	7.50		442.6	178.9	79,184		1.818	361,304	8.294
	7.60		443.4	179.7	79,682		1.829	369,247	8.477
	7.70		444.2	180.5	80,181		1.841	377,241	8.660
	7.80		445.0	181.3	80,681		1.852	385,284	8.845
	7.90		445.8	182.1	81,183		1.864	393,377	9.031
	8.00		446.6	182.9	81,686		1.875	401,520	9.218
	8.10		447.4	183.7	82,190		1.887	409,714	9.406
	8.20		448.2	184.5	82,696		1.898	417,958	9.595
	8.30		449.0	185.3	83,202		1.910	426,253	9.785
	8.40		449.8	186.1	83,710		1.922	434,599	9.977
	8.50		450.6	186.9	84,220		1.933	442,995	10.170
	8.60		451.4	187.7	84,730		1.945	451,443	10.364
	8.70		452.2	188.5	85,242		1.957	459,941	10.559
	8.80		453.0	189.3	85,756		1.969	468,491	10.755
	8.90		453.8	190.1	86,270		1.980	477,093	10.953
	9.00		454.6	190.9	86,786		1.992	485,745	11.151
	9.10		455.4	191.7	87,303		2.004	494,450	11.351
	9.20		456.2	192.5	87,821		2.016	503,206	11.552
	9.30		457.0	193.3	88,341		2.028	512,014	11.754
	9.40		457.8	194.1	88,862		2.040	520,874	11.958
	9.50		458.6	194.9	89,384		2.052	529,786	12.162
	9.60		459.4	195.7	89,907		2.064	538,751	12.368
	9.70		460.2	196.5	90,432		2.076	547,768	12.575

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	16.26	acres
Watershed Length =	962	ft
Watershed Length to Centroid =	481	ft
Watershed Slope =	0.027	ft/ft
Watershed Imperviousness =	85.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

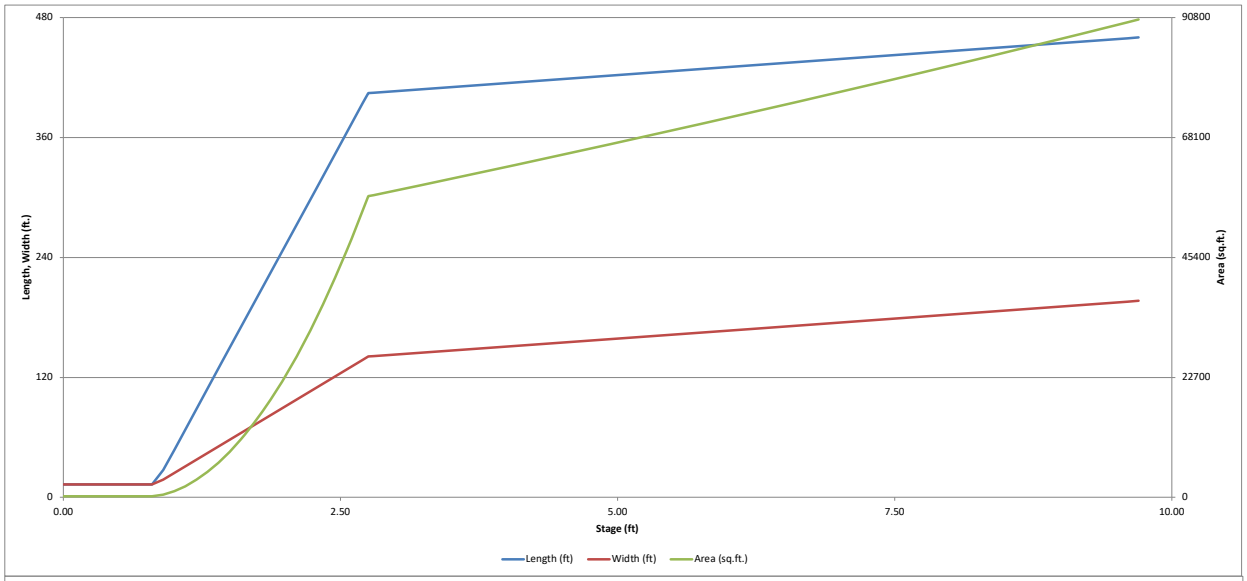
			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.491	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	1.849	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.264	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.634	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.931	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	2.266	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.594	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.968	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.29 in.) =	4.006	acre-feet	3.29 inches
Approximate 2-yr Detention Volume =	1.217	acre-feet	
Approximate 5-yr Detention Volume =	1.580	acre-feet	
Approximate 10-yr Detention Volume =	1.881	acre-feet	
Approximate 25-yr Detention Volume =	2.225	acre-feet	
Approximate 50-yr Detention Volume =	2.426	acre-feet	
Approximate 100-yr Detention Volume =	2.605	acre-feet	

