Final Drainage Report
Monument Ridge East – Filing No. 1
El Paso County, Colorado

Prepared for:

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September 22, 2026

SF-25-14

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 El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

COLORADO REGISTERED RAYMOND E. PEREZ II 37173 PROFESSIONAL ENGINEER

Signature: _____ Date: Sept. 22, 2026

Raymond Perez, II, P.E.
Registered Professional Engineer State of Colorado

DEVELOPER'S STATEMENT:

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

Name of Owner/Developer: **Monument Ridge East, LLC**

Authorized Signature: _____ Date: 9-22-2026

Title: Owner

Address: 5055 List Drive
Colorado Springs, CO 80919

EL PASO COUNTY:

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.

_____ _____

County Engineer – Joshua J. Palmer, P.E. Date

Conditions:

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I. INTRODUCTION

A. Purpose

The purpose of this Final Drainage Report for the Monument Ridge East – Filing No. 1 (hereinafter referred to as the "Project") is to identify major drainageways, detention areas, locations of culverts, open channels and drainage areas contained within and adjacent to the proposed development and quantify and evaluate the impacts of stormwater runoff generated by this project and to provide adequate water quality/detention treatment and flow conveyance. This study has been prepared with the goal that any permanent stormwater infrastructure (e.g. – pipe, inlets, ponds, etc.) being constructed with this first filing ("interim" condition) will be adequate for subsequent site development (i.e. – "future" condition). The future development assumptions contained herein are based on the best available information known to exist at the time this report was prepared.

B. Drainage Basin Planning Study

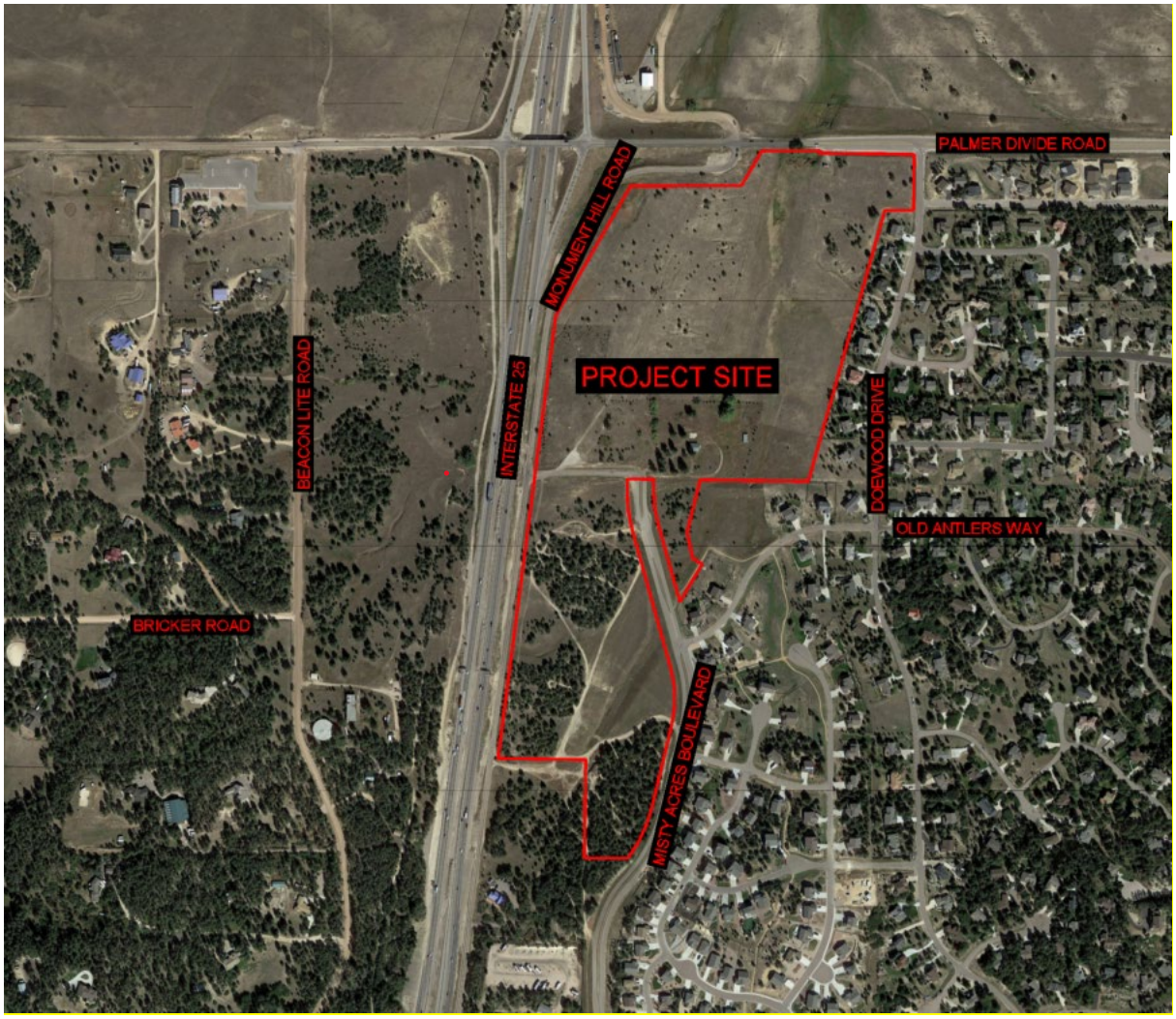
The project is adjacent to the Misty Acres development. The Misty Acres development area has been studied in the past since 2001. There is no known master drainage study on file that encompasses the entire project area (Bald Mountain watershed). Refer to the references listing for Misty Acres development record reports used.

C. General Project Description

This project is in El Paso County, Colorado. Access to the site is from Palmer Divide Road (aka – County line road). It is located in Section 2, Township 14 south, Range 67 west of the 6th Principal Meridian. A vicinity map is provided below in Figure 1 on the following page.

Figure 1 – Vicinity Map

(Source: Google Earth Imagery 2019)



The Project is a single-family development. The project will consist of single-family homes and associated site elements typical of residential development (e.g. – roadways, buildings, walkways, parks/open space, detention/water quality ponds etc.) The proposed development area is currently undeveloped with the exception of Misty Acres Boulevard on the south side of the site. The site is bounded by the north by existing Palmer-Divide Road to the east by Doewood Drive and Misty Acres Boulevard, to the west by Interstate 25.

D. Data Sources

General

The base mapping (including topography) and structure inventory was provided by Bear Creek Surveying, Inc. (now Colorado ILC Surveying). The field survey was conducted in the fall of 2022. To date there have been no environmental or geotechnical studies performed for the Project. Soils information is provided in section II.B. Additional topography for areas outside of the topographic survey was obtained from the Colorado Water Conservation Board (CWCB). CWCB topography consists of Digital Elevation Model (DEM) 2ft contours and 5ft contours. The 2' contours were used for off-site basin delineation. The 5ft contours were used in the drawings for the "overall" mapping.

E. Applicable Criteria and Standards

The hydrologic and hydraulic analysis performed in this report utilizes The City of Colorado Springs Drainage Criteria Volumes 1 (revised January 2021) & 2 (revised December 2020), hereinafter referred to as the CSDCM. In addition to the City Criteria Manual, the Urban Storm Drainage Criteria Manual (USDCM), Volumes 1-3, published by the Mile High Flood District (MHFD), latest updates, have been used to supplement the Drainage Criteria Manual for water quality capture volume (WQCV). Also, the El Paso County Drainage Criteria Manual and updates were incorporated. Stormwater runoff was determined using the Rational Method and was calculated for existing and proposed conditions for the 10-yr (minor) and 100-yr (major) recurrences.

II. PROJECT CHARACTERISTICS

A. Drainage Basin Planning Study Compliance

There is no Drainage Basin Planning Study of record that encompasses this project. All developed runoff from the site will be detained and released at pre-development peak rates, and the water quality capture volume will be treated. Detention and water quality were determined by the MHFD detention spreadsheet UD-Detention v4.04.

B. Land Features

1. Vegetation

Ground cover primarily consists of bare ground, sparse vegetation, and trees.

2. Soils

The general topography of the land slopes to the north. According to the Natural Resources Conservation Service (NRCS), the soils in this area can be classified as a Hydrologic Soil Group (HSG) Types B and D. This is used to predict storm water runoff rates. A soils report and map describing the HSG's and other soils

properties are provided in Appendix A. For the purposes of this report each basin defined has had runoff coefficients adjusted accordingly using the soils report and map.

3. Water Quality

There are no known existing water quality features located on the property.

4. Floodplain

Per the Flood Insurance Rate Map Numbers 08041C0065G and 0804C0276G, El Paso County, Colorado, Revised December 7, 2018, Federal Emergency Management Agency (FEMA) no portion of Monument Ridge East lies within the designated 100year floodplain. A FIRMette of the project area is included in Appendix A.

C. Existing and Proposed Land Uses

Presently, the site is unplatted and consists of undeveloped land. Monument Ridge East – Filing No. 1 is a proposed single-family residential development with associated streets and detention/water quality ponds.

III. HYDROLOGIC ANALYSIS

A. Rational Method

1. Method of Analysis

Storm sewer sizing for this project uses the Rational Method as recommended by the DCM for minor (10 year) and major (100 year) storms for drainage basins less than 100-acres in size.

The Rational Method uses the following equation:

$Q=C*I*A$

Where:
Q = Maximum runoff rate in cubic feet per second (cfs)
C = Runoff coefficient
I = Average rainfall intensity (inches/hour)
A = Area of drainage sub-basin (acres)

2. Runoff Coefficient

Coefficients from Table 6-6 of the EPC DCM Volume 1 update for developed land were utilized in the Rational Method calculations. See Appendix B for more information.

3. Time of Concentration

The time of concentration consists of the initial time of overland flow and the travel time in a hydraulic conveyance feature to a design point or similar location of interest. A minimum time of concentration of 5 minutes is utilized for urban development.

4. Rainfall Intensity
   The rainfall depths for the 1-hour storm duration were taken from Table 6-2 of the Colorado Springs Drainage Criteria Manual.

B. Storm Water Management Model (SWMM) Methodology

The EPC DCM requires the use of the EPA-SWMM modeling program to design and analyze detention for the site when the ponds treating and detaining water for the project are in series. The El Paso County engineering department requested a SWMM model to ensure the ponds do not affect each other so the system can function adequately and meet all pond requirements (e.g. – release rates, storage volumes, etc.) as well as storm pipe requirements (e.g. – adequate capacity, acceptable velocities, etc.). The model was created using pipe sizes and vertical and horizontal geometry from rational method computations as well the tributary basins converted into SWMM format for the determination of SWMM shape parameters. Refer to appendix. After creating the model and running the analysis, it was determined that the connected ponds do interact with each other (i.e. – backwater effects), but there were no negative impacts to the system pipe or ponds with the exception of two pipe runs immediately downstream of pond 2 (upsize 24" to 36") and one of the project outfall culverts (upsize 48" to 54"). Refer to pages 775 to 807 for pond release compliance data.

1. Runoff Analysis
   Runoff within the SWMM model is analyzed using the Horton Method as recommended in the DCM and Chapter 6 of the MHFD Drainage Criteria Manual, Volume 1 (See table 6-7 below). Please note that the MHFD lists the decay coefficient in units of 1/s, and SWMM requires an input in units of 1/hours, so the Decay Coefficient is multiplied by a constant of 3600 before input to SWMM.

Table 6-7. Recommended Horton's equation parameters

NRCS Hydrologic Soil Group	Infiltration (inches per hour)		Decay Coefficient—a
	Initial—f_i	Final—f_o	
A	5.0	1.0	0.0007
B	4.5	0.6	0.0018
C	3.0	0.5	0.0018
D	3.0	0.5	0.0018

2. Rainfall Events
   Rainfall event hydrographs created using the El Paso County rainfall depths and the distribution described in the El Paso County DCM.

Copying this Review 5 comment for reference/discussion as I still don't see any liner details in the V6 Soils Report:
I just want to note for my own tracking:
- The geotech report still does not have any details, specs, or discussion about the clay liner.
- The only change from the previous V4 version of the Soils Report (dated 8/7/24) to this latest V5 version (dated 7/16/26) in the groundwater section (on PDF page 9) was the addition of one paragraph and the table was revised.

C. Basin Hydrology – Existing Conditions

This project is located in the Bald Mountain major drainage basin. It is our understanding there is no Drainage Basin Planning Study (DBPS) on file that encompasses this project. Therefore, this project area is considered "unstudied" from a master drainage analysis perspective.

Stormwater runoff from the project generally flows to the north and ultimately discharges into an unnamed drainage way. Eleven (11) basins were delineated for this analysis. The aforementioned MDDP for Monument Ridge East contains the existing mapping and support calculations. There have been no changes in the existing conditions and therefore that information has not been included in this report. However, to aid review and for comparison purposes, the MDDP existing conditions map has been included.

D. Basin Hydrology – Interim Conditions

Stormwater runoff from the project generally flows to the north and ultimately discharges into a wetlands depression area south of and adjacent to Palmer Divide Road. Proposed grading of the site will generate sixteen (16) on-site basins and ten (10) off-site basins. Refer to the developed conditions map in Appendix D. All proposed storm piping, inlets and manholes within public right-of-way be publicly owned and maintained. All other proposed storm system elements will be privately owned and maintained. All public storm pipes will be RCP.

A groundwater determination has been made, and it appears that there are areas on site in locations where ponds will be built which have shallow groundwater. For permanent mitigation of groundwater entering the pond facility, a clay liner will be required on the bottom and side slopes. Refer to the geotechnical engineering report for the project for additional information related to the liner requirements.

The following Design Point narratives reflect the rational method peak flows and the associated routing as shown in the routing summary of this report (see appendix) which was submitted prior. The only difference is the flow values noted in the narratives are different for the systems with ponds connected in series due to the dynamic system computations in the SWMM program mentioned above.

Design Point F1 (Q10=9.9cfs, Q100=28.6cfs) flows are generated from basins MO2 (0.51ac) and AA (15.16ac). Basin MO2 consists of a small portion of the I25 roadway corridor. Basin AA consists of an offsite undeveloped parcel as well as undeveloped onsite areas. Runoff from basin MO2 enters the site via an existing 36" pipe and then combines with runoff from basin AA and then travels to a proposed low point where it will be captured by two 12' D-10-R sump inlets. Flows from this point will be routed to the north into pond 1.

Design Point F2 (Q10=2.0cfs, Q100=6.7cfs) flows are generated from basin BB (2.74ac). Basin BB consists of undeveloped land. Runoff from basin BB travels to a proposed culvert at Design Point F2 and is routed north under the road via a culvert into proposed pond 1 after collecting flows in a proposed depression area. The pipe will discharge runoff into a riprap rundown feature with an energy dissipation pool at the bottom. Refer to calculations in the appendix for rundown support calculations. Please note that the inlet channel has been modeled with the flow outfalling via an end section. The end section is tall enough at the invert to channel flow like a rectangular channel would. Therefore, the outfall discharge has been treated like an open channel for the purposes of this design.

Design Point F3 (Q10=14.4cfs, Q100=38.0cfs) flows are generated from Design Point F1 and F2 runoff. Basin CC (1.03ac) consists of pond 1 itself. The MHFD UD-Detention spreadsheet was used for sizing. The proposed detention and water quality ponds herein have been designed to accommodate the proposed condition as well as the future (MDDP) condition. A private full spectrum extended detention basin (EDB) is proposed at this location. The proposed on-site imperviousness contributing to this pond has been calculated to be 9.41%. The ponds' tributary area equals 19.44 acres. The pond facility will provide ~1.4acre-ft of detention volume and ~0.1acre-ft of WQCV. The EDB will have forebays, a maintenance access road, concrete trickle channel, micro pool and an outlet structure retrofitted at the end of one of the existing 48" culverts under Misty Acres Boulevard. The other 48" culvert will be capped on each end and abandoned. The full-spectrum EDB will have a rip rap emergency overflow spillway that will drain the 100yr peak flows in the event the outlet structure becomes entirely clogged and another 100yr event passes. The spillway (60lf crest) will be constructed of type VL soil rip rap. A minimum of 1.0' of freeboard will be provided. The spillway will be situated such that any overflow will be directed to a low point in Misty Acres Boulevard, Design Point F4C. Refer to the design calculations in Appendix B for additional pond design information.

Design Point F4A (Q10=3.3cfs, Q100=5.7cfs) flows are generated from basin MO3 (1.36ac). Basin O3 consists of a single lot and undeveloped land on the west side of the interstate. Runoff from this basin travels east via an existing 36" RCP connecting to an existing CDOT grated inlet at Design Point F4B.

Design Point F4B (Q10=3.0cfs, Q100=4.9cfs) flows are generated from basin MO4 (0.74ac). Basin O4 consists of Interstate 25 and Monument Hill Road. Runoff from this basin travels easterly overland to through basin DD prior to reaching design point F4C.

Design Point F4C (Q10=19.0cfs, Q100=42.9cfs) flows are generated from basin MO4 and basin DD (12.75ac). Basin MO4 consists of a small portion of interstate 25. Basin DD consists of undeveloped land. Runoff from this basin travels to a proposed low point where it will be captured by two 8' D-10-R sump inlets. Flows from this location will be routed to the north via a proposed storm pipe. It is noteworthy to mention that in the interim condition, more flow will be routed to this location due to the size of basin DD. The inlets and storm pipe system have been designed using these larger flow values.

Design Point F5 (Q10=3.6cfs, Q100=7.0cfs) flows are generated from basin EE (1.81ac). Basin EE consists of Monument Hill Road which is proposed to be re-aligned to connect with Misty Acres Boulevard. Runoff from this basin travels easterly via curb and gutter to an inlet where flow is captured. Flows are then routed in a pipe system which connects with the pipe from Design Point F4C. Flows are then routed to pond 2.

Design Point F6 (Q10=28.1cfs, Q100=64.0cfs) flows are generated from Design Points F4C and F5 as well as basin GG (4.90ac). Basin GG consists of pond 2 itself along with undeveloped land. A private full spectrum extended detention basin (EDB) is proposed at this location. The proposed on-site imperviousness contributing to this pond has been calculated to be 18.35%. The ponds' tributary area equals 22.36 acres. The pond facility will provide ~1.1acre-ft of detention volume and ~0.2acre-ft of WQCV. The EDB will have forebays, a maintenance access road, concrete trickle channel, micro pool and an outlet structure. The full-spectrum EDB will have a rip rap emergency overflow spillway that will drain the 100yr peak flows in the event the outlet structure becomes entirely clogged and another 100yr event passes. The spillway (35lf crest) will be constructed of type VL soil rip rap. A minimum of 1.0' of freeboard will be provided. The spillway will be situated such that any overflow will be directed on the north side of the pond such that overflow would be directed north to a low point in Misty Acres Boulevard, Design Point F7. Refer to the design calculations in Appendix B for additional pond design information.

Design Point F7 (Q10=14.9cfs, Q100=31.9cfs) flows are generated from basins FF (0.80ac) and HH (8.56ac). Basin FF consists of flows from undeveloped land. Basin HH consists of undeveloped land and a portion of Misty Acres Boulevard. Runoff from this basin travels to a proposed low point where it will be captured by two 16' D-10-R sump inlets. Flows from this location will be routed to the east into proposed pond 4 at Design Point F15. In the event clogging occurs, flows will overtop the roadway and enter pond 4.

Design Point F8 (Q10=1.5cfs, Q100=3.1cfs) flows are generated from basin II (0.90ac). Basin II consists of a small portion of Misty Acres Boulevard and undeveloped land to the west. Similar to Design Point F7, flows from the roadway are being captured by a 10' D-10-R at-grade inlet and routed to pond 4 for detention and water quality treatment.

Design Point F9 (Q10=59.2cfs, Q100=118.3cfs) flows are generated from pond 1 outflow and basin MO5 (60.15ac). Flows reaching this location (Misty Acres Filing No. 1 pond facility) are less than what was determined in the filing no. 1 report. The report planned on an inflow value of Q10=138cfs and a Q100 value of 301cfs with flow attenuation of Q10=58cfs and Q100=130cfs. This report has calculated inflow values of Q10=106cfs and Q100=203cfs which yields outflows of Q10=59cfs and Q100=118cfs. The reason for the difference is that areas planned to route runoff to the pond in filing no. 1 report are now being routed to the projects' pond 1. The existing pond was not designed to provide water quality and as such cannot be used for the projects water quality requirement. Therefore, this flow will be routed around the development along the east side of basins MD2 and ME therefore bypassing the proposed project site. The existing 48" RCP outfall pipe is undersized to capture and convey flows northerly under the proposed roadway and therefore must be upsized to a 54" RCP. The overflow path for this pond will be the roadway in which flows will be routed away from homes.

Design Point F10 (Q10=0.8cfs, Q100=2.4cfs) flows are generated by basin MO6 (0.63ac). Basin MO6 consists of an area that will be routed to a proposed grated inlet which sits above the proposed existing ponds' outfall extension pipe. This pipe is needed to route flow around the project and into the wetlands depression area as it is now being routed to. Due to the amount of flow planned to be released per the Misty Acres report) the pipe system needs to be sized according to the grades which the pipe will flow at. The computed pipe size from Design Point F10 to Design Point F12 is 54". The overflow path for this Design Point is the roadway itself. Overflow runoff will proceed northerly ultimately reaching Design Point F14 which is the low point adjacent and contributing flow to extended detention basin no. 4. Overflow at this low point will overtop the road and enter the pond directly.

Design Point F11 (Q10=102.6cfs, Q100=211.4cfs) is located where flow from the east, basins (MO7a and MO7b) enter the site. A proposed collection structure will be provided to capture and route flows via a 54" RCP ultimately discharging to the depression area, after combining with flows from the south. The collection structure will be in the form of a concrete channel 15' wide at the top, 3' bottom, 1.5:1 side slopes, 4' depth. It will have a slope of 0.5% to the triple CDOT Type D inlets, located in a sump condition. A 90' length of the collection structure has been conservatively set to capture the aforementioned flow from the east. The collection

structure will have a metal trash rack over the sump inlets to catch debris. In addition to this, a debris fence will be used as well to catch large debris from entering the facility. Refer to calculations in the appendix and see construction documents for additional information.

Design Point F12 (Q10=161.6cfs, Q100=324.5cfs). The proposed 54" RCP pipe coming from the existing Misty Acres Filing No. 1 Pond (aka – Bald Mountain pond) will enter the structure from the south. Flow will be captured in a collection structure (DP F11) and combine with that from Design Point F10. The collection structure will have an emergency spillway to route major storm flows to the west via a swale constructed between the adjacent lots. The swale will be 3' deep, 3:1 side slopes, with a bottom width of 20' and a slope of 0.5%, 2% and 10%. The velocity is over the 5ft/s erosivity threshold. Therefore Turf Reinforcement Mat (TRM) will be used to mitigate the flow velocities. Refer to construction drawings for additional information. Emergency overflow will then be routed to the west via the street corridor ultimately reaching pond 4.

Due to the amount of flow anticipated from basins MO7a and MO7b (Q100~211cfs) combined with that expected from the Misty Acres pond (Q100~118cfs) (aka – Bald Mountain Pond) for a total flow of ~329cfs, a 78" pipe is needed. The 78" pipe will route flows into the existing depression area thereby bypassing all offsite flows around the project. Due to the amount of flow and the likelihood of scouring to occur at the outfall location, energy dissipation will be required. This will be in the form of a riprap apron 65ft long and 28ft wide. Riprap will be type H (d50=18"). Refer to calculations for additional information.

Design Point F13 (Q10=15.6cfs, Q100=29.8cfs) flows are generated from a portion of basin MD2 (12.16ac). Basin MD2 consists of single-family home sites. Runoff from this basin travels north via curb and gutter to two 12' D-10-R at-grade inlets where flow is captured. Flows are then routed via pipe to Design Point F14.

Design Point F14 (Q10=12.3cfs, Q100=23.4cfs) flows are generated from a portion of basin MD2 (12.16ac). Runoff from this basin travels north and then west via curb and gutter to two 12' D-10-R sump inlets where flow is captured. Flows are then routed via pipe to proposed pond 4 (south) at Design Point F15 after combining with flows from Design Point F13.

Design Point F15 (Q10=37.9cfs, Q100=74.9cfs) is composed of the southern basin of the pond 4 facility, basin MD5 (1.58ac). Flow routed to this location will be routed to the north into the upper portion of the pond via a 36" pipe thereby combining the

See comment on page 23 of the CDs. Based on the 10 year HGL, of a statement can be made that the 5 year HGL will be less than 80% of the pipe, please include that statement. This will satisfy the ECM without needing to submit a deviation request for consideration (which may or may not be approved).

two areas into one facility. The connecting pipe is sized such that there is no backwater effect and captured runoff will flow freely to be detained and treated in the north basin. The reason for this approach is due to the existing wetlands adjacent to the pond and the distance from the Misty Acres Boulevard connection to Palmer Divide Road being so close. To minimize wetlands disturbance, the pond has been located along its western edge. This creates a configuration that necessitates two depression areas which as stated above will be connected by a pipe and will function like a normal water quality and detention facility.

Design Point F16 (Q10=41.1cfs, Q100=82.4cfs) flows are generated from Design Points F8 and F15. Basin MD5 (1.58ac) consists of pond 4 itself. A private full spectrum extended detention basin (EDB) is proposed at this location. The proposed on-site imperviousness contributing to this pond has been calculated to be 35.84%. The ponds' tributary area equals 23.20 acres. The pond facility will provide ~1.5acre-ft of detention volume and ~0.3acre-ft of WQCV. The EDB will have forebays, a maintenance access road, concrete trickle channel, micro pool and an outlet structure. The full-spectrum EDB will have a rip rap emergency overflow spillway that will drain the 100yr peak flows in the event the outlet structure becomes entirely clogged and another 100yr event passes. The spillway (50lf crest) will be constructed of type VL soil riprap. A minimum of 1.0' of freeboard will be provided. The spillway will be situated such that any overflow will be directed to a swale that runs along the south side of Palmer Divide Road, ultimately outfalling into the wetlands depression area. Refer to the design calculations in Appendix B for additional pond design information. Flows released from the pond will be routed to the north into the bypass pipe system at Design Point F17.

Design Point F17 (Q10=25.7cfs, Q100=67.2cfs) is a junction structure which connects system outflows from pond 2 with pond 4. This bypass system outfalls into the wetland depression area.

Design Point F18 (Q10=9.3cfs, Q100=17.4cfs) flows are generated from basin ME (3.21ac). Basin ME consists of single-family residential home sites as well as pond 5 itself. Flow will be captured by one 16' D-10-R sump inlet. A private full spectrum extended detention basin (EDB) is proposed at this location. The proposed on-site imperviousness contributing to this pond has been calculated to be 48.40%. The ponds' tributary area equals 3.21 acres. The pond facility will provide ~0.23acre-ft of detention volume and ~0.05acre-ft of WQCV. The EDB will have forebays, a maintenance access road, concrete trickle channel, micro pool and an outlet structure. The full-spectrum EDB will have a rip rap emergency overflow spillway that will drain the 100yr peak flows in the event the outlet structure becomes entirely clogged and another 100yr event passes. A spillway with a 5lf wide crest length will be constructed and will have a type VL soil rip rap on the downhill side. A minimum of 1.0' of freeboard will be provided. The spillway will be situated such that any overflow will be directed north into a vacant parcel, ultimately outfalling into the

wetlands depression area. Refer to the design calculations in Appendix B for additional pond design information.

Design Point F19 (Q10=161.6cfs, Q100=324.5cfs) is where pond 5 will discharge after being routed through a proposed retaining wall. At this outfall location, an energy dissipation feature is required in the form of a riprap apron which will be 65ft long and 28ft wide. Riprap will be d50=18" (type H) with a thickness of 36".

Design Point F20 (Q10=4.7cfs, Q100=8.0cfs) flows are generated from basin MO8 (1.38cfs). Design Point F20 is shown to represent where runoff from single-family residential home sites to the east crosses over the Palmer Divide roadway. Field evidence reveals a roadside swale on the south side of Palmer Divide Road that has very little capacity as it approaches Doewood Drive. Under Doewood Drive, there is an existing 24" RCP that seems to convey flow only from basin MO8. Basin MO8 consists of single-family residential development. The amount of flow anticipated from the east side of the projects study is assumed to be very large. Due to the current swale geometry and grades at the Doewood intersection, it is assumed the runoff overtops Palmer Divide Road during even minor storm events and is directed to the north. For this reason, no anticipated flow besides that of basin MO8 is anticipated to enter into basin JJ.

Design Point F21 (Q10=200.7cfs, Q100=420.3cfs) flows are generated from the projects' four ponds as well as the existing Misty Acres Filing No.1 pond (aka – Bald Mountain pond) and offsite basins. The table below is a comparison of the SWMM and rational method flow values for the project outfall. Therefore, this project releases less during the major (100yr) and minor (10yr) events for both the interim and future designs using both the SWMM and rational method methodologies. Also, it is noteworthy to mention that off-site basins MO7a and MO7b have ponds located within their development areas. These have not been considered in this report as a conservative measure. El Paso County requires a maintenance agreement for private flows being discharged in El Paso County right of way at this location. This agreement will be created and approved prior to construction.

PROJECT OUTFALL COMPARISON					
SWMM			Rational Method		
Design Point	Storm Event (yr)	Flow Value (cfs)	Design Point	Storm Event (yr)	Flow Value (cfs)
6	10	272	6	10	214
	100	560		100	488
F21	10	198	F21	10	201
	100	408		100	421
54	10	289	54	10	212
	100	444		100	436

Design Point F22 (Q10=200.7cfs, Q100=420.3cfs) is the outfall from the existing 48" RCP and the addition of 1-48" RCP and 1-54" RCP. The major and minor storm events will be adequately captured and conveyed beneath Palmer Divide Road with this addition of two culverts. At the outfall location there will need to be energy dissipation provided. A riprap apron is planned at this location which will be 40ft long and 42ft wide). Riprap will be d50=18" (type H) with a thickness of 36". An easement will be provided for temporary construction use and a permanent maintenance easement (Monument Ridge Metropolitan District) will be provided for the energy dissipation feature limits. Since the proposed peak runoff (420.3) has been determined to be less than the existing flow values (488cfs) and the road will no longer overtop, the proposed condition should minimize maintenance and safety risks along with infrastructure loss (i.e. – roadway features). Refer to plat of survey and construction documents for additional information.

Design Point F23 (Q10=1.2cfs, Q100=2.9cfs) flows are generated from basin KK (0.92ac). Basin KK is undeveloped land with a small portion of the east side of Monument Hill Road. Runoff from this basin is captured by an existing inlet. Flow is then routed to the north via an existing 18" RCP in which it will connect up to a proposed 18" RCP.

Design Point F24 (Q10=1.2cfs, Q100=2.3cfs) flows are generated from basin LL (0.51ac). Basin LL is undeveloped land with a small portion of the east side of Monument Hill Road. Runoff from this basin is captured by two 4' D-10-R sump inlets. Flow is then routed to the north via a proposed 18" RCP after combining with flows from Design Point F23.

The pipes and collection structures for pipes associated with Design Points 25 thru 29 have subsequently been analyzed in greater detail than found in this report. Tributary basins to these design points have been changed as a result of the "Beacon Lite Road Final Drainage Report". The Beacon Lite Road report contains the latest analysis for the associated design point system elements. Refer to the report prepared by PRC Engineering, dated March 8, 2026 for more information.

Design Point F25 (Q10=40.8cfs, Q100=113.3cfs) flows are generated from basin MO10 (60.47ac). Basin MO10 of undeveloped land and large lot single family development as well as a portion of Interstate 25. Runoff from this basin travels overland easterly to an existing 48" CMP which outfalls on the east side of Interstate 25 into basin MO11 at Design Point F26.

Design Point F26 (Q10=12.4cfs, Q100=20.1cfs) flows are generated from basin MO11 (3.00ac). Basin MO11 consists of Interstate 25 and Monument Hill Road.

Runoff from this basin travels easterly to an existing inlet and storm pipe located within basin MO11. Flow is then routed to Design Point F27 via an existing storm pipe.

Design Point F27 (Q5=40.8cfs, Q100=124.4cfs) consists of an outfall from basins MO10 and MO11. In the future, the proposed site is lower than the outfall and therefore a broad grass lined swale will be constructed to route flows towards Design Point F28 if needed. At this time, a swale is not warranted.

Design Point F28 (Q5=57.9cfs, Q100=150.5cfs) flows are generated from Design Point F23, F24 and F27 runoff and basin MM (10.31ac). Basin MM consists of a portion of existing Palmer Divide Road and undeveloped land. Flow is conveyed under Monument Hill Road via an existing 48" RCP towards Design Point F29.

Design Point F29 (Q5=65.4cfs, Q100=164.7cfs) flows are generated from basin MO13 (4.66ac). Basin MO13 consists of Interstate 25, an off-ramp and interchange gore areas. Runoff from this basin travels overland northeasterly via a broad grass lined swale to an existing 48" RCP which outfalls on the north side of Palmer Divide Road. Regrading the swale to the east is necessary to ensure flows east of the culvert drains to this location.

A summary of the basin runoff coefficients, peak flow rates and hydrologic analysis support calculations are provided in Appendix B.

E. Water Quality – 4 Step Process

Four-Step Process

El Paso County requires the MHFD Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls.

No water-quality exclusions are utilized for the applicable Filing No. 1 development area. Proposed developed impervious areas, including applicable roadway improvements, have been incorporated into the tributary area and imperviousness calculations used to determine WQCV for the proposed EDB facilities.

Step 1: Runoff Reduction Practices

This development address Low Impact Development strategies primarily through the utilization of landscape buffers, located in areas adjacent to the building and parking lot areas of the site. Runoff is routed over these grass areas via

unconcentrated sheet flow prior to being conveyed to water quality and detention facilities.

Step 2: Implement BMPs - Water Quality Capture Volume with Slow Release
On-site flow is directed to four private full-spectrum extended detention basins. These facilities provide Water Quality Capture Volume (WQCV) required for the site by releasing flows over a longer period of time. The proposed facilities meet or exceed the DCM standards for the release rates of full-spectrum detention ponds for water quality capture volumes. Due to the size of the watershed tributary to each pond and the resultant anticipated flow rates, infiltration practices cannot be implemented with the exception of pond 5. However, pond 5 has been designed as an EDB even though the tributary area (1.55ac) which is below the 2ac threshold for infiltration PCM use. Given the space constraints and potential for groundwater intrusion or groundwater being shallow and therefore creating an issue with percolation, an EDB was chosen.

Step 3: Stabilize Drainageways
All the flows generated from impervious portions of this site will be routed to private water quality and detention facilities. These flows will combine with flows from other areas adjacent to the site and discharge into a wetlands depression area at the north end of the project. Only minor channel improvements in basin O13 and JJ are being proposed with this development.

Step 4 – Implement Site Specific and Other Source Control BMPs
To adhere to the County's Municipal Separate Storm Sewer System (MS4) requirements, temporary construction BMP's and permanent post construction BMP's will be implemented to reduce the potential of pollutants entering the creek. The implementation of these BMP's will be provided in the Grading, Erosion and Stormwater Quality Control Plan and Stormwater Management Plan for the site. The Stormwater Management Plan also addresses structural and procedural source control BMP's such as materials storage and spill prevention, containment, and control, etc. during construction to protect downstream receiving waters. Refer to the Stormwater Management Plan for this site for additional source control BMP information specific to this site. If deemed necessary, site specific source controls including covering storage/handling areas and spill containment will be used.

F. Water Quality Improvements

The proposed full-spectrum extended detention basins have been analyzed in this study based on the interim site conditions as shown on the Developed Conditions Drainage Maps. To ensure the proposed facilities will not have to be removed and/or replaced when the future filings develop, calculations for the future condition have been made. The only anticipated modifications of the infrastructure will be the outlet structure orifice plate and restrictor plate as well as forebay notch widths.

Forebays are being constructed now versus adding them later. The forebays will be constructed with metal notches for those with different flow rates in the future. One forebay will not receive any flow at this time, pond 1-A. However, it was designed for future conditions. In the future the plates can be removed and replaced as needed. Those items are dependent on the tributary area and percentage of imperviousness, which varies between the interim and future phase(s) of development.

Full Spectrum Extended Detention Basins
For the purpose of this report, detailed pond designs were conducted based on anticipated future development. As such, the MHFD UD-Detention spreadsheet was used for approximate sizing. Private full spectrum extended detention basins (EDB) are proposed at various locations in the site. The EDB's will have forebays, maintenance access roads, concrete trickle channels, micro pools and outlet structures.

The full-spectrum EDB's will have soil rip rap emergency overflow spillways that will drain the 100yr peak flows in the event the outlet structure becomes entirely clogged and another 100yr event passes. The spillways will be constructed of soil rip rap. A minimum of 1.0' of freeboard will be provided. The spillway will be situated such that any overflow will be directed away from homes. Refer to the design calculations in Appendix B for additional information.

IV. HYDRAULIC ANALYSIS

Pipe and Inlet Calculations
Filing No. 1 is being developed at this time matching the MDDP on the east side of Misty Acres Boulevard with slight modifications from analysis refinement. On the west side, only a few dead-end streets and two ponds are being constructed at this time. As such, some of the pipes will be dry since they are stubs for future development (see pipe table in appendix B) while others convey flows less than those computed in the MDDP. The pipe sizes used in this report were based on the sizing calculations using the anticipated future development layout, not the interim development, except in one location (Design Point F4C) when more flow will enter the system than it will in the future. Pipe (hydraulic grade line) and inlet calculations have been provided with this report. The additional flow has been considered but will result in the minor storm HGL to be above 80% pipe depth. This will be a temporary condition until such time as the remainder of the project is developed. Flooding will not occur in the interim condition i.e. - HGL at least one foot below final grade. The HGL calculations for the pipe systems upstream of the ponds (which do not connect to a downstream pond) have been included in the report. The HGL's are valid for those systems. For the remainder of the systems, an HGL cannot be provided as the SWMM model dynamically determines the flow and resultant water surface for the duration of the storm event. Therefore, the EPA-SWMM model itself must be used to view the

dynamic flow and water surface in the pipe systems. Using the rational method pipe sizes and slopes and the upsized pipes mentioned above, the pipes adequately convey the flows to and from the ponds and meet the DCM requirements. The HGL's computed with the rational method inputs have all been included in this report. As stated prior, the HGL computations for the pipe systems upstream which do not connect ponds are valid. The others pipe systems can only be checked using the model.

A. Maintenance Requirements

The on-site full-spectrum ponds and storm sewer not in El Paso County right-of-way) outlined in this report shall be owned and maintained by the metropolitan district. Regular maintenance of stormwater facilities is essential to ensure long term functionality and effectiveness. The proposed pipes, inlets, manholes, along with the full-spectrum detention and water quality facilities should be inspected regularly, and after significant rainstorms, to verify functionality, document erosion, and remove sediment and debris. Refer to the project's Inspection and Maintenance (IM) Plan for additional information.

The following is a list of recommendations regarding drainage around structures:

- Maintain positive drainage away from all structures at all locations.
- Adhere to guidelines outlined in the geotechnical report (if one has been completed); otherwise refer to the latest International Residential Code (IRC) book.
- Avoid grading low points adjacent to any structures.

The proposed storm sewer facilities located within street right-of-way outlined in this report shall be owned and maintained by El Paso County.

B. Grading and Erosion Control Plans

Grading and Erosion Control Plans will be submitted separately.

V. FEE DEVELOPMENT

Unresolved Review 5 Comment: Add statement back in that bridge fees are $0/ac.

Bald Mountain drainage basin has drainage fees of $13,262/ac. Drainage basin fees are calculated based upon impervious area within the platted area. Tracts M and N are planned for future development. Approval of a final plat is required prior to initiation of a use or issuance of a building permit for the future development tracts. Drainage fees are not being charged with this filing and will be assessed and paid at the time of replatting the future development tracts.

The impervious areas in the Proposed Monument Ridge East Filing No. 1 development are:

- Roadways = 227,815.77 SF (5.230 AC)
- Sidewalks = 41,428.22 SF (0.951 AC)

Unresolved Review 5 Comment: Tracts M & N will not pay fees at this time, but the remainder of Filing 1 will need to have fees paid. Please revise paragraph accordingly.

- Lots (2,000 SF/Lot) x 33 Lots = 66,000 SF (1.515 AC)

Total Impervious area = 335,243.99 SF (7.696 AC)
(7.696 x $13,262) =
BALD MOUNTAIN DRAINAGE BASIN FEES = $102,066.24

VI. SUMMARY

This Final Drainage Report for Monument Ridge East – Filing No. 1 was prepared using the City of Colorado Springs Drainage Criteria Manuals, MHFD Urban Storm Drainage Criteria Manuals and the El Paso County DCM Volume 1 updates. Stormwater quality is provided by proposed private full spectrum extended detention basin facilities located on-site. Stormwater infrastructure in the form of pipe, inlets and ponds have been designed to accommodate future anticipated project site development. Site runoff, storm drain, and associated appurtenances will not adversely affect the downstream and surrounding developments. This report is in general conformance with all other previously approved reports which included portions of this site.

