

PRELIMINARY DRAINAGE REPORT

GRANDVIEW RESERVE FILING NO. 1

El Paso County, Colorado

PREPARED FOR: D.R. Horton 9555 S. Kingston Court Englewood, CO

PREPARED BY: Galloway & Company, Inc. 1155 Kelly Johnson Blvd., Suite 305 Colorado Springs, CO 80920

DATE: September 22, 2023

PCD Filing No.: PUDSP2110

ENGINEER'S STATEMENT

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

Brady A. Shyrock, PE #38164 For and on behalf of Galloway & Company, Inc.



DEVELOPER'S CERTIFICATION

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

Provide Signature

By:_

Address: D.R. Horton 9555 S. Kingston Court Englewood, CO

Date

EL PASO COUNTY CERTIFICATION

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.

Joshua Palmer, P.E. County Engineer/ECM Administrator

Date

Conditions:

TABLE OF CONTENTS

I.	Purpose4
II.	General Description4
III.	Drainage Criteria4
IV.	Existing Drainage Conditions5
V.	Four Step Process7
	1. Employ Runoff Reduction Practices7
	2. Stabilize Channels7
	3. Provide Water Quality Capture Volume (WQCV)7
	4. Consider Need for Industrial and Commercial BMPs7
VI.	Interim Drainage Conditions7
VII.	Proposed Drainage Conditions10
VIII.	Storm Sewer System19
IX.	Proposed Water Quality Detention Ponds20
Х.	Proposed Channel Improvements21
XI.	Maintenance22
XII.	Wetlands Mitigation
XIII.	Floodplain Statement
XIV.	Drainage Fees & Maintenance22
XV.	Conclusion
XVI.	References

Appendices:

	Α.	Exhibits and Figures
	В.	Hydrologic Computations
	C.	Hydraulic Computations These should be the last
	D.	Water Quality Computations
	Ε.	Drainage Maps & Water Quality Plan
279-374	F.	Eastonville PDR & Grandview Reserve CLQMR Report (03/22/23)
375-551	G.	MDDP & DBPS Sheet References
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I. Purpose

The purpose of this Preliminary Drainage Report is to identify on and offsite drainage patterns, locate and identify tributary or downstream drainage features and facilities that impact the site, and to identify which types of drainage facilities will be needed and where they will be located. This report will remain in general compliance with the approved MDDP prepared by HR Green, dated November 2020.

II. General Description

The project is a single-family residential development located in the Falcon area of El Paso County, Colorado. The site is located in a portion of the South half of Section 21, the North half of Section 28, Township 12 South, Range 64 West of the 6th Principal Meridian, County of El Paso, State of Colorado. The subject property includes Eastonville Road to the west, which was studied separately in the *"Eastonville Road Preliminary Drainage Report"*, by HR Green, September 2023 (**E-PDR**), and is currently in review with El Paso County. The project site is bounded by undeveloped land proposed as future development to the east, and undeveloped land within the Waterbury Development to the south. A Vicinity Map is included in **Appendix A**.

This preliminary drainage report is the basis for the drainage facility design in conformance with the previously approved MDDP for the site prepared by HR Green, "*Grandview Reserve Master Development Drainage Plan*", HR Green, November 2020 (**MDDP**). The site consists of approximately 189.479 acres and includes 565 dwelling units.

For upstream offsite runoff analysis, the basis for drainage concepts and calculations are derived form the approved "*Revision to: Master Development Drainage Plan, Meridian Ranch, El Paso County, Colorado*", Tech Contractors, July 2021 (**MR-MDDP**).

The existing soil types within the proposed site as determined by the NRCS Web Soil Survey for El Paso County Area consist of Columbine gravelly sandy loam (hydrologic soil group A) and Stapleton sandy loam (hydrologic soil group B). See the soils map included in **Appendix A**.

III. Drainage Criteria

Hydrology 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 City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014.

The drainage calculations were based on the criteria manual Figure 6-5 and IDF equations to determine the intensity and are listed in Table 1 below.

Table 1 - Precipitation Data

Return Period	One Hour Depth (in).	Intensity (in/hr)
5-year	1.50	5.17
100-year	2.52	8.68

The rational method was used to calculate peak flows as the tributary areas are less than 100 acres. The rational method has been proven to be accurate for basins of this size and is based on the following formula:

Q = CIA

Where:

Q = Peak Discharge (cfs)
C = Runoff Coefficient
I = Runoff intensity (inches/hour)
A = Drainage area (acres)

The runoff coefficients are calculated based on land use, percent imperviousness, and design storm for each basin, as shown in the drainage criteria manual (Table 6-6). Composite percent impervious and C values were calculated using the residential, streets, roofs, and lawns coefficients found in Table 6-6 of the manual.

The 100-year event was used as the major storm event. The 5-year event was used as the minor event. The UD-Inlets v5.01 spreadsheet was utilized for the sizing of the proposed sump inlets.

The UD-Detention v4.04 spreadsheet was utilized for the design of the proposed on-site water quality ponds, Ponds A, B, C, D, E, and Eastonville Pond.

IV. Existing Drainage Conditions

The site is contained fully within one major drainage basin; the Gieck Ranch Drainage Basin and is tributary to Black Squirrel Creek. The site generally drains from north to south with an average slope of 2% outside of the channel. The rational method was used to analyze the individual basins within the site because their size permits it.

There are two (2) major drainageways that currently convey existing on & off-site flows through the site to the southeast. These are the Main Stem (MS) and Main Stem Tributary Number 2 (MST) as referenced in the **MDDP**. These drainageways are referred to as Geick Ranch Trib #1 (Channel A) and Geick Ranch Trib #2 (Channel B), respectively, within the **E-PDR**. Both drainageways generally flow to the southeast towards Highway 24, before crossing via existing drainage structures. Currently, these channels receive flows from two off-site basins, one from the west (Design Point 4 per the **E-PDR** and *The Sanctuary Filing 1 FDR (Meridian Ranch)*, Tech Contractors, August 2022; 832.7 ac, Q₅ = 22.4 cfs, Q₁₀₀ = 491.0 cfs) and the second from the northwest (Design Point 1 per the **E-PDR** and *The Sanctuary Filing 1 FDR (Meridian Ranch)*; 321.5 ac, Q₅ = 28.3 cfs, Q₁₀₀ = 365.2 cfs) and are routed under Eastonville Road via existing pipe culverts. There is an existing 24" CMP that conveys runoff under Eastonville Road at the MS, a location approximately 650 feet north of the proposed Rex Road extension that directs runoff via overtopping

Galloway & Company, Inc.

Unresolved:

Please discuss the difference between FEMA flows (at Page	5 of 30
then-existing conditions), 514 cfs in Eastonville report, and Meridian	
Ranch MDDP - DP-G06 1.45 sq. mi., historic Q100=628, developed	
663 cfs. This will need to be resolved with the final drainage report.	

Eastonville Road at MST, and a 20" x 27" ECMP that directs runoff beneath Eastonville Road at the Falcon Regional Park.

While the **MDDP** shows a total of 22 basins that were analyzed as part of the overall Grandview Reserve development, for the purposes of this report, 7 of the Basins within the MDDP will be used for analysis. These Basins include A1, B1, B2, C1, B3, and the two off-site Basins situated to the northwest of Eastonville Road. See **Appendix G** for reference.

Existing upstream tributary analysis (the areas west of Eastonville Road) was performed as part of the **E-PDR** and includes basins EX1, EX2, EX3, EX4, EX5, EX6, and EX7. See the **E-PDR** in **Appendix F** for reference.

For a more in-depth analysis of existing tributary conditions as it pertains to this phase of development, an existing basin map has been prepared. The existing conditions drainage map can be found in **Appendix E** and basins are described below.

Basin ES-1 (16.17 AC, $Q_5 = 3.4$ cfs, $Q_{100} = 24.4$ cfs): Located on the southwest portion of the site, this basin consists of un-developed land. Runoff from this basin will sheet flow to the southeast before channelizing and eventually out falling into Main Stem (Channel A) channel **(DP X1)**.

Design Point X1 ($Q_5 = 5.5$ cfs, $Q_{100} = 35.5$ cfs): Located on the southern portion of the site, this design point accounts for the total combined flows from **Basins EX6, EX7, & ES-1**. Flows from this design point are conveyed off-site to the south, via a naturally formed channel, and discharges into the existing main stem tributary channel.

Basin ES-2 (46.05 AC, $Q_5 = 7.5$ cfs, $Q_{100} = 53.7$ cfs): Located in the southwest portion of the site, this basin consists of un-developed land. Runoff from this basin will sheet flow to the Main Stem channel (**DP X2**).

Design Point X2 ($Q_5 = 36.9$ cfs, $Q_{100} = 588.0$ cfs): Located on the southern portion of the site, this design point accounts for the total combined flows from **Basins EX5, EX4, & ES-2** and represents the total existing main stem tributary channel flows at that point. Flows from this design point are conveyed off-site to the south, via the main stem tributary channel.

Basin ES-3 (64.30 AC, $Q_5 = 10.0$ cfs, $Q_{100} = 71.5$ cfs): Located in the central portion of the site, this basin consists of un-developed land. Runoff from this basin will sheet flow to the southeast before channelizing and eventually out falling into Main Stem Tributary #2 channel (**DP X3**).

Basin ES-4 (2.68 AC, $Q_5 = 0.6$ cfs, $Q_{100} = 4.4$ cfs): Located on the eastern portion of the site, this basin consists of un-developed land. Runoff from this basin will sheet flow to the east into Main Stem Tributary #2 channel **(DP X4)**.

Basin ES-5 (26.15 AC, $Q_5 = 5.0$ cfs, $Q_{100} = 35.5$ cfs): Located in the north central portion of the site, this basin consists of un-developed land. Runoff from this basin will sheet flow to the southeast before channelizing and eventually out falling into Main Stem Tributary #2 channel (**DP X5**).

Basin ES-6 (31.26 AC, $Q_5 = 6.5$ cfs, $Q_{100} = 46.5$ cfs): Located on the northern portion of the site, this basin consists of un-developed land. Runoff from this basin will sheet flow to the southeast before channelizing and eventually out falling into Main Stem Tributary #2 channel (**DP X6**).

— should be higher?

Design Point X6 ($Q_5 = 14.3 \text{ cfs}$, $Q_{100} = 177.4 \text{ cfs}$): Located on the northeast portion of the site, this design point accounts for the total combined flows from **Basins EX3 & ES-6** and represents the total existing main stem tributary #2 channel flows at that point. Flows from this design point are conveyed offsite to the southeast, via the main stem tributary #2 channel.

Design Point 12 ($Q_5 = 89.2$ cfs, $Q_{100} = 976.3$ cfs): Located on the southeast portion of the site, this design point accounts for the total combined flows from **Design Points 3, 4, 5 & 6** and represents the total existing main stem tributary #2 channel flows at that point. Flows from this design point are conveyed off-site to the south, via the main stem tributary #2 channel.

V. Four Step Process

The Four Step Process is used to minimize the adverse impacts of urbanization and is a vital component of developing a balanced, sustainable project. Below identifies the approach to the four-step process:

1. Employ Runoff Reduction Practices

This step uses low impact development (LID) practices to reduce runoff at the source. Generally, rather than creating point discharges that are directly connected to impervious areas runoff is routed through pervious areas to promote infiltration. The Impervious Reduction Factor (IRF) method was used and calculations can be found in **Appendix D**.

2. Stabilize Channels

This step implements stabilization to channels to accommodate developed flows while protecting infrastructure and controlling sediment loading from erosion in the drainageways. Erosion protection in the form of riprap pads at all outfall points to the channel to prevent scouring of the channel from point discharges. The existing channel analysis and design for the Main Stem Tributary #2 (MST) is to be completed by others and a report for the channel improvements will be submitted for review separately.

3. Provide Water Quality Capture Volume (WQCV)

This step utilizes formalized water quality capture volume to slow the release of runoff from the site. The EURV volume will release in 72 hours, while the WQCV will release in no less than 40 hours. Onsite water quality control volume detention ponds will provide water quality treatment for all of the developed areas, prior to the runoff being released into either of the major drainage ways. Refer to WQCV Plan in **Appendix E.**

4. Consider Need for Industrial and Commercial BMPs

As this project is all residential development and no commercial or industrial development is proposed, there will be no need for any specialized BMPs which would be associated with an industrial or commercial site.

VI. Interim Drainage Conditions

In the interim condition, overlot grading operations will be taking place within the Grandview Reserve Subdivision in preparation for the ultimate proposed condition. While this activity is taking place within the proposed subdivision, no activity is anticipated west of Eastonville Road, including the construction of Eastonville Road. Removal of existing drainage infrastructure will take place with the construction of Eastonville Road. The proposed development lies completely within the Gieck Ranch Drainage Basin and consists of six (6) larger basins (EA, A, B, C, D, & E) which have been broken down into thirteen (13) smaller sub-basins for the Interim Condition. Adjacent Off-site Basins (OS) were also analyzed in the interim condition and have been broken down into five (5) smaller sub-basins. Site runoff will be collected via swales and diverted to one of the eleven proposed temporary sediment basins. All necessary calculations can be found within the appendices of this report.

While the existing upstream tributary analysis (the areas west of Eastonville Road) was performed as part of the **E-PDR** (including basins EX1, EX2, EX3, EX4, EX5, EX6, and EX7) in the Existing Sub-basin Description, additional analysis was conducted for all of the proposed Eastonville Road in conjunction with the offsite upstream tributary areas in the Proposed Sub-basin Description. This analysis consisted of basins OS1, OS2, OS3, OS4, OS5, OS6, OS7, EA1, EA2, EA3, EA4, EA5. EA6, EA7, EA8, EA9, EA10, EA11, and EA12. See the **E-PDR** in **Appendix F** for reference.

In addition to the upstream tributary analysis, the **E-PDR** also addressed the drainage analysis for all of Eastonville Road.

The proposed institutional use (**Sub-basin A-1**) area flows have been included in this analysis at a preliminary level only. The Sub-basin is located on the northwest corner of the site, East of Eastonville Rd. & south of the proposed extension of Rex Rd. In the interim condition, Sub-basin A-1 encompasses an area of 19.53 acres and interim developed runoff (imperviousness of 2.0%) for the site has been calculated to be $Q_5 = 5.4$ cfs, $Q_{100} = 38.5$ cfs. Runoff from this basin will sheet flow from the northwest to the southeast, intercepted by a proposed 4' bottom x 2' deep trapezoidal swale (Swale A-1). The interim runoff will be routed to the existing 100-year FEMA floodplain. Water quality and detention will be addressed with the future development of the institutional site.

Basin TSB-A1 (17.49 AC, $Q_5 = 4.9$ cfs, $Q_{100} = 35.0$ cfs): Located at the northern portion of the site, Basin TSB-A1 consists entirely of future residential lots and future roadways. In the interim overland graded phase of development, imperviousness for this sub-basin can be described as nearly bare ground (2%). Runoff from this basin will sheet flow to the southeast where it is intercepted by proposed TSB-A1. From there, treated runoff enters a proposed 4' bottom x 2' deep trapezoidal swale (Swale A-1). The interim runoff will be routed to the existing 100-year FEMA floodplain.

Design Point 10 ($Q_5 = 11.0$ cfs, $Q_{100} = 526.0$ cfs): Located at the northern portion of the site, this design point accounts for the total combined flows from **Basins EX3 & TSB-A1**. Flows from this design point are conveyed in a proposed 4' bottom x 2' deep trapezoidal swale (Swale A-1) that conveys the flow southeast to the existing 100-year FEMA floodplain.

Design Point 11 ($Q_5 = 12.0$ cfs, $Q_{100} = 185.7$ cfs): Located at the northern portion of the site and to the southeast of Design Point 1, this design point accounts for the total combined flows from **Basins EX3**, A-1, & **TSB-A1**. Flows from this design point are conveyed downstream within the existing 100-year FEMA floodplain.

Basin TSB-A2 (4.51 AC, $Q_5 = 1.4$ cfs, $Q_{100} = 10.1$ cfs): Located at the northern portion of the site, Basin TSB-A2 consists of future residential lots, future roadways, and future amenity facilities. In the interim overland graded phase of development, imperviousness for this sub-basin can be described as nearly bare ground (2%). Runoff from this basin will sheet flow to the southeast where it is intercepted by proposed TSB-A2 at **Design Point 13**. From there, treated runoff exits the TSB and sheet flows to the existing 100-year FEMA floodplain.

Basin TSB-A3 (9.49 AC, $Q_5 = 2.7$ cfs, $Q_{100} = 19.5$ cfs): Located at the north-central portion of the site, Basin TSB-A3 consists of future residential lots, future roadways, and future amenity facilities. In the interim overland graded phase of development, imperviousness for this sub-basin can be described as nearly bare ground (2%). Runoff from this basin will sheet flow to the southeast where it is intercepted by proposed TSB-A3 at **Design Point 14**. From there, treated runoff exits the TSB and sheet flows to the existing 100-year FEMA floodplain.

Basin TSB-B1 (13.64 AC, $Q_5 = 4.0$ cfs, $Q_{100} = 28.1$ cfs): Located at the northwestern portion of the site, Basin TSB-B1 consists of future residential lots and future roadways. In the interim overland graded phase of development, imperviousness for this sub-basin can be described as nearly bare ground (2%). Runoff from this basin will sheet flow to the south where it is intercepted by proposed TSB-B1 at **Design Point 15**. From there, treated runoff exits the TSB and sheet flows downstream to TSB-B3.

Basin TSB-B2 (5.12 AC, $Q_5 = 1.6$ cfs, $Q_{100} = 11.4$ cfs): Located at the central portion of the site, Basin TSB-B2 consists of future residential lots and future roadways. In the interim overland graded phase of development, imperviousness for this sub-basin can be described as nearly bare ground (2%). Runoff from this basin will sheet flow to the southeast where it is intercepted by proposed TSB-B2 at **Design Point 16**. From there, treated runoff exits the TSB and sheet flows downstream to TSB-B3.

Basin TSB-B3 (9.91 AC, $Q_5 = 3.0$ cfs, $Q_{100} = 21.2$ cfs): Located at the central portion of the site, Basin TSB-B3 consists of future residential lots and future roadways. In the interim overland graded phase of development, imperviousness for this sub-basin can be described as nearly bare ground (2%). Runoff from this basin will sheet flow to the south where it is intercepted by proposed TSB-B3 at **Design Point 17**. From there, treated runoff exits the TSB and sheet flows downstream to the existing Geick Ranch Tributary-1 / Channel A (**E-PDR**).

Design Point 17 ($Q_5 = 8.5$ cfs, $Q_{100} = 60.7$ cfs): Located at the south-central portion of the site and to the south of Design Point 7, this design point accounts for the total combined flows from **Basins TSB-B1**, **TSB-B2**, and **TSB-B3**. Flows from this design point are conveyed downstream to the existing Geick Ranch Tributary-1 / Channel A (**E-PDR**).

Basin TSB-C1 (6.84 AC, $Q_5 = 2.0$ cfs, $Q_{100} = 13.8$ cfs): Located at the eastern portion of the site, Basin TSB-C1 consists of future residential lots and future roadways. In the interim overland graded phase of development, imperviousness for this sub-basin can be described as nearly bare ground (2%). Runoff from this basin will sheet flow to the south where it is intercepted by proposed TSB-C1 at **Design Point 18**. From there, treated runoff exits the TSB and sheet flows downstream to TSB-C3 at **Design Point 20**.

Basin TSB-C2 (17.00 AC, $Q_5 = 4.8$ cfs, $Q_{100} = 34.0$ cfs): Located at the eastern portion of the site, Basin TSB-C2 consists of future residential lots and future roadways. In the interim overland graded phase of development, imperviousness for this sub-basin can be described as nearly bare ground (2%). Runoff from this basin will sheet flow to the south where it is intercepted by proposed TSB-C2 at **Design Point 19**. From there, treated runoff exits the TSB and sheet flows downstream to TSB-C3 at **Design Point 20**.

Basin TSB-C3 (18.56 AC, $Q_5 = 5.1$ cfs, $Q_{100} = 36.4$ cfs): Located at the southeastern portion of the site, Basin TSB-C3 consists of future residential lots and future roadways. In the interim overland graded phase of development, imperviousness for this sub-basin can be described as nearly bare ground (2%). Runoff from this basin will sheet flow to the southeast where it is intercepted by proposed TSB-C3 at **Design Point 20**. From there, treated runoff exits the TSB and sheet flows downstream to the existing 100-year FEMA floodplain. **Design Point 20** ($Q_5 = 11.8$ cfs, $Q_{100} = 84.3$ cfs): Located at the southeastern portion of the site and to the southeast of Design Point 1, this design point accounts for the total combined flows from **Basins TSB-C1, TSB-C2, & TSB-C3**. Flows from this design point exit via sheet flow through the TSB proposed spillway and are conveyed downstream within the existing 100-year FEMA floodplain.

Basin TSB-D1 (10.86 AC, $Q_5 = 3.0$ cfs, $Q_{100} = 21.1$ cfs): Located at the southwestern portion of the site, Basin TSB-D1 consists of future residential lots and future roadways. In the interim overland graded phase of development, imperviousness for this sub-basin can be described as nearly bare ground (2%). Runoff from this basin will sheet flow to the east where it is intercepted by proposed TSB-D1 at **Design Point 21**. From there, treated runoff exits the TSB and sheet flows downstream to the existing Geick Ranch Tributary-1 / Channel A (E-PDR).

Basin TSB-E1 (20.93 AC, $Q_5 = 5.5$ cfs, $Q_{100} = 39.0$ cfs): Located at the southern portion of the site, Basin TSB-E1 consists of future residential lots and future roadways. In the interim overland graded phase of development, imperviousness for this sub-basin can be described as nearly bare ground (2%). Runoff from this basin will sheet flow to the east where it is intercepted by proposed TSB-E1 at **Design Point 22**. From there, treated runoff exits the TSB and sheet flows downstream to the existing Geick Ranch Tributary-1 / Channel A (**E-PDR**).

Each of the temporary sediment basins (TSBs) has been sized according to the detail from City of Colorado Springs Stormwater Quality Manual, Figure SB-1 and the pond calculations in the Mile High Flood District (MHFD) spreadsheet. Downstream conveyance for each of the TSBs will follow the interim grading patterns, which will adhere to historic drainage patterns and eventually enter respective drainageways (Channels A & B).

Address sizing of TSBs and downstream conveyance

VII. Proposed Drainage Conditions

The proposed development lies completely within the Gieck Ranch Drainage Basin and consists of six (6) larger basins (EA, A, B, C, D, &E) which have been broken down into fifty-three (53) smaller sub-basins. Adjacent Off-site Basins (OS) were also analyzed in the proposed condition and have been broken down into five (5) smaller sub-basins. Site runoff will be collected via inlets & pipes and diverted to one of the six proposed full spectrum detention ponds or two sediment basins. All necessary calculations can be found within the appendices of this report.

These drainageways are referred to as Geick Ranch Trib #1 (Channel A) and Geick Ranch Trib #2 (Channel B), respectively, within the **E-PDR**. Currently, these channels receive flows from two off-site basins, one from the west (Design Point 4 per the **E-PDR** and *The Sanctuary Filing 1 FDR (Meridian Ranch)*, Tech Contractors, August 2022; 832.7 ac, $Q_5 = 22.4$ cfs, $Q_{100} = 491.0$ cfs) and the second from the northwest (Design Point 1 per the **E-PDR** and *The Sanctuary Filing 1 FDR (Meridian Ranch)*; 321.5 ac, $Q_5 = 28.3$ cfs, $Q_{100} = 365.2$ cfs) (see Existing Conditions comment)

Analysis was conducted for all of the proposed Eastonville Road in conjunction with the offsite upstream tributary areas in the Proposed Sub-basin Description. This analysis consisted of basins OS1, OS2, OS3, OS4, OS5, OS6, OS7, EA1, EA2, EA3, EA4, EA5. EA6, EA7, EA8, EA9, EA10, EA11, and EA12. See the **E-PDR** in **Appendix F** for reference.

Preliminary sizing calculations for the FSD facility have been completed with the E-PDR (Pond B) requiring approximately 1.212 ac-ft of storage capacity. Preliminary sizing for the MS and Eastonville

Road crossing has been included within **Appendix C**, by HR Green. This crossing will require dual 10' W x 3.5' H reinforced concrete box culvert (RCBC) with type M riprap for 50' L x 30' W at the downstream end.

There are no proposed major channel improvements for MS (**MDDP**) / Channel A (**E-PDR**) associated with this development -however, MST (**MDDP**) / Channel B (**E-PDR**) is proposed to be re-routed. The analysis for both channels and design of MST were done by others and a separate report will be submitted for review for all channel improvements.

The site will provide six (6) Full Spectrum Extended Detention Basins (EDBs). Ponds A, B, C, D, E, & Eastonville Pond will discharge treated runoff at historic rates directly into either the MS (**MDDP**) / Channel A (**E-PDR**) or MST Channel (**MDDP**) / Channel B (**E-PDR**). The project site will also provide two (2) Sediment Basins (SBs). SB-1 at Rex Road and SB-2 at the southern corner of the church property. Both of these SBs have been sized to function as PBMPs (and will remain in place until such time development east of the proposed site takes place) and will discharge treated runoff at historic rates directly into MST (**MDDP**) / Channel B (**E-PDR**) at the northern portion of the project site.

As has been mentioned previously, the site is proposed to have a land use of single family residential. The site will consist primarily of 1/8 Acre lots, with some 1/4 Acre and 1/3 Acre lots, public roadways, along with dedicated Tracts for amenity and/or institutional uses.

The proposed institutional use (Sub-basin A-1) area flows have been included in this analysis at a preliminary level only. The Sub-basin is located on the northwest corner of the site, East of Eastonville Rd. & south of the proposed extension of Rex Rd. It is assumed that the area will have a conservative ultimate imperviousness value of 90%. Sub-basin A-1 encompasses an area of 11.67 acres and proposed developed runoff for the site has been calculated to be $Q_5 = 46.4$ cfs, $Q_{100} = 90.7$ cfs. However, in the interim conditions (imperviousness of 2.0%), runoff from this basin ($Q_5 = 4.4$ cfs, $Q_{100} = 31.1$ cfs) will sheet flow from the northwest to the southeast, to a separate, onsite detention and water quality facility (SB-2) positioned at the southeastern corner of the property, where treated flows will be released to a proposed modified CDOT Type 'C' inlet on the west side of Ivybridge Boulevard (DP 1). Runoff that originates from the east side of Eastonville Road, outside of the dedicated ROW, will be conveyed to SB-2 via a proposed 4' bottom x 2' deep trapezoidal swale (Swale A-1). Flows will then be routed under Ivybridge Boulevard, via 24" RCP, to the updated Main Stem Tributary 2 channel (Channel B). It is anticipated that the property will be developed at a later date as a fill in subsequent to the proposed development of the majority of this project site. This property will need to submit a separate drainage report, complete with an updated water quality and detention design, as part of its development. Installation of an internal storm sewer system separate from the outfall for the property will be required. The development is responsible for ensuring the site drainage, once constructed, will not adversely impact any adjacent properties and downstream facilities. Preliminary pond sizing calculations have been provided in Appendix D for reference. As stated above, water quality and detention will be addressed with the future development of the institutional site. doesn't match plan

Design Point 35 (1.35 AC, $Q_5 = 5.6$ cfs, $Q_{100} = 10.3$ cfs): Located at the northern border of the site, Basins EA6 and EA7 contain the proposed Phase 1 improvements to Rex Rd. These drainage basins consist entirely of onsite roadway improvements within the project site and were evaluated as part of **E**-**PDR**. Runoff from this basin will sheet flow to the proposed curb & gutter along Rex Rd. The flows will then be routed to the east where they will be conveyed to a proposed Sediment Basin (SB-1) where runoff will be treated prior to discharging into Main Stem Tributary #2 channel. **Basin A-2a** (4.42 AC, $Q_5 = 8.5$ cfs, $Q_{100} = 19.9$ cfs): Located on the north portion of the site, this basin consists of residential lots, Tintagel Trail, and a portion of the north half of Dawlish Drive. Runoff from this basin will sheet flow from the lots to the adjacent road. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet, located on the northeast side of the intersection of Tintagel Trail and Dawlish Drive (**DP 2a**).

Basin A-2b (2.75 AC, $Q_5 = 8.4$ cfs, $Q_{100} = 16.7$ cfs): Located on the north portion of the site, this basin consists of residential lots, Ivybridge Boulevard, and a portion of the north half of Dawlish Drive. Runoff from this basin will sheet flow from the residential lots to the adjacent Dawlish Drive and directly from within the ROW of Ivybridge Boulevard. Flows will then be routed, via curb & gutter, to a proposed (public) 20' CDOT Type 'R' inlet in sump conditions, located on the northeast side of the intersection of Ivybridge Boulevard and Dawlish Drive (**DP 2b**).

Basin A-3 (0.36 AC, $Q_5 = 1.6$ cfs, $Q_{100} = 3.2$ cfs): Located on the north portion of the site, this basin consists of a portion of the south half of Dawlish Drive. Flows will be routed, via curb & gutter, to a proposed (public) 5' CDOT Type 'R' inlet in sump conditions, located on the southeast side of the intersection of Ivybridge Boulevard and Dawlish Drive (**DP 3**).

Basin A-4a (6.31 AC, Q₅ = 9.8 cfs, Q₁₀₀ = 22.8 cfs): Located on the northwestern portion of the site, this basin consists of residential lots, Primley Woods Path, and a portion of the west half of Dawlish Drive. Runoff from this basin will sheet flow from the lots to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet, located on the west side of Dawlish Drive (**DP 4a**), between Primley Woods Path and St Ives Way. Bypass flows will then be routed downstream to a proposed (public) 15' CDOT Type 'R' sump inlet, located on the west side of Dawlish Drive directly across from Sparkwell Street (**DP4**). Emergency overflows will be routed downstream via proposed curb and gutter to Design Point 7 within Sparkwell Street.

Basin A-4b (3.99 AC, $Q_5 = 6.5$ cfs, $Q_{100} = 15.2$ cfs): Located on the northwestern portion of the site, this basin consists of residential lots, St Ives Way, and a portion of the west half of Dawlish Drive. Runoff from this basin will sheet flow from the lots to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet, located on the west side of Dawlish Drive **(DP 4b)**, between Primley Woods Path and St Ives Way. Bypass flows will then be routed downstream to a proposed (public) 15' CDOT Type 'R' sump inlet, located on the west side of Dawlish Drive directly across from Sparkwell Street **(DP4)**. Emergency overflows will be routed downstream via proposed curb and gutter to Design Point 7 within Sparkwell Street.

Basin A-5 (0.35 AC, $Q_5 = 1.6$ cfs, $Q_{100} = 3.1$ cfs): Located on the north portion of the site, this basin consists of a portion of the east half of Dawlish Drive. Flows will be routed, via curb & gutter, to a proposed (public) 5' CDOT Type 'R' inlet in sump conditions, located on the east side of Dawlish Drive (DP 5), Just north of the intersection of Sparkwell Street and Dawlish Drive. Emergency overflows will be routed downstream via proposed curb and gutter to Design Point 7 within Sparkwell Street.

Basin A-6 (2.76 AC, $Q_5 = 4.6$ cfs, $Q_{100} = 10.7$ cfs): Located centrally on the site, this basin consists of residential lots, Penryn Circle, and a portion of the south half of Sparkwell Street. Runoff from this basin will sheet flow from the lots to the adjacent road. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' inlet in sump conditions, located on the south side of Sparkwell Street (**DP 6**), Just southeast of the intersection of Penryn Circle & Sparkwell Street. Emergency overflows will overtop Sparkwell Street crown to Design Point 7 (**DP 7**), then overtop curb and gutter and be routed downstream via an overflow swale to proposed Pond A.

Basin A-7 (0.23 AC, $Q_5 = 1.1$ cfs, $Q_{100} = 2.0$ cfs): Located centrally on the site, this basin consists of a portion of the north half of Sparkwell Street. Runoff from this basin will sheet flow from edge of ROW to the adjacent road. Flows will then be routed, via curb & gutter, to a proposed (public) 5' CDOT Type 'R' inlet in sump conditions, located on the north side of Sparkwell Street (**DP 7**), Just east of the intersection of Penryn Circle & Sparkwell Street. Emergency overflows will overtop curb and gutter and be routed downstream via an overflow swale to proposed Pond A.

Basin A-8 (5.44 AC, $Q_5 = 14.7$ cfs, $Q_{100} = 30.8$ cfs): Located centrally on the site, this basin consists entirely of proposed amenity / park facilities. Runoff from this basin will sheet flow to paved parking lot and drive aisle with curb and gutter. Flows will then be routed, via curb & gutter, to a series of proposed (public) CDOT Type 'R' inlets and area inlets with storm sewer piping conveying generated runoff downstream to Design Point 8 (**DP 8**), located at the southeast corner of the park site. Emergency overflows will overtop curb and gutter and will sheet flow, across green space, to proposed Pond A.

Basin A-9 (4.91 AC, $Q_5 = 7.4$ cfs, $Q_{100} = 17.3$ cfs): Located in the central portion of the site, directly west from Pond A. This basin consists of residential lots, one-half of Pixie Place, a section of Salcombe Trail, and a section of the west half of Sparkwell Street. Runoff from this basin will sheet flow to the proposed roadways, where runoff will be directed downstream, via curb & gutter, a proposed (public) 20' CDOT Type 'R' sump inlet (**DP 7a**). Runoff is then conveyed downstream to **DP 7b** where additional runoff is added from Sub-basin A-10.

Basin A-10 (1.02 AC, $Q_5 = 2.1$ cfs, $Q_{100} = 4.9$ cfs): Located in the central portion of the site, directly west from Pond A. This basin consists of residential lots and the easter half of a section of Sparkwell Street. Runoff from this basin will sheet flow to the proposed roadway, where runoff will be directed downstream, via curb & gutter, a proposed (public) 5' CDOT Type 'R' sump inlet (**DP 7b**). Runoff is then directed downstream to the northwest corner of Pond A. Flows will then be routed to the outlet structure (**DP 8**), via a concrete trickle channel, where it will eventually discharge, at historic rates, into the adjacent Main Stem Tributary #2 channel. Emergency overflows will overtop via an emergency spillway and be routed downstream directly to MST.

Basin A-11 (3.56 AC, $Q_5 = 2.0$ cfs, $Q_{100} = 8.6$ cfs): Located on the eastern limits of the site, adjacent to the proposed Main Stem Tributary #2 drainageway. This basin consists of the rear portion of lots along Sparkwell Street and the proposed (private) Full Spectrum Detention Pond A. Runoff from this basin will sheet flow directly to Pond A. Flows will then be routed to the outlet structure (**DP 8**), via a concrete trickle channel, where it will eventually discharge, at historic rates, into the adjacent Main Stem Tributary #2 channel. Emergency overflows will overtop via an emergency spillway and be routed downstream directly to MST.

Basin B-1 (3.81 AC, $Q_5 = 5.3$ cfs, $Q_{100} = 12.5$ cfs): Located on the western limits of the site, adjacent to Eastonville Road. This basin consists of residential lots and the southwest portion of Pixie Place. Runoff from this basin will sheet flow from the lots to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' inlet in sump conditions, located at the end of the Cul-De-Sac of Pixie Place (DP 9). Emergency overflows will overtop curb and gutter and be routed downstream via an overflow swale to Dawlish Drive and then downstream via curb & gutter to Design Point DP 10b.

Basin B-2 (4.62 AC, $Q_5 = 7.1$ cfs, $Q_{100} = 16.7$ cfs): Located on the western limits of the site, partially adjacent to Eastonville Road. This basin consists of residential lots, the northwest portion of Pixie Place

and the northwestern portion of Dawlish Drive. Runoff from this basin will sheet flow from the lots to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' at-grade inlet **(DP 10a)**, located on the northwest side of Dawlish Drive, northeast of Marazion Way. Bypass flows are conveyed downstream via curb & gutter to **DP 10b** where a proposed (public) 15' CDOT Type 'R' sump inlet captures flows.

Basin B-3 (4.15 AC, $Q_5 = 8.0$ cfs, $Q_{100} = 18.6$ cfs): Located on the western portion of the site, this basin consists of residential lots, the northwest portion of Dawlish Drive, and Marazion Way. Runoff from this basin will sheet flow from the lots to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 20' CDOT Type 'R' sump inlet (DP 10b), located northeast from the intersection of Dawlish Drive and Zelda Street. on the northwest side of Dawlish Drive, northeast of Marazion Way. Emergency overflows will overtop the crown of the roadway and be conveyed downstream via curb and gutter to Design Point DP 11, DP12b, and DP13.

Basin B-4 (1.37 AC, $Q_5 = 4.6$ cfs, $Q_{100} = 9.4$ cfs): Located in the west-central portion of the site. This basin consists of the southeast portion of Dawlish Drive. Runoff from this basin will sheet flow directly to the curb & gutter and be directed downstream to a proposed (public) 15' CDOT Type 'R' inlet in sump conditions, located east of the intersection of Dawlish Drive & Zelda Street (DP 11). Emergency overflows will overtop the curb return flowline and be conveyed downstream via curb and gutter to Design Point **DP 12b**.

Basin B-5 (5.12 AC, $Q_5 = 7.9$ cfs, $Q_{100} = 18.5$ cfs): Located centrally on the site, this basin consists of residential lots, Marazion Way, the northwest portion of Salcombe Trail, and the southwest portion of Pixie Place. Runoff from this basin will sheet flow from the lots to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' at-grade inlet (**DP 12a**), located on the northwest side of Salcombe Trail, northeast of the intersection between Zelda Street and Salcombe Trail. Bypass flows are conveyed downstream via curb & gutter to **DP 12b**.

Basin B-6 (2.28 AC, $Q_5 = 3.7$ cfs, $Q_{100} = 8.7$ cfs): Located centrally on the site. This basin consists of residential lots and the northwest portion of Plinky Plonk Path. Runoff from this basin will sheet flow from the lots to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' at-grade inlet, located on the northwest side of Plinky Plonk Path (DP 14). Bypass flows are conveyed downstream via curb & gutter to **DP 12b**.

Basin B-7 (0.89 AC, $Q_5 = 1.6$ cfs, $Q_{100} = 3.8$ cfs): Located centrally on the site. This basin consists of residential lots and the southeast portion of Plinky Plonk Path. Runoff from this basin will sheet flow from the lots to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' at-grade inlet, located on the southeast side of Plinky Plonk Path (DP 15). Bypass flows are conveyed downstream via curb & gutter to **DP 12b**.

Basin B-8 (3.23 AC, $Q_5 = 5.3$ cfs, $Q_{100} = 12.4$ cfs): Located centrally on the site. This basin consists of residential lots, the southeast portion of Plinky Plonk Path, and the northeast portion of Zelda Street. Runoff from this basin will sheet flow from the lots to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 20' CDOT Type 'R' sump inlet, located on the southeast side of the intersection between Plinky Plonk Path and Zelda Street (**DP 12b**). Emergency overflows will overtop the crown of the roadway and be conveyed downstream via curb and gutter to Design Point **DP 13**.

Basin B-9 (2.42 AC, $Q_5 = 3.8$ cfs, $Q_{100} = 9.0$ cfs): Located centrally on the site, adjacent to the Main Stem channel. This basin consists residential lots and the southwest portion of Zelda Street. Runoff from this

basin will sheet flow from the lots to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' sump inlet, located on the southwest side of the intersection between Plinky Plonk Path and Zelda Street (**DP 13**). Emergency overflows will overtop the curb & gutter of the roadway and be conveyed downstream via a graded swale into Pond B (**DP 16**).

Basin B-10 (1.10 AC, $Q_5 = 0.5$ cfs, $Q_{100} = 3.3$ cfs): Located centrally on the site, adjacent to the Main Stem channel. This basin consists of the proposed (private) Full Spectrum Detention Pond B. Runoff from this basin will sheet flow directly to Pond B. Flows will then be routed to the outlet structure **(DP 16)**, via a concrete trickle channel, where it will eventually discharge, at historic rates, into the adjacent Main Stem channel.

Basin C-1 (4.12 AC, $Q_5 = 6.8$ cfs, $Q_{100} = 16.0$ cfs): Located on the east portion of the site, this basin consists of residential lots and the eastern half of a portion of Salcombe Trail. Runoff from this basin will sheet flow from the lots to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet, located on the southeast side of the intersection of Stoke Gabriel Way and Totness Terrace (**DP 17b**). Bypass flows are conveyed downstream via curb & gutter to **DP 17e**.

Basin C-2 (2.71 AC, $Q_5 = 4.9$ cfs, $Q_{100} = 11.4$ cfs): Located on the eastern portion of the site, this basin consists of residential lots and the southern portion of Roads Stoke Gabriel Way and Glampton Drive, and the full section of Totness Terrace. Runoff from this basin will sheet flow from the lots to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet **(DP 17a)**, located on the southwest side of the intersection of Stoke Gabriel Way and Totness Terrace. Bypass flows are conveyed downstream via curb & gutter to **DP 17c**.

Basin C-3 (1.56 AC, $Q_5 = 0.8$ cfs, $Q_{100} = 4.5$ cfs): Located on the southeast portion of the site, this basin consists of the rear portion of residential lots along Stoke Gabriel Way. Runoff from this basin will sheet flow in an eastward direction towards the proposed channel. All roof drains (for lots 409-426 & 443) within this sub-basin will be directed toward Stoke Gabriel Way, no impervious surfaces will be allowed within the rear lot setbacks and runoff reduction will be implemented within this sub-basin.

Basin C-4 (2.47 AC, $Q_5 = 4.1$ cfs, $Q_{100} = 9.6$ cfs): Located on the southeast portion of the site, this basin consists of residential lots and the eastern half of Frogmore Lane. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet (**DP 17c**), located on the southwest side of the intersection of Stoke Gabriel Way and Frogmore Lane. Bypass flows are conveyed downstream via curb & gutter to **DP 17d**.

Basin C-5 (3.09 AC, $Q_5 = 5.5$ cfs, $Q_{100} = 12.8$ cfs): Located on the southeast portion of the site, this basin consists of residential lots and the western half of Stoke Gabriel Way. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet (DP 17d), located on the northwest side of the intersection of Stoke Gabriel Way and Glampton Drive. Bypass flows are conveyed downstream via curb & gutter to DP 17h.

Basin C-6 (2.10 AC, $Q_5 = 3.2$ cfs, $Q_{100} = 7.4$ cfs): Located on the southeast portion of the site, this basin consists of residential lots and the eastern half of Stoke Gabriel Way. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet (**DP 17e**), located on the northeast side of the intersection of Stoke Gabriel Way and Glampton Drive. Bypass flows are conveyed downstream via curb & gutter to **DP 17h**.

Basin C-7a (0.81 AC, $Q_5 = 1.1$ cfs, $Q_{100} = 3.2$ cfs): Located in the central portion of the site, this basin consists of the rear portion of residential lots, existing gas main, and proposed drainage swale (Swale C-7). Runoff from this basin will sheet flow to the proposed swale which will direct runoff to the adjacent roadway (**DP 18a**).

Basin C-7b (5.91 AC, $Q_5 = 9.9$ cfs, $Q_{100} = 23.2$ cfs): Located in the central portion of the site, this basin consists of residential lots, the western half of Glampton Drive, and a portion of Zelda Drive & Sparkwell Street. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet (**DP 18b**), located on the southwest side of the intersection of Totness Terrace and Glampton Drive. Bypass flows are conveyed downstream via curb & gutter to **DP 18c**.

Basin C-8 (5.11 AC, $Q_5 = 8.6$ cfs, $Q_{100} = 20.0$ cfs): Located in the central portion of the site, this basin consists of residential lots, a portion of Totness Terrace, and a portion of Glampton Drive to the west and south of the sub-basin. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet (**DP 17f**), located on the southeast side of the intersection of Totness Terrace and Glampton Drive. Bypass flows are conveyed downstream via curb & gutter to **DP 17g and DP 17h**.

Basin C-9a (3.5 AC, $Q_5 = 5.6$ cfs, $Q_{100} = 13.1$ cfs): Located on the southeast corner of the site, this basin consists of residential lots, a portion of Frogmore Lane, and the northern half of Glampton Drive. Runoff from this basin will sheet flow to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' sump inlet (**DP 17g**), located on the northeast corner of Glampton Drive and Frogmore Lane. Bypass flows are conveyed downstream via curb & gutter to **DP 17h**. Emergency overflows will overtop the crown of Glampton Drive and be routed downstream via proposed curb and gutter to Design Point **18b** within Glampton Drive.

Basin C-9b (3.69 AC, $Q_5 = 5.9$ cfs, $Q_{100} = 13.7$ cfs): Located on the southeast corner of the site, this basin consists of residential lots and the northern half of Glampton Drive. Runoff from this basin will sheet flow to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 20' CDOT Type 'R' sump inlet (**DP 17h**), located on the north side of Glampton Drive just north of Hope Cove Loop. Emergency overflows will overtop the crown of Glampton Drive and be routed downstream via proposed curb and gutter to Design Point **18b** within Glampton Drive.

Basin C-10 (3.47 AC, $Q_5 = 5.2$ cfs, $Q_{100} = 12.1$ cfs): Located on the southeast corner of the site, this basin consists of residential lots and the southern half of Glampton Drive. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' sump inlet (**DP 18c**), located on the south side of Glampton Drive just north of Hope Cove Loop. Emergency overflows will overtop the curb & gutter of Glampton Drive and be routed downstream via a graded grassed swale and curb & gutter within Hope Cove Loop to Design Point **19** within Hope Cove Loop.

Basin C-11 (0.46 AC, $Q_5 = 1.0$ cfs, $Q_{100} = 2.3$ cfs): Located on the southeast corner of the site, this basin consists of a grassed amenity area and the north half of Hope Cove Loop. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 5' CDOT Type 'R' sump inlet (**DP 19**), located on the north side of Hope Cove Loop. Emergency overflows will overtop the crown of Hope Cove Loop and be routed downstream via curb & gutter to Design Point **20** within Hope Cove Loop.

Basin C-12 (1.66 AC, $Q_5 = 2.9$ cfs, $Q_{100} = 6.7$ cfs): Located on the southeast corner of the site, this basin consists of residential lots and the south portion of Hope Cove Loop. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 5' CDOT Type 'R' sump inlet (**DP 20**), located on the south side of Hope Cove Loop. Emergency overflows will overtop the curb & gutter of Hope Cove Loop and be routed downstream via a graded swale to Design Point **21** within Pond C.

Basin C-13 (2.37 AC, $Q_5 = 0.8$ cfs, $Q_{100} = 5.5$ cfs): Located on the southeast corner of the site, adjacent to the Main Stem channel. This basin consists of the proposed (private) Full Spectrum Detention Pond C. Runoff from this basin will sheet flow directly to Pond C. Flows will then be routed to the outlet structure (DP 21), via a concrete trickle channel, where it will eventually discharge, at historic rates, into the adjacent Main Stem channel.

Basin C-14 (1.53 AC, $Q_5 = 0.5$ cfs, $Q_{100} = 3.8$ cfs): Located on the southeast corner of the site, adjacent to the Main Stem channel. This basin consists of the undeveloped area outside and downstream of the proposed (private) Full Spectrum Detention Pond C. Runoff from this basin will sheet flow directly to the Main Stem Tributary Number 2 (MST).

Basin C-15 (0.16 AC, $Q_5 = 0.1$ cfs, $Q_{100} = 0.5$ cfs): Located on the southeast corner of the site, adjacent to the Main Stem channel. This basin consists of the rear portion of Lot 444. Runoff from this basin will sheet flow directly to the Main Stem Tributary Number 2 (MST). Runoff from this basin will sheet flow in an eastward direction towards the proposed channel. All roof drains (for lot 444) within this sub-basin will be directed toward Glampton Drive, no impervious surfaces will be allowed within the rear lot setbacks and runoff reduction will be implemented within this sub-basin.

Basin D-1 (3.48 AC, $Q_5 = 5.4$ cfs, $Q_{100} = 12.7$ cfs): Located on the southwest portion of the site, adjacent to Eastonville Road. This basin consists of residential lots and the west half of Kate Meadow Lane. Runoff from this basin will sheet flow to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' at-grade inlet, located on the west side of Kate Meadow Lane **(DP 22)**, just south of the intersection of Kate Meadow Lane & Farm Close Court. Flows will continue downstream to Design Point **24** within Farm Close Court.

Basin D-2 (0.87 AC, $Q_5 = 1.7$ cfs, $Q_{100} = 4.0$ cfs): Located on the southwest portion of the site, this basin consists of residential lots and the eastern half of Kate Meadow Lane. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' flow by inlet, located on the east side of Kate Meadow Lane (DP 23), just southeast of the intersection of Kate Meadow Lane & Farm Close Court. Emergency overflows will pool up and be routed around the curb return at the intersection of Kate Meadow Lane and Farm Close Court downstream via curb & gutter to Design Point **24** within Farm Close Court.

Basin D-3 (3.62 AC, $Q_5 = 5.9$ cfs, $Q_{100} = 13.8$ cfs): Located on the southwest portion of the site, this basin consists of residential lots and the western half of Farm Close Court. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' inlet in sump conditions, located on the west side of Farm Close Court (**DP 24**), southeast of the intersection of Kate Meadow Lane & Farm Close Court. Emergency overflows will overtop the crown and be routed downstream via curb & gutter in Farm Close Court to Design Point **25**.

Basin D-4 (1.77 AC, $Q_5 = 3.3$ cfs, $Q_{100} = 7.7$ cfs): Located on the southwest portion of the site, this basin consists of residential lots and the eastern half of Farm Close Court. Runoff from this basin will sheet flow

to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 10' CDOT Type 'R' inlet in sump conditions, located on the east side of Farm Close Court **(DP 25)**, just southeast of the intersection of Kate Meadow Lane & Farm Close Court. Emergency overflows will overtop curb & gutter and be routed downstream via a graded swale within the maintenance access path to Pond D at Design Point **26**.

Basin D-5 (1.53 AC, $Q_5 = 2.0$ cfs, $Q_{100} = 6.0$ cfs): Located on the southeast corner of the site, adjacent to the Main Stem channel. This basin consists partially of residential lots and the proposed (private) Full Spectrum Detention Pond D. Runoff from this basin will sheet flow directly to Pond D. Flows will then be routed to the outlet structure (DP 26), via a concrete trickle channel, where it will eventually discharge, at historic rates, into the adjacent Main Stem channel.

Basin D-6 (0.83 AC, $Q_5 = 0.3$ cfs, $Q_{100} = 2.1$ cfs): Located on the southwest corner of the site, adjacent to the Main Stem channel. This basin consists of the undeveloped area outside and downstream of the proposed (private) Full Spectrum Detention Pond D. Runoff from this basin will sheet flow directly to the Main Stem channel (MS).

Basin D-7a (0.25 AC, $Q_5 = 0.2$ cfs, $Q_{100} = 0.8$ cfs): Located on the southwest corner of the site, adjacent to the Main Stem channel. This basin consists of the back portions of residential lots. Runoff from this basin will sheet flow directly to the Main Stem Channel. All roof drains (for lots 18-20) within this subbasin will be directed toward Farm Close Court, no impervious surfaces will be allowed within the rear lot setbacks and runoff reduction will be implemented within this sub-basin.

Basin D-7b (0.88 AC, $Q_5 = 1.7$ cfs, $Q_{100} = 4.0$ cfs): Located on the southwest corner of the site, adjacent to the Main Stem channel. This basin consists of the back portions of residential lots and a drainage swale (Swale D-7). Runoff from this basin will sheet flow from the residential lots, into the adjacent swale and will be routed directly to Pond D.

Basin E-1 (5.33 AC, $Q_5 = 9.8$ cfs, $Q_{100} = 22.9$ cfs): Located on the southern portion of the site, this basin consists of residential lots, the southern half of Brixham Drive, Starcross Court, and the southern half of Kate Meadow Lane. Runoff from this basin will sheet flow to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet, located on the southwest corner of the intersection between Kate Meadow Lane and Mill Yard Circle (**DP 27**), just north of the cul-de-sac. Bypass flows are conveyed downstream via curb & gutter to **DP 29**.

Basin E-2 (5.42 AC, $Q_5 = 10.1$ cfs, $Q_{100} = 23.6$ cfs): Located on the southern portion of the site, this basin consists of residential lots, a small portion of Mill Yard Circle, and the north half of Kate Meadow Lane. Runoff from this basin will sheet flow to the adjacent roadways. Flows will then be routed, via curb & gutter, to a proposed (public) 15' CDOT Type 'R' at-grade inlet, located on the northwest corner of the intersection between Kate Meadow Lane and Mill Yard Circle (**DP 28**), just north of the cul-de-sac. Bypass flows are conveyed downstream via curb & gutter to **DP 29**.

Basin E-3 (3.20 AC, $Q_5 = 6.0$ cfs, $Q_{100} = 14.0$ cfs): Located on the southern portion of the site, this basin consists of residential lots and the western half of Mill Yard Circle. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 20' CDOT Type 'R' sump inlet, located just northeast from the cul-de-sac of Mill Yard Circle (**DP 29**). Emergency overflows will overtop the crown of Mill Yard Circle and be routed downstream via curb & gutter to Design Point **30**.

Basin E-4 (6.28 AC, $Q_5 = 9.0$ cfs, $Q_{100} = 21.0$ cfs): Located on the southern portion of the site, this basin consists of residential lots and the eastern half of Mill Yard Circle. Runoff from this basin will sheet flow to the adjacent roadway. Flows will then be routed, via curb & gutter, to a proposed (public) 20' CDOT Type 'R' sump inlet, located just northeast from the cul-de-sac of Mill Yard Circle (**DP 30**). Emergency overflows will overtop the curb & gutter and be routed downstream via a graded swale within the maintenance access to Pond E at Design Point **31**.

Basin E-5 (1.13 AC, $Q_5 = 0.4$ cfs, $Q_{100} = 3.0$ cfs): Located on the southeast corner of the site, adjacent to the Main Stem channel. This basin consists of the proposed (private) Full Spectrum Detention Pond E. Runoff from this basin will sheet flow directly to Pond E. Flows will then be routed to the outlet structure (**DP 31**), via a concrete trickle channel, where it will eventually discharge, at historic rates, into the adjacent Main Stem channel.

Basin E-6 (0.74 AC, $Q_5 = 0.3$ cfs, $Q_{100} = 1.8$ cfs): Located on the southeast corner of the site, adjacent to the Main Stem channel. This basin consists of the undeveloped area outside and downstream of the proposed (private) Full Spectrum Detention Pond E. Runoff from this basin will sheet flow directly to the Main Stem channel (MS) and offsite to the south.

Basin EA-1 (7.79 AC, $Q_5 = 9.2$ cfs, $Q_{100} = 19.5$ cfs): Located on the western side of the site. This basin consists of the public right of way (Eastonville Road). Runoff from this basin will sheet flow to proposed curb & gutter and be conveyed downstream to a public 10' CDOT Type R inlet in sump conditions (EA1) located just west from Lots 17 & 18 at the end of the cul-de-sac for Farm Close Court. Emergency overflows will overtop the crown of Eastonville Road to Design Point EA2.

Basin EA-2 (5.59 AC, $Q_5 = 7.0$ cfs, $Q_{100} = 14.9$ cfs): Located on the western side of the site. This basin consists of the public right of way (Eastonville Road). Runoff from this basin will sheet flow to proposed curb & gutter and be conveyed downstream to a public 10' CDOT Type R inlet in sump conditions **(EA2)** located just west from Lots 16 & 17 at the end of the cul-de-sac for Farm Close Court. Emergency overflows will overtop the curb & gutter on the east side of Eastonville Road and be directed into the proposed Eastonville Pond via swale.

← EA-3 got deleted?

VIII. Storm Sewer System

All development is anticipated to be urban and will include storm sewer & street inlets. Storm sewers collect storm water runoff and convey the water to the water quality facilities prior to discharging. Storm sewer systems will be designed to the 100-year storm and checked with the 5-year storm. Inlets will be placed at sump areas and intersections where street flow is larger than street capacity. UDFCD Inlet spreadsheet has been used to determine the size of all sump inlets.

There will be a minimum of 5 proposed storm systems within the site. Each of the five storm sewer systems will discharge storm water into its correlated WQCV pond. Additionally, there will be two bypass storm sewer systems that collect off-site basin flows at **DP 32 & DP 35**.

The bypass system at **DP 32** will cross through on-site sub-basins **EA-1**, **EA-2**, **EA-3**, **D-1**, **D-3 & D-4**, and tie-into the outfall pipe from the Eastonville Road Pond, discharging directly into the main stem tributary channel. This bypass system will only convey flows from **DP 32** and will not be connected to any storm systems within any of the on-site sub-basins it crosses.

The bypass system at **DP 35** will cross through on-site sub-basins **EA-1**, **EA-2**, **A-4a**, **A-5 & A-8** and discharge directly main stem tributary #2. This bypass system will only convey flows from **DP 35** and will not be connected to any storm systems within any of the on-site sub-basins it crosses.

Each system will consist of reinforced concrete pipe (RCP), CDOT Type 'R' inlets, and storm sewer manholes.

Furthermore, there are three (3) proposed drainage swales that runs along the back of the residential lots in Basins A-1, C-7a, and D-7. The swales were analyzed using the Bentley software FlowMaster to properly size a trapezoidal channel (4' W x 2.0' D), (1' W x 1.50' D), & (1' W x 1.54' D), respectively, to convey the 100-year flows from the basin to corresponding outfall locations (SB-2, Glampton Drive, & Pond D), while providing 1.0-ft of freeboard. The sizing calculations can be found in **Appendix C**.

The Final drainage report will include details concerning at-grade inlet locations, street capacity, storm sewer sizing, outlet protection and location. Preliminary sump inlets have been sized and the calculations can be found in **Appendix C**. As mentioned, these sump inlets sizes are preliminary and are currently oversized. It is anticipated that the inlets will reduce in size with the addition of at-grade inlets at the time of the Final Drainage Report.

IX. Proposed Water Quality Detention Ponds

Eight (8) Water Quality Capture Volume Detention Ponds will be provided for the proposed site, six (6) of which are full spectrum ponds and two (2) of which are sediment basins. Of These, all six (6) of the ponds and the (2) Sediment Basins on-site are private and will be maintained by the DISTRICT, once established. These detention ponds are proposed to be full spectrum and will provide water quality and detention. The WQCV and EURV release will be controlled with an orifice plate. The release rates for the WQCV and EURV will be 40-hours and 72-hours, respectively. The 100-year volume will be controlled by orifice and/or restrictor plate and will be designed to release at or below the pre-development flow rate. Outlet structures, forebays, trickle channels, etc. will be designed with the final drainage report during final plat. The required FSD pond volumes are as described below:

Eastonville Road Pond: Located along the southwest side of the site. This pond will discharge into the Main Stem Tributary. The required volume WQCV and EURV are 0.233 Ac-Ft & 0.614 Ac-Ft, respectively. The provided storage for the WQCV and EURV are 0.234 Ac-Ft & 0.850 Ac-Ft, respectively. The total required detention basin volume is 1.301 Ac-Ft. The total provided detention basin storage is 1.320 Ac-Ft.

Pond A: Located to the north of the site, just west of the newly routed Main Stem Tributary #2 channel. This pond will discharge into the Main Stem Tributary #2, ultimately merging with Main Stem to the south, off-site. The required volume WQCV and EURV are 0.756 Ac-Ft & 2.115 Ac-Ft, respectively. The provided storage for the WQCV and EURV are 0.761 Ac-Ft & 2.882 Ac-Ft, respectively. The total required detention basin volume is 4.290 Ac-Ft. The total provided detention basin storage is 4.626 Ac-Ft.

Pond B: Located centrally on the site, just east of the Main Stem drainage way. This pond will discharge into the Main Stem channel. The required volume WQCV and EURV are 0.586 Ac-Ft & 1.610 Ac-Ft, respectively. The provided storage for the WQCV and EURV are 0.587 Ac-Ft & 2.197 Ac-Ft, respectively. The total required detention basin volume is 3.310 Ac-Ft. The total provided detention basin storage is 3.449 Ac-Ft.

Pond C: Located on the southeast portion of the site, between the Main Stem & Main Stem Tributary #2 channels. This pond will discharge into the Main Stem channel. The required volume WQCV and EURV are 0.828 Ac-Ft & 2.256 Ac-Ft, respectively. The provided storage for the WQCV and EURV are 0.831 Ac-Ft & 3.088 Ac-Ft, respectively. The total required detention basin volume is 4.633 Ac-Ft. The total provided detention basin storage is 5.040 Ac-Ft.

Pond D: Located centrally on the site, just west of the Main Stem channel. This pond will discharge into the Main Stem channel. The required volume WQCV and EURV are 0.244 Ac-Ft & 0.666 Ac-Ft, respectively. The provided storage for the WQCV and EURV are 0.246 Ac-Ft & 0.913 Ac-Ft, respectively. The total required detention basin volume is 1.373 Ac-Ft. The total provided detention basin storage is 1.373 Ac-Ft.

Pond E: Located on the south side of the site, just west of the Main Stem channel. This pond will discharge into the Main Stem channel. The required volume WQCV and EURV are 0.431 Ac-Ft & 1.163 Ac-Ft, respectively. The provided storage for the WQCV and EURV are 0.437 Ac-Ft & 1.601 Ac-Ft, respectively. The total required detention basin volume is 2.421 Ac-Ft. The total provided detention basin storage is 2.583 Ac-Ft.

SB-1: Located on the far north side of the site, just east of the extension of Rex Road. This TSB will discharge into the Main Stem Tributary Number 2 (MST). The TSB has been sized to treat the developed runoff for water quality prior to releasing into MST. This TSB captures an upstream tributary area of approximately 1.22 acres and per the MHFD standard, this TSB has been upsized to 2-acre tributary area.

SB-2: Located on the north side of the site, at the southeast corner of the church property. This TSB will discharge into the Main Stem Tributary Number 2 (MST This TSB captures an upstream tributary area of approximately 11.23 acres and per the MHFD standard, this TSB has been upsized to 12-acre tributary area.

X. Proposed Channel Improvements

According to the **MDDP**, there are two major drainage ways that run through the site. As was discussed within the Existing Conditions portion of the report, both the Main Stem channel (MS) and Main Stem Tributary #2 channel (MST) run through the site. There are no proposed major channel improvements for MS as part of this project (to be determined with CDR-22-008). An analysis has been done for the Main Stem channel (MS) with both existing and future condition flows as described within the *Grandview Reserve CLOMR Report*, HR Green; September 2021; revised January 2022 (**CLOMR**). All HEC-RAS modelling, velocities, shear, depths, etc. are included within the CLOMR, which can be found in **Appendix C**. Both scenarios, throughout the channel fall within the channel stability criteria.

The MST is proposed to be rerouted. As part of this rerouting of MST, offsite upstream tributary flows will be captured upstream from the proposed Rex Road extension and be conveyed via culvert to the rerouted MST. An analysis has been done for the Main Stem Tributary Number 2 (MST) with both existing and future condition flows as described within the *Grandview Reserve CLOMR Report*, HR Green; September 2021; revised January 2022 (**CLOMR**). Both scenarios, throughout the channel fall within the channel stability criteria.

A majority of the developed runoff will be captured and conveyed to one of the corresponding water quality and detention facilities and release at or below historic levels. Some basins will release directly into the respective adjacent channels. These basins are contained within the backs of lots and will provide water quality through runoff reduction; impervious areas will not be permitted in the back of these lots and roof drains are to drain to the front. Therefore, there will be no adverse impact to downstream facilities. The analysis for both drainage ways (MS and MST), offsite upstream tributary capture, and design of MST were done by HR Green within the *Grandview Reserve CLOMR Report*, HR Green; September 2021; revised January 2022 (**CLOMR**) which will be submitted separately for review. A copy of this report is included in **Appendix C**.

Additional channel stabilization may be required for erosion control prevention measures, pending the channel design review with the County.

XI. Maintenance

After completion of construction and upon the Board of County Commissioners acceptance, it is anticipated all drainage facilities within the public Right-of-Way are to be owned and maintained by El Paso County.

All private detention ponds are to be owned and maintained by the Grandview Reserve Metropolitan District No. 2 (DISTRICT), once established, unless an agreement is reached stating otherwise. The proposed Main Stem channel (MS) and Main Stem Tributary Number 2 (MST) will be maintained by the DISTRICT. Maintenance access for all full spectrum detention facilities will be provided from public Right-of-Way. Maintenance access for MS and MST will be provided along the respective eastern top of channel bank within the proposed tracts.

XII. Wetlands Mitigation

There are two existing wetlands on site associated with the two major channels, MS and MST. The wetlands are both contained within the existing channels with the wetland in MS being classified as jurisdictional and the wetland in MST classified as non-jurisdictional. The wetlands USACE determination will be provided with the *Grandview Reserve CLOMR Report*, HR Green; April 2022, which can be found in **Appendix C**. Wetlands maintenance will be the responsibility of the Grandview Reserve Metropolitan District No. 2 (DISTRICT).

XIII. Floodplain Statement

A portion of the project sit lies with Zone A Special Flood Hazard Area as defined by the FIRM Map number 08041C0552G and 08041C0556G effective December 7, 2018. A copy of the FIRM Panel is included in **Appendix A.** FEMA-approved floodplain elevations are required to be shown on final plats.

XIV. Drainage Fees & Maintenance

Gieck Ranch Basin is not listed as part of the El Paso County drainage basin fee program. Unless otherwise instructed, no drainage fees will be assessed. If it is found drainage basin fees are required, these will be included in the Final Drainage Report.

XV. Conclusion

The Grandview Reserve residential subdivision lies within the Gieck Ranch Drainage Basin. Water quality for the site is provided in six on-site Full Spectrum Detention Ponds; Ponds A, B, C, D, E, & Eastonville Pond as well as two Sediment Basins; SB-1 and SB-2. Both of these SBs have been sized to function as PBMPs (and will remain in place until such time development east of the proposed site takes place) and will discharge treated runoff at historic rates directly into MST at the northern portion of the project site. All drainage facilities within this report were sized according to the El Paso County Drainage Criteria Manuals. The proposed facilities are adequate to protect the site from generated runoff. The site runoff will not adversely affect the downstream facilities and surrounding developments. There are two major channels passing through the site Main Stem channel and Main Stem Tributary Number 2, which will be addressed by HR Green within the *Grandview Reserve CLOMR Report*, HR Green; September 2021; revised January 2022. The six (6) WQCV ponds will be maintained by a newly established Grandview Reserve Metropolitan District No. 2 (DISTRICT). A Final Drainage Report will be submitted along with the final plat and construction drawings.

XVI. References

- 1. El Paso County Drainage Criteria Manual, 1990.
- 2. Drainage Criteria Manual, Volume 2, City of Colorado Springs, 2002.
- 3. El Paso County Drainage Criteria Manual Update, 2015.
- 4. El Paso County Engineering Criteria Manual, 2020.
- 5. *Urban Storm Drainage Criteria Manual*, Urban Drainage and Flood Control District, January 2016 (with current revisions).
- 6. *Gieck Ranch Drainage Basin Study (DBPS),* Drexel Barrell, October 2010 (Not adopted by County).
- 7. Grandview Reserve Master Development Drainage Plan (MDDP), HR Green, November 2020.
- 8. *Grandview Reserve CLOMR Report*, HR Green; April 2022.
- 9. Meridian Ranch MDDP, January 2018, updated 2021.
- 10. Eastonville Road Preliminary Drainage Report", HR Green, September 2023.
- 11. The Sanctuary Filing 1 FDR (Meridian Ranch), Tech Contractors, August 2022.

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APPENDIX A Exhibits and Figures



GRANDVIEW RESERVE

EASTONVILLE RD SCALE: 1"=2,000' VICINITY MAP

Project No:	HRG1.20
Drawn By:	JDP
Checked By:	RGD
Date:	07/26/2021



1155 Kelly Johnson Blvd., Suite 305 Colorado Springs, CO 80920 719.900.7220 • GallowayUS.com



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To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodwarys** have been determined. users are encouraged to consult the Flood within the Flood thrauated users are encouraged to this FRIM. Users within the Flood insurate Study (FIS) report that accompanies tables contained within the Flood insurate Study (FIS) report that accompanies this FRIM. Users should be avain that EFEs alrow on the FIRM represent tourded whole-foot elevations. These BFEs are intended for flood insurance tables control whole-foot elevations. These BFEs are intended for flood insurance tables contraded whole-foot should not be used as the sole source of flood elevation information. Accordingly, the FIRM for proposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0 North American Vicent Datum of 1988 (NAVDBS). Users of this FIAM should be aware that coastal finded levations are also provided in the Summary of Sillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Sillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were beam on hydrating considerations with regard to requirements of the National Flood Insurance Program. Considerations with and other pertinent loodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control** structures. Refet to section 2.4 Flood Protection the servers of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

the The projection used in the preparation of this map was Universal Transve matchic (UTIX) cone 13. The horizontal adam was Noriversal Transve Differences in datum, spheroid, projection of UTIX zones zones used in Differences in map diagent juriscictions may result in slight positio differences in map features across jurisciction boundaries. These differences do affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum** of 1388 (NAVD88). These flood elevations must be compared to structure and ground elevations tenetroed to har aren vertical attum. For finamation regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.gs.noaa.gov/ or contact the National Geodetic Survey at the following address.

NGS Information Services NOAA, NNIGS12 National Geodetic Survey SSMC-3, #2002 1315 East-West Highway Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the information Sprevices Statent of the National Geodetic Survey at (201) 71:5-522 or visit its websile at http://www.ngs.nota.gov/

Base Map information shown on this FIRM was provided in digital format by EI Paso County, Cotordo Springe Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date stream channel configurations and floodpain defineations have hobes shown on the pervious FIRM for his juristicution. The floodpains and floodways that were transferred from the pervious. FIRM may have been adjusted to confrom to these new stream channel confluations. FIRM may have been adjusted to conform to these new stream channel confluations. As a result, the Flood Perfiels and Floodway Data tables in the Tood Insurance Study Report (which confains authoritative hydraulic data) may reflect stream channel datances that effer from what is shown on this map. The profile baselines depicted on this map. Propriesent the hydraulic flood insurance study basines may deviate significantly from the res / securit. As a result, the profile basines may deviate significantly from the new base map channel representation basine may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because charges due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county shrowing the layout of map panels, community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for located.

Contact FEMA Map Service Center (INSC) via the FEMA Map Information eXchange (FMIX) - 1927-355-257 for information on available products are with this FTRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9520 and its website at Mtp://www.msciena.gov/.

f you have questions about this map or questions concerning the National Flood nsurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or fait the FEMA website at http://www.fema.gov/business/infp.

sile at http://www.reune.g-... El Paso County Vertical Datum Offset Table Vertsal Datum Offset (ft) Flooding Source

REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map

 \vdash 1 This Digital Flood Insurance Rate Map (DFIRM) was produced through a propreating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).



Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.

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Certain areas not in Special Flood Hazard Areas may be protected by **flood control** structures. Reter to section 2.4 Flood Protection the secures of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The projection used in the preparation of this map was Universal Transver-tionation (UTIN) across 13. The proceeding adam was Universal Transver Differences in datum, spheroid, projection of UTIN zones zones used in 1 Differences in map diagramt jurisidiotors may result in slight positio differences in map features across jurisidiction boundaries. These differences do affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD88). These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For findmation regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.gs.noaa.gov/ or contact the National Geodetic Survey at the following address.

NGS Information Services NOAA, NNGS12 National Geodetic Survey SSMC-3, #9202 1315 East-West Highway Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for bench marks strown on this map, please contact the information for services stands of the National Geodetic Survey at (201) 713-5222 or visit its website at http://www.ngs.nga.gov/

Base Map information shown on this FIRM was provided in digital format by EI Paso County. Closicalo Strongs Utilities (by of Foruntia Bureau of Land Management, National Oceanic and Armospheric Administration. United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

This map reflects more detailed and up-to-date stream channel configurations and footpall defineations than throse shown on the previous FIRM may the elevation of the magnetic configurations where the strensferred from the previous FIRM may have been adjusted to confrom to here new stream channel configurations. As a result, the Flood Prefiles and Floodway Data tables in the Flood Insuance Study Report (which contains authoritative bydrains detail) may refer the standard standards authoritative bydrains class) may refer the standards and floodway Data tables in the Flood Insuance Study Report (which contains authoritative bydrains). The standards the flood profiles and Floodway Data tables in the Flood Insuance Study Resort (which contains authoritative bydrains). The profile baselines depicted on this map representing the profile paselines in the optime pagelines may devise significantly (ron the new base map channel representing and floodway Data Tables in the Flood and Floodway Data Tables). In the Flood Insuance Reporting the profile paselines the profile paselines the profile paselines in the profile paselines the profile paselines in the profile p and may appear outside of the floodplair

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to amaxisations or de-ambaxations may have concurred after this map was published. map users should contact appropriate community officials to verify current corporate limit locations.

101NS PANEL 0551

1420000 FT

Please refer to the separately printed Map Index for an overview map of the count, strowing the layout of map panels: community and resposits and a tabing of Communities table containing National Flood Insurance Program dates to each community as well as a listing of the panels on which each community is cated.

Contact FEMA Map Service Center (MSC) via the FEMA Map Information exchange (FMIX) -1377-355-75 for information on available products are with this FIRM. Available products may include previously issued Letters of Map Change. a Flood Insurance SLUK Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9520 and its website at Mtp///www.msc/enna.gov/.

you have questions about this map or questions concerning the National Flood surgine Program in generic, please call, **1577**-Fload MAP (1-877-336-2627) or an thor cart to unship of http://www.fload man on/hystichsek/flin am in g ance Prog

REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION ical Datum Offset (ft) site at http://www.renne.ywww.lenne.ywwe. El Paso County Vertical Datum Offset Table Vertica Flooding Source

Panel Location Map

 This Digital Flood Insurance Rate Map (DFIRM) was produced through a propreating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).



Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.

1415000 FT

38° 58' 7.50"





NOTES TO USERS

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LEGEND



USDA Natural Resources

Conservation Service



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	А	22.4	2.6%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	450.7	52.5%
83	Stapleton sandy loam, 3 to 8 percent slopes	В	385.4	44.9%
Totals for Area of Inter	est		858.5	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition Component Percent Cutoff: None Specified Tie-break Rule: Higher



Precipitation Frequency Data Server



NOAA Atlas 14, Volume 8, Version 2 Location name: Peyton, Colorado, USA* Latitude: 38.985°, Longitude: -104.565° Elevation: 6975.71 ft** * source: ESRI Maps ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS	-based po	int precip	itation fre	quency es	stimates v	vith 90% c	onfidenc	e interva	ls (in inc	hes) ¹
Duration				Average	recurrence	interval (yea	ars)			
Duration	1	2	5	10	25	50	100	200	500	1000
5-min	0.239	0.291	0.381	0.461	0.576	0.671	0.770	0.875	1.02	1.14
	(0.189-0.303)	(0.231-0.370)	(0.301-0.486)	(0.361-0.589)	(0.440-0.768)	(0.499-0.904)	(0.554-1.06)	(0.604-1.24)	(0.678-1.48)	(0 733-1.67)
10-min	0.350	0.426	0.558	0.674	0.844	0.982	1.13	1.28	1.49	1.66
	(0.277-0.444)	(0.338-0.542)	(0.441-0.711)	(0.529-0.863)	(0.644-1.13)	(0.731-1.32)	(0.811-1.56)	(0.884-1.81)	(0.992-2.17)	(1.07-2.44)
15-min	0.426	0.520	0.681	0.823	1.03	1.20	1.37	1.56	1.82	2.03
	(0.338-0.541)	(0.412-0.660)	(0.537-0.867)	(0.645-1.05)	(0.785-1.37)	(0.891-1.62)	(0.988-1.90)	(1.08-2.21)	(1.21-2.65)	(1.31-2.98)
30-min	0.608	0.740	0.968	1.17	1.46	1.70	1.94	2.21	2.57	2.86
	(0.482-0.771)	(0.586-0.940)	(0.764-1.23)	(0.916-1.49)	(1.11-1.94)	(1.26-2.29)	(1.40-2.68)	(1.52-3.12)	(1.71-3.73)	(1.85-4.19)
60-min	0.775	0.933	1.21	1.46	1.84	2.16	2.49	2.85	3.37	3.78
	(0.615-0.984)	(0 739-1 19)	(0.956-1.54)	(1.15-1.87)	(1.41-2.47)	(1.61-2.92)	(1.80-3.45)	(1.97-4.05)	(2.24-4.90)	(2.44-5.55)
2-hr	0.943	1.13	1.46	1.76	2.22	2.62	3.04	3.50	4.16	4.70
	(0.754-1.19)	(0.898-1.42)	(1.16-1.84)	(1.39-2.23)	(1.72-2.97)	(1.97-3.52)	(2.21-4.19)	(2.45-4.95)	(2.80-6.03)	(3.06-6.85)
3-hr	1.03	1.22	1.57	1.90	2.41	2.86	3.35	3.88	4.66	5.29
	(0.829-1.29)	(0.978-1.53)	(1.25-1.97)	(1.51-2.40)	(1.88-3.22)	(2.17-3.84)	(2.45-4.60)	(2.73-5.48)	(3.15-6.74)	(3.46-7.69)
6-hr	1.20	1.40	1.78	2.16	2.76	3.28	3.86	4.51	5.46	6.24
	(0.968-1.49)	(1.13-1.74)	(1.44-2.22)	(1.73-2.70)	(2.18-3.66)	(2.52-4.39)	(2.86-5.29)	(3.21-6.34)	(3.73-7.86)	(4.12-9.01)
12-hr	1.38	1.61	2.05	2.48	3.15	3.74	4.39	5.12	6.17	7.04
	(1 13-1 70)	(1.31-1.98)	(1.67-2.53)	(2.00-3.07)	(2.51-4.15)	(2.89-4.96)	(3.28-5.96)	(3.67-7.13)	(4.25-8.82)	(4.69-10.1)
24-hr	1.60	1.87	2.38	2.85	3.60	4.24	4.94	5.71	6.82	7.73
	(1.31-1.95)	(1.54-2.28)	(1.94-2.91)	(2.32-3.51)	(2.88-4.67)	(3.29-5.56)	(3.71-6.63)	(4.12-7.87)	(4.73-9.66)	(5.20-11.0)
2-day	1.85	2.18	2.76	3.29	4.11	4.80	5.54	6.35	7.50	8.44
	(1.54-2.24)	(1.80-2.63)	(2.28-3.35)	(2.70-4.01)	(3.30-5.27)	(3.76-6.22)	(4.19-7.36)	(4.62-8.68)	(5.25-10.5)	(5.73-11.9)
3-day	2.03	2.39	3.02	3.60	4.47	5.20	5.98	6.83	8.03	9.00
	(1.69-2.44)	(1.98-2.87)	(2.50-3.64)	(2.97-4.36)	(3.60-5.69)	(4.09-6.70)	(4.55-7.90)	(4.99-9.28)	(5.65-11.2)	(6.15-12.7)
4-day	2.18	2.56	3.22	3.82	4.73	5.49	6.30	7.18	8.43	9.43
	(1.82-2.61)	(2.13-3.06)	(2.68-3.87)	(3.16-4.62)	(3.83-6.00)	(4.33-7.04)	(4.81-8.30)	(5.26-9.72)	(5.95-11.7)	(6.46-13.3)
7-day	2.58	2.98	3.68	4.32	5.29	6.09	6.96	7.89	9.21	10.3
	(2.17-3.07)	(2.50-3.54)	(3.08-4.39)	(3.60-5.18)	(4.31-6.65)	(4.84-7.76)	(5.34-9.09)	(5.82-10.6)	(6.55-12.8)	(7.10-14.4)
10-day	2.93	3.37	4.13	4.81	5.83	6.68	7.58	8.55	9.92	11.0
	(2.48-3.47)	(2.84-3.98)	(3.47-4.90)	(4.02-5.74)	(4.76-7.29)	(5.32-8.45)	(5.85-9.86)	(6.34-11.4)	(7.09-13.7)	(7.65-15.4)
20-day	3.91	4.51	5.52	6.39	7.63	8.62	9.64	10.7	12.2	13.3
	(3.33-4.58)	(3.84-5.29)	(4.68-6.50)	(5.39-7.55)	(6.25-9.37)	(6.90-10.8)	(7.47-12.4)	(7.98-14.1)	(8.74-16.6)	(9.31-18.4)
30-day	4.70 (4.02-5.47)	5.44 (4.65-6.34)	6.65 (5.66-7.78)	7.66 (6.49-9.00)	9.06 (7.44-11.0)	10.1 (8.15-12.5)	11.2 (8.74-14.3)	12.3 (9.24-16.2)	13.8 (9.98-18.7)	15.0 (10.5-20.6)
45-day	5.67	6.55	7.97	9.12	10.7	11.9	13.0	14.2	15.6	16.7
	(4.88-6.57)	(5.63-7.60)	(6.82-9.27)	(7.77-10.7)	(8.79-12.9)	(9.56-14.5)	(10.2-16.4)	(10.6-18.4)	(11.3-21.0)	(11.9-23.0)
60-day	6.49	7.46	9.01	10.3	11.9	13.1	14.3	15.5	16.9	18.0
	(5.60-7.48)	(6.43-8.62)	(7.74-10.4)	(8.77-11.9)	(9.82-14.3)	(10.6-16.0)	(11.2-18.0)	(11.7-20.0)	(12.3-22.6)	(12.8-24.6)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical







- 5-min	- 2-day
- 10-min	— 3-day
- 15-min	- 4-day
- 30-min	- 7-day
- 60-min	- 10-day
- 2-hr	- 20-day
- 3-hr	- 30-day
- 6-hr	- 45-day
- 12-hr	- 60-day
- 24-hr	

NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Thu Dec 2 17:16:51 2021

Back to Top

Maps & aerials

Small scale terrain







Large scale aerial
Precipitation Frequency Data Server



Back to Top

US Department of Commerce National Oceanic and Atmospheric Administration National Weather Service National Water Center 1325 East West Highway Silver Spring, MD 20910 Questions?: <u>HDSC.Questions@noaa.gov</u>

<u>Disclaimer</u>

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APPENDIX B Hydrologic Computations

COMPOSITE % IMPERVIOUS CALCULATIONS: EXISTING & PROPOSED

Subdivision:Grandview ReserveLocation:CO, El Paso County

1	2	3	4	5	6	7	8	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
		Pav	ed/Gravel R	loads	La	wns/Undevelo	ped	Res	idential - 1/8	Acre	Res	idential - 1/4 A	Acre	Res	idential - 1/3	Acre	Res	idential - 1/2 A	Acre	Re	sidential - 1 A	cre	Basins Total
Basin ID	Total Area (ac)	% Imp	Area (ac)	Weighted	% Imp	\mathbf{A} resp. (e.g.)	Weighted	% Imp	Area (ac)	Weighted	% Imp	\mathbf{A} resp. (e.g.)	Weighted	% Imp	\mathbf{A} res (se)	Weighted	0/ Imn	$\mathbf{A}\mathbf{r}_{00}$	Weighted	% Imp	Area (ac)	Weighted	Weighted %
		76 mp.	Alea (ac)	% Imp.	76 mp.	Alea (ac)	% Imp.	76 mp.	Area (ac)	% Imp.	76 mp.	Area (ac)	% Imp.	76 mp.	Area (ac)	% Imp.	70 mp.	Area (ac)	% Imp.	76 mp.	Area (ac)	% Imp.	Imp.
PROPOSED																							
EA6 + EA7	1.35	100	1.28	94.8	2	0.07	0.1	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	94.9
EA12	0.92	100	0.02	2.2	2	0.90	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	4.2
For Existing West	ern Offsite Sub-bas	sin analysis a	nd Proposed	Eastonville R	oad Basin Ar	alvsis, see Rai	tional Calcs I	ncluded, fron	n titled "East	onville Road I	Preliminary I)rainage Repo	ort", by HR G	Freen, Septen	nber 2023	010		0100	010		0.00	010	
A-1	11.60	100	0.00	0.0	2	11.67	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
A-2a	4.42	100	0.00	0.0	2	0.00	0.0	65.0	4.42	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
A-2b	2.75	100	1.80	65.5	2	0.00	0.0	65.0	0.95	22.5	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	88.0
A-3	0.36	100	0.36	100.0	2	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	100.0
A-4a	6.31	100	0.00	0.0	2	0.00	0.0	65.0	6.31	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
A-4b	3.99	100	0.00	0.0	2	0.00	0.0	65.0	3.99	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
A-5	0.35	100	0.35	100.0	2	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	100.0
A-6	2.76	100	0.00	0.0	2	0.00	0.0	65.0	2.76	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
A-7	0.23	100	0.23	100.0	2	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	100.0
A-8	5.44	100	4.06	74.5	2	1.39	0.5	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	75.0
A-9	4.91	100	0.00	0.0	2	0.00	0.0	65.0	4.91	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
A-10	1.02	100	0.00	0.0	2	0.00	0.0	65.0	1.02	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
A-11	3.56	100	0.00	0.0	2	2.77	1.6	65.0	0.79	14.4	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	16.0
B-1	3.81	100	0.00	0.0	2	0.00	0.0	65.0	3.33	56.8	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	56.8
B-2	4.62	100	0.00	0.0	2	0.00	0.0	65.0	4.51	63.5	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	63.5
B-3	4.15	100	0.00	0.0	2	0.00	0.0	65.0	4.15	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0 79.5
B-4	1.57	100	1.07	/8.1	2	0.30	0.4	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	/8.5
D-J R 6	2.28	100	0.00	0.0	2	0.00	0.0	65.0	3.12	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
B-0	0.89	100	0.00	0.0	2	0.00	0.0	65.0	0.89	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
B-7	3.23	100	0.00	0.0	2	0.00	0.0	65.0	3 23	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
B-9	2 42	100	0.00	0.0	2	0.00	0.0	65.0	2 42	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
B-10	1 10	100	0.00	0.0	2	1 10	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
C-1	4.12	100	0.00	0.0	2	0.00	0.0	65.0	4.12	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
C-2	2.71	100	0.00	0.0	2	0.00	0.0	65.0	2.71	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
C-3	1.56	100	0.08	5.1	2	1.48	1.9	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	7.0
C-4	2.47	100	0.00	0.0	2	0.00	0.0	65.0	2.47	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
C-5	3.09	100	0.00	0.0	2	0.00	0.0	65.0	3.09	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
C-6	2.1	100	0.00	0.0	2	0.00	0.0	65.0	2.10	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
C-7a	0.81	100	0.00	0.0	2	0.26	0.6	65.0	0.55	44.1	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	44.7
C-7b	5.91	100	0.00	0.0	2	0.00	0.0	65.0	5.91	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
C-8	5.11	100	0.00	0.0	2	0.00	0.0	65.0	5.11	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
C-9a	3.5	100	0.00	0.0	2	0.00	0.0	65.0	3.50	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
C-9b	3.69	100	0.00	0.0	2	0.00	0.0	65.0	3.69	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
C-10	3.47	100	0.00	0.0	2	0.00	0.0	65.0	3.47	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
C-11	0.46	100	0.00	0.0	2	0.00	0.0	65.0	0.46	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
C-12	1.00	100	0.00	0.0	2	0.00	0.0	65.0	1.66	0.0	40	0.00	0.0	<u> </u>	0.00	0.0	25	0.00	0.0	20	0.00	0.0	05.0
C-13	2.57	100	0.00	0.0	2	2.57	2.0	03.U	0.00	0.0	40	0.00	0.0	20	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
C-14 C-15	0.16	100	0.00	63	2	0.15	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0 8.2
D_1	3.48	100	0.01	0.5	2	0.00	0.0	65.0	3.48	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65 D
D-1 D-2	0.87	100	0.00	0.0	2	0.00	0.0	65.0	0.87	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
D-3	3.69	100	0.00	0.0	2	0.00	0.0	65.0	3 69	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
D-4	1.75	100	0.00	0.0	2	0.00	0.0	65.0	1.75	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
D-5	1.53	100	0.00	0.0	2	0.71	0.9	65.0	0.82	34.8	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	35.7
D-6	0.83	100	0.00	0.0	2	0.83	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
D-7a	0.27	100	0.02	7.4	2	0.23	1.7	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	9.1
D-7b	0.88	100	0.00	0.0	2	0.00	0.0	65.0	0.88	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
E-1	5.33	100	0.00	0.0	2	0.00	0.0	65.0	5.33	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
E-2	5.42	100	0.00	0.0	2	0.00	0.0	65.0	5.42	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
E-3	3.20	100	0.00	0.0	2	0.00	0.0	65.0	3.20	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
E-4	6.28	100	0.00	0.0	2	0.00	0.0	65.0	6.28	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
E-5	1.13	100	0.00	0.0	2	1.13	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
E-6	0.74	100	0.00	0.0	2	0.74	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0

Lot Type Id	entification:
Lot Size (SF)	Lot Size (Acre)
0 - 8,167	1/8 Acre
8,168 - 12,704	1/4 Acre
12,705 - 18,149	1/3 Acre
18,150 - 32,670	1/2 Acre
32,671 - 43,560	1 Acre

NOTES:

% Impervious values are taken directly from Table 6-6 in the Colorado Springs DCM Vol. 1. CH. 6 (Referencing UDFCD 2001)

Project Name:Grandview Subdivision PDRProject No.:HRG01Calculated By:TJEChecked By:BASDate:9/20/23

 Subdivision:
 Grandview Reserve

 Location:
 CO, El Paso County

1	2	3	4	5	6	7	8	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
		Pav	ved/Gravel Ro	oads	Lav	wns/Undevelo	ped	Res	idential - 1/8	Acre	Res	idential - 1/4	Acre	Res	idential - 1/3	Acre	Res	idential - 1/2 A	Acre	Re	sidential - 1 A	cre	Basins Total
Basin ID	Total Area (ac)	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	Weighted % Imp.
EXISTING																							
For Existing Wes	tern Offsite Sub-bas	sin analysis, s	see Rational C	Calcs Included	l, from titled	"Eastonville	Road Prelimi	nary Drainaş	ge Report", b	y HR Green, S	September 20	023											
ES-1	16.17	100	0	0	2	16.17	2	65	0	0	40	0	0	30	0	0	25	0	0	20	0	0	2
ES-2	46.05	100	0	0	2	46.05	2	65	0	0	40	0	0	30	0	0	25	0	0	20	0	0	2
ES-3	64.3	100	0	0	2	64.3	2	65	0	0	40	0	0	30	0	0	25	0	0	20	0	0	2
ES-4	2.68	100	0	0	2	2.68	2	65	0	0	40	0	0	30	0	0	25	0	0	20	0	0	2
ES-5	26.15	100	0	0	2	26.15	2	65	0	0	40	0	0	30	0	0	25	0	0	20	0	0	2
ES-6	31.26	100	0	0	2	31.26	2	65	0	0	40	0	0	30	0	0	25	0	0	20	0	0	2
INTERIM	ARIM																						
For Existing Wes	tern Offsite Sub-bas	sin analysis, s	see Rational C	Calcs Included	l, from titled	"Eastonville	Road Prelimi	nary Draina	ge Report", b	y HR Green, S	September 20	023											
A-1	19.53	100	0.00	0.0	2	19.53	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
EA-1	2.01	100	0.00	0.0	2	2.01	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
TSB-A1	17.49	100	0.00	0.0	2	17.49	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
TSB-A2	4.51	100	0.00	0.0	2	4.51	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
TSB-A3	9.49	100	0.00	0.0	2	9.49	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
TSB-B1	13.64	100	0.00	0.0	2	13.64	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
TSB-B2	5.12	100	0.00	0.0	2	5.12	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
TSB-B3	9.91	100	0.00	0.0	2	9.91	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
TSB-C1	6.84	100	0.00	0.0	2	6.84	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
TSB-C2	17.00	100	0.00	0.0	2	17.00	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
TSB-C3	18.56	100	0.00	0.0	2	18.56	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
TSB-D1	10.86	100	0.00	0.0	2	10.86	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
TSB-E1	20.93	100	0.00	0.0	2	20.93	2.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0

Lot Type Id	entification:
Lot Size (SF)	Lot Size (Acre)
0 - 8,167	1/8 Acre
8,168 - 12,704	1/4 Acre
12,705 - 18,149	1/3 Acre
18,150 - 32,670	1/2 Acre
32,671 - 43,560	1 Acre

NOTES:

% Impervious values are taken directly from Table 6-6 in the Colorado Springs DCM Vol. 1. CH. 6 (Referencing UDFCD 2001)

Project Name:	Grandview Subdivision PDR - Interim Conditions
Project No.:	HRG01

Calculated By: TJE Checked By: BAS Date: 9/9/22

Subdivision:Grandview ReserveLocation:CO, El Paso County

<table-container> betw image <th< th=""><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th><th>17</th><th>18</th><th>19</th><th>20</th><th>21</th><th>22</th><th>23</th><th>24</th><th>25</th><th>26</th><th>27</th><th>28</th></th<></table-container>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Image Image <t< th=""><th></th><th></th><th>Pav</th><th>ed/Gravel Roads</th><th></th><th>Lav</th><th>wns/Undevelo</th><th>oped</th><th></th><th>Roofs</th><th></th><th>Res</th><th>idential - 1/8</th><th>Acre</th><th>Res</th><th>idential - 1/4</th><th>Acre</th><th>Res</th><th>sidential - 1/3</th><th>Acre</th><th>Resi</th><th>dential - 1/2</th><th>Acre</th><th>Re</th><th>sidential - 1 A</th><th>lcre</th><th></th><th>Composite</th></t<>			Pav	ed/Gravel Roads		Lav	wns/Undevelo	oped		Roofs		Res	idential - 1/8	Acre	Res	idential - 1/4	Acre	Res	sidential - 1/3	Acre	Resi	dential - 1/2	Acre	Re	sidential - 1 A	lcre		Composite
Part All Image Image <	Basin ID	Total Area (ac)	C ₅	C ₁₀₀ A1	rea (ac)	C.	C ₁₀₀	Area (ac)	C ₅	C100	Area (ac)	C5	C100	Area (ac)	C ₅	C100	Area (ac)	C.	C100	Area (ac)	C.	C ₁₀₀	Area (ac)	C.	C ₁₀₀	Area (ac)	Composite C ₅	C ₁₀₀
Product 1 1 1 1 <td></td> <td></td> <td>-3</td> <td>-100</td> <td>cu (uc)</td> <td>-3</td> <td>- 100</td> <td>iii cu (uc)</td> <td>-3</td> <td>- 100</td> <td>inica (ac)</td> <td>-5</td> <td>- 100</td> <td>in cu (uc)</td> <td>- 3</td> <td>- 100</td> <td>ini cu (uc)</td> <td>-3</td> <td>- 100</td> <td>inica (uc)</td> <td>-3</td> <td>- 100</td> <td>intea (ac)</td> <td>- 5</td> <td>- 100</td> <td>intea (ac)</td> <td></td> <td>- 100</td>			-3	-100	cu (uc)	-3	- 100	iii cu (uc)	-3	- 100	inica (ac)	-5	- 100	in cu (uc)	- 3	- 100	ini cu (uc)	-3	- 100	inica (uc)	-3	- 100	intea (ac)	- 5	- 100	intea (ac)		- 100
D. D. C. D. D. D. D. <thd.< th=""> D. D. <thd.< th=""> <thd.< t<="" td=""><td>PROPOSED</td><td></td><td></td><td></td><td> T</td><td></td><td></td><td>L</td><td></td><td></td><td></td><td>1</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>T</td><td></td><td></td><td></td></thd.<></thd.<></thd.<>	PROPOSED				T			L				1	1												T			
bit bit <td>EA6 + EA7</td> <td>1.35</td> <td>0.90</td> <td>0.96</td> <td>1.28</td> <td>0.09</td> <td>0.36</td> <td>0.07</td> <td>0.73</td> <td>0.81</td> <td>0.00</td> <td>0.45</td> <td>0.59</td> <td>0.00</td> <td>0.30</td> <td>0.50</td> <td>0.00</td> <td>0.25</td> <td>0.47</td> <td>0.00</td> <td>0.22</td> <td>0.46</td> <td>0.00</td> <td>0.20</td> <td>0.44</td> <td>0.00</td> <td>0.86</td> <td>0.93</td>	EA6 + EA7	1.35	0.90	0.96	1.28	0.09	0.36	0.07	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.86	0.93
The Markel of the Markel number was and a proving of the Markel and Markel free Mark	EA12	0.92	0.90	0.96	0.02	0.09	0.36	0.90	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.11	0.37
Had Had <td>For Existing West</td> <td>tern Offsite Sub-bas</td> <td>sin analysis a</td> <td>nd Proposed East</td> <td>onville Ro</td> <td>oad Basin An</td> <td>alysis, see Ra</td> <td>tional Calcs I</td> <td>Included, fron</td> <td>n titled "East</td> <td>onville Road</td> <td>Preliminary</td> <td>Drainage Rep</td> <td>ort", by HR (</td> <td>Green, Septer</td> <td>nber 2023</td> <td>T</td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td>-</td> <td></td> <td>-</td> <td>T</td> <td></td> <td></td>	For Existing West	tern Offsite Sub-bas	sin analysis a	nd Proposed East	onville Ro	oad Basin An	alysis, see Ra	tional Calcs I	Included, fron	n titled "East	onville Road	Preliminary	Drainage Rep	ort", by HR (Green, Septer	nber 2023	T			-			-		-	T		
Abs 4bs 4bs <td>A-1</td> <td>11.60</td> <td>0.90</td> <td>0.96</td> <td>0.00</td> <td>0.09</td> <td>0.36</td> <td>11.67</td> <td>0.73</td> <td>0.81</td> <td>0.00</td> <td>0.45</td> <td>0.59</td> <td>0.00</td> <td>0.30</td> <td>0.50</td> <td>0.00</td> <td>0.25</td> <td>0.47</td> <td>0.00</td> <td>0.22</td> <td>0.46</td> <td>0.00</td> <td>0.20</td> <td>0.44</td> <td>0.00</td> <td>0.09</td> <td>0.36</td>	A-1	11.60	0.90	0.96	0.00	0.09	0.36	11.67	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
Abs Cols Cols <thc< td=""><td>A-2a</td><td>4.42</td><td>0.90</td><td>0.96</td><td>0.00</td><td>0.09</td><td>0.36</td><td>0.00</td><td>0.73</td><td>0.81</td><td>0.00</td><td>0.45</td><td>0.59</td><td>4.42</td><td>0.30</td><td>0.50</td><td>0.00</td><td>0.25</td><td>0.47</td><td>0.00</td><td>0.22</td><td>0.46</td><td>0.00</td><td>0.20</td><td>0.44</td><td>0.00</td><td>0.45</td><td>0.59</td></thc<>	A-2a	4.42	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	4.42	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
A.A. U.D. U.D. U.D. U.D. U	A-2b	2.75	0.90	0.96	1.80	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.95	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.74	0.83
LAS US US US US US </td <td>A-3</td> <td>0.36</td> <td>0.90</td> <td>0.96</td> <td>0.36</td> <td>0.09</td> <td>0.36</td> <td>0.00</td> <td>0.73</td> <td>0.81</td> <td>0.00</td> <td>0.45</td> <td>0.59</td> <td>0.00</td> <td>0.30</td> <td>0.50</td> <td>0.00</td> <td>0.25</td> <td>0.47</td> <td>0.00</td> <td>0.22</td> <td>0.46</td> <td>0.00</td> <td>0.20</td> <td>0.44</td> <td>0.00</td> <td>0.90</td> <td>0.96</td>	A-3	0.36	0.90	0.96	0.36	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.90	0.96
b 135 030 104 135 130 135 131 130 131	A-4a	0.51	0.90	0.96	0.00	0.09	0.30	0.00	0.73	0.81	0.00	0.43	0.39	0.51	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.39
Add U	A-40	0.35	0.90	0.90	0.00	0.09	0.30	0.00	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.40	0.00	0.20	0.44	0.00	0.45	0.39
153 039 0.84 0.93 0.84 0.93 0.94 0.94 0.94 0.94 0.94 0.94 0.94 0.94 0.94 0.94 0	A-6	2 76	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	2.76	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.90	0.59
Add Odd Odd <td>A-7</td> <td>0.23</td> <td>0.90</td> <td>0.96</td> <td>0.23</td> <td>0.09</td> <td>0.36</td> <td>0.00</td> <td>0.73</td> <td>0.81</td> <td>0.00</td> <td>0.45</td> <td>0.59</td> <td>0.00</td> <td>0.30</td> <td>0.50</td> <td>0.00</td> <td>0.25</td> <td>0.47</td> <td>0.00</td> <td>0.22</td> <td>0.46</td> <td>0.00</td> <td>0.20</td> <td>0.44</td> <td>0.00</td> <td>0.90</td> <td>0.96</td>	A-7	0.23	0.90	0.96	0.23	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.90	0.96
A.S. U.S. U.S. U.S. U.S. U	A-8	5.44	0.90	0.96	4.06	0.09	0.36	1.39	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.69	0.81
A.H. L.G. UOM UOM </td <td>A-9</td> <td>4.91</td> <td>0.90</td> <td>0.96</td> <td>0.00</td> <td>0.09</td> <td>0.36</td> <td>0.00</td> <td>0.73</td> <td>0.81</td> <td>0.00</td> <td>0.45</td> <td>0.59</td> <td>4.91</td> <td>0.30</td> <td>0.50</td> <td>0.00</td> <td>0.25</td> <td>0.47</td> <td>0.00</td> <td>0.22</td> <td>0.46</td> <td>0.00</td> <td>0.20</td> <td>0.44</td> <td>0.00</td> <td>0.45</td> <td>0.59</td>	A-9	4.91	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	4.91	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
bit bit <td>A-10</td> <td>1.02</td> <td>0.90</td> <td>0.96</td> <td>0.00</td> <td>0.09</td> <td>0.36</td> <td>0.00</td> <td>0.73</td> <td>0.81</td> <td>0.00</td> <td>0.45</td> <td>0.59</td> <td>1.02</td> <td>0.30</td> <td>0.50</td> <td>0.00</td> <td>0.25</td> <td>0.47</td> <td>0.00</td> <td>0.22</td> <td>0.46</td> <td>0.00</td> <td>0.20</td> <td>0.44</td> <td>0.00</td> <td>0.45</td> <td>0.59</td>	A-10	1.02	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	1.02	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
h 1	A-11	3.56	0.90	0.96	0.00	0.09	0.36	2.77	0.73	0.81	0.00	0.45	0.59	0.79	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.17	0.41
h 4 4 5 6 0	B-1	3.81	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.33	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.39	0.52
hit hit <td>B-2</td> <td>4.62</td> <td>0.90</td> <td>0.96</td> <td>0.00</td> <td>0.09</td> <td>0.36</td> <td>0.00</td> <td>0.73</td> <td>0.81</td> <td>0.00</td> <td>0.45</td> <td>0.59</td> <td>4.51</td> <td>0.30</td> <td>0.50</td> <td>0.00</td> <td>0.25</td> <td>0.47</td> <td>0.00</td> <td>0.22</td> <td>0.46</td> <td>0.00</td> <td>0.20</td> <td>0.44</td> <td>0.00</td> <td>0.44</td> <td>0.58</td>	B-2	4.62	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	4.51	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.44	0.58
1 1.77 600 6.90 6.90 6.91 6.90 6.9	B-3	4.15	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	4.15	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
1 2.12 0.03 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.05 0.05 0.	B-4	1.37	0.90	0.96	1.07	0.09	0.36	0.30	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.72	0.83
b.s 0.00	B-5	5.12	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	5.12	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
bs 0.57 0.59 0.09 0.09 0.08 0.04 0.00 0.01 0	B-6	2.28	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	2.28	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
bot 1.22 0.00 0.00 0.00 0.01 0.03 0.03 0.04 0.00 0.03 0.04 0.00 0.04 0.00 0.04 0.00 0.04 0.00 0.04 0.00 0.04 0.00 0.04 0.00 0.04 0.00 0.04 0.00 0.04 0.00 0.03 0.04 0.00	B-/	0.89	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.89	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
h_{10} h_{10} h_{20}	B 0	2.42	0.90	0.90	0.00	0.09	0.30	0.00	0.73	0.81	0.00	0.43	0.39	2.42	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.40	0.00	0.20	0.44	0.00	0.45	0.39
Ci Li 0.09 0.09 0.09 0.09 0.09 0.01 0.01 0.02 0.07 0.00 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.04 0.00 0.02 0.04 0.00 0.02 0.04 0.00 0.02 0.04 0.00 0.02 0.01 0.02 0.04 0.00 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.01 0.01 0.	B-10	1 10	0.90	0.96	0.00	0.09	0.30	1.10	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.39
C2 271 0.90 0	C-1	4.12	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	4.12	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-3 158 0 90 0.96 0.99 0.19 0.19 0.90 0.23 0.44 0.00 0.23 0.44 0.00 0.23 0.44 0.00 0.23 0.44 0.00 0.23 0.44 0.00 0.13	C-2	2.71	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	2.71	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C4 2.47 0.09 0.06 0.00 0.30 0.00 0.37 0.84 0.00 0.55 2.47 0.30 0.50 0.57 0.50 0.52 0.47 0.00 0.52 0.46 0.00 0.22 0.46 0.00 0.23 0.44 0.00 0.55 0.57 C.6 2.10 0.00 0.05 0.00 0.55 0.67 0.00 0.52 0.46 0.00 0.23 0.44 0.00 0.53 0.57 C.6 2.10 0.00 0.05 0.00 0.57 0.81 0.00 0.55 0.50 0.50 0.57 0.50 0.57 0.50 0.50 0.55 0.57 0.50 0.52 0.57 0.50 0.55 0.50 0.55 0.50 0.55 0.57 0.50 0.52 0.57 0.50 0.55 0.57 0.50 0.55 0.57 0.50 0.55 0.57 0.50 0.55 0.57 0.50 0.55	C-3	1.56	0.90	0.96	0.08	0.09	0.36	1.48	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.13	0.39
C.5 S.90 0.80 0.80 0.81 0.41 0.81 0.41 0.45 0.41 0.41 0.43 0.43 0.45 0.41 0.40 0.20 0.44 0.00 0.20 0.44 0.00 0.20 0.44 0.00 0.43 0.44 0.45 0.57 0.51 0.50	C-4	2.47	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	2.47	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-6 2.10 0.90 0.90 0.90 0.90 0.90 0.20 0.91 0.90 0.92 0.90 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.50 C7/n 0.81 0.90 0.80 0.80 0.90 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.23 0.44 0.00 0.44 0.00 0.25 0.37 0.30 0.3	C-5	3.09	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.09	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C*7 0.81 0.90 0.90 0.90 0.90 0.90 0.90 0.02 0.46 0.00 0.20 0.44 0.00 0.21 0.46 0.00 0.20 0.44 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.21 0.44 0.00 0.21 0.44 0.00 0.21 0.44 0.00 0.21 0.44 0.00 0.21 0.44 0.00 0.21 0.44 0.00 0.23 0.47 0.00 0.22 0.46 0.00 0.21 0.44 0.00 0.45 0.59 C*0 3.47 0.00 0.45 0.57 3.47 0.00 0.25 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 C+10 4.46 0.90 0.95 0.90 0.35 3.47 0.30 0.50 0.60 0.22 0.44 0.00 0.21 0.44 0.00 0.21 0.44 <td>C-6</td> <td>2.10</td> <td>0.90</td> <td>0.96</td> <td>0.00</td> <td>0.09</td> <td>0.36</td> <td>0.00</td> <td>0.73</td> <td>0.81</td> <td>0.00</td> <td>0.45</td> <td>0.59</td> <td>2.10</td> <td>0.30</td> <td>0.50</td> <td>0.00</td> <td>0.25</td> <td>0.47</td> <td>0.00</td> <td>0.22</td> <td>0.46</td> <td>0.00</td> <td>0.20</td> <td>0.44</td> <td>0.00</td> <td>0.45</td> <td>0.59</td>	C-6	2.10	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	2.10	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-7b 5.91 0.99 0.96 0.00 0.95 0.90 0.90 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 C-9x 3.50 0.99 0.96 0.00 0.92 0.44 0.00 0.45 0.59 5.11 0.30 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 C-10 3.47 0.90 0.02 0.46 0.00 0.23 0.46 0.00 0.22 0.46 0.00 0.21 0.44 0.00 0.45 0.59 0.47 0.30 0.22 0.46 0.00 0.22 0.46 0.00 0.21 0.44 0.00<	C-7a	0.81	0.90	0.96	0.00	0.09	0.36	0.26	0.73	0.81	0.00	0.45	0.59	0.55	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.33	0.52
C-8 5.11 0.00 0.06 0.00 0.36 0.00 0.35 0.51 0.30 0.45 0.59 5.11 0.30 0.25 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 C-9b 3.60 0.96 0.00 0.03 0.00 0.23 0.41 0.00 0.42 0.44 0.00 0.43 0.59 C-9b 3.69 0.96 0.06 0.00 0.23 0.41 0.00 0.42 0.44 0.00 0.43 0.59 C-11 0.42 0.96 0.06 0.00 0.73 0.81 0.00 0.45 0.59 0.40 0.50 0.47 0.00 0.22 0.44 0.00 0.45 0.59 C-11 0.42 0.96 0.06 0.38 0.00 0.43 0.59 0.46 0.30 0.47 0.00 0.22 0.44 0.00 0.23 0.44 0.00	C-7b	5.91	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	5.91	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C 9s 3.50 0.90 0.96 0.00 0.09 0.36 0.00 0.25 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.25 0.37 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 C-10 3.47 0.90 0.96 0.00 0.49 0.36 0.00 0.43 0.59 3.47 0.30 0.25 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 C-11 0.46 0.99 0.00 0.45 0.59 0.46 0.30 0.50 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 0.46 0.30 0.50 0.00 0.25 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.44 0.00 0.44<	C-8	5.11	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	5.11	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-10 J.307 0.00 0.00 0.00 0.73 0.81 0.00 0.25 0.47 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.23 0.43 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.23 0.41 0.00 0.22 0.44 0.00 0.23 0.41 0.00 0.22 0.44 0.00 0.23 0.41 0.00 <	C-9a	3.50	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.50	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	C 10	3.69	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.69	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
c.1. c.c. c.c. <t< td=""><td>C 11</td><td>0.47</td><td>0.90</td><td>0.90</td><td>0.00</td><td>0.09</td><td>0.30</td><td>0.00</td><td>0.73</td><td>0.81</td><td>0.00</td><td>0.45</td><td>0.39</td><td>0.47 0.46</td><td>0.50</td><td>0.50</td><td>0.00</td><td>0.25</td><td>0.47</td><td>0.00</td><td>0.22</td><td>0.40</td><td>0.00</td><td>0.20</td><td>0.44</td><td>0.00</td><td>0.43</td><td>0.59</td></t<>	C 11	0.47	0.90	0.90	0.00	0.09	0.30	0.00	0.73	0.81	0.00	0.45	0.39	0.47 0.46	0.50	0.50	0.00	0.25	0.47	0.00	0.22	0.40	0.00	0.20	0.44	0.00	0.43	0.59
C_{13} L_{23} U_{23}	C-11	1.66	0.90	0.96	0.00	0.09	0.30	0.00	0.73	0.81	0.00	0.45	0.59	1.66	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-14 1.33 0.00 0.06 0.03 0.13 0.02 0.03 0.02 0.04 0.00 0.25 0.01 0.00 0.25 0.01 0.00 0.25 0.01 0.00 0.25 0.01 0.00 0.25 0.01 0.00 0.25 0.01 0.00 0.25 0.01 0.00 0.25 0.01 0.00 0.25 0.01 0.00 0.25 0.01 0.00 0.25 0.01 0.00 0.25 0.01 0.00 0.25 0.01 0.00 0.25 0.01 0.00 0.25 0.01 0.00 0.25 0.01 0.02 0.04 0.00 0.02 0.04 0.00 0.25 0.01 0.02 0.04 0.00 0.03 0.55 D-2 0.87 0.90 0.96 0.00 0.93 0.81 0.00 0.45 0.59 0.87 0.30 0.55 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.	C-13	2.37	0.90	0.96	0.00	0.09	0.36	2.37	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
C-15 0.16 0.90 0.96 0.01 0.09 0.36 0.15 0.73 0.81 0.00 0.45 0.59 0.00 0.25 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.14 0.40 D-1 3.48 0.90 0.96 0.00 0.99 0.36 0.00 0.73 0.81 0.00 0.45 0.59 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 D-3 3.69 0.90 0.96 0.00 0.99 0.36 0.00 0.73 0.81 0.00 0.45 0.59 0.30 0.50 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 D-4 1.75 0.90 0.96 0.00 0.99 0.36 0.01 0.73 0.81 0.00 0.45 0.59 1.53 0.90 0.22 0.46 0.00	C-14	1.53	0.90	0.96	0.00	0.09	0.36	1.53	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
D-1 3.48 0.90 0.96 0.00 0.09 0.36 0.00 0.45 0.59 3.48 0.30 0.50 0.00 0.22 0.46 0.00 0.22 0.44 0.00 0.45 0.59 D-2 0.87 0.90 0.96 0.00 0.09 0.36 0.00 0.73 0.81 0.00 0.45 0.59 0.87 0.30 0.50 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.44 0.00 0.45 0.59 D-3 3.69 0.90 0.96 0.00 0.09 0.36 0.00 0.73 0.81 0.00 0.45 0.59 3.69 0.30 0.50 0.00 0.22 0.44 0.00 0.44 0.00 0.45 0.59 D-4 1.75 0.90 0.96 0.00 0.09 0.36 0.71 0.73 0.81 0.00 0.45 0.59 0.00 0.25 0.47 0.00	C-15	0.16	0.90	0.96	0.01	0.09	0.36	0.15	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.14	0.40
D-2 0.87 0.90 0.96 0.00 0.07 0.81 0.00 0.45 0.59 0.87 0.30 0.50 0.00 0.22 0.46 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.46 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.20 0.44 0.00 0.45 0.59 D-5 1.53 0.90 0.96 0.00 0.96 0.00 0.96 0.36 0.33 0.59 0.30 0.50 0.00 0.22 0.44 0.00 0.20 0.44 0.00 0.20 0.44	D-1	3.48	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.48	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
D-3 3.69 0.90 0.96 0.00 0.09 0.36 0.00 0.73 0.81 0.00 0.45 0.59 3.69 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 D-4 1.75 0.90 0.96 0.00 0.09 0.36 0.00 0.73 0.81 0.00 0.45 0.59 0.50 0.50 0.00 0.25 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 D-5 1.53 0.90 0.96 0.00 0.96 0.00 0.36 0.81 0.00 0.45 0.59 0.82 0.30 0.50 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 D-6 0.83 0.90 0.96 0.00 0.96 0.00 0.43 0.59 0.83 0.50 0.00 0.22 0.46 0.00 0.20	D-2	0.87	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.87	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
D-4 1.75 0.90 0.96 0.00 0.09 0.36 0.00 0.73 0.81 0.00 0.45 0.59 1.75 0.30 0.50 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 D-5 1.53 0.90 0.96 0.00 0.96 0.00 0.36 0.71 0.73 0.81 0.00 0.45 0.59 0.82 0.30 0.50 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.28 0.43 D-6 0.83 0.90 0.96 0.00 0.96 0.00 0.36 0.50 0.00 0.25 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.20 0.44 0.00 0.20 0.44 0.00 0.20 0.44 0.00 0.20 0.44 0.00 0.36 0.36 0.30 0.50 0.00 0.25 0.47 0.00 0.22 <td>D-3</td> <td>3.69</td> <td>0.90</td> <td>0.96</td> <td>0.00</td> <td>0.09</td> <td>0.36</td> <td>0.00</td> <td>0.73</td> <td>0.81</td> <td>0.00</td> <td>0.45</td> <td>0.59</td> <td>3.69</td> <td>0.30</td> <td>0.50</td> <td>0.00</td> <td>0.25</td> <td>0.47</td> <td>0.00</td> <td>0.22</td> <td>0.46</td> <td>0.00</td> <td>0.20</td> <td>0.44</td> <td>0.00</td> <td>0.45</td> <td>0.59</td>	D-3	3.69	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	3.69	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
D-5 1.53 0.90 0.96 0.00 0.03 0.71 0.73 0.81 0.00 0.45 0.50 0.82 0.30 0.50 0.00 0.22 0.46 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.46 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.44 0.00 0.22 0.46 0.00 0.22 0.44 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.44 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.46 0.00 0.22 0.44 0.00 0.43 0.36 0.30 0.50 0.30 0.50 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59	D-4	1.75	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	1.75	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
D-6 0.83 0.90 0.96 0.00 0.09 0.36 0.83 0.07 0.81 0.00 0.45 0.59 0.00 0.25 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.26 $0.7a$ $0.7a$ 0.27 0.90 0.96 0.02 0.90 0.36 0.23 0.73 0.81 0.00 0.45 0.59 0.00 0.25 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.14 0.36 $D-7b$ 0.88 0.90 0.96 0.00 0.99 0.36 0.00 0.45 0.59 0.88 0.30 0.25 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.26 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.26 0.47 0.00 0.22	D-5	1.53	0.90	0.96	0.00	0.09	0.36	0.71	0.73	0.81	0.00	0.45	0.59	0.82	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.28	0.48
D-/a $0.2/$ 0.90 0.96 0.02 0.09 0.36 0.23 0.73 0.81 0.00 0.36 0.00 0.23 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.14 0.38 $D-7b$ 0.88 0.90 0.96 0.00 0.09 0.36 0.00 0.45 0.59 0.88 0.30 0.25 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 E-1 5.33 0.90 0.96 0.00 0.09 0.36 0.00 0.45 0.59 5.33 0.30 0.50 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.45 0.59 E-2 5.42 0.90 0.96 0.00 0.09 0.36 0.00 0.45 0.59 5.42 0.30 $0.$	D-6	0.83	0.90	0.96	0.00	0.09	0.36	0.83	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
D-70 0.88 0.90 <t< td=""><td>D-7a</td><td>0.27</td><td>0.90</td><td>0.96</td><td>0.02</td><td>0.09</td><td>0.36</td><td>0.23</td><td>0.73</td><td>0.81</td><td>0.00</td><td>0.45</td><td>0.59</td><td>0.00</td><td>0.30</td><td>0.50</td><td>0.00</td><td>0.25</td><td>0.47</td><td>0.00</td><td>0.22</td><td>0.46</td><td>0.00</td><td>0.20</td><td>0.44</td><td>0.00</td><td>0.14</td><td>0.38</td></t<>	D-7a	0.27	0.90	0.96	0.02	0.09	0.36	0.23	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.14	0.38
1-1 3.53 0.50 0.50 0.50 0.50 0.50 0.50 0.60 <	D-/b	0.88	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.88	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
1.2 0.76 <	E-1 F_2	5.55 5.42	0.90	0.90	0.00	0.09	0.30	0.00	0.73	0.81	0.00	0.45	0.39	5.55 5.42	0.50	0.50	0.00	0.25	0.47	0.00	0.22	0.40	0.00	0.20	0.44	0.00	0.43	0.39
E-4 6.28 0.90 0.96 0.00 0.09 0.81 0.00 0.45 0.50 0.60	E-2 F-3	3.42	0.90	0.90	0.00	0.09	0.30	0.00	0.73	0.81	0.00	0.45	0.59	3.42	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.40	0.00	0.20	0.44	0.00	0.45	0.59
E-5 1.13 0.90 0.96 0.00 0.00 0.01 0.00 0.45 0.00 0.45 0.00 0.45 0.00 0.45 0.00 0.45 0.00 0.45 0.00 0.45 0.00 0.45 0.00 0.45 0.00 0.45 0.00 0.45 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.99 0.36 E-6 0.74 0.90 0.96 0.00 0.45 0.59 0.00 0.30 0.50 0.47 0.00 0.22 0.46 0.00 0.44 0.00 0.99 0.36	E-4	6.28	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	6.28	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
E-6 0.74 0.90 0.96 0.00 0.74 0.73 0.81 0.00 0.45 0.50 0.47 0.00 0.22 0.46 0.00 0.20 0.44 0.00 0.09 0.36	E-5	1.13	0.90	0.96	0.00	0.09	0.36	1.13	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
	E-6	0.74	0.90	0.96	0.00	0.09	0.36	0.74	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36

Lot Type Ide	entification:
Lot Size (SF)	Lot Size (Acre)
0 - 8,167	= 1/8 Acre</td
8,168 - 12,704	1/4 Acre
12,705 - 18,149	1/3 Acre
18,150 - 32,670	1/2 Acre
32,671 - 43,560	1 Acre

NOTES:

C values are taken directly from Table 6-6 in the Colorado Springs DCM Vol. 1. CH. 6 (Referencing UDFCD 2001) Coeffficients use HSG A&B soils - Refer to "Appendix A: Exhibits and Figures" for soil map

Project Name:Grandview Subdivision PDRProject No.:HRG01

Calculated By: TJE Checked By: BAS Date: 9/20/23

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS: EXISTING & INTERIM

Subdivision:Grandview ReserveLocation:CO, El Paso County

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
		Pav	ved/Gravel R	oads	La	wns/Undevel	oped		Roofs		Res	idential - 1/8	Acre	Res	dential - 1/4	Acre	Res	idential - 1/3	Acre	Res	idential - 1/2	Acre	Re	sidential - 1 A	Acre		Composite
Basin ID	Total Area (ac)	C ₅	C ₁₀₀	Area (ac)	C ₅	C ₁₀₀	Area (ac)	C ₅	C ₁₀₀	Area (ac)	C ₅	C ₁₀₀	Area (ac)	C ₅	C ₁₀₀	Area (ac)	C ₅	C ₁₀₀	Area (ac)	C ₅	C100	Area (ac)	C ₅	C ₁₀₀	Area (ac)	Composite C ₅	Composite C ₁₀₀
EXISTING				•																	•						
For Existing Wes	tern Offsite Sub-ba	sin analysis,	see Rational	Calcs Include	ed, from title	ed "Eastonvill	e Road Prelin	inary Draina	age Report",	by HR Green	, September	2023															
ES-1	16.17	0.90	0.96	0.00	0.09	0.36	16.17	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
ES-2	46.05	0.90	0.96	0.00	0.09	0.36	46.05	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
ES-3	64.30	0.90	0.96	0.00	0.09	0.36	64.30	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
ES-4	2.68	0.90	0.96	0.00	0.09	0.36	2.68	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
ES-5	26.15	0.90	0.96	0.00	0.09	0.36	26.15	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
ES-6	31.26	0.90	0.96	0.00	0.09	0.36	31.26	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
INTERIM											-											-					
For Existing Wes	tern Offsite Sub-ba	sin analysis,	see Rational	Cales Include	ed, from title	ed "Eastonvill	e Road Prelin	inary Draina	age Report",	by HR Green	, September	2023															
A-1	19.53	0.90	0.96	0.00	0.09	0.36	19.53	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
EA-1	2.01	0.90	0.96	0.00	0.09	0.36	2.01	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
TSB-A1	17.49	0.90	0.96	0.00	0.09	0.36	17.49	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
TSB-A2	4.51	0.90	0.96	0.00	0.09	0.36	4.51	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
TSB-A3	9.49	0.90	0.96	0.00	0.09	0.36	9.49	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
TSB-B1	13.64	0.90	0.96	0.00	0.09	0.36	13.64	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
TSB-B2	5.12	0.90	0.96	0.00	0.09	0.36	5.12	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
TSB-B3	9.91	0.90	0.96	0.00	0.09	0.36	9.91	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
TSB-C1	6.84	0.90	0.96	0.00	0.09	0.36	6.84	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
TSB-C2	17.00	0.90	0.96	0.00	0.09	0.36	17.00	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
TSB-C3	18.56	0.90	0.96	0.00	0.09	0.36	18.56	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
TSB-D1	10.86	0.90	0.96	0.00	0.09	0.36	10.86	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
TSB-E1	20.93	0.90	0.96	0.00	0.09	0.36	20.93	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36

Lot Type Ide	entification:
Lot Size (SF)	Lot Size (Acre)
0 - 8,167	= 1/8 Acre</th
8,168 - 12,704	1/4 Acre
12,705 - 18,149	1/3 Acre
18,150 - 32,670	1/2 Acre
32,671 - 43,560	1 Acre

NOTES: C values are taken directly from Table 6-6 in the Colorado Springs DCM Vol. 1. CH. 6 (Referencing UDFCD 2001) Coeffficients use HSG A&B soils - Refer to "Appendix A: Exhibits and Figures" for soil map

Project Name: Grandview Subdivision PDR - Interim Conditions Project No.: HRG01 Calculated By: TJE

Calculated By:	IJE
Checked By:	BAS
Date:	9/9/22

STANDARD FORM SF-2: EXISTING & PROPOSED TIME OF CONCENTRATION

Sub	division:	Grandview							Projec	t Name:	Grandview	V Subdivision	PDR				
L	Location:	CO, El Pas	so County			•						Pro	ject No.:	HRG01			
						-						Calcula	ted By:	TJE			
												Chec	ked By:	BAS			
													Date:	9/20/23			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		SUB-B	ASIN	-	-	INITIA	AL/OVER	LAND		TF	RAVEL TI	ME			Tc CHECH	X	
		DA	ТА				(T _i)				(\mathbf{T}_{t})				(T _c)		FINAL
BASIN	D.A.	Hydrologic	Impervious	C ₅	C ₁₀₀	L	S	T _i	L	S	Cv	VEL.	T _t	COMP. T _c	TOTAL	Calculated T _c	T _c
ID	(AC)	Soils Group) (%)			(FT)	(%)	(MIN)	(FT)	(%)		(FPS)	(MIN)	(MIN)	LENGTH(FT)	(MIN)	(MIN)
PROPOSEI	D	-		-									_				
EA6 + EA7	1.35	А	94.9	0.86	0.93	26	2.0	1.8	630	1.7	20	2.6	4.0	5.8	656.0	13.6	5.8
EA12	0.92	A	4.2	0.11	0.37	30	10.0	4.6	95	33.0	20	11.5	0.1	4.7	125.0	10.7	5.0
For Existing	<u>g western</u>		2 0	and Prop	OSEC Easto	nville Koa	d Basin Al	nalysis, see	e Kational	Calcs Incl	udea, from	n titled "Ea	stonville 1	Koad Prelimi	1007 0	Keport^{**}, by HK	Green, Septe
A-2a	4.42	A	65.0	0.45	0.59	50	5.0	4.9	742	2.5	20	4.5	3.9	9.0	792.0	13.0	9.0
A-2b	2.75	A	88.0	0.74	0.83	250	2.0	8.3	300	2.5	20	3.2	1.6	9.9	550.0	13.1	9.9
A-3	0.36	А	100.0	0.90	0.96	18	2.0	1.2	560	1.9	20	2.8	3.4	4.6	578.0	13.2	5.0
A-4a	6.31	А	65.0	0.45	0.59	230	2.0	14.3	700	2.5	20	3.2	3.7	18.0	930.0	15.2	15.2
A-4b	3.99	Α	65.0	0.45	0.59	100	2.0	9.4	770	2.5	20	3.2	4.1	13.5	870.0	14.8	13.5
A-5	0.35	A	100.0	0.90	0.96	18	2.0	1.2	332	1.4	20	2.4	2.3	3.6	350.0	11.9	5.0
A-6	2.76	A A	65.0	0.45	0.59	217	4.5	10.6	310	1.0	20	2.0	2.6	13.2	376.0	12.9	12.9
A-8	5.44	A	75.0	0.69	0.90	250	2.0	9.4	340	2.0	20	2.8	1.9	11.2	550.0	12.1	11.2
A-9	4.91	A	65.0	0.45	0.59	160	2.0	11.9	950	1.5	20	2.4	6.5	18.4	1110.0	16.2	16.2
A-10	1.02	А	65.0	0.45	0.59	18	3.0	3.5	450	1.0	20	2.0	3.8	7.3	468.0	12.6	7.3
A-11	3.56	А	16.0	0.17	0.41	450	5.0	21.1	718	1.0	20	2.0	6.0	27.1	1168.0	16.5	16.5
B-1	3.81	A	56.8	0.39	0.52	210	3.5	12.4	560	1.7	20	2.6	3.6	16.0	770.0	14.3	14.3
B-2	4.62	A	63.5	0.44	0.58	230	3.0	12.7	611	2.5	20	3.2	3.2	15.9	841.0	14.7	14.7
B-3 B-4	4.13	A	78.5	0.43	0.39	10	2.0	3.3	700	2.7	20	3.3 2.0	5.4	9.0	714.0	14.0	9.0
B-5	5.12	A	65.0	0.45	0.59	60	1.0	9.2	946	1.0	20	2.6	6.0	15.3	1006.0	15.6	15.3
B-6	2.28	А	65.0	0.45	0.59	186	3.0	11.3	480	1.0	20	2.0	4.0	15.3	666.0	13.7	13.7
B-7	0.89	А	65.0	0.45	0.59	62	3.0	6.5	509	1.0	20	2.0	4.2	10.7	571.0	13.2	10.7
B-8	3.23	A	65.0	0.45	0.59	177	5.0	9.3	700	2.0	20	2.8	4.1	13.4	877.0	14.9	13.4
B-9	2.42	A	65.0	0.45	0.59	152	3.0	10.2	800	2.4	20	3.1	4.3	14.5	952.0	15.3	14.5
С-1	1.10	A A	65.0	0.09	0.50	65	25.0	5.1	1077	1.0	20	2.0	1.0	0.7	255.0	11.4	0.7
C-2	2.71	A	65.0	0.45	0.59	55	2.0	7.0	620	1.9	20	2.8	3.7	10.8	675.0	13.8	10.8
C-3	1.56	A	7.0	0.13	0.39	77	4.0	9.8	0	0.0	20	0.0	0.0	9.8	77.0	10.4	9.8
C-4	2.47	А	65.0	0.45	0.59	194	2.0	13.2	345	1.3	20	2.3	2.5	15.7	539.0	13.0	13.0
C-5	3.09	А	65.0	0.45	0.59	38	4.0	4.6	761	1.0	20	2.0	6.3	11.0	799.0	14.4	11.0
C-6	2.10	A	65.0	0.45	0.59	61	3.0	6.4	1176	1.0	20	2.0	9.8	16.2	1236.5	16.9	16.2
C-7a	0.81	A	44.7	0.33	0.52	142	8.3	8.3	136	2.5	15	2.4	1.0	9.3	278.0	11.5	9.3
C-8	5.11	A	65.0	0.45	0.59	58	4.0	7.2	834	1.7	20	2.5	5.5	12.0	892.0	17.5	12.0
C-9a	3.50	A	65.0	0.45	0.59	193	2.0	13.1	570	0.7	20	1.7	5.7	18.8	763.0	14.2	14.2
C-9b	3.69	А	65.0	0.45	0.59	160	3.0	10.4	665	2.0	20	2.8	3.9	14.4	825.0	14.6	14.4
C-10	3.47	A	65.0	0.45	0.59	122	3.0	9.1	1084	1.5	20	2.4	7.4	16.5	1206.0	16.7	16.5
C-11	0.46	A	65.0	0.45	0.59	26	2.0	4.8	152	0.5	20	1.4	1.8	6.6	178.0	11.0	6.6
C-12	1.66	A	65.0	0.45	0.59	160	4.0	9.5	200	0.5	20	1.4	2.4	11.8	360.0	12.0	11.8
C-13	1.53	A	2.0	0.09	0.36	300	13.0	11.5	0	1.0	20	2.0	2.9	14.2	300.0	15.2	15.2
C-15	0.16	A	8.2	0.14	0.40	72	5.0	8.7	0	0.0	20	0.0	0.0	8.7	72.0	10.4	8.7
D-1	3.48	А	65.0	0.45	0.59	170	3.0	10.8	715	1.0	20	2.0	6.0	16.7	885.0	14.9	14.9
D-2	0.87	А	65.0	0.45	0.59	10	2.0	3.0	700	1.3	20	2.3	5.1	8.1	710.0	13.9	8.1
D-3	3.69	А	65.0	0.45	0.59	140	3.0	9.8	660	2.2	20	3.0	3.7	13.5	800.0	14.4	13.5
D-4	1.75	A	65.0	0.45	0.59	50	3.0	5.8	663	2.0	20	2.8	3.9	9.7	713.0	14.0	9.7
D-5	1.53	A A	35.7	0.28	0.48	300	25.0	5.4	201	1.0	20	2.0	1./	/.1	311.0	11.7	/.1
D-7a	0.33	A	9.1	0.14	0.38	75	5.0	8.9	0	0.0	20	0.0	0.0	8,9	75.0	10.4	8.9
D-7b	0.88	A	65.0	0.45	0.59	75	8.0	5.2	478	2.0	15	2.1	3.8	8.9	553.0	13.1	8.9
E-1	5.33	А	65.0	0.45	0.59	25	4.0	3.7	1360	3.3	20	3.6	6.2	10.0	1385.0	17.7	10.0
E-2	5.42	А	65.0	0.45	0.59	20	2.0	4.2	1250	3.5	20	3.7	5.6	9.8	1270.0	17.1	9.8
E-3	3.20	A	65.0	0.45	0.59	10	2.0	3.0	965	1.5	20	2.4	6.6	9.6	975.0	15.4	9.6
E-4	6.28	A A	65.0	0.45	0.59	305	7.0	10.9	315	1.6	20	2.5	7.4	18.3	1430.0	17.9	17.9
E-6	0.74	A	2.0	0.09	0.30	350	23.0	27.5	113	2.0	10	2.0	2.0	9.8 28.8	442.0	12.5	9.0

NOTES:

 $T_i = (0.395^*(1.1 - C_5)^*(L)^0.5)/((S)^0.33)$, S in ft/ft $T_t = L/60V$ (Velocity From Fig. 501)

Velocity V=Cv*S^0.5, S in ft/ft

Tc Check = 10 + L/180

For Urbanized basins a minimum T_c of 5.0 minutes is required.

For non-urbanized basins a minimum T_c of 10.0 minutes is required

STANDARD FORM SF-2: EXISTING & INTERIM TIME OF CONCENTRATION

Subo	livision:	Grandview	Reserve									Project	Name:	Grandview	Subdivision	PDR - Interim	Conditions
L	ocation:	CO, El Paso	o County									Proj	ect No.:	HRG01			
												Calcula	ted By:	TJE			
												Check	ked By:	BAS			
													Date:	9/9/22			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		SUB-BA	SIN			INITIA	AL/OVER	LAND		TR	AVEL TI	ME			Te CHECK		
		DAT	A				(T _i)				(T _t)				(T _c)		FINAL
BASIN	D.A.	Hydrologic	Impervious	C ₅	C ₁₀₀	L	S	Ti	L	S	Cv	VEL.	Tt	COMP. T _c	TOTAL	Calculated T _c	Tc
ID	(AC)	Soils Group	(%)			(FT)	(%)	(MIN)	(FT)	(%)		(FPS)	(MIN)	(MIN)	LENGTH(FT)	(MIN)	(MIN)
EXISTING		•							-								
For Existing	Western	Offsite Sub-ba	asin analysis,	see Ratio	nal Calcs	Included, f	rom titled	"Eastony	ille Road l	Preliminar	y Drainag	e Report",	by HR Gr	een, Septeml	per 2023		
ES-1	16.17	A	2.0	0.09	0.36	300	3.3	21.6	1433	2.5	15	2.4	10.0	31.6	1732.7	19.6	31.6
ES-2	46.05	Α	2.0	0.09	0.36	300	2.5	23.6	3127	2.0	15	2.1	24.7	48.3	3427.0	29.0	48.3
ES-3	64.30	A	2.0	0.09	0.36	300	3.2	21.7	3964	2.1	15	2.2	30.4	52.1	4263.6	33.7	52.1
ES-4	2.68	A	2.0	0.09	0.36	300	2.5	23.8	462	2.4	15	2.3	3.3	27.1	762.3	14.2	27.1
ES-5	26.15	A	2.0	0.09	0.36	300	3.1	22.1	2121	2.3	15	2.3	15.6	37.7	2420.8	23.4	37.7
ES-6	31.26	A	2.0	0.09	0.36	300	3.6	20.9	1488	2.1	15	2.2	11.4	32.3	1788.5	19.9	32.3
INTERIM																	
For Existing	Western	Offsite Sub-ba	asin analysis,	see Ratio	nal Calcs	Included, f	rom titled	"Eastony	ille Road I	Preliminar	y Drainag	e Report",	by HR Gr	een, Septeml	per 2023		
A-1	19.53	A	2.0	0.09	0.36	50	2.0	10.4	1600	3.3	10	1.8	14.8	25.2	1650.0	19.2	19.2
EA-1	2.01	A	2.0	0.09	0.36	75	5.0	9.4	1037	0.8	10	0.9	19.1	28.5	1112.0	16.2	16.2
TSB-A1	17.49	A	2.0	0.09	0.36	100	2.0	14.7	1454	3.1	10	1.8	13.7	28.4	1554.0	18.6	18.6
TSB-A2	4.51	A	2.0	0.09	0.36	216	2.0	21.6	1210	1.1	10	1.1	9.3	30.9	807.0	14.5	14.5
TSB-A3	9.49	A	2.0	0.09	0.30	220	2.0	18.0	1219	1.0	10	1.0	20.3	38.9	13/9.0	17.7	17.7
TSB B2	5.12	A	2.0	0.09	0.30	230	2.0	11.4	<u> </u>	2.7	10	1.0	10.0	41.0	870.0	17.3	1/.3
TSB-B3	0.01	A	2.0	0.09	0.30	152	2.0	11.4	070	2.7	10	1.0	0.4	27.5	1131.0	14.9	14.9
TSB-C1	6.84		2.0	0.09	0.30	65	2.0	11.1	1300	2.0	10	1.7	9.4	27.3	1464.0	10.5	10.3
TSB-C2	17.00	A	2.0	0.09	0.36	50	2.0	10.4	1506	3.2	10	1.5	13.0	27.4	1556.0	18.1	18.6
TSB-C3	18.56	A	2.0	0.09	0.36	135	2.0	17.1	1553	2.0	10	1.0	18.5	35.5	1688.0	19.0	19.0
TSB-D1	10.86	A	2.0	0.09	0.36	120	2.0	16.1	1643	1.6	10	1.2	21.9	38.0	1763.0	19.8	19.8
TSB-E1	20.93	A	2.0	0.09	0.36	75	2.5	11.8	1979	1.7	10	1.3	25.3	37.1	2054.0	21.4	21.4

NOTES:

$$\begin{split} T_i &= (0.395^*(1.1 - C_5)^*(L)^*0.5)/((S)^*0.33), \ S \ in \ fl/ft \\ T_i &= L/60V \ (Velocity \ From \ Fig. \ 501) \\ Velocity \ V &= Cv^*S^*0.5, \ S \ in \ fl/ft \\ T_c \ Check &= 10 + L/180 \\ For \ Urbanized \ basins \ a \ minimum \ T_c \ of \ 5.0 \ minutes \ is \ required. \\ For \ non-urbanized \ basins \ a \ minimum \ T_c \ of \ 10.0 \ minutes \ is \ required. \end{split}$$

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

	110jec
Subdivision: Grandview Reserve	Pro
Location: CO, El Paso County	Calcula
Design Storm: 5-Year	Chec

Design Storm: 5-Year											Checked By: BAS																
	Date: 9/20/23																										
				DIRE	CT RUN	OFF			, , , , , , , , , , , , , , , , , , ,	TOTAL RUNOFF STREET PIPE TRAVELTIME																	
STREET	sign Point	sin ID	ea (Ac)	noff Coeff.	(uim)	A (Ac)	in/hr)	(cfs)	(mim)	A (Ac)	in/hr)	(cfs)	ope (%)	cet Flow (cfs)	sign Flow (cfs))pe (%)	be Size (inches)	ngth (ft)	locity (fps)	(iiiii)	REMARKS						
	De	Ba	Ar	Ru	Tc	Ű	I ()	Ø	Tc	Ű	I ()	Ø	Slo	Stı	Ď	SIG	Pij	Le	Ve	Τt							
PROPOSED	-								•	1				1	1	T	1			-							
		EA6 + EA7	1.35	0.86	5.8	1.16	4.91	5.7				5.7									East Leg of Rex Road Intersection						
		EA12	0.92	0.11	5.0	0.10	5.10	0.5				0.5									Eastonville Road Pond						
	For Exis	ting Western	Offsite Su	ıb-basin aı	nalysis and	l Proposed	d Eastonvill	le Road Ba	sin Analys	is, see Rat	ional Calo	s Include	d, from	titled "I	Eastony	/ille Roa	ad Preli	iminary	Draina	age Repor	t'', by HR Green, September 2023						
	1	A-1	11.60	0.09	9.6	1.04	4.16	4.3				4.3									Institutional Tract Basin will have own water quality & detention pond						
	2a	A-2a	4.42	0.45	8.8	1.99	4.29	8.5				8.5									On-Grade 15' CDOT Type R Inlet (0.6 cfs bypass to DP 2b)						
	21	A-2b	2.75	0.74	9.9	2.04	4.13	8.4				0.0									Summ 20/ CDOT Turne D Inlet (Descrives 0.6 of sumstances however)						
	3	A-3	0.36	0.90	5.0	0.32	5.10	1.6				9.0									ump 20' CDOT Type R Inlet (Receives 0.6 cfs upstream bypass) ump 5' CDOT Type R Inlet						
	4a	A-4a	6.31	0.45	15.2	2.84	3.44	9.8				9.8									On-Grade 15' CDOT Type R Inlet (1.2 cfs bypass to DP 4)						
	4b	A-4b	3.99	0.45	13.5	1.80	3.63	6.5				6.5									On-Grade 15' CDOT Type R Inlet (1.3 cfs bypass to DP 4) Sump 15' CDOT Type R Inlet (Receives 2.5 cfs upstream bypass)						
	5	A-5	0.35	0.90	5.0	0.32	5.10	1.6				1.6									Sump 15 CDOT Type R Inlet						
	6	A-6	2.76	0.45	12.9	1.24	3.70	4.6				4.6									On-Grade 10' CDOT Type R Inlet (0.4 cfs bypass to DP 7a)						
	7	A-7	0.23	0.90	5.0	0.21	5.10	1.1				1.1									On-Grade 5' CDOT Type R Inlet (0.1 cfs bypass to DP 7b)						
	8	A-8	5.44	0.69	11.2	3.75	3.93	14.7				14.7									Proposed Amenitity Center - Assumed 75% Imperviousness						
	7a	A-9	4.91	0.45	16.2	2.21	3.34	7.4				7.8									Sump 20' CDOT Type R Inlet (Receives 0.4 cfs upstream bypass)						
	7b	A-10	1.02	0.45	7.3	0.46	4.59	2.1				2.2									Sump 5' CDOT Type R Inlet (Receives 0.1 cfs upstream bypass)						
	8a	A-11	3.56	0.17	16.5	0.61	3.31	2.0	16.5	17.79	3.31	58.9									Total of Flows to Pond A						
	9	B-1	3.81	0.39	14.3	1.49	3.54	5.3				5.3									Sump 15' CDOT Type R Inlet						
	10a	B-2	4.62	0.44	14.7	2.03	3.50	7.1				7.1									On-Grade 10' CDOT Type R Inlet (1.6 cfs bypass to DP 10b)						
	10b	B-3	4.15	0.45	9.0	1.87	4.27	8.0				9.6									Sump 20' CDOT Type R Inlet (Receives 1.6 cfs of upstream bypass)						
	11	B-4	1.37	0.72	7.0	0.99	4.63	4.6				4.6									Sump 15' CDOT Type R Inlet						
	12a	B-5	5.12	0.45	15.3	2.30	3.43	7.9				7.9									On-Grade 10' CDOT Type R Inlet (2.0 cfs bypass to DP 12b)						
	14	B-6	2.28	0.45	13.7	1.03	3.61	3.7				3.7									On-Grade 10' CDOT Type R Inlet (0.1 cfs bypass to DP 12b)						
	15	B-7	0.89	0.45	10.7	0.40	3.99	1.6				1.6									On-Grade 10' CDOT Type R Inlet (0.0 cfs bypass to DP 12b)						
	12b	B-8	3.23	0.45	13.4	1.45	3.64	5.3				7.4									Sump 20' CDOT Type R Inlet (Receives 2.1 cfs of upstream bypass)						
	13	B-9	2.42	0.45	14.5	1.09	3.52	3.8				3.8									Sump 10' CDOT Type R Inlet						
	16	B-10	1.10	0.09	6.7	0.10	4.70	0.5	15.3	12.75	3.43	43.7									Total of flows to Pond B						
	17b	C-1	4.12	0.45	13.0	1.85	3.69	6.8				6.8									On-Grade 15' CDOT Type R (0.1 cfs bypass to DP 17e)						
	17a	C-2	2.71	0.45	10.8	1.22	3.99	4.9				4.9									On-Grade 15' CDOT Type R (1.7 cfs bypass to DP 17c)						
	17c	C-4	2.47	0.45	13.0	1.11	3.69	4.1				5.8									Receives 1.7 cfs of Bypass from DP 17a On-Grade 15' CDOT Type R (0.0 cfs bypass to DP 17d)						
		C-5	3.09	0.45	11.0	1.39	3.96	5.5													Receives 0.0 cfs of Bypass from DP 17c						

HRG01_Pr. Drainage Calcs.xlsm

Project Name: Grandview Subdivision PDR

oject No.: HRG01 lated By: TJE

, 20, 2

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Project No.: HRG01

Calculated By: TJE

 Checked By:
 BAS

 Date:
 9/20/23

Subdivision: Grandview Reserve Location: CO, El Paso County Design Storm: 5-Year

				DIRE	CT RUN	OFF			TOTAL RUNOFF STREET							PIPE	1	TRAV	VEL 7	IME					
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	l (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	l (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS				
	17d											5.5									On-Grade 15' CDOT Type R (0.0 cfs bypass to DP 17h)				
	17e	C-6	2.10	0.45	16.2	0.95	3.34	3.2				3.3									Receives 0.1 cfs of Bypass from DP 17b On-Grade 15' CDOT Type R (0.0 cfs bypass to DP 17h)				
	17f	C-8	5.11	0.45	12.7	2.30	3.73	8.6				8.6									n-Grade 15' CDOT Type R (0.6 cfs bypass to DP 17g)				
	17g	C-9a	3.50	0.45	14.2	1.58	3.54	5.6				6.2									Receives 0.6 cfs of Bypass from DP 17f On-Grade 15' CDOT Type R (0.0 cfs bypass to DP 17h)				
	17h	C-9b	3.69	0.45	14.4	1.66	3.53	5.9				5.9									ump 20' CDOT Type R (Receives 0.0 cfs of upstream bypass)				
	18a	C-7a	0.81	0.33	9.3	0.27	4.22	1.1				1.1									Drainage Swale/SW Chase - Flows to DP 18b				
	18b	C-7b	5.91	0.45	12.6	2.66	3.74	9.9	12.6	2.93	3.74	11.0									On-Grade 15' CDOT Type R (1.6 cfs bypass to DP 18c)				
	18c	C-10	3.47	0.45	16.5	1.56	3.31	5.2				6.9									Sump 15' CDOT Type R (Receives 1.6 cfs of upstream bypass)				
	19	C-11	0.46	0.45	6.6	0.21	4.72	1.0				1.0									Sump 5' CDOT Type R (Receives 0.0 cfs of upstream bypass)				
	20	C-12	1.66	0.45	11.8	0.75	3.84	2.9				2.9									Sump 5' CDOT Type R (Receives 0.0 cfs of upstream bypass)				
	21	C-13	2.37	0.09	13.2	0.21	3.66	0.8	16.5	17.72	3.31	58.7									Total combined flows to Pond C				
		C-3	1.56	0.13	9.8	0.20	4.13	0.8													Back of Lots 409-426 - Sheet Flows to MS 2				
		C-14	1.53	0.09	11.7	0.14	3.86	0.5													Un-developed area - Sheet flows to MS 2				
		C-15	0.16	0.14	8.7	0.02	4.31	0.1													Portion of Lot 444 - Sheet flows to MS 2				
	22	D-1	3.48	0.45	14.9	1.57	3.47	5.4				5.4									On-Grade 10' CDOT Type R Inlet (0.7 cfs bypass to DP 24)				
	23	D-2	0.87	0.45	8.1	0.39	4.42	1.7				1.7									On-Grade 10' CDOT Type R Inlet (0.0 cfs bypass to DP 24)				
	24	D-3	3.69	0.45	13.5	1.66	3.63	6.0				6.7									Receives 0.7 cfs of upstream bypass Sump 15' CDOT Type R Inlet				
	25	D-4	1.75	0.45	9.7	0.79	4.14	3.3				3.3									Sump 10' CDOT Type R Inlet				
	25a	D-7b	0.88	0.45	8.9	0.40	4.28	1.7				1.7									Sheet flows to Channel and Conveyed to Pond D				
	26	D-5	1.53	0.28	7.1	0.43	4.63	2.0	14.9	5.24	3.47	18.2									Total of flows to Pond D				
		D-6	0.83	0.09	11.7	0.07	3.86	0.3													Un-developed area - Sheet flows to MS				
		D-7a	0.27	0.14	8.9	0.04	4.28	0.2													Back of Lots 18-20 - Sheet Flows to MST				

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:	Grandview Reserve
Location:	CO, El Paso County
Design Storm:	5-Year

E-6

0.74

0.09

12.6

0.07

3.74

0.3

 Checked By:
 BAS

 Date:
 9/20/23
 DIRECT RUNOFF TOTAL RUNOFF STREET PIPE Design Flow (cfs) treet Flow (cfs) unoff Coeff. Design Point Slope (%) C*A (Ac) STREET Area (Ac) [¢]A (Ac) (%) asin ID Tc (min) Tc (min) (in/hr) (in/hr) Q (cfs) Q (cfs) ope 27 E-1 5.33 0.45 10.0 2.40 4.10 9.8 9.8 28 2.44 10.1 E-2 5.42 0.45 9.8 4.13 10.1 E-3 3.20 0.45 9.6 1.44 4.17 6.0 29 8.1 30 9.0 E-4 0.45 17.9 2.83 6.28 3.18 9.0 E-5 1.13 0.09 0.10 4.14 9.8 0.4 31 29.3 17.9 9.21 3.18

Project Name: Grandview Subdivision PDR

Project No.: HRG01 Calculated By: TJE

9/20/2	.3			
	TRAV	EL T	IME	
Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
				On-Grade 15' CDOT Type R Inlet (0.9 cfs bypass to DP 29)
				On-Grade 15' CDOT Type R Inlet (1.2 cfs bypass to DP 29)
				Receives 2.1 cfs of upstream bypass
				Sump 15' CDOT Type R Inlet
				Sump 20' CDOT Type R Inlet
				Total of flows to Pond E
				Un-developed area - Sheet flows to MS

STANDARD FORM SF-3: EXISTING & INTERIM

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

	Project Name: Grandview Subdivision PDR - Interim Conditions																						
Subdivision:	Grand	view Rese	rve						Project No.: HRG01														
Location:	<u>CO, E</u>	l Paso Cou	unty											Cal	culate	d By:	TJE						
Design Storm:	5-Yea	r								$\frac{\text{DAS}}{\text{Date:}}$													
																Date:	<u></u>						
		DIRECT RUNOFF							[TOTAL RUNOFF			STR	REET		PIPE		TRAV	/EL T	IME			
STREET	Jesign Point	3asin ID	Area (Ac)	tunoff Coeff.	[c (min)	℃*A (Ac)	(in/hr)	Q (cfs)	[c (min)	C*A (Ac)	(in/hr)	Q (cfs)	slope (%)	street Flow (cfs)	Design Flow (cfs)	slope (%)	ipe Size (inches)	ength (ft)	/elocity (fps)	ſt (min)	REMARKS		
EXISTING													01										
	2	EX2	321.53					28.3				17									**SEE NOTE		
	- 4	EX3	131.26					1.7				1./									**SEE NOTE		
	3	7387 A	022 50									6.1									MOTE NOTE		
	4	EX4	832.70					22.4				22.4									**SEE NOTE		
	5	EX5	22.35					7.0				7.0									**SEE NOTE		
		EX6	3.05					1.2				1.2									**SEE NOTE		
	EX7 1.47							0.9				0.9									**SEE NOTE		
	X1	ES-1	16.17	0.09	31.6	1.46	2.35	3.4				5.5									Sheet flow to Main Stem Channel Total Flow from DP 6, DP 7 & Basin ES-1		
		ES-2	46.05	0.09	48.3	4.14	1.82	7.5				26.0									Sheet flow to Main Stem Channel		
	x2 x3	ES-3	64.30	0.09	52.1	5.79	1.73	10.0				10.0									Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel		
	X4	ES-4	2.68	0.09	27.1	0.24	2.57	0.6				0.6									Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel		
	X5	ES-5	26.15	0.09	37.7	2.35	2.12	5.0				5.0									Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel		
	X6	ES-6	31.26	0.09	32.3	2.81	2.32	6.5				14.3									Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel Total Flow from DP 2, DP 3 & ES-6		
	8											88.9									Total Existing Flow offsite - outfalls to Main Stem Tributary #2 Channel		
			**For Ex	tisting We	stern Offs	site Sub-ba	isin analysi	s, see Ratio	onal Calcs	Included,	from title	d "Easton	ville Ro	oad Pre	liminar	y Drain	age Re	port", by	y HR G	reen, Se	ptember 2023		
INTERIM																							
	11	A-1	19.53	0.09	19.2	1.76	3.08	5.4				12.0									Institutional Tract-Undeveloped Combined flow from DP 2, DP 10 and A-1		
	12	EA-1	2.01	0.09	16.2	0.18	3.34	0.6				8.8									Existing Eastonville Road Combined flow from DP 5, DP 6 & EA-1		
	10	TSB-A1	17.49	0.09	18.6	1.57	3.12	4.9				11.0									Residential Undeveloped-Overland Graded		
	13	TSB-A2	4.51	0.09	14.5	0.41	3.52	1.4				1.4									Residential Undeveloped-Overland Graded		
	14	TSB-A3	9.49	0.09	17.7	0.85	3.21	2.7				2.7									Residential Undeveloped-Overland Graded		
	15	TSB-B1	13.64	0.09	17.5	1.23	3.22	4.0				4.0									Residential Undeveloped-Overland Graded		
	16	TSB-B2	5.12	0.09	14.9	0.46	3.47	1.6				1.6									Residential Undeveloped-Overland Graded		
	17	TSB-B3	9.91	0.09	16.3	0.89	3.33	3.0				8.5									Residential Undeveloped-Overland Graded Combined Flows from DP15, DP16, & TSB-B3		
	13B-C1 0.04 0.07 16.1 0.02 3.1/ 2.0 Residential Undeveloped-Overland Graded 18 TOD C2 17.00 0.00 16.7 2.0 D							Residential Undeveloped-Overland Graded															
	19	TSB-C2	17.00	0.09	18.6	1.53	3.12	4.8				4.8									Residential Undeveloped-Overland Graded		
	20	TSB-C3	18.56	0.09	19.4	1.67	3.06	5.1				11.8									Kesidential Undeveloped-Overland Graded Combined flows from DP18, DP19, & TSB-C3		
	21	198-01	10.80	0.09	19.8	0.98	5.05	5.0				3.0									Residential Undeveloped-Overland Graded		
	22	TSB-E1	20.93	0.09	21.4	1.88	2.91	5.5				5.5									Residential Undeveloped-Overland Graded		

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:	Grandview Reserve
Location:	CO, El Paso Count
Design Storm:	100-Year

				DIRE	CT RUN	OFF		,	TOTAL	RUNOF	F	ST		P		
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	
PROPOSED																
		EA6 + EA7	1.35	0.93	5.8	1.26	8.73	11.0				11.0				
		EA12	0.92	0.37	5.0	0.34	9.09	3.1				3.1				
	Fo	or Existing We	estern Offs	ite Sub-bas	sin analysis	s and Prop	osed Eastor	nville Road	Basin Ana	lvsis, see R	ational Ca	lcs Include	ed. from	titled "Eas	stonville	R
	1	A-1	11.60	0.36	9.6	4.18	7.40	30.9				30.9	-			Γ
	2a	A-2a	4.42	0.59	8.8	2.61	7.64	19.9				19.9				╞
		A-2b	2.75	0.83	9.9	2.28	7.34	16.7								╞
	2b 3	A-3	0.36	0.96	5.0	0.35	9.09	3.2				23.7 3.2				╞
	4a	A-4a	6.31	0.59	15.2	3.72	6.13	22.8				22.8				
	4b	A-4h	3 99	0.59	13.5	2 35	646	15.2				15.2				_
	4	A 5	0.35	0.06	5.0	0.34	0.10	3.1				16.1				
	5	A-J	0.55	0.50	12.0	1.62	5.05	10.7				10.7				
	0	A-0	2.76	0.59	12.9	1.63	6.58	10.7				10.7				
	7	A-7	0.23	0.96	5.0	0.22	9.09	2.0				2.0				
	8	A-8	5.44	0.81	11.2	4.41	6.99	30.8				30.8				
	7a	A-9	4.91	0.59	16.2	2.90	5.95	17.3				21.1				
	7b	A-10	1.02	0.59	7.3	0.60	8.17	4.9				5.3				
	8a	A-11	3.56	0.41	16.5	1.46	5.90	8.6	16.5	22.87	5 90	134.9				
	9	B-1	3.81	0.52	14.3	1.98	6.30	12.5	1010		0.30	12.5				
	10a	B-2	4.62	0.58	14.7	2.68	6.22	16.7				16.7				
	101	B-3	4.15	0.59	9.0	2.45	7.61	18.6				26.0				╞
	106	B-4	1.37	0.83	7.0	1.14	8.25	9.4				9.4				┢
	12a	B-5	5.12	0.59	15.3	3.02	6.11	18.5				18.5				┢
	14	B-6	2.28	0.59	13.7	1.35	6.42	8.7				8.7				
	15	B-7	0.89	0.59	10.7	0.53	7.10	3.8				3.8				╞
		B-8	3.23	0.59	13.4	1.91	6.48	12.4								┝
	12b 13	B-9	2.42	0.59	14.5	1.43	6.26	9.0				24.5 9.0				
		B-10	1.10	0.36	6.7	0.40	8.37	3.3								
	16 17b	C-1	4.12	0.59	13.0	2 / 3	6.57	16.0	15.3	16.89	6.11	103.2				
	170		2.71	0.59	10.0	1.0	7.10	10.0				11.0				
	1/a	C-2	2.71	0.59	10.8	1.00	/.10	11.4				11.4				
	17c	C-4	2.47	0.59	13.0	1.46	6.57	9.6				20.8				
	17d	C-5	3.09	0.59	11.0	1.82	7.04	12.8				20.2				
HRG01_Pr. Drainage Calcs.xlsm		C-6	2.10	0.59	16.2	1.24	5.94	7.4								

