FINAL DRAINAGE REPORT
FOR
STERLING RANCH EAST FILING NO. 2
&
FOURSQUARE AT STERLING RANCH EAST FILING NO. 1

See comments provided with SF2237 - Sterling Ranch East Filing No 2

March 2023

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Job no. 2183.23
PCD File # SF2236 & SF2237

FINAL DRAINAGE REPORT FOR STERLING RANCH EAST FILING NO. 2 &
FOURSQUARE AT STERLING RANCH EAST FILING NO. 1

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

David L Gibson, Colorado P.E. #46477 Date

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

Business Name: Classic SRJ Land, LLC

By:

Title:

Address: 2138 Flying Horse Club Dr.

Colorado Springs, CO 80921

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

For County Engineer / ECM Administrator Date
Conditions:

TABLE OF CONTENTS:

PURPOSE Page 4

PROJECT DESCRIPTION Page 4

PREVIOUS REPORTS Page 4

SOILS & GEOLOGY Page 5

DRAINAGE CRITERIA Page 5

FLOODPLAIN STATEMENT Page 6

EXISTING DRAINAGE CONDITIONS Page 6

PROPOSED DRAINAGE CONDITIONS Page 6

STORMWATER QUALITY (FOUR STEP PROCESS) Page 11

DRAINAGE AND BRIDGE FEES Page 15

CONSTRUCTION COST OPINION Page 16

SUMMARY Page 17

REFERENCES Page 18

APPENDICES

VICINITY MAP

SOILS MAP (S.C.S. SURVEY)

F.E.M.A. MAP

DEVELOPED CONDITIONS CALCULATIONS

DETENTION POND FSD 16 (WITH SF2236)

HYDRUALIC GRADE LINE (HGL) CALCULATIONS

DRAINAGE MAPS

PURPOSE

This document is the Final Drainage Report for Sterling Ranch East Filing No. 2 and Foursquare at Sterling Ranch East Filing No. 1. The purpose of this report is to identify onsite and offsite drainage patterns, define areas tributary to the proposed full spectrum detention and water quality facility (FSD Pond 16), and to safely route developed storm water runoff via a proposed storm sewer system. The proposed Sterling Ranch East Filing No. 2 and Foursquare at Sterling Ranch East Filing No. 1 developments shall be in adherence to the El Paso County approved Master Development Drainage Plan and MDDP Amendment for Sterling Ranch as well as current County Drainage Criteria.

PROJECT DESCRIPTION

The Sterling Ranch East Filing No. 2 development is 16.841 acres and Foursquare at Sterling Ranch East Filing No. 1 is 36.647 acres of the 321.37 total acres of Sterling Ranch East, a phased master planned community located in northern El Paso County, Colorado. These developments consist of public residential roadways and single-family home lots. The site is located in portion of Section 33 & 34, Township 12 South, Range 65 west of the 6th p.m. in El Paso County, Colorado. The site is located on the east side of Sand Creek. The site is bounded on the north, east and west by proposed and future Sterling Ranch East residential development, west and south by the proposed extension of Briargate Pkwy. The site is in the upper portion of both the Sand Creek and Sand Creek East Fork Drainage Basins. These sites will be constructed concurrently.

PREVIOUS REPORTS

The latest and most applicable previously approved drainage studies are the following:

1. "Sterling Ranch MDDP Amendment No. 2 & Preliminary Drainage Report for Sterling Ranch East Preliminary Plan No. 1," by Classic Consulting Engineers & Surveyors, LLC approval pending.
2. "Master Development Drainage Plan Amendment for Sterling Ranch," by JR Engineering, LLC, dated September 2022.
3. "2018 Sterling Ranch MDDP," by M&S Civil Consultants, Inc. June 2018.

4. “Drainage Letter for Sterling Ranch Road and Briargate Pkwy. Interim Plan,” by JR Engineering, LLC dated September 2022.
5. “Final Drainage Report for Sand Creek Restoration,” by JR Engineering, LLC, dated September 2022.

SOILS AND GEOLOGY

The soils within the Sterling Ranch East Filing No. 2 and Foursquare at Sterling Ranch East Filing No .1 site and tributary area are Hydrologic Soil Group A, Blakeland loamy sand and Columbine gravelly sandy loam and Soil Group B Pring Coarse Sandy Loam (included for future areas) (See Appendix for Soil Map).

DRAINAGE CRITERIA

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the DCM as revised in May 2014. Full Spectrum Detention and Stormwater quality analysis, Extended Detention Basin (EDB) design, are per the Mile High Flood District Manual and MHFD-Detention version 4.06 and UD-BMP version 3.07 spreadsheet. The Rational Method was used to estimate stormwater runoff from the developed project and tributary to the proposed full spectrum detention/water quality pond. The UDFCD UD-Inlet excel workbook was used to verify street capacities, size sump inlets, and calculate interception and flow-by rates of at-grade inlets. The UD-Sewer computer program was used to calculate the hydraulic grade line (HGL) within the storm sewer system. An overall tributary area exhibit is included to show the various types of pervious and impervious areas established to determine the overall imperviousness of the 220.90 ultimate acres tributary to the proposed full spectrum detention/water quality facility (FSD Pond 16) and 44.02 interim acres are tributary with development of Sterling Ranch East Filing No. 2 and Foursquare at Sterling Ranch East Filing No. 1 only.

FLOODPLAIN STATEMENT

No portions of the Sterling Ranch East Filing No. 2 and Foursquare at Sterling Ranch East Filing No. 1 are located within a floodplain as determined by the Flood Insurance Rate Maps (F.I.R.M.) Map Numbers 08041C 0533G, effective date, December 7, 2018.

EXISTING DRAINAGE CONDITIONS

The "Sterling Ranch MDDP Amendment No. 2 & Preliminary Drainage Report for Sterling Ranch East Preliminary Plan No. 1," by Classic Consulting Engineers & Surveyors, LLC is currently under review and approval process with El Paso County Development Services and in full detail describes the Existing Conditions of the proposed development area. Please see this report for the full descriptions. The Pre-Developed (Existing) Conditions Maps are included in the Appendix of this Report and include the Sterling Ranch East Filing No. 2 and Foursquare at Sterling Ranch East Filing No. 1 boundary's.

The proposed site is located within Basins EX-5, EX-7, EX-9 & EX10A of the Preliminary Drainage Report study and drains north to south. The site has been previously disturbed with mass grading operations and vegetation is sparse and of natural grassland consistency (no trees or shrubs). See previous reports for additional details on the Existing Conditions.

The adjacent Briargate Parkway and Sterling Ranch Road drainage and roadway design was completed by JR Engineering, "Drainage Letter for Sterling Ranch Road and Briargate Parkway Interim Plan," May 2022. These roadways and storm system will be constructed prior to and in conjunction with the proposed Filing No. 1 development. Therefore, the storm system described within this JR Engineering Letter and Construction Drawings is shown as 'Existing' with proposed storm sewer extensions into the storm system for Sterling Ranch East Filing No. 2 and Foursquare at Sterling Ranch East Filing No. 1.

PROPOSED DRAINAGE CONDITIONS

Developed runoff from Sterling Ranch East Filing No. 2 and Foursquare at Sterling Ranch East Filing No. 1 will be collected in a public-private storm system and piped into the Privately owned and maintained full spectrum detention/water quality facility (FSD Pond 16) that will detain and treat the developed runoff prior to releasing at or below historic rates to the downstream channel (Sand Creek Reach SC-9). As previously mentioned, the rational method was used to estimate developed runoff values. All storm sewer inlets and pipes collecting runoff within the County right-of-way will be 'Public'. All storm sewer outside of right-of-way, including the pond outfall pipe, is 'Private' as is the proposed full spectrum

detention facility. Private facilities will be owned and maintained by the Sterling Ranch Metropolitan District. HGL grade line calculations are included in the Appendix in support of the construction drawings for the proposed Public and Private storm systems.

Per the current El Paso County Drainage Criteria for stormwater capacity within street sections, the following summaries of Figures 7-7 applies: all proposed roads are Residential.

Street Type	***Allowable – Initial Storm (5 yr)***	***Allowable–Major Storm (100 yr)***
Residential w/Ramp Curb	1.5% street slope = 10 cfs 2% street slope = 12 cfs 4% street slope = 16.5 cfs 6% street slope = 19.5 cfs 8% street slope = 17.8 cfs 10% street slope = 16.5 cfs No curb overtopping.	1.5% street slope = 46 cfs 2% street slope = 44 cfs 4% street slope = 36 cfs 6% street slope = 32 cfs 8% street slope = 29 cfs 10% street slope = 27.5 cfs 12" maximum depth at flowline.
Residential w/Vertical Curb (6" Vertical Curb)	1.5% street slope = 13 cfs 2% street slope = 15 cfs 4% street slope = 20.5 cfs 6% street slope = 18 cfs 8% street slope = 16.8 cfs 10% street slope = 15.7 cfs No curb overtopping.	1.5% street slope = 45 cfs 2% street slope = 43 cfs 4% street slope = 35 cfs 6% street slope = 31 cfs 8% street slope = 28 cfs 10% street slope = 26.5 cfs 12" maximum depth at flowline.

At-grade inlets and sump (low-points) were designed in a way that street capacity is not an issue anywhere within the proposed Filings. Homes near sump inlets shall be constructed at least 1 foot above the 100-year water surface ponding elevation. Street capacity has also been verified at each design point by using the UD-Inlet Excel workbook (located in Appendix) from Urban Drainage Flood Control District (UDFCD). Inlet sizing is also per the UD-Inlet Excel workbook. Drainage from individual lots shall travel in side-lot swales to the street. One Site-Level Low Impact Development form (IRF form) is included in the Appendix of this report, for the basins that discharge to the proposed full spectrum detention and

water quality FSD Pond 16. A detailed description of the developed flows for Sterling Ranch East Filing No. 2 and Foursquare at Sterling Ranch East Filing No. 1 is as follows:

Design Point 1 (Q_5 = 5.2 cfs, Q_{100} = 14.6 cfs) consists of developed flows from Basin B. Basin B is 4.99 acres of proposed residential development with associated streets, landscaping, and homes. Flows travel south in the east curbline of Boise Court and west curbline of Boulder City Place to Design Point 1 where a proposed public 10' Type R sump inlet will intercept flows. Flow will be conveyed by a proposed 24" RCP public storm sewer (Pipe 1). The emergency overflow route for this inlet will be south to Design Point 2.

Design Point 2 (Q_5 = 3.6 cfs, Q_{100} = 10.0 cfs) consists of developed flows from Basin A. Basin A is 2.90 acres of proposed residential development with associated streets, landscaping, and homes. Flows travel south in the west curbline of Boise Court and to the south curbline of Catalina Road to Design Point 2 where a proposed public 5' Type R sump inlet will intercept flows. Flow will be conveyed by a proposed 24" RCP public storm sewer (Pipe 2). The emergency overflow route for this inlet will overtop the southeast curb return at the at the intersection of Catalina Road and Boulder City Place and continue south along Boulder City Place.

Design Point 3 (Q_5 = 8.2 cfs, Q_{100} = 23.1 cfs) consists of developed flows from Basin J. Basin J is 3.87 acres of proposed residential development with associated streets, landscaping, and homes. Flows travel south in the curbline of Salt Lake Drive and to the north curbline of Catalina Road to Design Point 3 where a proposed public 10' Type R sump inlet will intercept flows. Flow will be conveyed by a proposed 24" RCP public storm sewer (Pipe 6). The emergency overflow route for this inlet will be south to Design Point 4.

Design Point 4 (Q_5 = 2.2 cfs, Q_{100} = 6.1 cfs) consists of developed flows from Basin K. Basin K is 1.83 acres of proposed residential development with associated streets, landscaping, and homes. Flows travel south in the south curbline of Catalina Road to Design Point 4 where a proposed public 5' Type R sump inlet will intercept flows. Flow will be conveyed by a proposed 18" RCP public storm sewer (Pipe 7). The

emergency overflow route for this inlet will overtop curb behind Design Point 4 to Tract A and then to Briargate Parkway.

Design Point 5 (Q_5 = 3.0 cfs, Q_{100} = 7.0 cfs) consists of developed flows from Basin D, Basin F and Basin OS-1. Basin D is 0.20 acres of Idaho Falls Drive. Basin F is 0.49 acres of proposed Idaho Falls Drive. Basin OS-1 is 2.60 acres of future residential development north of Idaho Falls Drive. Flows travel east in the north curbline of Idaho Falls Drive to Design Point 5 where a proposed public 10' Type R sump inlet will intercept flows. Flow will be conveyed by a proposed 18" RCP public storm sewer (Pipe 9). The emergency overflow route for this inlet will be south to Design Point 6.

Unresolved - 2.18 Ac?

Design Point 6 (Q_5 = 0.7 cfs, Q_{100} = 1.3 cfs) consists of developed flows from Basin G. Basin G is 0.16 acres of proposed Idaho Falls Drive. Flows travel south in the south curbline of Idaho Falls Drive to Design Point 6 where a proposed public 5' Type R sump inlet will intercept flows. Flow will be conveyed by a proposed 18" RCP public storm sewer (Pipe 10). The emergency overflow route for this inlet will overtop the southeast curb return at the at the intersection of Idaho Falls Drive and Pagosa Springs Drive and continue south along Pagosa Springs Drive to Design Point 8.

Design Point 7 (Q_5 = 5.5 cfs, Q_{100} = 14.1 cfs) consists of developed flows from Basin H. Basin H is 4.01 acres of proposed residential development with associated streets, landscaping, and homes. Flows travel south in the west curbline of Pagosa Springs Drive to Design Point 7 where a proposed public 10' Type R sump inlet will intercept flows. Flow will be conveyed by a proposed 24" RCP public storm sewer (Pipe 12). The emergency overflow route for this inlet will overtop the highpoint in Pagosa Springs Drive to Design Point 3.

Design Point 8 (Q_5 = 1.1 cfs, Q_{100} = 4.6 cfs) consists of developed flows from Basin I. Basin I is 1.68 acres of proposed residential development with associated streets, landscaping, open space and homes. Flows travel south in the east curbline of Pagosa Springs Drive to Design Point 8 where a proposed public 5' Type R sump inlet will intercept flows. Flow will be conveyed by a proposed 18" RCP public storm sewer (Pipe 13). The emergency overflow route for this inlet will overtop the crown in the road to Design Point 7.

Design Point 9 (Q_5 = 7.6 cfs, Q_{100} = 21.9 cfs) consists of developed flows from Basin M and Basin N. Basin M is 4.10 acres and Basin N is 3.00 acres of proposed residential development with associated streets, landscaping, and homes. Developed flows travel east in the north curbline of Catalina Road to a proposed public 15' Type R at-grade inlet at Design Point 9. This at-grade inlet will intercept (Q_5= 7.1 cfs, Q_{100}= 13.2 cfs) with a flow-by of (Q_5= 0.5 cfs, Q_{100}= 8.7 cfs) that will travel in the north curb line of Catalina Road to Design Point 10. Intercepted flows will be conveyed by a proposed 24" RCP public storm sewer (Pipe 16).

Design Point 10 (Q_5 = 3.6 cfs, Q_{100} = 15.7 cfs) consists of developed flows from Basin L and Flow-by Design Point 9. Basin L is 2.20 acres of proposed residential development with associated streets, landscaping, open space and homes. Flows travel south in the south curbline of Catalina Road to Design Point 10 where a proposed public 15' Type R sump inlet will intercept flows. Flow will be conveyed by a proposed 24" RCP public storm sewer (Pipe 18). The emergency overflow route for this inlet will overtop the curb and into Tract A and then to Sterling Ranch Road.

Design Point 11 (Q_5 = 2.3 cfs, Q_{100} = 5.1 cfs) consists of developed flows from Basin R and Basin S. Basin R is 0.33 acres and Basin S is 1.00 acres of proposed residential development with associated streets, landscaping, and homes. Developed flows travel south in the east curbline of Boulder City Place to a proposed public 15' Type R at-grade inlet at Design Point 11. This at-grade inlet will intercept (Q_5= 2.3 cfs, Q_{100}= 5.1 cfs) with a flow-by of (Q_5= 0.0 cfs, Q_{100}= 0.0 cfs). Intercepted flows will be conveyed by a proposed 18" RCP public storm sewer (Pipe 4).

Design Point 12 (Q_5 = 3.6 cfs, Q_{100} = 15.7 cfs) consists of developed flows from Basin C and Basin Q. Basin C is 0.72 acres of open space tract that will discharge directly Briargate Parkway. Basin Q is 0.50 acres of open space tract that will discharge directly Briargate Parkway. Flows will be intercepted by an existing 20' Type R inlet in Briargate Parkway installed with Sterling Ranch East Filing No. 1. This is shown as a portion of Basin P1-A2 in the Sterling Ranch East Filing No. 1 Final Drainage Report and these flows were accounted for at this design point.

Design Point 13 (Q_5 = 5.4 cfs, Q_{100} = 15.1 cfs) consists of developed flows from Basin OS-2. Basin OS-2 is 4.35 acres of future residential development with associated streets, landscaping, and homes located north of Foursquare at Sterling Ranch East Filing No. 1 with the future extension of Sterling Ranch Road. Future Final Drainage Report for this area will detail this basin. For this report it is assumed that Developed flows travel south in the west curbline of future Sterling Ranch Road to a future public 15' Type R at-grade inlet at Design Point 13. This at-grade inlet will intercept (Q_5= 5.4 cfs, Q_{100}= 10.8 cfs) with a flow-by of (Q_5= 0.0 cfs, Q_{100}= 4.3 cfs) that will travel in the west curb line of Sterling Ranch Road to Design Point 15. Intercepted flows will be conveyed by a future public storm sewer constructed with future development.

Design Point 14 (Q_5 = 4.0 cfs, Q_{100} = 11.2 cfs) consists of developed flows from Basin OS-3. Basin OS-3 is 3.23 acres of future residential development with associated streets, landscaping, and homes located north of Foursquare at Sterling Ranch East Filing No. 1 with the future extension of Sterling Ranch Road. Future Final Drainage Report for this area will detail this basin. For this report it is assumed that Developed flows travel south in the east curbline of future Sterling Ranch Road to a future public 15' Type R at-grade inlet at Design Point 14. This at-grade inlet will intercept (Q_5= 4.0 cfs, Q_{100}= 9.1 cfs) with a flow-by of (Q_5= 0.0 cfs, Q_{100}= 2.1 cfs) that will travel in the east curb line of Sterling Ranch Road to Design Point 16. Intercepted flows will be conveyed by a future public storm sewer constructed with future development.

Design Point 15 (Q_5 = 2.9 cfs, Q_{100} = 10.1 cfs) consists of developed flows from Basin O and flow-by from Design Point 13. Basin O is 1.11 acres of open space tract and Sterling Ranch Road. Developed flows travel south in the west curb line of Sterling Ranch Road to a public 15' Type R at-grade inlet at Design Point 15. This at-grade inlet will intercept (Q_5= 2.9 cfs, Q_{100}= 8.9 cfs) with a flow-by of (Q_5= 0.0 cfs, Q_{100}= 2.1 cfs) that will travel in the east curb line of Sterling Ranch Road. Flows will be intercepted by an existing 20' Type R inlet in Briargate Parkway installed with Sterling Ranch East Filing No. 1. This is shown as a portion of Basin P1-C2 in the Sterling Ranch East Filing No. 1 Final Drainage Report and were accounted for in that report.