VII. REFERENCES

1. Drainage Criteria Manual, Volume I (revised January 2021) and Volume II (revised December 2020), City of Colorado Springs
2. Urban Storm Drainage Criteria Manual, Volumes I-III, Mile High Flood District (MHFD).
3. El Paso County Drainage Criteria Manual Volume 1 update, El Paso County Municode web site
4. El Paso County Engineering Criteria Manual, Drainage Criteria Manual Volume 2, Appendix I.
5. Monument Ridge East, Master Development Drainage Plan, 2024, PRC Engineering
6. Misty Acres Subdivision Filing No. 1, Final Drainage Report, 2002, Kiowa Engineering Corporation
7. Misty Acres Ranch, Master Development Drainage Plan, 2001, Kiowa Engineering Corporation
8. Interstate 25 Express Lanes: Castle Rock to Monument (The Gap), Hydrology and Hydraulics Report, 2020, CH2M
9. Flood Insurance Rate Map Numbers 08041C0065G and 0804C0276G, El Paso County, Colorado, Revised December 7, 2018, Federal Emergency Management Agency (FEMA)
10. Web Soil Survey, Natural Resources Conservation Service (NRCS)

Unresolved:
Provide discussion of what is downstream facility for flows as they leave project site. Provide analysis of appurtenance to show it is adequate. Note downstream drainage easements may be needed if there is any change. (Note, plans still show new culverts being installed at CLR, this requires downstream drainage easements)

Appendix A

MAPS

United States Department of Agriculture

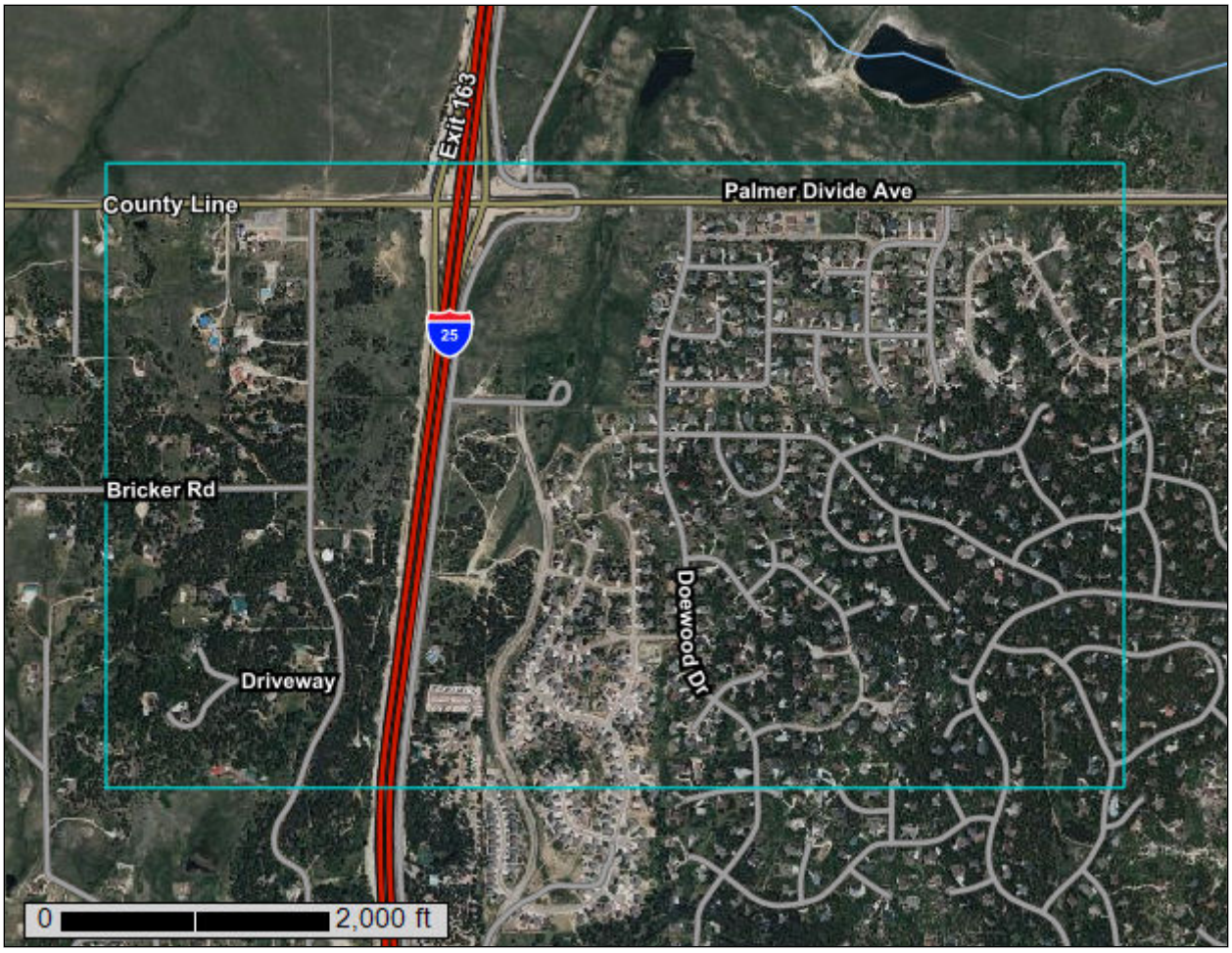
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Castle Rock Area, Colorado, and El Paso County Area, Colorado

Monument Ridge East



January 15, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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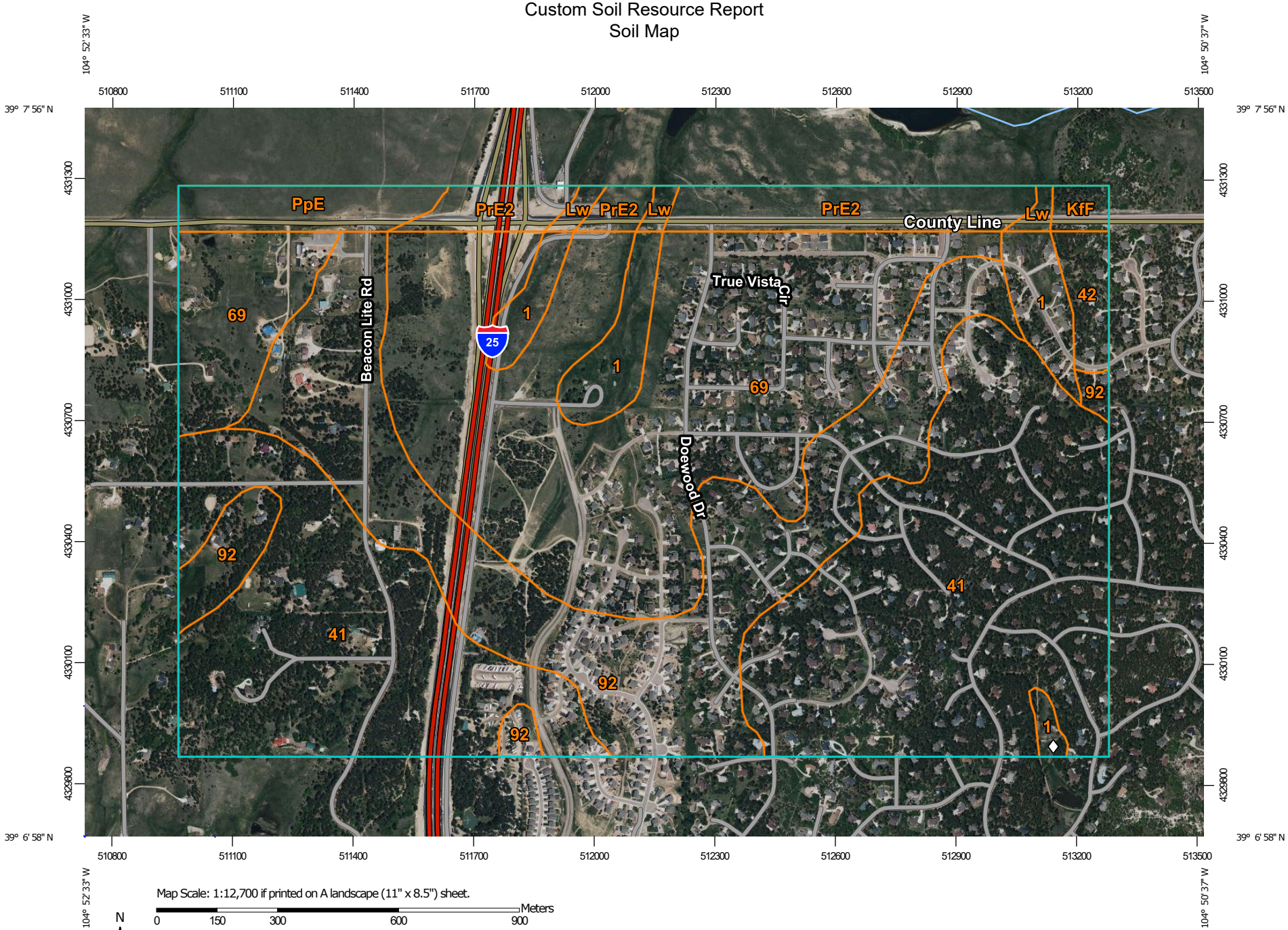
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Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:12,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 150 300 600 900

Feet
0 500 1000 2000 3000

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:20,000 to 1:24,000.

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

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

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

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

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 15, Sep 1, 2022

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

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
KfF	Kettle-Falcon complex, 9 to 65 percent slopes	4.0	0.5%
Lw	Loamy wet alluvial land	5.3	0.6%
PpE	Peyton-Pring-Crowfoot sandy loams, 5 to 25 percent slopes	17.5	2.1%
PrE2	Peyton-Pring-Crowfoot complex, 3 to 15 percent slopes, eroded	38.5	4.7%
Subtotals for Soil Survey Area		**65.2**	**8.0%**
Totals for Area of Interest		**813.1**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Alamosa loam, 1 to 3 percent slopes	35.2	4.3%
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	285.9	35.2%
42	Kettle-Rock outcrop complex	9.1	1.1%
69	Peyton-Pring complex, 8 to 15 percent slopes	245.8	30.2%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	171.9	21.1%
Subtotals for Soil Survey Area		**747.9**	**92.0%**
Totals for Area of Interest		**813.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion

of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Castle Rock Area, Colorado

KfF—Kettle-Falcon complex, 9 to 65 percent slopes

Map Unit Setting

National map unit symbol: jqz2
Elevation: 6,600 to 8,000 feet
Mean annual precipitation: 17 to 21 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 115 to 125 days
Farmland classification: Not prime farmland

Map Unit Composition

Kettle and similar soils: 50 percent
Falcon and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kettle

Setting

Landform: Hills, ridges
Landform position (three-dimensional): Side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Locally transported sandy alluvium derived from arkose

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 10 inches: loamy sand
H2 - 10 to 18 inches: sand
H3 - 18 to 60 inches: gravelly loamy coarse sand

Properties and qualities

Slope: 9 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F048AY925CO - Ponderosa Pine Forest
Hydric soil rating: No

Description of Falcon

Setting

Landform: Cliffs
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkosic sandstone and/or conglomerate

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 8 inches: sandy loam
H2 - 8 to 15 inches: gravelly sandy loam
H3 - 15 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 65 percent
Depth to restrictive feature: 4 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: F048AY925CO - Ponderosa Pine Forest
Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 7 percent
Hydric soil rating: No

Pring

Percent of map unit: 7 percent
Hydric soil rating: No

Aquic haploborolls

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

Lw—Loamy wet alluvial land

Map Unit Setting

National map unit symbol: jqzd
Elevation: 7,000 to 8,000 feet
Mean annual precipitation: 17 to 19 inches
Mean annual air temperature: 44 to 46 degrees F
Frost-free period: 115 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Loamy wet alluvial land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Loamy Wet Alluvial Land

Setting

Landform: Drainageways, swales, flood plains
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

H1 - 0 to 20 inches: sandy loam
H2 - 20 to 60 inches: stratified sand to clay

Properties and qualities

Slope: 1 to 5 percent
Drainage class: Poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 6.00 in/hr)
Depth to water table: About 0 to 24 inches
Frequency of flooding: FrequentNone
Calcium carbonate, maximum content: 5 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Sandy wet alluvial land
Percent of map unit: 14 percent
Hydric soil rating: No

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

PpE—Peyton-Pring-Crowfoot sandy loams, 5 to 25 percent slopes

Map Unit Setting
National map unit symbol: jqzn
Elevation: 6,500 to 8,000 feet
Mean annual precipitation: 15 to 18 inches
Mean annual air temperature: 44 to 46 degrees F
Frost-free period: 115 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition
Peyton and similar soils: 40 percent
Pring and similar soils: 25 percent
Crowfoot and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

Setting
Landform: Valley sides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Weathered alluvium derived from arkose

Typical profile
H1 - 0 to 11 inches: sandy loam
H2 - 11 to 30 inches: sandy clay loam
H3 - 30 to 40 inches: sandy loam
H4 - 40 to 60 inches: sandy loam

Properties and qualities
Slope: 5 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Description of Pring

Setting

Landform: Hills
Landform position (three-dimensional): Crest, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkosic sedimentary rock

Typical profile

H1 - 0 to 12 inches: sandy loam
H2 - 12 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 5 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Description of Crowfoot

Setting

Landform: Valley sides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from arkosic sedimentary rock

Typical profile

H1 - 0 to 6 inches: sandy loam
H2 - 6 to 19 inches: loamy sand
H3 - 19 to 32 inches: gravelly sandy clay loam
H4 - 32 to 43 inches: gravelly sandy loam
H5 - 43 to 60 inches: coarse sand

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Minor Components

Brussett

Percent of map unit: 3 percent
Hydric soil rating: No

Jarre

Percent of map unit: 3 percent
Hydric soil rating: No

Tomah

Percent of map unit: 3 percent
Hydric soil rating: No

Aquic haploborolls

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

PrE2—Peyton-Pring-Crowfoot complex, 3 to 15 percent slopes, eroded

Map Unit Setting

National map unit symbol: jqzp
Elevation: 6,500 to 8,000 feet
Mean annual precipitation: 15 to 18 inches
Mean annual air temperature: 44 to 46 degrees F
Frost-free period: 115 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Peyton, eroded, and similar soils: 40 percent
Pring, eroded, and similar soils: 25 percent
Crowfoot, eroded, and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton, Eroded

Setting

Landform: Plateaus, mesas
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Weathered alluvium derived from arkose

Typical profile

H1 - 0 to 11 inches: sandy loam
H2 - 11 to 30 inches: sandy clay loam
H3 - 30 to 40 inches: sandy loam
H4 - 40 to 60 inches: sandy loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Description of Pring, Eroded

Setting

Landform: Plateaus, mesas
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkosic sedimentary rock

Typical profile

H1 - 0 to 12 inches: gravelly sandy loam
H2 - 12 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Description of Crowfoot, Eroded

Setting

Landform: Plateaus, mesas
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from arkosic sedimentary rock

Typical profile

H1 - 0 to 6 inches: sandy loam
H2 - 6 to 19 inches: loamy sand
H3 - 19 to 32 inches: gravelly sandy clay loam
H4 - 32 to 43 inches: gravelly sandy loam
H5 - 43 to 60 inches: coarse sand

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Minor Components

Kippen

Percent of map unit: 8 percent
Hydric soil rating: No

Truckton

Percent of map unit: 7 percent
Hydric soil rating: No

El Paso County Area, Colorado

1—Alamosa loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3670
Elevation: 7,200 to 7,700 feet
Farmland classification: Prime farmland if irrigated and reclaimed of excess salts and sodium

Map Unit Composition

Alamosa and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alamosa

Setting

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

Typical profile

A - 0 to 6 inches: loam
Bt - 6 to 14 inches: clay loam
Btk - 14 to 33 inches: clay loam
Cg1 - 33 to 53 inches: sandy clay loam
Cg2 - 53 to 60 inches: sandy loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: NoneFrequent
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: D
Ecological site: R048AY241CO - Mountain Meadow
Hydric soil rating: Yes

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

41—Kettle gravelly loamy sand, 8 to 40 percent slopes

Map Unit Setting

National map unit symbol: 368h
Elevation: 7,000 to 7,700 feet
Farmland classification: Not prime farmland

Map Unit Composition

Kettle and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kettle

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

E - 0 to 16 inches: gravelly loamy sand
Bt - 16 to 40 inches: gravelly sandy loam
C - 40 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 8 to 40 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

42—Kettle-Rock outcrop complex

Map Unit Setting

National map unit symbol: 368j
Elevation: 6,800 to 7,700 feet
Frost-free period: 110 to 130 days
Farmland classification: Not prime farmland

Map Unit Composition

Kettle and similar soils: 60 percent
Rock outcrop: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kettle

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

E - 0 to 16 inches: gravelly loamy sand
Bt - 16 to 40 inches: gravelly sandy loam
C - 40 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 8 to 40 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

R - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 60 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

69—Peyton-Pring complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 369g
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 40 percent
Pring and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 12 inches: sandy loam
Bt - 12 to 25 inches: sandy clay loam
BC - 25 to 35 inches: sandy clay loam
C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 8 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Description of Pring

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

92—Tomah-Crowfoot loamy sands, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 36b9
Elevation: 7,300 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Tomah and similar soils: 50 percent
Crowfoot and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tomah

Setting

Landform: Alluvial fans, hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkose and/or residuum weathered from arkose

Typical profile

A - 0 to 10 inches: loamy sand
E - 10 to 22 inches: coarse sand
Bt - 22 to 48 inches: stratified coarse sand to sandy clay loam
C - 48 to 60 inches: coarse sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B

Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Description of Crowfoot

Setting

Landform: Hills, alluvial fans
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 12 inches: loamy sand
E - 12 to 23 inches: sand
Bt - 23 to 36 inches: sandy clay loam
C - 36 to 60 inches: coarse sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

National Flood Hazard Layer FIRMette

FEMA

104°51'58"W 39°7'50"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000

104°51'21"W 39°7'23"N

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

Legend

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

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

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

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

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

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

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

N

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

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

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National Flood Hazard Layer FIRMette

FEMA

104°51'59"W 39°7'38"N



104°51'22"W 39°7'10"N

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

1:6,000

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

Legend

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

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

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

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

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

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

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

N

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Appendix B

CALCULATIONS

(Stormwater Management Model (SWMM) calculations are located in appendix C)

MONUMENT RIDGE EAST - FILING NO.1
FINAL DRAINAGE REPORT
(Percent Impervious Summary - Interim)

Basin					*Area (acres)*					*% Imp*
	Streets/Drives/Walks	*Streets - Gravel*	*Roof*	*Lawn*	*Res 1/8*	*Res 1/4*	*Res 1/3*	*Res 1/2*	*TOTAL*	
AA	0.44			14.72					15.16	2.90
BB				2.74					2.74	0.00
CC	1.03								1.03	100.00
DD	1.67			11.08					12.75	13.10
EE	0.59			1.22					1.81	32.60
FF				0.8					0.80	0.00
GG	0.53			4.37					4.90	10.82
HH	2.29			6.27					8.56	26.75
II	0.23			0.67					0.90	25.56
MO2	0.36			0.15					0.51	70.59
MO3		0.84						0.52	1.36	58.97
MO4	0.51			0.23					0.74	68.92
MD2	1.51				2.80		6.25	1.60	12.16	46.09
MD5	0.19			1.39					1.58	12.03
ME	0.58				0.63		1.28	0.72	3.21	48.40

Composite Developed - Pond 1 (MO2,AA,BB,CC)	**19.44**	**9.41**
Composite Developed - Pond 2 (DD,EE,FF,GG,MO4,MO3)	**22.36**	**18.35**
Composite Developed - Pond 4 (HH,II,MD2,MD5)	**23.20**	**35.84**
Pond 5 (ME)	**3.21**	**48.40**

Land Use	**% Impervious**
Streets/Drives/Walks	100
Streets - Gravel	80
Roof	90
Lawn	0
Res 1/8ac or less	65
Res 1/4ac or less	40
Res 1/3ac or less	30
Res 1/2ac or less	25

MONUMENT RIDGE EAST - FILING NO. 1
FINAL DRAINAGE REPORT
(Percent Impervious Summary - Future)

Basin					*Area (acres)*				*% Imp*
	Streets/Drives/Walks	*Streets - Gravel*	*Roof*	*Lawn*	*Res 1/8*	*Res 1/3*	*Res 1/2*	*TOTAL*	
A Basins	5.79		3.12	6.742				15.65	54.93
O1 thru O4	0.87	1.32		7.42			0.52	10.13	20.30
B Basins	3.9		2.9	6.915	0.69			14.41	48.31
C Basins	1.15		0.88	4.02	3.47			9.52	44.09
D Basins	5.15			5.47	3.11	2.79	4.63	21.15	43.34
E	0.58				0.63	1.28	0.72	3.21	48.40

Composite Developed - Pond 1 (A Basins, O1 thru O4)	**25.78**	**41.32**
Composite Developed - Pond 2 (B Basins)	**14.41**	**48.31**
Composite Developed - Pond 3 (C Basins)	**9.52**	**44.09**
Composite Developed - Pond 4 (D Basins)	**21.15**	**43.34**
Pond 5 (Basin E)	**3.21**	**48.40**

Land Use	**% Impervious**
Streets/Drives/Walks	100
Streets - Gravel	80
Roof	90
Lawn	0
Res 1/8ac or less	65
Res 1/3ac	30
Res 1/2ac	25

MONUMENT RIDGE EAST - FILING NO. 1
FINAL DRAINAGE REPORT
(Composite Runoff Coefficients - Interim)

Basin	Basin Area (acres)	Land Use	Sub-Basin (5yr)		Composite	Sub-Basin (10yr)		Composite	Sub-Basin (100yr)		Composite
			C_5	Area (acres)	C_5	C_{10}	Area (acres)	C_{10}	C_{100}	Area (acres)	C_{100}
AA	15.16	Streets/Drive/Walks	0.90	0.44	0.10	0.92	0.44	0.17	0.96	0.44	0.37
		Roof	0.73	0.00		0.75	0.00		0.81	0.00	
		Lawn	0.08	14.72		0.15	14.72		0.35	14.72	
BB	2.74	Streets/Drive/Walks	0.90	0.00	0.08	0.92	0.00	0.15	0.96	0.00	0.35
		Roof	0.73	0.00		0.75	0.00		0.81	0.00	
		Lawn	0.08	2.74		0.15	2.74		0.35	2.74	
CC	1.03	Pond	0.90	1.03	0.90	0.92	1.03	0.92	0.96	1.03	0.96
		Roof	0.73	0.00		0.75	0.00		0.81	0.00	
		Lawn	0.08	0.00		0.15	0.00		0.35	0.00	
DD	12.75	Streets/Drive/Walks	0.90	1.67	0.19	0.92	1.67	0.25	0.96	1.67	0.43
		Roof	0.73	0.00		0.75	0.00		0.81	0.00	
		Lawn	0.08	11.08		0.15	11.08		0.35	11.08	
EE	1.81	Streets/Drive/Walks	0.90	0.59	0.35	0.92	0.59	0.40	0.96	0.59	0.55
		Roof	0.73	0.00		0.75	0.00		0.81	0.00	
		Lawn	0.08	1.22		0.15	1.22		0.35	1.22	
FF	0.80	Streets/Drive/Walks	0.90	0.00	0.08	0.92	0.00	0.15	0.96	0.00	0.35
		Roof	0.73	0.00		0.75	0.00		0.81	0.00	
		Lawn	0.08	0.80		0.15	0.80		0.35	0.80	
GG	4.90	Pond	0.90	0.53	0.20	0.92	0.53	0.28	0.96	0.53	0.49
		Roof	0.74	0.00		0.76	0.00		0.82	0.00	
		Lawn	0.12	4.37		0.20	4.37		0.43	4.37	

Basin	Basin Area (acres)	Land Use	Sub-Basin (5yr)		Composite	Sub-Basin (10yr)		Composite	Sub-Basin (100yr)		Composite
			C_5	Area (acres)	C_5	C_{10}	Area (acres)	C_{10}	C_{100}	Area (acres)	C_{100}
HH	8.56	Streets/Drive/Walks	0.90	2.29	0.33	0.92	2.29	0.39	0.96	2.29	0.57
		Roof	0.74	0.00		0.76	0.00		0.82	0.00	
		Lawn	0.12	6.27		0.20	6.27		0.43	6.27	
II	0.90	Streets/Drive/Walks	0.90	0.23	0.29	0.92	0.23	0.34	0.96	0.23	0.50
		Roof	0.73	0.00		0.75	0.00		0.81	0.00	
		Lawn	0.08	0.67		0.15	0.67		0.35	0.67	
JJ	6.78	Streets/Drive/Walks	0.90	0.94	0.24	0.92	0.94	0.31	0.96	0.94	0.51
		1/2 Ac	0.25	0.59		0.33	0.59		0.52	0.59	
		Lawn	0.12	5.25		0.20	5.25		0.43	5.25	
KK	0.92	Streets/Drive/Walks	0.90	0.16	0.22	0.92	0.16	0.28	0.96	0.16	0.46
		Roof	0.73	0.00		0.75	0.00		0.81	0.00	
		Lawn	0.08	0.76		0.15	0.76		0.35	0.76	
LL	0.51	Streets/Drive/Walks	0.90	0.17	0.36	0.92	0.17	0.41	0.96	0.17	0.56
		Roof	0.73	0.00		0.75	0.00		0.81	0.00	
		Lawn	0.08	0.33		0.15	0.33		0.35	0.33	
MM	10.31	Streets/Drive/Walks	0.90	0.59	0.19	0.92	0.59	0.29	0.96	0.59	0.53
		Roof	0.75	0.00		0.77	0.00		0.83	0.00	
		Lawn	0.15	9.72		0.25	9.72		0.50	9.72	
MD2	12.16	Streets/Drive/Walks	0.90	1.51	0.40	0.92	1.51	0.46	0.96	1.51	0.61
		1/8 Ac or Less	0.48	2.80		0.52	2.80		0.63	2.80	
		1/3 Ac	0.28	6.25		0.35	6.25		0.53	6.25	
		1/2 Ac	0.25	1.60		0.33	1.60		0.52	1.60	
MD5	1.58	Pond	0.90	0.19	0.21	0.92	0.19	0.29	0.96	0.19	0.49
		Lawn	0.12	1.39		0.20	1.39		0.43	1.39	

Basin	Basin Area (acres)	Land Use	Sub-Basin (5yr)		Composite	Sub-Basin (10yr)		Composite	Sub-Basin (100yr)		Composite
			C_5	Area (acres)	C_5	C_{10}	Area (acres)	C_{10}	C_{100}	Area (acres)	C_{100}
ME	3.21	Streets/Drive/Walks	0.90	0.58	0.42	0.92	0.58	0.48	0.96	0.58	0.63
		1/8 Ac or Less	0.48	0.63		0.52	0.63		0.63	0.63	
		1/3 Ac	0.28	1.28		0.35	1.28		0.53	1.28	
		1/2 Ac	0.25	0.72		0.33	0.72		0.52	0.72	
MO2	0.51	Streets/Drive/Walks	0.90	0.36	0.66	0.92	0.36	0.69	0.96	0.36	0.78
		Lawn	0.08	0.15		0.15	0.15		0.35	0.15	
MO3	1.36	Streets - Gravel	0.59	0.84	0.45	0.63	0.84	0.50	0.70	0.84	0.61
		1/2 Ac	0.22	0.52		0.30	0.52		0.46	0.52	
MO4	0.74	Streets/Drive/Walks	0.90	0.51	0.64	0.92	0.51	0.68	0.96	0.51	0.77
		Lawn	0.08	0.23		0.15	0.23		0.35	0.23	
MO5	60.15	Streets/Drive/Walks	0.90	10.77	0.35	0.92	10.77	0.41	0.96	10.77	0.55
		1/4 Ac	0.30	2.45		0.36	2.45		0.50	2.45	
		1/3 Ac	0.25	4.47		0.32	4.47		0.47	4.47	
		1/2 Ac	0.22	42.47		0.30	42.47		0.46	42.47	
MO6	0.63	Lawn	0.12	0.63	0.12	0.20	0.63	0.20	0.43	0.63	0.43
MO7A	65.57	Streets/Drive/Walks	0.90	3.81	0.27	0.92	3.81	0.34	0.96	3.81	0.49
		1/3 Ac	0.25	12.98		0.32	12.98		0.47	12.98	
		1/2 Ac	0.22	48.78		0.30	48.78		0.46	48.78	
MO7b	18.40	Streets/Drive/Walks	0.90	2.18	0.30	0.92	2.18	0.37	0.96	2.18	0.52
		1/2 Ac	0.22	16.22		0.30	16.22		0.46	16.22	
MO8	1.38	Streets/Drive/Walks	0.90	0.55	0.51	0.92	0.55	0.56	0.96	0.55	0.67
		1/3 Ac	0.25	0.83		0.32	0.83		0.47	0.83	
MO10	60.47	Streets/Drive/Walks	0.90	1.59	0.14	0.92	1.59	0.20	0.96	1.59	0.39
		Streets - Gravel	0.59	2.74		0.63	2.74		0.70	2.74	
		Roof	0.73	0.99		0.75	0.99		0.81	0.99	
		Lawn	0.08	55.15		0.15	55.15		0.35	55.15	
MO11	3.00	Streets/Drive/Walks	0.90	2.08	0.65	0.92	2.08	0.68	0.96	2.08	0.77
		Lawn	0.08	0.93		0.15	0.93		0.35	0.93	
MO13	4.66	Streets/Drive/Walks	0.90	1.91	0.44	0.92	1.91	0.49	0.96	1.91	0.65
		Lawn	0.12	2.75		0.20	2.75		0.43	2.75	

Notes:

1. Shaded cells indicate composite runoff coefficients with HSG B and HSG D soils.

Basin	Basin Area (acres)	Land Use	Sub-Basin (5yr)		Composite	Sub-Basin (10yr)		Composite	Sub-Basin (100yr)		Composite
			C_5	Area (acres)	C_5	C_{10}	Area (acres)	C_{10}	C_{100}	Area (acres)	C_{100}

2. All basins split between the two soil groups with >50% D are considered D soils (i.e. - conservative approach).

MONUMENT RIDGE EAST - FILING NO. 1
FINAL DRAINAGE REPORT
(Composite Runoff Coefficients - Future)

Basin	Basin Area (acres)	Land Use	Sub-Basin (5yr)		Composite	Sub-Basin (10yr)		Composite	Sub-Basin (100yr)		Composite
			C_5	Area (acres)	C_5	C_{10}	Area (acres)	C_{10}	C_{100}	Area (acres)	C_{100}
A1F	6.55	Streets/Drive/Walks	0.90	2.20	0.51	0.92	2.20	0.55	0.96	2.20	0.66
		Roof	0.73	1.55		0.75	1.55		0.81	1.55	
		Lawn	0.08	2.80		0.15	2.80		0.35	2.80	
A2F	0.29	Streets/Drive/Walks	0.90	0.08	0.31	0.92	0.08	0.37	0.96	0.08	0.52
		Roof	0.73	0.00		0.75	0.00		0.81	0.00	
		Lawn	0.08	0.21		0.15	0.21		0.35	0.21	
A3F	1.18	Streets/Drive/Walks	0.90	0.33	0.37	0.92	0.33	0.42	0.96	0.33	0.56
		Roof	0.73	0.10		0.75	0.10		0.81	0.10	
		Lawn	0.08	0.75		0.15	0.75		0.35	0.75	
A4F	5.65	Streets/Drive/Walks	0.90	2.40	0.58	0.92	2.40	0.62	0.96	2.40	0.72
		Roof	0.73	1.35		0.75	1.35		0.81	1.35	
		Lawn	0.08	1.91		0.15	1.91		0.35	1.91	
A5F	2.22	Streets/Drive/Walks	0.90	0.72	0.48	0.92	0.72	0.53	0.96	0.72	0.64
		Roof	0.73	0.47		0.75	0.47		0.81	0.47	
		Lawn	0.08	1.03		0.15	1.03		0.35	1.03	
B1F	5.02	Streets/Drive/Walks	0.90	1.80	0.55	0.92	1.80	0.59	0.96	1.80	0.70
		Roof	0.73	1.38		0.75	1.38		0.81	1.38	
		Lawn	0.08	1.84		0.15	1.84		0.35	1.84	
B2F	0.31	Streets/Drive/Walks	0.90	0.14	0.46	0.92	0.14	0.51	0.96	0.14	0.63
		Roof	0.73	0.00		0.75	0.00		0.81	0.00	
		Lawn	0.08	0.17		0.15	0.17		0.35	0.17	
B3F	0.36	Streets/Drive/Walks	0.90	0.13	0.67	0.92	0.13	0.70	0.96	0.13	0.78
		Roof	0.73	0.17		0.75	0.17		0.81	0.17	
		Lawn	0.08	0.07		0.15	0.07		0.35	0.07	
B4F	0.45	Streets/Drive/Walks	0.90	0.15	0.62	0.92	0.15	0.65	0.96	0.15	0.74
		Roof	0.73	0.19		0.75	0.19		0.81	0.19	
		Lawn	0.08	0.11		0.15	0.11		0.35	0.11	
B5F	1.11	Streets/Drive/Walks	0.90	0.58	0.67	0.92	0.58	0.70	0.96	0.58	0.78
		Roof	0.73	0.28		0.75	0.28		0.81	0.28	
		Lawn	0.08	0.26		0.15	0.26		0.35	0.26	

Basin	Basin Area (acres)	Land Use	Sub-Basin (5yr)		Composite C_5	Sub-Basin (10yr)		Composite C_{10}	Sub-Basin (100yr)		Composite C_{100}
			C_5	Area (acres)		C_{10}	Area (acres)		C_{100}	Area (acres)	
B6F	3.38	Streets/Drive/Walks	0.90	1.83	0.57	0.92	1.83	0.61	0.96	1.83	0.71
		Roof	0.73	0.25		0.75	0.25		0.81	0.25	
		Lawn	0.08	1.30		0.15	1.30		0.35	1.30	
B7F	0.74	Streets/Drive/Walks	0.90	0.21	0.55	0.92	0.21	0.59	0.96	0.21	0.69
		Roof	0.73	0.28		0.75	0.28		0.81	0.28	
		Lawn	0.08	0.26		0.15	0.26		0.35	0.26	
B8F	0.20	Streets/Drive/Walks	0.90	0.06	0.62	0.92	0.06	0.65	0.96	0.06	0.74
		Roof	0.73	0.08		0.75	0.08		0.81	0.08	
		Lawn	0.08	0.05		0.15	0.05		0.35	0.05	
B9F	1.17	Streets/Drive/Walks	0.90	0.69	0.73	0.92	0.69	0.76	0.96	0.69	0.83
		1/8 Ac or Less	0.49	0.48		0.54	0.48		0.65	0.48	
		Lawn	0.15	0.00		0.25	0.00		0.50	0.00	
C1F	9.66	Streets/Drive/Walks	0.90	4.53	0.66	0.92	4.53	0.70	0.96	4.53	0.79
		1/8 Ac or Less	0.49	4.50		0.54	4.50		0.65	4.50	
		Lawn	0.15	0.63		0.25	0.63		0.50	0.63	
D1F	7.42	Streets/Drive/Walks	0.90	3.15	0.48	0.92	3.15	0.54	0.96	3.15	0.70
		1/8 Ac or Less	0.49	0.21		0.54	0.21		0.65	0.21	
		Lawn	0.15	4.06		0.25	4.06		0.50	4.06	
D2F	0.61	Streets/Drive/Walks	0.90	0.30	0.52	0.92	0.30	0.58	0.96	0.30	0.72
		Lawn	0.15	0.31		0.25	0.31		0.50	0.31	
MD2	12.16	Streets/Drive/Walks	0.90	1.51	0.40	0.92	1.51	0.46	0.96	1.51	0.61
		1/8 Ac or Less	0.48	2.80		0.52	2.80		0.63	2.80	
		1/3 Ac	0.28	6.25		0.35	6.25		0.53	6.25	
		1/2 Ac	0.25	1.60		0.33	1.60		0.52	1.60	
MD5	1.58	Pond	0.90	0.19	0.21	0.92	0.19	0.29	0.96	0.19	0.49
		Lawn	0.12	1.39		0.20	1.39		0.43	1.39	

Notes:

1. Shaded cells indicate composite runoff coefficients with HSG B and HSG D soils.
2. All basins split between the two soil groups with >50% D are considered D soils (i.e. - conservative approach).