Pro	oject Na	ame:	Grand	view S	ubdivis	ion PI	DR
Cal	Project	t No.:	HRG()1			
	Culated	I DY:	BAS				
C	I	Dy: Date:	9/20/2	23			
г		DIDE		ТДАХ	7 FT T I	МЕ	
1	(s	PIPE	s)				
	Design Flow (cf	Slope (%)	Pipe Size (inche	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
							East Leg of Rex Road Intersection
							East Deg of New Road Intersection
							Lastonvine Road Pond
'East	tonville F	load Pi	relimina	ry Draiı	nage Rej	port", k	by HR Green, September 2023
							Institutional Tract
							Basin will have own water quality & detention pond On-Grade 15' CDOT Type R Inlet (7.0 cfs bypass to DP 2b)
							Sump 20' CDOT Type R Inlet (Receives 7.0 cfs upstream bypass) Sump 5' CDOT Type R Inlet
							On-Grade 15' CDOT Type R Inlet (9.0 cfs bypass to DP 4)
							On-Grade 15' CDOT Type R Inlet (7.1 cfs bypass to DP 4) Sump 15' CDOT Type R Inlet (Receives 16.1 cfs upstream bypass)
							Sump 5' CDOT Type R Inlet
							On-Grade 10' CDOT Type R Inlet (3.8 cfs bypass to DP 7a)
							On-Grade 5' CDOT Type R Inlet (0.4 cfs bypass to DP 7b)
							Proposed Amenitity Center - Assumed 75% Imperviousness
							Sump 20' CDOT Type R Inlet (Receives 3.8 cfs upstream bypass)
							Sump 5' CDOT Type R Inlet (Receives 0.4 cfs upstream bypass)
							Total of Flows to Pond A
							Sump 15' CDOT Type R Inlet
							On-Grade 10' CDOT Type R Inlet (8.3 cfs bypass to DP 10b)
							Sump 20' CDOT Type R Inlet (Receives 8.3 cfs of upstream bypass) Sump 15' CDOT Type R Inlet
							On-Grade 10' CDOT Type R Inlet (9.5 cfs bypass to DP 12b)
							On-Grade 10' CDOT Type R Inlet (2.5 cfs bypass to DP 12b)
							On-Grade 10' CDOT Type R Inlet (0.1 cfs bypass to DP 12b)
							Sump 20' CDOT Type R Inlet (Receives 12.1 cfs of upstream bypass)
							Sump 10' CDOT Type R Inlet
			1	Ì			
							Total of flows to Pond B On-Grade 15' CDOT Type R (4.3 cfs bypass to DP 17e)
							On-Grade 15' CDOT Type R (11.2 cfs bypass to DP 17c)
							Receives 11.2 cfs of Bypass from DP 17a
							On-Grade 15' CDOT Type R (7.4 cfs bypass to DP 17d) Receives 7.4 cfs of Bypass from DP 17c
							On-Grade 15' CDOT Type R (7.0 cfs bypass to DP 17h) Receives 4.3 cfs of Bypass from DP 17b
	1						Page 1 of 3 9/22/2023

Page 1 of 3 9/22/2023

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Grandview Reserve Location: CO, El Paso County Design Storm: 100-Year

DIRECT RUNOFF TOTAL RUNOFF STREET Design Flow (cfs) Street Flow (cfs) Design Point Runoff Coeff. STREET Area (Ac) '*A (Ac) Slope (%) *A (Ac) asin ID Tc (min) Tc (min) (in/hr) (in/hr) Q (cfs) (cfs) \sim 17e 11.7 17f C-8 5.11 0.59 12.7 3.01 6.63 20.0 20.0 C-9a 3.50 0.59 14.2 2.07 6.31 13.1 17g 20.0 C-9b 3.69 0.59 14.4 2.18 6.29 13.7 17h 29.5 18a 0.52 0.42 7.51 3.2 3.2 C-7a 0.81 9.3 C-7b 5.91 0.59 12.6 3.49 23.2 6.65 18b 12.6 3.91 6.65 26.0 3.47 2.05 12.1 C-10 0.59 16.5 5.90 23.3 18c C-11 0.46 0.59 6.6 0.27 8.41 2.3 2.3 19 C-12 0.59 11.8 0.98 6.83 6.7 1.66 20 6.7 C-13 2.37 0.36 13.2 0.85 6.52 5.5 21 16.5 23.87 5.90 140.8 C-3 0.39 7.35 4.5 1.56 9.8 0.61 C-14 1.53 0.36 11.7 0.55 6.87 3.8 C-15 0.40 7.68 0.5 0.16 8.7 0.06 22 12.7 D-1 3.48 0.59 14.9 2.05 6.18 12.7 23 D-2 0.87 0.59 8.1 0.51 7.88 4.0 4.0 D-3 3.69 0.59 13.5 2.18 6.46 14.1 24 19.5 25 D-4 1.75 7.37 0.59 9.7 1.03 7.6 7.6 25a D-7b 0.88 0.59 0.52 7.62 4.0 4.0 8.9 D-5 1.53 0.48 7.1 0.73 8.24 6.0 26 43.4 14.9 7.02 6.18 D-6 0.83 0.36 11.7 0.30 6.87 2.1 D-7a 0.27 0.38 8.9 0.10 7.62 0.8

Project Name: Grandview Subdivision PDR

Project No.: HRG01

Calculated By: TJE

Checked By: BAS

Date: 9/20/23

		I			
PIPE		TRAV	EL T	IME	
Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
				Ì	On-Grade 15' CDOT Type R (2.0 cfs bypass to DP 17h)
					On-Grade 15' CDOT Type R (6.9 cfs bypass to DP 17g)
					Receives 6.9 cfs of Bypass from DP 17f On-Grade 15' CDOT Type R (6.8 cfs bypass to DP 17h)
					Sump 20' CDOT Type R (Receives 15.8 cfs of upstream bypass)
					Dramage Swale/S w Chase - Flows to DF 180
					On-Grade 15' CDOT Type R (11.3 cfs bypass to DP 18c)
					Sump 15' CDOT Type R (Receives 11.3 cfs of upstream bypass)
					Sump 5' CDOT Type R (Receives 0.0 cfs of upstream bypass)
					Sump 5' CDOT Type R (Receives 0.0 cfs of upstream bypass)
					Total combined flows to Pond C
					Back of Lots 409-426 - Sheet Flows to MS 2
					Un-developed area - Sheet flows to MS 2
					Portion of Lot 444 - Sheet flows to MS 2
					On-Grade 10' CDOT Type R Inlet (5.2 cfs bypass to DP 24)
					On-Grade 10' CDOT Type R Inlet (0.2 cfs bypass to DP 24)
					Receives 5.4 cfs of upstream bypass Sump 15' CDOT Type R Inlet
					Sump 10' CDOT Type R Inlet
					Sheet flows to Channel and Conveyed to Pond D
					Total of flows to Pond D
					Un-developed area - Sheet flows to MS
					Back of Lots 18-20 - Sheet Flows to MST

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:	Grandview Reserve	
Location:	CO, El Paso County	Ca
Design Storm:	100-Year	(

				DIRE	CT RUN	OFF			r	FOTAL	RUNOF	F	ST	REET		ł
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	
	27	E-1	5.33	0.59	10.0	3.14	7.30	22.9				22.9				
	28	E-2	5.42	0.59	9.8	3.20	7.36	23.6				23.6				
	29	E-3	3.20	0.59	9.6	1.89	7.43	14.0				32.1				
	30	E-4	6.28	0.59	17.9	3.71	5.66	21.0				21.0				
	31	E-5	1.13	0.36	9.8	0.41	7.37	3.0	17.9	12.35	5.66	69.9				
		E-6	0.74	0.36	12.6	0.27	6.66	1.8								

Project Name: Grandview Subdivision PDR

Project No.: HRG01

Calculated By: TJE

Checked By: BAS

 Date:
 9/20/23

 PIPE
 TRAVEL TIME

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STANDARD FORM SF-3: EXISTING & INTERIM

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:	Grand	view Res	serve											Pro	oject N Projec	ame: t No.:	Grand HRG0	lview S)1	ubdivi	sion PI	DR - Interim Conditions
Location: Design Storm:	CO, E 100-V	l Paso Co	ounty											Cal	culate becke	d By: d By:	TJE BAS				
Design Storm.	100-1	cai												C	IIIII	Date:	9/9/22	2			
				DID	ECT DU	NOFE				TOTAL	DUDIOE		CT			DIDE		TDAX		o œ l	
				DIR	ECT RU	NOFF				TOTAL	RUNOF	f.	ST	REET	ŵ	PIPE		TRAV	EL T	IME	
STREET	sign Point	sin ID	ca (Ac)	noff Coeff.	(min)	A (Ac)	n/hr)	cfs)	(min)	A (Ac)	n/hr)	cfs)	pe (%)	eet Flow (cfs)	sign Flow (cf	pe (%)	e Size (inches	ıgth (ft)	locity (fps)	(min)	REMARKS
VICTING	De	Bas	Are	Rui	Tc	Č	I (ii	ŏ	Tc	Č	I (ii	0 0	Slo	Str	De	Slo	Pip	Ler	Vel	Ĕ	
AISTING	1 1	EX2	321.53				1	18.8		1			1 1	1	1						**SEE NOTE
	2											18.8									
	3	EX3	131.26					112.1				112.1									**SEE NOTE
	4	EX4	832.70					491.0				491.0									**SEE NOTE
	5	EX5	22.35					43.3				43.3									**SEE NOTE
	6	EX6	3.05					6.9				6.9									**SEE NOTE
	7	EX7	1.47					4.2				4.2									**SEE NOTE
	X1	ES-1	16.17	0.36	31.6	5.82	4.19	24.4				35.5									Sheet flow to Main Stem Channel Total Flow from DP 6, DP 7 & Basin ES-1
	x2	ES-2	46.05	0.36	48.3	16.58	3.24	53.7				588.0									Sheet flow to Main Stem Channel Total Flow from DP 4, DP 5 & Basin FS-2
	X3	ES-3	64.30	0.36	52.1	23.15	3.09	71.5				71.5									Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel
	X4	ES-4	2.68	0.36	27.1	0.96	4.57	4.4				4.4									Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel
	X5	ES-5	26.15	0.36	37.7	9.41	3.77	35.5				35.5									Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel
	X6	ES-6	31.26	0.36	32.3	11.25	4.13	46.5				177.4									Sheet flow offiste - outfalls to Main Stem Tributary #2 Channel Total Flow from DP 2, DP 3 & ES-6
	8											568.8									Total Existing Flow offsite - outfalls to Main Stem Tributary #2 Channel
			For E	xisting W	estern Off	fsite Sub-b	asin analy	sis, see Rati	ional Calo	s Included	, from titl	ed "Easto	nville R	oad Prelin	inary I	Drainag	е Repoi	rt", by I	IR Gre	en, Sept	tember 2023
NTERIM																					
	11	A-1	19.53	0.36	19.2	7.03	5.48	38.5				185.7									Institutional Tract-Undeveloped Combined flow from DP 2, DP 10 and A-1
	12	EA-1	2.01	0.36	16.2	0.72	5.95	4.3				15.4									Existing Eastonville Road Combined flow from DP 5, DP 6 & EA-1
	10	TSB-A1	17.49	0.36	18.6	6.30	5.56	35.0				526.0									Residential Undeveloped-Overland Graded Combined flow from DP 3 and TSB-A1
	13	TSB-A2	4.51	0.36	14.5	1.62	6.26	10.1				10.1									Residential Undeveloped-Overland Graded
	14	TSB-A3	9.49	0.36	17.7	3.42	5.71	19.5				19.5									Residential Undeveloped-Overland Graded
	15	TSB-B1	13.64	0.36	17.5	4.91	5.73	28.1				28.1									Residential Undeveloped-Overland Graded
	16	TSB-B2	5.12	0.36	14.9	1.84	6.18	11.4				11.4									Residential Undeveloped-Overland Graded
	17	TSB-B3	9.91	0.36	16.3	3.57	5.93	21.2				60.7									Residential Undeveloped-Overland Graded Combined Flows from DP15, DP16, & TSB-B3
	18	TSB-C1	6.84	0.36	18.1	2.46	5.63	13.8				13.8									Residential Undeveloped-Overland Graded
	19	TSB-C2	17.00	0.36	18.6	6.12	5.56	34.0				34.0									Residential Undeveloped-Overland Graded
	20	TSB-C3	18.56	0.36	19.4	6.68	5.45	36.4				84.3									Residential Undeveloped-Overland Graded Combined flows from DP18, DP19, & TSB-C3
	21	TSB-D1	10.86	0.36	19.8	3.91	5.39	21.1				21.1									Residential Undeveloped-Overland Graded
	22	TSB-E1	20.93	0.36	21.4	7.53	5.18	39.0				39.0									Residential Undeveloped-Overland Graded

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APPENDIX C

Hydraulic Computations



INLET ON A CONTIN	JUOUS G	RADF		
MHFD-Inlet, Version 5.0	1 (April 2021)			
r				
H-Curb Dury		5		
H-Vert Wb				
Lo (G)				
		MINOP	MAIOP	
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	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L ₀ =	15.00	5.00	ft
Clogging Factor for a Single Unit Grate (typical min value = 0.5)	vv _o =	N/A N/A	N/A N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C-C =	0.10	0.10	-
Street Hydraulics: OK - Q < Allowable Street Capacity'	2, 2	MINOR	MAJOR	
Design Discharge for Half of Street (from Inlet Management)	$Q_o =$	8.5	19.9	cfs
Water Spread Width	T =	13.2	16.0	ft
Water Depth at Flowline (outside of local depression)	d =	3.8	5.0	inches
Ratio of Gutter Flow to Design Flow	u _{CROWN} =	0.183	0.130	Inches
Discharge outside the Gutter Section W, carried in Section T_x	$\overline{Q}_{x} = \overline{Q}_{x}$	6.6	16.4	cfs
Discharge within the Gutter Section W	Q _w =	1.5	2.5	cfs
Discharge Behind the Curb Face	Q _{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	$A_W =$	0.23	0.32	sq ft
Velocity within the Gutter Section W Water Denth for Design Condition	v _w =	6.3	7.8	Tps inches
Grate Analysis (Calculated)	ulocal - I	MINOR	MAJOR	Inches
Total Length of Inlet Grate Opening	L =[N/A	N/A	ft
Ratio of Grate Flow to Design Flow	E _{o-GRATE} =	N/A	N/A	
Under No-Clogging Condition	у Г	MINOR	MAJOR	6
Minimum velocity where Grate Splash-Over Begins	V ₀ =	N/A N/A	N/A N/A	rps
Interception Rate of Side Flow	R _f =	N/A N/A	N/A	_
Interception Capacity	$Q_i =$	N/A	N/A	cfs
Under Clogging Condition	-	MINOR	MAJOR	_
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	_
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A N/A	
Minimum Velocity Where Grate Splash-Over Begins		N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	
Interception Rate of Side Flow	R _x =	N/A	N/A	
Actual Interception Capacity	$Q_a =$	N/A	N/A	cfs
Carry-Over Flow = $Q_0 - Q_a$ (to be applied to curb opening or next d/s inlet)	Q _b =	N/A MINOP	MA1OP	CTS
Equivalent Slope S. (based on grate carry-over)	s. =[0.087	0.068	ft/ft
Required Length L_T to Have 100% Interception	L _T =	18.41	31.80	ft
Under No-Clogging Condition	-	MINOR	MAJOR	_
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	15.00	15.00	ft
Interception Capacity	$Q_i = [$		12.9 MA10P	CTS
Clogging Contractor	CurbCoef =	1.31	1.31	7
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	-
Effective (Unclogged) Length	$L_e =$	14.34	14.34	ft
Actual Interception Capacity	$Q_a =$	7.7	12.8	cfs
$\frac{ \text{Larry-Uver FIOW} = Q_{h/GRATE} Q_a}{ \text{Summary}}$	Q _b =	U.8	MA10P	CTS
Total Inlet Interception Capacity	o = [7.7	12.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$\vec{Q_b} = \vec{Q_b}$	0.8	7.1	cfs
Capture Percentage $= 0 / 0 =$	<u>c%</u> –	90	64	9/2

MHFD-Inlet, Version 5.01	! (April 2021)
ALLOWABLE CAPACITY FOR ONE-HALF C	OF STREET (Minor & Major Storm
(Based on Regulated Criteria for Maximum Al	lowable Flow Depth and Spread)
Basin A-2b (DP2b)	
Gutter Geometry: Maximum Allowable Width for Spread Behind Curb	T _{new} = 75 ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{\text{pack}} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{\text{BACK}} = 0.020$
	UDACK 0.020
Height of Curb at Gutter Flow Line	H _{CURB} = 6.00 linches
Distance from Curb Face to Street Crown	$T_{CROWN} = 16.0$ ft
Gutter Width	W = 0.83 ft
Street Transverse Slope	$S_{x} = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_W = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n _{STREET} = 0.016
May Allowable Enroad for Minor & Major Storm	Minor Storm Major Storm
Max. Allowable Spread for Minor & Major Storm	$I_{MAX} = 10.0$ 10.0 It
Max. Allowable Depth at Gutter Flowline for Million & Major Storm	$u_{MAX} = 4.4$ 7.7 incres
Check boxes are not applicable in SUMP conditions	
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm
Water Depth without Gutter Depression (Eq. ST-2)	v = 3.84 3.84 linches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_c = 0.8$ 0.8 inches
Gutter Depression (d_c - (W * S _v * 12))	a = 0.63 0.63 inches
Water Depth at Gutter Flowline	d = 4.47 4.47 inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_x = 15.2$ 15.2 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.149 0.149$
Discharge outside the Gutter Section W, carried in Section T _x	$Q_{\rm X} = 0.0 0.0 {\rm cfs}$
Discharge within the Gutter Section W ($Q_T - Q_X$)	$Q_W = 0.0 0.0 cfs$
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 cfs$
Maximum Flow Based On Allowable Spread	Q _T = SUMP SUMP cfs
Flow Velocity within the Gutter Section	V = 0.0 0.0 fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d = 0.0 0.0
Maximum Canacity for 1/2 Street based on Allowable Denth	Minor Storm Major Storm
Theoretical Water Spread	$T_{Tru} = \begin{bmatrix} 15.6 \\ 29.4 \end{bmatrix} ft$
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{VTU} = 14.7$ 28.6 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Fg. ST-7)	$E_0 = 0.153 0.079$
Theoretical Discharge outside the Gutter Section W. carried in Section Tyme	$O_{VTH} = 0.0 0.000 \text{ cfs}$
Actual Discharge outside the Gutter Section W. (limited by distance Transition)	$Q_{\rm v} = 0.0$ 0.0 cfs
Discharge within the Gutter Section W ($Q_d - Q_v$)	$O_{W} = 0.0 0.0 cfs$
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 cfs$
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	O = 0.0 0.0 cfs
Average Flow Velocity Within the Gutter Section	V = 0.0 0.0 fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d = 0.0 0.0
Slope-Based Depth Safety Reduction Factor for Major & Minor (d > 6") Storm	R = SUMP SUMP
Max Flow Based on Allowable Depth (Safety Factor Applied)	Q _d = SUMP SUMP cfs
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d = inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} = inches
Resultant new Depth of Succe crown (Succe) ructor Applica	
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm



Verify this input value and warning, as it appears on several sheets

MHFD-Inlet, Version 5.01	! (April 2021)
ALLOWABLE CAPACITY FOR ONE-HALF C	OF STREET (Minor & Major Storm)
(Based on Regulated Criteria for Maximum Al	lowable Flow Depth and Spread)
): Basin A-3 (DP3)	
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} = 0.020
Height of Curb at Gutter Flow Line	H _{CURB} = 6.00 inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 16.0$ ft
Gutter Width	W = 2.00 ft
Street Transverse Slope	$S_{x} = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_{W} = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{\text{STREET}} = 0.016$
	Minor Storm Major Storm
Max. Allowable Spread for Minor & Maior Storm	$T_{MAX} = 16.0$ 16.0 ft
Max. Allowable Depth at Gutter Flowline for Minor & Maior Storm	$d_{MAX} = 4.4$ 7.7 inches
Check boxes are not applicable in SUMP conditions	
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm
Water Depth without Gutter Depression (Eq. ST-2)	y = <u>3.84</u> inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$a_c = 2.0 2.0$ inches
Gutter Depression ($a_c - (W + S_x + 12)$)	a = <u>1.51</u> inches
Water Depth at Gutter Flowline	d = 5.35 5.35 incres
Allowable Spread for Discharge outside the Gutter Section W (1 - W)	$I_X = 14.0$ 14.0 π
Discharge outside the Cutter Section W, carried in Section T	$E_0 = 0.372 0.372$
Discharge within the Gutter Section W $(Q = Q)$	$Q_{\rm X} = 0.0 0.0 {\rm cm}$
Discharge Behind the Curb (e.g., sidewalk, drivewaye, & lawns)	$Q_W = 0.0 0.0 \text{ Crs}$
Maximum Elow Based On Allowable Spread	$Q_{BACK} = 0.0 0.0 \text{ CIS}$
Flaw Valacity within the Cutter Section	$V_T = 0.0$ 0.0 from
V*d Product: Flow Velocity times Gutter Flowline Depth	V = 0.0 0.0 (ps)
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm Major Storm
Theoretical Water Spread	$I_{TH} = 11.9$ 25.7 ft
I neoretical Spread for Discharge outside the Gutter Section W (1 - W)	$I_{XTH} = 9.9 23.7 \text{ ft}$
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. SI-7)	$E_0 = 0.497 0.228$
Actual Discharge outside the Gutter Section W, Carried In Section I _{X TH}	$Q_{XTH} = 0.0 0.0 \text{ crs}$
Actual Discharge outside the Gutter Section W, (Imited by distance T_{CROWN})	$Q_X = 0.0 0.0 \text{CTS}$
Discharge within the Gutter Section W ($Q_d - Q_X$)	$Q_W = 0.0 0.0 \text{ crs}$
Discharge berlind the Curb (e.g., sluewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 CTS$
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 0.0 0.0 CTS
Average Flow Velocity Within the Gutter Section	v = 0.0 0.0 Jps
Signe-Based Depth Safety Reduction Factor for Major & Minor (d > 6") Storm	
Max Flow Based on Allowable Denth (Safety Factor Applied)	
Recultant Flow Denth at Gutter Flowline (Safety Factor Applied)	
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} = inches
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm

INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021) -Lo (C) H-Curb H-Vert Wo w Lo (G) CDOT Type R Curb Opening • Design Information (Input) MINOR MAJOR Type of Inlet CDOT Type R Curb Opening Type = Local Depression (additional to continuous gutter depression 'a' from above) 3.00 inches a_{local} Number of Unit Inlets (Grate or Curb Opening) Water Depth at Flowline (outside of local depression) $N_0 =$ Override Depths Ponding Depth = 4.4 inches Grate Information MINOF MAJOR Length of a Unit Grate $L_{0}(G) =$ N/A feet Width of a Unit Grate $W_o =$ N/A N/A feet Area Opening Ratio for a Grate (typical values 0.15-0.90) A_{ratio} = N/A 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 Grate Orifice Coefficient (typical value 0.60 - 0.80) Ċ₀ (G) N/A NL/ Curb Opening Information MINOR MAJOR Length of a Unit Curb Opening $L_{o}(C) =$ 5.00 feet Height of Vertical Curb Opening in Inches 6.00 inches H_{vert} = Height of Curb Orifice Throat in Inches inches 6.00 H_{throat} = Angle of Throat (see USDCM Figure ST-5) Theta = 63.40 degrees Side Width for Depression Pan (typically the gutter width of 2 feet) $W_p =$ 2.00 eet Clogging Factor for a Single Curb Opening (typical value 0.10) 0.10 $C_{f}(C) =$ 0.10 Curb Opening Weir Coefficient (typical value 2.3-3.7) Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) $C_{w}(C) = C_{o}(C) =$ 3.60 3.60 0.67 0.67 Grate Flow Analysis (Calculated) MINOF MAJOR Clogging Coefficient for Multiple Units Coef = N/A N/A Clogging Factor for Multiple Units Clog = N/A N/A Grate Capacity as a Weir (based on Modified HEC22 Method) MAJOR MINOR Interception without Clogging Q_{wi} = N/A N/A lcfs Interception with Clogging Grate Capacity as a Orifice (based on Modified HEC22 Method) cfs Q_{wa} = N/A N/A MINOR MAJOR Interception without Clogging N/A N/A cfs Q_{oi} : Interception with Clogging Grate Capacity as Mixed Flow $Q_{oa} =$ N/A N/A lcfs MINOF MAJOR Interception without Clogging Q_{mi} = cfs N/A N/A Interception with Clogging Q_{ma} = N/A N/A cfs Resulting Grate Capacity (assumes clogged of Curb Opening Flow Analysis (Calculated) QGrate = N/A N/A cfs clogged condition MINO Major Clogging Coefficient for Multiple Units Coef = 1.00 1.00 Clogging Factor for Multiple Units Clog = 0.10 0.10 Curb Opening as a Weir (based on Modified HEC22 Method) MINOF MAJOR Interception without Clogging Q_{wi} = 10.1 cfs 2.7 Interception with Clogging Q_{wa} = 2.4 9.1 cfs Curb Opening as an Orifice (based on Modified HEC22 Method) MINOR MAJOR Interception without Clogging cfs $Q_{0i} =$ 8.4 11.0 Interception without clogging Interception with Clogging Curb Opening Capacity as Mixed Flow 7.6 9.9 cfs $Q_{oa} =$ MINOR MAJOR Interception without Clogging Q_{mi} = 4.4 9.8 cfs Interception with Clogging Q_{ma} = 4.0 88 cfs Q_{Curb} Resulting Curb Opening Capacity (assumes clogged condition) Resultant Street Conditions 2.4 8.8 cfs MINOF MAJOR Total Inlet Length 5.00 feet 1 = 5.00 ft.>T-Crown 25.7 Resultant Street Flow Spread (based on street geometry from above) T = 11.9 Resultant Flow Depth at Street Crown d_{CROWN} 0.0 2.3 inches Low Head Performance Reduction (Calculated) MINOR MAJOR Depth for Grate Midwidth d_{Grate} = N/A 0.20 N/A 0.47 lft Depth for Curb Opening Weir Equation ft d_{Curb} Combination Inlet Performance Reduction Factor for Long Inlets 0.56 RF_{Combination} = 0.98 Curb Opening Performance Reduction Factor for Long Inlets RF_{Curb} = 1.00 1.00

	Curb			
Grated Inlet Performance Reduction Factor for Long Inlets	RF _{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q _a =	2.4	8.8	cfs
Inlet Canacity IS GOOD for Minor and Major Storms(>O PEAK)	Q PEAK REQUIRED =	1.6	3.0	cfs



INLET ON A CONTIN	NUOUS G	RADE		
MHFD-Inlet, Version 5.0	01 (April 2021)			
r				
H-Curb TH Mat				
- Wo				
	-			
Lo (G)				
CDOT Type R Curb Opening				
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R	Curb Opening	linghos
Total Number of Units in the Inlet (Grate or Curb Opening)	alocal =	<u> </u>	5.0	inches
Length of a Single Unit Inlet (Grate or Curb Opening)	L ₀ =	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	-
Street Hydraulics: OK - O < Allowable Street Capacity'	ل-1 = [MINOR	MAIOR	
Design Discharge for Half of Street (from <i>Inlet Management</i>)	$Q_0 = \int$	9.8	22.8	cfs
Water Spread Width	T =	14.2	16.0	ft
Water Depth at Flowline (outside of local depression)	d =	4.0	5.3	inches
Water Depth at Street Crown (or at I _{MAX})	d _{CROWN} =	0.0	0.9	inches
Discharge outside the Gutter Section W. carried in Section T _v	$C_0 = 0$	8.1	20.0	cfs
Discharge within the Gutter Section W	$Q_w^2 =$	1.7	2.8	cfs
Discharge Behind the Curb Face	Q _{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _W =	0.25	0.34	sq ft
Velocity within the Gutter Section W Water Depth for Design Condition	V _W =	<u> </u>	8.2	TDS inches
Grate Analysis (Calculated)	GLOCAL - 1	MINOR	MAJOR	Inches
Total Length of Inlet Grate Opening	L = [N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o-GRATE} =$	N/A	N/A	
Under No-Clogging Condition	v – F	MINOR	MAJOR	Ifoc
Interception Rate of Frontal Flow	$V_0 = R_f = I$	N/A	N/A	
Interception Rate of Side Flow	$R_x =$	N/A	N/A	
Interception Capacity	Q _i =	N/A	N/A	cfs
Under Clogging Condition	.	MINOR	MAJOR	-
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoet =	N/A	N/A N/A	_
Effective (unclogged) Length of Multiple-unit Grate Inlet	L, =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V _o =	N/A	N/A	fps
Interception Rate of Frontal Flow	$R_f =$	N/A	N/A	_
Interception Rate of Side Flow	R _x =	N/A	N/A	-
Carry-Over Flow = O_0 - O_0 (to be applied to curb opening or next d/s inlet)	$Q_a = 0_b = 0$	N/A	N/A N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S _e (based on grate carry-over)	S _e =	0.082	0.064	ft/ft
Required Length L_T to Have 100% Interception	L _T = L	20.84 MINOR	35.80 MATOR	tt
Effective Length of Curb Opening or Slotted Inlet (minimum of L. L.)	I = [15,00	15.00	Tft
Interception Capacity	$Q_i =$	8.8	14.2	cfs
Under Clogging Condition		MINOR	MAJOR	_
Clogging Coefficient	CurbCoef =	1.31	1.31	_
Ffective (Uncloaged) Length		13,03	13.03	
Actual Interception Capacity	$\mathbf{Q}_{a}^{e} = \mathbf{Q}_{a}^{e}$	8.6	13.8	cfs
Carry-Over Flow = Q _{b/(GRATE)} -Q _a	Q _b =	1.2	9.0	cfs
Summary		MINOR	MAJOR	
rotal Inlet Interception Capacity	Q =	8.6	13.8	CTS CTS
Canture Percentage = Ω_2/Ω_2 =	<u>ч</u> ь –	88	61	



INLET ON A CONTIN	NUOUS G	RADE		
MHFD-Inlet, Version 5.0	1 (April 2021)			
r				
H-Curb H-Vert				
- Wo				
Lo (G)				
		MINOD		
<u>Design Information (Input)</u> Type of Inlet	Type -	CDOT Type R	MAJOR 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	10.00	ft
Wight of a Unit Grate (cannot be greater than W, Gutter Wigth) Clogging Factor, for a Single Unit Grate (typical min, value = 0.5)	w _o =	N/A N/A	N/A N/A	- ''
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	CF-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	_
Design Discharge for Half of Street (from <i>Inlet Management</i>)	$Q_0 =$	6.5	15.2	cfs
Water Spread Width Water Denth at Flowling (outcide of local depression)	T =	12.1	16.0	ft inches
Water Depth at Street Crown (or at T _{MAX})		0.0	0.2	inches
Ratio of Gutter Flow to Design Flow	$E_0 =$	0.200	0.142	
Discharge outside the Gutter Section W, carried in Section T_x	$Q_x =$	5.2	13.1	cfs
Discharge within the Gutter Section W	Q _w =	1.3	2.2	cfs
Flow Area within the Gutter Section W		0.0	0.29	so ft
Velocity within the Gutter Section W	V _W =	6.0	7.4	fps
Water Depth for Design Condition	d _{LOCAL} =	6.5	7.7	inches
Grate Analysis (Calculated)	F	MINOR	MAJOR	74
Ratio of Grate Flow to Design Flow	E = E	N/Α	N/A N/A	
Under No-Clogging Condition	-O-GRATE	MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V _o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	_
Interception Rate of Side Flow	$R_x = 0$	N/A N/A	N/A N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Minimum Velocity Where Grate Splash-Over Begins	L _e = V. =	N/A N/A	N/A N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	- 190
Interception Rate of Side Flow	R _x =	N/A	N/A	
Actual Interception Capacity	$Q_a =$	<u>N/A</u>	N/A	cfs
Carry-Over Flow = $Q_0 \cdot Q_0$ (to be applied to curb opening or flext d/s milet) Curb or Slotted Inlet Opening Analysis (Calculated)	Q _b =	MINOR	MA1OR	CIS
Equivalent Slope S _e (based on grate carry-over)	S _e =	0.093	0.072	ft/ft
Required Length L_T to Have 100% Interception	L _T = [15.94	27.68	ft
Under No-Clogging Condition	, г	MINOR	MAJOR	1 4
Interception Capacity	L = 0; =	5,4	8.4	
Under Clogging Condition	-ει - L	MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Actual Interception Capacity	L _e = O ₂ =	6./5 5,2	8.1	- Cfs
Carry-Over Flow = $Q_{b(GRATE)}$ - Q_a	$\frac{\mathbf{Q}_{\mathbf{b}}}{\mathbf{Q}_{\mathbf{b}}} =$	1.3	7.1	cfs
Summary		MINOR	MAJOR	<u></u>
I otal Inlet Interception Capacity	Q =	5.2	8.1	cfs
Canture Percentage = Ω_2/Ω_2 =	Q _b =	80	53	

ALLOWABLE CAPACITY FOR ONE-HALF O	F STREET (Min	or & Ma	ior Stori
(Based on Regulated Criteria for Maximum All	owable Flow Depth and Sp	read)	
Grandview Reserve			
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} = 0.020]	
Height of Curb at Gutter Flow Line	Hauss = 6.00	Tinches	
Distance from Curb Face to Street Crown	T - 16.0	4	
Cuttor Width	10.0		
Street Transverse Slope	S - 0.020		
Gutter Croce Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_{X} = 0.020$		
Street Longitudinal Slone - Enter A for sump condition	S _w = 0.085		
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$3_0 = 0.000$		
	INSTREET - 0.010	-	
	Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T _{MAX} = 16.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d _{MAX} = 4.4	7.7	inches
Check boxes are not applicable in SUMP conditions			-
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm	Major Storm	_
Water Depth without Gutter Depression (Eq. ST-2)	y =3.84	3.84	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d _C = 2.0	2.0	inches
Gutter Depression (d _C - (W * S _x * 12))	a = 1.51	1.51	inches
Water Depth at Gutter Flowline	d = 5.35	5.35	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_{x} = 14.0$	14.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.372$	0.372	4.
Discharge outside the Gutter Section W, carried in Section T_{χ}	$Q_{X} = 0.0$	0.0	cfs
Discharge within the Gutter Section W ($Q_T - Q_X$)	Q _W = 0.0	0.0	cts
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0$	0.0	cfs
Maximum Flow Based On Allowable Spread	$Q_T = SUMP$	SUMP	cts
Flow Velocity within the Gutter Section	V = 0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d = 0.0	0.0	
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm	Major Storm	
Theoretical Water Spread	T _{TH} = 11.9	25.7	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	T _{X TH} = 9.9	23.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E ₀ = 0.497	0.228	
Theoretical Discharge outside the Gutter Section W, carried in Section T_{XTH}	Q _{X TH} = 0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN})	Q _X = 0.0	0.0	cfs
Discharge within the Gutter Section W ($Q_d - Q_X$)	Q _W = 0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q _{BACK} = 0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 0.0	0.0	cfs
Average Flow Velocity Within the Gutter Section	V = 0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d = 0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm	R = SUMP	SUMP	7
Max Flow Based on Allowable Depth (Safety Factor Applied)		SUMP	cfs
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =		inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} =		inches
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm	Major Storm	
MATOR CTORM Allowship Consists in based in R. 19 C. 2011			

INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAIOR	
Type of Inlet CDOT Type R Curb Opening	Type -		Curb Opening	۱ I
Legal Depression (additional to continuous sutter depression is) from above)	Type –	2.00		inchos
Local Depression (additional to continuous gutter depression a from above)	d _{local} =	5.00	5.00	Inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	linches
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 ₀ =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =	N/A	N/A	1
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_{\epsilon}(G) =$	N/A	N/A	
Grate Weir Coefficient (typical value 2 15 - 3 60)	(-) (-) (-)	N/A	N/A	- 1
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C (C) -	N/A	N/A	-
Guile Onlice Coefficient (typical value 0.00 - 0.00)	$C_0(0) =$	N/A	IN/A]
Curb Opening Information		MINUR		76
Length of a Unit Curb Opening	$L_0(C) =$	15.00	15.00	Ireet
Height of Vertical Curb Opening in Inches	H _{vert} =	6.00	6.00	linches
Height of Curb Orifice Throat in Inches	H _{throat} =	6.00	6.00	linches
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)	$C_{m}(C) =$	3.60	3.60	1
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_{0}(C) =$	0.67	0.67	- 1
Grate Flow Analysis (Calculated)	-0 (-)	MINOR	MAIOR	<u> </u>
Clogging Coefficient for Multiple Units	Coof -			ר ר
		N/A	IN/A	-
Clogging Factor for Multiple Units	Clog =	N/A	N/A]
Grate Capacity as a weir (based on Modified HEC22 Method)		MINOR	MAJOR	٦.
Interception without Clogging	Q _{wi} =	N/A	N/A	cts
Interception with Clogging	Q _{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q _{oi} =	N/A	N/A	cfs
Interception with Clogging	Q _{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	-
Interception without Clogging	O _{mi} =	N/A	N/A	lcfs
Interception with Clogging	Om =	N/A	N/A	cfs
Resulting Grate Canacity (assumes clogged condition)	O _{Grate} =	N/A	N/A	cfs
Curb Opening Flow Analysis (Calculated)	Colate	MINOR	MAIOR	1414
Clossing Coefficient for Multiple Units	Coof -	1 21	1 21	ר ר
Clogging Coefficient for Multiple Units		1.51	1.51	-
Crude On animal and Main (hand an Madified UECOO Mathad)	ciog =	0.04	0.04]]
Curb Opening as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	ч .
Interception without Clogging	Q _{wi} =	3.9	19.2	crs
Interception with Clogging	Q _{wa} =	3.8	18.4	cfs
Curb Opening as an Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	_
Interception without Clogging	Q _{oi} =	25.2	32.9	cfs
Interception with Clogging	Q _{oa} =	24.1	31.5	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	-
Interception without Clogging	O _{mi} =	9.2	23.4	lcfs
Interception with Clogging	0m =	8.8	22.4	cfs
Resulting Curb Opening Canacity (assumes clogged condition)	Q _{curb} =	3.8	18.4	cfs
Resultant Street Conditions	Cours	MINOR	MAIOR	
Total Jalot Longth	ı _	15.00	15.00	foot
Pagultant Street Flow Streed (based on street seemstry from shows)	L - T -	11.0	15.00	ft a T Crown
Resultant Sueet Flow Spread (based on sueet geometry nom above)	- I -	11.9	25.7	linehoo
Resultant riow Depth at Street Crown	u _{CROWN} =	0.0	2.3	linches
Louis Lload Developmenton Deduction (C-1-1-1-1-1)		MINOD	144300	
Low near Performance Reduction (Calculated)		MINOR	MAJOR	٦. ا
Depth for Grate Midwidth	d _{Grate} =	N/A	N/A	In I
Depth for Curb Opening Weir Equation	d _{Curb} =	0.20	0.47	_ft
Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	0.41	0.72	
Curb Opening Performance Reduction Factor for Long Inlets	RF _{Curb} =	0.67	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets	RF _{Grate} =	N/A	N/A]
-				-
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	0 . =	3.8	18.4	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>O PEAK)	Q PEAK REQUIRED =	2.5	16.1	cfs

MHFD-Inlet, Version 5.01	(April 2021)
ALLOWABLE CAPACITY FOR ONE-HALF C	F STREET (Minor & Major Storm
(Based on Regulated Criteria for Maximum All	owable Flow Depth and Spread)
Basin A-5 (DP5)	
Gutter Geometry:	
Maximum Allowable Width for Spread Behind Curb	T ₁₀₀ = 75 ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{\text{BACK}} = 0.020 \text{ ft/ft}$
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{\text{BACK}} = 0.020$ hyre
rianning's Roughness bening carb (typically between 0.012 and 0.020)	11BACK - 0.020
Height of Curb at Gutter Flow Line	House = 6.00 inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 16.0$ ft
Gutter Width	W = 2.00 ft
Street Transverse Slope	$S_{\rm x} = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_{\rm W} = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000 \text{ ft/ft}$
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	
(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	-Sheet
	Minor Storm Maior Storm
Max. Allowable Spread for Minor & Major Storm	T _{MAX} = 16.0 16.0 ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d _{MAX} = 4.4 7.7 inches
Check boxes are not applicable in SUMP conditions	
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm
Water Depth without Gutter Depression (Eq. ST-2)	y = 3.84 3.84 inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d _C = 2.0 2.0 inches
Gutter Depression (d_c - (W * S_x * 12))	a = 1.51 1.51 inches
Water Depth at Gutter Flowline	d = 5.35 5.35 inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_{\rm X} = 14.0$ 14.0 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.372 0.372$
Discharge outside the Gutter Section W, carried in Section T_X	$Q_X = 0.0 0.0 cfs$
Discharge within the Gutter Section W ($Q_T - Q_X$)	$Q_W = 0.0 0.0$ cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0$ cfs
Maximum Flow Based On Allowable Spread	Q _T = SUMP SUMP cfs
Flow Velocity within the Gutter Section	V = 0.0 0.0 fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d = 0.0 0.0
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm Major Storm
Theoretical Water Spread	$T_{TH} = 11.9$ 25.7 ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	T _{X TH} = 9.9 23.7 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.497 0.228$
Theoretical Discharge outside the Gutter Section W, carried in Section T_{XTH}	$Q_{XTH} = 0.0 0.0 cfs$
Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN})	$Q_{\rm X} = 0.0 0.0$ cfs
Discharge within the Gutter Section W ($Q_d - Q_X$)	Q _w = 0.0 0.0 cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 cfs$
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 0.0 0.0 cfs
Average Flow Velocity Within the Gutter Section	V = 0.0 0.0 fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d = 0.0 0.0
Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm	R = SUMP SUMP
Max Flow Based on Allowable Depth (Safety Factor Applied)	Q _d = SUMP SUMP cfs
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d = inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} = inches
II. I I I I I I I I I I I I I I I I I I	
MINOR CTORM Allowship Consults is bessel	Minor Channel Milling
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm



MHFD-Inlet, Version 5.01 (/	April 2021)		
ALLOWABLE CAPACITY FOR ONE-HALF OF	STREET (Mine	or & Majo	or Storm)
Based on Regulated Criteria for Maximum Allov t: Grandview Reserve	wable Flow Depth and Spr	ead)	
D: Basin A-6 (DP6)			
L bea L from d			
111.17			
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} = 0.020		
		-	
Height of Curb at Gutter Flow Line	H _{CURB} = 6.00	inches	
Distance from Curb Face to Street Crown	T _{CROWN} = 16.0	ft	
Gutter Width	W = 0.83	ft	
Street Transverse Slope	S _X = 0.020	ft/ft	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S _W = 0.083	ft/ft	
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.010$	ft/ft	
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n _{STRFET} = 0.016	1	
		-	
	Minor Storm	Major Storm	
Max, Allowable Spread for Minor & Major Storm	T _{MAX} = 16.0	16.0	lft
Max. Allowable Depth at Gutter Flowline for Minor & Maior Storm	d _{MAX} = 4.6	7.7	inches
Allow Flow Denth at Street Crown (check hox for yes, leave blank for no)			1
niow now bepartie bid eet crown (check box for yes) leave bidnik for noy			
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm	Maior Storm	
Water Depth without Gutter Depression (Eq. ST-2)	v = 3.84	3.84	linches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_c = 0.8$	0.8	inches
Gutter Depression (d_c - (W * S _v * 12))	a = 0.63	0.63	inches
Water Depth at Gutter Flowline	d = 4.47	4.47	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_{y} = 15.2$	15.2	ff
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Fg. ST-7)	$F_0 = 0.149$	0 149	
Discharge outside the Gutter Section W, carried in Section T _v	$0_{\rm v} = \frac{7.3}{7.3}$	73	cfs
Discharge within the Gutter Section $W(\Omega_{-}, \Omega_{-})$	$Q_{X} = \frac{7.5}{1.3}$	1.3	cfc
Discharge Rehind the Curb (e.g., cidewalk, drivewaye, \Re lawne)		1.5	lefe
Maximum Elow Based On Allowable Spread		0.0	cis
Flaw Velocity within the Cutton Social	Q T = 8.5	0.5	6.5
Flow velocity within the Gutter Section	V = 0.8	0.8	rps
V a Product. Flow velocity unles datter Flowline Deput	v·u =0.5	0.3	1
Maximum Canacity for 1/2 Street based on Allowable Depth	Minor Storm	Major Storm	
Theoretical Water Spread	$T_{TU} = \begin{bmatrix} 16.7 \end{bmatrix}$	20.4	7#
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{VTU} = 15.8$	29.1	fr fr
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Fg. ST-7)	$F_0 = 0.142$	0.070	1.
Theoretical Discharge outside the Gutter Section W carried in Section T	0 - 0.142	30.3	cfs
Actual Discharge outside the Gutter Section W. (limited by distance T	QXTH 0.2	24.1	cfc
Discharge within the Cutter Section W ($\Omega = \Omega$)	$Q_{\rm X} = \frac{8.2}{1.4}$	24.1	cr5
Discharge within the Gutter Section w $(Q_d - Q_X)$	$Q_W = 1.4$	3.4	
Tatal Discharge bening the Curb (e.g., sidewalk, griveways, & lawns)	$Q_{BACK} = 0.0$	0./	
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 9.5	38.2	
Average Flow Velocity Within the Gutter Section	V = 0.8	1.2	tps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d = 0.3	0.7	4
Here is the second s		1.00	4_
Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm	R = 1.00		Infe
Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)	R = 1.00 $Q_d = 9.5$	38.2	10.0
Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	R = 1.00 $Q_d = 9.5$ d = 4.63	38.2 7.68	inches
Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	$ \begin{array}{c} R = 1.00 \\ Q_d = 9.5 \\ d = 4.63 \\ d_{CROWN} = 0.17 \end{array} $	38.2 7.68 3.22	inches inches
Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	$R = 1.00$ $Q_{d} = 9.5$ $d = 4.63$ $d_{CROWN} = 0.17$	38.2 7.68 3.22	inches inches
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Spread Criterion	$ \begin{array}{c} R = 1.00 \\ Q_{d} = 9.5 \\ d = 4.63 \\ d_{CROWN} = 0.17 \\ Minor Storm $	38.2 7.68 3.22 Major Storm	inches inches
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Spread Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	$R = 1.00 \\ Q_{d} = 9.5 \\ d = 4.63 \\ d_{CROWN} = 0.17 \\ R_{allow} = 8.5 \\ R_{allow}$	38.2 7.68 3.22 Major Storm 38.2	inches inches inches



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 =	2	2	1
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_0 = [$	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	w ₀ =	N/A	N/A	- Ift
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	
Design Discharge for Half of Street (from Inlet Management)	$Q_0 = \Gamma$	4.6	10.7	lcfs
Water Spread Width	τ ₌ Γ	12.6	16.0	ft
Water Depth at Flowline (outside of local depression)	d = [3.7	4.8	linches
Water Depth at Street Crown (or at T _{MAX})	d _{CROWN} =	0.0	0.4	linches
Ratio of Gutter Flow to Design Flow	E ₀ =	0.191	0.136	
Discharge outside the Gutter Section W, carried in Section T,	0, =	3.7	9.2	lcfs
Discharge within the Gutter Section W	o = [0.9	1.5	lcfs
Discharge Behind the Curb Face	OPACK =	0.0	0.0	cfs
Flow Area within the Gutter Section W	Aw =	0.22	0.30	Iso ft
Velocity within the Gutter Section W	V =	3.9	4.8	fns
Water Denth for Design Condition		6.7	7.8	linches
Grate Analysis (Calculated)	GIULAI	MINOR	MAIOR	Interies
Total Length of Inlet Grate Opening	ı = [N/A	N/A	∃ft
Patio of Grate Flow to Design Flow	E	N/A	N/A	-1"
Under No-Clogging Condition	LO-GRATE - L	MINOR	MATOR	
Minimum Velocity Where Crate Splach-Over Begins	v - F	N/A		Ifoc
Interception Pate of Frontal Flow	v _o =	N/A	N/A	- 145
Interception Rate of Fide Flow		N/A	N/A	-
	~	N/A	N/A	ofc
Under Clogging Condition	Qi – L	MINOD		
Clogging Coefficient for Multiple-unit Crote Inlet	GrateCoof -	MINOR N/A		7
Clogging Eactor for Multiple unit Crate Inlet	CrateCleg -	N/A	N/A	
Effective (uncloaged) Length of Multiple unit Crote Inlet		N/A	N/A	
Minimum Valasity Where Crote Splach Quer Begins		N/A	N/A	
Interception Date of Frontel Flow	v _o =	N/A	IN/A	-l ^{ips}
		N/A	IN/A	-
Actual Interception Rate of Side Flow	~~	N/A	IN/A	
Actual Interception Capacity	Q _a =		N/A	
Carry-Over Flow = Q_0 - Q_a (to be applied to curb opening or next d/s inlet)	Q _b =	N/A MINOD		CTS
Curb of Siotled Intel Opening Analysis (Calculated)	с — Г	MINOR		
Equivalent Slope S_e (based on grate carry-over)	Se =	0.090	0.070	
Required Length L _T to Have 100% Interception		12.88	22.25	_π
		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		10.00	10.00	_π_
Interception Capacity	$Q_i = [$	4.3	/.0	cts
Under Clogging Condition	Curbon C	MINOR	MAJOR	-
	CurbCoet =	1.25	1.25	4
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	4.
Effective (Unclogged) Length	L _e =	9.37	9.37	_ tt_
Actual Interception Capacity	Qa =	4.2	6.9	cts
Carry-Over How = $Q_{b(GRATE)} - Q_a$	Q _b =	0.4	3.8	cts
Summary	-	MINOR	MAJOR	- -
Total Inlet Interception Capacity	Q = [4.2	6.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b =	0.4	3.8	cfs
ICapture Perceptage - 0 /0 -	C% -	92	64	10/2

MHFD-Inlet, Version 5.01 ((April 2021)		
ALLOWABLE CAPACITY FOR ONE-HALF O	F STREET (Mind	or & Majo	or Storm)
(Based on Regulated Criteria for Maximum Allo Grandview Reserve	wable Flow Depth and Spr	ead)	
Basin A-7 (DP7)			
L box L box			
Gutter Geometry:		1.	
Maximum Allowable Width for Spread Behind Curb	$I_{BACK} = 7.5$	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} = 0.020]	
Lleight of Curb at Cuttor Flow Line		1:	
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$	linches	
Distance from Curb Face to Street Crown	$I_{CROWN} = 16.0$	π c	
Gutter width	W = 2.00	π α.σ	
Street Transverse Slope	$S_x = 0.020$	ITT/IT	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_W = 0.083$	π/π	
Street Longitudinal Slope - Enter U for sump condition	$S_0 = 1.000$	π/π	
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{\text{STREET}} = 0.016$	l	
	Min en Chevre	Maian Channa	
Mary Alleynahle Caused for Minor O Maior Chause	Minor Storm	Major Storm	a.
Max. Allowable Spread for Minor & Major Storm	$I_{MAX} = 16.0$	16.0	IL inchos
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = 4.4$	/./	Inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		14°	
Maximum Canacity for 1/2 Street based On Allewable Spread	Minor Charm	Major Charma	
Maximum Capacity for 1/2 Street Dased On Allowable Spread	Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. S1-2)	y = <u>3.84</u>	3.84	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_{\rm C} = 2.0$	2.0	Inches
Guiler Depression ($u_c - (w + s_x + 12)$)		1.51	inches
Water Depth at Gutter Flowline	u = 5.35	5.35	inches
Cuttor Eleve to Docian Eleve Datio by EHWA HEC 22 method (Eq. ST. 7)	$1_{X} = 14.0$	14.0	11
Discharge outside the Cutter Section W. carried in Section T	$L_0 = 0.372$	0.372	ofo
Discharge within the Gutter Section $W(\Omega_{-2}, \Omega_{-1})$	$Q_{\rm X} = 56.7$	24.9	cfs
Discharge Within the Gutter Section W ($Q_{T}^{+} - Q_{X}^{+}$)	Qw - 34.8	34.0	cfc
Maximum Elew Pased On Allewable Spread		0.0	cis of c
Flow Velocity within the Cutter Section	QT - 93.5	93.5	CIS fine
N/*d Broducty Flow Velocity times Cutter Flowling Denth	V = 40.0	40.0	ips
V d Floddet. How velocity times datter Howine Depth	V u =	21.7	
Maximum Canacity for 1/2 Street based on Allowable Depth	Minor Storm	Major Storm	
Theoretical Water Spread	$T_{TU} = \begin{bmatrix} 11 & 0 \end{bmatrix}$	25.7	fr
Theoretical Spread for Discharge outside the Gutter Section W (T - W)		23.7	ft
Gutter Flow to Design Flow Ratio by FHWA HFC-22 method (Fg. ST-7)	$E_0 = 0.497$	0.228	-
Theoretical Discharge outside the Gutter Section W. carried in Section Type	0v TH = 23.1	239.0	cfs
Actual Discharge outside the Gutter Section W. (limited by distance Torough)	$0_{y} = 23.1$	217.0	cfs
Discharge within the Gutter Section W ($O_d - O_v$)	$O_{W} = 22.8$	70.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)		74	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	0 = 45.9	295.0	cfs
Average Flow Velocity Within the Gutter Section	V = 40.6	63.4	fns
V*d Product: Flow Velocity Times Gutter Flowline Denth	V*d = 14.8	40.6	
Slope-Based Depth Safety Reduction Factor for Major & Minor $(d > 6^{"})$ Storm	R = 0.13	0.04	
Max Flow Based on Allowable Depth (Safety Factor Applied)	$0_{4} = 62$	10.8	cfs
Resultant Flow Denth at Gutter Flowline (Safety Factor Applied)	d = 243	2.80	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	$d_{CROWN} = 0.00$	0.00	inches
		0.00	
MINOR STORM Allowable Capacity is based on Denth Criterion	Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm	Major Storm 10.8	cfs



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	1
Length of a Single Unit Inlet (Grate or Curb Opening)	L, =	5.00	5.00	Tft
Width of a Unit Grate (cannot be greater than W. Gutter Width)	w ₀ =	N/A	N/A	∃ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	CG =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min, value = 0.1)	C-C =	0.10	0.10	
Street Hydraulics: OK - O < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from Inlet Management)	0 ₀ = [1.1	2.0	lcfs
Water Spread Width	τ ₌	1.3	1.6	
Water Depth at Flowline (outside of local depression)	d =	1.3	1.6	linches
Water Depth at Street Crown (or at TMAX)	dcpown =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E. =	1.012	1.000	
Discharge outside the Gutter Section W. carried in Section T.	0.=	0.0	0.0	lcfs
Discharge within the Gutter Section W	0=	1 1	2.0	
Discharge Behind the Curch Face		0.0	0.0	- Cfs
Elow Area within the Gutter Section W		0.05	0.10	
Velocity within the Gutter Section W	₩	22.0	10.10	Ins
Water Denth for Design Condition	d	4.3	4.6	linches
Crate Applycic (Calculated)	GLOCAL - I	MINOP	MA10P	Inches
Total Length of Inlet Grate Opening	ı – [7#
Patie of Crate Flow to Design Flow		N/A	N/A	
Hador No Clogging Condition	⊏o-GRATE —			
Minimum Valasita Minimu Custa Calasta Custa Desira	у Г	MINOR		-
Minimum velocity where Grate Splash-Over Begins	v _o = -	N/A	N/A	-I ^{rps}
	R _f =	N/A	N/A	-
Interception Rate of Side Flow	K _x =	N/A	N/A	
Interception Capacity	$Q_i = [$	N/A	N/A	CTS
Under Clogging Condition		MINOR	MAJOR	-
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoer =	N/A	N/A	4
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	4.
Effective (unclogged) Length of Multiple-unit Grate Inlet		N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V _o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	_
Interception Rate of Side Flow	R _x =	N/A	N/A	
Actual Interception Capacity	Q _a =	N/A	N/A	cfs
Carry-Over Flow = $Q_0 - Q_a$ (to be applied to curb opening or next d/s inlet)	Q _b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	_	MINOR	MAJOR	-
Equivalent Slope S _e (based on grate carry-over)	S _e =	0.208	0.208	ft/ft
Required Length L_T to Have 100% Interception	L _T = [5.50	7.47	ft
Under No-Clogging Condition	_	MINOR	MAJOR	_
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.00	5.00	ft
Interception Capacity	Q _i =	1.1	1.7	cfs
Under Clogging Condition		MINOR	MAJOR	_
Clogging Coefficient	CurbCoef =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.10	0.10	
Effective (Unclogged) Length	L _e =	4.50	4.50	ft
Actual Interception Capacity	Q _a =	1.0	1.6	cfs
Carry-Over Flow = $Q_{b(GRATE)}$ - Q_a	Q _b =	0.1	0.4	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	Q = [1.0	1.6	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = [$	0.1	0.4	cfs
		05	01	

MHFD-Inlet, Version 5.01	(April 2021)				
ALLOWABLE CAPACITY FOR ONE-HALF C	F STREET (Minor & Major Storm)				
(Based on Regulated Criteria for Maximum All	owable Flow Depth and Spread)				
2: Basin A-9(DP7a)					
114.0%					
Gutter Geometry:					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 7.5$ ft				
Side Slope Benind Curb (leave blank for no conveyance credit benind curb)	$S_{BACK} = 0.020$ ft/ft				
Manning's Roughness Benind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$				
Height of Curb at Gutter Flow Line	H _{CURB} = 6.00 inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 16.0$ ft				
Gutter Width	W = 0.83 ft				
Street Transverse Slope	$S_x = 0.020$ ft/ft				
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S _W = 0.083 ft/ft				
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{\text{STREET}} = 0.016$				
	Minor Storm Major Storm				
Max, Allowable Spread for Minor & Major Storm	$T_{MAX} = \begin{bmatrix} 16.0 & 16.0 & \text{ft} \end{bmatrix}$				
Max. Allowable Depth at Gutter Flowline for Minor & Maior Storm	$d_{MAX} = 4.4$ 7.7 inches				
Check boxes are not applicable in SUMP conditions					
Maximum Capacity for 1/2 Street based On Allowable Spread	Minou Chouman Majou Chouma				
Water Depth without Cutter Depression (Eq. ST 2)	Millior Storm Major Storm				
Vertical Depth without Gutter Lip and Gutter Flowline (usually 2")	$d_{-} = 0.8$ 0.8 inches				
Gutter Depression $(d_{-} = (W \times S \times 12))$	a = 0.63 0.63 inches				
Water Depth at Gutter Flowline	d = 0.05 0.05 inches				
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_{v} = 15.2$ 15.2 ft				
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Fg. ST-7)	$F_0 = 0.149 0.149$				
Discharge outside the Gutter Section W. carried in Section T _v	$O_{\rm v} = 0.0$ 0.145 cfs				
Discharge within the Gutter Section W ($\Omega_{\rm T}$ - $\Omega_{\rm V}$)	$Q_{\rm M} = 0.0 0.0 {\rm cfs}$				
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{\text{RACK}} = 0.0$ 0.0 cfs				
Maximum Flow Based On Allowable Spread	Q _T = SUMP SUMP cfs				
Flow Velocity within the Gutter Section	V = 0.0 0.0 fps				
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d = 0.0 0.0				
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm Major Storm				
Theoretical Water Spread	$T_{TU} = \begin{bmatrix} 15.6 \\ 29.4 \end{bmatrix}$ ft				
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{VTV} = 14.7$ 28.6 ft				
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Fg. ST-7)	$F_0 = 0.153$ 0.079				
Theoretical Discharge outside the Gutter Section W. carried in Section Tyte	$O_{\rm YTH} = 0.0 0.0 \text{ cfs}$				
Actual Discharge outside the Gutter Section W. (limited by distance Trepown)	$O_{\rm Y} = 0.0$ 0.0 cfs				
Discharge within the Gutter Section W ($Q_d - Q_x$)	$Q_{W} = 0.0 0.0 \text{ cfs}$				
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 cfs$				
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 0.0 0.0 cfs				
Average Flow Velocity Within the Gutter Section	V = 0.0 0.0 fps				
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d = 0.0 0.0				
Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm	R = SUMP SUMP				
Max Flow Based on Allowable Depth (Safety Factor Applied)	Q _d = SUMP SUMP cfs				
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d = inches				
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} = inches				
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm				
MAIOR STORM Allowable Capacity is based on Depth Criterion					
	INLET IN A SUMP C	or sag loo	CATION		
-----------	--	-----------------------------	----------------	----------------	---------------------------
	MHFD-Inlet, Version	5.01 (April 2021)			
	۲۲ (C)				
	H-Curb				
	H-Veft Wo				
	¥ 20 (0)				
	Decian Information (Input)		MINOD	MAIOR	
	Type of Inlet	Type =	CDOT Type R	Curb Opening	1
	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) Water Depth at Flowline (outside of local depression)	No =	4	4	Override Depths inches
	Grate Information		MINOR	MAJOR	linches
	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
	Clogging Factor for a Single Grate (typical values 0.13-0.30)	$A_{ratio} = C_f(G) =$	N/A N/A	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	L (C) - [MINOR 5.00	MAJOR 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
warning 1	Clogging Eactor for a Single Curb Opening (typically une gutter width of 2 feet)	$W_p = C_r(C) = C_r(C)$	0.10	0.10	leet
	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	
	Grate Flow Analysis (Calculated) Clogging Coefficient for Multiple Units	Coof -	MINOR	MAJOR	1
	Clogging Eactor for Multiple Units	Clog =	N/A	N/A N/A	-
	Grate Capacity as a Weir (based on Modified HEC22 Method)	-	MINOR	MAJOR	-
	Interception without Clogging	Q _{wi} =	N/A	N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	Q _{wa} =	MINOR	MAJOR	las
	Interception without Clogging	Q _{oi} =	N/A	N/A	cfs
	Interception with Clogging	Q _{oa} =	N/A	N/A	cfs
	Grate Capacity as Mixed Flow	oF	MINOR N/A	MAJOR	Tefe
	Interception with Clogging	$Q_{ma} =$	N/A	N/A	cfs
	Resulting Grate Capacity (assumes clogged condition)	Q _{Grate} =	N/A	N/A	cfs
	Curb Opening Flow Analysis (Calculated)	Coof -	MINOR 1 33	MAJOR 1 33	1
	Clogging Factor for Multiple Units	Clog =	0.03	0.03	
	Curb Opening as a Weir (based on Modified HEC22 Method)	5 6	MINOR	MAJOR	-
	Interception without Clogging	Q _{wi} =	10.0	35.4	cfs
	Curb Opening as an Orifice (based on Modified HEC22 Method)	Q _{wa} = [MINOR	MA1OR	las
	Interception without Clogging	Q _{oi} =	33.6	43.9	cfs
	Interception with Clogging	Q _{oa} =	32.5	42.4	cfs
	CUID Opening Capacity as Mixed Flow	o . =Γ	17.0	MAJOR 36.7	lcfs
	Interception with Clogging	$Q_{ma} =$	16.5	35.5	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	Q _{Curb} =	9.7	34.3	cfs
	Resultant Street Conditions	ı – F	MINOR 20.00	MAJOR 20.00	foot
	Resultant Street Flow Spread (based on street geometry from above)	T =	15.6	20.00	ft.>T-Crown
	Resultant Flow Depth at Street Crown	d _{CROWN} =	0.0	3.2	inches
	ow Head Performance Reduction (Calculated)		MINOR	MAIOR	
	Depth for Grate Midwidth	d _{Grate} =	N/A	N/A	ft
	Depth for Curb Opening Weir Equation	d _{Curb} =	0.29	0.57	ft
	Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	0.41	0.72	4
	Grated Inlet Performance Reduction Factor for Long Inlets	RF _{Curb} =	N/A	N/A	
		Grate			-
	Total Inlet Intercention Canacity (accumes cleased condition)	o – [MINOR 97	MAJOR 34 3	ofs
	Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	Q PEAK REQUIRED =	7.8	21.1	cfs

ALLOWABLE CAPACITY FOR ONE-HALF O	F STREET (Minor & Major Storn
(Based on Regulated Criteria for Maximum Alle	owable Flow Depth and Spread)
D: Basin A-10(DP7b)	
- Tex	
Gutter Geometry: Maximum Allowable Width for Spread Behind Curb	T ₂ , 75 ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{\text{BACK}} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$
Height of Curb at Gutter Flow Line	Have = 6.00 inches
Distance from Curb Eace to Street Crown	$T_{CDOWN} = 16.0$ ft
Gutter Width	W = 0.83 ft
Street Transverse Slope	$S_{\rm x} = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_{W} = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000 \text{ ft/ft}$
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{\text{STREET}} = 0.016$
	Miner Chause Maine Chause
Max Allowable Spread for Minor & Major Storm	
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d = 4.4 7.7 inches
Check hoves are not applicable in SLIMP conditions	
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm
Water Depth without Gutter Depression (Eq. ST-2)	y = 3.84 3.84 inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_{\rm C} = 0.8$ 0.8 inches
Gutter Depression (d _c - (W * S _x * 12))	a = 0.63 0.63 inches
Water Depth at Gutter Flowline	d = 4.47 4.47 inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_x = 15.2$ 15.2 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.149 0.149$
Discharge outside the Gutter Section W, carried in Section T_{χ}	$Q_X = 0.0 0.0 cfs$
Discharge within the Gutter Section W ($Q_T - Q_X$)	$Q_{\rm W} = 0.0 0.0$ cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 cfs$
Maximum Flow Based On Allowable Spread	Q _T = SUMP SUMP cfs
Flow Velocity within the Gutter Section	V = 0.0 0.0 fps
V*a Product: Flow velocity times Gutter Flowline Depth	V*d = 0.0 0.0
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm Major Storm
Theoretical Water Spread	$T_{TH} = 15.6$ 29.4 ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X TH} = 14.7 28.6$ ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.153 0.079$
Theoretical Discharge outside the Gutter Section W, carried in Section T_{XTH}	$Q_{X TH} = 0.0 0.0 cfs$
Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN})	$Q_X = 0.0 0.0 cfs$
Discharge within the Gutter Section W ($Q_d - Q_X$)	$Q_{\rm W} = 0.0 0.0$ cfs
Discharge Benind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0$ 0.0 cfs
I otal Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 0.0 0.0 cfs
Average Flow Velocity Within the Gutter Section	v = 0.0 0.0 fps
Ivra Product: Flow Velocity Times Gutter Flowline Depth	$\mathbf{v}^{\star}\mathbf{d} = \underbrace{0.0}_{0.0} \underbrace{0.0}_{0.0}$
Storm Deput Safety Reduction Factor for Major & Minor ($a \ge 6^{\circ}$) Storm May Flow Pased on Allowable Depth (Safety Factor Applied)	
Pacultant Flow Darth at Cuttor Flowling (Safety Factor Applied)	Vd = SUMP SUMP CTS
IKesuitant Flow Depth at Gutter Flowline (Safety Factor Applied)	
Resultant Flow Depth at Street Crown (Safety Factor Applied)	1 10.0.1 0
Resultant Flow Depth at Street Crown (Safety Factor Applied)	
Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm

	INLET IN A SUMP C	or sag loo	CATION		
	MHFD-Inlet, Version	5.01 (April 2021)			
	۲۲ (C)				
	H-Curb				
	H-Vert Wo				
	4 20 (0)				
	Decian Information (Input)		MINOD	MAIOR	
	Type of Inlet	Type =	CDOT Type R	Curb Opening	1
	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) Water Depth at Flowline (outside of local depression)	No = Ponding Denth -	43	1	Override Depths inches
	Grate Information		MINOR	MAJOR	linches
	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
	Clogging Factor for a Single Grate (typical values 0.15-0.50)	$A_{ratio} = C_f(G) =$	N/A N/A	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	L (C) - [MINOR 5.00	MAJOR 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
warning 1	Clogging Eactor for a Single Curb Opening (typically une gutter width of 2 reet)	$W_p = C_1(C) = C_2(C)$	0.10	0.10	leet
	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	
	Grate Flow Analysis (Calculated) Clogging Coefficient for Multiple Units	Coof -	MINOR	MAJOR	1
	Clogging Eactor for Multiple Units	Clog =	N/A N/A	N/A N/A	-
	Grate Capacity as a Weir (based on Modified HEC22 Method)		MIŃOR	MAJOR	-
	Interception without Clogging	Q _{wi} =	N/A	N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	Q _{wa} = [MINOR	MAJOR	las
	Interception without Clogging	Q _{oi} =	N/A	N/A	cfs
	Interception with Clogging	Q _{oa} =	N/A	N/A	cfs
	Grate Capacity as Mixed Flow	oF	MINOR N/A	MAJOR	Tefe
	Interception with Clogging	$Q_{ma} =$	N/A	N/A	cfs
	Resulting Grate Capacity (assumes clogged condition)	Q _{Grate} =	N/A	N/A	cfs
	Curb Opening Flow Analysis (Calculated)	Coof -	MINOR 1 00	MAJOR 1 00	1
	Clogging Factor for Multiple Units	Clog =	0.10	0.10	
	Curb Opening as a Weir (based on Modified HEC22 Method)	J	MINOR	MAJOR	-
	Interception without Clogging	Q _{wi} =	3.6	10.8	cfs
	Curb Opening as an Orifice (based on Modified HEC22 Method)	Q _{wa} = _	MINOR	MAJOR	las
	Interception without Clogging	Q _{oi} =	8.3	11.2	cfs
	Interception with Clogging	Q _{oa} =	7.5	10.1	cfs
	Curb Opening Capacity as Mixed Flow	o . =Γ	MINOR 5 1	MAJOR 10.2	lcfs
	Interception with Clogging	$Q_{ma} =$	4.6	9.2	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	Q _{Curb} =	3.2	9.2	cfs
	Resultant Street Conditions	ı – F	MINOR 5.00	MAJOR 5 00	foot
	Resultant Street Flow Spread (based on street geometry from above)	с- Т=	15.2	30.7	ft.>T-Crown
	Resultant Flow Depth at Street Crown	d _{CROWN} =	0.0	3.5	inches
	ow Head Performance Reduction (Calculated)		MINOR	MAIOR	
	Depth for Grate Midwidth	d _{Grate} =	N/A	N/A	ft
	Depth for Curb Opening Weir Equation	d _{Curb} =	0.29	0.60	ft
	Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	0.55	1.00	4
	Grated Inlet Performance Reduction Factor for Long Inlets	RF _{Curb} =	N/A	N/A	
		Grate			-
	Total Inlet Intercention Canacity (assumes closed condition)	0 - F	MINOR 3.2	MAJOR 9 2	cfs
	Inlet Capacity IS GOOD for Minor and Major Storms(>0 PEAK)	$\mathbf{Q}_{\text{PEAK REQUIRED}} =$	2.2	5.3	cfs

MHFD-Inlet, Version 5.0	1 (April 2021)
ALLOWABLE CAPACITY FOR ONE-HALF (DF STREET (Minor & Major Storm)
(Based on Regulated Criteria for Maximum Al	llowable Flow Depth and Spread)
Basin B-1 (DP 9)	
Cutton Coomotra u	
Guiller Geometry: Maximum Allowable Width for Spread Behind Curb	T - 75 A
Gide Clope Rehind Curb (leave black for no conveyance credit behind curb)	$I_{BACK} = 7.5$ IL
Manning's Roughness Rehind Curb (hypically between 0.012 and 0.020)	$S_{BACK} = 0.020$ It/It
Manning's Roughness Benind Curb (typically between 0.012 and 0.020)	$H_{BACK} = 0.020$
Height of Curb at Gutter Flow Line	House = 6.00 linches
Distance from Curb Face to Street Crown	$T_{CROWN} = 16.0$ ft
Gutter Width	W = 0.83 ft
Street Transverse Slone	$S_{v} = 0.020 \text{ ft/ft}$
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S., - 0.083 ft/ft
Street Longitudinal Slone - Enter 0 for sumn condition	$S_{\rm W} = 0.005$ r/r
Manning's Roughness for Street Section (tynically between 0.012 and 0.020)	
	NSTREET - 0.010
	Minor Storm Major Storm
Max. Allowable Spread for Minor & Major Storm	T _{MAX} = 16.0 16.0 ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d _{MAX} = 4.4 7.7 inches
Check boxes are not applicable in SUMP conditions	
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm
Water Depth without Gutter Depression (Eq. S1-2)	y = <u>3.84</u> <u>3.84</u> inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_c = 0.8$ 0.8 inches
Gutter Depression ($d_c - (W * S_x * 12))$	a = 0.63 0.63 inches
Water Depth at Gutter Flowline	d = 4.4/ 4.4/ inches
Allowable Spread for Discharge outside the Gutter Section W (I - W)	$I_{\rm X} = 15.2$ 15.2 π
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. S1-7)	$E_0 = 0.149 0.149$
Discharge outside the Gutter Section W, carried in Section T_X	$Q_{\rm X} = 0.0 0.0$ cfs
Discharge within the Gutter Section W ($Q_T - Q_X$)	$Q_W = 0.0 0.0 cfs$
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0$ cfs
Maximum Flow Based On Allowable Spread	Q _T = SUMP SUMP cfs
Flow Velocity within the Gutter Section	V = 0.0 0.0 fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d = 0.0 0.0
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm Maior Storm
Theoretical Water Spread	$T_{TH} = 15.6$ 29.4 ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	T _{X TH} = 14.7 28.6 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.153 0.079$
Theoretical Discharge outside the Gutter Section W, carried in Section Tx TH	$O_{XTH} = 0.0 0.0 \text{ cfs}$
Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN})	$Q_x = 0.0 0.0 cfs$
Discharge within the Gutter Section W ($Q_d - Q_x$)	$Q_{W} = 0.0 0.0 \text{ cfs}$
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0$ 0.0 cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	O = 0.0 0.0 cfs
Average Flow Velocity Within the Gutter Section	V = 0.0 0.0 fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d = 0.0 0.0
Slope-Based Depth Safety Reduction Factor for Maior & Minor ($d > 6$ ") Storm	R = SUMP SUMP
Max Flow Based on Allowable Depth (Safety Factor Applied)	Q _d = SUMP SUMP cfs
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d = linches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} = inches
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm

	INLET IN A SUMP O	R SAGLOC	ATION		
	MHFD-Inlet, Version	5.01 (April 2021)			
	۲−−−−− Lo (C)−−−−−۲				
	H-Curb IT				
	H-Vert Wo		_		
	Lo (G)				
	CDOT Type R Curb Opening				
	Design Information (Input)		MINOR	MAJOR Curb Opening	-
	Local Depression (additional to continuous gutter depression 'a' from above)	Iype =	3.00	3.00	inches
	Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	Override Depths
	Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
	Grate Information	L (G) =	MINOR N/A	MAJOR	Teet
	Width of a Unit Grate	W ₀ =	N/A	N/A	feet
	Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =	N/A	N/A	
	Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_{f}(G) =$	N/A	N/A	
	Grate Weir Coefficient (typical value 2.15 - 3.60) Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_{w}(G) = 0$	N/A N/A	N/A N/A	-
	Curb Opening Information	c ₀ (c) = [MINOR	MAJOR	J
	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
	Angle of Throat (see LISDCM Figure ST-5)	H _{throat} = Theta =	63.40	63.40	Inches degrees
Warning 1	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	-
	Grate Flow Analysis (Calculated)	$C_0(C) =$	MINOR	MAIOR	
	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	1
	Clogging Factor for Multiple Units	Clog =	N/A	N/A]
	Grate Capacity as a Weir (based on Modified HEC22 Method)	0Г	MINOR N/A	MAJOR N/A	Tefe
	Interception with Clogging		N/A	N/A N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	-
	Interception without Clogging	$Q_{oi} =$	N/A	N/A	cfs
	Grate Capacity as Mixed Flow	Q _{oa} = [MINOR	MATOR	las
	Interception without Clogging	Q _{mi} =	N/A	N/A	cfs
	Interception with Clogging	Q _{ma} =	N/A	N/A	cfs
	Resulting Grate Capacity (assumes clogged condition)	Q _{Grate} =	N/A MINOP	MA10P	cts
	Clogging Coefficient for Multiple Units	Coef =	1.31	1.31	1
	Clogging Factor for Multiple Units	Clog =	0.04	0.04]
	Curb Opening as a Weir (based on Modified HEC22 Method)	0 - [MINOR	MAJOR	lefe
	Interception with Ologging		6.1	22.5	cfs
	Curb Opening as an Orifice (based on Modified HEC22 Method)	Cita	MINOR	MAJOR	
	Interception without Clogging	Q _{oi} =	25.2	32.9	cfs
	Interception with Clogging Curb Opening Capacity as Mixed Flow	Q _{oa} =	Z4.1 MINOR	31.5 MA1OR	lcis
	Interception without Clogging	Q _{mi} =	11.8	25.3	cfs
	Interception with Clogging	Q _{ma} =	11.2	24.2	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	Q _{Curb} =	6.1 MINOR	21.5 MA10P	cts
	Total Inlet Length	L=[15.00	15.00	feet
	Resultant Street Flow Spread (based on street geometry from above)	T =	15.6	29.4	ft.>T-Crown
	Resultant Flow Depth at Street Crown	d _{CROWN} =	0.0	3.2	inches
	Low Head Performance Reduction (Calculated)		MINOR	MAIOR	
	Depth for Grate Midwidth	d _{Grate} =	N/A	N/A	ft
	Depth for Curb Opening Weir Equation	d _{Curb} =	0.29	0.57	ft
	Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	0.41	0.72	-
	Grated Inlet Performance Reduction Factor for Long Inlets	RF _{Curb} =	N/A	0.00 N/A	
		- Grate	,		-
	Takal Inlak Intercontion Connaits (accument distant)	∧ – [□]	MINOR	MAJOR	lefe
	Inlet Capacity IS GOOD for Minor and Major Storms(>O PEAK)	$\mathbf{Q}_{\text{PEAK REQUIRED}} =$	5.3	12.5	cfs

MHFD-Inlet, Version 5.01	(April 2021)			
ALLOWABLE CAPACITY FOR ONE-HALF C	OF STRE	ET (Mino	or & Maj	or Storm
t: Grandview Reserve	lowable Flow	Depth and Spr	ead)	
): Basin B-2 (DP 10a)				
Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	TRACK =	7.5	Tft	
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	SBACK =	0.020	ff/ft	
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n _{BACK} =	0.020	1, 1, 1, 1	
······································	- BACK	0.020	1	
Height of Curb at Gutter Flow Line	HOURB =	6.00	linches	
Distance from Curb Face to Street Crown	TCROWN =	16.0	ft	
Gutter Width	W =	0.83	ft	
Street Transverse Slone	S. =	0.020	fr/fr	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	s	0.020	ft/ft	
Street Longitudinal Slope - Enter 0 for sumn condition	S	0.000	ft/ft	
Manning's Poughness for Street Section (typically between 0.012 and 0.020)		0.020		
rialining's Roughness for Street Section (typically between 0.012 and 0.020)	IISTREET -	0.010	1	
		Minor Storm	Major Storm	
Max Allowable Spread for Minor & Major Storm	т – Г	16.0	16.0	Tft
Max. Allowable Denth at Gutter Flowline for Minor & Major Storm	dum -	4.4	77	linches
Allow Elow Depth at Street Crown (check box for yes, leave blank for no)	UMAX -	т.т	7.7	incrica
Allow How Deput at Suleet Crown (check box for yes, leave blank for ho)		1	a.	
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	v = [3 84	3.84	linches
Vertical Depth hetween Gutter Lin and Gutter Flowline (usually 2")	d_ =	0.8	0.8	inches
Gutter Depression (d_{e} - (W * S * 12))	a=	0.63	0.63	inches
Water Depth at Gutter Flowline	- n	4 47	4 47	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	т. = Г	15.2	15.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Fg. ST-7)	Fo -	0 140	0.140	-
Discharge outside the Gutter Section W, carried in Section T.	0	10.2	10.2	cfc
Discharge within the Gutter Section $W_{1}(0, -0)$	~	10.5	10.3	cfs
Discharge Within the Gutter Section $W(Q_{T}^{-}, Q_{X})$	~~	1.0	1.0	- crs
Maximum Elew Pased On Allewable Spread		12.1	0.0	
Flaw Mala site within the Centre Centre	Q T -	12.1	12.1	
Flow Velocity within the Gutter Section	v =	1.1	1.1	
v*a Product: Flow velocity times Gutter Flowline Depth	v*a = [0.4	0.4	
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	т = Г	15.6	29.4	Tft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	T	14 7	29.5	
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Fg. ST-7)		0.153	0.079	-l'`
Theoretical Discharge outside the Gutter Section W carried in Section Tomo		0.135	55.6	ofs
Δ ctual Discharge outside the Gutter Section W. (limited by distance T)		9.5 0 F	20.0	
Discharge within the Gutter Section $W(\Omega, -\Omega_{c})$	Qx -	3.5	40.2	
Discharge Rehind the Curte (e.g., sidewalk, driveways, \Re lawns)	~~_F	1./	1.0	
		11.2	<u> </u>	
Total Discharge for Major 9 Minor Storm (Dro Safaty Factor)		11.2	54.0	
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	9	1 1	1 1 1	libs
Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section	V =	1.1	1.6	
Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth	V = V= V*d =	1.1 0.4	1.6	_
Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6^{\circ}$) Storm May Flow Flower Reduction Factor for Major & Minor ($d \ge 6^{\circ}$) Storm	V = V*d = R =	1.1 0.4 1.00	1.6 1.0 0.83	-
Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)	V = V*d = R = Q _d =	1.1 0.4 1.00 11.2	1.6 1.0 0.83 45.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	Q = V = V*d = R = Q _d = d =	1.1 0.4 1.00 11.2 4.36	1.6 1.0 0.83 45.0 7.17	cfs inches
Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	Q = V = V*d = R = Q _d = d = d _{CROWN} =	1.1 0.4 1.00 11.2 4.36 0.00	1.6 1.0 0.83 45.0 7.17 2.70	cfs inches inches
Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6^{\circ}$) Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	Q = V = V*d = R = Q_d = d = d _{CROWN} =	1.1 0.4 1.00 11.2 4.36 0.00	1.6 1.0 0.83 45.0 7.17 2.70	cfs inches inches
Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion	$ \begin{array}{c} \mathbf{Q} = \\ \mathbf{V} = \\ \mathbf{V} = \\ \mathbf{R} = \\ \mathbf{Q}_{\mathbf{d}} = \\ \mathbf{d} = \\ \mathbf{d}_{CROWN} = \\ \end{array} $	1.1 0.4 1.00 11.2 4.36 0.00 Minor Storm	1.6 1.0 0.83 45.0 7.17 2.70 Major Storm	cfs inches inches
Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	$\mathbf{Q} = \begin{bmatrix} \mathbf{V} \\ \mathbf{V} \\ \mathbf{R} \\ \mathbf{Q}_{\mathbf{d}} \\ \mathbf{Q}_{\mathbf{d}} \\ \mathbf{Q}_{\mathbf{d}} \\ \mathbf{Q}_{\mathbf{d}} \\ \mathbf{Q}_{\mathbf{CROWN}} \\ \mathbf{Q}_{\mathbf{allow}} \\ \mathbf{Q}_{\mathbf{allow}} \\ = \begin{bmatrix} \mathbf{Q}_{\mathbf{n}} \\ \mathbf{Q}_{\mathbf{n}} \end{bmatrix}$	1.1 0.4 1.00 11.2 4.36 0.00 Minor Storm 11.2	1.6 1.0 0.83 45.0 7.17 2.70 Major Storm 45.0	cfs inches inches cfs

INLET ON A CONTIN	JUOUS G	RADF		
MHFD-Inlet, Version 5.0	1 (April 2021)			
r				
H-Curb H-Vert		2		
Wo				
In E				
Lo (G)				
CDOT Type R Curb Opening				
		MINOR	MAIOR	
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)		10.00 N/A	10.00 N/A	
Clogging Factor for a Single Unit Grate (typical min, value = 0.5)	₩₀ = C-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.3)	C _f -C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from Inlet Management)	Q ₀ =	7.1	16.7	cfs
Water Spread Width	T =	13.1	16.0	ft
Water Depth at Flowline (outside of local depression)	d =	3.8	5.0	inches
Ratio of Gutter Flow to Design Flow	u _{CROWN} =	0.0	0.3	linches
Discharge outside the Gutter Section W, carried in Section T_x	$Q_x =$	5.8	14.5	cfs
Discharge within the Gutter Section W	Q _w =	1.3	2.2	cfs
Discharge Behind the Curb Face	Q _{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _W =	0.23	0.32	sq ft
Velocity within the Gutter Section W	V _W =	5./	6.9	tps inchos
Grate Analysis (Calculated)	ULOCAL -	MINOR	MA1OR	linches
Total Length of Inlet Grate Opening	L = [N/A	N/A	ft
Ratio of Grate Flow to Design Flow	E _{o-GRATE} =	N/A	N/A	
Under No-Clogging Condition	_	MINOR	MAJOR	_
Minimum Velocity Where Grate Splash-Over Begins	V ₀ =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A N/A	-
Interception Capacity	$R_x = 0$	N/A N/A	N/A N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		N/A	N/A	ft
Minimum velocity where Grate Splash-Over Begins	V ₀ =	N/A	N/A N/A	- ^{rps}
Interception Rate of Side Flow	R ₁ =	N/A N/A	N/A	-
Actual Interception Capacity	Q _a =	N/A	N/A	cfs
Carry-Over Flow = $Q_0 - Q_a$ (to be applied to curb opening or next d/s inlet)	Q _b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	- T	MINOR	MAJOR	
Equivalent Slope S _e (based on grate carry-over)	$S_e =$	0.08/	0.068	-ft/ft
Inder No-Clogging Condition	LT = [MINOR	1 29.43 MA1OR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L = [10.00	10.00	ft
Interception Capacity	Q _i =	5.7	8.8	cfs
Under Clogging Condition		MINOR	MAJOR	_
Clogging Coefficient	CurbCoef =	1.25	1.25	_
Coordination of the second second control of the second seco		8 75	0.06	
Actual Interception Capacity	0, =	5.5	8.4	cfs
Carry-Over Flow = $Q_{b(GRATE)}$ - Q_a	\tilde{Q}_{b} =	1.6	8.3	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	5.5	8.4	cfs
I otal Iniet Carry-Over Flow (flow bypassing iniet)	$Q_b =$	1.6	8.3	CTS

MHFD-Inlet, Version 5.01	(April 2021)
ALLOWABLE CAPACITY FOR ONE-HALF C	F STREET (Minor & Major Storm
(Based on Regulated Criteria for Maximum All	owable Flow Depth and Spread)
C: Grandview Reserve	
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} = 0.020
Height of Curb at Gutter Flow Line	H _{CURB} = 6.00 linches
Distance from Curb Face to Street Crown	$T_{CROWN} = 16.0$ ft
Gutter Width	W = 0.83 ft
Street Transverse Slope	$S_{x} = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S _W = 0.083 ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000 \text{ ft/ft}$
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n _{street} = 0.016
	Minor Storm Maior Storm
Max. Allowable Spread for Minor & Major Storm	T _{MAX} = 16.0 16.0 ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d _{MAX} = 4.4 7.7 inches
Check boxes are not applicable in SUMP conditions	C C
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm
Water Depth without Gutter Depression (Eq. ST-2)	v = 3.84 3.84 linches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_c = 0.8$ 0.8 inches
Gutter Depression (d_c - (W * S, * 12))	a = 0.63 0.63 inches
Water Depth at Gutter Flowline	d = 4.47 4.47 inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_x = 15.2$ 15.2 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.149 0.149$
Discharge outside the Gutter Section W, carried in Section T _x	$Q_{\rm X} = 0.0 0.0$ cfs
Discharge within the Gutter Section W ($Q_T - Q_X$)	$Q_W = 0.0 0.0 cfs$
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 cfs$
Maximum Flow Based On Allowable Spread	Q _T = SUMP SUMP cfs
Flow Velocity within the Gutter Section	V = 0.0 0.0 fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d = 0.0 0.0
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm Major Storm
Theoretical Water Spread	T _{TH} = 15.6 29.4 ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X TH} = 14.7$ 28.6 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.153 0.079$
Theoretical Discharge outside the Gutter Section W, carried in Section T_{XTH}	$Q_{X TH} = 0.0 0.0 cfs$
Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN})	$Q_{\rm X} = 0.0 0.0$ cfs
Discharge within the Gutter Section W ($Q_d - Q_X$)	Q _w = 0.0 0.0 cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 cfs$
I otal Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 0.0 0.0 cfs
Average Flow Velocity Within the Gutter Section	V = 0.0 0.0 fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d = 0.0 0.0
Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm	
Intax now based on Allowable Depth (Safety Factor Applied)	
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} = Inches
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm

	INLET IN A SUMP (or sag loo	CATION		
	MHFD-Inlet, Version	n 5.01 (April 2021)			
	۲ ــــــــــــــــــــــــــــــــــــ				
	H-Curb				
	Wo Wo				
	W Wp				
	Lo (G)				
	CDOT Type R Curb Opening				
	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
	Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
	Grate Information	-	MINOR	MAJOR	-
	Width of a Unit Grate	$L_{o}(G) = W_{o} = I$	N/A N/A	N/A N/A	feet
	Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =	N/A	N/A	
	Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_{f}(G) =$	N/A	N/A	-
	Grate Orifice Coefficient (typical value 2.15 - 3.00)	$C_{w}(G) = C_{h}(G) $	N/A N/A	N/A N/A	-
	Curb Opening Information	-0(-)	MINOR	MAJOR	-
	Length of a Unit Curb Opening	$L_{o}(C) =$	5.00	5.00	feet
	Height of Verdcal Curb Opening in 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
Warning 1	Side Width for Depression Pan (typically the gutter width of 2 feet)	$W_p = $	2.00	2.00	feet
	Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_{F}(C) = C_{w}(C) $	3.60	3.60	-
	Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C ₀ (C) =	0.67	0.67	
	Grate Flow Analysis (Calculated) Clogging Coefficient for Multiple Units	Coef -	MINOR	MAJOR N/A	1
	Clogging Factor for Multiple Units	Clog =	N/A	N/A	
	Grate Capacity as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	-
	Interception without Clogging	Q _{wi} =	N/A N/A	N/A N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	-twa	MINOR	MAJOR	
	Interception without Clogging	$Q_{oi} =$	N/A	N/A	cfs
	Grate Capacity as Mixed Flow	Q ₀₃ –	MINOR	MAJOR	
	Interception without Clogging	Q _{mi} =	N/A	N/A	cfs
	Interception with Clogging		N/A	N/A	cfs cfs
	Curb Opening Flow Analysis (Calculated)	CGrate	MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	
	Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method)	Clog =	0.03 MINOR	0.03 MA10R	1
	Interception without Clogging	Q _{wi} =	10.0	35.4	cfs
	Interception with Clogging	Q _{wa} =	9.7	34.3	cfs
	Interception without Clogging	Q _{oi} = [33.6	43.9	cfs
	Interception with Clogging	Q _{oa} =	32.5	42.4	cfs
	Curb Opening Capacity as Mixed Flow	0[MINOR 17.0	MAJOR 36.7	lcfs
	Interception with Clogging	Q _{mi} = Q _{ma} =	16.5	35.5	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	Q _{Curb} =	9.7	34.3	cfs
	Resultant Street Conditions	ı = [20.00	MAJOR 20.00	feet
	Resultant Street Flow Spread (based on street geometry from above)	T =	15.6	29.4	ft.>T-Crown
	Resultant Flow Depth at Street Crown	d _{CROWN} =	0.0	3.2	inches
	Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
	Depth for Grate Midwidth	d _{Grate} =	N/A	N/A	ft
	Depth for Curb Opening Weir Equation		0.29	0.57	π
	Curb Opening Performance Reduction Factor for Long Inlets	RF _{Curb} =	0.67	0.88]
	Grated Inlet Performance Reduction Factor for Long Inlets	RF _{Grate} =	N/A	N/A]
			MINOR	MAJOR	
	Total Inlet Interception Capacity (assumes clogged condition)	Q _a =	9.7	34.3	cfs
	Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK REQUIRED} =$	9.6	26.9	cts

	(April 2021)	
ALLOWABLE CAPACITY FOR ONE-HALF C	OF STREET (Minor & Major Storr	m)
(Based on Regulated Criteria for Maximum Al	lowable Flow Depth and Spread)	
D: Basin B-4 (DP 11)		
- box -l. from -l		
Gutter Geometry:		
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 8.0$ ft	
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft	
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n _{BACK} = 0.013	
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)	$S_{W} = 0.083$ ft/ft	
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000$ ft/ft	
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{\text{STREET}} = 0.016$	
	Minor Storm Major Storm	
Max Allowable Spread for Minor & Major Storm	$T_{\rm max} = \begin{bmatrix} 115 \\ 170 \end{bmatrix} \begin{bmatrix} 170 \\ 170 \end{bmatrix} ff$	
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{\text{MAX}} = 6.0$ 8.0 inches	
Check boxes are not applicable in SUMP conditions		
	1 I	
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y = <u>2.76</u> <u>4.08</u> inches	
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_c = 2.0$ 2.0 inches	
Gutter Depression ($d_c - (W * S_x * 12))$	a = 1.51 1.51 inches	
Water Depth at Gutter Flowline	d = 4.27 5.59 inches	
Allowable Spread for Discharge outside the Gutter Section W (1 - W)	$I_{\rm X} = 9.5$ 15.0 ft	
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. SI-7)	$E_0 = 0.511 0.350$	
Discharge outside the Gutter Section W, carried in Section T _x	$Q_x = 0.0 0.0 \text{ cfs}$	
Discharge within the Gutter Section W ($Q_T - Q_X$)	$Q_{\rm W} = 0.0 0.0 \text{ cfs}$	
Discharge Benind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 \text{ cfs}$	
Maximum Flow Based On Allowable Spread	$Q_T = SUMP SUMP Cfs$	
Flow Velocity within the Gutter Section	V = 0.0 0.0 rps	
V a rioddel. How velocity times outer howine beput		
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm Major Storm	
Theoretical Water Spread	$T_{TH} = 18.7$ 27.0 ft	
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{XTH} = 16.7$ 25.0 ft	
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.318 0.216$	
Theoretical Discharge outside the Gutter Section W, carried in Section T_{XTH}	$Q_{XTH} = 0.0 0.0 cfs$	
Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN})	$Q_{\rm X} = 0.0 0.0$ cts	
Discharge within the Gutter Section W ($Q_d - Q_x$)	$Q_{\rm W} = 0.0 0.0 \text{ cts}$	
Discharge Bening the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 \text{ cfs}$	
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 0.0 0.0 cts	
Average Flow velocity Within the Gutter Section	v = 0.0 0.0 fps	
Sland Pased Dopth Safety Reduction Easter for Major & Minor (d. h. 611) Chama	v = 0.0 0.0	
Superbased Depth Safety Reduction Factor for Major & Minor ($u \ge 6^{\circ}$) Storm Max Flow Based on Allowable Depth (Safety Factor Applied)		
Pacultant Flow Depth at Cutter Flowling (Safety Factor Applied)		
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} = inches	
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm	



MHFD-Inlet, Version 5.01	(April 2021)		0.14	
ALLOWABLE CAPACITY FOR ONE-HALF O		EI (MIN)	or & Maj	jor Storm
Gased on Regulated Criteria for Maximum An	owable riow	beput and Spi	eau)	
: Basin B-5 (DP 12a)				
- Two - Turon				
111 12				
Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T _{BACK} =	7.5	lft	
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	SBACK =	0.020	ft/ft	
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n _{BACK} =	0.020		
	DACK		-	
Height of Curb at Gutter Flow Line	HOURS =	6.00	linches	
Distance from Curb Face to Street Crown	TCROWN =	16.0	ft	
Gutter Width	W -	0.83		
Street Transverse Slope	s. –	0.03	ft/ft	
Gutter Cross Slope (hypically 2 inches over 24 inches or 0.083 ft/ft)	Sx =	0.020	H() H	
Street Longitudinal Slong Enter 0 for sume condition		0.003		
Manning's Doughnoss for Street Section (typically between 0.012 and 0.020)	- ³ 0 –	0.020		
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	IISTREET =	0.016		
		Min en Cherry	Main Channe	
May Allowable Caread for Minor 9, Major Storm	т — П	Minor Storm	Major Storm	_ _
Max. Allowable Spread for Millior & Major Storm		16.0	16.0	ll
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	a _{MAX} =	4.4	1./	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)			14 C	
Maximum Canacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	v – F	2 04		linches
Water Deput without Gutter Lip and Cutter Flowling (usually 2")	y =	3.04	3.64	linches
Cutter Depression $(d - (W + S + 12))$	u _c -	0.6	0.8	linches
Guiller Depression ($u_c = (w + S_x + 12)$)	a –	0.03	0.03	inches
Allowable Canad for Discharge subside the Cutter Castier W (T. M)		4.4/	4.47	incries
Allowable Spread for Discharge outside the Gutter Section W (1 - W)		15.2	15.2	
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. SI-7)	E0 =	0.149	0.149	
Discharge outside the Gutter Section W, carried in Section 1 _x	$Q_X =$	10.3	10.3	CTS
Discharge within the Gutter Section W ($Q_T - Q_X$)	$Q_W =$	1.8	1.8	cts
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} =$	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	Q _T =	12.1	12.1	cfs
Flow Velocity within the Gutter Section	V =	1.1	1.1	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.4	0.4	
Invaximum capacity for 1/2 Street based on Allowable Depth	- r	Minor Storm	Major Storm	
i neoretical water Spread	_I _{TH} =	15.6	29.4	$-\int_{a}^{t}$
I neoretical Spread for Discharge outside the Gutter Section W (1 - W)	$I_{XTH} =$	14.7	28.6	rt
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E ₀ =	0.153	0.079	4.
Theoretical Discharge outside the Gutter Section W, carried in Section T _{X TH}	Q _{х тн} =	9.5	55.6	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN})	Q _X =	9.5	48.2	cfs
Discharge within the Gutter Section W ($Q_d - Q_X$)	Q _W =	1.7	4.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} =$	0.0	1.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.2	54.0	cfs
Average Flow Velocity Within the Gutter Section	v = 1	1.1	1.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.4	1.0	
Slope-Based Depth Safety Reduction Factor for Maior & Minor $(d > 6")$ Storm	R =	1.00	0.83	
Max Flow Based on Allowable Depth (Safety Factor Applied)	0,=	11 2	45.0	cfs
Resultant Flow Denth at Gutter Flowline (Safety Factor Applied)		4 36	7 17	linches
Resultant Flow Depth at Street Crown (Safety Factor Applied)		0.00	2.70	linches
		0.00		
MINOR STORM Allowable Capacity is based on Depth Criterion		Minor Storm	Major Storm	
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q _{allow} = [11.2	45.0	cfs
Minor storm max, allowable canacity COOD - greater than the design flow give	en on sheet 'I	nlet Managen	nent'	
minor storm max, anowable capacity GOOD - greater than the design now give	ch on sheet 1			

INLET ON A CONTIN	NUOUS G	RADE		
MHFD-Inlet, Version 5.0	01 (April 2021)			
r				
H-Curb H-Mat		3		
Wo				
Lo (G)				
Decian Information (Input)		MINOR	MAIOD	
Type of Inlet	Type =	CDOT Type R		
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 =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening) Width of a Unit Grate (cannot be greater than W. Gutter Width)	L _o = . W = .	5.00 N/A	5.00 N/A	
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'	0 =[MINOR 7 9	MAJOR 18.5	ofs
Water Spread Width	τ =	13.6	16.0	ft
Water Depth at Flowline (outside of local depression)	d =	3.9	5.2	inches
Water Depth at Street Crown (or at T _{MAX}) Patie of Gutter Flow to Design Flow	d _{CROWN} =	0.0	0.7	inches
Discharge outside the Gutter Section W, carried in Section T_x	$Q_x = 0$	6.5	16.2	cfs
Discharge within the Gutter Section W	$Q_w =$	1.4	2.3	cfs
Discharge Behind the Curb Face	$Q_{BACK} =$	0.0	0.0	cfs
Velocity within the Gutter Section W	A _W = V _W =	5.8	7.1	sq it
Water Depth for Design Condition	d _{LOCAL} =	6.9	8.2	inches
Grate Analysis (Calculated)	, r	MINOR	MAJOR	
Ratio of Grate Flow to Design Flow	L =	N/A N/A	N/A N/A	_π
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V _o =	N/A	N/A	fps
Interception Rate of Frontal Flow Interception Rate of Side Flow	R _f = . R = .	N/A N/A	N/A N/A	_
Interception Capacity	$Q_i =$	N/A	N/A	cfs
Under Clogging Condition	- [MINOR	MAJOR	_
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoet =	N/A N/A	N/A N/A	_
Effective (unclogged) Length of Multiple-unit Grate Inlet	$L_e =$	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V _o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	_
Actual Interception Capacity	$Q_a =$	N/A	N/A	cfs
Carry-Over Flow = Q_0 - Q_a (to be applied to curb opening or next d/s inlet)	Q _b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	s –[0.084	MAJOR 0.066	_
Required Length L_T to Have 100% Interception	υ _e = . L _T =	18.17	31.40	ft
Under No-Clogging Condition		MINOR	MAJOR	_
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L _T)	L =	10.00	10.00	
Under Clogging Condition	$Q_i = [$	MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	4
Actual Interception Capacity	с _е = О _а =	9.37 5.9	9.57	cfs
Carry-Over Flow = $Q_{b/(GRATE)}$ - Q_a	Q _b =	2.0	9.5	cfs
Summary Total Julet Interception Capacity	o_[MINOR	MAJOR	cfc
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q = Q⊾ =	2.0	9.0	cfs
Capture Percentage = $\Omega_2/\Omega_2 =$	C% =	75	49	%



INLET ON A CONTIN	IUOUS G	RADF		
MHFD-Inlet, Version 5.0	1 (April 2021)			
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H-Curb IT H MA		5		
H Wen Wo				
Lo (G)				
		MINOR	MAIOR	
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 =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)		5.00	5.00	-ft
Clogging Eactor for a Single Unit Grate (typical min, value = 0.5)	vv. =	Ν/A Ν/Δ	N/A N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.3)	C _f -C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from Inlet Management)	Q ₀ =	3.7	8.7	cfs
Water Spread Width	T =	10.2	14.1	ft
Water Depth at Flowline (outside of local depression)	d =	3.1	4.0	inches
Ratio of Gutter Flow to Design Flow	u _{CROWN} = _	0.0	0.0	linches
Discharge outside the Gutter Section W, carried in Section T_x	$\overline{Q}_{x} =$	2.8	7.2	cfs
Discharge within the Gutter Section W	Q _w =	0.9	1.5	cfs
Discharge Behind the Curb Face	Q _{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _W =	0.18	0.25	sq ft
Velocity within the Gutter Section W	V _W =	4.8	5.9	tps inchos
Grate Analysis (Calculated)	ULOCAL =	MINOR	MAIOR	linches
Total Length of Inlet Grate Opening	L = [N/A	N/A	ft
Ratio of Grate Flow to Design Flow	E _{o-GRATE} =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	-]_
Minimum Velocity Where Grate Splash-Over Begins	V ₀ =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A N/A	N/A N/A	-
Interception Capacity	$O_i =$	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		N/A	N/A	
Interception Rate of Frontal Flow	$v_0 = R_f = 1$	N/A	N/A	- iha
Interception Rate of Side Flow	R _x =	N/A	N/A	-
Actual Interception Capacity	$\mathbf{Q}_{a} =$	N/A	N/A	cfs
Carry-Over Flow = Q_0 - Q_a (to be applied to curb opening or next d/s inlet)	Q _b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	с Г	MINOR	MAJOR	
Equivalent Slope Se (Dased on grate carry-over)	Se =	0.107	10.082	
Under No-Cloaging Condition	∟r – L	MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L _T)	L = [10.00	10.00	ft
Interception Capacity	Q _i =	3.6	6.4	cfs
Under Clogging Condition		MINOR	MAJOR	_
Logging Coefficient	CurbCoef =	1.25	1.25	_
Coogging Factor for Multiple-unit Curb Opening or Slotted Inlet Effective (Uncloaded) Lenath		9.06	9.06	
Actual Interception Capacity	o _a =	3.6	6.2	cfs
Carry-Over Flow = $Q_{h(GRATE)}$ - Q_a	Q _b =	0.1	2.5	cfs
Summary		MINOR	MAJOR	<u></u>
I otal Inlet Interception Capacity	Q =	3.6	6.2	cfs
Canture Percentage – 0. /0. –	$Q_b =$	0.1	2.5	

MHFD-Inlet, Version 5.01	1 (April 2021)			
ALLOWABLE CAPACITY FOR ONE-HALF C	OF STRE	ET (Mino	or & Maj	or Storm
(Based on Regulated Criteria for Maximum Ai : Grandview Reserve	llowable Flow	Depth and Spr	ead)	
: Basin B-7 (DP 15)				
- 500 - Joon -				
111 12				
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} =	0.020	1	
	-		-	
Height of Curb at Gutter Flow Line	H _{CURB} =	6.00	inches	
Distance from Curb Face to Street Crown	T _{CROWN} =	16.0	ft	
Gutter Width	W =	0.83	lft	
Street Transverse Slope	S _x =	0.020	ft/ft	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S _w =	0.083	ft/ft	
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 =$	0.020	ft/ft	
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n _{STREET} =	0.016	1 ' '	
			-	
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T _{MAX} =	16.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d _{MAX} =	4.4	7.7	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	-		1	_
Maximum Capacity for 1/2 Street based On Allowable Spread	-	Minor Storm	Major Storm	-
Water Depth without Gutter Depression (Eq. ST-2)	y =	3.84	3.84	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d _C =	0.8	0.8	inches
Gutter Depression (d _c - (W * S _x * 12))	a =	0.63	0.63	inches
Water Depth at Gutter Flowline	d =	4.47	4.47	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T _x =	15.2	15.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E ₀ =	0.149	0.149	
Discharge outside the Gutter Section W, carried in Section T_{χ}	Q _X =	10.3	10.3	cfs
Discharge within the Gutter Section W ($Q_T - Q_X$)	Q _W =	1.8	1.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} =$	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	Q _T =	12.1	12.1	cfs
Flow Velocity within the Gutter Section	V =	1.1	1.1	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.4	0.4	
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical water Spread	_ ^{ITH} =	15.6	29.4	$-\frac{\pi}{2}$
I neoretical Spread for Discharge outside the Gutter Section W (1 - W)	I _{X TH} =	14./	28.6	π
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. S1-7)	$E_0 =$	0.153	0.0/9	
Theoretical Discharge outside the Gutter Section W, carried in Section T _{XTH}	Q _{X TH} =	9.5	55.6	crs
Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN})	$Q_{\rm X} =$	9.5	48.2	crs
Discharge within the Gutter Section W ($Q_d - Q_X$)	Qw =	1.7	4.8	
Discharge bening the Curb (e.g., sidewaik, driveways, & lawns)	QBACK =	0.0	1.0	
I otal Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.2	54.0	Lcts
Average Flow Velocity Within the Gutter Section	V =	1.1	1.6	tps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.4	1.0	4
Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6''$) Storm	_R =	1.00	0.83	4.
Max How Based on Allowable Depth (Safety Factor Applied)	Q _d =	11.2	45.0	cfs
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.36	7.17	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} =	0.00	2.70	inches
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	• ·	11.0		- -
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	Q _{allow} =	11.2	45.0	cfs

INLET ON A CONTIN	NUOUS G	RADF		
MHFD-Inlet, Version 5.0	1 (April 2021)			
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- Wo				
W E				
10(0)				
CDOT Type R Curb Opening -				
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
l ength of a Single Unit Inlet (Grate or Curb Opening)		5.00	5.00	
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 MINOP	MA10P	
Design Discharge for Half of Street (from <i>Inlet Management</i>)	О ₀ = Г	1,6	3.8	cfs
Water Spread Width	Т =	7.3	10.3	ft
Water Depth at Flowline (outside of local depression)	d =	2.4	3.1	inches
Water Depth at Street Crown (or at T _{MAX})	d _{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow Discharge outside the Gutter Section W, carried in Section T.	E ₀ =	0.339	0.238	cfs
Discharge within the Gutter Section W	$Q_w =$	0.5	0.9	cfs
Discharge Behind the Curb Face	Q _{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _w =	0.14	0.19	sq ft
Velocity within the Gutter Section W Water Depth for Design Condition	V _W =	4.0	4.9	tps
Grate Analysis (Calculated)	ULOCAL - I	MINOR	MAJOR	Inches
Total Length of Inlet Grate Opening	L =[N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o-GRATE} =$	N/A	N/A	
Under No-Clogging Condition	v – F	MINOR	MAJOR	Ifoc
Interception Rate of Frontal Flow	V ₀ = R _f =	N/A	N/A N/A	
Interception Rate of Side Flow	R _x =	N/A	N/A	
Interception Capacity	$Q_i =$	N/A	N/A	cfs
Under Clogging Condition	CrotoCoof -	MINOR	MAJOR	-
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A N/A	_
Effective (unclogged) Length of Multiple-unit Grate Inlet	$L_{e} =$	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V _o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	_
Actual Interception Capacity	O ₂ =	N/A	N/A N/A	cfs
Carry-Over Flow = Q_0 - Q_a (to be applied to curb opening or next d/s inlet)	$\hat{\mathbf{Q}}_{\mathbf{b}}$ =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S _e (based on grate carry-over)	S _e =	0.143	0.106	
Under No-Cloaging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L _T)	L =[6.31	10.00	ft
Interception Capacity	$Q_i = [$	1.6	3.7	cfs
Under Llogging Condition	CurbCoof - [1 25	MAJOR 1 25	-
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbCloa =	0.06	0.06	-
Effective (Unclogged) Length	L _e =	9.37	9.37	ft
Actual Interception Capacity	Q _a =	1.6	3.7	cfs
$\frac{\text{Larry-Over How} = Q_{h(\text{GRATE})} - Q_a}{\text{Summary}}$	Q _b =	0.0 MINOD	0.1 MA10D	cts
Total Inlet Interception Capacity	o = [1.6	3.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_{b} =$	0.0	0.1	cfs
Capture Percentage = Ω_{-}/Ω_{-} =	<u>c%</u> –	100	97	0/0

MHFD-Inlet, Version 5.01	(April 2021)
ALLOWABLE CAPACITY FOR ONE-HALF C	F STREET (Minor & Major Storm
(Based on Regulated Criteria for Maximum All	owable Flow Depth and Spread)
C: Grandview Reserve	
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} = 0.020
Height of Curb at Gutter Flow Line	H _{CURB} = 6.00 linches
Distance from Curb Face to Street Crown	$T_{CROWN} = 16.0$ ft
Gutter Width	W = 0.83 ft
Street Transverse Slope	$S_{\rm x} = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_{\rm W} = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{\text{STREET}} = 0.016$
May Allowable Coursed for Minor O. Marian Channel	Minor Storm Major Storm
Max. Allowable Spread for Minor & Major Storm	$I_{MAX} = 16.0$ 16.0 ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$a_{MAX} = 4.4$ /./ inches
Check boxes are not applicable in SUMP conditions	
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Maior Storm
Water Depth without Gutter Depression (Eq. ST-2)	v = 3.84 3.84 linches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_c = 0.8$ 0.8 inches
Gutter Depression (d_c - (W * S _x * 12))	a = 0.63 0.63 inches
Water Depth at Gutter Flowline	d = 4.47 4.47 inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_x = 15.2$ 15.2 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.149 0.149$
Discharge outside the Gutter Section W, carried in Section T_x	$Q_x = 0.0 0.0 cfs$
Discharge within the Gutter Section W ($Q_T - Q_X$)	$Q_{W} = 0.0 0.0 \text{ cfs}$
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 cfs$
Maximum Flow Based On Allowable Spread	Q _T = SUMP SUMP cfs
Flow Velocity within the Gutter Section	V = 0.0 0.0 fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d = 0.0 0.0
Maximum Canacity for 1/2 Street based on Allowable Denth	Minor Storm Major Storm
Theoretical Water Spread	$T_{T_{T}} = \begin{bmatrix} 15.6 \\ 15.6 \\ 29.4 \end{bmatrix}$ ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{\rm H} = 13.0$ 23.4 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Fg. ST-7)	$E_0 = 0.153 0.079$
Theoretical Discharge outside the Gutter Section W, carried in Section Type	$O_{\rm VIII} = 0.0 0.0000 {\rm cfs}$
Actual Discharge outside the Gutter Section W. (limited by distance T _{comm})	$Q_{x} = 0.0$ 0.0 cfs
Discharge within the Gutter Section W ($Q_d - Q_v$)	$Q_{\rm W} = 0.0 0.0 {\rm cfs}$
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{\text{RACK}} = 0.0 0.0 \text{ cfs}$
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	O = 0.0 0.0 cfs
Average Flow Velocity Within the Gutter Section	V = 0.0 0.0 fms
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d = 0.0 0.0
Slope-Based Depth Safety Reduction Factor for Major & Minor $(d > 6")$ Storm	R = SUMP SUMP
Max Flow Based on Allowable Depth (Safety Factor Applied)	
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d = inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} = inches
INTIMUR STURM Allowable Canacity is based on Depth Criterion	Minor Storm Major Storm
MAJOR STORM Allowable Capacity is based on Denti Criterion	

	INLET IN A SUMP (or sag loo	CATION		
	MHFD-Inlet, Version	n 5.01 (April 2021)			
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	H-Curb				
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	W WP				
	Lo (G)				
	Design Information (Input)		MINOP	MAIOP	
	Type of Inlet	Type =	CDOT Type R	Curb Opening	1
	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) Water Depth at Flowline (outside of local depression)	No = Pondina Depth =	4.4	4	inches
	Grate Information		MINOR	MAJOR	
	Length of a Unit Grate	$L_{o}(G) =$	N/A	N/A	feet
	Width of a Unit Grate Area Opening Ratio for a Grate (typical values 0 15-0 90)	VV _o =	N/A N/A	N/A N/A	reet
	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) Curb Oppning Information	$C_{o}(G) =$	N/A MINOR	N/A MAIOR]
	Length of a Unit Curb Opening	$L_{0}(C) =$	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
Warning 1	Side Width for Depression Pan (typically the gutter width of 2 feet)	W _a =	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	-
	Grate Flow Analysis (Calculated)	$C_0(C) =$	MINOR	MAIOR	
	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A]
	Clogging Factor for Multiple Units	Clog =	N/A	N/A	
	Intercention without Clogging	0 = [MINOR N/A	MAJOR N/A	lcfs
	Interception with Clogging	Q _{wa} =	N/A	N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	-	MINOR	MAJOR	-
	Interception without Clogging Interception with Clogging	Q _{oi} = O =	N/A N/A	N/A N/A	crs
	Grate Capacity as Mixed Flow		MINOR	MAJOR]
	Interception without Clogging	Q _{mi} =	N/A	N/A	cfs
	Interception with Clogging Resulting Grate Canacity (assumes clogged condition)	Q _{ma} = Q _{Grate} =	N/A N/A	N/A N/A	crs cfs
	Curb Opening Flow Analysis (Calculated)	editic	MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	-
	Curb Opening as a Weir (based on Modified HEC22 Method)	Clog =	0.03 MINOR	0.03 MA10R]
	Interception without Clogging	Q _{wi} =	10.0	35.4	cfs
	Interception with Clogging	Q _{wa} =	9.7	34.3	cfs
	<u>Curb Opening as an Orifice (based on Modified HEC22 Method)</u> Interception without Clogging	0 _{ni} = [33.6	MAJOR 43.9	lcfs
	Interception with Clogging	Q _{oa} =	32.5	42.4	cfs
	Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	-]_e_
	Interception without Clogging Interception with Clogging	Q _{mi} = 0 =	17.0	36.7	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	Q _{Curb} =	9.7	34.3	cfs
	Resultant Street Conditions		MINOR	MAJOR	14 .
	l otal Inlet Length Resultant Street Flow Spread (based on street geometry from above)		20.00	20.00	feet ft >T-Crown
	Resultant Flow Depth at Street Crown	d _{CROWN} =	0.0	3.2	inches
		-	MINOD	MAJOD	
	Low near Performance Reduction (Calculated) Depth for Grate Midwidth	donta = [N/A	MAJOR N/A	lft
	Depth for Curb Opening Weir Equation	d _{Curb} =	0.29	0.57	ft
	Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	0.41	0.72	4
	Grated Inlet Performance Reduction Factor for Long Inlets		0.67 N/A	0.88 N/A	
		Grate -			J
		• F	MINOR	MAJOR	ofe
	Inter Capacity IS GOOD for Minor and Major Storms(>O PEAK)	$Q_{\text{PEAK REQUIRED}} =$	7.4	24.5	cfs

MHFD-Inlet, Version 5.01	(April 2021)
ALLOWABLE CAPACITY FOR ONE-HALF O	F STREET (Minor & Major Storm
(Based on Regulated Criteria for Maximum All	owable Flow Depth and Spread)
C: Grandview Reserve	
Gutter Geometry:	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 7.5$ ft
Side Slope Benind Curb (leave blank for no conveyance credit benind curb)	$S_{BACK} = 0.020$ ft/ft
Manning's Roughness Benind Curb (typically between 0.012 and 0.020)	$\Pi_{BACK} = 0.020$
Height of Curb at Gutter Flow Line	H _{CURB} = 6.00 inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 16.0$ ft
Gutter Width	W = 0.83 ft
Street Transverse Slope	$S_{\rm X} = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_W = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n _{STREET} = 0.016
	Minor Charm Major Charm
Max Allowable Spread for Minor & Major Storm	
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	dux = 4.4 7.7 inches
Check hoves are not applicable in SLIMP conditions	
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm
Water Depth without Gutter Depression (Eq. ST-2)	y = <u>3.84</u> <u>3.84</u> inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_{\rm C} = 0.8$ 0.8 inches
Gutter Depression ($d_c - (W * S_x * 12)$)	a = 0.63 0.63 inches
Water Depth at Gutter Flowline	d = 4.47 4.47 inches
Allowable Spread for Discharge outside the Gutter Section W (1 - W)	$I_X = 15.2$ 15.2 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. SI-7)	$E_0 = 0.149 0.149$
Discharge outside the Gutter Section W, carried in Section T_X	$Q_{\rm X} = 0.0$ 0.0 crs
Discharge Within the Guiter Section W $(Q_T - Q_X)$	$Q_{W} = 0.0 0.0 \text{ ds}$
Maximum Elow Based On Allowable Spread	$Q_{BACK} = 0.0$ 0.0 crs
Flow Velocity within the Cutter Section	V = 0.0 0.0 fpc
V*d Product: Flow Velocity times Gutter Flowline Depth	$V^{+}d = 0.0 0.0$ (p)
· · · · · · · · · · · · · · · · · · ·	
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm Major Storm
Theoretical Water Spread	$I_{TH} = 15.6$ 29.4 ft
Ineoretical Spread for Discharge outside the Gutter Section W (1 - W)	$I_{XTH} = 14.7$ 28.6 ft
Gutter Flow to Design Flow Ratio by FHWA HEL-22 method (Eq. SI-7)	$E_0 = 0.153 0.079$
Inteoretical Discharge outside the Gutter Section W, (dimed in Section T_{XTH}	$Q_{XTH} = 0.0 0.0 \text{ ds}$
Discharge within the Gutter Section $W_{(0, -0, -)}$	$Q_{\rm X} = 0.0$ 0.0 crs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{W} = 0.0 0.0 0.0 \text{ cfs}$
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	O = 0.0 0.0 cfs
Average Flow Velocity Within the Gutter Section	V = 0.0 0.0 fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d = 0.0 0.0
Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm	R = SUMP SUMP
Max Flow Based on Allowable Depth (Safety Factor Applied)	Q _d = SUMP SUMP cfs
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d = inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} = inches
	M 0
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm

MHFD-Inlet, Version 5.01 (April 2021) Image: Colspan="2">MHFD-Inlet, Version 5.01 (April 2021) Image: Colspan="2">Image: Colspan="2" Image: Colspan="2"	nches Override Depths nches eet eet eet iches egrees eet
Vertical Curb OpeningMINORMAIORCDOT Type R Curb OpeningVertical Depression (additional to continuous gutter depression 'a' from above)Number of Unit Intels (Grate or Curb Opening)Water Depth at Flowline (outside of local depression)Oracle InformationCarbo InformationLength of a Unit GrateWidth of a Unit GrateWidth of a Unit GrateWidth of a Unit GrateCurb Opening Ratio for a Grate (typical values 0.15-0.90)Corpging Factor for a Single Grate (typical value 0.60 - 0.70)Grate Unit Coefficient (typical value 0.60 - 0.70)Grate Veri Coefficient (typical value 0.60 - 0.80)Curb Opening InformationLength of a Unit Curb OpeningLength of a Unit Curb OpeningHeight of Curb Opening InformationLength of a Unit Curb Opening InformationLength of Curb Orifice Throat In InchesHeight of Curb Orifice Throat In InchesHeight of Curb Opening Intypical Verteu Victorial Verteu Victorial Curb Opening (typical value 0.10)Colspan Factor for a Single Curb Opening (typical value 0.10)Colspan Factor for a	nches Override Depths nches eet eet eet iches iches egrees eet
Warning 1Warning 1Warning 1Warning 1Warning 1Warning 1Warning 1Warning 1Set Warning 1Warning 1Warning 1Set Warning 1Warning 1Set Warning 1Warning 1Colspan="2">Minom Advance	nches Override Depths nches eet eet eet iches iches egrees eet
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	nches Override Depths nches eet eet eet iches egrees eet
Warring 1CDOT Type R Curb OpeningMINOR MAJORDesign Information (Input)Type of InletType of InletLocal Depression (additional to continuous gutter depression 'a' from above)No 2 2 Number of Unit Inlets (Grate or Curb Opening)No 2 2 \mathbb{C} CDOT Type R Curb OpeningWater Depth at Flowline (outside of local depression)Ponding Depth = 4.4 7.7 InclGrate InformationINNORMAJORLength of a Unit Grate W_0 = N/A N/A With of a Unit Grate W_0 = N/A N/A With of a Unit Grate W_0 = N/A N/A InclGrate Orefficient (typical value 0.15-0.90) C_1 (G) = N/A Choging Factor for a Single Grate (typical value 0.50 - 0.70) C_1 (G) = N/A Grate Orifice coefficient (typical value 0.60 - 0.80) C_0 (G) = N/A Curb Opening Information C_0 (G) = N/A N/A Leight of Curb Orifice Throat in Inches H_{hroat} H_{hroat} Height of Curb Opening in Inches H_{hroat} 6.00 6.00 Height of Depression Pan (typical value 0.10) C_1 (G) = 0.10 Cols Generation Unite Curb Opening (typical value 0.10) C_1 (G) = 0.10 Curb Origing Factor for a Single Curb Opening (typical value 0.10) C_1 (G) = 0.10 Curb Origing Factor for a Single Curb Opening (typical value 0.10) C_1 (G) = 0.10 Curb Opening In	nches Override Depths nches eet eet eet iches iches egrees eet
Wince the probability of the probability	nches Override Depths nches eet eet eet iches iches egrees eet
Use of Lo (G)Design Information (Input)Type of InletType of InletLocal Depression (additional to continuous gutter depression 'a' from above)Type = $CDOT Type R Curb Opening$ Number of Unit Inlets (Grate or Curb Opening) $No = 2$ 2 Water Depth at Flowline (outside of local depression)Ponding Depth = 4.4 Grate Information $Ponding Depth =$ 4.4 Length of a Unit Grate N/A N/A With of a Unit Grate $N_0 =$ N/A With of a Unit Grate N/A N/A Minog Grate Virice Coefficient (typical value $0.15 - 0.90$) $A_{ratio} =$ Orate Orifice Coefficient (typical value $0.50 - 0.70$) C_r (G) =Grate Virice Coefficient (typical value $0.50 - 0.70$) C_r (G) =Grate Virice Coefficient (typical value $0.50 - 0.70$) C_r (G) =Grate Orifice Coefficient (typical value $0.50 - 0.70$) C_r (G) =Grate Orifice Coefficient (typical value $0.50 - 0.70$) C_r (G) =Grate Orifice Coefficient (typical value $0.50 - 0.70$) C_r (G) =Grate Orifice Coefficient (typical value $0.50 - 0.70$) C_r (G) =Grate Orifice Coefficient (typical value $0.50 - 0.70$) C_r (G) =Grate Orifice Coefficient (typical value $0.50 - 0.70$) C_r (G) =Grate Orifice Coefficient (typical value $0.50 - 0.70$) C_r (G) =MINORMAIORLength of a Unit Curb Opening in Inches $H_{wett} =$ Height of Vertical Curb Opening in Inches $H_{wett} =$ Height of Throat (see USDCM Figu	nches Override Depths nches eet eet eet iches iches egrees eet
Lo (G)CDOT Type R Curb OpeningType of InletType of InletLocal Depression (additional to continuous gutter depression 'a' from above) $N_{iocal} = \frac{1}{3.00} \frac{3.00}{3.00}$ incdNumber of Unit Inlets (Grate or Curb Opening) $N_{o} = \frac{2}{2}$ $Z = 100000000000000000000000000000000000$	nches Override Depths nches eet eet eet iches egrees eet
CDOT Type R Curb OpeningDesign Information (Input) Type of Inlet Local Depression (additional to continuous gutter depression 'a' from above) Number of Unit Inlets (Grate or Curb Opening) Water Depth at Flowline (outside of local depression) Grate Information Length of a Unit GrateType = a.CODT Type R Curb Opening 3.00MAJOR inclWater Depth at Flowline (outside of local depression) Grate Information Length of a Unit GratePonding Depth =4.47.7inclWith of a Unit Grate Width of a Unit GrateLo (G) =N/AN/AfeelWith of a Unit Grate Orging Ratio for a Grate (typical values 0.15-0.90) Grate Weir Coefficient (typical value 0.50 - 0.70) Grate Weir Coefficient (typical value 0.50 - 0.70) Grate Weir Coefficient (typical value 0.50 - 0.70) Grate Weir Coefficient (typical value 0.50 - 0.80) Curb Opening Information Length of a Unit Curb Opening in Inches Height of Vertical Curb Opening in Inches Height of Curb Orifice Throat in Inches Angle of Throat (see USDCM Figure ST-5)MINOR MAIOR Lo (C) =MINOR MAIOR MAIORWarning 1Side Width for Depression Pan (typical value 0.10) Curb Opening Information to the value value 0.10)Cr (C) =0.100.10User Multic Office Throat (see USDCM Figure ST-5)Theta =63.4063.40degSide Width for Depression Pan (typical value 0.10)Cr (C) =0.100.100.10Out or Unit Curb Opening (typical value 0.10)Cr (C) =0.100.100.10	eet eet inches eet eet inches egrees eet
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MINORMAJORType of InletType of InletType of InletCDOT Type R Curb OpeningLocal Depression (additional to continuous gutter depression 'a' from above) $N_{0cal} =$ CDOT Type R Curb OpeningNumber of Unit Inlets (Grate or Curb Opening) $N_0 =$ 2 2 Water Depth at Flowline (outside of local depression)Ponding Depth = 4.4 7.7 Unit Grate N/A N/A N/A With of a Unit Grate $N_0 =$ N/A N/A With of a Unit Grate $N_0 =$ N/A N/A Mice Coefficient (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_r (G) = N/A N/A Grate Weir Coefficient (typical value 0.50 - 0.70) C_r (G) = N/A N/A Grate Veir Coefficient (typical value 0.50 - 0.80) C_o (G) = N/A N/A Curb Opening Information $MINOR$ $MAOR$ Length of a Unit Curb Opening L_o (C) = 5.00 5.00 Height of Vertical Curb Opening in Inches H_{vert} 6.00 6.00 inchHeight of Curb Orifice Throat in Inches H_{vert} 6.340 63.40 63.40 Angle of Throat (see USDCM Figure ST-5)Theta = 63.40 63.40 62 Side Width for Depression Pan (typical value 0.10) C_r (C) = 0.10 0.10 Out out this for the top ind top and the top ind top and top a	eet eet hches eet eet eet hches egrees eet
Type of The timeType of Curb OpeningLocal Depression (additional to continuous gutter depression 'a' from above) $N_{0cal} = \frac{3.00 3.00}{2}$ indNumber of Unit Inlets (Grate or Curb Opening) $N_0 = \frac{2}{2}$ 2 Water Depth at Flowline (outside of local depression)Ponding Depth = 4.4 7.7 indGrate Information $M_0 = \frac{1}{2}$ 4.4 7.7 indLength of a Unit Grate $N_0 = \frac{1}{2}$ N/A N/A With of a Unit Grate $N_0 = \frac{1}{2}$ N/A N/A Grate Stor for a Single Grate (typical values 0.15-0.90) $A_{ratio} = \frac{N/A}{10}$ N/A Clogging Factor for a Single Grate (typical value 0.50 - 0.70) C_r (G) = N/A N/A Grate Weir Coefficient (typical value 0.50 - 0.70) C_r (G) = N/A N/A Grate Veir Coefficient (typical value 0.60 - 0.80) C_o (G) = N/A N/A Curb Opening Information M_{NOR} M_{NOR} Length of a Unit Curb Opening in Inches H_{vert} 6.00 6.00 Height of Vertical Curb Opening in Inches H_{vert} 6.00 6.00 Height of Curb Orifice Throat in Inches H_{vert} $6.3.40$ 63.40 Angle of Throat (see USDCM Figure ST-5)Theta = 63.40 63.40 Side Width for Depression Pan (typical value 0.10) C_r (C) = 0.10 0.10 Out on the local data of a D = 0.100 C_r (C) = 0.10 0.10	nches Override Depths nches eet eet eet nches iches egrees eet
Number of Unit Inlets (Grate or Curb Opening)No 2 2 2 2 2 Water Depth at Flowline (outside of local depression)Ponding Depth = 4.4 7.7 inclGrate InformationLength of a Unit GrateMINORMADORUength of a Unit Grate V_0 N/A N/A N/A With of a Unit Grate V_0 N/A N/A N/A Grate Urip Coefficient (typical value $0.15 - 0.90$) A_{ratio} N/A N/A Grate Veir Coefficient (typical value $0.50 - 0.70$) C_r (G) = N/A N/A Grate Veir Coefficient (typical value $0.50 - 0.70$) C_r (G) = N/A N/A Grate Veir Coefficient (typical value $0.50 - 0.70$) C_r (G) = N/A N/A Grate Veir Coefficient (typical value $0.50 - 0.80$) C_o (G) = N/A N/A Length of a Unit Curb Opening L_o (C) = 5.00 5.00 Height of Vertical Curb Opening in Inches H_{vert} 6.00 6.00 inchHeight of Throat (see USDCM Figure ST-5)Theta = 63.40 63.40 degSide Width for Depression Pan (typical value 0.10) C_r (C) = 0.10 0.10 0.10 Cot or Opening Curb Opening (typical value 0.10) C_r (C) = 0.10 0.10	eet aches eet eet ches egrees eet
Water Depth at Flowline (outside of local depression) Grate Information Length of a Unit GratePonding Depth = 4.4 7.7 inclMINORMAIORMINORMAIORLength of a Unit Grate U_o (G) =N/AN/AfeedWidth of a Unit Grate U_o (G) =N/AN/AfeedArea Opening Ratio for a Grate (typical values 0.15-0.90) A_{ratio} =N/AN/AfeedGrate Wir Coefficient (typical value 2.15 - 3.60) C_w (G) =N/AN/AN/AGrate Orifice Coefficient (typical value 0.60 - 0.80) C_o (G) =N/AN/ACurb Opening InformationMINORMAIORLength of a Unit Curb Opening in Inches H_{wet} =6.006.00Height of Vertical Curb Opening in Inches H_{wet} =6.006.00inchAngle of Throat (see USDCM Figure ST-5)Theta =63.4063.40degSide Width for Depression Pan (typical value 0.10) C_r (C) =0.100.10feedCosto Control With Grate Structure and the opening (typical value 0.10) C_r (C) =0.100.10	nches eet eet nches egrees eet
Grate Information Length of a Unit GrateMINORMAJOR MAJORWidth of a Unit Grate L_o (G) =N/AN/AfeedWidth of a Unit Grate W_o =N/AN/AfeedArea Opening Ratio for a Grate (typical value 0.15-0.90) A_{ratio} =N/AN/AfeedGrate Weir Coefficient (typical value 2.15 - 3.60) C_v (G) =N/AN/AfeedGrate Weir Coefficient (typical value 0.60 - 0.80) C_o (G) =N/AN/AN/ACurb Opening Information C_o (G) =N/AN/AN/ALength of a Unit Curb Opening in Inches H_{vort} =6.006.00inchHeight of Vertical Curb Opening in Inches H_{vort} =6.006.00inchAngle of Throat (see USDCM Figure ST-5)Theta =63.4063.40degSide Width for Depression Pan (typical value 0.10) C_r (C) =0.100.10feedCost Opening Width Grade Augle and Paral0.100.100.100.100.10	eet eet nches nches egrees eet
Warning 1Comparison of the data set	eet nches nches egrees eet
Area Opening Ratio for a Grate (typical values 0.15-0.90) $A_{ratio} =$ N/A N/A Clogging Factor for a Single Grate (typical value 0.50 - 0.70) C_r (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 InformationMINORMAIORLength of a Unit Curb Opening L_o (C) = 5.00 5.00 Height of Vertical Curb Opening in Inches H_{vert} = 6.00 6.00 Angle of Throat (see USDCM Figure ST-5)Theta = 63.40 63.40 Warning 1Side Width for Depression Pan (typical value 0.10) C_r (C) = 0.10 0.10 Color Core Micro Widt Meta Para 0.2 0.2 0.2	eet 1ches 1ches egrees eet
Clogging Factor for a Single Grate (typical value $0.50 - 0.70$) C_r (G) =N/AN/AGrate Weir Coefficient (typical value $2.15 - 3.60$) C_w (G) =N/AN/AGrate Orifice Coefficient (typical value $0.60 - 0.80$) C_o (G) =N/AN/ACurb Opening Information C_o (G) =N/AN/ALength of a Unit Curb Opening N/A MINORMAIORHeight of Vertical Curb Opening in Inches H_{vert} = 6.00 6.00 inchHeight of Throat (see USDCM Figure ST-5)Theta = 63.40 63.40 63.40 feetWarning 1Side Width for Depression Pan (typical value 0.10) C_r (C) = 0.10 0.10 0.10 Code Depring Widter Widt Neigher Area 20 - 20 C_r (C) = 0.10 0.10 0.10	eet nches nches legrees eet
Grate Viel Coefficient (typical value 2.15 - 5.00) 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 C_o (G) = N/A N/A Length of a Unit Curb Opening in Inches H_{vert} = 6.00 6.00 Height of Vertical Curb Opening in Inches H_{vert} = 6.00 6.00 Height of Vertical Curb Opening in Inches H_{vert} = 6.00 6.00 Height of Curb Orifice Throat in Inches H_{vert} = $6.3.40$ 63.40 Marning 1Side Width for Depression Pan (typical value 0.10) W_p = 2.00 2.00 Cogoing Factor for a Single Curb Opening (typical value 0.10) C_f (C) = 0.10 0.10	eet nches nches legrees eet
Curb Opening InformationMINORMAJORLength of a Unit Curb OpeningLo (C) = 5.00 5.00 feedHeight of Vertical Curb Opening in Inches $H_{vert} = 6.00$ 6.00 inchHeight of Curb Orifice Throat in Inches $H_{vert} = 6.00$ 6.00 inchAngle of Throat (see USDCM Figure ST-5)Theta = 63.40 63.40 63.40 Side Width for Depression Pan (typical) value 0.10) C_f (C) = 2.00 2.00 feed	eet nches nches legrees set
Length of a Unit Curb Opening $L_o(C) =$ 5.00 feedHeight of Vertical Curb Opening in Inches $H_{vert} =$ 6.00 6.00 indHeight of Curb Orifice Throat in Inches $H_{vert} =$ 6.00 6.00 indAngle of Throat (see USDCM Figure ST-5)Theta = 63.40 63.40 63.40 63.40 Side Width for Depression Pan (typical) value 0.10) $C_f(C) =$ 0.10 0.10 0.10	eet nches nches legrees eet
Height of Vertical Curb Opening in Inches $H_{vert} = 6.00$ 6.00 inchHeight of Curb Orifice Throat in Inches $H_{troat} = 6.00$ 6.00 inchAngle of Throat (see USDCM Figure ST-5)Theta = 63.40 63.40 63.40 degSide Width for Depression Pan (typical) the gutter width of 2 feet) $W_p = 2.00$ 2.00 feetClogging Factor for a Single Curb Opening (typical value 0.10) C_f (C) = 0.10 0.10 0.10	nches nches legrees eet
Warning 1Curb Online Inforties $n_{troat} = 0.00$ 0.00 0.0	legrees eet
Warning 1 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 0.10	eet
Clogging Factor for a Single Curb Opening (typical value 0.10) C_{f} (C) = 0.10 0.10	
Curb Opening Weir Coefficient (typical value 2.5-5.7) $C_w(C) = 3.60$ 3.60 Curb Opening Orificient (typical value 2.65.7) $C_w(C) = 0.67$ 0.67	
Grate Flow Analysis (Calculated) MINOR MATOR	
Clogging Coefficient for Multiple Units Coef = N/A N/A	
Clogging Factor for Multiple Units Clog = N/A N/A	
[Grate Capacity as a Weir (based on Modified HEC22 Method) MINOR MAJOR	fc
Interception with Clogging $Q_{wa} = N/A = N/A = C $	fs
Grate Capacity as a Orifice (based on Modified HEC22 Method).	
Interception without Clogging $Q_{ol} = N/A N/A$ cfs	fs
Interception with dogging Q ₆₈ = <u>IV/A</u> IV/A US Grate Canacity as Mixed Flow MiXOR MATOR	15
Interception without Clogging Q _{mi} = N/A / N/A cfs	fs
Interception with Clogging Q _{ma} = <u>N/A</u> <u>N/A</u> cfs	fs
Resulting Grate Capacity (assumes clogged condition) QGrate = N/A N/A CTS Curb Opening Elow Analycis (Capulated) MilOP MAIOP	.15
Clogging Factor for Multiple Units Clog = 0.06 0.06	
Curb Opening as a Weir (based on Modified HEC22 Method) MINOR MAJOR	fa
Interception with Cloaging $Q_{wi} = \frac{0.1}{20.2}$ Us Interception with Cloaging $Q_{wi} = \frac{0.1}{20.2}$ Us	fs
Curb Opening as an Orifice (based on Modified HEC22 Method) MINOR MAJOR	
Interception without Clogging $Q_{ci} = \frac{16.8}{21.9}$ cfs	fs
Interception with dogging $Q_{oa} = 15.7$ 20.6 grs	rs
Interception without Clogging $Q_{mi} = 9.4$ 19.6 cfs	fs
Interception with Clogging $Q_{ma} = \frac{8.8}{18.3}$ cfs	fs
Resulting Curb Opening Capacity (assumes clogged condition) Qcurb = 5.7 18.3 [cfs	.fs
Total Totel Length = 10.00 10.00 feel	eet
Resultant Street Flow Spread (based on street geometry from above) $T = 15.6 29.4$ ft.>	t.>T-Crown
Resultant Flow Depth at Street Crown d _{CROWN} = 0.0 3.2 inch	nches
I ow Head Performance Reduction (Calculated)	
Depth for Grate Midwidth d _{Grate} N/A N/A ft	t
Depth for Curb Opening Weir Equation $d_{Curb} = 0.29$ 0.57ft	t
Combination Intel Performance Reduction Factor for Long Inlets RF _{Combination} = 0.41 0.72	
Grated Inlet Performance Reduction Factor for Long Inlets $RF_{Carbe} = 0.02$ 1.00 Grated Inlet Performance Reduction Factor for Long Inlets $RF_{Carbe} = N/A$ N/A	
	fe
$\mathbf{v}_{a} = \frac{5.7}{10.3} \mathbf{Crs}$	fs

MHFD-Inlet, Version 5.0.	1 (April 2021)			
ALLOWABLE CAPACITY FOR ONE-HALF C	OF STRE	ET (Mino	or & Maj	or Storm)
(Based on Regulated Criteria for Maximum A t: Grandview Reserve	llowable Flow	Depth and Spr	ead)	
: Basin C-1 (DP 17b)				
Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	TRACK =	7.5	lft	
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	SBACK =	0.020	ft/ft	
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n _{BACK} =	0.020	1	
	- BACK	0.020	1	
Height of Curb at Gutter Flow Line	HOURB =	6.00	linches	
Distance from Curb Face to Street Crown	TCROWN =	16.0	ft	
Gutter Width	W =	0.83	ft	
Street Transverse Slone	s. =	0.020	ff/ff	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	s –	0.020	H/H	
Street Longitudinal Slope - Enter 0 for sump condition	Sw =	0.005	fr/ft	
Manning's Poughness for Street Section (typically between 0.012 and 0.020)		0.025		
rialining's Roughness for Street Section (typically between 0.012 and 0.020)	IISTREET -	0.010	1	
		Minor Storm	Major Storm	
Max Allowable Spread for Minor & Major Storm	т – Г	16.0	16.0	ft
Max. Allowable Denth at Gutter Flowline for Minor & Major Storm	d	4.4	77	inches
Allow Flow Denth at Street Crown (check box for yes, leave blank for no)	umax -		<u> </u>	inches
			14°	
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Maior Storm	
Water Depth without Gutter Depression (Eq. ST-2)	v =[3.84	3.84	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_c = 1$	0.8	0.8	inches
Gutter Depression ($d_c = (W * S_c * 12)$)	a =	0.63	0.63	inches
Water Denth at Gutter Flowline	d =	4 47	4 47	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	т, =	15.2	15.2	- ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Fg. ST-7)	É _n =	0 149	0 149	-11
Discharge outside the Gutter Section W. carried in Section Ty	$\bar{0}_{v} = 1$	11.5	11.5	cfs
Discharge within the Gutter Section W ($\Omega_{-} = \Omega_{-}$)	Qx =	2.0	20	cfs
Discharge Rehind the Curch (e_{α} sidewalk driveways & lawns)	Qw =	2.0	2.0	cfs
Maximum Elow Based On Allowable Spread	QBACK -	12 5	12 5	ofe
Flow Velocity within the Cuttor Section		13.5	12.5	fnc
N/*d Product: Flow Velocity times Gutter Flowline Depth	- v - b*v	0.5	0.5	
V a Froduct. How velocity times datter Howine Deput	v u - L	0.5	0.5	
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	Т _{тн} = Г	15.6	29.4	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	Тутн =	14.7	28.6	
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_ =	0.153	0,079	1
Theoretical Discharge outside the Gutter Section W. carried in Section Tyme		10.6	62.1	lcfs
Actual Discharge outside the Gutter Section W. (limited by distance Terrows)	0, =	10.6	53.9	lcfs
Discharge within the Gutter Section W ($O_4 - O_2$)	<u> </u>	1 9	53.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & Jawns)		0.0	12	drfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)		12 5	60.4	- Cfs
Average Flow Velocity Within the Gutter Section	<u>v</u> –	1.2	1.8	fns
Average now velocity within the duter section	V*d –	0.4	1.0	-1'P3
IV/*d Product: Flow Velocity Times Gutter Flowline Depth	v·u =	1.00	0.70	-
V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor $(d > 6")$ Storm	<u>р_</u> Г	1.00	1 0.70	cfe
V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)	R =	12.5	42.1	
V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)	R = Q _d =	12.5	42.1	linghos
V^*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Description Elow Depth at Street Grown (Safety Factor Applied)	R = Q _d = d =	100 12.5 4.36	42.1 6.69	inches
V^*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	$R = \begin{bmatrix} \mathbf{Q}_{d} = \\ \mathbf{d}_{crown} \end{bmatrix}$	12.5 4.36 0.00	42.1 6.69 2.22	inches inches
V^*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion	$R = \begin{bmatrix} \mathbf{Q}_{d} = \\ \mathbf{d}_{d} = \\ \mathbf{d}_{CROWN} = \end{bmatrix}$	12.5 4.36 0.00	42.1 6.69 2.22	inches inches
V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	$R = \begin{bmatrix} R \\ Q_d = \\ d \\ d_{CROWN} \end{bmatrix}$	12.5 4.36 0.00 Minor Storm	42.1 6.69 2.22 Major Storm	inches inches
V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	$R = \begin{bmatrix} Q_d \\ Q_d \end{bmatrix} = \begin{bmatrix} d \\ d_{CROWN} \end{bmatrix} = \begin{bmatrix} 0 \\ Q_{allow} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$	12.5 4.36 0.00 Minor Storm 12.5	42.1 6.69 2.22 Major Storm 42.1	inches inches cfs

INLET ON A CONTIN	IUOUS G	RADF		
MHFD-Inlet, Version 5.0	1 (April 2021)			
r				
H-Curb IT		3		
H-Vert				
Lo (G)				
CDOT Type R Curb Opening				
Design Information (Input)	Turne –	MINOR	MAJOR Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	alocal =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_0 =$	5.00	5.00	ft
Clogging Factor, for a Single Unit Grate (typical min, value = 0.5)	$W_0 =$ C-G =	N/A N/A	N/A N/A	π
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	- F	MINOR	MAJOR	-
Design Discharge for Half of Street (from <i>Inlet Management</i>)	Q ₀ =	6.8	16.0	cfs
Water Depth at Flowline (outside of local depression)	d =	3.6	4.7	inches
Water Depth at Street Crown (or at T _{MAX})	d _{CROWN} =	0.0	0.3	inches
Ratio of Gutter Flow to Design Flow	E ₀ =	0.196	0.139	cfc
Discharge within the Gutter Section W	Q _x = Q _w =	1.3	2.2	cfs
Discharge Behind the Curb Face	Q _{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _W =	0.22	0.30	sq ft
Welocity within the Gutter Section w Water Denth for Design Condition		6.6	7.5	
Grate Analysis (Calculated)	GIULA	MINOR	MAJOR	Interfeo
Total Length of Inlet Grate Opening	_ L=	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{0-GRATE} = $	N/A MINOR	MA1OR	
Minimum Velocity Where Grate Splash-Over Begins	V _o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	
Interception Rate of Side Flow	R _x =	N/A	N/A N/A	cfs
Under Clogging Condition	Qi - L	MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V ₀ =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	
Interception Rate of Side Flow	$R_x =$	N/A	N/A	
Carry-Over Flow = $Q_0 - Q_3$ (to be applied to curb opening or next d/s inlet)	$Q_a = Q_b =$	N/A N/A	N/A N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	_
Equivalent Slope S _e (based on grate carry-over)	S _e =	0.091	0.071	ft/ft
Under No-Cloaging Condition	LT – [MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L _T)	L = [15.00	15.00	ft
Interception Capacity	$Q_i =$	6.7 MINOR	11.8 MA102	cfs
Clogging Condition	CurbCoef = [1.31	1.31	7
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	$L_e = $	14.34	14.34	ft
Actual Interception Capacity Carry-Over Flow = $O_{b/CRATE}$ - O_{2}	$Q_a = 0$	<u>6.7</u> 0,1	4.3	crs
Summary	×n = 1	MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	6.7	11.7	cfs
rotal Iniet Carry-Over Flow (flow bypassing iniet)	$Q_b =$	0.1	4.3	

MHFD-Inlet, Version 5.01	1 (April 2021)			
ALLOWABLE CAPACITY FOR ONE-HALF O	OF STRE	ET (Mino	or & Maj	or Storm)
(Based on Regulated Criteria for Maximum Al	llowable Flow	Depth and Spr	ead)	
): Basin C-2 (DP 17a)				
Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	TBACK =	7.5	lft	
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	SBACK =	0.020	ft/ft	
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n _{BACK} =	0.020	1,0,10	
······································	PACK	0.020	1	
Height of Curb at Gutter Flow Line	HOURS =	6.00	linches	
Distance from Curb Face to Street Crown	TCROWN =	16.0	ft	
Gutter Width	W =	0.83	ft	
Street Transverse Slone	s, =	0.020	ff/ff	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	s. –	0.020	H/H	
Street Longitudinal Slope - Enter 0 for sump condition	S	0.005	fr/ft	
Manning's Poughness for Street Section (typically between 0.012 and 0.020)		0.025		
rialining's Roughness for Street Section (typically between 0.012 and 0.020)	USTREET -	0.010	1	
		Minor Storm	Major Storm	
Max Allowable Spread for Minor & Major Storm	т – Г	16.0	16.0	ft
Max. Allowable Denth at Gutter Flowline for Minor & Major Storm	d	4.4	77	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	GMAX -		<u> </u>	inches
Allow How Deput at Suleet Crown (check box for yes, leave blank for ho)			14°	
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	v = [3 84	3 84	linches
Vertical Depth hetween Gutter Lin and Gutter Flowline (usually 2")	$d_c = 1$	0.8	0.8	inches
Gutter Depression (d_{e} - (W * S * 12))	a =	0.63	0.63	inches
Water Depth at Gutter Flowline	d –	4 47	4 47	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	т. = Г	15.2	15.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Fg. ST-7)	Fo -	0 140	0.140	-
Discharge outside the Gutter Section W, carried in Section T.	0	11 5	11 5	cfc
Discharge within the Gutter Section W ($\Omega_{-2} \Omega_{-1}$)	Qx -	2.0	20	cfs
Discharge Within the Gutter Section W ($Q_T^{-1}Q_X^{-1}$)	~~~	2.0	2.0	- crs
Maximum Elow Paced On Allowable Spread		13.5	12.5	
Flaw Mala site within the Centrer Castien	QT -	13.5	13.5	
Flow Velocity within the Gutter Section	V =	1.2	1.2	
v*a Product: Flow velocity times Gutter Flowline Depth	v*a = [0.5	0.5	
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	т., = Г	15.6	29.4	Tft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	тГ	14 7	29.5	
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Fg. ST-7)	- x TH	0.153	0.079	-l'`
Theoretical Discharge outside the Gutter Section W carried in Section To-		10.6	62 1	ofs
Actual Discharge subside the Cutter Section W, (limited by distance T		10.0	52.0	
	~x	10.0	53.9	
Actual Discharge outside the Gutter Section W, (influed by distance T_{CROWN})	<u>∩</u> – I	1.0		
Actual Discharge builde the Gutter Section W ($_{Qd} - Q_X$) Discharge within the Gutter Section W ($_{Qd} - Q_X$)	Q _W =	1.9	1 2	ICTC
Actual Discharge outside the Gutter Section W ($_{Qd} - Q_X$) Discharge within the Gutter Section W ($_{Qd} - Q_X$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q _W = Q _{BACK} =	0.0	1.2	- CTS
Discharge outside Gutter Section W ($Q_u - Q_x$) Discharge within the Gutter Section W ($Q_u - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q _W = Q _{BACK} = Q =	1.9 0.0 12.5	1.2 60.4	cfs
Discharge within the Gutter Section W ($Q_d - Q_X$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section	Q _W = Q _{BACK} = Q = V =	1.9 0.0 12.5 1.2	1.2 60.4 1.8	cfs cfs fps
Discharge within the Gutter Section W ($Q_d - Q_X$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth	Q _W = Q _{BACK} = Q = V = V*d =	1.9 0.0 12.5 1.2 0.4	1.2 60.4 1.8 1.2	crs cfs fps
Discharge within the Gutter Section W ($Q_4 - Q_X$) Discharge within the Gutter Section W ($Q_4 - Q_X$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm	Q _W = Q _{BACK} = Q = V = V*d = R =	1.9 0.0 12.5 1.2 0.4 1.00	1.2 60.4 1.8 1.2 0.70	crs cfs fps
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)	$Q_W = Q_{BACK} = Q_{CBACK} = Q_{CBACK} = Q_{CBACK} = Q_{CBACK} = Q_{CBACK} = Q_{CBACK} = Q_{CCAC} = Q_{CCAC}$	1.9 0.0 12.5 1.2 0.4 1.00 12.5	3.3 1.2 60.4 1.8 1.2 0.70 42.1	crs cfs fps cfs
Actual Discharge builde the Gutter Section W ($Q_d - Q_x$) Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6^{"}$) Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	$Q_W = Q_{BACK} = Q_{BACK} = Q = Q_{CM} = Q_{CM$	1.9 0.0 12.5 1.2 0.4 1.00 12.5 4.36	1.2 60.4 1.8 1.2 0.70 42.1 6.69	cfs fps cfs inches
Actual Discharge outside the Gutter Section W ($Q_4 - Q_X$) Discharge within the Gutter Section W ($Q_4 - Q_X$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6^{\circ}$) Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	$\begin{array}{c} Q_{W} = \\ Q_{BACK} = \\ Q = \\ V = \\ V = \\ R = \\ \mathbf{Q}_{\mathbf{d}} = \\ \mathbf{d}_{CROWN} = \end{array}$	1.9 0.0 12.5 1.2 0.4 1.00 12.5 4.36 0.00	1.2 60.4 1.8 1.2 0.70 42.1 6.69 2.22	cfs fps cfs inches inches
Discharge outside the Gutter Section W ($Q_d - Q_x$) Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	$\begin{array}{c} Q_{W} = \\ Q_{BACK} = \\ Q = \\ V = \\ V = \\ R = \\ \mathbf{Q}_{\mathbf{d}} = \\ \mathbf{d} = \\ \mathbf{d}_{CROWN} = \end{array}$	1.9 0.0 12.5 1.2 0.4 1.00 12.5 4.36 0.00	1.2 60.4 1.8 1.2 0.70 42.1 6.69 2.22	cfs fps cfs inches inches
Actual Discharge builside the Gutter Section W (Q _d - Q _x) Discharge within the Gutter Section W (Q _d - Q _x) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion	$Q_{W} = Q_{BACK} = Q = Q = V = Q = V = Q = Q = Q = Q = Q$	1.9 0.0 12.5 1.2 0.4 1.00 12.5 4.36 0.00 Minor Storm	1.2 60.4 1.8 1.2 0.70 42.1 6.69 2.22 Major Storm	cfs fps cfs inches inches
Actual Discharge builside the Gutter Section W ($u_d - Q_x$) Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	$\begin{array}{c} Q_{W} = \\ Q_{BACK} = \\ Q = \\ V = \\ V^{*}d = \\ \mathbf{Q}_{\mathbf{d}} = \\ \mathbf{Q}_{\mathbf{d}} = \\ \mathbf{d}_{CROWN} = \end{array}$	1.9 0.0 12.5 1.2 0.4 1.00 12.5 4.36 0.00 Minor Storm 12.5	1.2 60.4 1.8 1.2 0.70 42.1 6.69 2.22 Major Storm 42.1	crs fps cfs cfs cfs inches inches inches

INLET ON A CONTIN	IUOUS G	RADF		
MHFD-Inlet, Version 5.0	1 (April 2021)			
۲				
H-Curb Turun		<u></u>		
H-Ven Wb				
Lo (G)				
CDOT Type R Curb Opening				
Design Information (Input) Type of Inlet	Type -	MINOR	MAJOR Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	ai ocai =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	5.00	5.00	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$VV_0 = C_{e-G} = C_{e-G}$	N/A N/A	N/A N/A	IL
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'	o [MINOR	MAJOR	_ ,
Design Discharge for Haif of Street (from <i>Iniet Management</i>) Water Spread Width	Q ₀ =	11.3	26.3	- CTS ft
Water Depth at Flowline (outside of local depression)	d =	4.2	5.6	inches
Water Depth at Street Crown (or at T _{MAX})	d _{CROWN} =	0.0	1.1	inches
Ratio of Gutter Flow to Design Flow	E ₀ =	0.160	0.116	cfc
Discharge within the Gutter Section W	$Q_x = Q_w = $	1.8	3.0	cfs
Discharge Behind the Curb Face	Q _{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _W =	0.26	0.36	sq ft
Water Depth for Design Condition		7.2	8.6	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	_ L=	N/A	N/A	ft
Inder No-Clogging Condition	$\Box_{0-\text{GRATE}} = \Box$	MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V _o =	N/A	N/A	fps
Interception Rate of Frontal Flow	$R_f =$	N/A	N/A	_
Interception Rate of Side Flow	$R_x = 0$	N/A N/A	N/A N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet Effective (unclogged) Length of Multiple-unit Grate Inlet	GrateClog =	N/Α	N/A N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	$V_o =$	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	
Interception Rate of Side Flow	R _x =	N/A	N/A N/A	cfc
Carry-Over Flow = Q_0 - Q_a (to be applied to curb opening or next d/s inlet)	$\mathbf{Q}_{\mathbf{b}} = \mathbf{Q}_{\mathbf{b}}$	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	- 5	MINOR	MAJOR	_
Equivalent Slope S _e (based on grate carry-over) Required Length L _z to Have 100% Interception	S _e =	0.078	0.062	ft/ft
Under No-Clogging Condition	LT - [MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	15.00	15.00	ft
Interception Capacity	$Q_i = $	9.6 MINOP	15.3 MA10P	cfs
Clogging Coefficient	CurbCoef =	1.31	1.31	コ
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	$L_e =$	14.34	14.34	ft
Actual Interception Capacity Carry-Over Flow = $O_{\text{b/CPATE}}$ - O_{b}	Q _a = O⊾ =	9.6	15.1	crs cfs
Summary	<u> </u>	MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	9.6	15.1	cfs
Canture Percentage = 0.70. =	$Q_b = C_{0}^{b}$	<u>1./</u> 85	57	