Design Point 16 (Q_5 = 2.7 cfs, Q_{100} = 7.4 cfs) consists of developed flows from Basin U and flow-by from Design Point 14. Basin U is 0.60 acres of open space tract and Sterling Ranch Road. Developed flows travel south in the west curb line of Sterling Ranch Road to a public 15' Type R at-grade inlet at Design Point 16. This at-grade inlet will intercept (Q_5= 2.9 cfs, Q_{100}= 7.6 cfs) with a flow-by of (Q_5= 0.0 cfs, Q_{100}= 0.40 cfs) that will travel in the east curb line of Sterling Ranch Road. Flows will be intercepted by an existing 20' Type R inlet in Briargate Parkway installed with Sterling Ranch East Filing No. 1. This is shown as a portion of Basin P1-C2 in the Sterling Ranch East Filing No. 1 Final Drainage Report and were accounted for in that report.

Design Point 17 (Q_5 = 1.3 cfs, Q_{100} = 4.2 cfs) consists of developed flows from Basin V and flow-by from Design Point 15 & 16. Basin V is 0.45 acres of Sterling Ranch Road. Developed flows travel south in the curb lines of Sterling Ranch Road. Design Point represents flows from Sterling Ranch Road that enter Briargate Parkway. Flows will be intercepted by an existing 20' Type R inlet in Briargate Parkway installed with Sterling Ranch East Filing No. 1. This is shown as a portion of Basin P1-C2 in the Sterling Ranch East Filing No. 1 Final Drainage Report and were accounted for in that report.

Design Point 18 (Q_5 = 0.7 cfs, Q_{100} = 2.4 cfs) consists of developed flows from Basin P.
Basin P is 0.63 acres of open space tract that will discharge directly Briargate Parkway. Flows will be intercepted by an existing 20' Type R inlet in Briargate Parkway installed with Sterling Ranch East Filing No. 1. This is shown as a portion of Basin P1-A2 in the Sterling Ranch East Filing No. 1 Final Drainage Report and these flows were accounted for at this design point.

Design Point 19 (Q_5 = 48 cfs, Q_{100} = 130 cfs) consists of Basin T and Pipe 22 and represents to the total flows into the proposed private Full Spectrum Detention Facility from Sterling Ranch East Filing No. 2 and Foursquare at Sterling Ranch East Filing No. 1. Basin T is 11.19 acres of landscape slope and pond. Pipe 22 **(Q_5 = 49.8 cfs, Q_{100} = 121.5 cfs)** is a public 48" RCP storm.

Basin E (Q_5 = 2.2 cfs, Q_{100} = 16.3 cfs) is 7.82 acres of open space tract and adjacent Sand Creek (Reach SC-9) channel improvements and rear landscaped yards that are within the boundary of Sterling Ranch East Filing No. 2. This is shown as a portion of Basin SC-4 in the SKP-22-004/SP-22-004 MDDP

Amendment for Sterling Ranch East and consists of the anticipated rear yards of the lots adjacent to the creek that will continue to sheet flows directly towards the Sand Creek corridor. At this time, these rear yards are not able to be captured and routed to a formal stormwater quality facility. However, given the minimal unconnected impervious area and sizeable receiving pervious are within this basin, the WQCV reduction = 100% with 0 untreated WQCV. (See Appendix for references) All channel work is completed per the "Final Drainage Report for Sand Creek Restoration," by JR Engineering LLC, dated September 2022.

STORM WATER QUALITY/DETENTION

As required, storm water quality measures will be utilized in order to reduce the amount of sediment, debris and pollutants that are allowed to enter Sand Creek. Developed flows from Sterling Ranch East Filing No. 2 and Foursquare at Sterling Ranch East Filing No. 1 along with future flows from the Sterling Ranch East Preliminary Plan No. 1 will be routed to a private Full Spectrum Detention facility, FSD Pond 16 to be located in Tract H of Foursquare at Sterling Ranch East Filing No. 1. The facilities will release treated developed flows to an existing 48" RCP storm within future Briargate Parkway. Reference the "Drainage Letter for Sterling Ranch Road and Briargate Pkwy. Interim Plan", prepared by JR Engineering, LLC, dated December 2021 and the "Sterling Ranch Road and Briargate Pkwy. Storm Plans", prepared by JR Engineering, LLC, dated September 2022. These referenced design plans provide a 48" RCP outfall pipe at this location with an allowable release rate of (Q_{100} = 156.6 cfs)

Private FSD POND-16

The outlet structure will be designed in an interim condition until future tributary storm systems from developments north of Foursquare at Sterling Ranch East Filing No . 1 are developed. The interim condition consists of developed flows from both Foursquare at Sterling Ranch East Filing No. 1 and Sterling Ranch East Filing No. 2 as these sites will be constructed concurrently. As systems are designed and plans submitted for review, Final Drainage Reports will be submitted updated the outlet plate until the ultimate condition is reached. This report will detail the interim condition as well as estimated ultimate conditions based on tributary areas shown in the Preliminary Drainage Report for Foursquare at Sterling Ranch Preliminary Plan/PUD as well as the Sterling Ranch MDDP amendment No. 2.

The UD-BMP spreadsheet along with the UD-Detention spreadsheet were used to calculate the required volume for the EURV and 100-year release. User input 1-hour precipitation values in the UD-Detention spreadsheet were taken from Table 6-2 Volume 1 Colorado Springs El Paso County Drainage Criteria Manual. The UD-BMP IRF spreadsheet (see appendix) was used to calculate the overall total site imperviousness Sterling Ranch East Filing No. 2 and Foursquare at Sterling Ranch East Filing No. 1 to the EDB (Interim) and these subdivisions including the future tributary area (Ultimate). This total interim area is 44.02 acres. Per the IRF spread sheet a 100 Year Event 44.40% imperviousness will be used in the interim condition (see appendix). This total ultimate area is estimated at 220.90 acres. Per the IRF spread sheet a 100 Year Event 49.30% imperviousness will be used in the ultimate condition (See IRF Spreadsheet in Appendix)

Interim Condition (Sterling Ranch East Filing No. 2 & Foursquare at Sterling Ranch East Filing No. 1)

Per UD-Detention spreadsheet a 0.702 ac-ft. WQVC, 1.478 ac-ft. EURV, and a 3.5.81 ac-ft. 100-year flow volume is provided. The outlet structure will have a 4-hole configuration with 4 individual rectangular holes spaced 30 inches apart each hole with have an area of 3.50, 9.0, 16.0 and 16.0 square inches. The outlet box will be an 20'x4' grated inlet box 10.0' tall with a 48" RCP storm sewer outlet with a plate 26" from invert will connect to the existing 48" RCP storm sewer in Briargate Parkway. A 170' wide 2' deep emergency overflow weir will be installed in the pond berm with Type L rip-rap (see appendix for calculation). Flows will overtop the pond in the provided weir and travel directly to the adjacent Briargate Parkway. Maintenance and ownership of the Private detention/water quality facility and the entire proposed storm sewer is by the Sterling Ranch East Metropolitan District. An El Paso County Detention Pond Maintenance Agreement will be required indicating these Facilities to be ultimately owned and maintained by the Metro District

Planned release per the UD-Detention spreadsheet from the Full Spectrum EDB will be **Q_5= 0.70 cfs, Q_{100}= 1.60 cfs**. Allowable release into the existing 48" RCP outfall pipe at this location is anticipated to release rate of (Q_{100} = 156.6 cfs). This facility restricts the release to below pre-development (historic levels) per the MHFD-Detention spreadsheet and is in conformance with the Preliminary Drainage Report and MDDP Amendment.

revise?

Ultimate Condition (Sterling Ranch East Filing No. 2, Foursquare at Sterling Ranch East Filing No. 1 & Future Sterling Ranch East Development)

The Ultimate condition is an estimate only for the full assumed tributary area to Pond FSD 16 at full building out. I will be constructed with future developments. Per UD-Detention spreadsheet a 3.762 ac-ft. WQVC, 8.526ac-ft. EURV, and a 20.079 ac-ft. 100-year flow volume is provided. The outlet structure will have a 4-hole configuration with 4 individual rectangular holes spaced 30 inches apart each hole with have an area of 10.0, 14.0, 16.0 and 16.0 square inches. The outlet box will be an 20'x4' grated inlet box 10.0' tall with a 48" RCP storm sewer outlet with a plate 26" from invert will connect to the existing 48" RCP storm sewer in Briargate Parkway. A 170' wide 2' deep emergency overflow weir will be installed in the pond berm with Type L rip-rap (see appendix for calculation). Flows will overtop the pond in the provided weir and travel directly to the adjacent Briargate Parkway. Maintenance and ownership of the Private detention/water quality facility and the entire proposed storm sewer is by the Sterling Ranch East Metropolitan District. An El Paso County Detention Pond Maintenance Agreement will be required indicating these Facilities to be ultimately owned and maintained by the Metro District

Planned release per the UD-Detention spreadsheet from the Full Spectrum EDB will be **Q_5= 4.1 cfs, Q_{100}= 120.5 cfs**. Allowable release into the existing 48" RCP outfall pipe at this location is anticipated to release rate of (Q_{100} = 156.6 cfs). This facility restricts the release to below pre-development (historic levels) per the MHFD-Detention spreadsheet and is in conformance with the Preliminary Drainage Report and MDDP Amendment.

STORMWATER QUALITY (FOUR STEP PROCESS)

The City of Colorado Springs/El Paso County DCM requires the Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls. The Four Step Process pertains to management of smaller, frequently occurring storm events, as opposed to larger storms for which drainage and flood control infrastructure are sized. Implementation of these four steps helps to achieve storm water permit requirements.

1. **Employ Runoff Reduction Practices:** Proposed urban lot impervious area (roof tops, patios, etc.) will sheet flow across landscape areas (yards) and open space areas to slow runoff and increase time of concentration prior to being conveyed to the proposed public streets or detention facilities. This will minimize directly connected impervious areas within the project site. Water quality reduction will be employed for specific areas that are anticipated not able to be captured and routed to SWQ facilities.

2. **Stabilize Drainageways:** After developed flows utilize the runoff reduction practices through the front and rear yards, developed flows will travel via curb and gutter within the public streets of the development and eventually public storm systems. These collected flows are then routed directly to multiple extended detention basins (full-spectrum facilities). Sand Creek improvements and restoration plans are being proposed for this entire reach as described in "Final Design Report for Sand Creek Restoration", prepared by JR Engineering, LLC, dated September 2022.

3. **Provide Water Quality Capture Volume (WQCV):** Runoff from this development will be treated through capture and slow release of the WQCV and excess urban runoff volume (EURV) in the proposed Full-Spectrum permanent Extended Detention Basins designed per current El Paso County drainage criteria.

4. **Consider need for Industrial and Commercial BMPs**: No industrial uses are proposed within this development. A site-specific storm water quality and erosion control plan and narrative will be submitted along with the grading and erosion control plan. Details such as site-specific sediment and erosion control construction BMP's as well as temporary and permanent BMP's were detailed in this plan and narrative to protect receiving waters. BMP's will be constructed and maintained as the development has been graded and erosion control methods employed.

DRAINAGE AND BRIDGE FEES

This site lies entirely within the Sand Creek Drainage Basin boundaries.

The fees are calculated using the following impervious acreage method approved by El Paso County. The Sterling Ranch East Filing Filing No. 2 has a total area of 16.841 acres with the following different land uses proposed:

STERLING RANCH EAST FILING NO. 2

5.756 Ac.	Sand Creek Corridor (Tract)
1.087 Ac.	Open Space (Tract
9.998 Ac.	0.25 Ac. avg. lot size
16.841Ac.	**Total**

The percent imperviousness for this subdivision is calculated as follows:

Fees for Sand Creek Drainage Corridor

(Per El Paso County Percent Impervious Chart: 2**%**)

5.756 Ac. x 2% = **0.115 Impervious Ac.**

Fees for 1/4 Ac. lots (Avg. lot size of 9,800 SF)

(Per El Paso County Percent Impervious Chart: 40**%**)

9.998Ac. x 40% = **3.999 Impervious Ac.**

Total Impervious Acreage: **4.114 Imp. Ac.**

STERLING RANCH EAST FILING No. 2 (6.718 Impervious acres)

DRAINAGE FEE:

$23,821/acre x 4.114 acres $ 98,002.45

BRIDGE FEE:

$9,743/acre x 4.114 acres $ 40,082.70

This site lies entirely within the Sand Creek Drainage Basin boundaries.

The fees are calculated using the following impervious acreage method approved by El Paso County. The Foursquare at Sterling Ranch East Filing No. 1 has a total area of 36.647 acres with the following different land uses proposed:

FOURSQUARE AT STERLING RANCH EAST FILING NO. 1

11.191 Ac.	Detention Facilities & Park (Tract I)
5.141 Ac.	Open Space (Tracts A, B, C, D, G, E, F)
20.315 Ac.	0.125 Ac. avg. lot size
36.647Ac.	**Total**

The percent imperviousness for this subdivision is calculated as follows:

Fees for Detention Facilities & Park

(Per El Paso County Percent Impervious Chart: 7**%**)

11.191 Ac. x 7% = **0.783 Impervious Ac.**

Remove extra digit.

Fees for 1/8 Ac. lots (Avg. lot size of 3,900SF)

(Per El Paso County Percent Impervious Chart: 65**%**)

20.315 Ac. x 65% = **13,204 Impervious Ac**

FOURSQUARE AT STERLING RANCH EAST FILING No. 1 (13.987 Impervious acres)

DRAINAGE FEE:

$23,821/acre x 13.987 acres $ 333,1184.33

BRIDGE FEE:

$9,743/acre x 13.987 acres $ 136,275.34

Basin fees will be required to be paid prior to plat recordation.

SUMMARY

Developed runoff from the proposed Sterling Ranch East Filing No. 2 and Foursquare at Sterling Ranch East Filing No. 1 development is proposed to outfall to one proposed private Full Spectrum Detention (EDB) and Storm Water Quality Facility (owned and maintained by the Sterling Ranch Metropolitan District) prior to discharging to downstream facilities. The proposed Full Spectrum detention & water quality pond was sized using the current and applicable drainage criteria and provides release rates below existing allowable release rates. Therefore, the developed site runoff and proposed storm sewer facilities will not adversely affect the downstream facilities or surrounding developments.

PREPARED BY:

David L Gibson P.E.
Project Manager

dlg/118323/FDR-SRE FILING 1ª FSQ SER FILING 1.docx

REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual Volume 1, as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014.

2. "Urban Storm Drainage Criteria Manual Volume 1, 2 & 3," Urban Drainage and Flood Control District, dated January 2016.

3. "Sand Creek Drainage Basin Planning Study," by Kiowa Engineering Corporation, dated March 1996.

4. "2018 Sterling Ranch MDDP," by M&S Consultants, Inc., June 2018.

5. "Final Drainage Report for Retreat at TimberRidge Filing No. 1", Classic Consulting, approved November, 2020.

6. "Final Drainage Report for Retreat at TimberRidge Filing No. 2", Classic Consulting, dated March, 2022

7. "Final Design Report for Sand Creek Restoration", JR Engineering, LLC, dated September 2022

8. "Drainage Letter for Sterling Ranch Road and Briargate Pkwy. Interim Plan", prepared by JR Engineering, LLC, dated September 2022

9. "Master Development Drainage Plan Amendment for Sterling Ranch", prepared by JR Engineering, LLC, dated September 2022