MONUMENT RIDGE EAST - FILING NO. 1
FINAL DRAINAGE REPORT
(Basin Runoff Calculations - Interim)

					Overland Flow				Channel Flow					Travel Time (T_t)	Intensity		Total Flows	
Basin	Area Total (acres)	C_5	C_{10}	C_{100}	C_5	Length (ft)	Slope (ft/ft)	T_C (min)	Length (ft)	Slope (ft/ft)	Cv	Velocity (fps)	T_t (min)	TOTAL* (min)	I_{10} (in/hr)	I_{100} (in/hr)	Q_{10} (c.f.s.)	Q_{100} (c.f.s.)
AA	15.16	0.10	0.17	0.37	0.10	300	0.065	16.8	878	0.023	15	2.3	6.4	23.2	3.3	4.8	**8.7**	**26.8**
BB	2.74	0.08	0.15	0.35	0.08	91	0.108	8.0	345	0.046	15	3.2	1.8	9.8	4.9	7.0	**2.0**	**6.7**
CC	1.03	0.90	0.92	0.96	0.90									5.0	6.0	8.7	**5.7**	**8.6**
DD	12.75	0.19	0.25	0.43	0.19	215	0.084	12.0	287	0.070	15	4.0	1.2	13.2	4.3	6.2	**13.9**	**34.2**
EE	1.81	0.35	0.40	0.55	0.35	115	0.087	7.1	592	0.044	20	4.2	2.4	9.5	4.9	7.1	**3.6**	**7.0**
FF	0.80	0.08	0.15	0.35	0.08	26	0.308	3.0	321	0.062	15	3.7	1.4	4.5	6.2	9.0	**0.7**	**2.5**
GG	4.90	0.20	0.28	0.49	0.20	218	0.073	12.4	198	0.061	15	3.7	0.9	13.3	4.3	6.2	**5.9**	**14.8**

					Overland Flow				Channel Flow					Travel Time (T_t)	Intensity		Total Flows	
Basin	**Area Total (acres)**	C_5	C_{10}	C_{100}	C_5	**Length (ft)**	**Slope (ft/ft)**	T_C **(min)**	**Length (ft)**	**Slope (ft/ft)**	**Cv**	**Velocity (fps)**	T_t **(min)**	**TOTAL* (min)**	I_{10} **(in/hr)**	I_{100} **(in/hr)**	Q_{10} **(c.f.s.)**	Q_{100} **(c.f.s.)**
HH	8.56	0.33	0.39	0.57	0.33	300	0.069	12.8	130	0.018	20	2.7	0.8	13.6	4.3	6.2	**14.4**	**30.2**
II	0.90	0.29	0.34	0.50	0.29	156	0.077	9.3	169	0.012	20	2.2	1.3	10.6	4.7	6.8	**1.5**	**3.1**
JJ	6.78	0.24	0.31	0.51	0.24	300	0.069	14.2	30	0.052	15	3.4	0.1	14.4	4.2	6.0	**8.8**	**20.9**
KK	0.92	0.22	0.28	0.46	0.22	117	0.051	10.0	15	0.046	15	3.2	0.1	10.1	4.8	6.9	**1.2**	**2.9**
LL	0.51	0.36	0.41	0.56	0.36	87	0.092	6.0	31	0.008	20	1.8	0.3	6.3	5.6	8.1	**1.2**	**2.3**
MM	10.31	0.19	0.29	0.53	0.19	269	0.067	14.3	709	0.025	15	2.4	5.0	19.3	3.7	5.3	**10.9**	**28.6**
MD2	12.16	0.40	0.46	0.61	0.40	100	0.130	5.4	1050	0.015	20	2.5	7.1	12.5	4.4	6.4	**24.6**	**46.8**
MD5	1.58	0.21	0.29	0.49										5.0	6.0	8.7	**2.7**	**6.8**
ME	3.21	0.42	0.48	0.63										5.0	6.0	8.7	**9.3**	**17.4**
MO2	0.51	0.66	0.69	0.78										5.0	6.0	8.7	**2.1**	**3.5**

					Overland Flow				Channel Flow					Travel Time (T_t)	Intensity		Total Flows	
Basin	**Area Total (acres)**	C_5	C_{10}	C_{100}	C_5	**Length (ft)**	**Slope (ft/ft)**	T_C **(min)**	**Length (ft)**	**Slope (ft/ft)**	**Cv**	**Velocity (fps)**	T_t **(min)**	**TOTAL* (min)**	I_{10} **(in/hr)**	I_{100} **(in/hr)**	Q_{10} **(c.f.s.)**	Q_{100} **(c.f.s.)**
MO3	1.36	0.45	0.50	0.61	0.45	300	0.083	10.1						10.1	4.8	6.9	**3.3**	**5.7**
MO4	0.74	0.64	0.68	0.77										5.0	6.0	8.7	**3.0**	**4.9**
MO5	60.15	0.35	0.41	0.55	0.35	100	0.052	7.9	1370	0.065	15	3.8	6.0	13.9	4.2	6.1	**106.0**	**202.8**
MO6	0.63	0.12	0.20	0.43										5.0	6.0	8.7	**0.8**	**2.4**
MO7a	65.57	0.27	0.34	0.49	0.27	100	0.120	6.6	1935	0.070	15	4.0	8.1	14.8	4.1	6.0	**92.2**	**191.6**
MO7b	18.40	0.30	0.37	0.52	0.30	100	0.102	6.7	840	0.105	15	4.9	2.9	9.6	4.9	7.0	**33.6**	**67.2**
MO8	1.38	0.51	0.56	0.67										5.0	6.0	8.7	**4.7**	**8.0**
MO10	60.47	0.14	0.20	0.39	0.14	300	0.077	15.4	1480	0.044	15	3.1	7.8	23.2	3.3	4.8	**40.8**	**113.3**
MO11	3.00	0.65	0.68	0.77										5.0	6.0	8.7	**12.4**	**20.1**
MO13	4.66	0.44	0.49	0.65	0.44	100	0.040	7.6	1115	0.032	15	2.7	6.9	14.5	4.2	6.0	**9.6**	**18.1**

* 5 MINUTE TIME OF CONCENTRATION - MINIMUM

MONUMENT RIDGE EAST - FILING NO. 1
FINAL DRAINAGE REPORT
(Basin Runoff Calculations - Future)

					Overland Flow				Channel Flow					Travel Time (T_t)	Intensity		Total Flows	
Basin	Area Total (acres)	C_5	C_{10}	C_{100}	C_5	Length (ft)	Slope (ft/ft)	T_C (min)	Length (ft)	Slope (ft/ft)	Cv	Velocity (fps)	T_t (min)	TOTAL* (min)	I_{10} (in/hr)	I_{100} (in/hr)	Q_{10} (c.f.s.)	Q_{100} (c.f.s.)
A1F	6.55	0.51	0.55	0.66										5.0	6.0	8.7	**21.8**	**37.7**
A2F	2.41	0.31	0.37	0.52										5.0	6.0	8.7	**5.3**	**10.9**
A3F	1.18	0.37	0.42	0.56										5.0	6.0	8.7	**3.0**	**5.7**
A4F	4.65	0.58	0.62	0.72	ASSUME TC FOR ALL ON-SITE FUTURE BASINS IS 5 MINUTES (CONSERVATIVE APPROACH)									5.0	6.0	8.7	**17.4**	**29.0**
A5F	2.22	0.48	0.53	0.64										5.0	6.0	8.7	**7.1**	**12.4**
B1F	5.02	0.55	0.59	0.70										5.0	6.0	8.7	**17.9**	**30.3**
B2F	0.31	0.46	0.51	0.63										5.0	6.0	8.7	**0.9**	**1.7**
B3F	0.36	0.67	0.70	0.78										5.0	6.0	8.7	**1.5**	**2.4**
B4F	0.45	0.62	0.65	0.74										5.0	6.0	8.7	**1.8**	**2.9**

					Overland Flow				Channel Flow					Travel Time (T_t)	Intensity		Total Flows	
Basin	Area Total (acres)	C_5	C_{10}	C_{100}	C_5	Length (ft)	Slope (ft/ft)	T_C (min)	Length (ft)	Slope (ft/ft)	Cv	Velocity (fps)	T_t (min)	TOTAL* (min)	I_{10} (in/hr)	I_{100} (in/hr)	Q_{10} (c.f.s.)	Q_{100} (c.f.s.)
B5F	1.11	0.67	0.70	0.78	ASSUME TC FOR ALL ON-SITE FUTURE BASINS IS 5 MINUTES (CONSERVATIVE APPROACH)									5.0	6.0	8.7	**4.7**	**7.5**
B6F	3.38	0.57	0.61	0.71										5.0	6.0	8.7	**12.5**	**21.0**
B7F	0.74	0.55	0.59	0.69										5.0	6.0	8.7	**2.6**	**4.5**
B8F	0.20	0.62	0.65	0.74										5.0	6.0	8.7	**0.8**	**1.3**
B9F	1.17	0.73	0.76	0.83										5.0	6.0	8.7	**5.4**	**8.5**
C1F	9.66	0.66	0.70	0.79										5.0	6.0	8.7	**40.7**	**65.9**
D1F	7.42	0.48	0.54	0.70										5.0	6.0	8.7	**24.3**	**45.0**
D2F	0.61	0.52	0.58	0.72										5.0	6.0	8.7	**2.1**	**3.8**
O1	7.52	0.11	0.18	0.37	0.11	130	0.080	10.2	480	0.054	10	2.3	3.4	13.7	4.3	6.1	**5.8**	**17.2**
O2	0.51	0.66	0.69	0.78										5.0	6.0	8.7	**2.1**	**3.5**
O3	1.37	0.45	0.50	0.61	0.45	300	0.083	10.1						10.1	4.8	6.9	**3.3**	**5.7**
O4	0.74	0.64	0.68	0.77										5.0	6.0	8.7	**3.0**	**4.9**

* 5 MINUTE TIME OF CONCENTRATION - MINIMUM

MONUMENT RIDGE EAST - FILING NO. 1
FINAL DRAINAGE REPORT
(Surface Routing Summary - Interim)

					Intensity		*Flow*		
Design Point	***Contributing Basins/Design Points***	***Equivalent CA_{10}***	***Equivalent CA_{100}***	***Routed T_C***	***I_{10}***	***I_{100}***	***Q_{10}***	***Q_{100}***	***Comments***
F0	MO2	0.35	0.40	5.0	6.0	8.7	**2.1**	**3.5**	existing 36" RCP culvert
F1	AA,DP F0	2.96	5.97	23.2	3.3	4.8	**9.9**	**28.7**	proposed 2-12' D-10-R inlets, future Q100=29cfs at DPX1, size for future condition
F2	BB	0.41	0.96	9.8	4.9	7.0	**2.0**	**6.7**	proposed 18" RCP
F3	DP F1, DP F2,CC	4.32	7.92	23.2	3.3	4.8	**14.5**	**38.1**	flow to pond 1, unrouted
F4A	MO3	0.69	0.83	10.1	4.8	6.9	**3.3**	**5.7**	existing 36" RCP culvert
F4B	MO4	0.50	0.57	5.0	6.0	8.7	**3.0**	**4.9**	existing type C inlet
F4C	DP F4A, DP F4B, DD	4.39	6.88	13.2	4.3	6.2	**19.0**	**42.9**	proposed 2-8' D-10-R inlets, future Q100=21cfs at DPX5, size for interim condition
F5	EE	0.73	1.00	9.5	4.9	7.1	**3.6**	**7.0**	proposed triple type 16 inlet, future Q100=7.5cfs at DPX7, size for future condition
F6	DP F4C,DP F5,GG	6.47	10.26	13.2	4.3	6.2	**28.1**	**64.0**	flow to pond 2, unrouted
F7	FF,HH	3.48	5.17	13.6	4.3	6.2	**14.9**	**31.9**	proposed 2-16' D-10-R inlets, future Q100=45cfs at DPX9, size for future condition
F8	II	0.31	0.45	10.6	4.7	6.8	**1.5**	**3.1**	proposed 10' D-10-R inlet, future Q100=3.8cfs at DPX10, size for future condition
F9	POND 1 OUT,MO5	Flows added (i.e. - not routed)					**59.2**	**118.3**	Misty Ac 1 Pond Attenuation of Q10=58cfs, Q100=130cfs (per MDDP), yields Q10out=59.2cfs and Q100=118.3cfs)
F10	MO6	0.13	0.27	5.0	6.0	8.7	**0.8**	**2.4**	proposed type C inlet
F11	MO7A, MO7B	29.16	41.75	21.0	3.5	5.1	**102.6**	**211.4**	low point collection structure
F12	DP F9, DP F10, DP F11	Flows added (i.e. - not routed)					**162.6**	**332.0**	proposed 78" RCP
F13	50% MD2	2.78	3.68	6.3	5.6	8.1	**15.6**	**29.8**	proposed 2-12' D-10-R inlets
F14	50% MD2	2.78	3.68	12.5	4.4	6.4	**12.3**	**23.4**	proposed 2-12' D-10-R inlets
F15	DP F7, DP F13, DP F14	8.92	12.25	13.6	4.3	6.2	**38.2**	**75.5**	flow to pond 4 (south)
F16	DP F8, DP F15	9.68	13.49	13.6	4.3	6.2	**41.5**	**83.1**	total flow to pond 4

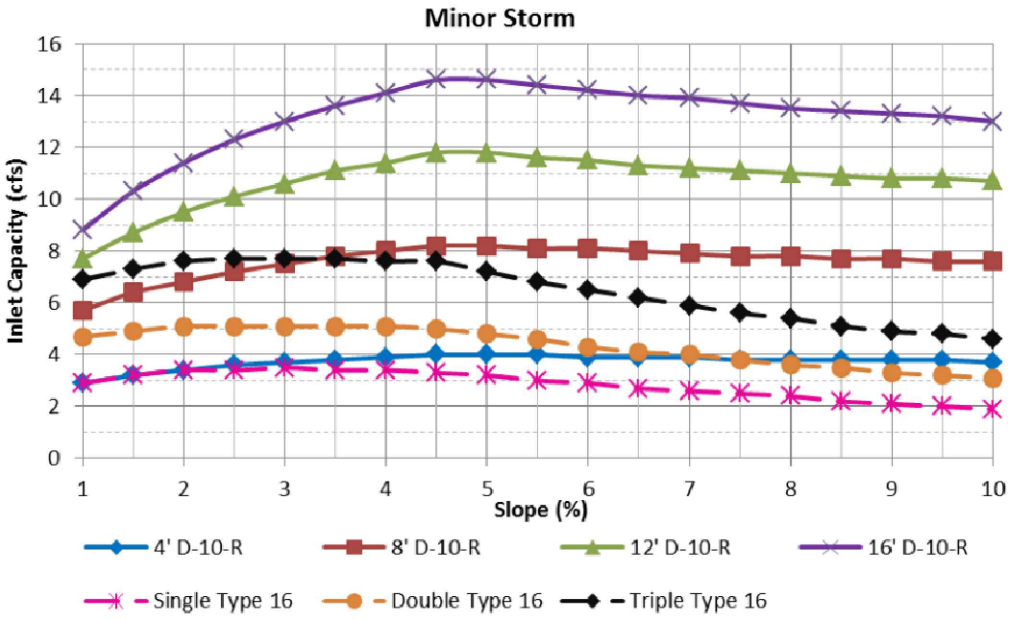
F17	POND 2 OUT,POND 4 OUT	Flows added (i.e. - not routed)					**25.7**	**67.2**	flow to depression area
F18	ME	1.55	2.01	5.0	6.0	8.7	**9.3**	**17.4**	proposed 16' D-10-R inlet
F19	DP F9,DP F10,DP F11, POND 5 OUT	Flows added (i.e. - not routed)					**161.6**	**324.5**	flow to depression area
F20	MO8	0.77	0.92	5.0	6.0	8.7	**4.7**	**8.0**	existing culvert, unk size
F21	POND 1 OUT, POND 2 OUT,POND 4 OUT, POND 5 OUT,DP F9,DP F10,DP F11,MO8,JJ	Flows added (i.e. - not routed)					**200.8**	**420.6**	Total flow routed to project outfall under Palmer Divide Road. The flows listed have already taken into consideration the future pond release values and flows entering the site from the east. i.e. - these values reflect future conditions after the entire Monument Ridge East project is developed.
F22	POND 1 OUT, POND 2 OUT,POND 4 OUT, POND 5 OUT,DP F9,DP F10,DP F11,MO8,JJ	Flows added (i.e. - not routed)					**200.8**	**420.6**	outfall location (design point for report reference only)
F23	KK	0.26	0.42	10.1	4.8	6.9	**1.2**	**2.9**	existing type C inlet
F24	LL	0.21	0.28	6.3	5.6	8.1	**1.2**	**2.3**	proposed 2-4' D-10-R inlets
F25	MO10	12.20	23.55	23.2	3.3	4.8	**40.8**	**113.3**	existing 48" RCP culvert
F26	MO11	2.05	2.32	5.0	6.0	8.7	**12.4**	**20.1**	existing dual type C inlet
F27	DP F25,DP F26	14.25	25.87	23.2	3.3	4.8	**47.6**	**124.4**	design Point F26 outfall
F28	DP F23, DP F24,DP F25, DP F26,MM	17.69	31.99	24.2	3.3	4.7	**57.9**	**150.5**	existing 48" RCP culvert
F29	DP F28,M013	20.00	35.00	24.2	3.3	4.7	**65.4**	**164.7**	existing 48" RCP culvert

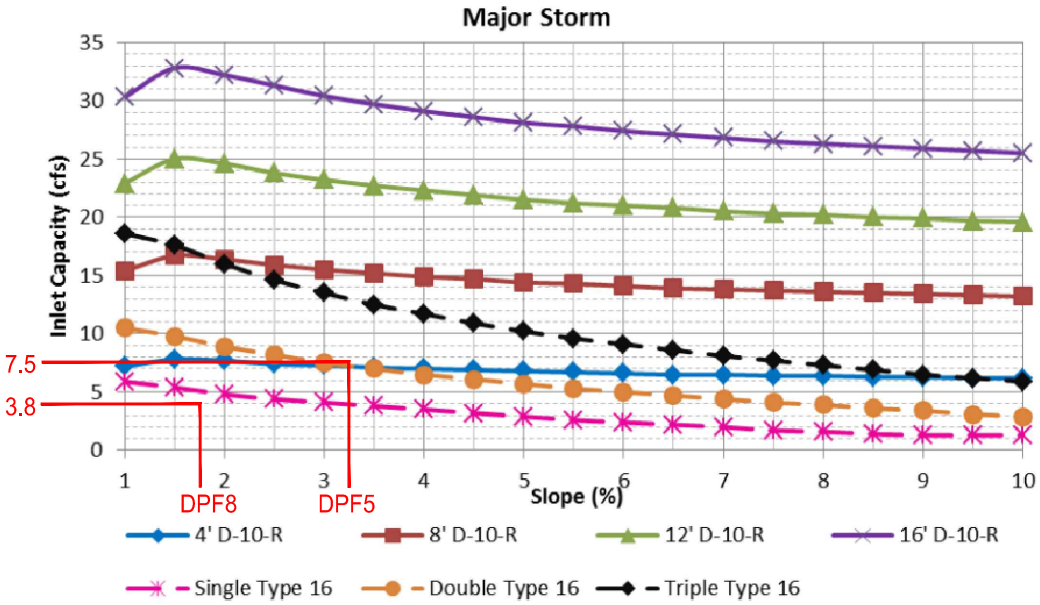
MONUMENT RIDGE EAST - FILING NO. 1
FINAL DRAINAGE REPORT
(Surface Routing Summary - Future)

					Intensity		*Flow*		
Design Point	***Contributing Basins***	***Equivalent CA_{10}***	***Equivalent CA_{100}***	***Routed T_C***	***I_{10}***	***I_{100}***	***Q_{10}***	***Q_{100}***	***Interim vs. Future Comparison Comments for Inlet and Pipe Sizing***
X1	A4F	2.88	3.34	5.0	6.0	8.7	**17.4**	**29.0**	DP F1 lower, use future values
X2	O1,A3F	1.85	3.46	13.7	4.3	6.1	**7.9**	**21.2**	DP F2 lower, use future values
X3	A2F,O2,O3,O4	2.43	3.05	5.0	6.0	8.7	**14.6**	**26.5**	No flow for interim, use future values
X4	B6F	2.07	2.42	5.0	6.0	8.7	**12.5**	**21.0**	DP F4c higher, use interim values
X5	B1F	2.97	3.49	5.0	6.0	8.7	**17.9**	**30.3**	No flow for interim, use future values
X6	B2F,B3F,B4F	0.70	0.81	5.0	6.0	8.7	**4.2**	**7.0**	No flow for interim, use future values
X7	B5F	0.78	0.87	5.0	6.0	8.7	**4.7**	**7.5**	DP F5 lower, use future values
X8	B1F,B2F,B3F,B4F,B5F, B6F,B7F,B8F,B9F	7.97	9.21	5.0	6.0	8.7	**48.1**	**80.0**	DP F6 lower, use future values
X9	D1F	4.02	5.19	5.0	6.0	8.7	**24.3**	**45.0**	DP F7 lower, use future values
X10	D2F	0.35	0.44	5.0	6.0	8.7	**2.1**	**3.8**	DP F8 lower, use future values

Figure 8-6. Inlet Capacity Chart Continuous Grade Conditions, Collector (without parking)

Street Section Data: Street Width Flowline to Flowline = 32'
Type of Curb and Gutter: D-10-R = 8" vertical
Type 16 = 6" vertical





The standard street section parameters as defined in Chapter 7 must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets. The maximum spread width is limited by the curb height based on no curb overtopping during a minor storm and flow being contained within the public right-of-way during the major storm. Calculations were done using UD-Inlet 3.00.xls, Mar., 2011 with the default clogging factors.

Figure 8-12. Inlet Capacity Chart Sump Conditions, Curb Opening (D-10-R) Inlet

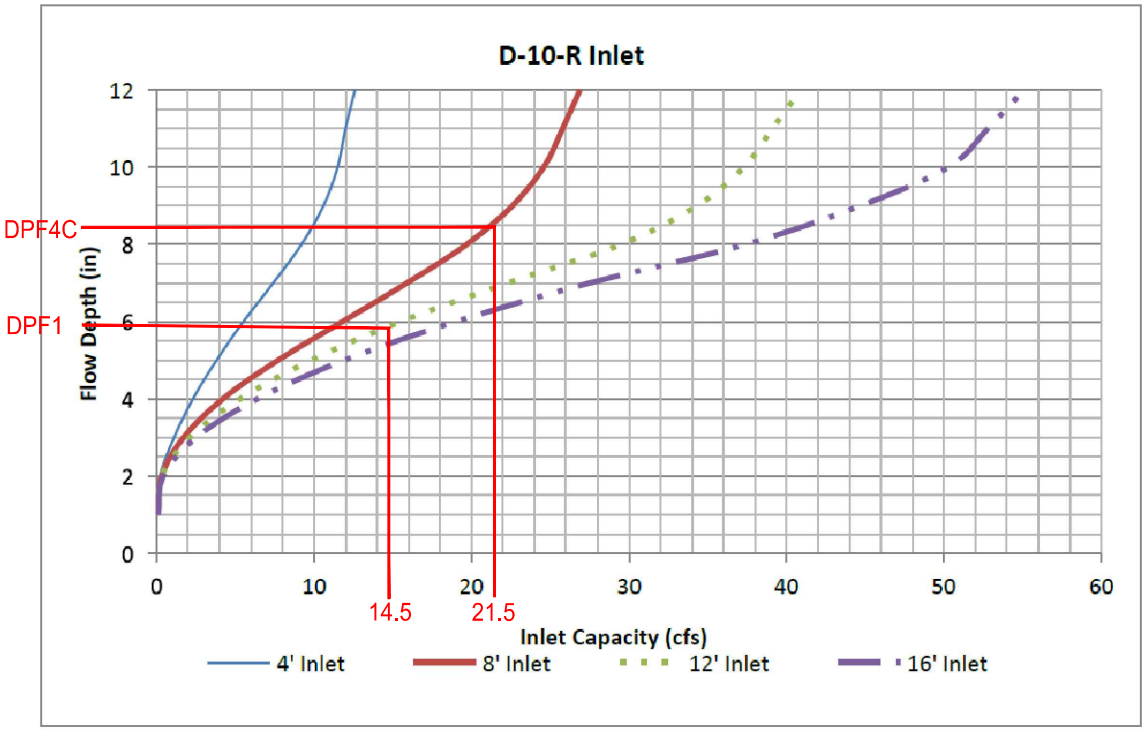


Figure 8-12. Inlet Capacity Chart Sump Conditions, Curb Opening (D-10-R) Inlet

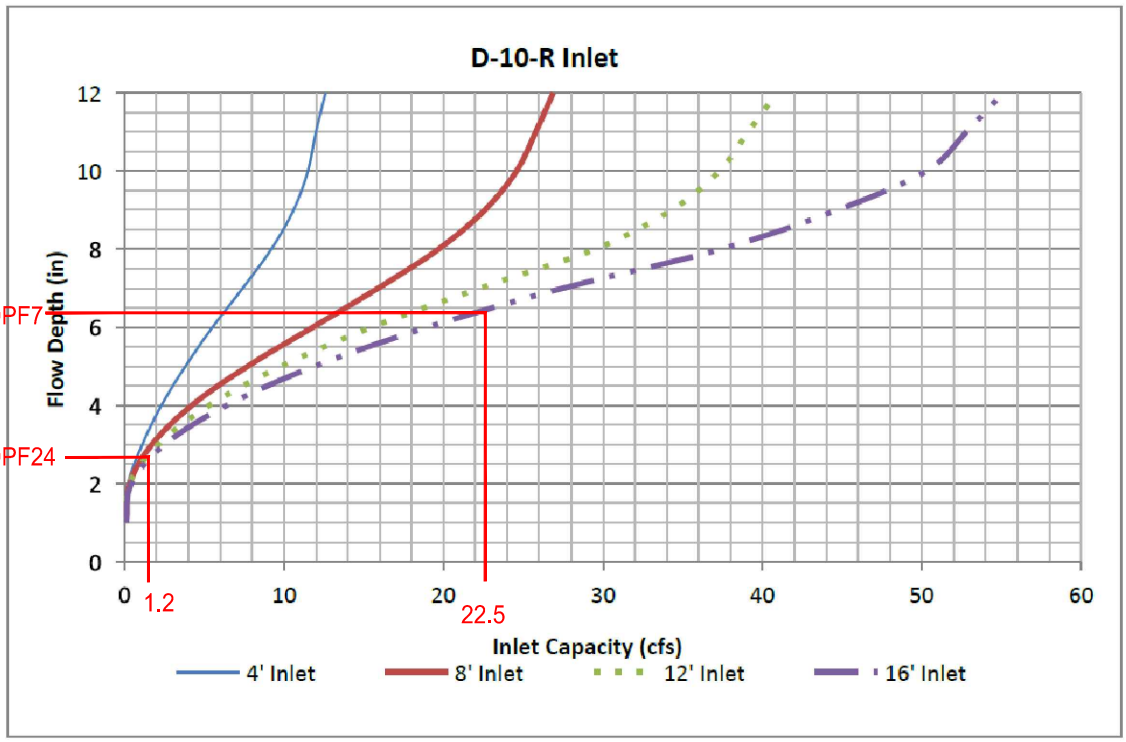
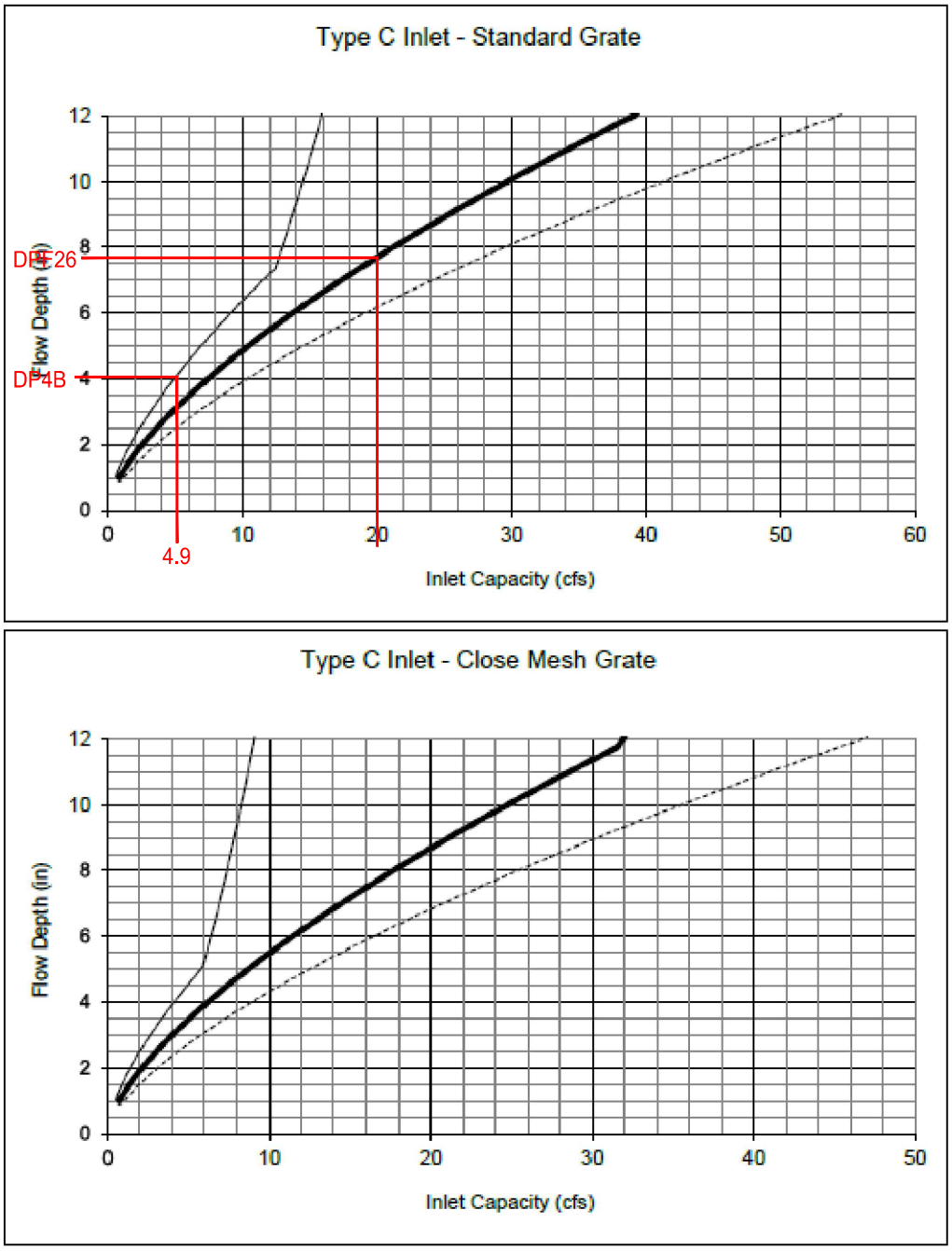


Figure 8-10. Inlet Capacity Chart Sump Conditions, Area (Type C) Inlet



Notes:
1. The standard inlet parameters must apply to use these charts.

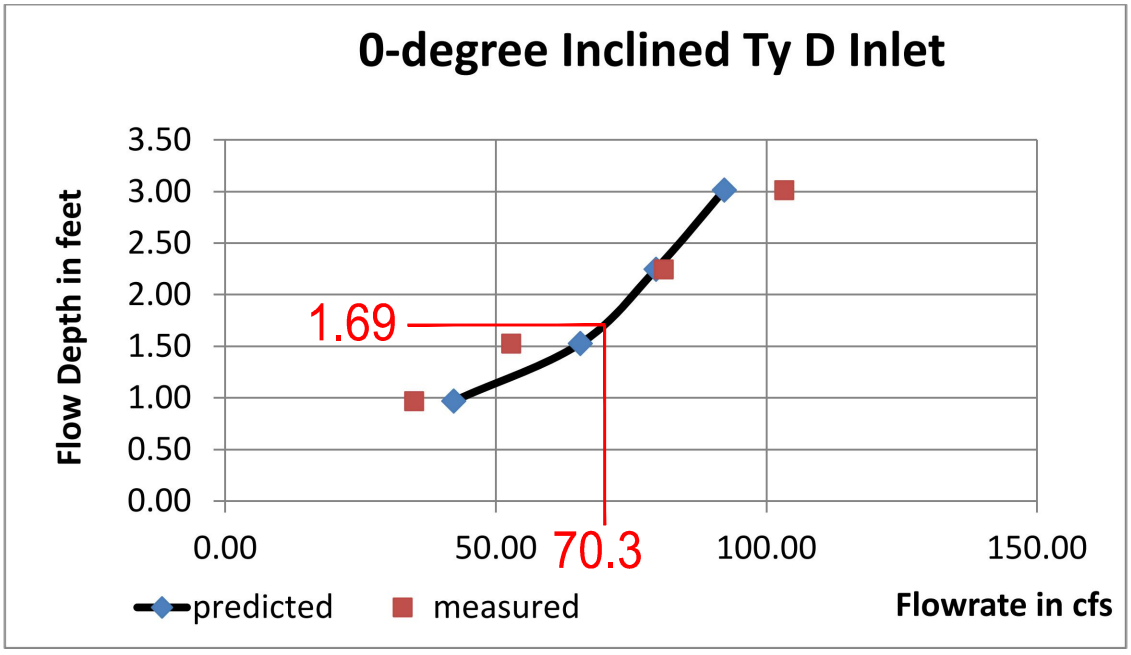
DESIGN POINT F11
COLLECTION STRUCTURE

HYDRAULIC CAPACITY of CDOT TYPE C and D AREA INLETS
(Installed in flat, depressed, and inclined configurations)

Prepared by
James C.Y. Guo, PhD and PE
Submitted to
Urban Drainage and Flood Control District,
Contract Agreement 10.07-04
Date: October 2011 (Draft)
Jan 25, 2012 (Revised)
March 5, 2012 (Revised)

Width of Grate	B	3.00		(input)
Inclined Length of Grate	L	6.00	ft	
Opening Ratio of Grate	n	0.70		(input)
Grate Discharge Coeff	Cd	0.79		(input)
Height of Box	Hb=	0.00	ft	
Inclined Angle	@	0.00	degree	(input)
Orifice/ Weir Coeff	Co=	0.53	Cw=	1.69
Orientation	Ko=	0		

Water Depth H	ubmerged Si Weir Length	Inclined Left S Weir	Inclined Right S Weir	Base Weir	Total Weir	Total Orifice	Predcited Flow	Observed Flow	Error	Sq error
ft	ft (X)	cfs	cfs	cfs	cfs	cfs	cfs	cfs	%	cfs^2
0.97	6.00	16.89	16.89	8.44	42.22	52.28	**42.22**	**34.9**	-20.97%	53.58
1.53	6.00	33.41	33.41	16.70	83.52	65.63	**65.63**	**52.8**	-24.27%	164.26
2.25	6.00	59.63	59.63	29.82	149.08	79.62	**79.62**	**81.0**	1.73%	1.96
3.02	6.00	92.69	92.69	46.34	231.71	92.22	**92.22**	**103.3**	10.72%	122.57
										342.37



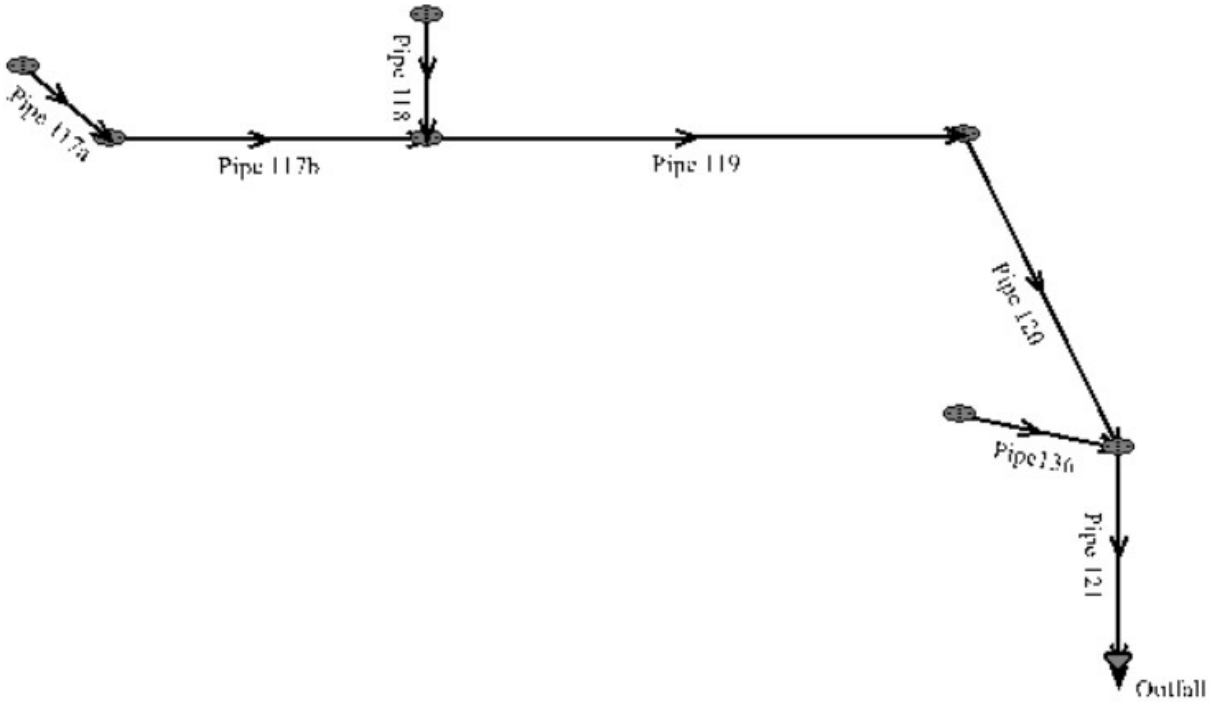
Q100 = 211CFS DIVIDED BY THREE INLETS = 70.3CFS EACH

HYDRAULIC GRADE LINE CALCULATIONS

9/22/26

System: CD Stm-01, 02 and 12 100yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7259.69

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	7263.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 121	7268.01	71.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 120	7268.01	28.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 119	7273.55	28.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 117b	7277.05	28.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 117a	7278.20	28.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 118	7274.05	5.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pipe136	7268.01	43.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe 121	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.20	
Pipe 120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.00	
Pipe 119	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.00	
Pipe 117b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.00	
Pipe 117a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.00	
Pipe 118	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.50	
Pipe136	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Manning s n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
Pipe 121	64.39	7257.49	2.4	7259.04	0.013	0.03	0.00	CIRCULAR	48.00 in	48.00 in
Pipe 120	194.35	7260.11	1.5	7263.03	0.013	0.05	0.25	CIRCULAR	36.00 in	36.00 in

Pipe 119	495.19	7263.31	0.7	7266.78	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
Pipe 117b	251.64	7267.03	1.3	7270.30	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
Pipe 117a	53.11	7270.58	1.1	7271.16	0.013	0.38	0.00	CIRCULAR	36.00 in	36.00 in
Pipe 118	16.00	7268.53	1.5	7268.77	0.013	1.32	1.00	CIRCULAR	24.00 in	24.00 in
Pipe136	36.40	7260.04	0.8	7260.33	0.013	1.19	1.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
Pipe 121	223.13	17.76	30.61	8.42	18.64	15.78	2.59	Supercritical	71.20	0.00	
Pipe 120	81.91	11.59	20.54	6.72	14.51	10.49	1.94	Supercritical Jump	28.00	0.60	
Pipe 119	55.95	7.92	20.54	6.72	18.01	7.92	1.29	Supercritical	28.00	0.00	
Pipe 117b	76.25	10.79	20.54	6.72	15.10	9.96	1.80	Supercritical	28.00	0.00	
Pipe 117a	70.14	9.92	20.54	6.72	15.82	9.37	1.65	Supercritical	28.00	0.00	
Pipe 118	27.78	8.84	9.93	4.48	7.24	6.88	1.84	Supercritical	5.50	0.00	
Pipe136	59.82	8.46	25.69	8.00	22.66	9.22	1.28	Supercritical	43.20	0.00	

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

- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
Pipe 121	71.20	CIRCULAR	48.00 in	48.00 in	33.00 in	33.00 in	48.00 in	48.00 in	12.57	Exceeds max. Depth/Rise
Pipe 120	28.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise
Pipe 119	28.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise
Pipe 117b	28.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise
Pipe 117a	28.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise
Pipe 118	5.50	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe136	43.20	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise

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

Grade Line Summary:

Tailwater Elevation (ft): 7259.69

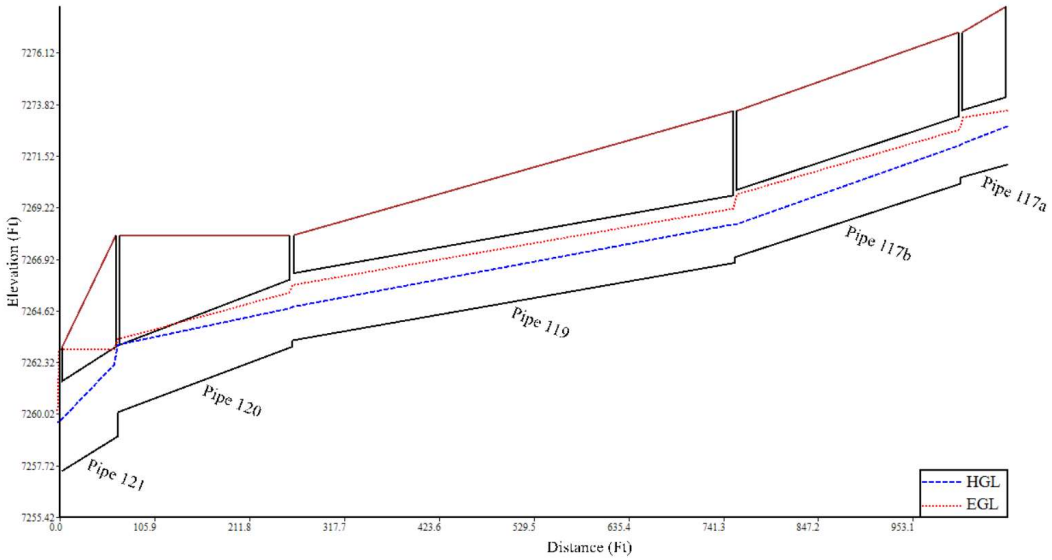
	Invert Elev.	**Downstream Manhole Losses**	**HGL**	**EGL**

Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pipe 121	7257.49	7259.04	0.00	0.00	7259.69	7262.24	7262.92	0.00	7262.92
Pipe 120	7260.11	7263.03	0.01	0.44	7263.12	7264.74	7263.37	2.08	7265.44
Pipe 119	7263.31	7266.78	0.01	0.00	7264.81	7268.49	7265.79	3.40	7269.19
Pipe 117b	7267.03	7270.30	0.01	0.00	7268.50	7272.01	7269.83	2.89	7272.71
Pipe 117a	7270.58	7271.16	0.09	0.00	7272.10	7272.87	7273.26	0.32	7273.57
Pipe 118	7268.53	7268.77	0.06	0.20	7269.13	7269.60	7269.87	0.04	7269.91
Pipe136	7260.04	7260.33	0.69	0.00	7263.03	7263.03	7263.61	0.07	7263.67

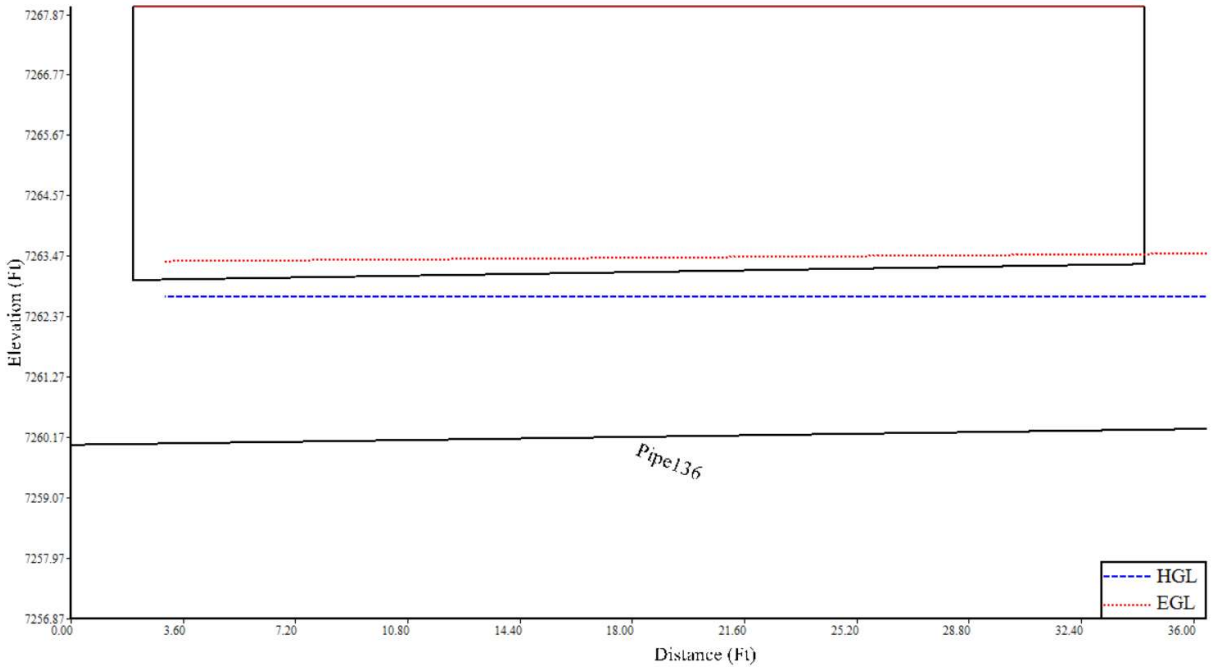
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):