MHFD-Inlet, Version 5.01	(April 2021)			
ALLOWABLE CAPACITY FOR ONE-HALF O		EI (MIN)	or & Maj	jor Storm
t: Grandview Reserve	Swable How I	beptil and Spi	eau)	
): Basin C-4 (DP 17c)				
- Sex - Loon -				
111-1-1-2				
Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T _{BACK} =	7.5	lft	
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	SBACK =	0.020	ft/ft	
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n _{BACK} =	0.020		
······································	- BACK	0.020	1	
Height of Curb at Gutter Flow Line	HOURB =	6.00	linches	
Distance from Curb Face to Street Crown	Tenoway =	16.0	ft	
Gutter Width	W -	0.83	ft ft	
Street Transverse Slope		0.00	H /A	
Cutter Cross Slope (typically 2 inches aver 24 inches or 0.092 ft/ft)	~	0.020	10/10 A/A	
Guiller Cross Slope (typically 2 incress over 24 incress of 0.003 it/it)	- 3w	0.083		
Street Longitudinal Slope - Enter 0 for sump condition	S ₀ =	0.020	π/π	
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	IISTREET =	0.016		
		Min en Cherry	Main Channe	
May Allowable Spread for Minor & Major Storm	т _П			A
Max. Allowable Dopth at Cutter Eleviling for Minor & Major Storm	d _	10.0	10.0	linchos
Max. Allowable Depth at Gutter Flowine for Minor & Major Storm	u _{MAX} –	4.4		inches
Allow Flow Deput at Street Crown (Check box for yes, leave blank for ho)			10	
Maximum Canacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	v = [3.84	3.84	linches
Vertical Depth Walder Outler Lin and Gutter Flowline (usually 2")	d,	0.8	0.04	linches
Gutter Depression (d_{-} ($W \neq S \neq 12$))		0.62	0.62	inches
Water Depte at Cutter Eleviting	a -	0.05	0.05	inches
Allowable Spread for Discharge outside the Cutter Section W/(T _ W)		15.2	15.2	
Allowable Spread for Discharge outside the Gutter Section w (1 - W)		15.2	15.2	- ⁿ
Guiller Flow to Design Flow Ratio by FHWA REC-22 Interflow (Eq. 51-7)	E0 =	0.149	0.149	ofo
Discharge outside the Gutter Section W, carried in Section I_{χ}	$Q_{x} = $	10.3	10.3	
Discharge within the Gutter Section W ($Q_T - Q_X$)	Q _W =	1.8	1.8	CTS
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} =$	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	Q _T =	12.1	12.1	cfs
Flow Velocity within the Gutter Section	V =	1.1	1.1	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.4	0.4	
Maximum Cana site for 1/2 Church based on Allowship Doubh				
Theoretical Water Spread	т. Г	Minor Storm	Major Storm	1 4
Theoretical Water Spread	_'™=_	15.6	29.4	
Cutton Flam to Design Flam Patie by FUN(A 1/50 22 and 1/5 (7 7))	1 X TH =	14./	28.6	$- ^{\pi}$
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. S1-7)	E ₀ =	0.153	0.079	
Theoretical Discharge outside the Gutter Section W, carried in Section I_{XTH}	Q _{X TH} =	9.5	55.6	cts
Actual Discharge outside the Gutter Section W, (limited by distance I _{CROWN})	$Q_X =$	9.5	48.2	cfs
	Q _W =	1.7	4.8	cfs
Discharge within the Gutter Section W ($Q_d - Q_x$)	<u> </u>	0.0	1.0	cfs
Discharge within the Gutter Section W ($Q_d - Q_X$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} =$	0.0		
Discharge within the Gutter Section W ($Q_d - Q_X$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor)	$Q_{BACK} = Q = Q$	11.2	54.0	CTS
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section	Q _{BACK} = Q = V =	<u>11.2</u> 1.1	54.0 1.6	fps
Discharge within the Gutter Section W (Q _d - Q _x) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth	Q _{BACK} = Q = V = V*d =	<u>11.2</u> <u>1.1</u> 0.4	54.0 1.6 1.0	fps
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm	Q _{BACK} = Q = V = V*d = R =	11.2 1.1 0.4 1.00	54.0 1.6 1.0 0.83	fps
Discharge within the Gutter Section W ($Q_d - Q_X$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)	Q _{BACK} = Q = V = V*d = R = Q _d =	11.2 1.1 0.4 1.00 11.2	54.0 1.6 1.0 0.83 45.0	fps cfs
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	Q _{BACK} = Q = V = V*d = R = Q _d = d =	11.2 1.1 0.4 1.00 11.2 4.36	54.0 1.6 1.0 0.83 45.0 7.17	crs fps cfs inches
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6^{"}$) Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	$Q_{BACK} = Q = Q = Q = Q = Q = Q = Q = Q = Q = $	11.2 1.1 0.4 1.00 11.2 4.36 0.00	54.0 1.6 1.0 0.83 45.0 7.17 2.70	crs fps cfs inches inches
Discharge within the Gutter Section W ($Q_d - Q_X$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	$Q_{BACK} = Q = Q = Q = Q = Q = Q = Q = Q = Q = $	11.2 1.1 0.4 1.00 11.2 4.36 0.00	54.0 1.6 1.0 0.83 45.0 7.17 2.70	crs fps cfs inches inches
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion	$Q_{BACK} = Q = Q = Q = Q = Q = Q = Q = Q = Q = $	11.2 1.1 0.4 1.00 11.2 4.36 0.00 Minor Storm	54.0 1.6 1.0 0.83 45.0 7.17 2.70 Major Storm	crs fps cfs inches inches
Discharge within the Gutter Section W (Q _d - Q _x) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	$Q_{BACK} = \begin{bmatrix} Q \\ Q \\ V \\ R \\ d \\ d \\ d \\ d_{CROWN} \end{bmatrix}$	11.2 1.1 0.4 1.00 11.2 4.36 0.00 Minor Storm 11.2	54.0 1.6 1.0 0.83 45.0 7.17 2.70 Major Storm 45.0	cfs fps cfs inches inches cfs

INLET ON A CONTIN	JUOUS G	RADF		
MHFD-Inlet, Version 5.0	1 (April 2021)			
r				
H-Curb Dury		3		
H-Vert Wo				
Lo (G)				
CDOT Type R Curb Opening				
Design Information (Input)	Turne –	MINOR	MAJOR Curb Opening	
l ocal Depression (additional to continuous gutter depression 'a')	alocal =	3.0	Curb Opening	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_0 =$	5.00	5.00	ft
Clogging Eactor, for a Single Unit Grate (typical min, value = 0.5)	$VV_0 =$ CrG =	N/A N/A	N/A N/A	T
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	٦.
Design Discharge for Half of Street (from <i>Inlet Management</i>)	$Q_0 = $	5.8	20.8	cfs
Water Depth at Flowline (outside of local depression)	d =	3.5	5.4	linches
Water Depth at Street Crown (or at T _{MAX})	d _{CROWN} =	0.0	0.9	inches
Ratio of Gutter Flow to Design Flow	$E_0 =$	0.200	0.121	
Discharge outside the Gutter Section W, carried in Section 1 _x	Q _x = O _w =	4.7	18.3	
Discharge Behind the Curb Face	Q _{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _W =	0.22	0.34	sq ft
Velocity within the Gutter Section W Water Depth for Design Condition	V _W =	5.4	7.3	tps inches
Grate Analysis (Calculated)	GLOCAL = 1	MINOR	MAJOR	Jinches
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o-GRATE} = L$	N/A MINOR	N/A MA1OR	
Minimum Velocity Where Grate Splash-Over Begins	V. =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	
Interception Rate of Side Flow	$R_x =$	N/A	N/A	
Under Clogging Condition	$Q_i = L$	MINOR	MA1OR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet Minimum Velocity Where Grate Splash-Over Begins	L _e =	N/A N/A	N/A N/A	ft
Interception Rate of Frontal Flow	$R_f =$	N/A	N/A	100
Interception Rate of Side Flow	R _x =	N/A	N/A	
Actual Interception Capacity Carry-Over Flow – O -O (to be applied to curb opening or peyt d/s inlet)	$Q_a = 0$	<u>N/A</u>	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	v _b −	MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S _e =	0.093	0.064	ft/ft
Required Length L_T to Have 100% Interception	L _T = [14.91 MINOR	33.79 MAJOR	ft
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =[14.91	15.00	lft
Interception Capacity	$Q_i =$	5.8	13.6	cfs
Under Clogging Condition	CurbCoof [MINOR	MAJOR	-
Cloaging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbCoer =	0.04	0.04	-
Effective (Unclogged) Length	$L_e = [$	14.34	14.34	ft
Actual Interception Capacity	$Q_a = $	5.8	13.4	cfs
$\frac{ Carry-Uver-rioW = Q_{b/(GRATE)} - Q_a}{ Summary }$	Q _b =	MINOR	MA1OR	CIS
Total Inlet Interception Capacity	Q =[5.8	13.4	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	7.4	cfs
	('V/a —		. 6/	1 1/0

MHFD-Inlet, Version 5.01	(April 2021)		0.14	
ALLOWABLE CAPACITY FOR ONE-HALF O		EI (MIN	or & Ma	jor Storm
Gased on Regulated Citteria for Maximum An	owable riow	Deput and Spi	eau)	
: Basin C-5 (DP 17d)				
- box				
11177				
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} =	0.020		
Height of Curb at Gutter Flow Line	$H_{CURB} =$	6.00	inches	
Distance from Curb Face to Street Crown	T _{CROWN} =	16.0	ft	
Gutter Width	W =	0.83	ft	
Street Transverse Slope	S _X =	0.020	ft/ft	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S _w =	0.083	ft/ft	
Street Longitudinal Slope - Enter 0 for sump condition	S ₀ =	0.015	ft/ft	
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n _{STREET} =	0.016		
			4	
		Minor Storm	Major Storm	ı
Max. Allowable Spread for Minor & Major Storm	T _{MAX} =	16.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d _{MAX} =	4.4	7.7	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)			(W)	
Maximum Capacity for 1/2 Street based On Allowable Spread	_	Minor Storm	Major Storm	1
Water Depth without Gutter Depression (Eq. ST-2)	y =	3.84	3.84	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d _C =	0.8	0.8	inches
Gutter Depression (d _c - (W * S _x * 12))	a =	0.63	0.63	inches
Water Depth at Gutter Flowline	d =	4.47	4.47	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T _x =	15.2	15.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E ₀ =	0.149	0.149	
Discharge outside the Gutter Section W, carried in Section T_{χ}	Q _X =	8.9	8.9	cfs
Discharge within the Gutter Section W ($Q_T - Q_X$)	Q _w =	1.6	1.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q _{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	O _T =	10.5	10.5	cfs
Flow Velocity within the Gutter Section	V =	1.0	1.0	fns
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.4	0.4	
	-			
Maximum Capacity for 1/2 Street based on Allowable Depth	_	Minor Storm	Major Storm	<u>1</u>
Theoretical Water Spread	Т _{тн} =	15.6	29.4	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	Т _{х тн} =	14.7	28.6	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E ₀ =	0.153	0.079	
Theoretical Discharge outside the Gutter Section W, carried in Section T_{XTH}	Q _{X TH} =	8.2	48.1	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN})	Q _x =	8.2	41.7	cfs
Discharge within the Gutter Section W ($Q_d - Q_x$)	$Q_w =$	1.5	4.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	QRACK =	0.0	0.9	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)		9,7	46.8	cfs
Average Flow Velocity Within the Gutter Section	v =	0.9	1.4	fns
V*d Product: Flow Velocity Times Gutter Flowline Denth	V*d -	0.3	1 0.9	
Slope-Based Denth Safety Reduction Factor for Major & Minor $(d > 6")$ Storm	* u =	1.00	1.00	-
May Flow Based on Allowable Depth (Safety Factor Applied)	<u> </u>	07	1.00	- cfs
Pacultant Flow Denth at Cutter Flowline (Safety Factor Applied)	v a –	4.26	7 40.0	
Resultant Flow Depth at Street Crown (Safety Factor Applied)	u =	4.30	7.00	linches
	ucrown -	0.00	3.22	
Resultant now Depth at Suleet Crown (Salety Factor Applied)				
MINOR STORM Allowable Capacity is based on Denth Criterion		Minor Storm	Major Storm	n
MINOR STORM Allowable Capacity is based on Depth Criterion MAIOR STORM Allowable Capacity is based on Depth Criterion	0 - - [Minor Storm 9.7	Major Storm	l cfs
MINOR STORM Allowable Capacity is based on Depth Criterion MAIOR STORM Allowable Capacity is based on Depth Criterion Maior storm max allowable capacity is based on Depth Criterion	Q _{allow} = [Minor Storm 9.7	Major Storm	cfs

INLET ON A CONTIN	JUOUS G	RADF		
MHFD-Inlet, Version 5.0	1 (April 2021)			
۲				
H-Curb IT		3		
H-Vert Wb				
Market Contraction				
Lo (G)				
		MINOP	MAIOP	
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 =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L ₀ =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width) Clogging Eactor, for a Single Unit Grate (typical min, value – 0.5)	vv _o =	N/A	N/A N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.3)	C-C =	0.10	0.10	-
Street Hydraulics: OK - Q < Allowable Street Capacity'	2, 2	MINOR	MAJOR	
Design Discharge for Half of Street (from Inlet Management)	Q ₀ =	5.5	20.2	cfs
Water Spread Width	T =	12.5	16.0	ft
Water Depth at Flowline (outside of local depression)	d =	3.6	5.6	inches
Patio of Gutter Flow to Design Flow	u _{CROWN} =	0.0	0.116	inches
Discharge outside the Gutter Section W, carried in Section $T_{\rm v}$	$O_{x} =$	4.4	17.9	cfs
Discharge within the Gutter Section W	Q _w =	1.1	2.3	cfs
Discharge Behind the Curb Face	Q _{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _W =	0.22	0.36	sq ft
Velocity within the Gutter Section W	V _W =	4.8	6.5	tps
Grate Analysis (Calculated)	ULOCAL -	MINOR	MAIOR	Inches
Total Length of Inlet Grate Opening	L = [N/A	N/A	ft
Ratio of Grate Flow to Design Flow	E _{o-GRATE} =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	-
Minimum Velocity Where Grate Splash-Over Begins	V ₀ =	N/A	N/A	fps
Interception Rate of Fional Flow	R _f =	N/A N/A	N/A N/A	-
Interception Rate of Side Flow	$O_i =$	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		N/A	N/A N/A	ft
Interception Rate of Frontal Flow	V ₀ – R _f =	N/A	N/A	103
Interception Rate of Side Flow	$R_x =$	N/A	N/A	
Actual Interception Capacity	Q _a =	N/A	N/A	cfs
Carry-Over Flow = Q_0 - Q_a (to be applied to curb opening or next d/s inlet)	Q _b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	с _Г	MINOR	MAJOR	
Required Length L _T to Have 100% Interception	5 _e =	14.40	33 15	
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =[14.40	15.00	ft
Interception Capacity	Q _i =	5.5	13.4	cfs
Under Clogging Condition	Currh Coof	MINOR	MAJOR	-
Clogging Eactor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog -	0.04	1.31	
Effective (Uncloaged) Lenath		14.34	14.34	
Actual Interception Capacity	\mathbf{Q}_{a} =	5.5	13.2	cfs
$Carry-Over Flow = Q_{b/(GRATE)} Q_a$	Q _b =	0.0	7.0	cfs
Summary	~ 「	MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	5.5	7.0	crs
Canture Percentage = Ω_2/Ω_2 =	чь – С% –	100	65	- 06

MHFD-Inlet, Version 5.01	(April 2021)			
ALLOWABLE CAPACITY FOR ONE-HALF C	OF STRE	ET (Mino	or & Maj	or Storm)
t: Grandview Reserve	owable Flow	Depth and Spr	ead)	
): Basin C-6 (DP 17e)				
Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	TRACK =	7.5	lft	
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	SBACK =	0.020	ft/ft	
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	nBACK =	0.020	1,0,10	
······································	- BACK	0.020	1	
Height of Curb at Gutter Flow Line	HOURB =	6.00	linches	
Distance from Curb Face to Street Crown	TCROWN =	16.0	ft	
Gutter Width	W =	0.83	ft	
Street Transverse Slone	S. =	0.020	ff/ff	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	s –	0.020	H/H	
Street Longitudinal Slope - Enter 0 for sumn condition	S ₂ -	0.005	fr/ft	
Manning's Poughness for Street Section (typically between 0.012 and 0.020)		0.015		
rialining's Roughness for Sulect Section (typically between 0.012 and 0.020)	IISTREET -	0.010	1	
		Minor Storm	Major Storm	
Max Allowable Spread for Minor & Major Storm	т – Г	16.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d	4.4	77	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	umax -	т.т	1.7	Inches
Allow How Deput at Street Crown (check box for yes, leave blank for ho)			14°	
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Fg. ST-2)	v =[3 84	3 84	linches
Vertical Depth hetween Gutter Lin and Gutter Flowline (usually 2")	d _c =	0.8	0.8	linches
Gutter Depression (d_{e} - (W * S * 12))	a=	0.63	0.63	linches
Water Depth at Gutter Flowline	- n	4 47	4 47	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	т. =	15.2	15.2	ff
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Fg. ST-7)	Fo -	0 140	0.140	
Discharge outside the Gutter Section W, carried in Section T.	0	0.145	0.145	cfs
Discharge within the Gutter Section $W(0, -0)$	~	1.6	0.9	cfs
Discharge Within the Gutter Section W $(Q_T - Q_X)$	~~~	1.0	1.0	
Maximum Elow Paced On Allowable Spread	QBACK -	10.0	10.0	
Flaw Mala site with in the Center Castien	v ₁ –	10.5	10.5	
Flow Velocity Within the Gutter Section	V =	1.0	1.0	
v*a Product: Flow velocity times Gutter Flowline Depth	v*a = [0.4	0.4	
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	т = Г	15.6	29.4	∃ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	T	14 7	29.5	
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Fg. ST-7)	'X TH -	0.153	0.079	-l.,
Theoretical Discharge outside the Gutter Section W. carried in Section Tu-		8.2	<u></u> <u></u> <u></u> <u></u>	fs
Δ ctual Discharge outside the Gutter Section W. (limited by distance T)		0.2 g n	41 7	- dis
(infince by distance T _{CROWN})	Qx -	0.2	41./	- Cfs
Discharge within the Gutter Section W $(\Omega_{1} - \Omega_{2})$	- vw	1.5	+.1	
Discharge within the Gutter Section W ($Q_d - Q_X$)	Ľ	0.0	1 11 11	
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Table Discharge for White θ , Misse Sterre (De Script Easter)	$Q_{BACK} =$	0.0	0.9	ofo
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q _{BACK} = Q =	0.0 9.7	46.8	cfs
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section	Q _{BACK} = Q = V =	0.0 9.7 0.9	0.9 46.8 1.4	cfs fps
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth	Q _{BACK} = Q = V = V*d =	0.0 9.7 0.9 0.3	0.9 46.8 1.4 0.9	cfs fps
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6^{"}$) Storm May Eleven Based on Elevents (Safety Factor for Major & Minor ($d \ge 6^{"}$) Storm	Q _{BACK} = Q = V = V*d = R =	0.0 9.7 0.9 0.3 1.00	0.9 46.8 1.4 0.9 1.00	cfs fps
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)	Q _{BACK} = Q = V = V*d = R = Q _d =	0.0 9.7 0.9 0.3 1.00 9.7	0.9 46.8 1.4 0.9 1.00 46.8	cfs fps cfs
Discharge within the Gutter Section W ($Q_d - Q_s$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	Q _{BACK} = Q = V = V*d = R = d =	0.0 9.7 0.9 0.3 1.00 9.7 4.36	0.9 46.8 1.4 0.9 1.00 46.8 7.68	cfs fps cfs inches
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6$ ") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	$\begin{array}{c} Q_{BACK} = \\ Q = \\ V = \\ V^*d = \\ R = \\ \mathbf{Q_d} = \\ d_{CROWN} = \end{array}$	0.0 9.7 0.9 0.3 1.00 9.7 4.36 0.00	0.9 46.8 1.4 0.9 1.00 46.8 7.68 3.22	cfs fps cfs inches inches
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6''$) Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	$Q_{BACK} = Q = Q = Q = Q = Q = Q = Q = Q = Q = $	0.0 9.7 0.9 0.3 1.00 9.7 4.36 0.00	0.9 46.8 1.4 0.9 1.00 46.8 7.68 3.22	cfs fps cfs inches inches
Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6^{"}$) Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion	$Q_{BACK} = Q = Q = Q = Q = Q = Q = Q = Q = Q = $	0.0 9.7 0.9 0.3 1.00 9.7 4.36 0.00 Minor Storm	46.8 1.4 0.9 1.00 46.8 7.68 3.22 Major Storm	cfs fps cfs inches inches
Discharge within the Gutter Section W (Q _d - Q _x) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	$Q_{BACK} = Q = Q = Q = Q = Q = Q = Q = Q = Q = $	0.0 9.7 0.9 0.3 1.00 9.7 4.36 0.00 Minor Storm 9.7	46.8 1.4 0.9 1.00 46.8 7.68 3.22 Major Storm 46.8	cfs fps cfs inches inches cfs

INLET ON A CONTIN	JUOUS G	RADF		
MHFD-Inlet, Version 5.0	1 (April 2021)			
r				
H-Curb IT H MA		5		
H Wen Wo				
Lo (G)				
CDOT Type B Curb Opening				
		MINOR	MAIOR	
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 =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		5.00	5.00	ft
Clogging Eactor, for a Single Unit Grate (typical min, value = 0.5)	vv _o = C-G =	N/A N/A	N/A	IL
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.3)	C-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from Inlet Management)	Q ₀ =	3.3	11.7	cfs
Water Spread Width	T =	10.3	16.0	ft
Water Depth at Flowline (outside of local depression)	d =	3.1	4.6	inches
Ratio of Gutter Flow to Design Flow	u _{CROWN} =	0.237	0.142	linches
Discharge outside the Gutter Section W, carried in Section T_x	$\vec{Q}_x =$	2.5	10.1	cfs
Discharge within the Gutter Section W	Q _w =	0.8	1.7	cfs
Discharge Behind the Curb Face	Q _{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _w =	0.19	0.29	sq ft
Velocity within the Gutter Section W	V _W =	4.2	5./	tps inchos
Grate Analysis (Calculated)	ULOCAL -	MINOR	MAIOR	linches
Total Length of Inlet Grate Opening	L = [N/A	N/A	ft
Ratio of Grate Flow to Design Flow	E _{o-GRATE} =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	-]_
Minimum Velocity Where Grate Splash-Over Begins	V ₀ =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A N/A	N/A N/A	-
Interception Capacity	$O_i =$	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		N/A	N/A	ft
Intercention Rate of Frontal Flow	v _o = R _f =	Ν/A Ν/Δ	N/A N/A	ips
Interception Rate of Side Flow	$R_x =$	N/A	N/A	-
Actual Interception Capacity	$\mathbf{Q}_{a} =$	N/A	N/A	cfs
Carry-Over Flow = Q_0 - Q_a (to be applied to curb opening or next d/s inlet)	Q _b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	c [MINOR	MAJOR	- C. (C.
Equivalent Slope Se (Dased on grate carry-over)	S _e =	10.30	0.072	
Under No-Clogging Condition	LT - L	MINOR	MA10R	itt
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L _T)	L = [10.30	15.00	ft
Interception Capacity	Q _i =	3.3	9.8	cfs
Under Clogging Condition		MINOR	MAJOR	_
Logging Coefficient	CurbCoef =	1.31	1.31	_
Coogging Factor for Multiple-unit Curb Opening or Slotted Inlet Effective (Uncloaded) Lenath		14 34	14 34	
Actual Interception Capacity	Q _a =	3.3	9.7	cfs
Carry-Over Flow = $Q_{h(GRATE)}$ - Q_a	Q _b =	0.0	2.0	cfs
Summary		MINOR	MAJOR	<u></u>
I otal Inlet Interception Capacity	Q =	3.3	9.7	cfs
Canture Percentage – 0. /0. –	Q _b =	100	2.0	



INLET ON A CONTIN	NUOUS G	RADE		
MHFD-Inlet, Version 5.0	01 (April 2021)			
LO (C)				
H-Curb H-Vert		2		
1 1 1 10		_		
W E				
Lo (G)				
CDOT Type R Curb Opening				
Design Information (Input)		MINOR	MAJOR	_
Type of Inlet Local Depression (additional to continuous dutter depression 'a')	Type =	CDOT Type R	Curb Opening	linches
Total Number of Units in the Inlet (Grate or Curb Opening)	alocal =	3.0	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L _o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W _o =	N/A	N/A	ft
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.5)	C _f -G = C _f -C =	0.10	0.10	-
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	_
Design Discharge for Half of Street (from <i>Inlet Management</i>)	$Q_0 =$	8.6	20.0	cfs
Water Spread Width Water Depth at Flowline (outside of local depression)	1 = d =	3.9	5.2	 inches
Water Depth at Street Crown (or at T_{MAX})	d _{CROWN} =	0.0	0.7	inches
Ratio of Gutter Flow to Design Flow	E _o =	0.174	0.125	
Discharge outside the Gutter Section W, carried in Section I_x	Q _x =	/.1	1/.5	Cfs
Discharge Behind the Curb Face	Q _{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _W =	0.24	0.33	sq ft
Velocity within the Gutter Section W	V _W =	6.1	7.5	fps inchoc
Grate Analysis (Calculated)	ULOCAL - I	MINOR	MAJOR	Inches
Total Length of Inlet Grate Opening	L = [N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o-GRATE} =$	N/A MINOR	N/A	
Minimum Velocity Where Grate Splash-Over Begins	V. =[N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	
Interception Rate of Side Flow	$R_x =$	N/A	N/A	
Interception Capacity	$Q_i = L$	MINOR	MA1OR	crs
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet Minimum Velocity Where Grate Splash-Over Begins	L _e =	N/A N/A	N/A N/A	TT fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	- 190
Interception Rate of Side Flow	$R_x =$	N/A	N/A	
Actual Interception Capacity Carry-Over Flow = $\Omega_{-}\Omega_{-}$ (to be applied to curb opening or pext d/s inlet)	Q _a =	<u>N/A</u>	N/A N/A	cts
Curb or Slotted Inlet Opening Analysis (Calculated)	4 b = 1	MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S _e =	0.083	0.065	ft/ft
Required Length L_T to Have 100% Interception	L _T = [19.17 MINOR	32.97 MA1OR	ft
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	15.00	15.00	ft
Interception Capacity	$Q_i =$	8.0	13.3	cfs
Under Clogging Condition	CurbCoof - [MINOR 1 31	MAJOR 1 31	7
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	-
Effective (Unclogged) Length	$L_e =$	14.34	14.34	ft
Actual Interception Capacity	Q _a =	8.0	13.1	cfs
Summary	Q b = [MINOR	MAJOR	
Total Inlet Interception Capacity	Q = [8.0	13.1	cfs
I otal Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = $	0.6	6.9	cfs

ALLOWABLE CAPACITY FOR ONE-HALE OF STREET (MINOR & Major Storm (Read on Regulated Citeria for Maximum Allowable Flow Depth and Spread) the stand - Star (P37) the stand - Star (P37) Start - Case (P37) Maximum Allowable Width for Spread Belmid Curb (See Stope Belmid Curb (Spread Reim Curb See Stope Belmid Curb (Spread Reim Curb Step Stope Stope Step Step Stope Step Step Stope Step Stope Stope Stope Stope Step Stope St	MHFD-Inlet, Version 5.0	1 (April 2021)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread) Toronchieve Reserve Basin C-58 (DP19) Subscription Curb (New blank for no conveyance criedit behind curb) Maximum Allowable With for Spread Behind Curb Side Space Behind Curb (Sueze blank for no conveyance criedit behind curb) Height of Curb at Cutter (How Line) Distance from Curb Face to Street Crown Gutter With Street Longuidant Space - Errel Or samp continu Maximum Capacity for 1/2 Street Allowable Spread Water Depth without Cutter Depression (Eq. ST-1) Next How Line Curb (Line) Face to Street Scroin (Line) (Line) How Storm Allow Flow Depth at Street Torwine Major Storm Allow Flow Depth at Street Torwine Conversion (Line) (Line) (Line) How Storm Allow Flow Depth at Street Torwine (Line) (Lin	ALLOWABLE CAPACITY FOR ONE-HALF	OF STREET (Minor & Major Storm)	
Sesin C-9: (0P179) Substime C-9: (0P179) Minor Storm Major Storm Minor Storm Major Storm Minor Storm Major Storm Major Storm Minor Storm Maj	t: Grandview Reserve (Based on Regulated Criteria for Maximum A	llowable Flow Depth and Spread)	
Summed Sector UP U Suffer Geometry: Maximum Allowable Width for Spread Behind Curb Take: <	D: Basin C-9a (DP17g)		
$ \frac{1}{12} $			
Gutter Geometry: Maximum Allowable Wath for Spread Behind Curb Side Slope Behind Curb (spically Edware 0.012 and 0.020)Tiscx =Tiscx = <th colsp<="" th=""><th></th><th></th></th>	<th></th> <th></th>		
Subset Section 12Maximum Analysies Selend Curb (typically between 0.012 and 0.020)Tacc = $\frac{7}{25}$ $\frac{1}{10}$ Height of Curb at Gutter Flow LineHouse $\frac{1}{10}$ $\frac{1}{10}$ $\frac{1}{10}$ $\frac{1}{10}$ Distance from Curb Face to Street Coven $\frac{1}{10}$ $$	Gutter Coometry:		
$\begin{aligned} & \text{Production hardness from Curb Case Under Bank for no conveyance credit behind curb)} \\ & \text{Maning's Roughness Behind Curb (typically between 0.012 and 0.020)} \\ & \text{Height of Curb at Gutte Flow Line} \\ & \text{Distance from Curb Face to Street Crown} \\ & \text{Gutter Width} \\ & \text{Street Transverse Slope} \\ & \text{Gutter Tow Street Dors undot for sum condition} \\ & \text{Maning's Roughness for Street Section (typically between 0.012 and 0.020)} \\ & \text{Max. Allowable Spread for Minor & Major Storm} \\ & \text{Max. Allowable Spread for Minor & Major Storm} \\ & \text{Max. Allowable Spread for Minor & Major Storm} \\ & \text{Max. Allowable Spread for Minor & Major Storm} \\ & \text{Max. Allowable Spread for Minor & Major Storm} \\ & \text{Max. Allowable Spread for Minor & Major Storm} \\ & \text{Max. Allowable Spread for Minor & Major Storm} \\ & \text{Max. Allowable Spread for Minor & Major Storm} \\ & \text{Max. Allowable Spread for Minor & Major Storm} \\ & \text{Max. Burber and Starter Flow Inte Gutter Section (typically between 0.012 and 0.020)} \\ & \text{Max. Movable Spread for Minor & Major Storm} \\ & \text{Max. Burber and Starter Flow Inte Gutter Section (typically between 0.012 and 0.020)} \\ & Max. Burber and Starter Flow Inte Gutter Section (typically Storm (the Cutter Section (typically 2')) \\ & \text{Gutter Flow to Design Flow Ratio by FHVA HEC-22 method (Eq. ST-7) \\ & \text{Discharge outside the Gutter Section (typically distarce Tcourd) \\ & \text{Maximum Capacity for 1/2 Street based on Allowable Spread \\ & \text{Flow Velocity within the Gutter Section (typically distarce Tcourd) \\ & \text{Maximum Capacity for 1/2 Street based on Allowable Depth \\ & \text{Theoretical Discharge outside the Gutter Section (typically distarce Tcourd) \\ & \text{Maximum Capacity for 1/2 Street based on Allowable Depth \\ & \text{Theoretical Discharge outside the Gutter Section (typically distance Tcourd) \\ & \text{Supper add for Discharge outside the Gutter Section (typically distance Tcourd) \\ & \text{Supper add for Discharge outside the Gutter Section (typically distance Tcourd) \\ & \text{Supper add for Discharge outside t$	Guller Geometry: Maximum Allowable Width for Spread Behind Curb	T - 75 A	
adde de lind college de la bedra de la de l	Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	BACK - 7.5 IL	
$\begin{aligned} & \text{Height of Curb a Gutter Flow Line} \\ & \text{Height of Curb a Gutter Flow Line} \\ & \text{Distance from Curb Face to Street Crown} \\ & \text{Gutter Width} \\ & \text{Street Transverse Slope} \\ & \text{Gutter Torss Slope (typically 2 inches over 24 inches or 0.083 ft/ft)} \\ & \text{Street Transverse Slope} \\ & \text{Gutter Torss Slope (typically 2 inches over 24 inches or 0.083 ft/ft)} \\ & \text{Street transverse Slope} \\ & \text{Gutter Flow there 0 for sum condition} \\ & \text{Manning's Roughness for Street Section (typically between 0.012 and 0.020)} \\ & \text{Max. Allowable Spread for Minor & Major Storm} \\ & \text{Max. Allowable Spread for Minor & Major Storm} \\ & \text{Max. Allowable Spread for Minor & Major Storm} \\ & \text{Max. Allowable Spread for Minor & Major Storm} \\ & \text{Max. Mowable Spread for Ninor & Major Storm} \\ & \text{Max. Mowable Spread for Discharge outside the Gutter Flowline (usually 2') \\ & \text{Vetrical Depth between Gutter Lip and Gutter Flowline (usually 2') \\ & \text{Water Depth without Gutter Depression (fc, ST-2) \\ & \text{Uster Depression (fc, ST, 12) } \\ & \text{Mater Depth a Gutter Flowline Gutter Flowline (usually 2') \\ & \text{Gutter Flow to Besign frow Ratio by FHWA HEC-32 method (fc, ST-7) \\ & \text{Discharge outside the Gutter Section W (T - W) \\ & \text{Discharge outside the Gutter Section W (T - W) \\ & \text{Maximum Flow Based On Allowable Spread \\ & \text{Minor Storm} \\ & \text{Maximum Flow Based On Allowable Spread \\ & \text{Pow Velocity With the Gutter Section W (Qr - Q_2) \\ & \text{Discharge outside the Gutter Section W (Qr - Q_2) \\ & \text{Discharge outside the Gutter Section W (Qr - Q_2) \\ & \text{Discharge outside the Gutter Section W (Qr - Q_2) \\ & \text{Maximum Flow Based On Allowable Spread \\ & \text{How Velocity Within the Gutter Section W (Gr - W) \\ & \text{Trans e Major Storm \\ & \text{Maximum Flow Based On Allowable Spread \\ & \text{How Velocity Within the Gutter Section W (Gr - W) \\ & \text{Maximum Flow Based On Allowable Spread \\ & \text{How Velocity Within the Gutter Section W (Gr - V) \\ & \text{Trans e Minor Storm \\ & \text{Maximum Flow Based On Allowable Spread \\ & \text{How Storm } Stare FlowWinco G$	Manning's Poughness Behind Curb (typically between 0.012 and 0.020)	SBACK - 0.020 IVIL	
Height of Curb at Gutter Flow LineHouse <t< td=""><td>rial ming's Roughness behind curb (typically between 0.012 and 0.020)</td><td>11_{BACK} – 0.020</td></t<>	rial ming's Roughness behind curb (typically between 0.012 and 0.020)	11 _{BACK} – 0.020	
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Catter With Gutter Transverse Siope Gutter VidabTagon =0.03 0.020ft ft ft ft Sreet Transverse Siope 0.020Tut ft ft ft Sreet Longitudinal Stope - Enter 0 for sump condition Some To sump condition 	Distance from Curb Face to Street Crown		
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Max. Allowable Spread for Minor & Major StormMax. Allowable Spread for Minor & Major StormMax. Allowable Construction of Major StormMajor StormMajor StormMaximum Capacity for 1/2 Street based On Allowable Spread $V = 1.00$ 1.44 7.7 inchesMater Depth without Gutter Depression (G ₁ , CV S ₂ , *12) $d_c = 0.8$ 0.8 0.8 inchesGutter Depth without Gutter Depression (G ₁ , CV S ₂ , *12) $d_c = 0.63$ 0.63 inchesGutter Depth at Gutter Flowline(usually 2") $d_c = 0.149$ 0.149 inchesGutter Devin to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) $E_0 = 0.149$ 0.149 0.149 Discharge outside the Gutter Section W ($T - Q_2$) $Q_{abccx} = 0.0$ 0.0 d_s Discharge Number Social Off ($T/2$ Street based on Allowable Depth $V = 1.1$ 1.1 1.1 Maximum Capacity for 1/2 Street based on Allowable Depth $V = 1.2.1$ $1.2.1$ f_s Maximum Capacity for 1/2 Street based on Allowable Depth $V = 1.2.1$ $1.2.2$ f_s Maximum Capacity for 1/2 Street based on Allowable Depth $V = 1.2.1$ 1.1 1.1 Maximum Capacity for 1/2 Street based on Allowable Depth $V = 1.2.1$ $1.2.2$ f_s Maximum Capacity for 1/2 Street based on Allowable Depth $V = 1.2.1$ $1.2.2$ f_s Maximum Capacity for 1/2 Street based on Allowable Depth $V = 0.4$ <t< td=""><td>Manning's Roughness for Street Section (typically between 0.012 and 0.020)</td><td>$n_{\text{CTDEFT}} = 0.016$</td></t<>	Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{\text{CTDEFT}} = 0.016$	
Max. Allowable Spread for Minor & Major Storm Max. Allowable Depth at Gutter Flowline for Minor & Major Storm Allow Flow Depth at Street Crown (check box for yes, leave blank for no) $T_{Max} = 16.0$ Major Storm (16.0ft (16.0)ft (16.0)	······································	-SIREEI 01010	
Max. Allowable Spread for Minor & Major Storm T_{Max} <td></td> <td>Minor Storm Major Storm</td>		Minor Storm Major Storm	
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm $d_{Max} = \frac{4.4}{4.7.72}$ inchesAllow Flow Depth at Street Crown (check box for yes, leave blank for no)Image: the street Crown (check box for yes, leave blank for no)Maximum Capacity for 1/2 Street based On Allowable SpreadImage: the street Crown (check box for yes, leave blank for no)Water Depth without Gutter Depression (cbc, ST-2)y = Water Depth without Gutter Depression (cbc, ST-2)y = Gutter Depression (cbc, (W * S_* 12))a = Water Depth at Gutter Flowlined = Allowable Spread for Discharge outside the Gutter Section W (T - W)T_x = Gutter Bornes outside the Gutter Section W, carried in Section T_xQ_x = Discharge outside the Gutter Section W, carried in Section T_xQ_w = Discharge outside the Gutter Section W (T - W)Q_{max} = Discharge outside the Gutter Section W (T - W)Q_{max} = Plow Velocity within the Gutter Section W, (T - W)T_x = Flow Velocity for 1/2 Street based on Allowable DepthT_TH = Maximum Capacity for 1/2 Street based on Allowable DepthT_TH = Theoretical Spread for Discharge outside the Gutter Section W (T - W)T_x = Gutter Flow to Design Flow Ratio by FlyMA HEC-22 method (Eq. ST-7)T_S = Discharge blind the Curb (e.g., sidewalk, driveways, & lawns)Q_{abcx} = Maximum Capacity for 1/2 Street based on Allowable DepthT_TH = Theoretical Spread for Discharge outside the Gutter Section W (T - W)T_X = Gutter Flow to Design Flow Ratio by FlyMA HEC-22 method (Eq. ST-7)T_S = <	Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = 16.0$ 16.0 ft	
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Maximum Capacity for 1/2. Street based On Allowable Spready =Minor StormMajor StormWater Depth without Gutter Depression (G, ST-2)y = 0.8 0.8 0.8 inchesGutter Depth at Gutter Flowline(usually 2")a = 0.63 0.63 inchesMainer Depth at Gutter Flowlined = 4.47 4.47 inchesAllowable Spread for Discharge outside the Gutter Section W (T - W)Tx = 15.2 11.2 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)Eq. = 0.149 0.149 Discharge Nutriki the Gutter Section W (Qr - Qx)Qw = 10.3 10.3 cfsDischarge Behind the Curb (e.g., sidewalk, driveways, & lawns)Quarker = 0.0 0.0 0.0 Maximum Capacity for 1/2 Street based on Allowable DepthV*d = 0.4 0.4 0.4 Theoretical Spread for Discharge outside the Gutter Section W (T - W) $T_{XT} =$ 15.5 29.4 ftGutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) E_0 = 0.153 0.079 fsFlow Velocity within the Gutter Section W, (minet by distance T _{CROWN}) $V_{x} =$ 9.5 55.6 ffMaximum Capacity for 1/2 Street based on Allowable Depth $T_{XT} =$ 9.5 48.2 cfsTheoretical Discharge outside the Gutter Section W, (Tr - W) $T_{XT} =$ 9.5 48.2 cfsGutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) E_0 = 9.5 48.2 ffTheoretical Starge outside the Gutter S	Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		
Maximum Capacity for 1/2 Street based On Allowable SpreadMinor StormMajor StormWater Depth without Gutter Depression (Eq. ST-2) $y = 3.84$ 3.84Water Depth between Gutter ID and Gutter Flowline (usually 2") $d = 0.8$ 0.8Gutter Depression ($d_c : (W * S_s * 12)$) $a = 0.63$ 0.63Water Depth a Gutter Flowline $d = 4.47$ 4.47Allowable Spread for Discharge outside the Gutter Section W (T - W) $T_x = 15.2$ 15.2Discharge outside the Gutter Section W (Q_r - Q_x) $Q_x = 10.3$ 10.3Discharge behind the Curb (e.g., sidewalk, driveways, & lawns) $Q_{accc} = 0.0$ 0.0Discharge behind the Curb (e.g., sidewalk, driveways, & lawns) $Q_{accc} = 1.1$ 1.1Maximum Capacity for 1/2 Street based on Allowable Depth $T_{TH} = 15.5$ 29.4Theoretical Spread for Discharge outside the Gutter Section W (T - W) $T_{TH} = 15.5$ 29.4Maximum Capacity for 1/2 Street based on Allowable Depth $T_{TH} = 15.5$ 29.4Theoretical Spread for Discharge outside the Gutter Section W (T - W) $T_{TH} = 15.5$ 29.4Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) $F_0 = 0.153$ 0.079Return Expread Theoretical Spread for Discharge outside the Gutter Section W ($T - W$) $T_{TH} = 14.7$ 28.6Theoretical Discharge outside the Gutter Section W ($T - W$) $T_{TH} = 9.5$ 55.6Gitter Flow to Design Flow Ratio by FHWA HEC-22 method (F_0 , ST-7) $F_0 = 0.153$ 0.079Rotar Discharge outside the Gutter Section W ($T - W$) $T_{TH} = 14.7$ 28.6ft<			
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Allowable Spread for Discharge outside the Gutter Section W (T - W) $T_x =$ 15.2 1	Water Depth at Gutter Flowline	d = 4.47 4.47 inches	
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)Eq. = 0.1490.1490.149Discharge outside the Gutter Section W ($Q_T - Q_0$)Q. $x = 10.3$ 10.310.310.310.30.1490.1400.1530.000.1530.079Theoretical SpreadTheoret	Allowable Spread for Discharge outside the Gutter Section W (T - W)	T _x = 15.2 15.2 ft	
Discharge outside the Gutter Section W, carried in Section T _x Discharge within the Gutter Section W (Q _T - Q _x) Discharge within the Gutter Section W (Q _T - Q _x) Maximum Flow Based On Allowable Spread Flow Velocity within the Gutter Section V*d Product: Flow Velocity times Gutter Flowline Depth Maximum Capacity for 1/2 Street based on Allowable Depth Theoretical Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) Theoretical Discharge outside the Gutter Section W, carried in Section T _{x TH} Actual Discharge outside the Gutter Section W, carried in Section T _{x TH} Actual Discharge outside the Gutter Section W, Carried in Section T _{x TH} Actual Discharge outside the Gutter Section W, Carried in Section T _{x TH} Actual Discharge outside the Gutter Section W, Carried in Section T _{x TH} Actual Discharge for Major & Minor Storm (Pre-Safety Factor) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MINOR STORM Allowable Capacity is based on Depth Criterion MIN	Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.149 0.149$	
Discharge within the Gutter Section W $(Q_T - Q_x)$ $Q_w = 1.8$ 1.8 0.0 <th c<="" td=""><td>Discharge outside the Gutter Section W, carried in Section T_x</td><td>$Q_X = 10.3$ 10.3 cfs</td></th>	<td>Discharge outside the Gutter Section W, carried in Section T_x</td> <td>$Q_X = 10.3$ 10.3 cfs</td>	Discharge outside the Gutter Section W, carried in Section T _x	$Q_X = 10.3$ 10.3 cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Maximum Flow Based On Allowable Spread Flow Velocity within the Gutter Section V*d Product: Flow Velocity times Gutter Flowline Depth Maximum Capacity for 1/2 Street based on Allowable Depth Theoretical Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) Theoretical Discharge outside the Gutter Section W, carried in Section T _{X TH} Actual Discharge outside the Gutter Section W, carried in Section T _{X TH} Actual Discharge outside the Gutter Section W, carried in Section T _{X TH} Discharge within the Gutter Section W (Q _a - Q _A) Discharge behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section Flow in the Gutter Flowline Depth Slope-Based On Allowable Depth Gitter Flowline Depth Max Flow Based on Allowable Depth Gifter Flowline Capethy Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MINOR STORM Allowable Capacity is based on Depth Criterion MI	Discharge within the Gutter Section W ($Q_T - Q_X$)	$Q_W = 1.8$ 1.8 cfs	
Maximum Flow Based On Allowable Spread $Q_{T} =$ 12.112.1cfsFlow Velocity within the Gutter Section $V^* d$ $V =$ 1.1 1.1 1.1 fps Maximum Capacity for 1/2 Street based on Allowable Depth $V^* d =$ 0.4 0.4 0.4 Maximum Capacity for 1/2 Street based on Allowable Depth $V^* d =$ 0.4 0.4 Theoretical Spread for Discharge outside the Gutter Section W (T - W) $T_{TH} =$ 15.6 29.4 ftGutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) $E_0 =$ 0.153 0.079 fsTheoretical Discharge outside the Gutter Section W, carried in Section $T_{X,TH}$ $Q_{X,TH} =$ 9.5 48.2 fsDischarge within the Gutter Section W (Qi - Q _X) $Q_W =$ 1.7 4.8 cfsfsDischarge behind the Curb (e.g., sidewalk, driveways, & lawns) $Q_{BCK} =$ 0.0 1.0 cfsTotal Discharge for Major & Minor Storm (Pre-Safety Factor) $V =$ 1.1 1.6 fpsAverage Flow Velocity Times Gutter Flowline Depth $V^*d =$ 0.4 1.0 fsSlope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm $R =$ 1.00 0.83 fsMax Flow Based on Allowable Depth Gisfety Factor Applied) $d =$ 4.36 7.17 inchesMinor Storm Max Flow Based on Depth Criterion $Q_{allow} =$ 11.2 45.0 cfsMinor Storm Mallowable Capacity is based on Depth Criterion $Q_{allow} =$ 11.2 45.0 cfs	Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 \text{ cfs}$	
Flow Velocity within the Gutter SectionV = 1.1 1.1 <td>Maximum Flow Based On Allowable Spread</td> <td>$Q_{T} = 12.1$ 12.1 cfs</td>	Maximum Flow Based On Allowable Spread	$Q_{T} = 12.1$ 12.1 cfs	
V*d Product: Flow Velocity times Gutter Flowline Depth Maximum Capacity for 1/2 Street based on Allowable Depth Theoretical Water Spread Theoretical Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) Theoretical Discharge outside the Gutter Section W, (T - W) Actual Discharge outside the Gutter Section W, carried in Section T _{X TH} Discharge outside the Gutter Section W, (limited by distance T _{CROWN}) Discharge outside the Gutter Section W, (limited by distance T _{CROWN}) Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm max, allowable Capacity is based on Depth Criterion Minor Storm Max, allowable Capa	Flow Velocity within the Gutter Section	V = <u>1.1</u> <u>1.1</u> fps	
Maximum Capacity for 1/2 Street based on Allowable Depth Theoretical Water SpreadMinor Storm T T T T T T T T T Theoretical Spread for Discharge outside the Gutter Section W (T - W) Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) Theoretical Discharge outside the Gutter Section W, carried in Section T T Theoretical Discharge outside the Gutter Section W, carried in Section T T T Theoretical Discharge outside the Gutter Section W, (limited by distance T CROWN)Minor Storm T T T Socharge outside the Gutter Section W, (limited by distance T CROWN)Minor Storm T C Q Q WMinor Storm T 48.2ft ft ft d Socharge outside the Gutter Section W, (limited by distance T CROWN)Minor Storm Q Q WMinor Storm 14.7Major Storm 14.7Re 28.6Discharge outside the Gutter Section W (Qd - Qx)Q WQ W9.548.2cfsDischarge for Major & Minor Storm (Pre-Safety Factor)Q W0.01.0cfsAverage Flow Velocity Within the Gutter SectionV V1.11.6fpsV*d Product: Flow Velocity Times Gutter Flowline DepthV*d =0.41.0fpsSlope-Based Depth Safety Reduction Factor Applied)R a11.245.0cfsResultant Flow Depth at Gutter Flowline (Safety Factor Applied)d d d crown (Safety Factor Applied)d d d d d crown11.245.0cfsMINOR STORM Allowable Capacity is based on Depth CriterionMinor Storm Major Storm MAJOR STORM Allowable Capacity is based on Depth CriterionMinor Storm Major Stor	V*d Product: Flow Velocity times Gutter Flowline Depth	V*d = 0.4 0.4	
Minor stormMajor stormMajor stormTheoretical Water SpreadTTTheoretical Spread for Discharge outside the Gutter Section W (T - W)TTGutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)E00.153Theoretical Discharge outside the Gutter Section W, carried in Section Tx THQx TH =9.5Actual Discharge outside the Gutter Section W, carried in Section Tx THQx =9.5Actual Discharge outside the Gutter Section W, QalowQw =1.74.8Discharge within the Gutter Section W (Qa - Qx)Qw =1.74.8cfsDischarge for Major & Minor Storm (Pre-Safety Factor)Q =11.11.6fpsAverage Flow Velocity Within the Gutter Section F (Pre-Safety Factor)V =1.11.6fpsV*d Product: Flow Velocity Times Gutter Flowline DepthV*d =0.41.0fsSlope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") StormR =1.000.83fsMax Flow Based on Allowable Depth (Safety Factor Applied)d =4.367.17inchesMINOR STORM Allowable Capacity is based on Depth CriterionMinor Storm Major StormMinor Storm Major StormMINOR STORM Allowable Capacity is based on Depth CriterionMinor Storm Major StormfsMINOR STORM Allowable Capacity is based on Depth CriterionMinor Storm Major StormfsMINOR STORM Allowable Capacity is based on Depth CriterionMinor Storm Major StormfsMINOR STORM Allowable Capacity is based on Depth CriterionMinor Storm Major	Maximum Canadity for 1/2 Church based on Allowable Double		
The effect of the original definition of the form of	Theoretical Water Spread		
Increated is plead to bischarge outside the Gutter Section W (1 · W) $I_{X,TH} =$ 14.7 28.5 ItGutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) $E_0 =$ 0.153 0.079 Theoretical Discharge outside the Gutter Section W, climited by distance T_{CROWN}) $Q_X =$ 9.5 55.6 cfs Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN}) $Q_X =$ 9.5 48.2 cfs Discharge outside the Gutter Section W ($Q_d - Q_X$) $Q_W =$ 1.7 4.8 cfs Discharge flow Velocity Within the Gutter SectionV $Q_{RCK} =$ 0.0 1.0 cfs Average Flow Velocity Within the Gutter SectionV 1.1 1.6 fps V*d Product: Flow Velocity Times Gutter Flowline DepthV*d = 0.4 1.0 fs Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6^{or}$) StormR = 1.00 0.83 Max Flow Based on Allowable Depth (Safety Factor Applied)d = 4.36 7.17 inchesResultant Flow Depth at Street Crown (Safety Factor Applied) $d_{CROWN} =$ 0.00 2.70 inchesMINOR STORM Allowable Capacity is based on Depth CriterionMinor Storm Major StormMinor Storm Major Storm fs Minor Storm max, allowable capacity is based on Depth Criterion $Minor Storm Major Storm$ fs fs	Theoretical Water Spread	$T_{\text{H}} = 15.0$ 29.4 T	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X,TH}$ Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN}) Discharge outside the Gutter Section W, (limited by distance T_{CROWN}) Discharge outside the Gutter Section W, (limited by distance T_{CROWN}) Discharge outside the Gutter Section W, (limited by distance T_{CROWN}) Discharge behind the Curb (e.g., sidewalk, driveways, & lawns) Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section M, (limited by distance T_{CROWN}) V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion Minor storm max, allowable capacity (GOOD - greater than the design flow given on sheet 'Intel Management'	Cuttor Eleve to Docign Eleve Datio by EHWA HEC 22 method (Eq. CT. 7)	$1_{XTH} = 14.7$ 28.0 TT	
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN}) $Q_X = \frac{9.5}{9.5} \frac{48.2}{48.2}$ cfs Discharge within the Gutter Section W ($Q_1 - Q_X$) $Q_W = \frac{1.7}{4.8}$ cfs $Q_{BACK} = \frac{0.0}{1.0}$ 1.0 $Q_{BACK} = \frac{0.0}{1.2}$ 54.0 $Q_{BACK} = \frac{0.0}{1.0}$ 1.0 $Q_{CW} = \frac{11.2}{54.0}$ cfs $Q_{CW} = \frac{11.2}{54.0}$ cfs $Q_{CW} = \frac{11.2}{54.0}$ cfs $Q_{CW} = \frac{11.2}{1.1}$ 1.6 $Q_{CW} = \frac{11.2}{1.2}$ 45.0 $Q_{CW} = \frac{11.2}{1.2}$ 45.0 $Q_{A} = \frac{11.2}{1.2}$ 45.0	Theoretical Discharge outside the Gutter Section W. carried in Section T	$C_0 = 0.153 = 0.0/9$	
Protection isolating outside the Gutter Section W (Q _d - Q _X)Q _X =9.548.2CfsDischarge within the Gutter Section W (Q _d - Q _X)Q _W =1.74.8cfsDischarge Behind the Curb (e.g., sidewalk, driveways, & lawns)Q _{BKC} =0.01.0cfsTotal Discharge For Major & Minor Storm (Pre-Safety Factor)Q =11.254.0cfsAverage Flow Velocity Within the Gutter SectionV =1.11.6fpsV*d Product: Flow Velocity Times Gutter Flowline DepthV*d +0.41.0dSlope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") StormR =1.000.83dMax Flow Based on Allowable Depth (Safety Factor Applied)Q _d =11.245.0cfsResultant Flow Depth at Street Crown (Safety Factor Applied)d =4.367.17inchesMINOR STORM Allowable Capacity is based on Depth CriterionMajor StormMajor StormMajor StormMajor StormMAX Flow Torm max, allowable capacity GOOD - greater than the design flow given on sheetTintet Management'fs	Actual Discharge outside the Gutter Section W, (limited by distance T	VXTH - 9.5 55.0 CIS	
Discharge Behind the Gutel Section W (Q ² - Q) Discharge Behind the Gutel Section W (Q ² - Q) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion Minor storm max, allowable capacity GOOD - greater than the design flow given on sheet 'Indet Management'	Discharge within the Gutter Section $W(\Omega, -\Omega)$	$Q_X = \frac{9.3}{1.7}$ 40.2 US	
Total Discharge for Major & Minor Storm (Pre-Safety Factor) $Q = 11.2 54.0$ CSAverage Flow Velocity Within the Gutter Section $V = 1.1$ 1.6fpsV*d Product: Flow Velocity Times Gutter Flowline Depth $V^*d = 0.4$ 1.0fpsSlope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq 6^{"}$) Storm $R = 1.00$ 0.83Max Flow Based on Allowable Depth (Safety Factor Applied) $Q_d = 11.2$ 45.0cfsResultant Flow Depth at Gutter Flowline (Safety Factor Applied) $d = 4.36$ 7.17inchesMINOR STORM Allowable Capacity is based on Depth Criterion $Minor Storm$ $Major Storm$ Major StormMAJOR STORM Allowable Capacity is based on Depth Criterion $Q_{allow} = 11.2$ 45.0cfsMinor Storm max, allowable capacity GOOD - greater than the design flow given on sheet 'Indet Management'Cfs	Discharge Rehind the Curch (e.g., sidewalk, drivewaye, & lawne)	$C_{\text{M}} = \frac{1.7}{0.0} + \frac{1.0}{1.0} \text{ cfc}$	
Average for helps for helps to helps that store interval (results) for all stores) $Q = 11.2$ 34.0 11.5 <th< td=""><td>Total Discharge for Major & Minor Storm (Pre-Safety Factor)</td><td>$C_{BACK} = 0.0 1.0 0.5$</td></th<>	Total Discharge for Major & Minor Storm (Pre-Safety Factor)	$C_{BACK} = 0.0 1.0 0.5$	
V*d Product: Flow Velocity Time To Botter JoccomV =1.11.0IpsV*d Product: Flow Velocity Time Source Townie DepthSlope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6^{"}$) StormR = 1.00 0.83 Max Flow Based on Allowable Depth (Safety Factor Applied) $Q_d =$ 11.2 45.0 cfsResultant Flow Depth at Street Crown (Safety Factor Applied) $d =$ 4.36 7.17 inchesMINOR STORM Allowable Capacity is based on Depth CriterionMinor StormMajor StormMajor StormMajor StormMINOR storm max, allowable capacity (GOOD - greater than the design flow given on sheet 'Intel Management'The Management'Street 'Intel Management'	Average Flow Velocity Within the Gutter Section	V = 11.2 57.0 (15) V = 1.1 1.6 fpc	
V $d = 0.7$ 1.0Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6^{\circ}$) StormR = 1.000.83Max Flow Based on Allowable Depth (Safety Factor Applied)Q = 1.245.0cfsMINOR STORM Allowable Capacity is based on Depth CriterionQ allow = 11.245.0cfsMINOR STORM Allowable Capacity is based on Depth CriterionQ allow = 11.245.0cfsMinor Storm Major StormMajor Storm max, allowable capacity GOOD - greater than the design flow given on sheet 'Indet Management'	V*d Product: Flow Velocity Times Gutter Flowling Denth	V = 1.1 1.0 IV	
Max Flow Based on Allowable Depth (Safety Factor Applied) $\mathbf{Q}_{\perp} = 1.00$ 1.2 45.0 Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) $\mathbf{d} = 4.36$ 7.17 Resultant Flow Depth at Street Crown (Safety Factor Applied) $\mathbf{d} = 4.36$ 7.17 MINOR STORM Allowable Capacity is based on Depth Criterion $\mathbf{Q}_{allow} = 11.2$ 45.0 Minor storm max. allowable Capacity is based on Depth Criterion $\mathbf{Q}_{allow} = 11.2$ 45.0 Cfs	Slope-Based Denth Safety Reduction Factor for Major & Minor $(d > 6")$ Storm	R = 1.00 0.83	
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) d = 4.36 7.17 inches Resultant Flow Depth at Street Crown (Safety Factor Applied) d = 4.36 7.17 inches MINOR STORM Allowable Capacity is based on Depth Criterion Minor Storm Major Storm Major Storm MAJOR STORM Allowable Capacity is based on Depth Criterion Qallow 11.2 45.0 cfs	Max Flow Based on Allowable Depth (Safety Factor Applied)	$0_{1} = 112$ 450 cfs	
Resultant flow Depth at Street Crown (Safety Factor Applied) $d_{crown} = \frac{1.30}{0.00}$ 7.17 indices MINOR STORM Allowable Capacity is based on Depth Criterion Minor Storm Major Storm Major Storm MAJOR STORM Allowable Capacity is based on Depth Criterion Qallow 11.2 45.0 cfs Minor Storm Major Storm Nailow sive on sheet Thiet Management 5.17 5.17	Resultant Flow Denth at Gutter Flowline (Safety Factor Applied)	d = 436 717 linches	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion Minor storm max, allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'	Resultant Flow Depth at Street Crown (Safety Factor Applied)	$d_{CROWN} = 0.00$ 2.70 inches	
MAJOR STORM Allowable Capacity is based on Depth Criterion Q _{allow} = <u>11.2</u> <u>45.0</u> cfs Minor storm max, allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'	MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Maior Storm	
Minor storm max, allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'	MAJOR STORM Allowable Capacity is based on Depth Criterion	Q _{allow} = 11.2 45.0 cfs	
	Minor storm max, allowable capacity GOOD - greater than the design flow g	iven on sheet 'Inlet Management'	



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 =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L _o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_ =	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	
Design Discharge for Half of Street (from Inlet Management)	$Q_0 = $	6.2	20.0	cfs
Water Spread Width	T =	12.4	16.0	ft
Water Depth at Flowline (outside of local depression)	d =	3.6	5.3	inches
Water Depth at Street Crown (or at T _{MAX})	d _{CROWN} =	0.0	0.8	inches
Ratio of Gutter Flow to Design Flow	$E_0 =$	0.195	0.123	1
Discharge outside the Gutter Section W, carried in Section T,	$Q_{v} =$	5.0	17.5	cfs
Discharge within the Gutter Section W	Q _w =	1.2	2.4	cfs
Discharge Behind the Curb Face	QBACK =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _W =	0.22	0.34	lsa ft
Velocity within the Gutter Section W	V =	5.5	7.3	fps
Water Depth for Design Condition	d. OCAL =	6.6	8.3	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =[N/A	N/A	Tft
Ratio of Grate Flow to Design Flow	EO-GRATE =	N/A	N/A	1
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V ₀ =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	
Interception Rate of Side Flow	R, =	N/A	N/A	1
Interception Capacity	0, =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	_
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	7
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	1
Effective (uncloaged) Length of Multiple-unit Grate Inlet	L. =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V. =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	
Interception Rate of Side Flow	R, =	N/A	N/A	1
Actual Interception Capacity	o _=	N/A	N/A	cfs
Carry-Over Flow = O_0 - O_0 (to be applied to curb opening or next d/s inlet)	$\tilde{O}_{h} =$	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	E 17	MINOR	MAJOR	
Equivalent Slope S _o (based on grate carry-over)	S. = [0.091	0.065	Tft/ft
Required Length L_{τ} to Have 100% Interception	L _T =	15.52	32.93	ft
Under No-Clogging Condition		MINOR	MAJOR	_
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =[15.00	15.00	Tft
Interception Capacity	O; =	6.2	13.3	cfs
Under Clogging Condition		MINOR	MAJOR	7
Clogging Coefficient	CurbCoef =	1.31	1.31	7
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbCloa =	0.04	0.04	1
Effective (Unclogged) Length	L, =	14.34	14.34	ft
Actual Interception Capacity	0 a =	6.2	13.1	cfs
Carry-Over Flow = $Q_{h(GRATE)} - Q_a$	Q _b =	0.0	6.8	cfs
Summary		MINOR	MAJOR	·
Total Inlet Interception Capacity	Q = [6.2	13.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$\mathbf{Q}_{\mathbf{b}} = \mathbf{I}$	0.0	6.8	cfs
Capture Percentage = Q_a/Q_0 =	C% =	100	66	%

MHFD-Inlet, Version 5.01	(April 2021)				
ALLOWABLE CAPACITY FOR ONE-HALF C	F STREET (Minor & Major Storm)				
(Based on Regulated Criteria for Maximum All	owable Flow Depth and Spread)				
t: Grandview Reserve					
5: Basili C-90 (DF17ii)					
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} = 0.020				
Height of Curb at Gutter Flow Line	H _{CURB} = 6.00 inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 16.0$ ft				
Gutter Width	W = 0.83 ft				
Street Transverse Slope	S _X = 0.018 ft/ft				
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_{W} = 0.083$ ft/ft				
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{\text{STREET}} = 0.016$				
	Minor Storm Major Storm				
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = 16.0$ 16.0 ft				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = 4.4$ 7.7 inches				
Check boxes are not applicable in SUMP conditions					
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm				
Water Depth without Gutter Depression (Eq. ST-2)	y = 3.46 3.46 inches				
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d _C = 0.8 0.8 inches				
Gutter Depression (d_c - (W * S_x * 12))	a = 0.65 0.65 inches				
Water Depth at Gutter Flowline	d = 4.10 4.10 inches				
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_{\rm X} = 15.2$ 15.2 ft				
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. S1-7)	$E_0 = 0.151 0.151$				
Discharge outside the Gutter Section W, Carned in Section T_X	$Q_{\rm X} = 0.0$ 0.0 cls				
Discharge Within the Gutter Section W $(Q_T - Q_X)$	$Q_{W} = 0.0 0.0 \text{ crs}$				
Maximum Flow Based On Allowable Spread					
Flow Velocity within the Gutter Section	V - 0.0 0.0 fps				
V*d Product: Flow Velocity times Gutter Flowline Depth	$V^*d = 0.0 0.0$				
Maximum Canacity for 1/2 Street based on Allowable Denth	Minor Storm Major Storm				
Theoretical Water Spread	$T_{TH} = \begin{bmatrix} 17.2 \\ 17.2 \end{bmatrix}$ 32.6 Ift				
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{\rm XTH} = 16.4$ 31.7 ft				
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.140 0.071$				
Theoretical Discharge outside the Gutter Section W, carried in Section T_{XTH}	$Q_{XTH} = 0.0 0.0 cfs$				
Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN})	$Q_X = 0.0 0.0 cfs$				
Discharge within the Gutter Section W ($Q_d - Q_x$)	$Q_{W} = 0.0 0.0 cfs$				
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 cfs$				
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 0.0 0.0 cfs				
Average Flow Velocity Within the Gutter Section	V = 0.0 0.0 fps				
V^a Product: Flow Velocity I mes Gutter Flowline Depth	$V^{\dagger}d = 0.0 0.0$				
Superbased Depth Safety Reduction Factor for Major & Minor ($a \ge b^{-}$) Storm Max Flow Based on Allowable Depth (Safety Factor Applied)					
Pecultant Flow Depth at Cutter Flowline (Safety Factor Applied)	d - SUMP SUMP CIS				
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d = incres				
MINOR CTORM Allowable Connector is based on Porth Criterion	Minor Charman Maine Charma				
MAJOR STORM Allowable Capacity is based on Depth Criterion					
	INLET IN A SUMP C	or sag loo	CATION		
-----------	--	---	---------------	---------------	---------------------
	MHFD-Inlet, Version	n 5.01 (April 2021)			
	۲۲ Lo (C)				
	H-Curb				
	H-veit Wo				
	W WP				
	Lo (G)				
1	Design Information (Input)		MINOP	MAIOP	
	Type of Inlet	Type =	CDOT Type R	Curb Opening	1
	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) Water Depth at Flowline (outside of local depression)	No = Ponding Depth =	4.4	4	inches
	Grate Information		MINOR	MAJOR	
	Length of a Unit Grate	$L_{o}(G) =$	N/A	N/A	feet
	Width of a Unit Grate Area Opening Ratio for a Grate (typical values 0, 15-0, 90)	vv _o =	N/A N/A	N/A N/A	reet
	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) Curb Opponing Information	$C_{o}(G) = $	N/A MINOR	N/A MAIOR]
	Length of a Unit Curb Opening	$L_{0}(C) =$	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
Warning 1	Side Width for Depression Pan (typically the gutter width of 2 feet)	W _n =	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	-
	Grate Flow Analysis (Calculated)	C ₀ (C) =	MINOR	MAIOR	
	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A]
	Clogging Factor for Multiple Units	Clog =	N/A	N/A	
	Interception without Clogging	0 = [N/A	MAJOR N/A	lcfs
	Interception with Clogging	Q _{wa} =	N/A	N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	- -	MINOR	MAJOR	-
	Interception without Clogging Interception with Clogging	Q _{oi} =	N/A N/A	N/A N/A	crs
	Grate Capacity as Mixed Flow	-0.04	MINOR	MAJOR]
	Interception without Clogging	Q _{mi} =	N/A	N/A	cfs
	Interception with Clogging Resulting Grate Canacity (assumes clogged condition)	Q _{ma} = Q _{Grate} =	N/A N/A	N/A N/A	crs cfs
	Curb Opening Flow Analysis (Calculated)	Contro	MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	-
	Curb Opening as a Weir (based on Modified HEC22 Method)	Clog = [0.03 MINOR	0.03 MA10R]
	Interception without Clogging	Q _{wi} =	10.0	35.4	cfs
	Interception with Clogging	Q _{wa} =	9.7	34.3	cfs
	<u>Curb Opening as an Orifice (based on Modified HEC22 Method)</u> Interception without Clogging	O _{ci} =	33.6	MAJOR 43.9	lcfs
	Interception with Clogging	Q _{oa} =	32.5	42.4	cfs
	Curb Opening Capacity as Mixed Flow	- -	MINOR	MAJOR	-]_e_
	Interception without Clogging Interception with Clogging	Q _{mi} =	17.0	36.7	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	Q _{Curb} =	9.7	34.3	cfs
	Resultant Street Conditions		MINOR	MAJOR	foot
	l otal Inlet Length Resultant Street Flow Spread (based on street geometry from above)		20.00	20.00	feet ft >T-Crown
	Resultant Flow Depth at Street Crown	d _{CROWN} =	0.3	3.6	inches
		_	MINOR	MAJOD	
	Low near Penormance Reduction (Calculated) Depth for Grate Midwidth	d _{cente} = [MINOR N/A	MAJOR N/A	lft
	Depth for Curb Opening Weir Equation	d _{Curb} =	0.29	0.57	ft
	Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	0.41	0.72	4
	Grated Inlet Performance Reduction Factor for Long Inlets		0.67 N/A	0.88 N/A	
		Grate -			J
		o ⊓	MINOR	MAJOR	ofo
	Inter Capacity IS GOOD for Minor and Major Storms(>O PEAK)	$Q_a = Q_{PEAK REQUIRED} = $	5.9	29.5	cfs

MHFD-Inlet, Version 5.01	(April 2021)			
ALLOWABLE CAPACITY FOR ONE-HALF C	OF STRE	ET (Mino	or & Maj	or Storm)
(Based on Regulated Criteria for Maximum All	owable Flow	Depth and Spr	ead)	
C. Grandview Reserve				
7. Basili C-70 (DF 100)				
Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	TRACK =	7.5	lft	
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	SRACK =	0.020	ft/ft	
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n _{BACK} =	0.020	1	
	brick		-	
Height of Curb at Gutter Flow Line	H _{CURB} =	6.00	linches	
Distance from Curb Face to Street Crown	T _{CROWN} =	16.0	ft	
Gutter Width	W =	0.83	ff	
Street Transverse Slope	S _v =	0.020	ff/ff	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	s. =	0.083	ft/ft	
Street Longitudinal Slope - Enter () for sumn condition	S. =	0.000	ft/ft	
Manning's Roughness for Street Section (tynically between 0.012 and 0.020)	nemer =	0.022	1910	
	INSTREET -	0.010	1	
		Minor Storm	Major Storm	
Max, Allowable Spread for Minor & Major Storm	Тину = [16.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	duax =	4.4	77	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	GMAX -			Inches
show now beparat of eet crown (check box for yes) reave blank for hoy		1	14	
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Maior Storm	
Water Depth without Gutter Depression (Eq. ST-2)	v = [3.84	3.84	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_c = 1$	0.8	0.8	inches
Gutter Depression ($d_c = (W * S_c * 12)$)	a=	0.63	0.63	inches
Water Denth at Gutter Flowline		4 47	4 47	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	т, =	15.2	15.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Fg. ST-7)	Éo =	0 149	0 149	-11
Discharge outside the Gutter Section W, carried in Section T,	0, =	10.8	10.9	cfs
Discharge within the Gutter Section W (Ω_{-} = Ω_{-})	Qx =	10.0	10.0	cfs
Discharge Rehind the Curb (e.g., sidewalk, driveways, & lawns)	~~	1.9	1.5	cfs
Maximum Elow Paced On Allowable Spread		12.7	12.7	
Flaw Mala site within the Center Center	Q T -	12.7	12.7	
Flow Velocity Within the Gutter Section	V =	1.2	1.2	
v*a Product: Flow velocity times Gutter Flowline Depth	v*a = [0.4	0.4	
Maximum Canacity for 1/2 Street based on Allowable Denth		Minor Storm	Major Storm	
Theoretical Water Spread	тГ	15.6		∃ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)		14.7	29.4	-
Gutter Elow to Design Elow Patio by EHWA HEC-22 method (Eq. ST-7)	'XTH -	0.152	20.0	
	~ ^{_0} -	10.0	0.079	ofe
Theoretical Discharge outside the Cutter Section W. carried in Section T	() =1	10.0	50.5	cis
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X TH}$		10.0	I EO C	10.5
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X TH}$ Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	$Q_{X TH} = Q_X =$	10.0	50.6	ofe
Theoretical Discharge outside the Gutter Section W, carried in Section T_{XTH} Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN}) Discharge within the Gutter Section W ($Q_d - Q_x$)	$Q_{X TH} = Q_X = Q_W =$	10.0 1.8	50.6	cfs
Theoretical Discharge outside the Gutter Section W, carried in Section T_{XTH} Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN}) Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{X TH} =$ $Q_{X} =$ $Q_{W} =$ $Q_{BACK} =$	10.0 1.8 0.0	50.6 5.0 1.1	cfs cfs
Theoretical Discharge outside the Gutter Section W, carried in Section T_{XTH} Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN}) Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor)	$Q_{X TH} =$ $Q_{X} =$ $Q_{W} =$ $Q_{BACK} =$ Q =	10.0 1.8 0.0 11.8	50.6 5.0 1.1 56.6	cfs cfs cfs
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X TH}$ Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN}) Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge from Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section	$\begin{array}{c} Q_{X \text{ TH}} = \\ Q_{X} = \\ Q_{W} = \\ Q_{BACK} = \\ Q = \\ V = \end{array}$	10.0 1.8 0.0 11.8 1.1	50.6 5.0 1.1 56.6 1.7	cfs cfs cfs fps
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X TH}$ Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN}) Discharge within the Gutter Section W ($Q_a - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth	$Q_X TH =$ $Q_X =$ $Q_W =$ $Q_{BACK} =$ Q = V = V*d =	10.0 1.8 0.0 11.8 1.1 0.4	50.6 5.0 1.1 56.6 1.7 1.1	cfs cfs cfs fps
Theoretical Discharge outside the Gutter Section W, carried in Section T _{X TH} Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN}) Discharge within the Gutter Section W ($Q_d - Q_X$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm	$Q_{X TH} =$ $Q_{X} =$ $Q_{W} =$ $Q_{BACK} =$ Q = V = V = R =	10.0 1.8 0.0 11.8 1.1 0.4 1.00	50.6 5.0 1.1 56.6 1.7 1.1 0.77	cfs cfs cfs fps
Theoretical Discharge outside the Gutter Section W, carried in Section T _{X TH} Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN}) Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied)	$\begin{array}{c} Q_X & \text{TH} = \\ Q_X = \\ Q_W = \\ Q_{BACK} = \\ Q = \\ V = \\ V^* d = \\ R = \\ \mathbf{Q}_d = \end{array}$	10.0 1.8 0.0 11.8 1.1 0.4 1.00 11.8	50.6 5.0 1.1 56.6 1.7 1.1 0.77 43.8	cfs cfs cfs fps cfs
Theoretical Discharge outside the Gutter Section W, carried in Section T _{X TH} Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN}) Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge from Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	$\begin{array}{c} Q_X \ \mbox{\tiny TH} = \\ Q_X = \\ Q_W = \\ Q_{BACK} = \\ Q_{BACK} = \\ V = \\ V = \\ V * d = \\ R = \\ \mathbf{Q_d} = \\ d = \end{array}$	10.0 1.8 0.0 11.8 1.1 0.4 1.00 11.8 4.36	50.6 5.0 1.1 56.6 1.7 1.1 0.77 43.8 6.96	cfs cfs cfs fps cfs inches
Theoretical Discharge outside the Gutter Section W, carried in Section T _{X TH} Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN}) Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	$\begin{array}{c} Q_X \ \mbox{\tiny TH} = \\ Q_X = \\ Q_W = \\ Q_{BACK} = \\ Q = \\ V = \\ V * d = \\ R = \\ \mathbf{Q}_d = \\ d = \\ d_{CROWN} = \end{array}$	10.0 1.8 0.0 11.8 1.1 0.4 1.00 11.8 4.36 0.00	50.6 5.0 1.1 56.6 1.7 1.1 0.77 43.8 6.96 2.49	cfs cfs cfs fps cfs inches inches
Theoretical Discharge outside the Gutter Section W, carried in Section T _{x TH} Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN}) Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	$\begin{array}{c} Q_{X \text{ TH}} = \\ Q_{X} = \\ Q_{W} = \\ Q_{BACK} = \\ Q = \\ Q = \\ V = \\ V * d = \\ R = \\ d_{CROWN} = \\ d_{CROWN} = \end{array}$	10.0 1.8 0.0 11.8 1.1 0.4 1.00 11.8 4.36 0.00	50.6 5.0 1.1 56.6 1.7 1.1 0.77 43.8 6.96 2.49	cfs cfs cfs fps cfs inches inches
Theoretical Discharge outside the Gutter Section W, carried in Section T _{x TH} Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN}) Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge for Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \ge 6^{"}$) Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion	$Q_{X TH} = Q_{X} = Q$	10.0 1.8 0.0 11.8 1.1 0.4 1.00 11.8 4.36 0.00 Minor Storm	50.6 5.0 1.1 56.6 1.7 1.1 0.77 43.8 6.96 2.49 Major Storm	cfs cfs fps cfs cfs cfs cfs inches
Theoretical Discharge outside the Gutter Section W, carried in Section T _{X TH} Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN}) Discharge within the Gutter Section W ($Q_d - Q_x$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) Total Discharge from Major & Minor Storm (Pre-Safety Factor) Average Flow Velocity Within the Gutter Section V*d Product: Flow Velocity Times Gutter Flowline Depth Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	$Q_{X TH} = Q_{W} = Q$	10.0 1.8 0.0 11.8 1.1 0.4 1.00 11.8 4.36 0.00 Minor Storm 11.8	50.6 5.0 1.1 56.6 1.7 1.1 0.77 43.8 6.96 2.49 Major Storm 43.8	cfs cfs fps cfs fps cfs inches inches cfs

INLET ON A CONTIN	JUOUS G	RADE		
MHFD-Inlet, Version 5.0	1 (April 2021)			
r				
H-Curb H-Vert		2		
Wo Wo				
In E				
Lo (G)				
CDOT Type R Curb Opening				
Design Information (Input)		MINOR	MAIOR	
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 =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L _o =	5.00	5.00	-Ift
Width of a Unit Grate (cannot be greater than W, Gutter Width)	w _o =	N/A	N/A	- ^{rr}
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	Cr-G =	N/A	N/A	-
Street Hydraulics: OK - O < Allowable Street Canacity'	ل-1 = [MINOR	MA10P	
Design Discharge for Half of Street (from <i>Inlet Management</i>)	O. = [11.0	26.4	cfs
Water Spread Width	τ_=	15.2	16.0	⊢ _{ft}
Water Depth at Flowline (outside of local depression)	d =	4.3	5.8	inches
Water Depth at Street Crown (or at T _{MAX})	d _{CROWN} =	0.0	1.3	inches
Ratio of Gutter Flow to Design Flow	E ₀ =	0.158	0.113	
Discharge outside the Gutter Section W, carried in Section T_x	Q _x =	9.3	23.4	cfs
Discharge within the Gutter Section W	Q _w =	1.7	3.0	cfs
Discharge Behind the Curb Face	$Q_{BACK} =$	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _W =	0.27	0.3/	sqft
Velocity within the Gutter Section w	v _w =	0.5	8.1	- inchos
Grate Applysis (Calculated)	ULOCAL -	MINOR	MA10P	linches
Total Length of Inlet Grate Opening	1 = [N/A	N/A	ft
Ratio of Grate Flow to Design Flow	Engrate =	N/A	N/A	
Under No-Clogging Condition	0 00012	MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V _o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	
Interception Rate of Side Flow	R _x =	N/A	N/A	
Interception Capacity	Q _i =	N/A	N/A	cfs
Under Clogging Condition	Current Court	MINOR	MAJOR	-
Clogging Coefficient for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A N/A	-
Effective (uncloaged) Length of Multiple-unit Grate Inlet		N/A	N/A	
Minimum Velocity Where Grate Splash-Over Begins	$V_{c} = $	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/A	N/A	1 '
Interception Rate of Side Flow	R _x =	N/A	N/A	
Actual Interception Capacity	Q _a =	N/A	N/A	cfs
Carry-Over Flow = $Q_0 - Q_a$ (to be applied to curb opening or next d/s inlet)	Q _b =	N/A	<u>N/A</u>	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	с Г	MINOR	MAJOR	
Equivalent Stope Se (Dased on grate carry-OVEr)	S _e =	0.0//	0.061	
Inder No-Clogging Condition	LT = [MINOP	MA10P	
Effective Length of Curb Opening or Slotted Inlet (minimum of L. L.)	I = [15.00	15.00	ft
Interception Capacity	Qi =	9.5	15.3	cfs
Under Clogging Condition		MINOR	MAJOR	_
Clogging Coefficient	CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L _e =	14.34	14.34	ft
Actual Interception Capacity	$Q_a =$	9.4	15.1	cfs
$Udity-Uver riow = Q_{h(GRATE)} - Q_a$	Q _b =	1.0 MINOD	MA100	CIS
Total Inlet Intercention Capacity	0 – [15 1	ofs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0. =	1.6	11.3	cfs
Canture Percentage = Ω_2/Ω_2 =	C% =	85	57	0/0

MHFD-Inlet, Version 5.01	(April 2021)
ALLOWABLE CAPACITY FOR ONE-HALF O	F STREET (Minor & Major Storm)
(Based on Regulated Criteria for Maximum Alle : Grandview Reserve	owable flow Depth and Spread)
Basin C-7b (DP 18b)	
L bea L from J	
Gutter Geometry:	-
Maximum Allowable Width for Spread Benind Curb	$I_{BACK} = 7.5$ 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} = 0.020
Height of Curb at Cuttor Flow Line	
Distance from Curb Ecce to Choose Crown	
Cutton Width	1 _{CROWN} = 10.0 IL
Guller Width	W = 0.85 IL
Sufeet Transverse Slope	$S_{\rm X} = 0.020$ ft/ft
Gutter Closs Slope (typically 2 incles over 24 incles of 0.005 it/it)	$S_W = 0.085$ It/It
Manning's Reughness for Street Section (typically between 0.012 and 0.020)	$S_0 = 0.022$ ft/ft
	$\Pi_{\text{STREET}} = 0.016$
	Minor Storm Major Storm
May Allowable Spread for Minor & Major Storm	
Max. Allowable Denth at Cutter Flowline for Minor & Major Storm	d = 44 77 inches
Allow Flow Donth at Street Crown (sheek bey for you loove blank for no)	
Allow Flow Depth at Street Crown (check box for yes, leave blank for ho)	
Maximum Canacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm
Water Denth without Gutter Depression (Eq. ST-2)	$v = \begin{bmatrix} 3.84 \\ 3.84 \end{bmatrix} \begin{bmatrix} 3.84 \\ 3.84 \end{bmatrix}$ inches
Vertical Depth hetween Gutter Lin and Gutter Flowline (usually 2")	$d_c = 0.8$ 0.8 inches
Gutter Depression ($d_c = (W * S * 12)$)	a = 0.63 0.63 inches
Water Depth at Gutter Flowline	d = 447 447 inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_v = 15.2$ 15.2 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$F_0 = 0.149 0.149$
Discharge outside the Gutter Section W. carried in Section T_{y}	$O_{\rm v} = 10.8$ 10.8 cfs
Discharge within the Gutter Section W ($\Omega_{T} - \Omega_{y}$)	$Q_{x} = 19$ 10.0 0.0
Discharge Rehind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{W} = 0.0$ 0.0 cfs
Maximum Flow Based On Allowable Spread	$Q_{BACK} = 0.0 0.0 0.0 0.3$
Flow Velocity within the Gutter Section	V = 12.7 12.7 cro
V*d Product: Flow Velocity times Gutter Flowline Denth	$V^{+}d = 0.4$ 0.4
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm Maior Storm
Theoretical Water Spread	T _{TH} = 15.6 29.4 ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{XTH} = 14.7$ 28.6 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.153 0.079$
Theoretical Discharge outside the Gutter Section W, carried in Section Tyth	Q _{X TH} = 10.0 58.3 cfs
Actual Discharge outside the Gutter Section W, (limited by distance T	$Q_x = 10.0$ 50.6 cfs
Discharge within the Gutter Section W ($Q_d - Q_x$)	$Q_{W} = 1.8$ 5.0 cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0$ 1.1 cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 11.8 56.6 cfs
Average Flow Velocity Within the Gutter Section	V = 1.1 1.7 fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d = 0.4 1.1
Slope-Based Depth Safety Reduction Factor for Major & Minor (d > 6") Storm	R = 1.00 0.77
Max Flow Based on Allowable Depth (Safety Factor Applied)	Q _d = 11.8 43.8 cfs
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d = 4.36 6.96 linches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	$d_{CROWN} = 0.00 2.49 \text{ inches}$
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm
WINNING STOREN ANDWARDE LADACITY IS DASED ON DEDTRICTIERTON	



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 =	3	3	1
Length of a Single Unit Inlet (Grate or Curb Opening)	L _o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W _o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_{f}-G =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_{f}-C =$	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity		MINOR	MAJOR	
Design Discharge for Half of Street (from Inlet Management)	$Q_0 = $	11.0	26.4	cfs
Water Spread Width	T =	15.2	16.0	ft
Water Depth at Flowline (outside of local depression)	d =	4.3	5.8	inches
Water Depth at Street Crown (or at T _{MAX})	d _{CROWN} =	0.0	1.3	inches
Ratio of Gutter Flow to Design Flow	E ₀ =	0.158	0.113	1
Discharge outside the Gutter Section W, carried in Section T _x	Q _x =	9.3	23.4	cfs
Discharge within the Gutter Section W	Q _w =	1.7	3.0	cfs
Discharge Behind the Curb Face	Q _{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _W =	0.27	0.37	sq ft
Velocity within the Gutter Section W	V _w =	6.5	8.1	fps
Water Depth for Design Condition	$d_{IOCAI} =$	7.3	8.8	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L = [N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{0-GRATE} =$	N/A	N/A	1
Under No-Clogging Condition		MINOR	MAJOR	-
Minimum Velocity Where Grate Splash-Over Begins	$V_0 = $	N/A	N/A	fps
Interception Rate of Frontal Flow	R _€ =	N/A	N/A	1
Interception Rate of Side Flow	R _v =	N/A	N/A	1
Interception Capacity	$\hat{O}_i = 1$	N/A	N/A	lcfs
Under Cloaging Condition		MINOR	MAJOR	-
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	7
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	1
Effective (unclogged) Length of Multiple-unit Grate Inlet	L. =	N/A	N/A	lft l
Minimum Velocity Where Grate Splash-Over Begins	V_ =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _€ =	N/A	N/A	1
Interception Rate of Side Flow	$R_{y} = 1$	N/A	N/A	1
Actual Interception Capacity	o _=	N/A	N/A	cfs
Carry-Over Flow = O_0 - O_0 (to be applied to curb opening or next d/s inlet)	O _b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S _e (based on grate carry-over)	S. =	0.077	0.061	∃ft/ft
Required Length L _T to Have 100% Interception	L _T =	22.49	39.20	lft l
Under No-Clogging Condition	· .	MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L,	L = [15.00	15.00	Tft
Interception Capacity	 O; =	9.5	15.3	lcfs
Under Clogging Condition		MINOR	MAJOR	
Cloaging Coefficient	CurbCoef =	1.31	1.31	7
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbCloa =	0.04	0.04	1
Effective (Uncloaged) Length	L_ =	14.34	14.34	
Actual Interception Capacity	0, =	9.4	15.1	cfs
Carry-Over Flow = $O_{h(CPATE)} = O_{a}$	0. =	1.6	11.3	cfs
Summary	x 0 = 1	MINOR	MAJOR	1
Total Inlet Interception Capacity	o = [9.4	15.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0 =	1.6	11.3	cfs
Capture Percentage = $Q_a/Q_a =$	℃ % =	85	57	%

	OF STREET (Minor & Major Sto	n
(Based on Regulated Criteria for Maximur	n Allowable Flow Depth and Spread)	
Grandview Reserve		
: Basin C-10 (DP 18c)		
111 12		
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} = 0.020	
Height of Curb at Gutter Flow Line	H _{cupp} = 6.00 linches	
Distance from Curb Face to Street Crown	$T_{convers} = 16.0$ ff	
Gutter Width	W = 0.83 ft	
Street Transverse Slone	$S_{v} = 0.020$ ft/ft	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_{W} = 0.083$ ft/ft	
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000$ ft/ft	
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{\text{STRFET}} = 0.016$	
	Since I and a second se	
	Minor Storm Major Storm	
Max. Allowable Spread for Minor & Major Storm	T _{MAX} = 16.0 16.0 ft	
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d _{MAX} = 4.4 7.7 inches	
Check boxes are not applicable in SUMP conditions		
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm	
Water Depth without Gutter Depression (Eq. S1-2)	y = <u>3.84</u> <u>3.84</u> inches	
Cutton Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_{\rm C} = 0.8$ 0.8 inches	
Gutter Depression ($d_c - (W + S_x + 12)$)	a = 0.63 0.63 Inches	
Water Depth at Gutter Flowline	d = 4.4/ 4.4/ Inches	
Allowable Spread for Discharge outside the Gutter Section w (1 - w)	$I_{\chi} = 15.2$ 15.2 II	
Discharge outside the Cutter Section W. carried in Section T	$E_0 = 0.149 0.149$	
Discharge within the Gutter Section W ($\Omega_{-2} \Omega_{-1}$)	$Q_{\rm X} = 0.0 0.0 \text{ cfs}$	
Discharge Within the Gutter Section W $(Q_1 - Q_X)$	$Q_W = 0.0$ 0.0 cfs	
Maximum Elow Based On Allowable Spread	$Q_{BACK} = 0.0$ 0.0 crs	
Flow Velocity within the Cutter Section		
V*d Product: Flow Velocity times Gutter Flowline Depth	V = 0.0 0.0 (ps	
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm Major Storm	
Theoretical Water Spread	$T_{TH} = 15.6$ 29.4 ft	
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{XTH} = 14.7$ 28.6 ft	
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.153 0.079$	
I neoretical Discharge outside the Gutter Section W, carried in Section T _{X TH}	$Q_{XTH} = 0.0 0.0 cfs$	
Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN})	$Q_{\rm X} = 0.0 0.0$ cfs	
Discharge within the Gutter Section W ($Q_d - Q_X$)	$Q_{W} = 0.0 0.0 \text{ cfs}$	
Uischarge Benind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0$ 0.0 cfs	
Local Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 0.0 0.0 cfs	
Average Flow Velocity Within the Gutter Section	V = 0.0 0.0 fps	
IV*a Product: Flow Velocity Times Gutter Flowline Depth	$V^{*}a = 0.0 0.0$	
Isope-based Depth Safety Reduction Factor for Major & Minor ($d \ge 6^{\circ}$) Storm		
Invite Flow Based on Allowable Depth (Safety Factor Applied)		
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d = inches	
Resultant Flow Depth at Street Crown (Safety Factor Applied)	a _{CROWN} = Inches	
MINOR STORM Allowable Canacity is based on Donth Criterion	Minor Storm Major Storm	
PILINON STORM ANOWADIE CAPACITY IS DASED ON DEPTH CHTENON		
MATOR STORM Allowable Canacity is based on Depth Criterion		

INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)



	Design Information (Input)		MINOR	MAIOR	
	Type of Inlet	Type -	CDOT Type R	Curb Opening	1
	Local Depression (additional to continuous gutter depression 'a' from above)		2 00	2.00	inchos
		a _{local} –	3.00	3.00	linches
	Number of Unit Inlets (Grate or Curb Opening)	NO =	3	3	
	Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
	Grate Information	_	MINOR	MAJOR	Verride Depths
	Length of a Unit Grate	$L_{o}(G) =$	N/A	N/A	feet
	Width of a Unit Grate	W ₀ =	N/A	N/A	feet
	Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =	N/A	N/A	1
	Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	G(G) =	N/A	N/A	
	Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	- 1
	Crate Orifice Coefficient (typical value 2.13 5.00)		N/A	N/A	·
	Grate Onlice Coefficient (typical value 0.00 - 0.00)	C ₀ (G) =	IN/A	N/A	1
	Curb Opening Information		MINOR	MAJOR	16.
	Length of a Unit Curb Opening	$L_0(C) =$	5.00	5.00	reet
	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
Warning 1	Side Width for Depression Pan (typically the gutter width of 2 feet)	W _n =	2.00	2.00	feet
-	Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_{f}(C) =$	0.10	0.10	1
	Curb Opening Weir Coefficient (typical value 2.3-3.7)	c_{i} $(c) = 1$	3.60	3.60	1
	Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_{1}(0) = 1$	0.67	0.67	†
	Grate Flow Analysis (Calculated)	S0 (S) -	MINOP	MAIOD	
	Clagging Coofficient for Multiple Units	Conf - F			1 I
			IN/A	IN/A	
	Clogging Factor for Multiple Units	Clog = L	N/A	N/A]
	Grate Capacity as a weir (based on Modified HEC22 Method)	а Г	MINOR	MAJOR	1.
	Interception without Clogging	$Q_{wi} =$	N/A	N/A	cts
	Interception with Clogging	Q _{wa} =	N/A	N/A	cts
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	_	MINOR	MAJOR	
	Interception without Clogging	Q _{oi} =	N/A	N/A	cfs
	Interception with Clogging	Q _{oa} =	N/A	N/A	cfs
	Grate Capacity as Mixed Flow	-	MINOR	MAJOR	
	Interception without Clogging	Q _{mi} =	N/A	N/A	cfs
	Interception with Clogging	Q _{ma} =	N/A	N/A	cfs
	Resulting Grate Capacity (assumes clogged condition)	Q _{Grate} =	N/A	N/A	cfs
	Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	1.31	1.31	1
	Clogging Factor for Multiple Units	Clog =	0.04	0.04	
	Curb Opening as a Weir (based on Modified HEC22 Method)	c.og L	MINOR	MAIOR	1
	Intercention without Clogging	о. –Г	7.5	26.6	lefe
	Interception with Clogging	~~	7.3	20.0	cfc
	Curb Opening as an Orifice (based on Medified HEC22 Method)	Q _{wa} – L	7.2 MINOD	23.7	us l
		о Г		MAJOR	1_6_
	Interception with Closeing	Q ₀ i = -	23.2	32.9	CIS of a
		Q _{oa} =	24.1	31.5	las
	Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	1.
	Interception without Clogging	Q _{mi} =	12.8	27.5	cts
	Interception with Clogging	Q _{ma} =	12.2	26.3	cts
	Resulting Curb Opening Capacity (assumes clogged condition)	Q _{Curb} =	7.2	25.4	cfs
	Resultant Street Conditions		MINOR	MAJOR	
	Total Inlet Length	L =	15.00	15.00	feet
	Resultant Street Flow Spread (based on street geometry from above)	T =	15.6	29.4	ft.>T-Crown
	Resultant Flow Depth at Street Crown	d _{CROWN} =	0.0	3.2	inches
					-
	Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
	Depth for Grate Midwidth	d _{cete} = [N/A	N/A	lft
	Depth for Curb Opening Weir Equation	da i =	0.29	0.57	ft
	Combination Inlet Performance Reduction Factor for Long Inlets		0.25	0.37	
	Curb Opening Defermance Reduction Factor for Long Inlets	Combination –	0.41	0.72	-
	Crated Talet Performance Reduction Factor for Long Inlets		0.07	0.00	
	Grateu The Performance Reduction Factor for Long Inlets	KF _{Grate} =	IN/A	IN/A	1
			MINOD	MAIOD	
		- 「	MINOR	MAJOR	1-6-
	I otal Inlet Interception Capacity (assumes clogged condition)	Qa =	7.2	25.4	crs
	Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	V PEAK REQUIRED =	6.8	23.4	CTS

MHFD-Inlet, Version 5.01	(April 2021)
ALLOWABLE CAPACITY FOR ONE-HALF C	F STREET (Minor & Major Storm
(Based on Regulated Criteria for Maximum All	owable Flow Depth and Spread)
t: Grandview Reserve	
Di Basili C-11 (DF 19)	
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} = 0.020
Height of Curb at Gutter Flow Line	H _{CURB} = 6.00 linches
Distance from Curb Face to Street Crown	$T_{CROWN} = 16.0$ ft
Gutter Width	W = 2.00 ft
Street Transverse Slope	$S_{x} = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_W = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{\text{STREET}} = 0.016$
	Minor Storm Major Storm
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = 16.0$ 16.0 ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d _{MAX} = 4.4 7.7 inches
Check boxes are not applicable in SUMP conditions	
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm
Water Depth without Gutter Depression (Eq. ST-2)	$\frac{1}{1}$
Vertical Depth without Gutter Lin and Gutter Flowline (usually 2")	$d_{0} = 2.0$ 2.0 inches
Gutter Depression ($d_{e} - (W * S * 12)$)	a = 151 151 inches
Water Depth at Gutter Flowline	d = 535 535 inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_{v} = 14.0$ 14.0 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.372 = 0.372$
Discharge outside the Gutter Section W, carried in Section T_v	$Q_{\rm y} = 0.0$ 0.0 cfs
Discharge within the Gutter Section W ($O_T - O_V$)	$O_{W} = 0.0 0.0 \text{ cfs}$
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 cfs$
Maximum Flow Based On Allowable Spread	Q _T = SUMP SUMP cfs
Flow Velocity within the Gutter Section	V = 0.0 0.0 fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d = 0.0 0.0
Maximum Capacity for 1/2 Street based on Allowable Denth	Minor Storm Major Storm
Theoretical Water Spread	$T_{TH} = \begin{bmatrix} 11.9 \\ 25.7 \end{bmatrix}$ ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{XTH} = 9.9$ 23.7 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.497$ 0.228
Theoretical Discharge outside the Gutter Section W, carried in Section T _{X TH}	$Q_{XTH} = 0.0 0.0 \text{ cfs}$
Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN})	$Q_x = 0.0 0.0 cfs$
Discharge within the Gutter Section W ($Q_d - Q_X$)	$Q_W = 0.0 0.0 cfs$
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q _{BACK} = 0.0 0.0 cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 0.0 0.0 cfs
Average Flow Velocity Within the Gutter Section	V = 0.0 0.0 fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d = 0.0 0.0
Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm	R = SUMP SUMP
Max Flow Based on Allowable Depth (Safety Factor Applied)	Q _d = SUMP SUMP cfs
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d = inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} = inches
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q _{allow} = SUMP SUMP cfs

INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021) -Lo (C) H-Curb H-Vert Wo w Lo (G) CDOT Type R Curb Opening -Design Information (Input) MINOR MAJOR Type of Inlet CDOT Type R Curb Opening Type = Local Depression (additional to continuous gutter depression 'a' from above) 3.00 inches a_{local} Number of Unit Inlets (Grate or Curb Opening) Water Depth at Flowline (outside of local depression) $N_0 =$ Override Depths Ponding Depth = 4.4 inches Grate Information MINOF MAJOR Length of a Unit Grate $L_{o}(G) =$ N/A feet Width of a Unit Grate $W_o =$ N/A N/A feet Area Opening Ratio for a Grate (typical values 0.15-0.90) A_{ratio} = N/A 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 Grate Orifice Coefficient (typical value 0.60 - 0.80) Ĉ₀ (G) N/A NL/ Curb Opening Information MINOR MAJOR Length of a Unit Curb Opening $L_{o}(C) =$ 5.00 feet Height of Vertical Curb Opening in Inches 6.00 inches H_{vert} = Height of Curb Orifice Throat in Inches inches 6.00 H_{throat} = Angle of Throat (see USDCM Figure ST-5) Theta = 63.40 degrees Side Width for Depression Pan (typically the gutter width of 2 feet) $W_p =$ 2.00 eet 0.10 Clogging Factor for a Single Curb Opening (typical value 0.10) $C_f(C) =$ 0.10 Curb Opening Weir Coefficient (typical value 2.3-3.7) Curb Opening Orifice Coefficient (typical value 2.3-0.70) $C_{w}(C) = C_{o}(C) =$ 3.60 3.60 0.67 0.67 Grate Flow Analysis (Calculated) MINOF MAJOR Clogging Coefficient for Multiple Units Coef = N/A N/A Clogging Factor for Multiple Units Clog = N/A N/A Grate Capacity as a Weir (based on Modified HEC22 Method) MAJOR MINOR Q_{wi} = N/A Interception without Clogging N/A lcfs Interception with Clogging Grate Capacity as a Orifice (based on Modified HEC22 Method) Q_{wa} = N/A N/A cfs MINOR MAJOR Interception without Clogging N/A N/A cfs Q_{oi} : Interception with Clogging $Q_{oa} =$ N/A N/A lcfs Grate Capacity as Mixed Flow MINOF MAJOR Q_{mi} = cfs Interception without Clogging N/A N/A Interception with Clogging Q_{ma} = N/A N/A cfs Resulting Grate Capacity (assumes clogged of Curb Opening Flow Analysis (Calculated) QGrate = N/A N/A cfs clogged condition MINO MAJOR Clogging Coefficient for Multiple Units Coef = 1.00 1.00 Clogging Factor for Multiple Units Clog = 0.10 0.10 Curb Opening as a Weir (based on Modified HEC22 Method) MINO MAJOR Interception without Clogging Q_{wi} = 10.1 cfs 2.7 Interception with Clogging Q_{wa} = 2.4 9.1 cfs Curb Opening as an Orifice (based on Modified HEC22 Method) MINOR MAJOR Interception without Clogging cfs $Q_{0i} =$ 8.4 11.0 Interception with Clogging 7.6 9.9 $Q_{oa} =$ cfs Curb Opening Capacity as Mixed Flow MINOR MAJOR Interception without Clogging Q_{mi} = 4.4 9.8 cfs Interception with Clogging Q_{ma} = 4.0 88 cfs Q_{Curb} Resulting Curb Opening Capacity (assumes clogged condition) Resultant Street Conditions 2.4 8.8 cfs MINOF MAJOR Total Inlet Length 5.00 feet 1 = 5.00 ft.>T-Crown 25.7 Resultant Street Flow Spread (based on street geometry from above) T = 11.9 Resultant Flow Depth at Street Crown d_{CROWN} = 0.0 2.3 inches Low Head Performance Reduction (Calculated) MINOR MAJOR Depth for Grate Midwidth $d_{Grate} =$ N/A 0.20 N/A 0.47 ft Depth for Curb Opening Weir Equation d_{Curb} = ft Combination Inlet Performance Reduction Factor for Long Inlets RF_{Combination} = 0.56 0.98 RF_{Curb} Curb Opening Performance Reduction Factor for Long Inlets 1.00 1.00 $\mathsf{RF}_{\mathsf{Grate}}$ Grated Inlet Performance Reduction Factor for Long Inlets N/A N/A MINOR MAJOR $Q_a =$ Total Inlet Interception Capacity (assumes clogged condition) 2.4 8.8 cfs Q PEAK REQUIRED = 1.0 2.3 cfs

MHFD-Inlet, Version 5.01	(April 2021)
ALLOWABLE CAPACITY FOR ONE-HALF C	F STREET (Minor & Major Storm
(Based on Regulated Criteria for Maximum All	owable Flow Depth and Spread)
D: Basin C-12 (DP 20)	
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} = 0.020
Height of Curb at Gutter Flow Line	Hours = 6.00 linches
Distance from Curb Face to Street Crown	$T_{CPOMN} = 16.0$ ft
Gutter Width	W = 0.83 ft
Street Transverse Slope	$S_x = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_{W} = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{\text{STREET}} = 0.016$
	Minor Storm Major Storm
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = \begin{bmatrix} 16.0 \\ 16.0 \end{bmatrix} \begin{bmatrix} 16.0 \\ 16.0 \end{bmatrix} ft$
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = 4.4$ 7.7 inches
Check boxes are not applicable in SUMP conditions	
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm
Water Depth without Gutter Depression (Eq. ST-2)	y = <u>3.84</u> <u>3.84</u> inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_{\rm C} = 0.8$ 0.8 inches
Gutter Depression ($d_c - (W * S_x * 12)$)	a = 0.63 0.63 inches
Water Depth at Gutter Flowline	$d = \frac{4.4}{4.4}$ inches
Allowable Spread for Discharge outside the Gutter Section W (1 - W)	$I_X = 15.2$ 15.2 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. SI-7)	$E_0 = 0.149 0.149$
Discharge outside the Gutter Section W, Carned in Section T_X	$Q_{\rm X} = 0.0 0.0 \text{ cfs}$
Discharge Robind the Gutter Section W ($Q_T - Q_X$)	$Q_{W} = 0.0 0.0 \text{ crs}$
Maximum Elow Based On Allowable Spread	$Q_{BACK} = 0.0 0.0 \text{ cls}$
Flow Velocity within the Gutter Section	$V_{\rm f} = 0.0$ 0.0 for
V*d Product: Flow Velocity times Gutter Flowline Depth	V = 0.0 0.0 105
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm Major Storm
Theoretical Water Spread	$I_{TH} = 15.6$ 29.4 ft
I neoretical Spread for Discharge outside the Gutter Section W (1 - W)	$I_{XTH} = 14.7$ 28.6 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. SI-7)	$E_0 = 0.153 0.079$
Actual Discharge outside the Gutter Section W, Carried In Section 1 _{XTH}	$Q_{XTH} = 0.0$ 0.0 cfs
Discharge within the Gutter Section $W(\Omega = \Omega)$	$Q_X = 0.0 0.0 \text{ CIS}$
Discharge Within the Gutter Section W ($Q_d = Q_X$) Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_W = 0.0 0.0 \text{ CIS}$
Total Discharge for Major & Minor Storm (Dro Cafety Easter)	
Average Flow Velocity Within the Gutter Section	V = 0.0 0.0 (IS
V*d Product: Flow Velocity Times Gutter Flowline Denth	
Slope-Based Depth Safety Reduction Factor for Major & Minor $(d > 6")$ Storm	
Max Flow Based on Allowable Depth (Safety Factor Applied)	
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d = John John Hard
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} = inches
MINOR CTORM Allowable Conseible is based on Durath Criterian	Minor Charman Maine Charma
IMINUK STUKM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm
MAJOR CTORM Allowship Consults is been down Rowth Cuitesian	

	INLET IN A SUMP (or sag loo	CATION		
	MHFD-Inlet, Version	n 5.01 (April 2021)			
	۲Lo (C)۲				
	H-Curb				
	H-veit Wo				
	W WP				
	Lo (G)				
	Design Information (Input)		MINOP	MAIOP	
	Type of Inlet	Type =	CDOT Type R	Curb Opening	1
	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) Water Depth at Flowline (outside of local depression)	No = Ponding Depth =	4.4	1	inches
	Grate Information		MINOR	MAJOR	
	Length of a Unit Grate	$L_{o}(G) =$	N/A	N/A	feet
	Width of a Unit Grate Area Opening Ratio for a Grate (typical values 0 15-0 90)	VV _o =	N/Α 	N/A N/A	reet
	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) Curb Oppning Information	$C_{o}(G) =$	N/A MINOR	N/A MAIOR]
	Length of a Unit Curb Opening	$L_{0}(C) =$	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
Warning 1	Side Width for Depression Pan (typically the gutter width of 2 feet)	W _a =	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	-
	Grate Flow Analysis (Calculated)	$C_0(C) =$	MINOR	MAIOR	
	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A]
	Clogging Factor for Multiple Units	Clog =	N/A	N/A	
	Intercention without Clogging	O = [MINOR N/A	MAJOR N/A	lcfs
	Interception with Clogging	Q _{wa} =	N/A	N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	-	MINOR	MAJOR	-
	Interception without Clogging Interception with Clogging	Q _{oi} =	N/A N/A	N/A N/A	crs
	Grate Capacity as Mixed Flow		MINOR	MAJOR]
	Interception without Clogging	Q _{mi} =	N/A	N/A	cfs
	Interception with Clogging Resulting Grate Canacity (assumes clogged condition)	Q _{ma} = Q _{Grate} =	N/A N/A	N/A N/A	crs cfs
	Curb Opening Flow Analysis (Calculated)	ediate	MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	-
	Curb Opening as a Weir (based on Modified HEC22 Method)	Clog =	0.10 MINOR	0.10 MA10R]
	Interception without Clogging	Q _{wi} =	3.7	10.1	cfs
	Interception with Clogging	Q _{wa} =	3.4	9.1	cfs
	<u>Curb Opening as an Orifice (based on Modified HEC22 Method)</u> Interception without Clogging	0 _{ni} = [MINOR 8.4	MAJOR 11.0	lcfs
	Interception with Clogging	Q _{oa} =	7.6	9.9	cfs
	Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	-]_e_
	Interception without Clogging Intercention with Clogging	Q _{mi} = 0 =	<u> </u>	9.8	crs
	Resulting Curb Opening Capacity (assumes clogged condition)	Q _{Curb} =	3.4	8.8	cfs
	Resultant Street Conditions		MINOR	MAJOR] 6 t
	lotal Inlet Length Resultant Street Flow Spread (based on street geometry from above)		15.6	5.00 29.4	ft.>T-Crown
	Resultant Flow Depth at Street Crown	d _{CROWN} =	0.0	3.2	inches
	Low Hood Portermoneo Reduction (Coloriated)	-	MINOD	MAJOD	
	Low near Performance Reduction (Calculated) Depth for Grate Midwidth	d _{cente} = [N/A	MAJOR N/A	lft
	Depth for Curb Opening Weir Equation	d _{Curb} =	0.29	0.57	ft
	Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	0.56	0.98	4
	Grated Inlet Performance Reduction Factor for Long Inlets		1.00 N/A	1.00 N/A	
		Grate -			J
		~ -	MINOR	MAJOR	ofe
	Inter Capacity IS GOOD for Minor and Major Storms(>O PEAK)	$Q_{\text{PEAK REQUIRED}} =$	2.9	6.7	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF (Based on Regulated Criteria for Maximum Allow Basin D-1 (DP 22)	TBACK 7.5 SBACK 0.020 $n_{BACK} =$ 0.020 HOURD 6.00 T 16.0	pr & Major ead)	Storm)
(Based on Regulated Criteria for Maximum Allow t: Grandview Reserve Basin D-1 (DP 22)	vable Flow Depth and Spr $T_{BACK} = 7.5$ $S_{BACK} = 0.020$ $n_{BACK} = 0.020$ $H_{CURB} = 6.00$ $T_{T} = 16.00$	ft ft/ft	
Gutter Geometry: Maximum Allowable Width for Spread Behind Curb Side Slope Behind Curb (Leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020) Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown Cutter Width	$T_{BACK} = \frac{7.5}{0.020}$ $R_{BACK} = \frac{0.020}{0.020}$ $H_{CURB} = \frac{6.00}{16.00}$]ft ft/ft]	
Gutter Geometry: Maximum Allowable Width for Spread Behind Curb Side Slope Behind Curb (leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020) Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown	$T_{BACK} = \frac{7.5}{S_{BACK}} = \frac{0.020}{0.020}$ $n_{BACK} = \frac{0.020}{0.020}$ $H_{CURB} = \frac{6.00}{16.00}$]ft ft/ft]	
Gutter Geometry: Maximum Allowable Width for Spread Behind Curb Side Slope Behind Curb (leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020) Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown Curbor Width	$T_{BACK} = \frac{7.5}{S_{BACK}} = \frac{0.020}{0.020}$ $H_{CURB} = \frac{6.00}{15.0}$]ft ft/ft]	
Gutter Geometry: Maximum Allowable Width for Spread Behind Curb Side Slope Behind Curb (leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020) Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown	$T_{BACK} = \frac{7.5}{S_{BACK}} = \frac{0.020}{0.020}$ $n_{BACK} = \frac{0.020}{0.020}$ $H_{CURB} = \frac{6.00}{15.0}$	ft ft/ft Junch and	
Maximum Allowable Width for Spread Behind Curb Side Slope Behind Curb (leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020) Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown	$T_{BACK} = \frac{7.5}{0.020}$ $R_{BACK} = \frac{0.020}{0.020}$ $H_{CURB} = \frac{6.00}{15.00}$]ft ft/ft]	
Side Slope Behind Curb (leave blank for no conveyance credit behind curb) Manning's Roughness Behind Curb (typically between 0.012 and 0.020) Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown	$S_{BACK} = 0.020$ $n_{BACK} = 0.020$ $H_{CURB} = 6.00$	ft/ft	
Manning's Roughness Behind Curb (typically between 0.012 and 0.020) Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown	$n_{BACK} = 0.020$ $H_{CURB} = 6.00$] ·····	
Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown	$H_{CURB} = \frac{6.00}{16.0}$	J]:	
Height of Curb at Gutter Flow Line Distance from Curb Face to Street Crown	$H_{CURB} = 6.00$	1	
Distance from Curb Face to Street Crown	T - 100	unches	
Cuttor Width		ft	
	W = 0.83	ft	
Street Transverse Slone	$S_{v} = 0.030$	fr/fr	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S _x = 0.020	H/H	
Street Longitudinal Slope - Enter () for sump condition	S - 0.005	A/A	
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$3_0 = 0.010$		
	IISTREET - 0.010	1	
	Minor Storm	Major Storm	
Max Allowable Spread for Minor & Major Storm			
Max. Allowable Depth at Cutter Flowline for Minor & Major Storm	d = 10.0	7.7 inc	hoc
Allow Flow Depth at Street Group (check her for use leave blank for no.)	u _{MAX} = 4.4		lies
Allow Flow Depth at Street Crown (check box for yes, leave blank for ho)		100	
Maximum Canacity for 1/2 Street based On Allowable Spread	Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y - 3.84	3.84 linc	hoc
Vertical Depth warout Gutter Lin and Gutter Flowline (usually 2")	do = 0.8	0.8 inc	hes
Gutter Depression $(d_{-}, (W * S * 12))$	a - 0.63	0.63 inc	hec
Water Depth at Gutter Flowline	d = 0.05	0.05 inc	hes
Allowable Spread for Discharge outside the Cuttor Section W/(T - W)	U = 4.47	4.4/ IIIU	les
Cutter Flow to Design Flow Datio by FHWA HEC 22 method (Fg. ST.7)	$I_X = 15.2$	15.2	
Discharge subside the Cutter Section W, envirod in Section T	$E_0 = 0.149$	0.149	
Discharge outside the Gutter Section W, Carned In Section T_{χ}	$Q_{\rm X} = 7.3$	7.3 CIS	
Discharge within the Gutter Section W ($Q_T - Q_X$) Discharge Rabing the Cutter Section W ($Q_T - Q_X$)	$Q_W = 1.3$	1.3 CIS	
Discharge Benind the Curb (e.g., sidewalk, driveways, & lawns)	Q _{BACK} = 0.0	0.0 crs	
Maximum Flow Based On Allowable Spread	$Q_T = 8.5$	8.5 CTS	
Flow Velocity within the Gutter Section	V = 0.8	0.8 fps	
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d = 0.3	0.3	
Maximum Canacity for 1/2 Streat based on Allowable Donth	Minor Charm	Majar Charma	
Theoretical Water Canad			
Theoretical Water Spread	TH = 15.6	29.4	
Cutter Flaw to David for Discharge outside the Gutter Section W (1 - W)	1 _{XTH} = 14.7	28.6	
Guiller Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 51-7)	$c_0 = 0.153$	0.0/9	
A study Discharge outside the Gutter Section W, carried in Section 1 _{XTH}	QXTH = 6.7	39.3 CTS	
Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN})	$Q_{\rm X} = 6.7$	34.1 cfs	
Discharge within the Gutter Section W ($Q_d - Q_X$)	Q _W = 1.2	3.4 cfs	
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q _{BACK} = 0.0	0.7 cfs	
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 7.9	38.2 cfs	
Average Flow Velocity Within the Gutter Section	V = 0.8	1.2 fps	
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d = 0.3	0.7	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm	R = 1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	Q _d = 7.9	38.2 cfs	:
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d = 4.36	7.68 inc	hes
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} = 0.00	3.22 inc	hes
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm	Major Storm	
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q _{allow} = 7.9	38.2 cfs	:
Minor storm max. allowable capacity GOOD - greater than the design flow given	on sheet 'Inlet Managem	ient'	



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 =	2	2	1
Length of a Single Unit Inlet (Grate or Curb Opening)	L ₀ =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_0 =	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	1
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from <i>Inlet Management</i>)	$Q_0 = [$	5.4	12.7	lcfs
Water Spread Width	т = I	13.4	16.0	ft
Water Depth at Flowline (outside of local depression)	d =	3.9	5.1	linches
Water Depth at Street Crown (or at TMAY)	d _{CROWN} =	0.0	0.6	linches
Ratio of Gutter Flow to Design Flow	E. =	0.179	0.128	
Discharge outside the Gutter Section W. carried in Section T.	0, =	4.4	11.1	cfs
Discharge within the Gutter Section W	0 =	1.0	1.6	cfs
Discharge Behind the Curb Face	OPACK =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _w =	0.24	0.32	Iso ft
Velocity within the Gutter Section W	V =	4.1	5.0	fns
Water Denth for Design Condition	d oca	6.9	8.1	linches
Grate Analysis (Calculated)	GIULAI I	MINOR	MAIOR	Interios
Total Length of Inlet Grate Opening	1 = [N/A	N/A	Tft
Ratio of Grate Flow to Design Flow	E- CDATE =	N/A	N/A	-1''
Under No-Clogging Condition	LO-GRATE -	MINOR	MAIOR	1
Minimum Velocity Where Grate Splash-Over Begins	v -[N/A		Ifne
Interception Pate of Frontal Flow	V ₀ –	N/A	N/A	145
Interception Rate of Side Flow	N _f =	N/A	N/A	-
Interception Capacity	Nx -	N/A	N/A	cfc
Under Clogging Condition	Qi - [MINOP	MA10P	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoof -	N/A		7
Clogging Eactor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	-
Effective (uncloaged) Length of Multiple-unit Grate Inlet		N/A	N/A	
Minimum Valasity Where Crate Splace Over Begins		N/A	N/A	fnc
Interception Date of Frontal Flow		N/A	N/A	-liha
Interception Rate of Fiond Flow	R _f =	N/A	N/A	4
Actual Interception Capacity		N/A	N/A	- cfc
Actual Interception capacity Carry Over Flow $= 0, 0, (to be applied to curb expering or port d/c inlet)$	Q	N/A		
Carry-Over Flow = $Q_0 - Q_0$ (to be applied to Carb opening or flext d/s linet)	Q _b - 1	N/A MINOD		CIS
Cuip of Siotley Intel Opening Analysis (Calculateu)	s _[]ه،م
Equivalent Sible S_e (based on grade carry-over)	5 _e –	0.065	0.000	
Required Lengui L _T to have 100% Interception		14.30	24.01	Tur
Under NO-Clogging Condition			MAJOR	٦٩
Effective Length of Curb Opening of Slotted Thiel (minimum of L, L_T)		10.00	10.00	
Interception Capacity	$Q_i = [$	4.8	/./	lcts
Under Clogging Condition	Curlice of		MAJOR	7
Clogging Coefficient	CurbCoef =	1.25	1.25	4
Clogging Factor for Multiple-Unit Curb Opening or Slotted Inlet		0.06	0.06	4
Effective (Unclogged) Length	L _e =	9.37	9.37	- ^m -
Actual Interception Capacity	$Q_a =$	4.7	7.5	CTS
$\frac{ \text{Carry-Over Flow} = Q_{h(\text{GRATE})} - Q_a}{ \text{Carry-Over Flow} = Q_{h(\text{GRATE})} - Q_a}$	Q _b =	0.7	5.2	CTS
<u>Summary</u>	~ 「	MINOR	MAJOR	¬ •
	Q =	4.7	7.5	CIS
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.7	5.2	cts
Capture Percentage = Q_a/Q_a =	C% =	87	59	%

MHFD-Inlet, Version 5.01	(April 2021)	
ALLOWABLE CAPACITY FOR ONE-HALF O	F STREET (Minor & M	ajor Storm)
Gased on Regulated Criteria for Maximum Air	bwable Flow Depth and Spread)	
Basin D-2 (DP 23)		
- bex - Loon -		
5mg 7, 5m		
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} = 0.020	
Height of Curb at Gutter Flow Line	H _{CURB} = 6.00 inches	
Distance from Curb Face to Street Crown	$T_{CROWN} = 16.0$ ft	
Gutter Width	W = 0.83 ft	
Street Transverse Slope	$S_x = 0.020$ ft/ft	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_W = 0.083$ ft/ft	
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.010$ ft/ft	
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{\text{STREET}} = 0.016$	
	Minor Storm Major Sto	rm
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = 16.0$ 16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d _{MAX} = 4.4 7.7	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Sto	rm
Water Depth without Gutter Depression (Eq. ST-2)	y = 3.84 3.84	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d _c = 0.8 0.8	inches
Gutter Depression (d_c - (W * S_x * 12))	a = 0.63 0.63	inches
Water Depth at Gutter Flowline	d = 4.47 4.47	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_{\rm X} = 15.2 15.2$	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. S1-7)	$E_0 = 0.149 0.149$	
Discharge outside the Gutter Section W, carried in Section T_X	$Q_X = 7.3$ 7.3	cts
Discharge within the Gutter Section W ($Q_T - Q_X$)	$Q_W = 1.3$ 1.3	CTS
Discharge Benind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0$	CTS
Flaw Valasity within the Cyther Castion	$Q_{\rm T} = 8.5 8.5$	fine
V*d Product: Flow Velocity times Gutter Flowline Depth	V = 0.8 0.8 V*d = 0.3 0.3	rps
	······	
International Water Coursed	Minor Storm Major Sto	rm e
Theoretical Spread for Discharge outside the Cutter Section W (T _ W)	$T_{\text{TH}} = 15.6$ 29.4	
Cuttor Elow to Docign Elow Datio by EHWA HEC 22 method (Eq. ST. 7)	IXTH = 14.7 20.0	
Theoretical Discharge outside the Gutter Section W carried in Section T.	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	
Actual Discharge outside the Gutter Section W. (limited by distance T)	$O_{V} = \begin{bmatrix} 0.7 & 39.3 \\ 6.7 & 24.1 \end{bmatrix}$	cfs
Discharge within the Gutter Section $W(\Omega_1 - \Omega_2)$	$Q_X = 0.7 \qquad 34.1$ $Q_{W} = 1.2 \qquad 3.4$	
Discharge Behind the Curb (e.g., sidewalk, driveways & lawns)	$Q_{\rm max} = 0.0 0.7$	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	O = 79 382	cfs
Average Flow Velocity Within the Gutter Section	V = 0.8 12	fns
V*d Product: Flow Velocity Times Gutter Flowline Denth	V*d = 0.3 0.7	
Slope-Based Depth Safety Reduction Factor for Major & Minor $(d > 6")$ Storm	B = 1.00 1.00	
	$Q_d = 7.9$ 38.2	cfs
Max Flow Based on Allowable Depth (Safety Factor Applied)		inches
Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d = 4.36 7.68	
Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	$d = \frac{4.36}{d_{CROWN}} = \frac{7.68}{0.00}$	inches
Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied)	$d = \frac{4.36}{0.00} \frac{7.68}{3.22}$ Minor Storm Major Stor	inches
Max Flow Based on Allowable Depth (Safety Factor Applied) Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	$d = \frac{4.36}{0.00} = \frac{7.68}{0.00}$ $d_{CROWN} = \frac{0.00}{0.00} = \frac{100}{3.22}$ Minor Storm Major Sto Qallow = 7.9 38.2	rm cfs



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 =	2	2	1
Length of a Single Unit Inlet (Grate or Curb Opening)	L, =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	w_ =	N/A	N/A	- Ift
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	CG =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min, value = 0.1)	C-C =	0.10	0.10	
Street Hydraulics: OK - O < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from Inlet Management)	$Q_0 = \Gamma$	1.7	4.0	lcfs
Water Spread Width	т = Г	8.6	12.0	ft
Water Depth at Flowline (outside of local depression)	d =	2.7	3.5	linches
Water Depth at Street Crown (or at T _{MAX})	d _{cpown} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E _c =	0.287	0.202	
Discharge outside the Gutter Section W. carried in Section T.	0. =	1.2	3.2	ofs
Discharge within the Gutter Section W	o =	0.5	0.8	lefs
Discharge Behind the Curb Face	0	0.0	0.0	
Flow Area within the Gutter Section W		0.16	0.21	lso ft
Velocity within the Gutter Section W	,=H	3.1	3.8	Ins
Water Denth for Design Condition	diagu =	5.7	6.5	linches
Grate Analysis (Calculated)		MINOR	MATOR	Inches
Total Length of Inlet Grate Opening	ı – F	N/A		Tet .
Patio of Grate Flow to Design Flow	E	N/A	N/A	
Under No-Clogging Condition	Lo-GRATE -	MINOP		
Minimum Velecity Where Crate Splach Over Regins	v _F			Ifor
Interception Date of Frontal Flow	v _o =	N/A	N/A	-lips
Interception Rate of Florida Flow		N/A	N/A	-
	R _x =	N/A	N/A	
Under Clogging Condition	Qi – L	IN/A MINOD		
Clogging Coofficient for Multiple unit Crate Inlet	CrateCoof -	MINOR		7
Clogging Coemcient for Multiple-unit Grate Inlet	GrateCoer =	IN/A	N/A	-
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Minimum Valenie Minimum Conte Calente Over Benine		IN/A	IN/A	
Infinimum velocity where Grate Splash-Over Begins	v _o = -	N/A	N/A	- ^{rps}
	R _f =	N/A	N/A	-
Interception Rate of Side Flow	R _x =	N/A	N/A	
Actual Interception Capacity	Q _a =	N/A	N/A	cts
Carry-Over Flow = $Q_0 - Q_a$ (to be applied to curb opening or next d/s inlet)	Q _b =	N/A	N/A	cts
Curb or Slotted Inlet Opening Analysis (Calculated)	с Г	MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S _e =	0.124	0.094	ft/ft
Required Length L _T to Have 100% Interception		6.6/	11./5	_ft
Under No-Clogging Condition		MINOR	MAJOR	٦.
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L=	6.67	10.00	tt
Interception Capacity	$Q_i = L$	1.7	3.9	cfs
Under Clogging Condition	-	MINOR	MAJOR	-
Clogging Coefficient	CurbCoef =	1.25	1.25	4
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	4
Effective (Unclogged) Length	L _e =	9.37	9.37	ft
Actual Interception Capacity	Q _a =	1.7	3.8	cfs
Carry-Over Flow = $Q_{b/(GRATE)} - Q_a$	Q _b =	0.0	0.2	cfs
Summary	-	MINOR	MAJOR	_
Total Inlet Interception Capacity	Q =	1.7	3.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b =	0.0	0.2	cfs
Contrary Deventered 0 /0	C 0/ _	100	06	0/

	(April 2021)
ALLOWABLE CAPACITY FOR UNE-HALF C	JF STREET (MINOR & Major Storm) lowable flow Depth and Spread)
t: Grandview Reserve	
D: Basin D-3 (DP 24)	
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} = 0.020
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 16.0$ ft
Gutter Width	W = 0.83 ft
Street Transverse Slope	$S_{x} = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_{W} = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000$ 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} = 16.0 16.0 ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d _{MAX} = 4.4 7.7 inches
Check boxes are not applicable in SUMP conditions	
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm
Water Depth without Gutter Depression (Eq. ST-2)	y = 3.84 3.84 inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d _C = 0.8 0.8 inches
Gutter Depression (d_c - (W * S _x * 12))	a = 0.63 0.63 inches
Water Depth at Gutter Flowline	d = 4.47 4.47 inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_{\rm x} = 15.2$ 15.2 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eg. ST-7)	$E_0 = 0.149$ 0.149
Discharge outside the Gutter Section W. carried in Section Ty	$O_{\rm v} = 0.0$ 0.0 cfs
Discharge within the Gutter Section W ($\Omega_{\tau} - \Omega_{v}$)	$O_{\rm W} = 0.0$ 0.0 cfs
Discharge Behind the Curch (e.g., sidewalk, driveways, & lawns)	
Maximum Flow Based On Allowable Spread	$Q_{BACK} = 0.0$ 0.0 crs
Flow Velocity within the Cutter Section	V = 0.0 0.0 fpc
V*d Product: Flow Velocity times Gutter Flowline Denth	V*d = 0.0 0.0 103
v a rioudel riow velocity arres dater riowine Depart	v u = 0.0 0.0
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm Major Storm
Theoretical Water Spread	T _{TH} = 15.6 29.4 ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{XTH} = 14.7$ 28.6 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.153$ 0.079
Theoretical Discharge outside the Gutter Section W. carried in Section Tyme	$O_{\rm VTH} = 0.0$ 0.0 cfs
Actual Discharge outside the Gutter Section W. (limited by distance Terrown)	$O_{\rm v} = 0.0$ 0.0 cfs
Discharge within the Gutter Section W ($\Omega_d - \Omega_v$)	$Q_{\rm W} = 0.0$ 0.0 cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & Jawns)	$O_{\text{MAX}} = 0.0$ 0.0 cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	$Q_{BACK} = 0.0$ 0.0 cfs
Average Flow Velocity Within the Cutter Section	V = 0.0 0.0 frs
V/*d Product: Flow Velocity Times Gutter Flowline Denth	
Slone-Based Denth Safety Reduction Factor for Major & Minor (d > 6") Storm	
Signature Deput Salety Reduction Factor for Major & Millior ($U \ge 0$) Storm Max Flow Based on Allowable Depth (Safety Easter Applied)	
Provident Flow Daster of Allowable Depth (Safety Factor Applied)	
INSEMUTION DEDUTAL GULLEL FLOWING (SATELY FACTOR ADDIRED)	
Decultant Flow Dopth at Street Crown (Cafety Factor Applied)	
Resultant Flow Depth at Street Crown (Safety Factor Applied)	u _{crown} =
Resultant Flow Depth at Street Crown (Safety Factor Applied)	U _{CROWN} =IIICITES
Resultant Flow Depth at Street Crown (Safety Factor Applied) MINOR STORM Allowable Capacity is based on Depth Criterion	Crown = incres

INLET IN A SUMP OR SAG LOCATION MHFD-Inlet, Version 5.01 (April 2021)



	Design Information (Input		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R	Curb Opening	
	l ocal Depression (additional to continuous gutter depression 'a' from above)	a, _ =	3.00	3.00	inches
	Number of Unit Inlote (Crote or Curb Opening)		3.00	5.00	inclica
	Number of onit frieds (Grate of Curb Opening)		3	3	in also a
	water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	/./	lincnes
	Grate Information	-	MINOR	MAJOR	Override Depths
	Length of a Unit Grate	$L_{o}(G) = L$	N/A	N/A	feet
	Width of a Unit Grate	W _o =	N/A	N/A	feet
	Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =	N/A	N/A	
	Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_{\ell}(G) =$	N/A	N/A	
	Grate Weir Coefficient (typical value 2.15 - 3.60)	(G) -	N/A	N/A	
	Grate Orifice Coefficient (hypical value 0.60 - 0.80)		N/A	N/A	
	Grate Onlice Coefficient (typical value 0.00 - 0.00)	C ₀ (G) = [N/A	11/74	1
	Curb Opening Information		MINOR	MAJOR	14 .
	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	dearees
Warning 1	Side Width for Depression Pan (typically the gutter width of 2 feet)	W ₀ =	2.00	2.00	feet
	Clogging Eactor for a Single Curb Opening (typical value 0.10)	പ്രവ്ച	0.10	0.10	
	Curb Opening Weir Coefficient (typical value 2 3-3 7)		3 60	3.60	
	Curb Opening Weil Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
		$c_0(c) =$	0.07	0.07	
	Grate Flow Analysis (Calculated)	.	MINOR	MAJOR	, l
	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
	Clogging Factor for Multiple Units	Clog =	N/A	N/A	
	Grate Capacity as a Weir (based on Modified HEC22 Method)	_	MINOR	MAJOR	
	Interception without Clogging	Q _{wi} = [N/A	N/A	cfs
	Interception with Clogging	O _{wa} =	N/A	N/A	cfs
	Grate Canacity as a Orifice (based on Modified HEC22 Method)	Civia L	MINOR	MATOR	
	Intercention without Clogging	o. – F	N/A	N/A	lefe
	Interception with Obagaing		N/A	N/A	cis efe
	Interception with Clogging	Q _{oa} = [IN/A	IN/A	cis
	Grate Capacity as Mixed Flow		MINOR	MAJOR	1
	Interception without Clogging	Q _{mi} =	N/A	N/A	cfs
	Interception with Clogging	Q _{ma} =	N/A	N/A	cfs
	Resulting Grate Capacity (assumes clogged condition)	Q _{Grate} =	N/A	N/A	cfs
	Curb Opening Flow Analysis (Calculated)	_	MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	1.31	1.31	
	Clogging Factor for Multiple Units	Clog =	0.04	0.04	
	Curb Opening as a Weir (based on Modified HEC22 Method)	5 6	MINOR	MAIOR	
	Intercention without Clogging	0 = [7.5	26.6	cfs
	Interception with Clogging	~E	7.2	25.4	cfs
	Curb Opening as an Orifice (based on Modified HEC22 Method)	Qwa - L	MINOD	MA100	0.5
		~ ~			lafa
	Interception without Clogging	$Q_{oi} =$	25.2	32.9	crs
	Interception with Clogging	Q _{oa} =	24.1	31.5	crs
	Curb Opening Capacity as Mixed Flow	-	MINOR	MAJOR	, I
	Interception without Clogging	Q _{mi} =	12.8	27.5	cfs
	Interception with Clogging	Q _{ma} =	12.2	26.3	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	Q _{Curb} =	7.2	25.4	cfs
	Resultant Street Conditions		MINOR	MAJOR	
	Total Inlet Length	ı = Г	15.00	15.00	feet
	Resultant Street Flow Spread (based on street geometry from above)	F	15.6	20.00	ft >T-Crown
	Resultant Succer now Spiced (based on succe geometry nom above)	a '-	15.0	3.1	inches
		ucrown =	0.0	J.2	
	Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
	Depth for Grate Midwidth	d _{Crate} = [N/A	N/A	ft
	Depth for Curb Opening Weir Equation	d _{curb} =	0.29	0.57	ft
	Combination Inlet Performance Reduction Factor for Long Inlets		0.25	0.37	
	Curb Opening Defermence Reduction Factor for Long Inlets	Combination =	0.71	0.72	
	Curbo Opening Performance Reduction Factor for Long Inlets		0.0/	0.88	
	Grated The Performance Reduction Factor for Long Inlets	KF _{Grate} =	N/A	IN/A	l
			MINOR	MAJOR	
	Total Inlet Interception Capacity (assumes clogged condition)	o . = [7.2	25.4	cfs
	Inlet Capacity IS GOOD for Minor and Major Storms(>O PEAK)	Q PEAK REOUIRED =	6.6	19.2	cfs

MHFD-Inlet, Version 5.01	l (April 2021)
ALLOWABLE CAPACITY FOR ONE-HALF C	OF STREET (Minor & Major Storm)
(Based on Regulated Criteria for Maximum Al	lowable Flow Depth and Spread)
C Basin D-4 (DP 25)	
. Basili D-4 (DF 25)	
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} = 0.020
Height of Curb at Gutter Flow Line	Hauna = 6.00 linches
Distance from Curb Face to Street Crown	$T_{constant} = 16.0 \text{ ft}$
Gutter Width	W = 0.83 ft
Street Transverse Slope	$S_{\rm V} = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_{W} = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{\text{STREET}} = 0.016$
May Allowahle Caread for Minor 9. Majar Charm	Minor Storm Major Storm
Max. Allowable Spread for Minor & Major Storm	$I_{MAX} = 16.0$ 16.0 T
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = 4.4$ /./ Incres
Check boxes are not applicable in SUMP conditions	
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm
Water Depth without Gutter Depression (Eq. ST-2)	y = 3.84 3.84 inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d _C = 0.8 0.8 inches
Gutter Depression (d _C - (W * S _x * 12))	a = 0.63 0.63 inches
Water Depth at Gutter Flowline	d = 4.47 4.47 inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_{\rm X} = 15.2$ 15.2 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.149 0.149$
Discharge outside the Gutter Section W, carried in Section T_x	$Q_x = 0.0 0.0$ cfs
Discharge within the Gutter Section W ($Q_T - Q_X$)	$Q_{W} = 0.0 0.0 cfs$
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 cfs$
Maximum Flow Based On Allowable Spread	Q _T = SUMP SUMP cfs
Flow Velocity within the Gutter Section	V = 0.0 0.0 fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d = 0.0 0.0
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm Major Storm
Theoretical Water Spread	$T_{TH} = 15.6$ 29.4 ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{XTH} = 14.7$ 28.6 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.153 0.079$
Theoretical Discharge outside the Gutter Section W, carried in Section T_{XTH}	$Q_{XTH} = 0.0 0.0 cfs$
Actual Discharge outside the Gutter Section W, (limited by distance T _{CROWN})	$Q_x = 0.0 0.0$ cfs
Discharge within the Gutter Section W ($Q_d - Q_X$)	$Q_W = 0.0 0.0 \text{ cfs}$
Discharge Benind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 \text{ cfs}$
I otal Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 0.0 0.0 cfs
Average Flow Velocity Within the Gutter Section	V = 0.0 0.0 fps
Vra Product: Flow Velocity Times Gutter Flowline Depth	
Superbased Depth Safety Reduction Factor for Major & Minor ($a \ge b^{"}$) Storm Max Flow Pased on Allowable Donth (Safety Factor Applied)	
Provide a second and the second secon	Vd = SUMP SUMP CTS
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	
Interview of the provide of the contraction of the providence of t	SCROWN - Inches
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor StormMajor Storm

	INLET IN A SUMP C	or sag loo	CATION		
	MHFD-Inlet, Version	n 5.01 (April 2021)			
	۲ Lo (C) ۲				
	H-Curb				
	H-Vert Wo		_		
	Lo (G)				
	CDOT Type R Curb Opening				
	Design Information (Input)	- [MINOR	MAJOR	1
	Local Depression (additional to continuous gutter depression 'a' from above)	Iype =	3.00	3.00	inches
	Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	Cverride Depths
	Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
	Grate Information	L (G) =[MINOR N/A	MAJOR N/A	Teet
	Width of a Unit Grate	W _o =	N/A	N/A	feet
	Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =	N/A	N/A	
	Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_{f}(G) =$	N/A	N/A	4
	Grate Weir Coefficient (typical value 2.15 - 3.60)	$C_{w}(G) = C_{v}(G) $	N/A N/A	N/A N/A	4
	Curb Opening Information	-0(-)	MINOR	MAJOR	1
	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
	Angle of Throat (see USDCM Figure ST-5)	n _{throat} = Theta =	63.40	63.40	degrees
Warning 1	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)	$C_w(C) = C_w(C) = C$	3.60	3.60	4
	Grate Flow Analysis (Calculated)	C ₀ (C) =	MINOR	MAIOR	
	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	1
	Clogging Factor for Multiple Units	Clog =	N/A	N/A]
	Grate Capacity as a Weir (based on Modified HEC22 Method)	0[MINOR N/A	MAJOR	Tefe
	Interception with Clogging	Q _{wi} = Q _{wa} =	N/A	N/A N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	end	MINOR	MAJOR	-
	Interception without Clogging	$Q_{oi} =$	N/A	N/A	cfs
	Grate Canacity as Mixed Flow	Q _{oa} = [MINOR	MA1OR	
	Interception without Clogging	Q _{mi} = [N/A	N/A	cfs
	Interception with Clogging	Q _{ma} =	N/A	N/A	cfs
	Resulting Grate Capacity (assumes clogged condition)	Q _{Grate} =	N/A MINOR		cts
	Clogging Coefficient for Multiple Units	Coef =	1.25	1.25	1
	Clogging Factor for Multiple Units	Clog =	0.06	0.06]
	Curb Opening as a Weir (based on Modified HEC22 Method)	~ ~ ~	MINOR	MAJOR	J _efe
	Interception with Clogging	Q _{wi} =	5.7	18.9	cfs
	Curb Opening as an Orifice (based on Modified HEC22 Method)	-cwa -	MINOR	MAJOR	
	Interception without Clogging	Q _{oi} =	16.8	21.9	cfs
	Interception with Clogging	Q _{oa} = [15./	20.6	cts
	Interception without Clogging	O _{mi} = [9.4	19.6	lcfs
	Interception with Clogging	Q _{ma} =	8.8	18.3	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	Q _{Curb} =	5.7	18.3	cfs
	Resultant Street Conditions	ı – [10.00	MAJOR I 10.00	feet
	Resultant Street Flow Spread (based on street geometry from above)	T =	15.6	29.4	ft.>T-Crown
	Resultant Flow Depth at Street Crown	d _{CROWN} =	0.0	3.2	inches
	I ow Head Performance Reduction (Calculated)		MINOP	MAIOP	
	Depth for Grate Midwidth	d _{Grate} =	N/A	N/A	lft
	Depth for Curb Opening Weir Equation	d _{Curb} =	0.29	0.57	ft
	Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	0.41	0.72	4
	Grated Inlet Performance Reduction Factor for Long Inlets		0.82 N/A	1.00 N/A	4
		Grate -			
			MINOR	MAJOR	7-6-
	I otal Inlet Interception Capacity (assumes clogged condition)	$Q_{a} = Q_{pEAK REQUIRED} = 0$	5./ 3.3	7.7	crs
	and capacity to coop for rand and ridjor storing(/ y r LAN)				1



MHFD-Inlet, Version 5.01 (April 2021)		
H-Curb H-Vert Wb		
H-Curb H-Vert Wb		
M E		
Lo(G)		
CDUT Type R Curb Opening	MAIOD	
Type of Inlet Type = CDOT Type F	R Curb Opening	7
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 = 3	3	_
Length of a Single Unit Inlet (Grate or Curb Opening) $L_0 = 5.00$	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width) $W_0 = \frac{N/A}{C}$	N/A	_ ^{rr}
Logging ratio for a single Unit Grade (typical mini, value = 0.3) $C_{r}C_{r} = \frac{N/A}{2}$	0.10	-
Street Hydraulics: OK - O < Allowable Street Capacity'	MA1OR	
Design Discharge for Half of Street (from Inlet Management) O- = 98	22.9	Cfs
Water Spread Width $T = 13.4$	16.0	\exists_{ft}
Water Depth at Flowline (outside of local depression) $d = 3.9$	5.1	inches
Water Depth at Street Crown (or at T_{MAX}) $d_{CROWN} = 0.0$	0.6	inches
Ratio of Gutter Flow to Design Flow $E_o = 0.179$	0.128	
Discharge outside the Gutter Section W, carried in Section T_x $Q_x = 8.1$	20.0	cfs
Discharge within the Gutter Section W $Q_w = 1.8$	2.9	cfs
Discharge Behind the Curb Face Q _{BACK} = 0.0	0.0	cfs
How Area within the Gutter Section W $A_W = 0.24$	0.32	sq ft
Velocity within the Gutter Section W $V_{W} = \frac{7.4}{6}$	9.1	fps
(water bepting bestin conduction discovery dis	MA10P	linches
$\frac{\text{Drade Antalysis (Calculated)}}{\text{Total length of Inlet Grate Opening}}$		٦ft
Batio of Grate Flow to Design Flow $E_{\text{Loc}PATE} = N/A$	N/A	
Under No-Cloaging Condition MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins V _o = N/A	N/A	fps
Interception Rate of Frontal Flow R _f = N/A	N/A	
Interception Rate of Side Flow $R_x = N/A$	N/A	
Interception Capacity Q _i = <u>N/A</u>	N/A	cfs
Under Clogging Condition MINOR	MAJOR	-
Cogging Coefficient for Multiple-unit Grate Inlet GrateCoef = N/A	<u>N/A</u>	_
Coogging Factor for Multiple-Unit Grate Inlet GrateLog = N/A	N/A	
$L_e = \frac{N/A}{Minimum Velocity Where Grate Splash-Over Begins V - N/A$		fns
Interception Rate of Frontal Flow $R_z = N/\Delta$	N/A	-1 ^{'p3}
Interception Rate of Side Flow $R_{\rm e} = N/A$	N/A	-
Actual Interception Capacity $Q_a = N/A$	N/A	cfs
Carry-Over Flow = $Q_0 - Q_a$ (to be applied to curb opening or next d/s inlet) $Q_b = N/A$	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated) MINOR	MAJOR	_
Equivalent Slope S _e (based on grate carry-over) $S_e = 0.085$	0.067	ft/ft
Required Length L _T to Have 100% Interception $L_T = 20.77$	35.88	tt
Under No-Llogging Lonaltion MINOR	MAJOR	7.
Energy of Curb Opening of Sioted Inter (minimum of L, L_T) $L = 15.00$	14.2	
$Q_i = \begin{bmatrix} 0.0 \\ MINOP \end{bmatrix}$	MA10P	
	1.31	Г
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	0.04	-
Effective (Unclogged) Length L _a = 14.34	14.34	Tft
Actual Interception Capacity Qa = 8.8	14.1	cfs
	8.8	cfs
$\begin{array}{ carry-Over How = Q_{b/GRATE} Q_{a} \\ \hline \end{array} \qquad \qquad$	MATOD	
Larry-Over How = Q _{h/GRATE1} -Q _a Q _b = 1.0 Summary MINOR	MAJOR	- -
Larry-Over How = $Q_{h/GRATE} Q_a$ Q_b = 1.0 Summary MINOR Total Inlet Interception Capacity Q = State Value Q =	MAJOR 14.1	cfs



INLET ON A CONTIN	JUOUS G	RADE		
MHFD-Inlet, Version 5.0	1 (April 2021)			
r				
H-Curb H-Vert		2		
Wo				
In E				
Lo (G)				
CDOT Type R Curb Opening				
Design Information (Input)		MINOR	MAIOR	
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 =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening) Width of a Unit Grate (cappot be greater than W. Gutter Width)		5.00 N/A	5.00 N/A	
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	vv₀ = C₅-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	
Design Discharge for Half of Street (from <i>Inlet Management</i>)	$Q_o =$	10.1	23.6	cfs
Water Spread Width	T =	13.4	16.0	ft
Water Depth at Flowline (outside of local depression)	a =	3.9	5.1	inches
Ratio of Gutter Flow to Design Flow	GCROWN –	0.179	0.128	linches
Discharge outside the Gutter Section W, carried in Section T_x	$\overline{Q}_{x} = \overline{Q}_{x}$	8.3	20.6	cfs
Discharge within the Gutter Section W	Q _w =	1.8	3.0	cfs
Discharge Behind the Curb Face	$Q_{BACK} =$	0.0	0.0	cfs
Flow Area within the Gutter Section W	A _w =	0.24	0.32	sq ft
Velocity within the Gutter Section W	V _W =	7.6	9.3	- tps
Grate Analysis (Calculated)	ULOCAL - I	MINOR	MAJOR	Inches
Total Length of Inlet Grate Opening	L = [N/A	N/A	ft
Ratio of Grate Flow to Design Flow	E _{o-GRATE} =	N/A	N/A	
Under No-Clogging Condition	г	MINOR	MAJOR	٦.
Minimum Velocity Where Grate Splash-Over Begins	V ₀ =	N/A	N/A	fps
Interception Rate of Frontal Flow	R _f =	N/Α	N/A N/A	-
Interception Rate of Side How	$O_i =$	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Internet (unclogged) Length of Multiple-Unit Grate Iniet		N/A	N/A N/A	fns
Interception Rate of Frontal Flow	V ₀ – R _f =	N/A N/A	N/A	- ips
Interception Rate of Side Flow	$R_x =$	N/A	N/A	-
Actual Interception Capacity	Q _a =	N/A	N/A	cfs
Carry-Over Flow = Q_0 - Q_a (to be applied to curb opening or next d/s inlet)	Q _b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	c [MINOR	MAJOR	- C. / C.
Equivalent Slope Se (based on grate carry-over)	S _e =	21 17	36.56	
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L _T)	L = [15.00	15.00	ft
Interception Capacity	Q _i =	9.0	14.5	cfs
Under Clogging Condition		MINOR	MAJOR	_
Clogging Coefficient	CurbCoef =	1.31	1.31	_
Effective (Uncloaged) Length		14.34	14 34	
Actual Interception Capacity	Q _a =	8.9	14.3	cfs
Carry-Over Flow = $Q_{h(GRATE)}$ - Q_a	Q _b =	1.2	9.3	cfs
Summary		MINOR	MAJOR	
I otal Inlet Interception Capacity	Q =	8.9	14.3	cfs
Canture Percentage = Ω_{c}/Ω_{c} =	Q _b =	88	9.3	

MIRD-INIEL, VERSION 5.01	t (April 2021)
ALLOWABLE CAPACITY FOR ONE-HALF C	DF STREET (Minor & Major Storm)
(Based on Regulated Criteria for Maximum Al	llowable Flow Depth and Spread)
C: Basin F-3 (DP 29)	
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} = 0.020
Height of Curb at Gutter Flow Line	H _{CURB} = 6.00 inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 16.0$ ft
Gutter Width	W = 0.83 ft
Street Transverse Slope	$S_X = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_W = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000 \text{ ft/ft}$
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	$T_{MAX} = 16.0$ 16.0 ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d _{MAX} = 4.4 7.7 inches
Check boxes are not applicable in SUMP conditions	
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm
Water Depth without Gutter Depression (Eq. ST-2)	y = 3.84 3.84 inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_c = 0.8$ 0.8 inches
Gutter Depression (d_c - (W * S_x * 12))	a = 0.63 0.63 inches
Water Depth at Gutter Flowline	d = 4.47 4.47 inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_x = 15.2$ 15.2 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.149 0.149$
Discharge outside the Gutter Section W, carried in Section T_X	$Q_x = 0.0 0.0$ cfs
Discharge within the Gutter Section W ($Q_T - Q_X$)	$Q_{W} = 0.0 0.0 \text{ cts}$
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 \text{ cts}$
Maximum Flow Based On Allowable Spread	$Q_T = SUMP SUMP cfs$
V*d Product: Flow Velocity times Gutter Flowline Depth	V = 0.0 Tps V*d = 0.0 0.0
Maximum Capacity for 1/2 Street based on Allowable Depth	Minor Storm Major Storm
Theoretical Water Spread	$T_{\rm TH} = 15.6$ 29.4 ft
Cutter Elevite Design Elevi Date by EHWA HEC 22 method (Eq. ST. 7)	$I_{XTH} = 14.7$ 28.6 IL
Theoretical Discharge outside the Gutter Section W. carried in Section Ture	$C_0 = 0.153 = 0.079$
Actual Discharge outside the Gutter Section W. (limited by distance T_{recurr})	$Q_{X} = 0.0 0.0 cfs$
Discharge within the Gutter Section W ($O_d - O_v$)	$Q_{\rm W} = 0.0$ 0.0 cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{\text{BACK}} = 0.0 0.0 \text{ cfs}$
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q = 0.0 0.0 cfs
Average Flow Velocity Within the Gutter Section	V = 0.0 0.0 fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d = 0.0 0.0
Slope-Based Depth Safety Reduction Factor for Major & Minor (d \geq 6") Storm	R = SUMP SUMP
Max Flow Based on Allowable Depth (Safety Factor Applied)	Q _d = SUMP SUMP cfs
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d = inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d _{CROWN} = inches
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm

	INLET IN A SUMP C	or sag loo	CATION		
	MHFD-Inlet, Version	5.01 (April 2021)			
	۲۲ Lo (C)۲				
	H-Curb				
	H-veit Wo				
	W WP				
	Lo (G)				
1	Design Information (Input)		MINOP	MAIOP	
	Type of Inlet	Type =	CDOT Type R	Curb Opening	1
	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) Water Depth at Flowline (outside of local depression)	No = Ponding Depth =	4.4	4	inches
	Grate Information		MINOR	MAJOR	
	Length of a Unit Grate	$L_{o}(G) =$	N/A	N/A	feet
	Width of a Unit Grate Area Opening Ratio for a Grate (typical values 0, 15-0, 90)	vv _o =	N/A N/A	N/A N/A	reet
	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 MINOR	N/A MAIOR]
	Length of a Unit Curb Opening	$L_{0}(C) =$	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
Warning 1	Side Width for Depression Pan (typically the gutter width of 2 feet)	W _n =	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	-
	Grate Flow Analysis (Calculated)	$C_0(C) =$	MINOR	MAIOR	
	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A]
	Clogging Factor for Multiple Units	Clog =	N/A	N/A	
	Interception without Clogging	0i = [N/A	MAJOR N/A	lcfs
	Interception with Clogging	Q _{wa} =	N/A	N/A	cfs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	о Г	MINOR	MAJOR	7-6-
	Interception with Clogging	Q _{0i} =	N/A N/A	N/A N/A	cfs
	Grate Capacity as Mixed Flow		MINOR	MAJOR	1
	Interception without Clogging	Q _{mi} =	N/A	N/A	cfs
	Resulting Grate Capacity (assumes clogged condition)	Q _{ma} = Q _{Grate} =	N/A N/A	N/A N/A	cfs
	Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	-
	Curb Opening as a Weir (based on Modified HEC22 Method)	clog = L	MINOR	MAJOR	1
	Interception without Clogging	Q _{wi} =	10.0	35.4	cfs
	Interception with Clogging	Q _{wa} =	9.7	34.3	cfs
	Interception without Clogging	Q _{oi} = [33.6	43.9	cfs
	Interception with Clogging	Q _{oa} =	32.5	42.4	cfs
	Curb Opening Capacity as Mixed Flow	o – F	MINOR	MAJOR].efa
	Interception without clogging	Q _{mi} = Q _{ma} =	16.5	35.5	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	Q _{Curb} =	9.7	34.3	cfs
	Resultant Street Conditions	. –	MINOR	MAJOR]e
	lotal Inlet Length Resultant Street Flow Spread (based on street geometry from above)		20.00	20.00	ft.>T-Crown
	Resultant Flow Depth at Street Crown	d _{CROWN} =	0.0	3.2	inches
	Low Hood Performance Poduction (Calculated)		MINOD	MAIOD	
	Low near Performance Reduction (Calculated) Depth for Grate Midwidth	down = [N/A	MAJOR N/A	lft
	Depth for Curb Opening Weir Equation	d _{Curb} =	0.29	0.57	ft
	Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	0.41	0.72	4
	Grated Inlet Performance Reduction Factor for Long Inlets		0.6/ N/A	0.88 N/A	
		Grate -			J
		• F	MINOR	MAJOR	ofo
	Inlet Capacity IS GOOD for Minor and Maior Storms(>O PEAK)	Q PEAK REQUIRED =	8.2	32.1	cfs

MHFD-Inlet, Version 5.01	(April 2021)
ALLOWABLE CAPACITY FOR ONE-HALF C	F STREET (Minor & Maior Storm)
(Based on Regulated Criteria for Maximum All	owable Flow Depth and Spread)
t: Grandview Reserve	
D: Basin E-4 (DP 30)	
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} = 0.020
Height of Curb at Gutter Flow Line	H _{CURB} = 6.00 linches
Distance from Curb Face to Street Crown	$T_{CROWN} = 16.0$ ft
Gutter Width	W = 0.83 ft
Street Transverse Slope	$S_{x} = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_{W} = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.000$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n _{STREET} = 0.016
May Allowable Careed for Minor & Major Charm	Minor Storm Major Storm
Max. Allowable Spread for Millior & Major Storini	$I_{MAX} = 16.0$ 16.0 It
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$a_{MAX} = 4.4$ /./ Incres
Maximum Capacity for 1/2 Street based On Allowable Spread	Minor Storm Major Storm
Water Depth without Gutter Depression (Eq. ST-2)	y = 3.84 3.84 inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	$d_c = 0.8$ 0.8 inches
Gutter Depression (d_c - (W * S _x * 12))	a = 0.63 0.63 inches
Water Depth at Gutter Flowline	d = 4.47 4.47 inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	$T_x = 15.2$ 15.2 ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	$E_0 = 0.149 0.149$
Discharge outside the Gutter Section W, carried in Section T_x	$Q_{\rm X} = 0.0 0.0 \text{ cfs}$
Discharge within the Gutter Section W ($Q_T - Q_X$)	$Q_{\rm W} = 0.0 0.0 \text{ cfs}$
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	$Q_{BACK} = 0.0 0.0 \text{ cfs}$
Maximum Flow Based On Allowable Spread	Q _T = SUMP SUMP cfs
Flow Velocity within the Gutter Section	V = 0.0 0.0 fps
/*d Product: Flow Velocity times Gutter Flowline Depth	V*d = 0.0 0.0
Maximum Canadity for 1/2 Streat based on Allowable Donth	
maximum capacity 101 1/2 Street Dased Off Allowable Depth Theoretical Water Spread	
Theoretical Spread for Discharge outside the Cuttor Section W/(T _ W)	$T_{\rm H} = 13.0$ 29.4 IL T = 14.7 20.6 ft
Cutter Eleve to Design Eleve Datio by ELIWA HEC 22 method (Eq. CT.7)	$I_{XTH} = 14.7$ 28.6 II
Duller Flow to Design Flow Ratio by FRIWA HEC-22 Method (Eq. S1-7)	$C_0 = 0.153 0.0/9$
Actual Discharge outside the Gutter Section W, Carried In Section 1xTH	$Q_{XTH} = 0.0$ 0.0 CTS
Discharge within the Cutter Section $W(Q = Q)$	$Q_X = 0.0 0.0 \text{ US}$
Discharge Rehind the Gutter Section W ($Q_d - Q_X$)	$Q_W = 0.0$ 0.0 crs
Tatal Discharge for Major & Minor Charm (Pro Cofeth Fonter)	$Q_{BACK} = 0.0 0.0 CTS$
Lischarge för Major & Minor Storm (Pre-Safety Factor)	Q = 0.0 0.0 CTS
Average now velocity within the Gutter Section	v = 0.0 0.0 Tps
Vra Product: Flow velocity I imes Gutter Flowline Depth	$V^{+} \mathbf{a} = \underbrace{\mathbf{U} \cdot \mathbf{U}}_{\mathbf{C} \mathbf{U} \mathbf{M} \mathbf{D}} \underbrace{\mathbf{U} \cdot \mathbf{U}}_{\mathbf{C} \mathbf{U} \mathbf{M} \mathbf{D}}$
Superdased Depth Safety Reduction Factor for Major & Minor ($a \ge 6^{\circ}$) Storm May Flow Record on Allowable Donth (Safety Factor Applied)	
I'liax Flow Dased on Allowable Depth (Safety Factor Applied)	Vd = SUMP SUMP CTS
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	a = inches
Resultant riow Depth at Street Crown (Safety Factor Applied)	u _{CROWN} = incres
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm
MAJOR STORM Allowable Capacity is based on Depth Criterion	

	INLET IN A SUMP (or sag loo	CATION		
	MHFD-Inlet, Version	n 5.01 (April 2021)			
	۲Lo (C)۲				
	H-Curb				
	Wo				
	W Wp				
	Lo (G)				
	CDQT Type R Curb Opening				
	Design Information (Input)		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R	Curb Opening	1
	Local Depression (additional to continuous gutter depression 'a' from above)	a _{local} =	3.00	3.00	inches
	Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	7.7	inches
	Grate Information		MINOR	MAJOR	-]6t
	Length of a Unit Grate Width of a Unit Grate	$L_{0}(G) = 0$	N/A N/A	N/A N/A	feet
	Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =	N/A	N/A]
	Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_{f}(G) =$	N/A	N/A	-
	Grate Orifice Coefficient (typical value 2.15 - 3.60)	$C_{w}(G) = C_{c}(G) = C_{c}(G)$	N/A	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 Verdcal Curb Opening in 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
Warning 1	Side Width for Depression Pan (typically the gutter width of 2 feet)	$W_p =$	2.00	2.00	feet
	Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_{r}(C) = C_{w}(C) $	3.60	3.60	
	Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_{o}(C) =$	0.67	0.67	
	Grate Flow Analysis (Calculated)	Coof -	MINOR	MAJOR	1
	Clogging Factor for Multiple Units	Clog =	N/A	N/A N/A	
	Grate Capacity as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	
	Interception without Clogging	Q _{wi} =	N/A N/A	N/A N/A	crs
	Grate Capacity as a Orifice (based on Modified HEC22 Method)	-twa	MINOR	MAJOR	
	Interception without Clogging	$Q_{oi} =$	N/A	N/A	cfs
	Grate Capacity as Mixed Flow	Q _{oa} =	MINOR	MAJOR	las
	Interception without Clogging	Q _{mi} =	N/A	N/A	cfs
	Interception with Clogging		N/A	N/A	cfs cfs
	Curb Opening Flow Analysis (Calculated)	CGrate	MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	
	Clogging Factor for Multiple Units Curb Opening as a Weir (based on Modified HEC22 Method)	Clog =	0.03 MINOR	0.03 MA10R]
	Interception without Clogging	Q _{wi} =	10.0	35.4	cfs
	Interception with Clogging	Q _{wa} =	9.7	34.3	cfs
	Interception without Clogging	Q _{oi} =	33.6	43.9	cfs
	Interception with Clogging	Q _{oa} =	32.5	42.4	cfs
	Curb Opening Capacity as Mixed Flow	о. –Г	MINOR 17.0	MAJOR 36.7	Tefs
	Interception with Clogging	$Q_{mi} = Q_{ma} = $	16.5	35.5	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	Q _{Curb} =	9.7	34.3	cfs
	Resultant Street Conditions	ι = Γ	20.00	MAJOR 20.00	feet
	Resultant Street Flow Spread (based on street geometry from above)	T =	15.6	29.4	ft.>T-Crown
	Resultant Flow Depth at Street Crown	d _{CROWN} =	0.0	3.2	inches
	Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
	Depth for Grate Midwidth	d _{Grate} =	N/A	N/A	ft
	Depth for Curb Opening Weir Equation	d _{Curb} =	0.29	0.57	lu l
	Curb Opening Performance Reduction Factor for Long Inlets	RF _{Curb} =	0.67	0.88	1
	Grated Inlet Performance Reduction Factor for Long Inlets	RF _{Grate} =	N/A	N/A]
			MINOR	MAJOR	
	Total Inlet Interception Capacity (assumes clogged condition)	Qa =	9.7	34.3	cfs
	Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	Q PEAK REQUIRED =	9.0	21.0	cts

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Wednesday, May 4 2022

BASIN D-7 SWALE

Trapezoidal

Trapezoidal		Highlighted	
Bottom Width (ft)	= 1.00	Depth (ft)	= 0.55
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 4.000
Total Depth (ft)	= 1.54	Area (sqft)	= 1.46
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 2.74
Slope (%)	= 2.00	Wetted Perim (ft)	= 4.48
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.51
		Top Width (ft)	= 4.30
Calculations		EGL (ft)	= 0.67
Compute by:	Known Q		
Known Q (cfs)	= 4.00		



Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Wednesday, May 4 2022

SWALE BASIN A-1

Trapezoidal

Trapezoidal		Highlighted	
Bottom Width (ft)	= 4.00	Depth (ft)	= 0.98
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 31.10
Total Depth (ft)	= 2.00	Area (sqft)	= 6.80
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 4.57
Slope (%)	= 2.00	Wetted Perim (ft)	= 10.20
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.97
		Top Width (ft)	= 9.88
Calculations		EGL (ft)	= 1.31
Compute by:	Known Q		
Known Q (cfs)	= 31.10		



Reach (ft)

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Wednesday, May 4 2022

Sidewalk Chase C-7a

	Highlighted	
= 1.00	Depth (ft)	= 0.50
= 0.50	Q (cfs)	= 3.200
	Area (sqft)	= 0.50
= 1.00	Velocity (ft/s)	= 6.40
= 2.00	Wetted Perim (ft)	= 2.00
= 0.013	Crit Depth, Yc (ft)	= 0.50
	Top Width (ft)	= 1.00
	EGL (ft)	= 1.14
Known Q		
= 3.20		
	= 1.00 = 0.50 = 2.00 = 0.013 Known Q = 3.20	= 1.00 $= 0.50$ $= 1.00$ $= 1.00$ $= 2.00$ $= 0.013$ $= 0.0013$ $= 0.013$



Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

SWALE BASIN C-7a

Trapezoidal

Trapezoidal		Highlighted	
Bottom Width (ft)	= 1.00	Depth (ft)	= 0.49
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 3.200
Total Depth (ft)	= 1.50	Area (sqft)	= 1.21
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 2.64
Slope (%)	= 2.00	Wetted Perim (ft)	= 4.10
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.45
		Top Width (ft)	= 3.94
Calculations		EGL (ft)	= 0.60
Compute by:	Known Q		
Known Q (cfs)	= 3.20		



Reach (ft)



Figure 8-11. Inlet Capacity Chart Sump Conditions, Curb Opening (Type R) Inlet

Notes:

1. The standard inlet parameters must apply to use this chart.

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

DP 32 30-Inch Bypass Culvert

Circular		Highlighted	
Diameter (ft)	= 2.50	Depth (ft)	= 1.74
		Q (cfs)	= 24.00
		Area (sqft)	= 3.65
Invert Elev (ft)	= 0.01	Velocity (ft/s)	= 6.57
Slope (%)	= 0.50	Wetted Perim (ft)	= 4.94
N-Value	= 0.013	Crit Depth, Yc (ft)	= 1.67
		Top Width (ft)	= 2.30
Calculations		EGL (ft)	= 2.41
Compute by:	Known Q		
Known Q (cfs)	= 24.00		



Reach (ft)

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

	MHFD-Culvert, Version 4.00 (May 2020)	
Project:	DP 32 headwater calc	

ID:

				121-121			
		Grade	rabert x certie	a rabert z section			
		Cont Tot	- w	D ()			
		Couper rate					
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		n estatu		N# 10	-		
			1	· · · · · · · · · · · · · · · · · · ·	1		
	<i>(</i> -)		Steps to	The second se	_		
Design Informatio	<u>n (Input):</u> Barrol Diamator in Ind	-hoc	5a.1	Settion 2	20	inchos	
Circular Culvert.	Inlet Edge Type (Cho	ose from pull-down lis	it)	D = So	uare Edge Projecting	inches	
<u>OR:</u>			· ·	- 1			
Box Culvert:	Barrel Height (Rise) ir	Feet		H (Rise) =		ft	
	Barrel Width (Span) in	1 Feet asa from pull down lis	+)	W (Span) =		ft	
	The Euge Type (Cho	use from pull-down is	st)				
	Number of Barrels			# Barrels =	1		
	Inlet Elevation at Culv	vert Invert		Elev IN =	5000	ft	
	Outlet Elevation OR S	olope		So =	0.005	ft/ft	
	Manning's Roughness			L = n =	0.013	it.	
	Bend Loss Coefficient			K _b =	0.7		
	Exit Loss Coefficient			K _x =	1		
Design Informatio	n (calculated):						
Design Informatio	Entrance Loss Coeffic	ient		K. =	0.20		
	Friction Loss Coefficie	nt		K _f =	7.34		
	Sum of All Loss Coeff	icients		K _s =	9.24		
	Orifice Inlet Condition	Coefficient		KElow =	0.1127		
	Office Inet Condition	Coefficient		C _d –	0.00		
Calculations of Cu	Ivert Capacity (out	<u>out):</u>	Backwater calculatio	ons required to obta	in Outlet Control Fl	owrate when HWo	< 0.75 * Culvert Ris
	Headwater	Tailwater	Inlet	Inlet	Outlet	Controlling	Flow
	Elevation	Elevation	Equation	Flowrate	Flowrate	Flowrate	Used
	(ft)	(ft)	Used	(cfs)	(cfs)	(cfs)	
	5000.00	5000.00	No Flow (WS < inlet)	0.00	0.00	0.00	N/A
	5000.30		Min. Energy. Eqn.	0.41	#N/A #N/A	#N/A #N/A	#N/A #N/A
	5000.90		Min. Energy. Eqn.	3.86	#N/A	#N/A	#N/A
	5001.20		Min. Energy. Eqn.	6.63	#N/A	#N/A	#N/A
	5001.50		Regression Eqn.	9.83	#N/A	#N/A	#N/A
	5001.80		Regression Eqn.	13.36	#N/A	#N/A	
	5002.10		Regression Eqn.	20,89	25.07	20.89	INLET
	5002.70		Regression Eqn.	24.51	27.65	24.51	INLET
	5003.00		Regression Eqn.	27.86	28.51	27.86	INLET
	5003.30		Regression Eqn.	30.95	29.35	29.35	OUTLET
	5003.00		Regression Fan	36,42	30,95	30.10	OUTLET
	5004.20		Regression Eqn.	38.87	31.72	31.72	OUTLET
	5004.50		Regression Eqn.	41.15	32.48	32.48	OUTLET
	5004.80		Regression Eqn.	43.31	33.22	33.22	OUTLET
	5005.10		Regression Eqn.	45.35 47.29	33.94 34.66	33.94	OUTLET
	<u>5005.70</u>		Regression Eqn.	49.15	35.35	35.35	OUTLET
	5006.00		Regression Eqn.	50.93	36.04	36.04	OUTLET
	5006.30		Regression Eqn.	52.65	36.71	36.71	OUTLET
	5006.60		Regression Eqn.	54.31 55 01	37.38	37.38	OUILET
	5007.20		Regression Ean.	57.47	38.67	38.67	OUTLET
	5007.50		Regression Eqn.	59.01	39.30	39.30	OUTLET
	5007.80		Orifice Eqn.	60.41	39.92	39.92	OUTLET
	5008.10		Orifice Eqn.	61.81	40.53	40.53	OUTLET
	5008.40		Ornice Eqn.	64.43	41.14	41.14	OUTLET OUTLET
	0000.70		Critice Equi	01115		12175	COLL!