APPENDIX

VICINITY MAP

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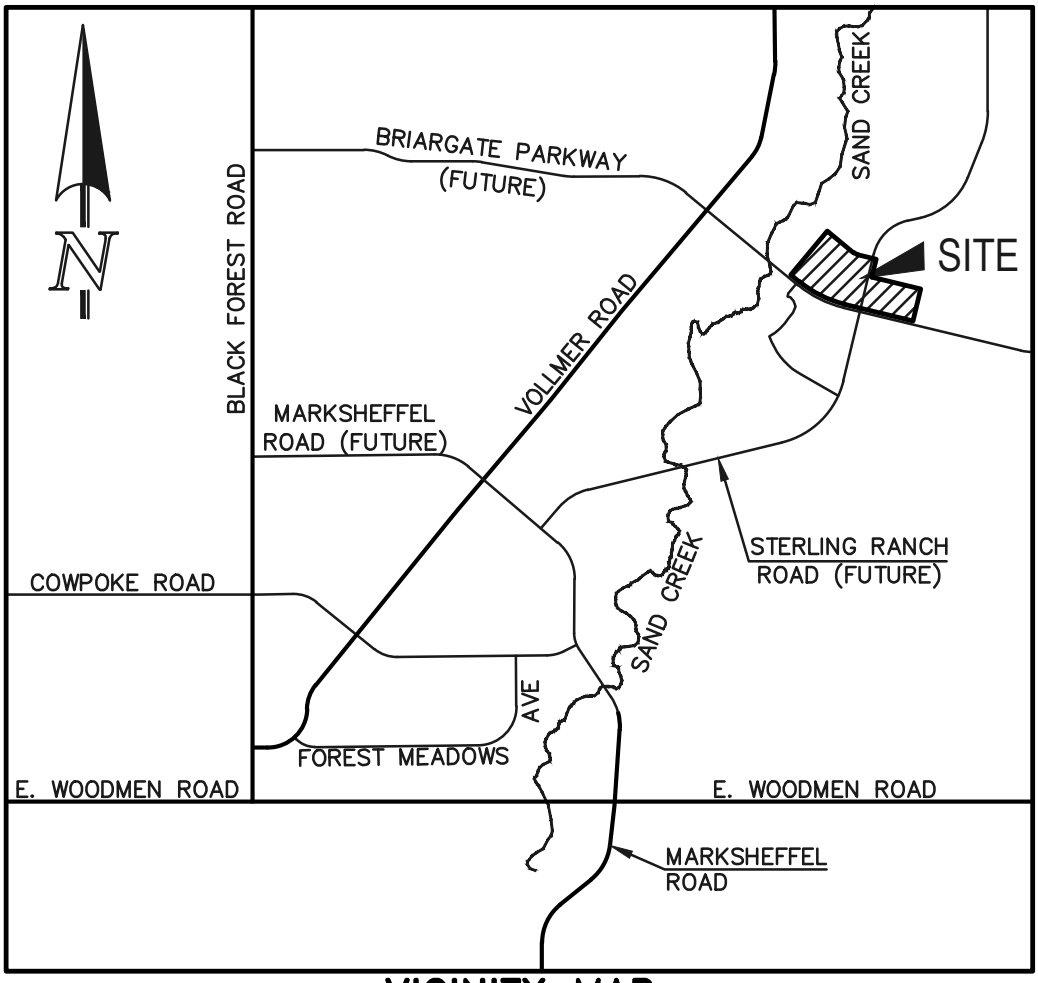
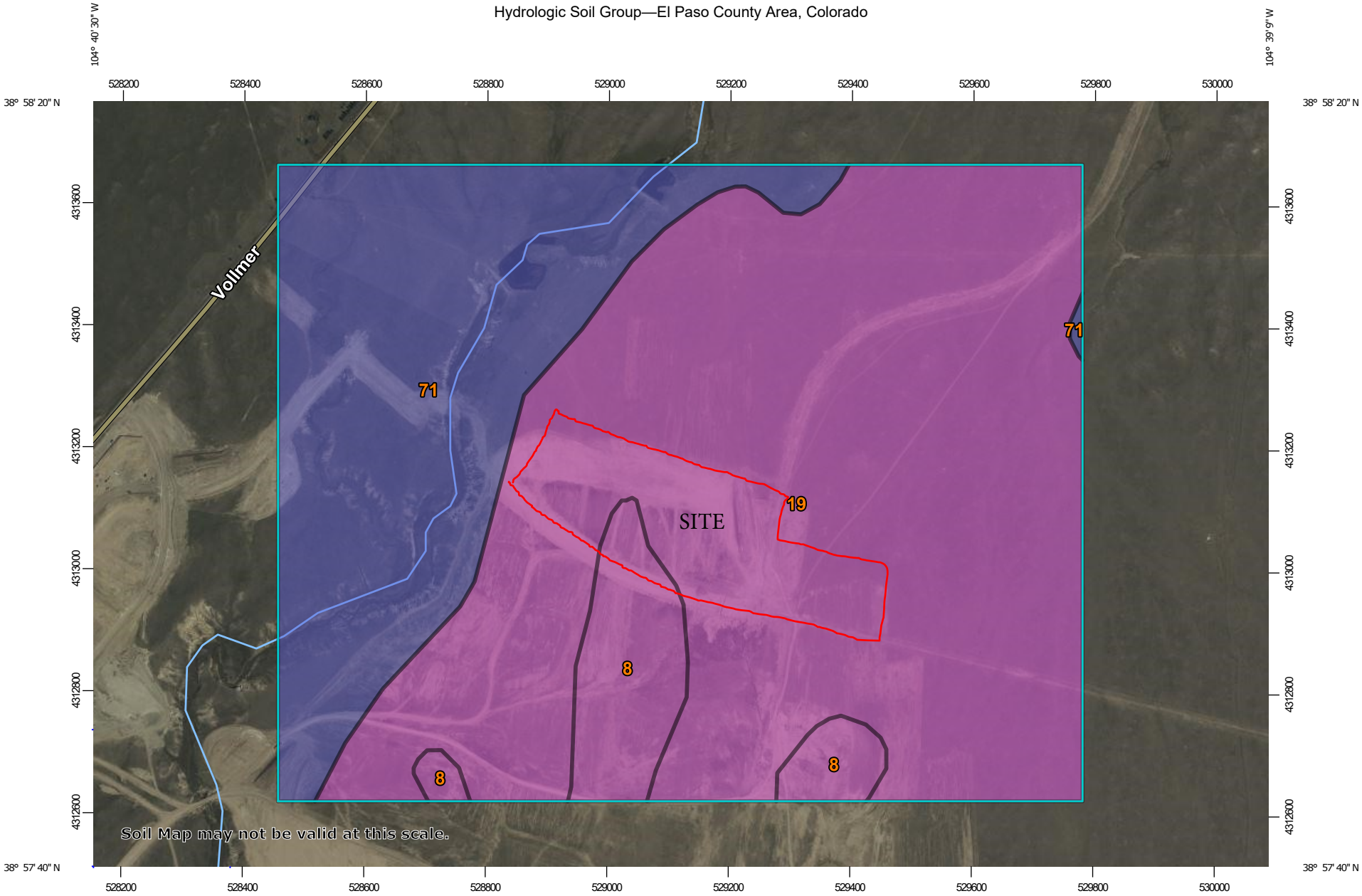


VICINITY MAP

NOT TO SCALE

SOILS MAP (S.C.S. SURVEY)

CLASSIC SM
CONSULTING
ENGINEERS & SURVEYORS



Map Scale: 1:8,850 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 400 800 1600 2400

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 20, Sep 2, 2022

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	23.0	6.7%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	219.5	64.0%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	100.4	29.3%
Totals for Area of Interest			**342.9**	**100.0%**

Description

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

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

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

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

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

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

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

F.E.M.A. MAP

CLASSIC SM
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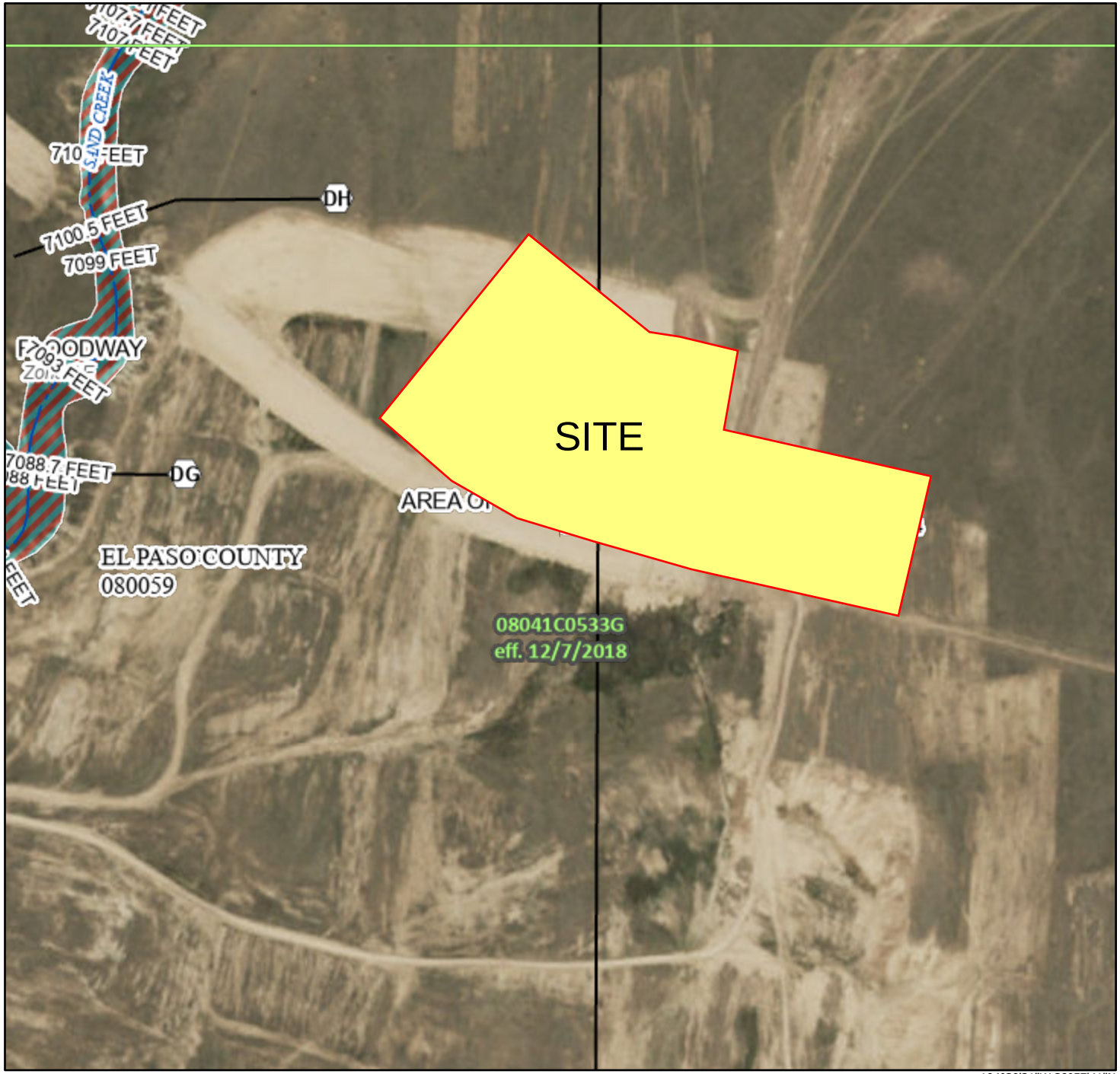
National Flood Hazard Layer FIRMette

FEMA

104°40'9"W 38°58'9"N



104°39'31"W 38°57'41"N

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

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

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
- 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 11/22/2022 at 4:39 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

DEVELOPED CONDITIONS CALCULATIONS

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JOB NAME: *STERLING RANCH EAST FIL NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL NO. 1*
JOB NUMBER: *1183.23*
DATE: *03/16/23*
CALCULATED BY: *DLG*

FINAL DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY

		DEVELOPED AREA (LOTS/ROADS)				LANDSCAPE TRACTS/UNDEVELOPED AREA				WEIGHTED				WEIGHTED CA		
BASIN	TOTAL AREA (AC)	AREA (AC)	C(2)	C(5)	C(100)	AREA (AC)	C(2)	C(5)	C(100)	USE	C(2)	C(5)	C(100)	CA(2)	CA(5)	CA(100)
A	2.90	2.90	0.23	0.30	0.50	0.00	0.02	0.08	0.35	1/4 RES	0.23	0.30	0.50	**0.67**	**0.87**	**1.45**
B	4.99	4.99	0.23	0.30	0.50	0.00	0.02	0.08	0.35	1/4 RES	0.23	0.30	0.50	**1.15**	**1.50**	**2.50**
C	0.72	0.19	0.89	0.90	0.96	0.53	0.02	0.08	0.35	ROAD/TRACT	0.25	0.30	0.51	**0.18**	**0.21**	**0.37**
D	0.20	0.20	0.89	0.90	0.96	0.00	0.02	0.08	0.35	ROAD	0.89	0.90	0.96	**0.18**	**0.18**	**0.19**
E	7.82	1.70	0.89	0.90	0.96	6.12	0.02	0.08	0.35	LANDSCAPE/TRACT	0.21	0.26	0.48	**1.64**	**2.02**	**3.77**
F	0.49	0.49	0.89	0.90	0.96	0.00	0.02	0.08	0.35	ROAD	0.89	0.90	0.96	**0.44**	**0.44**	**0.47**
G	0.16	0.16	0.89	0.90	0.96	0.00	0.02	0.08	0.35	ROAD	0.89	0.90	0.96	**0.14**	**0.14**	**0.15**
H	4.01	4.01	0.41	0.45	0.59	0.00	0.02	0.08	0.35	1/8 RES	0.41	0.45	0.59	**1.64**	**1.80**	**2.37**
I	1.68	1.09	0.41	0.45	0.59	0.59	0.02	0.08	0.35	1/8 RES/TRACT	0.27	0.32	0.51	**0.46**	**0.54**	**0.85**
J	3.87	3.87	0.41	0.45	0.59	0.00	0.02	0.08	0.35	1/8 RES	0.41	0.45	0.59	**1.59**	**1.74**	**2.28**
K	1.83	1.83	0.41	0.45	0.59	0.00	0.02	0.08	0.35	1/8 RES	0.41	0.45	0.59	**0.75**	**0.82**	**1.08**
L	2.20	2.20	0.41	0.45	0.59	0.00	0.02	0.08	0.35	1/8 RES	0.41	0.45	0.59	**0.90**	**0.99**	**1.30**
M	4.10	4.10	0.41	0.45	0.59	0.00	0.02	0.08	0.35	1/8 RES	0.41	0.45	0.59	**1.68**	**1.85**	**2.42**
N	3.00	1.23	0.41	0.45	0.59	1.77	0.02	0.08	0.35	1/8 RES/TRACT	0.18	0.23	0.45	**0.54**	**0.70**	**1.35**
O	1.11	0.74	0.89	0.90	0.96	0.37	0.02	0.08	0.35	ROAD/TRACT	0.60	0.63	0.76	**0.67**	**0.70**	**0.84**
P	0.63	0.10	0.89	0.90	0.96	0.53	0.02	0.08	0.35	LANDSCAPE TRACT	0.16	0.21	0.45	**0.10**	**0.13**	**0.28**
Q	0.50	0.10	0.89	0.90	0.96	0.40	0.02	0.08	0.35	LANDSCAPE TRACT	0.19	0.24	0.47	**0.10**	**0.12**	**0.24**
R	0.33	0.33	0.41	0.45	0.59	0.00	0.02	0.08	0.35	1/8 RES	0.41	0.45	0.59	**0.14**	**0.15**	**0.19**
S	1.00	1.00	0.41	0.45	0.59	0.00	0.02	0.08	0.35	1/8 RES	0.41	0.45	0.59	**0.41**	**0.45**	**0.59**
T	11.19	0.00	0.89	0.90	0.96	11.19	0.02	0.08	0.35	POND/TRACT	0.02	0.08	0.35	**0.22**	**0.90**	**3.92**
U	0.60	0.60	0.89	0.90	0.96	0.00	0.02	0.08	0.35	ROAD	0.89	0.90	0.96	**0.53**	**0.54**	**0.58**
V	0.45	0.35	0.89	0.90	0.96	0.10	0.02	0.08	0.35	ROAD/TRACT	0.70	0.72	0.82	**0.31**	**0.32**	**0.37**
P1-A2	6.59	4.20	0.89	0.90	0.96	2.39	0.02	0.08	0.35	TRACT/ROAD	0.57	0.62	0.75	**3.79**	**4.09**	**4.94**
OS-1	2.18	2.18	0.23	0.30	0.50	0.00	0.02	0.08	0.35	FUT 1/4 RES	0.23	0.30	0.50	**0.50**	**0.65**	**1.09**
OS-2	4.35	4.35	0.23	0.30	0.50	0.00	0.02	0.08	0.35	FUT 1/4 RES	0.23	0.30	0.50	**1.00**	**1.31**	**2.18**
OS-3	3.23	3.23	0.23	0.30	0.50	0.00	0.02	0.08	0.35	FUT 1/4 RES	0.23	0.30	0.50	**0.74**	**0.97**	**1.62**
OS-4	0.36	0.36	0.23	0.30	0.50	0.00	0.02	0.08	0.35	FUT 1/4 RES	0.23	0.30	0.50	**0.08**	**0.11**	**0.18**

JOB NAME: ***STERLING RANCH EAST FIL NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL NO. 1***

JOB NUMBER: ***1183.23***

DATE: ***03/28/03***

CALC'D BY: ***DLG***

Return Period	1-Hour Depth
2	1.19
5	1.50
10	1.75
25	2.00
50	2.25
100	2.52

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad V = C_v S_w^{0.5} \qquad \text{Tc=L/V}$$

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

$t_c = \frac{L}{180} + 10$

* For buried riprap, select C_v value based on type of vegetative cover.

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED			OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY			TOTAL FLOWS		
	CA(2)	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(2) (in/hr)	I(5) (in/hr)	I(100) (in/hr)	Q(2) (cfs)	Q(5) (cfs)	Q(100) (cfs)
A	0.67	0.87	1.45	0.08	50	2	8.2	300	2.0%	2.8	1.8	10.0	3.29	4.13	6.93	2.2	**3.6**	**10.0**
B	1.15	1.50	2.50	0.08	100	2.5	13.6	300	2.0%	2.8	1.8	15.4	2.78	3.48	5.85	3.2	**5.2**	**14.6**
C	0.18	0.21	0.37	0.08	50	1	10.4	0	0.0%	0.0	0.0	10.4	3.25	4.08	6.84	0.6	**0.9**	**2.5**
D	0.18	0.18	0.19	0.08	5	0.2	2.6	300	2.0%	2.8	1.8	5.0	4.12	5.17	8.68	0.7	**0.9**	**1.7**
E	1.64	2.02	3.77	0.08	100	3	12.8	0	0.0%	0.0	0.0	12.8	3.00	3.76	6.31	4.9	**7.6**	**23.8**
F	0.44	0.44	0.47	0.08	5	0.2	2.6	300	2.0%	2.8	1.8	5.0	4.12	5.17	8.68	1.8	**2.3**	**4.1**
G	0.14	0.14	0.15	0.08	5	0.2	2.6	100	2.0%	2.8	0.6	5.0	4.12	5.17	8.68	0.6	**0.7**	**1.3**
H	1.64	1.80	2.37	0.08	100	4	11.7	300	2.0%	2.8	1.8	13.4	2.94	3.69	6.19	4.8	**6.7**	**14.6**
I	0.46	0.54	0.85	0.08	100	4	11.7	100	2.0%	2.8	0.6	12.2	3.05	3.83	6.42	1.4	**2.1**	**5.5**
J	1.59	1.74	2.28	0.08	100	4	11.7	300	2.0%	2.8	1.8	13.4	2.94	3.69	6.19	4.7	**6.4**	**14.1**
K	0.75	0.82	1.08	0.08	100	4	11.7	300	2.0%	2.8	1.8	13.4	2.94	3.69	6.19	2.2	**3.0**	**6.7**
L	0.90	0.99	1.30	0.08	100	4	11.7	300	2.0%	2.8	1.8	13.4	2.94	3.69	6.19	2.7	**3.7**	**8.0**
M	1.68	1.85	2.42	0.08	100	4	11.7	300	2.0%	2.8	1.8	13.4	2.94	3.69	6.19	4.9	**6.8**	**15.0**
N	0.54	0.70	1.35	0.08	100	2	14.7	0	0.0%	0.0	0.0	14.7	2.84	3.56	5.97	1.5	**2.5**	**8.0**
O	0.67	0.70	0.84	0.08	50	5	6.1	300	2.0%	2.8	1.8	7.9	3.58	4.49	7.54	2.4	**3.1**	**6.3**
P	0.10	0.13	0.28	0.08	5	0.2	2.6	0	0.0%	0.0	0.0	5.0	4.12	5.17	8.68	0.4	**0.7**	**2.4**

JOB NAME: ***STERLING RANCH EAST FIL NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL NO. 1***

JOB NUMBER: ***1183.23***

DATE: ***03/28/03***

CALC'D BY: ***DLG***

Return Period	1-Hour Depth
2	1.19
5	1.50
10	1.75
25	2.00
50	2.25
100	2.52

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad V = C_v S_w^{0.5} \qquad \text{Tc=L/V}$$

Table 6-7. Conveyance Coefficient, C_v

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Heavy meadow	2.5
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Paved areas and shallow paved swales	20

$t_c = \frac{L}{180} + 10$

* For buried riprap, select C_v value based on type of vegetative cover.