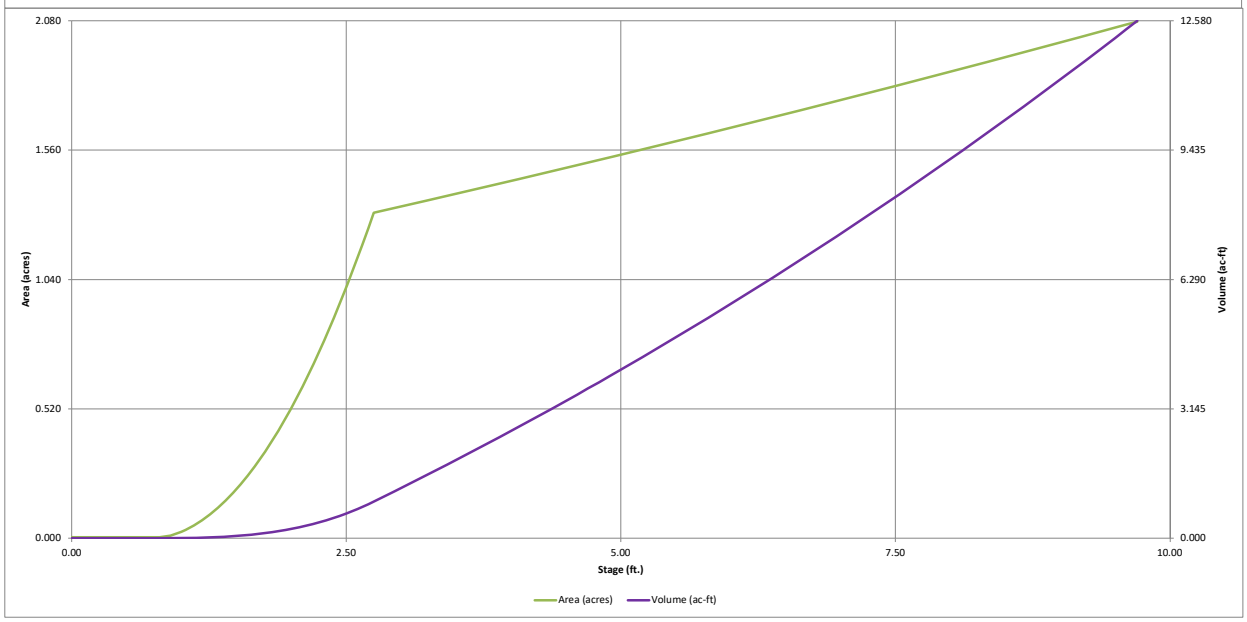
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.491	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.358	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.756	acre-feet
Total Detention Basin Volume =	2.605	acre-feet
Initial Surcharge Volume (ISV) =	55	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	4.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	3	
Initial Surcharge Area (A_{ISV}) =	167	ft^2
Surcharge Volume Length (L_{ISV}) =	12.9	ft
Surcharge Volume Width (W_{ISV}) =	12.9	ft
Depth of Basin Floor (H_{FLOOR}) =	1.92	ft
Length of Basin Floor (L_{FLOOR}) =	404.6	ft
Width of Basin Floor (W_{FLOOR}) =	140.9	ft
Area of Basin Floor (A_{FLOOR}) =	57,011	ft^2
Volume of Basin Floor (V_{FLOOR}) =	38,566	ft^3
Depth of Main Basin (H_{MAIN}) =	1.25	ft
Length of Main Basin (L_{MAIN}) =	414.6	ft
Width of Main Basin (W_{MAIN}) =	150.9	ft
Area of Main Basin (A_{MAIN}) =	62,566	ft^2
Volume of Main Basin (V_{MAIN}) =	74,708	ft^3
Calculated Total Basin Volume (V_{total}) =	**2.604**	acre-feet