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS) Project: DP 32 headwater calc



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Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

DP 35 48-Inch Bypass Culvert

Circular		Highlighted	
Diameter (ft)	= 4.00	Depth (ft)	= 2.88
		Q (cfs)	= 125.00
		Area (sqft)	= 9.71
Invert Elev (ft)	= 0.01	Velocity (ft/s)	= 12.87
Slope (%)	= 1.00	Wetted Perim (ft)	= 8.12
N-Value	= 0.013	Crit Depth, Yc (ft)	= 3.36
		Top Width (ft)	= 3.59
Calculations		EGL (ft)	= 5.46
Compute by:	Known Q		
Known Q (cfs)	= 125.00		


CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

	MHFD-Culvert, Version 4.00 (May 2020)
Project:	DP 35 headwater calc
ID:	

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			rabert x section	rabert serties			
		Course Vall	w w	P ()	•		
		17	1				
		N antros			22-222		
			\rightarrow	1			
		ць ў	Skepe Se				
Design Informat	ion (Input): Barrel Diameter in Ind	thes	dia.l	Tetim 7	48	inches	
circular curvert.	Inlet Edge Type (Cho	ose from pull-down lis	st)	Sc	quare Edge Projecting	linenes	
OF Rox Culvert	<u>Reveal Hoight (Disc) in</u>	Foot				<u>а</u>	
Box Cuivert.	Barrel Width (Span) in	n Feet		W (Span) =		ft	
	Inlet Edge Type (Cho	ose from pull-down lis	st)				
	Number of Barrels			# Barrels =	1		
	Inlet Elevation at Culv	vert Invert		Elev IN =	5000	ft	
	Outlet Elevation OR S	Slope		So =	0.01	ft/ft A	
	Manning's Roughness	1		L = n =	0.013	it.	
	Bend Loss Coefficient			K _b =	0.7		
	Exit Loss Coefficient			K _x =	1		
_							
Design Informat	ion (calculated):	ient		κ –	0.20	1	
	Friction Loss Coefficie	nt		K _e =	3.92		
	Sum of All Loss Coeff	icients		K _s =	5.82		
	Orifice Inlet Condition	Coefficient		KE _{low} = C _d =	0.0961		
				-u			
Calculations of C	Culvert Capacity (out	<u>out):</u>	Backwater calculatio	ns required to obta	in Outlet Control Fl	owrate when HWo	< 0.75 * Culvert Ris
	Headwater	Tailwater	Inlet	Inlet	Outlet	Controlling	Flow
	Surface	Surface	Control	Control	Control	Culvert	Control
	(ft)	(ft)	Used	(cfs)	(cfs)	(cfs)	Used
	5000.00	5000.00	No Flow (WS < inlet)	0.00	0.00	0.00	N/A
	5000.25		Min. Energy. Eqn. Min. Energy. Eqn.	0.32	#N/A #N/A	#N/A #N/A	#N/A #N/A
	5000.75		Min. Energy. Eqn.	3.07	#N/A	#N/A	#N/A
	5001.00		Min. Energy. Eqn.	6.25	#N/A	#N/A	#N/A
	5001.25		Min. Energy. Eqn.	13.61	#N/A #N/A	#N/A #N/A	# IN/A #N/A
	5001.75		Min. Energy. Eqn.	18.21	#N/A	#N/A	#N/A
	5002.00		Min. Energy. Eqn. Regression Fan.	23.35 28.71	#N/A #N/A	#N/A #N/A	#N/A #N/A
	5002.50		Regression Eqn.	34.34	#N/A	#N/A	#N/A
	5002.75		Regression Eqn.	40.31	#N/A	#N/A	
	5003.00		Regression Eqn.	40.51 52.85	115.45	40.51 52.85	INLET
	5003.50		Regression Eqn.	59.26	117.25	59.26	INLET
	5003.75		Regression Eqn.	65.62	119.01	65.62	
	5004.25		Regression Eqn.	77.91	122.48	77.91	INLET
	5004.50		Regression Eqn.	83.74	124.18	83.74	INLET
	5004.75		Regression Eqn.	89.33 94.71	125.86	89.33 94.71	
	5005.25		Regression Eqn.	99.82	129.16	99.82	INLET
	5005.50		Regression Eqn.	104.72	130.79	104.72	
	5005.75		Regression Eqn.	113.94	132.39	113.94	INLET
	5006.25		Regression Eqn.	118.31	135.55	118.31	INLET
	5006.50 5006.75		Regression Eqn.	122.45	137.10 138.63	122.45 126.51	INLET INLET
	5007.00		Regression Eqn.	130.41	140.16	130.41	INLET
	5007.25		Regression Eqn.	134.15	141.66	134.15	INLET

ID:

Project: <u>DP 35 headwater calc</u>



Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

DP 34 3 - 60-Inch RCP Culverts

Circular		Highlighted	
Diameter (ft)	= 5.00	Depth (ft)	= 3.12
		Q (cfs)	= 138.00
		Area (sqft)	= 12.93
Invert Elev (ft)	= 0.01	Velocity (ft/s)	= 10.67
Slope (%)	= 0.55	Wetted Perim (ft)	= 9.12
N-Value	= 0.013	Crit Depth, Yc (ft)	= 3.36
		Top Width (ft)	= 4.84
Calculations		EGL (ft)	= 4.89
Compute by:	Known Q		
Known Q (cfs)	= 138.00		



Reach (ft)

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: DP 34 headwater calc	MHFD-Culvert, Version 4.00 (May 2020)
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ID:

				1. 1			
		Couple Tealt	w		•		
		17	1				
				1 10 10	-		
		18.\$	Des 1	-			
Design Informatio	<u>n (Input):</u>	Sec	tion.1	Section 2		1	
Circular Culvert:	Barrel Diameter in Ind	ches ose from null-down lis	+)	D =	60 ware Edge Projecting	inches	
OR:	Thet Luge Type (cho			54	laare Eage Projecting	_	
Box Culvert:	Barrel Height (Rise) ir	n Feet		H (Rise) =		ft	
	Barrel Width (Span) ii Inlet Edge Type (Cho	n Feet ose from pull-down lis	; †)	W (Span) =		μt.	
	The Lage Type (cho						
	Number of Barrels			# Barrels =	3		
	Outlet Elevation at Culv	vert Invert Slope		Elev IN = So =	0.0055	ft ft/ft	
	Culvert Length			L =	170	ft	
	Manning's Roughness	i		n = ĸ. –	0.013		
	Exit Loss Coefficient			K _x =	1		
				~		1	
Design Informatio	n (calculated):						
Design mornado	Entrance Loss Coeffic	ient		K _e =	0.20]	
	Friction Loss Coefficie	nt		$K_{f} =$	0.62		
	Sum of All Loss Coeff	icients dition Coefficient		K _s = KF =	1.82		
	Orifice Inlet Condition	Coefficient		$C_d =$	0.60		
Calculations of Cu	ivert Capacity (out	<u>out):</u>	Backwater calculatio	ons required to obta	in Outlet Control FI	owrate when HWo	< 0.75 * Culvert Ris
	Headwater	Tailwater	Inlet	Inlet	Outlet	Controlling	Flow
	Surface	Surface	Control	Control	Control	Culvert	Control
	(ft)	(ft)	Used	(cfs)	(cfs)	(cfs)	Used
	5000.00	5000.00	No Flow (WS < inlet)	0.00	0.00	0.00	N/A
	5000.30		Min. Energy. Eqn.	1.53	#N/A #N/A	#N/A #N/A	#N/A #N/A
	5000.90		Min. Energy. Eqn.	14.82	#N/A	#N/A	#N/A
	5001.20		Min. Energy. Eqn.	30.03	#N/A	#N/A	#N/A
	5001.50		Min. Energy. Eqn. Min. Energy Eqn.	46.23 65.40	#N/A #N/A	#N/A #N/A	#N/A #N/A
	5002.10		Min. Energy. Eqn.	87.63	#N/A	#N/A	#N/A
	5002.40		Min. Energy. Eqn.	112.53	#N/A	#N/A	#N/A
	5002.70		Regression Eqn.	138.96 166.83	#N/A #N/Δ	#N/A #N/Δ	#Ν/Α #Ν/Δ
	<u>5003.3</u> 0		Regression Eqn.	196.23	#N/A	#N/A	#N/A
	5003.60		Regression Eqn.	226.83	#N/A	#N/A	#N/A
	5003.90		Regression Eqn.	258.42	323.65	258.42	
	5004.50		Regression Eqn.	322.83	397.56	322.83	INLET
	5004.80		Regression Eqn.	354.63	431.46	354.63	INLET
	5005.10		Regression Eqn.	385.68	463.94	385.68	
	5005.70		Regression Ean.	444.93	524.60	444.93	INLET
	5006.00		Regression Eqn.	472.86	553.11	472.86	INLET
	5006.30		Regression Eqn.	499.62	580.75	499.62	INLET
	5006.60		Regression Eqn.	525.33 549.93	633.42	525.33 549.93	
	5007.20		Regression Eqn.	573.63	658.75	573.63	INLET
	5007.50		Regression Eqn.	596.28	683.29	596.28	INLET
	5007.80		Regression Eqn.	618.15 639.24	707.16	618.15 639.24	
	5008.40		Regression Eqn.	659.73	753.43	<u>659.7</u> 3	INLET
	5008.70		Regression Eqn.	679.32	775.71	679.32	INLET

Processing Time: 01.87 Seconds

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)



Project: DP 34 headwater calc



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Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Tuesday, May 10 2022

DP33 - Q100 = 25.8 cfs

	Highlighted	
= 3.50	Depth (ft)	= 1.59
	Q (cfs)	= 30.00
	Area (sqft)	= 4.26
= 5800.00	Velocity (ft/s)	= 7.05
= 0.50	Wetted Perim (ft)	= 5.18
= 0.013	Crit Depth, Yc (ft)	= 1.69
	Top Width (ft)	= 3.49
	EGL (ft)	= 2.36
Known Q		
= 30.00		
	= 3.50 = 5800.00 = 0.50 = 0.013 Known Q = 30.00	= 3.50 $= 3.50$ $= 5800.00$ $= 0.50$ $= 0.013$ $= 0.013$ $Highlighted Depth (ft) Q (cfs) Area (sqft) Velocity (ft/s) Wetted Perim (ft) Crit Depth, Yc (ft) Top Width (ft) EGL (ft) Known Q = 30.00$



Reach (ft)

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

= 1.10

= 1.39

= 16.10

DPEA1 - Q100 = 16.1 cfs

Circular

Diameter (ft)

Invert Elev (ft)

Slope (%)

N-Value

=	5800.00
=	3.00
=	0.013

= 1.50

Calculations

Compute by: Known Q (cfs)



Highlighted	
Depth (ft)	
Q (cfs)	
Area (sqft)	
Velocity (ft/s)	

Velocity (ft/s)	= 11.57
Wetted Perim (ft)	= 3.09
Crit Depth, Yc (ft)	= 1.43
Top Width (ft)	= 1.32
EGL (ft)	= 3.18

Elev (ft)	Section		
5802.00			
5801.50			
5801.00			
5800.50			
5800.00			
5799.50 <u>0</u>	 1 2	3	

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

DPEA2.1 - Q100 = 30.0 cfs

Circular		Highlighted	
Diameter (ft)	= 2.00	Depth (ft)	= 1.31
		Q (cfs)	= 30.00
		Area (sqft)	= 2.19
Invert Elev (ft)	= 5800.00	Velocity (ft/s)	= 13.71
Slope (%)	= 3.00	Wetted Perim (ft)	= 3.78
N-Value	= 0.013	Crit Depth, Yc (ft)	= 1.87
		Top Width (ft)	= 1.90
Calculations		EGL (ft)	= 4.23
Compute by:	Known Q		
Known Q (cfs)	= 30.00		



Reach (ft)

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Friday, May 6 2022

INTERIM SWALE FOR GEC (DP7)





Reach (ft)

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Friday, May 6 2022

PROPOSED OFFSITE BASIN 0S-1 SWALE

Trapezoidal

Bottom Width (ft)	= 2.00	Depth (ft)	= 0.88
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 8.700
Total Depth (ft)	= 2.25	Area (sqft)	= 4.08
Invert Elev (ft)	= 1.88	Velocity (ft/s)	= 2.13
Slope (%)	= 0.78	Wetted Perim (ft)	= 7.57
N-Value	= 0.040	Crit Depth, Yc (ft)	= 0.62
		Top Width (ft)	= 7.28
Calculations		EGL (ft)	= 0.95
Compute by:	Known Q		
Known Q (cfs)	= 8.70		

Highlighted



Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Friday, May 6 2022

PROPOSED OFFSITE BASIN 0S-2 SWALE

Trapezoidal

Bottom Width (ft)	= 2.00	Depth (ft)	= 1.25
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 17.30
Total Depth (ft)	= 2.25	Area (sqft)	= 7.19
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 2.41
Slope (%)	= 0.66	Wetted Perim (ft)	= 9.91
N-Value	= 0.040	Crit Depth, Yc (ft)	= 0.88
		Top Width (ft)	= 9.50
Calculations		EGL (ft)	= 1.34
Compute by:	Known Q		
Known Q (cfs)	= 17.30		

Highlighted



Reach (ft)

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Friday, May 6 2022

= 1.19 = 19.10 = 6.63 = 2.88 = 9.53 = 0.93 = 9.14 = 1.32

PROPOSED OFFSITE BASIN 0S-4 SWALE

Trapezoidal

Bottom Width (ft)	= 2.00	Depth (ft)
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)
Total Depth (ft)	= 2.20	Area (sqft)
Invert Elev (ft)	= 1.00	Velocity (ft/s)
Slope (%)	= 1.00	Wetted Perim (ft)
N-Value	= 0.040	Crit Depth, Yc (ft)
		Top Width (ft)
Calculations		EGL (ft)
Compute by:	Known Q	
Known Q (cfs)	= 19.10	

Highlighted



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Provide HEC-RAS summary tables for both channels somewhere in the PDR

APPENDIX D

Water Quality Computations

	Project: Grandview - Interim
	Basin ID: TSB-A1
	Allowed a
LOT SO ST	1 (00)
street and and	
PROPERTY AND	Unit 1 Mill P
P904	Example Zone Configuration (Retention Pond)

Depth Increment = 1.00 ft

200	1 1000 1	(mone)	e.		Depth Increment =	1.00	π				Ontional			
Example Zone	Configurati	on (Retenti	on Pond)		Stage - Storage	Stane	Override	Length	Width	Area	Override	Area	Volume	Volume
Example 2016	oomigurati	on (netenti	on rona,		Description	(ff)	Stage (ft)	(fft)	(ff)	(ff ²)	Area (ft ²)	(acre)	(ft ³)	(ac-ft)
Webenehood Information					Ton of Missoneol	(10)	0.00	(10)	(10)	(10)	0.761	0.201	(10)	(dc ft)
watersned Information		-			T OP OT MICROPOOL		0.00				8,761	0.201		
Selected BMP Type =	EDB						1.00				10,293	0.236	9,527	0.219
Watershed Area -	17.40	acros					2.00				11 026	0.274	20.626	0.474
Watersneu Area -	17.45	acres					2.00	-			11,920	0.274	20,030	0.474
Watershed Length =	1,554	ft					3.00				13,660	0.314	33,429	0.767
Watershed Length to Centroid =	777	ft					4.00				15,495	0.356	48,007	1.102
Watershed Slene -	0.021	0 /0												
Watersneu Slope -	0.031	içit												
Watershed Imperviousness =	2.00%	percent												
Percentage Hydrologic Soil Group A =	100.0%	percent												
Percentage Hydrologic Soil Group B -	0.0%	nercent												
	0.070	, percent												
Percentage Hydrologic Soil Groups C/D =	0.0%	percent				-								
Target WQCV Drain Time =	40.0	hours												
Location for 1-hr Rainfall Denths =	Liser Innut	-				-								
After providing required inputs above inc	luding 1-hour	rainfall												
depths, click 'Run CUHP' to generate rund	off hydrograph	ns using												
the embedded Colorado Urban Hydro	graph Proced	ure.	Optional Use	er Overrides										
Water Quality Capture Volume (WOCV) -	0.022	acre-feet		acro-foot										
	0.022			dere rece										
Excess Urban Runoff Volume (EURV) =	0.016	acre-feet		acre-feet										
2-yr Runoff Volume (P1 = 1.19 in.) =	0.009	acre-feet	1.19	inches										
5-vr Runoff Volume (P1 = 1.5 in) =	0.017	acre-feet	1 50	inches		-								
	0.017	dere rece	1.50											
10-yr Runom Volume (P1 = 1.75 In.) =	0.025	acre-reet	1.75	incries		-								
25-yr Runoff Volume (P1 = 2 in.) =	0.219	acre-feet	2.00	inches										
50-yr Runoff Volume (P1 = 2.25 in.) =	0.441	acre-feet	2.25	inches										
100-vr Rupoff Volume (P1 = 2 E2 in) -	0 744	acre-feat	2 5 2	inches									<u> </u>	
100 yr Runon Volume (F1 - 2.52 III.) =	0.770	acre leet	2.32	ancines	-	-		-		-			<u> </u>	
500-yr Runoff Volume (P1 = 3.68 in.) =	2.185	acre-feet	3.68	inches										
Approximate 2-yr Detention Volume =	0.009	acre-feet												
Approximate 5-vr Detention Volume -	0.013	acre-feet												
Approximate 5-yr betenuon volume =	0.013	-			-	-		-		-			<u> </u>	
Approximate 10-yr Detention Volume =	0.019	acre-feet												
Approximate 25-yr Detention Volume =	0.028	acre-feet												
Approximate 50-vr Detention Volume -	0.069	acre-feet												
Annual 100 December 100	0.000				-								<u> </u>	
Approximate 100-yr Detention Volume =	0.189	acre-feet											L	
Define Zones and Basin Geometry														
Denne zones and Dasin Geometry		-												
Zone 1 Volume (WQCV) =	0.022	acre-feet				-								
Select Zone 2 Storage Volume (Optional) =		acre-feet	Total deter	ntion										
Select Zone 3 Storage Volume (Ontional) -		acre-feet	volume is	loce than										
Sciece zone 5 Storage Volume (Optional) =			100-year y	olume										
Total Detention Basin Volume =	0.022	acre-feet	100 year t	oranie.										
Initial Surcharge Volume (ISV) =	user	ft 3												
Initial Surcharge Depth (ISD) -	user	A												
indu Surcharge Depth (ISD) =	usci	-												
Total Available Detention Depth (H _{total}) =	user	ft												
Depth of Trickle Channel (H _{TC}) =	user	ft												
Slone of Trickle (hannel (See) -	user	A/A												
Slope of Thekie enaminer (STC) =	usci													
Slopes of Main Basin Sides (S _{main}) =	user	H:V												
Basin Length-to-Width Ratio (R _{L/W}) =	user													
		-				-								
		1												
Initial Surcharge Area (A _{ISV}) =	user	ft f												
Surcharge Volume Length $(L_{ISV}) =$	user	ft												
Surcharge Volume Width (Wrsy) =	user	ft				-								
Death of Death Floor (11)		<u>.</u>												
Depth of Basin Floor (H _{FLOOR}) =	user	- "												
Length of Basin Floor $(L_{FLOOR}) =$	user	ft				-								
Width of Basin Floor (WFLOOP) =	user	ft												
Area of Basin Floor (A) =	user	a 2												
Area of Basin Hoor (AFLOOR) -	usci	-".												
volume of Basin Floor (V _{FLOOR}) =	user	rt '											L	
Depth of Main Basin (H _{MAIN}) =	user	ft												
Length of Main Basin (Length) =	user	ft												
Middle of Mala David (LMAIN)	11000	A.											<u> </u>	
width of Main Basin (W_{MAIN}) =	user	- "											<u>↓ </u>	
Area of Main Basin (A _{MAIN}) =	user	ft ²												
Volume of Main Basin (V_{MATM}) =	user	ft ³												
Calculated Total Basin Volume (V) =	llear	acre-feet												
concentration rotar busin volume (v _{total}) =	4301								-	-			<u> </u>	
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MHFD-Detention, Version 4.06 (July 2022)



				LET STIL	CTOKE DE.				
Project	Grandview - Inter	M	HFD-Detention, V	ersion 4.06 (July J	2022)				
Basin ID:	TSB-A1	Im							
Alma a				Estimated	Estimated				
		_		Stage (ft)	Volume (ac-ft)	Outlet Type			
WILLING WARY WOOV			Zone 1 (WOCV)	0.11	0.022				
	AL DE LINE		Zone I (WQCV)	0.11	0.022	Office fiate			
2041 1 640 2	ORPICE		Zone z						
Frample Zone	Configuration (Re	tention Pond)	Zone 3						
	Configuration (rec			Total (all zones)	0.022				
User Input: Orifice at Underdrain Outlet (typical	y used to drain WQ	CV in a Filtration B	<u>4P)</u>	c			Calculated Parame	eters for Underdrain	
Underdrain Orifice Invert Depth =	N/A	rt (distance below i	the hitration media	surrace)	Underd	rain Unifice Area =	N/A	ft ⁻	
Underdrain Onlice Diameter =	N/A	incries			Underdrain	Office Centrold =	N/A	leet	
User Input: Orifice Plate with one or more orific	es or Elliptical Slot	Weir (typically used	to drain WOCV and	1/or FURV in a sedi	mentation BMP)		Calculated Parame	ters for Plate	
Centroid of Lowest Orifice =	0.00	ft (relative to basin	bottom at Stage =	0 ft)	WO Orifi	ce Area per Row =	1.028E-02	ft ²	
Depth at top of Zone using Orifice Plate =	0.11	ft (relative to basin	bottom at Stage =	= 0 ft)	Elli	otical Half-Width =	N/A	feet	
Orifice Plate: Orifice Vertical Spacing =	4.00	inches	-		Ellipti	cal Slot Centroid =	N/A	feet	
Orifice Plate: Orifice Area per Row =	1.48	sq. inches (diamete	er = 1-3/8 inches)		E	lliptical Slot Area =	N/A	ft ²	
								-	
User Input: Stage and Total Area of Each Orific	e Row (numbered f	rom lowest to highe	<u>est)</u>					1	1
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)	
Stage of Orifice Centroid (ft)	0.00	0.30	0.60	0.90	1.20				
Orifice Area (sq. inches)	1.48	1.48	1.48	1.48	1.48				l
	D. 0(D. 407	D. 447	D. 40 (D. 107	D. 447	D. 454	D. 464	1
	Row 9 (optional)	коw 10 (optional)	коw 11 (optional)	коw 12 (optional)	коw 13 (optional)	KOW 14 (optional)	коw 15 (optional)	KOW 16 (optional)	
Stage of Orlfice Centroid (ft)									
Orifice Area (sq. inches)									1
User Input: Vertical Orifice (Circular or Rectang	ular)						Calculated Parame	eters for Vertical Ori	fice
	Not Selected	Not Selected					Not Selected	Not Selected	1
Invert of Vertical Orifice =			ft (relative to basin	bottom at Stage =	0 ft) Ver	tical Orifice Area =			ft ²
Depth at top of Zone using Vertical Orifice =			ft (relative to basin	bottom at Stage =	= 0 ft) Vertical	Orifice Centroid =			feet
Vertical Orifice Diameter =			inches			-			-
User Input: Overflow Weir (Dropbox with Flat o	r Sloped Grate and	Outlet Pipe OR Rec	tangular/Trapezoid	al Weir and No Out	let Pine)		Calculated Parame	store for Overflow M	1-1-
					ice ripe)				l
Overflere Wein Frenze Edge Usiekt Us	Not Selected	Not Selected			v Usisht of Custo	Users Edge 11	Not Selected	Not Selected	<u>/eir</u>
Overflow Weir Front Edge Height, Ho =	Not Selected	Not Selected	ft (relative to basin b	pottom at Stage = 0 f	t) Height of Grate	e Upper Edge, H _t =	Not Selected	Not Selected	feet
Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length =	Not Selected	Not Selected	ft (relative to basin b feet	oottom at Stage = 0 f	t) Height of Grate Overflow W	e Upper Edge, H _t = eir Slope Length =	Not Selected	Not Selected	feet feet
Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz Length of Weir Sides =	Not Selected	Not Selected	ft (relative to basin b feet H:V feet	pottom at Stage = 0 f Gr	t) Height of Grate Overflow W ate Open Area / 10	e Upper Edge, H _t = eir Slope Length = 0-yr Orifice Area = Area w/o Debris =	Not Selected	Not Selected	feet feet
Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type =	Not Selected	Not Selected	ft (relative to basin b feet H:V feet	oottom at Stage = 0 f Gr Ov	t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open	: Upper Edge, $H_t =$ eir Slope Length = 0-yr Orifice Area = Area w/o Debris =	Not Selected	Not Selected	feet feet ft ² ft ²
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Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % =	Not Selected	Not Selected	ft (relative to basin t feet H:V feet %	nottom at Stage = 0 f Gr Ov C	t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open Iverflow Grate Oper	to Upper Edge, H_t = eir Slope Length = 0-yr Orifice Area = Area w/o Debris = h Area w/ Debris =	Not Selected	Not Selected	feet feet ft ² ft ²
Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate	Not Selected	Not Selected	ft (relative to basin t feet H:V feet % ectangular Orifice)	bottom at Stage = 0 f Gr Ov C	t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open overflow Grate Open <u>Ca</u>	Upper Edge, H _t = eir Slope Length = 0-yr Orifice Area = Area w/o Debris = h Area w/ Debris = lculated Parameters	Not Selected	Not Selected	feet feet ft ² ft ² ft ²
Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate	Not Selected	Not Selected estrictor Plate, or R Not Selected	ft (relative to basin t feet H:V feet % ectangular Orifice)	oottom at Stage = 0 f Gr Ov C	t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open Overflow Grate Open <u>Ca</u>	t Upper Edge, H _t = eir Slope Length = 0-yr Orifice Area = Area w/o Debris = n Area w/ Debris = Iculated Parameters	Not Selected	Not Selected Flow Restriction Pl Not Selected	feet feet ft ² ft ²
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Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage= Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Neter Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 97% of Inflow Volume (hours) =	Not Selected	Not Selected estrictor Plate, or R Not Selected ft (relative to basin feet H:V feet Fide the default CUI EURV N/A N/A N/A N/A N/A N/A N/A N/	ft (relative to basin to feet H:V feet % ectangular Orifice) ft (distance below basinches bottom at Stage = /// hydrographs and 2 Year 1.19 0.009 0.009 0.009 0.1 0.01 0.0 N/A Plate N/A N/A N/A 22 27 0.04	a rice und no con bottom at Stage = 0 f Gr Ov con asin bottom at Stage Half-Cent asin bottom at Stage Half-Cent 0 ft) 1.50 0.017 0.2 0.017 0.2 0.017 0.2 0.01 0.1 Plate N/A N/A 27 32 0.07	t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open Verflow Grate Open Overflow Grate Open iverflow Grate Open Ca ca = 0 ft) Ou Outlet ral Angle of Restrict Spillway Du Stage at T Basin Area at T Basin Area at T Basin Volume at T Ventering new Value 10 Year 1.75 0.025 0.3 0.025 0.3 0.025 0.3 0.0 0.1 Plate N/A N/A 31 36 0.11	e Upper Edge, H _t = eir Slope Length = 0-yr Orifice Area = Area w/o Debris = h Area w/ Debris = lculated Parameters vitlet Orifice Area = Orifice Centroid = cor Plate on Pipe = esign Flow Depth= op of Freeboard = op of Freeboard = op of Freeboard = op of Freeboard = op of Freeboard = <u>op of Freeboard =</u> <u>op of Freeboard =</u> <u>op of Carea and Area and Ar</u>	Calculated Pripe w/ s for Outlet Pipe w/ Not Selected N/A Calculated Parame 0.25 4.25 0.36 1.10 drographs table (Col 50 Year 2.25 0.441 5.8 0.33 5.8 0.3 0.0 Plate N/A 71 82 1.77	Image: Not Selected V Flow Restriction Pl Not Selected Not Selected Not Selected N/A ters for Spillway feet acres acres acres acres acres 0.746 0.746 0.746 0.54 9.5 0.4 0.0 Plate N/A 75 88 2.74	feet feet feet feet ft² ft² ft² feet foot feet feet feet foot feet feet feet foot feet feet feet feet feet feet feet feet feet stats feet 3.68 2.185 2.185 2.4.6 19.2 0.8 Spillway N/A N/A 54 78 20
Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage= Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Net-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Inflow Q (cfs) = Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 99% of Inflow Volume (hours) = Time to Drain 99% of Inflow Volume (hours) = Maximum Ponding Depth (ft) =	Not Selected	Not Selected estrictor Plate, or R Not Selected ft (relative to basin feet H:V feet ide the default CUI EURV N/A 0.016 N/A	ft (relative to basin the feet H:V feet % ectangular Orifice) ft (distance below basinches bottom at Stage = the hydrographs and 2 Year 1.19 0.0009 0.000 0.009 0.009 0.009 0.009 0.009 0.000 0.009 0.009 0.000 0.009 0.009 0.000 0.009 0.000 0.000 0.009 0.0000 0.0000 0.000000	a rice und to out bottom at Stage = 0 f Gr Ov c asin bottom at Stage Half-Cent = 0 ft)	t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open Verflow Grate Open Verflow Grate Open Dverflow Grate Open Ca = 0 ft) Ou Outlet ral Angle of Restrict Spillway Dr Stage at T Basin Area at T Basin Volume at T Basin Volume at T Centering new Value 10 Year 1.75 0.025 0.025 0.3 0.025 0.3 0.02 0.3 0.0 0.1 Plate N/A 31 36 0.11 0.20	e Upper Edge, H _t = eir Slope Length = 0-yr Orifice Area = Area w/o Debris = h Area w/ Debris = lculated Parameters vitlet Orifice Area = Orifice Centroid = cor Plate on Pipe = esign Flow Depth= op of Freeboard = op of Freeboard = 0.219 0.219 0.219 0.219 0.17 2.9 0.1 0.0 Plate N/A N/A 66 73 0.93 0.23	Calculated Pripe s for Outlet Pipe w/A Not Selected N/A Calculated Parame 0.25 4.25 0.36 1.10 drographs table (Col 50 Year 2.25 0.441 5.8 0.33 5.8 0.33 5.8 0.3 0.0 Plate N/A 71 82 1.73 0.26	Not Selected / Flow Restriction Pl Not Selected Not Selected Not Selected Not Selected N/A ters for Spillway feet feet acres acre-ft 00 Year 2.52 0.746 0.746 9.5 0.4 0.0 Plate N/A 75 88 2.74 0.30	feet feet feet feet ft² ft² ft² feet feet feet 3.68 2.185 2.185 2.185 2.4.6 19.2 0.8 Spillway N/A 54 78 3.39 0.33 0.33



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	WOCV [cfs]	FURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
Time Incervar	0:00:00	WQCV [CI3]		2 100 [03]	5 100 [03]		25 100 [03]		100 100 [03]	
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	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:20:00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
	0.25.00	0.00	0.00	0.05	0.13	0.20	0.04	0.07	0.10 4 34	0.32
	0:35:00	0.00	0.00	0.11	0.22	0.30	2.57	E 12	9.76	21.29
	0:40:00	0.00	0.00	0.11	0.22	0.32	2.37	5.80	9.46	21.20
	0:45:00	0.00	0.00	0.10	0.19	0.26	2.78	5.55	9 38	24 58
	0:50:00	0.00	0.00	0.09	0.17	0.24	2.53	5.01	8.54	23.35
	0:55:00	0.00	0.00	0.08	0.15	0.21	2.24	4.48	7.66	21.77
	1:00:00	0.00	0.00	0.07	0.14	0.19	2.02	4.03	6.92	20.37
	1:05:00	0.00	0.00	0.06	0.12	0.17	1.82	3.62	6.22	19.11
	1:10:00	0.00	0.00	0.06	0.11	0.16	1.62	3.23	5.55	17.30
	1:15:00	0.00	0.00	0.05	0.10	0.15	1.46	2.92	5.01	15.69
	1:20:00	0.00	0.00	0.05	0.09	0.13	1.33	2.65	4.55	14.20
	1:25:00	0.00	0.00	0.04	0.08	0.12	1.20	2.40	4.11	12.78
	1:30:00	0.00	0.00	0.04	0.07	0.11	1.08	2.14	3.68	11.44
	1:35:00	0.00	0.00	0.03	0.06	0.09	0.95	1.89	3.25	10.14
	1:40:00	0.00	0.00	0.03	0.05	0.08	0.83	1.64	2.83	8.85
	1.50.00	0.00	0.00	0.03	0.05	0.07	0.70	1.39	2.40	6.77
	1:55:00	0.00	0.00	0.02	0.05	0.07	0.01	1.23	1 07	6.13
	2:00:00	0.00	0.00	0.02	0.04	0.06	0.57	1.15	1.95	5.57
	2:05:00	0.00	0.00	0.02	0.04	0.05	0.48	0.95	1.63	5.06
	2:10:00	0.00	0.00	0.02	0.01	0.05	0.10	0.87	1.48	4.59
	2:15:00	0.00	0.00	0.02	0.03	0.04	0.39	0.78	1.34	4.13
	2:20:00	0.00	0.00	0.01	0.03	0.04	0.35	0.70	1.20	3.69
	2:25:00	0.00	0.00	0.01	0.02	0.03	0.31	0.61	1.05	3.27
	2:30:00	0.00	0.00	0.01	0.02	0.03	0.27	0.53	0.91	2.85
	2:35:00	0.00	0.00	0.01	0.01	0.02	0.23	0.44	0.77	2.44
	2:40:00	0.00	0.00	0.01	0.01	0.02	0.18	0.36	0.63	2.02
	2:45:00	0.00	0.00	0.00	0.01	0.01	0.14	0.28	0.48	1.60
	2:50:00	0.00	0.00	0.00	0.00	0.01	0.10	0.19	0.34	1.19
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.06	0.11	0.20	0.77
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.08	0.43
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.26
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.10
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
	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	0.01
	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
	4:20:00	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
	4:45:00	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
	5:10:00	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
	5:35:00	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

MHFD-Detention, Version 4.06 (July 2022) Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically. The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage	Area	Area	Volume	Volume	Total Outflow	
	լπյ	[ft*]	[acres]	[ft ⁻]	[ac-π]	[CTS]	
							For best results, include the
							changes (e.g. ISV and Floor)
							from the S-A-V table on
							Sheet 'Basin'.
							Also include the inverts of all
							outlets (e.g. vertical orifice,
							overflow grate, and spillway,
]
							l

Ontional

Project:	Grandview - Interim
Basin ID:	TSB-A2
=1-1-4	

COLUMN 2

Depth Increment = 1.00 ft

Example Zone	Configurati	on (Retenti	ion Pond)		Stage - Storage	Stage	Override	Length	Width	Area	Override	Area	Volume	Volume
Watershed Information					Description	(ft)	Stage (ft)	(ft)	(ft)	(ft ⁻)	Area (ft ⁻)	(acre)	(ft ⁻)	(ac-ft)
Column DMD Torres	500	1			тор от містороог		0.00	-		-	2,903	0.000	2.644	0.004
Selected BMP Type =	EDB	-					1.00				4,325	0.099	3,644	0.084
Watershed Area =	4.51	acres					2.00				5,941	0.136	8,///	0.201
Watershed Length =	807	ft					3.00				7,813	0.179	15,653	0.359
Watershed Length to Centroid =	404	ft					4.00				9,941	0.228	24,530	0.563
Watershed Slope =	0.011	ft/ft												
Watershed Imperviousness =	2.00%	percent												
Percentage Hydrologic Soil Group A =	100.0%	percent												
Percentage Hydrologic Soil Group B =	0.0%	percent												
Percentage Hydrologic Soil Groups C/D =	0.0%	percent												
Target WQCV Drain Time =	40.0	hours												
Location for 1-hr Rainfall Depths =	User Input													
After providing required inputs above incl	uding 1-hour	rainfall												
depths, click 'Run CUHP' to generate runo	ff hydrograph	ns using												
the embedded Colorado Urban Hydrog	graph Proced	ure.	Optional U	ser Overrides										
Water Quality Capture Volume (WQCV) =	0.006	acre-feet		acre-feet										
Excess Urban Runoff Volume (EURV) =	0.004	acre-feet		acre-feet										
2-yr Runoff Volume (P1 = 1.19 in.) =	0.002	acre-feet	1.19	inches										
5-yr Runoff Volume (P1 = 1.5 in.) =	0.004	acre-feet	1.50	inches										
10-yr Runoff Volume (P1 = 1.75 in.) =	0.006	acre-feet	1.75	inches										
25-yr Runoff Volume (P1 = 2 in.) =	0.056	acre-feet	2.00	inches										
50-yr Runoff Volume (P1 = 2.25 in.) =	0.114	acre-feet	2.25	inches										
100-vr Runoff Volume (P1 = 2,52 in.) =	0.192	acre-feet	2.52	inches										
500-yr Runoff Volume (P1 = 3.68 in.) =	0.563	acre-feet	3.68	inches										
Approximate 2-vr Detention Volume =	0.002	acre-feet												
Approximate 5-vr Detention Volume -	0.003	acre-feet												
Approximate 10-vr Detention Volume -	0.005	acre-feet												
Approximate 25-yr Detention Volume -	0.005	acro foot						-	-	-				
Approximate 20-yr Detention Volume =	0.007	acre foot						-		-				
Approximate 50-yr Detention Volume =	0.018	acre-leet												
Approximate 100-yr Detention Volume =	0.049	acre-feet												
Define Zones and Basin Geometry		7												
Zone 1 Volume (WQCV) =	0.006	acre-feet												
Select Zone 2 Storage Volume (Optional) =		acre-feet	Total det	ention										
Select Zone 3 Storage Volume (Optional) =		acre-feet	volume is	less than										
Total Detention Basin Volume =	0.006	acre-feet	100-year	volume.										
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 (STC) =	user	ft/ft												
Slopes of Main Basin Sides (Smain) =	user	H:V												
Basin Length-to-Width Ratio (RIAW) =	user													
• • • •		-												
Initial Surcharge Area (Area) =	user	ft 2												
Surcharge Volume Length (Ligu) =	user	ft												
Surcharge Volume Width (Wrov) =	user	θ.												
Depth of Basin Floor (Harson) =	user	n												
Longth of Pacin Floor (Lease) =	user	A.												
Width of Basin Floor (W) =	user	A.												
Area of Pacin Floor (A) =	usor	n 2												
Area of Dasin Floor (A _{FLOOR}) =	usei	π.			-	-								
Depth of Main Paoin (H	user	π-												
Deput of Main Basin (H _{MAIN}) =	user	и												
Length of Main Basin $(L_{MAIN}) =$	user	LL LL												
Width of Main Basin (W _{MAIN}) =	user	π												
Area of Main Basin (A _{MAIN}) =	user	ft.				-								
volume of Main Basin (V _{MAIN}) =	user	ft '												
Calculated Total Basin Volume (V_{total}) =	user	acre-feet												
						<u> </u>								
						-								
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MHFD-Detention, Version 4.06 (July 2022)



	DE	TENTION	BASIN OU	FLET STRU	CTURE DE	SIGN			
Project	Grandview - Inter	۸ im	1HFD-Detention, V	ersion 4.06 (July 2	2022)				
Basin ID:	TSB-A2								
20ml 1 20ml 1				Estimated	Estimated				
100mT - (-		Stage (ft)	Volume (ac-ft)	Outlet Type	_		
NOTWAL MAN MODE			Zone 1 (WQCV)	0.09	0.006	Orifice Plate			
	-100.755.4		Zone 2						
Performance Overces			Zone 3						
Example Zone	Configuration (Re	tention Pond)		Total (all zones)	0.006		_		
User Input: Orifice at Underdrain Outlet (typical	ly used to drain WC	CV in a Filtration B	<u>MP)</u>				Calculated Parame	ters for Underdra	<u>n</u>
Underdrain Orifice Invert Depth =	N/A	ft (distance below	the filtration media	surface)	Underd	Irain Orifice Area =	N/A	ft ²	
Underdrain Orifice Diameter =	N/A	inches			Underdrain	Orifice Centroid =	N/A	reet	
User Input: Orifice Plate with one or more orific	es or Elliptical Slot	Weir (typically used	to drain WOCV an	d/or EURV in a sedi	imentation BMP)		Calculated Parame	ters for Plate	
Centroid of Lowest Orifice =	0.00	ft (relative to basi	n bottom at Stage =	= 0 ft)	WQ Orifi	ce Area per Row =	2.361E-03	ft ²	
Depth at top of Zone using Orifice Plate =	0.09	ft (relative to basin	n bottom at Stage =	= 0 ft)	Elli	ptical Half-Width =	N/A	feet	
Orifice Plate: Orifice Vertical Spacing =	4.00	inches			Ellipti	ical Slot Centroid =	N/A	feet	
Orifice Plate: Orifice Area per Row =	0.34	sq. inches (diamet	er = 5/8 inch)		E	lliptical Slot Area =	N/A	ft ²	
User Input: Stage and Total Area of Each Orific	e Row (numbered f	rom lowest to high	est)						
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)	
Stage of Orifice Centroid (ft)	0.00	0.30	0.60	0.90	1.20				
Orifice Area (sq. inches)	0.34	0.34	0.34	0.34	0.34				
									-
	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)	1
Stage of Orifice Centroid (ft)									-
Office Area (sq. incres)									
User Input: Vertical Orifice (Circular or Rectang	<u>ular)</u>		_				Calculated Parame	eters for Vertical O	rifice
	Not Selected	Not Selected					Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basir	bottom at Stage =	= 0 ft) Ver	tical Orifice Area =			ft ²
Depth at top of Zone using Vertical Orifice =			ft (relative to basir	n bottom at Stage =	= 0 ft) Vertical	Orifice Centroid =			feet
Vertical Unitice Diameter -									
			inches						
			inches						
User Input: Overflow Weir (Dropbox with Flat c	r Sloped Grate and	Outlet Pipe OR Rea	Inches	al Weir and No Out	let Pipe)		Calculated Parame	eters for Overflow	Weir
User Input: Overflow Weir (Dropbox with Flat c	r Sloped Grate and Not Selected	Outlet Pipe OR Rev Not Selected	Jinches ctangular/Trapezoid	lal Weir and No Out	<u>:let Pipe)</u>		Calculated Parame	eters for Overflow Not Selected	<u>Weir</u>
User Input: Overflow Weir (Dropbox with Flat c	r Sloped Grate and Not Selected	Outlet Pipe OR Rev Not Selected	Inches ctangular/Trapezoid ft (relative to basin l	lal Weir and No Out	l <u>et Pipe)</u> t) Height of Grate	e Upper Edge, H _t =	Calculated Parame	eters for Overflow Not Selected	Weir feet
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User Input: Overflow Weir (Dropbox with Flat c Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage= Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) =	r Sloped Grate and Not Selected	Outlet Pipe OR Ree Not Selected	Inches tangular/Trapezoid ft (relative to basin 1 feet H:V feet % Rectangular Orifice) ft (distance below be inches bottom at Stage = HP hydrographs an 2 Year 1.19 0.002 0.02 0.02 0.02 0.02 0.02 0.02 0.	lal Weir and No Out bottom at Stage = 0 f Ov c asin bottom at Stage Half-Cent = 0 ft) <u>6 Year</u> 1.50 0.004 0.004	tet Pipe)_ t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open Dverflow Grate Open Ca = 0 ft) Or Outlet ral Angle of Restrict Spillway D Stage at T Basin Area at T Basin Volume at T Vertering new value 1.75 0.006 0.01	e Upper Edge, H _t = leir Slope Length = 0-yr Orifice Area = Area w/o Debris = n Area w/ Debris = lculated Parameter utlet Orifice Area = c Orifice Centroid = tor Plate on Pipe = esign Flow Depth= "op of Freeboard = "op of Streeboard =	Calculated Parame Not Selected s for Outlet Pipe w, Not Selected N/A Calculated Parame 0.18 4.18 0.23 0.56 Calculated Parame 0.18 Calculated Parame Calculated Parame	ters for Overflow Not Selected Flow Restriction Not Selected N/A ters for Spillway feet feet acres acre-ft bumns W through 100 Year 2.52 0.192 0.192 0.192 0.192	Weir feet feet ft ² ft ² feet radians AF). 500 Year 3.68 0.563 0.563
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User Input: Overflow Weir (Dropbox with Flat c Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage= Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = NewHour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Neutret Stage) OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Riow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Outflow Q (cfs) = Peak Outflow Q (cfs) = Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment O =	r Sloped Grate and Not Selected	Outlet Pipe OR Ree Not Selected	Inches tangular/Trapezoid ft (relative to basin I feet H:V feet % Rectangular Orifice) ft (distance below be inches h bottom at Stage = HP hydrographs and 2 Year 1.19 0.002 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Ial Weir and No Out bottom at Stage = 0 f Gr Ov asin bottom at Stage asin bottom at Stage Half-Cent = 0 ft) 5 Year 1.50 0.004 0.004 0.01 0.0 0.1	tet Pipe)_ t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open Dverflow Grate Open Dverflow Grate Open Ca = 0 ft) Or Outlet ral Angle of Restrict Spillway D Stage at T Basin Area at T Basin Volume at T Ventering new value 10 Year 1.75 0.006 0.006 0.1 0.1 0.0 0.0	e Upper Edge, H _t = leir Slope Length = 0-yr Orifice Area = Area w/o Debris = n Area w/ Debris = lculated Parameter utlet Orifice Area = c Orifice Centroid = tor Plate on Pipe = esign Flow Depth= "op of Freeboard = "op of Streeboard = "	Calculated Parame Not Selected	Iters for Overflow Not Selected	Weir feet feet ft² ft² ft² ft² feet ft² foot ft² foot ft² foot ft² ft² ft² foot ft² foot ft² ft² <
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37

0.03

0.07

43

0.05

0.07

48

0.08

0.07

104

0.67

0.09

Time to Drain 99% of Inflow Volume (hours) = Maximum Ponding Depth (ft) = Area at Maximum Ponding Depth (acres) = Maximum Volume Stored (acre-ft) = 46

0.09

0.07

41

0.06

0.07

>120 3.18 0.19 0.391

>120

1.22

0.11

>120

1.84

0.13



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	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:25:00	0.00	0.00	0.01	0.03	0.05	0.01	0.02	0.02	3.05
	0:35:00	0.00	0.00	0.02	0.05	0.06	0.56	1.10	1.78	4.52
	0:40:00	0.00	0.00	0.02	0.04	0.06	0.60	1.21	1.97	5.04
	0:45:00	0.00	0.00	0.02	0.04	0.06	0.58	1.17	1.98	5.21
	0:50:00	0.00	0.00	0.02	0.04	0.05	0.55	1.10	1.87	5.13
	0:55:00	0.00	0.00	0.02	0.03	0.05	0.50	1.00	1.71	4.82
	1:05:00	0.00	0.00	0.02	0.03	0.04	0.46	0.92	1.57	4.60
	1:10:00	0.00	0.00	0.01	0.03	0.04	0.39	0.78	1.34	4.09
	1:15:00	0.00	0.00	0.01	0.02	0.04	0.36	0.71	1.22	3.76
	1:20:00	0.00	0.00	0.01	0.02	0.03	0.33	0.65	1.12	3.44
	1:25:00	0.00	0.00	0.01	0.02	0.03	0.30	0.60	1.03	3.18
	1:35:00	0.00	0.00	0.01	0.02	0.03	0.28	0.56	0.96	2.94
	1:40:00	0.00	0.00	0.01	0.02	0.03	0.24	0.32	0.82	2.50
	1:45:00	0.00	0.00	0.01	0.01	0.02	0.22	0.44	0.75	2.29
ļ	1:50:00	0.00	0.00	0.01	0.01	0.02	0.20	0.40	0.68	2.09
	1:55:00	0.00	0.00	0.01	0.01	0.02	0.18	0.36	0.61	1.88
	2:00:00	0.00	0.00	0.01	0.01	0.01	0.16	0.32	0.54	1.68
	2:10:00	0.00	0.00	0.00	0.01	0.01	0.14	0.28	0.48	1.49
	2:15:00	0.00	0.00	0.00	0.01	0.01	0.12	0.23	0.40	1.25
	2:20:00	0.00	0.00	0.00	0.01	0.01	0.11	0.22	0.38	1.16
	2:25:00	0.00	0.00	0.00	0.01	0.01	0.10	0.21	0.35	1.08
	2:30:00	0.00	0.00	0.00	0.01	0.01	0.10	0.19	0.33	1.00
	2:35:00	0.00	0.00	0.00	0.01	0.01	0.09	0.18	0.31	0.93
	2:45:00	0.00	0.00	0.00	0.01	0.01	0.08	0.17	0.26	0.79
	2:50:00	0.00	0.00	0.00	0.00	0.01	0.07	0.14	0.24	0.72
	2:55:00	0.00	0.00	0.00	0.00	0.01	0.06	0.12	0.21	0.66
	3:00:00	0.00	0.00	0.00	0.00	0.01	0.06	0.11	0.19	0.59
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.17	0.52
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.13	0.39
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.03	0.06	0.10	0.32
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.08	0.26
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.05	0.19
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.12
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.04
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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
	4:30:00	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
	4:50:00	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
	5:05:00	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
	5:25:00	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
	5:40:00	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
·	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MHFD-Detention, Version 4.06 (July 2022) Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically. The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft ²]	Area [acres]	Volume [ft ³]	Volume [ac-ft]	Total Outflow [cfs]	
							For best results, include the
							stages of all grade slope
							changes (e.g. ISV and Floor) from the S-A-V table on
							Sheet 'Basin'.
							Also include the inverts of all
							outlets (e.g. vertical orifice,
							overflow grate, and spillway,
							where applicable).
-							
-							
			<u> </u>	<u> </u>			
		l]

Project:	Grandview - Interim
Basin ID:	TSB-A3

man

Depth Increment = 1.00 ft

Example Zone	Configuratio	on (Retenti	on Pond)		Stage - Storage	Stage	Optional Override	Length	Width	Area	Optional Override	Area	Volume	Volume
Example Echo	oomgalaa		on rona,		Description	(ft)	Stage (ft)	(ft)	(ft)	(ft ²)	Area (ft ²)	(acre)	(ft 3)	(ac-ft)
Watershed Information					Top of Micropool		0.00				6,050	0.139		
Selected BMP Type =	EDB						1.00				7.938	0.182	6.994	0.161
Waterchad Area -	0.40	acres				6	2.00	6			10.092	0.221	16 004	0.367
Watershed Least	1.270	acres				-	2.00				10,002	0.207	10,004	0.307
watershed Length =	1,379	π.					3.00				12,482	0.287	27,286	0.626
Watershed Length to Centroid =	690	ft					4.00				15,138	0.348	41,096	0.943
Watershed Slope =	0.010	ft/ft											L	
Watershed Imperviousness =	2.00%	percent			-									
Percentage Hydrologic Soil Group A =	100.0%	percent			-									
Percentage Hydrologic Soil Group B =	0.0%	percent												
Percentage Hydrologic Soil Groups C/D =	0.0%	percent												
Target WQCV Drain Time =	40.0	hours												
Location for 1-hr Rainfall Depths =	User Input													
After providing required inputs above inc	luding 1-hour	rainfall												
depths, click 'Run CUHP' to generate run	off hydrograph	s using												
the embedded Colorado Urban Hydro	ograph Procedu	ire.	Optional Use	r Overrides										
Water Quality Capture Volume (WQCV) =	0.012	acre-feet		acre-feet										
Excess Lirban Runoff Volume (FLIRV) =	0.009	acre-feet		acre-feet										
2-vr Runoff Volume (P1 = 1.19 in) =	0.005	acre-feet	1 10	inches										
2-yr Ruhon Volume (P1 = 1.19 m.) =	0.005	acre-leet	1.19	inches	-	-								
5-yr Runoff Volume (P1 = 1.5 in.) =	0.009	acre-feet	1.50	inches									L	
10-yr Runoff Volume (P1 = 1.75 in.) =	0.013	acre-feet	1.75	inches										
25-yr Runoff Volume (P1 = 2 in.) =	0.119	acre-feet	2.00	inches										
50-yr Runoff Volume (P1 = 2.25 in.) =	0.240	acre-feet	2.25	inches				-						
100-yr Runoff Volume (P1 = 2.52 in.) =	0.405	acre-feet	2.52	inches										
500-vr Runoff Volume (P1 = 3.68 in) =	1,187	acre-feet	3.68	inches										
Approximate 2-vr Detention Volume -	0.005	acre-feet												
Approximate E in Detertion Volume =	0.000	acre fart							-	-				
Approximate 5-yr Detention volume =	0.00/	acre-reet												
Approximate 10-yr Detention Volume =	0.010	acre-feet												
Approximate 25-yr Detention Volume =	0.015	acre-feet												
Approximate 50-yr Detention Volume =	0.037	acre-feet												
Approximate 100-yr Detention Volume =	0.103	acre-feet												
		-											(
Define Zones and Basin Geometry														
Zono 1 Volumo (WOCV) -	0.012	acro-foot												
Zone i volume (wQCv) =	0.012	acre-leet			-	-								
Select Zone 2 Storage Volume (Optional) =		acre-feet	Total deten	tion									L	
Select Zone 3 Storage Volume (Optional) =		acre-feet	volume is le	ess than										
Total Detention Basin Volume =	0.012	acre-feet	100-year vo	olume.										
Initial Surcharge Volume (ISV) =	user	ft ³												
Initial Surcharge Depth (ISD) =	user	ft												
Total Available Detention Donth (H) =	ucor	A												
Death of Telela Channel (U.)	usei	n.				-		-						
Depth of Trickle Channel $(H_{TC}) =$	user	π				-								
Slope of Trickle Channel (S _{TC}) =	user	ft/ft												
Slopes of Main Basin Sides (Smain) =	user	H:V												
Basin Length-to-Width Ratio (R _{L/W}) =	user													
Initial Surcharge Area (Arsv) =	user	ft ²												
Surcharge Volume Length (Ling) =	user	ft.												
Surcharge Volume Midth (M/	user	A.												
Surcharge Volume Width (W _{ISV}) =	user	π												
Depth of Basin Floor (H _{FLOOR}) =	user	π											L	
Length of Basin Floor (L _{FLOOR}) =	user	ft											L	
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 (Lynni) =	user	e de la companya de l												
Width of Main Pacin (M) =	licer	Ĥ												
Area of Main Desire (A	user	a 2												
Area or Main Basin (A _{MAIN}) =	user	π.												
volume of Main Basin (V _{MAIN}) =	user	ft '				-							—	
Calculated Total Basin Volume (V _{total}) =	user	acre-feet												
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MHFD-Detention, Version 4.06 (July 2022)



	DE	TENTION	BASIN OUT	LET STRU	CTURE DE	SIGN			
Project:	Grandview - Inter	// im	1HFD-Detention, V	ersion 4.06 (July 2	2022)				
Basin ID:	TSB-A3								
(Const a				Estimated	Estimated	0.11.1.7			
internet and and			7 4 44000	Stage (ft)	Volume (ac-ft)	Outlet Type	1		
Tutte			Zone I (WQCV)	0.09	0.012	Orifice Plate			
2048 1 898 2	ORMER		Zone 2						
Example Zone	Configuration (Re	tention Pond)	Zone 3	Total (all zones)	0.012		J		
User Input: Orifice at Underdrain Outlet (typical)	v used to drain WC	CV in a Filtration B	MP)	Total (all 2011es)	0.012	1	Calculated Parame	ters for Underdrair	1
Underdrain Orifice Invert Depth =	N/A	ft (distance below	the filtration media	surface)	Underc	Irain Orifice Area =	N/A	ft²	-
Underdrain Orifice Diameter =	N/A	inches			Underdrair	Orifice Centroid =	N/A	feet	
User Input: Orifice Plate with one or more orifice –	o oo	trelative to basir	to drain WQCV and bottom at Stage -	d/or EURV in a sedi	MO Orifi	ce Area per Pow -	Calculated Parame	ters for Plate	
Depth at top of Zone using Orifice Plate =	0.09	ft (relative to basir ft (relative to basir	n bottom at Stage =	= 0 ft)	Elli	ptical Half-Width =	N/A	feet	
Orifice Plate: Orifice Vertical Spacing =	4.00	inches	j	,	Ellipt	ical Slot Centroid =	N/A	feet	
Orifice Plate: Orifice Area per Row =	0.60	sq. inches (diamet	er = 7/8 inch)		E	Iliptical Slot Area =	N/A	ft ²	
User Transfer Change and Tabel Array of Fach Orific	- D (+>						
User Input: Stage and Total Area of Each Orifice	Row 1 (required)	Row 2 (optional)	Row 3 (ontional)	Row 4 (ontional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)	1
Stage of Orifice Centroid (ft)	0.00	0.30	0.60	0.90	1.20		Kow / (optional)	now o (optional)	
Orifice Area (sq. inches)	0.60	0.60	0.60	0.60	0.60				
	(n	T	(n	T	n	T	7
	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. incres)			1			1			1
User Input: Vertical Orifice (Circular or Rectange	ular)						Calculated Parame	ters for Vertical Or	fice
	Not Selected	Not Selected					Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin	bottom at Stage =	= 0 ft) Ver	tical Orifice Area =			ft ²
Depth at top of Zone using Vertical Orifice =			ft (relative to basin	bottom at Stage =	= 0 ft) Vertica	Orifice Centroid =			feet
			inches						
User Input: Overflow Weir (Dropbox with Flat o	r Sloped Grate and	Outlet Pipe OR Rec	ctangular/Trapezoid	al Weir and No Out	let Pipe)		Calculated Parame	ters for Overflow V	Veir
User Input: Overflow Weir (Dropbox with Flat o	r Sloped Grate and Not Selected	Outlet Pipe OR Rec Not Selected	ctangular/Trapezoid	al Weir and No Out	<u>let Pipe)</u>		Calculated Parame Not Selected	ters for Overflow V Not Selected	<u>Veir</u>
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho =	r Sloped Grate and Not Selected	Outlet Pipe OR Rec Not Selected	tangular/Trapezoid ft (relative to basin t	al Weir and No Out	t) Height of Grate	e Upper Edge, H _t =	Calculated Parame Not Selected	ters for Overflow V Not Selected	<u>Veir</u> feet
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope =	r Sloped Grate and Not Selected	Outlet Pipe OR Rec Not Selected	<u>tangular/Trapezoid</u> ft (relative to basin t feet H:V	al Weir and No Out pottom at Stage = 0 f Gr	t) Height of Grate Overflow W ate Open Area / 10	e Upper Edge, H _t = /eir Slope Length = 10-vr Orifice Area =	Calculated Parame Not Selected	ters for Overflow V Not Selected	<u>Veir</u> feet feet
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides =	r Sloped Grate and Not Selected	Outlet Pipe OR Rec	tangular/Trapezoid ft (relative to basin t feet H:V feet	al Weir and No Out oottom at Stage = 0 f Gr Ov	t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open	e Upper Edge, H _t = /eir Slope Length = 10-yr Orifice Area = Area w/o Debris =	Calculated Parame Not Selected	ters for Overflow V Not Selected	<u>Veir</u> feet feet ft ²
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type =	r Sloped Grate and Not Selected	Outlet Pipe OR Rec Not Selected	tangular/Trapezoid ft (relative to basin t feet H:V feet	al Weir and No Out pottom at Stage = 0 f Gr Ov C	let Pipe) t) Height of Grate Overflow W ate Open Area / 10 /erflow Grate Open Overflow Grate Open	e Upper Edge, H _t = /eir Slope Length = /o-yr Orifice Area = Area w/o Debris = n Area w/ Debris =	Calculated Parame	ters for Overflow V Not Selected	<u>Veir</u> feet feet ft ² ft ²
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % =	r <u>Sloped Grate and</u> Not Selected	Outlet Pipe OR Rec	tangular/Trapezoid ft (relative to basin t feet H:V feet %	al Weir and No Out nottom at Stage = 0 f Gr Ov C	tet Pipe) t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open Overflow Grate Open	e Upper Edge, H _t = leir Slope Length = 10-yr Orifice Area = Area w/o Debris = n Area w/ Debris =	Calculated Parame Not Selected	ters for Overflow V Not Selected	<u>veir</u> feet feet ft ² ft ²
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pine w/ Elew Pertiction Plate	r <u>Sloped Grate and</u> Not Selected	Outlet Pipe OR Rec Not Selected	tangular/Trapezoid ft (relative to basin t feet H:V feet % ectangular Orifica)	al Weir and No Out oottom at Stage = 0 f Gr Ov C	tet Pipe)	e Upper Edge, H _t = /eir Slope Length = /0-yr Orifice Area = Area w/o Debris = n Area w/ Debris =	Calculated Parame Not Selected	ters for Overflow V Not Selected	feet feet ft ² ft ²
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate	r <u>Sloped Grate and</u> Not Selected	Outlet Pipe OR Rec Not Selected	tangular/Trapezoid ft (relative to basin t feet H:V feet % tectangular Orifice)	al Weir and No Out oottom at Stage = 0 f Gr O\ C	tet Pipe)	e Upper Edge, H _t = /eir Slope Length = /0-yr Orifice Area = Area w/o Debris = n Area w/ Debris = /lculated Parameter	Calculated Parame Not Selected	ters for Overflow V Not Selected	Veir feet feet ft ² ft ²
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe =	<u>Sloped Grate and</u> Not Selected	Outlet Pipe OR Rec Not Selected estrictor Plate, or R Not Selected	tangular/Trapezoid ft (relative to basin t feet H:V feet % tectangular Orifice) ft (distance below ba	al Weir and No Out oottom at Stage = 0 f Gr O\ C asin bottom at Stage	tet Pipe)	e Upper Edge, H _t = /eir Slope Length = /0-yr Orifice Area = Area w/o Debris = n Area w/ Debris = /lculated Parameter: utlet Orifice Area =	Calculated Parame Not Selected s for Outlet Pipe w/ Not Selected	ters for Overflow V Not Selected	Veir feet feet ft ² ft ² ft ²
User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter =	<u>Sloped Grate and</u> Not Selected	Outlet Pipe OR Rec Not Selected estrictor Plate, or R Not Selected	tangular/Trapezoid ft (relative to basin t feet H:V feet % <u>tectangular Orifice)</u> ft (distance below ba inches	al Weir and No Out oottom at Stage = 0 f Gr Ov C asin bottom at Stage	tet Pipe) t) Height of Gratu Overflow W ate Open Area / 10 verflow Grate Open Overflow Grate Open Overflow Grate Open <u>Ca</u> = 0 ft) O Outlet	e Upper Edge, H _t = feir Slope Length = 10-yr Orifice Area = Area w/o Debris = n Area w/ Debris = <u>Ilculated Parameter</u> utlet Orifice Area = t Orifice Centroid =	Calculated Parame Not Selected s for Outlet Pipe w/ Not Selected	ters for Overflow V Not Selected	Veir feet feet ft ² ft ² ft ² ft ²
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter =	r <u>Sloped Grate and</u> Not Selected	Outlet Pipe OR Rec Not Selected estrictor Plate, or R Not Selected	tangular/Trapezoid ft (relative to basin t feet H:V feet % kectangular Orifice) ft (distance below ba inches	al Weir and No Out oottom at Stage = 0 f Ov C asin bottom at Stage Half-Cent	tet Pipe) t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open Sverflow Grate Open Ca = 0 ft) O Outled ral Angle of Restric	e Upper Edge, H_t = Yeir Slope Length = 10-yr Orifice Area = Area w/o Debris = n Area w/ Debris = Idulated Parameters utlet Orifice Area = t Orifice Centroid = tor Plate on Pipe =	Calculated Parame Not Selected s for Outlet Pipe w/ Not Selected Not Selected	ters for Overflow V Not Selected	Veir feet feet ft ² ft ² ft ² feet radians
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User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Snillway Invert Stage=	r Sloped Grate and Not Selected	Outlet Pipe OR Rec Not Selected	tangular/Trapezoid ft (relative to basin t feet H:V feet % kectangular Orifice) ft (distance below ba inches	al Weir and No Out pottom at Stage = 0 f Gr Ov C asin bottom at Stage Half-Cent	tet Pipe) t) Height of Gratu Overflow W ate Open Area / 10 verflow Grate Open Strengther Strengther Ca at Angle of Restrice Snillway D	e Upper Edge, H _t = feir Slope Length = 10-yr Orifice Area = Area w/o Debris = n Area w/ Debris = ilculated Parameter: utlet Orifice Area = t Orifice Centroid = tor Plate on Pipe = esion Flow Denth=	Calculated Parame Not Selected s for Outlet Pipe w/ Not Selected N/A Calculated Parame 0.19	ters for Overflow V Not Selected Flow Restriction P Not Selected N/A ters for Spillway	<u>veir</u> feet feet ft ² ft ² ft ² feet radians
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage= Spillway Crest Length =	r Sloped Grate and Not Selected	Outlet Pipe OR Rec Not Selected estrictor Plate, or R Not Selected ft (relative to basir feet	tangular/Trapezoid ft (relative to basin t feet H:V feet % kectangular Orifice) ft (distance below ba inches	al Weir and No Out pottom at Stage = 0 f Ov C asin bottom at Stage Half-Cent = 0 ft)	tet Pipe) t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open State Open Ca Ca Ca Ca Ca Ca Ca Ca Ca Ca	e Upper Edge, H_t = feir Slope Length = 10-yr Orifice Area = Area w/o Debris = n Area w/ Debris = ilculated Parameter: utlet Orifice Area = t Orifice Centroid = tor Plate on Pipe = esign Flow Depth= Top of Freeboard =	Calculated Parame Not Selected S for Outlet Pipe w/ Not Selected N/A Calculated Parame 0.19 4.19	Eleventic terms for Overflow V Not Selected Flow Restriction P Not Selected N/A ters for Spillway feet feet	<u>veir</u> feet feet ft ² ft ² ft ² feet radians
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage= Spillway Crest Length = Spillway End Slopes =	r Sloped Grate and Not Selected	Outlet Pipe OR Rec Not Selected estrictor Plate, or R Not Selected ft (relative to basir feet H:V	ttangular/Trapezoid ft (relative to basin t feet H:V feet % tectangular Orifice) ft (distance below ba inches	al Weir and No Out oottom at Stage = 0 f Ov C asin bottom at Stage Half-Cent = 0 ft)	tet Pipe)_ t) Height of Gratu Overflow W ate Open Area / 10 verflow Grate Open Verflow Grate Open Verflow Grate Open Ca Ca Ca Spillway D Stage at T Basin Area at T	e Upper Edge, H_t = feir Slope Length = 10-yr Orifice Area = Area w/o Debris = n Area w/ Debris = ilculated Parameter: utlet Orifice Area = t Orifice Centroid = tor Plate on Pipe = esign Flow Depth= Top of Freeboard = Top of Freeboard =	Calculated Parame Not Selected	Iters for Overflow V Not Selected	<u>veir</u> feet feet ft ² ft ² ft ² feet radians
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User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage= Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = OHHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 97% of Inflow Volume (hours) =	r Sloped Grate and Not Selected	Outlet Pipe OR Rec Not Selected estrictor Plate, or R Not Selected Not Selected tride the default CU/ feet H:V feet EURV N/A 0.009 N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	tangular/Trapezoid ft (relative to basin t feet H:V feet % Rectangular Orifice) ft (distance below ba inches h bottom at Stage = VP hydrographs and 2 Year 1.19 0.005 0.005 0.005 0.005 0.00 0.0 0.0 0.	al Weir and No Out bottom at Stage = 0 f Gr Ov C asin bottom at Stage Half-Cent = 0 ft)	t) Height of Gratt Overflow W ate Open Area / 10 verflow Grate Open Overflow Grate Open Overflow Grate Open Overflow Grate Open Car = 0 ft) O Stage at 1 Basin Area at 1 Basin Volume at 1 Ventering new value 10 Year 1.75 0.013 0.013 0.013 0.01 0.1 Plate N/A N/A 47	e Upper Edge, H _t = feir Slope Length = 10-yr Orifice Area = Area w/o Debris = n Area w/ Debris = ilculated Parameters utlet Orifice Area = t Orifice Centroid = tor Plate on Pipe = esign Flow Depth= Fop of Freeboard = Fop of Freeboard = Fop of Freeboard = Fop of Freeboard = Cop of Freeboard	Calculated Parame Not Selected	ters for Overflow V Not Selected Flow Restriction P Not Selected N/A ters for Spillway feet feet acres acre-ft 00 Year 2.52 0.405	Veir feet feet feet ft ² feet radians
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User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage= Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Peak Q (cfs) = Predevelopment Peak Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 99% of Inflow Volume (hours) = Time to Drain 99% of Inflow Volume (hours) = Time to Drain 99% of Inflow Volume (hours) = Maximum Ponding Depth (ft) = Area at Maximum Ponding Depth (ft) =	r Sloped Grate and Not Selected	Outlet Pipe OR Rec Not Selected estrictor Plate, or R Not Selected Not Selected trictor Plate, or R Not Selected EURV feet H:V feet CURV N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	tangular/Trapezoid ft (relative to basin t feet H:V feet % Rectangular Orifice) ft (distance below ba inches h bottom at Stage = VP hydrographs and 2 Year 1.19 0.005 0.005 0.005 0.00 0.00 0.00 0.00	al Weir and No Out bottom at Stage = 0 f Gr Ov C asin bottom at Stage Half-Cent = 0 ft)	t) Height of Gratt Overflow W ate Open Area / 10 verflow Grate Open Overflow Grate Open Overflow Grate Open Overflow Grate Open Car = 0 ft) O Stage at T Basin Area at T Basin Volume at T Basin Volume at T Contering new value 10 Year 1.75 0.013 0.013 0.01 0.01 0.1 Plate N/A N/A 47 56 0.08	e Upper Edge, H _t = feir Slope Length = 10-yr Orifice Area = Area w/o Debris = n Area w/ Debris = ilculated Parameters utlet Orifice Area = t Orifice Centroid = tor Plate on Pipe = esign Flow Depth= Fop of Freeboard = Fop of Freeboard = Fop of Freeboard = Fop of Freeboard = Cop of Freeboard	Calculated Parame Not Selected s for Outlet Pipe w// Not Selected N/A Calculated Parame 0.19 4.19 0.35 0.94 drographs table (CC 50 Year 2.25 0.240 0.240 0.240 0.240 0.240 0.240 0.240 0.240 0.240 0.240 0.240 0.240 0.240 0.240 0.240 0.240 0.240 0.22 2.1 0.1 0.1 0.1 0.22 2.1 0.1 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2	The second secon	Veir feet feet ft² ft² feet ate 0.98 9.3 4.8 0.5 Spillway N/A N/A 116 >120 3.23



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		FUDV [cfc]	2 Vear [cfc]	5 Voar [cfc]	10 Vear [cfc]	25 Vear [cfc]	50 Vear [cfc]	100 Vear [cfc]	500 Vear [cfc]
Time interval	0:00:00									
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	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:25:00	0.00	0.00	0.02	0.04	0.06	0.01	0.02	0.03	0.11
	0:30:00	0.00	0.00	0.04	0.08	0.11	0.36	0.94	1.41	4.30
	0:35:00	0.00	0.00	0.04	0.08	0.11	0.87	1./6	2.83	7.36
	0:40:00	0.00	0.00	0.04	0.08	0.11	1.03	2.07	3.37	8.62
	0:50:00	0.00	0.00	0.04	0.08	0.11	1.03	2.08	3.49	9.16
	0:55:00	0.00	0.00	0.03	0.07	0.09	0.96	1.92	3.25	9.09
	1:00:00	0.00	0.00	0.03	0.06	0.09	0.89	1.72	3.04	8 74
	1:05:00	0.00	0.00	0.03	0.06	0.08	0.83	1.65	2.82	8.42
	1:10:00	0.00	0.00	0.03	0.06	0.08	0.77	1.54	2.63	7.96
	1:15:00	0.00	0.00	0.03	0.05	0.07	0.72	1.44	2.46	7.47
	1:20:00	0.00	0.00	0.03	0.05	0.07	0.67	1.34	2.29	6.97
	1:25:00	0.00	0.00	0.02	0.04	0.06	0.63	1.25	2.13	6.49
	1:30:00	0.00	0.00	0.02	0.04	0.06	0.58	1.15	1.97	6.00
	1:35:00	0.00	0.00	0.02	0.04	0.06	0.54	1.08	1.84	5.60
	1:40:00	0.00	0.00	0.02	0.04	0.05	0.51	1.01	1.73	5.26
	1:45:00	0.00	0.00	0.02	0.04	0.05	0.48	0.96	1.63	4.94
	1:50:00	0.00	0.00	0.02	0.03	0.05	0.45	0.90	1.53	4.64
	1:55:00	0.00	0.00	0.02	0.03	0.04	0.42	0.84	1.43	4.34
	2:00:00	0.00	0.00	0.02	0.03	0.04	0.39	0.78	1.34	4.05
	2:10:00	0.00	0.00	0.01	0.03	0.04	0.36	0.73	1.24	3.70
	2:15:00	0.00	0.00	0.01	0.02	0.03	0.31	0.61	1.05	3.19
	2:20:00	0.00	0.00	0.01	0.02	0.03	0.28	0.55	0.95	2.91
	2:25:00	0.00	0.00	0.01	0.02	0.03	0.25	0.50	0.85	2.62
	2:30:00	0.00	0.00	0.01	0.02	0.02	0.23	0.45	0.77	2.39
	2:35:00	0.00	0.00	0.01	0.02	0.02	0.21	0.42	0.72	2.23
	2:40:00	0.00	0.00	0.01	0.02	0.02	0.20	0.40	0.68	2.09
	2:45:00	0.00	0.00	0.01	0.01	0.02	0.19	0.38	0.65	1.97
	2:50:00	0.00	0.00	0.01	0.01	0.02	0.18	0.36	0.61	1.86
	3.00.00	0.00	0.00	0.01	0.01	0.02	0.17	0.34	0.58	1.75
	3:05:00	0.00	0.00	0.01	0.01	0.02	0.10	0.32	0.55	1.55
	3:10:00	0.00	0.00	0.01	0.01	0.02	0.14	0.28	0.48	1.46
	3:15:00	0.00	0.00	0.01	0.01	0.01	0.13	0.26	0.45	1.36
	3:20:00	0.00	0.00	0.00	0.01	0.01	0.12	0.25	0.42	1.27
	3:25:00	0.00	0.00	0.00	0.01	0.01	0.11	0.23	0.39	1.18
	3:30:00	0.00	0.00	0.00	0.01	0.01	0.10	0.21	0.35	1.08
	3:35:00	0.00	0.00	0.00	0.01	0.01	0.09	0.19	0.32	0.99
	3:40:00	0.00	0.00	0.00	0.01	0.01	0.09	0.17	0.29	0.89
	3:50:00	0.00	0.00	0.00	0.01	0.01	0.08	0.15	0.20	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.01	0.06	0.13	0.25	0.61
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.05	0.09	0.16	0.51
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.04	0.07	0.13	0.42
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.03	0.05	0.10	0.33
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.06	0.23
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.09
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.08
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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
	5:15:00	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
	5:40:00	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

MHFD-Detention, Version 4.06 (July 2022) Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically. The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage	Stage	Area	Area	Volume	Volume	Total Outflow	
Description	[ft]	[ft ²]	[acres]	[ft ³]	[ac-ft]	[cfs]	
							For best results, include the
							stages of all grade slope
							from the S-A-V table on
							Sheet 'Basin'.
							Also include the inverts of all
							outlets (e.g. vertical orifice,
							where applicable).
			1	1	1		1
							1
							1
			-	-	-		
]
]

	Project: Grandview - Interim
	Basin ID: TSB-B1
	Example Zone Configuration (Retention Pond)
	Example Zone Comgaration (Retention Fond)
Watershed Information	

Depth Increment =	1.00	ft
		Optional

	1 1000 1	(minu)	e.		Depth Increment =	1.00	ft Ontional	1		1	Ontional			
Example Zone	Configurati	ion (Retenti	on Pond)		Stage - Storage Description	Stage (ft)	Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Override Area (ft ²)	Area (acre)	Volume (ft ³)	Volume (ac-ft)
Watershed Information		_			Top of Micropool		0.00				9,941	0.228		
Selected BMP Type =	EDB					-	1.00	-			12,325	0.283	11,132	0.256
Watershed Area =	13.64	acres					2.00				14,965	0.344	24,777	0.569
Watershed Length =	1,356	ft					3.00				17,861	0.410	41,189	0.946
Watershed Length to Centroid =	678	ft					4.00				21,013	0.482	60,626	1.392
Watershed Slope =	0.010	ft/ft												
Watershed Imperviousness =	2.00%	percent												
Percentage Hydrologic Soil Group A =	100.0%	percent												
Percentage Hydrologic Soil Group B =	0.0%	percent												
Percentage Hydrologic Soli Groups C/D =	0.0%	percent												
Location for 1 br Rainfall Donths =	40.0	nours				-		-						
Eocation for 1-In Rainian Depuis =	User Input													
After providing required inputs above inc depths, click 'Run CUHP' to generate run	cluding 1-hour	raintall hs using												
the embedded Colorado Urban Hydro	graph Proced	ure.	Ontional Use	r Overrides										
Water Quality Capture Volume (WOCV) =	0.017	acre-feet		acre-feet										
Excess Urban Runoff Volume (EURV) =	0.013	acre-feet		acre-feet										
2-yr Runoff Volume (P1 = 1.19 in.) =	0.007	acre-feet	1.19	inches										
5-yr Runoff Volume (P1 = 1.5 in.) =	0.014	acre-feet	1.50	inches										
10-yr Runoff Volume (P1 = 1.75 in.) =	0.019	acre-feet	1.75	inches										
25-yr Runoff Volume (P1 = 2 in.) =	0.171	acre-feet	2.00	inches										
50-yr Runoff Volume (P1 = 2.25 in.) =	0.345	acre-feet	2.25	inches		-		-						
100-yr Runoff Volume (P1 = 2.52 in.) =	0.582	acre-feet	2.52	inches										
500-yr Runoff Volume (P1 = 3.68 in.) =	1.706	acre-feet	3.68	inches										
Approximate 2-yr Detention Volume =	0.007	acre-feet		_										
Approximate 5-yr Detention Volume =	0.010	acre-feet				-		-						
Approximate 10-yr Detention Volume =	0.014	acre-feet												
Approximate 25-yr Detention Volume =	0.022	acre-feet												
Approximate 50-yr Detention Volume =	0.054	acre-feet												
Approximate 100-yr Detention Volume =	0.147	acre-feet												
Define Zones and Basin Geometry		-												
Zone 1 Volume (WQCV) =	0.017	acre-feet												
Select Zone 2 Storage Volume (Optional) =		acre-feet	Total deter	ition										
Select Zone 3 Storage Volume (Optional) =	0.017	acre-feet	volume is l 100-year y	ess than olume.										
I otal Detention Basin Volume =	0.017	acre-feet	200 , cai i	oranic.										
Initial Surcharge Volume (ISV) =	user	ft '												
Initial Surcharge Depth (ISD) =	user	π.												
Dopth of Trickle Chappel (H	user	н Ф				-		-						
Slope of Trickle Channel (P _{TC}) =	user	H (A				-		-						
Slope of Main Basin Sides (S) =	user	H·V				-								
Basin Longth to Width Patio (P) =	user													
basin Lengurto-Width Kato (KL/W) =	usci	_												
Initial Surcharge Area $(A_{red}) =$	user	ft 2												
Surcharge Volume Length (L_{15V}) =	user	ft												
Surcharge Volume Width (WISV) =	user	ft												
Depth of Basin Floor (HFLOOR) =	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												
						-		-						
						-								
]
						-								\square
						-								
						-								
						-								

MHFD-Detention, Version 4.06 (July 2022)



Project:	Grandview - Inter	/* im	IHFD-Detention, V	ersion 4.06 (July 2	2022)				
Basin ID:	TSB-B1								
(POINT &				Estimated	Estimated				
and T	-	-		Stage (ft)	Volume (ac-ft)	Outlet Type			
MOLINE BURY MOCY		-	Zone 1 (WOCV)	0.08	0.017	Orifice Plate	1		
	AL DE TRUE		Zone 1 (WQCV)	0.00	0.017	onnee nate			
2011 1 890 2	ONINCE		Zone 2						
Example Zone	Configuration (Re	tention Pond)	Zone 3	Total (all zonec)	0.017]		
User Input: Orifice at Underdrain Outlet (typical	ly used to drain WC	CV in a Filtration B	MP)		0.017	1	Calculated Parame	ters for Underdrair	.
Underdrain Orifice Invert Denth -	N/A	ft (distance below	the filtration media	surface)	Underg	Irain Orifice Area –	N/A	ft ²	1
Underdrain Orifice Diameter -	N/A	inches	the metadon media	Surface)	Underdrain	Orifice Centroid -	N/A	feet	
	N/A	inches			Underdrain		N/A	leet	
User Input: Orifice Plate with one or more orific	es or Elliptical Slot	Weir (typically used	I to drain WQCV an	d/or EURV in a sedi	imentation BMP)		Calculated Parame	ters for Plate	
Centroid of Lowest Orifice =	0.00	ft (relative to basir	n bottom at Stage =	= 0 ft)	WQ Orifi	ce Area per Row =	6.875E-03	ft ²	
Depth at top of Zone using Orifice Plate =	0.08	ft (relative to basir	n bottom at Stage =	= 0 ft)	Elli	ptical Half-Width =	N/A	feet	
Orifice Plate: Orifice Vertical Spacing =	4.00	inches	5		Ellipti	ical Slot Centroid =	N/A	feet	
Orifice Plate: Orifice Area per Row =	0.99	sq. inches (diamet	er = 1 - 1/8 inches)		E	Iliptical Slot Area =	N/A	ft ²	
			. ,					1	
User Input: Stage and Total Area of Each Orific	e Row (numbered f	rom lowest to high	<u>est)</u>	r	r			-	-
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)	
Stage of Orifice Centroid (ft)	0.00	0.30	0.60	0.90	1.20				
Orifice Area (sq. inches)	0.99	0.99	0.99	0.99	0.99				
		1	1	1	1	1	1	1	-
	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 Rectang	ular)		1				Calculated Parame	ters for Vertical Or	ifice
	Not Selected	Not Selected					Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basir	bottom at Stage =	= 0 ft) Ver	tical Orifice Area =			ft²
Depth at top of Zone using Vertical Orifice =			ft (relative to basir	bottom at Stage =	= 0 ft) Vertica	Orifice Centroid =			fee
Vertical Orifice Diameter =			inches						
Liser Input: Overflow Weir (Drophox with Elat o	r Sloped Crate and	Outlet Pipe OP Per	tangular/Tranozoid	al Weir and No Out	let Pine)		Calculated Parame	ters for Overflow V	Noir
Oser Input. Overnow weir (Dropbox with hat e	Not Selected	Not Selected			<u>ice npej</u>		Not Selected	Not Selected	1
Overflow Weir Front Edge Height, Ho -	Not Sciected	Not Sciected	ft (rolativo to bacin l	ottom at Stago = 0 f	+) Height of Grate	Unner Edge H	NOL Selected	NUL SEIELLEU	foo
Overflow Weir Front Edge Length -			feet	Jottom at Stage = 01	Overflow W	leir Slone Length -			fee
Overflow Weir Grate Slope -			H·V	Gr	ate Open Area / 10	0-vr Orifice Area -			-
Horiz Length of Weir Sides -			feet		verflow Grate Open	Area w/o Debris -			f +2
Overflow Grate Type -					Verflow Grate Open	n Area w/ Debris -			-n - 2
Debris Clogging % -			0/4	, c		II Alea W/ Deblis -		<u> </u>	lir
			70						
User Input: Outlet Pipe w/ Flow Restriction Plate	e (Circular Orifice, R	estrictor Plate, or F	Rectangular Orifice)		Ca	Iculated Parameter	s for Outlet Pipe w/	Flow Restriction P	late
- · · ·	Not Selected	Not Selected	1				Not Selected	Not Selected	1
Depth to Invert of Outlet Pipe =			ft (distance below b	asin bottom at Stage	= 0 ft) O	utlet Orifice Area =			ft ²
Circular Orifice Diameter =			inches		Outlet	Orifice Centroid =			fee
				Half-Cent	ral Angle of Restric	tor Plate on Pipe =	N/A	N/A	rad
					5		,		_
User Input: Emergency Spillway (Rectangular or	Trapezoidal)	_					Calculated Parame	ters for Spillway	
Spillway Invert Stage=	3.00	ft (relative to basir	n bottom at Stage =	= 0 ft)	Spillway D	esign Flow Depth=	0.20	feet	
Spillway Crest Length =	21.00	feet			Stage at T	Top of Freeboard =	4.20	feet	
Spillway End Slopes =	4.00	H:V			Basin Area at T	Top of Freeboard =	0.48	acres	
Freeboard above Max Water Surface =	1.00	feet			Basin Volume at T	Top of Freeboard =	1.39	acre-ft	
		-						•	

Routed Hydrograph Results	The user can over	rride the default CUI	HP hydrographs and	d runoff volumes by	entering new valu	es in the Inflow Hy	drographs table (Co	olumns W through A	4 <i>F).</i>
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	3.68
CUHP Runoff Volume (acre-ft) =	0.017	0.013	0.007	0.014	0.019	0.171	0.345	0.582	1.706
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.007	0.014	0.019	0.171	0.345	0.582	1.706
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.1	0.2	1.8	3.5	5.9	15.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.01	0.13	0.26	0.43	1.14
Peak Inflow Q (cfs) =	N/A	N/A	0.1	0.1	0.2	1.8	3.5	5.9	15.5
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	7.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.0	0.0	0.0	0.0	0.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Spillway
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) =	42	38	34	40	44	104	117	>120	113
Time to Drain 99% of Inflow Volume (hours) =	51	47	43	49	54	114	>120	>120	>120
Maximum Ponding Depth (ft) =	0.08	0.06	0.03	0.05	0.08	0.65	1.23	1.93	3.24
Area at Maximum Ponding Depth (acres) =	0.23	0.23	0.23	0.23	0.23	0.26	0.30	0.34	0.43
Maximum Volume Stored (acre-ft) =	0.018	0.014	0.005	0.011	0.016	0.160	0.322	0.542	1.042

ft²

feet

feet feet ft² ft²

ft² feet radians



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	WOCV [cfs]	FURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
Time Interval	0:00:00	WQCV [CI3]		2 100 [03]	5 100 [03]		25 100 [03]		100 100 [03]	
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	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	0:30:00	0.00	0.00	0.06	0.13	0.18	0.63	1.62	2.45	7.47
	0:35:00	0.00	0.00	0.07	0.14	0.19	1.50	3.04	4.88	12.68
	0:40:00	0.00	0.00	0.07	0.13	0.19	1.77	3.55	5.78	14.75
	0:45:00	0.00	0.00	0.07	0.13	0.18	1.75	3.52	5.92	15.52
	0:50:00	0.00	0.00	0.06	0.12	0.16	1.68	3.35	5.68	15.48
	0:55:00	0.00	0.00	0.06	0.11	0.15	1.55	3.09	5.25	14.73
	1:00:00	0.00	0.00	0.05	0.10	0.14	1.41	2.82	4.81	13.97
	1:05:00	0.00	0.00	0.05	0.09	0.13	1.30	2.59	4.44	13.41
	1:10:00	0.00	0.00	0.04	0.08	0.12	1.20	2.39	4.09	12.51
	1:15:00	0.00	0.00	0.04	0.08	0.11	1.10	2.19	3.76	11.51
	1:25:00	0.00	0.00	0.04	0.07	0.10	1.00	2.00	3.42	0.70
	1:30:00	0.00	0.00	0.03	0.07	0.10	0.92	1.04	2 92	8.98
	1:35:00	0.00	0.00	0.03	0.06	0.08	0.80	1.59	2.72	8.32
	1:40:00	0.00	0.00	0.03	0.05	0.08	0.74	1.47	2.52	7.69
	1:45:00	0.00	0.00	0.03	0.05	0.07	0.68	1.35	2.32	7.07
	1:50:00	0.00	0.00	0.02	0.04	0.06	0.62	1.24	2.12	6.47
	1:55:00	0.00	0.00	0.02	0.04	0.06	0.56	1.12	1.92	5.87
	2:00:00	0.00	0.00	0.02	0.04	0.05	0.50	1.00	1.72	5.29
	2:05:00	0.00	0.00	0.02	0.03	0.05	0.45	0.88	1.52	4.70
	2:10:00	0.00	0.00	0.02	0.03	0.04	0.39	0.79	1.35	4.21
	2:15:00	0.00	0.00	0.01	0.03	0.04	0.36	0.72	1.24	3.87
	2:20:00	0.00	0.00	0.01	0.03	0.04	0.34	0.68	1.16	3.59
	2:20:00	0.00	0.00	0.01	0.02	0.04	0.32	0.60	1.03	3.10
	2:35:00	0.00	0.00	0.01	0.02	0.03	0.30	0.56	0.95	2.89
	2:40:00	0.00	0.00	0.01	0.02	0.03	0.26	0.52	0.88	2.67
	2:45:00	0.00	0.00	0.01	0.02	0.03	0.24	0.48	0.81	2.47
	2:50:00	0.00	0.00	0.01	0.02	0.02	0.22	0.44	0.75	2.28
	2:55:00	0.00	0.00	0.01	0.01	0.02	0.20	0.40	0.68	2.08
	3:00:00	0.00	0.00	0.01	0.01	0.02	0.18	0.36	0.61	1.89
	3:05:00	0.00	0.00	0.01	0.01	0.02	0.16	0.32	0.55	1.69
	3:10:00	0.00	0.00	0.01	0.01	0.01	0.14	0.28	0.48	1.50
	3:15:00	0.00	0.00	0.00	0.01	0.01	0.12	0.24	0.41	1.30
	3.20.00	0.00	0.00	0.00	0.01	0.01	0.10	0.20	0.35	1.11
	3:30:00	0.00	0.00	0.00	0.00	0.01	0.06	0.10	0.28	0.91
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.04	0.08	0.15	0.52
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.08	0.33
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.18
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.11
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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
	4:45:00	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
	5:05:00	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
	5:30:00	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
	5:50:00	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
MHFD-Detention, Version 4.06 (July 2022) Summary Stage-Area-Volume-Discharge Relationships

Stage - Storage	Stage	Area	Area	Volume	Volume	Total	
Description	[ft]	[ft ²]	[acres]	[ft ³]	[ac-ft]	[cfs]	
							For best results, include the
							stages of all grade slope
							changes (e.g. ISV and Floor)
							from the S-A-V table on
							Sheet Dasin.
							Also include the inverts of all
							outlets (e.g. vertical orifice,
							overflow grate, and spillway,
							where applicable).
							•
							1
							1
			1	1	1	1	1
							1
							1
							1
							1
							1
							1
]
]
							4
							4
							4
							1
]
]
							4
							1
							1
							4
							1
							1
]
							4
							4
							1
]
]

NO. 1 ADD IN

COLUMN 2

Depth Increment = 1.00 ft

Example Zone		Stage - Storage	Stage	Override	Length	Width	Area	Override	Area	Volume	Volume			
							Stage (ft)	(ft)	(ft)	(ft ²)	Area (ft ²)	(acre)	(ft 3)	(ac-ft)
Watershed Information		_			Top of Micropool		0.00				2,965	0.068		
Selected BMP Type =	EDB						1.00				4,325	0.099	3,644	0.084
Watershed Area =	5.12	acres					2.00				5,941	0.136	8,777	0.201
Watershed Length =	879	ft					3.00				7,813	0.179	15,653	0.359
Watershed Length to Centroid =	440	ft					4.00				9,941	0.228	24,530	0.563
Watershed Slope =	0.027	ft/ft												
Watershed Imperviousness =	2.00%	nercent												
Percentage Hydrologic Soil Group A =	100.0%	nercent												
Percentage Hydrologic Soil Group R -	0.0%	nercent												
Percentage Hydrologic Soil Groups C/D =	0.0%	nercent												
Target WOCV Prain Time =	40.0	houre			-									
Leastion for 1 by Dainfall Donthe	Hoor Terrut	nours			-									
Location for 1-in Rainan Depuis -	oser input				-									
After providing required inputs above inc	luding 1-hour	rainfall												
the embedded Colorado Urban Hydro	araph Procedu	ure.	Orthogodala	0		-								
	0.000	 	Optional Use	er Overrides	-									
Water Quality Capture Volume (WQCV) =	0.006	acre-feet		acre-feet										
Excess Urban Runoff Volume (EURV) =	0.005	acre-feet		acre-feet	-									
2-yr Runoff Volume (P1 = 1.19 in.) =	0.002	acre-feet	1.19	inches										
5-yr Runoff Volume (P1 = 1.5 in.) =	0.005	acre-feet	1.50	inches										
10-yr Runoff Volume (P1 = 1.75 in.) =	0.007	acre-feet	1.75	inches										
25-yr Runoff Volume (P1 = 2 in.) =	0.064	acre-feet	2.00	inches										
50-yr Runoff Volume (P1 = 2.25 in.) =	0.129	acre-feet	2.25	inches				-						
100-yr Runoff Volume (P1 = 2.52 in.) =	0.218	acre-feet	2.52	inches										
500-yr Runoff Volume (P1 = 3.68 in.) =	0.638	acre-feet	3.68	inches		-								
Approximate 2-yr Detention Volume =	0.003	acre-feet												
Approximate 5-yr Detention Volume =	0.004	acre-feet				-								
Approximate 10-yr Detention Volume =	0.005	acre-feet												
Approximate 25-yr Detention Volume =	0.008	acre-feet												
Approximate 50-yr Detention Volume =	0.020	acre-feet												
Approximate 100-yr Detention Volume =	0.055	acre-feet												
··· ··· ·· · · · · · · · · · · · · · ·		-												
Define Zones and Basin Geometry														
Zono 1 Volumo (WOCV) =	0.006	acro-foot												
Colort Zone 2 Charges Volume (WQCV) -	0.000	acre-leet			-									
Select Zone 2 Storage Volume (Optional) =		acre-reet	Total deter	ntion										
Select Zone 3 Storage Volume (Optional) =		acre-reet	100-year v	ess than olume.	-	-								
I otal Detention Basin Volume =	0.006	acre-feet	100 /00. 0	oranici	-									
Initial Surcharge Volume (ISV) =	user	ft '												
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 _{TSV}) =	user	ft												
Surcharge Volume Width (Wrsv) =	user	ft												
Denth of Basin Floor (Hr.con) =	user	ft												
Length of Basin Floor (Lenger) =	user	n												
Width of Basin Floor (Wr.com) =	user	n												
Area of Basin Floor (Area) =	user	a 2												
Volume of Pasin Floor (V	usor	ы. а. 3												
Depth of Main Pasin (H	usei	а. А			-									
Deput of Main Basin (H _{MAIN}) =	user	п. 												
Lengui or Main Basin (L _{MAIN}) =	user	н. А												
width of Main Basin (W _{MAIN}) =	user	L.												
Area of Main Basin (A _{MAIN}) =	user	ft ~												
volume of Main Basin (V _{MAIN}) =	user	ft"				-								
Calculated Total Basin Volume (V _{total}) =	user	acre-feet												
						-								
						-								
						-							-	
													-	
						-								
						-							-	
						-							-	
						-							-	
						-								



	DE	TENTION	BASIN OUT	FLET STRU	CTURE DE	SIGN			
		٨	1HFD-Detention, V	ersion 4.06 (July J	2022)				
Project:	Grandview - Inter	im							
Basin ID:	TSB-B2								
(20ml 1 (20ml 1				Estimated	Estimated				
mart (Seal)	-	_		Stage (ft)	Volume (ac-ft)	Outlet Type			
WOLLARS BURY MOCY		-	Zone 1 (WOCV)	0.10	0.006	Orifice Plate	1		
				0.10	0.000				
2041 1 660 2	ORIPICE		Zone 2						
Perfamingue ORPICES			Zone 3						
Example Zone	Configuration (Re	tention Pond)		Total (all zones)	0.006		-		
User Input: Orifice at Underdrain Outlet (typical	v used to drain WC	CV in a Filtration B	MP)			•	Calculated Parame	eters for Underdrain	ı
Underdrain Orifice Invert Depth =	N/A	ft (distance below	the filtration media	surface)	Underg	drain Orifice Area =	N/A	ft ²	-
Underdrain Orifice Diameter =	N/A	inches		····,	Underdrair	Orifice Centroid =	N/A	feet	
	,,	incirco			onderaran				
User Input: Orifice Plate with one or more orific	es or Elliptical Slot	Weir (typically used	to drain WOCV and	d/or FLIRV in a sedi	imentation BMP)		Calculated Darame	tors for Plata	
Centroid of Lowest Orifice -		ft (relative to bacir	a bottom at Stage -	- 0 ft)	WO Orifi	ice Area per Pow -	2 361E-03	e ²	
Dopth at top of Zono using Orifice Plate -	0.00	ft (relative to basi	hottom at Stage -	- 0 ft)		intical Half Width -	2.301L 03	foot	
Orifice Distor Orifice Vertical Crassing -	0.10	inches	i Dollom al Slage =	= 0 10)	Ellist	ipucal Hall-Widuli =	N/A	feet	
	4.00	incries	5/0 : 1)		Empt		IN/A	1991	
Orifice Plate: Orifice Area per Row =	0.34	sq. inches (diamet	er = 5/8 inch)		E	illiptical Slot Area =	N/A	ft ²	
User Input: Stage and Total Area of Each Orific	e Row (numbered f	rom lowest to high	est)						_
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)	
Stage of Orifice Centroid (ft)	0.00	0.30	0.60	0.90	1.20				
Orifice Area (sg. inches)	0.34	0.34	0.34	0.34	0.34				
									-
	Row 9 (ontional)	Row 10 (ontional)	Row 11 (ontional)	Row 12 (ontional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)	1
Stage of Orifice Controid (#)		Row 10 (optional)	Row II (optional)		Row 15 (optional)	Row 14 (optional)	Row 15 (optional)	Row 10 (optional)	
Orifice Area (sq. inches)									1
	1.)						<u> </u>		-c
User Input: Vertical Orifice (Circular or Rectang	ular)		1				Calculated Parame	eters for Vertical Ori	ifice
	Not Selected	Not Selected					Not Selected	Not Selected	_
Invert of Vertical Orifice =			ft (relative to basin	bottom at Stage =	= 0 ft) Ver	tical Orifice Area =			ft²
Depth at top of Zone using Vertical Orifice =			ft (relative to basin	bottom at Stage =	= 0 ft) Vertica	I Orifice Centroid =			feet
Vertical Orifice Diameter =			inches						
User Input: Overflow Weir (Dropbox with Flat o	r Sloped Grate and	Outlet Pipe OR Red	ctangular/Trapezoid	al Weir and No Out	tlet Pipe)		Calculated Parame	eters for Overflow W	Veir
	Not Selected	Not Selected	1				Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =			ft (relative to basin h	oottom at Stage = 0 f	(Height of Grate	e Upper Edae. H₊ =	Hot beletted	Hot beletted	feet
Overflow Weir Front Edge Length -			feet	ottom at Stage - 01	Overflow W	leir Slone Length –			feet
Overflow Weir Fronte Edge Eenger				C,	rata Onan Araa / 10) 0 vr Orifico Aron -			icce
Heriz Longth of Mair Sides -			foot	Gi	ate Open Area / 10	Area w/a Dahria -			o2
Horiz. Length of Weir Sides =			reet	00	vernow Grate Open	Area w/o Debris =			ft ⁻
Overflow Grate Type =			-	Ĺ	Overflow Grate Ope	n Area w/ Debris =			ft
Debris Clogging % =			%						
User Input: Outlet Pipe w/ Flow Restriction Plate	e (Circular Orifice, R	estrictor Plate, or F	Rectangular Orifice)		Ca	Iculated Parameter	s for Outlet Pipe w	Flow Restriction Pl	late
	Not Selected	Not Selected					Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =			ft (distance below ba	asin bottom at Stage	= 0 ft) O	utlet Orifice Area =			ft ²
Circular Orifice Diameter =			inches		Outlet	t Orifice Centroid =			feet
			•	Half-Cent	tral Angle of Restric	tor Plate on Pipe =	N/A	N/A	radians
					5		,	. ,	-
User Input: Emergency Spillway (Rectangular or	Tranezoidal)						Calculated Parame	ters for Snillway	
Spillway Invert Stage-	3.00	ft (relative to bacir	hottom at Stage -	- 0 #)	Spillway D	esian Flow Denth-	0.18	feet	
Spillway Great Longth -	9.00	feet	- Dottoin at Stage -	- 0 10)	Spinway D	Con of Freeboard -	4.10	foot	
Spiliway Crest Length =	8.00	leel			Stage at 1	rop of Freeboard =	4.10	Teel	
Spiliway End Slopes =	4.00	H:V			Basin Area at	op of Freeboard =	0.23	acres	
Freeboard above Max Water Surface =	1.00	teet			Basin Volume at 1	op of Freeboard =	0.56	acre-ft	
Pouted Hydrograph Poculto	The user can over	ride the default (1)	HP hydrographs and	d runoff volumec b	v entering new valu	ues in the Inflow U	drographs table (C	olumns W/ through	AF)
Noted Hydrograph Results	WOCH			F Veer					- E00 Vaar
Design Storm Return Period =	N/A		2 rear	5 rear	1 75	25 Year 2 00	2 25	2 52	3.68
CLIHP Runoff Volume (acre-ft) =	0.006	0.005	0.002	0.005	0.007	0.064	0.129	0.218	0.638
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.002	0.005	0.007	0.064	0.129	0.218	0.638
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.1	0.1	0.8	1.6	2.7	6.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.16	0.32	0.52	1.35
Peak Inflow Q (cfs) =	N/A	N/A	0.0	0.1	0.1	0.8	1.6	2.7	6.9
	N/A						0.0		
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	3.3
Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q =	0.0 N/A	0.0 N/A	0.0 N/A	0.0	0.0	0.0	0.0	0.1 0.0	3.3 0.5
Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow =	0.0 N/A Plate	0.0 N/A Plate	0.0 N/A Plate	0.0 0.0 Plate	0.0 0.0 Plate	0.0 0.0 Plate	0.0 0.0 Plate	0.1 0.0 Plate	3.3 0.5 Spillway
Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) =	0.0 N/A Plate N/A	0.0 N/A Plate N/A	0.0 N/A Plate N/A	0.0 0.0 Plate N/A	0.0 0.0 Plate N/A	0.0 0.0 Plate N/A	0.0 0.0 Plate N/A	0.1 0.0 Plate N/A	3.3 0.5 Spillway N/A
Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to prain 97% of Inflow (Neuros (hereing) =	N/A 0.0 N/A Plate N/A N/A 38	0.0 N/A Plate N/A N/A	0.0 N/A Plate N/A N/A 30	0.0 0.0 Plate N/A N/A 36	0.0 0.0 Plate N/A N/A 42	0.0 0.0 Plate N/A N/A 07	0.0 0.0 Plate N/A N/A	0.1 0.0 Plate N/A N/A 117	3.3 0.5 Spillway N/A N/A
Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 99% of Inflow Volume (hours) =	0.0 N/A Plate N/A N/A 38 46	0.0 N/A Plate N/A N/A 36 44	0.0 N/A Plate N/A N/A 30 38	0.0 0.0 Plate N/A N/A 36 44	0.0 0.0 Plate N/A N/A 42 50	0.0 0.0 Plate N/A 97 107	0.0 0.0 Plate N/A N/A 109 >120	0.1 0.0 Plate N/A 117 >120	3.3 0.5 Spillway N/A N/A 109 >120

44 0.06 0.07 0.004

50 0.09 0.07 0.006

0.76 0.09 0.060

1.36 0.11 0.121

Time to Drain 99% of Inflow Volume (hours) = Maximum Ponding Depth (ft) = Area at Maximum Ponding Depth (acres) = Maximum Volume Stored (acre-ft) = **46** 0.09 0.07 0.006

44 0.08 0.07 0.006

38 0.03 0.07 0.002

3.25 0.19 0.404

>120 2.03 0.14 0.206

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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	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:25:00	0.00	0.00	0.02	0.04	0.06	0.01	0.02	0.03	0.10
	0:30:00	0.00	0.00	0.03	0.06	0.09	0.36	0.93	2.45	4.27
	0:40:00	0.00	0.00	0.03	0.06	0.09	0.70	1.64	2.45	6.82
	0:45:00	0.00	0.00	0.03	0.05	0.07	0.77	1.54	2.62	6.89
	0:50:00	0.00	0.00	0.02	0.05	0.06	0.70	1.39	2.38	6.55
	0:55:00	0.00	0.00	0.02	0.04	0.06	0.63	1.25	2.15	6.12
	1:00:00	0.00	0.00	0.02	0.04	0.05	0.57	1.14	1.95	5.76
	1:10:00	0.00	0.00	0.02	0.03	0.05	0.52	0.92	1.77	5.44 4 91
	1:15:00	0.00	0.00	0.01	0.03	0.04	0.42	0.84	1.43	4.47
	1:20:00	0.00	0.00	0.01	0.03	0.04	0.38	0.76	1.31	4.07
	1:25:00	0.00	0.00	0.01	0.02	0.03	0.35	0.69	1.19	3.69
	1:30:00	0.00	0.00	0.01	0.02	0.03	0.31	0.63	1.07	3.33
	1:35:00	0.00	0.00	0.01	0.02	0.03	0.28	0.56	0.96	2.98
	1:45:00	0.00	0.00	0.01	0.02	0.02	0.25	0.49	0.84	2.03
	1:50:00	0.00	0.00	0.01	0.01	0.02	0.18	0.37	0.63	2.01
	1:55:00	0.00	0.00	0.01	0.01	0.02	0.17	0.33	0.57	1.81
	2:00:00	0.00	0.00	0.01	0.01	0.02	0.15	0.31	0.52	1.65
	2:05:00	0.00	0.00	0.00	0.01	0.01	0.14	0.28	0.48	1.51
	2:10:00	0.00	0.00	0.00	0.01	0.01	0.13	0.26	0.44	1.38
	2:20:00	0.00	0.00	0.00	0.01	0.01	0.12	0.24	0.41	1.13
	2:25:00	0.00	0.00	0.00	0.01	0.01	0.10	0.19	0.33	1.02
	2:30:00	0.00	0.00	0.00	0.01	0.01	0.09	0.17	0.29	0.90
	2:35:00	0.00	0.00	0.00	0.00	0.01	0.07	0.15	0.25	0.79
	2:40:00	0.00	0.00	0.00	0.00	0.01	0.06	0.12	0.22	0.68
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.18	0.57
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.04	0.06	0.14	0.35
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.06	0.23
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.13
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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
	3:55:00	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
	4:20:00	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
	4:40:00	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
	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
	5:15:00	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 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
	5:55:00	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

MHFD-Detention, Version 4.06 (July 2022) Summary Stage-Area-Volume-Discharge Relationships

Stage - Storage Description	Stage [ft]	Area	Area [acres]	Volume	Volume [ac-ft]	Total Outflow [cfs]	
							For best results, include the
							stages of all grade slope
							changes (e.g. ISV and Floor)
							Sheet 'Basin'.
							Also include the inverts of all
							overflow grate, and spillway.
							where applicable).
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Proje	ect: Grandview - Interim
Basin	ID: TSB-B3
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COLUMN 2

Depth Increment = 1.00 ft

Example Zone	Configurati	ion (Retenti	ion Pond)		Stage - Storage	Stage	Override	Length	Width	Area	Override	Area	Volume	Volume
	•		,		Description	(ft)	Stage (ft)	(ft)	(ft)	(ft ²)	Area (ft ²)	(acre)	(ft 3)	(ac-ft)
Watershed Information					Top of Micropool		0.00				6786.125	0.156		
Selected BMP Type -	FDB						1.00				8 778	0 202	7 782	0.179
Selected Bin Type =	200	-					1.00				0,770	0.202	7,702	0.175
Watershed Area =	9.91	acres					2.00				11,026	0.253	17,684	0.406
Watershed Length =	1,131	ft					3.00				13,530	0.311	29,962	0.688
Watershed Length to Centroid =	566	ft					4.00				16,290	0.374	44,873	1.030
Watershed Slope =	0.030	£/£												
Watershed Terrarel	2.000/													
watershed imperviousness =	2.00%	percent												
Percentage Hydrologic Soil Group A =	100.0%	percent												
Percentage Hydrologic Soil Group B =	0.0%	percent												
Percentage Hydrologic Soil Groups C/D =	0.0%	percent												
Target WOCV Drain Time =	40.0	hours												
Leasting for 1 by Dainfall Donths -	Llees Tenut													
Locauon for 1-nr Rainiali Depuis =	User Input													
After providing required inputs above inc	luding 1-hour	rainfall												
depths, click 'Run CUHP' to generate run	off hydrograph	hs using												
the embedded Colorado Urban Hydro	graph Proced	ure.	Optional Use	er Overrides										
Water Quality Capture Volume (WOCV) =	0.012	acre-feet		acre-feet										
Excess Lirban Runoff Volume (FLIRV) =	0.009	acre-feet	-	acre-feet										
2 in Dunoff Volume (D1 - 1.10 in) -	0.005	acre feet	1.10	inchos										
2-yr Runon Volume (P1 = 1.19 III.) =	0.005	acre-leet	1.19	inches										
5-yr Runoff Volume (P1 = 1.5 in.) =	0.010	acre-feet	1.50	inches										
10-yr Runoff Volume (P1 = 1.75 in.) =	0.014	acre-feet	1.75	inches										
25-yr Runoff Volume (P1 = 2 in.) =	0.124	acre-feet	2.00	inches										
50-vr Runoff Volume (P1 = 2.25 in.) =	0.250	acre-feet	2.25	inches										
100-vr Runoff Volume (P1 = 2.52 in) =	0 422	acre-feet	2 5 2	inches									1	
100 yr Runoff Volume (P1 - 2.52 III.) =	1 220	acre icet	2.52	inelico										
500-yr Kunott volume (P1 = 3.68 in.) =	1.238	aure-reet	3.68	inches									<u> </u>	
Approximate 2-yr Detention Volume =	0.005	acre-feet											L	
Approximate 5-yr Detention Volume =	0.007	acre-feet												
Approximate 10-yr Detention Volume =	0.011	acre-feet												
Approximate 25-vr Detention Volume -	0.016	acre-feet												l
Approximate 50 yr Detention Volume -	0.020	acro foot				-			-	-				
Approximate 30-yr Detention volume =	0.039	acreateet											l	
Approximate 100-yr Detention Volume =	0.107	acre-feet												
													L	
Define Zones and Basin Geometry														
Zone 1 Volume (WOCV) =	0.012	acre-feet												
Select Zone 2 Storage Volume (Ontional) -		acre-feet												
Select Zone 2 Storage Volume (Optional) -		acre feet	Total deter	ntion										
Select Zone 5 Storage Volume (Optional) =	0.010	acresieer	100-year y	olume.				-						
I otal Detention Basin Volume =	0.012	acre-reet						-						
Initial Surcharge Volume (ISV) =	user	ft '												
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 (STC) =	user	ft/ft												
Slopes of Main Basin Sides (Smain) =	user	H:V												
Basin Longth to Width Batio (B) =	ucor					-								
basin tenguntorwidun kauo (kt/w) =	usci	_												
Total Complement Area (A														
Initial Surcharge Area (A _{ISV}) =	user	nt -				-								
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 (Arroon) =	user	⊕ ²												
Volume of Basin Floor (V=cor) =	user	A 3												
Dopth of Main Pacin (H	ucor	A .			-									
Deput of Main Dasin (In _{MAIN}) =	usei							-						
Length of Main Basin (L _{MAIN}) =	user	L.											<u> </u>	
Width of Main Basin (W _{MAIN}) =	user	nt.												
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												
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Proje	ect: Grandview - Interim
Basin	ID: TSB-B3
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COLUMN 2

Depth Increment = 1.00 ft

Example Zone	Configurati	ion (Retenti	ion Pond)		Stage - Storage	Stage	Override	Length	Width	Area	Override	Area	Volume	Volume
	•		,		Description	(ft)	Stage (ft)	(ft)	(ft)	(ft ²)	Area (ft ²)	(acre)	(ft 3)	(ac-ft)
Watershed Information					Top of Micropool		0.00				6786.125	0.156		
Selected BMP Type -	FDB						1.00				8 778	0 202	7 782	0.179
Selected Bin Type =	200	-					1.00				0,770	0.202	7,702	0.175
Watershed Area =	9.91	acres					2.00				11,026	0.253	17,684	0.406
Watershed Length =	1,131	ft					3.00				13,530	0.311	29,962	0.688
Watershed Length to Centroid =	566	ft					4.00				16,290	0.374	44,873	1.030
Watershed Slope =	0.030	£/£												
Watershed Terrarel	2.000/													
watershed imperviousness =	2.00%	percent												
Percentage Hydrologic Soil Group A =	100.0%	percent												
Percentage Hydrologic Soil Group B =	0.0%	percent												
Percentage Hydrologic Soil Groups C/D =	0.0%	percent												
Target WOCV Drain Time =	40.0	hours												
Leasting for 1 by Dainfall Donths -	Llees Tenut													
Locauon for 1-nr Rainiali Depuis =	User Input													
After providing required inputs above inc	luding 1-hour	rainfall												
depths, click 'Run CUHP' to generate run	off hydrograph	hs using												
the embedded Colorado Urban Hydro	graph Proced	ure.	Optional Use	er Overrides										
Water Quality Capture Volume (WOCV) =	0.012	acre-feet		acre-feet										
Excess Lirban Runoff Volume (FLIRV) =	0.009	acre-feet	-	acre-feet										
2 in Dunoff Volume (D1 - 1.10 in) -	0.005	acre feet	1.10	inchos										
2-yr Runon Volume (P1 = 1.19 III.) =	0.005	acre-leet	1.19	inches										
5-yr Runoff Volume (P1 = 1.5 in.) =	0.010	acre-feet	1.50	inches										
10-yr Runoff Volume (P1 = 1.75 in.) =	0.014	acre-feet	1.75	inches										
25-yr Runoff Volume (P1 = 2 in.) =	0.124	acre-feet	2.00	inches										
50-vr Runoff Volume (P1 = 2.25 in.) =	0.250	acre-feet	2.25	inches										
100-vr Runoff Volume (P1 = 2.52 in) =	0 422	acre-feet	2 5 2	inches									1	
100 yr Runoff Volume (P1 - 2.02 III.) =	1 220	acre icet	2.52	inelico										
500-yr Kunott volume (P1 = 3.68 in.) =	1.238	aure-reet	3.68	inches									<u> </u>	
Approximate 2-yr Detention Volume =	0.005	acre-feet											L	
Approximate 5-yr Detention Volume =	0.007	acre-feet												
Approximate 10-yr Detention Volume =	0.011	acre-feet												
Approximate 25-vr Detention Volume -	0.016	acre-feet												l
Approximate 50 yr Detention Volume -	0.020	acro foot				-			-	-				
Approximate 30-yr Detention volume =	0.039	acreateet											l	
Approximate 100-yr Detention Volume =	0.107	acre-feet												
													L	
Define Zones and Basin Geometry														
Zone 1 Volume (WOCV) =	0.012	acre-feet												
Select Zone 2 Storage Volume (Ontional) -		acre-feet												
Select Zone 2 Storage Volume (Optional) -		acre feet	Total dete	ntion										
Select Zone 5 Storage Volume (Optional) =	0.010	acresieer	100-year y	olume.				-						
I otal Detention Basin Volume =	0.012	acre-reet						-						
Initial Surcharge Volume (ISV) =	user	ft '												
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 (STC) =	user	ft/ft												
Slopes of Main Basin Sides (Smain) =	user	H:V												
Basin Longth to Width Batio (B) =	ucor					-								
basin tenguntorwidun kauo (kt/w) =	usci	_												
Total Complement Area (A														
Initial Surcharge Area (A _{ISV}) =	user	nt -				-								
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 (Arroon) =	user	⊕ ²												
Volume of Basin Floor (V=con) =	user	A 3												
Dopth of Main Pacin (H	ucor	A .			-									
Deput of Main Dasin (In _{MAIN}) =	usei							-						
Length of Main Basin (L _{MAIN}) =	user	L.											<u> </u>	
Width of Main Basin (W _{MAIN}) =	user	nt.												
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												
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Project:	Grandview - Interim
Basin ID:	TSB-C1
=1-1-4	

manner

COLUMN AND

Depth Increment = 1.00 ft

Example Zone		Stage - Storage	Stage	Override	Length	Width	Area	Override	Area	Volume	Volume			
· · · · · ·					Description	(ft)	Stage (ft)	(ft)	(ft)	(ft ²)	Area (ft ²)	(acre)	(ft 3)	(ac-ft)
Watershed Information					Top of Micropool		0.00				4,465	0.103		
Selected BMP Type =	EDB						1.00				6,105	0.140	5,285	0.121
Watershed Area =	6.84	acres					2.00				8,001	0.184	12,338	0.283
Watershed Length -	1 464	A				-	3.00				10 153	0.233	21 415	0.402
Watershed Length +	1,404	n.				-	3.00	-			10,133	0.200	21,713	0.752
watersned Length to Centrold =	732	IL 0.00				-	4.00				12,501	0.200	32,/72	0.752
Watershed Slope =	0.022	ft/ft												
Watershed Imperviousness =	2.00%	percent												
Percentage Hydrologic Soil Group A =	100.0%	percent												
Percentage Hydrologic Soil Group B =	0.0%	percent												
Percentage Hydrologic Soil Groups C/D =	0.0%	percent												
Target WQCV Drain Time =	40.0	hours												
Location for 1-hr Rainfall Depths =	User Input													
After providing required inputs above inc	ludina 1-hour	rainfall												
depths, click 'Run CUHP' to generate run	off hydrograph	s using												
the embedded Colorado Urban Hydro	graph Procedu	ıre.	Optional Use	r Overrides										
Water Quality Capture Volume (WOCV) =	0.009	acre-feet		acre-feet										
Excess Urban Runoff Volume (FURV) =	0.006	acre-feet		acre-feet										
2-vr Runoff Volume (P1 = 1 19 in) =	0.003	acre-feet	1 19	inches										
E yr Runoff Volume (P1 = 1 E in) =	0.005	acro-foot	1.50	inchoc										
10 up Dunoff Volume (P1 - 1.5 in.) -	0.000	acre-leet	1.30	inches	-									
10-yr Ruhon Volume (P1 = 1.75 m.) =	0.009	acre-leet	1.75	inches		-								
25-yr Runoff Volume (P1 = 2 in.) =	0.086	acre-feet	2.00	inches										
50-yr Runoff Volume (P1 = 2.25 in.) =	0.1/3	acre-feet	2.25	inches									L	
100-yr Runoff Volume (P1 = 2.52 in.) =	0.292	acre-feet	2.52	inches									⊢−−−−	
500-yr Runoff Volume (P1 = 3.68 in.) =	0.856	acre-feet	3.68	inches										
Approximate 2-yr Detention Volume =	0.004	acre-feet												
Approximate 5-yr Detention Volume =	0.005	acre-feet												
Approximate 10-yr Detention Volume =	0.007	acre-feet											L 7	7
Approximate 25-yr Detention Volume =	0.011	acre-feet												-
Approximate 50-yr Detention Volume =	0.027	acre-feet												
Approximate 100-yr Detention Volume =	0.074	acre-feet											(
,	I	4												
Define Zones and Basin Geometry														
Zono 1 Volumo (WOCV) -	0.000	acro-foot												
Zone i Volume (WQCV) =	0.009	acre-leet				-								
Select Zone 2 Storage Volume (Optional) =		acre-leet	Total deten	ition									—	
Tetal Detention Pagin Volume -	0.000	acre-leet	100-year v	olume.		-		-					—	
Total Detention Basin Volume -	0.009	acre-reet			-									
Initial Suicharge Volume (ISV) -	usei	π			-									
Initial Surcharge Depth (ISD) =	user	π												
I otal Available Detention Depth (H _{total}) =	user	π.												
Depth of Trickle Channel (H_{TC}) =	user	π.												
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													
		1.												
Initial Surcharge Area (A _{ISV}) =	user	ft f												
Surcharge Volume Length (L _{ISV}) =	user	ft												
Surcharge Volume Width (W _{ISV}) =	user	ft											L	
Depth of Basin Floor (H _{FLOOR}) =	user	ft												
Length of Basin Floor (L _{FLOOR}) =	user	ft												
Width of Basin Floor (W _{FLOOR}) =	user	ft											L	
Area of Basin Floor (A _{FLOOR}) =	user	ft ²											L	
Volume of Basin Floor (V _{FLOOR}) =	user	ft ³											L	
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												
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	DETENTION BASIN OUTLET STRUCTURE DESIGN
	MHFD-Detention, Version 4.06 (July 2022)
t:	Grandview - Interim
	TCD C1

Project:	Grandview - Inter	im	IHFD-Detention, V	ersion 4.06 (July 2	2022)								
Basin ID:	TSB-C1			Estimate d	Estimated								
(20ml)				Estimated	Estimated	Outlat Type							
WALKER RUNT RUNT RUNT			7 1 (11/001)	Stage (It)	voluitie (ac-it)	Outlet Type	1						
1-1-4			Zone I (WQCV)	0.09	0.009	Office Plate							
2048 1 660 2	ORPCK		Zone 2										
Pola Example Zone	Configuration (Re	tention Pond)	Zone 3										
	ooninguration (re			Total (all zones)	0.009	J							
User Input: Orifice at Underdrain Outlet (typically	y used to drain WC	CV in a Filtration Bl	<u>MP)</u>	C)			Calculated Parame	ters for Underdrain	L				
Underdrain Orifice Invert Depth =	N/A	ft (distance below	the filtration media	surrace)	Underd	Irain Orifice Area =	N/A	ft ^e					
Onderdrain Onlice Diameter =	N/A	inches			Underdrain		IN/A	reet					
User Input: Orifice Plate with one or more orific	es or Elliptical Slot	Weir (typically used	to drain WOCV and	d/or FURV in a sedi	imentation BMP)		Calculated Parame	ters for Plate					
Centroid of Lowest Orifice =	0.00	ft (relative to basir	bottom at Stage =	= 0 ft)	WO Orifi	ce Area per Row =	3.333E-03	ft ²					
Depth at top of Zone using Orifice Plate =	0.09	ft (relative to basir	n bottom at Stage =	= 0 ft)	Elli	, ptical Half-Width =	N/A	feet					
Orifice Plate: Orifice Vertical Spacing =	4.00	inches			Ellipti	ical Slot Centroid =	N/A	feet					
Orifice Plate: Orifice Area per Row =	0.48	sq. inches (diamet	er = 3/4 inch)		E	lliptical Slot Area =	N/A	ft ²					
User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest) Row 1 (required) Row 2 (optional) Row 3 (optional) Row 4 (optional) Row 5 (optional) Row 6 (optional) Row 7 (optional) Row 8 (optional)													
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)					
Stage of Orifice Centroid (ft)	0.00	0.30	0.60	0.90	1.20				-				
Unifice Area (sq. inches)	0.48	0.48	0.48	0.48	0.48				J				
	Row Q (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (ontional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)	1				
Stage of Orifice Centroid (ft)	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 15 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)					
Orifice Area (sq. inches)													
			1		1	1			•				
User Input: Vertical Orifice (Circular or Rectange	ular <u>)</u>		_				Calculated Parame	ters for Vertical Ori	fice				
	Not Selected	Not Selected					Not Selected	Not Selected					
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft) Vertical Orifice Area =										
Depth at top of Zone using Vertical Orifice =			ft (relative to basir	bottom at Stage =	= 0 ft) Vertica	Orifice Centroid =			feet				
Vertical Orifice Diameter =			inches										
Licer Input: Overflow Weir (Drephov with Elst e	r Sloped Crate and	Outlot Dipo OB Boo	tangular/Tranozoid	al Wair and No Out	lot Dipo)		Calculated Barama	tors for Overflow M	Voir				
Oser Input. Overnow weil (Dropbox with Flat o	Not Selected	Not Selected			<u>let ripe)</u>		Net Colorted	Net Colorted					
Overflow Weir Front Edge Height Ho =	Not Selected	Not Selected	ft (relative to basin h	ottom at Stage – 0 f	+) Height of Grate	Unner Edge H. =	NOL SEIECLEU	NOL SEIECLEU	feet				
Overflow Weir Front Edge Height, Ho =			feet	octom at Stage = 01	Overflow W	eir Slope Length =			feet				
Overflow Weir Grate Slope =			H:V	Gr	ate Open Area / 10	0-vr Orifice Area =							
Horiz. Length of Weir Sides =			feet	0	erflow Grate Open	Area w/o Debris =			ft ²				
Overflow Grate Type =				C	verflow Grate Oper	n Area w/ Debris =			ft ²				
Debris Clogging % =			%						-				
User Input: Outlet Pipe w/ Flow Restriction Plate	(Circular Orifice, R	estrictor Plate, or R	ectangular Orifice)		<u>Ca</u>	Iculated Parameters	s for Outlet Pipe w/	Flow Restriction P	late				
	Not Selected	Not Selected					Not Selected	Not Selected					
Depth to Invert of Outlet Pipe =			ft (distance below ba	asin bottom at Stage	= 0 ft) O	utlet Orifice Area =			ft ²				
Circular Orifice Diameter =			inches		Outlet	Orifice Centrold =	N1/A	N1/A	reet				
				Hair-Cent	ral Angle of Restric	tor Plate on Pipe =	IN/A	N/A	radians				
User Input: Emergency Spillway (Rectangular or	Trapezoidal)						Calculated Parame	ters for Spillwav					
Spillway Invert Stage=	3.00	ft (relative to basir	n bottom at Stage =	= 0 ft)	Spillway D	esign Flow Depth=	0.17	feet					
Spillway Crest Length =	11.00	feet		-	Stage at 1	op of Freeboard =	4.17	feet					
Spillway End Slopes =	4.00	H:V			Basin Area at T	op of Freeboard =	0.29	acres					
Freeboard above Max Water Surface =	1.00	feet			Basin Volume at T	op of Freeboard =	0.75	acre-ft					
Routed Hydrograph Results	The user can over	ride the default (11)	HP hvdrographs and	d runoff volumes h	/ entering new valu	es in the Inflow Hv	drographs table (Co	olumns W through .	4F).				
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	3.68				
CUHP Runoff Volume (acre-ft) =	0.009	0.006	0.003	0.006	0.009	0.086	0.173	0.292	0.856				
INNOW Hydrograph Volume (acre-ft) = CUHP Predevelonment Peak O (cfs) -	N/A N/A	N/A N/A	0.003	0.006	0.009	0.086	0.173	0.292	0.856				
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.1	0.1	0.7	1.5	2.5	0.0				
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.01	0.11	0.22	0.36	0.97				
Peak Inflow Q (cfs) =	N/A	N/A	0.0	0.1	0.1	0.7	1.5	2.5	6.6				
Peak Outflow Q (Cfs) = Ratio Peak Outflow to Predevelopment Ω =	0.0 N/A	0.0 N/A	0.0 N/A	0.0	0.0	0.0	0.1	0.1	0.5				
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Spillway				
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 39	N/A	N/A 100	N/A 112	N/A	N/A 112				
Time to Drain 97% of Inflow Volume (hours) =	49 49		32 40		51	111	>120	>120	>120				
Maximum Ponding Depth (ft) =	0.09	0.06	0.03	0.05	0.08	0.69	1.26	1.92	3.19				
Area at Maximum Ponding Depth (acres) =	0.11	0.10	0.10	0.10	0.11	0.13	0.15	0.18	0.24				
Maximum Volume Stored (acre-ft) =	0.009	0.006	0.002	0.005	0.007	0.078	0.158	0.269	0.537				



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	WOCV [cfc]	FURV [cfc]	2 Vear [cfc]	5 Vear [cfc]	10 Vear [cfc]	25 Vear [cfc]	50 Vear [cfc]	100 Vear [cfc]	500 Vear [cfc]
Time Incervar	0:00:00	WQCV [CI3]		2 100 [03]	5 100 [03]		25 100 [03]		100 100 [03]	
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	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:30:00	0.00	0.00	0.01	0.05	0.03	0.01	0.71	1.07	3.27
	0:35:00	0.00	0.00	0.03	0.06	0.08	0.64	1.28	2.06	5.32
	0:40:00	0.00	0.00	0.03	0.06	0.08	0.73	1.47	2.40	6.15
	0:45:00	0.00	0.00	0.03	0.05	0.08	0.73	1.47	2.48	6.51
	0:50:00	0.00	0.00	0.03	0.05	0.07	0.71	1.43	2.42	6.60
	0:55:00	0.00	0.00	0.02	0.05	0.07	0.68	1.36	2.30	6.45
	1:00:00	0.00	0.00	0.02	0.04	0.06	0.63	1.26	2.15	6.21
	1:05:00	0.00	0.00	0.02	0.04	0.06	0.59	1.17	2.00	5.99
	1:10:00	0.00	0.00	0.02	0.04	0.05	0.55	1.09	1.87	5.66
	1:20:00	0.00	0.00	0.02	0.04	0.05	0.51	0.96	1.75	4 97
	1:25:00	0.00	0.00	0.02	0.03	0.03	0.45	0.90	1.04	4.63
	1:30:00	0.00	0.00	0.01	0.03	0.04	0.41	0.83	1.41	4.29
	1:35:00	0.00	0.00	0.01	0.03	0.04	0.38	0.77	1.32	4.01
	1:40:00	0.00	0.00	0.01	0.03	0.04	0.36	0.73	1.24	3.77
	1:45:00	0.00	0.00	0.01	0.02	0.04	0.34	0.68	1.17	3.54
	1:50:00	0.00	0.00	0.01	0.02	0.03	0.32	0.64	1.10	3.33
	1:55:00	0.00	0.00	0.01	0.02	0.03	0.30	0.60	1.03	3.12
	2:00:00	0.00	0.00	0.01	0.02	0.03	0.28	0.56	0.96	2.92
	2:05:00	0.00	0.00	0.01	0.02	0.03	0.26	0.52	0.90	2.71
	2:10:00	0.00	0.00	0.01	0.02	0.02	0.24	0.48	0.83	2.52
	2:13:00	0.00	0.00	0.01	0.01	0.02	0.22	0.44	0.76	2.32
	2:25:00	0.00	0.00	0.01	0.01	0.02	0.20	0.36	0.63	1.92
	2:30:00	0.00	0.00	0.01	0.01	0.02	0.16	0.33	0.56	1.74
	2:35:00	0.00	0.00	0.01	0.01	0.02	0.15	0.30	0.52	1.61
	2:40:00	0.00	0.00	0.01	0.01	0.02	0.14	0.29	0.49	1.51
	2:45:00	0.00	0.00	0.00	0.01	0.01	0.14	0.27	0.47	1.43
	2:50:00	0.00	0.00	0.00	0.01	0.01	0.13	0.26	0.44	1.35
	2:55:00	0.00	0.00	0.00	0.01	0.01	0.12	0.25	0.42	1.27
	3:00:00	0.00	0.00	0.00	0.01	0.01	0.12	0.23	0.40	1.20
	3:05:00	0.00	0.00	0.00	0.01	0.01	0.11	0.22	0.38	1.13
	3:15:00	0.00	0.00	0.00	0.01	0.01	0.10	0.21	0.33	1.07
	3:20:00	0.00	0.00	0.00	0.01	0.01	0.10	0.15	0.31	0.93
	3:25:00	0.00	0.00	0.00	0.01	0.01	0.08	0.17	0.29	0.87
	3:30:00	0.00	0.00	0.00	0.01	0.01	0.08	0.15	0.26	0.80
	3:35:00	0.00	0.00	0.00	0.00	0.01	0.07	0.14	0.24	0.74
	3:40:00	0.00	0.00	0.00	0.00	0.01	0.06	0.13	0.22	0.67
	3:45:00	0.00	0.00	0.00	0.00	0.01	0.06	0.11	0.20	0.60
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.17	0.54
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.04	0.09	0.15	0.47
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.04	0.07	0.13	0.41
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.03	0.06	0.08	0.34
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.06	0.21
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.04	0.14
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.08
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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
	5:20:00	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
	5:45:00	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

MHFD-Detention, Version 4.06 (July 2022) Summary Stage-Area-Volume-Discharge Relationships

Stage - Storage	Stage	Area	Area	Volume	Volume	Total Outflow	
Description	[ft]	[ft ²]	[acres]	[ft ³]	[ac-ft]	[cfs]	
							For best results, include the
							stages of all grade slope
							from the S-A-V table on
							Sheet 'Basin'.
							Also include the inverts of all
							outlets (e.g. vertical orffice,
							where applicable).
							,
	-	-					
	-						
	1						
-							
		1					
			1	1	1	1	

Project	: Grandview - Interim
Basin ID	: TSB-C2
=	

Depth Increment = 1.00 ft

Example Zone Configuration (Retention Pond)					Stage - Storage	Stage	Override	Length	Width	Area	Override	Area	Volume	Volume
					Description	(ft)	Stage (ft)	(ft)	(ft)	(ft ²)	Area (ft ²)	(acre)	(ft 3)	(ac-ft)
Watershed Information					Top of Micropool		0.00				8,761	0.201		
Selected BMP Type -	EDB	1					1.00				10 203	0.236	0 527	0.219
Science Bin Type =	200						1.00				10,255	0.250	5,527	0.215
Watershed Area =	17.00	acres					2.00				11,926	0.274	20,636	0.474
Watershed Length =	1,556	ft					3.00				13,660	0.314	33,429	0.767
Watershed Length to Centroid =	778	ft					4.00				15,495	0.356	48,007	1.102
Watershed Slope =	0.032	£/A												
Waterched Imponiousness -	2.00%	norcont												
watersieu imperviousiess -	2.00%	percent .												
Percentage Hydrologic Soil Group A =	100.0%	percent												
Percentage Hydrologic Soil Group B =	0.0%	percent												
Percentage Hydrologic Soil Groups C/D =	0.0%	percent												
Target WQCV Drain Time =	40.0	hours												
Location for 1-hr Rainfall Denths =	User Input	4												
After providing required inputs above inc	cluding 1-hour I	rainfall												
the embedded Celerade Urban Hydro	orr nyorograph	s using												
the embedded colorado orban nydro	graph Procedu	iie.	Optional Use	r Overrides										
Water Quality Capture Volume (WQCV) =	0.021	acre-feet		acre-feet										
Excess Urban Runoff Volume (EURV) =	0.016	acre-feet		acre-feet										
2-vr Runoff Volume (P1 = 1.19 in.) =	0.009	acre-feet	1.19	inches										
Ever Runoff Volume (P1 = 1 E in) =	0.017	acro-foot	1.50	inchoc										
5-yr Kullon Volume (F1 = 1.5 III.) =	0.017	acrefieer	1.30	inches										
10-yr Runoff Volume (P1 = 1.75 in.) =	0.024	acre-feet	1.75	inches										
25-yr Runoff Volume (P1 = 2 in.) =	0.213	acre-feet	2.00	inches										
50-yr Runoff Volume (P1 = 2.25 in.) =	0.429	acre-feet	2.25	inches		-]	T	1
100-yr Runoff Volume (P1 = 2.52 in.) =	0.725	acre-feet	2.52	inches										
500-yr Runoff Volume (P1 = 3.68 in) =	2.124	acre-feet	3.68	inches										
Approximate 2-vr Detontion Volume -	0.000	acre-feot												
Approximate 2-yr Deteriuon volume =	0.009	acreneet												
Approximate 5-yr Detention Volume =	0.013	acre-feet												
Approximate 10-yr Detention Volume =	0.018	acre-feet												
Approximate 25-yr Detention Volume =	0.027	acre-feet											Т	1
Approximate 50-yr Detention Volume =	0.067	acre-feet												
Approximate 100-vr Detention Volume -	0.184	acre-feet												
- oproximate 200 yr betendon volume -	0.201								_					
						-								
Define Zones and Basin Geometry		-												
Zone 1 Volume (WQCV) =	0.021	acre-feet												
Select Zone 2 Storage Volume (Optional) =		acre-feet	Total deter	ntion				-						
Select Zone 3 Storage Volume (Optional) =		acre-feet	volume is l	ess than										
Total Detention Basin Volume =	0.021	acre-feet	100-year v	olume.										
Initial Surcharge Volume (ISV) -	ucor	a.3												
initial Suicharge Volume (13V) =	usei	π												
Initial Surcharge Depth (ISD) =	user	π				-								
Total Available Detention Depth (H _{total}) =	user	ft												
Depth of Trickle Channel (H _{TC}) =	user	ft												
Slope of Trickle Channel (STC) =	user	ft/ft												
Slopes of Main Basin Sides (Smain) =	user	H:V												
Basin Length-to-Width Ratio (Riou) =	user	1												
(,		1												
Initial Curcharge Area (A) -		a 2												
initial Suichaige Area (A _{ISV}) -	usei													
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 (Wr.com) =	user	ft												
Area of Pacin Eleor (A) =	ucor	a 2												
Area of Basin Hoor (A _{FLOOR}) -	usei	π.												
Volume of Basin Floor (V _{FLOOR}) =	user	ft '												
Depth of Main Basin $(H_{MAIN}) =$	user	ft												
Length of Main Basin $(L_{MAIN}) =$	user	ft											Т	1
Width of Main Basin (W _{MAIN}) =	user	ft												
Area of Main Basin (Assaul) =	user	ft ²												
Volume of Main Basin (V) =	licor	н ³												
Calculated Total Pasin Valume (1)	u3c1	IL DOTO FOOT						-						
calculated Total basili volume (v _{total}) =	user	aci e-ieet												
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			DASTIN OU	LEI SIKU	CIURE DE	SIGN				
		M	1HFD-Detention, V	ersion 4.06 (July 2	2022)					
Project:	Grandview - Inter	im								
Basin ID:	158-02									
(20ml)		24.5		Estimated	Estimated	Outlat Turns				
HOLDER ROOT				Stage (ft)	volume (ac-rt)	Outlet Type	1			
Town T and			Zone 1 (WQCV)	0.11	0.021	Orifice Plate				
1 marines	DRIPCE		Zone 2							
Perfamiliant Oversize			Zone 3							
Example Zone	Configuration (Re	etention Pond)		Total (all zones)	0.021					
User Input: Orifice at Underdrain Outlet (typical	<u>y used to drain WQ</u>	CV in a Filtration Bl	<u>MP)</u>				Calculated Parame	ters for Underdrain	Ļ	
Underdrain Orifice Invert Depth =	N/A	ft (distance below	the filtration media	surface)	Underc	Irain Orifice Area =	N/A	ft ²		
Underdrain Orifice Diameter =	N/A	inches			Underdrain	Orifice Centroid =	N/A	feet		
User Input: Orifice Plate with one or more orific	es or Elliptical Slot	Weir (typically used	to drain WQCV an	d/or EURV in a sedi	mentation BMP)		Calculated Parame	eters for Plate		
Centroid of Lowest Orifice =	0.00	ft (relative to basin	n bottom at Stage =	= 0 π)	WQ Orifi	ce Area per Row =	1.028E-02	ft ²		
Orifice Plate: Orifice Vertical Spacing -	0.11	It (relative to basir	i bottom at Stage =	= 0 ft)	Ellipti	ptical Hair-width =	N/A	feet		
Orifice Plate: Orifice Area per Row -	1 48	sa inches (diamet	er = 1-3/8 inches)		Empti	llintical Slot Area -	N/A	ft ²		
Office Plate. Office Area per Now -	1.10	sq. inches (diamet	ei – 1-5/6 inches)				N/A	III		
User Input: Stage and Total Area of Each Orific	e Row (numbered f	rom lowest to high	ect)							
oser input. Stage and Total Area of Eden onlice	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (ontional)	Row 5 (optional)	Row 6 (ontional)	Row 7 (optional)	Row 8 (ontional)	1	
Stage of Orifice Centroid (ft)	0.00	0.30	0.60	0.90	1.20		(optional)	non o (optional)		
Orifice Area (sq. inches)	1.48	1.48	1.48	1.48	1.48					
						•	•	•		
	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)	1	
Stage of Orifice Centroid (ft)										
Orifice Area (sq. inches)										
User Input: Vertical Orifice (Circular or Rectange	<u>ular)</u>	r	1				Calculated Parame	ters for Vertical Ori	fice	
	Not Selected	Not Selected					Not Selected	Not Selected	_	
Invert of Vertical Orifice =			ft (relative to basir	bottom at Stage =	0 ft) Ver	tical Orifice Area =			ft ²	
Depth at top of Zone using Vertical Orifice =	l		ft (relative to basir	bottom at Stage =	= 0 ft) Vertica	Orifice Centroid =			feet	
vertical Orifice Diameter =	<u> </u>		inches							
User Input: Overflow Weir (Drophox with Elat o	r Clanad Crata and	0.11.1.01.00.0								
		() ITIAT PINA ()R RAC	tangular/Tranezoid	al Weir and No Out	let Pine)		Calculated Parame	ters for Overflow V	loir	
	x will rat of sloped Gate and Outlet ripe OK Rectangular/Indezoldar weir and No Outlet Pipe) Calculated radiinteers for Overniow Weir									
Overflow Weir Front Edge Height, Ho =	Not Selected	Not Selected	tangular/Trapezoid	al Weir and No Out	l <u>et Pipe)</u>	upper Edge. H. =	Calculated Parame	Not Selected	<u>/eir</u> feet	
Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Leight, Ho =	Not Selected	Not Selected	<u>tangular/Trapezoid</u> ft (relative to basin t feet	al Weir and No Out	<u>let Pipe)</u> t) Height of Grate Overflow W	e Upper Edge, H _t = 'eir Slope Length =	Calculated Parame	eters for Overflow V Not Selected	<u>/eir</u> feet feet	
Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Front Edge Length = Overflow Weir Grate Slope =	Not Selected	Not Selected	tangular/Trapezoid ft (relative to basin t feet H:V	al Weir and No Out pottom at Stage = 0 f Gr	t) Height of Grate Overflow W ate Open Area / 10	e Upper Edge, H _t = /eir Slope Length = 0-vr Orifice Area =	Calculated Parame	eters for Overflow V Not Selected	<u>/eir</u> feet feet	
Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides =	Not Selected	Not Selected	<u>tangular/Trapezoid</u> ft (relative to basin t feet H:V feet	al Weir and No Out pottom at Stage = 0 f Gr Ov	t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open	e Upper Edge, H _t = leir Slope Length = 0-yr Orifice Area = Area w/o Debris =	Calculated Parame	ters for Overflow V Not Selected	feet feet ft ²	
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Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage= Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = CUHP Runoff Volume (acreft) = CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = Peak Inflow Q (cfs) = Peak Nufflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Max Velocity through Grate 1 (fps) = Time to Drain 97% of Inflow Volume (hours) =	Silpeu Grate and Not Selected	Outlet Pipe OR Rec Not Selected Image: Selected	tangular/Trapezoid ft (relative to basin I feet H:V feet (distance below be inches bottom at Stage = hottom at Stage = 2 Year 1.19 0.009 0.10 0.1 0.1 0.1 0.1 0.0 N/A Plate N/A N/A N/A 22 27	al Weir and No Out bottom at Stage = 0 f Gr Ov c asin bottom at Stage Half-Cent = 0 ft)	let Pipe) t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open verflow Grate Open verflow Grate Open verflow Grate Open verflow Grate Open Ca Ca Ca Ca Ca Ca Ca Ca Ca Ca	e Upper Edge, H _t = eir Slope Length = O-yr Orifice Area = Area w/ Debris = h Area w/ Debris = h Area w/ Debris = lculated Parameter: utlet Orifice Area = corifice Centroid = tor Plate on Pipe = esign Flow Depth= op of Freeboard = op of Freeboard = op of Freeboard = op of Freeboard = cop of Freeboard = cop of Freeboard = cop of Freeboard = 0 of Freebo	Calculated Parame Not Selected	Interface Selected Not Selected	feet feet feet ff² ft² ft² feet ate feet feet feet feet radians 500 Year 3.68 2.124 23.8 1.40 23.8 1.8.2 0.8 Spillway N/A N/A N/A 78	
Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage= Spillway Invert Stage= Spillway End Slopes = Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Inflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Max Velocity through Grate 1 (fps) =	Silpet Grate and Not Selected	Outlet Pipe OK Rec Not Selected Image: Selected	tangular/Trapezoid ft (relative to basin I feet H:V feet (distance below basin inches) ft (distance	al Weir and No Out bottom at Stage = 0 f Gr Ov asin bottom at Stage Half-Cent = 0 ft)	let Pipe) t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open verflow Grate Open verflow Grate Open verflow Grate Open (2) (2) (2) (2) (2) (2) (2) (2)	e Upper Edge, H _t = eir Slope Length = leir Slope Length = Area w/o Debris = h Area w/ Debris = h Area w/ Debris = lculated Parameter: utlet Orifice Area = : Orifice Centroid = tor Plate on Pipe = esign Flow Depth= "op of Freeboard = "op of Freeboard = "on of Freeboard =	Calculated Parame Not Selected	I Flow Restriction P Not Selected Not Selected Not Selected Not Selected Not Selected N/A ters for Spillway feet feet acres acre-ft 100 Year 2.52 0.725 9.1 0.54 9.1 0.4 0.0 Plate N/A N/A 74 88 2.67	Source Source<	
Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage= Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Predevelopment Unit Peak Rlow, q (cfs/acre) = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) = Maximum Ponding Depth (f) = Area at Maximum Ponding Depth (f) =	Silper Grate and Not Selected	Outlet Pipe OK Rec Not Selected estrictor Plate, or R Not Selected Not Selected ft (relative to basin feet H:V feet H:V feet N/A	tangular/Trapezoid ft (relative to basin I feet H:V feet fet ft (distance below basin ft (distance below basin inches ft (distance below basin ft (distance below ba	al Weir and No Out bottom at Stage = 0 f Gr Ov c asin bottom at Stage Half-Cent = 0 ft) = 0 ft) = 1.50 0.017 0.2 	let Pipe) t) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open verflow Grate Open verflow Grate Open verflow Grate Open verflow Grate Open Stage at 1 Basin Area at 1 Basin Area at 1 Basin Volume at 1 Basin Volume at 1 Centering new value 10 Year 1.75 0.024 0.3 0.02 0.3 0.02 0.3 0.0 0.1 Plate N/A N/A 36 0.10 0.20 0.20	e Upper Edge, H _t = eir Slope Length = leir Slope Length = Area w/o Debris = h Area w/ Debris = h Area w/ Debris = lculated Parameter: utlet Orifice Area = : Orifice Centroid = tor Plate on Pipe = esign Flow Depth = "op of Freeboard = "00 0.213 0.213 0.213 0.213 0.213 0.213 0.213 0.213 0.213 0.213 0.213 0.213 0.213 0.213 0.213 0.213 0.213 0.16 2.8 "O" "O" "O" "O" "O" "O" "O" "O	Calculated Parame Not Selected	Iters for Overflow V Not Selected Image: Select	feet feet feet ff² ff² ff² ff² feet ate ff² ff² feet radians ate 500 Year 3.68 2.124 2.3.8 18.2 0.8 Spillway N/A N/A 78 3.38 0.33 0.900	



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	WOCV [cfs]	FURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
Time Incervar	0:00:00	WQCV [CI3]		2 100 [03]	5 100 [03]		25 100 [03]		100 100 [03]	
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	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:25:00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
	0:30:00	0.00	0.00	0.03	0.21	0.29	1.07	2.78	4.20	12.80
	0:35:00	0.00	0.00	0.11	0.22	0.30	2.48	4.95	7.98	20.57
	0:40:00	0.00	0.00	0.10	0.20	0.29	2.80	5.60	9.14	23.30
	0:45:00	0.00	0.00	0.09	0.18	0.25	2.69	5.37	9.07	23.77
	0:50:00	0.00	0.00	0.08	0.16	0.23	2.45	4.85	8.27	22.61
	0:55:00	0.00	0.00	0.08	0.15	0.21	2.18	4.34	7.42	21.09
	1:00:00	0.00	0.00	0.07	0.13	0.18	1.96	3.91	6.70	19.74
	1:05:00	0.00	0.00	0.06	0.12	0.17	1.77	3.51	6.03	18.54
	1:10:00	0.00	0.00	0.06	0.11	0.15	1.57	3.13	5.39	16.77
	1:15:00	0.00	0.00	0.05	0.10	0.14	1.42	2.83	4.86	15.22
	1:25:00	0.00	0.00	0.05	0.09	0.13	1.29	2.56	4.42	13.79
	1:30:00	0.00	0.00	0.04	0.07	0.12	1.05	2.09	3.59	11.14
	1:35:00	0.00	0.00	0.03	0.06	0.09	0.93	1.85	3.17	9.88
	1:40:00	0.00	0.00	0.03	0.05	0.08	0.81	1.60	2.77	8.65
	1:45:00	0.00	0.00	0.03	0.05	0.07	0.69	1.36	2.36	7.44
	1:50:00	0.00	0.00	0.02	0.04	0.07	0.60	1.20	2.07	6.61
	1:55:00	0.00	0.00	0.02	0.04	0.06	0.55	1.10	1.88	5.98
	2:00:00	0.00	0.00	0.02	0.04	0.06	0.51	1.01	1.73	5.44
	2:05:00	0.00	0.00	0.02	0.03	0.05	0.47	0.93	1.59	4.95
	2:10:00	0.00	0.00	0.02	0.03	0.05	0.43	0.85	1.45	4.49
	2:15:00	0.00	0.00	0.02	0.03	0.04	0.39	0.77	1.31	4.04
	2:25:00	0.00	0.00	0.01	0.02	0.04	0.35	0.68	1.17	3.62
	2:30:00	0.00	0.00	0.01	0.02	0.03	0.36	0.52	0.90	2.82
	2:35:00	0.00	0.00	0.01	0.01	0.02	0.22	0.44	0.76	2.42
	2:40:00	0.00	0.00	0.01	0.01	0.02	0.18	0.36	0.63	2.02
	2:45:00	0.00	0.00	0.00	0.01	0.01	0.14	0.28	0.49	1.62
	2:50:00	0.00	0.00	0.00	0.01	0.01	0.10	0.20	0.36	1.22
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.06	0.12	0.22	0.82
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.03	0.05	0.09	0.45
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.27
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.17
	3.13.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.10
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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
	4:15:00	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
	4:40:00	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
	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
	5:25:00	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 5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00 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