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED			OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY			TOTAL FLOWS		
	CA(2)	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(2) (in/hr)	I(5) (in/hr)	I(100) (in/hr)	Q(2) (cfs)	Q(5) (cfs)	Q(100) (cfs)
Q	0.10	0.12	0.24	0.08	5	0.5	1.9	0	0.0%	0.0	0.0	5.0	4.12	5.17	8.68	0.4	**0.6**	**2.0**
R	0.14	0.15	0.19	0.08	100	4	11.7	50	2.0%	2.8	0.3	11.9	3.08	3.86	6.48	0.4	**0.6**	**1.3**
S	0.41	0.45	0.59	0.08	100	4	11.7	50	2.0%	2.8	0.3	11.9	3.08	3.86	6.48	1.3	**1.7**	**3.8**
T	0.22	0.90	3.92	0.08	100	4	11.7	0	2.0%	0.0	0.0	11.7	3.11	3.90	6.55	0.7	**3.5**	**25.6**
U	0.53	0.54	0.58	0.08	0	0	0.0	300	2.0%	2.8	1.8	5.0	4.12	5.17	8.68	2.2	**2.8**	**5.0**
V	0.31	0.32	0.37	0.08	50	2	8.2	100	2.0%	2.8	0.6	8.8	3.44	4.32	7.25	1.1	**1.4**	**2.7**
P1-A2	3.79	4.09	4.94	0.08	10	0.5	3.4	2350	0.9%	1.9	11.8	15.2	2.79	3.50	5.87	10.6	**14.3**	**29.0**
OS-1	0.50	0.65	1.09	0.08	100	2	14.7	0	0.0%	0.0	0.0	14.7	2.84	3.56	5.97	1.4	**2.3**	**6.5**
OS-2	1.00	1.31	2.18	0.08	50	2	8.2	300	2.0%	2.8	1.8	10.0	3.29	4.13	6.93	3	**5**	**15**
OS-3	0.74	0.97	1.62	0.08	50	2	8.2	300	2.0%	2.8	1.8	10.0	3.29	4.13	6.93	2	**4**	**11**
OS-4	0.08	0.11	0.18	0.08	50	2	8.2	0	0.0%	0.0	0.0	8.2	3.53	4.42	7.42	0	**0**	**1**

JOB NAME: *STERLING RANCH EAST FIL NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL NO. 1*
JOB NUMBER: *1183.23*
DATE: *03/16/23*
CALCULATED BY: *DLG*

FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
1	BASIN B	1.50	2.50	15.4	3.48	5.85	5.2	14.6	10' TYPE R SUMP PUBLIC
2	BASIN A	0.87	1.45	10.0	4.13	6.93	3.6	10.0	10' TYPE R SUMP PUBLIC
3	BASIN J	1.74	2.28	13.4	3.69	6.19	6.4	14.1	10' TYPE R SUMP PUBLIC
4	BASIN K	0.82	1.08	13.4	3.69	6.19	3.0	6.7	5' TYPE R SUMP PUBLIC
5	BASIN D, BASIN F & BASIN OS-1	1.28	1.75	14.7	3.56	5.97	4.5	10.5	10' TYPE R SUMP PUBLIC
6	BASIN G	0.14	0.15	5.0	5.17	8.68	0.7	1.3	5' TYPE R SUMP PUBLIC
7	BASIN H	1.80	2.37	13.4	3.69	6.19	6.7	14.6	10' TYPE R SUMP PUBLIC
8	BASIN I	0.54	0.85	12.2	3.83	6.42	2.1	5.5	5' TYPE R SUMP PUBLIC
9	BASIN M & BASIN N	2.54	3.76	14.7	3.56	5.97	9.0	22.5	15' TYPE R AT GRADE PUBLIC
10	BASIN L & FLOWBY DP 9	1.21	2.70	14.7	3.56	5.97	4.3	16.1	15' TYPE R SUMP PUBLIC
11	BASIN R & S	0.60	0.78	11.9	3.86	6.48	2.3	5.1	15' TYPE R AT GRADE PUBLIC
12	BASIN P1-A2(INCLUDE C & Q)	4.09	4.94	15.2	3.50	5.87	14.3	29.0	EX 20' TYPE R AT GRADE PUBLIC
13	BASIN OS-2	1.31	2.18	10.0	4.13	6.93	5.4	15.1	FUTURE 15' TYPE R AT GRADE PUBLIC
14	BASIN OS-3	0.97	1.62	10.0	4.13	6.93	4.0	11.2	FUTURE 15' TYPE R AT GRADE PUBLIC
15	BASIN O & FLOW-BY DP 13	0.70	1.46	10.0	4.13	6.93	2.9	10.1	15' TYPE R AT GRADE PUBLIC

JOB NAME: ***STERLING RANCH EAST FIL NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL NO. 1***
JOB NUMBER: ***1183.23***
DATE: ***03/16/23***
CALCULATED BY: ***DLG***

FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		
					I(5)	I(100)	Q(5)	Q(100)	Inlet Size
16	BASIN U, OS-4, & FLOW-BY DP 15	0.65	1.07	10.0	4.13	6.93	2.7	7.4	15' TYPE R AT GRADE PUBLIC
17	BASIN V & FLOW-BY DP 15 & 16	0.32	0.61	10.0	4.13	6.93	1.3	4.2	EXISTING 20' TYPE R SUMP PUBLIC
18	BASIN P	0.13	0.28	5.0	5.17	8.68	0.7	2.4	EXISTING 20' TYPE R AT GRADE PUBLIC
19	BASIN T & PIPE 17	13.84	22.16	15.4	3.48	5.85	48	130	POND IN

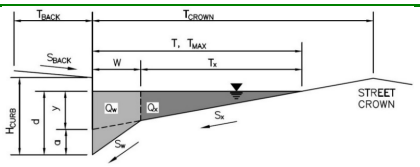
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **INLET DP 1**



Gutter Geometry:

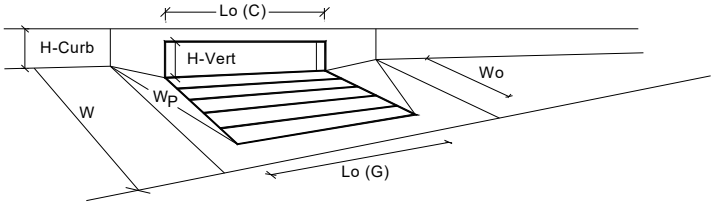
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



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	7.8	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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.42	0.57	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**11.5**	**18.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	5.2	14.6	cfs

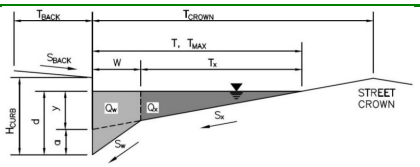
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **INLET DP 2**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

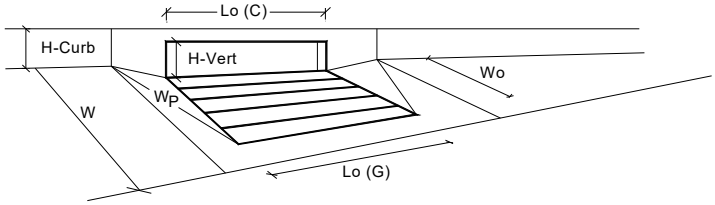
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



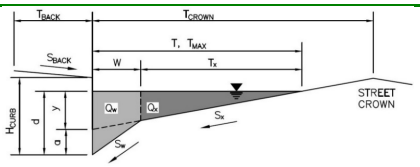
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	7.8	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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.42	0.57	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**11.5**	**18.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.6	10.0	cfs

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **INLET DP 3**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

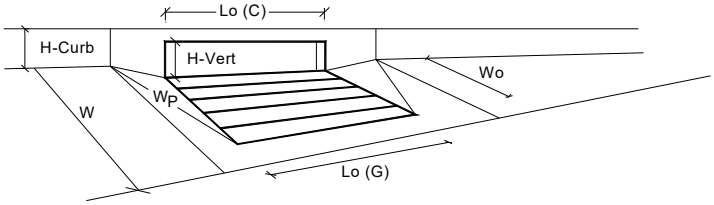
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



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	7.8	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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.42	0.57	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**11.5**	**18.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	6.4	14.1	cfs

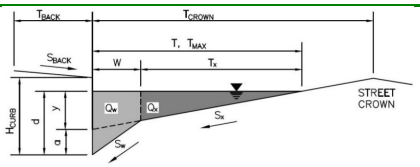
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **INLET DP 4**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

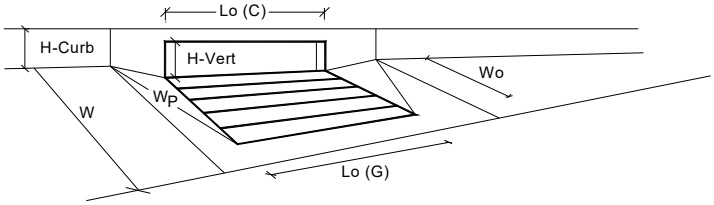
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



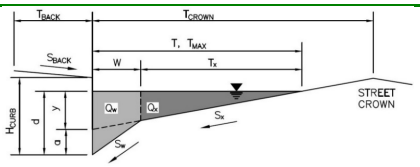
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	7.8	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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.42	0.57	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**7.5**	**9.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.0	6.7	cfs

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **INLET DP 5**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	6.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

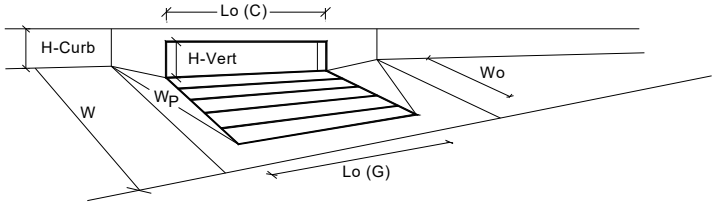
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



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 =	4.6	4.6	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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.30	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.84	0.84	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.3**	**6.3**	**cfs**
WARNING: Inlet Capacity < Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	4.5	10.5	cfs

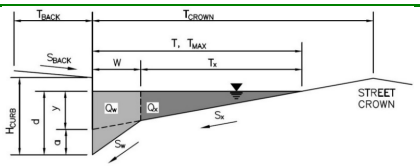
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **INLET DP 6**



Gutter Geometry:

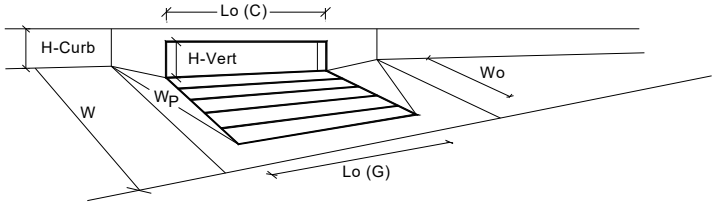
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



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 =	4.6	4.6	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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.30	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**4.6**	**4.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.7	1.3	cfs

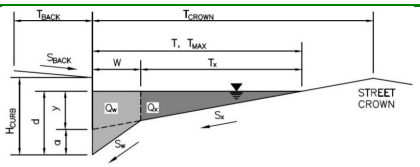
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **INLET DP 7**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

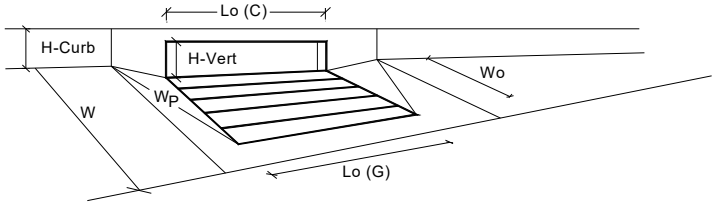
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



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	7.8	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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.42	0.57	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**11.5**	**18.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	6.7	14.6	cfs

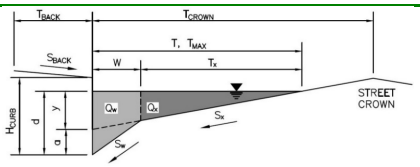
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **INLET DP 8**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

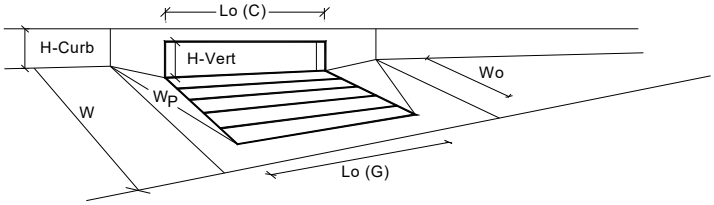
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



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	7.8	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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.42	0.57	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**7.5**	**9.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	2.1	5.5	cfs

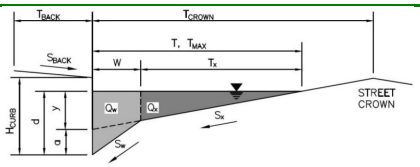
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **AT GRADE INLET DP 9**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

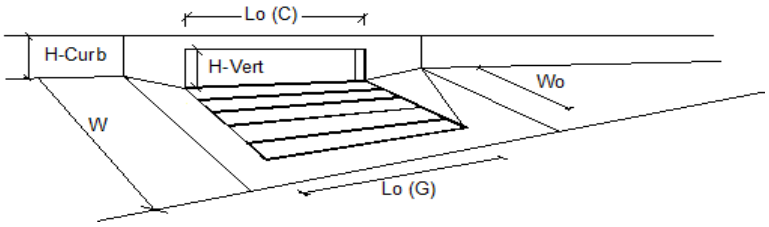
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**14.4**	**50.4**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 9.00 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 22.50 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	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 =	15.00	15.00	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	

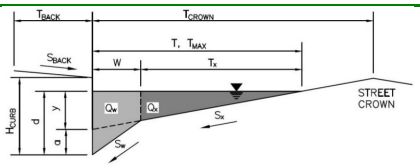
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.9**	**13.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**1.1**	**9.2**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**88**	**59**	**%**

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **INLET DP 10**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

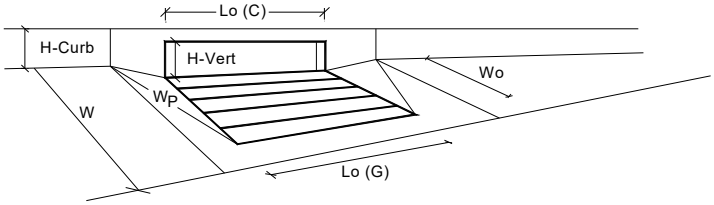
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



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	7.8	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
Open Area 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 =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.42	0.57	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.88	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**10.9**	**19.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	4.1	16.1	cfs

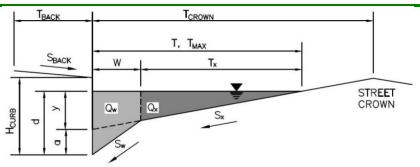
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **AT GRADE INLET DP 11**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.022	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

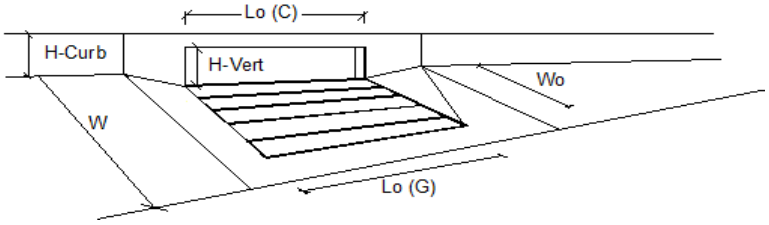
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**15.1**	**49.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.30 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.10 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	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 =	15.00	15.00	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 =**	**2.3**	**5.1**	**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**	**%**

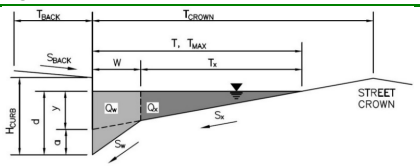
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **FUTURE AT GRADE DP 13**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
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 =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.035	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.3	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

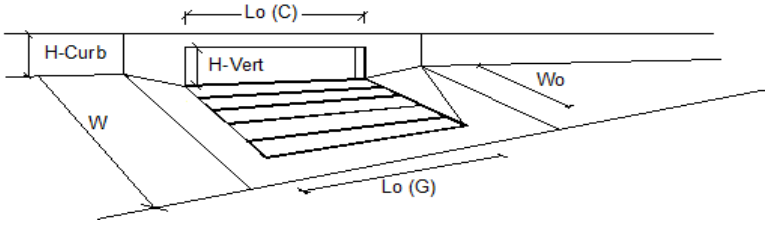
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**27.0**	**79.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 5.40 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 15.10 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	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 =	15.00	15.00	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 =**	**5.4**	**10.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**4.3**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**71**	**%**

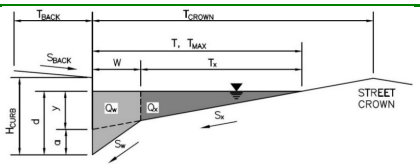
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **FUTURE AT GRADE DP 14**



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
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 =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.035	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.3	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

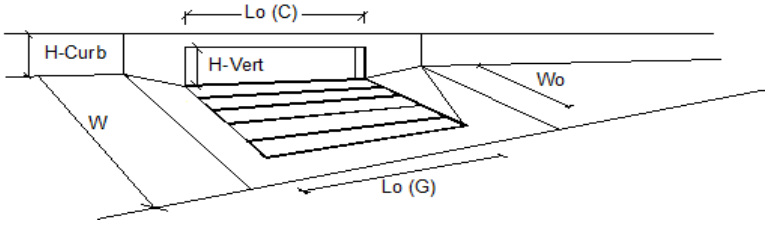
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**27.0**	**79.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 4.00 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 11.20 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	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 =	15.00	15.00	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 =**	**4.0**	**9.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.1**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**81**	**%**

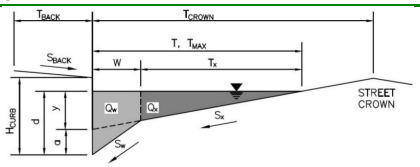
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **AT GRADE INLET DP 15**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
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 =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.030	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.3	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

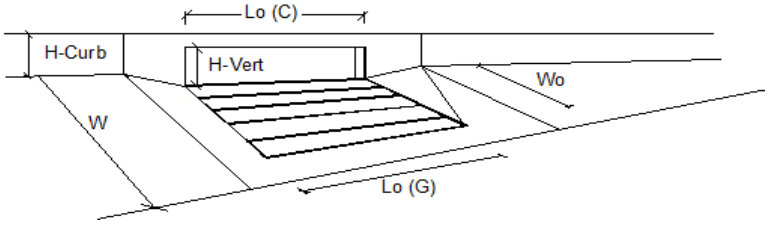
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**22.6**	**67.6**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.90 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 10.10 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	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 =	15.00	15.00	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 =**	**2.9**	**8.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.2**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**88**	**%**

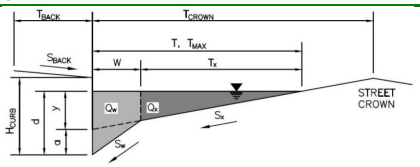
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: **STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL. NO. 1**

Inlet ID: **AT GRADE INLET DP 16**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
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 =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.042	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.030	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.020	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.3	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