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



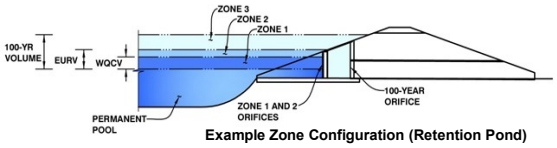


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Falcon Field

Basin ID: POND D



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.38	0.491	Orifice Plate
Zone 2 (EURV)	3.46	1.358	Orifice Plate
Zone 3 (100-year)	4.00	0.756	Weir&Pipe (Restrict)
Total (all zones)		2.605	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.46	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.15	2.40					
Orifice Area (sq. inches)	1.99	1.99	12.00					

	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			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.46	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.21	N/A	feet
Overflow Weir Front Edge Length =	3.00	N/A	feet	Overflow Weir Slope Length =	3.09	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	5.39	N/A	
Horiz. Length of Weir Sides =	3.00	N/A	feet	Overflow Grate Open Area w/o Debris =	6.49	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	6.49	N/A	ft^2
Debris Clogging % =	0%	N/A	%				

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.20	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.55	N/A	feet
Restrictor Plate Height Above Pipe Invert =	11.60		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.86	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	3.95	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.90	feet
Spillway Crest Length =	21.00	feet	Stage at Top of Freeboard =	5.85	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.63	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	5.45	acre-ft