MHFD-Detention, Version 4.06 (July 2022) Summary Stage-Area-Volume-Discharge Relationships

Stage - Storage	Stage	Area	Area	Volume	Volume	Total Outflow	
Description	[ft]	[ft ²]	[acres]	[ft ³]	[ac-ft]	[cfs]	
							For best results, include the
							stages of all grade slope
							from the S-A-V table on
							Sheet 'Basin'.
							Also include the inverts of all
							outlets (e.g. vertical orffice,
							where applicable).
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	-	-					
	-						
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			1	1	1	1	

Ontional

	Project:	Grandview - In	terim
В	asin ID: 1	SB-C3	
	(COMPANY)		
	110	1	
sound and make	- 2		G
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and the second s	Contractor of		

Depth Increment = 1.00 ft

Example Zone Co	onfiguratio	on (Retenti	ion Pond)		Stage - Storage	Stage	Override	Length	Width	Area	Override	Area	Volume	Volume
					Description	(ft)	Stage (ft)	(ft)	(ft)	(ft ²)	Area (ft ²)	(acre)	(ft ')	(ac-ft)
Watershed Information		-			Top of Micropool		0.00				10,186	0.234		
Selected BMP Type =	EDB						1.00				11,822	0.271	11,004	0.253
Watershed Area =	18.56	acres					2.00				13,558	0.311	23,694	0.544
Watershed Length =	1,688	ft					3.00				15,395	0.353	38,170	0.876
Watershed Length to Centroid =	844	ft					4.00				17,333	0.398	54,534	1.252
Watershed Slope =	0.020	ft/ft												
Watershed Imperviousness =	2.00%	percent												
Percentage Hydrologic Soil Group A =	100.0%	percent												
Percentage Hydrologic Soil Group B =	0.0%	nercent												
Percentage Hydrologic Soil Groups C/D =	0.0%	nercent												
Target WOCV Drain Time =	40.0	hours												
Location for 1-br Painfall Denths - Us	er Input	liouis												
	ci input													
After providing required inputs above includ	ing 1-hour	rainfall												
the embedded Colorado Urban Hydrogra	ph Procedu	is using Ire.	Orthogodala					-						
	0.022		Optional Us	er Overrides										
Water Quality Capture Volume (WQCV) =	0.023	acre-feet		acre-feet										
Excess Urban Runoff Volume (EURV) =	0.017	acre-feet		acre-feet										
2-yr Runoff Volume (P1 = 1.19 in.) =	0.010	acre-feet	1.19	inches										
5-yr Runoff Volume (P1 = 1.5 in.) =	0.018	acre-feet	1.50	inches										
10-yr Runoff Volume (P1 = 1.75 in.) =	0.026	acre-feet	1.75	inches										
25-yr Runoff Volume (P1 = 2 in.) =	0.233	acre-feet	2.00	inches										
50-yr Runoff Volume (P1 = 2.25 in.) =	0.469	acre-feet	2.25	inches										
100-yr Runoff Volume (P1 = 2.52 in.) =	0.792	acre-feet	2.52	inches		-								
500-yr Runoff Volume (P1 = 3.68 in.) =	2.321	acre-feet	3.68	inches										
Approximate 2-yr Detention Volume =	0.010	acre-feet		_										
Approximate 5-yr Detention Volume =	0.014	acre-feet												
Approximate 10-yr Detention Volume =	0.020	acre-feet												
Approximate 25-yr Detention Volume -	0.030	acre-feet												
Approximate 50-yr Detention Volume -	0.073	acre-feet												
Approximate 100 yr Detention Volume =	0.201	acro-foot				-		-	-	-				
Approximate 100-yr Detention volume =	0.201	Jaci 6-1661												
Define Zones and Basin Geometry		٦												
Zone 1 Volume (WQCV) =	0.023	acre-feet												
Select Zone 2 Storage Volume (Optional) =		acre-feet	Total dete	ntion										
Select Zone 3 Storage Volume (Optional) =		acre-feet	volume is	less than										
Total Detention Basin Volume =	0.023	acre-feet	100-year	volume.										
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 (STC) =	user	ft/ft												
Slopes of Main Basin Sides (Smain) =	user	H:V												
Basin Length-to-Width Patio (Pran) -	user													
busin cengur to widdi hado (kc/w) =	0501	1												
Initial Curchange Area (A)		a.2												
Initial Surcharge Area $(A_{ISV}) =$	user	π-						-						
Surcharge Volume Length (L _{ISV}) =	user	π												
Surcharge Volume Width (W _{ISV}) =	user	ft												
Depth of Basin Floor (H _{FLOOR}) =	user	π.												
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												
· war		-						-						
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	DE	TENTION	Basin Out	LEI SIRU	CIURE DES	SIGN			
			HFD-Detention, V	ersion 4.06 (July 2	2022)				
Project:	Grandview - Inter	im							
Basin ID:	138-03			- ·· · ·	- ·· · ·				
(2001.)				Estimated	Estimated	Outlat Turna			
HOUSE NEW TIME				Stage (IL)	volume (ac-it)		1		
TenTer			Zone 1 (WQCV)	0.10	0.023	Orifice Plate			
1 maines	DRIPCK		Zone 2						
Performance OMPICES			Zone 3						
Example Zone	Configuration (Re	tention Pond)		Total (all zones)	0.023				
User Input: Orifice at Underdrain Outlet (typicall	y used to drain WQ	CV in a Filtration Bl	<u>1P)</u>				Calculated Parame	ters for Underdrain	
Underdrain Orifice Invert Depth =	N/A	ft (distance below	the filtration media	surface)	Underd	rain Orifice Area =	N/A	ft ²	
Underdrain Orifice Diameter =	N/A	inches			Underdrain	Orifice Centroid =	N/A	feet	
User Input: Orifice Plate with one or more orific	es or Elliptical Slot	Weir (typically used	to drain WQCV and	d/or EURV in a sedi	mentation BMP)		Calculated Parame	ters for Plate	
Centroid of Lowest Orifice =	0.00	ft (relative to basir	bottom at Stage =	0π) 0 θ	WQ Orific	ce Area per Row =	1.438E-02	ft ^e	
Orifice Plate: Orifice Vertical Spacing -	0.10	It (relative to basir	bottom at Stage =	0π)	Ellip	cical Haif-Width =	N/A	feet	
Orifice Plate: Orifice Area per Pow -	2.00	inches sa inches (diamet	r = 1.5/8 inches)		Ellipti		N/A	4 ²	
office flate. Office Area per tow =	2.07	sq. menes (diamet	a = 1 5/0 menes)			ilptical Slot Area =	N/A	lic	
User Input: Stage and Total Area of Each Orific	Row (numbered f	rom lowest to high	st)						
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)]
Stage of Orifice Centroid (ft)	0.00	0.30	0.60	0.90	1.20	non o (optional)	(optional)	non e (optional)	
Orifice Area (sg. inches)	2.07	2.07	2.07	2.07	2.07				
(
	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 Rectange	ular)						Calculated Parame	ters for Vertical Ori	fice
	Not Selected	Not Selected					Not Selected	Not Selected	_
Invert of Vertical Orifice =			ft (relative to basin	bottom at Stage =	0 ft) Ver	tical Orifice Area =			ft ²
Depth at top of Zone using Vertical Orifice =			ft (relative to basin	bottom at Stage =	= 0 ft) Vertical	Orifice Centroid =			feet
Vertical Orifice Diameter =			inches						
User Input: Overflow Weir (Drephox with Elet a	r Sloped Crate and	Outlot Dipo OD Do	tangular/Trangzoid	al Wair and No Out	lot Dipo)		Calculated Darama	tors for Overflow M	loir
User Input: Overnow Weir (Dropbox with Flat o	Not Solocted	Not Solocted	tangular/ mapezolu		<u>iet Pipe)</u>		Calculated Parame	Net Celested	
Overflow Weir Front Edge Height Ho -	Not Selected	NOL Selected	ft (rolativo to bacin b	ottom at Stago = 0 f	+) Height of Grate	Upper Edge H	NOL SEIECLEU	NOT Selected	foot
Overflow Weir Front Edge Length =			feet	ottom at Stage – 0 i	Overflow W	eir Slone Length =			feet
Overflow Weir Grate Slope =			H:V	Gr	ate Open Area / 10)-vr Orifice Area =			
Horiz. Length of Weir Sides =			feet	0	verflow Grate Open	Area w/o Debris =			ft ²
Overflow Grate Type =				C	verflow Grate Oper	Area w/ Debris =			ft ²
Debris Clogging % =			%						
55 5									
User Input: Outlet Pipe w/ Flow Restriction Plate	(Circular Orifice, R	estrictor Plate, or R	ectangular Orifice)		Cal	culated Parameters	s for Outlet Pipe w/	Flow Restriction Pl	ate
	Not Selected	Not Selected					Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =			ft (distance below ba	isin bottom at Stage	= 0 ft) Ou	tlet Orifice Area =			ft ²
Circular Orifice Diameter =			inches		Outlet	Orifice Centroid =			feet
				Half-Cent	ral Angle of Restrict	or Plate on Pipe =	N/A	N/A	radians
User Input: Emergency Spillway (Rectangular or	Trapezoidal)						Calculated Parame	ters for Spillway	
Spillway Invert Stage=	3.00	It (relative to basir	bottom at Stage =	Uft)	Spillway De	esign Flow Depth=	0.22	teet	
Spillway Crest Length =	26.00	feet					4))	teet	
Spiliway End Siopes =	4 00			op of Freeboard =	1.22				
Events and all and Mary Water Conferen	4.00	H:V			Stage at T Basin Area at T	op of Freeboard = op of Freeboard =	0.40	acres	
Freeboard above Max Water Surface =	4.00 1.00	H:V feet			Stage at T Basin Area at T Basin Volume at T	op of Freeboard = op of Freeboard = op of Freeboard =	0.40	acres acre-ft	
Freeboard above Max Water Surface =	4.00 1.00	H:V feet			Stage at T Basin Area at T Basin Volume at T	op of Freeboard = op of Freeboard = op of Freeboard =	0.40	acres acre-ft	
Freeboard above Max Water Surface = Routed Hydrograph Results	4.00 1.00 The user can over	H:V feet <i>ride the default CUI</i>	HP hydrographs and	l runoff volumes by	Stage at T Basin Area at T Basin Volume at T entering new value	op of Freeboard = op of Freeboard = op of Freeboard = es in the Inflow Hyd	0.40 1.25 drographs table (Cd	acres acre-ft olumns W through J	4 <i>F).</i>
Freeboard above Max Water Surface = <u>Routed Hydrograph Results</u> Design Storm Return Period =	4.00 1.00 The user can over WQCV	H:V feet <i>ride the default CUI</i> EURV	<i>HP hydrographs and</i> 2 Year	l runoff volumes by 5 Year	Stage at T Basin Area at T Basin Volume at T <i>entering new value</i> 10 Year	op of Freeboard = op of Freeboard = op of Freeboard = <u>es in the Inflow Hyd</u> 25 Year	0.40 1.25 drographs table (Co 50 Year	acres acre-ft <i>olumns W through ,</i> 100 Year	4 <i>F).</i> 500 Year
Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = Current Statement Statem	4.00 1.00 The user can over WQCV N/A	H:V feet <i>ride the default CUI</i> EURV N/A	<i>IP hydrographs and</i> 2 Year 1.19	f runoff volumes by 5 Year 1.50	Stage at T Basin Area at T Basin Volume at T Ventering new value 10 Year 1.75	op of Freeboard = op of Freeboard = op of Freeboard = es in the Inflow Hype 25 Year 2.00	0.40 1.25 drographs table (CC 50 Year 2.25	acres acre-ft blumns W through / 100 Year 2.52	4 <i>F).</i> 500 Year 3.68
Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (arcreft) = Inflow Hydrograph Volume (arcreft) =	4.00 1.00 <i>The user can over</i> WQCV N/A 0.023 N/A	H:V feet <u>ide the default CUI</u> EURV N/A 0.017 N/A	<i>IP hydrographs and</i> 2 Year 1.19 0.010 0.010	1 runoff volumes by 5 Year 1.50 0.018 0.018	Stage at T Basin Area at T Basin Volume at T entering new value 10 Year 1.75 0.026 0.026	op of Freeboard = op of Freeboard = op of Freeboard = <u>es in the Inflow Hyte</u> 25 Year 2.00 0.233 0.233	0.40 1.25 drographs table (Cd 50 Year 2.25 0.469 0.469	acres acre-ft 100 Year 2.52 0.792 0.792	4 <i>F).</i> 500 Year 3.68 2.321 2.321
Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = CUHP Predevelopment Peak O (cfs) =	4.00 1.00 <i>The user can over</i> WQCV N/A 0.023 N/A N/A	H:V feet EURV N/A 0.017 N/A N/A	<i>IP hydrographs and</i> 2 Year 1.19 0.010 0.010 0.1	1 runoff volumes by 5 Year 1.50 0.018 0.018 0.2	Stage at T Basin Area at T Basin Volume at T Ventering new value 10 Year 1.75 0.026 0.026 0.3	op of Freeboard = op of Freeboard = op of Freeboard = <u>es in the Inflow Hyv</u> <u>25 Year</u> 2.00 0.233 0.233 2.6	0.40 1.25 drographs table (Cd 50 Year 2.25 0.469 0.469 5.3	acres acre-ft 100 Year 2.52 0.792 0.792 8.8	4 <i>F).</i> 3.68 2.321 2.321 2.3.0
Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs)	4.00 1.00 <i>The user can over</i> WQCV N/A 0.023 N/A N/A N/A	H:V feet EURV N/A 0.017 N/A N/A N/A	<i>IP hydrographs and</i> 2 Year 1.19 0.010 0.010 0.1	1 runoff volumes by 5 Year 1.50 0.018 0.018 0.2	Stage at T Basin Area at T Basin Volume at T eentering new valuu 10 Year 1.75 0.026 0.026 0.3	op of Freeboard = op of Freeboard = op of Freeboard = <u>es in the Inflow Hyy</u> <u>25 Year</u> <u>2.00</u> 0.233 0.233 <u>2.6</u>	0.40 1.25 drographs table (Cd 50 Year 2.25 0.469 0.469 5.3	acres acre-ft 100 Year 2.52 0.792 0.792 8.8	4 <i>F).</i> 3.68 2.321 2.321 23.0
Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) =	4.00 1.00 <i>The user can over</i> WOCV N/A 0.023 N/A N/A N/A N/A N/A N/A	H:V feet EURV N/A 0.017 N/A N/A N/A N/A N/A	IP hydrographs and 2 Year 1.19 0.010 0.1 0.1	1 runoff volumes by 5 Year 1.50 0.018 0.018 0.2 0.01	Stage at T Basin Area at T Basin Volume at T <i>entering new valuu</i> 10 Year 1.75 0.026 0.026 0.3 0.02 0.3	op of Freeboard = op of Freeboard = op of Freeboard = <u>es in the Inflow Hyy</u> <u>25 Year</u> 2.00 0.233 0.233 2.6 0.14	0.40 1.25 drographs table (Cd 50 Year 2.25 0.469 0.469 5.3 0.28 0.28	acres acre-ft 100 Year 2.52 0.792 0.792 8.8 0.47	4F). 500 Year 3.68 2.321 2.321 2.30
Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak	4.00 1.00 <i>The user can over</i> N/A 0.023 N/A N/A N/A N/A N/A N/A 0.0	H:V feet <i>ide the default CUI</i> N/A 0.017 N/A N/A N/A N/A N/A 0.0	P hydrographs and 2 Year 1.19 0.010 0.1 0.1 0.01 0.1 0.0	1 runoff volumes by 5 Year 1.50 0.018 0.2 0.01 0.2	Stage at T Basin Area at T Basin Volume at T <i>v entering new valuu</i> 10 Year 1.75 0.026 0.3 0.02 0.3 0.02 0.3	op of Freeboard = op of Freeboard = op of Freeboard = <u>es in the Inflow Hyy</u> <u>25 Year</u> 2.00 0.233 0.233 2.6 0.14 2.6 0.1	0.40 1.25 drographs table (CC 50 Year 2.25 0.469 0.469 5.3 0.28 5.3 0.3	acres acre-ft 100 Year 2.52 0.792 0.792 8.8 0.47 8.8 0.5	4 <i>F</i>). 500 Year 3.68 2.321 2.321 2.30 1.24 2.3.0 16.9
Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Inflow Q (cfs) = Ratio Peak Outflow to Predevelopment O =	4.00 1.00 <i>The user can overs</i> WOCV N/A 0.023 N/A N/A N/A N/A N/A N/A N/A N/A	H:V feet <i>EURV</i> N/A 0.017 N/A N/A N/A N/A N/A N/A N/A N/A	IP hydrographs and 2 Year 1.19 0.010 0.010 0.1 0.01 0.01 0.01 0.1 0.01 0.1 0.01 0.1 0.1	1 runoff volumes by 5 Year 1.50 0.018 0.2 0.01 0.2 0.0 0.1	Stage at T Basin Area at T Basin Volume at T <i>entering new valuu</i> <i>i o Year</i> 1.75 0.026 0.3 0.02 0.3 0.0 0.1	op of Freeboard = op of Freeboard = op of Freeboard = <u>es in the Inflow Hyy</u> <u>25 Year</u> <u>2.00</u> 0.233 0.233 2.6 0.14 2.6 0.1 0.1	0.40 1.25 drographs table (CC 50 Year 2.25 0.469 0.469 5.3 0.28 5.3 0.3 0.1	acres acre-ft 100 Year 2.52 0.792 0.792 8.8 0.47 8.8 0.47 8.8 0.5 0.1	4F). 500 Year 3.68 2.321 2.321 2.321 1.24 23.0 16.9 0.7
Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Inflow Q (cfs) = Peak Outflow to Predevelopment Q = Structure Controlling Flow =	4.00 1.00 The user can over WOCV N/A 0.023 N/A N/A N/A N/A N/A N/A N/A N/A	H:V feet N/A URV N/A 0.017 N/A N/A N/A N/A N/A N/A N/A N/A Plate	HP hydrographs and 2 Year 1.19 0.010 0.010 0.1 0.01 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	1 runoff volumes by 5 Year 1.50 0.018 0.018 0.2 0.01 0.2 0.01 0.2 0.01 0.2 0.01 0.2	Stage at T Basin Area at T Basin Volume at T <i>ventering new valuu</i> 10 Year 1.75 0.026 0.3 0.02 0.3 0.02 0.3 0.01 Plate	op of Freeboard = op of Freeboard = op of Freeboard = <u>es in the Inflow Hyo</u> <u>25 Year</u> 2.00 0.233 0.233 2.6 0.14 2.6 0.1 0.1 0.1 Plate	0.40 1.25 drographs table (CC 50 Year 2.25 0.469 0.469 5.3 0.28 5.3 0.28 5.3 0.3 0.1 Plate	acres acre-ft 100 Year 2.52 0.792 0.792 8.8 0.47 8.8 0.5 0.1 Plate	4F). 500 Year 3.68 2.321 2.321 2.321 2.30 1.24 23.0 16.9 0.7 Spillway
Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) =	4.00 1.00 The user can over WOCV N/A 0.023 N/A N/A N/A N/A N/A N/A N/A N/A	H:V feet N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	1/P hydrographs and 2 Year 1.19 0.010 0.010 0.1 0.1 0.1 0.1 0.1 0.1 N/A Plate N/A N/A	1 runoff volumes by 5 Year 1.50 0.018 0.2 0.01 0.2 0.01 0.2 0.01 0.2 0.1 Plate N/A	Stage at T Basin Area at T Basin Volume at T <i>entering new valuu</i> 10 Year 1.75 0.026 0.026 0.026 0.3 0.02 0.3 0.02 0.3 0.0 0.1 Plate N/A	op of Freeboard = op of Freeboard = op of Freeboard = <u>es in the Inflow Hype</u> <u>25 Year</u> 2.00 0.233 0.233 2.6 0.14 2.6 0.1 0.1 Plate N/A	0.40 1.25 1.25 1.25 0.469 0.469 0.469 0.469 0.469 0.469 0.469 0.469 0.469 0.469 0.469 0.469 0.469 0.469 0.40	acres acres acre-ft 100 Year 2.52 0.792 0.792 8.8 0.47 8.8 0.47 8.8 0.47 Plate N/A	4F). 500 Year 3.68 2.321 2.321 2.30 1.24 23.0 16.9 0.7 Spillway N/A
Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Teffow Volume (hourse)	4.00 1.00 The user can over WQCV N/A 0.023 N/A N/A N/A N/A N/A N/A N/A N/A	H:V feet <i>EURV</i> N/A 0.017 N/A N/A N/A N/A N/A N/A N/A N/A	IP hydrographs and 2 Year 1.19 0.010 0.01 0.1 0.01 N/A Plate N/A N/A 18	1 runoff volumes by 5 Year 1.50 0.018 0.2 0.01 0.2 0.01 0.2 0.0 0.1 Plate N/A N/A N/A 22	Stage at T Basin Area at T Basin Volume at T <i>v entering new valuu</i> 10 Year 1.75 0.026 0.026 0.026 0.02 0.02 0.0 0.02 0.0 0.1 Plate N/A N/A 25	op of Freeboard = op of Freeboard = op of Freeboard = <u>es in the Inflow Hyce</u> 25 Year 2.00 0.233 0.233 2.6 0.14 2.6 0.1 0.1 Plate N/A N/A N/A	0.40 1.25 <i>chographs table (Co</i> 50 Year 2.25 0.469 0.469 5.3 0.28 5.3 0.3 0.1 Plate N/A N/A	acres acre-ft 100 Year 2.52 0.792 0.792 8.8 0.47 8.8 0.47 8.8 0.5 0.1 Plate N/A N/A N/A 61	4F). 500 Year 3.68 2.321 2.321 2.30 1.24 23.0 16.9 0.7 Spillway N/A N/A N/A
Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Outflow to Predevelopment Q = Ratio Peak Outflow to Predevelopment Q = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 1 (fps) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 99% of Inflow Volume (hours)	4.00 1.00 The user can over WQCV N/A 0.023 N/A N/A N/A N/A N/A N/A N/A Plate N/A N/A N/A 23 27	H:V feet <i>EURV</i> N/A 0.017 N/A N/A N/A N/A N/A N/A N/A N/A	IP hydrographs and 2 Year 1.19 0.010 0.01 0.1 0.01 0.1 0.1 0.1 0.1 0.1 1.19 0.11 0.1 0.1 0.1 0.1 1.1 18 22	1 runoff volumes by 5 Year 1.50 0.018 0.2 0.01 0.2 0.01 0.2 0.01 0.2 0.01 0.2 0.01 Plate N/A N/A N/A 22 26	Stage at T Basin Area at T Basin Volume at T <i>entering new valuu</i> 10 Year 1.75 0.026 0.026 0.026 0.026 0.02 0.3 0.02 0.3 0.02 0.3 0.0 0.1 Plate N/A N/A N/A N/A 25 29	op of Freeboard = op of Freeboard = op of Freeboard = <u>es in the Inflow Hype</u> <u>25 Year</u> 2.00 0.233 2.6 0.14 2.6 0.1 0.1 Plate N/A N/A N/A 60	1.22 0.40 1.25 50 Year 2.25 0.469 0.469 5.3 0.28 5.3 0.3 0.1 Plate N/A N/A 59 67	acres acres acre-ft 100 Year 2.52 0.792 0.792 8.8 0.47 8.8 0.47 8.8 0.5 0.1 Plate N/A N/A 61 72	4F). 3.68 2.321 2.321 2.30 1.24 2.3.0 16.9 0.7 Spillway N/A N/A 47 66
Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) = Maximum Ponding Depth (ft) =	4.00 1.00 The user can over WQCV N/A 0.023 N/A N/A N/A N/A N/A N/A Plate N/A N/A N/A 23 27 0.10	H:V feet <i>EURV</i> N/A N/A N/A N/A N/A N/A N/A N/A	IP hydrographs and 2 Year 1.19 0.010 0.1 0.01 0.1 0.01 0.1 1.19 0.10 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 1.19 1.19 1.10 1.10 1.10 1.11 1.12 1.13 1.14 1.15 1.15 1.10 1.10 1.10 1.10 1.10 1.10 1.10 1.10 1.11 1.11 1.12 1.13 1.14 1.15 1.15 1.15 1.15 1.15	1 runoff volumes by 5 Year 1.50 0.018 0.2 0.01 0.2 0.01 0.2 0.0 0.1 Plate N/A N/A N/A 22 26 0.06	Stage at T Basin Area at T Basin Volume at T 0 Year 1.75 0.026 0.3 0.02 0.3 0.0 0.1 Plate N/A N/A 25 29 0.09	op of Freeboard = op of Freeboard = op of Freeboard = <u>es in the Inflow Hyve</u> <u>25 Year</u> 2.00 0.233 2.6 0.14 2.6 0.1 0.1 Plate N/A N/A 54 60 0.83	1.22 0.40 1.25 50 Year 2.25 0.469 0.469 5.3 0.28 5.3 0.3 0.1 Plate N/A N/A 59 67 1.57	acres acre-ft 100 Year 2.52 0.792 0.792 8.8 0.47 8.8 0.5 0.1 Plate N/A N/A 61 72 2.50	4F). 3.68 2.321 2.321 2.320 1.24 2.30 16.9 0.7 Spillway N/A N/A 47 66 3.34
Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 99% of Inflow Volume (hours) = Maximum Ponding Depth (ft) = Area at Maximum Ponding Depth (acres) =	4.00 1.00 The user can over WQCV N/A 0.023 N/A N/A N/A N/A N/A N/A N/A Plate N/A N/A 23 27 0.10 0.24 0.25	H:V feet <i>EURV</i> N/A 0.017 N/A N/A N/A N/A N/A N/A N/A Plate N/A N/A Plate N/A 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	IP hydrographs and 2 Year 1.19 0.010 0.1 0.01 0.1 0.01 0.1 0.1 0.1 0.01 0.1 0.03 0.23	1 runoff volumes by 5 Year 1.50 0.018 0.2 0.01 0.2 0.01 0.2 0.0 0.1 Plate N/A N/A N/A 22 26 0.06 0.24	Stage at T Basin Area at T Basin Volume at T <i>entering new valuu</i> <u>10 Year</u> <u>1.75</u> <u>0.026</u> <u>0.026</u> <u>0.026</u> <u>0.026</u> <u>0.026</u> <u>0.026</u> <u>0.026</u> <u>0.026</u> <u>0.026</u> <u>0.026</u> <u>0.026</u> <u>0.03</u> <u>0.02</u> <u>0.03</u> <u>0.01</u> <u>Plate</u> <u>N/A</u> <u>N/A</u> <u>N/A</u> <u>N/A</u> <u>0.09</u> <u>0.024</u> <u>29</u> <u>0.09</u> <u>0.245</u>	op of Freeboard = op of Freeboard = op of Freeboard = <u>es in the Inflow Hyy</u> <u>25 Year</u> 2.00 0.233 0.233 2.6 0.14 2.6 0.1 0.1 Plate N/A N/A N/A 54 60 0.83 0.27	1.22 0.40 1.25 50 Year 2.25 0.469 0.469 5.3 0.469 5.3 0.469 5.3 0.469 5.3 0.469 5.3 0.469 5.3 0.469 5.3 0.469 5.3 0.40 0.40 5.3 0.3 0.10 5.3 0.3 0.10 5.3 0.3 0.10 5.3 0.3 0.10 5.3 0.3 0.10 5.3 0.3 0.10 5.3 0.3 0.10 5.3 0.3 0.10 5.3 0.3 0.10 5.3 0.3 0.1 0.3 0.1 0.3 0.1 0.3 0.2 0.3 0.1 0.3 0.2 0.3 0.1 0.3 0.1 0.3 0.3 0.1 0.3 0.2 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3	acres acre-ft 100 Year 2.52 0.792 0.792 0.792 8.8 0.47 8.8 0.5 0.1 Plate N/A N/A 61 72 2.50 0.33	4F). 3.68 2.321 2.321 2.30 1.24 2.30 16.9 0.7 Spillway N/A N/A 47 66 3.34 0.37 2.57

these should be close to rational calculations



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	WOCV [cfs]	FURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
Time Incervar	0.00.00	WQCV [CI3]		2 100 [03]	5 100 [03]		25 100 [03]		100 100 [03]	
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	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	0.23.00	0.00	0.00	0.04	0.11	0.16	0.03	0.06	0.08	10.90
	0:35:00	0.00	0.00	0.10	0.13	0.27	0.91	2.57	3.30	10.90
	0:40:00	0.00	0.00	0.11	0.21	0.23	2.22	5.28	8.61	21.96
	0:45:00	0.00	0.00	0.10	0.18	0.26	2.60	5.22	8.77	22.97
	0:50:00	0.00	0.00	0.09	0.17	0.23	2.46	4.90	8.32	22.65
	0:55:00	0.00	0.00	0.08	0.15	0.21	2.23	4.43	7.56	21.23
	1:00:00	0.00	0.00	0.07	0.14	0.20	2.01	4.02	6.88	20.08
	1:05:00	0.00	0.00	0.07	0.13	0.18	1.85	3.68	6.32	19.16
	1:10:00	0.00	0.00	0.06	0.12	0.16	1.69	3.36	5.76	17.69
	1:15:00	0.00	0.00	0.06	0.11	0.15	1.52	3.03	5.21	16.07
	1:20:00	0.00	0.00	0.05	0.10	0.14	1.39	2.77	4.75	14.71
	1:25:00	0.00	0.00	0.05	0.09	0.13	1.28	2.55	4.37	13.51
	1:30:00	0.00	0.00	0.04	0.08	0.12	1.18	2.35	4.03	12.39
	1:35:00	0.00	0.00	0.04	0.08	0.11	1.08	2.16	3.69	11.34
	1:40:00	0.00	0.00	0.04	0.07	0.10	0.99	1.96	3.36	10.33
	1:40:00	0.00	0.00	0.03	0.06	0.09	0.89	1.77	3.03	9.33
	1.50:00	0.00	0.00	0.03	0.05	0.08	0.79	1.5/	2.70	0.34
	2:00:00	0.00	0.00	0.03	0.05	0.0/	0.70	1.30	2.3/	6 51
	2:05:00	0.00	0.00	0.02	0.04	0.06	0.01	1.20	1.87	5.91
	2:10:00	0.00	0.00	0.02	0.04	0.06	0.55	1.05	1.74	5.43
	2:15:00	0.00	0.00	0.02	0.04	0.05	0.48	0.95	1.62	5.01
	2:20:00	0.00	0.00	0.02	0.03	0.05	0.44	0.88	1.50	4.62
	2:25:00	0.00	0.00	0.02	0.03	0.04	0.41	0.82	1.39	4.26
	2:30:00	0.00	0.00	0.01	0.03	0.04	0.38	0.75	1.28	3.91
	2:35:00	0.00	0.00	0.01	0.03	0.04	0.34	0.68	1.17	3.57
	2:40:00	0.00	0.00	0.01	0.02	0.03	0.31	0.62	1.06	3.25
	2:45:00	0.00	0.00	0.01	0.02	0.03	0.28	0.55	0.95	2.93
	2:50:00	0.00	0.00	0.01	0.02	0.02	0.25	0.49	0.84	2.61
	2:55:00	0.00	0.00	0.01	0.01	0.02	0.21	0.42	0.73	2.28
	3:00:00	0.00	0.00	0.01	0.01	0.02	0.18	0.36	0.62	1.96
	3:05:00	0.00	0.00	0.01	0.01	0.01	0.15	0.29	0.51	1.64
	3:10:00	0.00	0.00	0.00	0.01	0.01	0.12	0.23	0.40	1.32
	3.13.00	0.00	0.00	0.00	0.00	0.01	0.09	0.16	0.29	1.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.08	0.68
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.08	0.37
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.14
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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
	4:25:00	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
	4:50:00	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
	5:15:00	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
	5:40:00	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

MHFD-Detention, Version 4.06 (July 2022) Summary Stage-Area-Volume-Discharge Relationships

Stage - Storage Description	Stage	Area	Area	Volume	Volume	Total Outflow	
	լπյ	[ft*]	[acres]	[ft ⁻]	[ac-π]	[CTS]	
							For best results, include the
							changes (e.g. ISV and Floor)
							from the S-A-V table on
							Sheet 'Basin'.
							Also include the inverts of all
							outlets (e.g. vertical orifice,
							overflow grate, and spillway,
				<u> </u>			
]
				-			
							l

	Project: Grandview - Interim	
	Basin ID: TSB-D1	
	(and)	
227 SS - ST		
etters and and		4
	- unit	-
research of the	State 1 March Sweece	

5 Depth Increment = 1.00 ft

Example Zone Configuration (Retention Pond)					Stage - Storage	Stage	Override	Length	Width	Area	Override	Area	Volume	Volume
Watershed Information					Description Top of Micropool	(ft) 	Stage (ft)	(ft) 	(ft) 	(ft*) 	Area (ft *) 7442	(acre) 0.171	(ft ²)	(ac-ft)
Colocted PMP Type -	EDB						1.00				0 522	0.210	9.497	0.105
Netershed Area -	10.96					-	2.00				11.050	0.219	10 172	0.155
Watershed Length -	10.00	acres				-	2.00				11,050	0.272	19,172	0.742
Watershed Length to Controld =	1,703	н Ф				-	3.00				17,450	0.332	49 200	1 107
Watershed Slope -	0.016	£/A				-	4.00				17,290	0.397	40,200	1.107
Watershed Imperviousness =	2.00%	percent												
Percentage Hydrologic Soil Group A =	100.0%	percent												
Percentage Hydrologic Soil Group B =	0.0%	percent												
Percentage Hydrologic Soil Groups C/D =	0.0%	percent												
Target WQCV Drain Time =	40.0	hours												
Location for 1-hr Rainfall Depths = User Input					-			-						
After providing required inputs above including 1-hour rainfall														
depths, click 'Run CUHP' to generate run	off hydrograph	ns using												
the embedded Colorado Urban Hydro	graph Proced	ure.	Optional Use	er Overrides										
Water Quality Capture Volume (WQCV) =	0.014	acre-feet		acre-feet										
Excess Urban Runoff Volume (EURV) =	0.010	acre-feet		acre-feet										
2-yr Runoff Volume (P1 = 1.19 in.) =	0.006	acre-feet	1.19	inches										
5-yr Runoff Volume (P1 = 1.5 In.) =	0.011	acre-reet	1.50	inches										
10-yr Runoff Volume (P1 = 1.75 In.) =	0.015	acre-reet	1.75	inches										
25-yr Runoff Volume (P1 = 2 III.) = 50-yr Runoff Volume (P1 = 2 25 in.) =	0.137	acre-feet	2.00	inches										
100 -vr Runoff Volume (P1 = 2.52 in.) =	0.275	acre-feet	2.23	inches										
500-vr Runoff Volume (P1 = 3.68 in.) =	1.359	acre-feet	3.68	inches										
Approximate 2-vr Detention Volume =	0.006	acre-feet												
Approximate 5-yr Detention Volume =	0.008	acre-feet												
Approximate 10-yr Detention Volume =	0.012	acre-feet												
Approximate 25-yr Detention Volume =	0.017	acre-feet												
Approximate 50-yr Detention Volume =	0.043	acre-feet												
Approximate 100-yr Detention Volume =	0.117	acre-feet												
		•												
Define Zones and Basin Geometry														
Zone 1 Volume (WQCV) =	0.014	acre-feet				-								
Select Zone 2 Storage Volume (Optional) =		acre-feet	Total dete	ntion										
Select Zone 3 Storage Volume (Optional) =		acre-feet	volume is	less than										
Total Detention Basin Volume =	0.014	acre-feet	100-year v	/olume.										
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 (Smain) =	user	H:V				-								
Basin Length-to-width Ratio $(R_{L/W}) =$	user					-								
Initial Surchargo Aroa (A) =	ucor	a 2												
Surcharge Volume Length (L) =	user					-								
Surcharge Volume Width (Wrov) =	user	n -												
Depth of Basin Floor ($H_{\rm HOOR}$) =	user	ft												
Length of Basin Floor (Lenger) =	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				1								
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												
						-								
						-								
												-		
						-								
						-								
]
						-								
]
						-								
						-								
					1									



		٨	1HFD-Detention, V	ersion 4.06 (July J	2022)				
Project:	Grandview - Inter	im							
Basin ID:	TSB-D1								
20ml 1				Estimated	Estimated				
Home T and the second		-		Stage (ft)	Volume (ac-ft)	Outlet Type	_		
NOTTHE BOAN MODA		-	Zone 1 (WQCV)	0.08	0.014	Orifice Plate			
	-100 FEAR		Zone 2						
2041 1 HOLD 2	DEPICE		Zone 3						
Example Zone	Configuration (Re	tention Pond)	Zone 5	Total (all zonoc)	0.014		1		
Llook Innuite Orifico at Undordenin Outlat (braine)	used to due in WC	C) / in a Filtration B	MD)	Total (all 2011es)	0.014	J	Coloulated Davame	tors for Undordening	
Underdrein Orifice Invert Denth		t (distance below	<u>IMP)</u> the filtration media	autoco)	Undow	Innin Orifica Aron -			<u>l</u>
	N/A	inches		surface)	Underdrain		N/A	Π foot	
Underdrain Unite Diameter -	IN/A	inches			Underdrain		N/A	leet	
Licor Input: Orifice Plate with one or more orific	oc or Elliptical Slot	Woir (typically use	to drain WOCV an	d/or EUDV in a codi	imontation RMD)			taua fau Diata	
Oser Input. Office Flate with one of Hore of Inde		ft (rolativo to basi				co Aron por Bow -		cters for Plate	
Depth at tap of Zono using Orifice Plate -	0.00	ft (relative to basi	hottom at Stage -	- 0 ft)	WQ UIII	ntical Half Width -	5.139E-03	π foot	
Orifice Plate: Orifice Vertical Spacing -	4.00	inches	i bolloni al Slage -	- 0 10)	Ellipti	ical Slot Centroid -	N/A	feet	
Orifice Plate: Orifice Area per Bow	4.00	inches ca. inches (diamet	r = 1E/16 inch)		Ellipti		N/A	neel a2	
Office Plate. Office Area per Row -	0.74	sq. inches (ulainet	er – 15/10 mcn)		L	iliptical Slot Alea –	N/A	π	
User Input: Stage and Total Area of Each Unific	e Row (numbered)	rom lowest to high	est)						1
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row / (optional)	Row 8 (optional)	
Stage of Orifice Centroid (ft)	0.00	0.30	0.60	0.90	1.20				-
Orifice Area (sq. inches)	0.74	0.74	0.74	0.74	0.74				
		r	1	1	r	1	1	1	1
	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 Rectang	ular)		7				Calculated Parame	ters for Vertical Ori	ifice
	Not Selected	Not Selected					Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basir	n bottom at Stage =	= 0 ft) Ver	tical Orifice Area =			ft ²
Depth at top of Zone using Vertical Orifice =			ft (relative to basir	n bottom at Stage =	= 0 ft) Vertica	Orifice Centroid =			feet
Vertical Orifice Diameter =			inches						
User Input: Overflow Weir (Dropbox with Flat o	r Sloped Grate and	Outlet Pipe OR Re	ctangular/Trapezoid	lal Weir and No Out	<u>let Pipe)</u>		Calculated Parame	ters for Overflow V	Veir
	Not Selected	Not Selected					Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =			ft (relative to basin I	bottom at Stage = 0 f	t) Height of Grate	e Upper Edge, $H_t =$			feet
Overflow Weir Front Edge Length =			feet		Overflow W	/eir Slope Length =			feet
Overflow Weir Grate Slope =			H:V	Gr	ate Open Area / 10	0-yr Orifice Area =			
Horiz. Length of Weir Sides =			feet	0\	erflow Grate Open	Area w/o Debris =			ft ²
Overflow Grate Type =				C	Overflow Grate Oper	n Area w/ Debris =			ft ²
Debris Clogging % =			%						
User Input: Outlet Pipe w/ Flow Restriction Plate	e (Circular Orifice, R	estrictor Plate, or F	Rectangular Orifice)		<u>Ca</u>	Iculated Parameter	s for Outlet Pipe w	Flow Restriction P	late
	Not Selected	Not Selected					Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =			ft (distance below b	asin bottom at Stage	= 0 ft) O	utlet Orifice Area =			ft ²
Circular Orifice Diameter =			inches		Outlet	t Orifice Centroid =			feet
				Half-Cent	ral Angle of Restric	tor Plate on Pipe =	N/A	N/A	radians
User Input: Emergency Spillway (Rectangular or	Trapezoidal)						Calculated Parame	ters for Spillway	
Spillway Invert Stage=	3.00	ft (relative to basi	n bottom at Stage =	= 0 ft)	Spillway D	esign Flow Depth=	0.17	feet	
Spillway Crest Length =	16.00	feet			Stage at 1	Fop of Freeboard =	4.17	feet	
Spillway End Slopes =	4.00	H:V			Basin Area at T	Fop of Freeboard =	0.40	acres	
Freeboard above Max Water Surface =	1.00	feet			Basin Volume at T	Fop of Freeboard =	1.11	acre-ft	
Poutod Hudrograph Posulta		wide the defends CU	UD budrographs an				drographs table (C	olumna W through	45)
	The user can over			d runoff volumer h	antering new value	lec in the Inflow U.			nı j.
Rouleu Hyurograph Results	The user can over		AP Hyulographs and	d runoff volumes by	entering new valu	es in the Inflow Hy	El Voor	100 Voor	E00 Voor
Design Storm Return Period =	The user can over WQCV N/A	EURV N/A	2 Year 1,19	d runoff volumes by 5 Year 1.50	v entering new valu 10 Year 1.75	25 Year 2,00	50 Year 2,25	100 Year 2,52	500 Year 3.68
Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) =	The user can over WQCV N/A 0.014	EURV N/A 0.010	2 Year 1.19 0.006	d runoff volumes by 5 Year 1.50 0.011	/ entering new valu 10 Year 1.75 0.015	<u>25 Year</u> 2.00 0.137	50 Year 2.25 0.275	100 Year 2.52 0.464	500 Year 3.68 1.359
Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) =	The user can over WQCV N/A 0.014 N/A	EURV N/A 0.010 N/A	2 Year 1.19 0.006 0.006	5 Year 1.50 0.011 0.011	/ entering new valu 10 Year 1.75 0.015 0.015	25 Year 2.00 0.137 0.137	50 Year 2.25 0.275 0.275	100 Year 2.52 0.464 0.464	500 Year 3.68 1.359 1.359
Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) =	The user can over WQCV N/A 0.014 N/A N/A	EURV N/A 0.010 N/A N/A	2 Year 1.19 0.006 0.006 0.0	d runoff volumes by 5 Year 1.50 0.011 0.011 0.1	entering new value 10 Year 1.75 0.015 0.015 0.1	25 Year 2.00 0.137 0.137 1.1	50 Year 2.25 0.275 0.275 2.3	100 Year 2.52 0.464 0.464 3.8	500 Year 3.68 1.359 1.359 10.1
Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) =	The user can over WQCV N/A 0.014 N/A N/A N/A N/A	EURV N/A 0.010 N/A N/A N/A	2 Year 1.19 0.006 0.006 0.0	d runoff volumes by 5 Year 1.50 0.011 0.011 0.1	v entering new valu 10 Year 1.75 0.015 0.015 0.1	25 Year 2.00 0.137 0.137 1.1	50 Year 2.25 0.275 0.275 2.3	100 Year 2.52 0.464 0.464 3.8	500 Year 3.68 1.359 1.359 10.1
Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Flow, q (cfs/acre) =	WQCV N/A 0.014 N/A N/A N/A N/A N/A	EURV N/A 0.010 N/A N/A N/A N/A N/A	2 Year 1.19 0.006 0.006 0.00 0.00 0.00	5 Year 1.50 0.011 0.011 0.1 0.01 0.01	v entering new value 10 Year 1.75 0.015 0.015 0.1 0.01 0.01	Life Inflow Hy 25 Year 2.00 0.137 0.137 0.137 1.1 0.10 1.1	S0 Year 2.25 0.275 0.275 2.3	100 Year 2.52 0.464 0.464 3.8 0.35 3.8	500 Year 3.68 1.359 1.359 10.1 0.93 10.1
Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Inflow C (cfs) =	WQCV N/A 0.014 N/A N/A N/A N/A N/A N/A 0.0	EURV N/A 0.010 N/A N/A N/A N/A N/A 0.0	2 Year 1.19 0.006 0.006 0.00 0.00 0.00 0.0 0.	d runoff volumes by 5 Year 1.50 0.011 0.1 0.01 0.01 0.01	v entering new valu 10 Year 1.75 0.015 0.015 0.1 0.01 0.1 0.0	Inflow Hy 25 Year 2.00 0.137 0.137 1.1 0.10 1.1 0.0	S0 Year 2.25 0.275 0.275 2.3 0.21 2.3 0.1	100 Year 2.52 0.464 0.464 3.8 0.35 3.8 0.1	500 Year 3.68 1.359 1.359 10.1 0.93 10.1 5.0
Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q =	WQCV N/A 0.014 N/A N/A N/A N/A N/A N/A N/A	N/A N/A 0.010 N/A N/A N/A N/A N/A N/A N/A N/A	2 Year 1.19 0.006 0.006 0.00 0.00 0.00 0.0 0.	d runoff volumes by 5 Year 1.50 0.011 0.11 0.01 0.01 0.01 0.01 0.01 0.1 0.0 0.1	v entering new valu 10 Year 1.75 0.015 0.015 0.01 0.01 0.1 0.0 0.1	es in the Inflow Hy 25 Year 2.00 0.137 0.137 1.1 0.10 1.1 0.0 0.0 0.0	Output State Click 50 Year 2.25 0.275 0.275 0.275 2.3 0.21 2.3 0.1 0.0	100 Year 2.52 0.464 3.8 0.35 3.8 0.1 0.0	500 Year 3.68 1.359 1.359 10.1 0.93 10.1 5.0 0.5
Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = CUHP Predevelopment Peak Q (cfs) = Predevelopment Unit Peak RIow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Sufflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow =	N/A N/A	N/A N/A 0.010 N/A Plate	2 Year 1.19 0.006 0.006 0.00 0.00 0.00 0.0 0.	Grunoff volumes by 5 Year 1.50 0.011 0.011 0.01 0.01 0.01 0.01 0.01 0.1 0.1 Plate	ventering new value 10 Year 1.75 0.015 0.015 0.1 0.01 0.1 0.0 0.1	es in the Inflow Hy 25 Year 2.00 0.137 0.137 1.1 0.10 1.1 0.0 0.0 Plate	Output Call <	100 Year 2.52 0.464 0.464 3.8 0.35 3.8 0.1 0.0 Plate	500 Year 3.68 1.359 1.359 10.1 0.93 10.1 5.0 0.5 Spillway
Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = CUHP Predevelopment Peak Q (cfs) = Predevelopment Veak Q (cfs) = Predevelopment Unit Peak RIow, q (cfs/acre) = Peak Inflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q Structure Controlling Flow = Max Velocity through Grate 1 (fps) =	N/A N/A	N/A N/A 0.010 N/A	2 Year 1.19 0.006 0.006 0.00 0.00 0.00 0.0 0.	d runoff volumes by 5 Year 1.50 0.011 0.011 0.01 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	V entering new value 10 Year 1.75 0.015 0.015 0.01 0.1 0.01 0.1 0.1 Plate N/A V/A	es in the Inflow Hy 25 Year 2.00 0.137 0.137 1.1 0.10 1.1 0.0 0.0 Plate N/A V/	Olympic family Call Column (Column) Column) Column)<	100 Year 2.52 0.464 0.464 0.464 0.38 0.35 3.8 0.1 0.0 Plate N/A	500 Year 3.68 1.359 10.1 0.93 10.1 5.0 0.5 Spillway N/A
Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = CUHP Predevelopment Peak Q (cfs) = Predevelopment Peak Q (cfs) = Predevelopment Vak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) =	Wocv N/A 0.014 N/A N/A	N/A N/A 0.010 N/A N/A	2 Year 1.19 0.006 0.006 0.00 0.00 0.00 0.0 0.	d runoff volumes by 5 Year 1.50 0.011 0.011 0.01 0.1 0.1 Plate N/A N/A	v entering new valu 10 Year 1.75 0.015 0.015 0.015 0.01 0.1 0.1 0.1 0.1 Plate N/A N/A N/A 46	es in the Inflow Hy 25 Year 2.00 0.137 0.137 1.1 0.10 1.1 0.0 0.0 Plate N/A N/A 106	Occupient Constraint 2.25 0.275 0.275 0.275 0.21 2.3 0.1 0.0 Plate N/A N/A 110	100 Year 2.52 0.464 0.464 0.464 3.8 0.35 3.8 0.1 0.0 Plate N/A N/A N/A N/A	500 Year 3.68 1.359 1.359 10.1 0.93 10.1 5.0 0.5 Spillway N/A N/A 11E

>120

3.21 0.35 0.813

>120

1.26

0.23

>120

1.95 0.27 0.427



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	WOCV [cfc]	FUDV [cfc]	2 Vear [cfc]	5 Vear [cfc]	10 Vear [cfc]	25 Vear [cfc]	50 Vear [cfc]	100 Vear [cfc]	500 Vear [cfc]
Time Interval	0.00.00									
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	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:25:00	0.00	0.00	0.02	0.04	0.06	0.01	0.02	0.03	0.11
	0:30:00	0.00	0.00	0.04	0.08	0.11	0.36	0.94	1.41	4.31
	0:35:00	0.00	0.00	0.04	0.09	0.12	0.91	1.85	2.96	7.76
	0:40:00	0.00	0.00	0.04	0.09	0.12	1.11	2.22	3.61	9.23
	0:50:00	0.00	0.00	0.04	0.08	0.12	1.12	2.25	3.77	9.87
	0:55:00	0.00	0.00	0.04	0.00	0.11	1.10	2.20	3.57	9.96
	1:00:00	0.00	0.00	0.04	0.07	0.10	0.99	1.98	3 37	9.67
	1:05:00	0.00	0.00	0.03	0.07	0.09	0.92	1.84	3.13	9.30
	1:10:00	0.00	0.00	0.03	0.06	0.09	0.85	1.71	2.92	8.83
	1:15:00	0.00	0.00	0.03	0.06	0.08	0.80	1.61	2.74	8.32
	1:20:00	0.00	0.00	0.03	0.05	0.08	0.76	1.51	2.58	7.82
	1:25:00	0.00	0.00	0.03	0.05	0.07	0.71	1.41	2.41	7.32
	1:30:00	0.00	0.00	0.02	0.05	0.07	0.66	1.32	2.25	6.83
	1:35:00	0.00	0.00	0.02	0.04	0.06	0.61	1.22	2.09	6.34
	1:40:00	0.00	0.00	0.02	0.04	0.06	0.57	1.15	1.96	5.95
	1:45:00	0.00	0.00	0.02	0.04	0.06	0.54	1.09	1.85	5.62
	1:50:00	0.00	0.00	0.02	0.04	0.06	0.51	1.03	1.75	5.30
	1:55:00	0.00	0.00	0.02	0.04	0.05	0.49	0.97	1.65	4.99
	2:00:00	0.00	0.00	0.02	0.03	0.05	0.46	0.91	1.55	4.69
	2:05:00	0.00	0.00	0.02	0.03	0.05	0.43	0.85	1.46	4.40
	2:10:00	0.00	0.00	0.02	0.03	0.04	0.40	0.80	1.36	4.10
	2:15:00	0.00	0.00	0.01	0.03	0.04	0.3/	0.74	1.26	3.82
	2:25:00	0.00	0.00	0.01	0.02	0.04	0.34	0.68	1.16	3.53
	2:30:00	0.00	0.00	0.01	0.02	0.03	0.28	0.55	0.97	2.96
	2:35:00	0.00	0.00	0.01	0.02	0.03	0.26	0.51	0.87	2.67
	2:40:00	0.00	0.00	0.01	0.02	0.03	0.23	0.47	0.80	2.48
	2:45:00	0.00	0.00	0.01	0.02	0.02	0.22	0.44	0.76	2.33
	2:50:00	0.00	0.00	0.01	0.02	0.02	0.21	0.42	0.72	2.20
	2:55:00	0.00	0.00	0.01	0.02	0.02	0.20	0.40	0.69	2.08
	3:00:00	0.00	0.00	0.01	0.01	0.02	0.19	0.38	0.65	1.97
	3:05:00	0.00	0.00	0.01	0.01	0.02	0.18	0.36	0.62	1.87
	3:15:00	0.00	0.00	0.01	0.01	0.02	0.17	0.33	0.59	1.70
	3:20:00	0.00	0.00	0.01	0.01	0.02	0.15	0.31	0.50	1.57
	3:25:00	0.00	0.00	0.01	0.01	0.02	0.14	0.29	0.49	1.48
	3:30:00	0.00	0.00	0.01	0.01	0.01	0.13	0.27	0.46	1.38
	3:35:00	0.00	0.00	0.00	0.01	0.01	0.12	0.25	0.42	1.29
	3:40:00	0.00	0.00	0.00	0.01	0.01	0.12	0.23	0.39	1.19
	3:45:00	0.00	0.00	0.00	0.01	0.01	0.11	0.21	0.36	1.10
	3:50:00	0.00	0.00	0.00	0.01	0.01	0.10	0.19	0.33	1.00
	3:55:00	0.00	0.00	0.00	0.01	0.01	0.09	0.17	0.29	0.90
	4:00:00	0.00	0.00	0.00	0.01	0.01	0.08	0.15	0.26	0.81
	4:05:00	0.00	0.00	0.00	0.00	0.01	0.07	0.13	0.23	0.71
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.05	0.09	0.20	0.52
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.04	0.08	0.13	0.43
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.03	0.06	0.10	0.33
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.07	0.24
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.14
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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
	5:30:00	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
	5:55:00	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

MHFD-Detention, Version 4.06 (July 2022) Summary Stage-Area-Volume-Discharge Relationships

Stage - Storage	Stage	Area	Area	Volume	Volume	Total	
Description	[ft]	[ft ²]	[acres]	[ft ³]	[ac-ft]	[cfs]	
							For best results include the
							stages of all grade slope
	ł – – – – – – – – – – – – – – – – – – –						changes (e.g. ISV and Floor)
							from the S-A-V table on
							Sheet 'Basin'.
							Also include the inverts of all
							overflow grate and spillway
							where applicable).
	-						
	-						
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			ļ	ļ	ļ		
							1
							4
							1
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						1	
						1]

Project:	Grandview	- Interim	Project: Grandview - Interim										
Basin ID:	TSB-E1												
-1-4 1	1		/	V	Depth Inci								
Example Zone	Configurati	on (Retentio	on Pond)		Stage - S Descrip								
Watershed Information					Top of Mi								
Selected BMP Type =	EDB												
Watershed Area =	20.93	acres											
Watershed Length =	2,054	ft											
Watershed Length to Centroid =	1,027	ft											
Watershed Slope =	0.017	ft/ft											
Watershed Imperviousness =	2.00%	percent											
Percentage Hydrologic Soil Group A =	100.0%	percent											
Percentage Hydrologic Soil Group B =	0.0%	percent											
Percentage Hydrologic Soil Groups C/D =	0.0%	percent											
Target WQCV Drain Time =	40.0	hours											
Location for 1-hr Rainfall Depths =	User Input												
After providing required inputs above inc	luding 1-hour	rainfall											
depths, click 'Run CUHP' to generate rund	off hydrograph	is using											
the embedded Colorado Urban Hydro	graph Proced	ure.	Optional User	Overrides									
Water Quality Capture Volume (WQCV) =	0.026	acre-feet		acre-feet									
Europe Linhan Dunoff Volume (EUDV) -	0.020	acre foot		neve feet									

EXCESS OIDAIT KUTIOIT VOIUTTE (EURV) =	0.020	acre-leet	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.011	acre-feet	1.19
5-yr Runoff Volume (P1 = 1.5 in.) =	0.021	acre-feet	1.50
10-yr Runoff Volume (P1 = 1.75 in.) =	0.030	acre-feet	1.75
25-yr Runoff Volume (P1 = 2 in.) =	0.263	acre-feet	2.00
50-yr Runoff Volume (P1 = 2.25 in.) =	0.529	acre-feet	2.25
100-yr Runoff Volume (P1 = 2.52 in.) =	0.894	acre-feet	2.52
500-yr Runoff Volume (P1 = 3.68 in.) =	2.620	acre-feet	3.68
Approximate 2-yr Detention Volume =	0.011	acre-feet	
Approximate 5-yr Detention Volume =	0.016	acre-feet	
Approximate 10-yr Detention Volume =	0.022	acre-feet	
Approximate 25-yr Detention Volume =	0.033	acre-feet	
Approximate 50-yr Detention Volume =	0.082	acre-feet	
Approximate 100-yr Detention Volume =	0.226	acre-feet	

Total de

Define Zones and Basin Geometry		
Zone 1 Volume (WQCV) =	0.026	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.026	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 (Smain) =	user	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	user	
Initial Surcharge Area (A _{ISV}) =	user	ft ²
Surcharge Volume Length $(L_{ISV}) =$	user	ft
Surcharge Volume Width $(W_{ISV}) =$	user	ft
Depth of Basin Floor $(H_{FLOOR}) =$	user	ft
Length of Basin Floor $(L_{FLOOR}) =$	user	ft
Width of Basin Floor (W _{FLOOR}) =	user	ft
Area of Basin Floor $(A_{FLOOR}) =$	user	ft ²
Volume of Basin Floor (V_{FLOOR}) =	user	ft ³
Depth of Main Basin $(H_{MAIN}) =$	user	ft
Length of Main Basin $(L_{MAIN}) =$	user	ft
Width of Main Basin (W _{MAIN}) =	user	ft
Area of Main Basin (A _{MAIN}) =	user	ft ²
Volume of Main Basin (V _{MAIN}) =	user	ft ³
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

		Depth Increment =	1.00	ft							
				Optional				Optional			
n Pond)		Stage - Storage	Stage	Override	Length	Width	Area	Override	Area	Volume	Volume
		Description	(ft)	Stage (ft)	(ft)	(ft)	(ft 2)	Area (ft ²)	(acre)	(ft 3)	(ac-ft)
		Top of Micropool		0.00				10,185	0.234		
				1.00				11.820	0.271	11.002	0.253
				2.00				10,000	0.211	22,001	0.544
			-	2.00				13,557	0.311	23,691	0.544
				3.00				15,395	0.353	38,167	0.876
				4.00				17,333	0.398	54,531	1.252
			-								
Ontional Lise	r Overrides										
optional obc	acreateet										
	acre rece										
	acre-reet										
1.19	inches		-								
1.50	inches										
1.75	inches										
2.00	inches										
2.25	inches									l	
2.52	inches										
3,68	inches										1
5.00	incrico										
volume is l	ess than										
100-year v	olume.										
			-								
											1
					-	-	-				
			-								
									-	· · · · ·	
			-								
											1
											l
									-		1
MHFD-Detention, Version 4.06 (July 2022)



	DE	TENTION	Basin Out	<u>LET STRU</u>	CTURE DES	SIGN			
			1HFD-Detention, V	ersion 4.06 (July 2	2022)				
Project: Basin ID:	Grandview - Inter	Im							
Jahne a	138-61			Estimate d	Estimate d				
(2008.)		2.01		Estimated Stage (ft)	Volume (ac-ft)	Outlet Type			
HOLME BURY T HOLD			7	5.12		Outlet Type	1		
T T T		\rightarrow	Zone I (WQCV)	0.12	0.026	Office Plate			
2011 1 100 1	ORPCX		Zone 2						
POD. Example Zene	Configuration (Ba	tontion Bond)	Zone 3						
Example Zone	Configuration (Re	tention Pond)		Total (all zones)	0.026				
User Input: Orifice at Underdrain Outlet (typical	y used to drain WQ	CV in a Filtration Bl	<u>MP)</u>				Calculated Parame	ters for Underdrain	L
Underdrain Orifice Invert Depth =	N/A	ft (distance below	the filtration media	surface)	Underd	rain Orifice Area =	N/A	ft ²	
Underdrain Orifice Diameter =	N/A	inches			Underdrain	Orifice Centroid =	N/A	feet	
Lloor Inputs Orifice Dista with and ar more orific	on or Elliptical Clot		to drain WOCV and	d/or EUD\/ in a codi	imontation RMD)		<u></u>		
Centroid of Lowest Orifice -		ft (relative to bacin	bottom at Stage -		WO Orifi	ce Area per Pow -	1 917E-02	ters for Plate	
Depth at top of Zone using Orifice Plate -	0.00	ft (relative to basir	hottom at Stage -	0ft)	Filio	ntical Half-Width -	1.917L-02	feet	
Orifice Plate: Orifice Vertical Spacing =	4.00	inches	- Dottoin at Stage -	010)	Ellipti	cal Slot Centroid =	N/A	feet	
Orifice Plate: Orifice Area per Row =	2.76	sa. inches (diamet	er = 1-7/8 inches)		Ellipti	liptical Slot Area =	N/A	ft ²	
	•				_				
User Input: Stage and Total Area of Each Orifice	e Row (numbered f	rom lowest to highe	est)						
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)	1
Stage of Orifice Centroid (ft)	0.00	0.30	0.60	0.90	1.20				
Orifice Area (sq. inches)	2.76	2.76	2.76	2.76	2.76				
			-				-	-	-
	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)									
									c
User Input: Vertical Orifice (Circular or Rectange	<u>ular)</u>		1				Calculated Parame	ters for Vertical Ori	fice
Toward of Monthead Origina	Not Selected	Not Selected	ft (uslatius to basis	hattan at Chasa	0.00		Not Selected	Not Selected	a2
Depth at top of Zone using Vertical Orlice =			ft (relative to basin	bottom at Stage -	= 0 IL) Ver - 0 ft) Vertical	Orifice Centroid -			TL feet
Vertical Orifice Diameter -			inches	Doctorn at Stage -	- 0 IL) Vertical				Teel
			inches						
User Input: Overflow Weir (Dropbox with Flat o	r Sloped Grate and	Outlet Pipe OR Rec	tangular/Trapezoid	al Weir and No Out	let Pipe)		Calculated Parame	ters for Overflow V	/eir
	Not Selected	Not Selected	<i></i>		<u></u>		Not Selected	Not Selected	1
Overflow Weir Front Edge Height, Ho =			ft (relative to basin b	ottom at Stage = 0 f	t) Height of Grate	Upper Edge, Ht =	Hot beletted	Hot beletted	feet
Overflow Weir Front Edge Length =			feet	5	Overflow W	eir Slope Length =			feet
Overflow Weir Grate Slope =			H:V	Gr	ate Open Area / 10	0-yr Orifice Area =			
Horiz. Length of Weir Sides =			feet	0	verflow Grate Open	Area w/o Debris =			ft ²
Overflow Grate Type =				C	Overflow Grate Oper	n Area w/ Debris =			ft ²
Debris Clogging % =			%						
User Input: Outlet Pipe w/ Flow Restriction Plate	(Circular Orifice, R	estrictor Plate, or R	ectangular Orifice)		<u>Ca</u>	Iculated Parameters	s for Outlet Pipe w/	Flow Restriction Pl	<u>ate</u>
	Not Selected	Not Selected					Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =			ft (distance below ba	isin bottom at Stage	= 0 ft) Ou	tlet Orifice Area =			ft ²
Circular Orifice Diameter =			inches		Outlet	Orifice Centroid =			feet
				Hair-Cent	rai Angle of Restrict	for Plate on Pipe =	IN/A	IN/A	radians
Liser Input: Emergency Spillway (Rectangular or	Tranezoidal)						Calculated Parame	ters for Spillway	
Spillway Invert Stage=	3.00	ft (relative to basin	bottom at Stage =	0 ft)	Spillway De	esian Flow Depth=	0.21	feet	
Spillway Crest Length =	28.00	feet	. Sottom at otage	0.0)	Stage at T	op of Freeboard =	4.21	feet	
Spillway End Slopes =	4.00	H:V			Basin Area at T	op of Freeboard =	0.40	acres	
Freeboard above Max Water Surface =	1.00	feet			Basin Volume at T	op of Freeboard =	1.25	acre-ft	
								1	
Routed Hydrograph Results	The user can over	ride the default CUI	HP hydrographs and	runoff volumes by	v entering new value	es in the Inflow Hy	drographs table (Co	olumns W through	4 <i>F).</i>
Design Storm Return Period =	WQCV N/A	EURV N/A	2 Year	5 Year 1 50	10 Year 1 75	25 Year	2 25	100 Year	3 68
CUHP Runoff Volume (acre-ft) =	0.026	0.020	0.011	0.021	0.030	0.263	0.529	0.894	2.620
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.011	0.021	0.030	0.263	0.529	0.894	2.620
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.3	2.5	5.1	8.5	22.5
UPIIONAL OVERIGE Predevelopment Peak Q (cfs) =	N/A N/A	N/A N/A	0.00	0.01	0.01	0.12	0.24	0.41	1.07
Peak Inflow O (cfs) =	N/A	N/A	0.1	0.2	0.3	2.5	5.1	8.5	22.5
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.7	17.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.1	0.1	0.1	0.1	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Spillway
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) =	18	16	14	17	20	42	45	47	35
Time to Drain 99% of Inflow Volume (hours) =	21	19	18	21	23	47	52	56	50
Maximum Ponding Depth (ft) =	0.12	0.09	0.03	0.07	0.10	0.88	1.65	2.65	3.34
Area at maximum Ponding Depth (acres) =	0.024	0.24	0.23	0.24	0.24	0.220	0.30	0.34	0.995
Maximum volume Storeu (acre-it) =								017 012	

MHFD-Detention_v4-06 - TSB-E1.xlsm, Outlet Structure



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.

Ι	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Timo Inton/ol	TIME		EUDV [cfc]	2 Voor [cfc]	E Voor [cfc]	10 Voor [cfc]	2E Voor [cfc]	E0 Voor [cfc]	100 Voor [cfc]	E00 Voor [cfc]
Time Interval			LOKV [CIS]							
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	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	0:25:00	0.00	0.00	0.04	0.09	0.13	0.02	0.05	0.07	0.22
	0:35:00	0.00	0.00	0.09	0.18	0.25	1.07	1.95	6.51	17.22
	0:40:00	0.00	0.00	0.10	0.20	0.20	2.50	5.00	8.13	20.76
	0:45:00	0.00	0.00	0.10	0.19	0.26	2.53	5.08	8.49	22.18
	0:50:00	0.00	0.00	0.09	0.17	0.24	2.45	4.90	8.29	22.49
	0:55:00	0.00	0.00	0.08	0.16	0.22	2.31	4.61	7.82	21.83
	1:00:00	0.00	0.00	0.08	0.15	0.21	2.12	4.21	7.19	20.65
	1:05:00	0.00	0.00	0.07	0.14	0.19	1.94	3.88	6.63	19.86
	1:10:00	0.00	0.00	0.07	0.13	0.18	1.80	3.60	6.16	18.74
	1:15:00	0.00	0.00	0.06	0.12	0.17	1.67	3.34	5.71	17.42
	1:20:00	0.00	0.00	0.06	0.11	0.16	1.54	3.08	5.26	16.09
	1:25:00	0.00	0.00	0.05	0.10	0.15	1.41	2.82	4.82	14.77
	1:30:00	0.00	0.00	0.05	0.10	0.14	1.30	2.61	4.46	13.69
	1:35:00	0.00	0.00	0.05	0.09	0.13	1.22	2.44	4.17	12.75
	1.40.00	0.00	0.00	0.04	0.08	0.12	1.14	2.29	3.90	11.89
	1:50:00	0.00	0.00	0.04	0.08	0.11	0.99	1.13	3.03	10.25
	1:55:00	0.00	0.00	0.04	0.07	0.10	0.99	1.97	3.10	9.45
	2:00:00	0.00	0.00	0.04	0.06	0.10	0.91	1.62	2.84	8.67
	2:05:00	0.00	0.00	0.03	0.05	0.08	0.76	1.51	2.58	7.90
	2:10:00	0.00	0.00	0.03	0.05	0.07	0.68	1.35	2.32	7.13
	2:15:00	0.00	0.00	0.02	0.04	0.06	0.60	1.20	2.06	6.36
	2:20:00	0.00	0.00	0.02	0.04	0.06	0.54	1.08	1.86	5.79
	2:25:00	0.00	0.00	0.02	0.04	0.06	0.51	1.01	1.73	5.36
	2:30:00	0.00	0.00	0.02	0.04	0.05	0.48	0.95	1.62	5.01
	2:35:00	0.00	0.00	0.02	0.03	0.05	0.45	0.90	1.53	4.69
	2:40:00	0.00	0.00	0.02	0.03	0.05	0.42	0.85	1.44	4.39
	2:45:00	0.00	0.00	0.02	0.03	0.04	0.40	0.80	1.35	4.10
	2:50:00	0.00	0.00	0.01	0.03	0.04	0.37	0.74	1.27	3.83
	2:55:00	0.00	0.00	0.01	0.03	0.04	0.35	0.69	1.18	3.56
	3:05:00	0.00	0.00	0.01	0.02	0.03	0.32	0.64	1.09	3.31
	3:10:00	0.00	0.00	0.01	0.02	0.03	0.29	0.59	1.00	3.05
	3:15:00	0.00	0.00	0.01	0.02	0.05	0.27	0.48	0.83	2.75
	3:20:00	0.00	0.00	0.01	0.02	0.02	0.21	0.43	0.74	2.28
	3:25:00	0.00	0.00	0.01	0.01	0.02	0.19	0.38	0.65	2.02
	3:30:00	0.00	0.00	0.01	0.01	0.02	0.17	0.33	0.56	1.77
	3:35:00	0.00	0.00	0.00	0.01	0.01	0.14	0.28	0.48	1.51
[3:40:00	0.00	0.00	0.00	0.01	0.01	0.11	0.22	0.39	1.25
	3:45:00	0.00	0.00	0.00	0.00	0.01	0.09	0.17	0.30	1.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.06	0.12	0.21	0.74
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.04	0.07	0.13	0.49
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.27
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.16
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.10
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	4:55:00	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
	5:05:00	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
	5:30:00	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
	5:55:00	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

MHFD-Detention, Version 4.06 (July 2022) Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically. The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage	Stage	Area	Area	Volume	Volume	Total Outflow	
Description	[ft]	[ft ²]	[acres]	[ft ³]	[ac-ft]	[cfs]	
							For best results, include the
							stages of all grade slope
							from the S-A-V table on
							Sheet 'Basin'.
							Also include the inverts of all
							outlets (e.g. vertical orifice,
							overflow grate, and spillway,
							where applicable).
]
]

Detention Pond Tributary Areas

Subdivision:Grandview ReserveLocation:CO, El Paso County

Project Name:	Grandview Reserve
Project No.:	HRG01
Calculated By:	TJE
Checked By:	BAS
Date:	3/1/22

Pond A		
Basin	Area	% Imp
A-2a	4.42	65
A-2b	2.75	88
A-3	0.36	100
A-4a	6.31	65
A-4b	3.99	65
A-5	0.35	100
A-6	2.76	65
A-7	0.23	100
A-8	5.44	75
A-9	4.91	65
A-10	1.02	65
A-11	3.56	16
Total	36.10	64.3

Pond B

Basin	Area	% Imp
B-1	3.81	56.8
B-2	4.62	63.5
B-3	4.15	65
B-4	1.37	78.5
B-5	5.12	65
B-6	2.28	65
B-7	0.89	65
B-8	3.23	65
B-9	2.42	65
B-10	1.10	2
Total	28.99	61.9

Pon	Ь	C
топ	u	U.

Basin	Area	% Imp
C-1	4.12	65
C-2	2.71	65
C-4	2.47	65
C-5	3.09	65
C-6	2.10	65
C-7a	0.81	44.7
C-7b	5.91	65
C-8	5.11	65
C-9a	3.50	65
C-9b	3.69	65
C-10	3.47	65
C-11	0.46	65
C-12	1.66	65
C-13	2.37	2
Total	41.47	61.0

Pond D

Basin	Area	% Imp
D-1	3.48	65
D-2	0.87	65
D-3	3.62	65
D-4	1.77	65
D-5	1.53	35.7
D-7b	0.88	65
Total	12.15	61.3

Pond E

Basin	Area	% Imp
E-1	5.33	65
E-2	5.42	65
E-3	3.20	65
E-4	6.28	65
E-5	1.13	2
Total	21.36	61.7

	LID C	Credit I	by Impe	ervious R	eductio	n Factor	(IRF) Me	thod						
User Input			UD	-BMP (Versior	13.06, Novem	ber 2016)								
Calculated cells				Designer:		TJE	8.6-							
***Design Storm: 1-Hour Bain Depth WOCV Event	0.60 inc	ches		Company: Date:		May 3. 20	& CO. 22							
##Minor Storm: 1-Hour Pain Depth 5-Vear Event	1.50 in	ches	D	Project:		Grandviev	 ve Reserve							
***Major Storm: 1-Hour Bain Denth 100-Year Event	2.52 in	ches		Location:		Pond A								
Optional User Defined Storm CUHP														
JHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm 100-Year Event														
Max Intensity for Optional User Defined Storm 0														
EINFORMATION (USER-INPUT)		2-	4.26			A 41-			. 7			4 10		
	A	4-Za	A-20	A-3	A-4a	A-40	A-5	A-0	A-7	A-9	A-9	A-10	A-11	
Receiving Pervious Area Soil Type	Sandy	ly Loam S	iandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	4.	.420	2.750	0.360	6.310	3.990	0.350	2.760	0.230	5.440	4.910	1.020	3.560	
Directly Connected Impervious Area (DCIA, acres)	2.1	.873	2.420	0.360	4.100	2.590	0.350	1.794	0.230	4.080	3.192	0.663	0.570	
Unconnected Impervious Area (UIA, acres)	0.0	.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Receiving Pervious Area (RPA, acres)	0.0	.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Separate Pervious Area (SPA, acres)	1.5	.547	0.330	0.000	2.210	1.400	0.000	0.966	0.000	1.360	1.718	0.357	2.990	
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)		с	с	С	с	с	с	с	с	с	с	с	с	
Total Calculate Area (ac, ficter, against input) Directly Connected Impervious Area (UIA, %) Unconnected Impervious Area (UIA, %) Receiving Pervious Area (RPA, %) A _R (RPA / UIA) I _s Check f / I for VQCV Event: f / I for Optional User Defined Storm CUHP. IRF for S-Year Event: IRF for S-Year Event: IRF for S-Year Event: IRF for S-Year Event: IRF for Optional User Defined Storm CUHP. Total Site Imperviousness: I _{stat} Effective Imperviousness for WQCV Event:	44-4 655 0 0 355 0.0 1 1 1 1 1 1 1 1 1 1 1 5 655 655 655	420 5.0% 0.0% 5.0% 5.0% 000 1.7 0.5 0.3 00 000 000 000 5.0% 5.0% 5.0%	2.750 88.0% 0.0% 0.0% 12.0% 0.000 1.000 1.00 1.07 0.5 0.3 1.00 1.00 1.00 1.00 88.0% 88.0%	0.360 100.0% 0.0% 0.0% 0.0% 0.000 1.000 1.7 0.5 0.3 1.000 1.0	65.0% 65.0% 65.0% 65.0% 65.0% 65.0% 65.0% 65.0%	3.990 64.9% 0.0% 35.1% 0.000 1.000 1.7 0.5 0.3 1.00 1.00 1.00 1.00 1.00 1.00 64.9% 64.9%	0.30% 100.0% 0.0% 0.0% 0.0% 0.000 1.000 1.7 0.5 0.3 1.00	2.780 65.0% 0.0% 0.0% 35.0% 0.000 1.000 1.00 1.00 1.00 1.00 1.00 1.00 65.0% 65.0%	0.230 100.0% 0.0% 0.0% 0.0% 0.000 1.000 1.7 0.5 0.3 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.	3,440 75.0% 0.0% 0.0% 25.0% 0.000 1.000 1.7 0.5 0.3 1.00 1.00 1.00 1.00 1.00 75.0% 75.0%	4.910 65.0% 0.0% 0.0% 35.0% 0.000 1.000 1.000 1.7 0.5 0.3 1.00 1.00 1.00 1.00 1.00 65.0% 65.0%	1.020 65.0% 0.0% 0.0% 35.0% 0.000 1.7 0.5 0.3 1.000 1.00 1.00 1.00 1.00 1.00 5.0% 65.0%	3.380 16.0% 0.0% 0.0% 84.0% 0.000 1.000 1.7 0.5 0.3 1.000 1.0	
Effective Imperviousness for 100-Year Event:	65	5.0%	88.0%	100.0%	65.0%	64.9%	100.0%	65.0%	100.0%	75.0%	65.0%	65.0%	16.0%	
Effective Imperviousness for Optional User Defined Storm CUHP:														
/ EFFECTIVE IMPERVIOUSNESS CREDITS	N/A O	0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
WQLV EVENT CREDIT: REDUCE Detention By: This line only for 10-Year Event	N/A 0. N/A N	N/A	0.0%	0.0% N/A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N
100-Year Event CREDIT**: Reduce Detention By: User Defined CUHP CREDIT: Reduce Detention By:	N/A 0.	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	N
Total Site Effective Imperv Total Site Effective Imperv	Total Site Imperviou iousness for WQCV iousness for 5-Year	usness: / Event: r Event:	64.3% 64.3% 64.3%		Notes: * Use Green * Flood con	Ampt average	ge infiltration	rate values f	rom Table 3- empirical eq	3. uations from	Storage Cha	pter of USDC	м.	

Site-Level I	ow Im	pact De	velopr	nent (L	ID) Des	ign Eff	ective I	mpervi	ous Ca	lculator	r			
	L	ID Credit	t by Imp	ervious F		n Factor	(IRF) Me	thod						
User Input			UL)-BMP (versioi	13.06, Novem	ber 2010)								
Calculated cells				Designer: Company:		TJE Galloway	& Co.							
***Design Storm: 1-Hour Rain Depth WQCV Event	0.60	inches		Date:		May 4, 20	22							
***Minor Storm: 1-Hour Rain Depth 5-Year Event	1.50	inches		Project:		Grandviev	w Reserve							
Major Storm: 1-Hour Rain Depth 100-Year Event	2.52	inches		Location:		Pond B								
Optional User Defined Storm CUHP														
UHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm 100-Year Event														
Max Intensity for Optional User Defined Storm 0														
TE INFORMATION (USER-INPUT)														
Sub-basin Identifier	B-1	B-2	B-3	B-4	B-5	B-6	B-7	B-8	B-9	B-10				
Receiving Pervious Area Soil Type	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam				
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	3.810	4.620	4.150	1.370	5.120	2.280	0.890	3.230	2.420	1.100				
Directly Connected Impervious Area (DCIA, acres)	2.164	2.934	2.698	1.075	3.328	1.482	0.579	2.100	1.573	0.022				
Unconnected Impervious Area (UIA, acres)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000				<u> </u>
Receiving Pervious Area (RPA, acres)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000				
Separate Pervious Area (SPA, acres)	1.646	1.686	1.453	0.295	1.792	0.798	0.312	1.131	0.847	1.078				
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	с	с	с	с	с	с	с	с	с	с				
Total Calculated Area (ac, check against input) Directly Connected Impervious Area (DCIA, %) Unconnected Impervious Area (DLA, %) Separate Pervious Area (RPA, %) Separate Pervious Area (RPA, %) Ag. (RPA / UIA) I, Check f / I for WQCV Event: f / I for 200-Year Event: IRF for WQCV Event: IRF for S-Year Event: IRF for 100-Year Event: IRF for Optional User Defined Storm CUHP: Total Site Imperviousness: fugal Effective Imperviousness for WQCV Event:	3.810 56.8% 0.0% 0.0% 43.2% 0.000 1.000 1.7 0.5 0.3 	4.620 63.5% 0.0% 0.00% 36.5% 36.5% 0.000 1.000 1.7 0.5 0.3 	4.150 65.0% 0.0% 35.0% 0.000 1.000 1.7 0.5 0.3 	1.370 78.5% 0.0% 0.0% 21.5% 0.000 1.000 1.7 0.5 0.3 	5.120 65.0% 0.0% 0.0% 0.000 1.000 1.7 0.5 0.3 	2.280 65.0% 0.0% 35.0% 0.000 1.000 1.7 0.5 0.3 1.00 1.00 1.00 1.00 1.00 1.00 1.00	0.890 65.0% 0.0% 0.0% 35.0% 0.000 1.000 1.00 1.00 1.00 1.00 1.00 1.00	3.230 65.0% 0.0% 0.0% 35.0% 0.000 1.000 1.7 0.5 0.3 	2.420 65.0% 0.0% 35.0% 0.000 1.000 1.7 0.5 0.3 	1.100 2.0% 0.0% 98.0% 0.000 1.000 1.7 0.5 0.3 1.00 1.00 1.00 1.00 2.0%				
Effective Imperviousness for WQCV Event:	56.8%	63.5%	65.0%	78.5%	65.0%	65.0%	65.0%	65.0%	65.0%	2.0%				+
Effective Imperviousness for 5-Year Event:	56.8%	63.5%	65.0%	78.5%	65.0%	65.0%	65.0%	65.0%	65.0%	2.0%				+
Effective Imperviousness for Optional User Defined Storm CUHP:	50.8%	03.5%	03.0%	78.3%	03.0%	03.0%	03.0%	03.0%	03.0%	2.0%				
/ FFFFCTIVE IMPERVIOUSNESS CREDITS														
WQCV Event CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A	N
This line only for 10-Year Event 100-Year Event CREDIT**: Reduce Detention By: User Defined CLUB CREDIT - Reduce Detention By:	N/A 0.0%	N/A 0.0%	N/A 0.0%	N/A 0.0%	N/A 0.0%	N/A 0.0%	N/A 0.0%	N/A 0.0%	N/A 0.0%	N/A -364.4%	N/A N/A	N/A N/A	N/A N/A	N
Total Site Effective Imper Total Site Effective Imper	Total Site Imp viousness for Viousness for V	erviousness: WQCV Event: 5-Year Event:	61.9% 61.9% 61.9%		Notes: * Use Green * Flood cont	Ampt averages	ge infiltration	rate values f dits based on	rom Table 3- empirical ec	3. Juations from	Storage Cha	pter of USDC	и.	

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator LID Credit by Impervious Reduction Factor (IRF) Method														
			UC	-BMP (Versior	3.06, Novem	ber 2016)								
User Input														
Colouistad colls				Decimory		TIE								
Calculated cells				Company:		Galloway	& Co.							
***Design Storm: 1-Hour Bain Depth WOCV Event	0.60	inches		Date:		May 4. 20	22							
***Minor Storm: 1-Hour Rain Depth 5-Year Event	1.50	inches		Project:		Grandviev	v Reserve							
Major Storm: 1-Hour Rain Depth 100-Year Event	2.52	inches		Location:		Pond C								
Optional User Defined Storm CUHP														
CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm 100-Year Event														
Max Intensity for Optional User Defined Storm 0														
ITE INFORMATION (USER-INPUT)														
Sub-basin Identifier	C-1	C-2	C-4	C-5	C-6	C-7a	C-7b	C-8	C-9a	C-9b	C-10	C-11	C-12	C-13
Receiving Pervious Area Soil Type	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Lo
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	4,120	2,710	2,470	3,090	2,100	0.810	5,910	5,110	3,500	3,690	3,470	0.460	1,660	2 370
Directly Connected Impervious Area (DCIA. acres)	2.678	1.762	1.606	2.009	1.365	0.362	3.842	3.322	2.275	2.399	2.256	0.299	1.000	0.047
Unconnected Impervious Area (UIA, acres)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Receiving Pervious Area (RPA, acres)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Separate Pervious Area (SPA, acres)	1.442	0.949	0.865	1.082	0.735	0.448	2.069	1.789	1.225	1.292	1.215	0.161	0.581	2.323
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	с	с	с	с	с	с	с	с	с	с	с	с	с	с
ALCULATED RESULTS (OUTPUT) Total Calculated Area (ac, check against input) Directly Connected Impervious Area (DCIA, %) Unconnected Impervious Area (UIA, %) Receiving Pervious Area (RPA, %) Separate Pervious Area (SPA, %)	4.120 65.0% 0.0% 35.0%	2.710 65.0% 0.0% 35.0%	2.470 65.0% 0.0% 35.0%	3.090 65.0% 0.0% 35.0%	2.100 65.0% 0.0% 35.0%	0.810 44.7% 0.0% 55.3%	5.910 65.0% 0.0% 35.0%	5.110 65.0% 0.0% 35.0%	3.500 65.0% 0.0% 35.0%	3.690 65.0% 0.0% 35.0%	3.470 65.0% 0.0% 35.0%	0.460 65.0% 0.0% 35.0%	1.660 65.0% 0.0% 35.0%	2.37(2.09 0.09 0.09 98.09
A _R (RPA / UIA)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
I _a Check	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f / I for WQCV Event:	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
f / I for 5-Year Event:	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
f / I for 100-Year Event:	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
f / I for Optional User Defined Storm CUHP:														
IRF for WQCV Event:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IRF for 5-Year Event:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IRE for Optional Liser Defined Storm CLUP:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total Site Imperviouspess	65.0%	65.0%	65.0%	65.0%	65.0%	44 7%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	2 0%
Effective Imperviousness for WOCV Event:	65.0%	65.0%	65.0%	65.0%	65.0%	44.7%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	2.0%
Effective Imperviousness for 5-Year Event:	65.0%	65.0%	65.0%	65.0%	65.0%	44.7%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	2.0%
Effective Imperviousness for 100-Year Event:	65.0%	65.0%	65.0%	65.0%	65.0%	44.7%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	2.0%
Effective Imperviousness for Optional User Defined Storm CUHP:														
D / FEFECTIVE IMPERVIOUSNESS CREDITS														
WQCV Event CREDIT: Reduce Detention Bv:	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.09
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: User Defined CUHP CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	-169.1
Total Site Effective Imperviousness for WQCV Event 61.0% Notes: Total Site Effective Imperviousness for WQCV Event 61.0% * Use Green-Ampt average infiltration rate values from Table 3-3. Total Site Effective Imperviousness for 5 Year Event: 61.0% * Elected control detention volume credits based on empirical equations from Storage Chapter of USD/CM														
Total Site Effective Impervio Total Site Effective Imperviousness for Option	ousness for 10 I User Defined	0-Year Event: I Storm CUHP:	61.0%]	*** Method	assumes that	at 1-hour rain	fall depth is	equivalent to	1-hour inten	isity for calcu	lation purpo	sed	

<section-header><form><form></form></form></section-header>														Works	neet Protected
<form><form><form><form></form></form></form></form>	Site-Level Low Impact Development (LID) Design Effective Impervious Calculator LID Credit by Impervious Reduction Factor (IRF) Method														
				c by imp	ci vious i	Cuucio	in actor		liiou						
<form><form> Image: 1 <</form></form>	User Input			UE	D-BMP (Version	1 3.06, Novem	ber 2016)								
	Calculated cells				Designer:		TJE								
		0.00			Company:		Galloway	& CO.							
	***Design Storm: 1-Hour Rain Depth WQCV Event	0.60	inches		Date:		Iviay 4, 20.								
	***Minor Storm: 1-Hour Rain Depth 5-Year Event	1.50	inches		Project:		Grandview	/ Reserve							
<form><form> And No worker Impact And No worker Impact</form></form>	Optional Licer Defined Storm Optional Licer Defined Storm Optional Licer Defined Storm	2.52	inches		Location.		Pollu D								
	(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm 100-Year Event														
Instruction Note of the structure o	Max Intensity for Optional User Defined Storm 0		•												
	SITE INFORMATION (LISER.INPLIT)														
Richtig Periode Artes Start Bais dash Beisch da	Sub-basin Identifier	D-1	D-2	D-3	D-4	D-5	D-7								
Mode Appl. Constraint of Product Appl. (Appl. Appl.) 1.00 0.00 0.000	Receiving Pervious Area Soil Type	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam								
Detroty concept mywork we have how we have been werk with a book of we have been werk werk werk werk werk werk werk werk	Total Area (ac., Sum of DCIA. UIA. RPA. & SPA)	3.480	0.870	3.620	1.770	1.530	0.880								
Unconvected improvious Area (DA, area) Dial Dial <thdia< th=""> <thdial< th=""> <thdial< th=""></thdial<></thdial<></thdia<>	Directly Connected Impervious Area (DCIA. acres)	2,262	0.566	2.353	1.151	0.546	0.572								
Resching Privious Area (PA, Area) Data (Data	Unconnected Impervious Area (UIA. acres)	0.000	0.000	0.000	0.000	0.000	0.000								
Support Periods area (SPA, area) 123 0.030 1247 0.620 0.984 0.308 Image: Control of the c	Receiving Pervious Area (RPA. acres)	0.000	0.000	0.000	0.000	0.000	0.000								
Bits Transmission C	Separate Pervious Area (SPA, acres)	1.218	0.305	1.267	0.620	0.984	0.308								
Name (v), or premiseds bravenet (v) C <thc< th=""> C C</thc<>	RPA Treatment Type: Conveyance (C).														
GUARD PESUIS (OUTPUT) Total Calculated Area (ic, check against Ippot Directly Connected Impervious Area (ICA, N) Directly Connected Impervious Area (ICA, N) Directly Connected Impervious Area (ICA, N) Separate Pervious Area (ICA, N) Separate Pervious Area (ICA, N) Colspan="2">Separate Pervious Area (ICA, N) Colspan="2">Colspan="2">Separate Pervious Area (ICA, N) Colspan="2">Colspan="2">Colspan="2">Colspan="2">Separate Pervious Area (ICA, N) Colspan="2">Colspan="2">Colspan="2">Colspan="2">Separate Pervious Area (ICA, N) Colspan="2">Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Col	Volume (V), or Permeable Pavement (PP)	С	с	с	С	с	С								
GULATED #SURTs (OUTPUT) Total Calculated Area (ac, check against input) 2.480 0.870 1.520 0.880 Directly Connected Impervious Area (DA, N) 0.0%															
Total Calculated Area (ac, heck against Input) 1.480 0.870 1.520 1.530 0.880 Image: Content Conte	CALCULATED RESULTS (OUTPUT)														
Directly Connected Impervious Area (DAI, N) 65.0% 65.0% 0.	Total Calculated Area (ac, check against input)	3.480	0.870	3.620	1.770	1.530	0.880								
Unconnected impervious Area (IIIA, N) Separate Pervious Area (IIA), N) Separate Pervisous	Directly Connected Impervious Area (DCIA, %)	65.0%	65.0%	65.0%	65.0%	35.7%	65.0%								
Beceiving Pervisous Area (BPA, 7) 0.0% 0.00 0.000	Unconnected Impervious Area (UIA, %)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%								
Separate Pervious Are (SPA, N) 25.0% <	Receiving Pervious Area (RPA, %)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%								
Ac (RPA / UA) 0.000	Separate Pervious Area (SPA, %)	35.0%	35.0%	35.0%	35.0%	64.3%	35.0%								
Index 1.000 <th< td=""><td>A_R (RPA / UIA)</td><td>0.000</td><td>0.000</td><td>0.000</td><td>0.000</td><td>0.000</td><td>0.000</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>	A _R (RPA / UIA)	0.000	0.000	0.000	0.000	0.000	0.000								
# // for WQCV Event: 17 1.7<	I _a Check	1.000	1.000	1.000	1.000	1.000	1.000								
f // for 5-Yar Event: 0.5 0.	f / I for WQCV Event:	1.7	1.7	1.7	1.7	1.7	1.7								
f // for 100-Year Event: 0.3 <td< td=""><td>f / I for 5-Year Event:</td><td>0.5</td><td>0.5</td><td>0.5</td><td>0.5</td><td>0.5</td><td>0.5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	f / I for 5-Year Event:	0.5	0.5	0.5	0.5	0.5	0.5								
If / for Optional User Defined Storm CUHP: Image: Control of the imperviousness for Vicer Event: Image: Control of the imp	f / I for 100-Year Event:	0.3	0.3	0.3	0.3	0.3	0.3								
Iff for WQC Vent: 1.00 1.	f / I for Optional User Defined Storm CUHP:														
IRF for 5-Var Event: 1.00<	IRF for WQCV Event:	1.00	1.00	1.00	1.00	1.00	1.00								
IRF for 100-Year Event: 1.00 1.	IRF for 5-Year Event:	1.00	1.00	1.00	1.00	1.00	1.00								
IRF for Optional User Defined Storm CUHP: Image: Control Stell Imperviousness for WQCV Event: Image: Control MQCV Event: Image: Con	IRF for 100-Year Event:	1.00	1.00	1.00	1.00	1.00	1.00								
Total Site Imperviousness for VQCV Event 65.0%	IRF for Optional User Defined Storm CUHP:														
Effective imperviousness for VQCV Event: 65.0% 65.0% 65.0% 35.7% 65.0% 0 0 0 0 Effective imperviousness for 30 ¹ /ere rest 65.0% 65.0% 65.0% 35.7% 65.0% 0 <td>Total Site Imperviousness: Itotal</td> <td>65.0%</td> <td>65.0%</td> <td>65.0%</td> <td>65.0%</td> <td>35.7%</td> <td>65.0%</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Total Site Imperviousness: Itotal	65.0%	65.0%	65.0%	65.0%	35.7%	65.0%								
Effective imperviousness for 5-Year Event: 65.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0%	Effective Imperviousness for WQCV Event:	65.0%	65.0%	65.0%	65.0%	35.7%	65.0%								
Effective Imperviousness for 100-Year Event: 65.0% 0.0% 0.0% N/A	Effective Imperviousness for 5-Year Event:	65.0%	65.0%	65.0%	65.0%	35.7%	65.0%								
Effective Imperviousness for Optional User Defined Storm CUHP: <	Effective Imperviousness for 100-Year Event:	65.0%	65.0%	65.0%	65.0%	35.7%	65.0%								
/ EFFECTIVE IMPERVIOUSNESS CREDITS WQCV Event CREDIT: Reduce Detention By: 0.0% 0.0% 0.0% 0.0% N/A N/A <td>Effective Imperviousness for Optional User Defined Storm CUHP:</td> <td></td>	Effective Imperviousness for Optional User Defined Storm CUHP:														
WQCV Event CREDIT: Reduce Detention By: This line only for 10-Year Event 100-Year Event CREDIT: Reduce Detention By: User Defined CUHP CREDIT: Reduce Detention By: 0.0% 0.0% 0.0% 0.0% N/A	ID / EFFECTIVE IMPERVIOUSNESS CREDITS														
This line only for 10 Year Event 100 Year Kettore Reduce Detention By: User Defined CUHP CREDIT: Reduce Detention By: User Defined CUHP CREDIT: Reduce Detention By: Total Site Effective Imperviousness for WQCV Event: Total Site Effective Imperviousness for 100 Year Event:	WQCV Event CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Autoreal event CHUTHT: Reduce Detention by: ULD?s ULD?s ULD?s ULD?s ULD?s ULD?s 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
Total Site Imperviousness: 61.3% Notes: Total Site Effective Imperviousness for WQCV Event: 61.3% `Use Green-Ampt average infiltration rate values from Table 3-3. Total Site Effective Imperviousness for 100-Year Event: 61.3% `Ise Green-Ampt average infiltration rate values from Table 3-3. Total Site Effective Imperviousness for 100-Year Event: 61.3% `Ise Green-Ampt average infiltration rate values from Table 3-3. Total Site Effective Imperviousness for 100-Year Event: 61.3% ``Hood control detention volume credits based on empirical equations from Storage Chapter of USDCM. Total Site Effective Imperviousness for Optional User Defined Storm CUHP: *** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed	User Defined CUHP CREDIT*: Reduce Detention By: User Defined CUHP CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	IN/A	IN/A	N/A	N/A	N/A	IN/A	IN/A	N/A
Total Site Effective Imperviousness for WQCV Event: 61.3% Total Site Effective Imperviousness for 5 Year Event: 61.3% Total Site Effective Imperviousness for 100-Year Event: 61.3% Total Site Effective Imperviousness for 100-Year Event: 61.3% Total Site Effective Imperviousness for 100-Year Event: 61.3% *** Method assumes that 1-hour rainfail depth is equivalent to 1-hour intensity for calculation purposed		Total Site Imp	perviousness:	61.3%]	Notes:									
Total Site Effective Imperviousness for OP/tear Event: 61.3%	Total Cita Effective Impor	viousness for	WOCV Event	61.2%	-	Line Come	Amot	o infiltenti	rate value - 4	from Table 2	2				
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	Total Site Effective Imper	viousness for	5-Year Event:	61.3%	1	"Flood con	-Ampt averag	e intiltration	race values f	rom rable 3-	 . /ul>	Storage Cha	inter of USDC	м	
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	Total Site Effective Impervio	ousness for 10	0-Year Event:	61.3%	1	*** Method	assumes tha	t 1-hour rain	fall depth is (equivalent to	1-hour inten	isity for calcu	lation purpos	ed	
	Total Site Effective Imperviousness for Optiona	l User Defined	Storm CUHP:]										

	L	.ID Credi	t by Imp	ervious F	eduction	n Factor	(IRF) Me	thod						
			UC	-BMP (Versior	n 3.06, Novem	ber 2016)								
User Input														
Calculated cells				Designer:		TJE								
				Company:		Galloway	& Co.							
***Design Storm: 1-Hour Rain Depth WQCV Event	0.60	inches		Date:		May 4, 20	22							
Hinor Storm: 1-Hour Rain Depth S-Year Event	1.50	inches		Project:		Grandviev	v Reserve							
***Major Storm: 1-Hour Rain Depth 100-Year Event	2.52	inches		Location:		Pond E								
Optional User Defined Storm CUHP		1												
JHP) NUAA 1 Hour Rainfall Depth and Frequency 100-Year Event for User Defined Storm														
Max Intensity for Optional User Defined Storm 0														
E INFORMATION (USER-INPUT)														
Sub-basin Identifier	E-1	E-2	E-3	E-4	E-5									
Becalving Dervious Area Call Tura	Sandy Loars	Sandy Loam	Sandy Loan	Sandy Loam	Sandy Loan									
neceiving relivious Area Soli Type	Sanuy Loam	Januy Loam	Sanuy Loam	Sanuy Loam	Sanuy Loam									
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	5.330	5.420	3.200	6.280	1.130									
Directly Connected Impervious Area (DCIA, acres)	3.465	3.523	2.080	4.082	0.023									<u> </u>
Unconnected Impervious Area (UIA, acres)	0.000	0.000	0.000	0.000	0.000									-
Receiving Pervious Area (RPA, acres)	0.000	0.000	0.000	0.000	0.000									-
PDA Tractment Turcu Conversions (C)	1.800	1.057	1.120	2.156	1.107									
Volume (V), or Permeable Pavement (PP)	С	с	с	с	с									
LCULATED RESULTS (OUTPUT)				1								1	1	
Total Calculated Area (ac, check against input)	5.330	5.420	3.200	6.280	1.130									
Directly Connected Impervious Area (DCIA, %)	65.0%	65.0%	65.0%	65.0%	2.0%									
Unconnected Impervious Area (UIA, %)	0.0%	0.0%	0.0%	0.0%	0.0%									-
Separate Pervious Area (SPA %)	35.0%	35.0%	35.0%	35.0%	98.0%									
An (RPA / UIA)	0.000	0.000	0.000	0.000	0.000									
I _a Check	1.000	1.000	1.000	1.000	1.000									
f / I for WQCV Event:	1.7	1.7	1.7	1.7	1.7									
f / I for 5-Year Event:	0.5	0.5	0.5	0.5	0.5									
f / I for 100-Year Event:	0.3	0.3	0.3	0.3	0.3									
f / I for Optional User Defined Storm CUHP:														
IRF for WQCV Event:	1.00	1.00	1.00	1.00	1.00									-
IRF for 5-Year Event:	1.00	1.00	1.00	1.00	1.00									-
IRF for Optional Licer Defined Charge Citility	1.00	1.00	1.00	1.00	1.00									
Total Site Imperviousness: 1	65.0%	65.0%	65.0%	65.0%	2.0%					-				+
Effective Imperviousness for WOCV Event:	65.0%	65.0%	65.0%	65.0%	2.0%							-		+
Effective Imperviousness for 5-Year Event:	65.0%	65.0%	65.0%	65.0%	2.0%									1
Effective Imperviousness for 100-Year Event:	65.0%	65.0%	65.0%	65.0%	2.0%						1	1		
Effective Imperviousness for Optional User Defined Storm CUHP:														
WQCV Event CREDIT: Reduce Detention Bv:	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N
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
100-Year Event CREDIT**: Reduce Detention By: User Defined CUHP CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	-354.7%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N
	Total Site Imr	perviousness:	61.7%]	Notes:									
Total Site Effective Imperi	iousness for 1	WOCV Event	61.7%	4	Lise Groce	Ampt puper	a infiltration	rate values i	rom Table 3					
Total Site Effective Imperv	iousness for	5-Year Event:	61.7%	1	" Flood cont	rol detention	volume cre	dits based or	empirical er	o. Suations from	Storage Cha	apter of USDC	M.	
			CA 70/	1	*** ***	. Ji acteridul			- inpiricar et		. Juliage elle			





Project: <u>Grandview</u> Basin ID: <u>Pond A</u> Server 1

81

Depth Increment - 0.50 ft

-And I state 100 Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB]
Watershed Area =	36.10	acres
Watershed Length =	2,360	ft
Watershed Length to Centroid =	1,180	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	64.30%	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.

2 - F		Optional User	Overnu
0.756	acre-feet		acre-fee
2.872	acre-feet		acre-fee
2.125	acre-feet	1.19	inches
2.788	acre-feet	1.50	inches
3.319	acre-feet	1.75	inches
4.018	acre-feet	2.00	inches
4.705	acre-feet	2.25	inches
5.540	acre-feet	2.52	inches
9.026	acre-feet	3.68	inches
1.867	acre-feet		
2.442	acre-feet		
2.945	acre-feet		
3.546	acre-feet		
3.909	acre-feet		
4.290	acre-feet		
	0.756 2.872 2.125 2.788 3.319 4.018 4.708 9.026 1.867 2.442 2.945 3.546 3.909 4.290	0.756 acre-feet 2.872 acre-feet 2.125 acre-feet 2.788 acre-feet 3.319 acre-feet 4.018 acre-feet 4.705 acre-feet 9.026 acre-feet 9.026 acre-feet 1.867 acre-feet 2.422 acre-feet 3.546 acre-feet 3.909 acre-feet 4.909 acre-feet	0.756 are-feet 0.756 0.757 are-feet 1.09 2.125 are-feet 1.50 3.319 are-feet 1.75 3.788 are-feet 1.75 4.018 are-feet 2.25 9.026 are-feet 3.68 1.867 are-feet 3.68 2.442 are-feet 3.69 3.546 are-feet 3.49 3.909 are-feet 4.290

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.756	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.115	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.418	acre-feet
Total Detention Basin Volume =	4.290	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) =	user	e l

Suiciaige volume Lengui (LISV) -	usei	i c
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

	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				35	0.001		
	6971		0.50				2,047	0.047	520	0.012
	6972		1.00				10,771	0.247	3,725	0.086
	0372		2.00				41,785	0.959	30,656	0.300
	6973		2.50				43,839	1.006	52,062	1.195
			3.00				45,918	1.054	74,501	1.710
	6974		3.50				48,022	1.102	97,986	2.249
	6975		4.00				52,306	1.151	122,529	3.401
			5.00				54,486	1.251	174,842	4.014
	6976		5.50				56,691	1.301	202,636	4.652
	6077		6.00				58,921	1.353	231,538	5.315
User Overrides	0977		0.50				01,170	1.404	201,502	0.005
acre-feet										
acre-feet										
inches										
inches										
inches										
inches										
inches										
		-								
		-								



	DE	TENTION	BASIN OUT	FLET STRU	CTURE DES	SIGN						
MHFD-Detention, Version 4.04 (February 2021) Project: Grandview												
Project: Basin ID:	Grandview Pond A											
(Allowed as				Estimated	Estimated							
	-	_		Stage (ft)	Volume (ac-ft)	Outlet Type						
Time ten Tent			Zone 1 (WQCV)	2.06	0.756	Orifice Plate	1					
	- and and a second		Zone 2 (EURV)	4.06	2.115	Rectangular Orifice						
Planatic Barrow	perci		Zone 3 (100-year)	5.22	1.418	Weir&Pipe (Restrict)						
Example Zone	Configuration (Ret	ention Pond)	2010 0 (222 /22 /	Total (all zones)	4.290		1					
User Input: Orifice at Underdrain Outlet (typical	y used to drain WQ	CV in a Filtration BM	<u>4P)</u>				Calculated Parame	ters for Underdrain	<u>.</u>			
Underdrain Orifice Invert Depth =	N/A	ft (distance below t	the filtration media	surface)	Underd	rain Orifice Area =	N/A]ft ²				
Underdrain Orifice Diameter =	N/A	inches			Underdrain	Orifice Centroid =	N/A	feet				
11 Tout Offer Deta with and an more avite		tt in (transingly upon			tetter DMD)							
User Input: Onnice Plate with one or more on the Invert of Lowest Orifice =		Neir (typically used of the second se	<u>to arain woocv and</u>	I/Or EURV III a Seuli - 0 ft)	<u>שויים mentation אוייי)</u> WO Orifi	- Area ner Row =	Calculated Parame	ters for Plate				
Depth at top of Zone using Orifice Plate =	2.06	ft (relative to basin	hottom at Stage =	: 0 ft)	Elli	ntical Half-Width =	N/A	π feet				
Orifice Plate: Orifice Vertical Spacing =	8.20	inches	bottom at 1129	010,	Ellipti	cal Slot Centroid =	N/A	feet				
Orifice Plate: Orifice Area per Row =	3.00	sq. inches (diamete	er = 1-15/16 inches	;)	E	liptical Slot Area =	N/A	ft ²				
	- (the bishes										
User Input: Stage and Total Area of Each Onito	2 Row (numbered in	Om lowest to nigne	<u>st)</u>	Bow 4 (ontional)	Bow E (ontional)	Bow 6 (ontional)	Bow 7 (optional)	Dow 9 (optional)	1			
Stage of Orifice Centroid (ft)			1 40	Row 4 (opuonar)	KOW 5 (optional)	Row o (opuonar)	ROW / (optional)	KOW 6 (Opuonai)				
Orifice Area (sq. inches)	3.00	3.00	3.00									
									1			
	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)												
Line Tabuta Vortical Orifica (Circular or Poctana							Colculated Parame	tore for Vertical Ori	fina			
User Input: vertical Office (Circular or Rectang	<u>ilar)</u>	· · · · · · · · · · · · · · · · · · ·					Calculateu Parame	ters for vertical on	<u>fice</u> 1			
	Zone 2 Pectangular	Not Selected	1				Zono 2 Pertangula	 Not Selected 				
Invert of Vertical Orifice =	Zone 2 Rectangular 2.10	Not Selected	ft (relative to basin	bottom at Stage =	.∩ft) Ver	tical Orifice Area =	Zone 2 Rectangula	Not Selected	⊕ ²			
Invert of Vertical Orifice = Denth at top of Zone using Vertical Orifice =	Zone 2 Rectangular 2.10 4.06	Not Selected N/A N/A	ft (relative to basin ft (relative to basin	bottom at Stage =	0 ft) Ver 0 ft) Vertical	tical Orifice Area = Orifice Centroid =	Zone 2 Rectangula 0.10 0.08	Not Selected N/A N/A	ft ² feet			
Invert of Vertical Orifice = Depth at top of Zone using Vertical Orifice = Vertical Orifice Height =	Zone 2 Rectangular 2.10 4.06 2.00	Not Selected N/A N/A N/A	ft (relative to basin ft (relative to basin inches	<pre>bottom at Stage = bottom at Stage =</pre>	= 0 ft) Ver = 0 ft) Vertical	tical Orifice Area = Orifice Centroid =	Zone 2 Rectangula 0.10 0.08	Not Selected	ft ² feet			
Invert of Vertical Orifice = Depth at top of Zone using Vertical Orifice = Vertical Orifice Height = Vertical Orifice Width =	Zone 2 Rectangular 2.10 4.06 2.00 7.00	Not Selected N/A N/A N/A	ft (relative to basin ft (relative to basin inches inches	i bottom at Stage = i bottom at Stage =	0 ft) Ver 0 ft) Vertical	tical Orifice Area = Orifice Centroid =	Zone 2 Rectangula 0.10 0.08	Not Selected	ft ² feet			
Invert of Vertical Orifice = Depth at top of Zone using Vertical Orifice = Vertical Orifice Height = Vertical Orifice Width =	Zone 2 Rectangulai 2.10 4.06 2.00 7.00	Not Selected N/A N/A N/A	ft (relative to basin ft (relative to basin inches inches	i bottom at Stage = i bottom at Stage =	e 0 ft) Ver e 0 ft) Vertical	tical Orifice Area = Orifice Centroid =	Zone 2 Rectangula 0.10 0.08	Not Selected	ft ² feet			
Invert of Vertical Orifice = Depth at top of Zone using Vertical Orifice = Vertical Orifice Height = Vertical Orifice Width = User Input: Overflow Weir (Dropbox with Flat or	Zone 2 Rectangular 2.10 4.06 2.00 7.00 - Sloped Grate and	Not Selected N/A N/A N/A Outlet Pipe OR Rect	ft (relative to basin ft (relative to basin inches inches angular/Trapezoida	 bottom at Stage = bottom at Stage = Weir (and No Out) 	: 0 ft) Ver : 0 ft) Vertical	tical Orifice Area = Orifice Centroid =	Zone 2 Rectangula 0.10 0.08 Calculated Parame	Not Selected N/A N/A	ft ² feet			
Invert of Vertical Orifice = Depth at top of Zone using Vertical Orifice = Vertical Orifice Height = Vertical Orifice Width = User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Scont Edge Height, He	Zone 2 Rectangular 2.10 4.06 2.00 7.00 r Sloped Grate and C Zone 3 Weir 4.10	Not Selected N/A N/A N/A Outlet Pipe OR Rect Not Selected	ft (relative to basin ft (relative to basin inches inches tangular/Trapezoida	bottom at Stage = bottom at Stage = <u>al Weir (and No Out</u>	tlet Pipe)	tical Orifice Area = Orifice Centroid =	Zone 2 Rectangula 0.10 0.08 Calculated Parame Zone 3 Weir	ters for Overflow W Not Selected	ft ² feet			
Invert of Vertical Orifice = Depth at top of Zone using Vertical Orifice = Vertical Orifice Height = Vertical Orifice Width = User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho =	Zone 2 Rectangular 2.10 4.06 2.00 7.00 7.00 7.00 7.00 7.00 4.10 3.00	Not Selected N/A N/A N/A Outlet Pipe OR Rect Not Selected N/A	ft (relative to basin ft (relative to basin inches inches tangular/Trapezoida ft (relative to basin b froat	bottom at Stage = bottom at Stage = <u>al Weir (and No Out</u> ottom at Stage = 0 ft	: 0 ft) Ver : 0 ft) Vertical tlet Pipe) :) Height of Grate Overflow W	tical Orifice Area = Orifice Centroid = e Upper Edge, H _t =	Zone 2 Rectangula 0.10 0.08 Calculated Parame Zone 3 Weir 4.85 3.09	Not Selected N/A N/A ters for Overflow W Not Selected N/A	ft ² feet			
Invert of Vertical Orifice = Depth at top of Zone using Vertical Orifice = Vertical Orifice Height = Vertical Orifice Width = User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope =	Zone 2 Rectangular 2.10 4.06 2.00 7.00 7.00 7.00 7.00 4.10 3.00 4.00	Not Selected N/A N/A N/A Outlet Pipe OR Rect Not Selected N/A N/A	ft (relative to basin ft (relative to basin inches inches tangular/Trapezoida ft (relative to basin b feet H-V	bottom at Stage = bottom at Stage = <u>al Weir (and No Out</u> bottom at Stage = 0 ft Gr	: 0 ft) Ver : 0 ft) Vertical tlet Pipe) :) Height of Grate Overflow W rate Open Area / 10	tical Orifice Area = Orifice Centroid = e Upper Edge, H _t = eir Slope Length = 0-vr Orifice Area =	Zone 2 Rectangula 0.10 0.08 Calculated Parame Zone 3 Weir 4.85 3.09 7.31	Not Selected N/A N/A N/A Not Selected N/A N/A N/A	ft ² feet feet feet feet			
Invert of Vertical Orifice = Depth at top of Zone using Vertical Orifice = Vertical Orifice Height = Vertical Orifice Width = User Input: Overflow Weir (Dropbox with Flat of Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides =	Zone 2 Rectangular 2.10 4.06 2.00 7.00	Not Selected N/A N/A N/A Outlet Pipe OR Rect Not Selected N/A N/A N/A	ft (relative to basir ft (relative to basin inches inches tangular/Trapezoida ft (relative to basin b feet H:V feet	bottom at Stage = bottom at Stage = <u>al Weir (and No Out</u> oottom at Stage = 0 ft Gr	0 ft) Ver 0 ft) Vertical tlet Pipe). t) Height of Grate Overflow W rate Open Area / 10 verflow Grate Open	tical Orifice Area = Orifice Centroid = e Upper Edge, H _t = eipr Slope Length = 0-yr Orifice Area = Area w/o Debris =	Zone 2 Rectangula 0.10 0.08 Calculated Parame Zone 3 Weir 4.85 3.09 7.31 6.46	Not Selected N/A N/A N/A Not Selected N/A N/A N/A N/A	ft ² feet feet feet feet			
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Maximum Ponding Depth (ft) = Area at Maximum Ponding Depth (acres) = Maximum Volume Stored (acre-ft) =

0.96

1.16

1.08 1.966 1.13

1.18

1.22

1.26

1.30

<u>1.36</u> 5 410



Outflow Hydrograph Workbook Filename:

	Inflow Hydrog	raphs								
	The user can ov	verride the calcu	lated inflow hyd	rographs from t	his workbook wi	th inflow hydrog	raphs developed	l in a separate pr	ogram.	
	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	0.34	0.03	2.02
	0:15:00	0.00	0.00	3.00	4.88	6.06	4.07	5.14	4.98	9.37
	0:20:00	0.00	0.00	11.17	14.80	17.46	11.06	12.95	13.80	21.83
	0:25:00	0.00	0.00	23.37	30.89	37.17	23.12	26.44	28.44	45.91
	0:30:00	0.00	0.00	28.73	37.68	44.43	47.38	56.52	63.76	106.09
	0:35:00	0.00	0.00	27.51	35.49	41.42	57.02	68.02	81.26	133.30
	0:40:00	0.00	0.00	25.06	31.80	37.01	55.62	50.23	79.74	130.23
	0:50:00	0.00	0.00	19.43	25.29	29.30	45.28	53.56	65.81	120.11
	0:55:00	0.00	0.00	17.14	22.37	25.94	39.80	46.90	58.26	96.14
	1:00:00	0.00	0.00	15.25	19.80	23.14	34.65	40.63	51.57	85.17
	1:05:00	0.00	0.00	13.98	18.08	21.34	30.38	35.43	45.88	75.95
	1:10:00	0.00	0.00	12.57	16.86	20.05	26.79	31.15	39.58	65.30
	1:15:00	0.00	0.00	11.24	15.45	18.85	23.90	27.69	34.19	55.97
	1:20:00	0.00	0.00	10.04	13.84	17.12	20.93	24.17	28.86	46.85
	1:25:00	0.00	0.00	8.90	12.27	14.88	18.09	20.81	23.97	38.57
	1:30:00	0.00	0.00	7.83	10.85	12.81	15.24	17.47	19.68	31.36
	1.35.00	0.00	0.00	6.96	9.70	11.15	12.64	14.40	15.8/	24.93
	1:45:00	0.00	0.00	6.15	7 71	9.50	0.51	11.88	12.70	19.61
	1:50:00	0.00	0.00	6.01	7.15	9.09	8.36	9.41	9.55	14.50
	1:55:00	0.00	0.00	5.41	6.72	8.65	7.84	8.82	8.79	13.19
	2:00:00	0.00	0.00	4.82	6.27	7.99	7.48	8.41	8.24	12.25
	2:05:00	0.00	0.00	3.86	5.05	6.43	6.05	6.80	6.56	9.68
	2:10:00	0.00	0.00	2.98	3.88	4.95	4.63	5.19	4.93	7.22
	2:15:00	0.00	0.00	2.30	2.99	3.80	3.54	3.97	3.72	5.41
	2:20:00	0.00	0.00	1.76	2.28	2.88	2.69	3.02	2.82	4.10
	2:25:00	0.00	0.00	1.33	1.73	2.17	2.03	2.28	2.14	3.10
	2:30:00	0.00	0.00	1.01	1.28	1.61	1.51	1.69	1.60	2.31
	2:35:00	0.00	0.00	0.74	0.93	1.20	1.11	1.24	1.19	1.71
	2:45:00	0.00	0.00	0.34	0.08	0.63	0.65	0.93	0.64	0.92
	2:50:00	0.00	0.00	0.24	0.33	0.42	0.41	0.46	0.44	0.62
	2:55:00	0.00	0.00	0.14	0.20	0.26	0.26	0.28	0.27	0.38
	3:00:00	0.00	0.00	0.07	0.11	0.13	0.14	0.15	0.14	0.20
	3:05:00	0.00	0.00	0.03	0.04	0.05	0.06	0.06	0.05	0.07
	3:10:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	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
	3:30:00	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
	4:15:00	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
	4:40:00	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
	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
	5:20:00	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
	5:40:00	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
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Project: Grandview Basin ID: Pond B Server 1

10

Example Zone Configuration (Retention Pond)

-



Posts

		ersned information
	EDB	Selected BMP Type =
acres	28.99	Watershed Area =
ft	1,700	Watershed Length =
ft	850	Watershed Length to Centroid =
ft/ft	0.020	Watershed Slope =
percen	61.90%	Watershed Imperviousness =
percen	100.0%	Percentage Hydrologic Soil Group A =
percen	0.0%	Percentage Hydrologic Soil Group B =
percen	0.0%	Percentage Hydrologic Soil Groups C/D =
hours	40.0	Target WQCV Drain Time =
-	User Input	Location for 1-hr Rainfall Depths =

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

			opuona
Water Quality Capture Volume (WQCV) =	0.586	acre-feet	
Excess Urban Runoff Volume (EURV) =	2.197	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	1.628	acre-feet	1.1
5-yr Runoff Volume (P1 = 1.5 in.) =	2.140	acre-feet	1.5
10-yr Runoff Volume (P1 = 1.75 in.) =	2.552	acre-feet	1.7
25-yr Runoff Volume (P1 = 2 in.) =	3.104	acre-feet	2.0
50-yr Runoff Volume (P1 = 2.25 in.) =	3.648	acre-feet	2.2
100-yr Runoff Volume (P1 = 2.52 in.) =	4.314	acre-feet	2.5
500-yr Runoff Volume (P1 = 3.68 in.) =	7.093	acre-feet	3.6
Approximate 2-yr Detention Volume =	1.426	acre-feet	
Approximate 5-yr Detention Volume =	1.867	acre-feet	
Approximate 10-yr Detention Volume =	2.255	acre-feet	
Approximate 25-yr Detention Volume =	2.722	acre-feet	
Approximate 50-yr Detention Volume =	3.006	acre-feet	
Approximate 100-yr Detention Volume =	3.310	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.586	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.610	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.114	acre-feet
Total Detention Basin Volume =	3.310	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 (Lucy) =	user	ft

Surcharge volume Lengun $(L_{ISV}) =$	user	ii.
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 =	0.50	ft							
				Optional				Optional			
		Stage - Storage	Stage	Override	Length	Width	Area	Override	Area	Volume	Volume
		Description	(ft)	Stage (ft)	(ft)	(ft)	(ft²)	Area (ft ²)	(acre)	(ft 3)	(ac-ft)
		Top of Micropool		0.00				35	0.001		
				0.50				3,203	0.074	809	0.019
		6964		1.00				29,135	0.669	8,894	0.204
				1 50				30.250	0.604	22 7/10	0.545
				1.50			-	30,230	0.094	23,740	0.040
		6965		2.00				31,366	0.720	39,144	0.899
				2.50				32,485	0.746	55,107	1,265
		cocc		2.00				22,000	0.771	71.000	1.644
		6966		3.00				33,606	0.771	/1,629	1.644
				3.50				34,729	0.797	88,713	2.037
		6067		4.00				25.956	0.922	106 260	2 442
		0307		4.00		-		33,830	0.823	100,300	2.442
				4.50				36,987	0.849	124,570	2.860
		6968		5.00				38,126	0.875	143,348	3.291
		6069 F		E E0				20.275	0.002	162,609	2 725
		0900.5		5.50				39,275	0.902	102,090	3.735
	0										
i User	Overrides										
	acre-feet										
	acre-feet										
0	inchos										
9	incries										
0	inches										
5	inches										
0	inchos										
J	in unes			-							
5	inches										
2	inches										
8	inchor										
0											
										-	
										1	
										1	



DETENTION BASIN OUTLET STRUCTURE DESIGN									
MHFD-Detention, Version 4.04 (February 2021)									
Project:	Grandview			-	· ·				
Basin 10:	Pond B								
(come t				Estimated	Estimated	0.11.5.7			
TT I I	1			Stage (ft)	Volume (ac-ft)	Outlet Type	1		
street seal way			Zone 1 (WQCV)	1.56	0.586	Orifice Plate			
1	CONTRACT OF		Zone 2 (EURV)	3.70	1.610	Rectangular Orifice			
Financial Sector	• figuration (Bot		Zone 3 (100-year)	5.03	1.114	Weir&Pipe (Restrict)			
Example Zone	Configuration (Rei	ention Pona)		Total (all zones)	3.310				
User Input: Orifice at Underdrain Outlet (typical	y used to drain WQ	CV in a Filtration BN	<u>4P)</u>				Calculated Parame	ters for Underdrain	L
Underdrain Orifice Invert Depth =	N/A	ft (distance below	the filtration meaia	surface)	Underd	drain Orifice Area =	N/A	ft ²	
Underdrain Orifice Diameter =	IN/A	Inches			Underdrain	Orifice Centrold =	N/A	feet	
User Input: Orifice Plate with one or more orific	es or Elliptical Slot V	Neir (typically used	to drain WOCV and	d/or EURV in a sedi	mentation BMP)		Calculated Parame	ters for Plate	
Invert of Lowest Orifice =	ice = 0.00 ft (relative to basin bottom at Stage = 0 ft) WQ Orifice Area per Row = $1.875E-02$ ft ²								
Depth at top of Zone using Orifice Plate =	1.57	ft (relative to basin	bottom at Stage =	= 0 ft)	Elli	ptical Half-Width =	N/A	feet	
Orifice Plate: Orifice Vertical Spacing =	6.30	inches			Ellipti	ical Slot Centroid =	N/A	feet	
Orifice Plate: Orifice Area per Row =	2.70	sq. inches (diamete	er = 1-13/16 inches	5)	E	Iliptical Slot Area =	N/A	ft ²	
User Input: Stage and Total Area of Each Orific	e Row (numbered fi	rom lowest to highe	<u>est)</u>						7
Change of Oriflan Combusid (A)	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 Orlifice Centroid (ft)	2.70	2.52	2.70						-
Office Area (sq. litcles)	2.70	2.70	2.70						
	Row 9 (optional)	Row 10 (ontional)	Row 11 (optional)	Row 12 (ontional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)	1
Stage of Orifice Centroid (ft)		rion 10 (optional)	(optional)	(optional)			(optional)		
Orifice Area (sq. inches)									
			•	•					-
User Input: Vertical Orifice (Circular or Rectang	ular)	-					Calculated Parame	ters for Vertical Ori	fice
	Zone 2 Rectangula	Not Selected					Zone 2 Rectangula	Not Selected	
Invert of Vertical Orifice =	1.60	N/A	ft (relative to basin	bottom at Stage =	= 0 ft) Ver	rtical Orifice Area =	0.06	N/A	ft ²
Depth at top of Zone using Vertical Orifice =	3.76	N/A	ft (relative to basin	<pre>bottom at Stage =</pre>	= 0 ft) Vertica	I Orifice Centroid =	0.06	N/A	feet
Vertical Orifice Height =	1.50	N/A	inches						
Vertical Orifice Width =	6.00		inches						
Lass Innuts Overflew Weis (Drenhey with Flet	" Clanad Crata and	Outlat Ding OD Dag	ton aulou/Tuon onoid	al Main (and Na Out	Hat Dina)		Coloulated Davame	tore for Overflow M	lain
User Input: Overnow Weir (Dropbox With Flat o	Zono 3 Weir	Not Selected	langular/Trapezolua	ai weir (and No Ou	<u>tiet Pipe)</u>			Lers for Overflow w	7
Overflow Weir Front Edge Height Ho =	3.80	N/A	ft (relative to basin h	ottom at Stage – 0 fi	 Height of Grate 	e linner Edge H. =	20ne 3 weir 4 55	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	ottom at Stage = 0 h	Overflow W	eir Slope Length =	3.09	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	G	rate Open Area / 10	0-yr Orifice Area =	8.04	N/A	
Horiz. Length of Weir Sides =	3.00	N/A	feet	O	verflow Grate Open	Area w/o Debris =	8.61	N/A	ft ²
Overflow Grate Type =	Type C Grate	N/A		(Overflow Grate Ope	n Area w/ Debris =	4.30	N/A	ft ²
Debris Clogging % =	50%	N/A	%						-
User Input: Outlet Pipe w/ Flow Restriction Plate	(Circular Orifice, R	estrictor Plate, or Re	ectangular Orifice)		<u>Ca</u>	alculated Parameter	s for Outlet Pipe w/	Flow Restriction Pla	late T
Darth to Towart of Outlet Dire	Zone 3 Restrictor	Not Selected					Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below ba	asin bottom at Stage	= 0 ft) Outlet	t Orifice Controld =	1.07	N/A	
Restrictor Plate Height Above Pipe Invert -	10.00	IN/A	inches	Half-Con	tral Angle of Restric	tor Plate on Pine -	1 74	N/A N/A	Iradians
Restrictor rate neight Above ripe invert =	10.50	l	inches	fian cen		tor rate on ripe -	1.74	IN/A	
User Input: Emergency Spillway (Rectangular or	Trapezoidal)						Calculated Parame	ters for Spillway	
Spillway Invert Stage=	5.25	ft (relative to basin	bottom at Stage =	= 0 ft)	Spillway D	esign Flow Depth=	0.49	feet	
Spillway Crest Length =	68.00	feet			Stage at 1	Top of Freeboard =	6.74	feet	
Spillway End Slopes =	4.00	H:V			Basin Area at 1	Top of Freeboard =	0.90	acres	
Freeboard above Max Water Surface =	1.00	feet			Basin Volume at 7	Top of Freeboard =	3.74	acre-ft	
Routed Hydrograph Results	The user can over	ride the default CUI	HP hydrographs and	d runoff volumes by	entering new value	es in the Inflow Hvo	frographs table (Co	lumns W through A	F).
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	3.68
CUHP Runoff Volume (acre-ft) =	0.586 N/A	2.197 N/A	1.628	2.140	2.552	3.104	3.648	4.314	7.093
CUHP Predevelopment Peak O (cfs) =	N/A N/A	N/A	0.2	0.4	0.5	5.0	9.9	16.2	42.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.17	0.34	0.56	1.45
Peak Inflow Q (cfs) =	N1/A		/5 /		1 38.4	50.3	60.3	/3.0	120.5
Posk Outflow O (ofc) -	N/A	N/A	0.7	00	12	35	65	11.4	37.6
Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment O =	N/A 0.3 N/A	N/A 0.9 N/A	0.7 N/A	0.9	1.2	3.5 0.7	6.5 0.7	11.4 0.7	37.6
$\begin{array}{l} \mbox{Peak Outflow Q (cfs)} = \\ \mbox{Ratio Peak Outflow to Predevelopment Q} = \\ \mbox{Structure Controlling Flow} = \end{array}$	N/A 0.3 N/A Plate	N/A 0.9 N/A Vertical Orifice 1	0.7 N/A Vertical Orifice 1	0.9 2.2 Vertical Orifice 1	1.2 2.1 Overflow Weir 1	3.5 0.7 Overflow Weir 1	6.5 0.7 Overflow Weir 1	11.4 0.7 Outlet Plate 1	37.6 0.9 N/A
Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) =	N/A 0.3 N/A Plate N/A	N/A 0.9 N/A Vertical Orifice 1 N/A	0.7 N/A Vertical Orifice 1 N/A	0.9 2.2 Vertical Orifice 1 N/A	1.2 2.1 Overflow Weir 1 0.0	3.5 0.7 Overflow Weir 1 0.3	6.5 0.7 Overflow Weir 1 0.6	11.4 0.7 Outlet Plate 1 1.2	37.6 0.9 N/A 1.2
Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) =	N/A 0.3 N/A Plate N/A N/A 40	N/A 0.9 N/A Vertical Orifice 1 N/A N/A 66	0.7 N/A Vertical Orifice 1 N/A N/A 60	0.9 2.2 Vertical Orifice 1 N/A N/A 66	1.2 2.1 Overflow Weir 1 0.0 N/A 70	3.5 0.7 Overflow Weir 1 0.3 N/A 71	6.5 0.7 Overflow Weir 1 0.6 N/A 70	11.4 0.7 Outlet Plate 1 1.2 N/A 68	37.6 0.9 N/A 1.2 N/A 62
Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 99% of Inflow Volume (hours) =	N/A 0.3 N/A Plate N/A N/A 40 42	N/A 0.9 N/A Vertical Orifice 1 N/A N/A 66 71	0.7 N/A Vertical Orifice 1 N/A N/A 60 65	0.9 2.2 Vertical Orifice 1 N/A N/A 66 71	1.2 2.1 Overflow Weir 1 0.0 N/A 70 76	3.5 0.7 Overflow Weir 1 0.3 N/A 71 77	6.5 0.7 Overflow Weir 1 0.6 N/A 70 77	11.4 0.7 Outlet Plate 1 1.2 N/A 68 77	37.6 0.9 N/A 1.2 N/A 62 74

Maximum Ponding Depth (ft) = Area at Maximum Ponding Depth (acres) = Maximum Volume Stored (acre-ft) =

0.70

0.81

0.76

0.80

0.82

0.84

0.86

0.88

0.90



Outflow Hydrograph Workbook Filename:

	Inflow Hydrographs									
	The user can ov	verride the calcu	lated inflow hyd	rographs from t	his workbook wi	th inflow hydrog	raphs developed	l in a separate pr	ogram.	
	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	0.34	0.03	2.04
	0:15:00	0.00	0.00	3.02	4.91	6.09	4.10	5.12	5.00	9.11
	0:20:00	0.00	0.00	10.77	14.11	16.60	10.48	12.21	13.09	20.49
	0:25:00	0.00	0.00	21.79	28.81	34.81	21.55	24.59	26.44	42.94
	0:30:00	0.00	0.00	25.16	33.07	38.94	44.29	53.29	60.57	102.02
	0:40:00	0.00	0.00	22.90	29.59	29.62	46.96	56.21	68.24	112.40
	0:45:00	0.00	0.00	17.06	21.91	25.61	40.51	48.31	60.24	99.69
	0:50:00	0.00	0.00	14.44	18.97	21.87	35.63	42.32	52.43	87.38
	0:55:00	0.00	0.00	12.47	16.33	18.94	29.94	35.34	44.54	74.23
	1:00:00	0.00	0.00	11.19	14.55	17.09	25.32	29.67	38.26	63.98
	1:05:00	0.00	0.00	10.18	13.18	15.62	22.22	25.93	34.19	57.50
	1:10:00	0.00	0.00	8.72	11.88	14.16	19.09	22.17	28.45	47.40
	1:15:00	0.00	0.00	7.35	10.29	12.75	16.28	18.81	23.2/	38.32
	1:25:00	0.00	0.00	5.40	7.62	0.32	10.84	12.30	13.72	29.42
	1:30:00	0.00	0.00	4.97	7.02	8.31	8.74	9.89	10.55	16.67
	1:35:00	0.00	0.00	4.76	6.73	7.68	7.47	8.43	8.72	13.60
	1:40:00	0.00	0.00	4.63	6.08	7.23	6.70	7.54	7.63	11.71
	1:45:00	0.00	0.00	4.55	5.54	6.90	6.19	6.96	6.89	10.41
	1:50:00	0.00	0.00	4.49	5.15	6.68	5.84	6.56	6.38	9.52
	1:55:00	0.00	0.00	3.94	4.86	6.36	5.60	6.30	6.02	8.89
	2:00:00	0.00	0.00	3.46	4.51	5.79	5.43	6.11	5.78	8.46
	2:03:00	0.00	0.00	2.61	2.48	4.35	4.12 2.08	4.03	4.30	4 50
	2:15:00	0.00	0.00	1.91	1.80	2 28	2.90	2 43	2 30	3 34
	2:20:00	0.00	0.00	1.00	1.29	1.65	1.57	1.76	1.67	2.43
	2:25:00	0.00	0.00	0.71	0.90	1.16	1.10	1.24	1.18	1.71
	2:30:00	0.00	0.00	0.48	0.61	0.81	0.77	0.86	0.82	1.19
	2:35:00	0.00	0.00	0.32	0.42	0.56	0.54	0.60	0.57	0.83
	2:40:00	0.00	0.00	0.19	0.27	0.35	0.35	0.39	0.37	0.53
	2:45:00	0.00	0.00	0.10	0.16	0.19	0.20	0.22	0.21	0.30
	2:50:00	0.00	0.00	0.04	0.07	0.08	0.09	0.10	0.10	0.13
	3:00:00	0.00	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.03
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	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
	4:20:00	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
	4:40:00	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
	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
	5:15:00	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
	5:35:00	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
	5:55:00	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

Project: <u>Grandview</u> Basin ID: <u>Pond C</u> - market

41

10.00



Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	41.47	acres
Watershed Length =	1,890	ft
Watershed Length to Centroid =	1,050	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	61.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

	2		Optional User	Overnu
Water Quality Capture Volume (WQCV) =	0.828	acre-feet		acre-fee
Excess Urban Runoff Volume (EURV) =	3.084	acre-feet		acre-fee
2-yr Runoff Volume (P1 = 1.19 in.) =	2.295	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.020	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	3.602	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	4.390	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	5.166	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	6.119	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.68 in.) =	10.099	acre-feet	3.68	inches
Approximate 2-yr Detention Volume =	2.001	acre-feet		
Approximate 5-yr Detention Volume =	2.620	acre-feet		
Approximate 10-yr Detention Volume =	3.167	acre-feet		
Approximate 25-yr Detention Volume =	3.827	acre-feet		
Approximate 50-yr Detention Volume =	4.228	acre-feet		
Approximate 100-yr Detention Volume =	4.663	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.828	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.256	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.579	acre-feet
Total Detention Basin Volume =	4.663	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 =	0.50	ft							
			Optional				Optional			
	Stage - Storage	Stage	Override	Length	Width	Area	Override	Area	Volume	Volume
	Description	(ft)	Stage (ft)	(ft)	(ft)	(ft ²)	Area (ft ²)	(acre)	(ft 3)	(ac-ft)
	Top of Micropool		0.00				35	0.001		
			0.00				35	0.001		
	6927		0.50				246	0.006	70	0.002
					1			0.4	-	0.077
			1.00				8,508	0.195	2,258	0.052
	6928		1.50				40.729	0.935	14.567	0.334
			2.00		+	l	42,100	0.071	25,557	0.012
			2.00				42,406	0.974	35,351	0.812
	6929		2.50				44,107	1.013	56,979	1.308
			2.00		1	1	45,000	1.053	70.000	1.024
			3.00				45,833	1.052	/9,464	1.824
	6930		3.50				47,584	1.092	102.818	2.360
			4.00		1	1	40,250	1.122	107.054	2.017
			4.00				49,360	1.133	127,054	2.917
	6931		4,50				51,160	1.174	152,184	3,494
					t	l	52,000	1.015	170.221	4.001
			5.00		-		52,986	1.216	178,221	4.091
	6932		5,50				54,836	1,259	205,176	4,710
			0.00		t	1	5.,000	1.205	222,270	
	6932.5		6.00				56,711	1.302	233,063	5.350
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DETENTION BASIN OUTLET STRUCTURE DESIGN									
MHFD-Detention, Version 4.04 (February 2021)									
Project:	Grandview				, ,				
Basin ID:	Pond C								
Comment of the second s				Estimated	Estimated				
and the second	-			Stage (ft)	Volume (ac-ft)	Outlet Type			
arrent ene T exc.			Zone 1 (WQCV)	2.02	0.828	Orifice Plate			
1	CHEVELAN COMPLEX		Zone 2 (EURV)	4.15	2.256	Rectangular Orifice			
PERSONAL DEPOCIS			Zone 3 (100-year)	5.47	1.579	Weir&Pipe (Restrict)			
Example Zone Configuration (Retention Pond) Total (all zones) 4.663									
User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP) Calculated Parameters for Underdrain									
Underdrain Orifice Invert Depth =	N/A	ft (distance below	the filtration media	surface)	Underd	Irain Orifice Area =	N/A	ft ²	
Underdrain Orifice Diameter =	N/A	inches			Underdrain	Orifice Centroid =	N/A	feet	
User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP) Calculated Parameters for Plate									
Invert of Lowest Orlfice =	0.00	ft (relative to basin	bottom at Stage =	0π)	WQ Urifi	ce Area per Row =	2.083E-02	ft ²	
Depth at top of Zone using Onfice Plate =	2.02	It (relative to basin	bottom at Stage =	0π)	EIII	ptical Hair-Width =	N/A	reet	
Orifice Plate: Orifice Vertical Spacing =	8.30	Inches	an 1 15/16 inches		Ellipti	lical Slot Centrold =	N/A	reet	
Office Place: Office Area per Row =	3.00	sq. inches (diamete	er = 1-15/10 inches)	E	nipucai siot Area =	IN/A	jπ-	
User Input: Stage and Total Area of Each Orifice	Row (numbered fo	rom lowest to highe	ust)						
oser input. Stage and total fired of Each office	Row 1 (required)	Row 2 (ontional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)	1
Stage of Orifice Centroid (ft)	0.00	0.67	1 35				(optional)		
Orifice Area (so inches)	3.00	3.00	3.00						1
office Area (sq. menes)	5.00	5.00	5.00						1
	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (ontional)	Row 13 (ontional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)	1
Stage of Orifice Centroid (ft)			(optional)	(optional)	(optional)	Row IT (optional)	Row 15 (optional)		
Orifice Area (sq. inches)									1
									1
User Input: Vertical Orifice (Circular or Rectange	ular)						Calculated Parame	eters for Vertical Orif	fice
	Zone 2 Rectangula	Not Selected					Zone 2 Rectangula	Not Selected	1
Invert of Vertical Orifice =	2.02	N/A	ft (relative to basin	bottom at Stage =	0 ft) Ver	tical Orifice Area =	0.10	N/A	ft ²
Depth at top of Zone using Vertical Orifice =	4.15	N/A	ft (relative to basin	bottom at Stage =	0 ft) Vertical	Orifice Centroid =	0.10	N/A	feet
Vertical Orifice Height =	2.50	N/A	inches	5	,				
Vertical Orifice Width =	6.00		inches						
User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe) Calculated Parameters for Overflow Weir									
User Input: Overflow Weir (Dropbox with Flat or	r Sloped Grate and	Outlet Pipe OR Rec	tangular/Trapezoida	al Weir (and No Out	tlet Pipe)		Calculated Parame	eters for Overflow W	leir
User Input: Overflow Weir (Dropbox with Flat or	r Sloped Grate and Zone 3 Weir	Outlet Pipe OR Rec Not Selected	tangular/Trapezoida	al Weir (and No Out	tlet Pipe)		Calculated Parame	ters for Overflow W Not Selected	/ <u>eir</u>
User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho =	r Sloped Grate and Zone 3 Weir 4.20	Outlet Pipe OR Rec Not Selected N/A	tangular/Trapezoida ft (relative to basin t	al Weir (and No Out	t <u>let Pipe)</u>) Height of Grate	e Upper Edge, H _t =	Calculated Parame Zone 3 Weir 4.95	eters for Overflow W Not Selected N/A	<u>/eir</u> feet
User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length =	r Sloped Grate and Zone 3 Weir 4.20 3.00	Outlet Pipe OR Rec Not Selected N/A N/A	tangular/Trapezoida ft (relative to basin t feet	al Weir (and No Out	tlet Pipe)) Height of Grate Overflow W	e Upper Edge, H _t = /eir Slope Length =	Calculated Parame Zone 3 Weir 4.95 3.09	eters for Overflow W Not Selected N/A N/A	feet feet
User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope =	r <u>Sloped Grate and</u> Zone 3 Weir 4.20 3.00 4.00	Outlet Pipe OR Rec Not Selected N/A N/A N/A	tangular/Trapezoida ft (relative to basin t feet H:V	al Weir (and No Out Nottom at Stage = 0 ft Gi	tlet Pipe)) Height of Grate Overflow W rate Open Area / 10	e Upper Edge, H _t = /eir Slope Length = 10-yr Orifice Area =	Calculated Parame Zone 3 Weir 4.95 3.09 6.00	ters for Overflow W Not Selected N/A N/A N/A	feet feet
User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides =	r <u>Sloped Grate and</u> Zone 3 Weir 4.20 3.00 4.00 3.00	Outlet Pipe OR Rec Not Selected N/A N/A N/A N/A	tangular/Trapezoida ft (relative to basin t feet H:V feet	al Weir (and No Out Nottom at Stage = 0 ft Gi Ov	tlet Pipe)) Height of Grate Overflow W rate Open Area / 10 verflow Grate Open	e Upper Edge, H _t = /eir Slope Length = 10-yr Orifice Area = Area w/o Debris =	Calculated Parame Zone 3 Weir 4.95 3.09 6.00 6.46	tters for Overflow W Not Selected N/A N/A N/A N/A	feet feet feet ft ²
User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type =	r Sloped Grate and Zone 3 Weir 4.20 3.00 4.00 3.00 Type C Grate	Outlet Pipe OR Rect Not Selected N/A N/A N/A N/A N/A	tangular/Trapezoida ft (relative to basin t feet H:V feet	al Weir (and No Out Nottom at Stage = 0 ft Gi Ov Ov C	tlet Pipe)) Height of Grate Overflow W rate Open Area / 10 verflow Grate Open Overflow Grate Open	e Upper Edge, H _t = /eir Slope Length = 10-yr Orifice Area = Area w/o Debris = n Area w/ Debris =	Calculated Parame Zone 3 Weir 4.95 3.09 6.00 6.46 3.23	ters for Overflow W Not Selected N/A N/A N/A N/A N/A	feet feet ft ² ft ²
User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % =	r Sloped Grate and Zone 3 Weir 4.20 3.00 4.00 3.00 Type C Grate 50%	Outlet Pipe OR Rec N/A Selected N/A N/A N/A N/A N/A N/A	tangular/Trapezoida ft (relative to basin t feet H:V feet %	al Weir (and No Out nottom at Stage = 0 ft Gr O C	ilet Pipe)) Height of Grate Overflow W rate Open Area / 10 verflow Grate Open Overflow Grate Open	e Upper Edge, H _t = /eir Slope Length = 00-yr Orifice Area = Area w/o Debris = n Area w/ Debris =	Calculated Parame Zone 3 Weir 4.95 3.09 6.00 6.46 3.23	ters for Overflow W Not Selected N/A N/A N/A N/A N/A	feet feet ft ² ft ²
User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % =	r Sloped Grate and Zone 3 Weir 4.20 3.00 4.00 3.00 Type C Grate 50%	Outlet Pipe OR Rec: Not Selected N/A N/A N/A N/A N/A N/A	tangular/Trapezoida ft (relative to basin t feet H:V feet %	al Weir (and No Out nottom at Stage = 0 ft Gr Ov C	tet Pipe)) Height of Grate Overflow W rate Open Area / 10 verflow Grate Open Iverflow Grate Open	e Upper Edge, H _t = /eir Slope Length = /0-yr Orifice Area = Area w/o Debris = n Area w/ Debris =	Calculated Parame Zone 3 Weir 4.95 3.09 6.00 6.46 3.23	ters for Overflow W Not Selected N/A N/A N/A N/A N/A	feet feet feet ft ² ft ²
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User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectangular or Spillway Crest Length = Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Reuted Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Reudoff Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) =	r Sloped Grate and. Zone 3 Weir 4.20 3.00 4.00 3.00 Type C Grate 50% (Circular Orifice, R Zone 3 Restrictor 0.25 24.00 9.00 Trapezoidal) 6.00 60.00 4.00 1.00 The user can over WOCV N/A 0.828 N/A N/A N/A N/A N/A N/A N/A N/A	Outlet Pipe OR Rec Not Selected N/A N/A N/A N/A N/A N/A estrictor Plate, or R Not Selected N/A N/A ft (relative to basin feet H:V feet <i>ide the default CUF</i> EURV N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	tangular/Trapezoida ft (relative to basin to feet H:V feet % ectangular Orifice) ft (distance below basin inches inches bottom at Stage = 1/P hydrographs and 2 Year 1.19 2.295 2.295 2.295 0.3 0.01 35.5 1.0 N/A Vertical Orifice 1 N/A 61 62	al Weir (and No Out oottom at Stage = 0 ft Gi Ov C asin bottom at Stage = Half-Cent 0 ft)	ciet Pipe) c) Height of Grate Overflow W rate Open Area / 10 verflow Grate Open Overflow Grate Open Overflow Grate Open Caral Angle of Restrict Spillway D Stage at T Basin Area at T Basin Volume at T Basin Volume at T entering new value 10 Year 1.75 3.602 3.602 3.602 0.8 c.	e Upper Edge, H _t = feir Slope Length = 10-yr Orifice Area = Area w/o Debris = n Area w/ Debris = alculated Parameter utlet Orifice Area = t Orifice Centroid = tor Plate on Pipe = esign Flow Depth= Fop of Freeboard = Fop of Freeboard = Fop of Freeboard = Fop of Freeboard = Cop of Freeboard	Calculated Parame Zone 3 Weir 4.95 3.09 6.00 6.46 3.23 s for Outlet Pipe w/ Zone 3 Restrictor 1.08 0.44 1.32 Calculated Parame 0.67 7.67 1.30 5.35 Irographs table (Co Softee 5.166 5.166 5.166 5.166 5.166 5.166 5.166 0.34 85.8 7.6 0.5 Overflow Weir 1 1.0 N/A 72	ters for Overflow W Not Selected N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	(eir feet feet ft ² ft ² feet radians (<i>f</i>) f ² feet radians (<i>f</i>) feet radians (<i>f</i>)

Maximum Ponding Depth (ft) = Area at Maximum Ponding Depth (acres) = Maximum Volume Stored (acre-ft) =

0.98

1.15

1.08

1.13

1.17

1.21

1.24

1.28 5.040

1.3



Outflow Hydrograph Workbook Filename:

	Inflow Hydrographs									
	The user can ov	verride the calcu	lated inflow hyd	rographs from t	his workbook wi	th inflow hydrog	raphs developed	l in a separate pr	ogram.	
	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	0.47	0.05	2.77
	0:15:00	0.00	0.00	4.11	6.67	8.28	5.57	6.99	6.81	12.53
	0:20:00	0.00	0.00	14.84	19.53	23.00	14.54	16.96	18.16	28.48
	0:25:00	0.00	0.00	30.31	40.06	48.42	29.97	34.20	36.77	59.81
	0:30:00	0.00	0.00	35.49	46.73	55.15	61.71	74.34	84.53	142.93
	0:40:00	0.00	0.00	28 50	36.14	49.08	66.86	80.18	97.61	1/2.29
	0:45:00	0.00	0.00	24.17	31.05	36.32	57.67	68.91	86.01	142.85
	0:50:00	0.00	0.00	20.44	26.87	31.02	50.61	60.24	74.82	125.19
	0:55:00	0.00	0.00	17.63	23.10	26.80	42.59	50.37	63.54	106.35
	1:00:00	0.00	0.00	15.80	20.57	24.16	35.91	42.16	54.43	91.39
	1:05:00	0.00	0.00	14.38	18.63	22.07	31.48	36.78	48.56	82.03
	1:10:00	0.00	0.00	12.34	16.79	20.01	27.07	31.47	40.52	67.82
	1:15:00	0.00	0.00	10.39	14.56	18.01	23.07	26.68	33.08	54.71
	1:25:00	0.00	0.00	7.62	12.35	13.00	15.89	17.50	25.74	42.02
	1:30:00	0.00	0.00	7.02	9.95	11.74	12 37	14.01	14 96	23 71
	1:35:00	0.00	0.00	6.71	9.50	10.85	10.57	11.92	12.34	19.28
	1:40:00	0.00	0.00	6.54	8.59	10.21	9.47	10.66	10.78	16.58
	1:45:00	0.00	0.00	6.42	7.83	9.74	8.74	9.83	9.73	14.72
	1:50:00	0.00	0.00	6.33	7.27	9.42	8.24	9.27	9.02	13.46
	1:55:00	0.00	0.00	5.58	6.86	8.98	7.90	8.89	8.50	12.55
	2:00:00	0.00	0.00	4.89	6.37	8.19	7.66	8.62	8.16	11.95
	2:05:00	0.00	0.00	3./2	4.86	6.20	5.8/	6.60	6.21	9.07
	2:15:00	0.00	0.00	1.07	2.56	3 24	3.07	3.45	3 27	4 74
	2:20:00	0.00	0.00	1.42	1.84	2.34	2.22	2.49	2.38	3.44
	2:25:00	0.00	0.00	1.01	1.28	1.65	1.57	1.75	1.68	2.42
	2:30:00	0.00	0.00	0.69	0.87	1.15	1.09	1.22	1.17	1.69
	2:35:00	0.00	0.00	0.46	0.60	0.79	0.76	0.85	0.81	1.17
	2:40:00	0.00	0.00	0.28	0.39	0.50	0.49	0.55	0.52	0.75
	2:45:00	0.00	0.00	0.14	0.22	0.27	0.28	0.31	0.30	0.42
	2:50:00	0.00	0.00	0.06	0.10	0.12	0.13	0.14	0.14	0.19
	3:00:00	0.00	0.00	0.02	0.03	0.03	0.04	0.04	0.04	0.05
	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
	3:45:00	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
	4:20:00	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
	4:40:00	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
	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
	5:15:00	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
	5:35:00	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
	5:55:00	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

Project: <u>Grandview</u> Basin ID: <u>Pond D</u>

Denth Increment - 0.50 ft



Watershed Information

EDB	
12.15	acres
1,200	ft
600	ft
0.020	ft/ft
61.30%	percent
100.0%	percent
0.0%	percent
0.0%	percent
40.0	hours
User Input	
	EDB 12.15 1,200 600 0.020 61.30% 100.0% 0.0% 0.0% 40.0 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 osci	overnu
Water Quality Capture Volume (WQCV) =	0.244	acre-feet		acre-fee
Excess Urban Runoff Volume (EURV) =	0.909	acre-feet		acre-fee
2-yr Runoff Volume (P1 = 1.19 in.) =	0.666	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.876	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.045	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.272	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.496	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.770	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.68 in.) =	2.916	acre-feet	3.68	inches
Approximate 2-yr Detention Volume =	0.590	acre-feet		
Approximate 5-yr Detention Volume =	0.772	acre-feet		
Approximate 10-yr Detention Volume =	0.934	acre-feet		
Approximate 25-yr Detention Volume =	1.128	acre-feet		
Approximate 50-yr Detention Volume =	1.246	acre-feet		
Approximate 100-yr Detention Volume =	1.373	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.244	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.666	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.464	acre-feet
Total Detention Basin Volume =	1.373	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 (STC) =	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

		Deput Increment =	0.50	Optional				Optional			
		Stage - Storage	Stage	Override	Length	Width	Area	Override	Area	Volume	Volume
		Description	(ft)	Stage (ft)	(ft)	(ft)	(ft²)	Area (ft ²)	(acre)	(ft 3)	(ac-ft)
		Top of Micropool		0.00				35	0.001		
		6969		0.50				35	0.001	18	0.000
				1.00				5,514	0.127	1,404	0.032
		6970		1.50				13,763	0.316	6,223	0.143
				2.00				14,669	0.337	13,331	0.306
		6971		2.50				15,600	0.358	20,899	0.480
				3.00				16,556	0.380	28,938	0.664
		6972		3.50				17,537	0.403	37,461	0.860
				4.00				18,542	0.426	46,481	1.067
		6973		4.50				19,573	0.449	56,009	1.286
				5.00				20,628	0.474	66,059	1.517
		6974		5.50				21,708	0.498	76,643	1.759
User	Overrides										
	acre-feet										
-	acre-feet										
9	inches										
)	inches										
5	inches										
2	inches										
5	inches										
2	inches										
3	inches										
						-					
						-					



	DE	TENTION	BASIN OUT	FLET STRU	CTURE DE	SIGN			
		MHI	D-Detention, Ver	sion 4.04 (Februar	ry 2021)	01011			
Project: Basin ID:	Grandview Rond D								
Basili ID.	Polid D			Estimate d	Estimate d				
The second second				Stage (ft)	Volume (ac-ft)	Outlet Type			
The Twee Tweet			7000 1 (WOCV)	1.82	0 244	Orifice Plate	1		
	A CONTRACT		Zone 2 (FURV)	3.63	0.211	Circular Orifice			
1000 1 000 V	OWNER		Zono 2 (100 year)	4 70	0.000	Woir& Bipo (Bostrict)	-		
Example Zone	Configuration (Ret	ention Pond)	Zone 3 (100-year)	4.70	0.404	weirapipe (Restrict)			
User Input: Orifice at Underdrain Outlet (typical	v used to drain WO	CV in a Filtration BN	ND)	Total (all 2011es)	1.373]	Calculated Parame	ters for Underdrain	
Underdrain Orifice Invert Depth =	N/A	ft (distance below	the filtration media	surface)	Under	Irain Orifice Area =	N/A		
Underdrain Orifice Diameter =	N/A	inches		,	Underdrair	Orifice Centroid =	N/A	feet	
							-	1	
User Input: Orifice Plate with one or more orific	es or Elliptical Slot V	Weir (typically used	to drain WQCV and	d/or EURV in a sedi	mentation BMP)		Calculated Parame	ters for Plate	
Invert of Lowest Orifice =	0.00	ft (relative to basin	bottom at Stage =	= 0 ft)	WQ Orifi	ice Area per Row =	6.597E-03	ft²	
Depth at top of Zone using Orifice Plate =	1.82	ft (relative to basin	bottom at Stage =	= 0 ft)	Elli	ptical Half-Width =	N/A	feet	
Orifice Plate: Orifice Vertical Spacing =	7.10	linches			Ellipt	ical Slot Centroid =	N/A	feet	
Orifice Plate: Orifice Area per Row =	0.95]sq. inches (diameti	er = 1-1/16 inches)		E	lliptical Slot Area =	N/A]ft [.]	
User Input: Stage and Total Area of Each Orific	e Row (numbered fi	rom lowest to highe	est)						
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)]
Stage of Orifice Centroid (ft)	0.00	0.61	1.21						1
Orifice Area (sq. inches)	0.95	0.95	0.95]
,									-
	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)	1
Stage of Orifice Centroid (ft)									_
Orifice Area (sq. inches)									1
User Input: Vertical Orifice (Circular or Pectang	ular)						Calculated Paramo	tors for Vortical Ori	fico
User Input. Vertical Onlice (Circular of Rectang	Zone 2 Circular	Not Selected	1				Zone 2 Circular	Not Selected	<u>nce</u> 1
Invert of Vertical Orifice =	1.90	N/A	ft (relative to basir	bottom at Stage =	=0ft) Ver	tical Orifice Area =	0.03	N/A	ft ²
Depth at top of Zone using Vertical Orifice =	3.63	N/A	ft (relative to basir	bottom at Stage =	= 0 ft) Vertica	Orifice Centroid =	0.10	N/A	feet
Vertical Orifice Diameter =	2.50	N/A	inches					,	1
User Input: Overflow Weir (Dropbox with Flat o	r Sloped Grate and	Outlet Pipe OR Rec	tangular/Trapezoid	al Weir (and No Ou	tlet Pipe)		Calculated Parame	ters for Overflow W	<u>/eir</u>
User Input: Overflow Weir (Dropbox with Flat o	r Sloped Grate and Zone 3 Weir	Outlet Pipe OR Rec	tangular/Trapezoid	al Weir (and No Out	tlet Pipe)		Calculated Parame Zone 3 Weir	ters for Overflow W Not Selected	<u>/eir</u>]
User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho	r Sloped Grate and Zone 3 Weir 3.67	Outlet Pipe OR Rec Not Selected N/A	tangular/Trapezoid ft (relative to basin t	al Weir (and No Out	tlet Pipe)t) Height of Grate	e Upper Edge, H _t =	Calculated Parame Zone 3 Weir 4.42	ters for Overflow M Not Selected N/A	<u>/eir</u> feet
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Outflow Hydrograph Workbook Filename:

	Inflow Hydrographs											
	The user can ov	verride the calcu	lated inflow hyd	rographs from t	his workbook wi	th inflow hydrog	raphs developed	l in a separate pr	ogram.			
	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	0.14	0.01	0.80		
	0:15:00	0.00	0.00	1.19	1.94	2.41	1.62	2.02	1.98	3.58		
	0:20:00	0.00	0.00	4.23	5.53	6.50	4.10	4.78	5.12	8.02		
	0:25:00	0.00	0.00	8.53	11.29	13.66	8.45	9.65	10.36	16.88		
	0:30:00	0.00	0.00	9.83	12.93	15.22	17.43	21.01	23.91	40.39		
	0:40:00	0.00	0.00	9.02	10.21	13.04	19.73	23.67	28.70	47.46		
	0:45:00	0.00	0.00	6.92	8.91	10.43	16.25	19.40	24.18	40.12		
	0:50:00	0.00	0.00	5.95	7.82	9.03	14.49	17.24	21.32	35.63		
	0:55:00	0.00	0.00	5.17	6.77	7.85	12.35	14.60	18.38	30.71		
	1:00:00	0.00	0.00	4.65	6.05	7.10	10.51	12.33	15.86	26.53		
	1:05:00	0.00	0.00	4.27	5.53	6.55	9.28	10.85	14.23	23.97		
	1:10:00	0.00	0.00	3.73	5.07	6.04	8.09	9.41	12.03	20.09		
	1:15:00	0.00	0.00	3.23	4.49	5.53	7.04	8.16	10.09	16.66		
	1:25:00	0.00	0.00	2.76	3.80	4.82	5.90 4.90	5.61	6.35	13.22		
	1:30:00	0.00	0.00	2.30	2 99	3 51	3 93	4 47	4.89	7 75		
	1:35:00	0.00	0.00	1.99	2.81	3.21	3.26	3.68	3.89	6.09		
	1:40:00	0.00	0.00	1.92	2.53	3.01	2.86	3.23	3.32	5.14		
	1:45:00	0.00	0.00	1.88	2.31	2.87	2.62	2.94	2.96	4.51		
	1:50:00	0.00	0.00	1.85	2.15	2.77	2.45	2.76	2.72	4.09		
	1:55:00	0.00	0.00	1.63	2.03	2.64	2.34	2.63	2.55	3.78		
	2:00:00	0.00	0.00	1.44	1.88	2.41	2.26	2.54	2.43	3.57		
	2:05:00	0.00	0.00	1.10	1.44	1.84	1./3	1.94	1.83	2.6/		
	2:15:00	0.00	0.00	0.63	0.80	1.01	0.95	1.44	1.00	1.90		
	2:20:00	0.00	0.00	0.46	0.59	0.74	0.70	0.79	0.75	1.08		
	2:25:00	0.00	0.00	0.33	0.42	0.54	0.51	0.57	0.54	0.78		
	2:30:00	0.00	0.00	0.24	0.30	0.39	0.36	0.41	0.39	0.56		
	2:35:00	0.00	0.00	0.17	0.21	0.28	0.26	0.30	0.28	0.41		
	2:40:00	0.00	0.00	0.11	0.14	0.19	0.18	0.20	0.19	0.28		
	2:45:00	0.00	0.00	0.06	0.09	0.12	0.12	0.13	0.12	0.17		
	2:50:00	0.00	0.00	0.03	0.05	0.06	0.07	0.07	0.07	0.10		
	3:00:00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.03	0.04		
	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		
	3:45:00	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		
	4:20:00	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		
	4:40:00	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		
	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		
	5:15:00	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		
	5:35:00	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		
	5:55:00	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		

Project: <u>Grandview</u> Basin ID: <u>Pond E</u>

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Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	21.36	acres
Watershed Length =	1,800	ft
Watershed Length to Centroid =	900	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	61.70%	percent
Percentage Hydrologic Soil Group A =	90.0%	percent
Percentage Hydrologic Soil Group B =	10.0%	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, dick 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

	2 . F		Optional
Water Quality Capture Volume (WQCV) =	0.431	acre-feet	
Excess Urban Runoff Volume (EURV) =	1.594	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	1.208	acre-feet	1.19
5-yr Runoff Volume (P1 = 1.5 in.) =	1.585	acre-feet	1.50
10-yr Runoff Volume (P1 = 1.75 in.) =	1.887	acre-feet	1.75
25-yr Runoff Volume (P1 = 2 in.) =	2.347	acre-feet	2.00
50-yr Runoff Volume (P1 = 2.25 in.) =	2.751	acre-feet	2.25
100-yr Runoff Volume (P1 = 2.52 in.) =	3.260	acre-feet	2.52
500-yr Runoff Volume (P1 = 3.68 in.) =	5.338	acre-feet	3.68
Approximate 2-yr Detention Volume =	1.052	acre-feet	
Approximate 5-yr Detention Volume =	1.381	acre-feet	
Approximate 10-yr Detention Volume =	1.680	acre-feet	
Approximate 25-yr Detention Volume =	2.004	acre-feet	
Approximate 50-yr Detention Volume =	2.201	acre-feet	
Approximate 100-yr Detention Volume =	2.421	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.431	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.163	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.828	acre-feet
Total Detention Basin Volume =	2.421	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) =	licor	A

user	ft
user	ft
user	ft ²
user	ft ³
user	ft
user	ft
user	ft
user	ft ²
user	ft ³
user	acre-feet
	user user user user user user user user

		Deptn Increment =	0.50	rt							
				Optional			Area	Optional		Valuma	
		Stage - Storage	Stage	Override Stage (#)	Length	Width (e)	Ared (0 ⁻²)	Aron (6 2)	Area	voluine (#3)	volume
			(10)	Stage (IL)	(10)	(10)	(11)	Area (it)	(acre)	(11)	(ac-it)
		Top of Micropool		0.00				35	0.001		
				0.50				1,362	0.031	349	0.008
		6947		1.00				12.615	0.200	2 9/12	0.099
		0947		1.00				12,015	0.290	5,045	0.000
				1.50				25,422	0.584	13,352	0.307
		6948		2.00				26,944	0.619	26,443	0.607
				2.50				28,490	0.654	40,302	0.925
		6949		3.00				30.062	0.690	54 940	1 261
		0949		3.00				30,002	0.090	34,340	1.201
				3.50				31,660	0.727	70,370	1.615
		6950		4.00				33,282	0.764	86,606	1.988
				4.50				34,931	0.802	103,659	2.380
		6951		5.00				36 604	0.840	121 543	2 790
		0551		5.00				30,001	0.010	121,515	2.750
				5.50				38,303	0.879	140,270	3.220
		6952		6.00			-	40,027	0.919	159,852	3.670
Hser	Overrides										
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	DF	TENTION	BASIN OUT	I FT STRU	CTURE DE	SIGN			
		MHF	DASIN CC	sion 4.04 (Februar	v 2021)				
Project:	Grandview				,,				
Basin ID:	Pond E								
Contract of the second				Estimated	Estimated	_			
and and the				Stage (ft)	Volume (ac-ft)	Outlet Type	•		
arrent the T exc.			Zone 1 (WQCV)	1.72	0.431	Orifice Plate			
	Constant Constant		Zone 2 (EURV)	3.48	1.163	Rectangular Orifice			
Particular Dervices	C. C. Standard (Det	the second	Zone 3 (100-year)	4.56	0.828	Weir&Pipe (Restrict)			
Example Zone	Configuration (Ret	ention Pona)		Total (all zones)	2.421		-		
User Input: Orifice at Underdrain Outlet (typicall	y used to drain WQC	CV in a Filtration BM	<u>1P)</u>		_		Calculated Parame	ters for Underdrain	<u>l</u>
Underdrain Orifice Invert Depth =	N/A	ft (distance below t	the filtration media	surface)	Underc	Irain Orifice Area =	N/A	ft ²	
Underdrain Urifice Diameter =	N/A	inches			Underdrain	Orifice Centrola =	N/A	feet	
User Input: Orifice Plate with one or more orific	es or Elliptical Slot V	Neir (typically used	to drain WOCV and	l/or FLIRV in a sedi	mentation BMP)		Calculated Parame	tors for Plate	
Invert of Lowest Orifice =	0.00	ft (relative to basin	bottom at Stage =	: 0 ft)	WQ Orifi	ice Area per Row =	1.250E-02	A ²	
Depth at top of Zone using Orifice Plate =	1.72	ft (relative to basin	bottom at Stage =	0 ft)	Elli	ptical Half-Width =	N/A	feet	
Orifice Plate: Orifice Vertical Spacing =	6.80	inches			Ellipti	ical Slot Centroid =	N/A	feet	
Orifice Plate: Orifice Area per Row =	1.80	sq. inches (diamete	er = 1-1/2 inches)		E	lliptical Slot Area =	N/A	ft²	
User Input: Stage and Total Area of Each Orifice	e Row (numbered fr	om lowest to highe	<u>st)</u>						7
	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 Orlfice Centroid (ft)	1.90	0.57	1.15						1
Office Area (sq. inches)	1.00	1.60	1.00						
	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)	7
Stage of Orifice Centroid (ft)		(0) 00 (0) 00 (0)							1
Orifice Area (sq. inches)									1
								•	-
User Input: Vertical Orifice (Circular or Rectange	<u>ular)</u>						Calculated Parame	ters for Vertical Ori	<u>ifice</u>
	Zone 2 Rectangular	Not Selected					Zone 2 Rectangula	Not Selected	
Invert of Vertical Orifice =	1.75	N/A	ft (relative to basin	bottom at Stage =	= 0 ft) Ver	tical Orifice Area =	0.06	N/A	ft ²
Depth at top of Zone using Vertical Orifice =	3.48	N/A	ft (relative to basir	bottom at Stage =	= 0 ft) Vertica	Orifice Centroid =	0.06	N/A	feet
Vertical Orifice Height =	1.50	N/A	inches						
	6 00	1	inches						
vertical Office width =	6.00	1	inches						
User Input: Overflow Weir (Dropbox with Flat o	6.00	Jutlet Pipe OR Rect	inches	al Weir (and No Ou	tlet Pine)		Calculated Parame	ters for Overflow W	Veir
User Input: Overflow Weir (Dropbox with Flat o	6.00 r Sloped Grate and 0 Zone 3 Weir	Outlet Pipe OR Rect	inches tangular/Trapezoida	al Weir (and No Ou	tlet Pipe)		Calculated Parame	ters for Overflow V	Veir
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho =	6.00 r Sloped Grate and C Zone 3 Weir 3.50	Outlet Pipe OR Rect Not Selected N/A	inches tangular/Trapezoida ft (relative to basin b	al Weir (and No Ou bottom at Stage = 0 f	t <u>let Pipe)</u> t) Height of Grate	e Upper Edge, H _t =	Calculated Parame Zone 3 Weir 4.25	eters for Overflow W Not Selected N/A	Veir feet
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length =	6.00 r Sloped Grate and 1 Zone 3 Weir 3.50 3.00	Outlet Pipe OR Rect Not Selected N/A N/A	inches tangular/Trapezoida ft (relative to basin t feet	al Weir (and No Ou pottom at Stage = 0 f	t <u>let Pipe)</u> t) Height of Grate Overflow W	e Upper Edge, H _t = /eir Slope Length =	Calculated Parame Zone 3 Weir 4.25 3.09	Not Selected N/A N/A	Veir feet feet
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope =	6.00 <u>Sloped Grate and 1</u> Zone 3 Weir 3.50 3.00 4.00	Outlet Pipe OR Rect Not Selected N/A N/A N/A	inches tangular/Trapezoida ft (relative to basin t feet H:V	al Weir (and No Ou bottom at Stage = 0 f G	tlet Pipe) t) Height of Grate Overflow W rate Open Area / 10	e Upper Edge, H _t = /eir Slope Length = 10-yr Orifice Area =	Calculated Parame Zone 3 Weir 4.25 3.09 6.40	ters for Overflow W Not Selected N/A N/A N/A	Veir feet feet
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides =	6.00 r Sloped Grate and (Zone 3 Weir 3.50 3.00 4.00 3.00	Outlet Pipe OR Rect Not Selected N/A N/A N/A N/A	inches tangular/Trapezoida ft (relative to basin t feet H:V feet	al Weir (and No Ou bottom at Stage = 0 f G O	tlet Pipe) t) Height of Grate Overflow W rate Open Area / 10 verflow Grate Open	e Upper Edge, H _t = /eir Slope Length =)0-yr Orifice Area = Area w/o Debris =	Calculated Parame Zone 3 Weir 4.25 3.09 6.40 6.46	ters for Overflow W Not Selected N/A N/A N/A N/A	Veir feet feet ft ²
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type =	6.00 r Sloped Grate and 1 Zone 3 Weir 3.50 3.00 4.00 3.00 Type C Grate	Outlet Pipe OR Rect Not Selected N/A N/A N/A N/A N/A	inches tangular/Trapezoida ft (relative to basin t feet H:V feet	al Weir (and No Ou oottom at Stage = 0 f G O (tlet Pipe) Overflow W rate Open Area / 10 verflow Grate Open Overflow Grate Open	e Upper Edge, H _t = feir Slope Length = 10-yr Orifice Area = Area w/o Debris = n Area w/ Debris =	Calculated Parame Zone 3 Weir 4.25 3.09 6.40 6.46 3.23	ters for Overflow V Not Selected N/A N/A N/A N/A N/A	Veir feet feet ft ² ft ²
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % =	6.00 r Sloped Grate and 1 Zone 3 Weir 3.50 3.00 4.00 3.00 Type C Grate 50%	Outlet Pipe OR Rect N/A N/A N/A N/A N/A N/A N/A N/A	inches tangular/Trapezoida ft (relative to basin t feet H:V feet %	al Weir (and No Ou bottom at Stage = 0 f G O (tlet Pipe)	e Upper Edge, H _t = leir Slope Length = 0-yr Orifice Area = Area w/o Debris = n Area w/ Debris =	Calculated Parame Zone 3 Weir 4.25 3.09 6.40 6.46 3.23	ters for Overflow V Not Selected N/A N/A N/A N/A N/A	feet feet ft ² ft ²
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % =	6.00 r Sloped Grate and (Zone 3 Weir 3.50 4.00 4.00 3.00 Type C Grate 50%	Outlet Pipe OR Rect Not Selected N/A N/A N/A N/A N/A N/A	inches tangular/Trapezoida ft (relative to basin t feet H:V feet %	al Weir (and No Ou Nottom at Stage = 0 f G O (tlet Pipe)_ t) Height of Grate Overflow W rate Open Area / 10 verflow Grate Open Overflow Grate Open	e Upper Edge, H _t = leir Slope Length = 00-yr Orifice Area = Area w/o Debris = n Area w/ Debris =	Calculated Parame Zone 3 Weir 4.25 3.09 6.40 6.46 3.23	ters for Overflow V Not Selected N/A N/A N/A N/A N/A	Veir feet feet ft ² ft ²
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % =	6.00 r Sloped Grate and 4 Zone 3 Weir 3.50 3.00 4.00 Type C Grate 50% (Circular Orifice, Ref Zone 3 Pertrictor	Outlet Pipe OR Rect Not Selected N/A N/A N/A N/A N/A N/A Strictor Plate, or Re	inches tangular/Trapezoida ft (relative to basin t feet H:V feet % ectangular Orifice)	al Weir (and No Ou oottom at Stage = 0 f G O (tlet Pipe) t) Height of Gratu Overflow W varte Open Area / 10 verflow Grate Open Overflow Grate Open Overflow Grate Open <u>Ca</u>	e Upper Edge, H _t = feir Slope Length = J0-yr Orifice Area = Area w/o Debris = n Area w/ Debris = alculated Parameter	Calculated Parame Zone 3 Weir 4.25 3.09 6.40 6.46 3.23	ters for Overflow W Not Selected N/A N/A N/A N/A N/A (Flow Restriction Pl Not Selected	Veir feet feet ft ² ft ²
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Derth to Invert of Outlet Pipe =	6.00 r Sloped Grate and . Zone 3 Weir 3.50 3.00 4.00 3.00 Type C Grate 50% (Circular Orifice, Re Zone 3 Restrictor 0.25	Outlet Pipe OR Rect Not Selected N/A N/A N/A N/A N/A Strictor Plate, or Re N/A	inches tangular/Trapezoida ft (relative to basin t feet H:V feet % ectangular Orifice) ft (dictages bolow b	al Weir (and No Ou bottom at Stage = 0 f G O C Via bottom at Stage	tlet Pipe)_ t) Height of Grate Overflow W rate Open Area / 10 verflow Grate Open Overflow Grate Open <u>Ca</u>	e Upper Edge, H _t = feir Slope Length = 00-yr Orifice Area = Area w/o Debris = n Area w/ Debris = alculated Parameter	Calculated Parame Zone 3 Weir 4.25 3.09 6.40 6.46 3.23 s for Outlet Pipe w/ Zone 3 Restrictor	tters for Overflow W Not Selected N/A N/A N/A N/A N/A Flow Restriction P N/A	Veir feet feet ft ² ft ² ft ²
User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Outlet Pipe Diameter =	6.00 r Sloped Grate and. Zone 3 Weir 3.50 3.00 4.00 3.00 Type C Grate 50% (Circular Orifice, Re Zone 3 Restrictor 0.25 18.00	Outlet Pipe OR Rec: Not Selected N/A N/A N/A N/A N/A <u>strictor Plate, or Re</u> Not Selected N/A	inches tangular/Trapezoidi ft (relative to basin t feet H:V feet % ectangular Orifice) ft (distance below ba inches	al Weir (and No Ou oottom at Stage = 0 f G O (asin bottom at Stage	tlet Pipe)_ t) Height of Gratu Overflow W rate Open Area / 10 verflow Grate Open Overflow Grate Open <u>Ca</u> = 0 ft) O Outlet	e Upper Edge, H _t = leir Slope Length = 0-yr Orifice Area = Area w/o Debris = n Area w/ Debris = alculated Parameter utlet Orifice Area =	Calculated Parame Zone 3 Weir 4.25 3.09 6.40 6.46 3.23 s for Outlet Pipe w/ Zone 3 Restrictor 1.01 0.48	tters for Overflow V Not Selected N/A N/A N/A N/A Y Flow Restriction Pl Not Selected N/A N/A	Veir feet feet ft ² ft ² ft ²
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User Input: Overflow Weir (Dropbox with Flat o Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage= Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Flow, Q (cfs) = Peak Inflow Q (cfs) = Peak Inflow Q (cfs) = Ratio Peak Outflow to Predevelopment Peak Q (cfs) = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 1 (fps) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 97% of Inflow Volume (hours) =	6.00 r Sloped Grate and Zone 3 Weir 3.50 3.00 4.00 3.00 Type C Grate 50% (Circular Orifice, Re Zone 3 Restrictor 0.25 18.00 10.00 Trapezoidal) 4.80 60.00 4.00 1.00 The user can overn WOCV N/A 0.431 N/A	Outlet Pipe OR Rec Not Selected N/A N/A N/A N/A N/A N/A N/A Selected Not Selected N/A N/A N/A ft (relative to basin feet H:V feet <i>ide the default CUF</i> EURV N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	inches tangular/Trapezoida ft (relative to basin t feet H:V feet % ectangular Orifice) ft (distance below ba inches inches bottom at Stage = <i>IP hydrographs and</i> 2 Year 1.19 1.208 1.208 0.1 0.01 16.4 0.6 N/A Vertical Orifice 1 N/A 60 64	al Weir (and No Ou bottom at Stage = 0 f G O asin bottom at Stage Half-Cen Half-Cen 1.50 1.585 1.585 0.3 0.01 21.6 0.7 2.5 Vertical Orifice 1 N/A 65 70	tiet Pipe)	e Upper Edge, H _t = feir Slope Length = 0-yr Orifice Area = Area w/o Debris = n Area w/ o Debris = alculated Parameter utlet Orifice Area = tor Plate on Pipe = tor Plate on Pipe = tor Plate on Pipe = Fop of Freeboard = Con of Freeboar	Calculated Parame Zone 3 Weir 4.25 3.09 6.40 6.41 3.23 s for Outlet Pipe w Zone 3 Restrictor 1.01 0.48 1.68 Calculated Parame 0.40 6.20 0.92 3.67 <i>trographs table (Colored parame of the state) of the state of th</i>	ters for Overflow W Not Selected N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	Veir feet feet ft ² ft ² ft ² feet radians 5.00 Year 3.68 5.338 28.7 1.34 79.0 47.6 1.7 Spillway 1.5 N/A 60 77

0.60

0.73

0.67

0.71

0.74

0.77

0.79

0.82

0.8



DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

	Inflow Hydrog	araphs								
	The user can ov	verride the calcu	lated inflow hyd	Irographs from t	his workbook wi	th inflow hydrog	raphs developed	l in a separate pr	ogram.	
	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	0.21	0.02	1.22
	0:15:00	0.00	0.00	1.81	2.94	3.65	2.46	3.08	3.00	5.54
	0:20:00	0.00	0.00	6.56	8.65	10.19	6.44	7.52	8.04	12.67
	0:25:00	0.00	0.00	13.50	18.10	21.83	13.40	15.46	16.66	27.54
	0:35:00	0.00	0.00	16.45	21.57	25.41	28.55	34.13	38.59	79.06
	0:40:00	0.00	0.00	14 18	17.96	20.91	32.82	39.01	46.90	76.90
	0:45:00	0.00	0.00	12.48	15.99	18.69	29.51	34.96	43.23	70.73
	0:50:00	0.00	0.00	11.00	14.33	16.57	26.62	31.43	38.92	64.02
	0:55:00	0.00	0.00	9.71	12.64	14.68	23.28	27.41	34.41	56.89
	1:00:00	0.00	0.00	8.65	11.20	13.09	20.22	23.75	30.43	50.54
	1:05:00	0.00	0.00	7.93	10.23	12.08	17.68	20.71	27.08	45.20
	1:10:00	0.00	0.00	7.11	9.55	11.36	15.54	18.15	23.23	38.67
	1:15:00	0.00	0.00	6.37	8.75	10.68	13.85	16.11	20.05	33.16
	1:20:00	0.00	0.00	5./1	7.84	9.69	12.10	14.03	16.89	27.70
	1:30:00	0.00	0.00	4 46	6.16	7 25	8 79	10.11	11.53	18 54
	1:35:00	0.00	0.00	3.96	5.50	6.30	7.28	8.32	9.28	14.71
	1:40:00	0.00	0.00	3.63	4.81	5.70	6.02	6.83	7.40	11.53
	1:45:00	0.00	0.00	3.48	4.34	5.35	5.21	5.89	6.19	9.59
	1:50:00	0.00	0.00	3.39	4.03	5.12	4.73	5.34	5.47	8.39
	1:55:00	0.00	0.00	3.04	3.79	4.87	4.43	5.00	5.01	7.58
	2:00:00	0.00	0.00	2.71	3.53	4.49	4.22	4.76	4.68	7.00
	2:05:00	0.00	0.00	2.16	2.81	3.58	3.37	3.79	3.67	5.44
	2:10:00	0.00	0.00	1.6/	2.1/	2.76	2.58	2.90	2.76	4.05
	2:20:00	0.00	0.00	0.99	1.00	1.62	1.90	1.69	2.00	2 30
	2:25:00	0.00	0.00	0.75	0.97	1.02	1.14	1.09	1.30	1.74
	2:30:00	0.00	0.00	0.57	0.72	0.91	0.85	0.95	0.90	1.30
	2:35:00	0.00	0.00	0.42	0.53	0.67	0.63	0.70	0.67	0.96
	2:40:00	0.00	0.00	0.31	0.39	0.50	0.47	0.53	0.50	0.73
	2:45:00	0.00	0.00	0.22	0.27	0.36	0.34	0.38	0.37	0.53
	2:50:00	0.00	0.00	0.14	0.19	0.24	0.24	0.26	0.25	0.36
	2:55:00	0.00	0.00	0.08	0.12	0.15	0.15	0.16	0.16	0.22
	3:05:00	0.00	0.00	0.04	0.05	0.08	0.08	0.09	0.08	0.12
	3:10:00	0.00	0.00	0.02	0.03	0.03	0.03	0.04	0.03	0.01
	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
	3:50:00	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
	4:25:00	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
	4:45:00	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
	5:05:00	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
	5:20:00	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
	5:40:00	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
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Optional

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	Project: Grandview - Pond REX RD
	Basin ID: SB-1
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served that and	
	A COLUMN THE
	CANADA CONTRACTOR

-Depth Increment = 0.20 ft

	1 mmillion					0.20	Optional				Optional			
Example Zone	Configurati	on (Retenti	on Pond)		Stage - Storage Description	Stage (ft)	Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Override Area (ft ²)	Area (acre)	(ft 3)	Volume (ac-ft)
Watershed Information					Media Surface		0.00				35	0.001	(10)	(de rej
Selected BMP Type =	SF	1					0.20				979	0.022	101	0.002
Watershed Area -	1.22	acres					0.40				1.076	0.025	307	0.007
Watershed Longth -	625	A A					0.40				1,070	0.025	507	0.007
Watershed Length to Controld =	400	A A					0.00				1,170	0.027	770	0.012
Watershed Length to Centrold -	0.025	A/A					1.00				1,204	0.023	1.046	0.010
Watershed Imponiousness -	100.00%	norcont					1.00				1,554	0.032	1,040	0.024
Porcentage Hydrologic Soil Group A -	100.00%	porcont					1.20				1,500	0.033	1,550	0.031
Percentage Hydrologic Soll Group A =	100.0%	percent					1.40				1,020	0.037	1,000	0.036
Percentage Hydrologic Soil Group B =	0.0%	percent					1.00				1,740	0.040	1,907	0.040
Target WOC/ Drain Time -	12.0	heure					2.00				2,002	0.045	2,349	0.054
Target WQCV Drain Time =	12.0	liours					2.00				2,003	0.040	2,/3/	0.003
Location for 1-hr Rainfail Depuis =	user input						2.20				2,130	0.049	3,151	0.072
After providing required inputs above inc denthe aligh 'Bur CUUD' to concepte run	luding 1-hour	rainfall					2.40				2,270	0.052	3,392	0.002
the embedded Colorado Urban Hydro	orraph Proced	ure.	0				2.00				2,410	0.050	4,002	0.095
			Optional Us	er Overrides	-		2.80				2,564	0.059	4,560	0.105
water Quality Capture Volume (WQCV) =	0.041	acre-reet		acre-reet	-		3.00				2,/14	0.062	5,087	0.117
Excess orbait Runoff Volume (EORV) =	0.1/1	acre-leet	1.10	dure-reet			3.20				2,000	0.060	5,040	0.130
2-yr Runoff Volume (P1 = 1.19 In.) =	0.119	acre-reet	1.19	inches			3.40				3,026	0.069	6,235	0.143
5-yr Runoff Volume (P1 = 1.5 in.) =	0.153	acre-feet	1.50	inches			3.60				3,188	0.073	6,856	0.15/
10-yr Runoff Volume (P1 = 1.75 in.) =	0.180	acre-feet	1./5	inches			3.80				3,354	0.077	7,511	0.1/2
25-yr Runoff Volume (P1 = 2 in.) =	0.206	acre-feet	2.00	inches	-		4.00				3,525	0.081	8,199	0.188
50-yr Runoff Volume (P1 = 2.25 in.) =	0.233	acre-feet	2.25	inches			4.20				3,699	0.085	8,921	0.205
100-yr Runoff Volume (P1 = 2.52 in.) =	0.263	acre-feet	2.52	inches			4.40				3,877	0.089	9,678	0.222
500-yr Runoff Volume (P1 = 3.68 in.) =	0.388	acre-feet	3.68	Inches			4.60				4,060	0.093	10,472	0.240
Approximate 2-yr Detention Volume =	0.113	acre-feet					4.80				4,246	0.097	11,303	0.259
Approximate 5-yr Detention Volume =	0.146	acre-feet					5.00				4,436	0.102	12,171	0.279
Approximate 10-yr Detention Volume =	0.173	acre-feet											ļ	
Approximate 25-yr Detention Volume =	0.203	acre-feet										 	ļ	
Approximate 50-yr Detention Volume =	0.220	acre-feet												
Approximate 100-yr Detention Volume =	0.234	acre-feet										L		
												L		
Define Zones and Basin Geometry		-										L		
Zone 1 Volume (WQCV) =	0.041	acre-feet												
Select Zone 2 Storage Volume (Optional) =		acre-feet	Total dete	ntion										
Select Zone 3 Storage Volume (Optional) =		acre-feet	volume is	less than										
Total Detention Basin Volume =	0.041	acre-feet	100-year	volume.										
Initial Surcharge Volume (ISV) =	N/A	ft ³												
Initial Surcharge Depth (ISD) =	N/A	ft												
Total Available Detention Depth (H _{total}) =	user	ft												
Depth of Trickle Channel $(H_{TC}) =$	N/A	ft												
Slope of Trickle Channel $(S_{TC}) =$	N/A	ft/ft												
Slopes of Main Basin Sides (Smain) =	user	H:V												
Basin Length-to-Width Ratio (R _{L/W}) =	user	1												
, .		-												
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 (WFLOOR) =	user	ft												
Area of Basin Floor (AFLOOR) =	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 (WMAIN) =	user	ft												
Area of Main Basin (Amain) =	user	ft ²												
Volume of Main Basin (VMAIN) =	user	ft ³												
Calculated Total Basin Volume (V	user	acre-feet												
(total														
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DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



	DE	TENTION	BASIN OUT	FLET STRU	CTURE DE	SIGN			
Project	Grandview - Pond	MHI REX RD	D-Detention, Vers	sion 4.04 (Februar	y 2021)				
Basin ID:	SB-1	KEA RD							
(compt				Estimated	Estimated				
TTTT I	-	-		Stage (ft)	Volume (ac-ft)	Outlet Type	1		
accent the way			Zone 1 (WQCV)	1.48	0.041	Filtration Media			
	Constant of the		Zone 2			Not Utilized			
Example Zone	Configuration (Re	tention Pond)	Zone 3			Not Utilized			
Liese Tanute Orifice at Underdusin Outlet (trained)		C) (in a Filtration B)	40)	Total (all zones)	0.041		Calculated Davama	tous fou Undoudusin	
Underdrain Orifice Invert Depth =		ft (distance below)	<u>(IP)</u> the filtration media	surface)	Underd	rain Orifice Area =			
Underdrain Orifice Diameter =	1.00	inches		barrace)	Underdrain	Orifice Centroid =	0.04	feet	
								-	
User Input: Orifice Plate with one or more orifice	es or Elliptical Slot \	Neir (typically used	to drain WQCV and	I/or EURV in a sedir	mentation BMP)		Calculated Parame	ters for Plate	
Invert of Lowest Urifice =	N/A	N/A ft (relative to basin bottom at Stage = 0 ft) WQ Orifice Area per Kow = N/A ft ²							
Orifice Plate: Orifice Vertical Spacing =	N/A N/A	inches	- Doctorn at Stage	010)	Ellipti	cal Slot Centroid =	N/A N/A	feet	
Orifice Plate: Orifice Area per Row =	N/A	inches			E	lliptical Slot Area =	N/A	ft ²	
								-	
User Input: Stage and Total Area of Each Orifice	e Row (numbered fr	rom lowest to highe	<u>st)</u>	Dow 4 (antianal)	Dow E (antional)	Dow 6 (antianal)	Dow 7 (antianal)	Daw 9 (antianal)	1
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A N/A	N/A N/A	-
							· ·	· ·	-
	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-
Office Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1
User Input: Vertical Orifice (Circular or Rectangu	<u>ılar)</u>						Calculated Parame	eters for Vertical Ori	fice
	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) Ver	tical Orifice Area =	N/A	N/A	ft ²
Vertical Orifice Diameter =	Ν/Α Ν/Δ	N/A N/A	inches	i bollom at Stage =	UIL) Vertical	Office Centrold =	IN/A	IN/A	lieet
	14/7		linenes						
User Input: Overflow Weir (Dropbox with Flat or	Sloped Grate and	Outlet Pipe OR Rec	tangular/Trapezoida	al Weir (and No Out	let Pipe)		Calculated Parame	ters for Overflow W	leir
User Input: Overflow Weir (Dropbox with Flat or	Not Selected	Outlet Pipe OR Rec Not Selected	tangular/Trapezoida	al Weir (and No Out	let Pipe)	lloper Edge H. =	Calculated Parame	Not Selected	<u>/eir</u>
User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length =	r Sloped Grate and Not Selected N/A N/A	Outlet Pipe OR Rec Not Selected N/A N/A	tangular/Trapezoida ft (relative to basin b feet	al Weir (and No Out	l <u>et Pipe)</u>) Height of Grate Overflow W	e Upper Edge, H _t = eir Slope Length =	Calculated Parame Not Selected N/A N/A	ters for Overflow W Not Selected N/A N/A	<u>/eir</u> feet feet
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User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage = Spillway Crest Length = Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Row, q (cfs) = Peak Inflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 97% of Inflow Volume (hours) =	r Sloped Grate and Not Selected N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	Outlet Pipe OR Rec Not Selected N/A N/A N/A N/A N/A N/A N/A estrictor Plate, or Re Not Selected N/A N/A N/A ft (relative to basin feet H:V feet H:V feet CURV N/A 0.171 N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	tangular/Trapezoida ft (relative to basin to feet H:V feet % ectangular Orifice) ft (distance below basis) inches bottom at Stage = <i>IP hydrographs and</i> 2 Year 1.19 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.10 Hitration Media N/A N/A 28 29	al Weir (and No Out oottom at Stage = 0 ft Gri On C asin bottom at Stage = Half-Cent 1 runoff volumes by 5 Year 1.50 0.153 0.153 0.153 0.153 0.153 0.153 0.153 0.1 1.9 0.1 1.9 0.1 6.2 Filtration Media N/A N/A 35 36	tet Pipe)) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open Verflow Grate Open Ca = 0 ft) O Ca = 0 ft) O Stage at 1 Basin Area at 1 Basin Volume at 1 Basin Volume at 1 Basin Volume at 1 Entering new value 10 Year 1.75 0.180 0.0 0.180 0.0 0.1 4.6 Filtration Media N/A N/A 41	e Upper Edge, H _t = eir Slope Length = 0-yr Orifice Area = Area w/ o Debris = h Area w/ o Debris = ilculated Parameter utlet Orifice Area = orifice Centroid = tor Plate on Pipe = esign Flow Depth = fop of Freeboard = op of Freeboard = con of Freeboard = on of Freeboard = con of Free	Calculated Parame Not Selected N/A N/A N/A N/A N/A S for Outlet Pipe w// Not Selected N/A N/A N/A Calculated Parame Calc	ters for Overflow W Not Selected N/A N/A N/A N/A N/A N/A N/A N/A	feir feet feet ft ² ft ² ft ² feet radians <i>f</i> ¹ feet radians <i>f</i> ² feet radians
User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage= Spillway Crest Length = Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Row, q (cfs/acre) = Peak Inflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) =	r Sloped Grate and Not Selected N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	Outlet Pipe OR Rec Not Selected N/A N/A N/A N/A N/A N/A N/A estrictor Plate, or Re Not Selected N/A N/A ft (relative to basin feet H:V feet H:V feet H:V feet M/A 0.171 N/A 0.171 N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	tangular/Trapezoida ft (relative to basin to feet H:V feet % ectangular Orifice) ft (distance below basis) inches bottom at Stage = <i>IP hydrographs and</i> 2 Year 1.19 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.28 29 2.85	al Weir (and No Out oottom at Stage = 0 ft Gr Or C asin bottom at Stage = Half-Cent 1.50 0.153 0.153 0.153 0.153 0.153 0.153 0.1 1.9 0.1 1.9 0.1 1.9 0.1 1.9 0.1 3.3 3.3 0 3.3 0 0 0 0 0 0 0 0 0 0 0 0 0	let Pipe)) Height of Grate Overflow Viate Open Area / 10 verflow Grate Open Ca ca Ca c 0 ft) Outlet ral Angle of Restrict Spillway D Stage at T Basin Area at T Basin Volume at T 1.75 0.180 0.0 0.11 4.6 Filtration Media N/A N/A 40 41 3.73	e Upper Edge, H _t = eir Slope Length = 0-yr Orifice Area = Area w/o Debris = h Area w/ Debris = ilculated Parameter utlet Orifice Area = orifice Centroid = tor Plate on Pipe = esign Flow Depth = op of Freeboard = con of Freeboard = on of Freeboard = on of Freeboard = con of Freeboard = on of Freeboard = con of Freeboard	Calculated Parame Not Selected N/A N/A N/A N/A N/A S for Outlet Pipe w/ Not Selected N/A N/A N/A Calculated Parame Calcu	ters for Overflow W Not Selected N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	feir feet feet ft ² ft ² ft ² feet radians 500 Year 3.68 0.388 1.1 0.1 0.1 0.1 0.1 N/A N/A N/A 75 77 5.00
User Input: Overflow Weir (Dropbox with Flat or Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Grate Slope = Horiz. Length of Weir Sides = Overflow Grate Type = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate Depth to Invert of Outlet Pipe = Circular Orifice Diameter = User Input: Emergency Spillway (Rectangular or Spillway Invert Stage = Spillway Crest Length = Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = CUHP Predevelopment Peak Q (cfs) = Predevelopment Unit Peak Row, q (cfs/acre) = Peak Inflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling How = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 97% of Inflow Volume (hours) = Time to Train 97% of Inflow Volume (hours) =	r Sloped Grate and Not Selected N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	Outlet Pipe OR Rec Not Selected N/A N/A N/A N/A N/A N/A N/A estrictor Plate, or Re Not Selected N/A N/A N/A ft (relative to basin feet H:V feet H:V feet H:V feet N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	tangular/Trapezoida ft (relative to basin to feet H:V feet % ectangular Orifice) ft (distance below basis) inches bottom at Stage = IP hydrographs and 2 Year 1.19 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.119 0.10 Filtration Media N/A Piltration Media N/A 29 2.85 0.06 0.100	al Weir (and No Out oottom at Stage = 0 ft Gr Or asin bottom at Stage = Half-Cent 1.50 0.153 0.155	let Pipe)) Height of Grate Overflow W ate Open Area / 10 verflow Grate Open Verflow Grate Open Ca = 0 ft) O Ca = 0 ft) O Uutlet ral Angle of Restrict Spillway D Stage at T Basin Volume at T Basin Volume at T Basin Volume at T Entering new value 10 Year 1.75 0.180 0.180 0.180 0.01 2.2 0.1 4.6 Filtration Media N/A N/A 41 3.73 0.086	e Upper Edge, H _t = eir Slope Length = 0-yr Orifice Area = Area w/o Debris = h Area w/ Debris = ilculated Parameter utlet Orifice Area = orifice Centroid = tor Plate on Pipe = esign Flow Depth = op of Freeboard = on of Freeboar	Calculated Parame Not Selected N/A N/A N/A N/A N/A S for Outlet Pipe w/ Not Selected N/A N/A N/A N/A Calculated Parame C	ters for Overflow W Not Selected N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	feir feet feet ft² ft² ft² ft² feet ate ft² feet ate ft² feet radians 0.388 0.388 0.1 0.1 N/A N/A N/A 75 77 5.00 0.10 0.222



DETENTION BASIN OUTLET STRUCTURE DESIGN Outflow Hydrograph Workbook Filename:

	Inflow Hydrographs									
	The user can ov	verride the calcu	lated inflow hyd	rographs from t	his workbook wi	th inflow hydrog	raphs developed	l in a separate pro	ogram.	
	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	0.02	0.00	0.12
	0:15:00	0.00	0.00	0.18	0.29	0.36	0.24	0.30	0.29	0.53
	0:20:00	0.00	0.00	0.63	0.83	0.97	0.61	0.71	0.76	1.19
	0:25:00	0.00	0.00	1.29	1.65	1.93	1.27	1.45	1.53	2.30
	0:30:00	0.00	0.00	1.52	1.90	2.17	2.33	2.64	2.88	4.26
	0:35:00	0.00	0.00	1.45	1 79	2.04	2 59	2 92	3 34	4 92
	0:40:00	0.00	0.00	1.34	1.63	1.86	2.54	2.87	3.27	4.81
	0:45:00	0.00	0.00	1.19	1.48	1.70	2.35	2.65	3.09	4.54
	0:50:00	0.00	0.00	1.07	1.35	1.54	2.18	2.46	2.86	4.19
	0:55:00	0.00	0.00	0.96	1.22	1.39	1.95	2.20	2.60	3.82
	1:00:00	0.00	0.00	0.86	1.09	1.27	1.75	1.97	2.38	3.49
	1:05:00	0.00	0.00	0.79	1.00	1.17	1.58	1.78	2.18	3.20
	1:10:00	0.00	0.00	0.71	0.94	1.11	1.40	1.58	1.90	2.79
	1:15:00	0.00	0.00	0.65	0.87	1.06	1.28	1.44	1.69	2.47
	1:20:00	0.00	0.00	0.59	0.80	0.98	1.14	1.28	1.46	2.14
	1:25:00	0.00	0.00	0.54	0.72	0.87	1.02	1.14	1.26	1.85
	1:30:00	0.00	0.00	0.48	0.65	0.77	0.88	0.99	1.09	1.58
	1:35:00	0.00	0.00	0.43	0.59	0.68	0.76	0.86	0.92	1.35
	1:40:00	0.00	0.00	0.39	0.51	0.61	0.65	0.73	0.78	1.14
	1:45:00	0.00	0.00	0.36	0.45	0.55	0.56	0.63	0.66	0.96
	1:50:00	0.00	0.00	0.34	0.41	0.52	0.50	0.56	0.57	0.84
	1:55:00	0.00	0.00	0.31	0.39	0.50	0.46	0.52	0.52	0.76
	2:00:00	0.00	0.00	0.28	0.36	0.46	0.44	0.49	0.49	0.71
	2:05:00	0.00	0.00	0.22	0.29	0.37	0.35	0.39	0.38	0.56
	2:10:00	0.00	0.00	0.18	0.23	0.29	0.27	0.31	0.30	0.43
	2:15:00	0.00	0.00	0.14	0.18	0.23	0.22	0.24	0.23	0.34
	2:20:00	0.00	0.00	0.11	0.14	0.18	0.17	0.19	0.18	0.26
	2:25:00	0.00	0.00	0.08	0.11	0.14	0.13	0.15	0.14	0.20
	2:30:00	0.00	0.00	0.07	0.08	0.11	0.10	0.11	0.10	0.15
	2:35:00	0.00	0.00	0.05	0.06	0.08	0.08	0.08	0.08	0.12
	2:40:00	0.00	0.00	0.04	0.05	0.06	0.06	0.06	0.06	0.09
	2:45:00	0.00	0.00	0.03	0.04	0.05	0.04	0.05	0.05	0.07
	2:50:00	0.00	0.00	0.02	0.03	0.03	0.03	0.04	0.03	0.05
	2:55:00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.02	0.04
	3:00:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02
	3:05:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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
	2:25:00	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
	4:45:00	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
	5:15:00	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
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

TT. T. A	11	1
and real and	1	
	- tent mar	(Married)

Example Zone Configuration (Retention Pond)

Total de

volume is less 100-year volu

Watershed Information

222

	SF	Selected BMP Type =
acres	11.67	Watershed Area =
ft	930	Watershed Length =
ft	465	Watershed Length to Centroid =
ft/ft	0.020	Watershed Slope =
percent	2.00%	Watershed Imperviousness =
percent	100.0%	Percentage Hydrologic Soil Group A =
percent	0.0%	Percentage Hydrologic Soil Group B =
percent	0.0%	Percentage Hydrologic Soil Groups C/D =
hours	12.0	Target WQCV Drain Time =
-	User Input	Location for 1-hr Rainfall Depths =

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

Water Quality Capture Volume (WQCV) = 0.012 acre-feet	acr
	acr
Excess Urban Runoff Volume (EURV) = 0.011 acre-feet	uc.
2-yr Runoff Volume (P1 = 1.19 in.) = 0.006 acre-feet 1.19	inc
5-yr Runoff Volume (P1 = 1.5 in.) = 0.012 acre-feet 1.50	inc
10-yr Runoff Volume (P1 = 1.75 in.) = 0.016 acre-feet 1.75	inc
25-yr Runoff Volume (P1 = 2 in.) = 0.146 acre-feet 2.00	inc
50-yr Runoff Volume (P1 = 2.25 in.) = 0.294 acre-feet 2.25	inc
100-yr Runoff Volume (P1 = 2.52 in.) = 0.496 acre-feet 2.52	inc
500-yr Runoff Volume (P1 = 3.68 in.) = 1.453 acre-feet 3.68	inc
Approximate 2-yr Detention Volume = 0.006 acre-feet	_
Approximate 5-yr Detention Volume = 0.009 acre-feet	
Approximate 10-yr Detention Volume = 0.012 acre-feet	
Approximate 25-yr Detention Volume = 0.019 acre-feet	
Approximate 50-yr Detention Volume = 0.046 acre-feet	
Approximate 100-yr Detention Volume = 0.126 acre-feet	

Define Zones and Basin Geometry

nine zones una busin deometry		
Zone 1 Volume (WQCV) =	0.012	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.012	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft ³
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H _{total}) =	user	ft
Depth of Trickle Channel (H _{TC}) =	N/A	ft
Slope of Trickle Channel (S _{TC}) =	N/A	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
Curchange Valume Length (L.) -		a.

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 =	0.20	ft							
	Change Changes	Change	Optional	Longth	\A/Ldbb	Area	Optional	A	Volume	Valuma
	Description	Stage (ff)	Stage (ft)	Length (ft)	(fft)	(ft ²)	Area (ft ²)	(acre)	(ft 3)	(ac-ft)
	Media Surface	(10)	0.00		(10)	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	35	0.001	(10)	(de le)
	Media Surrace		0.00				55	0.001	101	
			0.20				979	0.022	101	0.002
			0.40				1,076	0.025	307	0.007
			0.60				1,178	0.027	532	0.012
			0.80				1.284	0.029	778	0.018
			1.00				1 304	0.032	1.046	0.024
			1.00				1,354	0.032	1,040	0.024
			1.20				1,508	0.035	1,336	0.031
			1.40				1,626	0.037	1,650	0.038
			1.60				1,748	0.040	1,987	0.046
			1.80				1.874	0.043	2,349	0.054
			2.00				2 003	0.046	2 737	0.063
			2.20				2 120	0.040	2 1 5 1	0.072
			2.20				2,130	0.049	3,151	0.072
			2.40				2,276	0.052	3,592	0.082
			2.60				2,418	0.056	4,062	0.093
r Overrides			2.80				2,564	0.059	4,560	0.105
acre-feet			3.00				2,714	0.062	5,087	0.117
acre-feet			3.20				2.868	0.066	5.646	0.130
inchoc			2.40				2 026	0.060	6 225	0.142
incries			3.40				3,020	0.009	0,233	0.143
inches			3.60				3,188	0.073	6,856	0.157
inches			3.80				3,354	0.077	7,511	0.172
inches			4.00				3,525	0.081	8,199	0.188
inches										
inches										
inches										
L'IICIICS										
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DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)







DETENTION BASIN OUTLET STRUCTURE DESIGN Outflow Hydrograph Workbook Filename:

	Inflow Hydrog	<u>iraphs</u>								
	The user can o	verride the calcu	lated inflow hyd	rographs from t	his workbook wi	th inflow hydrog	raphs developed	l in a separate pro	ogram.	
	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]
E 00 min	0.00.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:20:00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
	0:25:00	0.00	0.00	0.05	0.12	0.18	0.03	0.07	0.09	0.30
	0:30:00	0.00	0.00	0.09	0.19	0.25	1.02	2.66	4.01	12.22
	0:35:00	0.00	0.00	0.09	0.18	0.25	2.23	4.35	7.06	17.90
	0:40:00	0.00	0.00	0.08	0.16	0.22	2.32	4.63	7.58	19.26
	0:45:00	0.00	0.00	0.07	0.14	0.19	2.10	4.16	7.09	18.60
	0:50:00	0.00	0.00	0.06	0.12	0.17	1.84	3.66	6.26	17.41
	0:55:00	0.00	0.00	0.05	0.10	0.15	1.62	3.21	5.51	15.85
	1:00:00	0.00	0.00	0.05	0.09	0.13	1.41	2.79	4.81	14.39
	1:05:00	0.00	0.00	0.04	0.08	0.12	1.23	2.46	4.25	13.42
	1:10:00	0.00	0.00	0.04	0.07	0.10	1.10	2.19	3.77	11.98
	1:15:00	0.00	0.00	0.03	0.06	0.09	0.97	1.93	3.33	10.56
	1:20:00	0.00	0.00	0.03	0.05	0.08	0.85	1.68	2.89	9.17
	1:25:00	0.00	0.00	0.02	0.05	0.07	0.72	1.42	2.46	7.84
	1:30:00	0.00	0.00	0.02	0.04	0.06	0.60	1.17	2.04	6.55
	1:35:00	0.00	0.00	0.02	0.04	0.05	0.50	1.01	1.74	5.68
	1:40:00	0.00	0.00	0.02	0.03	0.05	0.45	0.90	1.56	5.04
	1:45:00	0.00	0.00	0.02	0.03	0.04	0.41	0.82	1.40	4.48
	1:50:00	0.00	0.00	0.01	0.03	0.04	0.37	0.73	1.25	3.97
	1:55:00	0.00	0.00	0.01	0.02	0.03	0.32	0.64	1.11	3.49
	2:00:00	0.00	0.00	0.01	0.02	0.03	0.28	0.56	0.96	3.02
	2:05:00	0.00	0.00	0.01	0.02	0.02	0.24	0.47	0.82	2.58
	2:10:00	0.00	0.00	0.01	0.01	0.02	0.20	0.39	0.67	2.16
	2:15:00	0.00	0.00	0.01	0.01	0.01	0.16	0.30	0.53	1.74
	2:20:00	0.00	0.00	0.00	0.01	0.01	0.11	0.22	0.39	1.32
	2:25:00	0.00	0.00	0.00	0.00	0.00	0.07	0.13	0.25	0.90
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.03	0.05	0.11	0.50
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.29
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.18
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.11
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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
	4:45:00	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
	5:20:00	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
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	I	ID Credit	by Impe	ervious R	eductio	n Factor	(IRF) Me	thod						
			UD	-BMP (Version	n 3.06, Novem	ber 2016)								
User Input														
Calculated cells				Designer:		Treven Ed	wards							
Calculated tells				Company:		Galloway	& Comnan	,						
webesign Storm: 1-Hour Pain Depth WOCV Event	0.60	inches		Date:		May 4, 202	22							
wathing Storm: 1-Hour Pain Depth 5-Year Event	1 50	inches		Project:		Grandview	 /							
##Major Storm: 1-Hour Rain Depth 100-Vear Event	2.50	inches		Location		Basins C-3	& C-15							
Optional User Defined Storm CUHP	2.52	inches		Location.		busins c-s	a c-15							
UHP) NOAA 1 Hour Rainfall Depth and Frequency														
for User Defined Storm														
Max Intensity for Optional User Defined Storm 0														
E INFORMATION (USER-INPUT)														
Sub-basin Identifier	C-3	C-15												
Receiving Pervious Area Soil Type	Sandy Loam	Sandy Loam												
	Sundy Louin	Sundy Louin												
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	1.560	0.160												
Directly Connected Impervious Area (DCIA, acres)	0.000	0.000												
Unconnected Impervious Area (UIA, acres)	0.109	0.013												
Receiving Pervious Area (RPA, acres)	1.451	0.147												
Separate Pervious Area (SPA, acres)	0.000	0.000												
RPA Treatment Type: Conveyance (C),	с	с												
Volume (V), or Permeable Pavement (PP)														
Total Calculated Area (as shock against input)	1 5 60	0.160												1
Directly Connected Impanyious Area (DCIA %)	0.0%	0.100												
Linconnected Impervious Area (LIIA, %)	7.0%	8.2%												-
Peceluing Perulous Area (PPA %)	93.0%	0.2/0												-
Separate Pervious Area (SPA %)	0.0%	0.0%												-
(PDA / UIA)	13 286	11 105												-
	0.070	0.080												
f / I for WOCV Event:	1.7	1.7												
f / I for 5-Year Event:	0.5	0.5												-
f / I for 100-Year Event:	0.3	0.3												-
f / I for Optional User Defined Storm CUHP:														-
IRE for WOCV Event:	0.18	0.21												-
IRF for 5-Year Event:	0.30	0.34												
IRE for 100-Year Event:	0.31	0.35												
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: Instal	7.0%	8.2%												
Effective Imperviousness for WOCV Event:	1.3%	1.7%												1
Effective Imperviousness for 5-Year Event:	2.1%	2.8%												
Effective Imperviousness for 100-Year Event:	2.2%	2.9%												
Effective Imperviousness for Optional User Defined Storm CUHP:														1
	·	· · · · · · ·												
/ EFFECTIVE IMPERVIOUSNESS CREDITS	90.19/	77.0%	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	N/A	N/A N/A	N/A	
100-Year Event CREDIT**: Reduce Detention By:	96.6%	87.1%	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:														
		Г	1											
	Total Site Imp	erviousness:	7.1%		Notes:									
Total Site Effective Imper	viousness for	WQCV Event:	1.3%		* Use Green	-Ampt averag	e infiltration	rate values f	rom Table 3-	3.				
Total Site Effective Imperviousness for 5-Year Event					"Flood con	trol detentior	volume cre	lits based on	empirical eq	uations from	Storage Cha	pter of USDC	M.	
			0.00/		Arr 10 1 1 1 1 1 1 1 1 1							A		



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APPENDIX E

Drainage Maps





Galloway 6162 S. Willow Drive, Suite 320 Greenwood Village, CO 80111 303.770.8884 GallowayUS.com



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	EXISTING PROPERTY LINE
	PROPOSED PROPERTY LINE
<u> </u>	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
	BASIN BOUNDARY LINE
	-BASIN DESIGNATION
	-5-YEAR RUNOFF IN CUBIC FEET PER SECOND
0.71 1.8	-100-YEAR RUNOFF IN CUBIC FEET PER SECOND
<u> </u>	-BASIN AREA IN ACRES
1	DESIGN POINT
	DIRECTION OF RUNOFF
	EXISTING BOUNDARY EASEMENT
TELE	EXISTING TELEPHONE LINE
OH	EXISTING POWER LINE
XX	EXISTING FENCE
GAS	EXISTING GAS LINE
	EXISTING WETLANDS
<u> </u>	EXISTING LIMITS OF WETLAND
	EXISTING WETLAND SETBACK
	EXISTING FEMA FLOOD PLAIN, ZONE A

_____ NOTE: FOR EXISTING WESTERN OFFSITE SUB-BASIN ANALYSIS AS WELL AS PROPOSED EASTONVILLE ROAD SUB-BASIN ANALYSIS, SEE "EASTONVILLE ROAD FINAL DRAINAGE REPORT", BY HR GREEN, SEPTEMBER 2022.

RUNOFF	SUMMARY
-	DIE

Basin	Area	Qs	Q100	
ID	(acres)	(cfs)	(cfs)	
*EX2	321.53	28.3	0.0	
*EX3	131.26	1.7	0.0	
*EX4	832.70	22.4	0.0	
*EX5	22.35	7.0	0.0	
*EX6	3.05	1.2	0.0	
*EX7	1.47	0.9	0.0	
ES-1	16.17	3.4	24.4	
ES-2	46.05	7.5	53.7	
ES-3	64.30	10.0	71.5	
ES-4	2.68	0.6	4.4	
ES-5	26.15	5.0	35.5	
ES-6	31.26	6.5	46.5	

* Values taken from Eastonville Road PDR prepared by HR Green, Dated September 2024

Design	Qş	Q100
Point	(cfs)	(cfs)
X1	5.5	35.5
X2	36.9	588.0
X3	10.0	71.5
X4	0.6	4.4
X5	5.0	35.5
X6	14.3	177.4
'2	1.7	18.8
*3	6.1	112.1
*4	22.4	491.0
*5	7.0	43.3
*6	1.2	6.9
.7	0.9	42
12	88.9	568.8
* Values ta Road PDR Green, Da	ken from E prepared ed Septen	laston vill by HR iber 2023

missing values, please make tables clearer



PRELIMINARY DRAINAGE PLAN GRANDVIEW RESERVE	FOR HR GREEN, INC	EASTONVILLE RD	EL PASO COUNTY, PEYTON, CO 80831
# Date	Issue / Description		Init.
-			
-			
-			
-			
-			
-			
_			

Project No:	HRG 1.20
Drawn By:	TJE
Checked By:	GRD
Date:	9/21/2023
	05.110

EXISTING DRAINAGE MAP





Basin	Area	Qs	Q100	
ID	(acres)	(cfs)	(cfs)	
*EX2	321.53	28.3	18.8	
*EX3	131.26	1.7	112.1	
'EX4	832.70	22.4	491.0	
*EX5	22.35	7.0	43.3	
*EX6	3.05	1.2	6.9	
*EX7	1.47	0.9	4.2	
A-1	19.53	5.4	38.5	
EA-1	2.01	0.6	4.3	
TSB-A1	17.49	4.9	35.0	
TSB-A2	4.51	1.4	10.1	
TSB-A3	9.49	2.7	19.5	
TSB-B1	13.64	4.0	28.1	
TSB-B2	5.12	1.6	11.4	
TSB-B3	9.91	3.0	21.2	
TSB-C1	6.84	2.0	13.8	
TSB-C2	17.00	4.8	34.0	
TSB-C3	18.56	5.1	36.4	
TSB-D1	10.86	3.0	21.1	
TSB-E1	20.93	5.5	39.0	

Design	Qs	Q100	
Point	(cfs)	(cfs)	
2	1.7	18.8	
*3	6.1	112.1	
*4	22.4	491.0	
*5	7.0	43.3	
*6	1.2	6.9	
*7	0.9	4.2	
8	88.9	568.8	
10	11.0	526.0	
11	12.0	185.7	
12	8.8	15.4	
13	1.4	10.1	
14	2.7	19.5	
15	4.0	28.1	
16	1.6	11.4	
17	8.5	60.7	
18	2.0	13.8	
19	4.8	34.0	
20	11.8	84.3	
21	3.0	21.1	
22	5.47	39.01	

	-				
	_		-		
			-		
			-	 	
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	Pro	ject No:			
	Dra	iwn By:			
	Che	ecked By:			
	Dat	e:			







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PROPOSED CHANNEL DESIGN AND ANALYSIS FOR BOTH ON-SITE TRIBUTARIES (MAIN STEM AND MAIN STEM TRIBUTARY NUMBER 2) IS PROVIDED IN A SEPARATE REPORT "GRANDVIEW RESERVE CLOMR REPORT", BY HR GREEN, JULY 2022. ALL CHANNEL CULVERTS ARE SHOWN FOR REFERENCE ONLY AND ACTUAL SIZING AND ANALYSIS IS PROVIDED WITHIN THE CLOMR REPORT.

RUNOFF SUMMARY TABLE					
Basin	Area	Qs	Q100		
ID	(acres)	(cfs)	(cfs)		
*EX2	321.53	28.3	18.8		
*EX3	131.26	1.7	112.1		
*EX4	832.70	22.4	491.0		
*EX5	22.35	7.0	43.3		
*EX6	3.05	1.2	6.9		
'EX7	1.47	0.9	4.2		
A-1	19.53	5.4	38.5		
EA-1	2.01	0.6	4.3		
TSB-A1	17.49	4.9	35.0		
TSB-A2	4.51	1.4	10.1		
TSB-A3	9.49	2.7	19.5		
TSB-B1	13.64	4.0	28.1		
TSB-B2	5.12	1.6	11.4		
TSB-B3	9.91	3.0	21.2		
TSB-C1	6.84	2.0	13.8		
TSB-C2	17.00	4.8	34.0		
TSB-C3	18.56	5.1	36.4		
TSB-D1	10.86	3.0	21.1		
TSB-E1	20.93	5.5	39.0		

*Values taken from Eastonville Road PDR prepared by HR Green, Dated September 2024

DESIGN POINT SUMMARY TABLE		
Design	Qs	Q100
Point	(cfs)	(cfs)
2	1.7	18.8
-3	6.1	112.1
'4	22.4	491.0
*5	7.0	43.3
*6	1.2	6.9
*7	0.9	4.2
8	88.9	568.8
10	11.0	526.0
11	12.0	185.7
12	8.8	15.4
13	1.4	10.1
14	2.7	19.5
15	4.0	28.1
16	1.6	11.4
17	8.5	60.7
18	2.0	13.8
19	4.8	34.0
20	11.8	84.3
21	3.0	21.1
22	5.47	39.01

Green, Dated September 2023

83. PRELIMINARY DRAINAGE PLAN GRANDVIEW RESERVE FILING FOR HR GREEN, INC Ο Ō EASTONVILLE RD EL PASO COUNTY, # Date Issue / Description Init. _____ _ ____ _____ - _____ ____ _____

Date:	9/20/2023
Checked By:	GRD
Drawn By:	TJE
Project No:	HRG 1.20

INTERIM DRAINAGE MAP





ICO, Falcon-HRG00001.20-GrandViewIOCIVIDrain Reports/PropIDesign/HRG01_Pr. Drainage Map.dvg - Caleb Johnson - 9/22/2023







SCALE: 1"=100'



Basin	Area	Qs	Q100
ID	(acres)	(cfs)	(cfs)
C-1	4.12	6.8	16.0
C-2	2.71	4.9	11.4
C-3	1.56	0.8	4.5
C-4	2.47	4.1	9.6
C-5	3.09	5.5	12.8
C-6	2.10	3.2	7.4
C-9b	3,69	5.9	13.7
C-10	3.47	5.2	12.1
C-11	0.46	1.0	2.3
C-12	1.66	2.9	6.7
C-13	2.37	0.8	5.5
C-14	1.53	0.5	3.8
C-15	0.16	0.1	0.5

Design	Qs	Q100
Point	(cfs)	(cfs)
17a	4.9	11.4
17b	6.8	16.0
17c	5.8	20.8
17d	5.5	20.2
17e	3.3	11.7
17h	5.9	29.5
18c	6.9	23.3
19	1.0	2.3
20	2.9	6.7
21	58.7	140.8

HRG 1.20 Project No: TJE Drawn By: GRD Checked By Date: 9/22/2023 PROPOSED DRAINAGE

MAP

_ ____





CO, Falcon-HRG000001.20-GrandView/0CIVIDrain Reports/Prop/Design/HRG01_WQ Map.dwg - Brady Shyrock - 9/9/2022







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Project No:	HRG 1.20
Drawn By:	NJA
Checked By:	GRD
Date:	9/9/2022
WQ MAP	

DR-4

DRAINAGE LEGEND

	PROPERTY LINE
	PROPOSED ROAD CENTERLINE
	BASIN BOUNDARY LINE
	EXISTING WETLANDS
	EXISTING LIMITS OF WETLAND
	EXISTING WETLAND SETBACK
	EXISTING FEMA FLOOD PLAIN, ZONE A
→···	CENTERLINE OF STREAM
	PROPOSED RIPRAP
	PROPOSED MAINTENANCE ACCESS
	-BASIN DESIGNATION
	-5-YEAR RUNOFF IN CUBIC FEET PER SECOND
0.71 1.8	-100-YEAR RUNOFF IN CUBIC FEET PER SECOND
	-BASIN AREA IN ACRES
	FUTURE DEVELOPMENT (NOT PART - TSB PROVIDED)
	ROADWAY (DESIGN BY OTHERS - SEE NOTE 1)
	AREA TO BE DETAINED IN PBMP (POND A)
	AREA TO BE DETAINED IN PBMP (POND B)
	AREA TO BE DETAINED IN PBMP (POND C)
	AREA TO BE DETAINED IN PBMP (POND D)
	AREA TO BE DETAINED IN PBMP (POND E)
	AREA NOT TO BE DETAINED IN PBMP PER SECTION I.7.1.B.7 (LAND DISTURBANCE TO UNDEVELOPED LAND THAT WILL REMAIN UNDEVELOPED)
	AREA TO BE DETAINED IN FUTURE PBMP WITH THE REMAINDER OF THE REX RD DEVELOPMENT - TSB PROVIDED
	AREA WHERE WATER QUALITY IS ACHIEVED THROUGH RUNOFF REDUCTION (ROOF DRAINS & IMPERVIOUS SURFACES NOT PERMITTED ON BACK OF THESE LOTS)
	AREA TO BE DETAINED IN PUBLIC PBMP (EASTONVILLE ROAD)

NOTES:

EASTONVILLE ROAD AND THE WESTERN PORTION OF REX ROAD AT EASTONVILLE IS TO BE CONSTRUCTED CONCURRENTLY WITH THIS DEVELOPMENT. DRAINAGE FOR THESE AREAS WILL BE CAPTURED AND TREATED BY OFFSITE INFRASTRUCTURE AND PONDS AS DESCRIBED IN THE "FINAL DRAINAGE REPORT FOR EASTONVILLE ROAD FROM FUTURE REX ROAD TO LONDONDERRY DRIVE", BY HR GREEN, MARCH 2022. BASIN SHOWN ARE FOR REFERENCE ONLY. _

APPENDIX F EASTONVILLE PDR



PRELIMINARY FOR REFERENCE ONLY

▶ HRGREEN.COM

Eastonville Road – Londonderry Dr. to Rex Rd. Preliminary Drainage Report

September 2023 HR Green Project No: 201662.08

Prepared For:

D.R. Horton Contact: Riley Hillen, P.E. 9555 S. Kingston Ct. Englewood, CO 80112

Prepared By:

HR Green Development, LLC Contact: Colleen Monahan, P.E., LEED AP cmonahan@hrgreen.com (719) 394-2433



Engineer's Statement:

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

Colleen Monahan, P.E., LEED AP	Date
State of Colorado No. 56067	
For and on behalf of HR Green Development, LLC	

Owner/Developer's Statement:

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

-	
D.,	
DV	
	•

Authorized Sig	gnature
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Address: D.R. Horton 9555 S. Kingston Court Englewood, CO

El Paso County Statement

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.

Joshua Palmer, P.E.

County Engineer/ECM Administrator

Conditions:

Date

Date



Table of Contents

Tab	le of Contents	2
I.	General Purpose, Location and Description	3
а	. Purpose	3
b	. Location	3
С	. Description of Property	3
d	. Floodplain Statement	4
II.	Drainage Design Criteria	4
а	. Drainage Criteria	4
III.	Drainage Basins and Subbasins	4
а	. Major Basin Description	4
b	. Existing Subbasin Description	5
с	Proposed Subbasin Description	6
IV.	Drainage Facility Design	9
а	. General Concept	9
b	. Water Quality & Detention	9
с	. Inspection and Maintenance	10
V.	Wetlands Mitigation	
VI.	Four Step Method to Minimize Adverse Impacts of Urbanization	10
VII.	Drainage and Bridge Fees	
VIII.	Opinion of Probable Cost	11
IX.	Hydraulic Grade Line Analysis	11
Х.	Summary	11
XI.	Drawings	
XII.	References	11

Appendices

- A. Vicinity Map, FEMA Map, NRCS Soil Survey
- B. Hydrologic Analysis
- C. Hydraulic Analysis
- D. Water Quality and Detention Calculations
- E. Reference Material
- F. Drainage Maps



I. General Purpose, Location and Description

a. Purpose

The purpose of this Preliminary Drainage Report (PDR) for Eastonville Road is to describe the onsite and offsite drainage patterns, size drainage infrastructure to safely capture and convey developed runoff to water quality and detention facilities, and to safely route detained stormwater to adequate outfalls. This drainage report will detail the improvements of Eastonville Road from Londonderry Drive to Rex Road.

b. Location

Eastonville Road from Londonderry Drive to Rex Road, referred to as 'the site' herein, is an existing road in El Paso County, Colorado. The site lies within a tract of land within Sections 21 and 28, Township 12 South, Range 64 West of the 6th Principal Meridian, in El Paso County, State of Colorado.

The site is bound by undeveloped land to the east and west that has historically been used as ranching lands. Falcon Regional Park, which contains ballparks and parking, and Falcon High School also border the site to the west. All lands to the east and west of the site are unplatted. A vicinity map is presented in Appendix A.

c. Description of Property

The site is approximately 1.3 miles (15.8 acres) of existing temporary pavement roadway north of Londonderry Drive and south of Rex Road. The temporary pavement width for the length of the project is 26' wide. 4' wide sand shoulders and weedy swales are located on both sides of the roadway. Offsite stormwater is bypassed under the road through a series of existing culverts. See Appendix A for existing condition photo.

The existing roadway has slopes ranging from 0.3% up to about 4%. The general topography of the surrounding area is typical of high desert, short prairie grass with gently rolling hillside with slopes ranging from 2% to 4%. The project site drains generally from the west to the east and is tributary to Black Squirrel Creek.

Per a NRCS soil survey, the site is made up of Type A Columbine gravelly sandy loam, Type A Blakeland loamy sand and Type B Stapleton sandy loam. The NRCS soil survey is presented in Appendix A.

Gieck Ranch Tributary #1 (Channel A) is the only drainageway that traverses the site in the west to east direction through an existing culvert under Eastonville Road. The channel is a mapped wetland and a wetland permit will be required for a part of this Eastonville Road improvement project. Channel A is not within a FEMA floodplain.

Gieck Ranch Tributary #2 is located north of the project site and will not be impacted by this project. There are no known irrigation facilities in the area.

Existing utilities include an underground gas line that runs along the east and western sides of Eastonville, an existing raw water line that follows the west side of Eastonville north of Falcon Regional Park, and an existing aboveground electrical line along the western side of Eastonville Road. An existing drainage map with these facilities is presented in Appendix F.



d. Floodplain Statement

Based on FEMA Firm map 08041C0552G December 7, 2018, the site is not located in any FEMA designated floodplain. See FEMA Firm Map in Appendix A. There is a Zone A floodplain north of the site and a Zone AE south of the site, both of which will not be altered with the associated Eastonville Road improvements.

II. Drainage Design Criteria

a. Drainage Criteria

Hydrologic data and calculations were performed using Drainage Criteria Manual Volume 1 of El Paso County (EPCDCM), with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs Drainage Criteria Manual (CCSDCM), May 2014 revised January 2021.

Onsite drainage improvements are designed for the 5-year storm (minor event) and 100-year storm (major event) using rainfall values from CCSDCM Table 6-2 below. Runoff was calculated per CCSDCM Section 6.3.0 - Rational Method. Private, full spectrum pond design was completed using the latest version of Mile High Flood District's (MHFD) UD-Detention per CCSDCM Section 13.3.2.1 – Private, full spectrum Detention. Detention pond allowable release rate will be limited to less than historic rates.

Table 6-2: Rainfall Depths for Colorado Springs			
Return Period (yr)	5	100	
1-hr Rainfall Depth (in)	1.50	2.52	

Inlet sizing was performed per the methods described in EPCDCM Section III Chapter 7 – Street Drainage and Storm Water Inlets. Storm sewer sizing was performed per the methods described in EPCDCM Section III Chapter 8 – Storm Drains and Appurtenances.

III. Drainage Basins and Subbasins

a. Major Basin Description

The site is located within the Gieck Ranch Drainage Basin. The site's drainage characteristics were previously studied in the following reports:

- 1. "Gieck Ranch Drainage Basin Planning Study" prepared by Drexel, Barrel & Co, February 2010.
- 2. "Master Development Drainage Plan Meridian Ranch" prepared by Tech Contractors, July 2021.
- 3. "Final Drainage Report for The Sanctuary Filing 1 at Meridian Ranch" by Tech Contractors, August 2022.

Gieck Ranch Drainage Basin is a 22.05 square mile watershed located in El Paso County, Colorado. Gieck Ranch Drainage Basin is tributary to Black Squirrel Creek which drains to the Arkansas River. The majority of the basin is undeveloped and is rolling range land typical of Colorado's semi-arid climates. It should be noted that the Gieck Ranch DBPS has not been approved at the time of this report.





The Meridian Ranch MDDP and The Final Drainage Report for The Sanctuary Filing 1 at Meridian Ranch indicate that the Eastonville Road culvert crossing at the Gieck Ranch Tributary #1, within the project boundary, does not provide enough capacity for the historic flow rates. This culvert will be upgraded as part of this project.

Within the Gieck Ranch Drainage Basin, ranching has historically dominated the area, with rolling topography between 2%-4% slopes. However, more recently urbanization is occurring, most notably for this project are Meridian Ranch and Latigo Trails Developments. Both are single family residential neighborhoods located upstream to the west and northwest of the Eastonville project site.

b. Existing Subbasin Description

Eastonville Road from Londonderry Drive to Rex Road (the site) accepts flows from areas to the west and northwest of the site, including portions of Meridian Ranch and Latigo Development. The flows and design points used in the following descriptions are taken from the approved Meridian Ranch MDDP and The Final Drainage Report for The Sanctuary Filing 1 at Meridian Ranch which provide the detailed analysis of the pond releases and flows as they outfall from those developments upstream of this Eastonville Road site. For the purpose of this report, full buildout of the Meridian Ranch development was assumed; hence the developed peak flow rates from the "future buildout conditions" for the entirety of Meridian Ranch were used to evaluate the existing conditions below.

Basin EX1 (The Sanctuary Filing 1 FG-38) is 85.16 acres of undeveloped area and temporary pavement area to the crown of Eastonville Road roadway. Stormwater from this basin combines with flows from Latigo Trails South Pond (The Sanctuary Filing 1 G-17) is conveyed overland to DP1 for a total area of 321.5 acres (The Sanctuary Filing 1 G18). Flows at DP1 ($Q_5 = 28.3$ cfs $Q_{100} = 365.2$ cfs) are conveyed across Eastonville Road in an existing 24" CMP culvert and discharges to Gieck Ranch Tributary #2 (Channel B). This basin is located upstream of the Eastonville project and is presented here to show where flows go that are upstream of the project site. The Eastonville project will have no impact on this basin.

Basin EX2 (The Sanctuary Filing 1 FG36) is 18.88 acres undeveloped area, parking lot, and temporary pavement to the crown of Eastonville Road roadway. Stormwater from this basin is conveyed overland to DP2 (The Sanctuary Filing 1 FG36). Flows at DP2 ($Q_5 = 1.7$ cfs $Q_{100} = 18.8$ cfs) are conveyed southerly across Rex Road in an existing 24" RCP culvert and discharges to Basin EX3.

Basin EX3 is 51.06 acres of undeveloped area and the Falcon Regional Park ball fields and temporary pavement to the crown of Eastonville Road roadway. Stormwater from this basin combines with flows from The Sanctuary Filing 1 Design Point G15 via an existing roadside swale where it then combines with DP2 flows. Flows travel to DP3 for a total area of 131.3 acres (The Sanctuary Filing 1 Design Point G16) where they are conveyed across Eastonville Road in an existing 24" CMP culvert ($Q_5 = 6.1 \text{ cfs } Q_{100} = 112.1 \text{ cfs}$).

Basin EX4 is 62.87 acres of undeveloped area and temporary pavement to the crown of Eastonville Road roadway. Stormwater from this basin combines with flows from The Sanctuary Filing 1 Design Point G12 (Meridian Ranch Pond G) to Gieck Ranch Tributary #1 and an existing roadside swale to DP 4 for a total area of 832.7 acres (The Sanctuary Filing 1 Design Point G06) ($Q_5 = 22.4$ cfs $Q_{100} = 491$ cfs). Flows at DP4 are conveyed across Eastonville Road in an existing 18" CMP culvert and discharges to Gieck Ranch Tributary #1 (Channel A).



Basin EX5 is 22.35 acres of undeveloped area and temporary pavement to the crown of Eastonville Road roadway. Stormwater from this basin ($Q_5 = 7.0$ cfs $Q_{100} = 43.3$ cfs) is conveyed in an existing roadside swale to DP5. Flows at DP5 are conveyed across Eastonville Road in an existing 18" CMP culvert.

Basin EX6 is 3.05 acres of undeveloped area and temporary pavement. to the crown of Eastonville Road roadway Stormwater from this basin ($Q_5 = 1.2$ cfs $Q_{100} = 6.9$ cfs) is conveyed in an existing roadside swale to DP6. Flows at DP6 are conveyed across Eastonville Road in an existing 18" CMP culvert.

Basin EX7 is 1.47 acres of undeveloped area and temporary pavement to the crown of Eastonville Road roadway. Stormwater from this basin ($Q_5 = 0.9$ cfs $Q_{100} = 4.2$ cfs) is conveyed in an existing roadside swale to DP7. Flows at DP7 are conveyed across Eastonville Road in an 18" CMP culvert.

Basin EX8 is 13.13 acres of undeveloped area and temporary pavement to the crown of Eastonville Road roadway. Stormwater from this basin ($Q_5 = 3.8$ cfs $Q_{100} = 22.6$ cfs) is conveyed in an existing roadside swale to DP8. Flows at DP8 are conveyed across Eastonville Road in an existing an existing 24" CMP culvert.

Basin EX9 is 1.59 acres of undeveloped area and temporary pavement to the crown of Eastonville Road roadway. Stormwater from this basin ($Q_5 = 0.9$ cfs $Q_{100} = 3.7$ cfs) is conveyed in an existing roadside swale to DP9. Flows at DP9 are conveyed across Eastonville Road in an existing an existing 36" CMP culvert.

c. Proposed Subbasin Description

Description of Proposed Project

The proposed project includes improvements to Eastonville Road from Londonderry Drive to Rex Road. As described above, the current condition of the existing roadway in this area consists of 26' wide temporary pavement roadway with 4' wide sand shoulders and weedy swales located on both sides of the roadway. Offsite stormwater is bypassed under the road through a series of existing culverts.

The proposed improvements from Rex Road south to the southern property line of the proposed Grandview Reserve Filing 1 include removal of the 26' wide temporary pavement and replacing the road with a Modified Urban Minor Arterial Roadway Cross-Section consisting of 48' pavement and Type A EPC curb (53' back of curb to back of curb). This includes Basins EA1-EA12.

The proposed improvements from southern property line of the proposed Grandview Reserve south to Londonderry Drive include resurfacing the existing temporary pavement by providing full-depth pavement to replace the temporary pavement along this length of roadway. This is anticipated to be an interim condition until the completion of the full roadway section by others. The proposed interim roadway will be consistent with the Modified Rural Major Collector Roadway Cross-Section, with two 12' wide lanes and 4' shoulders, with existing roadside swales on both sides. The total width of the roadway is 32' including both shoulders, which adds 6' of pavement to the existing 26' temporary pavement roadway. Per ECM Appendix I.7.1.B.2.2, this area of the project is excluded from the requirements of Section 1.7 since the site does not add more than 8.25' of paved width at any location of the existing roadway. This includes Basins EA13-EA15.

Eastonville Road Basins

Basin EA1 is 0.22 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater ($Q_5 = 0.7$ cfs $Q_{100} = 1.3$ cfs) is conveyed in curb and gutter to DP2. Flows at DP2 are captured in a 5' Type R sump inlet (Public) and piped to Pond A Sand Filter. Basin EA1 will be detained Pond A Sand Filter.



Basin EA2 is 0.25 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater ($Q_5 = 0.8$ cfs $Q_{100} = 1.5$ cfs) is conveyed in curb and gutter to DP3. Flows at DP3 are captured in a 5' Type R sump inlet (Public) and piped to Pond A. Basin EA2 will be detained Pond A Sand Filter.

Basin EA3 is 0.20 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater ($Q_5 = 0.7$ cfs $Q_{100} = 1.4$ cfs) is conveyed in curb and gutter to DP5. Flows at DP5 are captured in a 10' Type R sump inlet (Public) and piped to DP9.1. Basin EA3 will not be detained per the Meridian Ranch MDDP as this basin has been over-detained within Meridian Ranch.

Basin EA4 is 0.17 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater ($Q_5 = 0.5$ cfs $Q_{100} = 1.1$ cfs) is conveyed in curb and gutter to DP6. Flows at DP6 are captured in a 5' Type R sump inlet (Public) and piped to DP9.1. Basin EA4 will not be detained per the Meridian Ranch MDDP as this basin has been over-detained within Meridian Ranch.

Basin EA5 is 0.16 acres of undeveloped area and includes Pond A Sand Filter. Stormwater ($Q_5 = 0.1$ cfs $Q_{100} = 0.4$ cfs) is flows directly into Pond A Sand Filter.

Basin EA6 is 0.70 acres of undeveloped area that will be future roadway (Rex Road) once the Grandview Filing 1 development is constructed. Stormwater ($Q_5 = 3.1 \text{ cfs } Q_{100} = 5.5 \text{ cfs}$) is conveyed in a swale to DP10: Temporary Sediment Basin #1 (TSB #1). TSB #1 has been sized for the paved area of the roundabout and the future paved area of Rex Road within Basin EA6. The swale will be removed with the construction of Rex Road curb and gutter. Basin EA6 will be detained in TSB #1.

Basin EA7 is 0.65 acres of undeveloped area that will be future roadway (Rex Road) once the Grandview Filing 1 development is constructed. Stormwater ($Q_5 = 2.5$ cfs $Q_{100} = 4.7$ cfs is conveyed in a swale to DP10: Temporary Sediment Basin #1 (TSB #1). TSB #1 has been sized for the paved area of the roundabout and the future paved area of Rex Road within Basin EA7. The swale will be removed with the construction of Rex Road curb and gutter. Basin EA7 will be detained in TSB #1.

Basin EA8 is 2.08 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater ($Q_5 = 5.0 \text{ cfs } Q_{100} = 9.0 \text{ cfs}$) is conveyed in curb and gutter to DP14. Flows at DP14 are captured in a 10' Type R sump inlet (Public) and piped to Pond B. Basin EA8 will be detained Pond B Full Spectrum Detention Basin.

Basin EA9 is 2.99 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater ($Q_5 = 4.6$ cfs $Q_{100} = 9.5$ cfs) is conveyed in curb and gutter to DP15. Flows at DP15 are captured in a 10' Type R sump inlet (Public) and piped to Pond B. Basin EA9 will be detained Pond B Full Spectrum Detention Basin.

Basin EA10 is 1.34 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater ($Q_5 = 4.0 \text{ cfs } Q_{100} = 7.4 \text{ cfs}$) is conveyed in curb and gutter to DP17. Flows at DP17 are captured in a 10' Type R sump inlet (Public) and piped to Pond B. Basin EA10 will be detained Pond B Full Spectrum Detention Basin.

Basin EA11 is 1.99 acres of proposed roadway (Modified Urban Minor Arterial Roadway Cross-Section). Stormwater ($Q_5 = 4.1 \text{ cfs } Q_{100} = 8.5 \text{ cfs}$) is conveyed in curb and gutter to DP18. Flows at DP18 are captured in a 10' Type R sump inlet (Public) and piped to Pond B. Basin EA11 will be detained Pond B Full Spectrum Detention Basin.

Basin EA12 is 0.92 acres of undeveloped area and includes Pond B. Stormwater ($Q_5 = 0.5$ cfs $Q_{100} = 2.9$ cfs) flows directly into Pond B Full Spectrum Detention Basin.



Basin EA13 is 1.31 acres of undeveloped area and proposed pavement to the crown of Eastonville Road roadway (Modified Rural Major Collector Roadway Cross-Section). Stormwater ($Q_5 = 1.0 \text{ cfs } Q_{100} = 4.0 \text{ cfs}$) is conveyed in existing roadside swale to an existing 18" CMP storm pipe at DP22 (EX DP 7). Per ECM Appendix I.7.1.B.2.2, this area of the project is excluded from the requirements of Section 1.7.

Basin EA14 is 13.13 acres of undeveloped area and proposed pavement to the crown of Eastonville Road roadway (Modified Rural Major Collector Roadway Cross-Section). Stormwater ($Q_5 = 4.0 \text{ cfs } Q_{100} = 23.0 \text{ cfs}$) is conveyed in existing roadside swale to an existing 24" CMP storm pipe at DP23 (EX DP8). Per ECM Appendix I.7.1.B.2.2, this area of the project is excluded from the requirements of Section 1.7.

Basin EA15 is 1.59 acres of undeveloped area and proposed pavement to the crown of Eastonville Road roadway (Modified Rural Major Collector Roadway Cross-Section). Stormwater ($Q_5 = 1.0 \text{ cfs } Q_{100} = 3.9 \text{ cfs}$) is conveyed in existing roadside swale to an existing 36" CMP storm pipe at DP24 (EX DP 9). Per ECM Appendix I.7.1.B.2.2, this area of the project is excluded from the requirements of Section 1.7.

Offsite Basins

Basin OS1 (EX1) is 85.16 acres of undeveloped area. Stormwater from this basin combines with flows from Latigo Trails South Pond (The Sanctuary Filing 1 G-17) is conveyed overland to DP1 (The Sanctuary Filing 1 G18). Flows at DP1 ($Q_5 = 28.3$ cfs $Q_{100} = 365.2$ cfs) are conveyed across Eastonville Road in an existing 24" CMP culvert and discharges to Gieck Ranch Tributary #2 (Channel B). This basin is located upstream of the Eastonville project and is presented here to show where flows go that are upstream of the project site. The Eastonville project will have no impact on this basin.

Basin OS2 is 15.03 acres of undeveloped land and parking area north of Rex Road and contains a portion of Rex Road ($Q_5 = 4.2$ cfs $Q_{100} = 21.6$ cfs). Stormwater is conveyed to DP7 and is captured in a proposed 24" RCP culvert and piped south across Rex Road. No development associated with Eastonville Road will occur in Basin OS2.

Basin OS3 is 1.00 acre of undeveloped land ($Q_5 = 0.2$ cfs $Q_{100} = 1.2$ cfs) along the western edge of Eastonville Road. Stormwater is conveyed to DP8 and is captured in a proposed 15" RCP culvert and piped south across Rex Road. No development associated with Eastonville Road will occur in Basin OS3.

Basin OS4 is 9.60 acres of undeveloped land ($Q_5 = 3.8 \text{ cfs } Q_{100} = 17.3 \text{ cfs}$) along the western edge of Eastonville Road. Stormwater is conveyed to DP11 in a roadside swale where it combines with Meridian Ranch DP G15 flows ($Q_5 = 8 \text{ cfs } Q_{100} = 54.0 \text{ cfs}$) before being captured in a proposed 30" RCP culvert and piped to Channel B. The combined flows as it reaches DP11 is $Q_5 = 10.5 \text{ cfs } Q_{100} = 144.5 \text{ cfs}$.

Basin OS5 is 40.26 acres of undeveloped land and Falcon Regional Park ($Q_5 = 13.3$ cfs $Q_{100} = 64.0$ cfs) along the western edge of Eastonville Road. Stormwater is conveyed to DP12 in a roadside swale and is captured in a proposed 48" RCP culvert and piped to Channel B.

Basin OS6 is 60.97 acres of undeveloped land ($Q_5 = 8.9 \text{ cfs } Q_{100} = 60.6 \text{ cfs}$) along the western edge of Eastonville Road. Basin OS6 flows are adapted directly from the approved The Sanctuary Filing 1 FDR. Stormwater is conveyed to DP16 in a roadside swale where it combines with Meridian Ranch DP G12 flows before being conveyed across Eastonville Road in dual 10' x 3.5' RCBC to Channel A. The combined flows at DP16 (EX4) are $Q_5 = 22.4 \text{ cfs } Q_{100} = 491 \text{ cfs}$.

Basin OS7 is 23.46 acres of undeveloped land ($Q_5 = 5.7$ cfs $Q_{100} = 38.6$ cfs) along the western edge of Eastonville Road. Stormwater is conveyed to DP21 in a roadside swale and is captured in a proposed 30" RCP culvert and piped to Channel A.



Basin OS8 is future outflow of 11.42 acres of a future stormwater detention pond outflow developed land that will be detained to meet existing conditions ($Q_5 = 3.4$ cfs $Q_{100} = 22.7$ cfs) in the southeast corner of Eastonville Road and Rex Road. From there, stormwater is piped to Channel B.

IV. Drainage Facility Design

a. General Concept

The proposed improvements from Rex Road south to the southern property line of the proposed Grandview Reserve Filing 1 include removal of the 26' wide temporary pavement and replacing the road with a Modified Urban Minor Arterial Roadway Cross-Section consisting of 48' pavement and Type A EPC curb (53' back of curb to back of curb). Inlets will be placed at low points and roundabout entrances. Stormwater from this roadway will be piped to either a full spectrum detention pond, sand filter or temporary sediment basin. All ponds and water quality features will discharge at less than historic rates.

The proposed improvements from southern property line of the proposed Grandview Reserve south to Londonderry Drive include resurfacing the existing temporary pavement by providing full-depth pavement to replace the temporary pavement along this length of roadway. This is anticipated to be an interim condition until the completion of the full roadway section by others. The proposed interim roadway will be consistent with the Modified Rural Major Collector Roadway Cross-Section, with two 12' wide lanes and 4' shoulders, with existing roadside swales on both sides. The total width of the roadway is 32' including both shoulders, which adds 6' of pavement to the existing 26' temporary pavement roadway. Per ECM Appendix I.7.1.B.2.2, this area of the project is excluded from the requirements of Section 1.7 since the site does not add more than 8.25' of paved width at any location of the existing roadway. This includes Basins EA13-EA15.

b. Water Quality & Detention

Pond A (Sand Filter)

Water quality for Basins EA1, EA2 & EA5 is provided in Pond A; a water quality sand filter. A total of 0.63 acres at 54.0% composite imperviousness will be treated. The WQCV is 523 ft³ and is released in 12 hours. A 12" PVC underdrain with 5/8" orifices will run beneath the filter material to facilitate the discharge to Channel B. The sand filter design calculations are presented in Appendix D.

Pond B (Full Spectrum Detention Basin)

Water quality and detention for Basins EA8 – EA12 is provided in Pond B; a private, full spectrum detention pond within Filing 1 of Grandview Reserve. A total of 9.32 acres at 70% composite imperviousness will be detained. The WQCV is 0.215 ac-ft, the EURV is 0.832 ac-ft, and the 100-year volume is 1.230 ac-ft. The WQCV, EURV and 100-year storms are released in 40, 72 and 76 hours, respectively. A forebay is located at the outfall into the pond and a 2.0' trickle channel conveys flow towards the outlet structure. A 10' access and maintenance road is provided to the bottom of the pond to facilitate maintenance of the pond facilities. A 6' emergency overflow spillway is provided that conveys the developed, peak 100-yr flow rate with 2.0' of freeboard towards Channel A.

Temporary Sediment Basin #1 (TSB #1)

Basin EA6 and EA7 will be detained in a temporary sediment basin (TSB #1) at the end of the Rex Road improvements, in the interim condition. When Rex Road develops further to the east, a permanent, full


spectrum extended detention basin will be required. TSB #1 detains 1.35 acres at 90% composite imperviousness. A Type L riprap emergency spillway is provided with a crest length of 5.0' and a 1.0' of freeboard. The WQCV, EURV and 100-year volume are released in 40, 67 and 71 hours respectively. TSB #1 releases at less than historic rates for the design storms.

c. Inspection and Maintenance

After completion of construction and upon the Board of County Commissioners acceptance, it is anticipated that all drainage facilities within the public Right-of-Way are to be owned and maintained by El Paso County.

All private detention ponds are to be owned and maintained by the Grandview Reserve Metropolitan District NO. 2 (DISTRICT), once established, unless an agreement is reached stating otherwise. Maintenance access for all full spectrum detention facilities will be provided from public Right-of-Way. Maintenance access for the drainageways will be provided through the proposed tracts.

V. Wetlands Mitigation

There is an existing wetland in Gieck Ranch Tributary #1 (Channel A). The wetland is contained entirely within the channel and is classified as jurisdictional. A Nationwide Wetland Permit will be applied for due to the disturbed area at the Dawlish Roundabout. Wetlands maintenance will be the responsibility of the DISTRICT.

VI. Four Step Method to Minimize Adverse Impacts of Urbanization

Step 1 – Reducing Runoff Volumes: Low impact development (LID) practices are utilized to reduce runoff at the source. In general, stormwater discharges are routed across pervious areas prior to capture in storm sewer. This practice promotes infiltration and reduces peak runoff rates. The Impervious Reduction Factor (IRF) method was used and is presented in Appendix D.

Step 2 – Treat and slowly release the WQCV: This step utilizes full spectrum water quality and detention to capture the WQCV and slowly release runoff from the site. Onsite full spectrum detention pond provides water quality treatment for the site. The WQCV is released over a period of 40 hours while the EURV is release over a period of 72 hours.

Step 3 – Stabilize stream channels: This step establishes practices to stabilize drainageways and provide scour protection at stormwater outfalls. Erosion protection is provided at all concentrated stormwater discharge points in the form of riprap pads.

Step 4 – Consider the need for source controls: No industrial or commercial uses are proposed within this development and therefore no source controls are proposed.

VII. Drainage and Bridge Fees

Gieck Ranch drainage basin has not been established as a fee basin within El Paso County. Therefore, no drainage basin fees are due at time of platting.



VIII. Opinion of Probable Cost

An engineer's opinion of probable cost will be provided with subsequent submittals of the Final Drainage Report.

IX. Hydraulic Grade Line Analysis

Hydraulic grade line analysis and final pipe sizes will be presented in a subsequent submittal of the Final Drainage Report.

X. Summary

Eastonville Road lies within the Gieck Ranch Drainage Basin. Water quality and detention for the site is provided in full spectrum water quality and detention ponds, sand filters and temporary sediment basins. There is one major drainageway that traverses the site: Gieck Ranch Tributary 1. The water quality and detention features ponds will be maintained by the Grandview Reserve Metropolitan District No. 2 (DISTRICT). All drainage facilities were sized per the El Paso County Drainage Criteria Manuals.

Based on following EPC methodology for hydrology in the existing and proposed conditions, the development of this project will not adversely affect downstream properties.

XI. Drawings

Please refer to the appendices for vicinity and drainage basin maps.

XII. References

- 1. City of Colorado Springs Drainage Criteria Manual, May 2014, Revised January 2021.
- 2. Drainage Criteria Manual of El Paso, Colorado, October 2018.
- 3. Urban Storm Drainage Criteria Manual, Urban Drainage Flood Control District, January 2018.
- 4. "Gieck Ranch Drainage Basin Planning Study" prepared by Drexel, Barrel & Co, February 2010.
- 5. "Master Development Drainage Plan Meridian Ranch" prepared by Tech Contractors, July 2021.
- 6. "The Sanctuary Filing 1 at Meridian Ranch" prepared by Tech Contactors, August 2022.



Eastonville Road Preliminary Drainage Report Project No.: 201662.08

APPENDIX A - VICINITY MAP, PHOTOS, SOIL MAP, FEMA MAP



Photo - at Londonderry and Eastonville looking north



Natural Resources Conservation Service

SDAL



Hydrologic Soil	Group
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Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	А	10.4	0.6%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	839.5	49.8%
83	Stapleton sandy loam, 3 to 8 percent slopes	В	835.7	49.6%
Totals for Area of Intere	est		1,685.6	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition Component Percent Cutoff: None Specified Tie-break Rule: Higher







Eastonville Road Preliminary Drainage Report Project No.: 201662.08

APPENDIX B – HYDROLOGIC CALCULATIONS

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	EASTONVILLE ROAD	<u>Calc'd by:</u>	СМ	
	EXISTING CONDITIONS	Checked by:	СМ	
1	EL PASO COUNTY, CO	Date:	9/8/2023	

.

	SUMMARY RUNOFF TABLE													
BASIN	AREA (ac)	% IMPERVIOUS	Q ₅ (cfs)	Q ₁₀₀ (cfs)										
G18*	321.53	-	28.3	365.2										
FG36*	18.88	-	1.7	18.8										
G16*	131.26	-	6.1	112.1										
G06*	832.70	-	22.4	491.0										
EX5	22.35	3	7.0	43.3										
EX6	3.05	5	1.2	6.9										
EX7	1.47	9	0.9	4.2										
EX8	13.13	4	3.8	22.6										
EX9	1.59	12	0.9	3.7										
	*.	AREA AND Q TAKE	EN FROM 1	THE SANCTU	JAF									

DES	SIGN POINT SU	MMARY T	ABLE									
DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)									
1	G18*	28.3	365.2									
2	FG36*	1.7	18.8									
3	G16*	6.1	112.1									
4	G06*	22.4	491.0									
5	EX5	7.0	43.3									
6	EX6	1.2	6.9									
7	EX7	0.9	4.2									
8	EX8	3.8	22.6									
9 EX9 0.9 3.7												
ILING 1 FD	R											

LCTI	EASTONVIL	LE ROAD							<u>Calc'o</u>	<u>d by:</u>		C	ж				
	EXISTING C	ONDITIC	DNS						<u>Checl</u>	<u>ked by:</u>		C	M				
HRGreen	EL PASO COUNT	Υ, CO							Date:	_		9/8/	2023				
				CO	MPOSI	TE '(C' F/	ACTOF	RS								
BASIN	UNDEVELOPED	WALKS & DRIVES	SINGLE Family	TOTAL	SOIL	UNI	DEVEI	.OPED	WAL	KS & DR	IVES	SINC	GLE F/	MILY	CO IMPERV	MPOSI IOUSNI	TE ESS & C
		ACRES			TYPE	%	C ₅	C ₁₀₀	%	C ₅	C ₁₀₀	%I	C ₅	C ₁₀₀	%	C ₅	C ₁₀₀
EX1 - EX4*																	
EX5	22.09	0.26	0.00	22.35	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	3	0.10	0.37
EX6	2.96	0.09	0.00	3.05	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	5	0.11	0.38
EX7	1.36	0.11	0.00	1.47	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	9	0.15	0.40
EX8	12.88	0.25	0.00	13.13	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	4	0.11	0.37
EX9	1.43	0.16	0.00	1.59	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	12	0.17	0.42
* FLOWS TO DESI	GN POINTS 1-4 WERE	TAKEN FROM	"THE SANCTUA	ARY FILING	1 FDR" SO	C WAS	S NOT (CALCULA	TED FOR	R CONTRI	BUTING						
AREAS EX1 - EX4																	

1122	EAST	ONVILL	.E ROAD					Calc'd b	y:	СМ					
ברדו	EXIS	ring Co	ONDITIO	Checked	by:	СМ									
HRGreen	EL PAS	O COUNT		9/8	/2023										
BAS	IN DATA	L	OVER	EL TIME (T _t)		TOTAL								
DESIGNATION	C ₅	AREA (ac)	LENGTH (ft)	SLOPE %	t _i (min)	C _V	LENGTH (ft)	SLOPE %	V (ft/s)	t _t (min)	<i>t</i> _c (min)				
EX1-EX4*															
EX5	0.10	22.35	117	11.6	8.8	10	1162	3.4	1.8	10.5	19.3				
EX6	0.11	3.05	207	9.0	12.5	10	250	4.0	2.0	2.1	14.6				
EX7	0.15	1.47	50	3.4	8.2	10	174	4.4	2.1	1.4	9.6				
EX8	0.11	13.13	125	3.1	14.0	10	1219	3.5	1.9	10.9	24.8				
EX9	0.17	1.59	148	4.0	13.0	10	418	3.0	1.7	4.0	17.1				
* FLOWS TO THE AREAS EX1 - EX4	SE DESIGN	N POINTS WE	ERE TAKEN FR	OM "THE SA	NCTUARY FI	LING 1 FDR"	SO TC WAS N	NOT CALCUI	LATED FOR C	ONTRIBL	ITING				

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

Table 6-7. Conveyance Coefficient, C,

Type of Land Surface	<i>C</i> ,
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

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

	2							E	AST	'ON\	/ILL	E R	DAD								Cal	ic'd by	СМ
	\prec	i l						EX	IST	ING	CON	IDIT	ION	S							Che	cked b	<u>у:</u> СМ
1								DE	SIG	N ST	ORM:	: 5-Y	'EAR								1	Date:	9/8/2023
HR	Gree	n																					
				DI	T	OTAL	RUNO)FF	SI	REE	г		PIF	PE		T	RAVE		REMARKS				
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C ₅	t _e (min)	C ₅ *A (ac)	/ (in./ hr.)	a (cfs)	t _c (min)	C ₅ *A (ac)	/ (in./ hr.)	a (cfs)	Q _{street} (cfs)	C ₅ *A (ac)	SLOPE %	Q _{PIPE} (cfs)	C ₅ *A (ac)	SLOPE %	PIPE SIZE (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min	
				•					-			•				•			_	1-			
	1	G18*	321.53									28.3											DP 1 CAPTURED IN GIECK RANCH TRIB #2 (CHANNEL B)
	2	FG36*	18.88									1.7											DP 2 CAPTURED IN 24" RCP CULVERT, PIPED TO BASIN EX3
	3	G16*	131.26									6.1											BASIN EX2, DP2 & DPG15 (SANCTUARY FDR Q5=3 CFS) CAPTURED IN 24" CMP CULVERT, PIPED ACROSS EASTONVILLE ROAD
	4	G06*	832.70									22.4											BASIN EX4 & DPG12 (SANCTUARY FDR Q5 = 21 CFS) CAPTURED IN 18" CMP CULVERT, PIPED ACROSS EASTONVILLE ROAD TO GIECK RANCH TRIB #1 (CHANNEL A)
<u> </u>	5	EX5	22.35	0.10	19.3	2.22	3.15	7.0)													-	BASIN EX5 CAPTURED IN 18" CMP, PIPED ACROSS EASTONVILLE ROAD
	6	EX6	3.05	0.11	14.6	0.35	3.56	1.2															BASIN EX6 CAPTURED IN 18" CMP, PIPED ACROSS EASTONVILLE ROAD
	7		4 47	0.45	0.0	0.00	4.00	0.0															
	1	EAI	1.47	0.15	9.0	0.22	4.20	0.8	,					_									BASIN EAT CAFTORED IN 18 CIVIF, FIFED ACROSS EASTONVILLE ROAD
	8	EX8	13.13	0.11	24.8	1.38	2.76	3.8	3														BASIN EX8 CAPTURED IN 24" CMP, PIPED ACROSS EASTONVILLE ROAD
		-																					
┣───	9	EX9	1.59	0.17	17.1	0.27	3.33	0.9	,													+	BASIN EX9 CAPTURED IN 36" CMP, PIPED ACROSS EASTONVILLE ROAD
																							* AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR

		~							EAST	ON/	/ILLI	E RO	AD								Calc	d by:	СМ
_	+	ì						I	EXIST	ΓING	CON	DITIO	NS								Chec	ked by	СМ
1		1						DE	SIGN	STO	RM:	100-ነ	(EAI	R							Da	ate:	9/8/2023
HR	Gree	en																					
				DIF	TOTAL RUNOFF STREET PIPE TR/									PE		TR	AVEL	TIME	REMARKS				
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C100	t _c (min)	C ₁₀₀ *A (ac)	/ (in./ hr.)	Q (cfs)	<i>t_c (</i> min)	C ₁₀₀ *A (ac)	/ (in./ hr.)	Q (cfs)	Q _{street} (cfs)	C ₁₀₀ *A (ac)	SLOPE %	Q _{PIPE} (cfs)	C ₁₀₀ *A (ac)	SLOPE %	PIPE SIZE (ft)	LENGTH (ft)	VEL. (ft/s)	TRAVEL TIME (min)	
		040	004 50									005.0											
	1	G18	321.53									305.2											DP 1 CAPTURED IN GIECK RANCH TRIB #2 (CHANNEL B)
	2	FG36*	18.88									18.8											DP 2 CAPTURED IN 24" RCP CULVERT, PIPED TO BASIN EX3
	3	G16*	131.26									112.1											BASIN EX2, DP2 & DPG15 (SANCTUARY FDR Q5=3 CFS) CAPTURED IN 24" CMP CULVERT, PIPED ACROSS EASTONVILLE ROAD
	4	G06*	832.70									491.0											BASIN EX4 & DPG12 (SANCTUARY FDR Q5 = 21 CFS) CAPTURED IN 18" CMP CULVERT, PIPED ACROSS EASTONVILLE ROAD TO GIECK RANCH TRIB #1 (CHANNEL A)
	5	EX5	22.35	0.37	10.3	8 20	5.28	13 3	2														BASIN EX5 CAPTURED IN 18" CMP. PIPED ACROSS EASTONVILLE ROAD
	Ŭ	EXO	22.00	0.01	10.0	0.20	0.20	40.0															
	6	EX6	3.05	0.38	14.6	1.15	5.98	6.9)														BASIN EX6 CAPTURED IN 18" CMP, PIPED ACROSS EASTONVILLE ROAD
	7	FX7	1 47	0.40	9.6	0.60	7 04	4 2	, ,														BASIN EX7 CAPTURED IN 18" CMP. PIPED ACROSS FASTONVILLE ROAD
																					1		
	8	EX8	13.13	0.37	24.8	4.88	4.64	22.6	6		<u> </u>										-		BASIN EX8 CAPTURED IN 24" CMP, PIPED ACROSS EASTONVILLE ROAD
	0	EYO	1 50	0.42	17.1	0.67	5 50	37	,														
<u> </u>	9	EVA	1.09	0.42	17.1	0.07	0.09	3.7												+	+	+	
																							* AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR

1177	EAST	ONVILL	E ROAD	Calc'd by:	СМ					
1773	PROP	OSED C	ONDITION	S				Checked by:	СМ	
HRGreen	EL PAS	O COUNT	Y, CO					Date:	9/8/2023	
		BASIN	SUMMARY	TABLE			DES	SIGN POINT SU	MMARY TA	BLE
	BASIN	AREA (ac)	% IMPERVIOUS	Q ₅ (cfs)	Q ₁₀₀ (cfs)	DESI	GN IT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
	OS1	85.16	-	-	-	1		OS1 & G17	28.3	365.2
	OS2	15.03	7	4.2	21.6	2		EA1	0.8	1.5
	OS3	1.00	2	0.2	1.7	3		EA2	0.9	1.7
	OS4	9.60	9	3.8	17.3	3.1		DP2 & DP3	1.6	3.2
	OS5	40.26	8	13.3	64.0	4		EA5 & DP3.1	1.6	3.4
	OS6	60.97	2	8.9	60.6	5		EA3	0.7	1.4
	OS7	23.46	2	5.7	38.6	6		EA4	0.5	1.1
	OS8	11.42	2	3.4	22.7	6.1		DP5 & DP6	1.2	2.4
	EA1	0.22	73	0.8	1.5	7		OS2	4.2	21.6
	EA2	0.25	73	0.9	1.7	8		OS3	0.2	1.7
	EA3	0.20	71	0.7	1.4	8.1		DP7 & DP8	4.4	22.9
	EA4	0.17	65	0.5	1.1	9.1		DP6.1 & DP8.1	4.9	23.8
	EA5	0.16	2	0.1	0.5	10		EA7 & EA6	5.6	10.3
	EA6	0.70	100	3.2	5.7	11		OS4 & G15 & DP9.1	10.5	144.3
	EA7	0.65	89	2.6	4.8	12		OS5	13.3	64.0
	EA8	2.08	99	5.0	9.0	12.	1	DP11 & DP12	21.6	103.1
	EA9	2.99	64	4.6	9.5	13		OS8	3.4	22.7
	EA10	1.34	94	4.0	7.4	13.	1	DP12.1 & DP13	23.4	115.2
	EA11	1.99	66	4.1	8.5	14		EA8	5.0	9.0
	EA12	0.92	4	0.5	3.0	15		EA9	4.6	9.5
	EA13	1.31	12	1.0	4.0	15.	1	DP14 & DP15	9.3	17.9
	EA14	13.13	4	4.0	23.0	16		OS6 & G12 (G6*)	22.4	491.0
	EA15	1.59	14	1.0	3.9	17		EA10	4.0	7.4

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18.1 19.1

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23

24

EA10 EA11 DP17 & DP18 DP15.1 & DP18.1 EA12 OS7 EA13 EA14

EA14 EA15

8.5 15.4

28.8

3.0 38.6 4.0

23.0 3.9

4.1

8.0

15.0

0.5 5.7 1.0

4.0

1.0

LCT I	EASTONVIL	LE ROAD)						Calc'	<u>d by:</u>		C	СМ				
	PROPOSED	CONDITI	ONS						<u>Chec</u>	ked by:		C	M				
HRGreen	EL PASO COUNT	Ύ, CO							Date:	_		9/8/	2023				
	•			CO	MPOSI	TE '	'C' F	АСТО	RS								
BASIN	UNDEVELOPED	PAVED	SINGLE Family	TOTAL	SOIL	UNI	DEVEL	.OPED		PAVED		SING	GLE FA	MILY	CO IMPERV	MPOSI IOUSNI	TE ESS & C
		ACRES		_	TIPE	%	C ₅	C ₁₀₀	%	C ₅	C ₁₀₀	%	C ₅	C ₁₀₀	%	C 5	C ₁₀₀
OS1	85.16	0.00	0.00	85.16	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	2	0.09	0.36
OS2	14.33	0.70	0.00	15.03	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	7	0.13	0.39
OS3	1.00	0.00	0.00	1.00	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	2	0.09	0.36
OS4	8.90	0.70	0.00	9.60	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	9	0.15	0.40
OS5	37.90	2.36	0.00	40.26	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	8	0.14	0.40
056	60.97	0.00	0.00	60.97	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	2	0.09	0.36
087	23.46	0.00	0.00	23.46	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	2	0.09	0.36
058	11.42	0.00	0.00	11.42	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	2	0.09	0.36
EA1	0.06	0.10	0.00	0.22	A/B	2	0.09	0.30	100	0.90	0.96	00	0.73	0.81	73	0.67	0.80
EA2	0.07	0.10	0.00	0.25		2	0.09	0.30	100	0.90	0.90	65	0.73	0.01	73	0.67	0.79
	0.00	0.14	0.00	0.20	A/B	2	0.09	0.30	100	0.90	0.90	65	0.73	0.01	65	0.00	0.76
	0.00	0.11	0.00	0.17	A/B	2	0.09	0.30	100	0.90	0.90	65	0.73	0.01	2	0.01	0.75
EA6	0.10	0.00	0.00	0.10	Δ/B	2	0.03	0.30	100	0.90	0.90	65	0.73	0.01	100	0.03	0.00
EA7	0.00	0.58	0.00	0.65	A/B	2	0.00	0.36	100	0.00	0.96	65	0.73	0.81	89	0.81	0.00
EA8	0.02	2.06	0.00	2.08	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	99	0.89	0.95
EA9	1.11	1.88	0.00	2.99	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	64	0.60	0.74
EA10	0.08	1.26	0.00	1.34	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	94	0.85	0.92
EA11	0.69	1.30	0.00	1.99	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	66	0.62	0.75
EA12	0.90	0.02	0.00	0.92	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	4	0.11	0.37
EA13	1.17	0.14	0.00	1.31	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	12	0.18	0.42
EA14	12.82	0.31	0.00	13.13	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	4	0.11	0.37
EA15	1.39	0.20	0.00	1.59	A/B	2	0.09	0.36	100	0.90	0.96	65	0.73	0.81	14	0.19	0.44
POND A				0.63											54		
POND B				9.32											70		
TSB #1				1.35											90		
Total				11.30													

1177	EAST	ONVILL	E ROAD					Calc'd b	y:		СМ
HAA	PROP	OSED C	ONDITIO	DNS				Checked	by:		СМ
HRGreen	EL PAS	о соинт	'Y, CO					Date:		9/8	/2023
				TIME O	F CONCE	NTRATIO	DN				
BAS	IN DATA		TRAV	EL TIME (T_t		TOTAL				
DESIGNATION	C ₅	AREA (ac)	LENGTH (ft)	SLOPE %	t _i (min)	Cv	LENGTH (ft)	SLOPE %	V (ft/s)	t _t (min)	t _c (min)
OS1 (EX1)*											
OS2	0.13	15.03	220	2.3	20.0	10	1450	2.3	1.5	15.9	36.0
OS3	0.09	1.00	220	2.1	21.4	10	345	2.3	1.5	3.8	25.2
OS4	0.15	9.60	153	3.1	14.8	10	1124	2.5	1.6	11.8	26.6
OS5	0.14	40.26	300	4.4	18.7	10	1267	2.6	1.6	13.1	31.7
OS6	0.09	60.97	300	1.0	32.1	10	1790	2.0	1.4	21.1	53.2
057	0.09	23.46	300	11.6	14.2	10	1300	3.4	1.8	11.8	25.9
058	0.09	11.42	200	11.6	11.6	10	675	3.4	1.8	6.1	17.7
EA1	0.68	0.22	34	2.0	3.6	20	137	1.4	2.4	1.0	5.0
EA2	0.67	0.25	34	2.0	3.6	20	60	1.4	2.4	0.4	5.0
EA3	0.60	0.20	34	2.0	3.8	20	120	1.4	2.4	0.9	5.0
	0.01	0.17	20	2.0	4.1	20	120	3.0	3.9	0.5	5.0
EAG	0.09	0.10	20	2.0	1.5	20	630	17	2.6	0.0	5.5
EA0	0.90	0.70	20	2.0	1.5	20	630	1.7	2.0	4.0	0.0 6.1
EA8	0.01	2.08	24	2.0	1.5	20	2500	0.7	1.7	24.0	26.4
EA9	0.03	2.00	20	2.0	3.7	20	2500	0.7	1.7	24.5	28.6
EA10	0.85	1.34	26	2.0	1.8	20	1220	0.6	1.5	13.1	15.0
EA11	0.62	1.99	26	2.0	3.6	20	1220	0.6	1.5	13.1	16.7
EA12	0.11	0.92	30	10.0	4.6	20	95	33.0	11.5	0.1	5.0
EA13	0.18	1.31	50	3.4	8.0	10	174	4.4	2.1	1.4	9.3
EA14	0.11	13.13	125	3.1	13.9	10	1219	3.5	1.9	10.9	24.8
EA15	0.19	1.59	148	4.0	12.8	10	418	3.0	1.7	4.0	16.8
* FLOWS TO THE	SE DESIGN	I POINTS WE	RE TAKEN FRO	OM "THE SAN	ICTUARY FIL	ING 1 FDR" S	SO TC WAS N	OT CALCUL	ATED		

 $t_c = \frac{0.395(1.1 - C_1)\sqrt{L}}{S^{0.5}} \qquad V = C_v S_w^{-0.5}$

Table 6-7. Conveyance Coefficient, C,

Type of Land Surface	С,
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

For buried riptap, select C, value based on type of vegetative cover.

1	5	EASTONVILLE ROAD																Ca	alc'd	d by:	NQJ		
	t イ オ						PRO	POS	ED (CON	DIT	ION	S							Ch	ecke	ed by:	
	Croop						DES	SIGN	STO	RM:	5-YE	AR									Dat	e:	9/8/2023
	Green																						
				DIREC	TRUN	NOFF	-	Т	OTAL	RUNG	DFF	S	WALE	:		PIF	PE	1	TR	AVE	IL TI	IME	REMARKS
DESIGN POINT	BASIN ID	AREA (ac)	C ₅	t _e (min)	C ₅ *A (ac)	/ (in./ hr.)	Q (cfs)	t _e (min)	C ₅ *A (ac)	/ (in./ hr.)	Q (cfs)	Q _{swale} (cfs)	C ₅ *A (ac)	SLOPE %	Q _{PIPE} (cfs)	C ₅ *A (ac)	% adone	PIPE SIZE (ft)	LENGTH (FT)	VEL. (FPS)		TRAVEL TIME (min	
1	OS1 G18*	85.16 321.53					28.3	3															BASIN OS1 AND G17 FLOW TO DP1 (DPG18), FOLLOWS HISTORIC DRAINAGE PATTERNS TO CHANNEL B
2	EA1	0.22	0.68	5.0	0.15	5.17	0.8	3							0.8	0.15	2.0	1.5	56	10.	.2	0.09	BASIN EA1 CAPTURED IN 5' TYPE R INLET @ DP2, PIPE TO DP3.1
3	EA2	0.25	0.67	5.0	0.17	5.17	0.9	9							0.9	0.17							BASIN EA2 CAPTURED IN 5' TYPE R INLET@ DP3, PIPE TO DP3.1
3.1								5 1	0.32	5 14	1.6				1.6	0.32	2.0	1.5	95	10	2	0.14	
5.1	515					1.75		5.1	0.32		1.0				1.0	0.52	2.0	1.5	00	10.	.2	0.14	
4	EA5	0.16	0.09	6.6	0.01	4.75	0.1	6.6	0.33	4.75	1.6												COMBINED DP3.1 & BASIN EA5, TOTAL FLOW ENTERING POND A
5	EA3	0.20	0.66	5.0	0.13	3 5.17	0.7	, 		_					0.7	0.13	2.0	1.5	48	10.	.2	0.08	BASIN EA3 CAPTURED IN 5' TYPE R INLET @ DP5, PIPE TO DP6.1
6	EA4	0.17	0.61	5.0	0.10	5.17	0.5	5							0.5	0.10	2.0	1.5	i				BASIN EA4 CAPTURED IN 5' TYPE R INLET @ DP6, PIPE TO DP6.1
6.1								5.1	0.24	1 5.15	1.2	:			0.0	0.24	2.0	1.5	1146	10.	.2	1.88	DP3 & DP4 FLOW @ DP5.1, PIPE TO DP9.1
7	OS2	15.03	0.13	36.0	1.92	2 2.21	4.2	2							4.2	1.92	2.0	1.5	44	10.	.2	0.07	BASIN OS2 CAPTURED IN 18" FES, PIPE TO DP8.1
8	OS3	1.00	0.09	25.2	0.09	2.74	0.2	2							0.2	0.09	2.0	1.5	38	10.	.2	0.06	BASIN OS3 CAPTURED IN 18" FES, PIPE TO DP8.1
8.1								36.0	2.01	1 2.21	4.4				4.4	2.01	2.0	1.5	55	10.	.2	0.09	COMBINED DP7 & DP8 @ DP8.1, PIPE TO DP9.1
9.1								36.1	2.25	2.20	4.9	4.9	2.25	1.7					620	2.6	6	3.96	COMBINED DP6.1 & DP8.1 @ DP9.1, DISCHARGE TO ROADSIDE SWALE TO DP11
	EAG	0.70	0.00	5.5	0.63	5.02	3.2																
40	EAG	0.70	0.90	5.5	0.03	5 5.02	5.2																
10	EA7	0.65	0.81	6.1	0.53	4.88	2.6	6.1	1.16	5 4.88	5.6	3.0	3.68	1.7									BASIN EA6 & EA7 @ DP10 (TEMPORARY SEDIMENT BASIN #1)
11	OS4	9.60	0.15	26.6	1.43	2.66	3.8	40.1	3.68	3 2.05	7.5			_	10.5	3.68	2.0	2.0	85	10.	.2	0.14	BASIN OS4, DP9.1 CAPTURED & MERIDIAN RANCH DPG15 (3 CFS) IN 30" FES @ DP11, PIPE TO DP12.1
12	OS5	40.26	0.14	31.7	5.54	2.40	13.3	3							13.3	5.54	2.0	2.0	616	10.	.2	1.01	BASIN OS5 CAPTUREDI N 48° FES @ DP12, PIPE TO DP12.1
12.1								32.8	9.21	1 2.35	21.6				21.6	9.21	2.0	3.5	891	10.	.2	1.46	COMBINED DP11 & DP12 @ DP12.1, PIPE TO DP13.1
13	OS8	11.42	0.09	17.7	1.03	3.28	3.4	4							3.4	1.03	2.0	2.0	28	10.	.2	0.05	BASIN OS8 CAPTURED @ DP13 IN TYPE C INLET, PIPE TO DP13.1
13.1								34.2	10.24	1 2.28	23.4												COMBINED DP12.1 & DP13, PIPE TO CHANNEL B
14	EA8	2.08	0.89	26.4	1.86	2.67	5.0)							5.0	1.86	2.0	2.0	8	10.	.2	0.01	BASIN EA8 CAPTURED IN 10' TYPE R SUMP @ DP14, PIPE TO DP15.1
15	EA9	2.99	0.60	28.6	1.79	2.55	4.6	6							4.6	1.79	2.0	2.0	54	10.	.2	0.09	BASIN EA8 CAPTURED IN 10' TYPE R SUMP @ DP15, PIPE TO DP15.1
15.1								28.7	3.65	2.55	9.3				9.3	3.65	2.0	2.0	641	10	2	1.05	COMBINED DP14 & DP15, PIPE TO DP19.1
16	OS6	60.97	0.09	53.2	5.49	1.62	8.9	9			22.4												
10	500	0.02.7	0.05	45.0		0.50	4.0				22.4				4.0				50	10	~	0.00	
1/	EA10	1.34	0.85	15.0	1.14	3.52	4.0								4.0	1.14	2.0	2.0	52	10.	.2	0.09	BASIN EATU CAPTURED IN 5' TYPE R SUMP, PIPE TO DP18.1
18	EA11	1.99	0.62	16.7	1.23	3.36	4.1								4.1	1.23	2.0	2.0	52	10.	.2	0.09	BASIN EA11 CAPTURED IN 5' TYPE R SUMP, PIPE TO DP18.1
18.1								16.8	2.37	3.35	8.0			-+	8.0	2.37	2.0	2.0	157	10.	.2	0.26	COMBINED DP17 & DP18 @ DP18.1, PIPE TO DP19.1
19.1								29.8	6.02	2 2.49	15.0				15.0	6.02	2.0	2.0	42	10.	.2	0.07	COMBINED DP15.1 & DP18.1, PIPE TO DP20

1	100						ĒA	STC	NVI	LLE	RO	AD								Calc	d by:	NQJ
-	+++						PRO	POS	ED (CON	DITI	ONS	5							Chec	ked by:	
<u> </u>	1 1/1						DES	IGN	STO	RM:	5-YE	AR								D	ate:	9/8/2023
H	RGreen																					
			DIRECT RUNOFF TOTAL RUNOFF SWALE PIPE													PIPE			TR/	AVEL	TIME	REMARKS
DESIGN POINT	BASIN ID	AREA (ac)	C ₅	t _e (min)	C ₅ *A (ac)	/ (in./ hr.)	Q (cfs)	t _c (min)	C₅*A (ac)	/ (in./ hr.)	Q (cfs)	Q _{swale} (cfs)	C ₅ *A (ac) si OBE %	Guine (cfs)	Cr*A (ac)		SLOPE %	PIPE SIZE (ft)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min	
20) EA12	0.92	0.11	5.0	0.10	5.17	0.5	29.8	6.12	2.49	15.2											COMBINED DP19.1 & BASIN EA12, TOTAL FLOW ENTERING POND B
2	1 OS7	23.46	0.09	25.9	2.11	2.70	5.7															BASIN OS7 TO DP21 BYPASS TO CHANNEL A
22	2 EA13	1.31	0.18	9.3	0.23	4.23	1.0															BASIN EA13 CAPTURED IN EX 18" CMP, PIPED ACROSS EASTONVILLE ROAD
23	3 EA14	13.13	0.11	24.8	1.43	2.77	4.0															BASIN EA14 CAPTURED IN EX 24" CMP, PIPED ACROSS EASTONVILLE ROAD
2	1 EA15	1.50	0.10	16.0	0.21	2.25	1.0															
2	+ EA15	1.59	0.19	16.8	0.31	3.35	1.0							_		_						BASIN EATS CAPTURED IN EATS CMP, PIPED ACROSS EASTONVILLE ROAD
																						* FLOWS TO THESE DESIGN POINTS WERE TAKEN FROM "THE SANCTUARY FILING 1 FDR" SO TC WAS NOT CALCULATED

1 1	20	EASTONVILLE ROAD	Calc'd by:	CM
-	$\prec -i$	PROPOSED CONDITIONS	Checked by:	СМ
1 1	1	DESIGN STORM: 100-YEAR	Date:	9/8/2023

HRGreen

ПП	Green	DIRECT RUNOFF TOTAL RUNOFF SWALF DIDE TRAVEL TIME																				
			DIF	RECT	RUNOI	FF		т	DTAL I	RUNO	FF		SWAL	E		PI	PE		TF	RAVEL	TIME	REMARKS
DESIGN POINT	BASIN ID	AREA (ac)	C100	t _e (min)	C ₁₀₀ *A (ac)	/ (in./ hr.)	Q (cfs)	t _c (min)	C ₁₀₀ *A (ac)	/ (in./ hr.)	Q (cfs)	Q _{swale} (cfs)	C ₁₀₀ *A (ac)	SLOPE %	Q _{PIPE} (cfs)	C ₁₀₀ *A (ac)	SLOPE %	PIPE SIZE (ft)	LENGTH (ft)	VEL. (ft/s)	TRAVEL TIME (min)	
	OS1	85.16																				
1	G18*	321.53					365.2										-					BASIN OST AND G17 FLOW TO DP1 (DPG18), FOLLOWS HISTORIC DRAINAGE PATTERNS TO CHANNEL B
2	EA1	0.22	0.80	5.0	0.18	8.68	1.5								1.5	0.18	2.0	1.5	56	8.4	0.11	BASIN EA1 CAPTURED IN 5' TYPE R INLET @ DP2, PIPE TO DP3.1
3	EA2	0.25	0.79	5.0	0.20	8.68	1.7								1.7	0.20)					BASIN EA2 CAPTURED IN 5' TYPE R INLET@ DP3, PIPE TO DP3.1
3.1								5.1	0.37	8.62	3.2				3.2	0.37	2.0	1.5	85	8.4	0.17	COMBINED DP2 & DP3 @ DP3.1, PIPE TO DP4 (POND A)
4	EA5	0.16	0.36	6.6	0.06	7.98	0.5	6.6	0.43	7.98	3.4						-					COMBINED DP3.1 & BASIN EA5, TOTAL FLOW ENTERING POND A
5	EA3	0.20	0.78	5.0	0.16	8.68	1.4								1.4	0.16	2.0	1.5	48	8.4	0.10	BASIN EA3 CAPTURED IN 5' TYPE R INLET @ DP5, PIPE TO DP6.1
6	EA4	0.17	0.75	5.0	0.13	8.68	1.1								1.1	0.13	2.0	1.5				BASIN EA4 CAPTURED IN 5' TYPE R INLET @ DP6, PIPE TO DP6.1
0.4								5.4	0.00	0.00						0.00					0.07	
6.1								5.1	0.28	8.63	2.4				0.0	0.28	2.0	1.5	1146	5 8.4	2.27	DP3 & DP4 FLOW @ DP5.1, PIPE TO DP9.1
7	OS2	15.03	0.39	36.0	5.83	3.71	21.6								21.6	5.83	2.0	1.5	44	8.4	0.09	BASIN OS2 CAPTURED IN 18" FES, PIPE TO DP8.1
8	OS3	1.00	0.36	25.2	0.36	4.60	1.7								1.7	0.36	2.0	1.5	38	8.4	0.08	BASIN OS3 CAPTURED IN 18" FES, PIPE TO DP8.1
0.4								20.0	6.40	0.74	22.0					0.40		1.5	100	0.4	0.00	
0.1								30.0	0.19	3.71	22.9	23.8	6.47	1.7	0.0	0.15	2.0	1.5	620	2.6	3.96	COMBINED DP6.1 & DP8 @ DP8.1, PIPE 10 DP9.1 COMBINED DP6.1 & DP8.1 @ DP9.1, DISCHARGE TO ROADSIDE SWALE TO DP11
9.1								36.3	6.47	3.68	23.8											
	EA6	0.70	0.96	5.5	0.67	8.43	5.7															BASIN EA6 @ DP10 (TEMPORARY SEDIMENT BASIN #1)
10	E 4 7	0.65	0.00	6.1	0.59	0 10	4.0	6.1	1.25	0 10	10.2											
10	EAT	0.05	0.90	0.1	0.00	0.19	4.0	0.1	1.20	0.19	10.3	54.9	10.35	1.7								
11	OS4	9.60	0.40	26.6	3.88	4.46	17.3	40.3	10.35	3.42	89.4				144.3	10.35	2.0	2.0	85	8.4	0.17	BASIN OS4, DP9.1 CAPTURED & MERIDIAN RANCH DPG15 (54.9 CFS) IN 30" FES @ DP11, PIPE TO DP12.1
12	OS5	40.26	0.40	31.7	15.91	4.02	64.0								64.0	15.91	2.0	2.0	616	8.4	1.22	BASIN OS5 CAPTUREDI N 48" FES @ DP12, PIPE TO DP12.1
12.1								33.0	26.26	3.03	103 1				103 1	26.26	2.0	3.6	801	8.4	1 77	
12.1								33.0	20.20	3.83	103.1				103.1	20.20	, 2.0	0.0	091	0.4	1.77	
13	OS8	11.42	0.36	17.7	4.11	5.53	22.7								22.7	4.11	2.0	2.0	28	8.4	0.06	BASIN OS8 CAPTURED @ DP13 IN TYPE C INLET, PIPE TO DP13.1
13.1								34.7	30.37	3.79	115.2											COMBINED DP12.1 & DP13, PIPE TO CHANNEL B
1/	EA8	2.08	0.95	26.4	1 08	4 51	9.0								9.0	1 98	2.0	20	8	8.4	0.02	
14	LAO	2.00	0.95	20.4	1.90	4.51	9.0								9.0	1.50	2.0	2.0	0	0.4	0.02	
15	EA9	2.99	0.74	28.6	2.20	4.32	9.5								9.5	2.20	2.0	2.0	54	8.4	0.11	BASIN EA8 CAPTURED IN 10' TYPE R SUMP @ DP15, PIPE TO DP15.1
15.1								28.7	4.19	4.27	17.9				17.9	4.19	2.0	2.0	641	8.4	1.27	COMBINED DP14 & DP15, PIPE TO DP19.1
16	OS6 G06*	60.97 832 7	0.36	53.2	21.95	2.76	60.6				491 0									1		THE SANCTUARY FILING 1 DPG06 (491 CES). BYPASSED UNDER EASTONVILLE ROAD IN DUAL 10' v 3 5' CLILVERTS
10	000	002.1									401.0											
17	EA10	1.34	0.92	15.0	1.24	5.94	7.4				<u> </u>				7.4	1.24	2.0	2.0	52	8.4	0.10	BASIN EA10 CAPTURED IN 5' TYPE R SUMP, PIPE TO DP18.1
18	EA11	1.99	0.75	16.7	1.50	5.67	8.5								8.5	1.50	2.0	2.0	52	8.4	0.10	BASIN EA11 CAPTURED IN 5' TYPE R SUMP, PIPE TO DP18.1
18.1								16.8	2.73	5.63	15.4				15.4	2.73	2.0	2.0	157	8.4	0.31	COMBINED DP17 & DP18 @ DP18.1. PIPE TO DP19.1
								10.0		0.00	.0.4				.0.4	2.70	2.0			5.7		
19.1								30.0	6.92	4.16	28.8				28.8	6.92	2.0	2.0	42	8.4	0.08	COMBINED DP15.1 & DP18.1, PIPE TO DP20

1100	EASTONVILLE ROAD	Calc'd by:	СМ
$1 \rightarrow $	PROPOSED CONDITIONS	Checked by:	СМ
	DESIGN STORM: 100-YEAR	Date:	9/8/2023
HRGreen			

	CICCI	ľ.																				
			DI	RECT	RUNOF	FF		т	TAL F	RUNO	FF	5	WAL	E		PI	PE		TR	AVEL .	TIME	REMARKS
DESIGN POINT	BASIN ID	AREA (ac)	C100	t _e (min)	C ₁₀₀ *A (ac)	/ (in./ hr.)	Q (cfs)	t _c (min)	C ₁₀₀ *A (ac)	/ (in./ hr.)	Q (cfs)	Q _{swale} (cfs)	C ₁₀₀ *A (ac)	SLOPE %	Q _{PIPE} (cfs)	C ₁₀₀ *A (ac) SLOPE % PIPE SIZE (ft)				VEL. (ft/s)	TRAVEL TIME (min)	
20	FA12	0.92	0.37	5.0	0 34	8 70	3.0	30.1	7 27	4 16	30.2											COMBINED DP19 1 & RASIN EA12 TOTAL FLOW ENTERING POND R
20	L/TZ	0.02	0.07	0.0	0.04	0.70	0.0	00.1	1.21	4.10	00.2											
21	OS7	23.46	0.36	25.9	8.45	4.57	38.6															BASIN OS7 CAPTURED IN 30" FES, PIPED TO CHANNEL A
22	EA13	1.31	0.42	9.3	0.56	7.13	4.0										_					BASIN EA13 CAPTURED IN EX 18" CMP, PIPED ACROSS EASTONVILLE ROAD
23	EA14	13.13	0.37	24.8	4.91	4.68	23.0															BASIN EA14 CAPTURED IN EX 24" CMP, PIPED ACROSS EASTONVILLE ROAD
24	EA15	1.59	0.44	16.8	0.69	5.66	3.9															BASIN EA15 CAPTURED IN EX 36" CMP, PIPED ACROSS EASTONVILLE ROAD
																						* FLOWS TO THESE DESIGN POINTS WERE TAKEN FROM "THE SANCTUARY FILING 1 FDR" SO TC WAS NOT CALCULATED



Eastonville Road Preliminary Drainage Report Project No.: 201662.08

APPENDIX C – HYDRAULIC CALCULATIONS







Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R	Curb Opening	
Local Depression (additional to c	ontinuous gutter depression 'a' from above)	a _{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or 0	Curb Opening)	No =	1	1	
Water Depth at Flowline (outside	e of local depression)	Ponding Depth =	5.9	7.3	inches
Grate Information		-	MINOR	MAJOR	Override Depths
Length of a Unit Grate		$L_{o}(G) =$	N/A	N/A	feet
Width of a Unit Grate		W _o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grat	e (typical value 0.50 - 0.70)	$C_{f}(G) =$	N/A	N/A	
Grate Weir Coefficient (typical va	ilue 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 Fig	ure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (t	ypically the gutter width of 2 feet)	W _p =	2.00	2.00	feet
Clogging Factor for a Single Curt	Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	
Curb Opening Weir Coefficient (t	ypical 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 Reduce	tion (Calculated)	-	MINOR	MAJOR	_
Depth for Grate Midwidth		d _{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Eq	uation	d _{Curb} =	0.32	0.44	ft
Combination Inlet Performance F	Reduction Factor for Long Inlets	RF _{Combination} =	0.75	0.93	
Curb Opening Performance Redu	ction Factor for Long Inlets	RF _{Curb} =	1.00	1.00	
Grated Inlet Performance Reduct	tion Factor for Long Inlets	RF _{Grate} =	N/A	N/A	
					_
		-	MINOR	MAJOR	_
Total Inlet Interception Capacity	(assumes clogged condition)	Q _a =	5.1	8.1	cfs
Inlet Canacity IS GOOD for M	linor and Major Storms(>O PEAK)	$Q_{PEAK PEOLITEED} =$	0.8	1.5	cfs







Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =			
Local Depression (additional to continuous gutter depression 'a' from above)	a _{local} =			inches
Number of Unit Inlets (Grate or Curb Opening)	No =			
Water Depth at Flowline (outside of local depression)	Ponding Depth =			inches
Grate Information	_	MINOR	MAJOR	C Override Depths
Length of a Unit Grate	$L_{o}(G) =$			feet
Width of a Unit Grate	W _o =			feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =			
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_{f}(G) =$			
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =			
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_{o}(G) =$			
Curb Opening Information	_	MINOR	MAJOR	_
Length of a Unit Curb Opening	$L_{o}(C) =$			feet
Height of Vertical Curb Opening in Inches	H _{vert} =			inches
Height of Curb Orifice Throat in Inches	H _{throat} =			inches
Angle of Throat (see USDCM Figure ST-5)	Theta =			degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W _p =			feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_{f}(C) =$			
Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_w(C) =$			
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_{o}(C) =$			
				-
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	٦. ا
Depth for Grate Midwidth	d _{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d _{Curb} =	N/A	N/A	ft
Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF _{Curb} =	N/A	N/A	
Grated Inlet Performance Reduction Factor for Long Inlets	RF _{Grate} =	N/A	N/A	
	- T	MINOR	MAJUK	7-6-
Total Inlet Interception Capacity (assumes clogged condition)	Qa =			cts
	Q PEAK REQUIRED -			CTS







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 =	5.9	7.3	inches
Grate Information		MINOR	MAJOR	C Override Depths
Length of a Unit Grate	$L_{o}(G) =$	N/A	N/A	feet
Width of a Unit Grate	W _o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_{f}(G) =$	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_o(G) =$	N/A	N/A	
Curb Opening Information	_	MINOR	MAJOR	_
Length of a Unit Curb Opening	$L_{o}(C) =$	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H _{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H _{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	$W_p =$	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_w(C) =$	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_{o}(C) =$	0.67	0.67	
				=
Low Head Performance Reduction (Calculated)	_	MINOR	MAJOR	-
Depth for Grate Midwidth	$d_{Grate} =$	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d _{Curb} =	0.32	0.44	ft
Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	0.75	0.93	
Curb Opening Performance Reduction Factor for Long Inlets	$RF_{Curb} =$	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	$RF_{Grate} =$	N/A	N/A	
	_	MINOR	MAJOR	_
Total Inlet Interception Capacity (assumes clogged condition)	Q _a =	5.1	8.1	cfs
Inlet Canacity IS GOOD for Minor and Major Storms(>O PEAK)	$Q_{PEAK REQUIRED} =$	0.7	1.4	cfs







Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' 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 =	3.5	3.5	inches
Grate Information			MINOR	MAJOR	Override Depths
Length of a Unit Grate		$L_{o}(G) =$	N/A	N/A	feet
Width of a Unit Grate		W _o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_{f}(G) =$	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical	Grate Orifice Coefficient (typical value 0.60 - 0.80)		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} =	0.13	0.13	ft
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	0.45	0.45	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	0.99	0.99	
Grated Inlet Performance Reduct	RF _{Grate} =	N/A	N/A		
					—
			MINOR	MAJOR	
Total Inlet Interception Capacity	Q _a =	1.2	1.2	cfs	
Inlet Canacity IS GOOD for N		0.5	11	cfs	







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 =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.9	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
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_{f}(G) =$	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C _w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_{o}(G) =$	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	_
Length of a Unit Curb Opening	$L_{o}(C) =$	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H _{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H _{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W _p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_{f}(C) =$	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_{w}(C) =$	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_{o}(C) =$	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d _{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d _{Curb} =	0.32	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	0.55	0.73	
Curb Opening Performance Reduction Factor for Long Inlets	RF _{curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF _{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q _a =	9.9	18.6	cfs
Inlet Canacity IS GOOD for Minor and Major Storms(>O PEAK)	O REAK RECUIRED =	5.0	9.0	cfs







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 =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.9	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
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_{f}(G) =$	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_o(G) =$	N/A	N/A	
Curb Opening Information	-	MINOR	MAJOR	
Length of a Unit Curb Opening	$L_{o}(C) =$	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H _{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H _{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W _p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_{f}(C) =$	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_w(C) =$	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_{o}(C) =$	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d _{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d _{Curb} =	0.32	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	0.55	0.73	
Curb Opening Performance Reduction Factor for Long Inlets	RF _{Curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF _{Grate} =	N/A	N/A	
	- T	MINOR	MAJOR	7.4.
Total Inlet Interception Capacity (assumes clogged condition)	$Q_a = 0$	9.9 4.6	10.0	cfs






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 =	5.9	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
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_{f}(G) =$	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	$C_{w}(G) =$	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_{o}(G) =$	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	-
Length of a Unit Curb Opening	$L_{o}(C) =$	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H _{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H _{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W _p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_{w}(C) =$	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_{o}(C) =$	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d _{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d _{Curb} =	0.32	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	0.75	0.99	
Curb Opening Performance Reduction Factor for Long Inlets	RF _{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF _{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Qa =	5.1	8.9	cfs
Inlet Canacity IS GOOD for Minor and Major Storms(>O PEAK)	Q PEAK REQUIRED =	4.0	7.4	cfs







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 =	5.9	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
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_{f}(G) =$	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C _w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_{o}(G) =$	N/A	N/A	
Curb Opening Information	_	MINOR	MAJOR	_
Length of a Unit Curb Opening	$L_{o}(C) =$	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H _{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H _{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W _p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_{f}(C) =$	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_w(C) =$	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_{o}(C) =$	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d _{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d _{Curb} =	0.32	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets	RF _{Combination} =	0.75	0.99	
Curb Opening Performance Reduction Factor for Long Inlets	RF _{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF _{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q _a =	5.1	8.9	cfs
Inlet Canacity IS GOOD for Minor and Major Storms(>O PEAK)	O DEAK RECUIRED =	4.1	8.5	cfs

CULVERT SIZING (I	INLET vs. OUTLET (CONTROL WITH	TAILWATER EFFECTS)
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MHFD-Culvert, Version 4.00 (May 2020)

Project	: EASTONVILLE F	ROAD					
ID): <u>DP7</u>						
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		- Andrew	1	eff 14			
			The second	1	-/		
		15 ¥			_		
Design Informat	ion (Input):	4	etim.1	Setion 2			
Circular Culvert:	Barrel Diameter in Inc	ches		D =	24	inches	
	Inlet Edge Type (Cho	ose from pull-down li	st)	Gro	oved Edge Projecting		
OF	<u>R:</u>		/				
Box Culvert:	Barrel Height (Rise) ir	n Feet		H (Rise) =		ft	
	Barrel Width (Span) i	n Feet		W (Span) =		ft	
	Inlet Edge Type (Cho	ose from pull-down li	st)			-	
						_	
	Number of Barrels			# Barrels =	1		
	Inlet Elevation at Culv	ert Invert		Elev IN =	7022	ft	
	Outlet Elevation OR S	lope		Elev OUT =	7021.65	ft	
	Culvert Length			L =	44	ft	
	Manning's Roughness			n =	0.012	_	
	Bend Loss Coefficient			K _b =	0		
	Exit Loss Coefficient			$K_x =$	1]	
Docian Informat	ion (calculated)						
Design Informat	Entrance Loss Coeffici	iont		κ –	0.20	1	
	Friction Loss Coefficie	ien.		K _e =	0.20	-	
	Sum of All Loss Coeffi	icients		K –	1.66	-	
	Minimum Energy Con	dition Coefficient		KE _{low} =	-0.0119		
	Orifice Inlet Condition	Coefficient		C. =	0.67		
				-0		4	
Calculations of C	Culvert Capacity (out	tput):	Backwater calculation	ns required to obtai	n Outlet Control Fla	wrate when HWo <	0.75 * Culvert Rise
	Headwater	Tailwater	Inlet	Inlet	Outlet	Controlling	Flow
	Surface	Surface	Control	Control	Control	Culvert	Control
	Elevation	Elevation	Equation	Flowrate	Flowrate	Flowrate	Used
	(ft)	(ft)	Used	(cfs)	(cfs)	(cfs)	
	7022.00		No Flow (WS < inlet)	0.00	0.00	0.00	N/A
	7022.50		Min. Energy. Eqn.	1.21	#N/A	#N/A	#N/A
	7023.00		Min. Energy. Eqn.	4.36	#N/A	#N/A	#N/A
	7023.50		Regression Eqn.	8.67	10.29	8.67	INLET
21.6 cfs	7024.00		Regression Eqn.	14.01	15.63	14.01	INLET
\	7024.50		Regression Eqn.	18.74	20.01	18.74	INLET
\	7025.00	7025.00	Regression Eqn.	22.57	0.00	0.00	N/A
	7025.50	7025.00	Regression Eqn.	25.81	13.85	13.85	OUTLET
· · · · · · · · · · · · · · · · · · ·	7026.00	7025.00	Regression Fan	28.61	19 57	19 57	OUTLET

DP7 Q100 =

Processing Time: 01.04 Seconds

23.96

27.66

30.92

33.87

36.59

39.11

47.29

49.27

51.18

53.01

54.78

56.50

58.17

59.79

61.36

62.90

64.40

65.87

67.31

68.71

70.09

23.96

27.66

30.92

33.87

36.59

39.11

43.17

44.80

46.37

47.89

49.37

50.81

52.19

53.55

54.91

56.16

57.42

58.66

59.87

61.05

62.22

7026.50

7027.00

7027.50

7028.00

7028.50

7029.00

7029.50

7030.00

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7031.00

7031.50

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7035.00

7035.50

7036.00

7036.50

7025.00

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7025.00

7025.00

7025.00

7025.00

Regression Egn.

Regression Eqn.

Regression Eqn.

Regression Eqn.

Orifice Eqn.