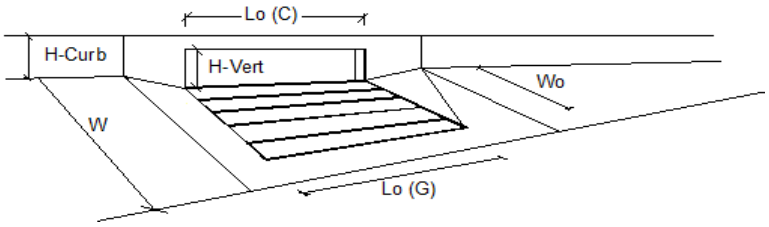
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**22.6**	**67.6**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.90 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.00 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	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 =	15.00	15.00	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 =**	**2.9**	**7.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.4**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**95**	**%**

JOB NAME: ***STERLING RANCH EAST FIL NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL NO. 1***
JOB NUMBER: ***1183.23***
DATE: ***03/16/23***
CALCULATED BY: ***DLG***

* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

FINAL DRAINAGE REPORT ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
1	DP 1	1.50	2.50	15.4	3.48	5.85	5.2	14.6	24" PUBLIC RCP STORM
2	DP 2	0.87	1.45	10.0	4.13	6.93	3.6	10.0	24" PUBLIC RCP STORM
3	PIPE 1 & PIPE 2	2.37	3.95	15.4	3.48	5.85	8.2	23.1	24" PUBLIC RCP STORM
4	DP 11	0.60	0.78	11.9	3.86	6.48	2.3	5.1	18" PUBLIC RCP STORM
5	PIPE 3 & 4	2.97	4.73	15.4	3.48	5.85	10.3	27.7	30" PUBLIC RCP STORM
6	DP 3	1.74	2.28	13.4	3.69	6.19	6.4	14.1	24" PUBLIC RCP STORM
7	DP 4	0.82	1.08	13.4	3.69	6.19	3.0	6.7	18" PUBLIC RCP STORM
8	PIPE 5, PIPE 6 & PIPE 7	5.53	8.09	15.4	3.48	5.85	19.3	47.3	36" PUBLIC RCP STORM
9	DP 5	1.28	1.75	14.7	3.56	5.97	4.5	10.5	18" PUBLIC RCP STORM
10	DP 6	0.14	0.15	5.0	5.17	8.68	0.7	1.3	18" PUBLIC RCP STORM
11	PIPE 9 & PIPE 10	1.42	1.91	14.7	3.56	5.97	5.0	11.4	24" PUBLIC RCP STORM
12	DP 7	1.80	2.37	13.4	3.69	6.19	6.7	14.6	24" PUBLIC RCP STORM
13	DP 8	0.54	0.85	12.2	3.83	6.42	2.1	5.5	18" PUBLIC RCP STORM
14	PIPE 11, PIPE 12, PIPE 13	3.76	5.12	14.7	3.56	5.97	13.4	30.6	24" PUBLIC RCP STORM

JOB NAME: ***STERLING RANCH EAST FIL NO. 2 & FOURSQUARE AT STERLING RANCH EAST FIL NO. 1***
JOB NUMBER: ***1183.23***
DATE: ***03/16/23***
CALCULATED BY: ***DLG***

* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

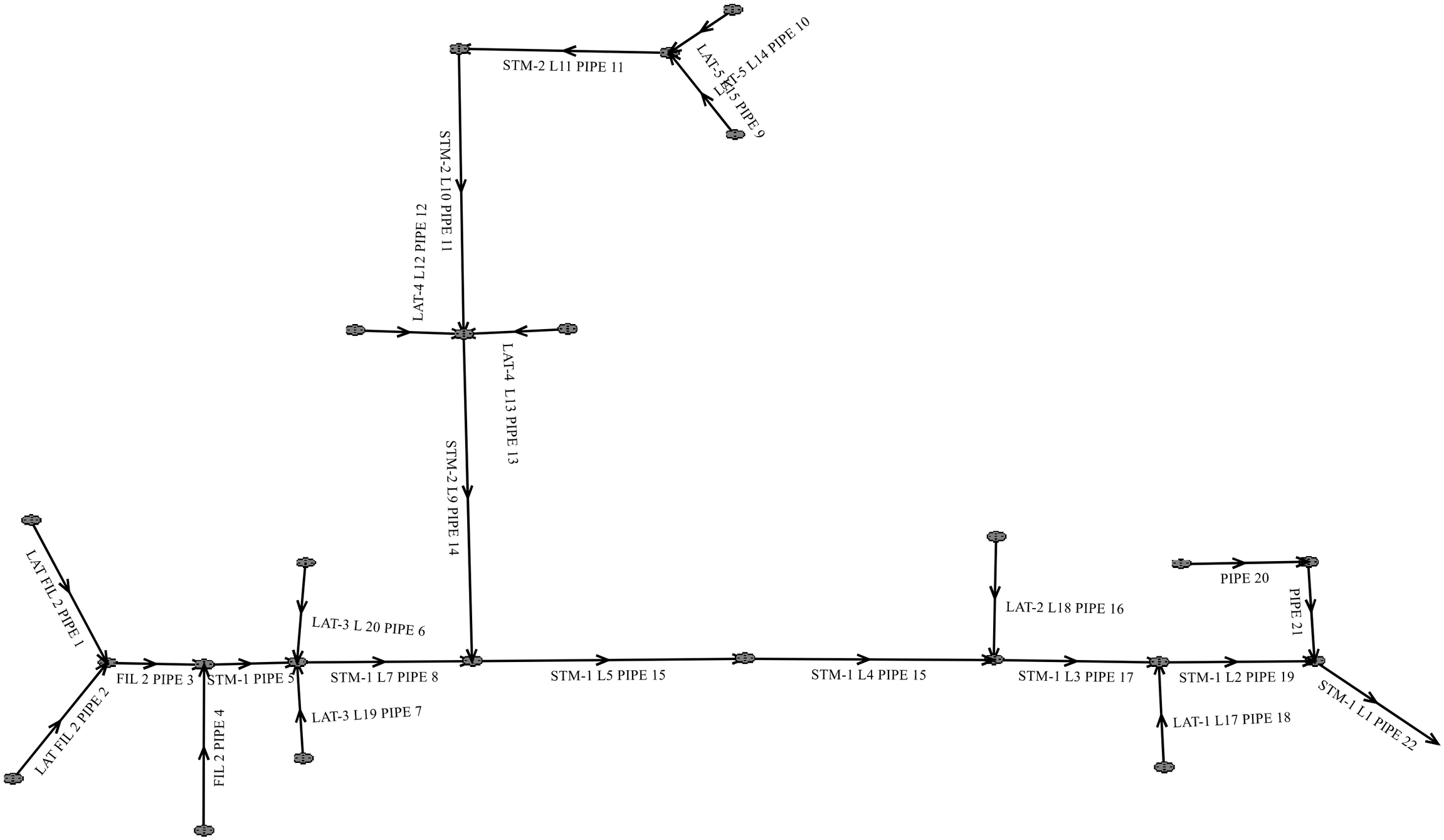
FINAL DRAINAGE REPORT ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
15	PIPE 8 & PIPE 14	9.29	13.21	15.4	3.48	5.85	32.4	77.3	42" PUBLIC RCP STORM
16	DP 9 INTERCEPTED	2.44	2.33	14.7	3.56	5.97	8.7	13.9	24" PUBLIC RCP STORM
17	PIPE 15 & PIPE 16	11.73	15.55	15.4	3.48	5.85	40.9	90.9	42" PUBLIC RCP STORM
18	DP 10	1.21	2.70	14.7	3.56	5.97	4.3	16.1	24" PUBLIC RCP STORM
19	PIPE 17 & PIPE 18	12.94	18.25	15.4	3.48	5.85	45.1	106.7	42" PUBLIC RCP STORM
20	DP 15 INTERCEPTED	0.70	1.46	10.0	4.13	6.93	2.9	10.1	42" PUBLIC RCP STORM
21	DP 16 INTERCEPTED & PIPE 20	1.34	2.53	10.0	4.13	6.93	5.5	17.5	42" PUBLIC RCP STORM
22	PIPE 19 & PIPE 21	14.29	20.77	15.4	3.48	5.85	49.8	121.5	48" PUBLIC RCP STORM

HYDRAULIC GRADE LINE (HGL)

CALCULATIONS

CLASSIC SM
CONSULTING
ENGINEERS & SURVEYORS


STM-2 L11 PIPE 11
LAT-5 L14 PIPE 10
LAT-5 L15 PIPE 9
STM-2 L10 PIPE 11
LAT-4 L12 PIPE 12
LAT-4 L13 PIPE 13
STM-2 L9 PIPE 14
LAT FIL 2 PIPE 1
LAT FIL 2 PIPE 2
FIL 2 PIPE 3
FIL 2 PIPE 4
STM-1 PIPE 5
LAT-3 L 20 PIPE 6
LAT-3 L19 PIPE 7
STM-1 L7 PIPE 8
STM-1 L5 PIPE 15
STM-1 L4 PIPE 15
LAT-2 L18 PIPE 16
STM-1 L3 PIPE 17
PIPE 20
PIPE 21
STM-1 L2 PIPE 19
LAT-1 L17 PIPE 18
STM-1 L1 PIPE 22

System Input Summary 100 YEAR

Backwater Calculations:

Tailwater Elevation (ft): 7097.60

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
OUTFALL 1	7102.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STM-1 L1 PIPE 22	7107.04	121.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 21	7107.94	17.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 20	7107.94	10.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STM-1 L2 PIPE 19	7111.34	106.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STM-1 L3 PIPE 17	7112.39	90.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LAT-2 L18 PIPE 16	7112.63	13.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STM-1 L4 PIPE 15	7117.81	77.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STM-1 L5 PIPE 15	7117.57	77.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STM-1 L7 PIPE 8	7116.79	47.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LAT-3 L19 PIPE 7	7116.90	6.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

STM-1 PIPE 5	7118.50	27.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FIL 2 PIPE 3	7117.53	23.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LAT FIL 2 PIPE 2	7117.80	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LAT FIL 2 PIPE 1	7118.07	14.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FIL 2 PIPE 4	7118.03	11.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LAT-3 L 20 PIPE 6	7116.90	14.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STM-2 L9 PIPE 14	7119.40	30.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STM-2 L10 PIPE 11	7126.37	11.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STM-2 L11 PIPE 11	7125.97	11.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LAT-5 L15 PIPE 9	7126.07	10.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LAT-5 L14 PIPE 10	7126.07	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LAT-4 L13 PIPE 13	7119.57	5.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LAT-4 L12 PIPE 12	7119.57	14.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LAT-1 L17 PIPE 18	7111.06	16.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	10.45	11.63	0.14	121.50	
STM-1 L1 PIPE 22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	121.50	
PIPE 21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.50	
PIPE 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.10	
STM-1 L2 PIPE 19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	106.70	
STM-1 L3 PIPE 17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	90.90	
LAT-2 L18 PIPE 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.90	
STM-1 L4 PIPE 15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	77.30	
STM-1 L5 PIPE 15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	77.30	
STM-1 L7 PIPE 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.30	
LAT-3 L19 PIPE 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.70	
STM-1 PIPE 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.70	
FIL 2 PIPE 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.10	
LAT FIL 2 PIPE 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	
LAT FIL 2 PIPE 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.60	
FIL 2 PIPE 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.40	
LAT-3 L 20 PIPE 6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.10	
STM-2 L9 PIPE 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.60	
STM-2 L10 PIPE 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.40	
STM-2 L11 PIPE 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.40	

LAT-5 L15 PIPE 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.50	
LAT-5 L14 PIPE 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	
LAT-4 L13 PIPE 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.50	
LAT-4 L12 PIPE 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.60	
LAT-1 L17 PIPE 18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.10	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
STM-1 L1 PIPE 22	79.03	7094.50	0.8	7095.13	0.013	0.05	1.00	CIRCULAR	48.00 in	48.00 in
PIPE 21	16.81	7101.80	2.0	7102.14	0.013	0.29	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 20	59.63	7102.46	1.7	7103.47	0.013	1.00	0.00	CIRCULAR	18.00 in	18.00 in
STM-1 L2 PIPE 19	93.14	7099.80	0.8	7100.55	0.013	0.10	0.25	CIRCULAR	42.00 in	42.00 in
STM-1 L3 PIPE 17	94.79	7100.65	0.8	7101.41	0.013	0.05	0.25	CIRCULAR	42.00 in	42.00 in
LAT-2 L18 PIPE 16	24.67	7107.27	2.0	7107.76	0.013	1.00	0.00	CIRCULAR	24.00 in	24.00 in
STM-1 L4 PIPE 15	368.17	7101.75	0.8	7104.70	0.013	0.05	0.25	CIRCULAR	42.00 in	42.00 in
STM-1 L5 PIPE 15	278.55	7104.81	0.5	7106.20	0.013	0.05	1.00	CIRCULAR	42.00 in	42.00 in
STM-1 L7 PIPE 8	84.52	7106.69	1.0	7107.54	0.013	0.05	0.25	CIRCULAR	36.00 in	36.00 in
LAT-3 L19 PIPE 7	5.67	7113.06	1.9	7113.17	0.013	1.00	0.00	CIRCULAR	18.00 in	18.00 in
STM-1 PIPE 5	369.56	7107.64	0.5	7109.49	0.013	0.05	0.25	CIRCULAR	36.00 in	36.00 in
FIL 2 PIPE 3	125.71	7109.56	1.0	7110.82	0.013	0.05	0.25	CIRCULAR	36.00 in	36.00 in
LAT FIL 2 PIPE 2	5.68	7112.86	0.5	7112.89	0.013	1.01	0.00	CIRCULAR	24.00 in	24.00 in

LAT FIL 2 PIPE 1	26.95	7112.86	0.5	7112.99	0.013	0.48	0.00	CIRCULAR	24.00 in	24.00 in
FIL 2 PIPE 4	29.86	7112.73	1.0	7113.03	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
LAT-3 L 20 PIPE 6	24.67	7112.55	1.0	7112.80	0.013	1.00	0.00	CIRCULAR	24.00 in	24.00 in
STM-2 L9 PIPE 14	249.88	7106.86	1.6	7110.86	0.013	1.00	0.00	CIRCULAR	30.00 in	30.00 in
STM-2 L10 PIPE 11	490.62	7112.01	1.7	7120.35	0.013	0.05	0.25	CIRCULAR	24.00 in	24.00 in
STM-2 L11 PIPE 11	48.37	7120.65	1.0	7121.13	0.013	1.00	1.00	CIRCULAR	24.00 in	24.00 in
LAT-5 L15 PIPE 9	26.43	7121.64	1.0	7121.90	0.013	0.29	0.00	CIRCULAR	18.00 in	18.00 in
LAT-5 L14 PIPE 10	9.55	7121.63	1.0	7121.73	0.013	0.29	0.00	CIRCULAR	18.00 in	18.00 in
LAT-4 L13 PIPE 13	5.67	7115.61	1.1	7115.67	0.013	1.00	0.00	CIRCULAR	18.00 in	18.00 in
LAT-4 L12 PIPE 12	24.67	7115.11	1.0	7115.36	0.013	1.00	0.00	CIRCULAR	24.00 in	24.00 in
LAT-1 L17 PIPE 18	24.38	7102.06	8.2	7104.06	0.013	1.00	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
STM-1 L1 PIPE 22	128.82	10.25	39.79	10.91	37.10	11.66	1.17	Supercritical	121.50	0.00	
PIPE 21	14.90	8.43	18.00	9.90	18.00	9.90	0.00	Pressurized	17.50	16.81	
PIPE 20	13.73	7.77	14.69	6.54	11.47	8.50	1.65	Pressurized	10.10	59.63	
STM-1 L2 PIPE 19	90.23	9.38	42.00	11.09	42.00	11.09	0.00	Pressurized	106.70	93.14	
STM-1 L3 PIPE 17	90.23	9.38	42.00	9.45	42.00	9.45	0.00	Pressurized	90.90	94.79	
LAT-2 L18 PIPE 16	32.08	10.21	16.11	6.20	11.04	9.85	2.06	Supercritical	13.90	0.00	
STM-1 L4 PIPE 15	90.23	9.38	33.00	9.53	29.93	10.54	1.22	Pressurized	77.30	368.17	
STM-1 L5 PIPE 15	71.33	7.41	42.00	8.03	42.00	8.03	0.00	Pressurized	77.30	278.55	
STM-1 L7 PIPE 8	66.88	9.46	26.88	8.36	22.35	10.26	1.44	Pressurized	47.30	84.52	
LAT-3 L19 PIPE 7	14.52	8.22	12.02	5.34	8.59	8.05	1.90	Pressurized	6.70	5.67	
STM-1 PIPE 5	61.48	8.70	20.42	6.69	16.94	8.47	1.43	Pressurized	27.70	369.56	
FIL 2 PIPE 3	86.94	12.30	18.57	6.28	12.67	10.40	2.08	Pressurized	23.10	125.71	
LAT FIL 2 PIPE 2	20.85	6.64	13.58	5.46	11.71	6.57	1.33	Pressurized	10.00	5.68	
LAT FIL 2 PIPE 1	20.85	6.64	16.52	6.33	14.80	7.18	1.24	Pressurized	14.60	26.95	
FIL 2 PIPE 4	13.69	7.75	15.46	7.06	12.55	8.67	1.56	Pressurized	11.40	29.86	
LAT-3 L 20 PIPE 6	22.68	7.22	16.23	6.24	13.70	7.61	1.39	Pressurized	14.10	24.67	
STM-2 L9 PIPE 14	52.02	10.60	22.62	7.71	16.54	11.03	1.84	Pressurized	30.60	249.88	
STM-2 L10 PIPE 11	29.58	9.41	14.54	5.73	10.34	8.80	1.92	Supercritical Jump	11.40	140.07	
STM-2 L11 PIPE 11	22.68	7.22	14.54	5.73	12.04	7.23	1.43	Supercritical	11.40	0.00	

LAT-5 L15 PIPE 9	10.53	5.96	14.94	6.70	14.70	6.79	1.04	Supercritical	10.50	0.00	
LAT-5 L14 PIPE 10	10.53	5.96	5.12	3.14	4.27	4.05	1.42	Supercritical	1.30	0.00	
LAT-4 L13 PIPE 13	11.05	6.25	10.85	4.94	8.98	6.24	1.44	Supercritical	5.50	0.00	
LAT-4 L12 PIPE 12	22.68	7.22	16.52	6.33	14.01	7.67	1.38	Supercritical	14.60	0.00	
LAT-1 L17 PIPE 18	64.96	20.68	17.36	6.62	8.14	17.15	4.29	Pressurized	16.10	24.38	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
STM-1 L1 PIPE 22	121.50	CIRCULAR	48.00 in	48.00 in	48.00 in	48.00 in	48.00 in	48.00 in	12.57	
PIPE 21	17.50	CIRCULAR	18.00 in	18.00 in	21.00 in	21.00 in	18.00 in	18.00 in	1.77	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
PIPE 20	10.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
STM-1 L2 PIPE 19	106.70	CIRCULAR	42.00 in	42.00 in	48.00 in	48.00 in	42.00 in	42.00 in	9.62	Existing height is smaller than the suggested height. Existing width is smaller

										than the suggested width. Exceeds max. Depth/Rise
STM-1 L3 PIPE 17	90.90	CIRCULAR	42.00 in	42.00 in	48.00 in	48.00 in	42.00 in	42.00 in	9.62	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
LAT-2 L18 PIPE 16	13.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
STM-1 L4 PIPE 15	77.30	CIRCULAR	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	9.62	
STM-1 L5 PIPE 15	77.30	CIRCULAR	42.00 in	42.00 in	48.00 in	48.00 in	42.00 in	42.00 in	9.62	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
STM-1 L7 PIPE 8	47.30	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
LAT-3 L19 PIPE 7	6.70	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
STM-1 PIPE 5	27.70	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
FIL 2 PIPE 3	23.10	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
LAT FIL 2 PIPE 2	10.00	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
LAT FIL 2 PIPE 1	14.60	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
FIL 2 PIPE 4	11.40	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
LAT-3 L 20 PIPE 6	14.10	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
STM-2 L9 PIPE 14	30.60	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
STM-2 L10 PIPE 11	11.40	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
STM-2 L11 PIPE 11	11.40	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
LAT-5 L15 PIPE 9	10.50	CIRCULAR	18.00 in	18.00 in	21.00 in	21.00 in	18.00 in	18.00 in	1.77	Existing height is smaller than the suggested height.