Calculated Parameters for Spillway

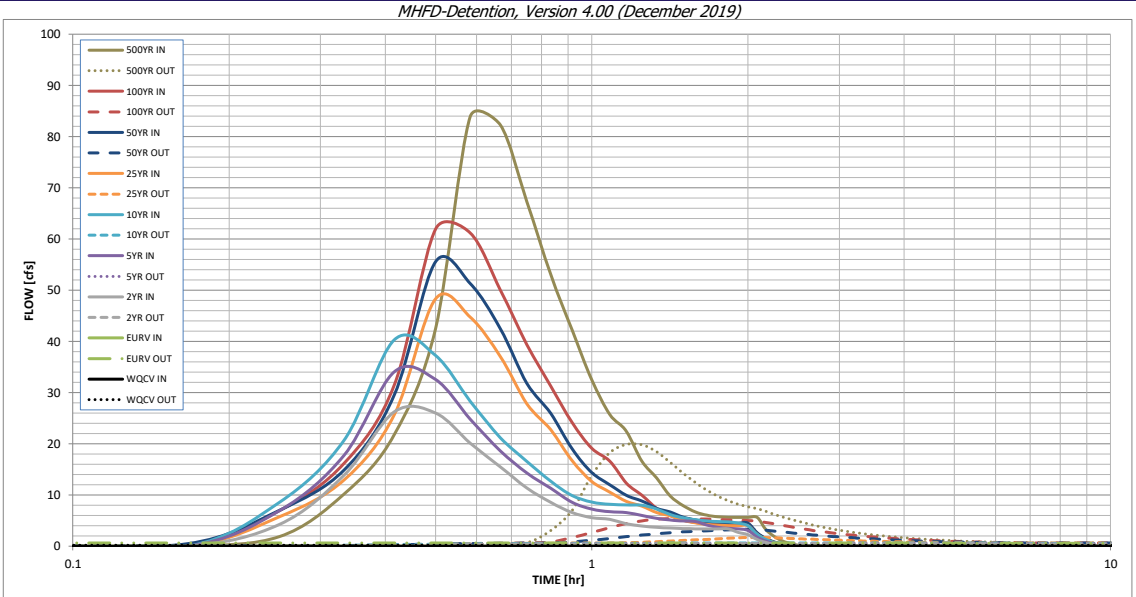
Routed Hydrograph Results

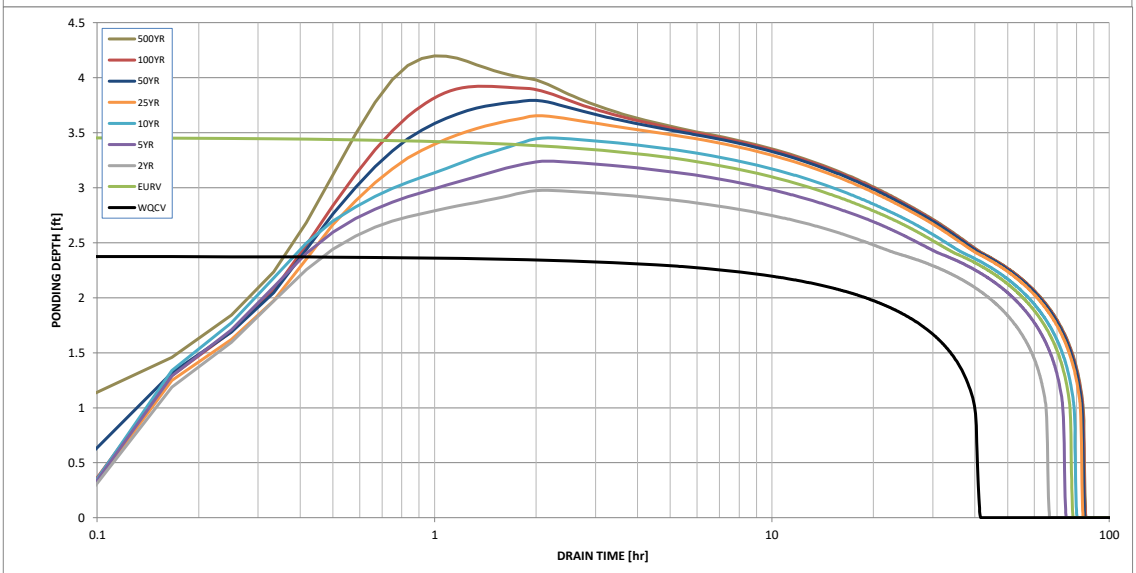
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

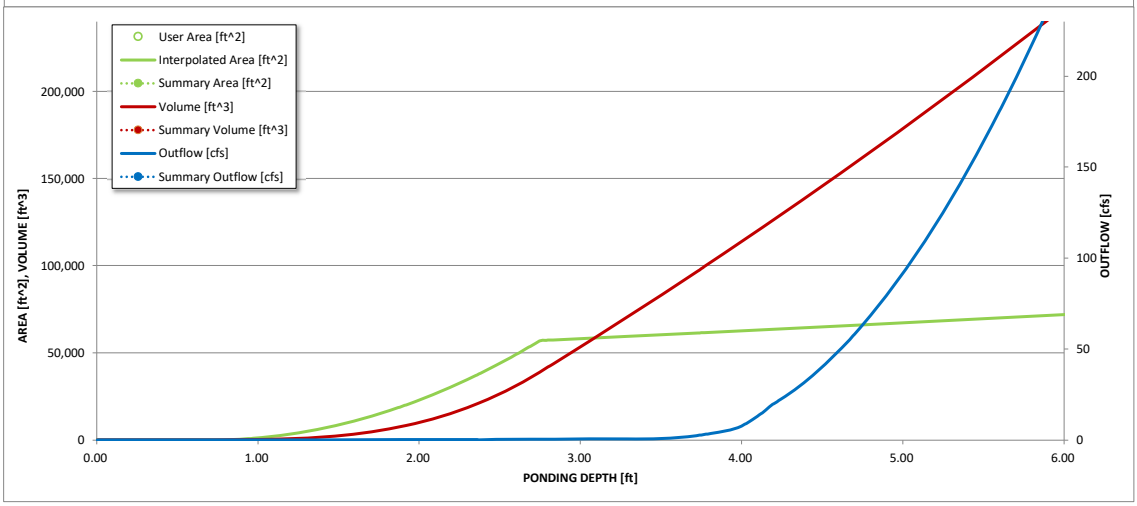
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.29
CUHP Runoff Volume (acre-ft) =	0.491	1.849	1.264	1.634	1.931	2.266	2.594	2.968	4.006
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.264	1.634	1.931	2.266	2.594	2.968	4.006
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.2	0.3	0.4	3.8	7.5	12.3	24.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.23	0.46	0.76	1.50
Peak Inflow Q (cfs) =	N/A	N/A	26.3	34.1	40.3	48.4	55.6	61.9	83.9
Peak Outflow Q (cfs) =	0.2	0.6	0.5	0.6	0.6	1.7	3.3	5.4	19.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.9	1.5	0.5	0.4	0.4	0.8
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.2	0.4	0.7	1.7
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	61	68	72	75	75	74	72
Time to Drain 99% of Inflow Volume (hours) =	**40**	75	64	71	77	80	80	80	79
Maximum Ponding Depth (ft) =	2.38	3.46	2.98	3.24	3.45	3.65	3.79	3.92	4.20
Area at Maximum Ponding Depth (acres) =	0.88	1.38	1.33	1.36	1.38	1.40	1.41	1.43	1.46
Maximum Volume Stored (acre-ft) =	0.493	1.850	1.185	1.548	1.836	2.114	2.311	2.496	2.885