31.21

33.53

35.75

37.86

39.71

41.48

43.17

44.80

46.37

47.89

49.37

50.81

52.19

53.55

54.91

56.16

57.42

58.66

59.87

61.05

62.22

INLET N/A OUTLET OUTLET

OUTLET

OUTLET

OUTLET

OUTLET

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OUTLET

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Project: <u>EASTONVILLE ROAD</u> ID: <u>DP7</u>



Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Friday, Sep 8 2023

DP9.1 SWALE

Trapezoidal		Highlighted	
Bottom Width (ft)	= 2.00	Depth (ft)	= 0.96
Side Slopes (z:1)	= 4.00, 4.00	Q (cfs)	= 23.80
Total Depth (ft)	= 2.00	Area (sqft)	= 5.61
Invert Elev (ft)	= 5500.00	Velocity (ft/s)	= 4.25
Slope (%)	= 1.60	Wetted Perim (ft)	= 9.92
N-Value	= 0.030	Crit Depth, Yc (ft)	= 0.96
		Top Width (ft)	= 9.68
Calculations		EGL (ft)	= 1.24
Compute by:	Known Q		
Known Q (cfs)	= 23.80		



Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Friday, Sep 8 2023

DP10 Swale

Triangular		Highlighted	
Side Slopes (z:1)	= 3.00, 3.00	Depth (ft)	= 0.93
Total Depth (ft)	= 2.00	Q (cfs)	= 10.30
		Area (sqft)	= 2.59
Invert Elev (ft)	= 5500.00	Velocity (ft/s)	= 3.97
Slope (%)	= 2.00	Wetted Perim (ft)	= 5.88
N-Value	= 0.030	Crit Depth, Yc (ft)	= 0.94
		Top Width (ft)	= 5.58
Calculations		EGL (ft)	= 1.17
Compute by:	Known Q		
Known Q (cfs)	= 10.30		



Reach (ft)

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

MHFD-Culvert, Version 4.00 (May 2020)