										Existing width is smaller than the suggested width.
LAT-5 L14 PIPE 10	1.30	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
LAT-4 L13 PIPE 13	5.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
LAT-4 L12 PIPE 12	14.60	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
LAT-1 L17 PIPE 18	16.10	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 7097.60

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
STM-1 L1 PIPE 22	7094.50	7095.13	0.00	0.00	7097.60	7098.45	7099.70	0.59	7100.29
PIPE 21	7101.80	7102.14	0.44	0.00	7103.30	7103.77	7104.83	0.46	7105.29
PIPE 20	7102.46	7103.47	0.51	0.00	7105.29	7105.84	7105.80	0.55	7106.35
STM-1 L2 PIPE 19	7099.80	7100.55	0.19	0.97	7103.30	7104.35	7105.21	1.04	7106.26
STM-1 L3 PIPE 17	7100.65	7101.41	0.07	1.56	7106.50	7107.27	7107.89	0.77	7108.66
LAT-2 L18 PIPE 16	7107.27	7107.76	0.30	0.00	7108.19	7109.10	7109.69	0.01	7109.70
STM-1 L4 PIPE 15	7101.75	7104.70	0.05	1.14	7108.84	7111.00	7109.84	2.16	7112.01
STM-1 L5 PIPE 15	7104.81	7106.20	0.05	0.00	7111.05	7112.69	7112.06	1.64	7113.69
STM-1 L7 PIPE 8	7106.69	7107.54	0.03	0.83	7113.86	7114.28	7114.56	0.42	7114.98
LAT-3 L19 PIPE 7	7113.06	7113.17	0.22	0.00	7114.98	7115.00	7115.20	0.02	7115.22
STM-1 PIPE 5	7107.64	7109.49	0.01	0.64	7115.39	7115.76	7115.63	0.38	7116.00
FIL 2 PIPE 3	7109.56	7110.82	0.01	0.20	7116.04	7116.13	7116.21	0.09	7116.29
LAT FIL 2 PIPE 2	7112.86	7112.89	0.16	0.00	7116.30	7116.30	7116.45	0.01	7116.46
LAT FIL 2 PIPE 1	7112.86	7112.99	0.16	0.00	7116.29	7116.36	7116.63	0.07	7116.69
FIL 2 PIPE 4	7112.73	7113.03	0.03	0.00	7115.79	7116.00	7116.44	0.21	7116.65
LAT-3 L 20 PIPE 6	7112.55	7112.80	0.31	0.00	7114.98	7115.07	7115.29	0.10	7115.39
STM-2 L9 PIPE 14	7106.86	7110.86	0.60	0.00	7113.69	7115.08	7114.30	1.38	7115.68

STM-2 L10 PIPE 11	7112.01	7120.35	0.01	0.55	7116.04	7121.56	7116.24	5.83	7122.07
STM-2 L11 PIPE 11	7120.65	7121.13	0.20	0.00	7121.77	7122.34	7122.46	0.39	7122.85
LAT-5 L15 PIPE 9	7121.64	7121.90	0.16	0.00	7122.86	7123.15	7123.58	0.26	7123.84
LAT-5 L14 PIPE 10	7121.63	7121.73	0.00	0.00	7122.84	7122.84	7122.85	0.00	7122.86
LAT-4 L13 PIPE 13	7115.61	7115.67	0.15	0.00	7116.42	7116.57	7116.91	0.04	7116.95
LAT-4 L12 PIPE 12	7115.11	7115.36	0.34	0.00	7116.28	7116.74	7117.19	0.17	7117.36
LAT-1 L17 PIPE 18	7102.06	7104.06	0.41	0.00	7106.26	7106.38	7106.66	0.12	7106.79

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

DETENTION & STORMWATER

QUALITY POND

(CONSTRUCTED WITH SF2236)

CLASSIC SM
CONSULTING
ENGINEERS & SURVEYORS

Worksheet Protected

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.53	inches	**Designer:**	**dlg**
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches	**Company:**	**Classic Consulting**
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches	**Date:**	**August 17, 2020**
Optional User Defined Storm	CUHP			**Project:**	**Foursquare at Sterling Ranch East Filing No. 1 & Sterling Ranch East Filing No. 2**
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event	2.52		**Location:**	**FSD Pond 16 TRIBUTARY INTERIM**
Max Intensity for Optional User Defined Storm	2.51496				

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	FIL 2	FSQ												
Receiving Pervious Area Soil Type	Sand	Sand												
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	8.600	35.420												
Directly Connected Impervious Area (DCIA, acres)	2.543	5.703												
Unconnected Impervious Area (UIA, acres)	3.355	9.417												
Receiving Pervious Area (RPA, acres)	2.702	6.738												
Separate Pervious Area (SPA, acres)	0.000	13.562												
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C												

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	8.600	35.420												
Directly Connected Impervious Area (DCIA, %)	29.6%	16.1%												
Unconnected Impervious Area (UIA, %)	39.0%	26.6%												
Receiving Pervious Area (RPA, %)	31.4%	19.0%												
Separate Pervious Area (SPA, %)	0.0%	38.3%												
A_R (RPA / UIA)	0.805	0.716												
I_a Check	0.550	0.580												
f / I for WQCV Event:	11.0	11.0												
f / I for 5-Year Event:	0.6	0.6												
f / I for 100-Year Event:	0.6	0.6												
f / I for Optional User Defined Storm CUHP:	0.57	0.57												
IRF for WQCV Event:	0.63	0.65												
IRF for 5-Year Event:	0.87	0.87												
IRF for 100-Year Event:	0.88	0.89												
IRF for Optional User Defined Storm CUHP:	0.88	0.89												
Total Site Imperviousness: I_{total}	68.6%	42.7%												
Effective Imperviousness for WQCV Event:	54.3%	33.4%												
Effective Imperviousness for 5-Year Event:	63.4%	39.3%												
Effective Imperviousness for 100-Year Event:	63.9%	39.7%												
Effective Imperviousness for Optional User Defined Storm CUHP:	63.9%	39.7%												

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	18.7%	13.5%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	6.5%	7.1%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:	8.4%	5.8%												

Total Site Imperviousness:	**47.7%**
Total Site Effective Imperviousness for WQCV Event:	**37.5%**
Total Site Effective Imperviousness for 5-Year Event:	**44.0%**
Total Site Effective Imperviousness for 100-Year Event:	**44.4%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	**44.4%**

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: DLG
Company: CLASSIC CONSULTING
Date: March 16, 2023
Project: STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FILING NO. 1
Location: POND FSD 16 INTERIM CONDITION (FILING 2 & FOURSQUARE ONLY)

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 44.4 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.444

C) Contributing Watershed Area — Area = 44.020 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.43 in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- ○ Water Quality Capture Volume (WQCV)
- ◉ Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time
($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)
V_{DESIGN} = ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN} / 0.43))$)
$V_{DESIGN\ OTHER}$ = 0.702 ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)
$V_{DESIGN\ USER}$ = ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
- i) Percentage of Watershed consisting of Type A Soils — HSG_A = 100 %
- ii) Percentage of Watershed consisting of Type B Soils — HSG_B = 0 %
- iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = 0 %

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
$EURV_{DESIGN}$ = 2.180 ac-f t

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)
$EURV_{DESIGN\ USER}$ = ac-f t

2. Basin Shape: Length to Width Ratio

(A basin length to width ratio of at least 2:1 will improve TSS reduction.)

L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)

Z = 4.00 ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 3% of the WQCV)
V_{FMIN} = 0.021 ac-ft

B) Actual Forebay Volume
V_F = 0.021 ac-ft

C) Forebay Depth
(D_F = 18 inch maximum)
D_F = 12.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge
Q_{100} = 121.50 cfs

ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$)
Q_F = 2.43 cfs

E) Forebay Discharge Design

Choose One
- ○ Berm With Pipe
- ◉ Wall with Rect. Notch
- ○ Wall with V-Notch Weir

Flow too small for berm w/ pipe

F) Discharge Pipe Size (minimum 8-inches)
Calculated D_P = in

G) Rectangular Notch Width
Calculated W_N = 11.2 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer: DLG
Company: CLASSIC CONSULTING
Date: March 16, 2023
Project: STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FILING NO. 1
Location: POND FSD 16 INTERIM CONDITION (FILING 2 & FOURSQUARE ONLY)

6. Trickle Channel	
A) Type of Trickle Channel	Choose One: (●) Concrete ( ) Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 650 sq ft
C) Outlet Type	Choose One: (●) Orifice Plate ( ) Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 1.75 inches
E) Total Outlet Area	A_{ot} = 48.50 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 6 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 92 cu ft
C) Initial Surcharge Provided Above Micropool	V_s = 325.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 1,581 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)	*Aluminum Amico-Klemp SR Series with Cross Rods 2" O.C.*
Other (Y/N): N	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 2227 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 10 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 148 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 15.0 inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: DLG
Company: CLASSIC CONSULTING
Date: March 16, 2023
Project: STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FILING NO. 1
Location: POND FSD 16 INTERIM CONDITION (FILING 2 & FOURSQUARE ONLY)

10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping:

6 on CDs sheet 23

B) Slope of Overflow Embankment
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Ze = 4.00 ft / ft

11. Vegetation

Choose One
- ○ Irrigated
- ○ Not Irrigated

12. Access

A) Describe Sediment Removal Procedures

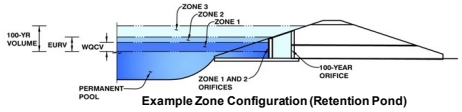
Notes:

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FILING NO. 1

Basin ID: POND FSD 16 INTERIM CONDITION (STERLING RANCH EAST FILING NO.2 & FOURSQUARE AT STERLING RACNH EAST FILING 1 ONLY)



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	44.02	acres
Watershed Length =	1,800	ft
Watershed Length to Centroid =	900	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	44.40%	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) =	0.702	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	2.180	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.642	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.196	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.638	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	3.403	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	4.148	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	5.111	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3 in.) =	6.695	acre-feet	3.00 inches
Approximate 2-yr Detention Volume =	1.395	acre-feet	
Approximate 5-yr Detention Volume =	1.841	acre-feet	
Approximate 10-yr Detention Volume =	2.260	acre-feet	
Approximate 25-yr Detention Volume =	2.785	acre-feet	
Approximate 50-yr Detention Volume =	3.130	acre-feet	
Approximate 100-yr Detention Volume =	3.581	acre-feet	

Define Zones and Basin Geometry

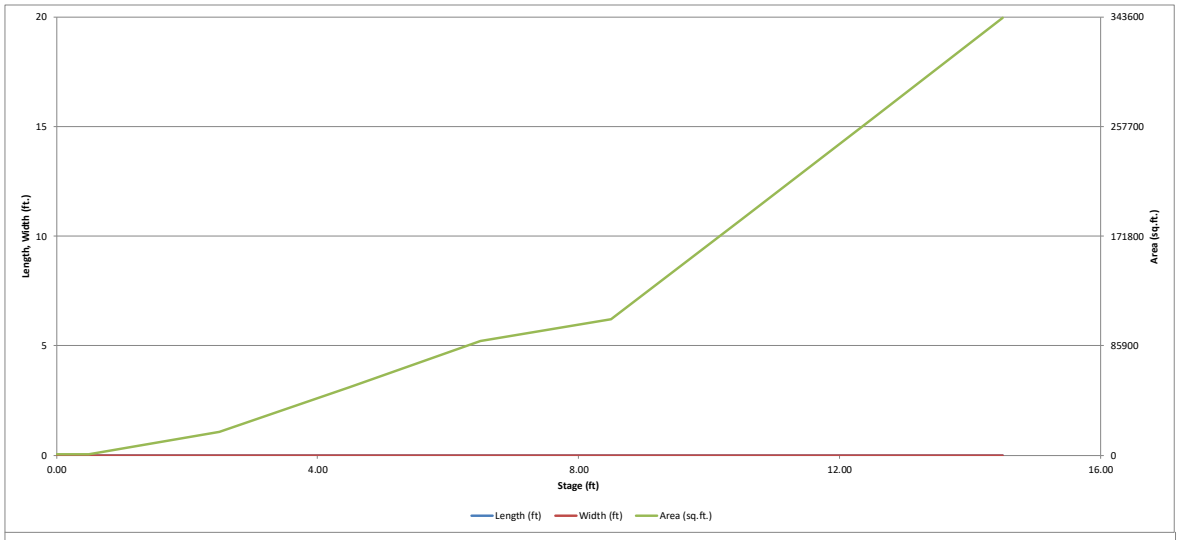
Zone 1 Volume (WQCV) =	0.702	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.478	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.401	acre-feet
Total Detention Basin Volume =	3.581	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

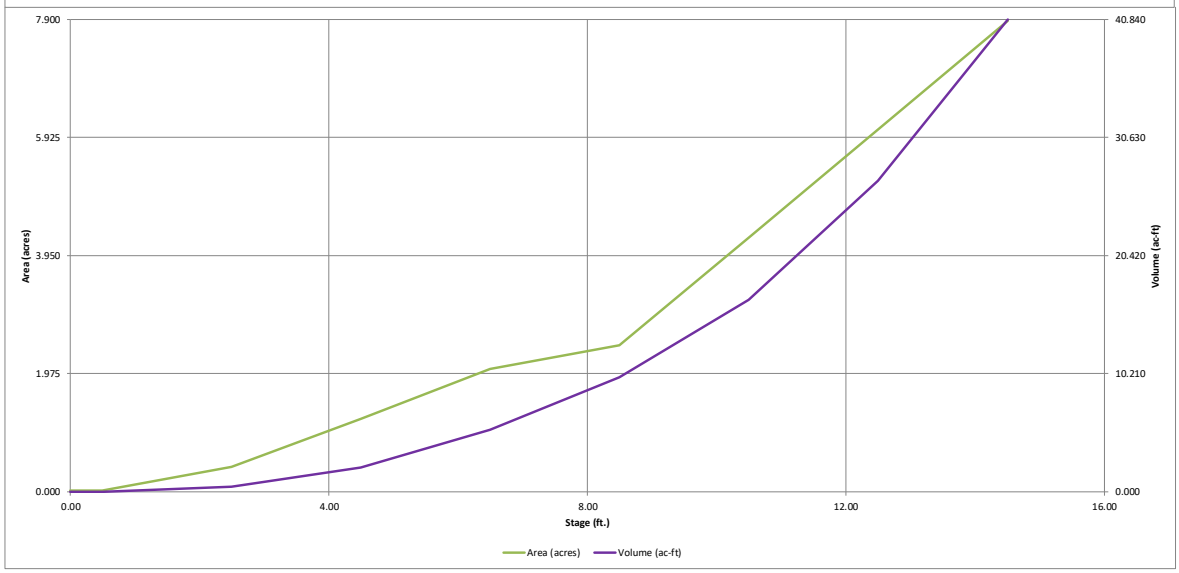
Depth Increment = 2.00 ft

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	--	--	--	1,027	0.024		
7092	--	0.50	--	--	--	1,027	0.024	514	0.012
7094	--	2.50	--	--	--	18,288	0.420	19,828	0.455
7096	--	4.50	--	--	--	53,295	1.223	91,412	2.099
7098	--	6.50	--	--	--	89,516	2.055	234,223	5.377
7100	--	8.50	--	--	--	106,783	2.451	430,522	9.883
7102	--	10.50	--	--	--	185,108	4.249	722,413	16.584
7104	--	12.50	--	--	--	263,928	6.059	1,171,449	26.893
7106	--	14.50	--	--	--	343,298	7.881	1,778,675	40.833

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



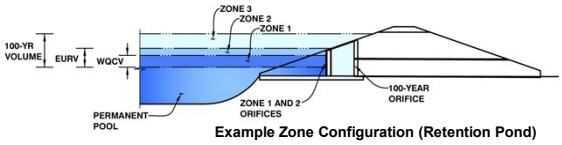


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FILING NO. 1

Basin ID: POND FSD 16 INTERIM CONDITION (STERLING RANCH EAST FILING NO.2 & FOURSQUARE AT STERLING RACNH EAST FILING 1 ONLY)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.98	0.702	Orifice Plate
Zone 2 (EURV)	4.57	1.478	Orifice Plate
Zone 3 (100-year)	5.54	1.401	Weir&Pipe (Restrict)
Total (all zones)		3.581	

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)

Centroid 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 =	10.00	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	30.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

Does not match sheet 25 of CDs

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	2.50	5.00	7.50				
Orifice Area (sq. inches)	3.50	9.00	16.00	16.00				

	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 =	10.00	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	10.00	N/A	feet
Overflow Weir Front Edge Length =	20.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	8.01	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	55.68	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	27.84	N/A	ft^2
Debris Clogging % =	50%	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 =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	6.95	N/A	ft^2
Outlet Pipe Diameter =	48.00	N/A	inches	Outlet Orifice Centroid =	1.24	N/A	feet
Restrictor Plate Height Above Pipe Invert =	26.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.65	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	12.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.32	feet
Spillway Crest Length =	170.00	feet	Stage at Top of Freeboard =	13.82	feet
Spillway End Slopes =	6.00	H:V	Basin Area at Top of Freeboard =	7.26	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	35.68	acre-ft