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.05	1.89
	0:15:00	0.00	0.00	4.26	6.92	8.56	5.74	7.01	6.97	10.18
	0:20:00	0.00	0.00	13.87	17.77	20.72	12.94	14.90	16.17	21.80
	0:25:00	0.00	0.00	26.26	34.09	40.30	25.72	29.55	31.50	42.53
	0:30:00	0.00	0.00	26.04	32.55	37.23	48.35	55.59	61.93	83.89
	0:35:00	0.00	0.00	20.11	24.81	28.33	44.75	51.30	61.22	82.32
	0:40:00	0.00	0.00	15.51	18.63	21.23	37.10	42.51	50.09	67.31
	0:45:00	0.00	0.00	11.36	14.29	16.58	27.84	31.83	39.41	53.04
	0:50:00	0.00	0.00	8.57	11.31	12.69	22.74	25.95	31.28	42.23
	0:55:00	0.00	0.00	6.56	8.57	9.91	16.69	19.00	24.15	32.53
	1:00:00	0.00	0.00	5.59	7.23	8.60	12.65	14.39	19.14	25.78
	1:05:00	0.00	0.00	5.23	6.73	8.19	10.58	12.04	16.62	22.45
	1:10:00	0.00	0.00	4.40	6.55	8.05	8.77	9.93	12.32	16.57
	1:15:00	0.00	0.00	3.96	6.02	7.99	7.82	8.84	9.96	13.35
	1:20:00	0.00	0.00	3.70	5.44	7.25	6.57	7.41	7.39	9.83
	1:25:00	0.00	0.00	3.56	5.11	6.19	5.92	6.67	6.01	7.94
	1:30:00	0.00	0.00	3.46	4.92	5.55	5.05	5.68	5.11	6.72
	1:35:00	0.00	0.00	3.40	4.81	5.17	4.55	5.12	4.63	6.05
	1:40:00	0.00	0.00	3.39	4.11	4.95	4.26	4.79	4.42	5.77
	1:45:00	0.00	0.00	3.39	3.71	4.81	4.11	4.62	4.33	5.65
	1:50:00	0.00	0.00	3.39	3.48	4.75	4.03	4.54	4.31	5.63
	1:55:00	0.00	0.00	2.68	3.35	4.53	4.00	4.50	4.31	5.63
	2:00:00	0.00	0.00	2.26	3.09	3.99	3.99	4.49	4.31	5.63
	2:05:00	0.00	0.00	1.29	1.77	2.31	2.32	2.60	2.50	3.26
	2:10:00	0.00	0.00	0.73	1.01	1.31	1.33	1.50	1.44	1.87
	2:15:00	0.00	0.00	0.37	0.54	0.69	0.71	0.80	0.77	1.00
	2:20:00	0.00	0.00	0.17	0.28	0.35	0.38	0.43	0.41	0.53
	2:25:00	0.00	0.00	0.07	0.11	0.13	0.15	0.17	0.16	0.21
	2:30:00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.02	0.03
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00