Project: EASTONVILLE ROAD ID: DP11

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		Course Vault		· U.			
			1	*****			
		T T	-				
				1 -	-/		
	<i>(</i> -	·····	Shipe Se	- Martine -	_		
Design Informati	On (Input): Barrel Diameter in Inc	hec	class 1	Setien J	30	inches	
circular curvert.	Inlet Edge Type (Cho	ose from pull-down lis	t)	Gro	ooved Edge Projecting	inches	
OR	1					1.	
Box Culvert:	Barrel Height (Rise) ir	n Feet		H (Rise) =		ft e	
	Inlet Edge Type (Cho	ose from pull-down lis	t)	w (Spair) –		In	
	5 // (·					
	Number of Barrels			# Barrels =	2		
	Outlet Elevation OR S	lope		Elev OUT =	7001	ft	
	Culvert Length			L =	77	ft	
	Manning's Roughness			n = 2	0.012		
	Exit Loss Coefficient			κ _b = Κ _v =	1		
				^		1	
Decian Informati	an (anlaulated).						
Design Informati	Entrance Loss Coeffici	ient		К. =	0.20	1	
	Friction Loss Coefficie	nt		K _f =	0.60		
	Sum of All Loss Coeffi	cients		K _s =	1.80		
	Orifice Inlet Condition	Coefficient		KE _{low} = C ₂ =	-0.3344		
				-0		1	
Calculations of C	ulvert Capacity (out	tput):	Backwater calculation	ns required to obtain	n Outlet Control Flo	wrate when HWo <	0.75 * Culvert Rise
	Headwater	Tailwater	Inlet	Inlet	Outlet	Controlling	Flow
	Surface	Surface	Control	Control	Control	Culvert	Control
	Elevation	Elevation	Equation	Flowrate	Flowrate	Flowrate	Used
	(π) 7010-00	(π)	Used No Flow (WS < inlet)	(cfs) 0.00	(CfS) 0.00	(CfS) 0.00	N/A
	7010.30		Min. Energy. Eqn.	1.02	#N/A	#N/A	#N/A
	7010.60		Min. Energy. Eqn.	4.46	#N/A	#N/A	#N/A
	7010.90		Min. Energy. Eqn. Min. Energy. Eqn.	9.70	#N/A #N/A	#N/A #N/A	#N/A #N/Δ
	7011.50		Regression Eqn.	23.88	#N/A	#N/A	#N/A
	7011.80		Regression Eqn.	32.02	#N/A	#N/A	#N/A
	7012.10		Regression Eqn.	41.02	1/2.2/	41.02	INLEI INLET
	7012.70		Regression Eqn.	58.26	178.04	58.26	INLET
	7013.00		Regression Eqn.	65.74	180.93	65.74	INLET
	7013.30		Regression Eqn.	72.46	183.76	72.46	INLET INLET
	7013.90		Regression Eqn.	84.22	189.30	84.22	INLET
	7014.20		Regression Eqn.	89.42	192.02	89.42	INLET
	7014.50		Regression Eqn.	94.34	194.68	94.34	INLET
	7014.80		Regression Eqn.	103.42	197.32	103.42	INLET
	7015.40		Regression Eqn.	107.66	202.49	107.66	INLET
	7015.70		Regression Eqn.	111.74	205.03	111.74	INLET
	7016.00		Regression Eqn.	115.68	207.53	115.68	INLE I INLET
3 of c	7016.60		Regression Eqn.	123.22	212.45	123.22	INLET
	7016.90		Regression Eqn.	126.84	214.87	126.84	INLET
	7017.20		Regression Eqn.	130.42	217.27	130.42	
\	7017.80		Orifice Eqn.	137.00	221.97	137.00	INLET
```	7018.10		Orifice Eqn.	140.10	224.29	140.10	INLET
	7018.40		Orifice Eqn.	143.14	226.58	143.14	INLET
	/018./0		Unite Eqn.	140.12	220.05	140.12	TINEE I

Processing Time: 00.70 Seconds Project: <u>EASTONVILLE ROAD</u> ID: <u>DP11</u>

STAGE-DISCHARGE CURVE FOR THE CULVERT 7020 7019 Δ Δ Λ 7018  $\triangle$  $\triangle$  $\Delta$ 7017 Δ Δ Δ 7016 Λ Stage (feet, elev) Δ Δ ۲ 7015 Δ Δ  $\triangle$ 7014 Δ  $\Delta$ Δ 7013 Δ Δ Δ 7012 7011 7010 50 100 150 250 0 200 **Discharge (cfs)** Inlet Control △ Outlet Control Stage-Discharge

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Friday, Sep 8 2023

## **DP11 SWALE**

Trapezoidal		Highlighted	
Bottom Width (ft)	= 2.00	Depth (ft)	= 2.08
Side Slopes (z:1)	= 4.00, 4.00	Q (cfs)	= 144.30
Total Depth (ft)	= 2.70	Area (sqft)	= 21.47
Invert Elev (ft)	= 5500.00	Velocity (ft/s)	= 6.72
Slope (%)	= 1.60	Wetted Perim (ft)	= 19.15
N-Value	= 0.030	Crit Depth, Yc (ft)	= 2.18
		Top Width (ft)	= 18.64
Calculations		EGL (ft)	= 2.78
Compute by:	Known Q		
Known Q (cfs)	= 144.30		



Reach (ft)

### CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

MHFD-Culvert, Version 4.00 (May 2020)

Project: <u>EASTONVILLE ROAD</u> ID: <u>DP12</u>

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		Course from					
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		15 2					
Design Information	on (Input):	5-	Shipe Se tion.1	Setion J			
Circular Culvert:	Barrel Diameter in Inc	hes		D =	48	inches	
OR:	Inlet Edge Type (Choo	ose from pull-down list	E)	Gro	oved Edge Projecting		
Box Culvert:	Barrel Height (Rise) in	Feet		H (Rise) =		ft	
	Barrel Width (Span) in	Feet		W (Span) =		ft	
	Inlet Edge Type (Choc	ose from pull-down list	E)				
	Number of Barrels			# Barrels =	1		
	Inlet Elevation at Culve	ert Invert		Elev IN =	7005	ft	
	Outlet Elevation <b>OR</b> SI	lope		Elev OUT =	7004.03	ft e	
	Manning's Roughness			L = n =	0.012	it.	
	Bend Loss Coefficient			K _b =	0		
	Exit Loss Coefficient			K _x =	1		
Design Information	on (calculated):						
	Entrance Loss Coefficie	ent		K _e =	0.20		
	Friction Loss Coefficier	nt		K _f =	0.34		
	Minimum Energy Conc	lition Coefficient		KE _{low} =	-0.0218		
	Orifice Inlet Condition	Coefficient		C _d =	0.67		
Calculations of Cl	livert Capacity (out	<u>put):</u>	Backwater calculation	s required to obtain	Outlet Control Flow	wrate when HWo < (	0.75 * Culvert Rise
	Headwater	Tailwater	Inlet	Inlet	Outlet	Controlling	Flow
	Surface	Surface	Control	Control	Control	Culvert	Control
	Elevation	Elevation	Equation	Flowrate	Flowrate	Flowrate	Used
	(ft) 7005.00	(ft)	Used No Flow (WS < inlet)	(cts)	(cts)	(cfs)	N/A
	7005.50		Min. Energy. Eqn.	1.41	#N/A	#N/A	#N/A
	7006.00		Min. Energy. Eqn.	6.62	#N/A	#N/A	#N/A
	7006.50		Min. Energy. Eqn.	14.42	#N/A	#N/A	#N/A
	7007.00		Min. Energy. Eqn. Regression Egn	24.74	#N/A #N/A	#Ν/Α #Ν/Δ	#N/A #N/Δ
	7008.00		Regression Eqn.	49.22	68.69	49.22	INLET
	7008.50		Regression Eqn.	64.21	84.22	64.21	INLET
	7009.00		Regression Eqn.	79.41	98.27	79.41	INLET
	7009.50		Regression Eqn.	93.51	111.15	93.51	INLET INLET
— /	7010.50		Regression Eqn.	117.52	134.36	117.52	INLET
	7011.00		Regression Eqn.	127.81	145.02	127.81	INLET
+.0 CIS	7011.50		Regression Eqn.	137.22	155.13	137.22	INLET
	7012.00		Regression Eqn.	145.90	104.77	145.96	
	7013.00		Regression Eqn.	161.92	182.90	161.92	INLET
	7013.50		Regression Eqn.	169.31	191.43	169.31	INLET
	7014.00		Regression Eqn.	176.41	199.62	176.41	INLET
	7014.50		Regression Eqn.	183.21	207.56	183.21	INLET INLET
	7015.50		Regression Eqn.	196.13	222.63	196.13	INLET
	7016.00		Regression Eqn.	202.33	229.83	202.33	INLET
	7016.50		Regression Eqn.	208.36	236.84	208.36	INLET
	7017.00		Orifice Fan	214.24	243.62	214.24	INLE I INI FT
	7018.00		Orifice Eqn.	224.70	256.72	224.70	INLET
	7018.50		Orifice Eqn.	229.75	263.03	229.75	INLET
	7019.00		Orifice Eqn.	234.71	269.20	234.71	INLET
	/019.50		Orifice Eqn.	239.53	2/5.24 Processing Times	239.53 01.06 Seconde	INLEI
					Troccosing Time:	VI.VU SECUIUS	

**DP12** Q100 = 64 Project: <u>EASTONVILLE ROAD</u> ID: <u>DP12</u> MHFD-Culvert, Version 4.00 (May 2020)



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Friday, Sep 8 2023

## **DP12 SWALE**

Trapezoidal		Highlighted	
Bottom Width (ft)	= 2.00	Depth (ft)	= 1.76
Side Slopes (z:1)	= 4.00, 4.00	Q (cfs)	= 64.00
Total Depth (ft)	= 3.00	Area (sqft)	= 15.91
Invert Elev (ft)	= 5500.00	Velocity (ft/s)	= 4.02
Slope (%)	= 0.70	Wetted Perim (ft)	= 16.51
N-Value	= 0.030	Crit Depth, Yc (ft)	= 1.52
		Top Width (ft)	= 16.08
Calculations		EGL (ft)	= 2.01
Compute by:	Known Q		
Known Q (cfs)	= 64.00		



CULVERT	SIZING	(INLET vs. C	DUTLET	CONTROL WITH	TAILWATER EFFECTS)
---------	--------	--------------	--------	--------------	--------------------

D =

0.50

0.38

1.88

-0.0001

0.65

inches

MHFD-Culvert, Version 4.00 (May 2020)





1.5



OR: Box Culvert: Barrel Height (Rise) in Feet

**DP16** Q100

Box Culvert:	Barrel Height (Rise) in Feet	H (Rise) =	3.50	ft
	Barrel Width (Span) in Feet	W (Span) =	10.00	ft
	Inlet Edge Type (Choose from pull-down list)	1:1 Bevel w/ 45	deg. Flared Wingwall	
	Number of Barrels	# Barrels =	2	
	Inlet Elevation at Culvert Invert	Elev IN =	6997	ft
	Outlet Elevation OR Slope	So =	0.0165	ft/ft
	Culvert Length	L =	110	ft
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	K _b =	0	
	Exit Loss Coefficient	K _x =	1	
Design Inform	ation (calculated):			

epe Se

Entrance Loss Coefficient K_e = Friction Loss Coefficient K_f = Sum of All Loss Coefficients  $K_s =$ Minimum Energy Condition Coefficient KE_{low} = Orifice Inlet Condition Coefficient C_d =

Calcu	ulations of Cu	Ivert Capacity (out	tput):	Backwater calculation	ns required to obtai	n Outlet Control Flov	wrate when HWo < (	).75 * Culvert Rise
		Headwater	Tailwater	Inlet	Inlet	Outlet	Controlling	Flow
		Surface	Surface	Control	Control	Control	Culvert	Control
		Elevation	Elevation	Equation	Flowrate	Flowrate	Flowrate	Used
		(ff)	(ff)	Lised	(cfs)	(cfs)	(cfs)	USCU
		6997.00	6995 25	No Flow (WS < inlet)	0.00	0.00	0.00	N/A
		6997.50	0555.25	Min Energy Egn	21.86	#N/Δ	#N/Δ	#N/Δ
		6998.00		Min. Energy. Eqn.	61.82	#N/A	#N/A	#N/A
		6998.50		Min. Energy. Eqn.	113.50	#N/A	#N/A	#N/A
		6999.00		Regression Fan.	172.94	#N/A	#N/A	#N/A
491.0 cfs		6999.50		Regression Egn.	237.14	#N/A	#N/A	#N/A
		7000.00		Regression Egn.	305.86	529.17	305.86	INLET
		7000.50		Regression Egn.	376.74	588.75	376.74	INLET
	7	7001.00		Regression Egn.	447.08	644.17	447.08	INLET
		7001.50		Regression Egn.	514.76	696.17	514.76	INLET
		7002.00		Regression Egn.	578.74	745.66	578.74	INLET
		7002.50		Rearession Ean.	638.70	799.92	638.70	INLET
		7003.00		Rearession Ean.	694.82	850.72	694.82	INLET
		7003.50		Regression Egn.	747.46	898.67	747.46	INLET
		7004.00		Regression Egn.	797.02	944.17	797.02	INLET
		7004.50		Regression Egn.	843.90	987.58	843.90	INLET
		7005.00		Regression Egn.	888.42	1,029.17	888.42	INLET
		7005.50		Regression Egn.	930.88	1,069.13	930.88	INLET
		7006.00		Regression Eqn.	971.54	1,107.66	971.54	INLET
		7006.50		Regression Eqn.	1,010.62	1,144.89	1,010.62	INLET
		7007.00		Regression Eqn.	1,048.26	1,180.95	1,048.26	INLET
						Processing Time:	00.16 Seconds	

Project: <u>Eastonville Road</u> ID: <u>DP16</u>



MHFD-Culvert, Version 4.00 (May 2020)

Project: EASTONVILLE ROAD ID: DP21



**DP16** 

Project: <u>EASTONVILLE ROAD</u> ID: <u>DP21</u>

MHFD-Culvert, Version 4.00 (May 2020)



Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Friday, Sep 8 2023

## **DP21 SWALE**

Trapezoidal		Highlighted	
Bottom Width (ft)	= 2.00	Depth (ft)	= 1.32
Side Slopes (z:1)	= 4.00, 4.00	Q (cfs)	= 38.60
Total Depth (ft)	= 2.50	Area (sqft)	= 9.61
Invert Elev (ft)	= 5500.00	Velocity (ft/s)	= 4.02
Slope (%)	= 1.00	Wetted Perim (ft)	= 12.88
N-Value	= 0.030	Crit Depth, Yc (ft)	= 1.20
		Top Width (ft)	= 12.56
Calculations		EGL (ft)	= 1.57
Compute by:	Known Q		
Known Q (cfs)	= 38.60		



Reach (ft)



Eastonville Road Preliminary Drainage Report Project No.: 201662.08

### **APPENDIX D – WATER QUALITY & DETENTION**

Site-Lev	el Low	Imp LI	act De D Credit	velopn by Impe	n <mark>ent (Ll</mark> ervious R	D) Des eductio	sign Eff	ective (IRF) M	Imperv ethod	vious Ca	alculato	or			
				UD	-BMP (Version	3.06, Noven	nber 2016)	<u> </u>							
User Input															
Calculated ce	ls				Designer:	NQJ									
					Company:	HR G	REEN								
***Design Storm: 1-Hour Rain Depth WQCV Even	0	0.60	inches		Date:	Septe	ember 2, 20	022							
***Minor Storm: 1-Hour Rain Depth 5-Year Even	1	50	inches		Project:	EAST		DAD							
***Major Storm: 1-Hour Rain Depth 100-Year Eve	t 2	.52	inches		Location:	PONI	AC								
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm 100-Year Eve	t														
Max Intensity for Optional User Defined Storm 0															
SITE INFORMATION (USER-INPUT)															
Sub-basin Ide	ntifier E	A1	EA2	EA5											
Receiving Pervious Area Sc	Type Sand	y Loam	Sandy Loam	Sandy Loam											
Total Area (ac., Sum of DCIA, UIA, RPA,	SPA) 0.	220	0.250	0.160											
Directly Connected Impervious Area (DCIA,	acres) 0.3	160	0.180	0.000											
Unconnected Impervious Area (UIA,	acres) 0.0	000	0.000	0.000											
Receiving Pervious Area (RPA,	acres) 0.0	000	0.000	0.160											
Separate Pervious Area (SPA,	acres) 0.0	060	0.070	0.000											
RPA Treatment Type: Conveyar Volume (V), or Permeable Paveme	e (C), t (PP)	с	С	v											
CALCULATED RESULTS (OUTPUT)	(aput) 0	220	0.350	0.160			1	1	1	1					
Directly Connected Impensious Area (D	IA %) 72	220	72.0%	0.160											<u> </u>
Linconnected Impervious Area (D	IA, %) 72	0%	0.0%	0.0%											
Receiving Pervious Area (	PA.%) 0	.0%	0.0%	100.0%											
Separate Pervious Area (	PA. %) 27	7.3%	28.0%	0.0%											
A _R (RP4	/ UIA) 0.0	000	0.000	0.000											
	Check 1.	000	1.000	1.000											
f / I for WQCV	vent: 1	L.7	1.7	1.7											
f / I for 5-Year	vent: 0	).5	0.5	0.5											
f / I for 100-Year	vent: 0	0.3	0.3	0.3											
f / I for Optional User Defined Storm	UHP:														
IRF for WQCV	vent: 1.	.00	1.00	0.00											
IRF for 5-Year	vent: 1	.00	1.00	1.00											
IRF for 100-Year	event: 1.	.00	1.00	1.00											
IRF for Optional User Defined Storm	UHP:														
Total Site Imperviousnes	: I _{total} 72	2.7%	72.0%	0.0%											
Effective Imperviousness for WQCV	vent: 72	2.7%	72.0%	0.0%											<u> </u>
Effective Imperviousness for 5-Year	vent: 72	2.7%	72.0%	0.0%											<u> </u>
Effective Imperviousness for 100-Year	ivent: 72	2.7%	72.0%	0.0%											<u> </u>
Effective imperviousness for Optional User Defined Storm	UHP:														
LID / EFFECTIVE IMPERVIOUSNESS CREDITS															
WQCV Event CREDIT: Reduce Detent	on By: 0	.0%	0.0%	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-Yea 100-Year Event CREDIT**: Reduce Detent User Defined CURP CREDIT: Peduce Detent	Event N on By: 0.	N/A .0%	N/A 0.1%	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
Use Denied Connickedin, Reduce Deterit	Total S	Site Imp	erviousness:	54.0%	·  ]	Notes:	ļ	I	I	1	I	ļ		I	<b>↓</b> ↓
Total Site Effective	Imperviousn	ess for V	VQCV Event:	54.0%	4	Use Greer	n-Ampt avera	ge infiltratio	n rate values	from Table 3	3-3.				
Total Site Effective	Imperviousn	ess for 5	-Year Event:	54.0%	4	Flood cor	ntrol detentio	n volume cr	edits based o	n empirical e	quations fro	m Storage C	hapter of USI	DCM.	
Total Site Effective In Total Site Effective Imperviousness for 0	perviousnes ptional User I	s tor 100 Defined	-rear Event: Storm CUHP:	54.0%	-	· · · · Metho	u assumes th	at 1-nour rai	man depth is	equivalent t	o 1-nour inte	ensity for cal	culation purp	iusea	

	Design Procedure Forr	n: Sand Filter (SF)	
	UD-BMP (Version 3.07	, March 2018)	Sheet 1 of 2
Designer:	NQJ		
Company:	August 31, 2022		
Project:	FASTONVILLE ROAD		
Location:	EL PASO COUNTY, COLORADO		
-			
1. Basin Sto	rage Volume		
A) Effectiv (100%	ve Imperviousness of Tributary Area, I _a if all paved and roofed areas upstream of sand filter)	I _a = 24.1 %	
B) Tribut	ary Area's Imperviousness Ratio (i = I _a /100)	i = 0.241	
C) Water WQC	Quality Capture Volume (WQCV) Based on 12-hour Drain Time $V\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$	WQCV = 0.11 watershed i	nches
D) Contri	buting Watershed Area (including sand filter area)	Area = <u>61,420</u> sq ft	
E) Water V _{wqc}	Quality Capture Volume (WQCV) Design Volume _v = WQCV / 12 * Area	V _{WQCV} =cu ft	
F) For W Avera	atersheds Outside of the Denver Region, Depth of ge Runoff Producing Storm	d ₆ = in	
G) For W Water	/atersheds Outside of the Denver Region, [,] Quality Capture Volume (WQCV) Design Volume	V _{WQCV OTHER} =cu ft	
H) User I (Only i	nput of Water Quality Capture Volume (WQCV) Design Volume f a different WQCV Design Volume is desired)	V _{WQCV USER} = 523 cu ft	
2. Basin Ge	ometry		
A) WQCV	/ Depth	D _{WQCV} = 1.5 ft	
B) Sand F 4:1 or	ilter Side Slopes (Horizontal distance per unit vertical, flatter preferred). Use "0" if sand filter has vertical walls.	Z = 4.00 ft / ft	
C) Minimu	ım Filter Area (Flat Surface Area)	A _{Min} = <u>185</u> sq ft	
D) Actual	Filter Area	A _{Actual} = 703 sq ft	
E) Volum	e Províded	V _T =cu ft	
3. Filter Mat	erial	Choose One 18" CDOT Class B or C Filter Mate Other (Explain):	erial
4. Underdra	in System	Choose One	
A) Are un	derdrains provided?		
B) Under	drain system orifice diameter for 12 hour drain time		
	i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice	y = <u>1.0</u> ft	
	ii) Volume to Drain in 12 Hours	Vol ₁₂ = 523 cu ft	
	iii) Orifice Diameter, 3/8" Minimum	D _o = <u>5/8</u> in	

	Design Procedure Forr	n: Sand Filter (SF)	
			Sheet 2 of 2
Designer:	NQJ		_
Company:	HR GREEN		_
Date:	August 31, 2022		_
Project:	EASTONVILLE ROAD		_
Location:	EL PASO COUNTY, COLORADO		_
5. Impermea A) Is an i of stru	able Geomembrane Liner and Geotextile Separator Fabric impermeable liner provided due to proximity uctures or groundwater contamination?	O YES ● NO	
6. Inlet / Out	ilet Works		
A) Descr	ibe the type of energy dissipation at inlet points and means of		
conve	ying flows in excess of the WQCV through the outlet		
Notes:		Į	

Site-Level L	ow Imp L	Dact De	velopn by Impe	nent (Ll ervious R	D) Des	ign Eff n Factor	ective (IRF) Me	Imperv ethod	vious Ca	alculato	or			
			UD	-BMP (Versior	3.06. Novem	ber 2016)	. ,							
User Input				(	,	,								
Calculated cells				Designer:	NQJ									
				Company:	HR GF	REEN								
***Design Storm: 1-Hour Rain Depth WQCV Event	0.60	inches		Date:	Augus	st 31, 2022								
***Minor Storm: 1-Hour Rain Depth 5-Year Event	1.50	inches		Project:	EASTO	ONVILLE RO	DAD							
***Major Storm: 1-Hour Rain Depth 100-Year Event	2.52	inches		Location:	POND	в								
Optional User Defined Storm CUHP														
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm														
Max Intensity for Optional User Defined Storm 0														
SITE INFORMATION (USER-INPUT)														
Sub-basin Identifier	EA8	EA9	EA10	EA11	EA12									
Receiving Pervious Area Soil Type	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam									
Total Area /ac Sum of DCIA 1110 PDA & CDAL	2 080	2 000	1 340	1 000	0 020									
Directly Connected Impervious Area (DCIA, acres)	2.060	1.880	1.340	1 300	0.020									
Inconnected Impenvious Area (UCA, dCles)	0.000	0.000	0.000	0.000	0.020									
Desching Denious Area (DDA	0.000	0.000	0.000	0.000	0.000									
Constate Desideus Area (CDA)	0.000	1 110	0.000	0.000	0.000									
DDA Taastanant Turan Campung (C)	0.020	1.110	0.080	0.090	0.500									
Volume (V), or Permeable Pavement (PP)	С	С	С	С	v									
CALCULATED RESULTS (OUTPUT)														
Total Calculated Area (ac, check against input)	2.080	2.990	1.340	1.990	0.920									
Directly Connected Impervious Area (DCIA, %)	99.0%	62.9%	94.0%	65.3%	2.2%									
Unconnected Impervious Area (UIA. %)	0.0%	0.0%	0.0%	0.0%	0.0%									
Receiving Pervious Area (RPA, %)	0.0%	0.0%	0.0%	0.0%	0.0%									
Separate Pervious Area (SPA. %)	1.0%	37.1%	6.0%	34.7%	97.8%									
A₀ (BPA / UIA)	0.000	0.000	0.000	0.000	0.000									
I, Check	1.000	1.000	1.000	1.000	1.000									
f / I for WOCV Event:	17	17	17	17	17									
f / I for 5-Year Event:	0.5	0.5	0.5	0.5	0.5									
f / I for 100-Year Event:	0.3	0.3	0.3	0.3	0.3									
f / I for Optional User Defined Storm CUHP:														
IBE for WOCV Event:	1.00	1.00	1.00	1.00	0.00									
IRF for 5-Year Event:	1.00	1.00	1.00	1.00	1.00				1			1		
IRE for 100-Year Event:	1.00	1.00	1.00	1.00	1.00				1	<u> </u>	t	1		
IRF for Optional User Defined Storm CLIHP:									1	<u> </u>	t	1		
Total Site Imperviousness: Instal	99.0%	62.9%	94.0%	65.3%	2.2%				1			1		
Effective Imperviousness for WOCV Event	99.0%	62.9%	94.0%	65.3%	2.2%				1			1		
Effective Imperviousness for 5-Year Event:	99.0%	62.9%	94.0%	65.3%	2.2%				1			1		
Effective Imperviousness for 100-Year Event:	99.0%	62.9%	94.0%	65.3%	2.2%				1					
Effective Imperviousness for Optional User Defined Storm CUHP:														
LID / EFFECTIVE IMPERVIOUSNESS CREDITS														
WQCV Event CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	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 100-Year Event CREDIT**: Reduce Detention By:	N/A 0.0%	N/A 0.0%	N/A 0.0%	N/A 0.0%	N/A 11.6%	N/Α N/Δ	N/Α N/Δ	N/A N/A	N/Α N/Δ	N/A N/A	N/A N/A	N/A N/A	N/Α N/Δ	N/A N/A
User Defined CUHP CREDIT: Reduce Detention by:		2.070	2.070	2.070										
	Total Site Imp	erviousness:	70.0%	]	Notes:									
Total Site Effective Imper	viousness for l	NOCV Event	70.0%	1	Lico Gross	Amot avera	ao infiltrati-	n rata val····	from Table					
Total Site Effective Imper	viousness for	5-Year Event:	70.0%		"Flood com	-Ampt avera	ge muitration	n rate Values	nom lable	o-o. Aquations fro	m Storage C	hanter of Lici	DCM	
Total Site Effective Impervio	ousness for 10	D-Year Event:	70.0%		*** Method	assumes th	at 1-hour rai	nfall depth is	s equivalent	o 1-hour inte	ensity for cal	culation pure	losed	
Total Site Effective Imperviousness for Optiona	User Defined	Storm CUHP:		1								1 P		

### DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Stage (ft)

Depth Increment =

Stage - Storage Description

6983.17 Top of Micropool

Optional User Overrid

1.19 inches

1.50 inches 1.75 inches 2.00 inches inches 2.25 2.52 inches 3.68 inches

acre-feet

acre-feet

acre-feet

acre-feet ft ³

ft

ft/ft

H:V

	( Chinas	-
The I and		1-
ana sa	1	10.00

manufact -Example Zone Configuration (Retention Pond)

#### Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	9.32	acres
Watershed Length =	1,750	ft
Watershed Length to Centroid =	500	ft
Watershed Slope =	0.009	ft/ft
Watershed Imperviousness =	70.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

Water Quality Capture Volume (WQCV) =	0.214	acre-feet
Excess Urban Runoff Volume (EURV) =	0.827	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.605	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.790	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.938	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	1.124	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	1.306	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	1.525	acre-feet
500-yr Runoff Volume (P1 = 3.68 in.) =	2.435	acre-feet
Approximate 2-yr Detention Volume =	0.539	acre-feet
Approximate 5-yr Detention Volume =	0.704	acre-feet
Approximate 10-yr Detention Volume =	0.846	acre-feet
Approximate 25-yr Detention Volume =	1.013	acre-feet
Approximate 50-yr Detention Volume =	1.112	acre-feet
Approximate 100-yr Detention Volume =	1.212	acre-feet

#### Define Zones and Basin Geometry

WQCV) = 0.214	Zone 1 Volume (W
one 1) = 0.613	Zone 2 Volume (EURV - Zo
1 & 2) = 0.385	Zone 3 Volume (100-year - Zones 1
/olume = 1.212	Total Detention Basin Vo
e (ISV) = user	Initial Surcharge Volume
n (ISD) = user	Initial Surcharge Depth
(H _{total} ) = user	Total Available Detention Depth (I
l (H _{TC} ) = user	Depth of Trickle Channel
I (S _{TC} ) = user	Slope of Trickle Channel
(S _{main} ) = user	Slopes of Main Basin Sides (S
(R _{L/W} ) = user	Basin Length-to-Width Ratio (

#### ٦_{ft} : Initial Surcharge Area (A_{ISV}) = user Surcharge Volume Length (LISV) = user Surcharge Volume Width $(W_{ISV}) =$ user Depth of Basin Floor (H_{FLOOR}) = user Length of Basin Floor (L_{FLOOR}) = user Width of Basin Floor ( $W_{FLOOR}$ ) = user Area of Basin Floor (A_{FLOOR}) = user Volume of Basin Floor (V_{FLOOR}) = user Depth of Main Basin $(H_{MAIN}) =$ user Length of Main Basin (LMAIN) = user Width of Main Basin ( $W_{MAIN}$ ) = user Area of Main Basin $(A_{MAIN}) =$ Volume of Main Basin $(V_{MAIN}) =$ user ÷. user Calculated Total Basin Volume (V_{total}) =

user

	6984		0.83				1,862	0.043	773	0.018
	C005		1.02				6 027	0.150	F 170	0.110
	6985	-	1.83	-	-	-	6,937	0.159	5,172	0.119
	6986		2.83				8.399	0.193	12.840	0.295
	6987		3.83				9,955	0.229	22,017	0.505
	6988		4.83				11 608	0.266	32 700	0.753
	0500		4.05				11,000	0.200	52,755	0.755
	6989		5.83				13,342	0.306	45,274	1.039
	6000		6 02				15 220	0.250	E0 E64	1 267
	0990		0.85	-		-	13,230	0.330	39,304	1.307
	6991		7.83				17,212	0.395	75,789	1.740
	6002		0 02				10 204	0.442	04.047	2 150
	0992		0.03	-		-	19,304	0.445	94,047	2.159
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----- Volume (ft³)

Volume (ac-ft)

Area

(acre)

0.000

rea (ft²

0

Area

(ft²)

Width

(ft)

Length

(ft)

Stage (ft

0.00

### DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



#### DETENTION BASIN OUTLET STRUCTURE DESIGN MHFD-Detention, Version 4.05 (January 2022) Project: Eastonville Road Basin ID: POND B: BASIN EA8 - EA12 Estimated Estimated Stage (ft) Volume (ac-ft) Outlet Type Zone 1 (WQCV) 2.40 0.214 Orifice Plate Zone 2 (EURV) 5.11 0.613 Circular Orifice COME I AND 2 Zone 3 (100-year) 6.38 0.385 Weir&Pipe (Restrict) Example Zone Configuration (Retention Pond) Total (all zones) 1.212 User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP) Calculated Parameters for Underdrain ft (distance below the filtration media surface) Underdrain Orifice Area Underdrain Orifice Invert Depth = N/A N/A $ft^2$ Underdrain Orifice Diameter = N/A inches Underdrain Orifice Centroid = N/A feet User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP) Calculated Parameters for Plate Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft) WQ Orifice Area per Row 6.319E-03 $ft^2$ Depth at top of Zone using Orifice Plate = 2.40 ft (relative to basin bottom at Stage = 0 ft) Elliptical Half-Width = N/A eet Orifice Plate: Orifice Vertical Spacing = Elliptical Slot Centroid = 9.60 inches N/A feet Orifice Plate: Orifice Area per Row = 0.91 sq. inches (diameter = 1-1/16 inches) Elliptical Slot Area = N/A $ft^2$ User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest) Row 5 (optional) Row 1 (required) Row 2 (optional) Row 3 (optional) Row 4 (optional) Row 6 (optional) Row 7 (optional) Row 8 (optional) Stage of Orifice Centroid (ft 0.00 0.80 1.60 Orifice Area (sq. inches) 0.91 0.91 0.91 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 (sg. inches) User Input: Vertical Orifice (Circular or Rectangular) Calculated Parameters for Vertical Orifice Zone 2 Circular Not Selected Zone 2 Circular Not Selected Invert of Vertical Orifice 2.40 N/A ft (relative to basin bottom at Stage = 0 ft) Vertical Orifice Area 0.01 N/A ft (relative to basin bottom at Stage = 0 ft) Vertical Orifice Centroid = Depth at top of Zone using Vertical Orifice = 5.11 N/A 0.06 N/A feet Vertical Orifice Diameter = 1.45 N/A inches User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe) Calculated Parameters for Overflow Weir Zone 3 Weir Not Selected Zone 3 Weir Not Selected Overflow Weir Front Edge Height, Ho = N/A ft (relative to basin bottom at Stage = 0 ft) Height of Grate Upper Edge, Ht = 5.11 5.11 N/A eet Overflow Weir Front Edge Length 2.00 N/A feet Overflow Weir Slope Length 2.00 N/A feet Overflow Weir Grate Slope = 0.00 N/A H:V Grate Open Area / 100-yr Orifice Area = 12.01 N/A Horiz. Length of Weir Sides = Overflow Grate Open Area w/o Debris = ft² 2.00 N/A feet 2.78 N/A Overflow Grate Open Area w/ Debris = Overflow Grate Type = Type C Grate N/A 1.39 N/A $ft^2$ Debris Clogging % = 50% N/A User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice) Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate Zone 3 Restrictor Not Selected Zone 3 Restrictor Not Selected Depth to Invert of Outlet Pipe 2.17 N/A ft (distance below basin bottom at Stage = 0 ft) Outlet Orifice Area 0.23 N/A Outlet Pipe Diameter 18.00 N/A Outlet Orifice Centroid 0.17 N/A inches feet Restrictor Plate Height Above Pipe Invert = 3.40 inches Half-Central Angle of Restrictor Plate on Pipe = 0.90 N/A radians User Input: Emergency Spillway (Rectangular or Trapezoidal) Calculated Parameters for Spillway Spillway Invert Stage= 6.40 ft (relative to basin bottom at Stage = 0 ft) Spillway Design Flow Depth= 0.81 feet Stage at Top of Freeboard = Spillway Crest Length : 6.00 feet 8.21 feet Basin Area at Top of Freeboard Spillway End Slopes 4.00 H:V 0.41 acres acre-ft Freeboard above Max Water Surface = 1.00 feet Basin Volume at Top of Freeboard = 1.89 Routed Hydrograph Results The user can override the default CUHP hydroaraphs and runoff volumes by entering new values in the Inflow Hydroaraphs table (Columns W through AF). Design Storm Return Period WOCV FURV 2 Year 5 Year 10 Year 25 Year 50 Year 100 Year 500 Year One-Hour Rainfall Depth (in) N/A 0.214 2.25 2.52 3.68 2.435 N/A 1.19 1.50 1.75 0.938 2.00 0.827 0.605 0.790 CUHP Runoff Volume (acre-ft) 1.124 Inflow Hydrograph Volume (acre-ft) 0.605 1.525 2.435 N/A N/A 0.790 0.938 1.124 1.306 CUHP Predevelopment Peak Q (cfs) N/A N/A 0.0 0.1 0.1 1.0 2.1 3.4 9.2 OPTIONAL Override Predevelopment Peak Q (cfs) N/A N/A Predevelopment Unit Peak Flow, q (cfs/acre) 0.00 0.01 0.01 0.11 0.22 0.37 0.99 N/A N/A N/A 30.7 Peak Inflow Q (cfs) N/A 7.1 9.2 10.8 13.7 16.2 19.1 Peak Outflow Q (cfs) 0.1 0.2 0.3 0.9 2.9 3.1 3.2 16.0 0.3 N/A Plate Ratio Peak Outflow to Predevelopment O N/A N/A 0.9 Structure Controlling Flow Overflow Weir 1 Vertical Orifice 1 Vertical Orifice 1 Overflow Weir 1 Outlet Plate 1 Outlet Plate 1 Outlet Plate Spillway Max Velocity through Grate 1 (fps) N/A N/A N/A 0.2 1.0 N/A 1.1 1.0 Max Velocity through Grate 2 (fps) N/A N/A N/A N/A N/A N/A N/A N/A N/A Time to Drain 97% of Inflow Volume (hours) 65 58 65 68 67 66 65 60 40 Time to Drain 99% of Inflow Volume (hours) 72 64 71 75 75 74 74 71

4.79

0.26

0.740

4.08

0.24

0.56

5.11

0.28

0.829

2.40

0.18

0.215

5 24

0.28

0.863

5.46

0.29

5 77

0.30

1.02

6.31

0.33

1.188

Maximum Ponding Depth (ft)

Maximum Volume Stored (acre-ft)

Area at Maximum Ponding Depth (acres)

7.05

0.36

1.442



### 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
5.00 11111	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	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.78	1.26	1.56	1.05	1.32	1.28	2.36
	0:20:00	0.00	0.00	2.81	3.70	4.35	2.75	3.22	3.43	5.43
	0:25:00	0.00	0.00	5.83	7.70	9.23	5.78	6.63	7.10	11.35
	0:30:00	0.00	0.00	7.12	9.25	10.83	11.69	13.81	15.47	25.15
	0:35:00	0.00	0.00	6.95	8.90	10.35	13.73	16.17	19.13	30.70
	0:40:00	0.00	0.00	6.51	8.21	9.53	13.71	16.14	19.14	30.65
	0:45:00	0.00	0.00	5.88	7.50	8.74	12.73	14.96	18.14	29.11
	0:50:00	0.00	0.00	5.35	6.93	7.26	11.84	13.87	15.77	26.99
	1:00:00	0.00	0.00	4.30	5.78	6.74	0.60	11.30	14.06	27.69
	1:05:00	0.00	0.00	4.09	5.27	6.19	8.78	10.21	12.95	20.93
	1:10:00	0.00	0.00	3.66	4.87	5.77	7.79	9.03	11.29	18.18
	1:15:00	0.00	0.00	3.35	4.54	5.50	6.99	8.07	9.87	15.83
	1:20:00	0.00	0.00	3.10	4.21	5.16	6.28	7.24	8.61	13.76
	1:25:00	0.00	0.00	2.87	3.91	4.72	5.69	6.55	7.57	12.02
	1:30:00	0.00	0.00	2.66	3.63	4.29	5.08	5.83	6.66	10.52
	1:35:00	0.00	0.00	2.46	3.36	3.89	4.51	5.17	5.84	9.16
	1:40:00	0.00	0.00	2.25	2.9/	3.51	3.98	4.55	5.06	6.71
	1:50:00	0.00	0.00	2.05	2.00	2,86	3.48	3.44	3,70	5.65
	1:55:00	0.00	0.00	1.64	2.07	2,62	2,65	2,99	3,15	4,76
	2:00:00	0.00	0.00	1.46	1.91	2.40	2.39	2.69	2.76	4.16
	2:05:00	0.00	0.00	1.20	1.57	1.98	1.93	2.17	2.20	3.30
	2:10:00	0.00	0.00	0.97	1.27	1.61	1.54	1.73	1.73	2.58
	2:15:00	0.00	0.00	0.79	1.03	1.30	1.23	1.38	1.36	2.02
	2:20:00	0.00	0.00	0.63	0.83	1.05	0.98	1.10	1.06	1.57
	2:25:00	0.00	0.00	0.50	0.66	0.84	0.78	0.87	0.83	1.21
	2:30:00	0.00	0.00	0.40	0.52	0.66	0.61	0.69	0.64	0.93
	2:33:00	0.00	0.00	0.32	0.41	0.51	0.46	0.55	0.30	0.72
	2:45:00	0.00	0.00	0.25	0.32	0.31	0.28	0.32	0.30	0.30
	2:50:00	0.00	0.00	0.15	0.19	0.24	0.22	0.25	0.24	0.34
	2:55:00	0.00	0.00	0.11	0.14	0.18	0.17	0.19	0.18	0.26
	3:00:00	0.00	0.00	0.08	0.10	0.13	0.12	0.14	0.13	0.19
	3:05:00	0.00	0.00	0.05	0.07	0.09	0.09	0.10	0.09	0.13
	3:10:00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.06	0.08
	3:15:00	0.00	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.04
	3:20:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	3.23.00	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
	4:15:00	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
	4:40:00	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 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
	5:20:00	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
	5:40:00	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
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Stage-Area-Volu The user can create a summ	IENTION M Ime-Discharge I ary S-A-V-D by er	BASIN HFD-Detention Relationships Intering the desi	OUTLET	nents and the re	<b>TURE D</b> 2022) emainder of the	ESIGN	ate automatically.
The user should graphically o Stage - Storage Description	Stage	Mary S-A-V-D to	Area	Volume	Volume	Total Outflow	all key transition points.
	[IC]	լույ	[acres]	[tt ]	[ac-it]	[CIS]	For best results, include the
							stages of all grade slope
							from the S-A-V table on
							Sheet 'Basin'.
							Also include the inverts of all
							outlets (e.g. vertical orifice, overflow grate, and spillway,
							where applicable).
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### Pond_B.xlsm, Outlet Structure

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:	NQJ									
				Company:	HR G	REEN								
***Design Storm: 1-Hour Rain Depth WQCV Event	0.60	inches		Date:	Sept	ember 1, 20	022							
Minor Storm: 1-Hour Rain Depth 5-Year Event	1.50	inches		Project:	EAST	ONVILLE R	DAD							
***Major Storm: 1-Hour Rain Depth 100-Year Event	2.52	inches		Location:	TSB ‡	1								
Optional User Defined Storm CUHP (CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm 100-Year Event														
Max Intensity for Optional User Defined Storm 0														
SITE INFORMATION (USER-INPUT)														
Sub-basin Identifier	EA6	EA7												
Receiving Pervious Area Soil Type	Sandy Loam	Sandy Loam												
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	0 700	0.650												
Directly Connected Impervious Area (DCIA, acres)	0.700	0.580												
Unconnected Impervious Area (UIA. acres)	0.000	0.000												
Receiving Pervious Area (RPA, acres)	0.000	0.000												
Separate Pervious Area (SPA, acres)	0.000	0.070					İ		İ		İ			
RPA Treatment Type: Conveyance (C),	C	c												
Volume (V), or Permeable Pavement (PP)	Ľ	Ľ												
CALCULATED RESULTS (OUTPUT)	0.700	0.050				1	r	1	r	1	r	1		,
I otal Calculated Area (ac, check against input)	0.700	0.650												
Directly Connected Impervious Area (DCIA, %)	100.0%	89.2%												
Beceiving Pervious Area (BPA %)	0.0%	0.0%												
Separate Pervious Area (SPA, %)	0.0%	10.8%												
A _R (RPA / UIA)	0.000	0.000												
I, Check	1.000	1.000												
f / I for WQCV Event:	1.7	1.7												
f / I for 5-Year Event:	0.5	0.5												
f / I for 100-Year Event:	0.3	0.3												
f / I for Optional User Defined Storm CUHP:														
IRF for WQCV Event:	1.00	1.00												
IRF for 5-Year Event:	1.00	1.00												
IRF for 100-Year Event:	1.00	1.00												
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: I _{total}	100.0%	89.2%												
Effective Imperviousness for WQCV Event:	100.0%	89.2%							+		+			├───┤
Effective Imperviousness for 5-Year Event:	100.0%	89.2%												
Effective Imperviousness for Optional User Defined Storm CUHP:	100.0%	07.270												
														_
LID / EFFECTIVE IMPERVIOUSNESS CREDITS														
WQCV Event CREDIT: Reduce Detention By:	0.0%	0.0%	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
User Defined CUHP CREDIT**: Reduce Detention By:	0.0%	0.0%	N/A	IN/A	IN/A	N/A	N/A	N/A	N/A	IN/A	IN/A	N/A	IN/A	IN/A
	Total Site Imp	erviousness:	94.8%	]	Notes:									
Total Site Effective Imperv	iousness for	NQCV Event:	94.8%		Use Gree	n-Ampt avera	ge infiltratio	n rate values	from Table	3-3.				
Total Site Effective Imper-	viousness for	5-Year Event:	94.8%	1	** Flood cor	trol detentio	n volume cr	edits based o	n empirical e	quations fro	m Storage Cl	hapter of USI	DCM.	
Total Site Effective Impervio	usness for 10	0-Year Event:	94.8%		*** Metho	d assumes th	at 1-hour rai	infall depth is	equivalent t	o 1-hour inte	ensity for cal	culation purp	osed	
Total Site Effective Imperviousness for Optional	User Defined	Storm CUHP:		l										

### DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project:	EASTONVIL	LE ROAD												
Basin ID: 1	TSB #1													
(74m)	-	-												
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	-	oteri	•		Depth Increment =		ft Optional				Optional			
Example Zone		Stage - Storage	Stage	Override	Length	Width	Area	Override	Area	Volume	Volume			
Watershed Information				7009	Top of Micropool		0.00				860	0.020	(10)	(ac it)
Selected BMP Type =	EDB	1		7005	7010		1.00	-			1,239	0.028	1,049	0.024
Watershed Area =	1.35	acres			7011		2.00				1,676	0.038	2,507	0.058
Watershed Length =	500	ft			7012		3.00				2,169	0.050	4,429	0.102
Watershed Length to Centroid =	50	ft			7013		4.00	-			2,718	0.062	6,873	0.158
Watershed Slope =	0.010	ft/ft			7014		5.00	-			3,323	0.076	9,893	0.227
Percentage Hydrologic Soil Group A =	100.0%	percent			7015		7.00	-	-	-	4,711	0.092	17,902	0.411
Percentage Hydrologic Soil Group B =	0.0%	percent												
Percentage Hydrologic Soil Groups C/D =	0.0%	percent				1		-						
Target WQCV Drain Time =	40.0	hours						-						L
Location for 1-hr Rainfall Depths = I	User Input							-						<u> </u>
After providing required inputs above incl depths, click 'Run CUHP' to generate rung	luding 1-hour	rainfall hs using						-		-				<u> </u>
the embedded Colorado Urban Hydrog	graph Proced	ure.	Optional Use	er Overrides										
Water Quality Capture Volume (WQCV) =	0.050	acre-feet		acre-feet										
Excess Urban Runoff Volume (EURV) =	0.177	acre-feet		acre-feet				1						
2-yr Runoff Volume (P1 = 1.19 in.) =	0.114	acre-feet	1.19	inches				-						µ]
5-yr Runoff Volume (P1 = 1.5 in.) =	0.146	acre-feet	1.50	inches				-						┝───┤
25-yr Runoff Volume (P1 = 1.75 in.) =	0.1/2	acre-feet	2.00	inches				-		-				
50-yr Runoff Volume (P1 = 2.25 in.) =	0.227	acre-feet	2.25	inches										
100-yr Runoff Volume (P1 = 2.52 in.) =	0.256	acre-feet	2.52	inches										
500-yr Runoff Volume (P1 = 3.68 in.) =	0.383	acre-feet	3.68	inches				-						
Approximate 2-yr Detention Volume =	0.117	acre-feet												
Approximate 5-yr Detention Volume =	0.151	acre-feet												<b>⊢</b>
Approximate 10-yr Detention Volume =	0.179	acre-feet												<b>⊢</b> −−−
Approximate 25-yr Detention Volume =	0.210	acre-feet						-						<u> </u>
Approximate 100-vr Detention Volume =	0.228	acre-feet						-		-				
,,, , , , , , , , , , , , , , , , , ,								-						
Define Zones and Basin Geometry														
Zone 1 Volume (WQCV) =	0.050	acre-feet						-		-				
Select Zone 2 Storage Volume (Optional) =		acre-feet	Total deter	ntion										
Select Zone 3 Storage Volume (Optional) =	0.050	acre-feet	volume is l	less than				-						L
I otal Detention Basin Volume =	0.050	acre-reet	100 ,ca. (	olullici										<u> </u>
Initial Surcharge Denth (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							-						L
Initial Surpharea Area (A) =	ucor	a 2						-						<b>⊢</b>
Surcharge Volume Length $(L_{RSV}) =$	user	ft ft						-	-	-				<u> </u>
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 -					-							<u> </u>
Volume of Basin Floor (V _{FLOOR} ) =	user	nt í												<u> </u>
Length of Main Rasin (I 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						-						µ
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### DETENTION BASIN STAGE-STORAGE TABLE BUILDER





	DE	IENTION I	BASIN OU	ILET STRU	CIURE DE	SIGN							
Project:	EASTONVILLE RO	AD	HFD-Detention, v	ersion 4.06 (July	2022)								
Basin ID:	TSB #1												
( Jones -	-			Estimated	Estimated								
ma t				Stage (ft)	Volume (ac-ft)	Outlet Type	I .						
some Town T and			Zone 1 (WQCV)	1.81	0.050	Orifice Plate							
The same	LIN YEAR		Zone 2										
Pathematics	Carfinuetion (P	fantion Bond)	Zone 3										
	Configuration (13	etention Fond)		Total (all zones)	0.050								
User Input: Orifice at Underdrain Outlet (typical	ly used to drain Wo	OCV in a Filtration E	<u>3MP)</u> the filture time are dis		المربحة والمراجع المراجع		Calculated Parame	eters for Underdrai	<u>n</u>				
Underdrain Orifice Diameter -	N/A	ft (distance below	the filtration media	surface)	Underd	rain Orifice Area =	N/A	ft ^e					
	N/A	inches			Underdrain		N/A	leet					
User Input: Orifice Plate with one or more orific	ces or Elliptical Slot	Weir (typically use	d to drain WQCV a	nd/or EURV in a se	dimentation BMP)			ini te					
Centroid of Lowest Orifice =	0.00	ft (relative to basir	n bottom at Stage =	= 0 ft)	WQ Orific		INI DAS						
Depth at top of Zone using Orifice Plate =	2.42	ft (relative to basir	n bottom at Stage =	= 0 ft)	Ellip	WILL US	SE RISEF	२					
Orifice Plate: Orifice Vertical Spacing =	N/A	inches			Ellipti	PIPF W	ітн						
Orifice Plate: Orifice Area per Row =	0.46	sq. inches (diamet	er = 3/4 inch)		E								
$\frown$	$\sim$	$\sim$	$\sim$	$\sim$		CORRE	SPONDI	NG					
User Input: Stage and Total Area of Fach Orific	e Row (numbered	from lowest to high	hest)	· · · ·	X		ES						
osci input. Stage and rotal Area of Edentarine	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	NOW O CODIIONAL		Now a contional)	1				
Stage of Orifice Centroid (ft)	0.00	0.81	1.75	2.25			(0)		_				
Orifice Area (sq. inches)	0.46	0.46	0.46	0.46	く								
(	ممد	~ ~ ~ ~	ىدىد	<u> </u>					-				
C	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 Rectand	ular)						Calculated Parame	ators for Vertical O	rifice				
oser input. Vertical onlice (circular of Acetang	Not Selected	Not Selected	1				Not Selected	Not Selected					
Invert of Vertical Orifice =	The belocica	The beleeted	ft (relative to basir	n bottom at Stage :	= 0 ft) Vert	ical Orifice Area =		Hot beletted	ft ²				
Depth at top of Zone using Vertical Orifice =			ft (relative to basir	n bottom at Stage :	= 0 ft) Vertical	Orifice Centroid =			feet				
Vertical Orifice Diameter = inches													
User Input: Overflow Weir (Dropbox with Flat o	or Sloped Grate and	Outlet Pipe OR Re	ctangular/Trapezoi	dal Weir and No O	<u>utlet Pipe)</u>		Calculated Parame	eters for Overflow	Weir				
Overflow Weir Front Edge Height Ho -	Not Selected	Not Selected	ft (relative to basin l	hottom at Stage – 0	ft) Height of Grate	Inner Edge H. =	Not Selected	Not Selected	feet				
Overflow Weir Front Edge Height, Ho =			feet	bottom at Stage = 0	Overflow W	eir Slope Length =	-		feet				
Overflow Weir Grate Slope =			H:V	Gra	ate Open Area / 100	)-yr Orifice Area =							
Horiz. Length of Weir Sides =			feet	Ov	erflow Grate Open	Area w/o Debris =			ft ²				
Overflow Grate Type =				C	verflow Grate Oper	Area w/ Debris =			ft²				
Debris Clogging % =			%										
			De eterre de la Orifica	、	6-1	- Jaha d Davia a shaw			N-+-				
User Input: Outlet Pipe W/ Flow Restriction Plate	Not Selected	Not Selected	Rectangular Orifice	2	<u>Cai</u>	culated Parameters	Not Selected	Not Selected	late				
Depth to Invert of Outlet Pipe =	Not Selected	Not Selected	ft (distance below b	asin hottom at Stage	= 0 ft) OI	itlet Orifice Area =	NOL Selected	Not Selected	ft ²				
Circular Orifice Diameter =			inches	asin bottom at stage	Outlet	Orifice Centroid =			feet				
				Half-Cent	ral Angle of Restrict	or Plate on Pipe =	N/A	N/A	radians				
User Input: Emergency Spillway (Rectangular or	r Trapezoidal)						Calculated Parame	eters for Spillway					
Spillway Invert Stage=	5.10	ft (relative to basir	n bottom at Stage =	= 0 ft)	Spillway De	esign Flow Depth=	0.43	feet					
Spillway Crest Length =	5.00	feet			Stage at T	op of Freeboard =	6.53	feet					
Spiliway End Siopes =	4.00	H:V feet			Basin Area at T	op of Freeboard =	0.10	acres					
Fleeboard above Max Water Surface -	1.00	leet			Dasin volume at 1		0.30	acre-it					
Routed Hydrograph Results	The user can over	ride the default CU	HP hydrographs an	d runoff volumes b	by entering new valu	ies in the Inflow H	vdrographs table (C	Columns W throug	<i>h AF).</i>				
Design Storm Return Period =	N/A	EURV N/A	2 Year 1 19	5 Year 1 50	10 Year	25 Year	2 25	2 52	3 68				
CUHP Runoff Volume (acre-ft) =	0.050	0.177	0.114	0.146	0.172	0.200	0.227	0.256	0.383				
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.114	0.146	0.172	0.200	0.227	0.256	0.383				
CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A N/A	N/Α N/Δ	0.0	0.0	0.0	0.3	0.6	1.0	2.5				
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.24	0.46	0.75	1.88				
Peak Inflow Q (cfs) =	N/A	N/A	2.5	3.2	3.7	4.4	5.0	5.5	8.2				
Peak Outflow Q (cfs) =	0.0 N/A	0.1 N/A	0.1 N/A	0.1	0.1	0.1	0.1	0.2	2.8				
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Spillway	Spillway				
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 37	N/A 49	N/A 45	N/A 48	N/A 50	N/A 51	N/A 53	N/A 54	N/A 50				
Time to Drain 99% of Inflow Volume (hours) =	40	56	51	54	56	59	61	63	60				
Maximum Ponding Depth (ft) =	1.80	4.30	3.04	3.60	4.01	4.42	4.78	5.14	5.38				
Area at Maximum Ponding Depth (acres) =	0.04	0.07	0.05	0.06	0.06	0.07	0.07	0.08	0.08				
(acie-it) =	0.000	0.1//	0.103	0.100	0.100	0.103	0.211	0.200	J.2J/				



# DETENTION BASIN OUTLET STRUCTURE DESIGN Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The upper cap of de the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program

	SOURCE	CLIHP	CLIHP	CLIHP	CLIHP	CLIHP	СШНР	СШНР	CLIHP	CLIHP
Time Interval	TIME	WOCV [cfc]	FUDV [cfc]	2 Voar [cfc]	5 Voar [cfc]	10 Year [cfc]	25 Vear [cfc]	50 Voar [cfc]	100 Voar [cfc]	500 Voar [cfc]
TIME THE Val	0.00.00		EURV [CIS]					SU Teal [CIS]		
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.27
	0.13.00	0.00	0.00	1.22	1.60	0.83	1.22	0.67	1.52	2.22
	0:25:00	0.00	0.00	2.48	3.16	3.71	2.44	2.77	2 94	2.33
	0:30:00	0.00	0.00	2.38	2.94	3.33	4.37	4.96	5.47	8.15
	0:35:00	0.00	0.00	1.81	2.20	2.50	3.91	4.43	5.23	7.75
	0:40:00	0.00	0.00	1.38	1.64	1.86	3.20	3.62	4.22	6.24
	0:45:00	0.00	0.00	0.97	1.22	1.42	2.39	2.71	3.32	4.91
	0:50:00	0.00	0.00	0.71	0.94	1.05	1.92	2.17	2.59	3.84
	0:55:00	0.00	0.00	0.55	0.72	0.83	1.37	1.54	1.95	2.90
	1:00:00	0.00	0.00	0.49	0.63	0.76	1.05	1.19	1.58	2.34
	1:05:00	0.00	0.00	0.47	0.60	0.73	0.92	1.04	1.42	2.10
	1:10:00	0.00	0.00	0.39	0.59	0.73	0.77	0.87	1.05	1.50
	1.13.00	0.00	0.00	0.33	0.34	0.72	0.09	0.78	0.64	0.94
	1:25:00	0.00	0.00	0.32	0.46	0.55	0.53	0.59	0.52	0.76
	1:30:00	0.00	0.00	0.31	0.44	0.50	0.45	0.50	0.44	0.65
	1:35:00	0.00	0.00	0.31	0.43	0.46	0.40	0.45	0.41	0.60
	1:40:00	0.00	0.00	0.31	0.37	0.44	0.38	0.43	0.39	0.58
	1:45:00	0.00	0.00	0.31	0.33	0.43	0.37	0.41	0.39	0.57
	1:50:00	0.00	0.00	0.31	0.31	0.43	0.36	0.41	0.39	0.57
	1:55:00	0.00	0.00	0.24	0.30	0.41	0.36	0.41	0.39	0.57
	2:00:00	0.00	0.00	0.20	0.28	0.36	0.36	0.41	0.39	0.57
	2:05:00	0.00	0.00	0.11	0.15	0.20	0.20	0.22	0.22	0.31
	2:10:00	0.00	0.00	0.06	0.08	0.11	0.06	0.12	0.12	0.17
	2:20:00	0.00	0.00	0.03	0.04	0.03	0.00	0.00	0.00	0.09
	2:25:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	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
	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
	4:30:00	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
	4:55:00	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
	5:15:00	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
	5:35:00	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
	5:55:00	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
Summary Stage-Area-Volu The user can create a summ	ITENTION	BASIN MHFD-Deter Relationships Intering the designary SAVID	OUTLE ntion, Version red stage incrementable to the full	A.06 (July 20 ments and the m	CTURE D	ESIGN	ate automatically.			
-------------------------------------------------------	----------	----------------------------------------------------------------------	----------------------------------------------------------------	----------------------------------	-------------------	------------------	------------------------------------------------------------------------------------------------------------------------			
Stage - Storage Description	Stage	Area	Area	Volume	Volume [ac-ft]	Total Outflow	all key transition points.			
							For best results, include the stages of all grade slope changes (e.g. ISV and Floor			
							from the S-A-V table on Sheet 'Basin'.			
							Also include the inverts of a outlets (e.g. vertical orifice, overflow grate, and spillway where applicable).			
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Eastonville Road Preliminary Drainage Report Project No.: 201662.08

### **APPENDIX E – REFERENCE MATERIAL**

Final Drainage Report for The Sanctuary Filing 1 at Meridian Ranch



EL PASO COUNTY, COLORADO

August 2022

Prepared For:

GTL DEVELOPMENT, INC. P.O. Box 80036 San Diego, CA 92138

Prepared By: Tech Contractors 11910 Tourmaline Dr., Ste 130 Falcon, CO 80831 719.495.7444

PCD Project No. SF22-020

### Future Drainage - SCS Calculation Method

Following is a tabulation of the surface drainage characteristics for the future conditions using the SCS calculation method. Please refer to Figure 6 - Meridian Ranch SCS Calculations – Future Basins Map

### Table 5: Future Drainage Basins-SCS

FUTURE SCS (Full Spectrum)						
		PEAK	PEAK	PEAK	PEAK	PEAK
		DISCHARGE	DISCHARGE	DISCHARGE	DISCHARGE	DISCHARGE
		Q100	Q50	Q10	Q5	Q2
	(SQ. IVII.)	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)
OS06	0.1313	80	52	12	3.8	0.5
G1a	0.1313	80	52	12	3.8	0.5
G1a-G2	0.1313	79	52	11	3.7	0.5
OS05	0.0578	39	26	5.6	1.8	0.2
OS05-G1	0.0578	39	25	5.5	1.7	0.2
FG01	0.0538	31	22	7.0	3.4	0.9
FG01-G1	0.0538	31	22	7.0	3.4	0.9
G1	0.1116	61	41	11	4.9	1.1
G1-G2	0.1116	61	41	11	4.8	1.1
FG02	0.0391	32	22	6.4	2.7	0.5
G2	0.2820	167	112	27	10	1.9
G2-G3	0.2820	163	108	27	10	1.9
FG03	0.0203	24	17	5.9	3.0	0.8
FG04	0.0172	22	16	5.8	3.1	0.9
G3	0.3195	185	123	31	12	2.4
FG06	0.0675	56	40	12	5.8	1.3
FG05	0.0580	45	33	12	6.7	2.4
OS07ab	0.0170	12	7.9	1.8	0.5	0.07
OS07ab-POND F	0.0170	12	7.6	1.7	0.5	0.07
POND F IN	0.4620	293	200	54	23	5.1
POND F	0.4620	178	121	16	8.0	2.1
POND F-G7	0.4620	177	120	16	8.0	2.1
OS07c	0.0296	19	12	2.7	0.9	0.12
OS07c-G4	0.0296	19	12	2.6	0.9	0.12
FG21a	0.0095	5.9	4.0	1.0	0.4	0.06
G4	0.0391	25	16	3.6	1.2	0.2
G4-G7	0.0391	24	16	3.5	1.2	0.2
FG21b	0.0150	21	16	6.5	3.9	1.7
G7	0.5161	194	131	18	8.9	2.3
G7-G8	0.5161	194	131	18	8.9	2.3
FG22	0.1354	121	88	32	17	5.4
OS08a	0.0251	16	11	2.3	0.7	0.10
OS08-G8	0.0251	16	10	2.3	0.7	0.10
FG23a	0.0216	21	15	5.2	2.7	0.8
OS07d	0.0034	2.5	1.6	0.4	0.11	0.01
OS07d-G8	0.0034	2.4	1.6	0.3	0.11	0.01
G8	0.7016	279	178	46	24	7.7
G8-G10	0.7016	278	177	45	24	7.6
FG24b	0.0589	76	57	24	15	6.5
FG24a	0.0348	24	16	4.5	2.0	0.4
US08b	0.0165	9.5	6.3	1.4	0.5	0.07
US08b-G9a	0.0165	9.4	6.0	1.4	0.5	0.07
OS09a	0.0093	5.3	3.5	0.8	0.3	0.04
OS09a-G9a	0.0093	5.2	3.4	0.7	0.3	0.04
G9a	0.1195	97	71	28	16	6.7

	FUTURE SCS (Full Spectrum)						
		PEAK	PEAK	PEAK	PEAK	PEAK	
		DISCHARGE	DISCHARGE	DISCHARGE	DISCHARGE	DISCHARGE	
		Q100	Q50	Q10	Q5	Q2	
	(SQ. IVII.)	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)	
G9a-G9b	0.1195	96	70	27	16	6.6	
FG24c	0.0291	40	30	13	8.4	4.0	
FG24d	0.0262	39	30	14	8.7	4.4	
G9b	0.1748	170	127	53	32	14	
REX RD WQCV	0.1748	158	125	51	31	14	
G9b-G10	0.1748	158	123	50	31	13	
FG23b	0.0236	17	11	2.7	0.9	0.13	
G10	0.9000	390	263	90	46	15	
G10-G11	0.9000	389	254	85	44	15	
FG23c	0.0109	11	7.6	2.2	1.0	0.2	
G11	0.9109	393	258	86	44	15	
FG25	0.1084	111	84	36	22	9.9	
FG28	0.0184	15	10	3.0	1.2	0.2	
POND G IN-WEST	1.0377	503	350	122	63	22	
FG27	0.0679	98	79	42	30	18	
FG26	0.0570	65	50	24	16	8.2	
G13	0.0570	65	50	24	16	8.2	
G13-POND G	0.0570	64	50	24	16	8.1	
POND G IN-EAST	0.1249	160	127	64	44	25	
POND G	1.1626	450	293	52	21	5.3	
G12	1.1626	450	293	52	21	5.3	
G12-G06	1.1626	449	293	52	21	5.3	
FG29	0.0983	60	39	8.9	2.9	0.4	
FG32	0.0402	51	40	20	14	7.5	
FG32-G06	0.0402	50	40	19	13	7.4	
G06	1.3011	491	317	57	22	7.5	

### **Rational Calculations**

The Rational Hydrologic Calculation Method was used to estimate the total runoff from the 5-year and the 100-year design storm and thus establish the storm drainage system design. Using the rational calculation methodology outlined in the Hydrology Section (Ch 6) of the COSDCM coupled with the El Paso County EPCDCM an effective storm drainage design for the Sanctuary Filing 1 has been designed. The storm drainage facilities have been designed such that the minor storm will be captured by the inlets and conveyed by the storm drain pipes such that the street flow does not overtop the curbs. The storm drainage facility has been designed such that the major storm will be captured by the inlets and conveyed by the storm drain pipes such that the street flow does not exceed the right-of-way widths for residential streets and the hydraulic grade line will be less than one foot below the surface.

The site is located within the Gieck Ranch Drainage Basin. The storm drain runoff will be collected by a series of inlets and storm drain pipe then conveyed through the project and discharge directly into the existing Pond G that is properly sized to safely convey the storm water flows away from the project without damaging adjacent property.

### Rational Narrative

The following is a detailed narrative of the storm drainage system located in the Sanctuary Filing 1. These storm drainage systems meet the requirements of as found in the El Paso





Eastonville Road Preliminary Drainage Report Project No.: 201662.08

### **APPENDIX F – DRAINAGE MAPS**





	_
SCRIPTION	

<u> </u>							
SUMMARY RUNOFF TABLE						DES	IGN POINT SU
BASIN	AREA (ac)	% IMPERVIOUS	Q ₅ (cfs)	Q ₁₀₀ (cfs)		DESIGN POINT	CONTRIBUTING BASINS
G18*	321.53	-	28.3	365.2		1	G18*
FG36*	18.88	-	1.7	18.8		2	FG36*
G16*	131.26	-	6.1	112.1	1	3	G16*
G06*	832.70	-	22.4	491.0		4	G06*
EX5	22.35	3	7.0	43.3		5	EX5
EX6	3.05	5	1.2	6.9		6	EX6
EX7	1.47	9	0.9	4.2		7	EX7
EX8	13.13	4	3.8	22.6		8	EX8
EX9	1.59	12	0.9	3.7		9	EX9
	*	AREA AND Q TAK	EN FROM	THE SANCTL	JARY I	FILING 1 FDF	2

MMARY TABLE  $\Sigma Q_5$  (cfs)  $\Sigma Q_{100}$  (cfs) 28.3 365.2 1.7 18.8 6.1 112.1 22.4 491.0 7.0 43.3 1.2 6.9 0.9 4.2 3.8 22.6 0.9 3.7

LEGEND: EXISTING MAJOR CONTOUR — — — 5250 [·] — — EXISTING MINOR CONTOUR _____ EX STORM SEWER _ _ _ EX DRAINAGE SWALE EX PROPERTY LINE _____ EXISTING FLOW DIRECTION PROPOSED DRAINAGE BASIN ____ DESIGN POINT 13 PROPOSED BASIN LABEL NAME

AREA



SCRIPTION	

### SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q ₅ (cfs)	Q ₁₀₀ (cfs)
G18*	321.53	-	28.3	365.2
FG36*	18.88	-	1.7	18.8
G16*	131.26	-	6.1	112.1
G06*	832.70	-	22.4	491.0
EX5	22.35	3	7.0	43.3
EX6	3.05	5	1.2	6.9
EX7	1.47	9	0.9	4.2
EX8	13.13	4	3.8	22.6
EX9	1.59	12	0.9	3.7

### DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	$\Sigma Q_5$ (cfs)	$\Sigma Q_{100}$ (cfs)
1	G18*	28.3	365.2
2	FG36*	1.7	18.8
3	G16*	6.1	112.1
4	G06*	22.4	491.0
5	EX5	7.0	43.3
6	EX6	1.2	6.9
7	EX7	0.9	4.2
8	EX8	3.8	22.6
9	EX9	0.9	3.7

* AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR

# LEGEND:

EXISTING MAJOR CONTOUR	— — — 5250 [·] — —
EXISTING MINOR CONTOUR	
EX STORM SEWER	
EX DRAINAGE SWALE	
EX PROPERTY LINE	
EXISTING FLOW DIRECTION	-
PROPOSED DRAINAGE BASIN	
DESIGN POINT	13

(NAME) (AREA)



SCRIPTION			
	1975 RESEARCH PKWY SUITE 230	EASTONVILLE ROAD	
	COLORADO SPRINGS CO 80920 PHONE: 719 300 4140	D.R. HORTON	
	HRGreen FAX: 713.965.0044	EL PASO COUNTY, CO	

### SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q ₅ (cfs)	Q ₁₀₀ (cfs)
G18*	321.53	-	28.3	365.2
FG36*	18.88	-	1.7	18.8
G16*	131.26	-	6.1	112.1
G06*	832.70	-	22.4	491.0
EX5	22.35	3	7.0	43.3
EX6	3.05	5	1.2	6.9
EX7	1.47	9	0.9	4.2
EX8	13.13	4	3.8	22.6
EX9	1.59	12	0.9	3.7
		ADEA AND O TAK		CULC CANOT

## DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	$\Sigma Q_5$ (cfs)	$\Sigma Q_{100}$ (cfs)
1	G18*	28.3	365.2
2	FG36*	1.7	18.8
3	G16*	6.1	112.1
4	G06*	22.4	491.0
5	EX5	7.0	43.3
6	EX6	1.2	6.9
7	EX7	0.9	4.2
8	EX8	3.8	22.6
9	EX9	0.9	3.7

AREA AND Q TAKEN FROM THE SANCTUARY FILING 1 FDR

# LEGEND:

EXISTING MAJOR CONTOUR	— — — 5250 [·] — —
EXISTING MINOR CONTOUR	
EX STORM SEWER	
EX DRAINAGE SWALE	
EX PROPERTY LINE	
EXISTING FLOW DIRECTION	◄
PROPOSED DRAINAGE BASIN	
DESIGN POINT	13



	BASIN	SUMMARY	TABLE		DES	IGN POINT SU	MMARY T	ABLE
BASIN	AREA (ac)	% IMPERVIOUS	Q ₅ (cfs)	Q ₁₀₀ (cfs)	DESIGN POINT	CONTRIBUTING BASINS	$\Sigma Q_5$ (cfs)	∑Q ₁₀₀ (cfs)
OS1	85,16	-	-	-	1	OS1 & G17	28.3	365.2
OS2	15.03	7	4.2	21.6	2	EA1	0.8	1.5
OS3	1.00	2	0.2	1.7	3	EA2	0.9	1.7
OS4	9.60	9	3.8	17.3	3.1	DP2 & DP3	1.6	3.2
OS5	40.26	8	13.3	64.0	4	EA5 & DP3.1	1.6	3.4
OS6	60.97	2	8.9	60.6	5	EA3	0.7	1.4
OS7	23.46	2	5.7	38.6	6	EA4	0.5	1.1
OS8	11.42	2	3.4	22.7	6.1	DP5 & DP6	1.2	2.4
EA1	0.22	73	0.8	1.5	7	OS2	4.2	21.6
EA2	0.25	73	0.9	1.7	8	OS3	0.2	1.7
EA3	0.20	71	0.7	1.4	8.1	DP7 & DP8	4.4	22.9
EA4	0.17	65	0.5	1.1	9.1	DP6.1 & DP8.1	4.9	23.8
EA5	0.16	2	0.1	0.5	10	EA7 & EA6	5.6	10.3
EA6	0.70	100	3.2	5.7	11	OS4 & G15 & DP9.1	10.5	144.3
EA7	0.65	89	2.6	4.8	12	OS5	13.3	64.0
EA8	2.08	99	5.0	9.0	12.1	DP11 & DP12	21.6	103.1
EA9	2.99	64	4.6	9.5	13	OS8	3.4	22.7
EA10	1.34	94	4.0	7.4	13.1	DP12.1 & DP13	23.4	115.2
EA11	1.99	66	4.1	8.5	14	EA8	5.0	9.0
EA12	0.92	4	0.5	3.0	15	EA9	4.6	9.5
EA13	1.31	12	1.0	4.0	15.1	DP14 & DP15	9.3	17.9
EA14	13.13	4	4.0	23.0	16	OS6 & G12 (G6*)	22.4	491.0
EA15	1.59	14	1.0	3.9	17	EA10	4.0	7.4
					18	EA11	4.1	8.5
					18.1	DP17 & DP18	8.0	15.4
					19.1	DP15.1 & DP18.1	15.0	28.8
					20	EA12	0.5	3.0
					21	OS7	5.7	38.6
					22	EA13	1.0	4.0
					23	EA14	4.0	23.0
					24	EA15	1.0	3.9

### LEGEND:

PROPOSED MAJOR CONTOUR PROPOSED MINOR CONTOUR EXISTING MAJOR CONTOUR EXISTING MINOR CONTOUR PROPOSED STORM SEWER PROPOSED DRAINAGE SWALE PROPERTY LINE PROPOSED FLOW DIRECTION EXISTING FLOW DIRECTION PROPOSED DRAINAGE BASIN DESIGN POINT







,					
BASIN SUMMARY TABLE					
BASIN	AREA (ac)	% IMPERVIOUS	Q ₅ (cfs)	Q ₁₀₀ (cfs)	
OS1	85.16	-	-	-	
OS2	15.03	7	4.2	21.6	
OS3	1.00	2	0.2	1.7	
OS4	9.60	9	3.8	17.3	
OS5	40.26	8	13.3	64.0	
OS6	60.97	2	8.9	60.6	
OS7	23.46	2	5.7	38.6	
OS8	11.42	2	3.4	22.7	
EA1	0.22	73	0.8	1.5	
EA2	0.25	73	0.9	1.7	
EA3	0.20	71	0.7	1.4	
EA4	0.17	65	0.5	1.1	
EA5	0.16	2	0.1	0.5	
EA6	0.70	100	3.2	5.7	
EA7	0.65	89	2.6	4.8	
EA8	2.08	99	5.0	9.0	
EA9	2.99	64	4.6	9.5	
EA10	1.34	94	4.0	7.4	
EA11	1.99	66	4.1	8.5	
EA12	0.92	4	0.5	3.0	
EA13	1.31	12	1.0	4.0	
EA14	13.13	4	4.0	23.0	
EA15	1.59	14	1.0	3.9	

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PROPOSED MAJOR CONTOUR PROPOSED MINOR CONTOUR EXISTING MAJOR CONTOUR EXISTING MINOR CONTOUR PROPOSED STORM SEWER PROPOSED DRAINAGE SWALE PROPERTY LINE PROPOSED FLOW DIRECTION EXISTING FLOW DIRECTION PROPOSED DRAINAGE BASIN DESIGN POINT

PROPOSED BASIN LABEL



#### DESIGN POINT SUMMARY TABLE DESIGN CONTRIBUTING $\Sigma Q_5$ (cfs) $\Sigma Q_{100}$ (cfs BASINS POINT 1 OS1 & G17 28.3 365.2 0.8 1.5 2 EA1 3 0.9 1.7 EA2 DP2 & DP3 3.2 3.1 1.6 1.6 0.7 4 EA5 & DP3.1 3.4 5 1.4 EA3 0.5 EA4 1.1 6 6.1 1.2 DP5 & DP6 2.4 7 OS2 4.2 21.6 0.2 8 1.7 OS3 DP7 & DP8 4.4 22.9 8.1 4.9 23.8 9.1 DP6.1 & DP8.1 EA7 & EA6 5.6 10.3 10 10.5 OS4 & G15 & DP9.1 144.3 13.3 64.0 OS5 DP11 & DP12 21.6 103.1 12.1 3.4 13 OS8 22.7 13.1 DP12.1 & DP13 23.4 115.2 5.0 9.0 14 EA8 9.5 15 4.6 EA9 15.1 DP14 & DP15 9.3 17.9 16 OS6 & G12 (G6*) 22.4 491.0 17 EA10 4.0 7.4 18 8.5 EA11 4.1 18.1 DP17 & DP18 8.0 15.4 15.0 19.1 DP15.1 & DP18.1 28.8 0.5 3.0 20 EA12

OS7

EA13

EA14

EA15

21

22

23

24

5.7

1.0

4.0

1.0 3.9

38.6

4.0

23.0

PROPOSED CONDITIONS - DRAINAGE MAP







	•
BASIN SUM	MARY TABLE

64

94

66

4

EA131.31121.04.0EA1413.1344.023.0

EA15 1.59 14 1.0 3.9

BASIN ARE

OS1 OS2

OS3

OS4

OS5

OS7 058

EA1

EA2 EA3

EA4 EA5

EA6

EA7

EA8

EA9

EA11

2.99

1.99

EA10 1.34

EA12 0.92

BASIN	DES	10			
REA (ac)	% IMPERVIOUS	Q ₅ (cfs)	Q ₁₀₀ (cfs)	DESIGN POINT	
85.16	-	-	-	1	
15.03	7	4.2	21.6	2	
1.00	2	0.2	1.7	3	
9.60	9	3.8	17.3	3.1	
40.26	8	13.3	64.0	4	
60.97	2	8.9	60.6	5	
23.46	2	5.7	38.6	6	
11.42	2	3.4	22.7	6.1	
0.22	73	0.8	1.5	7	
0.25	73	0.9	1.7	8	
0.20	71	0.7	1.4	8.1	
0.17	65	0.5	1.1	9.1	
0.16	2	0.1	0.5	10	
0.70	100	3.2	5.7	11	Ľ
0.65	89	2.6	4.8	12	
2.08	99	5.0	9.0	12.1	

4.6 9.5 4.0 7.4

4.1 8.5

0.5 3.0

### 

DES	IGN POINT 50		ABLE
DESIGN	CONTRIBUTING		
POINT	BASINS	$\Sigma Q_5$ (CIS)	∑Q ₁₀₀ (CIS)
1	OS1 & G17	28.3	365.2
2	EA1	0.8	1.5
3	EA2	0.9	1.7
3.1	DP2 & DP3	1.6	3.2
4	EA5 & DP3.1	1.6	3.4
5	EA3	0.7	1.4
6	EA4	0.5	1.1
6.1	DP5 & DP6	1.2	2.4
7	OS2	4.2	21.6
8	OS3	0.2	1.7
8.1	DP7 & DP8	4.4	22.9
9.1	DP6.1 & DP8.1	4.9	23.8
10	EA7 & EA6	5.6	10.3
11	OS4 & G15 & DP9.1	10.5	144.3
12	OS5	13.3	64.0
12.1	DP11 & DP12	21.6	103.1
13	OS8	3.4	22.7
13.1	DP12.1 & DP13	23.4	115.2
14	EA8	5.0	9.0
15	EA9	4.6	9.5
15.1	DP14 & DP15	9.3	17.9
16	OS6 & G12 (G6*)	22.4	491.0
17	EA10	4.0	7.4
18	EA11	4.1	8.5
18.1	DP17 & DP18	8.0	15.4
19.1	DP15.1 & DP18.1	15.0	28.8
20	EA12	0.5	3.0
21	OS7	5.7	38.6
22	EA13	1.0	4.0
23	EA14	4.0	23.0
24	EA15	1.0	3.9

## LEGEND:

PROPOSED MAJOR CONTOUR PROPOSED MINOR CONTOUR EXISTING MAJOR CONTOUR EXISTING MINOR CONTOUR PROPOSED STORM SEWER PROPOSED DRAINAGE SWALE PROPERTY LINE PROPOSED FLOW DIRECTION EXISTING FLOW DIRECTION PROPOSED DRAINAGE BASIN DESIGN POINT









# BASIN SUMMARY TABLE

BASIN AREA (ac) % IMPERVIOUS On (cfs) One

DASIN	AREA (ac)	% INPERVIOUS	$Q_5$ (CIS)	Q ₁₀₀ (CIS)
OS1	85.16	-	-	-
OS2	15.03	7	4.2	21.6
OS3	1.00	2	0.2	1.7
OS4	9.60	9	3.8	17.3
OS5	40.26	8	13.3	64.0
OS6	60.97	2	8.9	60.6
OS7	23.46	2	5.7	38.6
OS8	11.42	2	3.4	22.7
EA1	0.22	73	0.8	1.5
EA2	0.25	73	0.9	1.7
EA3	0.20	71	0.7	1.4
EA4	0.17	65	0.5	1.1
EA5	0.16	2	0.1	0.5
EA6	0.70	100	3.2	5.7
EA7	0.65	89	2.6	4.8
EA8	2.08	99	5.0	9.0
EA9	2.99	64	4.6	9.5
EA10	1.34	94	4.0	7.4
EA11	1.99	66	4.1	8.5
EA12	0.92	4	0.5	3.0
EA13	1.31	12	1.0	4.0
EA14	13.13	4	4.0	23.0
EA15	1.59	14	1.0	3.9

DES	IGN POINT SU	MMARY TA	ABLE
DESIGN POINT	CONTRIBUTING BASINS	$\Sigma Q_5$ (cfs)	∑Q ₁₀₀ (cfs)
1	OS1 & G17	28.3	365.2
2	EA1	0.8	1.5
3	EA2	0.9	1.7
3.1	DP2 & DP3	1.6	3.2
4	EA5 & DP3.1	1.6	3.4
5	EA3	0.7	1.4
6	EA4	0.5	1.1
6.1	DP5 & DP6	1.2	2.4
7	OS2	4.2	21.6
8	OS3	0.2	1.7
8.1	DP7 & DP8	4.4	22.9
9.1	DP6.1 & DP8.1	4.9	23.8
10	EA7 & EA6	5.6	10.3
11	OS4 & G15 & DP9.1	10.5	144.3
12	OS5	13.3	64.0
12.1	DP11 & DP12	21.6	103.1
13	OS8	3.4	22.7
13.1	DP12.1 & DP13	23.4	115.2
14	EA8	5.0	9.0
15	EA9	4.6	9.5
15.1	DP14 & DP15	9.3	17.9
16	OS6 & G12 (G6*)	22.4	491.0
17	EA10	4.0	7.4
18	EA11	4.1	8.5
18.1	DP17 & DP18	8.0	15.4
19.1	DP15.1 & DP18.1	15.0	28.8
20	EA12	0.5	3.0
21	0\$7	5.7	38.6
22	EA13	1.0	4.0
23	EA14	4.0	23.0
24	EA15	1.0	3.9

# LEGEND:

PROPOSED MAJOR CONTOUR PROPOSED MINOR CONTOUR EXISTING MAJOR CONTOUR EXISTING MINOR CONTOUR PROPOSED STORM SEWER PROPOSED DRAINAGE SWALE PROPERTY LINE PROPOSED FLOW DIRECTION EXISTING FLOW DIRECTION PROPOSED DRAINAGE BASIN DESIGN POINT

PROPOSED BASIN LABEL



PROPOSED CONDITIONS - DRAINAGE MAP

SHEET DRN



# Grandview Reserve CLOMR REPORT

July 2022 Revised: March 22, 2023 HR Green Project No: 201662.03 PCD File No. CDR228

Prepared By:

HR Green Development, LLC Contact: Greg Panza, PE gpanza@hrgreen.com 720-602-4999 > HRGREEN.COM



# **Table of Contents**

Granc	Iview Reserve CLOMR Report1
Projec	t Narrative1
Hydro	logy2
Hydra	ulics
a.	Duplicate Effective Model5
b.	Existing Conditions Model5
C.	Proposed Conditions Model5
Mainte	enance Considerations
Conclu	usion6
Apper	dix A MT-2 Forms7
Apper	dix B Certified Topo8
Apper	dix C Annotated Firm9
Apper	dix D Proposed Plans
Apper	dix E Floodway Notice
Apper	dix F Endangered Species Act Compliance12
Apper	dix G MT – 2 Checklist
Apper	dix H Existing Condition Cross Sections 14
Apper	dix I Future Condition Cross Sections
Apper	dix J Proposed Hydrology Calculations and Reference Materials
Apper	dix K Preliminary Onsite Pond Sizing Spreadsheets 17



# **Grandview Reserve CLOMR Report**

# **Project Narrative**

This report was prepared by HR Green to support the submission of MT-2 forms and documents in a request for a Conditional Letter of Map Revision (CLOMR) for channel improvements along Geick Ranch Tributary 1 and Geick Ranch Tributary 2. This request impacts the current delineation of the 100-year boundary on Flood Insurance Rate Maps (FIRMs) 08041C0552G and 08041C0556G.

Grandview Reserve is located in Falcon, Colorado within El Paso County and contains approximately 776 acres within the south half of section 21 and 22 and the north half of section 27 and 28, Township 12 South, and Range 66 West of the Sixth Principal Meridian in Ela Paso County, Colorado.

Grandview Reserve (GVR) falls within the Gieck Ranch Drainage Basin which covers approximately 22 square miles. This drainage basin is tributary to Black Squirrel Creek and joins said creek just to the south of Elicott, CO about 18 miles to the south. Black Squirrel Creek eventually drains to the Arkansas River in Pueblo Colorado. Much of the Gieck Ranch Drainage basin is undeveloped consisting of rural farmland. The Gieck Ranch Drainage basin lies north of the Haegler Ranch drainage basin. The channels through the Grandview property can all be described as gently sloping drainages that roll through the site towards the creeks, they are tributary too.

Per the NRCS web soil survey, the site is made up entirely of Type A and B soils. The majority of which are Type A soils. The predominate soils are Blakeland loamy sand, Columbine gravelly sandy loam, and Stapleton sandy loam. The first two soils are Type A soil and cover approximately 55.1% of the site and the later soil is a Type B soil and covers the remaining 44.9% of the site.

The vegetation found within Grandview Reserve consists of wetland communities in the floodplain with a transitional area to shortgrass prairie communities that dominate the site. The primary species found in the shortgrass prairie regions include little bluestem, blue grama, and buffalograss. The transitional area between the wetlands and shortgrass prairie includes patches of snowberry, and wood's rose. There are a few plains cottonwoods along the main channels. The area has historically been heavily grazed and there are weeds throughout the site. Weeds found onsite include Canada thistle, Russian thistle, common mullein and yellow toadflax spp.

Observations of the existing channels suggest that they are at equilibrium with their watershed flows; evidence including relatively stable bankfull channels, adequate floodplain (above bankfull channel elevations) and in-tact plant communities that would be expected in this type of reach support the notion that the reach is in equilibrium.

At present, the preliminary analysis and design of Geick Ranch Tributary 1 (GRT1) and Geick Ranch Tributary 2 (GRT2) has been completed. Geick Ranch Tributary 1 is to be left in its current state with the exception of the reach surrounding the existing breached stock pond berm. This berm is to be removed and the surrounding region is to be regraded and stabilized to match the existing channel conditions.

Proposed improvements for Geick Ranch Tributary 2 include the realignment of the channel, generally shifting the channel towards the west to accommodate the proposed land plan. There is to be a dedicated 100' wide corridor in which the valley will meander. The valley is the area needed to fully contain the 100-year event plus freeboard requirements. Preliminary analysis indicates the valley will have an average width of approximately 63'; initial sizing approximates the bankfull width to be 8.8' - 13.8'. The valley and channel thalweg will generally follow the same profile, with some deviation as the bankfull channel meanders through the valley in turn decreasing the low flow channels average slope. The average valley profile is to be approximately 1% with a series of grade control



structures to both decrease elevation and dissipate energy to meet natural channel criteria as outlined in El Paso County criteria.

# Hydrology

Proposed flows were used for the existing and proposed HEC-RAS models for GR1 and GR2.

Offsite flows entering the site were assumed to remain the same as presented in the locally approved and accepted basin study referred to as the Meridian Ranch Master Development Drainage Plan (MDDP). This report was published by Tech Contractors in July of 2021. Flows were pulled from the most current version of the HEC-HMS model for the Meridian Ranch MDDP for Gieck Ranch Tributary 1 (GRT1) at design point G06 and for Gieck Ranch Tributary 2 (GRT2) at design point G16. The location of these drainage basins and design points can be visualized in the Grandview Proposed Drainage Map exhibit in Appendix J. The proposed HEC- HMS model did not have a 100-year peak discharges for design point G18, basin OS10, basin OS10, and basin FG38. These values were calculated, and the existing model was updated to assess flows entering Geick Ranch Tributary 2 at Eastonville Road. Calculations can be found in Appendix J.

Per the proposed Meridian Ranch HEC-HMS model, the 100-year flow entering GRT2 on the north boundary of the site at design point G18 is 365.2 CFS (station 70+29.02 along the existing channel alignment). As the channel works through the existing site, the 100-year flow increases to 528.6 cfs at station 35+75 along the existing channel where design point G16 (112.1 CFS) is expected to enter the channel. The 100-year flow entering GRT1 on the west boundary of the site via design point G06 is 491 CFS.

Onsite flows will remain the same as historic or runoff due to development will be controlled by the various ponds that are to be constructed near the channel. Proposed onsite flows were calculated via CUHP and preliminary pond sizing/peak discharge rates can be found in Appendix K. Peak discharges were used in the HEC-RAS model for a more conservative approach. The locations of the proposed ponds can be found on the Grandview Proposed Drainage Map exhibit in Appendix J.

See Table 1 and Table 2 for summaries of proposed flows for the existing GRT1 and GRT2 respectively.

STATION	CUMULATIVE 100-YR STORM (CFS)	INPUT DESCRIPTION AND FLOW (CFS)
37+12.84	491.0	Design Point G06 (491.0 cfs)
34+24+50	521.0	Tributary 1 Flows (30.0 cfs)
23+03.17	541.4	Pond B (14.7 cfs) and Pond D (5.7 cfs)
12+97.03	551.9	Pond E (10.5 cfs)

### Table 1 – PROPOSED FLOWS FOR THE EXISTING GEICK RANCH TRIBUTARY 1

#### Table 2 – PROPOSED FLOWS FOR THE EXISTING GEICK RANCH TRIBUTARY 2

STATION	CUMULATIVE 100-YR STORM (CFS)	INPUT DESCRIPTION AND FLOW (CFS)
70+29.02	365.2	Design Point G18 (365.2 cfs)
53+21.63	477.3	Tributary 2 flows + OS-11 (14.0 cfs)
35+75.47	528.6	Design Point G16 (112.1 cfs)
29+55.21	544	Pond A (15.4 cfs)
25+59.12	591.9	Pond F (18.6 cfs)
8+02.78	614.4	Pond G (69.2 cfs)
4+60.25	702.5	Pond C (22.5 cfs)



### Table 3 and Table 4 summarize the proposed flows for GRT1 and the realigned portion of GRT2 respectively.

STATION	CUMULATIVE 100-YR STORM (CFS)	INPUT DESCRIPTION AND FLOW (CFS)						
37+12.84	491.0	Design Point G06 (491.0 cfs)						
34+24+50	521.0	Tributary 1 Flows (30.0 cfs)						
24+78.84	541.4	Pond B (14.7 cfs) and Pond D (5.7 cfs)						
12+97.03	551.9	Pond E (10.5 cfs)						

Table 3 - FUTURE FLOWS FOR PROPOSED GEICK RANCH TRIBUTARY 1

### Table 4- FUTURE FLOWS FOR PROPOSED GEICK RANCH TRIBUTARY 2

STATION	CUMULATIVE 100-YR STORM (CFS)	INPUT DESCRIPTION AND FLOW (CFS)
70+29.02	365.2	Design Point G18 (365.2 cfs)
56+42	477.3	Tributary 2 flows + OS-11 (14.0 cfs)
38+80	528.6	Design Point G16 (112.1 cfs)
30+40	544	Pond A (15.4 cfs)
27+15	591.9	Pond A (18.6 cfs)
10+50	614.4	Pond B (69.2 cfs)
7+45	702.5	Pond C (22.5 cfs)

# **Hydraulics**

Design criteria were developed to guide a preliminary layout of channel dimension, planform, and profile for the realigned segment of GRT2. Published criteria from the Urban Stormwater Drainage Criteria Manual, Volume 1 (USDCM; Urban Drainage and Flood Control District, 2016), El Paso County DCM and various other reports currently in process for the drainages through GVR and completed for GVR drainages were used for initial design parameter and flow rates. Parameters used and minimum bankfull geometry is summarized in Table 5.

### Table 5 - DESIGN PARAMETERS

Design Parameter	Design Value
Roughness values	EPC Table 10-2
Maximum 5-year velocity, main channel (within bankfull channel width) (ft/s)	EPC: 2.5 ft/s MHFD: 5 ft/s*
Maximum 100-year velocity, main channel (within bankfull channel width) (ft/s)	EPC: 2.5 ft/s MHFD: 7 ft/s*
Froude No., 5-year, main channel (within bankfull channel width)	0.7
Froude No., 100-year, main channel (within bankfull channel width)	0.85
Maximum shear stress, 100-year, main channel (within bankfull channel width)	1.2 lb/sf
Minimum bankfull capacity of bankfull channel (based on future development conditions)	2 year, 19 - 33.5 cfs
Minimum bankfull channel geometry ¹	
Design Channel Type	C4
Entrenchment Ratio	2.7-31.65 (x=5.26)
Width to depth ratio	13.5-75.0 (x=29.28)
Sinuosity	1.43-2.80 (x=1.92)



Slope	0.0001-0.0184 (x=0.0045)
D ₅₀	12-14mm (~0.5 in)
d ₈₄	32-48mm (~1.6in)
Meander Length ²	34-92 (x=56)
Belt Width ²	18-55 (x=32)
Radius of Curvature ²	7-28 (x=11)
Minimum Floodplain Terrace	6 ft
Maximum overbank side slope	4(H):1(V)
Maximum bankfull side slope	2.5(H):1(V)
Maximum bankfull side slope	2.5(H):1(V)
Minimum bottom width ³	4.8 ft
Freeboard	1.5 ft

¹ These values were derived from empirical data and will be used as guidelines for design and will be used in conjunction with hydraulic regime equations as outlined in "Spreadsheet Tools for River Evaluation, Assessment, and Monitoring: The STREAM Diagnostic Modules"

²These values are derived from "Spreadsheet Tools for River Evaluation, Assessment, and Monitoring: The STREAM Diagnostic Modules"

 3 Minimum bottom width shown is for the low flow channel only. The main channel will be  41  ft wide

The 2-year frequency was selected for the design of the bankfull channel to approximate the flow most likely to govern a stable geometry. Prior reports estimated future 2-year flow as ~15-cfs and assumes no culvert effects; i.e., open channel flow un-affected by a culvert. The future 2-year flow (19-33.5 cfs) was used to size the low flow channel. This resulted in a channel with a minimum bottom width varying from 4.8 feet - 9.8 feet, 0.8 feet deep with 2.5:1 side slopes for a bankfull width varying from 8.8 feet to 13.8 feet, assuming a mean channel longitudinal slope of 0.9%. Equations as shown in the spreadsheet should produce low shear values within the channel section however further analysis using HEC-RAS was completed to determine the final geometry of said channel. The effective discharge channel is highly correlated to the "bankfull" channel (Leopold 1994) As several channel geometrics are derived from bankfull channel width, depth, cross sectional area and sinuosity, and that USDCM and the OSP report design criteria parameters relate to bankfull width, we have chosen bankfull width to serve as the foundation of design.

To determine an appropriate bankfull width, Leopold's generalized width estimate was first calculated (1994, as presented in USDCM Vol 1):

 $W = aQ^{0.5}$ 

Where:

w = bankfull width of channel (top width when conveying bankfull discharge)

- Q = bankfull discharge (10.5 cfs)
- a = 2.7 (wide bankfull channel)
  - 2.1 (average bankfull channel width)
  - 1.5 (narrow bankfull channel)

Assuming an average bankfull width, the equation would estimate a 6.8-ft bankfull width. It is important to note that the Leopold equation lumps all channel types of varying width-to-depth rations. To perform a check on this estimation, worksheet alternative iterations of channel width from 4-12 feet were performed to find the depth associated with the 2-year flow. Chanel slope was set to 0.09 to best fit the average valley slope, side slopes were assumed to be 2.5:1 and manning's "n" was assumed to be 0.035. The resulting channel depth was divided into each iteration's width to identify the iteration with a width-to-depth ratio most closely associated with a Type-C



channel. Given the valley type of the proposed project (Unconfined Alluvial Valley), we can expect Type-C and Type-E channels to represent stable channel geomorphologies. Given the setting and valley slope, we have chosen a Type-C (riffle-pool morphology) channel. Type-C channels typical have width-to-depth ratios >12, with gravel and sand bottomed systems averaging 29 and 27, respectively (13.5-28.7 for 60% of gravel bed streams 12.6-29.2 for 50% of sand bed streams; Rosgen 1996). Given these ranges, the channel alternative with a OPC 2-yr flow-dependent channel depth that, when divided into its corresponding width, yielded a W/D between 10.7 – 36.7.

The resulting channel, then, has the following general dimensions:

- Bottom width = 4.8 ft 9.8 ft
- Top Width = 8.8 ft 13.8 ft
- Average Depth_{Riffle} = 0.8 ft
- Width:Depth (W/D) Ratio = 11.3
- Cross Sectional Area = 5.44 ft² 9.44 ft²

The resulting channel dimensions listed above were then used to do the initial site grading of GRT2. The channel was then modeled in HEC- RAS and the geometry was further refined to reduce velocities, shear stresses, and the Froude number to fall within acceptable ranges.

GRT1 is to be left in its current state as analysis indicates it will remain in a stable state after development. The only proposed change is to remove the existing stock pond; that segment of the channel is to be graded to match the adjacent existing geometry.

Ultimate project hydraulics were evaluated through HEC-RAS 5.0.5. The following sections delve into the use and evaluation of the duplicate effective model and the development of the proposed conditions model.

### a. Duplicate Effective Model

There is no existing effective model.

### b. Existing Conditions Model

The existing conditions models were created to serve as a baseline for comparing future conditions to existing conditions. The existing conditions models were created by exporting cross sections from CAD along the existing channel alignments. Manning's roughness "n" values were selected to represent the existing conditions of the channel by following EPC's guidance in table 10-2. Existing flow rates were derived as described in the hydrology section above and are summarized in Table 1 and Table 2. Resulting water surface elevation for the 100-year event can be found in Appendix H.

### c. Proposed Conditions Model

The proposed conditions model for GRT1 was developed by copying the geometry for the existing channel and updating the cross sections surrounding the existing stock pond to account for its removal and regrading of that segment of the channel. Manning's roughness "n" values were selected to represent the proposed conditions of the project area and follow EPC's guidance in table 10-2.

In the existing GRT1 model, the steady flow rate data included four changes in flow rate to account for flow contributions from the project site, which correspond to the same sections in the proposed condition model. Flows were modeled in the future condition using flow rates that remained the same as future detention along the channel is to release at historic rates, these flows are summarized in the preceding hydrology section in Table 2



and Table 3. The last three cross sections were used to confirm the water surface elevation remained within tolerance. Cross sections can be referenced in Appendix I.

The proposed conditions model for GRT2 was developed to account for changes to the channel alignment, geometry, and the proposed culverts along the new channel alignment. The proposed conditions model was created by exporting sample lines along the new alignment that sampled the proposed grading. Manning's roughness "n" values were selected to represent the proposed conditions of the project area and follow EPC's guidance in table 10-2.

In the existing GRT2 model, the steady flow rate data included seven changes in flow rate along the channel, these changes are described in the preceding hydrology section in Table 2 and Table 4. Ineffective flow areas were added to cross sections within the project reach upstream and downstream of culverts to account for areas not actively conveying water due to turbulence. The last three cross sections along the modeled channel are identical to the last three cross sections in the existing conditions model and were used to confirm the water surface elevation remained within tolerance and to adequately evaluate the tailwater. Cross sections can be referenced in Appendix I.

# **Maintenance Considerations**

Natural stream design approaches take into consideration short and long term maintenance needs by providing a high functioning low maintenance stream (HFLMS). By spreading more frequent storm events into the floodplain terrace, water is introduced into the uplands species of the riparian corridor to provide irrigation flows. Additionally using naturally armored rundown riffles and pools vs larger grade control structures maintenance is limited to mainly trash removal and noxious weed control. Additionally as outlined above the design takes into consideration various flow regimes in order to analyze proposed stream corridor stresses and apply low maintenance stabilization measures to help stabilize and control sediment degradation and aggradation within the channel.

## Conclusion

After evaluating the impacts of the proposed channel improvements to the segment of GRT1 and GRT2 between Eastonville Road to the northwest (upstream) and the south-central project boundary (downstream) it is not anticipated that the BFE will change outside of the project. The reevaluation of the 1% chance of annual occurrence event limits has been delineated and has a footprint for GRT2 that does not fall entirely within the boundary delineated in the FIRM effective 2018; this is largely due to the realignment of the channel, improved topography within the Zone A area and the overall footprint of the 1% chance of annual occurrence is significantly narrower than the previous delineation. BFEs at the location of tie in at the boundary of the site is not shown to rise more than 0.00' in the modeling completed in this assessment. Cross sections for GRT1 and GRT2 can be found in Appendix H and Appendix I to compare the 100year water surface elevation for both the existing and proposed conditions.



Grandview Reserve CLOMR Report Project No.: 201662.03

Appendix A MT-2 Forms

#### PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. Please do not send your completed survey to the above address.

#### PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

**PRINCIPAL PURPOSE(S):** This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

**ROUTINE USE(S):** The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

**DISCLOSURE:** The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

#### A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a (check one):

CLOMR: A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

LOMR: A letter from DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72)

#### **B. OVERVIEW**

1.	1. The NFIP map panel(s) affected for all impacted communities is (are):										
Cor	Community No. Community Name						State	Map No.	Panel No.	Effective Date	
Exa	mple	: 480301 480287	City of Katy Harris County					TX TX	48473C 48201C	0005D 0220G	02/08/83 09/28/90
080	059		EL PASO COUNTY	•				со	08041C0552G	0552G	12/7/2018
080	059		EL PASO COUNTY					со	08041C0556G	0556G	12/7/2018
2.	a. F	looding Sour	Ce: Geick Ranch Ti	ributary 2							
	b. T	ypes of Flood	ding: 📕 Riverin	ne	☐ Coastal	☐ Shallow	Flooding (e.g.,	Zones AO	and AH)		
			🗌 Alluvia	lfan	Lakes	Other (	Attach Descripti	ion)			
3.	Pro	ject Name/Ide	entifier: GRANDV	IEW RESI	ERVE GEICK RANCI	H TRIBUTARY 1 A	AND 2 IMPROVEME	NTS			
4.	FEN	/IA zone desi	gnations affected	d: A	(choices: A, A	AH, AO, A1-A	30, A99, AE, AF	R, V, V1-V3	0, VE, B, C, D,	X)	
5.	Bas	is for Reques	and Type of R	evision:							
	a.	The basis fo	or this revision re	equest is	s (check all that	apply)					
		E Physical	Change	📕 Imp	proved Methodo	logy/Data	Regulatory	/ Floodway	Revision [	🗌 Base Map Cł	nanges
	🗌 Coastal Analysis 📃 Hyd			draulic Analysis		Hydrologic Analysis		I	Corrections		
	U Weir-Dam Changes		Levee Certification     Alluv		🗌 Alluvial Fan Analysis		I	Natural Changes			
New Topographic Data 🛛 Other (Attach Description)											
	Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.										

b. The area of revision encompasses the following structures (check	all that apply)	b. The area of revision encompasses the following structures (check all that apply)							
Structures: Channelization Levee/Floodwall Bridge/Culvert									
🗆 Dam 🔷 Fill		Other (Attach Des	scription)						
6. Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information.									
C. REVI	C. REVIEW FEE								
Has the review fee for the appropriate request category been included?									
		No, Attach Explana	tion						
Please see the DHS-FEMA Web site at http://www.fema.gov/plan/prevent/fl	hm/frm_fees.shtm f	or Fee Amounts and	Exemptions.						
D. SIGN	IATURE								
All documents submitted in support of this request are correct to the best of r fine or imprisonment under Title 18 of the United States Code, Section 1001.	ny knowledge. I un	derstand that any fals	e statement may be punishable by						
Name: GREG PANZA	Company: HR GR	EEN							
Mailing Address: 5619 DTC PARKWAY	Daytime Telepho	Daytime Telephone No.: 720-602-4939 Fax No.:							
GREENWOOD VILLAGE, CO 80111	E-Mail Address: gpanza@hrgreen.com								
Signature of Requester (required):		Date: 7/22/2022							
As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirements for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For Conditional LOMR requests, the applicant has documented Endangered Species Act (ESA) compliance to FEMA prior to FEMA's review of the Conditional LOMR application. For LOMR requests, I acknowledge that compliance with Sections 9 and 10 of the ESA has been achieved independently of FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and									
Community Official's Name and Title: KEITH CURTIS, CFM, FLOODPLAIN ADMINIS	STRATOR	Community Name:	EL PASO COUNTY/PPRBD						
Mailing Address: 2880 INTERNATIONAL CIRCLE	Daytime Telepho	ne No.: 719-327-2898	Fax No.:						
COLORADO SPRINGS, CO 80910	E-Mail Address:	KEITH@PPRBD.ORG	1						
Community Official's Signature (required):	<u> </u>	Date: 7/22/2022							
CERTIFICATION BY REGISTERED PROFESSI	ONAL ENGINEE	R AND/OR LAND	SURVEYOR						
This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.									
Certifier's Name: GREG PANZA	License No.: 37081 Expiration Date: 10-31-2023								
Company Name: HR GREEN	Telephone No.:         720-602-4939         Fax No.:								
Signature: Jugo Date: 7/22/2022 E-Mail Address: gpanza@hrgreen.com									

Ensure the forms that are appropriate to your revision request are included in your submittal.							
Form Name and (Number) Required if							
Riverine Hydrology and Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations	A Care and					
Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam	Kosta-					
Coastal Analysis Form (Form 4)	New or revised coastal elevations	7/22/2022					
Coastal Structures Form (Form 5)	Addition/revision of coastal structure	SONAL EN					
Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans						

#### U.S. DEPARTMENT OF HOMELAND SECURITY FEDERAL EMERGENCY MANAGEMENT AGENCY RIVERINE HYDROLOGY & HYDRAULICS FORM

#### PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.** 

#### PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

**PRINCIPAL PURPOSE(S):** This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

**ROUTINE USE(S):** The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

**DISCLOSURE:** The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Geick Ranch Tributary 1

Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1.	. Reason for New Hydrologic Analysis (check all that apply)						
	□ Not revised (skip to section B)	No existing analysis		Improved data			
	Alternative methodology	Proposed Conditions (		Changed physical cor	ndition of watershed		
2.	Comparison of Representative 1%-Ann	ual-Chance Discharges					
	Location	Drainage Area (Sq. Mi.)	Effective/FIS (	cfs)	Revised (cfs)		
	Upstream of project site, west of Eastonville Road	1.04	413		491		
3.	Methodology for New Hydrologic Analys	sis (check all that apply)		SCS Curve Number Method Meridian Ranch MDDP Appr	/HEC-HMS Model from roved July 2021 by Tech		
	Statistical Analysis of Gage Records	s Precipitation/Runoff M	odel $\rightarrow$ Specify Model	Contractors			
	Regional Regression Equations	Other (please attach d	escription)				
	Please enclose all relevant models in di new analysis.	gital format, maps, computations	(including computation	of parameters), and do	ocumentation to support the		
4.	Review/Approval of Analysis						
	If your community requires a regional, s	tate, or federal agency to review t	he hydrologic analysis,	, please attach evidenc	e of approval/review.		
5.	Impacts of Sediment Transport on Hydr	ology					
	Is the hydrology for the revised flooding	source(s) affected by sediment tr	ansport? 🗌 Yes 🛛	No			
	If yes, then fill out Section F (Sediment	Transport) of Form 3. If No, then	attach your explanatior	n			

### **B. HYDRAULICS**

1. Reach to be Revised									
	Descript	tion	Cross Section	Water-Surface E	levations (ft.)				
Downstream Limit*	IMMEDIATELY DS OI	F IMPROVEMENTS	2121.94	Effective 6961.58	Proposed/Revised 6961.58				
Upstream Limit*	IMMEDIATELY US O	F IMPROVEMENTS	3424.5	6987.63	6987.63				
*Proposed/Revised elevations must ti	ie-into the Effective e	levations within 0.5	foot at the downstream a	and upstream limits of rev	vision.				
2. Hydraulic Method/Model Used:	2. Hydraulic Method/Model Used: HEC RAS 5.0.5 (with vertical datum: North American Vertical Datum of 1988 (NAVD88))								
<ol> <li>Pre-Submittal Review of Hydraulic DHS-FEMA has developed two re respectively. We recommend that</li> </ol>	<u>c Models*</u> view programs, CHE ; you review your HE(	CK-2 and CHECK-F C-2 and HEC-RAS r	AS, to aid in the review nodels with CHECK-2 a	of HEC-2 and HEC-RAS nd CHECK-RAS.	hydraulic models,				
4. Models Submitted	Natura	<u>ll Run</u>	<u>FI</u>	loodway Run	<u>Datum</u>				
Duplicate Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:					
Corrected Effective Model*	File Name:	N/A Plan Name:	File Name:	Plan Name:					
Existing or Pre-Project	File Name:	Plan Name:	File Name:	Plan Name:					
Revised or Post-Project Conditions Model	GRT1.prj File Name: GRT1.prj	Plan Name: GRT1 PROPOSED	File Name:	N/A Plan Name:					
Other - (attach description)	File Name:	N/.	A File Name:	Plan Name:					
* For details, refer to the correspondir	ng section of the instr	ructions.							
	📒 Di	igital Models Submit	ted? (Required)						
	C	C. MAPPING REC	QUIREMENTS						
A certified topographic work map must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).									
Topographic Information: <u>vertical datur</u>	m: North American Vertical I	Datum of 1988 (NAVD88)							
Source:		Date:	7/22/2022						
Accuracy:									
Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach <b>a copy of the effective FIRM and/or FBFM</b> , at the same scale as the original, annotated to show the boundaries of the revised 1%-and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%-and 0.2%-annual-chance floodplain and regulatory floodway that tie-in with the boundaries of the effective 1%-and 0.2%-annual-chance floodplain and regulatory floodway the area on revision.									

### D. COMMON REGULATORY REQUIREMENTS*

1.	For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase?	🗌 Yes 📕 No
	a. For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the	VFIP regulations:
	The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot compa conditions.	red to pre-project
	<ul> <li>The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases abo compared to pre-project conditions.</li> </ul>	ove 1.00 foot
	b. Does this LOMR request cause increase in the BFE and/or SFHA compared with the effective BFEs and/or SFHA? If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of notifications can be found in the MT-2 Form 2 Instructions.	Yes 📕 No 🗹 Yes
2.	Does the request involve the placement or proposed placement of fill?	🗌 Yes 📕 No
	If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in according NFIP regulations set forth at 44 CFR 60.3(A)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more inform	ructures or ordance with the nation.
З.	For LOMR requests, is the regulatory floodway being revised?	🗌 Yes 📕 No
	If Yes, attach <b>evidence of regulatory floodway revision notification</b> . As per Paragraph 65.7(b)(1) of the NFIP Regulations, required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-char [studied Zone A designation] unless a regulatory floodway is being established. Elements and examples of regulatory floodway notification can be found in the MT-2 Form 2 Instructions.)	notification is nce floodplains / revision
4.	For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Section Endangered Species Act (ESA).	is 9 and 10 of the
For con	actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the ag npliance with Section 7(a)(2) of the ESA. Please see the MT-2 instructions for more detail.	jency showing its

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY
RIVERINE STRUCTURES FORM

O.M.B. NO. 1660-0016 Expires February 28, 2014

#### PAPERWORK BURDEN DISCLOSURE NOTICE

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Flooding Source: Geick Ranch Tributary 1

Note: Fill out one form for each flooding source studied.

			A. GENERAL							
Comp	Complete the appropriate section(s) for each Structure listed below: Channelizationcomplete Section B Bridge/Culvertcomplete Section C Damcomplete Section D Levee/Floodwallcomplete Section E Sediment Transportcomplete Section F (if required)									
1.	Name of Structure: Tributary 1									
	Type (check one):	Channelization	Bridge/Culvert	Levee/Floodwall	🗌 Dam					
	Downstream Limit/Cross Se	Section:								
2.	Name of Structure:	_								
	Type (check one):	Channelization	Bridge/Culvert	Levee/Floodwall	🗌 Dam					
	Location of Structure:									
	Downstream Limit/Cross	Section:								
	Upstream Limit/Cross Se	ection:								
3.	Name of Structure:	_								
	Type (check one)	Channelization	Bridge/Culvert	Levee/Floodwall	🗌 Dam					
	Location of Structure:									
	Downstream Limit/Cross	Section:								

	Upstream Limit/Cross Section:			
	NOTE: FOR MORE STRUCTURES, ATTACH ADDITIONAL PAGES AS NEEDED.			
	B. CHANNELIZATION			
Floo	ding Source: Geick Ranch Tributary 1			
Nam	Name of Structure: Tributary 1			
1.	Hydraulic Considerations			
	The channel was designed to carry (cfs) and/or the <u>100</u> -year flood.			
	The design elevation in the channel is based on (check one):			
	□ Subcritical flow □ Critical flow □ Supercritical flow ■ Energy grade line			
	If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.			
	□ Inlet to channel □ Outlet of channel □ At Drop Structures □ At Transitions			
	Other locations (specify):			
2.	Channel Design Plans			
	Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.			
3.	Accessory Structures			
	The channelization includes (check one):         Levees [Attach Section E (Levee/Floodwall)]       Drop structures       Superelevated sections         Transitions in cross sectional geometry       Debris basin/detention basin [Attach Section D (Dam/Basin)]       Energy dissipator			
	Weir Other (Describe):			
4.	Sediment Transport Considerations			
A	Are the hydraulics of the channel affected by sediment transport? 🔲 Yes 📕 No			
lf cons	yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not the channel was besigned to include armoning as needed to prevent adverse sediment transport/scouring.			

#### U.S. DEPARTMENT OF HOMELAND SECURITY FEDERAL EMERGENCY MANAGEMENT AGENCY RIVERINE HYDROLOGY & HYDRAULICS FORM

#### PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.** 

#### PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

**PRINCIPAL PURPOSE(S):** This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

**ROUTINE USE(S):** The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

**DISCLOSURE:** The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Geick Ranch Tributary 2

Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1.	Reason for New Hydrologic Analysis (check all that apply)				
	Not revised (skip to section B)	No existing analysis		Improved data	
	Alternative methodology	Proposed Conditions	(CLOMR)	Changed physical cond	dition of watershed
2.	Comparison of Representative 1%-Annual	I-Chance Discharges			
	Location D	rainage Area (Sq. Mi.)	Effective/FIS (	cfs)	Revised (cfs)
	Upstream of project site, west of Eastonville Road	0.5	280		365.2
3.	Methodology for New Hydrologic Analysis (check all that apply) SCS Curve Number Method/HEC-HMS Model from				HEC-HMS Model from
	Statistical Analysis of Gage Records	Precipitation/Runoff M	lodel $\rightarrow$ Specify Model	Contractors. Calcs provided.	wed July 2021 by Tech
	Regional Regression Equations	Other (please attach of a stach  lescription)			
	Please enclose all relevant models in digit new analysis.	al format, maps, computations	(including computation	of parameters), and doc	cumentation to support the
4.	Review/Approval of Analysis				
	If your community requires a regional, stat	e, or federal agency to review	the hydrologic analysis,	please attach evidence	of approval/review.
5.	Impacts of Sediment Transport on Hydrold	рду			
	Is the hydrology for the revised flooding so	ource(s) affected by sediment t	ransport? 🗌 Yes	No	
	If yes, then fill out Section F (Sediment Tra	ansport) of Form 3. If No, then	attach your explanation	ı	

### **B. HYDRAULICS**

1. <u>Reach to be Revised</u>				
	Description	Cross Section	Water-Surface El	evations (ft.)
Downstream Limit*	IMMEDIATELY DS OF PROJECT	-296.57	Effective 6909.26	Proposed/Revised 6909.26
Upstream Limit*	EASTONVILLE RD	5964.05	7034.59	7034.59
*Proposed/Revised elevations must tie-i	nto the Effective elevations wit	hin 0.5 foot at the downstream a	nd upstream limits of revi	sion.
2. <u>Hydraulic Method/Model Used</u> :	IEC RAS 5.0.5			
3. Pre-Submittal Review of Hydraulic M	odels*			
DHS-FEMA has developed two revier respectively. We recommend that yo	w programs, CHECK-2 and Cl u review your HEC-2 and HEC	HECK-RAS, to aid in the review of C-RAS models with CHECK-2 and	of HEC-2 and HEC-RAS I d CHECK-RAS.	ydraulic models,
4. Models Submitted	Natural Run	Flo	Floodwav Run	
Duplicate Effective Model*	File Name: Plan 1	Name: File Name:	Plan Name:	
Corrected Effective Model*	File Name: Plan 1	N/A Jame: File Name:	Plan Name:	
Existing or Pre-Project	File Name: Plan N	Name: File Name:	Plan Name:	
Revised or Post-Project Conditions Model GR	T2.prj GR12_EX File Name: Plan I T2.prj GRT2 PR	Vame: File Name:	N/A Plan Name:	
Other - (attach description)	File Name: Plan M	Name: Name:	Plan Name:	
* For details, refer to the corresponding s	section of the instructions.			
	Digital Models	Submitted? (Required)		
	_			
	C. MAPPIN	IG REQUIREMENTS		
A certified topographic work map must and proposed conditions 1%-annual-cha floodplains and regulatory floodway (for indicated; stream, road, and other alignn property; certification of a registered prof referenced vertical datum (NGVD, NAVE	t be submitted showing the fo ince floodplain (for approximat detailed Zone AE, AO, and AF nents (e.g., dams, levees, etc. fessional engineer registered i 0, etc.).	llowing information (where applic e Zone A revisions) or the bound I revisions); location and alignme ); current community easements n the subject State; location and GIS/CADD) Data Submitted (pre	cable): the boundaries of t daries of the 1%- and 0.2% ent of all cross sections wi and boundaries; boundar description of reference r eferred)	he effective, existing, 6-annual-chance th stationing control ies of the requester's narks; and the
EDWARD JAMES				
Source:		Date:		
Accuracy: +/- 0.08 ft				
Note that the boundaries of the existing must tie-in with the effective floodplain a scale as the original, annotated to show the boundaries of the effective 1%-and 0 revision.	or proposed conditions floodpl nd regulatory floodway bound the boundaries of the revised 0.2%-annual-chance floodplair Annotated FIF	ains and regulatory floodway to I aries. Please attach <b>a copy of th</b> 1%-and 0.2%-annual-chance flo and regulatory floodway at the u RM and/or FBFM (Required)	be shown on the revised F the effective FIRM and/or odplains and regulatory flug upstream and downstrean	^{IRM} and/or FBFM <b>FBFM</b> , at the same bodway that tie-in with in limits of the area on

### D. COMMON REGULATORY REQUIREMENTS*

1.	For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase?	🗌 Yes 📕 No
	a. For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the I	NFIP regulations:
	The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot compa conditions.	red to pre-project
	The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases about compared to pre-project conditions.	ove 1.00 foot
	b. Does this LOMR request cause increase in the BFE and/or SFHA compared with the effective BFEs and/or SFHA? If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of notifications can be found in the MT-2 Form 2 Instructions.	Yes 📕 No 🗖 Yes
2.	Does the request involve the placement or proposed placement of fill?	📕 Yes 🗌 No
	If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in account NFIP regulations set forth at 44 CFR 60.3(A)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more inform	ructures or ordance with the nation.
3.	For LOMR requests, is the regulatory floodway being revised?	📕 Yes 🗌 No
	If Yes, attach <b>evidence of regulatory floodway revision notification</b> . As per Paragraph 65.7(b)(1) of the NFIP Regulations, required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chai [studied Zone A designation] unless a regulatory floodway is being established. Elements and examples of regulatory floodway notification can be found in the MT-2 Form 2 Instructions.)	notification is nce floodplains / revision
4.	For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Section Endangered Species Act (ESA).	as 9 and 10 of the
For cor	actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the ag npliance with Section 7(a)(2) of the ESA. Please see the MT-2 instructions for more detail.	ency showing its

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY
RIVERINE STRUCTURES FORM

O.M.B. NO. 1660-0016 Expires February 28, 2014

#### PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 7 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20598-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. Please do not send your completed survey to the above address.

#### PRIVACY ACT STATEMENT

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**DISCLOSURE:** The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Geick Ranch Tributary 2

Note: Fill out one form for each flooding source studied.

		A. GENERAL		
Comp Descr	lete the appropriate section(s) for each Structure listed Channelizationcomplete Section B Bridge/Culvertcomplete Section C Damcomplete Section D Levee/Floodwallcomplete Section E Sediment Transportcomplete Section F (if req iption Of Modeled Structure	below: uuired)		
1.	Name of Structure: Tributary 2			
	Type (check one): Channelization	Bridge/Culvert	Levee/Floodwall	🗌 Dam
	Location of Structure: LOCATED BETWEEN EASTONVILLE R	OAD AND NORTHWEST OF HIGHWA	NY 24	
	Downstream Limit/Cross Section:	RY OF GRANDVIEW RESERVE, SEC	TION 70.18	
	Upstream Limit/Cross Section:	LE ROAD, SECTION 5642		
2.	Name of Structure: 10' X 4' BOX Culvert at US end of project			
	Type (check one):	Bridge/Culvert	Levee/Floodwall	🗌 Dam
	Location of Structure:			
	Downstream Limit/Cross Section:			
	Upstream Limit/Cross Section:			
3.	Name of Structure: 4' BOX Culverts MID project			
	Type (check one)	Bridge/Culvert	Levee/Floodwall	🗌 Dam
	Location of Structure:	ROPSOED ROAD THROUGH FUTUR	E DEVELOPMENT	
	Downstream Limit/Cross Section:	UPSTREAM LIMIT / CROSS	SECTION: SECTION 3880	

	NAME OF STRUCTURE: 3 - 8' x 4' BOX CULVERTSOUTHERN END OF PROJECT TYPE: BRIDGE CULVERT						
	LOCATION OF STRUCTURE: MID GEICK RANCH TRIB 2, UNDER PROPSOED ROAD THROUGH FUTURE DEVELOPMENT DOWNSTREAM LIMIT: 1285 UPSTREAM LIMIT: 1385						
	NOTE: FOR MORE STRUCTURES, ATTACH ADDITIONAL PAGES AS NEEDED.						
	B. CHANNELIZATION						
F100	Geick Ranch Tributary 2						
Nam	ne of Structure: Tributary 2						
1.	Hydraulic Considerations						
	The channel was designed to carry (cfs) and/or the 100 -year flood.						
	The design elevation in the channel is based on (check one):						
	□ Subcritical flow □ Critical flow □ Supercritical flow ■ Energy grade line						
	If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.						
	Inlet to channel 🔲 Outlet of channel 📕 At Drop Structures 🗌 At Transitions						
	Other locations (specify):						
2.	Channel Design Plans						
	Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.						
3.	Accessory Structures						
	The channelization includes (check one):						
	Levees [Attach Section E (Levee/Floodwall)]						
	Transitions in cross sectional geometry Debris basin/detention basin [Attach Section D (Dam/Basin)] Energy dissipator						
	Weir Other (Describe):						
4.	Sediment Transport Considerations						
ŀ	Are the hydraulics of the channel affected by sediment transport?						
lf cons	f yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not sidered. THE CHANNEL WAS DESIGNED TO INCLUDE ARMORING AS NEEDED TO PREVENT ADVERSE SEDIMENT TRANSPORT/ SCOURING.						
	C. BRIDGE/CULVERT						
------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------	--	--	--	--	--
Floc	Flooding Source: Geick Ranch Tributary 2						
Nan	ne of Structure: 10' X 4' BOX Culvert at US end of project						
1.	This revision reflects (check one):						
	Bridge/culvert not modeled in the FIS There is no existing FIS						
	Modified bridge/culvert previously modeled in the FIS						
	Revised analysis of bridge/culvert previously modeled in the F	IS					
2.	Hydraulic model used to analyze the structure (e.g., HEC-2 with s If different than hydraulic analysis for the flooding source, justify w the structures. Attach justification.	pecial bridge routine, WSPRO, HY8): HEC-RAS thy the hydraulic analysis used for the flooding source could not analyze					
3.	Attach plans of the structures certified by a registered professiona (check the information that has been provided):	I engineer. The plan detail and information should include the following					
	Dimensions (height, width, span, radius, length)	Distances Between Cross Sections					
	Shape (culverts only)	Erosion Protection					
	Material	Low Chord Elevations – Upstream and Downstream					
	Beveling or Rounding	□ Top of Road Elevations – Upstream and Downstream					
	U Wing Wall Angle	Structure Invert Elevations – Upstream and Downstream					
	Skew Angle	Stream Invert Elevations – Upstream and Downstream					
		Cross-Section Locations					
4.	Sediment Transport Considerations						
	Are the hydraulics of the structure affected by sediment transport	? 🗌 Yes 📕 No					
	If Yes, then fill out Section F (Sediment Transport) of Form 3. If r	no, then attach an explanation.					

THE CULVERT WAS DESIGNED TO INCLUDE ARMORING AS NEEDED TO PREVENT ADVERSE SEDIMENT TRANSPORT/ SCOURING.

	C. BRIDGE/CULVERT						
Floc	Flooding Source: Geick Ranch Tributary 2						
Nan	Name of Structure: 3 - 8' x 4' BOX Culverts MID project						
1.	This revision reflects (check one):						
	Bridge/culvert not modeled in the FIS There is no existing FIS						
	Modified bridge/culvert previously modeled in the FIS						
	Revised analysis of bridge/culvert previously modeled in the F	IS					
2.	Hydraulic model used to analyze the structure (e.g., HEC-2 with s If different than hydraulic analysis for the flooding source, justify w the structures. Attach justification.	pecial bridge routine, WSPRO, HY8): HEC-RAS thy the hydraulic analysis used for the flooding source could not analyze					
3.	Attach plans of the structures certified by a registered professiona (check the information that has been provided):	I engineer. The plan detail and information should include the following					
	Dimensions (height, width, span, radius, length)	Distances Between Cross Sections					
	Shape (culverts only)	Erosion Protection					
	Material	Low Chord Elevations – Upstream and Downstream					
	Beveling or Rounding	□ Top of Road Elevations – Upstream and Downstream					
	U Wing Wall Angle	Structure Invert Elevations – Upstream and Downstream					
	Skew Angle	Stream Invert Elevations – Upstream and Downstream					
		Cross-Section Locations					
4.	Sediment Transport Considerations						
	Are the hydraulics of the structure affected by sediment transport	? 🗌 Yes 📕 No					
	If Yes, then fill out Section F (Sediment Transport) of Form 3. If r	no, then attach an explanation.					

THE CULVERT WAS DESIGNED TO INCLUDE ARMORING AS NEEDED TO PREVENT ADVERSE SEDIMENT TRANSPORT/ SCOURING.

	C. BRIDGE/CULVERT						
Floc	Flooding Source: Geick Ranch Tributary 2						
Nan	Name of Structure: 3 - 8' x 4' BOX CULVERTS SOUTHERN END OF PROJECT						
1.	This revision reflects (check one):						
	Bridge/culvert not modeled in the FIS There is no existing FIS						
	Modified bridge/culvert previously modeled in the FIS						
	$\hfill\square$ Revised analysis of bridge/culvert previously modeled in the F	IS					
2.	Hydraulic model used to analyze the structure (e.g., HEC-2 with s If different than hydraulic analysis for the flooding source, justify w the structures. Attach justification.	pecial bridge routine, WSPRO, HY8): HEC-RAS hy the hydraulic analysis used for the flooding source could not analyze					
3.	Attach plans of the structures certified by a registered professional (check the information that has been provided):	al engineer. The plan detail and information should include the following					
	Dimensions (height, width, span, radius, length)	Distances Between Cross Sections					
	Shape (culverts only)	Erosion Protection					
	Material	Low Chord Elevations – Upstream and Downstream					
	Beveling or Rounding	Top of Road Elevations – Upstream and Downstream					
	U Wing Wall Angle	Structure Invert Elevations – Upstream and Downstream					
	Skew Angle	Stream Invert Elevations – Upstream and Downstream					
		Cross-Section Locations					
4.	Sediment Transport Considerations						
	Are the hydraulics of the structure affected by sediment transport	? 🗌 Yes 📕 No					
	If Yes, then fill out Section F (Sediment Transport) of Form 3. If r	no, then attach an explanation.					

THE CULVERT WAS DESIGNED TO INCLUDE ARMORING AS NEEDED TO PREVENT ADVERSE SEDIMENT TRANSPORT/ SCOURING.



Grandview Reserve CLOMR Report Project No.: 201662.03

Appendix B Certified Topo



DEGREES 52 MINUTES 26 SECONDS WEST, A DISTANCE OF 5290.17 FEET.

NAVD88 6866.33







DEGREES 52 MINUTES 26 SECONDS WEST, A DISTANCE OF 5290.17 FEET.

NAVD88



Ż	Job No.:	201662
	Prepared By:	SJF
31	Date:	3/21/2023

FLOODPLAIN EXHIBIT





### **GENERAL NOTES:**

- 1. THIS TOPOGRAPHIC MAP WAS CREATED FROM DATA GATHERED FROM A FIELD SURVEY CONDUCTED ON THE GROUND MARCH 21, 2023.
- 2. THIS TOPOGRAPHIC MAP DOES NOT REPRESENT A MONUMENTED LAND SURVEY AND CAN NOT BE RELIED UPON FOR DEFINITIVE PROPERTY BOUNDARY INFORMATION. THE BOUNDARY IS SHOWN PLACED PER FOUND MONUMENTS. NO MONUMENTATION WAS SET AT TIME OF SURVEY. FURTHER SURVEY WORK REQUIRED IS TO ESTABLISH ADDITIONAL BOUNDARY MONUMENTS.
- 3. VERTICAL CONTOUR INTERVAL FOR THIS MAP IS 1 FOOT.
- 4. BENCHMARK(BM): THE BENCHMARK FOR THIS TOPOGRAPHIC MAP IS NGS MONUMENT F24, WITH AN ASSUMED ELEVATION OF 6866.33 FEET. NAVD88
- 5. NO UTILITY LOCATES WERE ORDERED.

### SURVEYOR'S STATEMENT:

I, JONATHAN W. TESSIN, A PROFESSIONAL LAND SURVEYOR IN THE STATE OF COLORADO, DO HEREBY STATE THAT THIS TOPOGRAPHIC SURVEY HAS BEEN PREPARED UNDER MY DIRECTION, AND THAT THIS SURVEY DOES ACCURATELY SHOW THE DESCRIED TRACT OF LAND TO THE BEST OF MY KNOWLEDGE AND BELIEF.



JONATHAN W. TESSIN, PROFESSIONAL LAND SURVEYOR COLORADO P.L.S. NO. 33196 FOR AND ON BEHALF OF EDWARD-JAMES SURVEYING, INC.

# **ASBUILT EXHIBIT** EXISTING BERM







Grandview Reserve CLOMR Report Project No.: 201662.03

Appendix C Annotated Firm

Page | 8

### NOTES TO USERS administering the National Flood Insurance Program. It does

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD88). These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services NOAA, N/NGS12

National Geodetic Survey SSMC-3, #9202

1315 East-West Highway Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

**Base Map** information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

This map reflects more detailed and up-to-date stream channel configurations and floodplain delineations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

> El Paso County Vertical Datum Offset Table Vertical Datum

Flooding Source Offset (ft) REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

### **Panel Location Map**



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).



Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



### NOTES TO USERS

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Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The projection used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The horizontal datum was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD88). These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services NOAA, N/NGS12 National Geodetic Survey SSMC-3, #9202 1315 East-West Highway Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for bench marks shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by EI Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date stream channel configurations and floodplain delineations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed Map Index for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact FEMA Map Service Center (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website a http://www.msc.fema.gov/.

If you have questions about this map or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

> El Paso County Vertical Datum Offset Table Vertical Datum Flooding Source Offset (ft)

REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY

FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map

This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA)



Additional Flood Hazard Information and resources are available from local communities and the Colorado Water Conservation Board.





Grandview Reserve CLOMR Report Project No.: 201662.03

Appendix D Proposed Plans

SHFFT INDEX							
PAGE	SHEET						
NUMBER	SHEET NUMBER	SHEET TITLE					
01	TS1	TITLE SHEET					
02	GN1	GENERAL NOTES					
03	SC1	SURVEY CONTROL PLAN					
04	UP1	OVERALL UTILITY PLAN					
05	GR1	TRIBUTARY 1 Grading					
06	GR2	TRIBUTARY 2 Valley Grading					
07	GR3	IRIBUTARY 2 Valley Grading					
08	GR4	TRIBUTARY 2 Valley Grading					
09	GR5	TRIBUTARY 2 Valley Grading					
10	GR6	TRIBUTARY 2 Valley Grading					
12	GR7	TRIBLITARY 2 Valley Grading					
13	GR9	TRIBUTARY 2 Valley Grading					
13	GR10	TRIBUTARY 2 Bankfull Grading					
45		TRIBUTARY 2 Bankfull Crading					
15	GR11						
16	GR12	TRIBUTARY 2 Bankfull Grading					
17	GR13	TRIBUTARY 2 Bankfull Grading					
18	GR14	TRIBUTARY 2 Bankfull Grading					
19	EC1	INITIAL EROSION CONTROL					
20	EC2	INITIAL EROSION CONTROL					
21	EC3	INITIAL EROSION CONTROL					
22	EC4	FINAL EROSION CONTROL					
23	EC5	FINAL EROSION CONTROL					
24	EC6	FINAL EROSION CONTROL					
25	PP1	DRAINAGE TRIBUTARY 1 PLAN AND PROFILE					
26	PP2	DRAINAGE TRIBUTARY 2 PLAN AND PROFILE					
27	PP3	DRAINAGE TRIBUTARY 2 PLAN AND PROFILE					
28	PP4	DRAINAGE TRIBUTARY 2 PLAN AND PROFILE					
29	PP5	DRAINAGE CULVERTS PLAN AND PROFILE					
30	PP6	DRAINAGE CULVERT PLAN AND PROFILE					
31	CS1	TRIBUTARY 2 CROSS SECTIONS					
32	CS2	TRIBUTARY 2 CROSS SECTIONS					
33	CS3	TRIBUTARY 2 CROSS SECTIONS					
34	CS4	TRIBUTARY 2 CROSS SECTIONS					
35	CS5	TRIBUTARY 2 CROSS SECTIONS					
36	CS6	TRIBUTARY 2 CROSS SECTIONS					
37	CS7	TRIBUTARY 2 CROSS SECTIONS					
38	CS8	TRIBUTARY 2 CROSS SECTIONS					
39	CS9	TRIBUTARY 2 CROSS SECTIONS					
40	CS10	TRIBUTARY 2 CROSS SECTIONS					
41	CS11	TRIBUTARY 2 CROSS SECTIONS					
42	DT1	DETAILS					
43	DT2	DETAILS					
44	DT3	DETAILS					
45	DT4	DETAILS					
46	DT5	DETAILS					
47	DT6	DETAILS					

SYMBOLS, ABBREVIATIONS, AND LINETYPES LEGEND

(CWA) CONCRETE WASHOUT AREA ( CF ) CONSTRUCTION FENCE IP ) INLET PROTECTION ( OP ) OUTLET PROTECTION (SF) SILT FENCE ŚŚA ) STABILIŻED STAGING AREA VTC ) VEHICLE TRACKING CONTROL (LOC) LIMITS OF CONSTRUCTION ( CD ) CHECK DAM SM ) SEEDING AND MULCHING  $\oplus$ ŚBB) SEDIMENT BASIN (SR) SURFACE ROUGHENING ECB) EROSION CONTROL BLANKET CIP ) CULVERT INLET PROTECTION D (RS) ROCK SOCK 0 STORM INLET TYPE R STORM END SECTION STORM MANHOLE SANITARY MANHOLE FIRE HYDRANT LIGHT POLE WATER VALVE PROPERTY LINE ROAD CENTERLINE - RIGHT-OF-WAY LINE PROPOSED DRAINAGE ——5250 —— PROPOSED MAJOR CONTOUR PROPOSED MINOR CONTOUR EXISTING MINOR CONTOUR ··· — > FLOW ARROW ----- EFFECTIVE 100-YR FLOODWAY POTENTIAL WALL STORM SEWER SANITARY SEWER AIR RELEASE VALVE ARV CP CATHODIC PROTECTION STA STATION MUE MULTI USE EASEMENT APRX APPROXIMATE PR PROPOSED FT FEET DIA DIAMETER LF LINEAL FEET EL ELEVATION

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## GRANDVIEW RESERVE (DRAINAGE A & B) **GIECK RANCH TRIBUTARY, 1 GIECK RANCH TRIBUTARY 2**

SECTIONS 21, 22, 27 & 28, TOWNSHIP 12 S, RANGE 64 W CITY OF FALCON, EL PASO COUNTY, STATE OF COLORADO



VICINITY MAP SCALE: 1" = 5000'



### BASIS OF BEARINGS

THE EAST LINE OF SECTION 21, BEING MONUMENTED AT THE SOUTHEAST CORNER BY A 3-1/4" ALUMINUM SURVEYOR'S CAP STAMPED "PS INC PLS 30087 1996", BEING APPROPRIATELY MARKED, AND BEING MONUMENTED AT THE NORTHEAST CORNER BY A 3-1/4" ALUMINUM SURVEYOR'S CAP STAMPED "PS INC PLS 30087 1996", BEING APPROPRIATELY MARKED, BEING ASSUMED TO BEAR NORTH 00 DEGREES 52 MINUTES 26 SECONDS WEST, A DISTANCE OF 5290.17 FEET.

### **BENCHMARK:**

**DESIGNATION = F 24** PID = JK0240 DESCRIPTION = DISK ON TOP OF CONCRETE MONUMENT CONTROL POINT COORDINATE SYSTEM: NAVD88 NORTHING: 1421049.80 EASTING: 3273631.55 ELEVATION: 6866.33

### LEGAL DESCRIPTION:

A TRACT OF LAND BEING PORTIONS OF THE SOUTH HALF OF SECTION 21, SOUTH HALF OF SECTION 22, NORTH HALF OF SECTION 28 AND SECTION 27, TOWNSHIP 12 SOUTH, RANGE 64 WEST OF THE SIXTH PRINCIPAL MERIDIAN, EL PASO COUNTY, COLORADO, BEING DESCRIBED AS FOLLOWS:

BASIS OF BEARINGS: THE EAST LINE OF SECTION 21, BEING MONUMENTED AT THE SOUTHEAST CORNER BY A 3-1/4" ALUMINUM SURVEYOR'S CAP STAMPED "PS INC PLS 30087 1996", BEING APPROPRIATELY MARKED, AND BEING MONUMENTED AT THE NORTHEAST CORNER BY A 3-1/4" ALUMINUM SURVEYOR'S CAP STAMPED "PS INC PLS 30087 1996", BEING APPROPRIATELY MARKED, BEING ASSUMED TO BEAR NORTH 00 DEGREES 52 MINUTES 26 SECONDS WEST, A DISTANCE OF 5290.17 FEET.

COMMENCING AT THE SOUTHEAST CORNER OF SAID SECTION 21; THENCE NORTH 00 DEGREES 52 MINUTES 26 SECONDS WEST ON THE EAST LINE OF SAID SECTION, A DISTANCE OF 2645.09 FEET TO THE NORTHEAST CORNER OF THE SOUTHEAST QUARTER OF SAID SECTION 21, SAID POINT BEING THE POINT OF BEGINNING; THENCE NORTH 89 DEGREES 41 MINUTES 03 SECONDS EAST ON THE NORTH LINE OF THE SOUTH HALF OF SAID SECTION 22, A DISTANCE OF 3938.20 FEET; THENCE SOUTH 00 DEGREES 41 MINUTES 58 SECONDS EAST ON THE EAST LINE OF THE WEST HALF OF THE SOUTHEAST QUARTER OF SECTION 22, A DISTANCE OF 2117.66 FEET TO A POINT ON THE NORTHWESTERLY RIGHT OF WAY LINE OF THE ROCK ISLAND REGIONAL TRAIL AS GRANTED TO EL PASO COUNTY IN THAT WARRANTY DEED RECORDED OCTOBER 21, 1994 IN BOOK 6548 AT PAGE 892, RECORDS OF EL PASO COUNTY, COLORADO; THENCE ON SAID NORTHWESTERLY RIGHT OF WAY, THE FOLLOWING FIVE (5) COURSES:

SECTION 22;

(2) NORTH 89 DEGREES 38 MINUTES 06 SECONDS EAST ON SAID SOUTH LINE, A DISTANCE OF 36.18 FEET; (3) SOUTH 45 DEGREES 55 MINUTES 49 SECONDS WEST, A DISTANCE OF 3818.92 FEET TO A POINT ON THE NORTH LINE OF THE SOUTHWEST QUARTER OF SAID SECTION 27:

(4) SOUTH 89 DEGREES 39 MINUTES 01 SECONDS WEST ON SAID NORTH LINE, A DISTANCE OF 36.17 FEET; (5) SOUTH 45 DEGREES 55 MINUTES 49 SECONDS WEST, A DISTANCE OF 855.35 FEET TO A POINT ON THE EASTERLY LINE OF SAID SECTION 28;

THENCE NORTH 00 DEGREES 21 MINUTES 45 SECONDS WEST ON THE EAST LINE OF THE SOUTHEAST QUARTER OF SAID SECTION 28, A DISTANCE OF 591.16 FEET TO THE NORTHEAST CORNER OF SAID SOUTHEAST QUARTER; THENCE NORTH 00 DEGREES 21 MINUTES 38 SECONDS WEST ON THE EAST LINE OF THE NORTHEAST QUARTER OF SAID SECTION 28, A DISTANCE OF 1319.24 FEET TO THE SOUTH LINE OF THE NORTH HALF OF THE NORTH HALF OF SAID SECTION 28: THENCE NORTH 89 DEGREES 47 MINUTES 08 SECONDS WEST ON SAID SOUTH LINE, A DISTANCE OF 4692.55 FEET TO A POINT ON THE EASTERLY RIGHT OF WAY LINE OF EXISTING EASTONVILLE ROAD (60.00 FOOT WIDE); THENCE ON SAID EASTERLY RIGHT OF WAY AS DEFINED BY CERTIFIED BOUNDARY SURVEY, AS RECORDED JULY 18, 2001 UNDER RECEPTION NO. 201900096, THE FOLLOWING FIVE (5) COURSES:

(2) NORTH 07 DEGREES 40 MINUTES 18 SECONDS WEST, A DISTANCE OF 777.34 FEET TO A POINT OF CURVE; TO A POINT OF TANGENT:

(4) NORTH 31 DEGREES 20 MINUTES 52 SECONDS EAST, A DISTANCE OF 1517.37 FEET TO A POINT OF CURVE; (5) ON THE ARC OF A CURVE TO THE LEFT, HAVING A DELTA OF 02 DEGREES 07 MINUTES 03 SECONDS, A RADIUS OF 1330.00 FEET, A DISTANCE OF 49.15 FEET TO A POINT ON THE NORTH LINE OF THE SOUTH HALF OF SAID SECTION 21;

THENCE SOUTH 89 DEGREES 50 MINUTES 58 SECONDS EAST ON SAID NORTH LINE, A DISTANCE OF 3635.53 FEET TO THE POINT OF BEGINNING;

ENGINEER'S STATEMENT THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE COUNTY FOR DETAILED ROADWAY, DRAINAGE, GRADING AND EROSION CONTROL PLANS AND SPECIFICATIONS, AND SAID PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH APPLICABLE MASTER DRAINAGE PLANS AND MASTER TRANSPORTATION PLANS. SAID PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR ROADWAY AND DRAINAGE FACILITIES ARE DESIGNED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR OMISSIONS ON MY PART IN PREPARATION OF THESE DETAILED PLANS AND SPECIFICATIONS.

ENGINEER OF RECORD SIGNATURE

### OWNER'S STATEMENT

I, THE OWNER/DEVELOPER HAVE READ AND WILL COMPLY WITH THE REQUIREMENTS OF THE GRADING AND EROSION CONTROL PLAN AND ALL OF THE REQUIREMENTS SPECIFIED IN THESE DETAILED PLANS AND SPECIFICATIONS.

### OWNER SIGNATURE 4 SITE INVESTMENTS LLC

1271 KELLY JOHNSON BLVD STE 100 COLORADO SPRINGS CO, 80902

EL PASO COUNTY: COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR

THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/ OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/ OR ACCURACY OF THIS DOCUMENT. FILED IN ACCORDANCE WITH THE REQUIREMENTS OF THE EL PASO COUNTY LAND DEVELOPMENT CODE, DRAINAGE CRITERIA MANUAL VOLUMES 1 AND 2, AND ENGINEERING CRITERIA MANUAL, AS AMENDED. IN ACCORDANCE WITH ECM SECTION 1.12, THESE CONSTRUCTION DOCUMENTS WILL BE VALID FOR CONSTRUCTION FOR A PERIOD OF 2 YEARS FROM THE DATE SIGNED BY THE EL PASO COUNTY ENGINEER. IF CONSTRUCTION HAS NOT STARTED WITHIN THOSE 2 YEARS, THE PLANS WILL NEED TO BE RESUBMITTED FOR APPROVAL, INCLUDING PAYMENT OF REVIEW FEES AT THE PLANNING AND COMMUNITY DEVELOPMENT DIRECTOR'S DISCRETION. DATE JOSHUA PALMER, P.E.

CDR-228

**INTERIM COUNTY ENGINEER / ECM ADMINISTRATOR** 

5619 DTC PARKWAY, SUITE 1150 | GREENWOOD VILLAGE, COLORADO 80111 Phone: 720.602.4999 | Toll Free: 800.728.7805 | HRGreen.com

HR GREEN - DENVER 5619 DTC PARKWAY SUITE 1150 DENVER CO 80111 PHONE: 720.602.4999 FAX: 844.273.1057

GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO

(1) SOUTH 45 DEGREES 55 MINUTES 49 SECONDS WEST, A DISTANCE OF 758.36 FEET TO A POINT ON THE SOUTH LINE OF THE SOUTHEAST QUARTER OF SAID

(1) ON THE ARC OF A CURVE TO THE LEFT, WHOSE CENTER BEARS NORTH 73 DEGREES 08 MINUTES 46 SECONDS WEST, HAVING A DELTA OF 24 DEGREES 31 MINUTES 32 SECONDS, A RADIUS OF 1630.00 FEET, A DISTANCE OF 697.73 FEET TO A POINT OF TANGENT;

(3) ON THE ARC OF A CURVE TO THE RIGHT, HAVING A DELTA OF 39 DEGREES 01 MINUTES 10 SECONDS, A RADIUS OF 1770.00 FEET, A DISTANCE OF 1205.40 FEET

DATE

### DATE

EL PASO PDC FILE NO.

ENGINEER CONTACT(S): HR GREEN DEVELOPMENT, LLC GREG PANZA, P.E. 5619 DTC PARKWAY, SUITE 1150 GREENWOOD VILLAGE, CO 80111 PH: 720-602-4999 gpanza@hrgreen.com

CONSTRUCTION DOCUMENTS	SHEET	
TITLE SHEET	TS1	01

STANDARD NOTES FOR EL PASO COUNTY CONSTRUCTION PLANS

ALL DRAINAGE AND ROADWAY CONSTRUCTION SHALL MEET THE STANDARDS AND SPECIFICATIONS OF THE CITY OF COLORADO SPRINGS/EL PASO COUNTY DRAINAGE CRITERIA MANUAL, VOLUMES 1 AND 2, AND THE EL PASO COUNTY ENGINEERING

CRITERIA MANUAL 2. CONTRACTOR SHALL BE RESPONSIBLE FOR THE NOTIFICATION AND FIELD NOTIFICATION OF ALL EXISTING UTILITIES, WHETHER SHOWN ON THE PLANS OR NOT, BEFORE BEGINNING CONSTRUCTION. LOCATION OF EXISTING UTILITIES SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. CALL 811 TO CONTACT THE UTILITY NOTIFICATION CENTER OF COLORADO (UNCC). CONTRACTOR SHALL KEEP A COPY OF THESE APPROVED PLANS, THE GRADING AND EROSION CONTROL PLAN, THE STORMWATER MANAGEMENT PLAN (SWMP), THE SOILS AND GEOTECHNICAL REPORT, AND THE APPROPRIATE DESIGN AND CONSTRUCTION STANDARDS AND SPECIFICATIONS AT THE JOB SITE AT ALL TIMES, INCLUDING THE FOLLOWING:

A. EL PASO COUNTY ENGINEERING CRITERIA MANUAL (ECM) B. CITY OF COLORADO SPRINGS/EL PASO COUNTY DRAINAGE CRITERIA MANUAL, VOLUMES 1 AND 2

C. COLORADO DEPARTMENT OF TRANSPORTATION (CDOT) STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION

D. CDOT M & S STANDARDS

NOTWITHSTANDING ANYTHING DEPICTED IN THESE PLANS IN WORDS OR GRAPHIC REPRESENTATION, ALL DESIGN AND CONSTRUCTION RELATED TO ROADS, STORM DRAINAGE AND EROSION CONTROL SHALL CONFORM TO THE STANDARDS AND REQUIREMENTS OF THE MOST RECENT VERSION OF THE RELEVANT ADOPTED EL PASO COUNTY STANDARDS, INCLUDING THE LAND DEVELOPMENT CODE. THE ENGINEERING CRITERIA MANUAL. THE DRAINAGE CRITERIA MANUAL, AND THE DRAINAGE CRITERIA MANUAL VOLUME 2. ANY DEVIATIONS FROM REGULATIONS AND STANDARDS MUST BE REQUESTED, AND APPROVED, IN WRITING. ANY MODIFICATIONS NECESSARY TO MEET CRITERIA AFTER-THE-FACT WILL BE ENTIRELY THE DEVELOPER'S RESPONSIBILITY TO RECTIFY.

5. IT IS THE DESIGN ENGINEER'S RESPONSIBILITY TO ACCURATELY SHOW EXISTING CONDITIONS, BOTH ONSITE AND OFFSITE, ON THE CONSTRUCTION PLANS. ANY MODIFICATIONS NECESSARY DUE TO CONFLICTS, OMISSIONS, OR CHANGED CONDITIONS WILL BE ENTIRELY THE DEVELOPER'S RESPONSIBILITY TO RECTIFY. CONTRACTOR SHALL SCHEDULE A PRE-CONSTRUCTION MEETING WITH EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT DEPARTMENT (PCD) - INSPECTIONS, PRIOR TO STARTING CONSTRUCTION.

7. IT IS THE CONTRACTOR'S RESPONSIBILITY TO UNDERSTAND THE REQUIREMENTS OF ALL JURISDICTIONAL AGENCIES AND TO OBTAIN ALL REQUIRED PERMITS, INCLUDING BUT NOT LIMITED TO EL PASO COUNTY EROSION AND STORMWATER QUALITY CONTROL PERMIT (ESQCP), REGIONAL BUILDING FLOODPLAIN DEVELOPMENT PERMIT, U.S. ARMY CORPS OF ENGINEERS-ISSUED 401 AND/OR 404 PERMITS, AND COUNTY AND STATE FUGITIVE DUST PERMITS.

3. CONTRACTOR SHALL NOT DEVIATE FROM THE PLANS WITHOUT FIRST OBTAINING WRITTEN APPROVAL FROM THE DESIGN ENGINEER AND PCD. CONTRACTOR SHALL NOTIFY THE DESIGN ENGINEER IMMEDIATELY UPON DISCOVERY OF ANY ERRORS OR INCONSISTENCIES. ALL STORM DRAIN PIPE SHALL BE CLASS III RCP UNLESS OTHERWISE NOTED AND APPROVED BY PCD.

10. CONTRACTOR SHALL COORDINATE GEOTECHNICAL TESTING PER ECM STANDARDS. PAVEMENT DESIGN SHALL BE APPROVED BY EL PASO COUNTY PCD PRIOR TO PLACEMENT OF CURB AND GUTTER AND PAVEMENT

11. ALL CONSTRUCTION TRAFFIC MUST ENTER/EXIT THE SITE AT APPROVED CONSTRUCTION ACCESS POINTS. 12. SIGHT VISIBILITY TRIANGLES AS IDENTIFIED IN THE PLANS SHALL BE PROVIDED AT ALL INTERSECTIONS. OBSTRUCTIONS GREATER THAN 18 INCHES ABOVE FLOWLINE ARE NOT ALLOWED WITHIN SIGHT TRIANGLES.

13. SIGNING AND STRIPING SHALL COMPLY WITH EL PASO COUNTY AND MUTCD CRITERIA. [IF APPLICABLE, ADDITIONAL SIGNING AND STRIPING NOTES WILL BE PROVIDED.] 14. CONTRACTOR SHALL OBTAIN ANY PERMITS REQUIRED BY EL PASO COUNTY DPW, INCLUDING WORK WITHIN THE RIGHT-OF-WAY AND SPECIAL TRANSPORT PERMITS.

15. THE LIMITS OF CONSTRUCTION SHALL REMAIN WITHIN THE PROPERTY LINE UNLESS OTHERWISE NOTED. THE OWNER/DEVELOPER SHALL OBTAIN WRITTEN PERMISSION AND EASEMENTS, WHERE REQUIRED, FROM ADJOINING PROPERTY OWNER(S) PRIOR TO ANY OFF-SITE DISTURBANCE, GRADING, OR CONSTRUCTION.

STANDARD NOTES FOR EL PASO COUNTY GRADING AND EROSION CONTROL PLANS

STORMWATER DISCHARGES FROM CONSTRUCTION SITES SHALL NOT CAUSE OR THREATEN TO CAUSE POLLUTION,

CONTAMINATION, OR DEGRADATION OF STATE WATERS. ALL WORK AND EARTH DISTURBANCE SHALL BE DONE IN A

MANNER THAT MINIMIZES POLLUTION OF ANY ON-SITE OR OFF-SITE WATERS, INCLUDING WETLANDS. NOTWITHSTANDING ANYTHING DEPICTED IN THESE PLANS IN WORDS OR GRAPHIC REPRESENTATION, ALL DESIGN AND CONSTRUCTION RELATED TO ROADS, STORM DRAINAGE AND EROSION CONTROL SHALL CONFORM TO THE STANDARDS AND REQUIREMENTS OF THE MOST RECENT VERSION OF THE RELEVANT ADOPTED EL PASO COUNTY STANDARDS, INCLUDING THE LAND DEVELOPMENT

CODE, THE ENGINEERING CRITERIA MANUAL, THE DRAINAGE CRITERIA MANUAL, AND THE DRAINAGE CRITERIA MANUAL VOLUME 2. ANY DEVIATIONS FROM REGULATIONS AND STANDARDS MUST BE REQUESTED, AND APPROVED, IN WRITING. 3. A SEPARATE STORMWATER MANAGEMENT PLAN (SMWP) FOR THIS PROJECT SHALL BE COMPLETED AND AN EROSION AND STORMWATER QUALITY CONTROL PERMIT (ESQCP) ISSUED PRIOR TO

COMMENCING CONSTRUCTION. MANAGEMENT OF THE SWMP DURING CONSTRUCTION IS THE RESPONSIBILITY OF THE DESIGNATED QUALIFIED STORMWATER MANAGER OR CERTIFIED EROSION CONTROL INSPECTOR. THE SWMP SHALL BE LOCATED ON-SITE AT ALL TIMES DURING CONSTRUCTION AND SHALL BE KEPT UP TO DATE WITH WORK PROGRESS AND CHANGES IN THE FIELD ONCE THE ESQCP IS APPROVED AND A "NOTICE TO PROCEED" HAS BEEN ISSUED, THE CONTRACTOR MAY INSTALL THE INITIAL STAGE EROSION AND SEDIMENT CONTROL MEASURES AS INDICATED ON THE APPROVED GEC. A PRECONSTRUCTION MEETING BETWEEN THE CONTRACTOR, ENGINEER, AND EL PASO COUNTY WILL BE HELD PRIOR TO ANY CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE APPLICANT TO COORDINATE THE MEETING TIME AND PLACE WITH COUNTY STAFF.

CONTROL MEASURES MUST BE INSTALLED PRIOR TO COMMENCEMENT OF ACTIVITIES THAT COULD CONTRIBUTE POLLUTANTS TO STORMWATER. CONTROL MEASURES FOR ALL SLOPES, CHANNELS, DITCHES, AND DISTURBED LAND AREAS SHALL BE INSTALLED IMMEDIATELY UPON COMPLETION OF THE DISTURBANCE.

. ALL TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES SHALL BE MAINTAINED AND REMAIN IN EFFECTIVE OPERATING CONDITION UNTIL PERMANENT SOIL EROSION CONTROL MEASURES ARE IMPLEMENTED AND FINAL STABILIZATION IS ESTABLISHED. ALL PERSONS ENGAGED IN LAND DISTURBANCE ACTIVITIES SHALL ASSESS THE ADEQUACY OF CONTROL MEASURES AT THE SITE AND IDENTIFY IF CHANGES TO THOSE CONTROL MEASURES ARE NEEDED TO ENSURE THE CONTINUED EFFECTIVE PERFORMANCE OF THE CONTROL MEASURES. ALL CHANGES TO TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES MUST BE INCORPORATED INTO THE STORMWATER MANAGEMENT PLAN.

TEMPORARY STABILIZATION SHALL BE IMPLEMENTED ON DISTURBED AREAS AND STOCKPILES WHERE GROUND DISTURBING CONSTRUCTION ACTIVITY HAS PERMANENTLY CEASED OR TEMPORARILY CEASED FOR LONGER THAN 14 DAYS.

8. FINAL STABILIZATION MUST BE IMPLEMENTED AT ALL APPLICABLE CONSTRUCTION SITES. FINAL STABILIZATION IS ACHIEVED WHEN ALL GROUND DISTURBING ACTIVITIES ARE COMPLETE AND ALL DISTURBED AREAS EITHER HAVE A UNIFORM VEGETATIVE COVER WITH INDIVIDUAL PLANT DENSITY OF 70 PERCENT OF PRE-DISTURBANCE LEVELS ESTABLISHED OR EQUIVALENT PERMANENT ALTERNATIVE STABILIZATION METHOD IS IMPLEMENTED. ALL TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES SHALL BE REMOVED UPON FINAL STABILIZATION AND BEFORE PERMIT CLOSURE. 9. ALL PERMANENT STORMWATER MANAGEMENT FACILITIES SHALL BE INSTALLED AS DESIGNED IN THE APPROVED PLANS. ANY PROPOSED CHANGES THAT EFFECT THE DESIGN OR FUNCTION OF PERMANENT STORMWATER MANAGEMENT STRUCTURES MUST BE APPROVED BY THE ECM ADMINISTRATOR PRIOR TO IMPLEMENTATION.

70% OF THE 2-YR FLOW INTERVAL). 10. EARTH DISTURBANCES SHALL BE CONDUCTED IN SUCH A MANNER SO AS TO EFFECTIVELY MINIMIZE ACCELERATED SOIL EROSION AND RESULTING SEDIMENTATION. ALL DISTURBANCES SHALL BE DESIGNED, CONSTRUCTED, AND COMPLETED SO THAT THE EXPOSED AREA OF ANY DISTURBED LAND SHALL BE LIMITED TO THE SHORTEST PRACTICAL PERIOD OF TIME. PRE-EXISTING VEGETATION SHALL MILE HIGH FLOOD DISTRICT'S (MHFD) DESIGN MANUAL VOLUME 1 ALSO PRESENTS THE OPTION OF USING 10% OF THE 100-YR DISCHARGE TO SIZE THE BANKFULL CHANNEL'S CAPACITY. IN THE CASE OF THIS PROJECT, WE HAVE NOT BE PROTECTED AND MAINTAINED WITHIN 50 HORIZONTAL FEET OF A WATERS OF THE STATE UNLESS SHOWN TO BE INFEASIBLE AND SPECIFICALLY REQUESTED AND APPROVED. OPTED FOR THIS ALTERNATIVE. OUR CONCERN IS THAT THE RESULTING CHANNEL CROSS SECTIONAL AREA DERIVED FROM THIS ALTERNATIVE WOULD BE OVERSIZED AND LEAD TO SEDIMENT ACCUMULATION ON THE BED THROUGH 11. COMPACTION OF SOIL MUST BE PREVENTED IN AREAS DESIGNATED FOR INFILTRATION CONTROL MEASURES OR WHERE FINAL STABILIZATION WILL BE ACHIEVED BY VEGETATIVE COVER. AREAS TIME (AGGRADATION). AGGRADATION OCCURS WHEN INSUFFICIENT STREAM POWER IS PRESENT TO TRANSPORT SEDIMENT THROUGH THE CHANNEL, WHICH CAN RESULT FROM AN OVERSIZED BANKFULL CHANNEL. IN THESE CASES, DESIGNATED FOR INFILTRATION CONTROL MEASURES SHALL ALSO BE PROTECTED FROM SEDIMENTATION DURING CONSTRUCTION UNTIL FINAL STABILIZATION IS ACHIEVED. IF COMPACTION PREVENTION MID-CHANNEL BARS CAN FORM WHICH PUSH FLOWS INTO THE BANKS INCREASING THE RISK OF EROSION AND LATERAL MIGRATION OF THE CHANNEL. IS NOT FEASIBLE DUE TO SITE CONSTRAINTS, ALL AREAS DESIGNATED FOR INFILTRATION AND VEGETATION CONTROL MEASURES MUST BE LOOSENED PRIOR TO INSTALLATION OF THE CONTROL MEASURE(S).

Minimum Floodplain Terrace

Maximum overbank side slope

12. ANY TEMPORARY OR PERMANENT FACILITY DESIGNED AND CONSTRUCTED FOR THE CONVEYANCE OF STORMWATER AROUND, THROUGH, OR FROM THE EARTH DISTURBANCE AREA SHALL BE A STABILIZED CONVEYANCE DESIGNED TO MINIMIZE EROSION AND THE DISCHARGE OF SEDIMENT OFF-SITE.

13. CONCRETE WASH WATER SHALL BE CONTAINED AND DISPOSED OF IN ACCORDANCE WITH THE SWMP. NO WASH WATER SHALL BE DISCHARGED TO OR ALLOWED TO ENTER STATE WATERS, INCLUDING ANY SURFACE OR SUBSURFACE STORM DRAINAGE SYSTEM OR FACILITIES. CONCRETE WASHOUTS SHALL NOT BE LOCATED IN AN AREA WHERE SHALLOW GROUNDWATER MAY BE PRESENT. OR WITHIN 50 FEET OF A SURFACE WATER BODY, CREEK OR STREAM.

14. DURING DEWATERING OPERATIONS, UNCONTAMINATED GROUNDWATER MAY BE DISCHARGED ON-SITE, BUT SHALL NOT LEAVE THE SITE IN THE FORM OF SURFACE RUNOFF UNLESS AN APPROVED STATE DEWATERING PERMIT IS IN PLACE.

15. EROSION CONTROL BLANKETING OR OTHER PROTECTIVE COVERING SHALL BE USED ON SLOPES STEEPER THAN 3:1.

16. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF ALL WASTES FROM THE CONSTRUCTION SITE FOR DISPOSAL IN ACCORDANCE WITH LOCAL AND STATE REGULATORY REQUIREMENTS. NO CONSTRUCTION DEBRIS, TREE SLASH, BUILDING MATERIAL WASTES OR UNUSED BUILDING MATERIALS SHALL BE BURIED, DUMPED, OR DISCHARGED AT THE SITE. 17. WASTE MATERIALS SHALL NOT BE TEMPORARILY PLACED OR STORED IN THE STREET, ALLEY, OR OTHER PUBLIC WAY, UNLESS IN ACCORDANCE WITH AN APPROVED TRAFFIC CONTROL PLAN. CONTROL MEASURES MAY BE REQUIRED BY EL PASO COUNTY ENGINEERING IF DEEMED NECESSARY, BASED ON SPECIFIC CONDITIONS AND CIRCUMSTANCES. 18. TRACKING OF SOILS AND CONSTRUCTION DEBRIS OFF-SITE SHALL BE MINIMIZED. MATERIALS TRACKED OFF-SITE SHALL BE CLEANED UP AND PROPERLY DISPOSED OF IMMEDIATELY. 19. THE OWNER/DEVELOPER SHALL BE RESPONSIBLE FOR THE REMOVAL OF ALL CONSTRUCTION DEBRIS, DIRT, TRASH, ROCK, SEDIMENT, SOIL, AND SAND THAT MAY ACCUMULATE IN ROADS, STORM

DRAINS AND OTHER DRAINAGE CONVEYANCE SYSTEMS AND STORMWATER APPURTENANCES AS A RESULT OF SITE DEVELOPMENT. 20. THE QUANTITY OF MATERIALS STORED ON THE PROJECT SITE SHALL BE LIMITED, AS MUCH AS PRACTICAL, TO THAT QUANTITY REQUIRED TO PERFORM THE WORK IN AN ORDERLY SEQUENCE. ALL MATERIALS STORED ON-SITE SHALL BE STORED IN A NEAT, ORDERLY MANNER, IN THEIR ORIGINAL CONTAINERS, WITH ORIGINAL MANUFACTURER'S LABELS. 21. NO CHEMICAL(S) HAVING THE POTENTIAL TO BE RELEASED IN STORMWATER ARE TO BE STORED OR USED ON-SITE UNLESS PERMISSION FOR THE USE OF SUCH CHEMICAL(S) IS GRANTED IN WRITING

BY THE ECM ADMINISTRATOR. IN GRANTING APPROVAL FOR THE USE OF SUCH CHEMICAL(S), SPECIAL CONDITIONS AND MONITORING MAY BE REQUIRED. 22. BULK STORAGE OF ALLOWED PETROLEUM PRODUCTS OR OTHER ALLOWED LIQUID CHEMICALS IN EXCESS OF 55 GALLONS SHALL REQUIRE ADEQUATE SECONDARY CONTAINMENT PROTECTION TO CONTAIN ALL SPILLS ON-SITE AND TO PREVENT ANY SPILLED MATERIALS FROM ENTERING STATE WATERS, ANY SURFACE OR SUBSURFACE STORM DRAINAGE SYSTEM OR OTHER FACILITIES. 23. NO PERSON SHALL CAUSE THE IMPEDIMENT OF STORMWATER FLOW IN THE CURB AND GUTTER OR DITCH EXCEPT WITH APPROVED SEDIMENT CONTROL MEASURES. 24. OWNER/DEVELOPER AND THEIR AGENTS SHALL COMPLY WITH THE "COLORADO WATER QUALITY CONTROL ACT" (TITLE 25, ARTICLE 8, CRS), AND THE "CLEAN WATER ACT" (33 USC 1344), IN ADDITION TO THE REQUIREMENTS OF THE LAND DEVELOPMENT CODE, DCM VOLUME II AND THE ECM APPENDIX I. ALL APPROPRIATE PERMITS MUST BE OBTAINED BY THE CONTRACTOR PRIOR TO CONSTRUCTION (1041, NPDES, FLOODPLAIN, 404, FUGITIVE DUST, ETC.). IN THE EVENT OF CONFLICTS BETWEEN THESE REQUIREMENTS AND OTHER LAWS, RULES, OR REGULATIONS OF OTHER FEDERAL, STATE, LOCAL, OR

COUNTY AGENCIES, THE MOST RESTRICTIVE LAWS, RULES, OR REGULATIONS SHALL APPLY.

25. ALL CONSTRUCTION TRAFFIC MUST ENTER/EXIT THE SITE ONLY AT APPROVED CONSTRUCTION ACCESS POINTS.

26. PRIOR TO CONSTRUCTION THE PERMITTEE SHALL VERIFY THE LOCATION OF EXISTING UTILITIES.

27. A WATER SOURCE SHALL BE AVAILABLE ON-SITE DURING EARTHWORK OPERATIONS AND SHALL BE UTILIZED AS REQUIRED TO MINIMIZE DUST FROM EARTHWORK EQUIPMENT AND WIND. 28. THE SOILS REPORT FOR THIS SITE HAS BEEN PREPARED BY [COMPANY NAME, DATE OF REPORT] AND SHALL BE CONSIDERED A PART OF THESE PLANS. 29. AT LEAST TEN (10) DAYS PRIOR TO THE ANTICIPATED START OF CONSTRUCTION, FOR PROJECTS THAT WILL DISTURB ONE (1) ACRE OR MORE, THE OWNER OR OPERATOR OF CONSTRUCTION ACTIVITY SHALL SUBMIT A PERMIT APPLICATION FOR STORMWATER DISCHARGE TO THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT, WATER QUALITY DIVISION. THE APPLICATION CONTAINS CERTIFICATION OF COMPLETION OF A STORMWATER MANAGEMENT PLAN (SWMP), OF WHICH THIS GRADING AND EROSION CONTROL PLAN MAY BE A PART. FOR INFORMATION OR APPLICATION MATERIALS CONTACT:

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT WATER QUALITY CONTROL DIVISION WQCD – PERMITS 4300 CHERRY CREEK DRIVE SOUTH

DENVER, CO 80246-1530 ATTN: PERMITS UNIT

DRAWN BY: TBI	JOB DATE:	5/26/2022	BAR IS ONE INCH ON	NO.	DATE	BY	REVISION DESCRIPTION
APPROVED: CMM	JOB NUMBER:	201662.03	0 1"				
CAD DATE: 3/27/2023			IF NOT ONE INCH,				
CAD FILE: J:\2020\2	01662.03\CAD\Dwgs\C\G	ENERAL NOTES	ADJUST SCALE ACCORDINGET.				

### Grandview R Design Parameter Roughness values EPC Maximum 5-year velocity, main channel (within bankfull channel width) (ft/s) Maximum 100-year velocity, main channel (within bankfull channel width) (ft/s) Froude No., 5-year, main channel (within bankfull channel width) Froude No., 100-year, main channel (within bankfull channel width) Maximum shear stress, 100-year, main channel (within bankfull channel width) Minimum bankfull capacity of bankfull channel (based on future development conditions) 70% of Minimum bankfull channel geometry1 Design Channel Type 2.7-31 Entrenchment Ratio

Width to depth ratio

Meander Length2

Radius of Curvature2

Belt Width2

Sinuosity

Slope

D50

d84

Freeboard

Maximum bankfull side slope

Minimum bottom width

*THE DESIGN'S BANKFULL CROSS SECTION GEOMETRY WAS ESTIMATED ASSUMING 70% OF THE 2-YEAR FLOW (AN OPTION DESCRIBED IN MILE HIGH FLOOD DISTRICT'S DESIGN MANUAL VOLUME 1). LEOPOLD (A VIEW OF THE RIVER, 1994; FLUVIAL PROCESSES ON GEOMORPHOLOGY, 1992) SHOWED A VERY STRONG CORRELATION BETWEEN THE EFFECTIVE DISCHARGE CHANNEL AND FIELD-DETERMINED BANKFULL GEOMETRY WHERE THE OBSERVED EQUILIBRIUM CHANNEL'S SPILL-OVER POINT TO THE FLOODPLAIN. THIS POINT IS MOST OFTEN CORRELATED TO A FLOW RETURN INTERVAL BETWEEN 1.0-2.0 YEARS WITH AN AVERAGE OF 1.5-YEARS (THOUGH EXCEPTIONS DO EXIST). AS WE DO NOT HAVE GAUGE DATA TO PERFORM A FLOW FREQUENCY ANALYSIS FOR THIS PROJECT'S CHANNEL, NOR A SUITABLE REFERENCE REACH TO SERVE AS AN ANALOGUE WITH WHICH TO SCALE USING DIMENSIONLESS RATIOS RELATED TO THE BANKFULL WIDTH, WE HAVE CHOSEN TO USE THE 2-YEAR FREQUENCY RAINFALL TO APPROXIMATE THE HYDROLOGIC CONDITION OF THE WATERSHED THAT WOULD RESULT IN THE 1.5-1.8 YR FLOW INTERVAL (APPROXIMATELY

EXISTING FLOWS FOR MAIN STEM (DRAINAGE A)								
STATION	100-YR STORM							
37+13	23 cfs	67 cfs	413 cfs					
25+92	26.45 cfs	80.03 cfs	479.80 cfs					
15+57	26.45 cfs	80.03 cfs	479.80 cfs					

FUTURE FLOWS FOR MAIN STEM (DRAINAGE A)								
STATION	2-YR STORM	5-YR STORM	YR STORM         100-YR STORM           67 cfs         413 cfs           67 cfs         413 cfs					
37+13	23 cfs	67 cfs	413 cfs					
25+92	23 cfs	67 cfs	413 cfs					
15+57	27.75 cfs	67.69 cfs	466.95 cfs					

# CHANNEL DESIGN PARAMETERS

andview Reserve Design Value	Design Value From MHFD	El Paso County
5 ft	5 ft	5 ft
EPC Table 10-2	Per Table 8-5	EPC Table 10-2
5 ft/s	5 ft/s	EPC Table 10-3 and 10-4
7 ft/s	7 ft/s	EPC Table 10-3 and 10-4
0.7	0.7	
0.8	0.8	0.9 (From section 10.7)
1.2 lb/sf	1.2 lb/sf	
70% of 2 year, 10.5 cfs	70% of 2-year discharge or 10% of 100-yr discharge, whichever is greater*	10-yr storm, to be concrte lined or rip rap, ECM 10.5.4
	Per Table 8-2	
C4		
2.7-31.65 (x=5.26)		
13.5-75.0 (x=29.28)		
1.43-2.80 (x=1.92)		
0.0001-0.0184 (x=0.0045)		
12-14mm (~0.5 in)		
32-48mm (~1.6in)		
34-92 (x=56)		
18-55 (x=32)		
7-28 (x=11)		
6 ft		
4(H):1(V)	4(H):1(V)	4(H):1(V) when grassed, 2(H):1(V) when concrete, 2.5(H):1(V) when riprap
2.5(H):1(V)	2.5(H):1(V)	
3.8 ft		At lease twice depth, but not less than 8 ft for channels conveying at least 400 cfs
1.5 ft	18 inch min	freeboard in ft = 1.0 + 0.025 (velocity in fps)(depth in ft)0.33, to be 12 inch minimum

EXISTING FLOWS FOR MAIN STEM TRIBUTARY (DRAINAGE B)									
STATION	2-YR STORM	5-YR STORM	100-YR STORM						
45+30	19 cfs	59 cfs	280 cfs						
22+59	20.14 cfs	68.95 cfs	390.70 cfs						
6+14	22.14 cfs	85.99 cfs	597.42 cfs						

FUTURE FLOWS FOR MAIN STEM TRIBUTARY (DRAINAGE B)										
STATION	2-YR STORM	100-YR STORM								
47+49	19 cfs	59 cfs	280 cfs							
36+50	31.72 cfs	60.52 cfs	395.83 cfs							
5+54	33.53 cfs	63.16 cfs	553.68 cfs							

CONSTRUCTION DOCUMENTS
GENERAL NOTES



	HR GREEN - DENVER	GRANDVIEW RESERVE (DRAINAGE A
	5619 DTC PARKWAY SUITE 1150	
コーフ	DENVER CO 80111	DR HORTON
	PHONE: 720.602.4999	
 HRGreen	FAX: 844.273.1057	FALCON, COLORADO







NORTH KEYMAP ----- PROPERTY LINE ----- ROAD CENTERLINE — RIGHT-OF-WAY LINE — — — EXISTING EASEMENT ---- PROPOSED MINOR CONTOUR ---- EXISTING MINOR CONTOUR FLOW ARROW — — — LIMITS OF CONSTRUCTION EFFECTIVE 100-YR FLOODPLAIN + + + + + + EXISTING WETLANDS PROPOSED MAINTENANCE TRAIL BASIS OF BEARINGS: THE EAST LINE OF SECTION 21, BEING MONUMENTED AT THE SOUTHEAST CORNER BY A 3-1/4" ALUMINUM SURVEYOR'S CAP STAMPED "PS INC PLS 30087 1996", BEING APPROPRIATELY MARKED, AND BEING MONUMENTED AT THE NORTHEAST CORNER BY A 3-1/4" ALUMINUM SURVEYOR'S CAP STAMPED "PS INC PLS 30087 1996", BEING APPROPRIATELY MARKED, BEING ASSUMED TO BEAR NORTH 00 DEGREES 52 MINUTES 26 SECONDS WEST, A DISTANCE OF 5290.17 FEET. DESCRIPTION = DISK ON TOP OF CONCRETE CONTROL POINT COORDINATE SYSTEM: CHANNEL A TO BE CONSTRUCTED WITH FILING A (AREA SOUTH OF CHANNEL A), CHANNEL B TO BE CONSTRUCTED WITH FILING 2 (AREA NORTH OF CHANNEL A AND SOUTHWEST OF CHANNEL B), BOX CULVERTS/ CROSSINGS ALONG CHANNEL B TO BE CONSTRUCTED WITH

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TRIBUTARY 2 VALLEY GRADING







		T	RIBUTARY 2 BANKF	FULL			Т	RIBUTARY 2 BANKI	TRIBUTAR				
+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	Line #/ Curve #	LENGTH	LINE/ CHORD DIRECTION	RADIUS	CHORD LENGTH	Line # Curve	/ # LENGTH	LINE/ CHORD DIRECTION	RADIUS	CHORD LENGTH	Line #/ Curve #	LENGTH	LINE/ C DIRE(
	L1	9.89	S88° 49' 06.33"W			L18	4.39	S59° 22' 08.97"W			L35	7.94	N41° 58'
+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	C1	6.90	S75° 38' 45.23"W	15.00	6.84	C18	38.87	N58° 46' 08.84"W	18.00	31.75	C35	30.67	N1° 57'
+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	L2	27.06	S62° 28' 25.15"W			L19	5.62	N3° 05' 33.34"E			L36	6.69	N45° 53'
+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	C2	18.13	N65° 34' 35.15"W	10.00	15.75	C19	20.22	N54° 49' 10.98"W	10.00	16.94	C36	21.98	N29° 44'
+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	L3	13.71	N13° 37' 37.78"W			L20	8.89	S67° 16' 02.85"W			L37	6.04	S87° 20'
+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	C3	28.09	S85° 53' 56.81"W	10.00	19.72	C20	29.97	N78° 23' 15.03"W	25.00	28.21	C37	24.33	N64° 47'
	L4	9.08	S5° 25' 31.40"W			L21	6.03	N44° 02' 34.76"W			L38	6.03	N36° 54'
	C4	14.66	S47° 25' 06.79"W	10.00	13.38	C21	12.18	N9° 09' 50.08"W	10.00	11.44	C38	12.18	N2° 01'
	L5	17.98	S89° 24' 40.12"W			L22	7.66	N25° 42' 58.88"E			L39	7.66	N32° 51'
	C5	14.28	N49° 41' 34.57"W	10.00	13.10	C22	22.24	N38° 00' 14.82"W	10.00	17.93	C39	22.24	N30° 52'
	L6	9.68	N10° 01' 15.02"W			L23	5.78	S78° 16' 31.48"W			L40	5.78	S85° 24'
	C6	24.93	N81° 26' 08.67"W	10.00	18.96	C23	26.11	N26° 55' 16.86"W	10.00	19.30	C40	26.11	N19° 47'
	L7	16.41	S27° 08' 57.68"W			L24	10.85	N47° 52' 55.97"E			L41	10.85	N55° 01'
	C7	23.51	N85° 30' 01.53"W	10.00	18.46	C24	27.51	N30° 55' 05.47"W	10.00	19.62	C41	28.00	N25° 12'
	L8	10.05	N18° 09' 00.75"W			L25	11.08	S70° 16' 53.09"W			L42	7.95	S74° 34'
	C8	12.41	N53° 42' 56.01"W	10.00	11.63	C25	28.25	N28° 46' 50.28"W	10.00	19.75	C42	19.88	N67° 27'
	L9	9.00	N89° 16' 51.27"W			L26	5.93	N52° 09' 25.02"E			L43	9.47	N29° 29'
/ APPROXIMATE EXTENT	C9	27.92	S64° 03' 41.24"W	30.00	26.92	C26	19.91	N14° 07' 50.40"E	15.00	18.48	C43	19.55	N1° 29' :
OF CHANNEL GRADING	L10	11.13	S37° 24' 13.76"W			L27	29.00	N23° 53' 44.22"W			L44	9.44	N26° 30'
	C10	19.37	N87° 06' 06.88"W	10.00	16.48	C27	13.70	N63° 08' 25.63"W	10.00	12.65	C44	60.26	N31° 01'
	L11	12.09	N31° 36' 29.11"W			L28	7.09	S77° 36' 52.95"W			L45	8.65	N88° 44'
PROPOSED 15.00'	C11	29.37	N87° 41' 42.39"W	15.00	24.90	C28	11.33	N82° 06' 28.45"W	16.00	11.09			
- MAINTENANCE TRAIL (BY OTHERS). SEE DT2	L12	9.63	S36° 13' 03.45"W			L29	6.19	N61° 49' 49.96"W					
	C12	17.51	S52° 56' 31.48"W	30.00	17.27	C29	21.24	N0° 59' 36.21"W	10.00	17.46			
గా	L13	8.13	S69° 39' 59.52"W			L30	8.71	N59° 50' 37.55"E					
6 ⁰ ⁱ r	C13	16.88	N61° 58' 49.13"W	10.00	14.95	C30	29.87	N25° 42' 48.35"W	10.00	19.94			
	L14	13.71	N13° 37' 37.78"W			L31	8.42	S68° 43' 48.11"W					
	C14	19.03	N68° 09' 01.05"W	10.00	16.29	C31	28.24	N30° 22' 03.52"W	10.00	19.75			
	L15	24.68	S57° 19' 35.67"W			L32	10.54	N50° 32' 04.84"E					
	C15	7.87	S79° 51' 58.09"W	10.00	7.67	C32	14.48	N9° 02' 55.12"E	10.00	13.25			
	L16	17.98	N77° 35' 39.50"W			L33	9.11	N32° 26' 14.61"W					
	C16	14.06	N37° 18' 36.32"W	10.00	12.93	C33	12.97	N69° 35' 54.92"W	10.00	12.08			
	L17	9.90	N2° 58' 25.37"E			L34	9.22	S73° 14' 27.45"W					
	C17	21.57	N58° 49' 43.74"W	10.00	17.63	C34	11.31	N74° 22' 01.89"W	10.00	10.71			
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HR GREEN - DENVER 5619 DTC PARKWAY SUITE 1150 
 DENVER CO 80111

 PHONE: 720.602.4999

 FAX: 844.273.1057

# GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO

BUTARY 2 BANKF	ULL	
LINE/ CHORD DIRECTION	RADIUS	CHORD LENGTH
V41° 58' 31.24"W		
N1° 57' 37.87"E	20.00	27.75
N45° 53' 48.79"E		
129° 44' 05.55"W	9.95	17.77
687° 20' 24.95"W		
N64° 47' 02.52"W	25.00	23.38
136° 54' 29.99"W		
N2° 01' 42.66"W	10.00	11.44
N32° 51' 03.64"E		
130° 52' 10.06"W	10.00	17.93
685° 24' 36.24"W		
V19° 47' 11.92"W	10.00	19.30
N55° 01' 00.73"E		
V25° 12' 26.69"W	10.00	19.71
\$74° 34' 07.03"W		
N67° 27' 49.92"W	15.00	18.46
129° 29' 45.09"W		
N1° 29' 29.61"W	20.00	18.78
N26° 30' 44.27"E		
N31° 01' 55.35"W	30.00	50.63
188° 44' 02.24"W		
		-



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5	N57° 07' 38.05"E		
1	N21° 40' 23.39"W	10.00	19.62
3	S79° 31' 35.17"W		
5	N19° 32' 09.56"W	10.00	19.75
	N61° 24' 07.11"E		
6	N6° 19' 39.33"W	15.00	27.76
	N74° 03' 25.76"W		
1	N57° 19' 57.73"W	30.00	17.27
	N40° 36' 29.69"W		
3	N7° 44' 41.02"E	10.00	14.95
1	N56° 05' 53.01"E		
)	N24° 22' 32.40"W	10.00	19.72
	S75° 09' 02.19"W		
6	N62° 51' 23.45"W	10.00	13.38
3	N20° 51' 49.09"W		
6	N19° 25' 12.37"E	10.00	12.93
	N59° 42' 15.77"E		
3	N11° 42' 37.88"W	10.00	18.96
1	N83° 07' 31.53"W		
5	N11° 04' 35.90"W	10.00	19.03
	N60° 58' 19.72"E		
3	N22° 24' 52.51"E	10.04	12.49

TRIBUTARY 2 BANKFULL								
Line #/ Curve #	LENGTH	LINE/ CHORD DIRECTION	RADIUS	CHORD LENGTH				
L79	9.57	N19° 33' 20.48"W						
C79	31.24	N49° 23' 19.62"W	30.00	29.85				
L80	9.97	N79° 13' 18.76"W						
C80	22.55	N14° 38' 03.74"W	10.00	18.06				
L81	12.49	N49° 57' 11.27"E						
C81	32.47	N12° 03' 07.24"W	15.00	26.49				
L82	9.63	N74° 03' 25.76"W						
C82	17.93	N56° 56' 48.00"W	30.03	17.66				
L83	7.72	N40° 36' 29.69"W						
C83	16.88	N7° 44' 41.66"E	10.00	14.95				
L84	13.71	N56° 05' 53.01"E						
C84	28.09	N24° 22' 32.40"W	10.00	19.72				
L85	9.08	S75° 09' 02.19"W						
C85	14.66	N62° 51' 23.45"W	10.00	13.38				
L86	17.98	N20° 51' 49.09"W						
C86	14.06	N19° 25' 13.34"E	10.00	12.93				
L87	9.90	N59° 42' 15.77"E						
C87	24.93	N11° 42' 37.88"W	10.00	18.96				
L88	16.41	N83° 07' 31.53"W						





	TRIBUTARY 2 BANKFULL					TRIBUTARY 2 BANKFULL					TRIBUTARY 2 BANKFULL				TRIBUTARY 2 BANKFULL					
	Line #/ Curve #	LENGTH	LINE/ CHORD DIRECTION	RADIUS	CHORD LENGTH	Line #/ Curve #	LENGTH	LINE/ CHORD DIRECTION	RADIUS	CHORD LENGTH		Line #/ Curve #	LENGTH	LINE/ CHORD DIRECTION	RADIUS	CHORD LENGTH	Line #/ Curve #	LENGTH	LINE/ CHORD DIRECTION	RADIUS
	C88	25.60	N9° 49' 25.51"W	10.01	19.17	C99	16.60	N71° 05' 03.19"W	10.00	14.76		C110	6.34	N1° 52' 20.28"W	20.00	6.31	C121	28.82	N48° 22' 34.68"W	10.00
	L89	9.40	N60° 58' 19.72"E			L100	3.40	N23° 32' 19.06"W				L111	12.01	N10° 57' 10.46"W			L122	10.32	N34° 12' 03.40"E	
	C89	14.05	N20° 42' 28.75"E	10.00	12.93	C100	18.39	N11° 35' 14.13"E	15.00	17.26		C111	18.36	N63° 33' 38.89"W	10.00	15.89	C122	30.57	N53° 22' 36.38"W	10.00
	L90	9.00	N19° 33' 20.48"W			L101	7.45	N46° 42' 47.32"E				L112	8.57	S63° 49' 52.68"W			L123	4.56	S39° 02' 43.84"W	
	C90	31.24	N49° 23' 19.62"W	30.00	29.85	C101	27.23	N31° 16' 54.81"W	10.00	19.56		C112	27.63	N37° 01' 43.76"W	10.00	19.64	C123	11.68	S72° 30' 24.37"W	10.00
	L91	9.97	N79° 13' 18.76"W			L102	11.56	S70° 43' 23.06"W				L113	9.63	N42° 06' 38.48"E			L124	7.77	N74° 01' 55.09"W	
	C91	25.04	N7° 29' 02.80"W	10.00	18.99	C102	18.45	N56° 25' 05.12"W	10.00	15.94		C113	17.41	N7° 45' 10.26"W	10.00	15.29	C124	19.62	N17° 48' 40.14"W	10.00
	L92	8.18	N64° 15' 13.15"E			L103	11.04	N3° 33' 33.30"W			-	L114	6.55	N57° 36' 59.00"W			L125	8.77	N38° 24' 34.82"E	
	C92	28.54	N17° 30' 12.68"W	10.00	19.79	C103	7.18	N17° 00' 28.86"E	10.00	7.03	-	C114	23.33	N79° 53' 57.95"W	30.00	22.75	C125	26.96	N38° 49' 54.33"W	10.00
	L93	12.06	S80° 44' 21.49"W			L104	7.94	N37° 34' 32.53"E			-	L115	11.69	S77° 49' 02.26"W			L126	6.80	S63° 55' 35.19"W	
	C93	19.18	N53° 27' 44.45"W	12.00	17.21	C104	26.39	N38° 01' 19.21"W	10.00	19.37		C115	24.92	N30° 47' 49.85"W	10.00	18.95	C126	6.95	S73° 52' 28.77"W	20.00
	L94	5.34	N7° 39' 51.64"W			L105	7.71	S66° 22' 49.05"W				L116	8.54	N40° 35' 18.03"E			L127	9.62	S83° 49' 22.37"W	
	C94	18.75	N13° 48' 59.59"E	25.00	18.31	C105	9.04	N87° 43' 09.16"W	10.00	8.74		C116	14.25	N0° 13' 44.58"W	10.00	13.07	C127	18.49	N43° 12' 01.69"W	10.00
	L95	10.94	N35° 17' 50.82"E			L106	10.63	N61° 49' 07.38"W				L117	6.03	N41° 02' 45.55"W			L128	6.51	N9° 46' 34.25"E	
	C95	26.76	N41° 22' 36.53"W	10.00	19.46	C106	20.13	N4° 08' 31.80"W	10.00	16.90		C117	16.43	N88° 07' 30.46"W	10.00	14.65	C128	19.46	N12° 31' 16.03"W	25.00
	L96	8.88	S61° 56' 54.42"W			L107	7.18	N53° 32' 03.79"E				L118	9.89	S44° 47' 44.63"W			L129	22.46	N34° 49' 06.32"W	
	C96	30.75	N29° 57' 02.15"W	10.00	19.99	C107	29.03	N29° 37' 53.19"W	10.00	19.86		C118	27.21	N57° 14' 52.82"W	10.00	19.56	C129	16.69	N82° 37' 49.88"W	10.00
	L97	9.16	N58° 09' 01.28"E			L108	7.51	S65° 47' 53.53"W				L119	6.59	N20° 42' 28.68"E			L130	11.08	S49° 33' 25.22"W	
	C97	14.05	N17° 54' 31.25"E	10.00	12.92	C108	12.50	S89° 40' 03.85"W	15.00	12.14		C119	6.02	N12° 04' 56.94"E	20.00	6.00	C130	29.21	N46° 45' 12.25"W	10.00
	L98	4.80	N22° 19' 58.77"W			L109	4.30	N66° 27' 45.83"W				L120	7.20	N3° 27' 24.15"E			L131	4.58	N36° 56' 10.28"E	
	C98	16.81	N70° 28' 52.54"W	10.00	14.90	C109	12.86	N29° 37' 38.53"W	10.00	11.99	-	C120	23.46	N63° 44' 54.30"W	10.00	18.44	C131	6.28	N18° 56' 28.97"E	10.00
	L99	9.34	S61° 22' 13.69"W			L110	9.31	N7° 12' 29.90"E				L121	9.75	S49° 02' 47.25"W			L132	5.56	N0° 56' 47.66"E	
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TRIBUTARY 2 BANKFULL								
	Line #/ Curve #	LENGTH	LINE/ CHORD DIRECTION	RADIUS	CHORD LENGTH			
	C132	24.70	N63° 23' 02.96"W	11.00	19.83			
	L133	10.86	S52° 17' 06.42"W					
	C133	30.80	N47° 30' 08.73"W	11.00	21.68			
	L134	10.39	N32° 42' 36.11"E					
	C134	28.56	N49° 06' 33.36"W	10.00	19.80			
	L135	11.09	S49° 04' 18.88"W					
	C135	18.28	N78° 32' 58.75"W	10.00	15.84			
	L136	4.96	N26° 10' 15.15"W					
	C136	14.36	N1° 57' 51.31"W	17.00	13.94			
	L137	6.32	N22° 14' 32.53"E					
	C137	21.42	N39° 07' 50.41"W	10.00	17.56			
	L138	6.17	S79° 29' 45.47"W					
	C138	5.15	S72° 07' 04.39"W	20.00	5.14			
	L139	6.44	S64° 44' 22.55"W					
	C139	27.69	N35° 56' 37.45"W	10.00	19.65			

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GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO



CONSTRUCTION DOCUMENTS



TRIBUTARY 2 BANKFULL									
ГН	LINE/ CHORD DIRECTION	RADIUS	CHORD LENGTH						
	N12° 34' 50.10"W								
5	N30° 17' 24.70"E	13.00	17.69						
	N73° 09' 39.51"E								
7	N12° 50' 28.15"E	13.00	22.59						
	N47° 28' 43.14"W								
	N60° 46' 40.20"W	20.00	9.20						
	N74° 04' 37.26"W								
)	N3° 27' 36.79"E	13.00	25.39						
	N80° 59' 48.77"E								
2	N15° 02' 30.14"E	10.00	18.26						
	N50° 54' 48.49"W								
	N60° 54' 24.89"W	20.00	6.94						
	N70° 54' 01.29"W								
1	N9° 19' 54.43"E	10.00	19.71						
	N89° 33' 50.14"E								
)	N10° 14' 07.28"E	10.00	19.65						
	N69° 05' 35.58"W								
3	N48° 48' 57.75"W	16.00	11.09						
	N28° 32' 18.50"W								
1	N32° 17' 55.26"E	10.00	17.46						
	S86° 51' 50.99"E								
7	N7° 34' 43.57"E	10.00	19.94						

Line #/ Curve #         LENGTH         LINE/ CHORD DIRECTION         RADIUS           L173         8.42         N77° 58' 40.42"W            C173         28.24         N2° 55' 27.94"E         10.00           L174         10.54         N83° 49' 36.31"E         10.00           L175         9.11         N0° 51' 16.85"E         10.00           L175         12.97         N36° 18' 22.81"W         10.00           L176         9.22         N73° 28' 01.08"W         10.08"W	CHORD LENGTH 19.75 13.25 13.25
L173       8.42       N77° 58' 40.42"W         C173       28.24       N2° 55' 27.94"E       10.00         L174       10.54       N83° 49' 36.31"E       10.00         C174       14.48       N42° 20' 27.12"E       10.00         L175       9.11       N0° 51' 16.85"E       10.00         L175       12.97       N36° 18' 22.81"W       10.00         L176       9.22       N73° 28' 01.08"W       10.08"W	19.75 13.25 12.08
C173         28.24         N2° 55' 27.94"E         10.00           L174         10.54         N83° 49' 36.31"E            C174         14.48         N42° 20' 27.12"E         10.00           L175         9.11         N0° 51' 16.85"E            C175         12.97         N36° 18' 22.81"W         10.00           L176         9.22         N73° 28' 01.08"W	19.75 13.25 12.08
L174         10.54         N83° 49' 36.31"E           C174         14.48         N42° 20' 27.12"E         10.00           L175         9.11         N0° 51' 16.85"E         10.00           C175         12.97         N36° 18' 22.81"W         10.00           L176         9.22         N73° 28' 01.08"W         10.00	13.25
C174         14.48         N42° 20' 27.12"E         10.00           L175         9.11         N0° 51' 16.85"E         10.00           C175         12.97         N36° 18' 22.81"W         10.00           L176         9.22         N73° 28' 01.08"W         10.00	13.25
L175         9.11         N0° 51' 16.85"E           C175         12.97         N36° 18' 22.81"W         10.00           L176         9.22         N73° 28' 01.08"W         10.00	12.08
C175         12.97         N36° 18' 22.81"W         10.00           L176         9.22         N73° 28' 01.08"W	12.08
L176 9.22 N73° 28' 01.08"W	
C176 11.31 N41° 04' 30.43"W 10.00	10.71
L177 7.94 N8° 40' 59.77"W	
C177 30.67 N35° 15' 10.24"E 20.00	27.75
L178 6.69 N79° 11' 20.25"E	
C178 24.18 N9° 54' 38.33"E 10.00	18.71
L179 5.63 N59° 22' 03.58"W	
C179 24.74 N31° 57' 25.91"W 25.02	23.74
L180 6.03 N3° 36' 58.53"W	
C180 12.18 N31° 15' 48.29"E 10.00	11.44
L181 7.66 N66° 08' 35.11"E	
C181 22.24 N2° 25' 20.57"E 10.00	17.93
L182 5.78 N61° 17' 52.29"W	
C182 26.11 N13° 30' 19.95"E 10.00	19.30
L183 10.85 N88° 18' 32.19"E	
C183 25.90 N14° 07' 05.96"E 10.00	19.24

TRIBUTARY 2 BANKFULL										
Line #/ Curve #	LENGTH	LINE/ CHORD DIRECTION	RADIUS	CHORD LENGTH						
C184	16.43	N28° 42' 03.81"W	15.00	15.62						
L184	99.90	N5° 02' 22.98"E								
C185	15.22	N42° 21' 19.37"E	10.20	13.85						
C186	26.99	N7° 47' 17.92"E	10.00	19.51						
L185	8.04	N69° 32' 08.29"W								
C187	6.99	N52° 51' 05.76"W	12.00	6.89						
L186	4.55	N36° 10' 04.44"W								





	TRIBUTARY 2 BANKFULL					TRIBUTARY 2 BANKFULL				TRIBUTARY 2 BANKFULL					TRIBUTARY 2 BANKFULL				
Line #/ Curve #	LENGTH	LINE/ CHORD DIRECTION	RADIUS	CHORD LENGTH	Line #/ Curve #	LENGTH	LINE/ CHORD DIRECTION	RADIUS	CHORD LENGTH	Line #/ Curve #	LENGTH	LINE/ CHORD DIRECTION	RADIUS	CHORD LENGTH	Line #/ Curve #	LENGTH	LINE/ CHORD DIRECTION	RADIUS	CHORD LENGTH
C188	31.01	N23° 03' 08.00"E	15.00	25.77	C199	16.25	N38° 56' 32.72"W	10.00	14.52	C210	28.51	N3° 07' 09.79"W	10.00	19.79	C221	5.69	N54° 20' 47.67"E	10.00	5.61
L187	8.57	N82° 16' 20.45"E			L198	7.68	N85° 29' 08.51"W			L209	8.46	N78° 32' 34.74"E			L220	6.73	N70° 37' 59.36"E		
C189	27.86	N2° 27' 47.70"E	10.00	19.68	C200	12.69	N49° 08' 07.23"W	10.00	11.85	C211	14.61	N36° 42' 02.06"E	10.00	13.34	C222	48.94	N0° 31' 49.94"E	20.00	37.61
L188	8.98	N77° 20' 45.04"W			L199	7.41	N12° 47' 05.96"W			L210	8.67	N5° 08' 30.61"W			L221	5.41	N69° 34' 19.48"W		
C190	13.59	N38° 24' 33.75"W	10.00	12.57	C201	18.38	N22° 19' 25.40"E	15.00	17.25	C212	14.91	N43° 58' 27.24"W	11.00	13.79	C223	14.28	N28° 39' 19.30"W	10.00	13.10
L189	7.25	N0° 31' 37.54"E			L200	6.36	N57° 25' 56.76"E			L211	8.19	N82° 48' 23.87"W			L222	4.50	N12° 15' 40.88"E		
C191	16.68	N40° 20' 56.81"E	12.00	15.37	C202	9.39	N43° 58' 55.22"E	20.00	9.30	C213	26.57	N6° 41' 31.89"W	10.00	19.42	C224	13.50	N50° 56' 31.94"E	10.00	12.50
L190	8.96	N80° 10' 17.29"E			L201	7.15	N30° 31' 53.67"E			L212	8.16	N69° 25' 20.09"E			L223	10.57	N89° 37' 23.01"E		
C192	21.88	N27° 56' 06.99"E	12.00	18.97	C203	20.51	N28° 13' 22.72"W	10.00	17.10	C214	14.65	N34° 26' 50.24"E	12.00	13.76	C225	27.53	N10° 45' 04.72"E	10.00	19.62
L191	8.16	N24° 18' 02.22"W			L202	9.76	N86° 58' 39.11"W			L213	16.46	N0° 31' 38.34"W			L224	7.19	N68° 07' 13.58"W		
C193	11.91	N37° 57' 08.05"W	25.00	11.80	C204	27.90	N7° 03' 17.54"W	10.00	19.69	C215	14.80	N35° 50' 59.34"W	12.00	13.88	C226	39.83	N7° 57' 20.84"E	15.00	29.12
L192	7.82	N51° 36' 13.15"W			L203	11.50	N72° 52' 05.09"E			L214	10.77	N71° 10' 19.33"W			L225	8.26	N84° 01' 56.33"E		
C194	33.65	N12° 39' 37.26"E	15.00	27.02	C205	17.33	N31° 30' 17.31"E	12.00	15.86	C216	44.55	N7° 21' 53.33"W	20.00	35.89	C227	26.80	N7° 15' 53.12"E	10.00	19.47
L193	10.43	N76° 55' 28.56"E			L204	8.67	N9° 51' 30.46"W			L215	8.98	N56° 26' 32.67"E			L226	7.02	N69° 30' 11.53"W		
C195	12.48	N41° 09' 53.91"E	10.00	11.69	C206	13.00	N47° 06' 03.14"W	10.00	12.10	C217	40.28	N7° 39' 50.77"W	18.00	32.39	C228	25.40	N8° 52' 21.36"W	12.00	20.92
L194	8.34	N5° 24' 21.11"E			L205	11.78	N84° 20' 35.82"W			L216	10.56	N72° 16' 23.80"W			L227	5.33	N51° 45' 28.05"E		
C196	31.18	N30° 19' 39.76"W	25.00	29.20	C207	28.95	N1° 25' 03.64"W	10.00	19.85	C218	25.52	N0° 49' 59.43"E	10.00	19.14	C229	20.70	N31° 59' 12.89"E	30.00	20.30
L195	7.80	N66° 03' 40.62"W			L206	9.39	N81° 30' 28.54"E			L217	11.94	N73° 56' 22.67"E			L228	21.01	N12° 12' 56.98"E		
C197	25.58	N7° 13' 52.01"E	10.00	19.16	C208	26.62	N5° 15' 07.22"E	10.00	19.43	C219	31.22	N0° 35' 35.12"W	12.00	23.13				<b>I</b>	•
L196	9.62	N80° 31' 24.64"E			L207	4.72	N71° 00' 14.11"W			L218	8.82	N75° 07' 32.91"W							
C198	12.73	N44° 03' 44.76"E	10.00	11.89	C209	2.40	N77° 53' 34.21"W	10.00	2.40	C220	27.28	N19° 18' 27.19"W	14.00	23.16					
L197	4.77	N7° 36' 03.07"E			L208	7.28	N84° 46' 54.32"W			L219	7.63	N38° 03' 34.92"E							
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HRGreen PHONE: 720.602.4999 FAX: 844.273.1057

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CONSTRUCTION DOCUMENTS TRIBUTARY 2 BANKFULL GRADING



























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GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO

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GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO

TRIBUTARY 2 CROSS SECTIONS

CONSTRUCTION DOCUMENTS

PROPOSED GRADES TO TIE INTO GRANDVIEW RESERVE FILING 1. REFER TO THE GRANDVIEW RESERVE FILING 1 PLAN SET FOR CONTINUATION OF GRADING THAT IS BEING TIED INTO OUTSIDE











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GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO

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GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO

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GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO

TRIBUTARY 2 CROSS SECTIONS

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GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO

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HR GREEN - DENVER 5619 DTC PARKWAY SUITE 1150 DENVER CO 80111 PHONE: 720.602.4999 FAX: 844.273.1057

GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO

TRIBUTARY 2 CROSS SECTIONS









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CONSTRUCTION DOCUMENTS

TRIBUTARY 2 CROSS SECTIONS

OF CHANNEL GRADING LIMITS.



HR GREEN - DENVER 5619 DTC PARKWAY SUITE 1150 DENVER CO 80111 PHONE: 720.602.4999 FAX: 844.273.1057

GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO











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HR GREEN - DENVER 5619 DTC PARKWAY SUITE 1150 DENVER CO 80111 PHONE: 720.602.4999 FAX: 844.273.1057

GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO

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HR GREEN - DENVER 5619 DTC PARKWAY SUITE 1150 DENVER CO 80111 PHONE: 720.602.4999 FAX: 844.273.1057

GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO

TRIBUTARY 2 CROSS SECTIONS

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GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO

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5619 DTC PARKWAY SUITE 1150



DETAILS

GRANDVIEW RESERVE (DRAINAGE A & B) DR HORTON FALCON, COLORADO

FINISHED SLOPE

TOE WALL

* DDES NOT INCLUDE TOE WALL QUANTITIES

DESIGN FOOTING LINE-

SEE SHEET 2 OF 2 FOR REINFORCING STEEL QUANTITY

BOX ELEVATION m = h, Bg OR RISE + (1'-4") UNLESS OTHERWISE SHOWN ON PLANS

#4 @ 12" HORIZONTAL BAR NOT SHOWN FOR CLARITY

SEE NOTE 6

w = 6' - 2'

#5 PLACE ALONG

TOP OF WALL (TOT. 2)

5' 6' 7' 8' '-6" 1'-8" 1'-10" 2'-0"

CONSTRUCTION FOOTING LINE.

-8" 3'-0" 3'-4" 3'-8" 4'-0"

9-21







SSA-4	Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual Volume 3	November 2010	
NSTRUCTION DOCU	JMENTS	SHEET DT3	44

VEGETATION	IN AREAS	WHERE RE	CYCLED CO	NCRETE WA	s placed.	
NOTE: MANY CONSULT WI DIFFERENCE:	JURISDIC ITH LOCAL S ARE NO	TIONS HAVE JURISDICTIO TED.	BMP DETA DNS AS TO	ils that v Which de	ary from U( Tail Should	dfod st be usi
(DETAILS ADAPTI	ed From Dol	IGLAS COUNTY,	COLORADO, N	ot available i	n Autocad)	

NOTE: MANY MUNICIPALITIES PROHIBIT THE USE OF RECYCLED CONCRETE AS GRANULAR MATERIAL FOR STABILIZED STAGING AREAS DUE TO DIFFICULTIES WITH RE-ESTABLISHMENT OF TANDARD DETAILS. ED WHEN

6. THE STABILIZED STAGING AREA SHALL BE REMOVED AT THE END OF CONSTRUCTION. THE GRANULAR MATERIAL SHALL BE REMOVED OR, IF APPROVED BY THE LOCAL JURISDICTION, USED ON SITE, AND THE AREA COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY LOCAL JURISDICTION.

STABILIZED STAGING AREA MAINTENANCE NOTES 5. STABILIZED STAGING AREA SHALL BE ENLARGED IF NECESSARY TO CONTAIN PARKING, STORAGE, AND UNLOADING/LOADING OPERATIONS.

**SM-6** 

# **Stabilized Staging Area (SSA)**

VTC-6

Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual Volume 3 November 2010

(DETAILS ADAPTED FROM CITY OF BROOMFIELD, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

5. SEDIMENT TRACKED ONTO PAVED ROADS IS TO BE REMOVED THROUGHOUT THE DAY AND AT THE END OF THE DAY BY SHOVELING OR SWEEPING. SEDIMENT MAY NOT BE WASHED DOWN STORM SEWER DRAINS.

4. ROCK SHALL BE REAPPLIED OR REGRADED AS NECESSARY TO THE STABILIZED ENTRANCE/EXIT TO MAINTAIN A CONSISTENT DEPTH.

EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY. 3. WHERE BMP® HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE. 2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN

STABILIZED CONSTRUCTION ENTRANCE/EXIT MAINTENANCE NOTES 1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS

5. A NON-WOVEN GEOTEXTILE FABRIC SHALL BE PLACED UNDER THE STABILIZED CONSTRUCTION ENTRANCE/EXIT PRIOR TO THE PLACEMENT OF ROCK. 6. UNLESS OTHERWISE SPECIFIED BY LOCAL JURISDICTION, ROCK SHALL CONSIST OF DOT SECT. #703, AASHTO #3 COARSE AGGREGATE OR 6" (MINUS) ROCK.

WHERE VEHICLES ACCESS THE CONSTRUCTION SITE FROM PAVED RIGHT-OF-WAYS. 4. STABILIZED CONSTRUCTION ENTRANCE/EXIT SHALL BE INSTALLED FRIOR TO ANY LAND DISTURBING ACTIVITIES.

3. A STABILIZED CONSTRUCTION ENTRANCE/EXIT SHALL BE LOCATED AT ALL ACCESS POINTS

2. CONSTRUCTION MAT OR TRM STABILIZED CONSTRUCTION ENTRANCES ARE ONLY TO BE USED ON SHORT DURATION PROJECTS (TYPICALLY RANGING FROM A WEEK TO A MONTH) WHERE THERE WILL BE LIMITED VEHICULAR ACCESS.

-LOCATION OF CONSTRUCTION ENTRANCE(S)/EXIT(S). -TYPE OF CONSTRUCTION ENTRANCE(S)/EXITS(S) (WITH/WITHOUT WHEEL WASH, CONSTRUCTION MAT OR TRM).

STABILIZED CONSTRUCTION ENTRANCE/EXIT INSTALLATION NOTES 1. SEE PLAN VIEW FOR







Temporary	Outlet	Protection	(TOP)
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**EC-8** 

<ul> <li>TEMPORARY CULTET PROTECTION INSTALLATION NOTES</li> <li>9.9 SEE PLAN VIEW FOR <ul> <li>1.0 CANTON OF CULTET PROTECTION.</li> <li>1.0 CETAL, SINTENDED FOR PRESSION REQUIRED FOR STEEPER SLOPES.</li> <li>1.0 CETAL, SINTENDED FOR PRESSION REQUIRED FOR STEEPER SLOPES.</li> <li>1.0 CETAL, SINTENDED FOR TRECTION INFORMATION IS FOR CULTET INTENDED TO BE UTILIZED</li> <li>1.2 SENTEMAN 2 YEARS.</li> <li>TEMPORARY CULTET PROTECTION INFORMATION IS FOR CULTET INTENDED TO BE UTILIZED</li> <li>1.3 SINTENDED FOR PRESSION REQUIRED FOR STEEPER SLOPES.</li> <li>TEMPORARY CULTET PROTECTION INFORMATION THEM IN EFFCTIVE OPERATING CONDITION.</li> <li>1.4 SINTENNO.E OF BURP SCHU WORKAY, AND MAINTAIN THEM IN EFFCTIVE OPERATING CONDITION.</li> <li>1.5 SINTENDED FOR TABLE AND A VALUES AND A MAINTENNACE. HOT REACTLE.</li> <li>1.5 SINTENDE OF BURP SCHULD BE PROACTLE, NOT REACTLE.</li> <li>1.5 SESTEME (AND ALMAYS WITHIN 124 HOURS (5) CLOWING A STORM THAT CLAUSES SHOULD BE DECOMENTING CONDITION</li></ul></li></ul>		
November 2010Urban Drainage and Flood Control DistrictToUrban Storm Drainage Criteria Manual Volume 3	OP-3	
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INCORMATION CO				SE	DIMENT BASIN MAINTENANCE NOTES	
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ge and Flood Co rainage Criteria	ontrol District a Manual Volume 3		August 2013	August 2013	Urban Drainage and Flood Control District SB-7 Urban Storm Drainage Criteria Manual Volume 3	,

Sediment Basin (SB)

Sediment Basin (SB)

**SC-7** 



]	CONSTRUCTION DOCUMENTS	SHEET	
		DT6	47
	DETAILS		



Grandview Reserve CLOMR Report Project No.: 201662.03

Appendix E Floodway Notice



▷ 5619 DTC Parkway | Suite 1150 | Greenwood Village, CO 80111
 Main 720.602.4999 + Fax 844.273.1057

**HRGREEN.COM** 

### March 2023

4-Way Ranch Joint Venture LLC

PO Box 50223

Colorado Springs, CO 80949-0223

Re: Notification of establishment in 1-percent-annual-chance water-surface elevations and/or future flood hazard revisions

The Flood Insurance Rate Map (FIRM) for a community depicts the Special Flood Hazard Area (SFHA), the area that has been determined to be subject to a 1-percent or greater chance of flooding in any given year. The FIRM is used to determine flood insurance rates and to help the community with floodplain management.

HR Green, Inc. is applying for a Conditional Letter of Map Revision (CLOMR) from the Federal Emergency Management Agency (FEMA) on behalf of D.R. Horton to revise FIRMs 08041C0552G and 08041C0556G for El Paso County along Gieck Ranch Tributary 1 and Gieck Ranch Tributary 2. D.R. Horton is proposing to realign and create a creek corridor as part of the Grandview Reserve Development. The proposed project will result in increases in the 1% annual chance (base) water-surface elevations for a portion of Geick Ranch Tributary 1 and Geick Ranch Tributary 2.

Once the project has been completed, a Letter of Map Revision (LOMR) request should be submitted that will, in part, revise the following flood hazards along Gieck Ranch Tributary 1 and Gieck Ranch Tributary 2.

The SFHA will increase and decrease along Geick Ranch Tributary 1 and Geick Ranch Tributary 2.

This letter is to inform you of the proposed project that may affect flood elevations on your property at Stapleton Dr. This letter is also to inform you of the potential changes to the effective flood hazard information that would result after the project is completed and a LOMR request is submitted to FEMA.

Maps and detailed analysis of the floodway revision can be reviewed at the Pikes Peak Regional Building Department at 2880 International Circle, Colorado Springs, Colorado 80910. If you have any questions or concerns about the proposed project or its effect on your property, you may contact Keith Curtis, CFM, Floodplain Administrator of El Paso County at <u>Keith@pprbd.org</u> from {date TBD} to {date TBD} or Jeff Rice with El Paso County at <u>JeffRice@elpasoco.com</u> from {date TBD} to {date TBD}.

HR GREEN, INC

Greg Panza, PE Lead Engineer



▷ 5619 DTC Parkway | Suite 1150 | Greenwood Village, CO 80111
 Main 720.602.4999 + Fax 844.273.1057

**HRGREEN.COM** 

### March 2023

JMJK Holdings LLC

3855 Ambrosia St. Ste 304

Castle Rock, CO 80109

Re: Notification of establishment in 1-percent-annual-chance water-surface elevations and/or future flood hazard revisions

The Flood Insurance Rate Map (FIRM) for a community depicts the Special Flood Hazard Area (SFHA), the area that has been determined to be subject to a 1-percent or greater chance of flooding in any given year. The FIRM is used to determine flood insurance rates and to help the community with floodplain management.

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Once the project has been completed, a Letter of Map Revision (LOMR) request should be submitted that will, in part, revise the following flood hazards along Gieck Ranch Tributary 1 and Gieck Ranch Tributary 2.

The SFHA will increase and decrease along Geick Ranch Tributary 1 and Geick Ranch Tributary 2.

This letter is to inform you of the proposed project that may affect flood elevations on your property at Eastonville Rd. This letter is also to inform you of the potential changes to the effective flood hazard information that would result after the project is completed and a LOMR request is submitted to FEMA.

Maps and detailed analysis of the floodway revision can be reviewed at the Pikes Peak Regional Building Department at 2880 International Circle, Colorado Springs, Colorado 80910. If you have any questions or concerns about the proposed project or its effect on your property, you may contact Keith Curtis, CFM, Floodplain Administrator of El Paso County at <u>Keith@pprbd.org</u> from {date TBD} to {date TBD} or Jeff Rice with El Paso County at <u>JeffRice@elpasoco.com</u> from {date TBD} to {date TBD}.

#### HR GREEN, INC

Greg Panza, PE Lead Engineer



Grandview Reserve CLOMR Report Project No.: 201662.03

### Appendix F Endangered Species Act Compliance

Page | 11

### Igel, Trevor

From:	Grant Gurnee <grant@ecologicalbenefits.com></grant@ecologicalbenefits.com>
Sent:	Monday, July 25, 2022 11:32 AM
То:	Panza, Gregory
Cc:	Jon Dauzvardis
Subject:	RE: FEMA TES comment
Importance:	High

This email came from outside the HR Green organization. Please use caution when clicking on hyperlinks and opening attachments

### Greg –

Perhaps it is best to remind FEMA that the 2020 ESA No Effect Concurrence Request Memo did include all of the information they requested, as Section 4 clearly states that Ecos screened all potential TES in the County as that is what the USFWS IPaC Trust Resources Report provides; and , we provided an Effects Determination in Section 5.

### **4.0 FEDERAL LISTED SPECIES**

A number of species that occur in El Paso County are listed as candidate, threatened or endangered by the USFWS (USFWS, 2018) under the ESA. Ecos compiled the Federally-listed species for the Site in Table 1 based on the Site-specific, USFWS IPaC Trust Resources Report we ran for the Project (Appendix A); and our onsite assessment. Ecos has provided our professional opinion regarding the probability that these species may occur within the Site and their probability of being impacted by the Project.

The likelihood that the Project would impact any of the species listed below is very low to none. Most are not expected occur in the Project area or on the Site; nor will they be affected by the direct or indirect effects of the project.

### **5.0 EFFECTS DETERMINATION**

The Site is not located within any USFWS designated critical habitat or known occupied habitat for federally listed threatened or endangered species. Please refer to the IPaC database (Appendix A) and Table 1. The Project will have **No Effect** on the following listed species:

• Listed species in Nebraska, as the Site is not located in the North Platte, South Platte or Laramie River basins.

• Greenback cutthroat trout, Mexican spotted owl and North American wolverine, as suitable habitat does not exist on the Site.

- Western prairie fringed orchid, as the Site will not alter or deplete flows to the Platte River system.
- Ute ladies'-tresses orchid is unlikely to occur as the Site is situated between 6,860 and 7,020 feet above mean sea level, which is higher than the 6,500-foot elevation limits documented for the species and recommended for conducting surveys by the USFWS.

• Preble's meadow jumping mouse: This species occurs in the County but is not known to occur on the Site due to:

- o The absence of habitat required to support the life requisites of the species;
- $\circ~$  Negative trapping results (i.e., Trapped Not Found) reported by USFWS upstream and
- downstream of the Site on West Kiowa Creek, and east of the Site on Kiowa Creek;
- $\,\circ\,$  2.5 mile distance from the closest CPW "Potential" Occupied Habitat;

- $\circ~$  6.5 mile distance from the closest USFWS Critical Habitat; and
- The lack of viable habitat connection corridors from known, occupied habitat to the Site.

If the above information does not suffice, please forward FEMA this email.

No Take Statement:

Ecos hereby confirms that "Take" as defined under the Endangered Species Act will not occur to threatened and endangered species present in the county as a result of the project.

Thank you, Grant

### Grant Gurnée, P.W.S.

Owner - Restoration Ecologist - Fish & Wildlife Biologist

## ecosystem services LLC

(o): 970-812-ECOS (3267)

(c): 303-746-0091

(w): <u>www.ecologicalbenefits.com</u>

(e): grant@ecologicalbenefits.com

Life is like a river...we all must learn to adapt to the challenges of dynamic equilibrium



**Informal Consultation Request** 

April 10, 2020

Mr. Drue DeBerry Acting Colorado Field Supervisor U.S. Fish and Wildlife Service Colorado Ecological Services Field Office 134 Union Blvd., Suite 670 Lakewood, Colorado 80228

### RE: Request for Technical Assistance Regarding the Likelihood of Take of Federally-listed Threatened and Endangered Species resulting from the proposed development of the Grandview Reserve Project in El Paso County, Colorado

Dear Mr. DeBerry:

Ecosystem Services, LLC (ecos) has prepared the enclosed habitat evaluation on behalf of 4 Site Investments to describe the physical/ecological characteristics of the Grandview Reserve site (Site) and evaluate the potential effects of the proposed development project (Project) on the Federally-listed threatened and endangered (T&E) species protected under the Endangered Species Act (ESA).

The El Paso County Environmental Division has completed its review of the Project and has requested that 4 Site Investments provide a "Clearance Letter" obtained from the U.S. Fish and Wildlife Service (USFWS) to the Planning and Community Development Department prior to project commencement "where the project will result in ground disturbing activity in habitat occupied or potentially occupied by threatened or endangered species and/or where development will occur within 300 feet of the centerline of a stream or within 300 feet of the 100 year floodplain, whichever is greater."

At this time there is no Federal action and no Federal agency is making a formal effects determination under Section 7 (a)(2) of the ESA. Therefore, ecos is requesting technical assistance from USFWS regarding 4 Site Investments' (i.e., the non-federal party) responsibilities under the ESA, and specifically the likelihood of the Project (described herein) resulting in take of listed species. If the USFWS concurs with the findings presented herein we request that you issue an informal letter of concurrence for use in the El Paso County Project review process.

### **1.0 SITE LOCATION and PROJECT DESCRIPTION**

The Site is located in the Falcon/Peyton area of El Paso County and is bounded along the north by 4 Way Ranch Phase I, along the south by Waterbury, along the southeast by Highway 24, and along the west by Eastonville Road. There are no existing structures, roads, or other infrastructure on the Site. The Site is located approximately 4.14 miles southwest of Peyton, 4.16 miles northeast of Falcon and 4.66 miles south of Eastonville, in El Paso County, Colorado. The Site is generally located within the south ½ of Section 21, south ½ of Section 22, the north ½ of Section 27, and the north ½ of Section 28, Township 12 South, Range 64 West in El Paso County, Colorado. The Site is situated at approximately Latitude 38.98541389 north, -104.55472222 east (refer to Figure 1). The Applicant proposes to develop the 768.2-acre Site as a mixed use residential and commercial community with the total number of units ranging from 2,496 to 3,261 as summarized below:

Table 1 – Land Use Summary									
Land Use	A 0100.000	Acrosco %	Density Units/Acre		Units				
Category	Acreage	Acreage /0	Min.	Max.	Min.	Max.			
Institutions	16.9 acres	2.2%	NA	NA	NA	NA			
Low Density Residential	136.4 acres	17.8%	1	2	136	272			
Medium Density Residential	258.4 acres	33.6%	3	4	775	1033			
Medium-High Density Residential	68.6 acres	8.9%	6	8	411	548			
High Density Residential	117.4 acres	15.3%	10	12	1174	1408			
Commercial	17.0 acres	2.2%	NA	NA	NA	NA			
Open Space ₁	132.5 acres	17.2%	NA	NA	NA	NA			
Rex Rd. & Collector	21.0 acres	2.7%	NA	NA	NA	NA			
TOTAL	768.2 acres	100%	NA	NA	NA	NA			
Note 1: Open Space includes: Detention Ponds, Drainage Corridors, General Open Space & Easements and R.O.W. Buffers of Eastonville Road and Highway 24									

Please refer to Figure 2.



USGS 7.5 min. Quad: Falcon Latitude: 38.985713°N Longitude: -104.552854°W Section 21, 22, 27 & 28, Township 12 South, Range 64 West



LAND USE CATEGORY	ACREAGE	ACREAGE %	DU/AC	UN
CHURCH	6.2 ac.	0.8%	N/A	٩
LOW DENSITY	88.8 ac.	11.6%	1.45	1
MEDIUM DENSITY	158.6 ac.	20.7%	3.10	4
HIGH DENSITY	343.4 ac.	44.9%	4.00	1:
COMMERCIAL	17.0 ac.	2.2%	N/A	Ν
SCHOOL	10.7 ac.	1.4%	N/A	Ν
OPEN SPACE	119.1 ac.	15.6%	N/A	N
<b>REX &amp; COLLECTOR</b>	21.0 ac.	2.7%	N/A	Ν
OPEN SPACE INCLUDES: DETENTION, DRAINAGE CORRIDO	RS, GENERAL OPEN SPACE AND EAS	EMENTS, AND R.O.W./BUFFER OF	EASTONVILLE RD. & HWY	24
Total	764.8 ac.	100%		1



FALCON, CO

### 2.0 METHODOLOGY

### 2.1 Office Assessment

Ecos performed an office assessment in which available databases, resources, literature and field guides on local flora and fauna were reviewed to gather background information on the environmental setting of the Site. We consulted several organizations, agencies, and their databases, including:

- Colorado Department of Agriculture (CDA) Noxious Weed List;
- Colorado Natural Heritage Program (CNHP);
- Colorado Oil and Gas Conservation Commission (COGCC) GIS Online;
- Colorado Parks and Wildlife (CPW);
- El Paso County Master Plan;
- El Paso County, Sub-Area Plan (provided by Client);
- Federal Emergency Management Agency (FEMA);
- Google Earth current and historic aerial imagery;
- Survey of Critical Biological Resources, El Paso County, Colorado;
- Survey of Critical Wetlands and Riparian Areas in El Paso and Pueblo Counties, Colorado;
- U.S. Army Corps of Engineers (USACE) 1987Corps of Engineers Wetlands Delineation Manual;
- USACE 2010 Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Great Plains Region;
- U.S. Department of Agriculture (USDA) PLANTS Database;
- U.S. Fish and Wildlife Service (USFWS) Region 6;
- USFWS National Wetland Inventory (NWI);
- USFWS IPaC database search; and
- U.S. Geological Survey (USGS).

Ecos also reviewed pertinent, site-specific background data provided by 4 Site Investments and their consulting Team, including topographic base mapping, site development plans, and other data pertinent to the assessment.

### 2.2 Onsite Assessment

Following the collection and review of existing data and background information, ecos conducted a field assessment of the Site on October 10 and 11, 2018 to identify any potential impacts to natural resources associated with the Project. Field reconnaissance concentrated on identification of wetland habitat, waters of the U.S., wildlife habitat (including habitat suitable to support threatened and endangered wildlife) significant topographic features, noxious weeds and vegetation. Wetland habitat and waters of the U.S. boundaries, wildlife habitat, major vegetation communities, and significant weed stands were sketched on topographic and aerial base maps and located using a hand-held Global Positioning System as deemed necessary. Representative photographs were taken to assist in describing and documenting Site conditions and potential ecological impacts.

### **3.0 ENVIRONMENTAL SETTING**

The Site is located in the Southwestern Tablelands Ecological Region (Chapman et al, 2006), which is primarily comprised of sub-humid grassland and semiarid rangeland. More specifically, the Site is located in the Foothills Grassland sub-region (26j) which contains a mix of grassland types with some small areas of isolated tallgrass prairie species that are more common much farther east. The proximity to runoff and moisture from the Front Range and the more loamy, gravelly, and deeper soils are able to support more tallgrass and midgrass species than neighboring ecoregions. Big and little bluestem, yellow indiangrass and switchgrass occur, along with foothill grassland communities. The annual precipitation of 14 to 20 inches tends to be greater than in regions farther east. Soils are loamy, gravelly, moderately deep, and mesic. Rangeland and pasture are common , with small areas of cropland. Urban and suburban development has increased in recent years, expanding out from Colorado Springs and the greater Denver area.

The Site contains no Colorado Natural Heritage Conservation Areas or Potential Conservation Areas according to the CNHP (CNHP, 2018), and no Wildlife Refuges or Hatcheries according to the USFWS IPaC Trust Resources Report (USFWS, 2016a) (refer to Appendix A).

### 3.1 Topography

The Site is generally characterized as gently sloping from northwest to southeast with four ephemeral drainages (prairie sloughs) present, two of which are discontinuous and two are tributary to Black Squirrel Creek offsite. Naturally undulating swales drain toward the sloughs, which contain wetlands in low areas and dry areas where alluvial deposits have formed. Site topography ranges from a high elevation of 7020 feet above mean sea level (AMSL) in the northwestern corner to a low elevation of 6860 feet above AMSL where the northeastern tributary exits the Site on the east boundary along Highway 24; for a total elevation drop of 160 feet. An ill-defined and undulating hill, which is likely an eroded remnant bluff, is present in the north-central portion of the Site. Refer to Figure 3.

### 3.2 Soils

Ecos utilized the U.S. Department of Agriculture, Natural Resource Conservation Service Web Soil Survey (USDA, NRCS, 2018) to determine if hydric soils are present within the Site, as this data assist in informing the presence/absence of potential wetland habitat regulated under the Clean Water Act. The soils data were also utilized to supplement the field observations of vegetation, as the USDA provides correlation of native vegetation species by soils types. Please refer to Figure 4, USDA NRCS Soil Map and Appendix A for additional USFWS wetland information.

### 3.3 Vegetation

The vegetation within the Site is primarily comprised of shortgrass prairie with wetland vegetation in the swales and sloughs (Figure 5). The shortgrass prairie is dominated by little bluestem (*Schizachyrium scoparium*), blue grama (*Bouteloua gracilis*), and buffalograss (*Bouteloua dactyloides*) with occasional associative grass and forb species including western wheatgrass (*Pascopyrum smithii*), yellow Indiangrass (*Sorghastrum nutans*), Canada wildrye (*Elymus canadensis*), needle and thread (*Hesperostipa comata*), switchgrass (*Panicum virgatum*), Western yarrow (*Achillea millefolium*), broom snakeweed (*Gutierrezia sarothrae*), fringed sage (*Artemisia frigida*), Prickly pear (*Opuntia* spp.), and prairie aster spp. (*Symphyotrichum spp.*). Occasional patches of snowberry (*Symphoricarpos albus*) and Wood's rose (*Rosa woodsii*) occupy the transitional areas between uplands and wetlands. A few, single plains cottonwood (*Populus deltoides*) occur along the drainages. The Site is heavily impacted by historic and ongoing grazing and there are weeds scattered throughout, including Canada thistle (*Cirsium arvense*), Scotch thistle (*Onopordum acanthium*),

Russian thistle (*Salsola kali*), common mullein (*Verbascum thapsus*), and yellow toadflax spp. (*Linaria vulgaris*). Hydrophytic vegetation (wetland vegetation) is present within the swales and sloughs (refer to Section 3.4.2).




Summary by Mep Unit - El Paso County Area, Colorado (CD625)

Summary by Map	Unit El Paso-County Area, Colorado (CD625)			
Hap unit symbol	Map unit name	Roting	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	Blakeland loamy sand, 1 to 9 percent slopes	17.5	2.3%
19	Columbine pravelly sandy loam, 0 to 3 percent slopes	Columbine gravelly sandy loam, 0 to 3 percent slopes	428.6	55.8%
83	Stapleton sandy loam, 3 to 8 percent slopes	Stapleton sandy loam, 3 to 8 percent slopes	322.2	41.9%
Totals for Area of Interest				100.0%



## 3.4 Wetland Habitat and Waters of the U.S.

## 3.4.1 Methodology

Ecos utilized the National Wetland Inventory (NWI) Wetlands Mapper (USFWS 2018a); Colorado Wetland Inventory Mapping Tool (CNHP, 2018); historic and current Google Earth aerial photography; USGS 7.5-minute topographic mapping; and detailed Project topographic mapping to screen the Site for potential wetland habitat and waters of the U.S. Additionally, ecos performed a jurisdictional delineation to identify the Waters of the United States (WOUS), including wetlands.

The mapping data above were proofed during the field assessment and a wetland delineation was conducted to determine the presence/absence of potential WOUS, including wetland habitat. Once a feature was verified to be present, ecos determined whether it is a jurisdictional wetland/waters under the Clean Water Act. The U.S. Army Corps of Engineers (USACE), wetland delineation methodology was employed to document the 3 field indicators (parameters) of wetland habitat (i.e., wetland hydrology, hydric soils and a predominance of hydrophytic vegetation as explained in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987) and supplemented by the Regional Supplement to the *Corps of Engineers Wetlands Delineation Manual: Western Mountains, Valleys and Coast Region (Version 2)* (USACE, 2010). The wetland delineation was surveyed by the project team surveyor

Consistent with the NWI and Colorado Wetland Inventory Mapping Tool (Figure 6) and topographic mapping, the wetland/waters delineation revealed the presence of four drainages with the potential to support wetland habitat (Figure 7). Two of the drainages (i.e. northeast Drainage D and southwest Drainage A) were preliminarily determined to be jurisdictional (pending USACE verification) and support predominantly palustrine emergent wetland (PEMC1) habitat with minor occurrences of palustrine scrub-shrub (PSS) and palustrine forested (PFO) species along their fringes. The central Drainage C and south-central Drainage B were investigated found to be discontinuous, prairie sloughs that are non-jurisdiction, "isolated" features. Please refer to Figure 6 for a composite of the NWI and CNHP Wetland and Riparian Areas mapping, Figure 7 for the ECOS Wetland and Waters Sketch Map, and Appendix B for representative photographs.

## 3.4.2 Field Assessment Findings

The results of the onsite assessment for each of the four onsite drainages is summarized below, with an explanation of the field indicators (parameters) of wetland habitat/waters that were observed, and an explanation as to whether ecos preliminarily determined each feature was jurisdictional or non-jurisdictional under Section 404 of the Clean Water Act. Jurisdictional features are mapped on Figure 7.

## 1) Jurisdictional wetland habitat and waters of the U.S.

a. <u>PEMC1 Wetland Habitat</u> – Northeast Drainage D is classified as a Palustrine Emergent, Persistent, Seasonally Flooded wetland (PEMC1). Wetland Area A is tributary to Black Squirrel Creek off of the Site to the southeast. It is dominated by Nebraska sedge, redtop, clustered field sedge, three-square bulrush, swordleaf rush, soft-stem bulrush, poverty rush, Baltic rush, and watercress. Other species were present, including water mint, sporadic patches of sandbar willow, cutleaf evening primrose, fireweed, curly dock, and water milfoil, and snowberry, wild licorice and Wood's rose along the high banks. Soil samples indicate the presence of field indicators of hydric soils (organic horizon from 0-2 inches, 10YR4/2 clay loam from 2-9 inches, 10YR4/1 clay loam from 9-14 inches, and 10YR5/1 sandy clay from 14-18+ inches). Sustaining hydrology was evident as flowing water is present within a defined channel and saturated soils are present at the surface and throughout the

floodplain, including groundwater driven side-slope seepage. This area meets all 3 parameters for jurisdictional wetland habitat.

- b. <u>PEMC1 Wetland Habitat</u> Southwest Drainage A is classified as a Palustrine Emergent, Persistent, Seasonally Flooded wetlands (PEMC1 Wetland Area D is tributary to Black Squirrel Creek off of the Site to the southeast. It is dominated by Nebraska sedge, clustered field sedge, swordleaf rush, redtop, poverty rush, Baltic rush, and pussytoes. Other species were present, including soft-stem bulrush, three-square bulrush, smartweed, saltgrass, foxtail barley, water mint, scouring rush, wild geranium, watercress, narrowleaf cattail, and snowberry, wild licorice and Wood's rose along the high banks. Sporadic occurrences of sandbar willow, crack willow and plains cottonwood were present. Soil samples indicate the presence of field indicators of hydric soils (10YR2/2 loamy clay from 0-6 inches, 10YR4/2 sand from 6-12 inches, 10YR4/1 sand from 12-16 inches, and 10YR4/1 clayey sand from 16-18+ inches). Sustaining hydrology from groundwater seepage was evident as saturated soil is present at or within 8-12 inches of the ground surface. These areas meet all 3 parameters for jurisdictional wetland habitat.
- 2) <u>Non-Jurisdictional, Isolated Wetlands -</u> The central Drainage C and south-central Drainage B were investigated found to be discontinuous, prairie sloughs with reaches that are upland swales; they exhibited upland "breaks" in which they did not exhibit defined bed or bank (Figure 7); and they were also found to be "isolated" as they did not connect with downstream WOUS. Patches of PEMC1 Wetland exists in these drainages that exhibits the same characteristics of other wetlands on site and meets all 3 parameters for jurisdictional wetland habitat. However, they are clearly disconnected from Black Squirrel Creek by uplands that do not exhibit a defined bed or bank. Therefore, these drainages are isolated, non-jurisdictional features and as such were not delineated.

## 3.4.3 Summary of Jurisdictional and Non-Jurisdictional Wetlands and Waters

<u>Jurisdictional Habitat</u> – Northeast Drainage D and southwest Drainage A (refer to Figure 7) are jurisdictional wetland habitat and WOUS as they are tributary to the jurisdictional habitat in Black Squirrel Creek. These natural features meet the criteria that the USACE uses to assert jurisdiction, as they are:

- Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months); and
- Wetlands that directly abut such tributaries.

<u>Non-Jurisdictional Areas</u> – The central Drainage C and south-central Drainage B are considered nonjurisdictional. They do not meet the criteria that the Corps uses to assert jurisdiction, as they are not:

- Traditional navigable waters;
- Wetlands adjacent to traditional navigable waters;
- Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months); and
- Wetlands that directly abut such tributaries.

Furthermore, Drainages B and C are not considered "tributaries", as "a tributary includes natural, manaltered, or man-made water bodies that carry flow directly or indirectly into a traditional navigable water." These drainages are ephemeral swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow) over which the Corps does not assert jurisdiction.

## 3.4.4 Verification by the U.S. Army Corps of Engineers

On July 5, 2019 the USACE provided an email to Ecos to confirm our findings of non-jurisdiction for Drainages B and C. Note that we did not request a jurisdictional determination of Drainages A and D as we have documented them to be jurisdictional. An excerpt of the USACE response from Tony Martinez, Regulatory Program Manager for the Albuquerque District, Southern Colorado Regulatory Branch of the USACE is copied below, and the original email is contained in Appendix C.

"Based on the information provided in the attached email and our site visit on June 21, 2019 our office concurs with your observations that central Drainage C and south-central Drainage B are isolated and are located entirely upland therefore, we conclude that No permit is required."



SOURCE: USFWS, National Wetland Inventory & CNHP, Colorado Wetland Inventory



SOURCE: Ecosystem Services, LLC On-site Delineation, 10-11-18

## 3.5 Wildlife Communities

The stated purpose and intent of the "El Paso County Development Standards" section on wildlife is to ensure that proposed development is reviewed in consideration of the impacts on wildlife and wildlife habitat, and to implement the provisions of the Master Plan (El Paso County, 2018b). Ecos has determined that the wildlife impact potential for development of the Site is expected to be low.

The Site currently provides poor to moderate habitat for wildlife, as illustrated in the representative photographs (Appendix B). There are two primary vegetation types on the Site, including shortgrass prairie and wetland habitat.

The project would develop most of the shortgrass prairie, however the drainages and adjacent short grass prairie would be preserved as Open Space. A noxious weed management plan will be implemented per State and County requirements to improve wildlife habitat; and a native plant re-vegetation plan for the Open Space is recommended to provide additional benefit to wildlife habitat.

The habitat preferences of the observed species are reflective of the habitat on Site. Two species of raptors were observed and appear to either be residents or frequent hunters to this Site: ferruginous hawk (*Buteo regalis*) and great horned owl (*Bubo virginianus*). Sandhill crane (*Grus canadensis*) were observed flying over during their migration, although they are not likely to utilize the Site. Prairie species such as jackrabbit (*Lepus townsendii*), pronghorn (*Antilocapra americana*), black-tailed prairie dog (*Cynomys ludovicianus*) and thirteen-lined ground squirrel (*Ictidomys tridecemlineatus*) were present. The remaining species are considered generalists and included mourning doves (*Zenaida macroura*) and American crows (*Corvus brachyrhynchos*). The Site provides very limited tree nesting habitat for raptors; however, ferruginous hawks may also use ground nests. No existing nest sites for any raptors were noted during the Site visit.

The Site provides habitat for mammals including rodents, antelope, and carnivores. The site provides foraging and breeding habitat for predators such as coyote and fox. The Site also provides habitat for reptiles but limited habitat for amphibians due to the lack of persistent standing and flowing water.

The Site contains no Wildlife Refuges or Hatcheries according to the USFWS IPaC Trust Resources Report (USFWS, 2018b) (Appendix A).

### **4.0 FEDERAL LISTED SPECIES**

A number of species that occur in El Paso County are listed as candidate, threatened or endangered by the USFWS (USFWS, 2018) under the ESA. Ecos compiled the Federally-listed species for the Site in Table 1 based on the Site-specific, USFWS IPaC Trust Resources Report we ran for the Project (Appendix A); and our onsite assessment. Ecos has provided our professional opinion regarding the probability that these species may occur within the Site and their probability of being impacted by the Project.

The likelihood that the Project would impact any of the species listed below is very low to none. Most are not expected occur in the Project area or on the Site; nor will they be affected by the direct or indirect effects of the project.

TABLE 1 - FEDERAL LISTED SPECIES ASSESSED FOR THE PROJECT						
Species	Status	Habitat Requirements and Presence	Probability of Impact by Project			
FISH						
Greenback cutthroat trout (Oncorhynchus clarki stomias)	Threatened	Cold, clear, gravely headwater streams and mountain lakes that provide an abundant food supply of insects.	None. Suitable habitat does not exist on the Site.			
Pallid sturgeon (Scaphirhynchus albus)	Endangered	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. The proposed Project is not located in the watershed of any of the listed river basins.			
REPTILES AND AMPHIBIANS						
BIRDS						
Least tern (Sternula antillarum)	Endangered	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. The proposed Project is not located in the watershed of any of the listed river basins.			
Mexican spotted owl (Strix occidentalis lucida)	Threatened	Mature, old-growth forests of white pine, Douglas fir, and ponderosa pine; steep slopes and canyons with rocky cliffs. The closest USFWS designated Critical habitat is over 15 miles southwest of the Site in mountainous terrain (USFWS, 2018).	None. Suitable habitat does not exist on the Site.			
Piping plover (Charadrius melodus)	Threatened	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. The proposed Project is not located in the watershed of any of the listed river basins.			
Whooping crane (Grus americana)	Endangered	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. The proposed Project is not located in the watershed of any of the listed river basins.			
MAMMALS						

TABLE 1 - FEDERAL LISTED SPECIES ASSESSED FOR THE PROJECT							
Species	Status	Habitat Requirements and Presence	Probability of Impact by Project				
Preble's meadow jumping mouse (Zapus hudsonius preblei)	Threatened	Inhabits well-developed riparian habitat with adjacent, relatively undisturbed grassland communities, and a nearby water source. Well-developed riparian habitat includes a dense combination of grasses, forbs and shrubs; a taller shrub and tree canopy may be present. Has been found to regularly use uplands at least as far out as 100 meters beyond the 100-year floodplain.	None. Not likely to occur on Site due to: 1) the absence of habitat required to support the life requisites of the species (Figure 8 and Appendix B); 2) negative trapping results reported by USFWS adjacent to the Site (Figure 9); 3) 10.22-mile distance from closest CPW "Potential" Occupied Habitat - west/northwest of the Site in Colorado Springs (refer to Figure 8); 4) 6.5-mile distance from closest USFWS Critical Habitat - southwest of the Site along Black Squirrel Creek in Colorado Springs (refer to Figure 8); and 5) lack of habitat connection corridor from known habitat to the Site.				
PLANTS							
Ute ladies'-tresses orchid ( <i>Spiranthes</i> <i>diluvialis</i> )	Threatened	Primarily occurs along seasonally flooded river terraces, sub-irrigated or spring-fed abandoned stream channels or valleys, and lakeshores. May also occur along irrigation canals, berms, levees, irrigated meadows, excavated gravel pits, roadside borrow pits, reservoirs, and other human-modified wetlands.	Very Low. Unlikely to occur as the Site is situated between 6,860 and 7,020 feet above mean sea level, which is higher than the 6,500- foot elevation limits documented for the species and recommended for conducting surveys by the USFWS.				
Western prairie fringed orchid (Platanthera praeclara)	Threatened	Occurs in tallgrass prairie in Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and Oklahoma. Upstream depletions to the Platte River system in Colorado and Wyoming may affect the species in Nebraska.	None. The proposed Project will not alter or deplete flows to the Platte River system.				





### **5.0 EFFECTS DETERMINATION**

The Site is not located within any USFWS designated critical habitat or known occupied habitat for federally listed threatened or endangered species. Please refer to the IPaC database (Appendix A) and Table 1.

The Project will have **No Effect** on the following listed species:

- Listed species in Nebraska, as the Site is not located in the North Platte, South Platte or Laramie River basins.
- Greenback cutthroat trout, Mexican spotted owl and North American wolverine, as suitable habitat does not exist on the Site.
- Western prairie fringed orchid, as the Site will not alter or deplete flows to the Platte River system.
- Ute ladies'-tresses orchid is unlikely to occur as the Site is situated between 6,860 and 7,020 feet above mean sea level, which is higher than the 6,500-foot elevation limits documented for the species and recommended for conducting surveys by the USFWS.
- Preble's meadow jumping mouse: This species occurs in the County but is not known to occur on the Site due to:
  - The absence of habitat required to support the life requisites of the species;
  - Negative trapping results (i.e., Trapped Not Found) reported by USFWS upstream and downstream of the Site on West Kiowa Creek, and east of the Site on Kiowa Creek;
  - o 2.5 mile distance from the closest CPW "Potential" Occupied Habitat;
  - o 6.5 mile distance from the closest USFWS Critical Habitat; and
  - The lack of viable habitat connection corridors from known, occupied habitat to the Site.

## **6.0 CONSERVATION MEASURES**

Species that occur in wetland and riparian habitat are expected to benefit from the proposed change in land use. All four onsite drainages will be protected via drainage easements and will also be located in Open Space. Eliminating cattle grazing from the Site would allow for more native herbaceous and woody vegetation to grow along the drainages, thus improving habitat for many wildlife species. A noxious weed management plan will be implemented per State and County requirements to improve wildlife habitat; and a native plant revegetation plan for the Open Space is recommended to provide additional benefit to wildlife habitat. Implementation of the stormwater management plan will further assist in protecting water quality in all drainages, provide consistent flows to non-jurisdictional/ephemeral drainages, and ameliorate development impacts on aquatic wildlife species, such as leopard frogs.

The following, additional recommendations are intended to reduce potential impacts to wildlife:

- 1. Limit the use of herbicides, pesticides, and fertilizers as they can negatively impact aquatic wildlife species.
- 2. Minimize the installation of fencing. When fencing is needed, use wildlife friendly fences or include specific wildlife crossings along fence lines. Pronghorn are of particular concern because they do not jump over fences and can be injured by barbed-wire fences.
- 3. Road crossings over the Creek should be designed to enable wildlife underpass and allow use the Creek as a movement corridor to reduce collisions with vehicles.
- 4. Dogs should be kept in fenced pens and be leashed when on walks. At least one designated off-leash area for dogs should be provided, as this will increase compliance with leash rules in other areas.
- 5. Cats should not be allowed outdoors because they kill birds and native rodents.

#### 7.0 CONCURRENCE REQUEST

Ecos requests informal concurrence from the USFWS with our No Effects Determination based on the information presented herein. The Project and its direct and indirect environmental effects don't occur in any designated critical habitat. The majority of the ESA-listed species don't occur in the Project area and are absent from all areas where the Project will have direct or indirect environmental effects. Preble's meadow jumping mouse and Ute ladies'-tresses orchid occur in the County but are not known to occur in the Project area and area and areas where the Project will have direct or indirect environmental effects.

Thank you for your assistance with this project. Please feel free to call ecos (970) 812-3267 if you have any questions.

Sincerely,

**Ecosystem Services, LLC** 

an Va

Jon Dauzvardis, P.W.S. Owner - Restoration Ecologist

Cc: Peter Martz, 4 Site Investments

Frant E. Surnée

Grant E. Gurnée, P.W.S. *Owner - Restoration Ecologist* 

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**Informal Consultation Request** 

April 10, 2020

Mr. Drue DeBerry Acting Colorado Field Supervisor U.S. Fish and Wildlife Service Colorado Ecological Services Field Office 134 Union Blvd., Suite 670 Lakewood, Colorado 80228

## RE: Request for Technical Assistance Regarding the Likelihood of Take of Federally-listed Threatened and Endangered Species resulting from the proposed development of the Grandview Reserve Project in El Paso County, Colorado

Dear Mr. DeBerry:

Ecosystem Services, LLC (ecos) has prepared the enclosed habitat evaluation on behalf of 4 Site Investments to describe the physical/ecological characteristics of the Grandview Reserve site (Site) and evaluate the potential effects of the proposed development project (Project) on the Federally-listed threatened and endangered (T&E) species protected under the Endangered Species Act (ESA).

The El Paso County Environmental Division has completed its review of the Project and has requested that 4 Site Investments provide a "Clearance Letter" obtained from the U.S. Fish and Wildlife Service (USFWS) to the Planning and Community Development Department prior to project commencement "where the project will result in ground disturbing activity in habitat occupied or potentially occupied by threatened or endangered species and/or where development will occur within 300 feet of the centerline of a stream or within 300 feet of the 100 year floodplain, whichever is greater."

At this time there is no Federal action and no Federal agency is making a formal effects determination under Section 7 (a)(2) of the ESA. Therefore, ecos is requesting technical assistance from USFWS regarding 4 Site Investments' (i.e., the non-federal party) responsibilities under the ESA, and specifically the likelihood of the Project (described herein) resulting in take of listed species. If the USFWS concurs with the findings presented herein we request that you issue an informal letter of concurrence for use in the El Paso County Project review process.

### **1.0 SITE LOCATION and PROJECT DESCRIPTION**

The Site is located in the Falcon/Peyton area of El Paso County and is bounded along the north by 4 Way Ranch Phase I, along the south by Waterbury, along the southeast by Highway 24, and along the west by Eastonville Road. There are no existing structures, roads, or other infrastructure on the Site. The Site is located approximately 4.14 miles southwest of Peyton, 4.16 miles northeast of Falcon and 4.66 miles south of Eastonville, in El Paso County, Colorado. The Site is generally located within the south ½ of Section 21, south ½ of Section 22, the north ½ of Section 27, and the north ½ of Section 28, Township 12 South, Range 64 West in El Paso County, Colorado. The Site is situated at approximately Latitude 38.98541389 north, -104.55472222 east (refer to Figure 1). Technical Assistance Tracking Number: ____

## U.S. FISH AND WILDLIFE SERVICE

NO CONCERNS

C CONCUR NOT LIKELY TO ADVERSELY AFFECT

O NO COMMENT

Liisa Schmoele DATE Colorado Assistant Field Supervisor

Remarks:

Grandview Reserve CLOMR Report Project No.: 201662.03



# Appendix G MT – 2 Checklist

#### **MT-2 REVISION REQUEST SUBMITTAL CHECKLIST**

#### PART A: GENERAL REQUIREMENTS **ELEMENTS** Yes N/A **NARRATIVE:** Please provide a written description about the purpose of the request and the scope of the $\times$ proposed/as-built project and the methodology used to analyze the project effects. MT-2 APPLICATION FORMS: Please provide completed forms applicable to your request. Ensure that MT-2 Form 1 was signed by the requester, certifying engineer, and each community affected by the revision. HYDROLOGIC ANALYSIS: If applicable, please provide a FEMA acceptable hydrologic analysis in digital format, drainage area map and associated backup information (e.g., calculations used to determine lag time, CN and loss values as well as landuse and soil maps). FEMA-acceptable models can be accessed at www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/numerical-models-meetingminimum-requirements. HYDRAULIC ANALYSIS: Please provide a FEMA acceptable hydraulic analysis in digital format. FEMA-acceptable models can be accessed at www.fema.gov/national-flood-insurance-program-flood-hazardmapping/numerical-models-meeting-minimum-requirements. **CERTIFIED TOPOGRAPHIC WORK MAP:** Please provide a certified topographic work map that meets the mapping requirements outlined in MT-2 Form 2. If available, please provide digital Computer-Aided Design (CAD) or Geographic Information System (GIS) data that is spatially referenced. ANNOTATED FIRM: Please submit a revised FIRM, at the scale of the effective FIRM, which shows the revised boundary delineation of the base floodplain, 0.2-percent-annual-chance floodplain, and regulatory floodway and how it ties into the boundary delineation shown on the effective FIRM at the downstream and upstream ends of the revised reach. **REVIEW FEE PAYMENT:** Please include the appropriate review fee payment. The current fee schedule is available on the FEMA Web site at https://www.fema.gov/flood-map-related-fees. **MEET 65.10 REOUIREMENT:** If the request intends to show that a berm/levee/flood wall provides flood protection, please submit all of the data requirements outlined in Section 65.10 of the NFIP regulations. **OPERATION AND MAINTENANCE PLAN:** If the request involves a berm, levee, flood wall, dam. and/or detention basin project, please submit an officially adopted maintenance and operation plan. **PROPOSED/AS-BUILT PLANS:** If applicable, please submit proposed/as-built plans, certified by a registered Professional Engineer, for all the project elements. FLOODWAY NOTICE: If the revision result in changing or establishing floodway boundaries, please provide floodway public notice or a statement by your community that it has notified all affected property owners, in compliance with NFIP regulation Subparagraph 65.7(b)(1). **PROPERTY OWNER NOTIFICATION:** If the revision result in any widening/shifting/establishing of the base floodplain and/or any BFE increases/establishing BFEs, please provide copy of the individual legal notices sent to all the property owners affected by any increases in the flood hazard information.

#### PART B: CLOMR SPECIFIC REQUIREMENTS

Endangered Species Act COMPLIANCE: Please submit documentation of compliance with the ESA Requirements. To learn more about ESA Compliance, please see the MT-2 Instructions manual. 65.12 REGULATORY REQUIREMENTS: If the Base (1-percent-annual-chance) Flood Elevation (BFE) increases greater than 0.00 foot as a result of encroachment within a floodway or 1.0 foot within Zone AE that has no floodway/Zone A, between the pre-project (existing) conditions and the proposed conditions as a result of the proposed project. Please submit a). Certification that no structures are affected by the increased BFE; b). Documentation of individual legal notice to all affected property owners, explaining the impact of the proposed action on their property; and c). An evaluation of alternatives that would not result in an increase in BFE.

**Note:** Applicants are encouraged to submit their revision request using the Online LOMC tool. To learn more about the Online LOMC tool, visit the FEMA website at <u>www.fema.gov/online-lomc</u>.



# Appendix H Existing Condition Cross Sections

























## Appendix I Future Condition Cross Sections


































# Appendix J Proposed Hydrology Calculations and Reference Materials





<u>KEYMAP</u>
PROJECT LEGEND: PROPERTY LINE
ROAD CENTERLINE     RIGHT-OF-WAY LINE     BROROSED DETENTION BASIN
PROPOSED DETENTION BASIN     PROPOSED MAJOR CONTOUR     PROPOSED MINOR CONTOUR
G06 DESIGN POINT
NOTE:
1. BASINS WEST OF EASTONVILLE ROAD ARE FROM THE LOCALLY APPROVED AND ACCEPTED BASIN STUDY REFERRED TO AS THE MERIDIAN RANCH
<ol> <li>MASTER DEVELOPMENT DRAINAGE PLAN</li> <li>ALL PONDS ARE SIZED AND HAVE DISCHARGE</li> </ol>
RATES BASED OFF OF MHFD UD-DETENTION SPREADSHEET LOCATED IN APPENDIX K.
3. VERTICAL DATUM IS NAVD88.
RADO LICEA
UNCC CALL BEFORE YOU DIG 811
1-800-922-1987
Utility Notification Center of Colorado

## HEC-HMS STICK MODEL



								COMP	OSITE 'C' F	ACTORS									
PROJECT:							T	The Sanctua	ry PDR-FDR								Date	3/21/2	023
BASIN DESIGNATION	UNDEV	LATIGO UNDEV.	GRADED	2.5 AC	1 DU/AC	2 DU/AC	3 DU/AC	AREA 4 DU/AC	(AC.) 5 DU/AC	6 DU/AC	8 DU/AC or more	STREETS	SCHOOL, CLUB HSE, REC CTR	OPEN SPACE PARKS/GC	COMM.	TOTAL	AREA (MI ² )	COMPOSITE 'C' FACTOR	PERCENT IMPERV.
									FUTURE						-				
OS05	37															37	0.0578	61.0	0.0%
OS06	84															84	0.1313	61.0	0.0%
OS07ab	11															11	0.0170	61.0	0.0%
OS07c	19															19	0.0296	61.0	0.0%
OS07d	2.2															2.2	0.0034	61.0	0.0%
OS08a	16															16	0.0251	61.0	0.0%
OS08b	11															11	0.0165	61.0	0.0%
OS09a	5.9															5.9	0.0093	61.0	0.0%
OS09b	28															28	0.0435	61.0	0.0%
FG01	13				19										2.1	34	0.0538	66.4	16.9%
FG02	12				13											25	0.0391	64.6	10.4%
FG03					13											13	0.0203	68.0	20.0%
FG04					11											11	0.0172	68.0	20.0%
FG05	1.5				33							3.0				37	0.0580	70.1	25.7%
FG06	15				27							0.9		0.5		43	0.0675	66.1	14.4%
FG21a	4.7				1.4											6.1	0.0095	62.6	4.6%
FG21b					10	3.8								2.5	3.3	9.6	0.0150	73.1	43.1%
FG22	17				16	48						2.1		0.9	3.3	87	0.1354	69.0	23.4%
FG23a	3.1					2.8	5.0					0.6		2.3		14	0.0216	68.6	20.6%
FG23b	14							0.9					-			15	0.0236	61.8	2.4%
FG23c	4.9							2.1	0.4				-			7.0	0.0109	65.2	12.0%
FG24a	18					0.7	44.0	2.3	2.4				-	0.1		22	0.0348	64.3	8.8%
FG24b	0.2				4.1	2.7	11.3	14	5.7				-	0.1		38	0.0589	73.4	34.0%
FG24C	5.5							19				4.0		0.0		19	0.0291	75.0	40.0%
FG240	0.0						0.2	5.7	0.0			4.0		0.8		60	0.0262	76.4	42.3%
FG23							9.5	51	0.9			0.4		2.0		09	0.1084	74.1	37.3%
FG26	25								30		25	0.4		0.5		30	0.0570	78.0	43.1%
FG27	2.5							17	1.7		0.1	2.0		1.7		43	0.0079	83.3	56.2%
FG20	62							1.7			0.1			10		62	0.0082	64.1	8.0%
FG29	02							0.7					26			26	0.0903	61.2	0.4%
F032	16								1.0				20			10	0.0402	60.0	52.0%
FG34	10								1.0			15				10	0.0275	62.7 65.5	4.4%
FG36	10								1.0			2.4				10	0.0202	65.5	12.4%
FG30	48											2.4				51	0.0200	63.5	6.7%
0911	40											3.4				4	0.0070	61.0	2.0%
0311	4.0			1	1		1	1	1						1		0.0070	01.0	2.0 /0

#### Additional Time of Concentration Calcs

	Sheet Flow					Shallow Concentrated Flow (Unpaved)				Shallow Concentrated Flow (Paved)								
Name	Length (ft)	US Elev	DS Elev	Slope (ft/ft)	Manning's n	Travel Time (hr)	Length (ft)	US Elev	DS Elev	Slope (ft/ft)	Velocity (fps)	Travel Time (hr)	Length (ft)	US Elev	DS Elev	Slope (ft/ft)	Velocity (fps)	Travel Time (hr)
OS10	300.0	7266.0	7258.0	0.027	0.04	0.16	3061.0	7258.0	7140.0	0.039	3.2	0.27				0.000	0.0	0.00
FG38	300.0	7134.0	7120.0	0.047	0.15	0.37	1572.0	7120.0	7075.0	0.029	2.7	0.16				0.000	0.0	0.00
OS11	500.0	7030.0	7020.0	0.020	0.04	0.27	248.0	7020.0	7014.0	0.024	2.5	0.03				0.000	0.0	0.00

Channel Flow											
Length (ft)	US Elev	DS Elev	Slope (ft/ft)	Manning's n	Bottom Width (ft)	Side Slopes (X:1)	Depth (ft)	Hydraulic Radius (ft)	Velocity (fps)	Travel Time (hr)	Time of Conc. (hr)
2168.0	7140.0	7098.0	0.019	0.035	10	5	5.0	2.9	12.0	0.05	0.48
2152.4	7075.0	7029.0	0.021	0.035	28	20	1.5	1.0	6.2	0.10	0.62
3782.3	6994.9	6917.9	0.020	0.035	10	4	2.0	1.4	7.5	0.14	0.14
7728.5	7051.8	6903.3	0.019	0.035	25	4	2.5	1.9	9.1	0.24	0.24

Name	Time of Conc. (min)	Lag Time (min)
OS10	28.66	17.19
FG38	37.34	22.41
OS11	0.30	0.18
GR1	8.46	5.08
GR2	14.14	8.49

	HEC-HMS	Input Data	
Subbasin	Area	Curve	Lag Time
Subbasili	(sq.mi.)	Number	(min)
FG01	0.0538	66.4	33.8
FG02	0.0391	64.6	16.1
FG03	0.0203	68	11.6
FG04	0.0172	68	7.6
FG05	0.058	70.1	28.4
FG06	0.0675	66.1	18.4
FG21a	0.0095	62.6	21.4
FG21b	0.015	73.1	12.7
FG22	0.1354	69	20.3
FG23a	0.0216	68.6	18
FG23b	0.0236	61.8	15
FG23c	0.0109	65.2	12.1
FG24a	0.0348	64.3	21.9
FG24b	0.0589	73.4	14.5
FG24c	0.0291	75	14.7
FG24d	0.0262	76.4	13.9
FG25	0.1084	74.1	23.8
FG26	0.057	78	25.5
FG27	0.0679	83.3	22.1
FG28	0.0184	64.1	14.8
FG29	0.0983	61.2	19.1
FG32	0.0402	80	23.9
FG34	0.0275	62.7	16.8
FG35	0.0292	65.3	15
FG36	0.0295	65.1	25.8
FG37	0.0754	61.4	21
FG38	0.133064	61	22.41
GR1	0.028	61	5.08
GR2	0.021	61	22.6
OS05	0.0578	61	15.2
OS06	0.1313	61	18.7
OS07ab	0.017	61	13.9
OS07c	0.0296	61	17.4
OS07d	0.0034	61	13.1
OS08a	0.0251	61	16.7
OS08b	0.0165	61	20.3
OS09a	0.0093	61	20.9
OS09b	0.0435	61	25.4
OS10	0.369334	64.72	17.19
OS11	0.0077	61	0.18

HEC-HMS Proposed 5-Year Flows								
Hudrologic Flomont	Area	Peak Discharge	Time of Peak	Volume				
Hydrologic Element	(sq.mi.)	CFS	(min)	(in)				
FG01	0.0538	3.4	01Jul2015, 12:36	0.28				
FG01-G1	0.0538	3.4	01Jul2015, 12:36	0.28				
FG02	0.0391	2.7	01Jul2015, 12:18	0.24				
FG03	0.0203	3	01Jul2015, 12:06	0.33				
FG04	0.0172	3.1	01Jul2015, 12:06	0.34				
FG05	0.058	6.7	01Jul2015, 12:30	0.4				
FG06	0.0675	5.8	01Jul2015, 12:18	0.28				
FG21a	0.0095	0.4	01Jul2015, 12:24	0.19				
FG21b	0.015	3.9	01Jul2015, 12:06	0.5				
FG22	0.1354	16.8	01Jul2015, 12:18	0.36				
FG23a	0.0216	2.7	01Jul2015, 12:18	0.35				
FG23b	0.0236	0.9	01Jul2015, 12:18	0.18				
FG23c	0.0109	1	01Jul2015, 12:12	0.26				
FG24a	0.0348	2	01Jul2015, 12:24	0.23				
FG24b	0.0589	14.8	01Jul2015, 12:12	0.52				
FG24c	0.0291	8.4	01Jul2015, 12:12	0.58				
FG24d	0.0262	8.7	01Jul2015, 12:06	0.64				
FG25	0.1084	21.8	01Jul2015, 12:18	0.54				
FG26	0.057	15.6	01Jul2015, 12:18	0.7				
FG27	0.0679	30	01Jul2015, 12:18	0.97				
FG28	0.0184	1.2	01Jul2015, 12:12	0.23				
FG29	0.0983	2.9	01Jul2015, 12:24	0.16				
FG32	0.0402	13.6	01Jul2015, 12:18	0.8				
FG32-G06	0.0402	13.2	01Jul2015, 12:24	0.8				
FG34	0.0275	1.3	01Jul2015, 12:18	0.2				
FG35	0.0292	2.4	01Jul2015, 12:12	0.26				
FG36	0.0295	1.7	01Jul2015, 12:30	0.25				
FG36-G16	0.0295	1.7	01Jul2015, 12:36	0.25				
FG37	0.0754	2.3	01Jul2015, 12:30	0.17				
FG38	0.133064	3.5	01Jul2015, 12:30	0.16				
GR1	0.028	1.2	01Jul2015, 12:06	0.16				
GR1-G19	0.028	1.2	01Jul2015, 12:36	0.16				
GR2	0.021	0.6	01Jul2015, 12:30	0.16				
GR2-G20	0.0287	0.7	01Jul2015, 14:06	0.15				
G06	1.3011	22.4	01Jul2015, 15:30	0.24				
G1	0.1116	4.9	01Jul2015, 12:36	0.22				
G1a	0.1313	3.8	01Jul2015, 12:24	0.16				
G1a-G2	0.1313	3.7	01Jul2015, 12:30	0.16				
G1-G2	0.1116	4.8	01Jul2015, 12:36	0.22				
G10	0.9	45.9	01Jul2015, 12:30	0.26				
G10-G11	0.9	43.8	01Jul2015, 12:36	0.26				
G11	0.9109	44.3	01Jul2015, 12:36	0.26				
G12	1.1626	20.5	01Jul2015, 15:24	0.23				
G12-G06	1.1626	20.5	01Jul2015, 15:36	0.23				

G13	0.057	15.6	01Jul2015, 12:18	0.7
G13-POND G	0.057	15.6	01Jul2015, 12:24	0.7
G14	0.071	2	01Jul2015, 12:36	0.17
G14-G15	0.071	1.9	01Jul2015, 12:54	0.17
G15	0.1002	3	01Jul2015, 12:48	0.19
G15-G16	0.1002	3	01Jul2015, 13:06	0.19
G16	0.2051	6.1	01Jul2015, 12:36	0.19
G17	0.369334	25.5	01Jul2015, 12:18	0.24
G17-G18	0.369334	24.7	01Jul2015, 12:30	0.24
G18	0.502397	28.3	01Jul2015, 12:30	0.22
G19	0.0287	0.7	01Jul2015, 12:30	0.16
G2	0.282	10.3	01Jul2015, 12:30	0.19
G2-G3	0.282	10.2	01Jul2015, 12:42	0.19
G20	0.0287	0.7	01Jul2015, 14:06	0.15
G21	0.028	1.2	01Jul2015, 12:36	0.16
G3	0.3195	12.1	01Jul2015, 12:36	0.21
G4	0.0391	1.2	01Jul2015, 12:36	0.16
G4-G7	0.0391	1.2	01Jul2015, 12:36	0.16
G7	0.5161	8.9	01Jul2015, 14:12	0.2
G7-G8	0.5161	8.9	01Jul2015, 14:18	0.2
G8	0.7016	24	01Jul2015, 12:18	0.23
G8-G10	0.7016	23.8	01Jul2015, 12:30	0.23
G9a	0.1195	16.2	01Jul2015, 12:12	0.35
G9a-G9b	0.1195	15.5	01Jul2015, 12:18	0.35
G9b	0.1748	32.3	01Jul2015, 12:12	0.43
G9b-G10	0.1748	30.8	01Jul2015, 12:18	0.42
OS05	0.0578	1.8	01Jul2015, 12:18	0.16
OS05-G1	0.0578	1./	01Jul2015, 12:24	0.16
OS06	0.1313	3.8	01Jul2015, 12:24	0.16
OS07ab	0.01/	0.5	01Jul2015, 12:18	0.16
OS07ab-POND F	0.017	0.5	01Jul2015, 12:42	0.16
0507c	0.0296	0.9	01Jul2015, 12:24	0.16
05076-04	0.0296	0.9	01Jul2015, 12:36	0.16
	0.0034	0.1	01Jul2015, 12:18	0.16
05070-08	0.0054	0.1	011012015, 12.50	0.10
0308a	0.0231	0.7	01Jul2015, 12:24	0.10
0308b 0508b-69a	0.0105	0.4	011/012015, 12:24	0.10
05085-058	0.0105	0.4	011/012015, 13:00	0.15
0508-08	0.0231	0.7	01Jul2015, 12:30	0.10
0509a	0.0000	0.3	01Jul2015, 12:50	0.10
OS096 056	0.0000	1.1	01Jul2015, 12:36	0.15
OS09h-G14	0.0435	1.1	01/ul2015, 12:50	0.10
0510	0.369334	25 5	01/ul2015, 12:18	0.10
0511	0.0077	23.3 0 5	01/ul2015, 12:10	0.24
POND F	0.0077	0.5	01/ul2015, 12:00	0.10
	0.462	27 Q	01/0/2015, 17:26	0.2
	0.402	22.0		0.24

POND F-G7	0.462	8	01Jul2015, 14:24	0.19
POND G	1.1626	20.5	01Jul2015, 15:24	0.23
POND G IN-EAST	0.1249	44.3	01Jul2015, 12:18	0.85
POND G IN-WEST	1.0377	63.3	01Jul2015, 12:30	0.29
REX RD WQCV	0.1748	30.9	01Jul2015, 12:18	0.42

HEC-HMS Proposed 100-Year Flows								
Hudrologic Flomont	Area	Peak Discharge	Time of Peak	Volume				
Hydrologic Element	(sq.mi.)	CFS	(min)	(in)				
FG01	0.0538	31.2	01Jul2015, 12:30	1.7				
FG01-G1	0.0538	31.1	01Jul2015, 12:30	1.7				
FG02	0.0391	32	01Jul2015, 12:12	1.58				
FG03	0.0203	23.6	01Jul2015, 12:06	1.84				
FG04	0.0172	22.2	01Jul2015, 12:00	1.84				
FG05	0.058	45	01Jul2015, 12:24	1.98				
FG06	0.0675	56.2	01Jul2015, 12:12	1.69				
FG21a	0.0095	5.9	01Jul2015, 12:18	1.43				
FG21b	0.015	20.7	01Jul2015, 12:06	2.24				
FG22	0.1354	121.3	01Jul2015, 12:12	1.91				
FG23a	0.0216	20.6	01Jul2015, 12:12	1.88				
FG23b	0.0236	16.9	01Jul2015, 12:12	1.38				
FG23c	0.0109	10.8	01Jul2015, 12:06	1.63				
FG24a	0.0348	23.6	01Jul2015, 12:18	1.55				
FG24b	0.0589	75.9	01Jul2015, 12:06	2.26				
FG24c	0.0291	39.5	01Jul2015, 12:06	2.4				
FG24d	0.0262	39	01Jul2015, 12:06	2.52				
FG25	0.1084	111.4	01Jul2015, 12:18	2.31				
FG26	0.057	65	01Jul2015, 12:18	2.65				
FG27	0.0679	98.2	01Jul2015, 12:12	3.14				
FG28	0.0184	15	01Jul2015, 12:12	1.55				
FG29	0.0983	59.5	01Jul2015, 12:12	1.34				
FG32	0.0402	50.9	01Jul2015, 12:18	2.83				
FG32-G06	0.0402	50.3	01Jul2015, 12:18	2.82				
FG34	0.0275	19.9	01Jul2015, 12:12	1.45				
FG35	0.0292	25.3	01Jul2015, 12:12	1.63				
FG36	0.0295	18.8	01Jul2015, 12:18	1.61				
FG36-G16	0.0295	18.7	01Jul2015, 12:24	1.6				
FG37	0.0754	43.8	01Jul2015, 12:18	1.35				
FG38	0.133064	72.9	01Jul2015, 12:18	1.32				
GR1	0.028	30	01Jul2015, 12:00	1.34				
GR1-G19	0.028	26.8	01Jul2015, 12:12	1.3				
GR2	0.021	11.5	01Jul2015, 12:18	1.32				
GR2-G20	0.0287	13	01Jul2015, 12:54	1.38				
G06	1.3011	491	01Jul2015, 12:48	1.66				
G1	0.1116	61	01Jul2015, 12:18	1.51				
G1a	0.1313	79.8	01Jul2015, 12:12	1.33				
G1a-G2	0.1313	78.6	01Jul2015, 12:18	1.32				
G1-G2	0.1116	60.6	01Jul2015, 12:18	1.5				
G10	0.9	390.3	01Jul2015, 12:24	1.63				
G10-G11	0.9	389.1	01Jul2015, 12:30	1.62				
G11	0.9109	392.7	01Jul2015, 12:30	1.62				
G12	1.1626	449.6	01Jul2015, 12:48	1.66				
G12-G06	1.1626	448.7	01Jul2015, 12:54	1.65				

G13	0.057	65	01Jul2015, 12:18	2.65
G13-POND G	0.057	63.5	01Jul2015, 12:24	2.64
G14	0.071	37.3	01Jul2015, 12:18	1.36
G14-G15	0.071	37.1	01Jul2015, 12:24	1.35
G15	0.1002	54.9	01Jul2015, 12:18	1.43
G15-G16	0.1002	53.8	01Jul2015, 12:24	1.41
G16	0.2051	112.1	01Jul2015, 12:24	1.41
G17	0.369334	296.1	01Jul2015, 12:12	1.59
G17-G18	0.369334	292.3	01Jul2015, 12:18	1.57
G18	0.502397	365.2	01Jul2015, 12:18	1.51
G19	0.0287	14	01Jul2015, 12:00	1.33
G2	0.282	166.7	01Jul2015, 12:18	1.43
G2-G3	0.282	163.4	01Jul2015, 12:18	1.42
G20	0.0287	13	01Jul2015, 12:54	1.38
G21	0.028	26.8	01Jul2015, 12:12	1.3
G3	0.3195	184.9	01Jul2015, 12:18	1.47
G4	0.0391	24.7	01Jul2015, 12:18	1.35
G4-G7	0.0391	23.8	01Jul2015, 12:18	1.34
G7	0.5161	194.5	01Jul2015, 12:42	1.47
G7-G8	0.5161	194	01Jul2015, 12:42	1.46
G8	0.7016	279	01Jul2015, 12:30	1.55
G8-G10	0.7016	277.7	01Jul2015, 12:36	1.54
G9a	0.1195	97.2	01Jul2015, 12:12	1.85
G9a-G9b	0.1195	95.7	01Jul2015, 12:12	1.84
G9b	0.1748	170.1	01Jul2015, 12:12	2.04
G9b-G10	0.1748	157.9	01Jul2015, 12:18	2.02
OS05	0.0578	39.1	01Jul2015, 12:12	1.33
OS05-G1	0.0578	38.6	01Jul2015, 12:12	1.33
OS06	0.1313	79.8	01Jul2015, 12:12	1.33
OS07ab	0.017	11.9	01Jul2015, 12:06	1.33
OS07ab-POND F	0.017	11.8	01Jul2015, 12:18	1.31
OS07c	0.0296	18.9	01Jul2015, 12:12	1.33
OS07c-G4	0.0296	18.8	01Jul2015, 12:18	1.32
OS07d	0.0034	2.5	01Jul2015, 12:06	1.33
OS07d-G8	0.0034	2.4	01Jul2015, 12:12	1.32
OS08a	0.0251	16.3	01Jul2015, 12:12	1.33
OS08b	0.0165	9.5	01Jul2015, 12:18	1.33
OS08b-G9a	0.0165	9.4	01Jul2015, 12:30	1.29
OS08-G8	0.0251	15.6	01Jul2015, 12:18	1.32
OS09a	0.0093	5.3	01Jul2015, 12:18	1.33
OS09a-G9a	0.0093	5.2	01Jul2015, 12:30	1.3
OS09b	0.0435	21.8	01Jul2015, 12:24	1.32
OS09b-G14	0.0435	21.7	01Jul2015, 12:24	1.31
OS10	0.369334	296.1	01Jul2015, 12:12	1.59
OS11	0.0077	9.4	01Jul2015, 12:00	1.34
POND F	0.462	177.6	01Jul2015, 12:42	1.46
POND F IN	0.462	293	01Jul2015, 12:18	1.56

POND F-G7	0.462	177.3	01Jul2015, 12:42	1.45
POND G	1.1626	449.6	01Jul2015, 12:48	1.66
POND G IN-EAST	0.1249	160.3	01Jul2015, 12:18	2.91
POND G IN-WEST	1.0377	503.2	01Jul2015, 12:24	1.69
REX RD WQCV	0.1748	158.1	01Jul2015, 12:18	2.02

Grandview Reserve CLOMR Report Project No.: 201662.03



# Appendix K Preliminary Onsite Pond Sizing Spreadsheets

# MHFD

# MILE HIGH FLOOD DISTRICT DETENTION BASIN DESIGN WORKBOOK

	MHFD-Detention, Version 4.06 (July 2022) Mile High Flood District Denver, Colorado www.mhfd.org
<u>Purpose:</u>	This workbook aids in the estimation of stormwater detention basin sizing and outlet routing based on the modified puls routing method for urban watersheds. Several different BMP types and various outlet configurations can be sized.
Function:	<ol> <li>Approximates the stage-area-volume relationship for a detention basin based on watershed parameters and basin geometry parameters. Also evaluates existing user-defined basin stage-area relationships.</li> </ol>
	2. Sizes filtration media orifice, outlet orifices, elliptical slots, weirs, trash racks, and develops stage-discharge relationships. Uses the Modified Puls method to route a series of hydrographs (i.e., 2-, 5-, 10-, 25-, 50-, 100- and 500-year) and calibrates the peak discharge out of the basin to match the pre-development peak discharges for the watershed.
Content:	This workbook consists of the following sheets:
Basin	Tabulates stage-area-volume relationship estimates based on watershed parameters
<b>Outlet Structure</b>	Tabulates a stage-discharge relationship for the user-defined outlet structure (inlet control).
Reference	Provides reference equations and figures.
User Tips and Tools	Provides instructions and video links to assist in using this workbook. Includes a stage-area calculator.
BMP Zone Images	Provides images of typical BMP zone confirgurations corresponding with Zone pulldown selections.
<u>Acknowledgements:</u>	Spreadsheet Development Team: Ken MacKenzie, P.E., Holly Piza, P.E. Mile High Flood District
	Derek N. Rapp, P.E. Peak Stormwater Engineering, LLC
	Dr. James C.Y. Guo, Ph.D., P.E. Professor, Department of Civil Engineering, University of Colorado at Denver
<u>Comments?</u> <u>Revisions?</u>	Direct all comments regarding this spreadsheet workbook to: <b>MHFD E-Mail</b> Check for revised versions of this or any other workbook at: <b>Downloads</b>

Project:	Grandview	- Filing 2												
Basin ID:	Basin ID: Basin A													
(These														
the last the last	-	-												
The second second second second second second second second second second second second second second second s	1	-	-	-	Depth Increment =		ft							
NUMBER OF TAXABLE PARTY	100.00	-	•		Dependicinent		Optional				Optional			
Example Zone	e Configura	tion (Reter	ntion Pond)		Stage - Storage	Stage	Override Stage (#)	Length	Width	Area (# ² )	Override Aroa (ft ² )	Area (acro)	Volume (+ 3)	Volume
Watershed Information				coc 7 4	Top of Micropool		0.00					0.000	(10)	(ac-it)
Colocted PMD Type -	EDR			6967.47	6069		0.00				69	0.000	19	0.000
Selected Drift Type -	26.12				0908		1.52				00	0.002	10	0.000
watersneu Area =	30.13	acres					1.55		-		6,024	0.196	4,304	0.100
Watershed Length =	2,360	π					2.53				40,781	0.936	29,066	0.66/
Watershed Length to Centrold -	1,100	HL					4.52		-		F1 022	1.000	122 720	2.070
Watershed Imponiouspace -	64 2006	norcont					4.55		-		56,607	1.192	177 029	4.064
Percentage Hydrologic Soil Group A =	100.0%	percent					6.53		-		61 730	1.302	236 252	5 424
Percentage Hydrologic Soil Group R =	0.0%	percent			6975		7.53	-	_	_	65 473	1.503	200,252	6.884
Percentage Hydrologic Soil Groups C/D =	0.0%	nercent			6975.3		7.83				68 045	1.562	319 881	7 343
Target WOCV Drain Time =	40.0	hours			057.010		7.05				00,015	1.502	515,001	7.515
Location for 1-hr Rainfall Depths =	User Input	nours												
After providing required inputs above inc	luding 1 hour	minfall												
depths, click 'Run CUHP' to generate run	off hydrograph	is using				-				-				
the embedded Colorado Urban Hydro	graph Proced	ure.	Optional Us	er Overrides										
Water Quality Capture Volume (WQCV) =	0.757	acre-feet		acre-feet										
Excess Urban Runoff Volume (EURV) =	2.874	acre-feet		acre-feet										
2-yr Runoff Volume (P1 = 1.19 in.) =	2.126	acre-feet	1.19	inches										
5-yr Runoff Volume (P1 = 1.5 in.) =	2.790	acre-feet	1.50	inches										
10-yr Runoff Volume (P1 = 1.75 in.) =	3.322	acre-feet	1.75	inches										
25-yr Runoff Volume (P1 = 2 in.) =	4.022	acre-feet	2.00	inches										
50-yr Runoff Volume (P1 = 2.25 in.) =	4.709	acre-feet	2.25	inches										
100-yr Runoff Volume (P1 = 2.52 in.) =	5.545	acre-feet	2.52	inches										
500-yr Runoff Volume (P1 = 3.68 in.) =	9.033	acre-feet	3.68	inches						-				
Approximate 2-yr Detention Volume =	1.869	acre-feet		_										
Approximate 5-yr Detention Volume =	2.444	acre-feet												
Approximate 10-yr Detention Volume =	2.948	acre-feet												
Approximate 25-yr Detention Volume =	3.549	acre-feet												
Approximate 50-yr Detention Volume =	3.912	acre-feet												
Approximate 100-yr Detention Volume =	4.293	acre-feet												
	,	-												
Define Zones and Basin Geometry														
Zone 1 Volume (WQCV) =	0.757	acre-feet							-					
Zone 2 Volume (EURV - Zone 1) =	2.117	acre-feet							-					
Zone 3 Volume (100-year - Zones 1 & 2) =	1.419	acre-feet						-	-	-				
Total Detention Basin Volume =	4.293	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	ft²								-				
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"												
Volume of Basin Floor (V _{FLOOR} ) =	user	ft'												
Depth of Main Basin (H _{MAIN} ) =	user	nt o												
Length of Main Basin (L _{MAIN} ) =	user	ft e												
width of Main Basin (W _{MAIN} ) =	user	1C									-			<u> </u>
Area of Main Basin (A _{MAIN} ) =	user	π*												L
volume of Main Basin (VMAIN) =	user													<u> </u>
$(v_{total}) =$	user	Jacie-leet							-		-			
						-								
												-		
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MHFD-Detention, Version 4.06 (July 2022)



# DETENTION BASIN OUTLET STRUCTURE DESIGN MHFD-Detention, Version 4.06 (July 2022)



Project:	Grandview - Filing	2			/			
Basin ID:	Basin A							
alone a				Estimated	Estimated			
wat - I	1	<hr/>		Stage (ft)	Volume (ac-ft)	Outlet Type		
NUTRE FIRST MOCE			Zone 1 (WQCV)	2.63	0.757	Orifice Plate		
1	-100-YEAR GANYCE		Zone 2 (EURV)	4.58	2.117	Rectangular Orifice		
Polasagor Grancas			Zone 3 (100-year)	5.71	1.419	Weir&Pipe (Restrict)		
Example Zone	Configuration (Re	tention Pond)		Total (all zones)	4.293		-	
User Input: Orifice at Underdrain Outlet (typical	y used to drain WQ	CV in a Filtration BN	<u>1P)</u>				Calculated Paramet	ters for Underdrain
Underdrain Orifice Invert Depth =	N/A	ft (distance below	the filtration media	surface)	Underc	drain Orifice Area =	N/A	ft ²
Underdrain Orifice Diameter =	N/A	inches			Underdrain	Orifice Centroid =	N/A	feet
Licer Input: Orifice Plate with one or more orific	oc or Elliptical Clot \	Noir (typically used	to drain WOCV and	/or ELID\/ in a codir	montation PMD)		Calculated Daramai	tore for Diato
Centroid of Lowest Orifice -		ft (relative to basin	bottom at Stage -	0 ft)	WO Orifi	ice Area per Row -	1 681F-02	ers for Plate
Depth at top of Zone using Orifice Plate =	2.63	ft (relative to basin	bottom at Stage =	0 ft)	Flli	intical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	10.50	inches			Ellipt	ical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.42	sq. inches (diamete	er = 1-3/4 inches)		E	Iliptical Slot Area =	N/A	ft²
		-						
User Input: Stage and Total Area of Each Orifice	e Row (numbered fi	rom lowest to highe	<u>st)</u>					
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.88	1.75					
Orifice Area (sq. inches)	2.42	2.42	2.42					
	Row Q (optional)	Pow 10 (antional)	Pow 11 (optional)	Pow 12 (optional)	Pow 13 (antional)	Pow 14 (antional)	Pow 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)	Row 9 (optional)	Kow 10 (optional)	Row II (optional)	Row 12 (optional)	Kow 13 (optional)	Kow 14 (optional)	Kow 13 (optional)	Row 10 (optional)
Orifice Area (sg. inches)								
		1			1	1	1	
User Input: Vertical Orifice (Circular or Rectangu	<u>ular)</u>						Calculated Paramet	ters for Vertical Orif
	Zone 2 Rectangula	Not Selected					Zone 2 Rectangular	Not Selected
Invert of Vertical Orifice =	2.63	N/A	ft (relative to basin	bottom at Stage =	0 ft) Ver	tical Orifice Area =	0.10	N/A
Depth at top of Zone using Vertical Orifice =	4.58	N/A	ft (relative to basin	bottom at Stage =	0 ft) Vertica	I Orifice Centroid =	0.08	N/A
Vertical Orifice Height =	2.00	N/A	inches					
Vertical Orifice Width =	6.89	l	inches					
User Input: Overflow Weir (Dropbox with Flat o	r Sloped Grate and	Outlet Pine OR Rec	angular/Tranezoida	Weir and No Outl	et Pine)		Calculated Paramet	ters for Overflow W
Oser Input. Overnow weir (Dropbox with hat of	Zone 3 Weir	Not Selected					Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, Ho =	4.58	N/A	ft (relative to basin b	ottom at Stage = 0 fi	t) Height of Grate	e Upper Edge, H _t =	4.58	N/A
Overflow Weir Front Edge Length =	4.00	N/A	feet	5	Overflow W	/eir Slope Length =	4.00	N/A
Overflow Weir Grate Slope =	0.00	N/A	H:V	Gi	rate Open Area / 10	0-yr Orifice Area =	8.02	N/A
Horiz. Length of Weir Sides =	4.00	N/A	feet	O	verflow Grate Open	Area w/o Debris =	11.14	N/A
Overflow Grate Type =	Type C Grate	N/A		0	Overflow Grate Ope	n Area w/ Debris =	5.57	N/A
Debris Clogging % =	50%	N/A	%					
					6-	laulata d Davana ataw		
User Input: Outlet Pipe W/ Flow Restriction Plate	Circular Orifice, Ri	Not Soloctod	ectangular Orifice)		<u>La</u>	ilculated Parameters	S for Outlet Pipe W/	Flow Restriction Pla
Denth to Invert of Outlet Pine –	0.25	N/A	ft (distance below ba	isin bottom at Stage -	- 0 <del>ft</del> ) O	utlet Orifice Area -	1 39	NUL SEIECLEU
Outlet Pipe Diameter =	18.00	N/A	inches	isin bottom at stage -	Outlet	t Orifice Centroid =	0.61	N/A
Restrictor Plate Height Above Pipe Invert =	13.20		inches	Half-Cent	tral Angle of Restric	tor Plate on Pipe =	2.06	N/A
5		1			5			
User Input: Emergency Spillway (Rectangular or	Trapezoidal)						Calculated Paramet	ters for Spillway
Spillway Invert Stage=	5.70	ft (relative to basin	bottom at Stage =	0 ft)	Spillway D	esign Flow Depth=	0.97	feet
Spillway Crest Length =	25.00	feet			Stage at 1	Fop of Freeboard =	7.67	feet
Spillway End Slopes =	4.00	H:V			Basin Area at 1	Fop of Freeboard =	1.53	acres
Freeboard above Max Water Surface =	1.00	feet			Basin Volume at	op of Freeboard =	7.10	acre-ft
Routed Hydrograph Results	The user can over	ride the default CUP	IP hydrographs and	runoff volumes by	entering new value	es in the Inflow Hyd	lrographs table (Col	lumns W through Al
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A 0.757	N/A	1.19	2 790	1./5	2.00	2.25	2.52
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.126	2.790	3.322	4.022	4.709	5.545
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.2	0.4	0.6	5.0	10.1	16.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	0.01	0.02	0.14	0.29	0.47
Predevelopment Unit Peak How, q (CTS/acre) = Peak Inflow $\Omega$ (cfs) =	N/A N/A	N/A	28.8	37.7	44.5	57.1	68.1	81.4
Peak Outflow Q (cfs) =	0.3	1.1	0.9	1.0	2.8	8.0	14.3	15.4
Ratio Peak Outflow to Predevelopment $Q =$	N/A	N/A	N/A	2.6	5.0			0.9
Structure Controlling Flow = Max Velocity through Grate 1 (fps) =	N/A	N/A	Vertical Orifice 1	Vertical Orifice 1 N/A	0.1		1.2	1.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	67	61	67	70	69	68	66
Fime to Drain 99% of Inflow Volume (hours) =	<b>40</b>	/2 4 59	65 3 81	/2	/6 4 74	/5	/5	/5
Area at Maximum Ponding Depth (acres) =	0.95	1.20	1.11	1.17	1.21	1.24	1.27	1.31
	0 702	2 077	1 076	2 616	2 070	3 377	3 653	4 208



ice	
ft ² feet	
eir	
feet feet	
ft ² ft ²	
<u>ite</u>	
ft ² feet radians	





## 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

ĺ										CUIUD
	SOURCE	CURP	СОПР	СОПР	СОПР	СОПР	CURP	СОПР	СОПР	СОПР
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	0.34	0.03	2.03
	0:15:00	0.00	0.00	3.01	4.89	6.06	4.08	5.15	4.99	9.39
	0:20:00	0.00	0.00	11.19	14.81	17.48	11.07	12.96	13.82	21.85
	0:25:00	0.00	0.00	23.40	30.92	37.22	23.15	26.47	28.47	45.97
	0:30:00	0.00	0.00	28.77	37.72	44.48	47.43	56.58	63.83	106.22
	0:35:00	0.00	0.00	27.53	35.53	41.46	57.08	68.10	81.36	133.45
	0:40:00	0.00	0.00	25.09	31.83	37.05	55.68	66.30	79.83	130.37
	0:45:00	0.00	0.00	22.11	28.32	33.07	50.29	59.71	73.41	120.23
	0:50:00	0.00	0.00	19.45	25.34	29.32	45.33	53.61	65.87	108.49
	1.00.00	0.00	0.00	17.10	10.91	23.90	39.63	40.94	50.51	90.22
	1:05:00	0.00	0.00	13.20	19.01	23.13	30.40	35.45	45.01	76.01
	1:10:00	0.00	0.00	12.58	16.88	20.07	26.81	31.18	39.61	65.35
	1:15:00	0.00	0.00	11.24	15.46	18.87	23.92	27.71	34.22	56.01
	1:20:00	0.00	0.00	10.05	13.85	17.13	20.94	24.19	28.88	46.87
	1:25:00	0.00	0.00	8.90	12.27	14.89	18.10	20.82	23.98	38.59
	1:30:00	0.00	0.00	7.83	10.86	12.81	15.24	17.47	19.69	31.36
	1:35:00	0.00	0.00	6.96	9.71	11.15	12.64	14.40	15.87	24.92
	1:40:00	0.00	0.00	6.42	8.55	10.11	10.51	11.88	12.70	19.60
	1:45:00	0.00	0.00	6.16	7.72	9.51	9.17	10.33	10.73	16.46
	1:50:00	0.00	0.00	6.01	7.15	9.10	8.36	9.41	9.56	14.51
	1:55:00	0.00	0.00	5.42	6.73	8.66	7.85	8.83	8.79	13.19
	2:00:00	0.00	0.00	4.82	6.27	8.00	7.49	8.42	8.25	12.25
	2:05:00	0.00	0.00	3.8/	5.05	6.44	6.05	6.80 F 30	6.5/	9.68
	2:10:00	0.00	0.00	2.96	3.00	4.95	4.03	3.20	4.93	5.41
	2:20:00	0.00	0.00	1.76	2.99	2.88	2 69	3.97	2.83	4 10
	2:25:00	0.00	0.00	1.33	1.73	2.17	2.03	2.28	2.14	3.10
	2:30:00	0.00	0.00	1.01	1.28	1.61	1.51	1.69	1.60	2.31
	2:35:00	0.00	0.00	0.74	0.93	1.20	1.11	1.24	1.19	1.71
	2:40:00	0.00	0.00	0.54	0.68	0.89	0.83	0.93	0.89	1.28
	2:45:00	0.00	0.00	0.38	0.48	0.63	0.60	0.68	0.64	0.92
	2:50:00	0.00	0.00	0.24	0.33	0.42	0.41	0.46	0.44	0.62
	2:55:00	0.00	0.00	0.14	0.20	0.26	0.26	0.28	0.27	0.38
	3:00:00	0.00	0.00	0.07	0.11	0.13	0.14	0.15	0.14	0.20
	3.03.00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.05	0.07
	3:15:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	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
	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
	4:35:00	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
	4:55:00	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
	5:20:00	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
	5:40:00	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
	0.00.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00

# MHFD

# MILE HIGH FLOOD DISTRICT DETENTION BASIN DESIGN WORKBOOK

	MHFD-Detention, Version 4.06 (July 2022) Mile High Flood District Denver, Colorado www.mhfd.org
<u>Purpose:</u>	This workbook aids in the estimation of stormwater detention basin sizing and outlet routing based on the modified puls routing method for urban watersheds. Several different BMP types and various outlet configurations can be sized.
Function:	<ol> <li>Approximates the stage-area-volume relationship for a detention basin based on watershed parameters and basin geometry parameters. Also evaluates existing user-defined basin stage-area relationships.</li> </ol>
	2. Sizes filtration media orifice, outlet orifices, elliptical slots, weirs, trash racks, and develops stage-discharge relationships. Uses the Modified Puls method to route a series of hydrographs (i.e., 2-, 5-, 10-, 25-, 50-, 100- and 500-year) and calibrates the peak discharge out of the basin to match the pre-development peak discharges for the watershed.
Content:	This workbook consists of the following sheets:
Basin	Tabulates stage-area-volume relationship estimates based on watershed parameters
<b>Outlet Structure</b>	Tabulates a stage-discharge relationship for the user-defined outlet structure (inlet control).
Reference	Provides reference equations and figures.
User Tips and Tools	Provides instructions and video links to assist in using this workbook. Includes a stage-area calculator.
BMP Zone Images	Provides images of typical BMP zone confirgurations corresponding with Zone pulldown selections.
<u>Acknowledgements:</u>	Spreadsheet Development Team: Ken MacKenzie, P.E., Holly Piza, P.E. Mile High Flood District
	Derek N. Rapp, P.E. Peak Stormwater Engineering, LLC
	Dr. James C.Y. Guo, Ph.D., P.E. Professor, Department of Civil Engineering, University of Colorado at Denver
<u>Comments?</u> <u>Revisions?</u>	Direct all comments regarding this spreadsheet workbook to: <b>MHFD E-Mail</b> Check for revised versions of this or any other workbook at: <b>Downloads</b>

Project:	Grandview	- Filing	2
Basin ID:	Basin B		
			_

T-I-T-2.27

Example Zone Configuration (Retention Pond) -

### Watershed Information

Selected BMP Type =	EDB						
Watershed Area =	28.83	acres					
Watershed Length =	1,700	ft					
Watershed Length to Centroid =	850	ft					
Watershed Slope =	0.020	ft/ft					
Watershed Imperviousness =	61.90%	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.

the embedded colorado orban nydrograph nocedure.									
Water Quality Capture Volume (WQCV) =	0.583	acre-feet							
Excess Urban Runoff Volume (EURV) =	2.184	acre-feet							
2-yr Runoff Volume (P1 = 1.19 in.) =	1.618	acre-feet							
5-yr Runoff Volume (P1 = 1.5 in.) =	2.128	acre-feet							
10-yr Runoff Volume (P1 = 1.75 in.) =	2.537	acre-feet							
25-yr Runoff Volume (P1 = 2 in.) =	3.086	acre-feet							
50-yr Runoff Volume (P1 = 2.25 in.) =	3.627	acre-feet							
100-yr Runoff Volume (P1 = 2.52 in.) =	4.289	acre-feet							
500-yr Runoff Volume (P1 = 3.14 in.) =	5.737	acre-feet							
Approximate 2-yr Detention Volume =	1.418	acre-feet							
Approximate 5-yr Detention Volume =	1.856	acre-feet							
Approximate 10-yr Detention Volume =	2.243	acre-feet							
Approximate 25-yr Detention Volume =	2.707	acre-feet							
Approximate 50-yr Detention Volume =	2.989	acre-feet							
Approximate 100-yr Detention Volume =	3.292	acre-feet							

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### Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.583	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.601	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.107	acre-feet
Total Detention Basin Volume =	3.292	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 (STC) =	user	ft/ft
Slopes of Main Basin Sides (Smain) =	user	H:V
Basin Length-to-Width Ratio (R _{L/W} ) =	user	

Initial	Surcharge Area $(A_{1SV}) =$	user	ft "
Surcharge	Volume Length $(L_{ISV}) =$	user	ft
Surcharge	Volume Width $(W_{1SV}) =$	user	ft
Depth o	f Basin Floor ( $H_{FLOOR}$ ) =	user	ft
Length o	of Basin Floor $(L_{FLOOR}) =$	user	ft
Width of	$f Basin Floor (W_{FLOOR}) =$	user	ft
Area o	f Basin Floor $(A_{FLOOR}) =$	user	ft ²
Volume o	f 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

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		Depth Increment =	0.50	ft (							
		- operation children =	-100	Optional				Optional			
tion Pond		Stage - Storage	Stage	Override	Lenath	Width	Area	Override	Area	Volume	Volume
uonn onu)		Description	(ff)	Stage (ft)	(ff)	(#)	(ff ² )	$\Delta rea (ft^2)$	(acre)	(ft ⁻³ )	(ac-ft)
		Top of Mineres	1.27	0.00	1.07	1.57		· · · · · · · · · · · · · · · · · · ·	0.000		(00.10)
	6962.5	TOP OF MICROPOOL		0.00		-		U	0.000		
		6963		0.50				544	0.012	136	0.003
		6963.5		1.00				5,847	0.134	1,/34	0.040
		6964		1.50				16 307	0 374	7 272	0 167
				1.50				10,507	0.571	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	0.107
		6964.5		2.00				28,817	0.662	18,553	0.426
		6965		2.50				40.205	0.923	35,808	0.822
		0505		2.50				10/200	0.525	55,000	UIULL
		6965.5		3.00				44,431	1.020	56,967	1.308
		6966		3.50				45,303	1.040	79.401	1.823
		0500		5.50				13,505	1.0 10	75,101	1.025
		6966.5		4.00				46,440	1.066	102,337	2.349
		6967		4 50				47 282	1.085	125 767	2 887
		0507		4.50				47,202	1.005	125,707	2.007
		6967.5		5.00				48,125	1.105	149,619	3.435
		6968		5 50				48 060	1 174	173 802	3 002
		0500		5.50				10,505	11121	115,052	31332
		6968.5		6.00				49,816	1.144	198,589	4.559
		6060		6 50				50.666	1 163	223 200	5 136
		0505		0.50				50,000	1.105	223/105	5.150
Optional Use	r Overrides	6969.5		7.00				51,522	1.183	249,256	5.722
	acro-foot	6070		7 50				52 387	1 203	275 233	6 3 1 8
	dere rece	0570		7.50				52,507	1.205	2/5,255	0.510
	acre-feet										
1.19	inches										
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MHFD-Detention, Version 4.06 (July 2022)


Project: Grandview - Filing 2												
Basin ID:	Basin B											
ADME S				Estimated	Estimated							
in T T I		<hr/>		Stage (ft)	Volume (ac-ft)	Outlet Type						
NOTWEL STRAT MODE			Zone 1 (WQCV)	2.22	0.583	Orifice Plate						
1	- INFRAM				1.601	Rectangular Orifice						
PERMANENT OPPCER	Zone 3 (100-year)	4.88	1.107	Weir&Pipe (Restrict)	1							
Example Zone	Configuration (Re	tention Pond)		Total (all zones)	3.292							
User Input: Orifice at Underdrain Outlet (typically	<u>/ used to drain WQ</u>	CV in a Filtration BN	<u>1P)</u>				Calculated Paramet	ters for Underdrain				
Underdrain Orifice Invert Depth =	N/A	ft (distance below	the filtration media	surface)	Under	Irain Orifice Area =	N/A	ft²				
Underdrain Orifice Diameter =	N/A	inches			Underdrair	Orifice Centroid =	N/A	feet				
Laser Inputs Orifice Plate with and as more crific	an an Elliptical Clat )	Noir (typically used	to drain WOCV and	/or EUD\/ in a codir	montation RMD)			have fau Diata				
User Input: Onnice Plate with one or more ornice		t (rolativo to basin	to drain wQCV and	OF EURV IN a sedir	MO Orif	co Aron por Bow -		ers for Plate				
Depth at top of Zone using Orifice Plate -	2.18	ft (relative to basin	bottom at Stage -	0 ft)	WQ UNI	ntical Half-Width -	N/A	rt feet				
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	bottom ut stuge -	010)	Ellipt	ical Slot Centroid =	N/A	feet				
Orifice Plate: Orifice Area per Row =	N/A	sq. inches			E	lliptical Slot Area =	N/A	ft ²				
User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)												
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)				
Stage of Orifice Centroid (ft)	0.00	0.73	1.50									
Orifice Area (sq. inches)	2.11	2.11	2.11									
	Row Q (antional)	Pow 10 (antianal)	Pow 11 (antional)	Pow 12 (antianal)	Pow 12 (antional)	Pow 14 (antional)	Pow 15 (antional)	Pour 16 (antianal)				
Stage of Orifice Centroid (ft)	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)				
Orifice Area (so, inches)												
User Input: Vertical Orifice (Circular or Rectangu	ılar)						Calculated Paramet	ters for Vertical Orif				
	Zone 2 Rectangular	Not Selected					Zone 2 Rectangular	Not Selected				
Invert of Vertical Orifice =	2.22	N/A	ft (relative to basin	bottom at Stage =	0 ft) Ve	tical Orifice Area =	0.08	N/A				
Depth at top of Zone using Vertical Orifice =	N/A	in (relative to pash) bottom at stage = 0 rt) vertical Orifice Centrold = 0.08 N/A										
Vertical Orifice Height =	N/A	inches										
vertical Online width =	5.40		Inches									
User Input: Overflow Weir (Dropbox with Flat or	Sloped Grate and	Outlet Pipe OR Rec	tangular/Trapezoida	Weir and No Outl	et Pipe)		Calculated Paramet	ters for Overflow W				
(	Zone 3 Weir	Not Selected					Zone 3 Weir	Not Selected				
Overflow Weir Front Edge Height, Ho =	3.83	N/A	ft (relative to basin b	ottom at Stage = 0 fi	t) Height of Grate	e Upper Edge, $H_t =$	3.83	N/A				
Overflow Weir Front Edge Length =	4.00	N/A	feet		Overflow W	eir Slope Length =	4.00	N/A				
Overflow Weir Grate Slope =	0.00	N/A	H:V	Gi	rate Open Area / 10	0-yr Orifice Area =	7.60	N/A				
Horiz. Length of Weir Sides =	4.00	N/A	feet	O	verflow Grate Open	Area w/o Debris =	11.14	N/A				
Overflow Grate Type =	Type C Grate	N/A		(	Overflow Grate Ope	n Area w/ Debris =	5.57	N/A				
Debris Clogging % =	50%	N/A	%									
Liser Input: Outlet Pipe w/ Flow Restriction Plate	(Circular Orifice R	estrictor Plate or R	ectangular Orifice)		Ca	culated Parameters	s for Outlet Pine w/	Flow Restriction Pla				
Oser input. Outlet ripe w/ now Restriction riate	Zone 3 Restrictor	Not Selected			<u></u>		Zone 3 Restrictor	Not Selected				
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below ba	sin bottom at Stage :	= 0 ft) O	utlet Orifice Area =	1.46	N/A				
Outlet Pipe Diameter =	18.00	N/A	inches	_	Outle	Orifice Centroid =	0.64	N/A				
Restrictor Plate Height Above Pipe Invert =	13.90		inches	Half-Cent	tor Plate on Pipe =	2.15	N/A					
User Input: Emergency Spillway (Rectangular or	Trapezoidal)						Calculated Paramet	ters for Spillway				
Spillway Invert Stage=	4.80	It (relative to basin	bottom at Stage =	u tt)	esign Flow Depth=	= 0.67 feet						
Spillway Crest Length =	38.00	reet			op of Freeboard =	6.4/	reet					
Spillway Eliu Slopes = Freeboard above Max Water Surface -	1.00	n.v feet			fop of Freeboard =	5.10	acre-ft					
Freeboard above max water sulface -	1.00				Subin volume dt		5.10					
Routed Hydrograph Results	The user can over	ride the default CUP	IP hydrographs and	runoff volumes by	entering new value	es in the Inflow Hyd	rographs table (Col	umns W through Al				
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52				
CUHP Runoff Volume (acre-ft) =	0.583	2.184	1.618	2.128	2.537	3.086	3.627	4.289				
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.618	2.128	2.537	3.086	3.627	4.289				
CUHP Predevelopment Peak Q (cfs) =	N/A N/A	N/A N/A	0.2	0.4	0.5	4.9	9.8	16.1				
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	<u>N/A</u>	0.01	0.01	0.02	0.17	0.34	0.56				
Peak Inflow Q (cfs) =	N/A	N/A	24.9	32.7	38.5	49.7	59.6	72.1				
Peak Outflow Q (cfs) =	0.3	0.9 N/A	0.7 N/A	0.8	2.5	6.6	12.0	14.7				
Structure Controlling Flow =	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1				
Max Velocity through Grate 1 (fps) =	N/A	0.01	N/A	N/A	0.1	0.5	1.0	1.2				
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A 70	N/A	N/A	N/A				
Time to Drain 97% of Inflow Volume (nours) =		72	65	72	70	75	75	74				
Maximum Ponding Depth (ft) =	2.22	3.85	3.20	3.67	3.99	4.19	4.40	4.76				
Area at Maximum Ponding Depth (acres) =	0.78	1.06	1.03	1.05	1.07	1.07	1.08	1.10				
Maximum Volume Stored (acre-ft) =	0.584	2.190	1.513	2.000	2.339	2.553	2./68	3.1/1				



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Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

he user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate progran

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WOCV [cfs]	FURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
E 00 min	0.00.00	0.00	0.00	0.00		0.00	25 Tear [ei3]		0.00	
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
	0:15:00	0.00	0.00	3.00	4.87	6.04	4.06	5.08	4 96	7.13
	0:20:00	0.00	0.00	10.67	13.98	16.45	10.38	12.09	12.97	16.87
	0:25:00	0.00	0.00	21.56	28.51	34.45	21.33	24.33	26.17	34.87
	0:30:00	0.00	0.00	24.85	32.66	38.46	43.83	52.74	59.96	81.45
	0:35:00	0.00	0.00	22.59	29.18	34.04	49.69	59.55	72.15	96.83
	0:40:00	0.00	0.00	19.88	25.15	29.24	46.35	55.47	67.35	90.29
	0:45:00	0.00	0.00	16.87	21.67	25.35	40.00	47.70	59.47	80.09
	0.50.00	0.00	0.00	14.33	16.83	18.84	35.20	41.88	51.87 44.19	70.16
	1:00:00	0.00	0.00	11.16	14.51	17.05	25.19	29.53	38.05	51.31
	1:05:00	0.00	0.00	10.19	13.20	15.63	22.18	25.89	34.10	46.13
	1:10:00	0.00	0.00	8.78	11.95	14.24	19.14	22.24	28.50	38.29
	1:15:00	0.00	0.00	7.43	10.39	12.85	16.40	18.96	23.43	31.20
	1:20:00	0.00	0.00	6.26	8.81	11.11	13.49	15.51	18.34	24.25
	1:25:00	0.00	0.00	5.42	7.64	9.33	11.01	12.56	14.01	18.36
	1:35:00	0.00	0.00	4.97	6.71	8.29	8.81 7.50	9.97	8 70	11.34
	1:40:00	0.00	0.00	4,61	6.05	7.21	6.71	7,55	7,67	9,81
	1:45:00	0.00	0.00	4.53	5.52	6.88	6.19	6.96	6.91	8.76
	1:50:00	0.00	0.00	4.47	5.14	6.65	5.83	6.56	6.40	8.06
	1:55:00	0.00	0.00	3.92	4.85	6.34	5.59	6.29	6.03	7.55
	2:00:00	0.00	0.00	3.44	4.50	5.77	5.42	6.09	5.77	7.20
	2:05:00	0.00	0.00	2.60	3.40	4.35	4.11	4.62	4.34	5.41
	2:15:00	0.00	0.00	1.92	2.40	2 30	2.90	2 44	2 31	2.87
	2:20:00	0.00	0.00	1.40	1.31	1.67	1.58	1.77	1.69	2.10
	2:25:00	0.00	0.00	0.72	0.92	1.19	1.12	1.26	1.20	1.49
	2:30:00	0.00	0.00	0.50	0.63	0.83	0.79	0.88	0.85	1.05
	2:35:00	0.00	0.00	0.34	0.44	0.58	0.56	0.62	0.60	0.74
	2:40:00	0.00	0.00	0.21	0.29	0.37	0.37	0.41	0.39	0.48
	2:45:00	0.00	0.00	0.11	0.1/	0.21	0.22	0.24	0.23	0.28
	2:55:00	0.00	0.00	0.03	0.08	0.10	0.10	0.03	0.03	0.13
	3:00:00	0.00	0.00	0.02	0.02	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
	3.23.00	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
	4:05:00	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
	4:30:00	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
	4:50:00	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
	5:10:00	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
	5:25:00	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
	5:45:00	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
	0.00.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00

# MHFD

# MILE HIGH FLOOD DISTRICT DETENTION BASIN DESIGN WORKBOOK

	MHFD-Detention, Version 4.06 (July 2022) Mile High Flood District Denver, Colorado www.mhfd.org
<u>Purpose:</u>	This workbook aids in the estimation of stormwater detention basin sizing and outlet routing based on the modified puls routing method for urban watersheds. Several different BMP types and various outlet configurations can be sized.
Function:	<ol> <li>Approximates the stage-area-volume relationship for a detention basin based on watershed parameters and basin geometry parameters. Also evaluates existing user-defined basin stage-area relationships.</li> </ol>
	2. Sizes filtration media orifice, outlet orifices, elliptical slots, weirs, trash racks, and develops stage-discharge relationships. Uses the Modified Puls method to route a series of hydrographs (i.e., 2-, 5-, 10-, 25-, 50-, 100- and 500-year) and calibrates the peak discharge out of the basin to match the pre-development peak discharges for the watershed.
Content:	This workbook consists of the following sheets:
Basin	Tabulates stage-area-volume relationship estimates based on watershed parameters
<b>Outlet Structure</b>	Tabulates a stage-discharge relationship for the user-defined outlet structure (inlet control).
Reference	Provides reference equations and figures.
User Tips and Tools	Provides instructions and video links to assist in using this workbook. Includes a stage-area calculator.
BMP Zone Images	Provides images of typical BMP zone confirgurations corresponding with Zone pulldown selections.
<u>Acknowledgements:</u>	Spreadsheet Development Team: Ken MacKenzie, P.E., Holly Piza, P.E. Mile High Flood District
	Derek N. Rapp, P.E. Peak Stormwater Engineering, LLC
	Dr. James C.Y. Guo, Ph.D., P.E. Professor, Department of Civil Engineering, University of Colorado at Denver
<u>Comments?</u> <u>Revisions?</u>	Direct all comments regarding this spreadsheet workbook to: MHFD E-Mail Check for revised versions of this or any other workbook at: Downloads

#### DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project:	Grandview						, 2022)							
Basin ID:	Basin C													
- 77	line :	-	_											
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	int	- 333	÷		Depth Increment =		ft							
Example Zone	e Configura	tion (Reter	ntion Pond)		Stage - Storage	Stage	Optional Override	Length	Width	Area	Optional Override	Area	Volume	Volume
Watershed Information	•				Description	(ft)	Stage (ft)	(ft)	(ft)	(ft ² )	Area (ft ² )	(acre)	(ft 3)	(ac-ft)
Selected BMP Type =	EDB	1		6925	тор от містороог		1.00				885	0.000	442	0.010
Watershed Area =	43.52	acres					2.00				18,707	0.429	10,238	0.235
Watershed Length =	1,890	ft					3.00				42,382	0.973	40,783	0.936
Watershed Length to Centroid =	1,050	ft					4.00				46,291	1.063	85,119	1.954
Watershed Slope = Watershed Imperviousness =	61.20%	nercent					5.00				49,702	1.141	133,116	3.056
Percentage Hydrologic Soil Group A =	100.0%	percent					7.00				56,755	1.303	239,532	5.499
Percentage Hydrologic Soil Group B =	0.0%	percent				-	8.00	-	-		60,439	1.387	298,129	6.844
Percentage Hydrologic Soil Groups C/D =	0.0%	percent					9.00				64,244	1.475	360,471	8.275
Location for 1-hr Rainfall Depths =	User Input	nours												
After providing required inputs above inc	luding 1-hour	rainfall												
depths, click 'Run CUHP' to generate run the embedded Colorado Urban Hydro	off hydrograph graph Procedi	ns using		0										
Water Quality Capture Volume (WQCV) =	0.871	acre-feet	Optional Use	acre-feet										
Excess Urban Runoff Volume (EURV) =	3.250	acre-feet	-	acre-feet										
2-yr Runoff Volume (P1 = 1.19 in.) =	2.420	acre-feet	1.19	inches										
5-yr Runoff Volume (P1 = 1.5 in.) =	3.184	acre-feet	1.50	inches										
25-yr Runoff Volume (P1 = 1.75 lh.) =	4.625	acre-feet	2.00	inches										
50-yr Runoff Volume (P1 = 2.25 in.) =	5.440	acre-feet	2.25	inches										
100-yr Runoff Volume (P1 = 2.52 in.) =	6.440	acre-feet	2.52	inches										
500-yr Runott Volume (P1 = 3.68 in.) = Approximate 2-yr Detention Volume -	2.109	acre-feet	3.68	inches										
Approximate 2 yr Detention Volume =	2.761	acre-feet												
Approximate 10-yr Detention Volume =	3.338	acre-feet												
Approximate 25-yr Detention Volume =	4.031	acre-feet												
Approximate 100-yr Detention Volume =	4.454	acre-feet												
		_												
Define Zones and Basin Geometry		٦.												
Zone 1 Volume (WQCV) = Zone 2 Volume (ELIR)( - Zone 1) =	0.871	acre-feet												
Zone 3 Volume (100-year - Zones 1 & 2) =	1.661	acre-feet												
Total Detention Basin Volume =	4.910	acre-feet				-		-						
Initial Surcharge Volume (ISV) =	user	ft ³												
Total Available Detention Depth (Hotal) =	user	π 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 $(W_{ISV}) =$ Depth of Basin Floor (HFLOOR) =	user	π 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												
Depth of Main Basin (H _{MAIN} ) =	user	ft												
Length of Main Basin (L _{MAIN} ) =	user	ft												
Width of Main Basin (W _{MAIN} ) =	user	ft A ²												
Area or Main Basin (A _{MAIN} ) = Volume of Main Basin (V _{MAIN} ) =	user	π ft ³												
Calculated Total Basin Volume (V _{total} ) =	user	acre-feet												
							-							
									-	-				
									-					
									-					
									-	-				
							-							

#### DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



Project: Grandview												
Basin ID:	Basin C											
down a come a				Estimated	Estimated							
in the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second se				Stage (ft)	Volume (ac-ft)	Outlet Type	1					
econd time and			Zone 1 (WQCV)	2.94	0.871	Orifice Plate						
1	DAPICE		Zone 2 (EURV)	5.17	2.379	Rectangular Orifice						
PERMANENT CHURCES			Zone 3 (100-year)	6.55	1.661	Weir&Pipe (Restrict)						
Example Zone	Configuration (Re	tention Pond)		Total (all zones)	4.910							
User Input: Orifice at Underdrain Outlet (typically	used to drain WQ	CV in a Filtration BN	<u>1P)</u>				Calculated Paramet	ters for Underdrain				
Underdrain Orifice Invert Depth =	N/A	ft (distance below	the filtration media	surface)	Under	drain Orifice Area =	N/A	ft ²				
Underdrain Orifice Diameter =	N/A	inches			Underdrair	Orifice Centroid =	N/A	feet				
User Input: Orifice Plate with one or more orifice	es or Elliptical Slot	Neir (typically used	to drain WOCV and	/or FLIRV in a sedir	mentation BMP)		Calculated Paramet	ters for Plate				
Centroid of Lowest Orifice =		ft (relative to basin	bottom at Stage =	0 ft)	WO Orifi	ice Area per Row =	1 840F-02					
Depth at top of Zone using Orifice Plate =	2.94	ft (relative to basin	bottom at Stage =	0 ft)	Elli	ptical Half-Width =	N/A	feet				
Orifice Plate: Orifice Vertical Spacing =	11.80	inches	5	,	Ellipt	ical Slot Centroid =	N/A	feet				
Orifice Plate: Orifice Area per Row =	2.65	sq. inches (diamete	er = 1-13/16 inches	)	E	Iliptical Slot Area =	N/A	ft²				
User Input: Stage and Total Area of Each Orifice	Row (numbered f	rom lowest to highe	<u>st)</u>									
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row / (optional)	Row 8 (optional)				
Stage of Orlfice Centroid (ft)	0.00	0.98	1.96									
Office Area (sq. inches)	2.05	2.05	2.05		1	1						
	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)				(0) 000								
Orifice Area (sq. inches)												
User Input: Vertical Orifice (Circular or Rectangu	llar)		1				Calculated Paramet	ters for Vertical Orif				
	Zone 2 Rectangula	Not Selected					Zone 2 Rectangular	Not Selected				
Invert of Vertical Orifice =	2.94	N/A	ft (relative to basin	bottom at Stage =	= 0 ft) Vei	tical Orifice Area =	0.10	N/A				
Vertical Orifice Height -	2.00	N/A	inches	Dollom at Stage =	vertica	i Onnce Centrola =	0.08	N/A				
Vertical Orifice Width =	7 19	N/A	inches									
	7.15	J	linenes									
User Input: Overflow Weir (Dropbox with Flat or	Sloped Grate and	Outlet Pipe OR Rec	tangular/Trapezoida	I Weir and No Outl	et Pipe)		Calculated Paramet	ters for Overflow W				
	Zone 3 Weir	Not Selected					Zone 3 Weir	Not Selected				
Overflow Weir Front Edge Height, Ho =	5.19	N/A	ft (relative to basin b	ottom at Stage = 0 f	t) Height of Grate	e Upper Edge, $H_t$ =	5.19	N/A				
Overflow Weir Front Edge Length =	4.00	N/A	feet		Overflow W	/eir Slope Length =	4.00	N/A				
Overflow Weir Grate Slope =	0.00	N/A	H:V	Gi	rate Open Area / 10	0-yr Orifice Area =	5.85	N/A				
Horiz. Length of Weir Sides =	4.00	N/A	feet	O	verflow Grate Open	Area w/o Debris =	11.14	N/A				
Overflow Grate Type =	Type C Grate	N/A	0/	(	Overflow Grate Ope	n Area w/ Debris =	5.57	N/A				
Debris Clogging % =	50%	N/A	70									
User Input: Outlet Pipe w/ Flow Restriction Plate	(Circular Orifice, R	estrictor Plate, or Re	ectangular Orifice)		Ca	lculated Parameter	s for Outlet Pipe w/	Flow Restriction Pla				
	Zone 3 Restrictor	Not Selected			<u></u>		Zone 3 Restrictor	Not Selected				
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below ba	isin bottom at Stage :	= 0 ft) O	utlet Orifice Area =	1.90	N/A				
Outlet Pipe Diameter =	24.00	N/A	inches		Outle	t Orifice Centroid =	0.66	N/A				
Restrictor Plate Height Above Pipe Invert =	14.00		inches	Half-Cent	tral Angle of Restric	tor Plate on Pipe =	1.74	N/A				
User Input: Emergency Spillway (Rectangular or	Trapezoidal)		hattan i Ci	0.45			Calculated Paramet	ters for Spillway				
Spillway Invert Stage=	6.50	rt (relative to basin	bottom at Stage =	urt)	0.94	reet						
Spillway Crest Length =	37.00	Teet			Top of Freeboard =	8.44 1.43	reet					
Freeboard above Max Water Surface =	1.00	feet			Basin Volume at 7	Top of Freeboard =	7 46	acre-ft				
	100						,,,,,					
Routed Hydrograph Results	The user can over	ride the default CUP	IP hydrographs and	runoff volumes by	entering new value	es in the Inflow Hyd	rographs table (Col	lumns W through Ai				
Design Storm Return Period = One-Hour Rainfall Depth (in) =	N/A	EURV N/A	2 Year 1.19	5 Year 1.50	10 Year	25 Year 2.00	2.25	2.52				
CUHP Runoff Volume (acre-ft) =	0.871	3.250	2.420	3.184	3.797	4.625	5.440	6.440				
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.420	3.184	3.797	4.625	5.440	6.440				
CUHP Predevelopment Peak Q (cfs) = OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A N/A	N/A N/A	0.3	0.6	0.8	1./	15.3	25.1				
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.18	0.35	0.58				
Peak Inflow Q (cfs) =	N/A	N/A	38.0	50.0	59.0	76.3	91.6	111.0				
Peak Outflow Q (cfs) =	A	1 1 2	1.0	1.2	3.6	9.8	18.2	22.5				
Patio Peak Outflow to Prodovolonment O	U.4 N/A	1.2 N/A	NI/A	2.0	4 2	1 2	1 2	0.0				
Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow =	0.4 N/A Vertical Orifice 1	N/A Vertical Orifice 1	N/A Vertical Orifice 1	2.0 Vertical Orifice 1	4.3 Overflow Weir 1	1.3 Overflow Weir 1	1.2 Overflow Weir 1	0.9 Outlet Plate 1				
Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) =	0.4 N/A Vertical Orifice 1 N/A	N/A Vertical Orifice 1 N/A	N/A Vertical Orifice 1 N/A	2.0 Vertical Orifice 1 N/A	4.3 Overflow Weir 1 0.2	1.3 Overflow Weir 1 0.8	1.2 Overflow Weir 1 1.5	0.9 Outlet Plate 1 1.9				
Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) =	0.4 N/A Vertical Orifice 1 N/A N/A 30	N/A Vertical Orifice 1 N/A N/A	N/A Vertical Orifice 1 N/A N/A 61	2.0 Vertical Orifice 1 N/A N/A	4.3 Overflow Weir 1 0.2 N/A 70	1.3 Overflow Weir 1 0.8 N/A	1.2 Overflow Weir 1 1.5 N/A 6°	0.9 Outlet Plate 1 1.9 N/A				
Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 99% of Inflow Volume (hours) = Time to Drain 99% of Inflow Volume (hours) =	0.4 N/A Vertical Orifice 1 N/A N/A 38 <b>40</b>	N/A Vertical Orifice 1 N/A N/A 67 72	N/A Vertical Orifice 1 N/A N/A 61 65	2.0 Vertical Orifice 1 N/A N/A 68 72	4.3 Overflow Weir 1 0.2 N/A 70 76	1.3 Overflow Weir 1 0.8 N/A 69 75	1.2 Overflow Weir 1 1.5 N/A 68 75	0.9 Outlet Plate 1 1.9 N/A 66 74				
Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 99% of Inflow Volume (hours) = Maximum Ponding Depth (ft) =	0.4 N/A Vertical Orifice 1 N/A N/A 38 <b>40</b> 2.94	N/A Vertical Orifice 1 N/A N/A 67 72 5.17	N/A Vertical Orifice 1 N/A N/A 61 65 4.29	2.0 Vertical Orifice 1 N/A N/A 68 72 4.95	4.3 Overflow Weir 1 0.2 N/A 70 76 5.39	1.3 Overflow Weir 1 0.8 N/A 69 75 5.67	1.2 Overflow Weir 1 1.5 N/A 68 75 5.94	0.9 Outlet Plate 1 1.9 N/A 66 74 6.42				
Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 99% of Inflow Volume (hours) = Maximum Ponding Depth (ft) = Area at Maximum Ponding Depth (acres) =	0.4 N/A Vertical Orifice 1 N/A N/A 38 <b>40</b> 2.94 0.94	N/A Vertical Orifice 1 N/A N/A 67 72 5.17 1.15	N/A Vertical Orifice 1 N/A N/A 61 65 4.29 1.09	2.0 Vertical Orifice 1 N/A N/A 68 72 4.95 1.14	4.3 Overflow Weir 1 0.2 N/A 70 76 5.39 1.17	1.3 Overflow Weir 1 0.8 N/A 69 75 5.67 1.19	1.2 Overflow Weir 1 1.5 N/A 68 75 5.94 1.22	0.9 Outlet Plate 1 1.9 N/A 66 74 6.42 1.26				



ice
ft ² feet
eir
feet feet
ft ² ft ²
<u>ate</u>
ft ² feet radians





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

						CUUD				CUUD
	SOURCE	CURP	СОПР	СОПР	СОПР	СОПР	CURP	СОПР	СОПР	СОПР
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	0.50	0.05	2.99
	0:15:00	0.00	0.00	4 43	7.20	8 94	6.01	7.53	7.34	13 50
	0:20:00	0.00	0.00	15.99	21.02	24.75	15.65	18.24	19.54	30.61
	0:25:00	0.00	0.00	32.57	43.04	52.02	32.20	36.74	39.50	64 21
	0:30:00	0.00	0.00	38.00	50.01	58.99	66.24	79.77	90.70	153.22
	0:35:00	0.00	0.00	34 58	44 76	52.23	76.30	91.64	111.00	183.84
	0:40:00	0.00	0.00	30.23	38.20	44 51	70.30	85.23	103 75	171 13
	0:45:00	0.00	0.00	25.40	22.24	20.20	61.00	72.07	01.10	171.15
	0:10:00	0.00	0.00	23.49	29.21	22.54	52.26	62.47	79.96	121.01
	0.55.00	0.00	0.00	19 52	20.21	32.J <del>1</del>	44.66	52.75	66 59	111 20
	1:00:00	0.00	0.00	16.52	21.27	20.14	27.65	44.16	57.05	05 71
	1:05:00	0.00	0.00	14.00	10.41	23.32	37.03	28.40	57.05	95.71
	1:10:00	0.00	0.00	14.99	17.41	22.99	32.90	30.40	42.04	70.20
	1:15:00	0.00	0.00	10.64	14.97	18 55	20.00	27.42	34.00	56.12
	1.13.00	0.00	0.00	8.06	12.57	16.04	10.26	27.42	26.11	42.49
	1:25:00	0.00	0.00	7 90	11.19	12.72	19.20	17.67	10.51	72.70
	1.20.00	0.00	0.00	7.09	10.41	12.75	12.20	14.26	15.31	23.05
	1.35.00	0.00	0.00	7.54	0.06	11.20	10.04	12 22	12.67	10.72
	1.35.00	0.00	0.00	6.97	9.90	10.60	0.94	12.33	11.12	17.02
	1.45.00	0.00	0.00	6.75	9.01	10.09	9.05	10.24	10.09	17.03
	1.10.00	0.00	0.00	6.66	0.20	9.88	9.11	9.69	9 37	13.19
	1:55:00	0.00	0.00	5.00	7.02	0.41	8.01 8.27	9.09	8.86	13.03
	2:00:00	0.00	0.00	5.65	7.19	9.41	8.02	9.30	0.00	13.03
	2:05:00	0.00	0.00	2.97	5.05	6.45	6.12	5.03	6.19	0.45
	2:00:00	0.00	0.00	2.81	3.64	4.62	4 38	4 97	4 64	6.75
	2:15:00	0.00	0.00	2.01	2.67	2 22	2.16	2.52	2.26	1.99
	2:20:00	0.00	0.00	1 44	1.86	2 38	2.26	2.53	2 42	3 50
	2:25:00	0.00	0.00	1.44	1.28	1.66	1.58	1.76	1.69	2 44
	2:30:00	0.00	0.00	0.68	0.87	1 14	1.09	1.73	1.03	1.68
	2:35:00	0.00	0.00	0.00	0.59	0.77	0.75	0.84	0.80	1.00
	2:40:00	0.00	0.00	0.26	0.37	0.47	0.47	0.57	0.50	0.71
	2:45:00	0.00	0.00	0.13	0.20	0.1/	0.26	0.32	0.27	0.37
	2:50:00	0.00	0.00	0.15	0.20	0.24	0.20	0.12	0.11	0.15
	2:55:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.02
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02
	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
	4:35:00	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
	5:05:00	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
	5:35:00	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
	0.00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Ponds D and E Peak Discharges are from this PDR Report of Filing No. 1

# Galloway

# PRELIMINARY DRAINAGE REPORT

# **GRANDVIEW RESERVE FILING NO. 1**

El Paso County, Colorado

Omit duplicative / old appendixes (pdf pages 552-957)

PREPARED FOR: D.R. Horton 9555 S. Kingston Court Englewood, CO

PREPARED BY: Galloway & Company, Inc. 1155 Kelly Johnson Blvd., Suite 305 Colorado Springs, CO 80920

DATE: May 27, 2022

PCD Filing No.: PUDSP2110