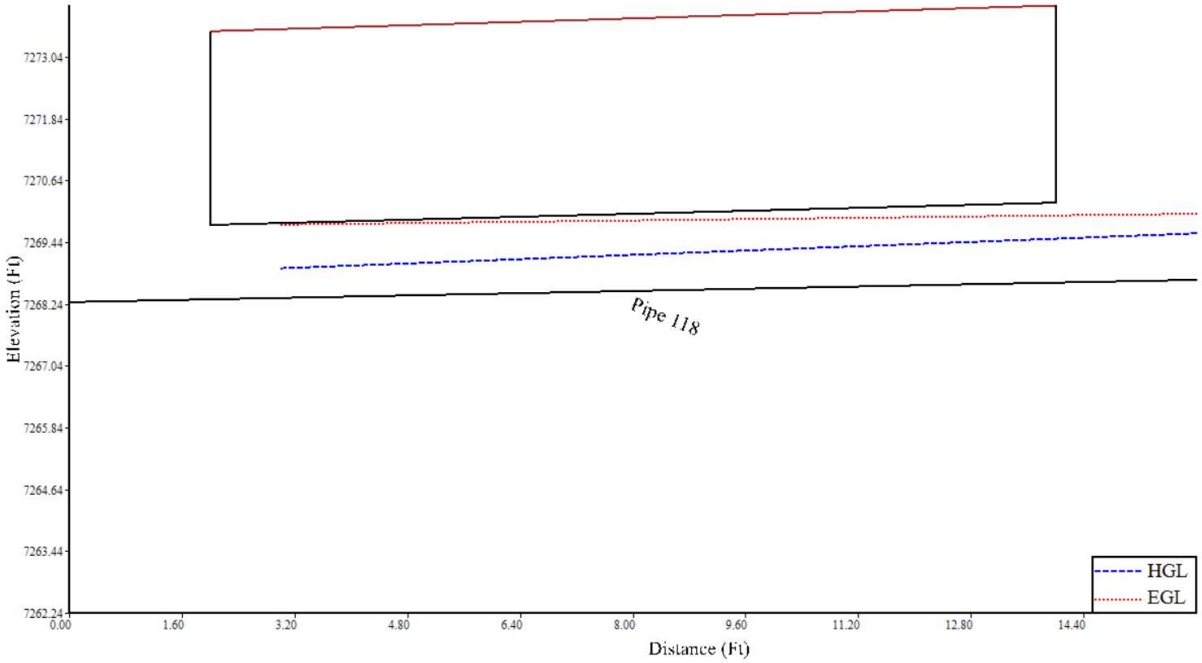
Stm-01


Elevation (Ft)
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7273.82
7271.52
7269.22
7266.92
7264.62
7262.32
7260.02
7257.72
7255.42
0.0
105.9
211.8
317.7
423.6
529.5
635.4
741.3
847.2
953.1
Distance (Ft)
Pipe 117a
Pipe 117b
Pipe 119
Pipe 120
Pipe 121
HGL
EGL

Stm-02

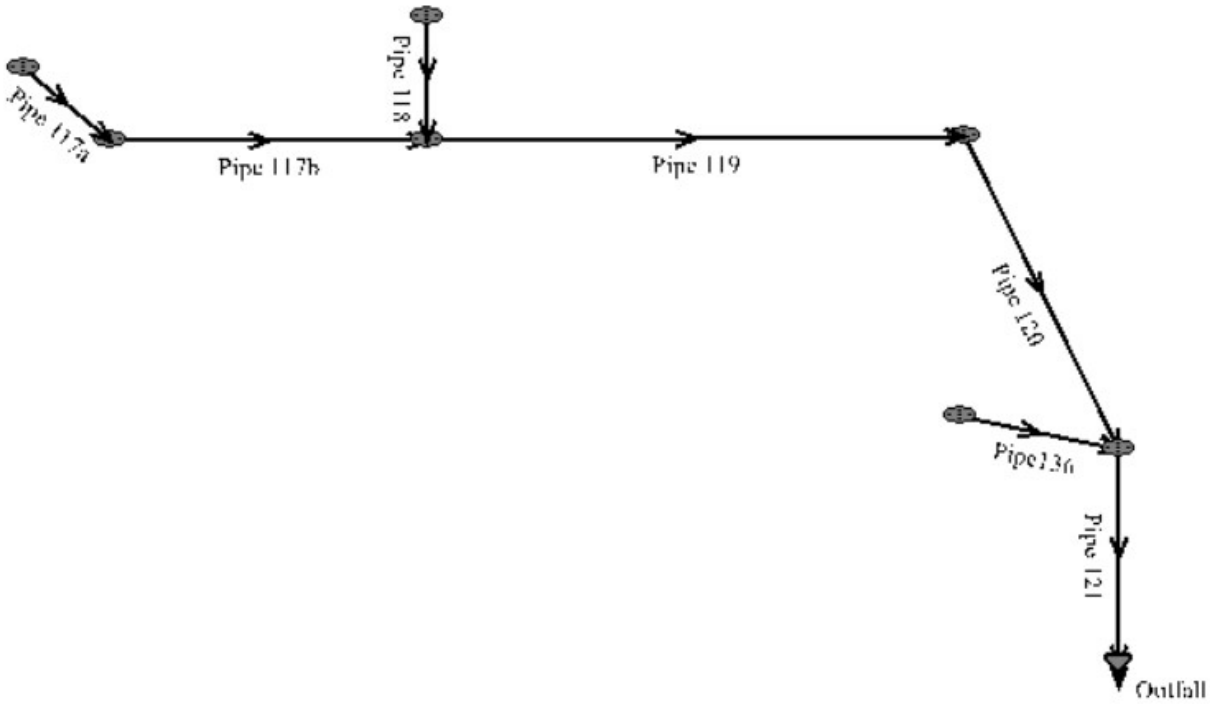

Elevation (Ft)
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7266.77
7265.67
7264.57
7263.47
7262.37
7261.27
7260.17
7259.07
7257.97
7256.87
0.00
3.60
7.20
10.80
14.40
18.00
21.60
25.20
28.80
32.40
36.00
Distance (Ft)
Pipe136
HGL
EGL

Stm-12


7273.04
7271.84
7270.64
7269.44
7268.24
7267.04
7265.84
7264.64
7263.44
7262.24
Elevation (Ft)
Pipe 118
0.00
1.60
3.20
4.80
6.40
8.00
9.60
11.20
12.80
14.40
Distance (Ft)
HGL
EGL

System: CD Stm-01, 02 and 12 10yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 10
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7259.21

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	7263.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 121	7268.01	19.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 120	7268.01	7.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 119	7273.55	7.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 117b	7277.05	7.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 117a	7278.20	7.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 118	7274.05	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe136	7268.01	12.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution	Total Design Flow	

Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe 121	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.70	
Pipe 120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.60	
Pipe 119	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.60	
Pipe 117b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.60	
Pipe 117a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.60	
Pipe 118	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	
Pipe136	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pipe 121	64.39	7257.49	2.4	7259.04	0.013	0.03	0.00	CIRCULAR	48.00 in	48.00 in
Pipe 120	194.35	7260.11	1.5	7263.03	0.013	0.05	0.25	CIRCULAR	36.00 in	36.00 in
Pipe 119	495.19	7263.31	0.7	7266.78	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
Pipe 117b	251.64	7267.03	1.3	7270.30	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
Pipe 117a	53.11	7270.58	1.1	7271.16	0.013	0.38	0.00	CIRCULAR	36.00 in	36.00 in

Pipe 118	16.00	7268.53	1.5	7268.77	0.013	1.32	1.00	CIRCULAR	24.00 in	24.00 in
Pipe136	36.40	7260.04	0.8	7260.33	0.013	1.19	1.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
Pipe 121	223.13	17.76	15.67	5.53	9.64	10.95	2.57	Supercritical	19.70	0.00	
Pipe 120	81.91	11.59	10.42	4.48	7.41	7.25	1.94	Supercritical	7.60	0.00	
Pipe 119	55.95	7.92	10.42	4.48	8.96	5.53	1.34	Supercritical	7.60	0.00	
Pipe 117b	76.25	10.79	10.42	4.48	7.68	6.89	1.81	Supercritical	7.60	0.00	
Pipe 117a	70.14	9.92	10.42	4.48	8.00	6.50	1.67	Supercritical	7.60	0.00	
Pipe 118	27.78	8.84	2.24	2.02	1.76	2.91	1.63	Supercritical	0.30	0.00	Velocity is Too Low
Pipe136	59.82	8.46	13.31	5.14	11.03	6.64	1.44	Supercritical	12.20	0.00	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
Pipe 121	19.70	CIRCULAR	48.00 in	48.00 in	21.00 in	21.00 in	48.00 in	48.00 in	12.57	Exceeds max. Depth/Rise
Pipe 120	7.60	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise
Pipe 119	7.60	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise
Pipe 117b	7.60	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise
Pipe 117a	7.60	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise
Pipe 118	0.30	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe136	12.20	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise

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

Grade Line Summary:

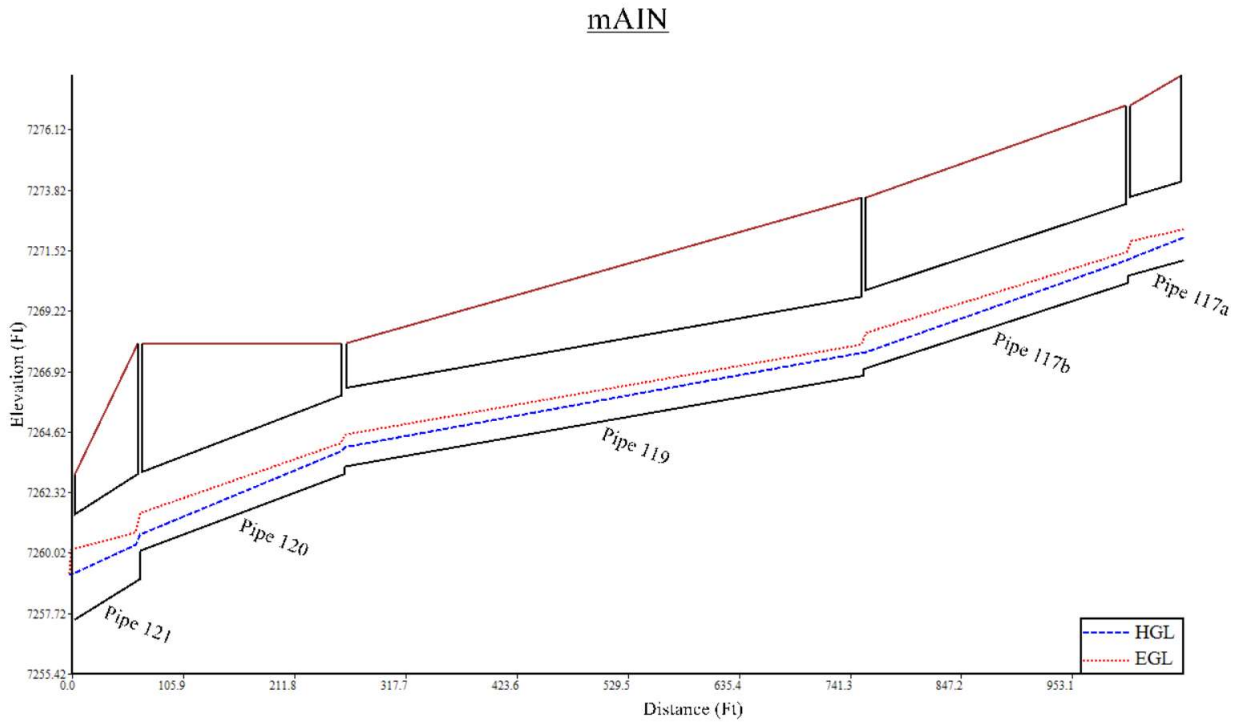
Tailwater Elevation (ft): 7259.21

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Pipe 121	7257.49	7259.04	0.00	0.00	7259.21	7260.35	7260.16	0.66	7260.82

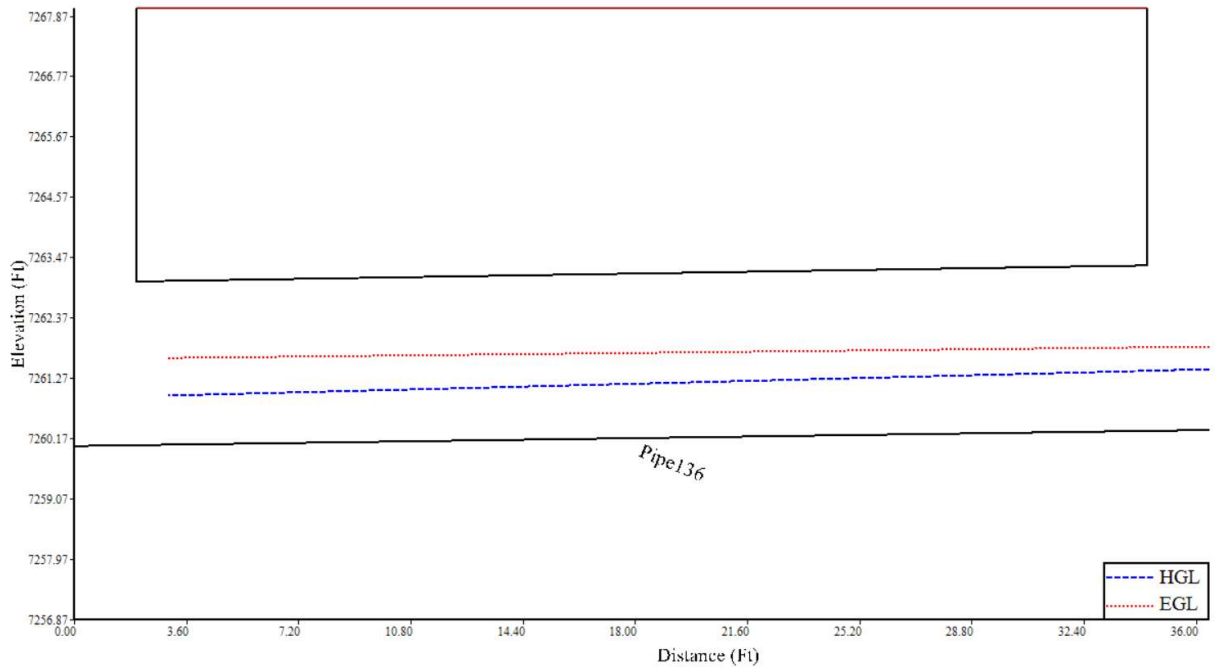
Pipe 120	7260.11	7263.03	0.00	0.03	7260.73	7263.90	7261.55	2.66	7264.21
Pipe 119	7263.31	7266.78	0.00	0.00	7264.06	7267.65	7264.54	3.42	7267.96
Pipe 117b	7267.03	7270.30	0.00	0.00	7267.67	7271.17	7268.41	3.07	7271.48
Pipe 117a	7270.58	7271.16	0.01	0.00	7271.24	7272.03	7271.90	0.44	7272.34
Pipe 118	7268.53	7268.77	0.00	0.02	7268.68	7268.96	7268.81	0.21	7269.02
Pipe136	7260.04	7260.33	0.06	0.00	7260.96	7261.44	7261.64	0.21	7261.85

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

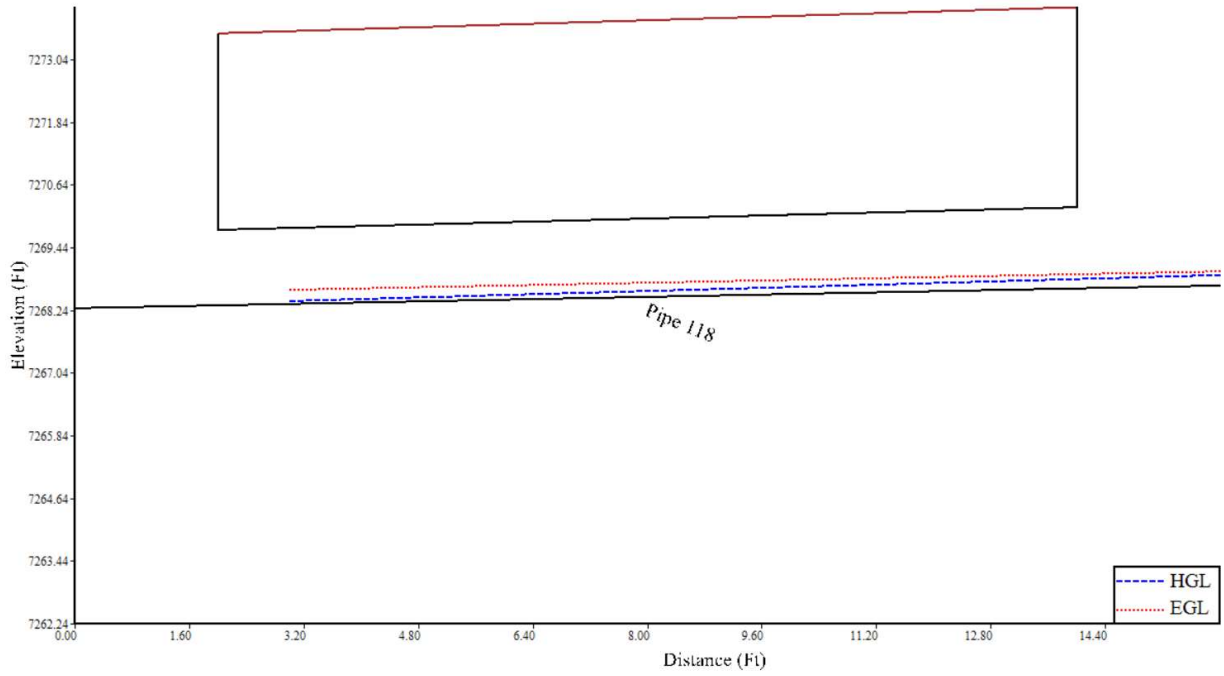
Profile(s):



Stm-02

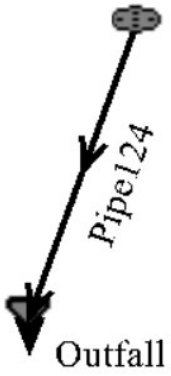

7267.87
7266.77
7265.67
7264.57
7263.47
7262.37
7261.27
7260.17
7259.07
7257.97
7256.87
Elevation (Ft)
Pipe136
HGL
EGL
0.00
3.60
7.20
10.80
14.40
18.00
21.60
25.20
28.80
32.40
36.00
Distance (Ft)

Stm-12


7273.04
7271.84
7270.64
7269.44
7268.24
7267.04
7265.84
7264.64
7263.44
7262.24
Elevation (Ft)
Pipe 118
HGL
EGL
0.00
1.60
3.20
4.80
6.40
8.00
9.60
11.20
12.80
14.40
Distance (Ft)

System: CD Stm-03 100yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7267.18

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	7266.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe124	7273.56	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
Pipe124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.80	Surface Water Present (Downstream)

Sewer Input Summary:

	Elevation	Loss Coefficients	Given Dimensions

Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pipe124	80.56	7263.00	7.0	7268.64	0.013	0.00	0.00	CIRCULAR	18.00 in	18.00 in

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Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pipe124	27.87	15.77	8.94	4.34	4.49	11.03	3.78	Supercritical Jump	3.80	39.00	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pipe124	3.80	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.

- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

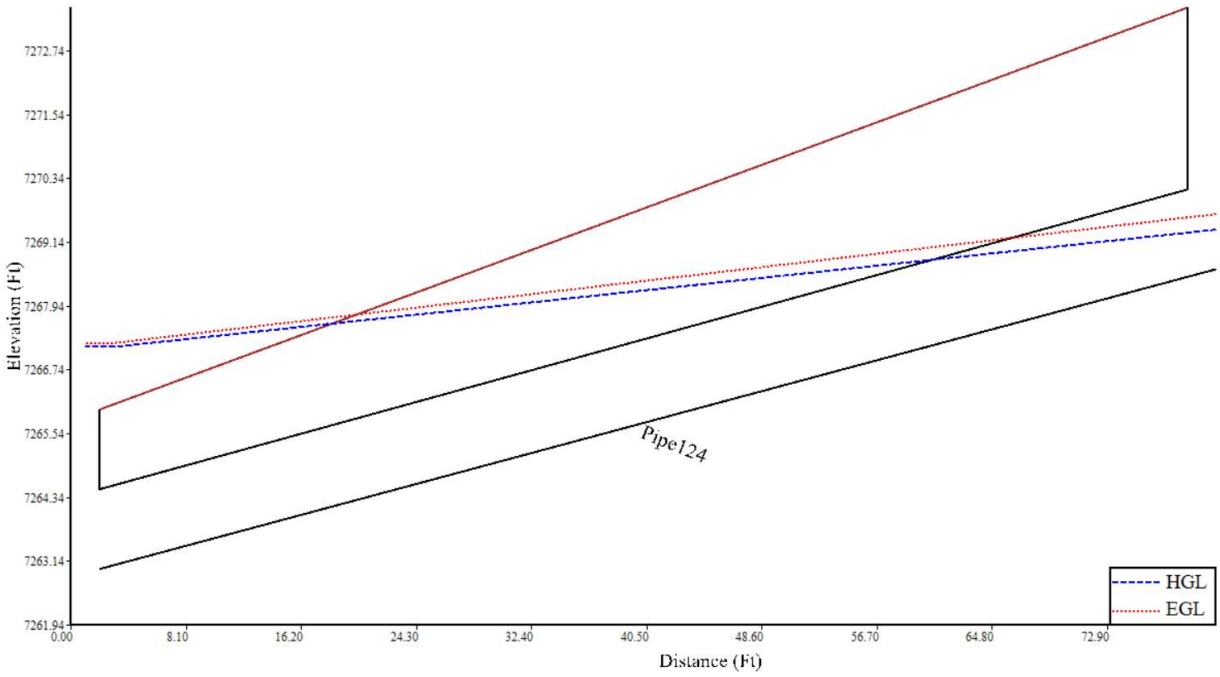
Tailwater Elevation (ft): 7267.18

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Pipe124	7263.00	7268.64	0.00	0.00	7267.18	7269.39	7267.25	2.43	7269.68

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

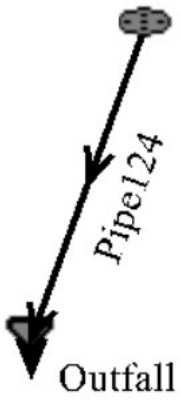
Profile(s):

Stm-03


7272.74
7271.54
7270.34
7269.14
7267.94
7266.74
7265.54
7264.34
7263.14
7261.94
Elevation (Ft)
0.00
8.10
16.20
24.30
32.40
40.50
48.60
56.70
64.80
72.90
Distance (Ft)
Pipe124
HGL
EGL

System: CD Stm-03 10yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 10
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7266.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	7266.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe124	7273.56	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
Pipe124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.10	Surface Water Present (Downstream)

Sewer Input Summary:

	Elevation	Loss Coefficients	Given Dimensions

Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pipe124	80.56	7263.00	7.0	7268.64	0.013	0.00	0.00	CIRCULAR	18.00 in	18.00 in

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Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pipe124	27.87	15.77	6.56	3.60	3.34	9.28	3.71	Supercritical Jump	2.10	28.72	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pipe124	2.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.

- All hydraulics where calculated using the 'Used' parameters.

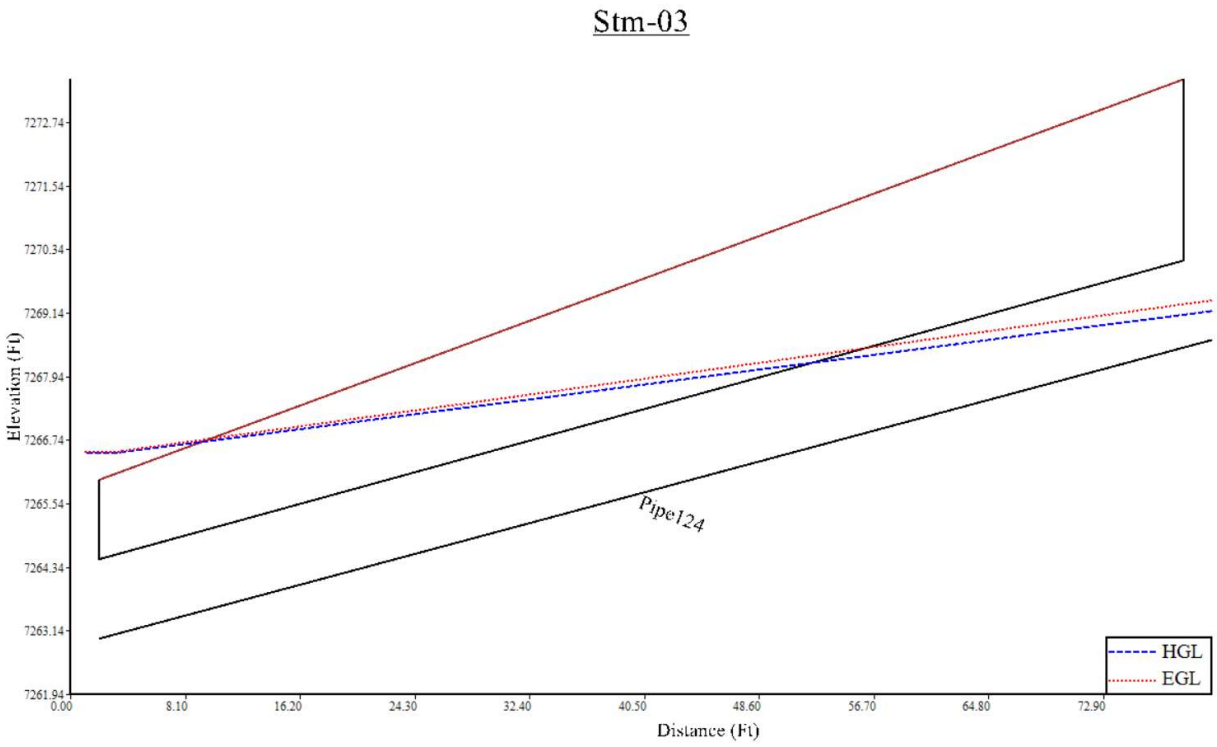
Grade Line Summary:

Tailwater Elevation (ft): 7266.50

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Pipe124	7263.00	7268.64	0.00	0.00	7266.50	7269.19	7266.52	2.87	7269.39

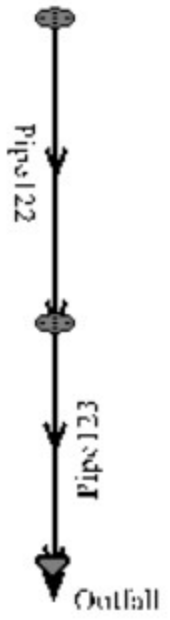
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):


Stm-03
7272.74
7271.54
7270.34
7269.14
7267.94
7266.74
7265.54
7264.34
7263.14
7261.94
Elevation (Ft)
0.00
8.10
16.20
24.30
32.40
40.50
48.60
56.70
64.80
72.90
Distance (Ft)
Pipe124
HGL
EGL

System: CD Stm-05 100yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7267.18

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	7267.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe123	7273.28	45.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe122	7273.28	22.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
Pipe123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.00	Surface Water

										Present (Downstream)
Pipe122	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.50	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Manning s n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
Pipe123	70.49	7264.05	3.3	7266.38	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
Pipe122	53.00	7266.88	2.0	7267.94	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
Pipe123	74.71	15.22	26.70	9.75	16.79	15.92	2.63	Supercritical Jump	45.00	29.78	
Pipe122	32.08	10.21	20.29	7.94	14.82	11.05	1.90	Supercritical Jump	22.50	43.77	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pipe123	45.00	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe122	22.50	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise

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

Grade Line Summary:

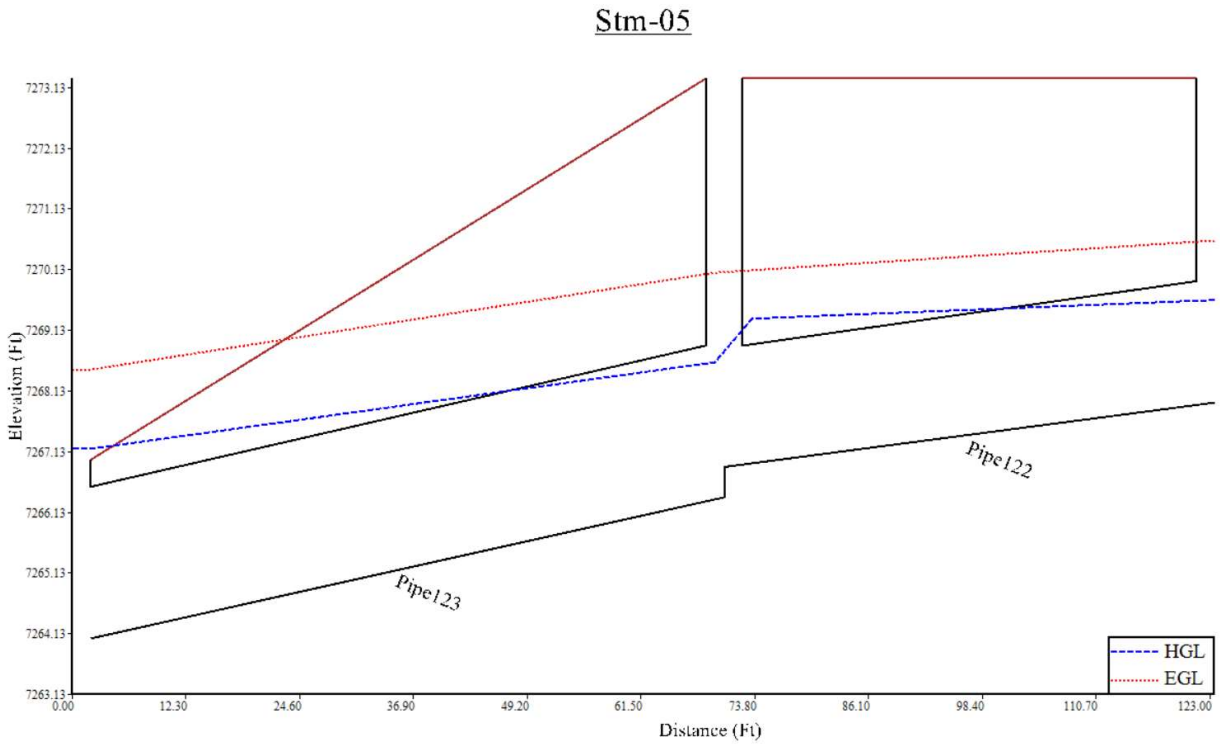
Tailwater Elevation (ft): 7267.18

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pipe123	7264.05	7266.38	0.00	0.00	7267.18	7268.61	7268.48	1.60	7270.08
Pipe122	7266.88	7267.94	0.04	0.00	7269.32	7269.63	7270.12	0.49	7270.61

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

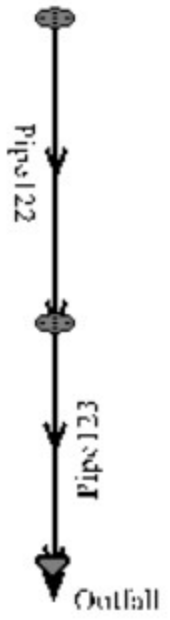
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):



System: CD Stm-05 10yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 10
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7266.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	7267.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe123	7273.28	24.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe122	7273.28	12.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.30	
Pipe122	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.10	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pipe123	70.49	7264.05	3.3	7266.38	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
Pipe122	53.00	7266.88	2.0	7267.94	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pipe123	74.71	15.22	20.15	6.93	11.77	13.60	2.80	Supercritical	24.30	0.00	
Pipe122	32.08	10.21	15.00	5.86	10.22	9.49	2.08	Supercritical	12.10	0.00	

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

Sewer Sizing Summary:

	Existing	Calculated	Used	

Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pipe123	24.30	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe122	12.10	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise

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

Grade Line Summary:

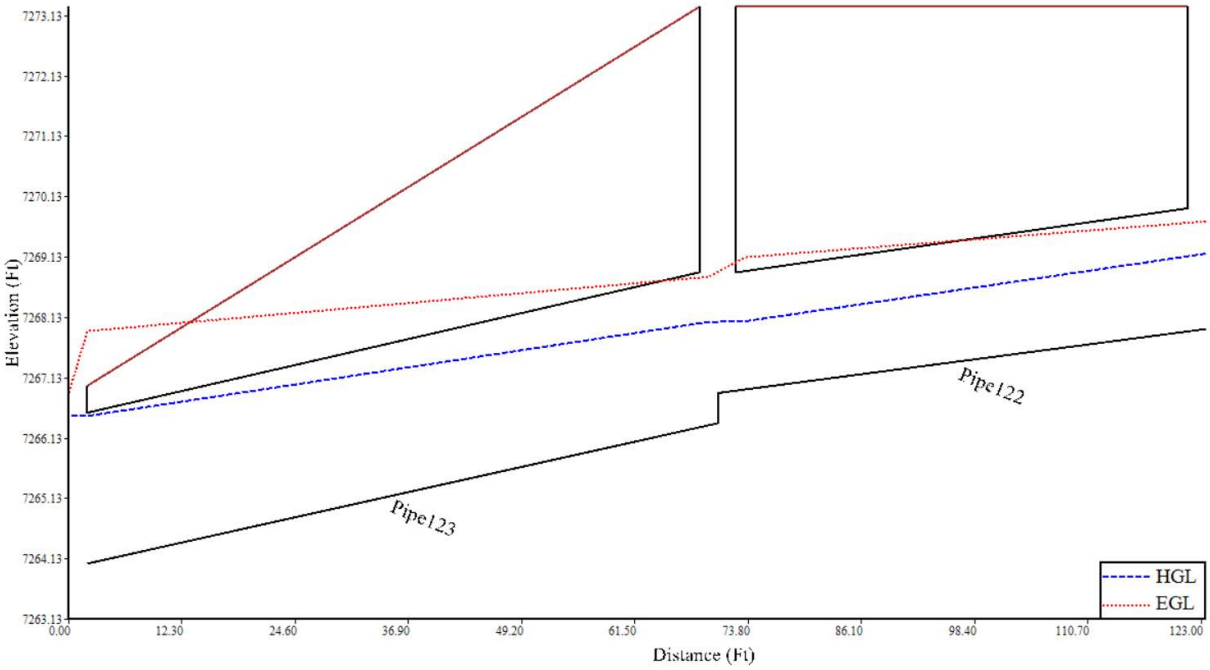
Tailwater Elevation (ft): 7266.50

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pipe123	7264.05	7266.38	0.00	0.00	7266.50	7268.06	7267.91	0.90	7268.81
Pipe122	7266.88	7267.94	0.01	0.00	7268.07	7269.19	7269.13	0.59	7269.72

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

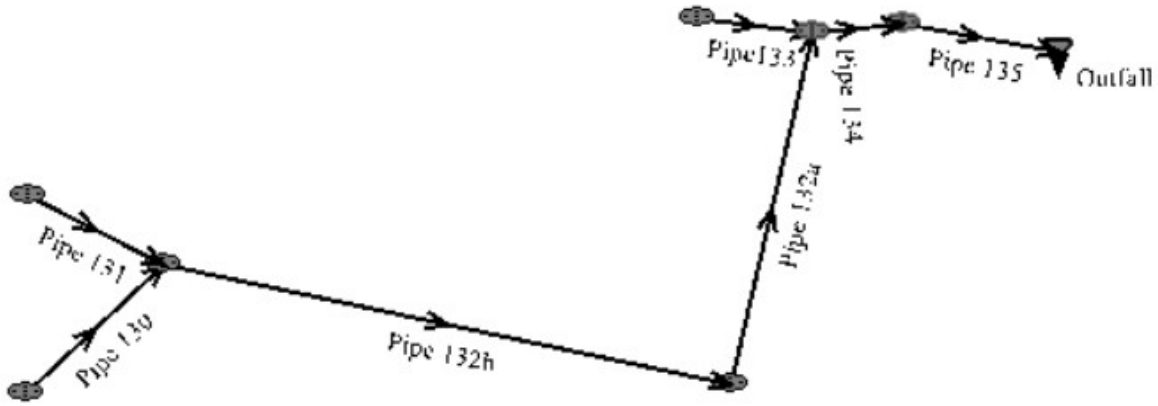
Profile(s):

Stm-05


7273.13
7272.13
7271.13
7270.13
7269.13
7268.13
7267.13
7266.13
7265.13
7264.13
7263.13
Elevation (Ft)
0.00
12.30
24.60
36.90
49.20
61.50
73.80
86.10
98.40
110.70
123.00
Distance (Ft)
Pipe123
Pipe122
HGL
EGL

System: CD Stm-06, 07 and 08 100yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7267.18

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	7268.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 135	7273.95	53.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 134	7273.29	41.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 132a	7278.30	29.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 132b	7282.98	29.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 130	7283.20	14.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 131	7283.20	14.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe133	7273.95	11.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Pipe 135	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.20	
Pipe 134	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.50	
Pipe 132a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.80	
Pipe 132b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.80	
Pipe 130	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.90	
Pipe 131	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.90	
Pipe133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.70	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Manning s n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
Pipe 135	39.92	7265.96	1.5	7266.56	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
Pipe 134	26.02	7267.06	2.0	7267.58	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
Pipe 132a	182.61	7267.89	2.3	7272.09	0.013	1.19	0.25	CIRCULAR	30.00 in	30.00 in
Pipe 132b	273.78	7272.37	1.7	7277.02	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
Pipe 130	28.78	7277.52	6.3	7279.33	0.013	0.63	0.44	CIRCULAR	24.00 in	24.00 in
Pipe 131	6.43	7277.52	4.0	7277.78	0.013	0.38	0.44	CIRCULAR	30.00 in	30.00 in
Pipe133	6.16	7267.83	9.9	7268.44	0.013	1.19	1.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pipe 135	81.91	11.59	28.44	8.88	21.13	12.33	1.80	Supercritical	53.20	0.00	
Pipe 134	58.16	11.85	25.92	9.20	18.73	12.87	1.97	Supercritical	41.50	0.00	
Pipe 132a	62.37	12.71	22.33	7.61	14.61	12.56	2.27	Supercritical Jump	29.80	105.87	
Pipe 132b	53.62	10.92	22.33	7.61	15.98	11.21	1.91	Supercritical	29.80	0.00	
Pipe 130	56.93	18.12	16.69	6.39	8.38	15.26	3.76	Supercritical Jump	14.90	9.40	
Pipe 131	82.26	16.76	15.61	5.77	8.65	12.72	3.12	Supercritical	14.90	0.00	
Pipe133	129.40	26.36	13.76	5.33	6.10	16.37	4.84	Pressurized	11.70	6.16	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment

Pipe 135	53.20	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise
Pipe 134	41.50	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe 132a	29.80	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe 132b	29.80	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe 130	14.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe 131	14.90	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe133	11.70	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise

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

Grade Line Summary:

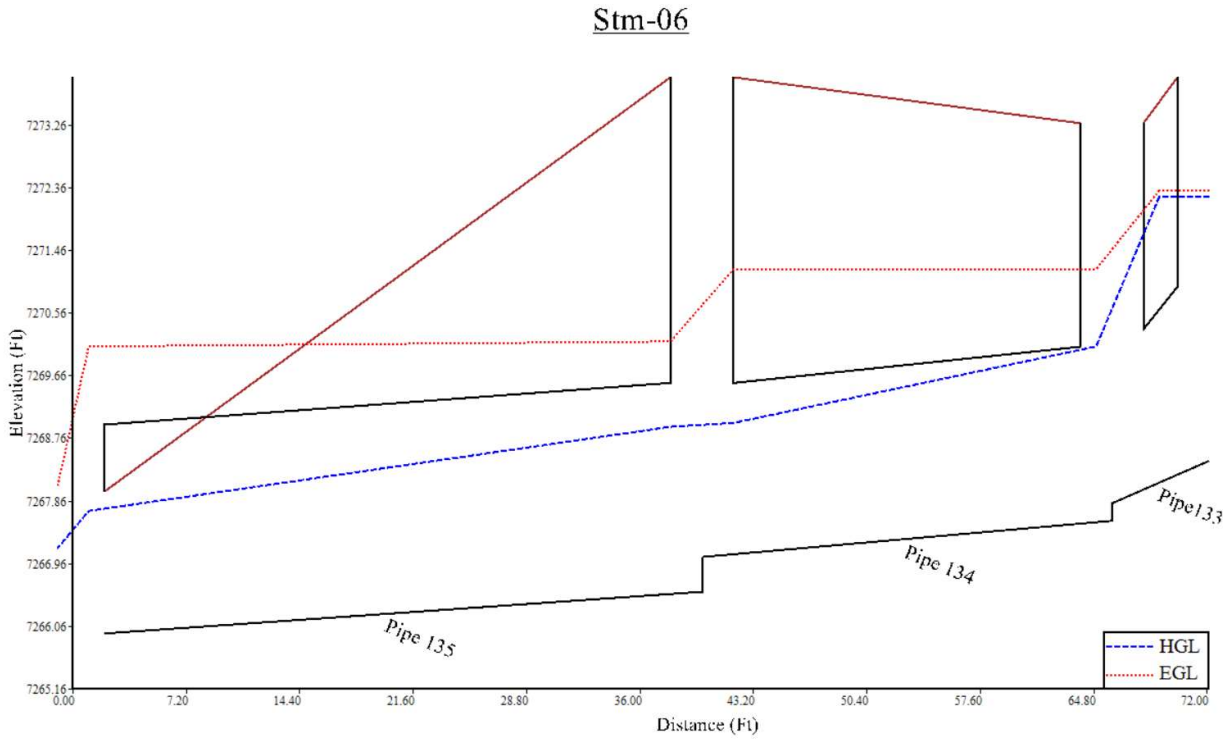
Tailwater Elevation (ft): 7267.18

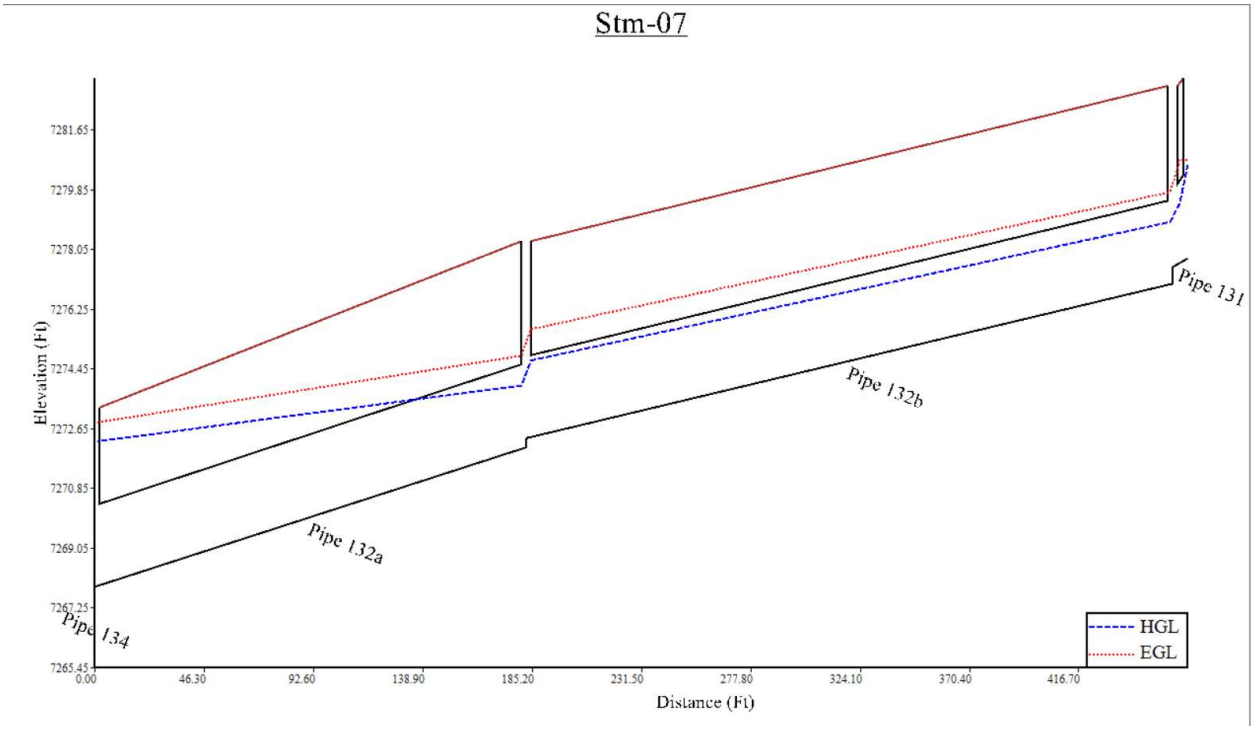
	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Pipe 135	7265.96	7266.56	0.00	0.00	7267.72	7268.93	7270.08	0.07	7270.16
Pipe 134	7267.06	7267.58	0.06	0.00	7268.99	7270.08	7271.19	0.00	7271.19
Pipe 132a	7267.89	7272.09	0.68	0.97	7272.27	7273.95	7272.84	2.01	7274.85

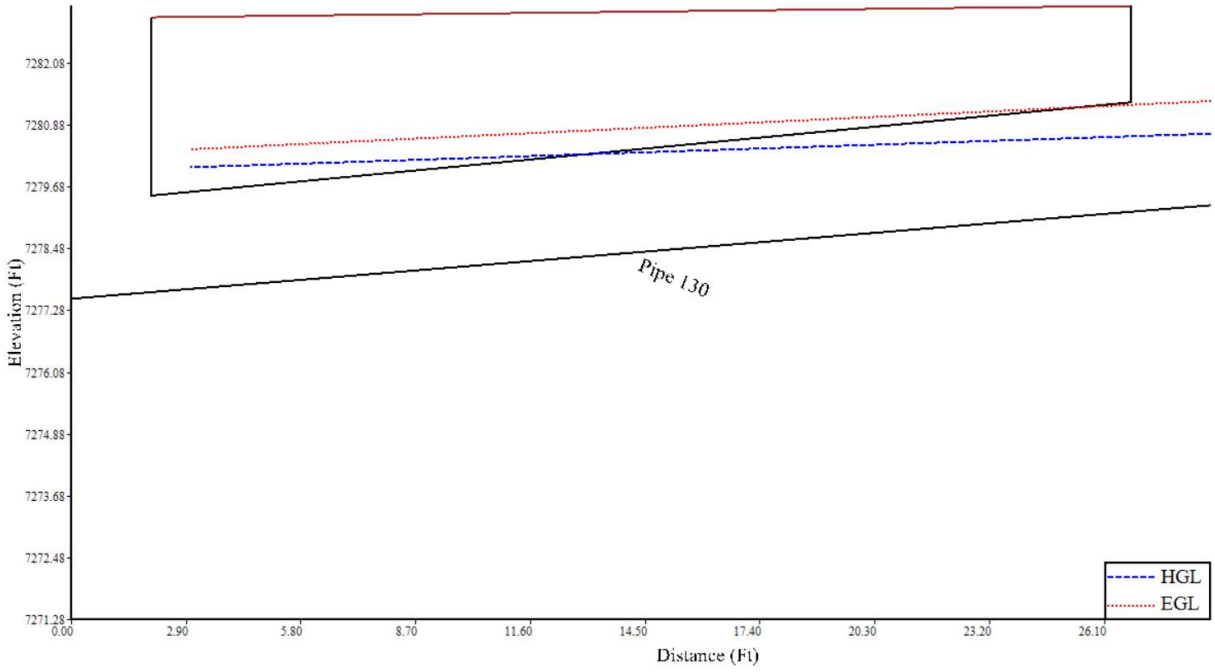
Pipe 132b	7272.37	7277.02	0.76	0.00	7274.71	7278.88	7275.65	4.13	7279.78
Pipe 130	7277.52	7279.33	0.22	0.42	7280.07	7280.72	7280.42	0.94	7281.35
Pipe 131	7277.52	7277.78	0.05	0.51	7279.44	7280.61	7280.76	0.00	7280.76
Pipe133	7267.83	7268.44	0.10	1.02	7272.23	7272.24	7272.32	0.00	7272.33

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

Profile(s):

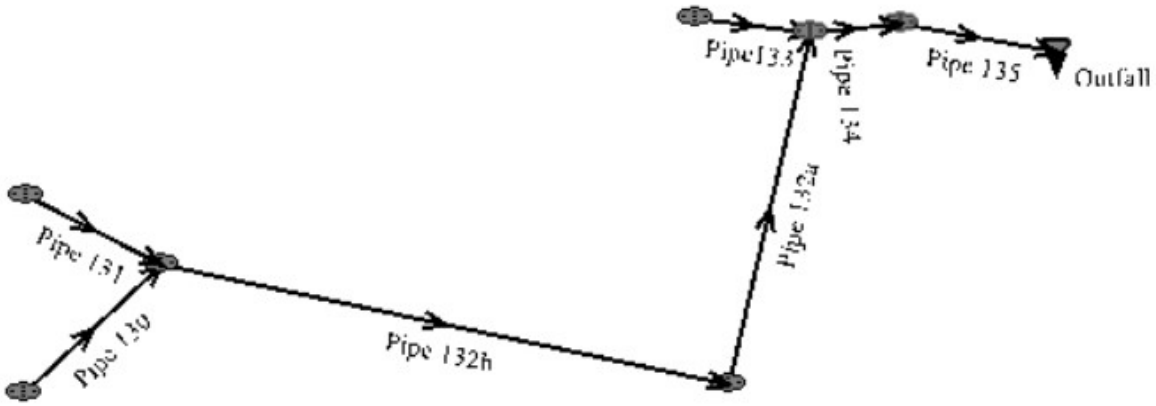



Stm-07
Elevation (Ft)
7281.65
7279.85
7278.05
7276.25
7274.45
7272.65
7270.85
7269.05
7267.25
7265.45
Pipe 131
Pipe 132b
Pipe 132a
Pipe 134
HGL
EGL
0.00
46.30
92.60
138.90
185.20
231.50
277.80
324.10
370.40
416.70
Distance (Ft)


Stm 08
Elevation (Ft)
7282.08
7280.88
7279.68
7278.48
7277.28
7276.08
7274.88
7273.68
7272.48
7271.28
Pipe 130
HGL
EGL
0.00
2.90
5.80
8.70
11.60
14.50
17.40
20.30
23.20
26.10
Distance (Ft)

System: CD Stm-06, 07 and 08 10yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 10
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7266.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	7268.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 135	7273.95	28.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 134	7273.29	21.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 132a	7278.30	15.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 132b	7282.98	15.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 130	7283.20	7.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 131	7283.20	7.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe133	7273.95	6.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Pipe 135	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.00	
Pipe 134	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.80	
Pipe 132a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.60	
Pipe 132b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.60	
Pipe 130	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.80	
Pipe 131	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.80	
Pipe133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Manning s n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
Pipe 135	39.92	7265.96	1.5	7266.56	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
Pipe 134	26.02	7267.06	2.0	7267.58	0.013	0.94	1.00	CIRCULAR	30.00 in	30.00 in
Pipe 132a	182.61	7267.89	2.3	7272.09	0.013	0.71	0.25	CIRCULAR	30.00 in	30.00 in
Pipe 132b	273.78	7272.37	1.7	7277.02	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
Pipe 130	28.78	7277.52	6.3	7279.33	0.013	0.63	0.44	CIRCULAR	24.00 in	24.00 in
Pipe 131	6.43	7277.52	4.0	7277.78	0.013	0.38	0.44	CIRCULAR	30.00 in	30.00 in
Pipe133	6.16	7267.83	9.9	7268.44	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
Pipe 135	81.91	11.59	20.54	6.72	14.51	10.49	1.94	Supercritical	28.00	0.00	
Pipe 134	58.16	11.85	19.05	6.63	12.72	11.00	2.16	Supercritical	21.80	0.00	
Pipe 132a	62.37	12.71	15.99	5.86	10.23	10.56	2.36	Supercritical	15.60	0.00	
Pipe 132b	53.62	10.92	15.99	5.86	11.08	9.47	2.02	Supercritical	15.60	0.00	
Pipe 130	56.93	18.12	11.92	5.01	6.00	12.70	3.76	Supercritical	7.80	0.00	
Pipe 131	82.26	16.76	11.14	4.70	6.24	10.55	3.08	Supercritical	7.80	0.00	
Pipe133	210.43	29.77	9.38	4.23	4.24	13.25	4.75	Supercritical	6.20	0.00	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
Pipe 135	28.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise
Pipe 134	21.80	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise

Pipe 132a	15.60	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe 132b	15.60	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe 130	7.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe 131	7.80	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe133	6.20	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise

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

Grade Line Summary:

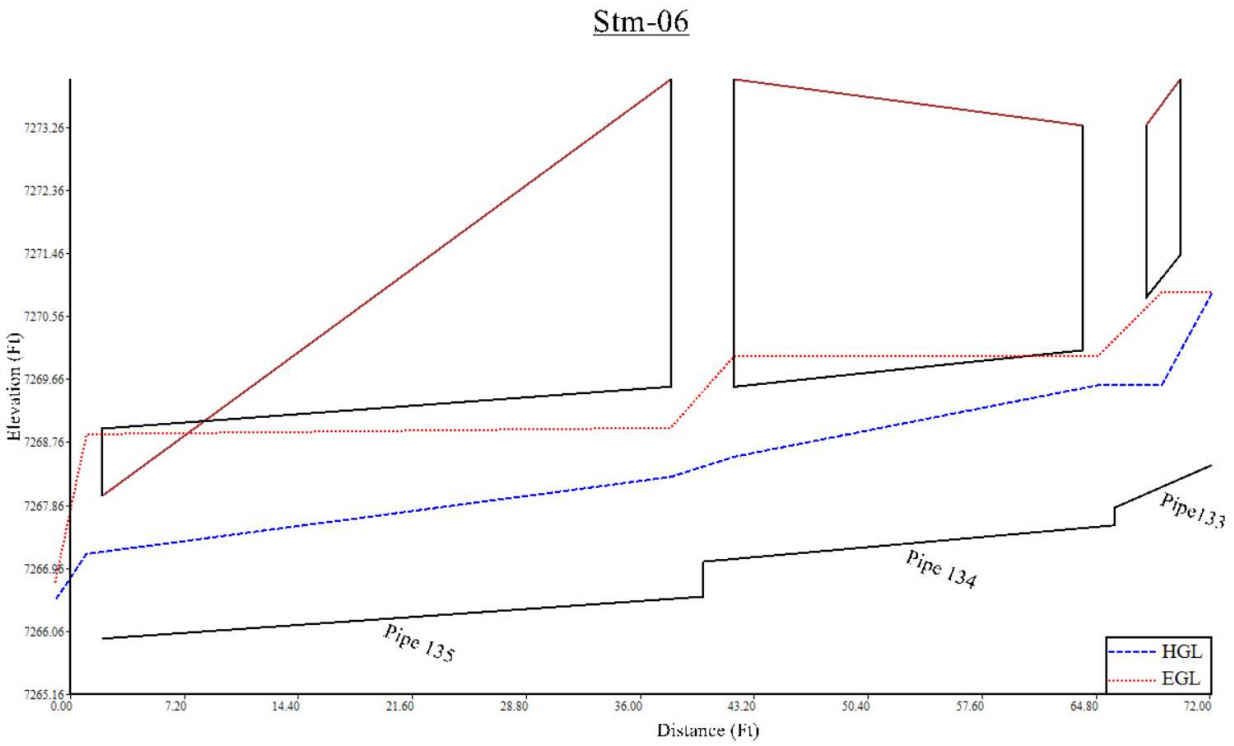
Tailwater Elevation (ft): 7266.50

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Pipe 135	7265.96	7266.56	0.00	0.00	7267.17	7268.27	7268.88	0.09	7268.97
Pipe 134	7267.06	7267.58	0.29	0.00	7268.56	7269.58	7270.00	0.00	7270.00
Pipe 132a	7267.89	7272.09	0.11	0.27	7269.96	7273.42	7270.47	3.48	7273.96
Pipe 132b	7272.37	7277.02	0.21	0.00	7273.63	7278.35	7274.68	4.20	7278.89
Pipe 130	7277.52	7279.33	0.06	0.11	7278.53	7280.32	7280.52	0.19	7280.71

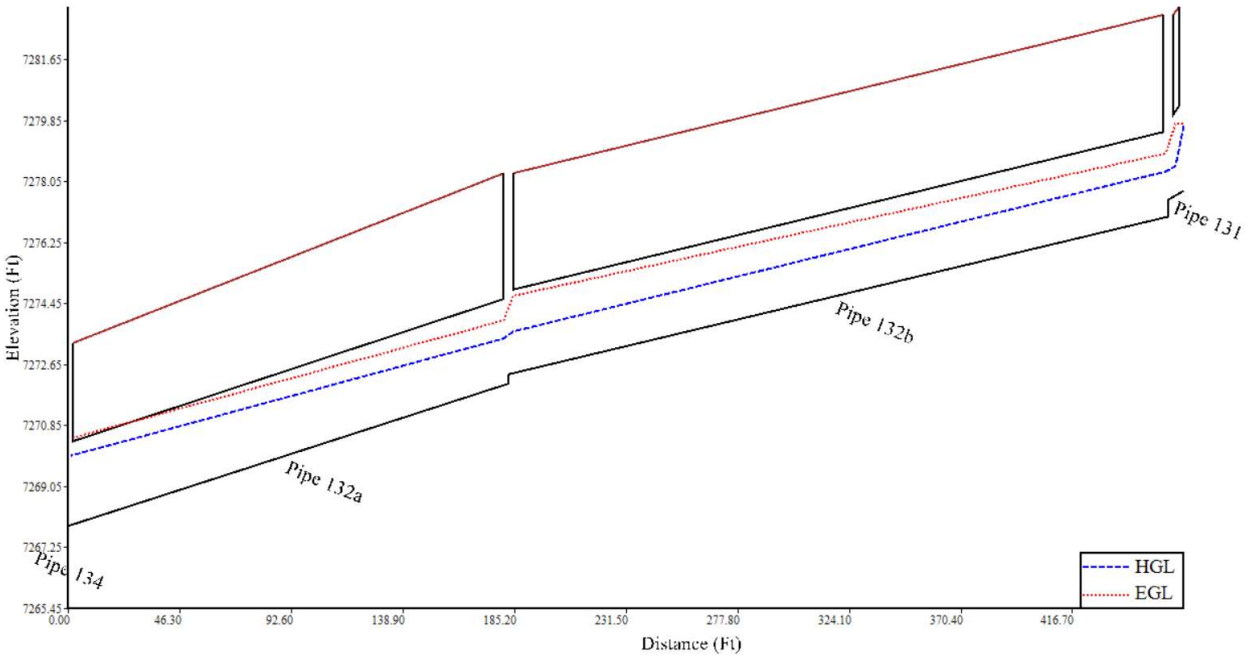
Pipe 131	7277.52	7277.78	0.01	0.14	7278.51	7279.71	7279.77	0.00	7279.77
Pipe133	7267.83	7268.44	0.00	0.00	7269.58	7270.89	7270.91	0.00	7270.91

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

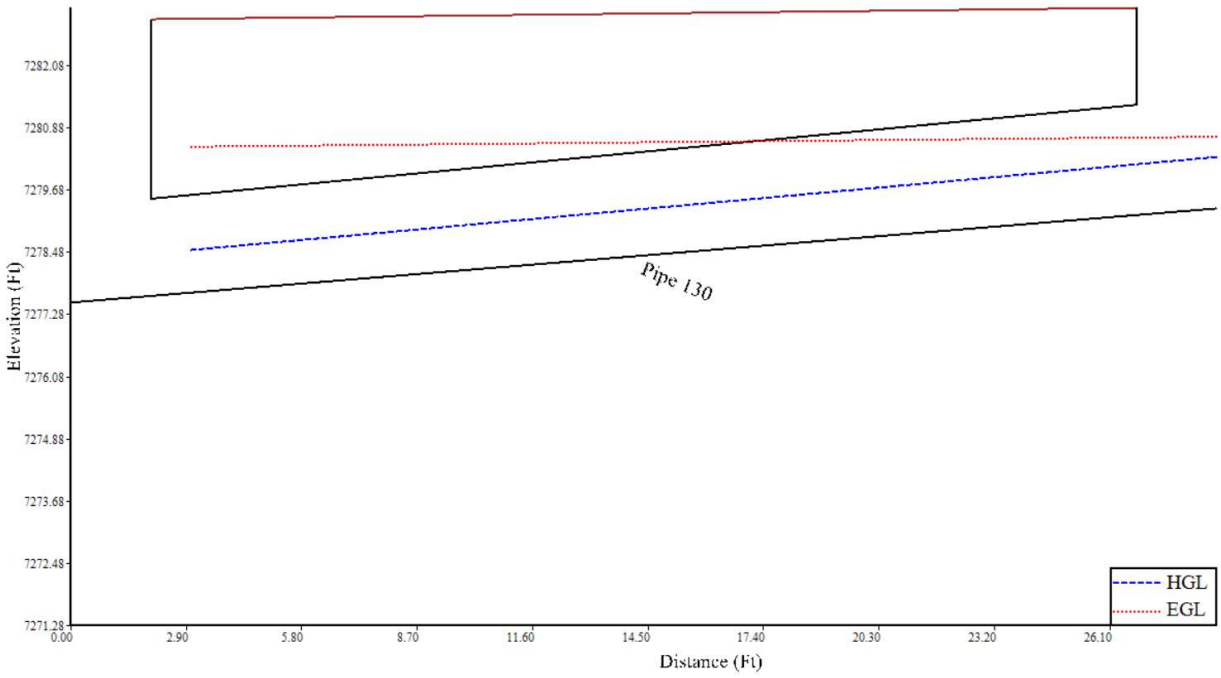
Profile(s):



Stm 07

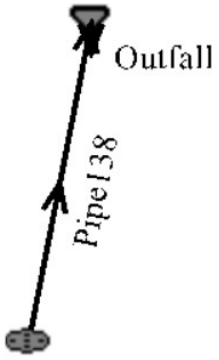

Elevation (Ft)
7281.65
7279.85
7278.05
7276.25
7274.45
7272.65
7270.85
7269.05
7267.25
7265.45
0.00
46.30
92.60
138.90
185.20
231.50
277.80
324.10
370.40
416.70
Distance (Ft)
Pipe 131
Pipe 132b
Pipe 132a
Pipe 134
HGL
EGL

Stm-08


Elevation (Ft)
7282.08
7280.88
7279.68
7278.48
7277.28
7276.08
7274.88
7273.68
7272.48
7271.28
0.00
2.90
5.80
8.70
11.60
14.50
17.40
20.30
23.20
26.10
Distance (Ft)
Pipe 130
HGL
EGL

System: CD Stm-09 100yr

Diagram:



System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7264.39

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	7266.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe138	7273.01	6.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe138	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.50	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)

Pipe138	63.97	7263.31	5.5	7266.83	0.013	0.03	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
Pipe138	24.70	13.98	11.83	5.28	6.30	11.79	3.35	Supercritical	6.50	0.00	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
Pipe138	6.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	Exceeds max. Depth/Rise

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

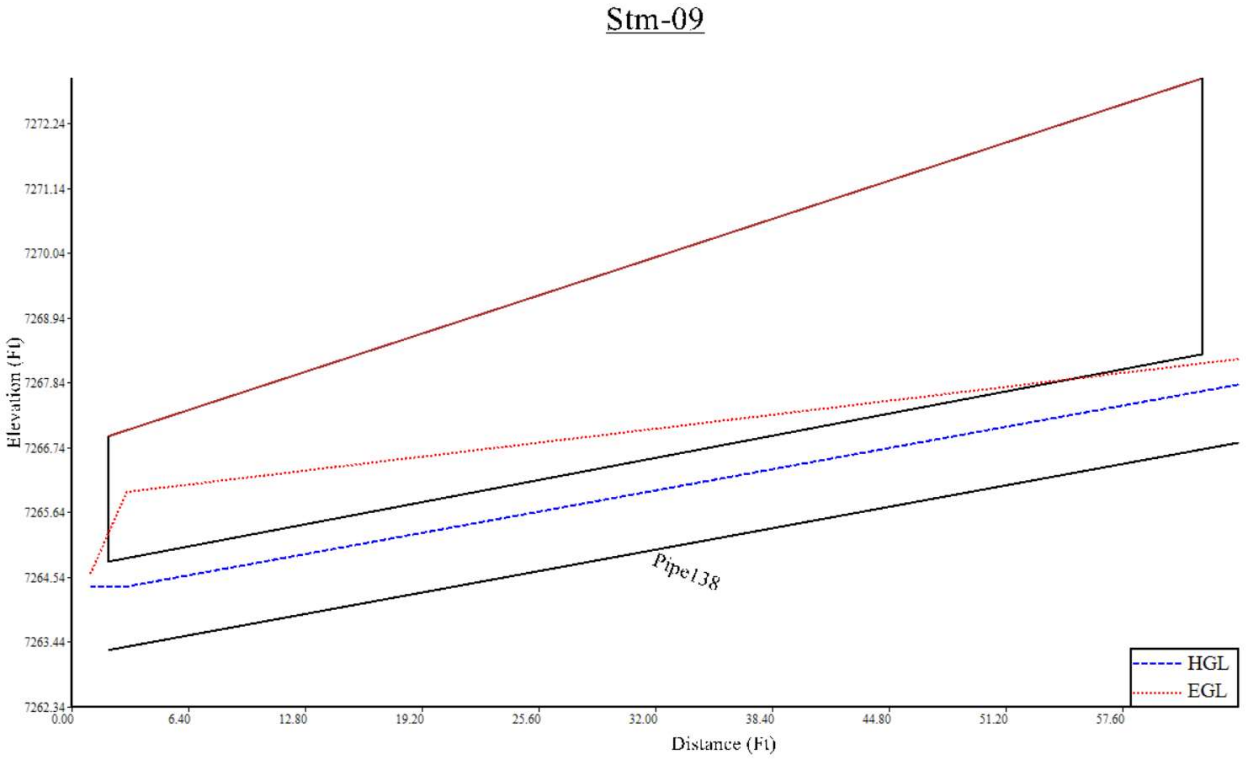
Grade Line Summary:

Tailwater Elevation (ft): 7264.39

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pipe138	7263.31	7266.83	0.00	0.00	7264.39	7267.82	7265.99	2.25	7268.25

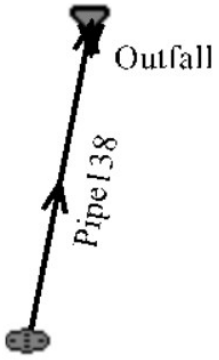
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):



System: CD Stm-09 10yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 10
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7263.79

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	7266.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe138	7273.01	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe138	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pipe138	63.97	7263.31	5.5	7266.83	0.013	0.03	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pipe138	24.70	13.98	5.70	3.33	3.10	7.87	3.27	Supercritical	1.60	0.00	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pipe138	1.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	Exceeds max. Depth/Rise

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

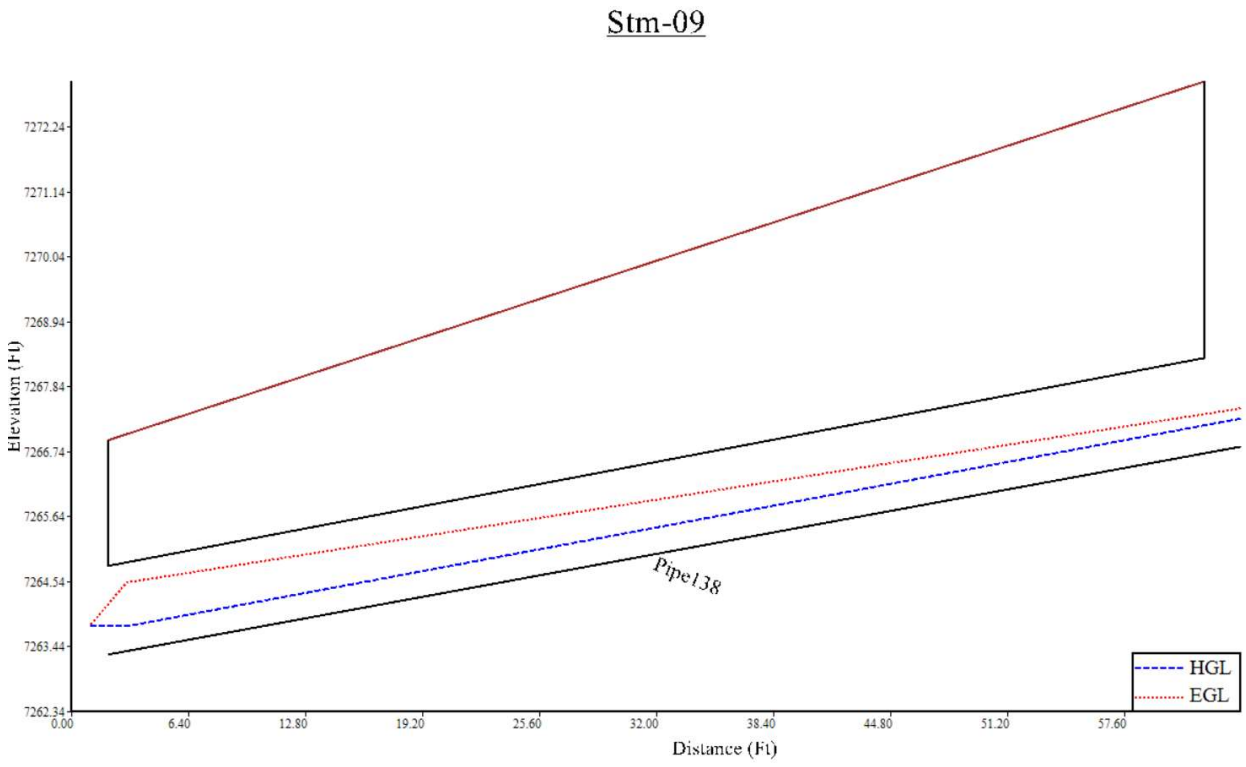
Grade Line Summary:

Tailwater Elevation (ft): 7263.79

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pipe138	7263.31	7266.83	0.00	0.00	7263.79	7267.31	7264.53	2.95	7267.48

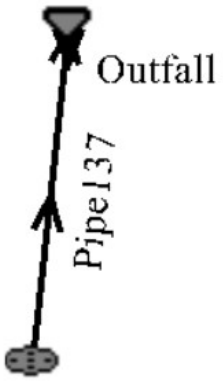
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):



System: CD Stm-10 100yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7274.05

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	7273.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe137	7276.37	17.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
Pipe137	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.40	Surface Water Present (Downstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Lengt	Downstream	Slope (%)	Upstream	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft	Span (ft

	h (ft)	Invert (ft)		Invert (ft)					or in)	or in)
Pipe137	45.32	7271.11	3.5	7272.70	0.013	0.00	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pipe137	42.49	13.53	18.04	6.87	10.70	12.85	2.74	Supercritical Jump	17.40	32.20	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pipe137	17.40	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise

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

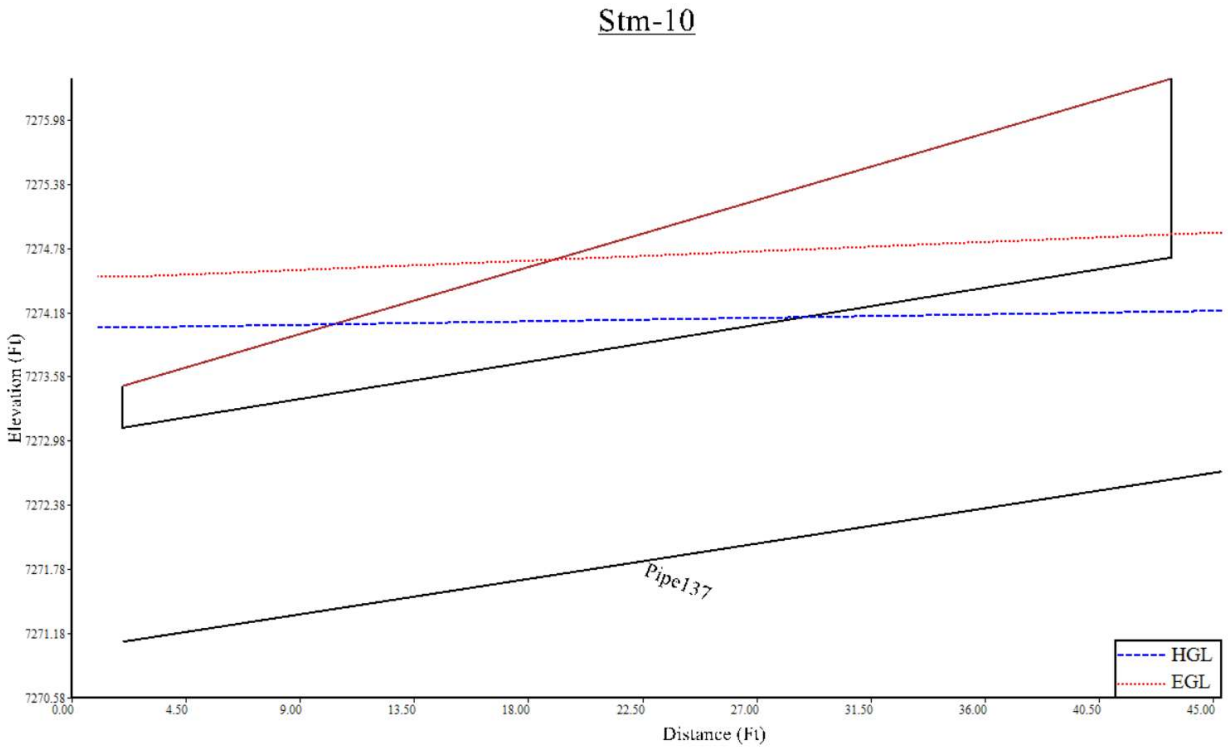
Grade Line Summary:

Tailwater Elevation (ft): 7274.05

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pipe137	7271.11	7272.70	0.00	0.00	7274.05	7274.20	7274.53	0.41	7274.94

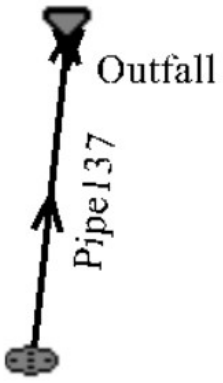
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):



System: CD Stm-10 10yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 10
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7273.71

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	7273.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe137	7276.37	9.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
Pipe137	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.30	Surface Water Present (Downstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Lengt	Downstream	Slope (%)	Upstream	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft	Span (ft

	h (ft)	Invert (ft)		Invert (ft)					or in)	or in)
Pipe137	45.32	7271.11	3.5	7272.70	0.013	0.00	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pipe137	42.49	13.53	13.07	5.32	7.63	10.83	2.81	Supercritical Jump	9.30	17.97	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pipe137	9.30	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise

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

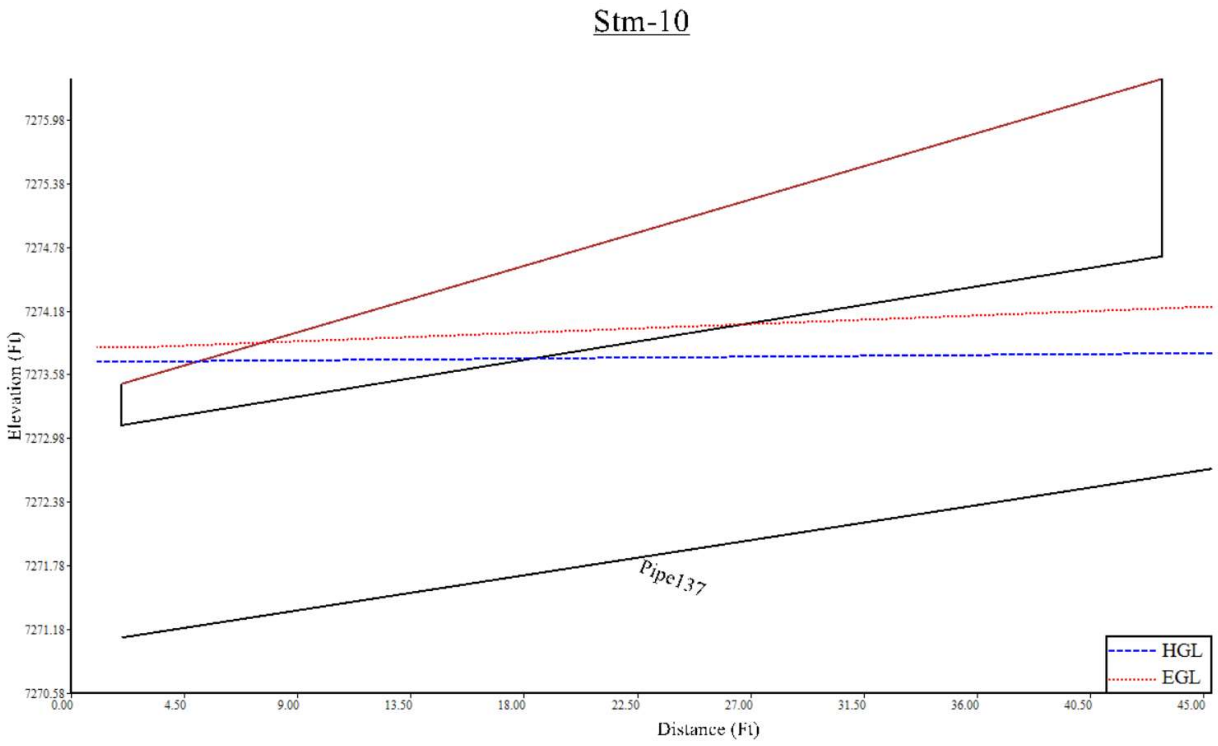
Grade Line Summary:

Tailwater Elevation (ft): 7273.71

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pipe137	7271.11	7272.70	0.00	0.00	7273.71	7273.79	7273.85	0.38	7274.23

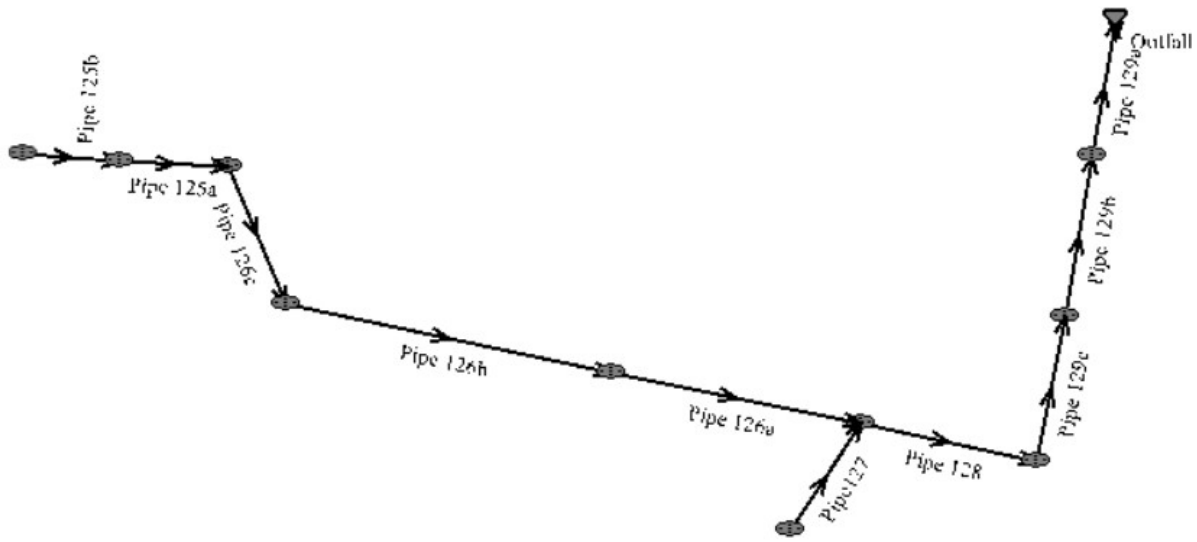
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):



System: CD Stm-11, and 11a 100yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00

Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7267.82

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	7271.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 129a	7276.34	332.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 129b	7277.86	332.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 129c	7279.98	332.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 128	7281.74	332.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 126a	7285.88	121.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 126b	7292.77	121.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 126c	7292.43	121.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 125a	7296.70	118.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 125b	7295.10	118.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe127	7278.70	211.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe 129a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	332.40	
Pipe 129b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	332.40	
Pipe 129c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	332.40	
Pipe 128	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	332.40	
Pipe 126a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	121.10	
Pipe 126b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	121.10	
Pipe 126c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	121.10	
Pipe 125a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	118.30	
Pipe 125b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	118.30	
Pipe127	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	211.40	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pipe 129a	40.17	7262.77	0.5	7262.97	0.013	0.03	0.00	CIRCULAR	78.00 in	78.00 in