HIGHWAY - 24
HIGHWAY - 24
(R.O.W. VARIES)
EXISTING DOUBLE 5' X 11' CONCRETE BOX CULVERT
HIGHWAY - 24
It appears that there is a drainageway from the northern property that enters the site. Please address in your report/analysis.
ZONE: CC
USE: OFFICES
OWNER: HEFFNER JOSEPH D LIVING TRUST
SUB: LOT 18 BLK 2 FALCON RANCH ESTATES SUB
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: EVANOIKA RHONDA L
UNPLATTED
ZONE: RR-5
USE: MOBILE ON OWNED LAND
OWNER: WADE LARRY
SUB: LOT 17 BLK 2 FALCON RANCH ESTATES SUB
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: FREDERICK RUSSELL L
SUB: LOT 13 ARROWHEAD ESTATES FIL NO 1
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: NORTH MICAH & KRISTEN
SUB: LOT 11 ARROWHEAD ESTATES FIL NO 1
ZONE: RR-5
USE: RELIGIOUS WORSHIP
OWNER: DIOCESE OF COLORADO SPRINGS
UNPLATTED
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: SCHUTTS CAROLYN S
SUB: LOT 14 ARROWHEAD ESTATES FIL NO 1
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: CHAFFIN BURT W & MELISSA M
SUB: LOT 14 BLK 1 FALCON RANCH ESTATES SUB
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: MOON BOYD W & ELVA M
SUB: LOT 15 ARROWHEAD ESTATES FIL NO 1
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: TERRY HIGGINS TRUST
SUB: LOT 13 BLK 1 FALCON RANCH ESTATES SUB
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: POLLARD HEIDEMARIE
SUB: LOT 10 ARROWHEAD ESTATES FIL NO 1
CHIEF RD
PINTO PONY RD
PINTO PONY RD
LEGEND
EXISTING 1' CONTOUR
EXISTING 5' CONTOUR
DITCH CENTERLINE
PROPOSED 2' CONTOUR
PROPOSED 10' CONTOUR
EXISTING BASIN BOUNDARY
EXISTING FLOW PATH
FLOW ARROW
EXISTING DESIGN POINT
EXISTING BASIN LABEL
Show limits of existing basins in color and bold linetype for clarify.

BASIN SUMMARY TABLE

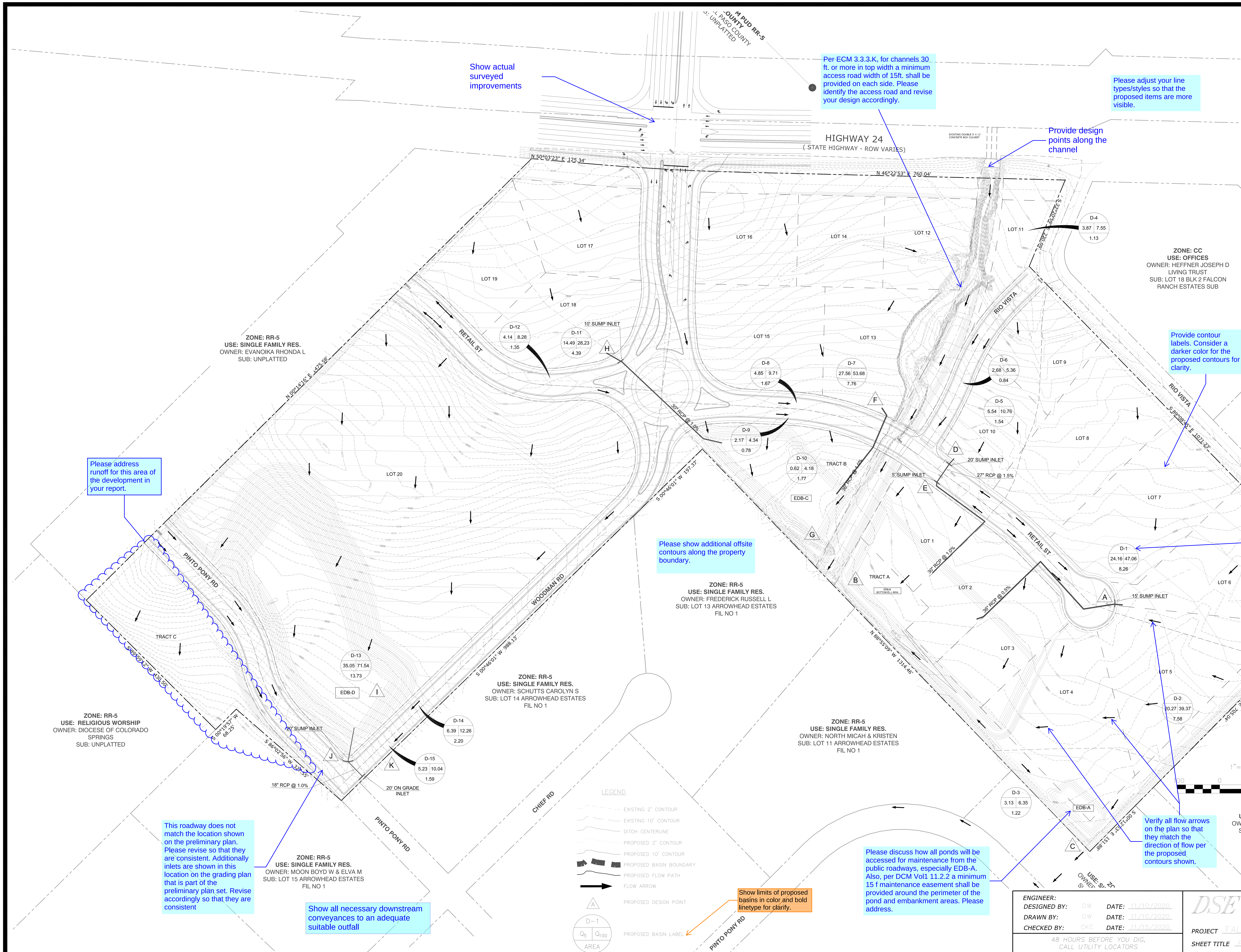
BASIN	AREA	Q (5) (cfs)	Q (100) (cfs)
E-1	2.16	0.61	3.42
E-2	8.06	1.92	10.81
E-3	7.46	2.87	12.54
E-4	13.89	2.9	19.48
E-5	13.41	2.60	17.44
E-6	8.09	1.95	13.08
E-7	0.55	0.18	1.19
E-8	0.40	0.15	1.00
E-9	5.07	1.18	7.90