165ft on Sht 23 of CDs

Calculated Parameters for Spillway

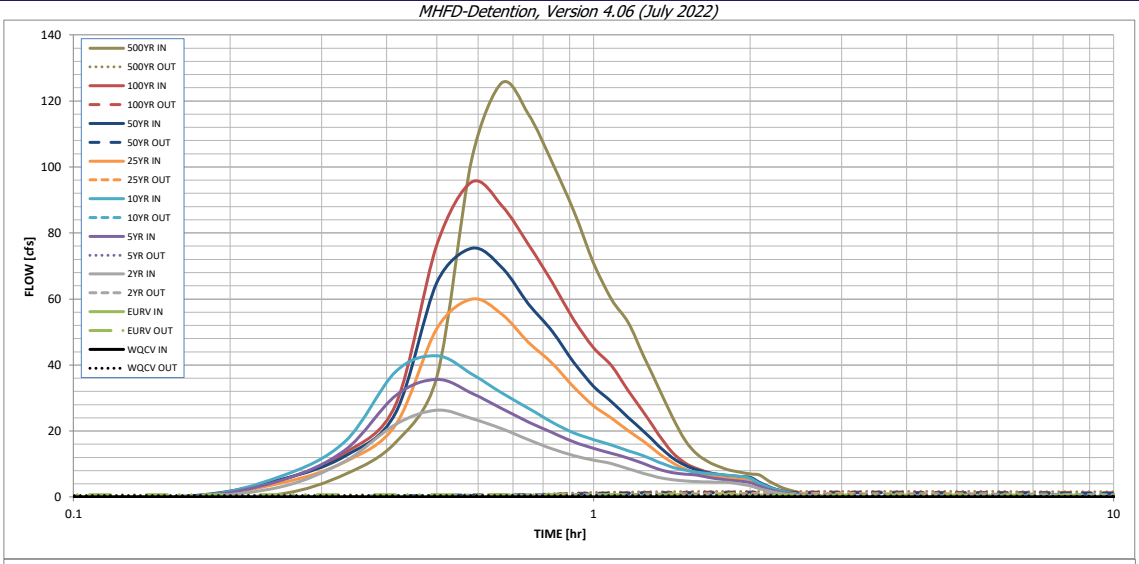
Routed Hydrograph Results

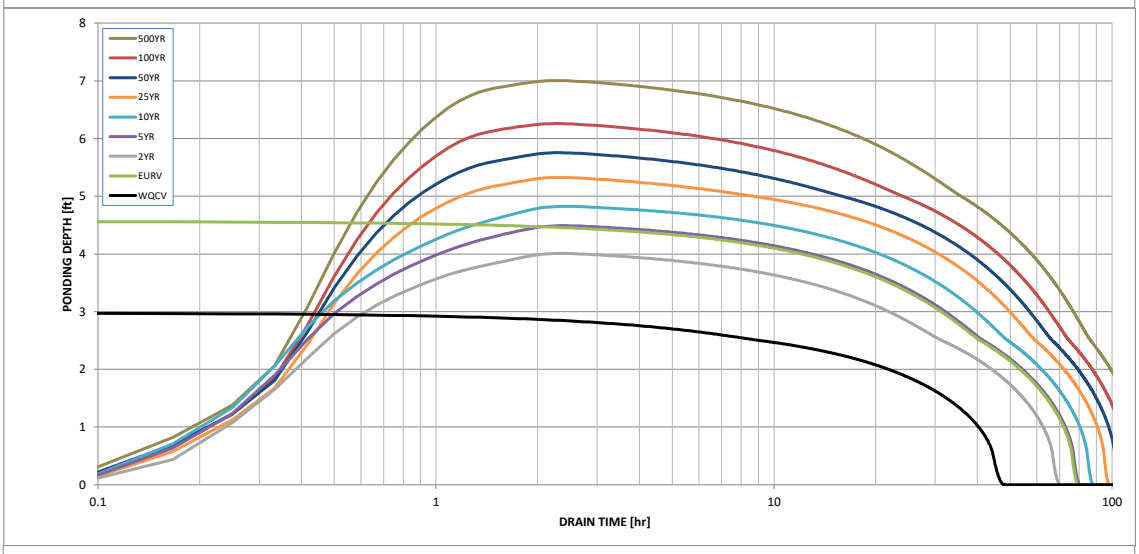
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

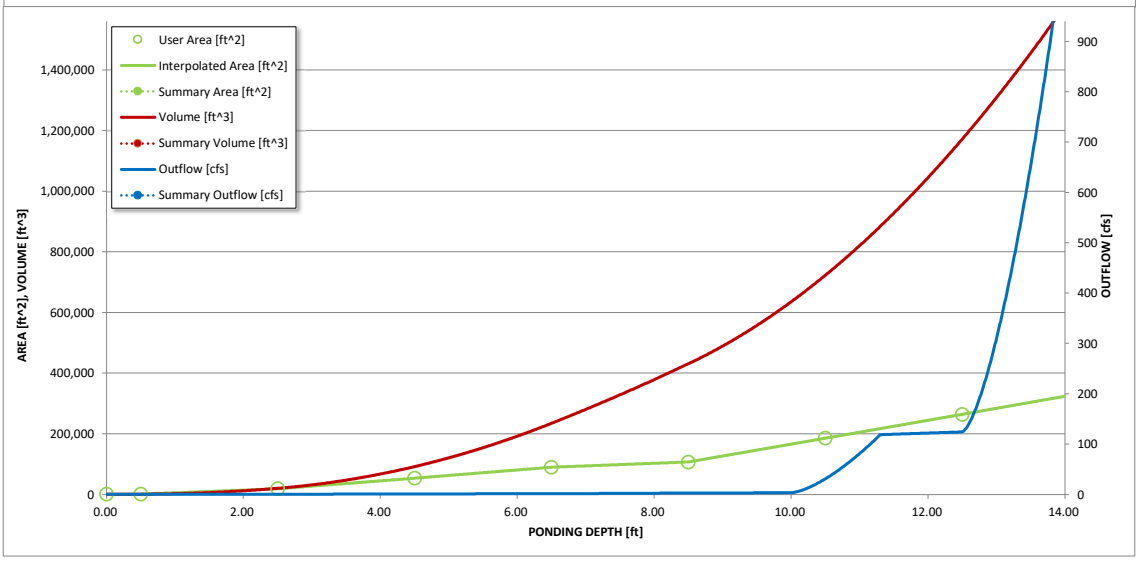
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.00
CUHP Runoff Volume (acre-ft) =	0.702	2.180	1.642	2.196	2.638	3.403	4.148	5.111	6.695
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.642	2.196	2.638	3.403	4.148	5.111	6.695
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.4	0.8	1.1	9.9	19.7	32.2	51.4
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	0.23	0.45	0.73	1.17
Peak Inflow Q (cfs) =	N/A	N/A	26.3	35.7	42.8	60.0	75.4	95.4	125.4
Peak Outflow Q (cfs) =	0.4	0.7	0.6	0.7	0.7	1.1	1.3	1.5	1.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	0.7	0.1	0.1	0.0	0.0
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Plate
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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) =	43	70	63	71	77	86	91	97	104
Time to Drain 99% of Inflow Volume (hours) =	**45**	75	66	76	83	92	99	106	116
Maximum Ponding Depth (ft) =	2.98	4.57	4.01	4.49	4.82	5.33	5.75	6.26	7.00
Area at Maximum Ponding Depth (acres) =	0.61	1.25	1.02	1.22	1.36	1.56	1.74	1.95	2.15
Maximum Volume Stored (acre-ft) =	0.703	2.185	1.537	2.074	2.511	3.242	3.953	4.876	6.429

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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	0.35	0.04	0.89
	0:15:00	0.00	0.00	3.08	5.00	6.23	4.21	5.27	5.17	6.92
	0:20:00	0.00	0.00	10.93	14.32	16.91	10.70	12.49	13.43	16.59
	0:25:00	0.00	0.00	22.05	30.77	38.04	21.96	25.67	28.12	36.37
	0:30:00	0.00	0.00	26.31	35.66	42.78	51.06	64.95	76.41	102.35
	0:35:00	0.00	0.00	23.80	31.49	37.29	59.96	75.39	95.43	125.45
	0:40:00	0.00	0.00	20.70	26.77	31.51	55.39	69.59	88.30	116.03
	0:45:00	0.00	0.00	17.36	22.76	26.89	46.87	58.53	76.50	101.28
	0:50:00	0.00	0.00	14.60	19.50	22.64	40.51	50.16	64.95	86.62
	0:55:00	0.00	0.00	12.57	16.67	19.47	33.30	40.76	53.65	71.03
	1:00:00	0.00	0.00	11.20	14.76	17.42	27.68	33.61	45.27	59.90
	1:05:00	0.00	0.00	10.12	13.24	15.72	23.86	28.85	39.76	52.91
	1:10:00	0.00	0.00	8.57	11.77	14.03	20.11	24.10	32.26	42.54
	1:15:00	0.00	0.00	7.13	10.07	12.46	16.76	19.86	25.57	33.28
	1:20:00	0.00	0.00	5.98	8.46	10.65	13.33	15.57	19.06	24.48
	1:25:00	0.00	0.00	5.26	7.44	9.08	10.49	11.99	13.60	17.16
	1:30:00	0.00	0.00	4.88	6.93	8.15	8.45	9.59	10.33	12.94
	1:35:00	0.00	0.00	4.68	6.63	7.54	7.25	8.19	8.55	10.60
	1:40:00	0.00	0.00	4.57	5.98	7.10	6.52	7.35	7.45	9.11
	1:45:00	0.00	0.00	4.49	5.45	6.79	6.03	6.79	6.72	8.13
	1:50:00	0.00	0.00	4.43	5.07	6.57	5.71	6.42	6.22	7.47
	1:55:00	0.00	0.00	3.88	4.78	6.25	5.49	6.17	5.86	6.99
	2:00:00	0.00	0.00	3.40	4.44	5.68	5.33	5.99	5.64	6.70
	2:05:00	0.00	0.00	2.55	3.33	4.23	4.01	4.49	4.23	5.02
	2:10:00	0.00	0.00	1.85	2.40	3.04	2.87	3.21	3.03	3.58
	2:15:00	0.00	0.00	1.33	1.73	2.18	2.06	2.31	2.19	2.58
	2:20:00	0.00	0.00	0.95	1.23	1.56	1.47	1.64	1.56	1.84
	2:25:00	0.00	0.00	0.66	0.84	1.08	1.02	1.14	1.08	1.27
	2:30:00	0.00	0.00	0.45	0.57	0.75	0.71	0.78	0.74	0.87
	2:35:00	0.00	0.00	0.29	0.39	0.50	0.48	0.53	0.50	0.58
	2:40:00	0.00	0.00	0.17	0.24	0.30	0.30	0.32	0.30	0.35
	2:45:00	0.00	0.00	0.08	0.13	0.15	0.16	0.17	0.15	0.17
	2:50:00	0.00	0.00	0.03	0.05	0.06	0.06	0.06	0.05	0.06
	2:55:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	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

Worksheet Protected

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

				Designer:	**dlg**
				Company:	**Classic Consulting**
***Design Storm: 1-Hour Rain Depth	WQCV Event	0.53	inches	**Date:**	**August 17, 2020**
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches	**Project:**	**Foursquare at Sterling Ranch East Filing No. 1 & Sterling Ranch East Filing No. 2**
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches	**Location:**	**FSD Pond 16 TRIBUTARY ULTIMATE**
Optional User Defined Storm	CUHP				
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event	2.52			
Max Intensity for Optional User Defined Storm	2.51496				

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	FIL 1A	FSQ	FUTURE											
Receiving Pervious Area Soil Type	Sand	Sand	Sand											
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	8.600	35.420	176.880											
Directly Connected Impervious Area (DCIA, acres)	2.543	5.703	25.942											
Unconnected Impervious Area (UIA, acres)	3.355	9.417	71.984											
Receiving Pervious Area (RPA, acres)	2.702	6.738	57.953											
Separate Pervious Area (SPA, acres)	0.000	13.562	21.001											
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C	C											

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	8.600	35.420	176.880											
Directly Connected Impervious Area (DCIA, %)	29.6%	16.1%	14.7%											
Unconnected Impervious Area (UIA, %)	39.0%	26.6%	40.7%											
Receiving Pervious Area (RPA, %)	31.4%	19.0%	32.8%											
Separate Pervious Area (SPA, %)	0.0%	38.3%	11.9%											
A_R (RPA / UIA)	0.805	0.716	0.805											
I_a Check	0.550	0.580	0.550											
f / I for WQCV Event:	11.0	11.0	11.0											
f / I for 5-Year Event:	0.6	0.6	0.6											
f / I for 100-Year Event:	0.6	0.6	0.6											
f / I for Optional User Defined Storm CUHP:	0.57	0.57	0.57											
IRF for WQCV Event:	0.63	0.65	0.63											
IRF for 5-Year Event:	0.87	0.87	0.87											
IRF for 100-Year Event:	0.88	0.89	0.88											
IRF for Optional User Defined Storm CUHP:	0.88	0.89	0.88											
Total Site Imperviousness: I_{total}	68.6%	42.7%	55.4%											
Effective Imperviousness for WQCV Event:	54.3%	33.4%	40.5%											
Effective Imperviousness for 5-Year Event:	63.4%	39.3%	50.0%											
Effective Imperviousness for 100-Year Event:	63.9%	39.7%	50.5%											
Effective Imperviousness for Optional User Defined Storm CUHP:	63.9%	39.7%	50.5%											

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	18.7%	13.5%	18.2%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	6.5%	7.1%	8.6%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:	8.4%	5.8%	8.6%											

Total Site Imperviousness:	**53.8%**
Total Site Effective Imperviousness for WQCV Event:	**39.9%**
Total Site Effective Imperviousness for 5-Year Event:	**48.8%**
Total Site Effective Imperviousness for 100-Year Event:	**49.3%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	**49.3%**

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

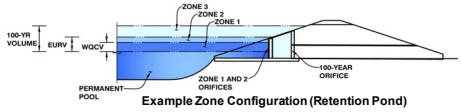
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FILING NO. 1

Basin ID: POND FSD 16 ULTIMATE (STERLING RANCH EAST FILING NO. 2, FOURSQUIRE AT STERLING RANCH EAST FILING NO.1 & PLANNED FUTURE DEVELOPMENT)



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	220.90	acres
Watershed Length =	4,000	ft
Watershed Length to Centroid =	2,000	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	49.30%	percent
Percentage Hydrologic Soil Group A =	75.0%	percent
Percentage Hydrologic Soil Group B =	25.0%	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) =	3.762 acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	12.288 acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	9.710 acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	12.839 acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	15.865 acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	20.998 acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	25.112 acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	30.660 acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3 in.) =	39.447 acre-feet	3.00	inches
Approximate 2-yr Detention Volume =	8.219 acre-feet		
Approximate 5-yr Detention Volume =	10.945 acre-feet		
Approximate 10-yr Detention Volume =	13.685 acre-feet		
Approximate 25-yr Detention Volume =	16.244 acre-feet		
Approximate 50-yr Detention Volume =	17.832 acre-feet		
Approximate 100-yr Detention Volume =	20.079 acre-feet		

Define Zones and Basin Geometry

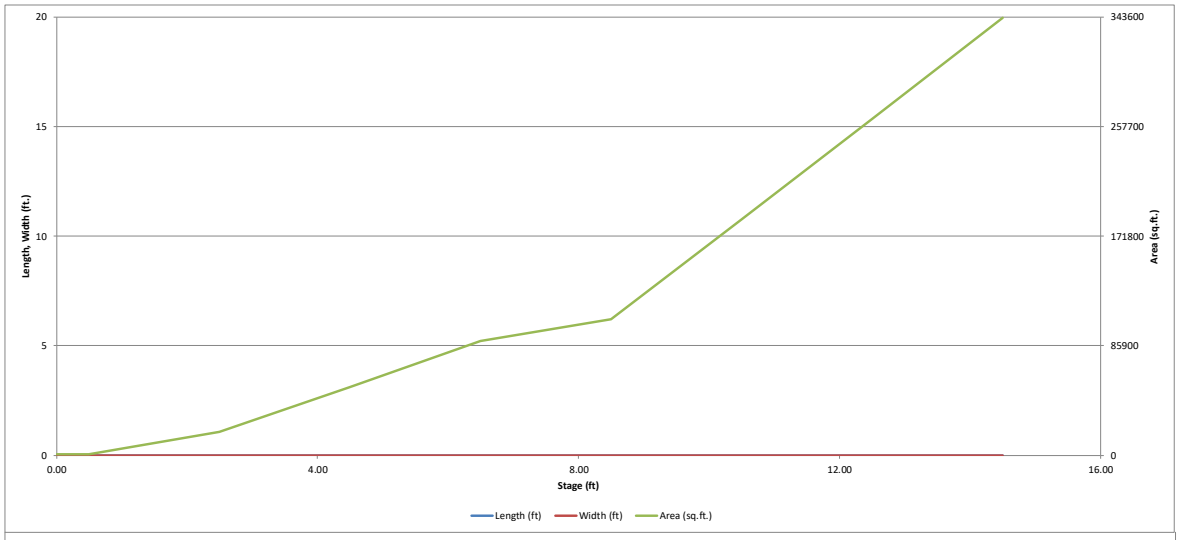
Zone 1 Volume (WQCV) =	3.762	acre-feet
Zone 2 Volume (EURV - Zone 1) =	8.526	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	7.791	acre-feet
Total Detention Basin Volume =	20.079	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

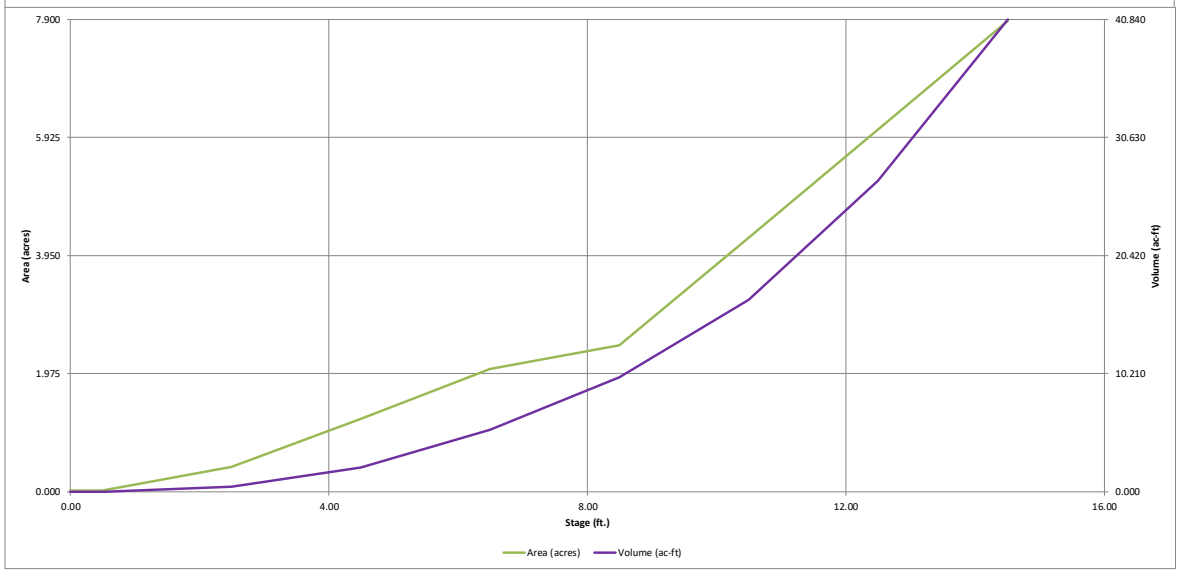
Depth Increment = ft

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	--	--	--	1,027	0.024		
7092	--	0.50	--	--	--	1,027	0.024	514	0.012
7094	--	2.50	--	--	--	18,288	0.420	19,828	0.455
7096	--	4.50	--	--	--	53,295	1.223	91,411	2.099
7098	--	6.50	--	--	--	89,516	2.055	234,222	5.377
7100	--	8.50	--	--	--	106,783	2.451	430,521	9.883
7102	--	10.50	--	--	--	185,108	4.249	722,412	16.584
7104	--	12.50	--	--	--	263,928	6.059	1,171,448	26.893
7106	--	14.50	--	--	--	343,298	7.881	1,778,674	40.833