ENGINEER:
DESIGNED BY: DW DATE:
DRAWN BY: DW DATE:
CHECKED BY: CKC DATE:

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
811

DSE Dakota Springs Engineering
31 N. TEJON ST., SUITE 514
COLORADO SPRINGS, CO 80903
P: (719) 227-7388
F: (719) 227-7392

PROJECT FALCON FIELD
SHEET TITLE EXISTING DRAINAGE MAP
FROM N/A TO N/A
JOB NO. SHEET 1 OF 1



HIGHWAY 24
(STATE HIGHWAY - ROW VARIES)
Show actual surveyed improvements
Per ECM 3.3.3.K, for channels 30 ft. or more in top width a minimum access road width of 15ft. shall be provided on each side. Please identify the access road and revise your design accordingly.
Please adjust your line types/styles so that the proposed items are more visible.
Provide design points along the channel
N 50°03'23" E 125.34'
N 46°22'53" E 760.04'
LOT 11
LOT 12
LOT 14
LOT 16
LOT 17
LOT 19
LOT 18
LOT 15
LOT 13
LOT 9
LOT 10
LOT 8
LOT 7
LOT 6
LOT 5
LOT 4
LOT 3
LOT 2
LOT 1
LOT 20
TRACT A
TRACT B
TRACT C
RETAIL ST
RIO VISTA
WOODMAN RD
PINTO PONY RD
CHIEF RD
ZONE: CC
USE: OFFICES
OWNER: HEFFNER JOSEPH D LIVING TRUST
SUB: LOT 18 BLK 2 FALCON RANCH ESTATES SUB
Provide contour labels. Consider a darker color for the proposed contours for clarity.
Show and label the spring and proposed conveyance
ZONE: RR-5
USE: MOBILE ON OWNED LAND
OWNER: WADE LARRY
SUB: LOT 17 BLK 2 FALCON RANCH ESTATES SUB
It is difficult to identify the basin boundaries. Please add color, bold lines are other line types so that the boundary lines are clear.
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: EVANOIKA RHONDA L
SUB: UNPLATTED
Please address runoff for this area of the development in your report.
10' SUMP INLET
30" RCP @ 1.0%
5' SUMP INLET
20' SUMP INLET
27" RCP @ 1.5%
15' SUMP INLET
30" RCP @ 0.5%
30" RCP @ 1.0%
Please show additional offsite contours along the property boundary.
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: FREDERICK RUSSELL L
SUB: LOT 13 ARROWHEAD ESTATES
FIL NO 1
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: SCHUTTS CAROLYN S
SUB: LOT 14 ARROWHEAD ESTATES
FIL NO 1
ZONE: RR-5
USE: RELIGIOUS WORSHIP
OWNER: DIOCESE OF COLORADO SPRINGS
SUB: UNPLATTED
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: NORTH MICAH & KRISTEN
SUB: LOT 11 ARROWHEAD ESTATES
FIL NO 1
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: CHAFFIN BURT W & MELISSA M
SUB: LOT 14 BLK 1 FALCON RANCH ESTATES SUB
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: TERRY HIGGINS TRUST
SUB: LOT 13 BLK 1 FALCON RANCH ESTATES SUB
ZONE: RR-5
USE: SINGLE FAMILY RES.
OWNER: MOON BOYD W & ELVA M
SUB: LOT 15 ARROWHEAD ESTATES
FIL NO 1
18" RCP @ 1.0%
20' ON GRADE INLET
EDB-A
EDB-C
EDB-D
1"=100'
This roadway does not match the location shown on the preliminary plan. Please revise so that they are consistent. Additionally inlets are shown in this location on the grading plan that is part of the preliminary plan set. Revise accordingly so that they are consistent
Show all necessary downstream conveyances to an adequate suitable outfall
Show limits of proposed basins in color and bold linetype for clarify.
Please discuss how all ponds will be accessed for maintenance from the public roadways, especially EDB-A. Also, per DCM Vol1 11.2.2 a minimum 15 f maintenance easement shall be provided around the perimeter of the pond and embankment areas. Please address.
Verify all flow arrows on the plan so that they match the direction of flow per the proposed contours shown.
LEGEND
EXISTING 2' CONTOUR
EXISTING 10' CONTOUR
DITCH CENTERLINE
PROPOSED 2' CONTOUR
PROPOSED 10' CONTOUR
PROPOSED BASIN BOUNDARY
PROPOSED FLOW PATH
FLOW ARROW
PROPOSED DESIGN POINT
PROPOSED BASIN LABEL

BASIN SUMMARY TABLE

BASIN	AREA	Q (5) (cfs)	Q (100) (cfs)
D-1	8.26	24.16	47.06
D-2	7.58	20.27	39.37
D-3	1.22	3.13	6.35
D-4	1.13	3.87	7.55
D-5	1.54	5.54	10.76
D-6	0.84	2.68	5.36
D-7	7.76	27.56	53.68
D-8	1.67	4.85	9.71
D-9	0.78	2.17	4.34
D-10	1.77	0.62	4.18
D-11	4.39	14.49	28.23
D-12	1.35	4.14	8.28
D-13	13.73	35.05	71.54
D-14	2.20	6.39	12.26
D-15	1.59	5.23	10.04

DESIGN POINT SUMMARY TABLE

DESIGN POINT	AREA	Q (5) (cfs)	Q (100) (cfs)
A	8.26	24.16	47.06
B	7.58	20.27	39.37
C	1.22	3.00	6.16
D	5.18	18.82	35.70
E	0.78	2.17	4.34
F	7.76	27.56	53.68
G	1.77	0.62	4.18
H	5.74	17.92	35.12
I	13.73	35.05	71.54
J	2.20	6.39	12.26
K	1.59	5.23	10.04

ENGINEER:
DESIGNED BY: DW DATE: 11/10/2020
DRAWN BY: DW DATE: 11/10/2020
CHECKED BY: CKC DATE: 11/15/2020

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
811

DSE Dakota Springs Engineering
31 N. TEJON ST., SUITE 514
COLORADO SPRINGS, CO 80903
P: (719) 227-7388
F: (719) 227-7392

PROJECT FALCON FIELD
SHEET TITLE PROPOSED DRAINAGE MAP
FROM N/A TO N/A
JOB NO. 14-08 SHEET 1 OF 1