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



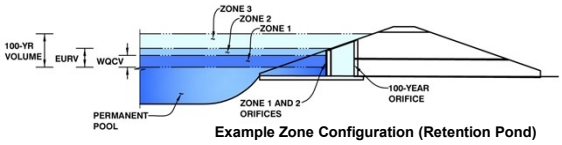


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: STERLING RANCH EAST FILING NO. 2 & FOURSQUARE AT STERLING RANCH EAST FILING NO. 1

Basin ID: POND FSD 16 ULTIMATE (STERLING RANCH EAST FILING NO. 2, FOURSQUIRE AT STERLING RANCH EAST FILING NO.1 & PLANNED FUTURE DEVELOPMENT)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	5.64	3.762	Orifice Plate
Zone 2 (EURV)	9.35	8.526	Orifice Plate
Zone 3 (100-year)	11.27	7.791	Weir&Pipe (Restrict)
Total (all zones)		20.079	

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)

Centroid 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 =	10.00	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	30.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. 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	2.50	5.00	7.50				
Orifice Area (sq. inches)	10.00	14.00	16.00	16.00				

	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 =	10.00	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	10.00	N/A	feet
Overflow Weir Front Edge Length =	20.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	8.01	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	55.68	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	27.84	N/A	ft^2
Debris Clogging % =	50%	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 =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	6.95	N/A	ft^2
Outlet Pipe Diameter =	48.00	N/A	inches	Outlet Orifice Centroid =	1.24	N/A	feet
Restrictor Plate Height Above Pipe Invert =	26.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.65	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	12.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.00	feet
Spillway Crest Length =	170.00	feet	Stage at Top of Freeboard =	14.50	feet
Spillway End Slopes =	6.00	H:V	Basin Area at Top of Freeboard =	7.88	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	40.83	acre-ft

165ft on Sht 23 of CDs

Calculated Parameters for Spillway

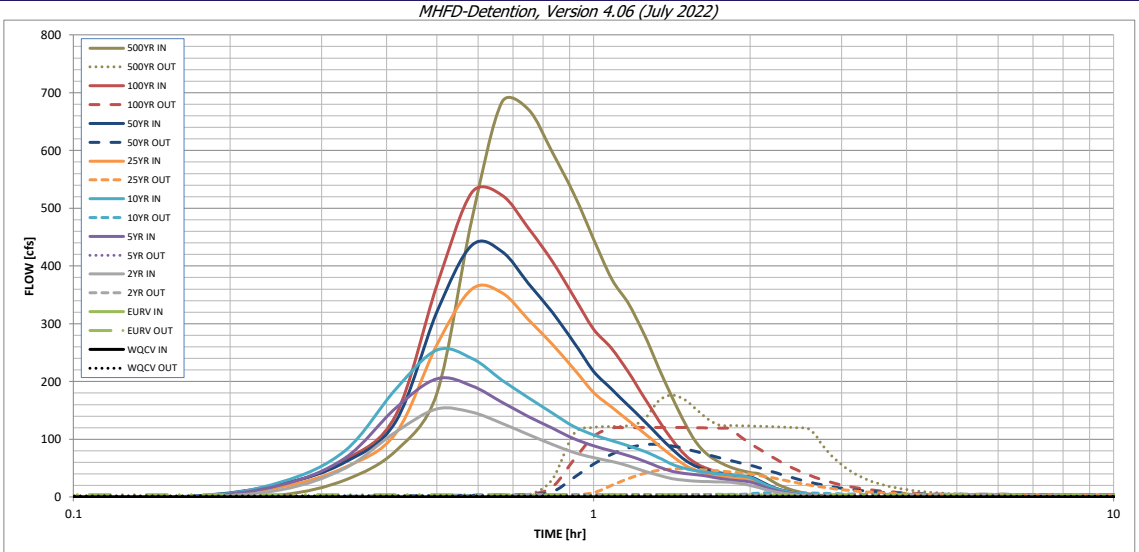
Routed Hydrograph Results

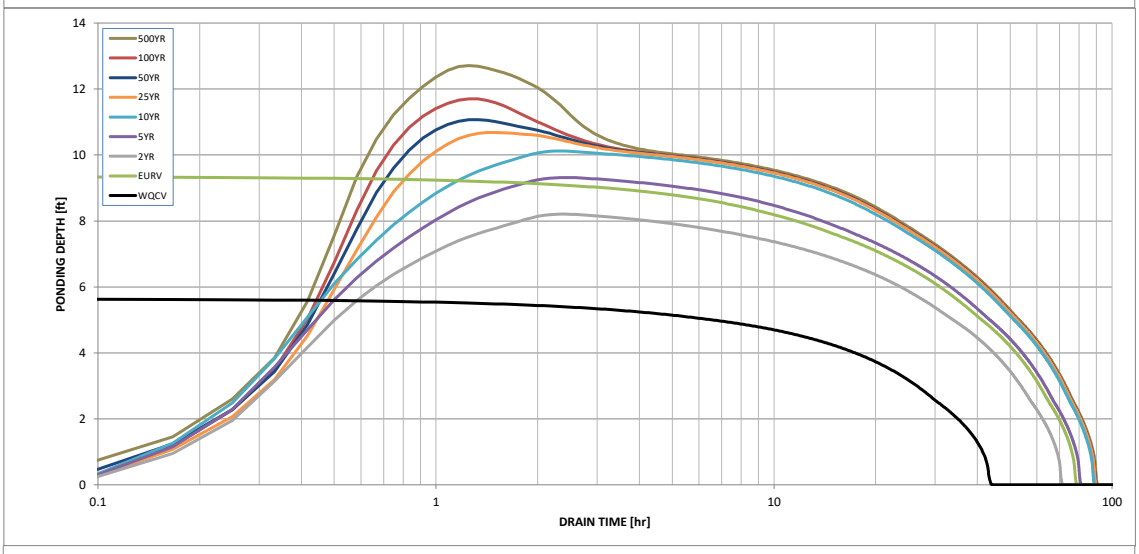
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

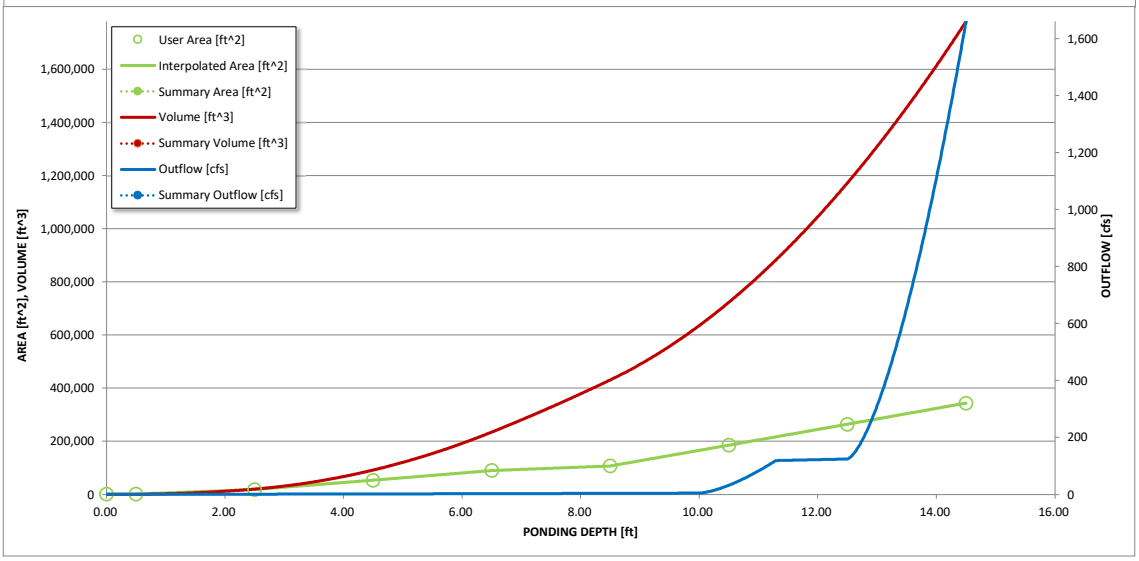
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.00
CUHP Runoff Volume (acre-ft) =	3.762	12.288	9.710	12.839	15.865	20.998	25.112	30.660	39.447
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	9.710	12.839	15.865	20.998	25.112	30.660	39.447
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.7	4.5	23.4	95.7	140.7	204.0	304.3
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	0.11	0.43	0.64	0.92	1.38
Peak Inflow Q (cfs) =	N/A	N/A	152.5	204.8	254.6	360.0	435.8	526.8	683.4
Peak Outflow Q (cfs) =	2.0	4.1	3.5	4.1	7.7	48.7	91.2	120.5	176.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	0.3	0.5	0.6	0.6	0.6
Structure Controlling Flow =	Plate	Plate	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	0.1	0.8	1.6	2.1	2.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	67	62	69	75	73	72	70	68
Time to Drain 99% of Inflow Volume (hours) =	**42**	74	67	76	83	82	81	80	79
Maximum Ponding Depth (ft) =	5.64	9.35	8.21	9.32	10.12	10.69	11.08	11.71	12.72
Area at Maximum Ponding Depth (acres) =	1.70	3.22	2.39	3.18	3.91	4.41	4.77	5.34	6.25
Maximum Volume Stored (acre-ft) =	3.763	12.292	9.157	12.164	15.034	17.364	19.153	22.335	28.185

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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	1.43	0.14	3.62
	0:15:00	0.00	0.00	12.44	20.45	25.45	17.15	22.10	21.06	29.79
	0:20:00	0.00	0.00	49.95	67.93	80.76	51.54	60.65	64.31	80.17
	0:25:00	0.00	0.00	112.89	154.25	186.90	110.26	130.88	142.02	179.25
	0:30:00	0.00	0.00	152.50	204.77	254.63	263.28	320.19	366.16	479.40
	0:35:00	0.00	0.00	146.91	192.55	240.26	359.97	435.83	526.76	683.43
	0:40:00	0.00	0.00	127.54	163.96	202.57	353.47	425.20	522.87	671.00
	0:45:00	0.00	0.00	108.38	139.47	171.92	307.02	369.68	465.38	596.64
	0:50:00	0.00	0.00	90.99	119.22	145.25	264.20	319.64	408.08	524.81
	0:55:00	0.00	0.00	77.23	101.13	122.03	221.74	268.00	346.70	447.50
	1:00:00	0.00	0.00	68.05	88.70	107.64	181.24	218.13	291.22	377.73
	1:05:00	0.00	0.00	61.61	79.80	97.82	155.65	186.70	257.42	335.71
	1:10:00	0.00	0.00	53.69	71.64	88.57	132.77	158.60	216.83	282.60
	1:15:00	0.00	0.00	45.18	62.25	79.43	111.19	132.27	173.26	225.06
	1:20:00	0.00	0.00	37.74	52.41	68.53	90.05	106.35	133.89	172.81
	1:25:00	0.00	0.00	32.01	44.58	56.81	71.10	83.09	99.27	126.82
	1:30:00	0.00	0.00	28.84	40.63	49.29	55.04	63.81	72.61	92.09
	1:35:00	0.00	0.00	27.37	38.65	45.08	45.30	52.21	57.01	71.87
	1:40:00	0.00	0.00	26.56	35.49	42.11	39.66	45.39	48.11	60.03
	1:45:00	0.00	0.00	26.06	32.15	39.96	36.16	41.11	42.04	51.84
	1:50:00	0.00	0.00	25.68	29.76	38.50	33.76	38.23	38.03	46.36
	1:55:00	0.00	0.00	23.31	28.01	36.80	32.20	36.37	35.22	42.49
	2:00:00	0.00	0.00	20.32	26.12	33.83	31.11	35.07	33.29	39.85
	2:05:00	0.00	0.00	16.11	20.97	26.83	25.36	28.54	26.84	32.00
	2:10:00	0.00	0.00	11.81	15.19	19.29	18.23	20.47	19.27	22.90
	2:15:00	0.00	0.00	8.60	11.01	13.88	13.14	14.73	13.92	16.51
	2:20:00	0.00	0.00	6.21	7.91	10.00	9.50	10.65	10.13	12.00
	2:25:00	0.00	0.00	4.43	5.51	7.06	6.69	7.48	7.15	8.46
	2:30:00	0.00	0.00	3.05	3.75	4.90	4.63	5.18	4.94	5.84
	2:35:00	0.00	0.00	2.06	2.58	3.40	3.27	3.65	3.48	4.09
	2:40:00	0.00	0.00	1.29	1.70	2.17	2.15	2.39	2.27	2.66
	2:45:00	0.00	0.00	0.70	1.00	1.23	1.26	1.39	1.31	1.53
	2:50:00	0.00	0.00	0.31	0.48	0.56	0.60	0.66	0.62	0.71
	2:55:00	0.00	0.00	0.11	0.15	0.16	0.19	0.20	0.18	0.20
	3:00:00	0.00	0.00	0.01	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

Figure 13-12c. Emergency Spillway Protection

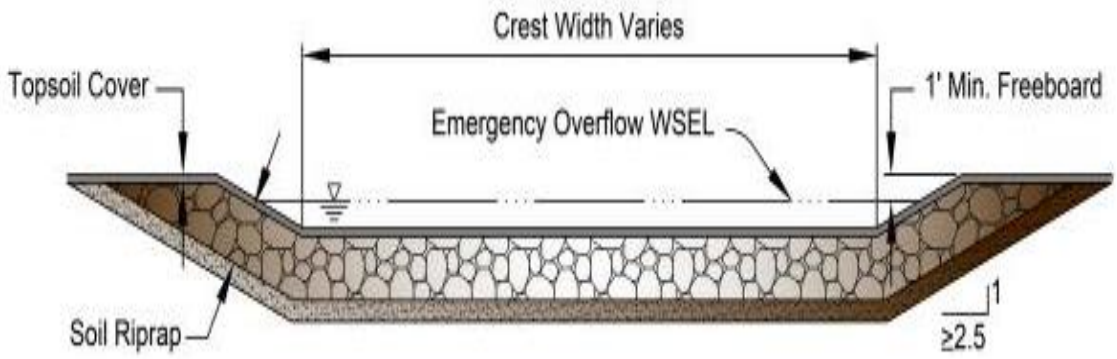
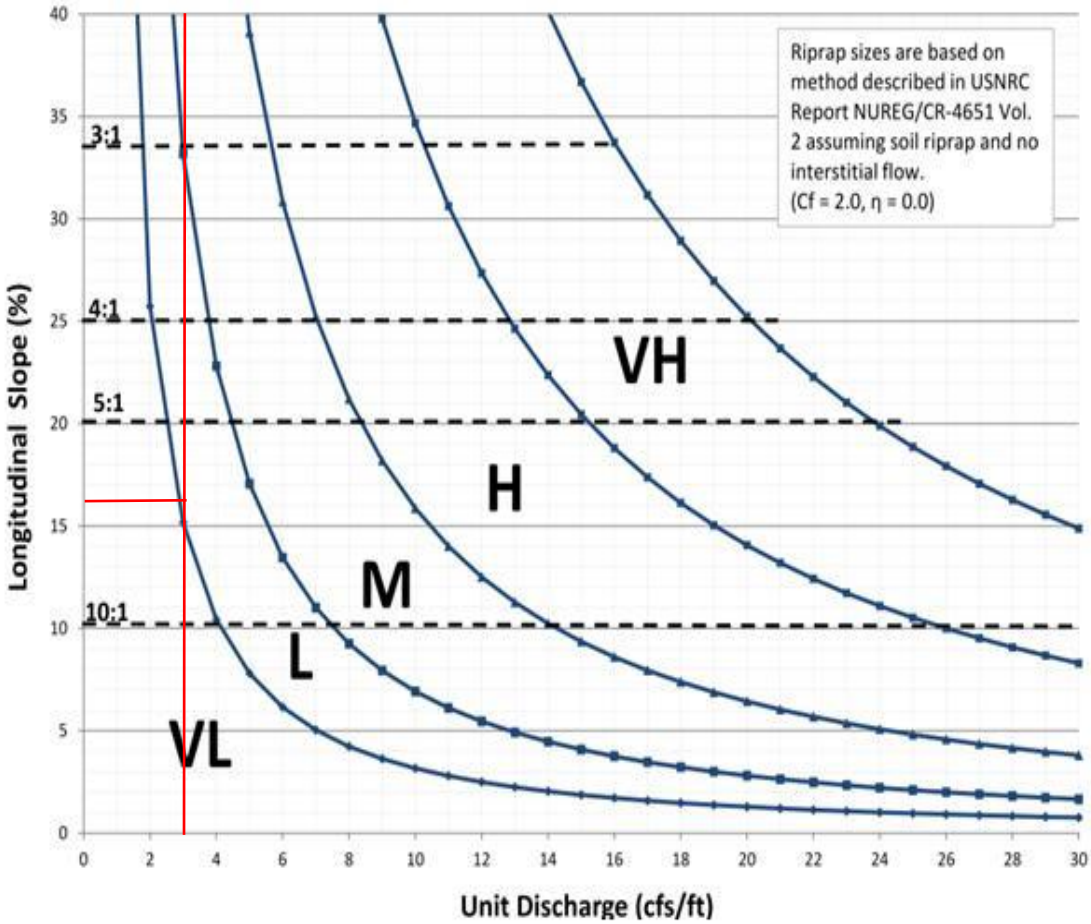


Figure 13-12d. Riprap Types for Emergency Spillway Protection



ULTIMATE &
INTERIM
CONDITION

Worksheet for TRICKLE CHANNEL

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	0.005 ft/ft
Bottom Width	3.00 ft
Discharge	4.86 cfs

Results	
Normal Depth	5.1 in
Flow Area	1.3 ft²
Wetted Perimeter	3.8 ft
Hydraulic Radius	3.9 in
Top Width	3.00 ft
Critical Depth	5.2 in
Critical Slope	0.005 ft/ft
Velocity	3.85 ft/s
Velocity Head	0.23 ft
Specific Energy	0.65 ft
Froude Number	1.045
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	5.1 in
Critical Depth	5.2 in
Channel Slope	0.005 ft/ft
Critical Slope	0.005 ft/ft

REFERENCE MATERIALS FROM PREVIOUS REPORTS

EPA- 600/R-14/413b
Revisied September 2015

Storm Water Management Model User's Manual Version 5.1

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September 2015