Pipe 129b	153.25	7263.22	0.5	7263.99	0.013	0.05	0.00	CIRCULAR	78.00 in	78.00 in
Pipe 129c	109.24	7264.96	1.1	7266.16	0.013	0.05	0.00	CIRCULAR	78.00 in	78.00 in
Pipe 128	306.10	7266.41	0.5	7267.94	0.013	1.32	0.00	CIRCULAR	78.00 in	78.00 in
Pipe 126a	493.46	7270.08	1.3	7276.49	0.013	0.05	0.33	CIRCULAR	54.00 in	54.00 in
Pipe 126b	399.01	7276.64	1.3	7281.83	0.013	0.05	0.00	CIRCULAR	54.00 in	54.00 in
Pipe 126c	162.73	7282.00	1.0	7283.63	0.013	0.63	0.00	CIRCULAR	54.00 in	54.00 in
Pipe 125a	52.42	7283.88	1.0	7284.40	0.013	1.19	0.00	CIRCULAR	54.00 in	54.00 in
Pipe 125b	23.82	7288.62	1.8	7289.05	0.013	0.05	0.00	CIRCULAR	48.00 in	48.00 in
Pipe127	35.27	7269.94	1.6	7270.50	0.013	0.63	0.00	CIRCULAR	54.00 in	54.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
Pipe 129a	371.72	11.20	58.72	12.40	57.54	12.67	1.04	Supercritical	332.40	0.00	
Pipe 129b	371.72	11.20	58.72	12.40	57.54	12.67	1.04	Supercritical	332.40	0.00	
Pipe 129c	551.35	16.62	58.72	12.40	43.68	17.39	1.78	Supercritical	332.40	0.00	
Pipe 128	371.72	11.20	58.72	12.40	57.54	12.67	1.04	Pressurized	332.40	306.10	
Pipe 126a	224.82	14.14	38.87	9.88	28.22	14.40	1.86	Supercritical Jump	121.10	276.74	

Pipe 126b	224.82	14.14	38.87	9.88	28.22	14.40	1.86	Supercritical	121.10	0.00	
Pipe 126c	197.18	12.40	38.87	9.88	30.59	13.03	1.59	Supercritical	121.10	0.00	
Pipe 125a	197.18	12.40	38.42	9.78	30.15	12.96	1.60	Supercritical Jump	118.30	26.99	
Pipe 125b	193.24	15.38	39.32	10.74	27.14	16.15	2.09	Supercritical	118.30	0.00	
Pipe127	249.41	15.68	49.28	13.89	38.16	17.60	1.81	Pressurized	211.40	35.27	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
Pipe 129a	332.40	CIRCULAR	78.00 in	78.00 in	78.00 in	78.00 in	78.00 in	78.00 in	33.18	Exceeds max. Depth/Rise
Pipe 129b	332.40	CIRCULAR	78.00 in	78.00 in	78.00 in	78.00 in	78.00 in	78.00 in	33.18	Exceeds max. Depth/Rise
Pipe 129c	332.40	CIRCULAR	78.00 in	78.00 in	66.00 in	66.00 in	78.00 in	78.00 in	33.18	Exceeds max. Depth/Rise
Pipe 128	332.40	CIRCULAR	78.00 in	78.00 in	78.00 in	78.00 in	78.00 in	78.00 in	33.18	Exceeds max. Depth/Rise
Pipe 126a	121.10	CIRCULAR	54.00 in	54.00 in	48.00 in	48.00 in	54.00 in	54.00 in	15.90	Exceeds max. Depth/Rise
Pipe 126b	121.10	CIRCULAR	54.00 in	54.00 in	48.00 in	48.00 in	54.00 in	54.00 in	15.90	Exceeds max. Depth/Rise
Pipe 126c	121.10	CIRCULAR	54.00 in	54.00 in	48.00 in	48.00 in	54.00 in	54.00 in	15.90	Exceeds max. Depth/Rise

Pipe 125a	118.30	CIRCULAR	54.00 in	54.00 in	48.00 in	48.00 in	54.00 in	54.00 in	15.90	Exceeds max. Depth/Rise
Pipe 125b	118.30	CIRCULAR	48.00 in	48.00 in	42.00 in	42.00 in	48.00 in	48.00 in	12.57	Exceeds max. Depth/Rise
Pipe127	211.40	CIRCULAR	54.00 in	54.00 in	54.00 in	54.00 in	54.00 in	54.00 in	15.90	Exceeds max. Depth/Rise

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

Grade Line Summary:

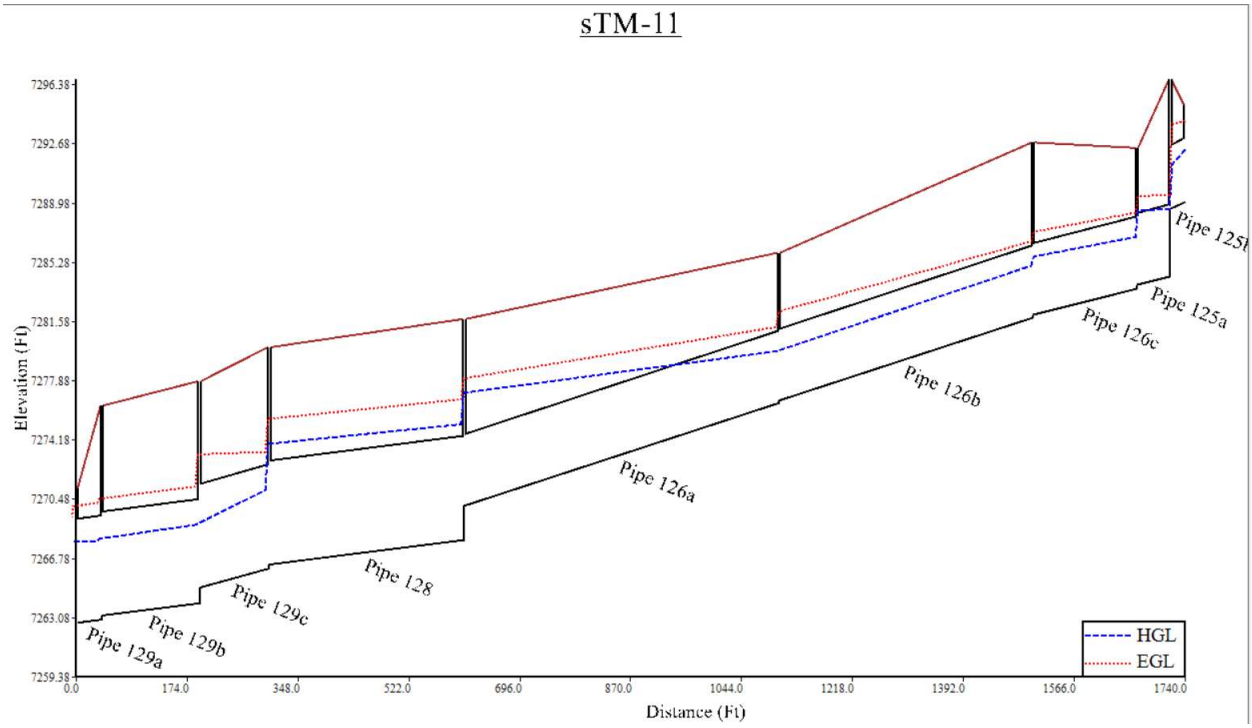
Tailwater Elevation (ft): 7267.82

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Pipe 129a	7262.77	7262.97	0.00	0.00	7267.82	7267.86	7270.06	0.20	7270.25
Pipe 129b	7263.22	7263.99	0.08	0.00	7268.02	7268.88	7270.51	0.76	7271.27
Pipe 129c	7264.96	7266.16	0.08	0.00	7268.96	7271.05	7273.29	0.15	7273.44
Pipe 128	7266.41	7267.94	2.06	0.00	7273.94	7275.16	7275.50	1.22	7276.72
Pipe 126a	7270.08	7276.49	0.05	1.26	7277.13	7279.73	7278.03	3.22	7281.25
Pipe 126b	7276.64	7281.83	0.05	0.00	7279.77	7285.07	7282.21	4.37	7286.59
Pipe 126c	7282.00	7283.63	0.57	0.00	7285.64	7286.87	7287.19	1.20	7288.39

Pipe 125a	7283.88	7284.40	1.02	0.00	7288.55	7288.59	7289.41	0.10	7289.50
Pipe 125b	7288.62	7289.05	0.07	0.00	7291.39	7292.33	7293.91	0.21	7294.12
Pipe127	7269.94	7270.50	1.73	0.00	7276.89	7277.30	7279.64	0.41	7280.04

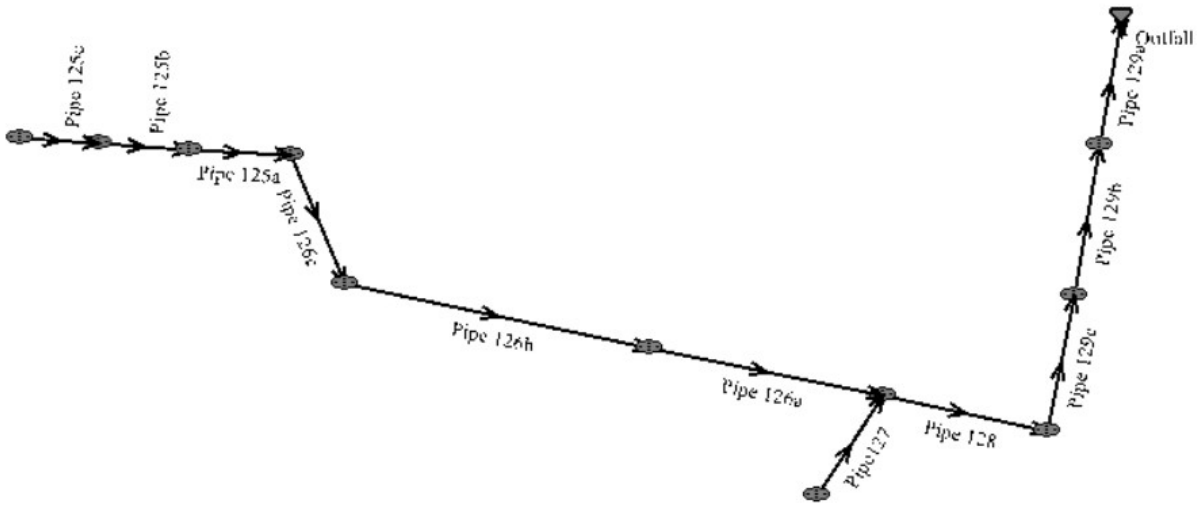
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):



System: CD Stm-11, and 11a 10yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 10
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00

Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7266.22

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	7271.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 129a	7276.34	162.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 129b	7277.86	162.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 129c	7279.98	162.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 128	7281.74	162.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 126a	7285.88	60.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 126b	7292.77	60.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 126c	7292.43	60.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 125a	7296.70	59.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 125b	7295.10	59.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe127	7278.70	102.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe 129a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	162.80	
Pipe 129b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	162.80	
Pipe 129c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	162.80	
Pipe 128	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	162.80	
Pipe 126a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	60.20	
Pipe 126b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	60.20	
Pipe 126c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	60.20	
Pipe 125a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.20	
Pipe 125b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.20	
Pipe127	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	102.60	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pipe 129a	40.17	7262.77	0.5	7262.97	0.013	0.03	0.00	CIRCULAR	78.00 in	78.00 in

Pipe 129b	153.25	7263.22	0.5	7263.99	0.013	0.05	0.00	CIRCULAR	78.00 in	78.00 in
Pipe 129c	109.24	7264.96	1.1	7266.16	0.013	0.05	0.00	CIRCULAR	78.00 in	78.00 in
Pipe 128	306.10	7266.41	0.5	7267.94	0.013	1.32	0.00	CIRCULAR	78.00 in	78.00 in
Pipe 126a	493.46	7270.08	1.3	7276.49	0.013	0.05	0.33	CIRCULAR	54.00 in	54.00 in
Pipe 126b	399.01	7276.64	1.3	7281.83	0.013	0.05	0.00	CIRCULAR	54.00 in	54.00 in
Pipe 126c	162.73	7282.00	1.0	7283.63	0.013	0.63	0.00	CIRCULAR	54.00 in	54.00 in
Pipe 125a	52.42	7283.88	1.0	7284.40	0.013	1.19	0.00	CIRCULAR	54.00 in	54.00 in
Pipe 125b	23.82	7288.62	1.8	7289.05	0.013	0.05	0.00	CIRCULAR	48.00 in	48.00 in
Pipe127	35.27	7269.94	1.6	7270.50	0.013	0.63	0.00	CIRCULAR	54.00 in	54.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
Pipe 129a	371.72	11.20	40.65	9.31	36.12	10.83	1.25	Supercritical	162.80	0.00	
Pipe 129b	371.72	11.20	40.65	9.31	36.12	10.83	1.25	Supercritical	162.80	0.00	
Pipe 129c	551.35	16.62	40.65	9.31	29.04	14.46	1.90	Supercritical	162.80	0.00	
Pipe 128	371.72	11.20	40.65	9.31	36.12	10.83	1.25	Supercritical	162.80	0.00	
Pipe 126a	224.82	14.14	27.05	7.55	19.08	11.98	1.95	Supercritical	60.20	0.00	
Pipe 126b	224.82	14.14	27.05	7.55	19.08	11.98	1.95	Supercritical	60.20	0.00	

Pipe 126c	197.18	12.40	27.05	7.55	20.47	10.89	1.71	Supercritical	60.20	0.00	
Pipe 125a	197.18	12.40	26.81	7.51	20.29	10.84	1.71	Supercritical	59.20	0.00	
Pipe 125b	193.24	15.38	27.81	7.84	18.23	13.52	2.24	Supercritical	59.20	0.00	
Pipe127	249.41	15.68	35.72	9.19	24.13	14.92	2.12	Supercritical	102.60	0.00	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
Pipe 129a	162.80	CIRCULAR	78.00 in	78.00 in	60.00 in	60.00 in	78.00 in	78.00 in	33.18	Exceeds max. Depth/Rise
Pipe 129b	162.80	CIRCULAR	78.00 in	78.00 in	60.00 in	60.00 in	78.00 in	78.00 in	33.18	Exceeds max. Depth/Rise
Pipe 129c	162.80	CIRCULAR	78.00 in	78.00 in	54.00 in	54.00 in	78.00 in	78.00 in	33.18	Exceeds max. Depth/Rise
Pipe 128	162.80	CIRCULAR	78.00 in	78.00 in	60.00 in	60.00 in	78.00 in	78.00 in	33.18	Exceeds max. Depth/Rise
Pipe 126a	60.20	CIRCULAR	54.00 in	54.00 in	33.00 in	33.00 in	54.00 in	54.00 in	15.90	Exceeds max. Depth/Rise
Pipe 126b	60.20	CIRCULAR	54.00 in	54.00 in	33.00 in	33.00 in	54.00 in	54.00 in	15.90	Exceeds max. Depth/Rise
Pipe 126c	60.20	CIRCULAR	54.00 in	54.00 in	36.00 in	36.00 in	54.00 in	54.00 in	15.90	Exceeds max. Depth/Rise
Pipe 125a	59.20	CIRCULAR	54.00 in	54.00 in	36.00 in	36.00 in	54.00 in	54.00 in	15.90	Exceeds max. Depth/Rise

Pipe 125b	59.20	CIRCULAR	48.00 in	48.00 in	33.00 in	33.00 in	48.00 in	48.00 in	12.57	Exceeds max. Depth/Rise
Pipe127	102.60	CIRCULAR	54.00 in	54.00 in	42.00 in	42.00 in	54.00 in	54.00 in	15.90	Exceeds max. Depth/Rise

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

Grade Line Summary:

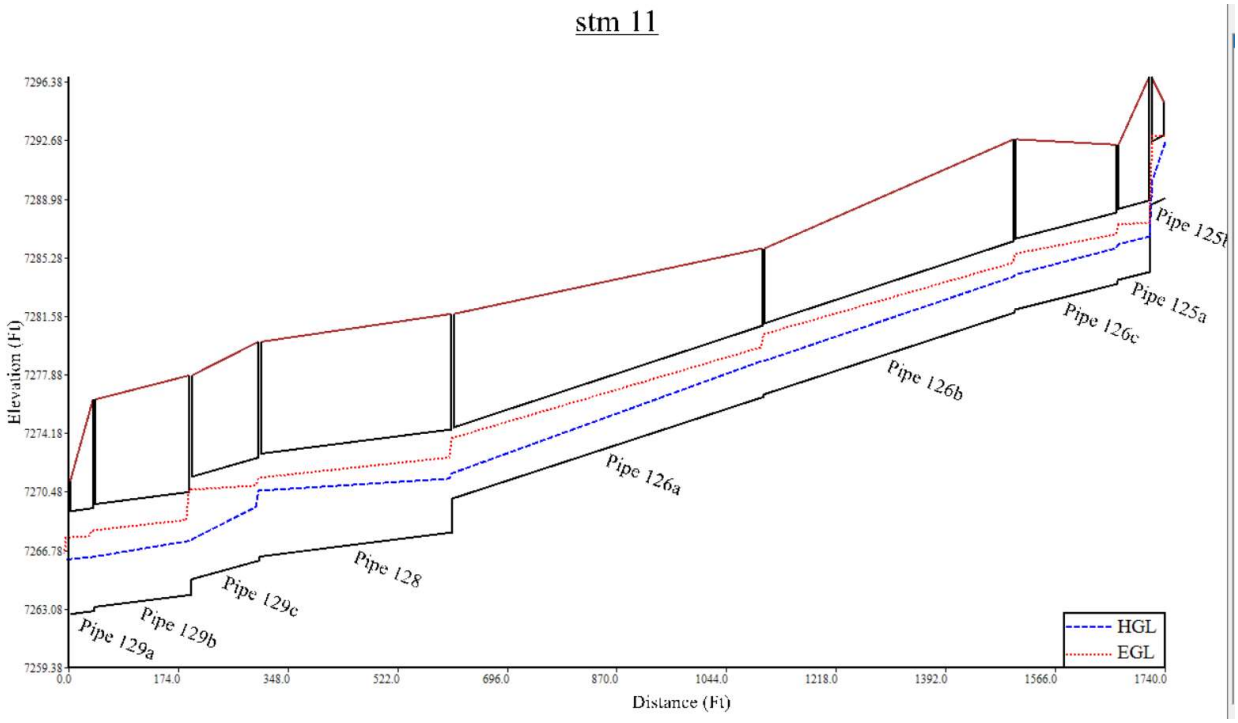
Tailwater Elevation (ft): 7266.22

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Pipe 129a	7262.77	7262.97	0.00	0.00	7266.22	7266.36	7267.60	0.10	7267.70
Pipe 129b	7263.22	7263.99	0.02	0.00	7266.38	7267.38	7268.06	0.67	7268.72
Pipe 129c	7264.96	7266.16	0.02	0.00	7267.40	7269.55	7270.63	0.27	7270.89
Pipe 128	7266.41	7267.94	0.49	0.00	7270.57	7271.33	7271.39	1.29	7272.67
Pipe 126a	7270.08	7276.49	0.01	0.30	7271.67	7278.74	7273.89	5.74	7279.63
Pipe 126b	7276.64	7281.83	0.01	0.00	7278.76	7284.08	7280.46	4.51	7284.97
Pipe 126c	7282.00	7283.63	0.14	0.00	7284.22	7285.88	7285.55	1.22	7286.77
Pipe 125a	7283.88	7284.40	0.26	0.00	7286.14	7286.63	7287.39	0.12	7287.51

Pipe 125b	7288.62	7289.05	0.02	0.00	7290.14	7292.58	7292.98	0.00	7292.98
Pipe127	7269.94	7270.50	0.41	0.00	7271.95	7274.72	7275.40	0.00	7275.40

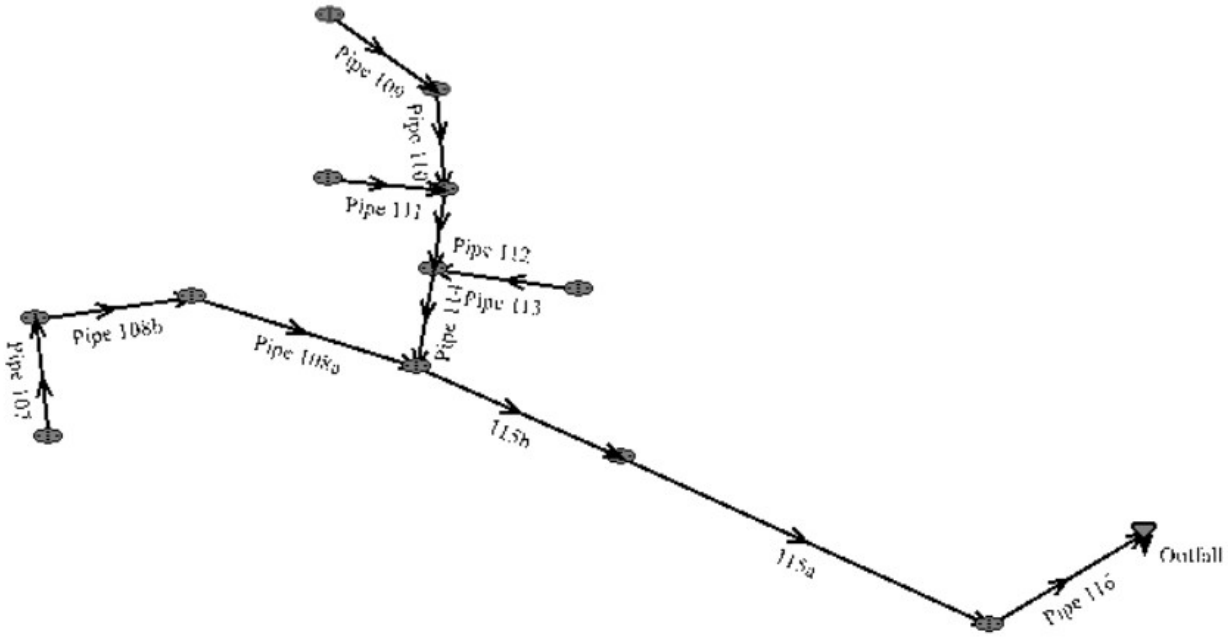
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):



System: CD Stm-13,14,16,17 100yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7276.90

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	7281.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 116	7288.85	65.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
115a	7299.28	65.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
115b	7304.20	65.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 108a	7312.04	21.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 108b	7311.46	21.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 107	7311.46	10.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 114	7304.60	44.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 113	7304.40	7.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 112	7305.90	37.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 111	7311.30	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pipe 110	7315.62	30.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 109	7318.42	30.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe 116	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	65.80	
115a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	65.80	
115b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	65.80	
Pipe 108a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.00	
Pipe 108b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.00	
Pipe 107	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.50	
Pipe 114	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.80	
Pipe 113	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.50	
Pipe 112	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.30	
Pipe 111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	
Pipe 110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.30	
Pipe 109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.30	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pipe 116	62.76	7275.82	1.5	7276.76	0.013	0.03	0.00	CIRCULAR	48.00 in	48.00 in
115a	170.49	7281.97	2.7	7286.57	0.013	0.05	0.00	CIRCULAR	48.00 in	48.00 in
115b	189.79	7292.58	2.5	7297.32	0.013	0.05	0.00	CIRCULAR	48.00 in	48.00 in
Pipe 108a	466.50	7299.05	1.3	7305.11	0.013	0.05	0.25	CIRCULAR	30.00 in	30.00 in
Pipe 108b	56.31	7305.37	1.0	7305.93	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
Pipe 107	53.00	7306.18	1.0	7306.71	0.013	1.06	0.00	CIRCULAR	24.00 in	24.00 in
Pipe 114	20.20	7298.16	1.0	7298.36	0.013	1.32	1.00	CIRCULAR	36.00 in	36.00 in
Pipe 113	22.58	7300.12	2.7	7300.73	0.013	1.32	1.00	CIRCULAR	24.00 in	24.00 in
Pipe 112	33.54	7298.60	2.9	7299.57	0.013	0.05	0.25	CIRCULAR	36.00 in	36.00 in
Pipe 111	32.00	7300.56	4.6	7302.03	0.013	1.32	1.00	CIRCULAR	24.00 in	24.00 in
Pipe 110	188.21	7299.98	5.1	7309.58	0.013	0.08	0.25	CIRCULAR	30.00 in	30.00 in
Pipe 109	34.91	7309.83	1.3	7310.28	0.013	1.19	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity	Critical Flow	Normal Flow	

Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pipe 116	176.40	14.04	29.38	8.16	20.30	13.01	2.03	Supercritical	65.80	0.00	
115a	236.67	18.83	29.38	8.16	17.31	16.12	2.76	Supercritical	65.80	0.00	
115b	227.73	18.12	29.38	8.16	17.67	15.68	2.65	Supercritical	65.80	0.00	
Pipe 108a	46.89	9.55	18.68	6.53	14.07	9.29	1.72	Supercritical	21.00	0.00	
Pipe 108b	41.13	8.38	18.68	6.53	15.19	8.42	1.49	Supercritical	21.00	0.00	
Pipe 107	22.68	7.22	13.93	5.55	11.47	7.08	1.45	Supercritical	10.50	0.00	
Pipe 114	66.88	9.46	26.16	8.14	21.56	10.14	1.46	Supercritical	44.80	0.00	
Pipe 113	37.27	11.86	11.68	4.94	7.30	9.28	2.47	Supercritical Jump	7.50	5.53	
Pipe 112	113.89	16.11	23.84	7.51	14.18	14.42	2.71	Supercritical	37.30	0.00	
Pipe 111	48.65	15.49	11.26	4.83	6.15	11.01	3.21	Supercritical Jump	7.00	18.46	
Pipe 110	92.88	18.92	22.51	7.67	11.79	16.92	3.48	Supercritical Jump	30.30	9.38	
Pipe 109	46.89	9.55	22.51	7.67	17.55	10.16	1.63	Supercritical Jump	30.30	20.52	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pipe 116	65.80	CIRCULAR	48.00 in	48.00 in	36.00 in	36.00 in	48.00 in	48.00 in	12.57	Exceeds max. Depth/Rise
115a	65.80	CIRCULAR	48.00 in	48.00 in	30.00 in	30.00 in	48.00 in	48.00 in	12.57	Exceeds max. Depth/Rise
115b	65.80	CIRCULAR	48.00 in	48.00 in	33.00 in	33.00 in	48.00 in	48.00 in	12.57	Exceeds max. Depth/Rise
Pipe 108a	21.00	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe 108b	21.00	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe 107	10.50	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe 114	44.80	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise
Pipe 113	7.50	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe 112	37.30	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise
Pipe 111	7.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe 110	30.30	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe 109	30.30	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise

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

Grade Line Summary:

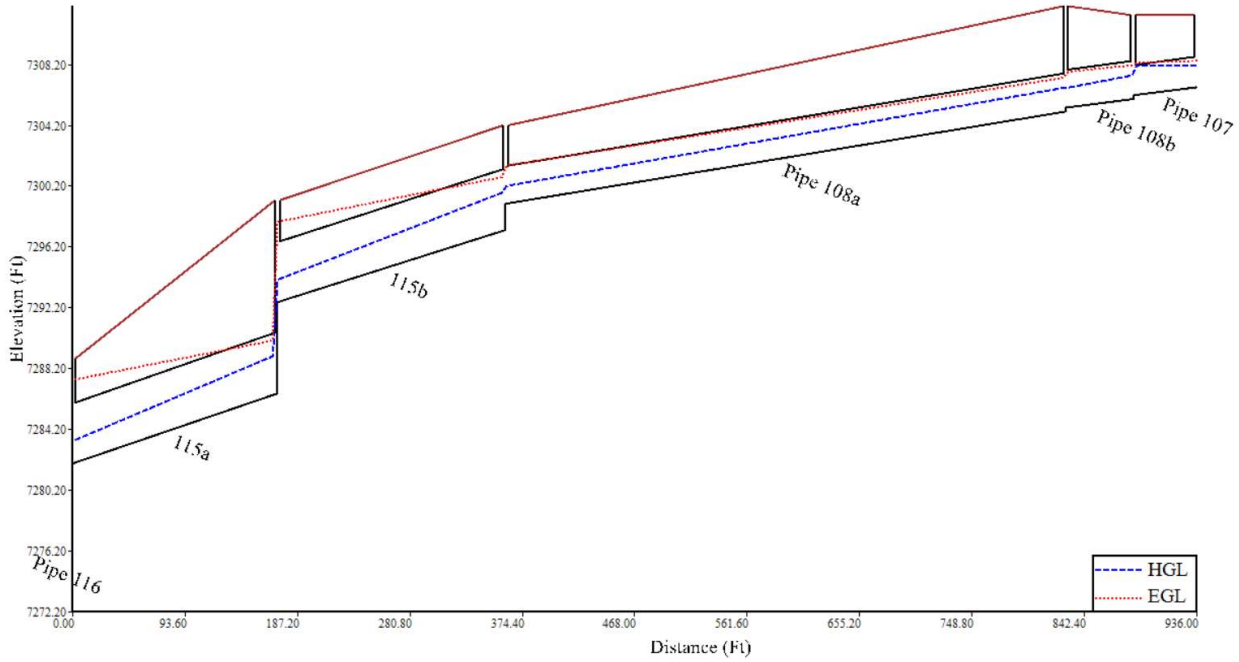
Tailwater Elevation (ft): 7276.90

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pipe 116	7275.82	7276.76	0.00	0.00	7277.51	7279.21	7280.14	0.10	7280.24
115a	7281.97	7286.57	0.02	0.00	7283.41	7289.02	7287.45	2.61	7290.05
115b	7292.58	7297.32	0.02	0.00	7294.05	7299.77	7297.86	2.94	7300.80
Pipe 108a	7299.05	7305.11	0.01	0.35	7300.22	7306.67	7301.56	5.77	7307.33
Pipe 108b	7305.37	7305.93	0.01	0.00	7306.68	7307.49	7307.73	0.42	7308.15
Pipe 107	7306.18	7306.71	0.18	0.00	7308.16	7308.16	7308.33	0.11	7308.45
Pipe 114	7298.16	7298.36	0.82	0.00	7300.97	7300.97	7301.63	0.07	7301.70
Pipe 113	7300.12	7300.73	0.12	0.54	7302.26	7302.26	7302.35	0.04	7302.39
Pipe 112	7298.60	7299.57	0.02	0.52	7301.51	7302.58	7303.01	0.00	7303.01
Pipe 111	7300.56	7302.03	0.10	0.36	7303.39	7303.39	7303.47	0.07	7303.54
Pipe 110	7299.98	7309.58	0.05	0.28	7302.91	7311.46	7303.50	8.87	7312.37
Pipe 109	7309.83	7310.28	0.70	0.00	7312.48	7312.52	7313.07	0.11	7313.18

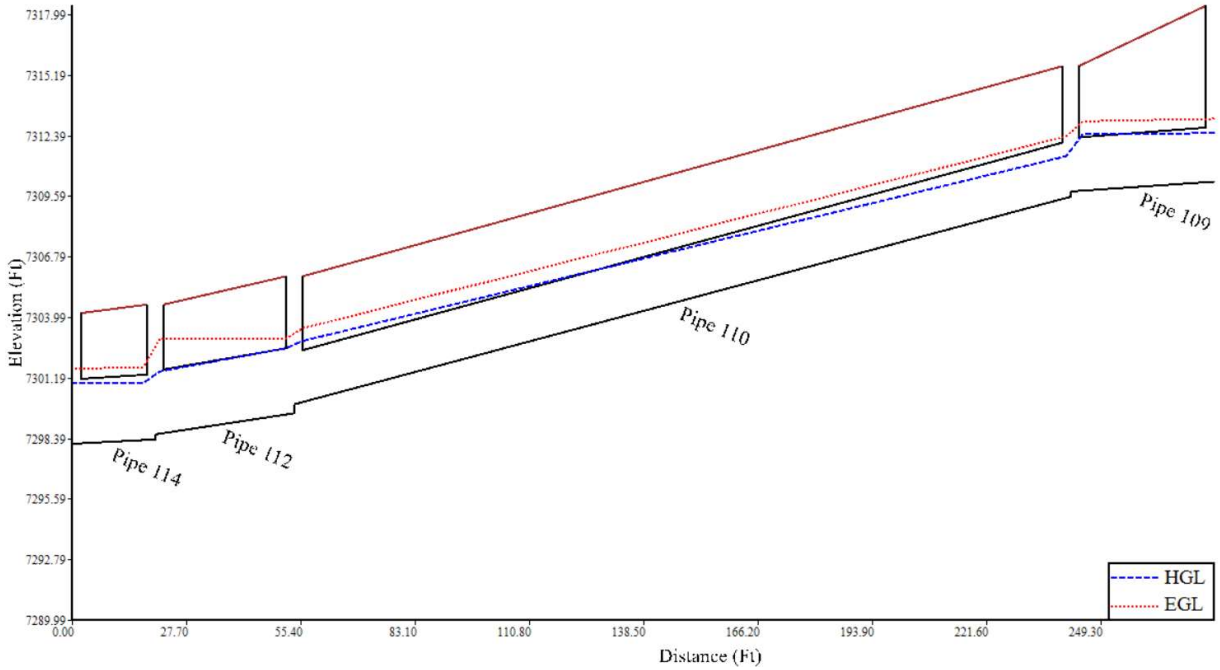
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):

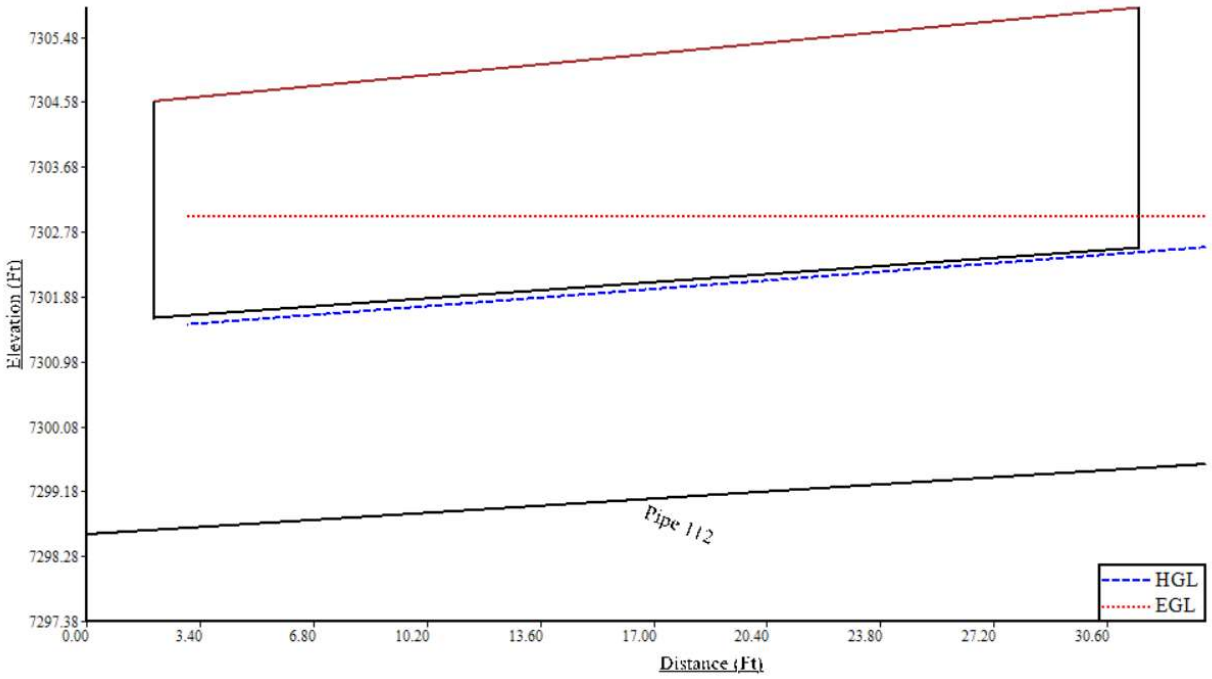
STm 13



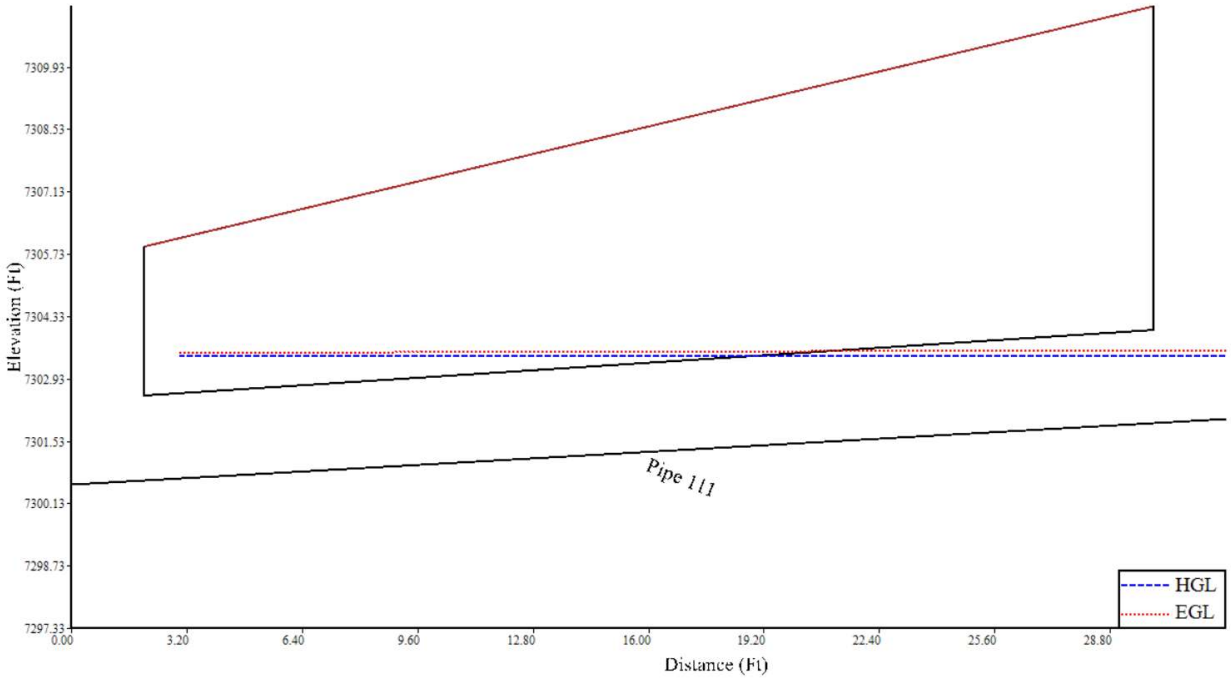
stm 14



stm 16

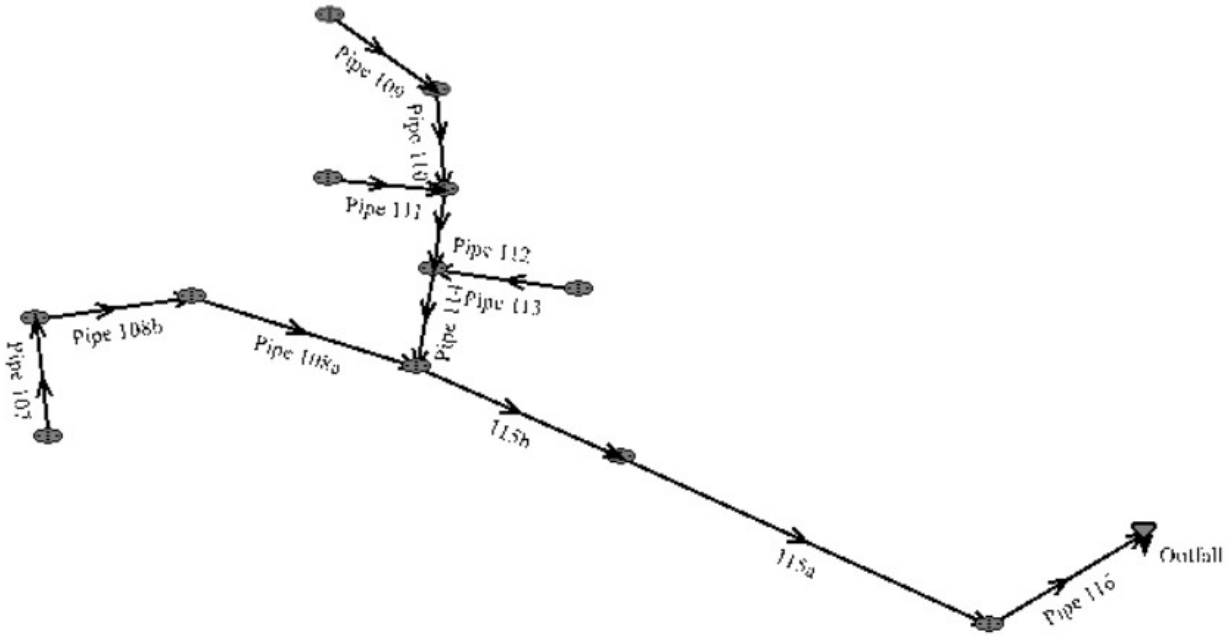


Stm-17



System: CD Stm-13,14,16,17 10yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 10
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00

Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7276.07

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	7281.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 116	7288.85	39.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
115a	7299.28	39.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
115b	7304.20	39.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 108a	7312.04	12.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 108b	7311.46	12.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 107	7311.46	6.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 114	7304.60	26.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 113	7304.40	4.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 112	7305.90	22.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 111	7311.30	4.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 110	7315.62	17.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pipe 109	7318.42	17.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe 116	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.30	
115a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.30	
115b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.30	
Pipe 108a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.50	
Pipe 108b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.50	
Pipe 107	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.20	
Pipe 114	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.80	
Pipe 113	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.70	
Pipe 112	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.10	
Pipe 111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.20	
Pipe 110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.90	
Pipe 109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.90	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pipe 116	62.76	7275.82	1.5	7276.76	0.013	0.03	0.00	CIRCULAR	42.00 in	42.00 in
115a	170.49	7281.97	2.7	7286.57	0.013	0.38	0.00	CIRCULAR	42.00 in	42.00 in
115b	189.79	7292.58	2.5	7297.32	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in
Pipe 108a	466.50	7299.05	1.3	7305.11	0.013	0.05	0.25	CIRCULAR	30.00 in	30.00 in
Pipe 108b	56.31	7305.37	1.0	7305.93	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
Pipe 107	53.00	7306.18	1.0	7306.71	0.013	1.06	0.00	CIRCULAR	24.00 in	24.00 in
Pipe 114	20.20	7298.16	1.0	7298.36	0.013	1.32	1.00	CIRCULAR	36.00 in	36.00 in
Pipe 113	22.58	7300.12	2.7	7300.73	0.013	1.32	1.00	CIRCULAR	24.00 in	24.00 in
Pipe 112	33.54	7298.60	2.9	7299.57	0.013	0.05	0.25	CIRCULAR	36.00 in	36.00 in
Pipe 111	32.00	7300.56	4.6	7302.03	0.013	1.32	1.00	CIRCULAR	24.00 in	24.00 in
Pipe 110	188.21	7299.98	5.1	7309.58	0.013	0.08	0.25	CIRCULAR	30.00 in	30.00 in
Pipe 109	34.91	7309.83	1.3	7310.28	0.013	1.19	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment

Pipe 116	123.55	12.84	23.38	7.14	16.28	11.41	2.00	Supercritical	39.30	0.00	
115a	165.76	17.23	23.38	7.14	13.92	14.11	2.70	Supercritical	39.30	0.00	
115b	159.51	16.58	23.38	7.14	14.20	13.73	2.60	Supercritical	39.30	0.00	
Pipe 108a	46.89	9.55	14.24	5.44	10.58	8.08	1.77	Supercritical	12.50	0.00	
Pipe 108b	41.13	8.38	14.24	5.44	11.35	7.35	1.55	Supercritical	12.50	0.00	
Pipe 107	22.68	7.22	10.57	4.65	8.57	6.15	1.50	Supercritical	6.20	0.00	
Pipe 114	66.88	9.46	20.07	6.62	15.85	8.94	1.57	Supercritical	26.80	0.00	
Pipe 113	37.27	11.86	9.15	4.27	5.76	8.12	2.46	Supercritical	4.70	0.00	
Pipe 112	113.89	16.11	18.14	6.19	10.75	12.47	2.74	Supercritical	22.10	0.00	
Pipe 111	48.65	15.49	8.63	4.13	4.77	9.48	3.17	Supercritical	4.20	0.00	
Pipe 110	92.88	18.92	17.19	6.15	8.93	14.62	3.52	Supercritical	17.90	0.00	
Pipe 109	46.89	9.55	17.19	6.15	12.85	8.91	1.74	Supercritical	17.90	0.00	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**

Pipe 116	39.30	CIRCULAR	42.00 in	42.00 in	30.00 in	30.00 in	42.00 in	42.00 in	9.62	Exceeds max. Depth/Rise
115a	39.30	CIRCULAR	42.00 in	42.00 in	27.00 in	27.00 in	42.00 in	42.00 in	9.62	Exceeds max. Depth/Rise
115b	39.30	CIRCULAR	42.00 in	42.00 in	27.00 in	27.00 in	42.00 in	42.00 in	9.62	Exceeds max. Depth/Rise
Pipe 108a	12.50	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe 108b	12.50	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe 107	6.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe 114	26.80	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise
Pipe 113	4.70	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe 112	22.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	Exceeds max. Depth/Rise
Pipe 111	4.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe 110	17.90	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise
Pipe 109	17.90	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise

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

Grade Line Summary:

Tailwater Elevation (ft): 7276.07

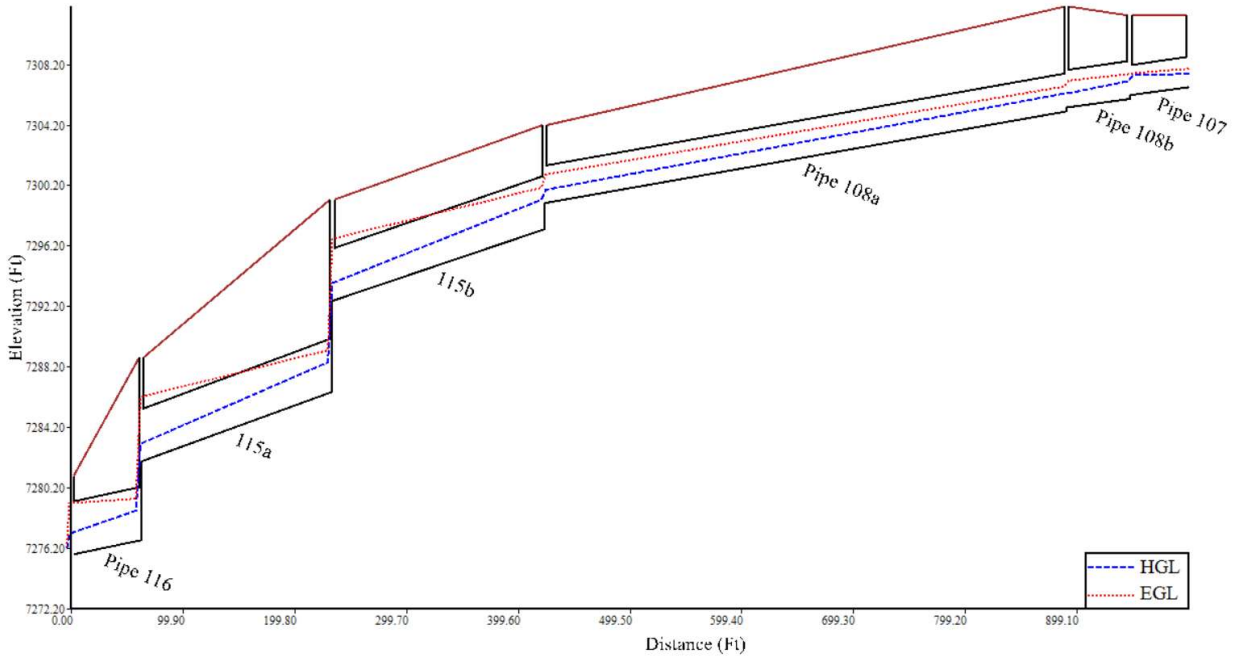
	Invert Elev.	Downstream Manhole Losses	HGL	EGL

Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pipe 116	7275.82	7276.76	0.00	0.00	7277.18	7278.71	7279.20	0.30	7279.50
115a	7281.97	7286.57	0.10	0.00	7283.13	7288.52	7286.22	3.09	7289.31
115b	7292.58	7297.32	0.01	0.00	7293.76	7299.27	7296.68	3.38	7300.06
Pipe 108a	7299.05	7305.11	0.01	0.23	7299.93	7306.30	7300.94	5.82	7306.76
Pipe 108b	7305.37	7305.93	0.01	0.00	7306.31	7307.12	7307.15	0.43	7307.58
Pipe 107	7306.18	7306.71	0.06	0.00	7307.52	7307.59	7307.64	0.29	7307.93
Pipe 114	7298.16	7298.36	0.29	0.04	7299.60	7300.12	7300.72	0.00	7300.72
Pipe 113	7300.12	7300.73	0.05	0.19	7300.60	7301.49	7301.62	0.15	7301.78
Pipe 112	7298.60	7299.57	0.01	0.19	7300.31	7301.62	7301.91	0.00	7301.91
Pipe 111	7300.56	7302.03	0.04	0.12	7301.78	7302.75	7302.35	0.66	7303.01
Pipe 110	7299.98	7309.58	0.02	0.10	7301.74	7311.01	7304.04	7.56	7311.60
Pipe 109	7309.83	7310.28	0.25	0.00	7311.26	7311.71	7312.13	0.17	7312.30

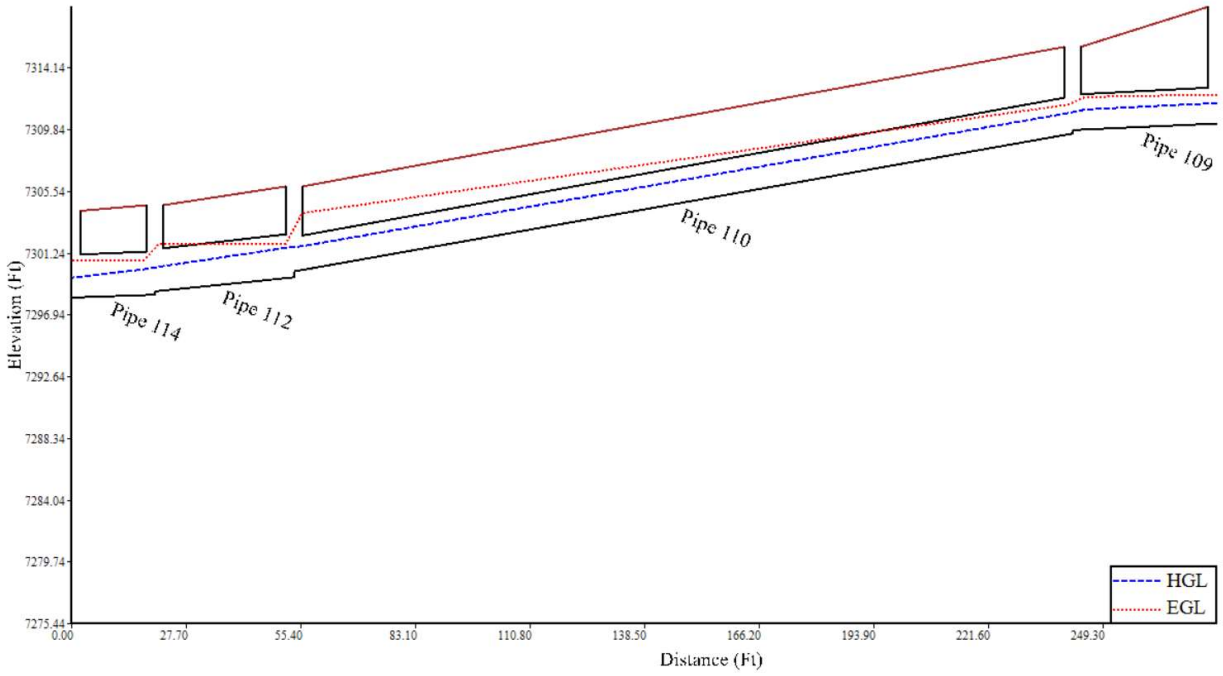
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).

Profile(s):

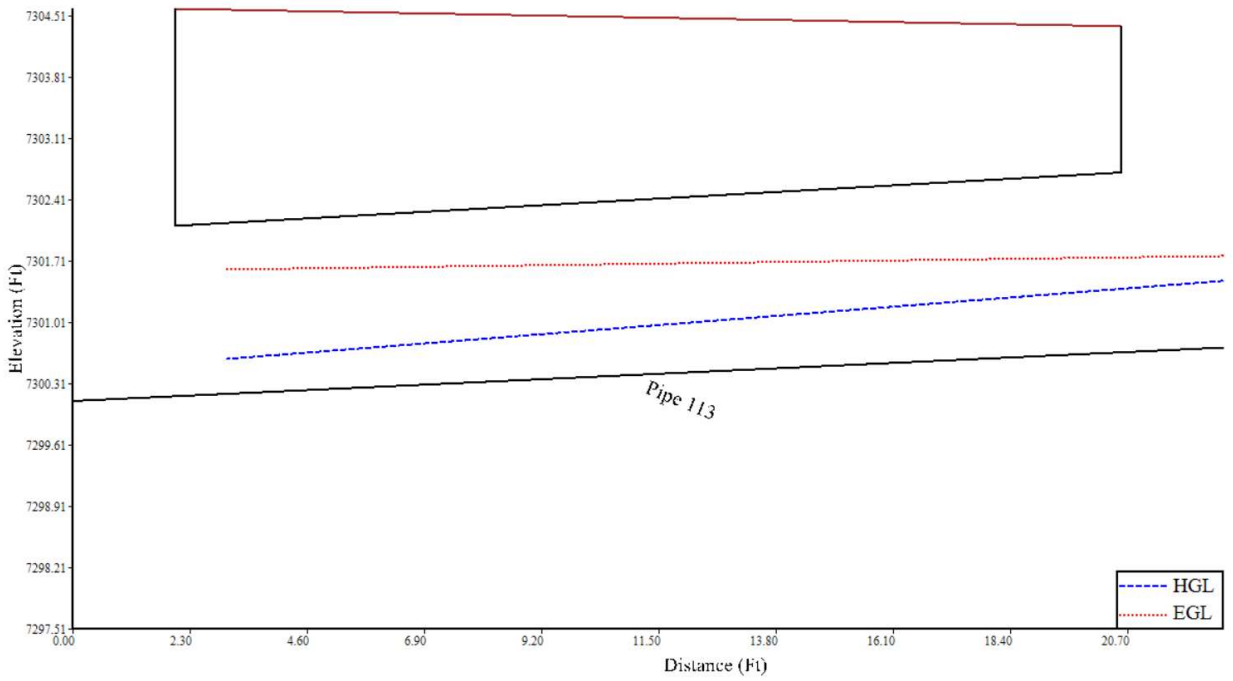
Stm-13


Elevation (Ft)
7308.20
7304.20
7300.20
7296.20
7292.20
7288.20
7284.20
7280.20
7276.20
7272.20
0.00
99.90
199.80
299.70
399.60
499.50
599.40
699.30
799.20
899.10
Distance (Ft)
Pipe 116
115a
115b
Pipe 108a
Pipe 108b
Pipe 107
HGL
EGL

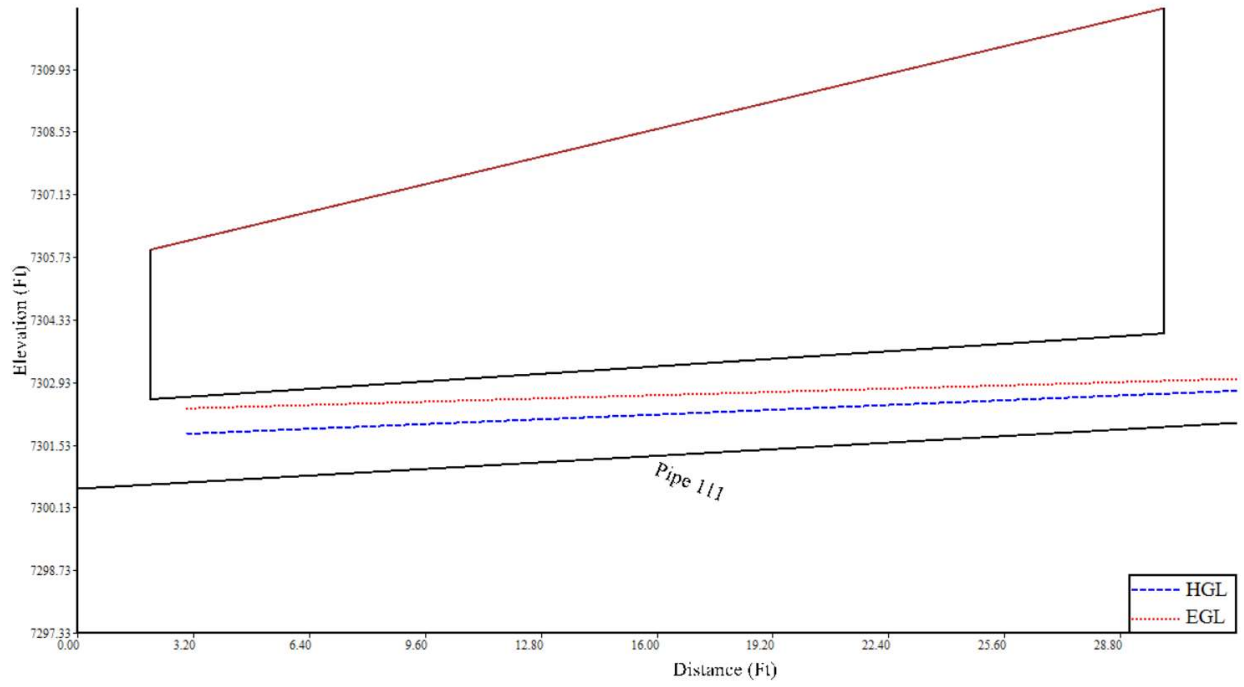
Stm-14


Elevation (Ft)
7314.14
7309.84
7305.54
7301.24
7296.94
7292.64
7288.34
7284.04
7279.74
7275.44
0.00
27.70
55.40
83.10
110.80
138.50
166.20
193.90
221.60
249.30
Distance (Ft)
Pipe 114
Pipe 112
Pipe 110
Pipe 109
HGL
EGL

Stm-16

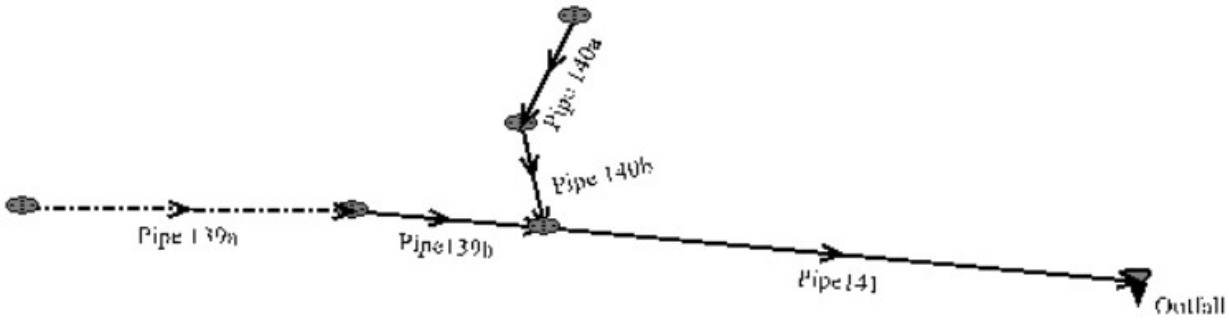

7304.51
7303.81
7303.11
7302.41
7301.71
7301.01
7300.31
7299.61
7298.91
7298.21
7297.51
Elevation (Ft)
Pipe 113
HGL
EGL
0.00
2.30
4.60
6.90
9.20
11.50
13.80
16.10
18.40
20.70
Distance (Ft)

Stm-17


7309.93
7308.53
7307.13
7305.73
7304.33
7302.93
7301.53
7300.13
7298.73
7297.33
Elevation (Ft)
Pipe 111
HGL
EGL
0.00
3.20
6.40
9.60
12.80
16.00
19.20
22.40
25.60
28.80
Distance (Ft)

System: CD Stm-18,19 100yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7315.42

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	7317.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe141	7328.20	5.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe139b	7329.05	2.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 139a	7330.45	2.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 140b	7328.02	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 140a	7328.02	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe141	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.20	
Pipe139b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.90	
Pipe 139a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.90	
Pipe 140b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	

Pipe 140a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Manning s n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
Pipe141	144.39	7314.57	5.0	7321.84	0.013	0.03	0.00	CIRCULAR	18.00 in	18.00 in
Pipe139b	39.62	7322.84	4.6	7324.67	0.013	0.05	0.25	CIRCULAR	18.00 in	18.00 in
Pipe 139a	84.25	7325.17	4.3	7328.79	0.013	0.05	0.00	ELLIPSE	23.00 in	14.00 in
Pipe 140b	13.90	7322.84	2.0	7323.12	0.013	1.19	1.00	CIRCULAR	18.00 in	18.00 in
Pipe 140a	35.34	7323.37	2.0	7324.08	0.013	0.38	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
Pipe141	23.63	13.37	10.54	4.84	5.74	10.73	3.21	Supercritical	5.20	0.00	
Pipe139b	22.64	12.81	7.76	3.98	4.35	8.80	3.06	Supercritical	2.90	0.00	
Pipe 139a	23.49	12.58	7.70	3.95	4.39	8.56	2.97	Supercritical	2.90	0.00	
Pipe 140b	14.96	8.46	4.91	3.07	3.45	5.07	2.00	Supercritical	1.20	0.00	

Pipe 140a	14.93	8.45	3.45	2.54	2.46	4.13	1.94	Supercritical	0.60	0.00	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
Pipe141	5.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	Exceeds max. Depth/Rise
Pipe139b	2.90	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	Exceeds max. Depth/Rise
Pipe 139a	2.90	ELLIPSE	23.00 in	14.00 in	18.00 in	18.00 in	23.00 in	14.00 in	1.87	Width is too small. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
Pipe 140b	1.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	Exceeds max. Depth/Rise
Pipe 140a	0.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	Exceeds max. Depth/Rise

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

Grade Line Summary:

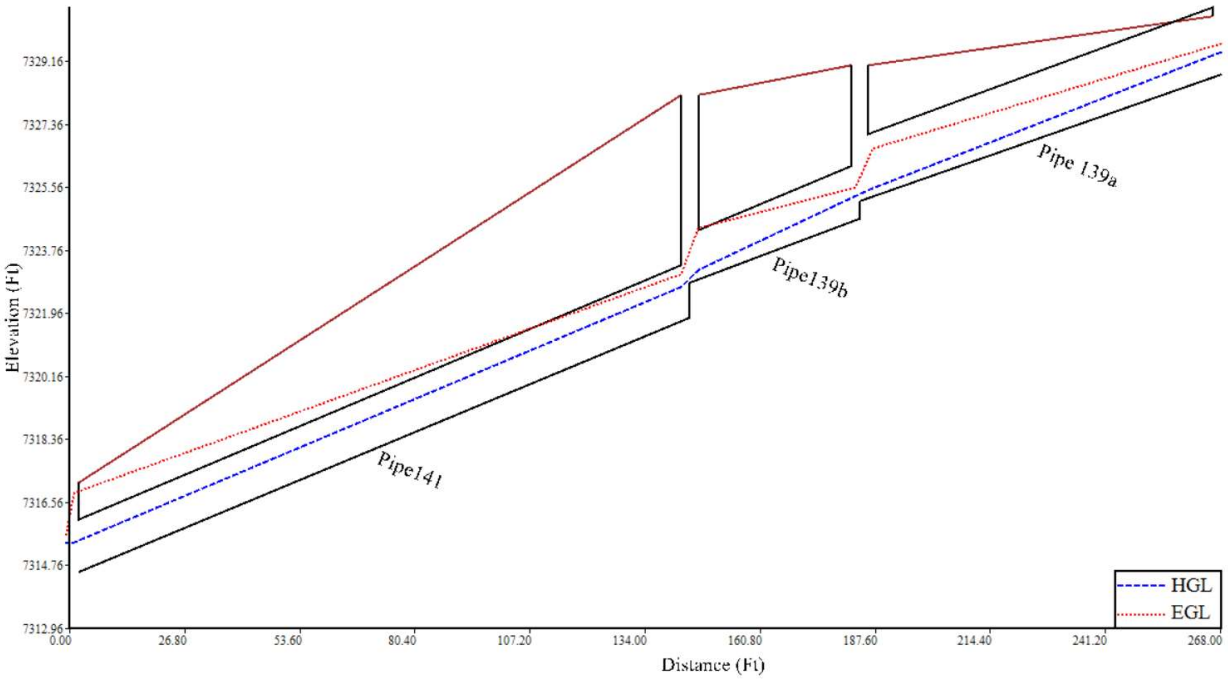
Tailwater Elevation (ft): 7315.42

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Pipe141	7314.57	7321.84	0.00	0.00	7315.42	7322.72	7316.83	6.25	7323.08
Pipe139b	7322.84	7324.67	0.00	0.12	7323.20	7325.32	7324.41	1.16	7325.56
Pipe 139a	7325.17	7328.79	0.00	0.00	7325.54	7329.43	7326.67	3.00	7329.67
Pipe 140b	7322.84	7323.12	0.01	0.13	7323.13	7323.53	7323.53	0.15	7323.68
Pipe 140a	7323.37	7324.08	0.00	0.00	7323.58	7324.37	7323.84	0.63	7324.47

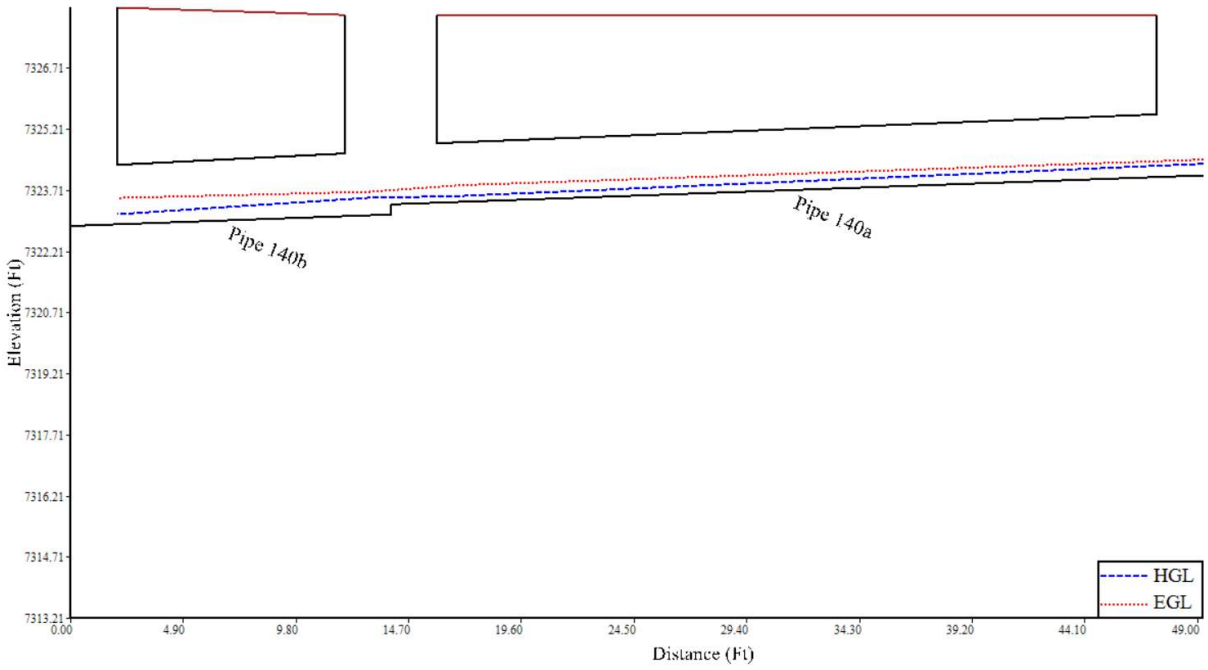
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):

Stm-18

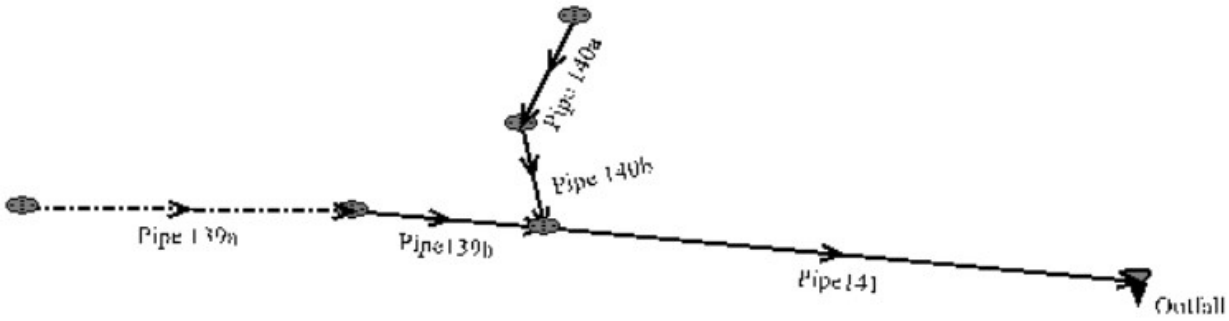

Elevation (Ft)
7329.16
7327.36
7325.56
7323.76
7321.96
7320.16
7318.36
7316.56
7314.76
7312.96
0.00
26.80
53.60
80.40
107.20
134.00
160.80
187.60
214.40
241.20
268.00
Distance (Ft)
Pipe 139a
Pipe139b
Pipe141
HGL
EGL

Stm-19


Elevation (Ft)
7326.71
7325.21
7323.71
7322.21
7320.71
7319.21
7317.71
7316.21
7314.71
7313.21
0.00
4.90
9.80
14.70
19.60
24.50
29.40
34.30
39.20
44.10
49.00
Distance (Ft)
Pipe 140b
Pipe 140a
HGL
EGL

System: CD Stm-18,19 10yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 10
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7314.97

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	7317.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe141	7328.20	2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe139b	7329.05	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 139a	7330.45	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 140b	7328.02	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 140a	7328.02	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe141	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.40	
Pipe139b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	
Pipe 139a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	
Pipe 140b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	

Pipe 140a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Manning s n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
Pipe141	144.39	7314.57	5.0	7321.84	0.013	0.03	0.00	CIRCULAR	18.00 in	18.00 in
Pipe139b	39.62	7322.84	4.6	7324.67	0.013	0.05	0.25	CIRCULAR	18.00 in	18.00 in
Pipe 139a	84.25	7325.17	4.3	7328.79	0.013	0.05	0.00	ELLIPSE	23.00 in	14.00 in
Pipe 140b	13.90	7322.84	2.0	7323.12	0.013	1.19	1.00	CIRCULAR	18.00 in	18.00 in
Pipe 140a	35.34	7323.37	2.0	7324.08	0.013	0.38	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
Pipe141	23.63	13.37	7.03	3.75	3.87	8.59	3.18	Supercritical	2.40	0.00	
Pipe139b	22.64	12.81	4.91	3.07	2.82	6.79	2.97	Supercritical	1.20	0.00	
Pipe 139a	23.49	12.58	4.88	3.05	2.84	6.60	2.88	Supercritical	1.20	0.00	
Pipe 140b	14.96	8.46	4.91	3.07	3.45	5.07	2.00	Supercritical	1.20	0.00	

Pipe 140a	14.93	8.45	3.45	2.54	2.46	4.13	1.94	Supercritical	0.60	0.00	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
Pipe141	2.40	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	Exceeds max. Depth/Rise
Pipe139b	1.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	Exceeds max. Depth/Rise
Pipe 139a	1.20	ELLIPSE	23.00 in	14.00 in	18.00 in	18.00 in	23.00 in	14.00 in	1.87	Width is too small. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
Pipe 140b	1.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	Exceeds max. Depth/Rise
Pipe 140a	0.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	Exceeds max. Depth/Rise

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

Grade Line Summary:

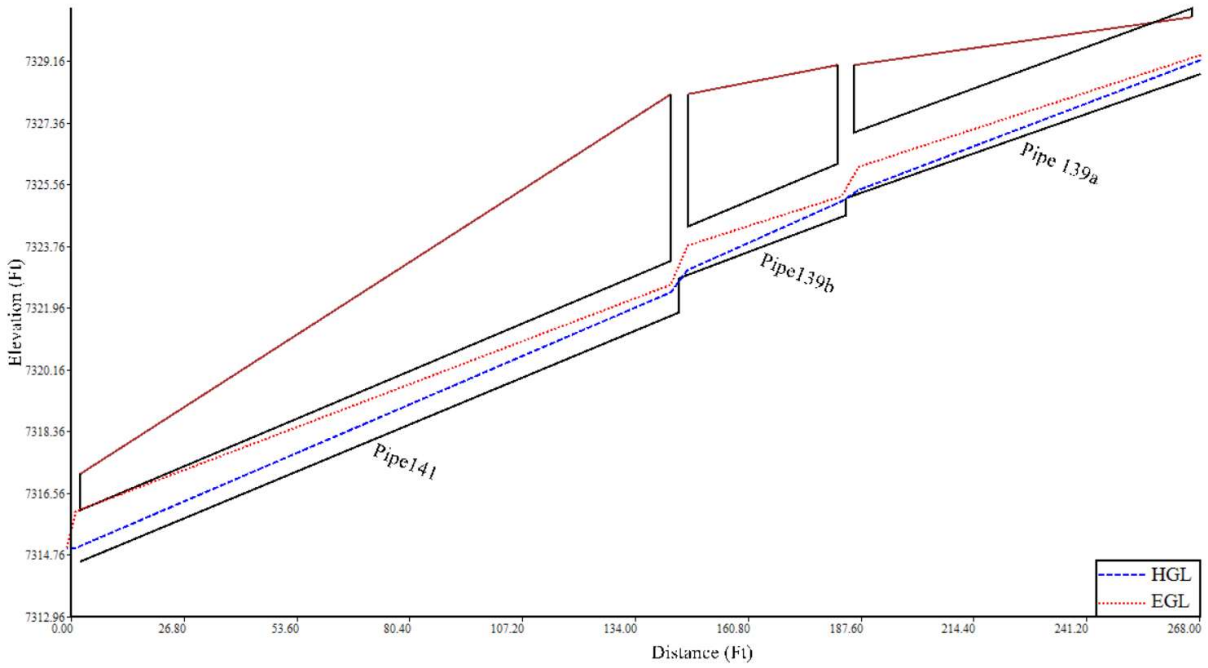
Tailwater Elevation (ft): 7314.97

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Pipe141	7314.57	7321.84	0.00	0.00	7314.97	7322.43	7316.04	6.61	7322.64
Pipe139b	7322.84	7324.67	0.00	0.03	7323.07	7325.08	7323.79	1.43	7325.23
Pipe 139a	7325.17	7328.79	0.00	0.00	7325.41	7329.20	7326.08	3.26	7329.34
Pipe 140b	7322.84	7323.12	0.01	0.02	7323.13	7323.53	7323.53	0.15	7323.68
Pipe 140a	7323.37	7324.08	0.00	0.00	7323.58	7324.37	7323.84	0.63	7324.47

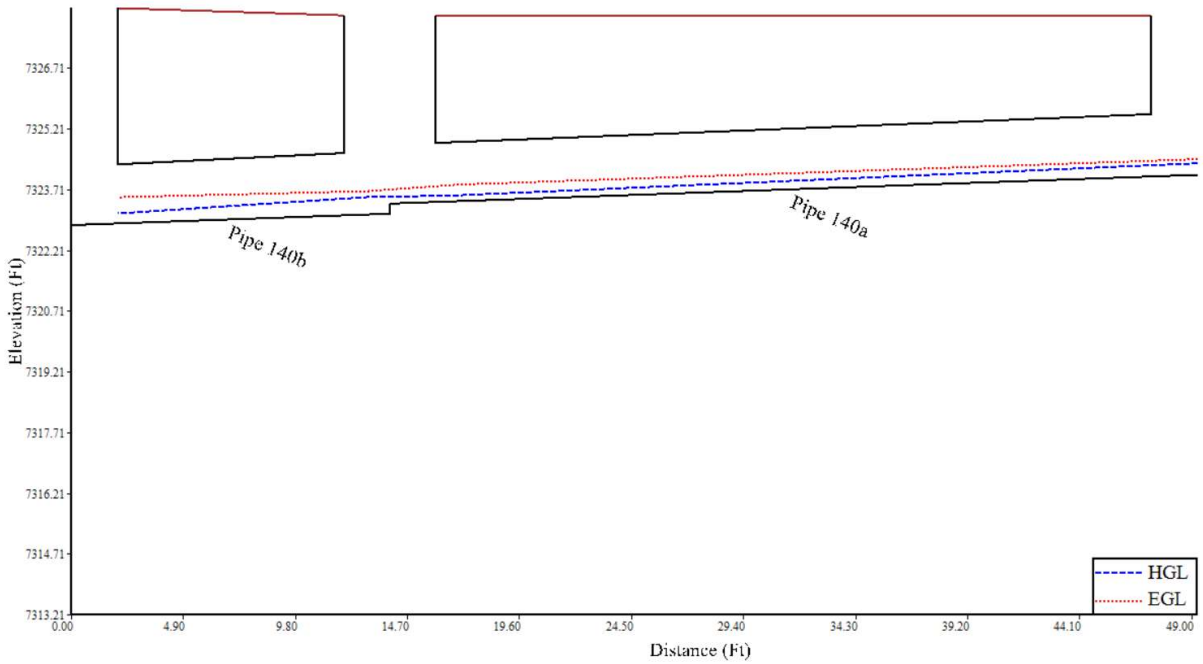
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):

Stm-18

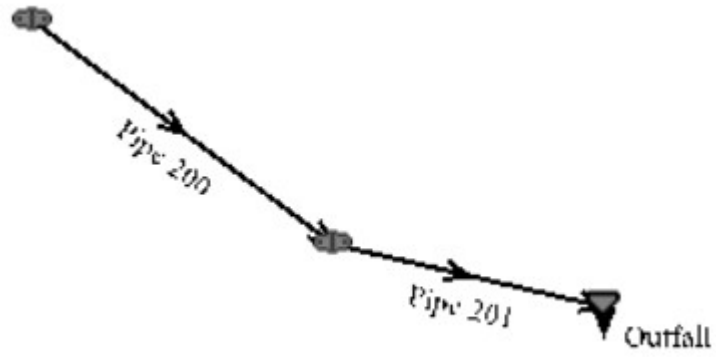

Elevation (Ft)
7329.16
7327.36
7325.56
7323.76
7321.96
7320.16
7318.36
7316.56
7314.76
7312.96
0.00
26.80
53.60
80.40
107.20
134.00
160.80
187.60
214.40
241.20
268.00
Distance (Ft)
Pipe141
Pipe139b
Pipe 139a
HGL
EGL

Stm-19


Elevation (Ft)
7326.71
7325.21
7323.71
7322.21
7320.71
7319.21
7317.71
7316.21
7314.71
7313.21
0.00
4.90
9.80
14.70
19.60
24.50
29.40
34.30
39.20
44.10
49.00
Distance (Ft)
Pipe 140b
Pipe 140a
HGL
EGL

System: CD Stm-20 100yr (for Filing No. 1 Only)

Diagram:



Rainfall Parameters

Rainfall Return Period: 100
ainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7304.30

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	7312.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 201	7315.06	34.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 200	7311.20	34.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe 201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.50	
Pipe 200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.50	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Lengt	Downstream	Slope (%)	Upstream	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft	Span (ft

	h (ft)	Invert (ft)		Invert (ft)					or in)	or in)
Pipe 201	110.75	7302.71	2.2	7305.15	0.013	0.00	0.00	CIRCULAR	48.00 in	48.00 in
Pipe 200	62.72	7305.32	0.5	7305.63	0.013	0.08	0.00	CIRCULAR	30.00 in	30.00 in

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Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pipe 201	213.63	17.00	20.96	6.54	13.04	12.49	2.50	Supercritical	34.50	0.00	
Pipe 200	29.08	5.92	30.00	7.03	30.00	7.03	0.00	Pressurized	34.50	62.72	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pipe 201	34.50	CIRCULAR	48.00 in	48.00 in	27.00 in	27.00 in	48.00 in	48.00 in	12.57	Exceeds max. Depth/Rise
Pipe 200	34.50	CIRCULAR	30.00 in	30.00 in	33.00 in	33.00 in	30.00 in	30.00 in	4.91	Existing height is smaller than the

										suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

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

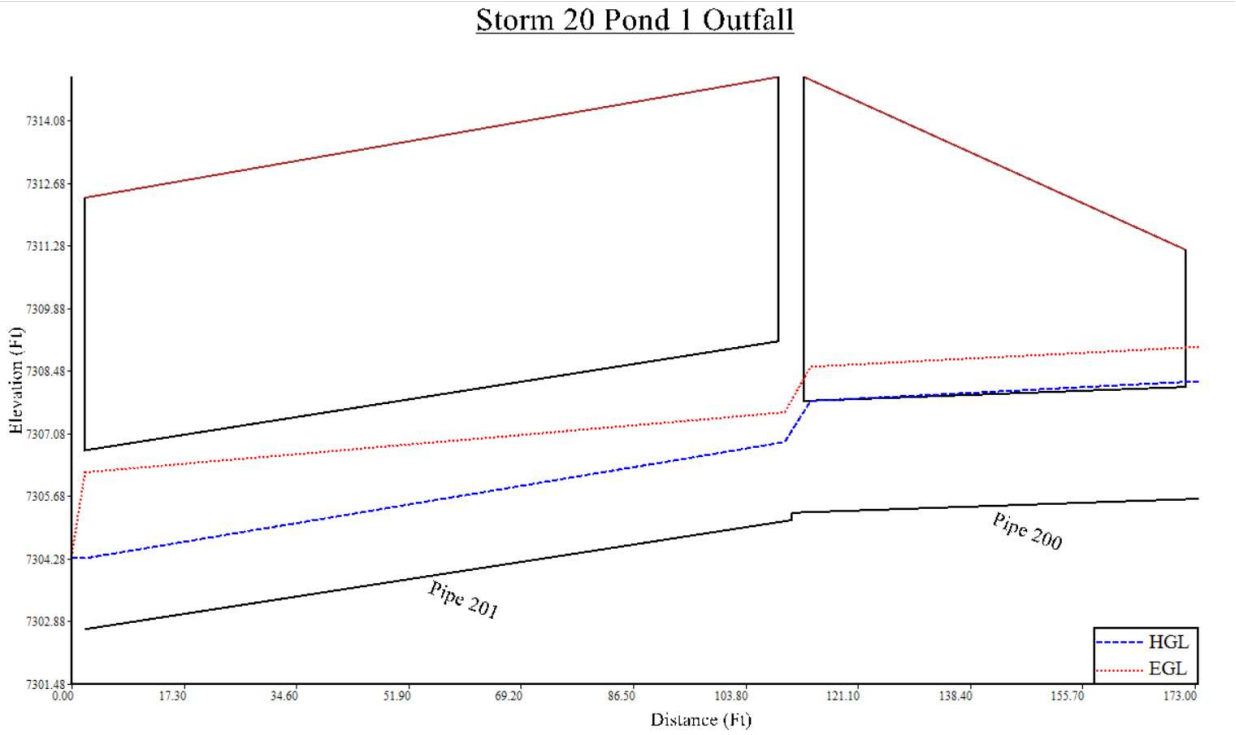
Grade Line Summary:

Tailwater Elevation (ft): 7304.30

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Pipe 201	7302.71	7305.15	0.00	0.00	7304.30	7306.90	7306.22	1.34	7307.56
Pipe 200	7305.32	7305.63	0.06	0.00	7307.82	7308.26	7308.58	0.44	7309.02

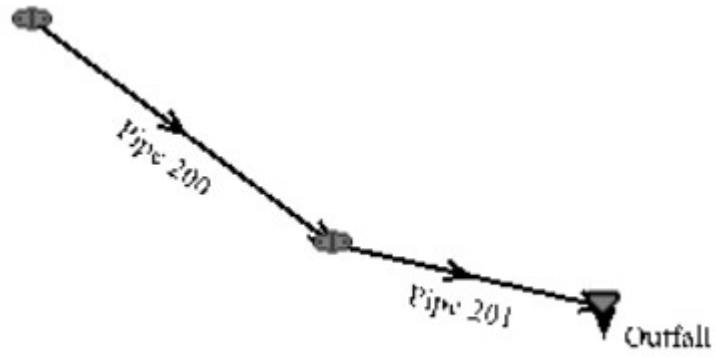
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):


Storm 20 Pond 1 Outfall
Elevation (Ft)
7314.08
7312.68
7311.28
7309.88
7308.48
7307.08
7305.68
7304.28
7302.88
7301.48
0.00
17.30
34.60
51.90
69.20
86.50
103.80
121.10
138.40
155.70
173.00
Distance (Ft)
Pipe 201
Pipe 200
HGL
EGL

System: CD Stm-20 10yr (for Filing No. 1 only)

Diagram:



Rainfall Parameters

Rainfall Return Period: 10
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7304.30

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	7312.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 201	7315.06	11.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 200	7311.20	11.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe 201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.40	
Pipe 200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.40	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Lengt	Downstream	Slope (%)	Upstream	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft	Span (ft

	h (ft)	Invert (ft)		Invert (ft)					or in)	or in)
Pipe 201	110.75	7302.71	2.2	7305.15	0.013	0.00	0.00	CIRCULAR	48.00 in	48.00 in
Pipe 200	62.72	7305.32	0.5	7305.63	0.013	0.08	0.00	CIRCULAR	30.00 in	30.00 in

---

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pipe 201	213.63	17.00	11.82	4.74	7.53	9.03	2.42	Supercritical	11.40	0.00	
Pipe 200	29.08	5.92	13.57	5.28	13.05	5.56	1.08	Supercritical	11.40	0.00	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pipe 201	11.40	CIRCULAR	48.00 in	48.00 in	18.00 in	18.00 in	48.00 in	48.00 in	12.57	Exceeds max. Depth/Rise
Pipe 200	11.40	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise

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

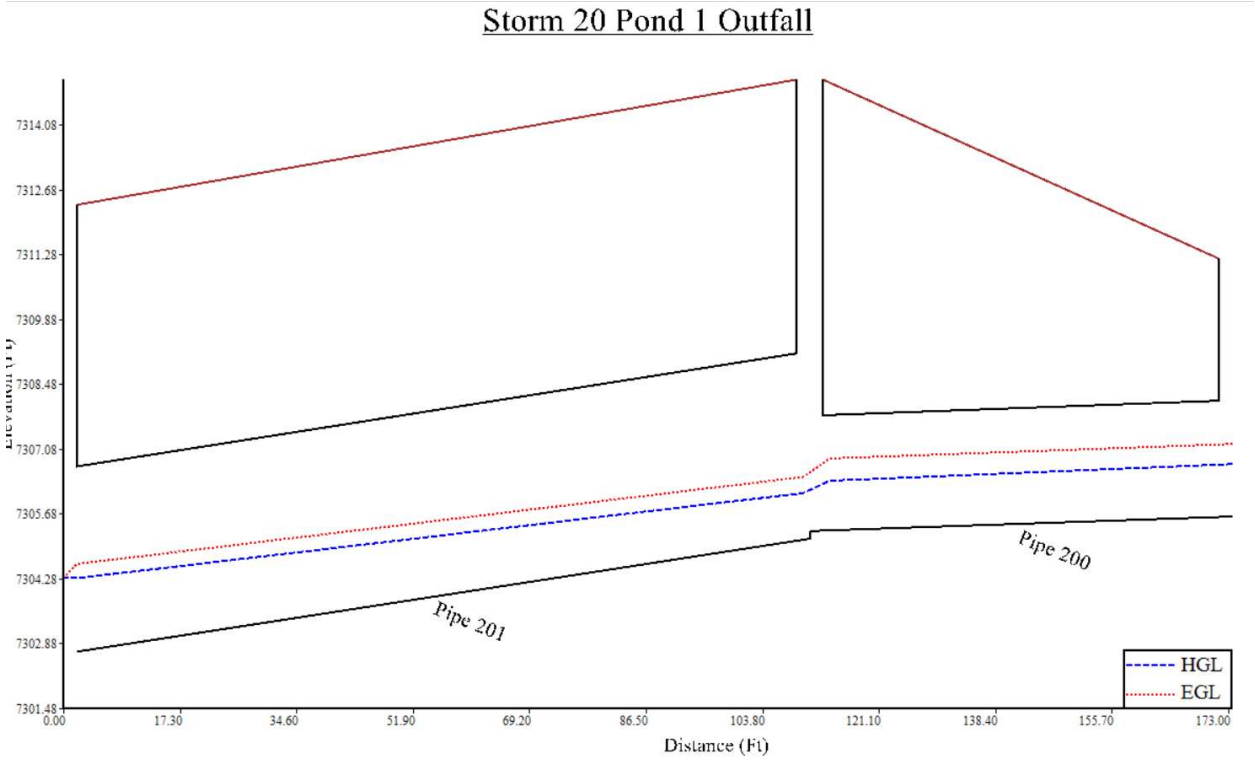
Grade Line Summary:

Tailwater Elevation (ft): 7304.30

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pipe 201	7302.71	7305.15	0.00	0.00	7304.30	7306.14	7304.61	1.88	7306.48
Pipe 200	7305.32	7305.63	0.01	0.00	7306.40	7306.76	7306.88	0.31	7307.19

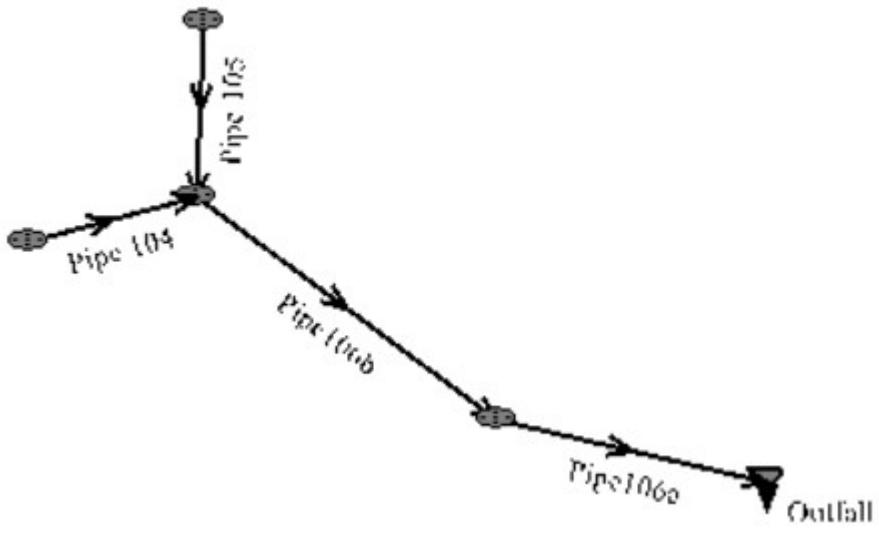
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profiles:



System: CD Stm-22,24 100yr (Future – added 104 and 105)

Diagram:



Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7311.01

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	7312.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pipe106a	7322.11	64.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe106b	7322.48	64.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 105	7323.01	26.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 104	7321.40	37.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe106a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	64.20	
Pipe106b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	64.20	
Pipe 105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.50	
Pipe 104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.70	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
Pipe106a	52.00	7301.57	3.0	7303.13	0.013	0.03	0.00	CIRCULAR	42.00 in	42.00 in
Pipe106b	45.80	7312.54	3.0	7313.91	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in

Pipe 105	16.00	7316.40	2.3	7316.77	0.013	0.38	0.44	CIRCULAR	24.00 in	24.00 in
Pipe 104	16.00	7315.90	1.0	7316.06	0.013	0.38	0.44	CIRCULAR	30.00 in	30.00 in

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Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
Pipe106a	174.73	18.16	30.14	8.69	17.62	16.77	2.81	Pressurized	64.20	52.00	
Pipe106b	174.73	18.16	30.14	8.69	17.62	16.77	2.81	Supercritical	64.20	0.00	
Pipe 105	34.40	10.95	21.57	8.91	15.80	12.08	1.98	Supercritical	26.50	0.00	
Pipe 104	41.13	8.38	24.92	8.65	22.60	9.50	1.23	Supercritical	37.70	0.00	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
Pipe106a	64.20	CIRCULAR	42.00 in	42.00 in	30.00 in	30.00 in	42.00 in	42.00 in	9.62	Exceeds max. Depth/Rise

Pipe106b	64.20	CIRCULAR	42.00 in	42.00 in	30.00 in	30.00 in	42.00 in	42.00 in	9.62	Exceeds max. Depth/Rise
Pipe 105	26.50	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe 104	37.70	CIRCULAR	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise

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

Grade Line Summary:

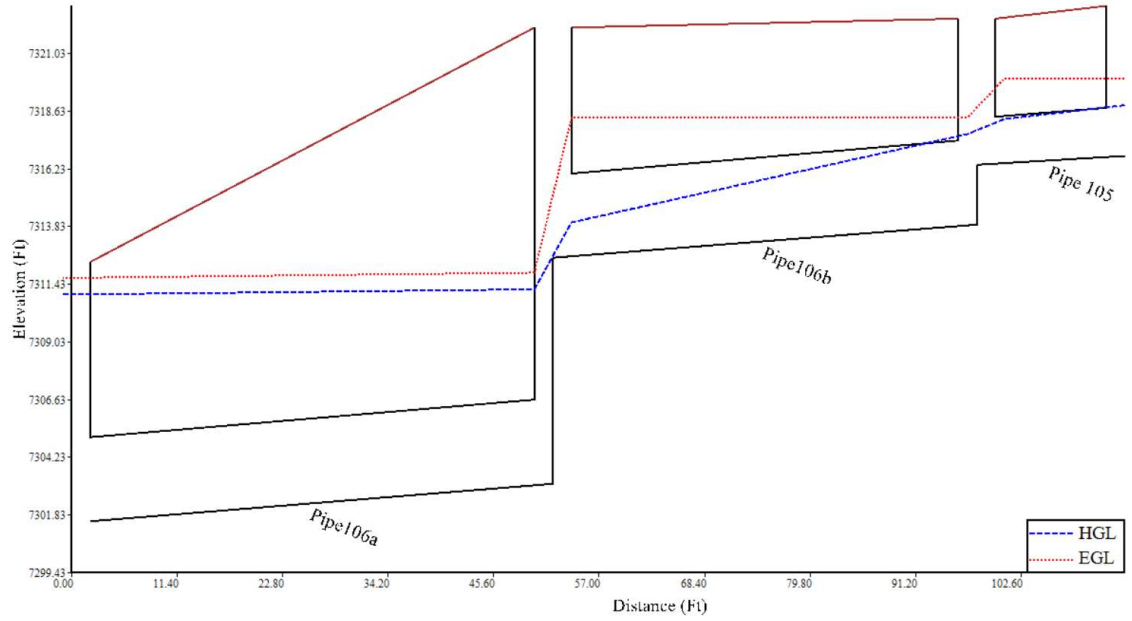
Tailwater Elevation (ft): 7311.01

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Pipe106a	7301.57	7303.13	0.00	0.00	7311.01	7311.22	7311.70	0.21	7311.91
Pipe106b	7312.54	7313.91	0.03	0.00	7314.00	7317.68	7318.37	0.00	7318.37
Pipe 105	7316.40	7316.77	0.42	0.21	7318.30	7318.88	7319.98	0.00	7319.98
Pipe 104	7315.90	7316.06	0.35	0.29	7318.32	7318.32	7319.19	0.15	7319.33

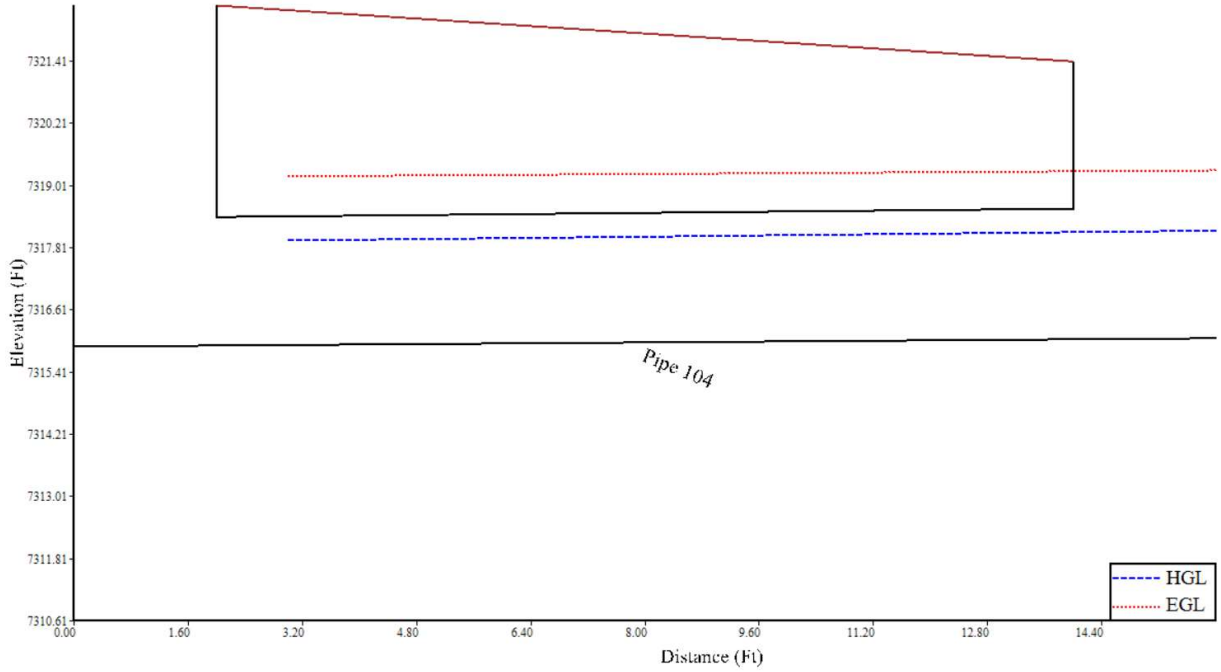
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):

Stm-22

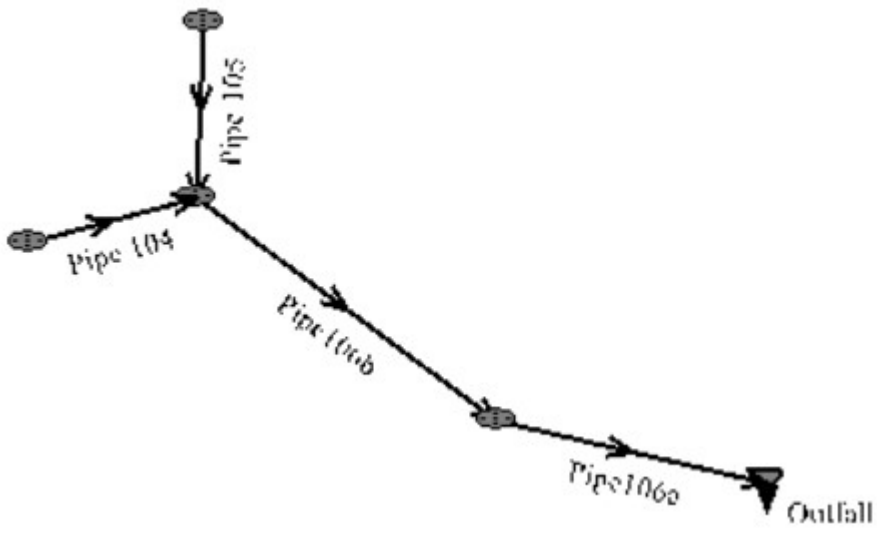


Stm-24



System: CD Stm-22, 24 10yr (Future – added 104 and 105)

Diagram:



Rainfall Parameters

Rainfall Return Period: 10
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7310.25

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	7312.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe106a	7322.11	36.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe106b	7322.48	36.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 105	7323.01	14.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 104	7321.40	21.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe106a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.40	
Pipe106b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.40	
Pipe 105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.60	

Pipe 104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.80	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Manning s n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
Pipe106a	52.00	7301.57	3.0	7303.13	0.013	0.03	0.00	CIRCULAR	42.00 in	42.00 in
Pipe106b	45.80	7312.54	3.0	7313.91	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in
Pipe 105	16.00	7316.40	2.3	7316.77	0.013	0.38	0.44	CIRCULAR	24.00 in	24.00 in
Pipe 104	16.00	7315.90	1.0	7316.06	0.013	0.38	0.44	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
Pipe106a	174.73	18.16	22.46	6.95	13.01	14.34	2.85	Pressurized	36.40	52.00	
Pipe106b	174.73	18.16	22.46	6.95	13.01	14.34	2.85	Supercritical	36.40	0.00	
Pipe 105	34.40	10.95	16.52	6.33	10.92	10.50	2.22	Supercritical	14.60	0.00	
Pipe 104	41.13	8.38	19.05	6.63	15.53	8.50	1.48	Supercritical	21.80	0.00	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
Pipe106a	36.40	CIRCULAR	42.00 in	42.00 in	24.00 in	24.00 in	42.00 in	42.00 in	9.62	Exceeds max. Depth/Rise
Pipe106b	36.40	CIRCULAR	42.00 in	42.00 in	24.00 in	24.00 in	42.00 in	42.00 in	9.62	Exceeds max. Depth/Rise
Pipe 105	14.60	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe 104	21.80	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise

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

Grade Line Summary:

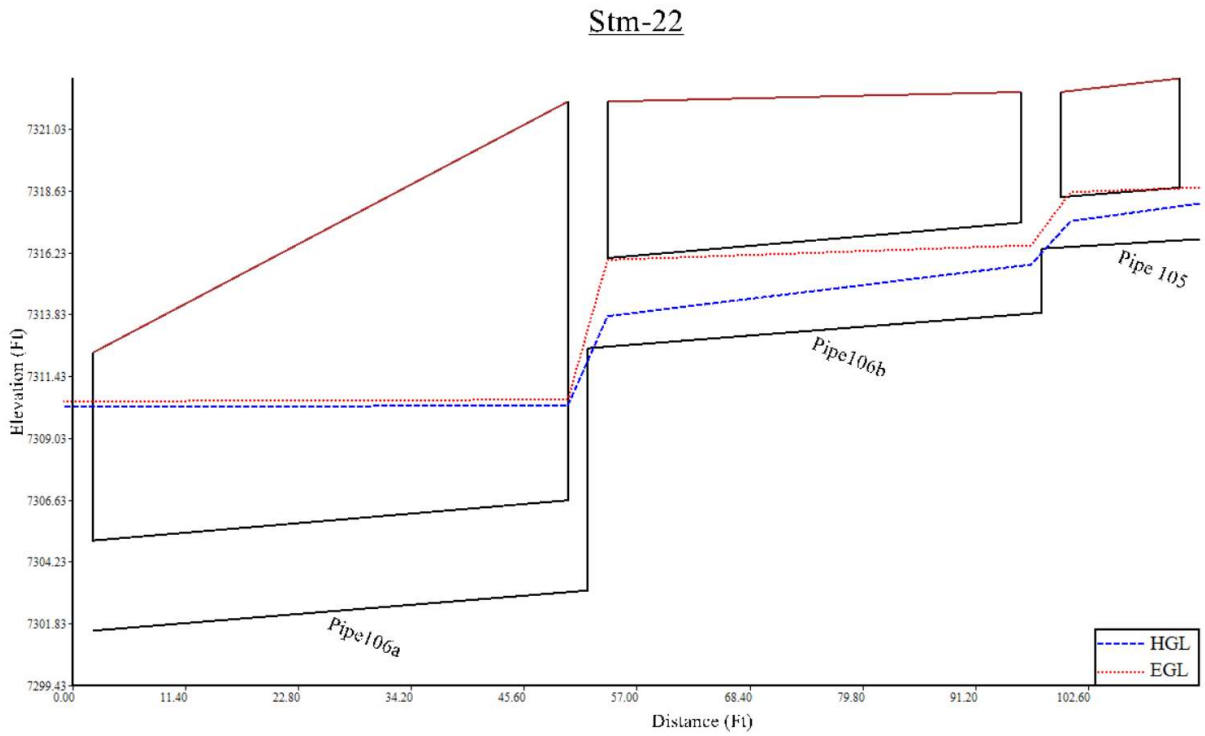
Tailwater Elevation (ft): 7310.25

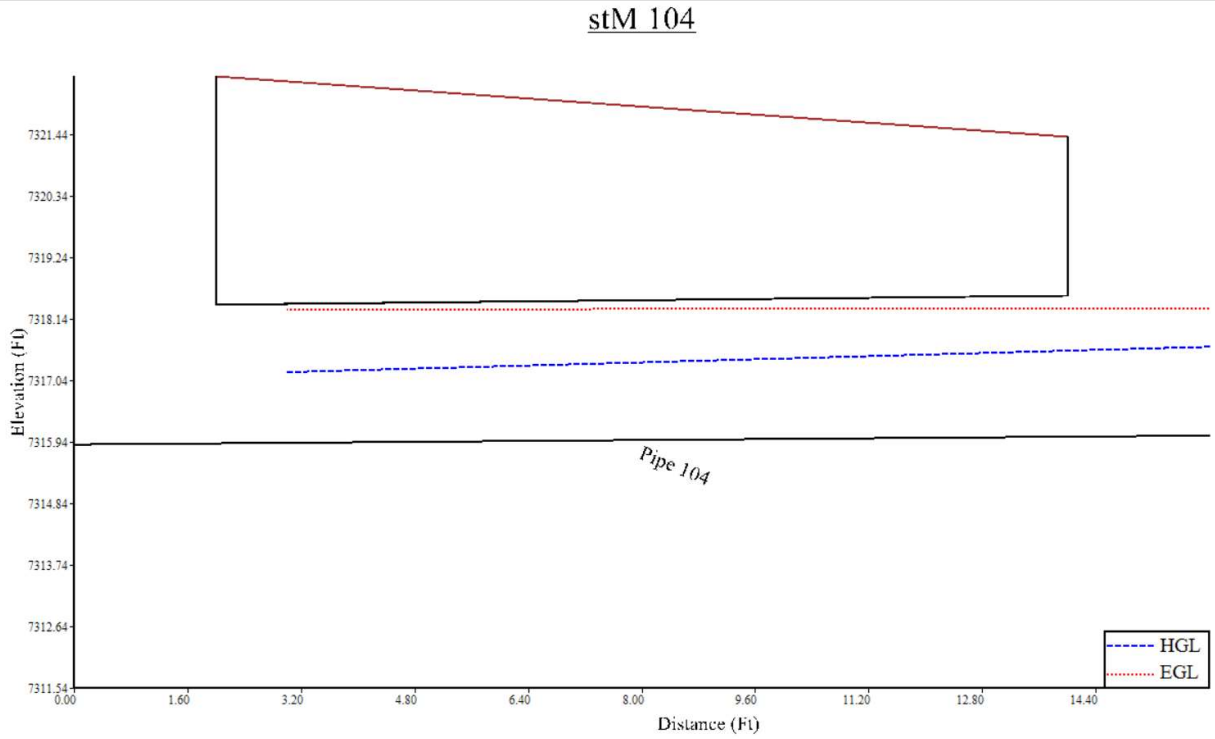
	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Los**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**

			s (ft)						
Pipe106a	7301.57	7303.13	0.00	0.00	7310.25	7310.32	7310.47	0.07	7310.54
Pipe106b	7312.54	7313.91	0.01	0.00	7313.78	7315.78	7315.96	0.57	7316.53
Pipe 105	7316.40	7316.77	0.13	0.07	7317.47	7318.15	7318.60	0.17	7318.77
Pipe 104	7315.90	7316.06	0.12	0.09	7317.19	7317.65	7318.32	0.01	7318.33

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

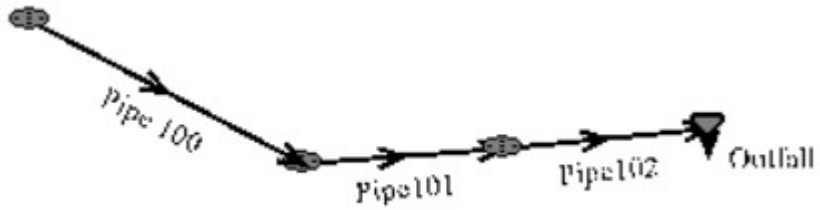
Profile(s):





System: CD Stm-21 100yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7311.01

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	7312.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe102	7315.84	29.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe101	7320.73	29.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 100	7321.18	14.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution	Total Design Flow	

Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.00	
Pipe101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.00	
Pipe 100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.50	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pipe102	30.00	7308.03	5.3	7309.62	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in
Pipe101	22.24	7309.87	10.0	7312.09	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
Pipe 100	44.34	7313.10	7.5	7316.43	0.013	0.38	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pipe102	52.22	16.62	22.15	9.57	12.78	17.06	3.26	Supercritical Jump	29.00	26.74	

Pipe101	71.73	22.83	22.15	9.57	10.62	21.62	4.64	Supercritical	29.00	0.00	Velocity is Too High
Pipe 100	62.12	19.77	16.46	6.31	7.89	16.12	4.11	Supercritical Jump	14.50	38.08	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
Pipe102	29.00	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe101	29.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe 100	14.50	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise

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

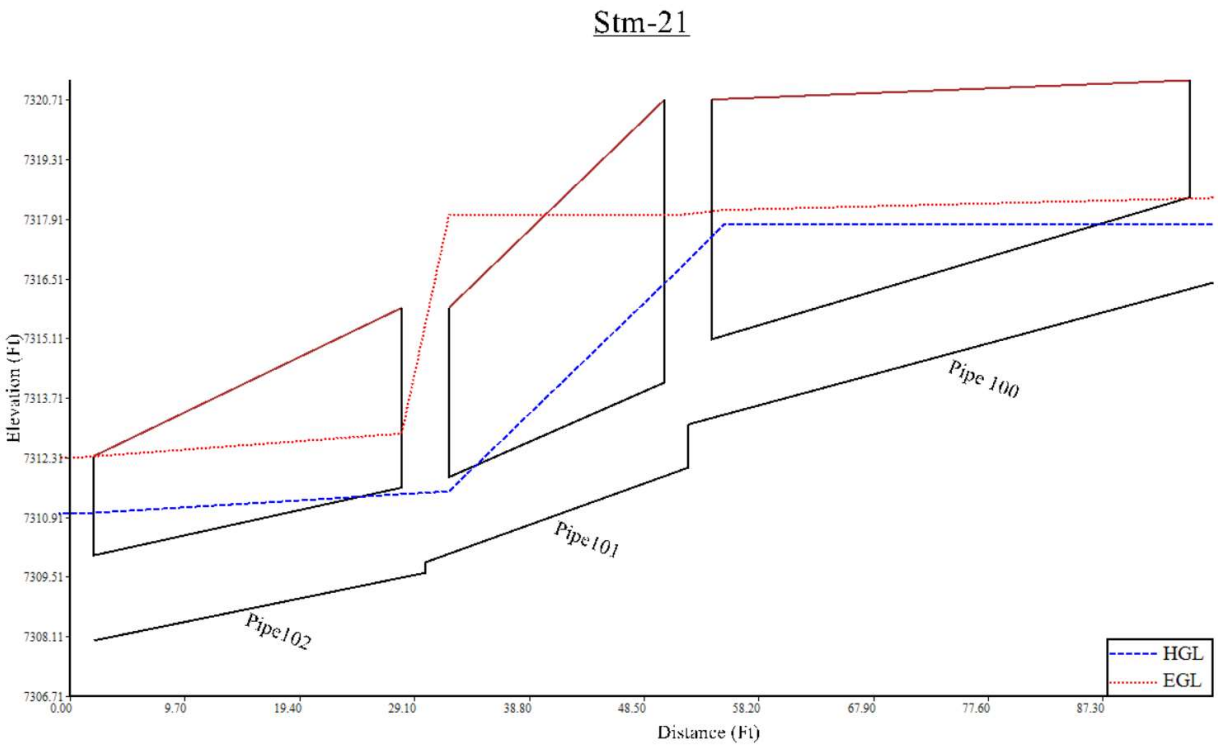
Grade Line Summary:

Tailwater Elevation (ft): 7311.01

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Pipe102	7308.03	7309.62	0.00	0.00	7311.01	7311.47	7312.33	0.55	7312.89
Pipe101	7309.87	7312.09	0.07	0.00	7311.53	7316.69	7318.01	0.00	7318.01
Pipe 100	7313.10	7316.43	0.13	0.00	7317.81	7317.81	7318.14	0.28	7318.42

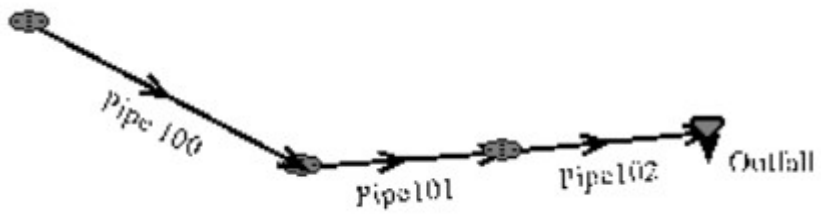
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):



System: CD Stm-21 10yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 10
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7310.25

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	7312.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe102	7315.84	17.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe101	7320.73	17.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 100	7321.18	8.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.40	
Pipe101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.40	
Pipe 100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.70	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)

Pipe102	30.00	7308.03	5.3	7309.62	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in
Pipe101	22.24	7309.87	10.0	7312.09	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
Pipe 100	44.34	7313.10	7.5	7316.43	0.013	0.38	0.00	CIRCULAR	24.00 in	24.00 in

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Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
Pipe102	52.22	16.62	18.04	6.87	9.54	14.95	3.42	Supercritical Jump	17.40	4.67	
Pipe101	71.73	22.83	18.04	6.87	8.05	18.82	4.74	Supercritical	17.40	0.00	Velocity is Too High
Pipe 100	62.12	19.77	12.62	5.20	6.07	13.94	4.10	Supercritical Jump	8.70	11.68	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**

Pipe102	17.40	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe101	17.40	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise
Pipe 100	8.70	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	Exceeds max. Depth/Rise

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

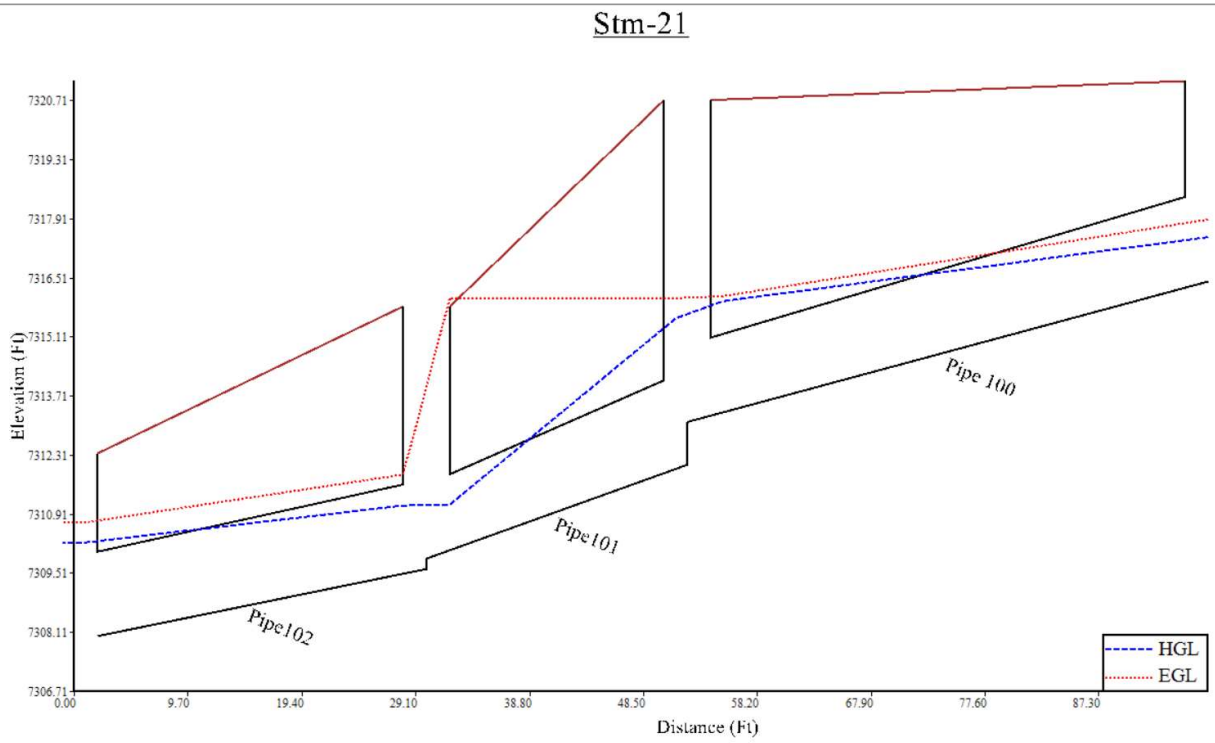
Grade Line Summary:

Tailwater Elevation (ft): 7310.25

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Pipe102	7308.03	7309.62	0.00	0.00	7310.25	7311.12	7310.73	1.13	7311.86
Pipe101	7309.87	7312.09	0.02	0.00	7311.15	7315.56	7316.04	0.00	7316.04
Pipe 100	7313.10	7316.43	0.05	0.00	7315.96	7317.48	7316.08	1.82	7317.90

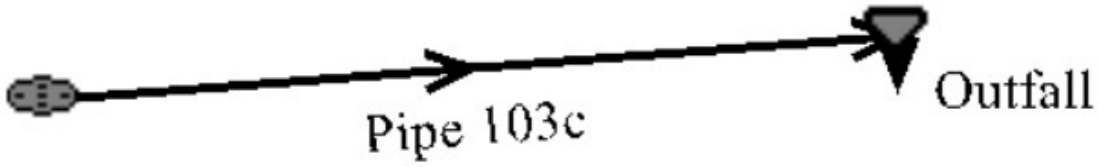
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):



System: CD Stm-23 100yr

Diagram:



Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7315.14

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	7320.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 103c	7320.80	21.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe 103c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning's n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pipe 103c	89.78	7314.08	2.0	7315.88	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pipe 103c	58.16	11.85	18.77	6.56	12.53	10.92	2.17	Supercritical	21.20	0.00	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pipe 103c	21.20	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise

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

Grade Line Summary:

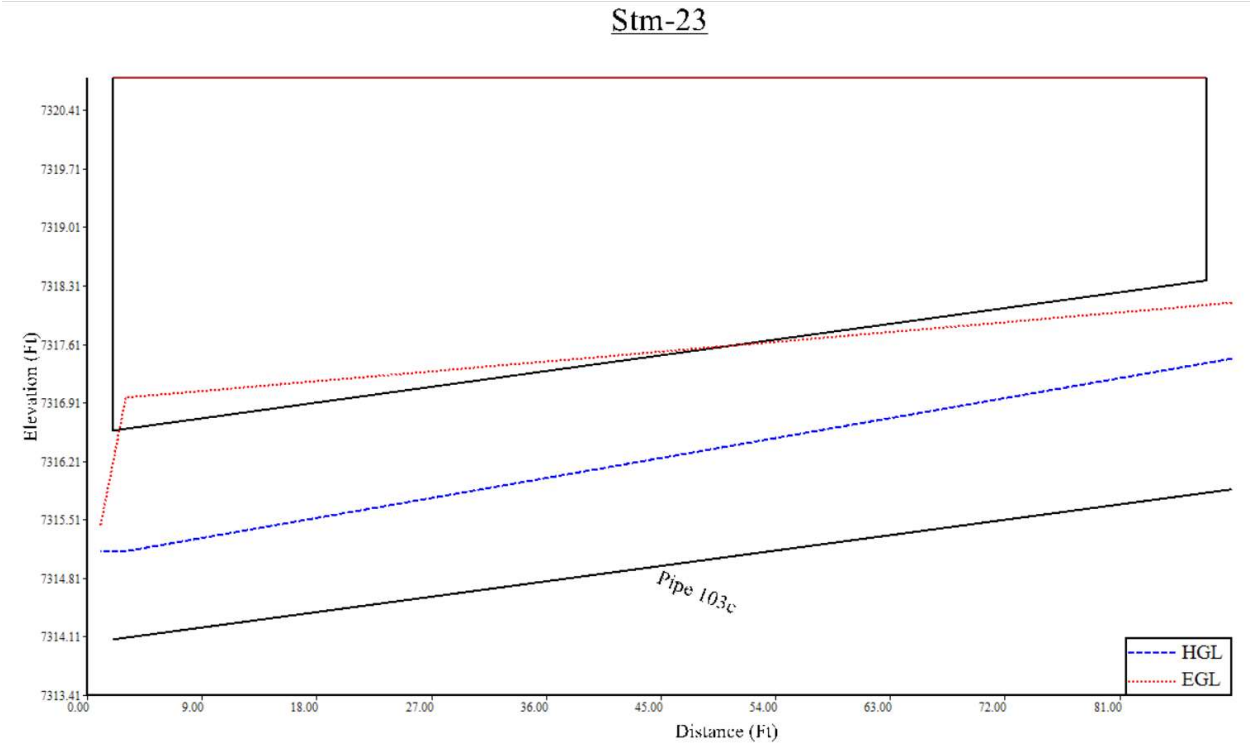
Tailwater Elevation (ft): 7315.14

	Invert Elev.	Downstream Manhole Losses	HGL	EGL

Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pipe 103c	7314.08	7315.88	0.00	0.00	7315.14	7317.44	7316.98	1.13	7318.11

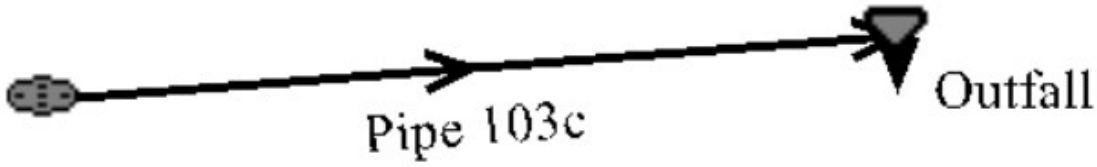
- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Profile(s):



System: CD Stm-23 10yr

Diagram:



System Input Summary

Rainfall Parameters

Rainfall Return Period: 10
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.00
Maximum Rural Overland Len. (ft): 0
Maximum Urban Overland Len. (ft): 0
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.00
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 7315.09

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	7320.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe 103c	7320.80	7.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pipe 103c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.90	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning s n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pipe 103c	89.80	7314.08	2.0	7315.88	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pipe 103c	58.16	11.85	11.21	4.72	7.47	8.28	2.20	Supercritical	7.90	0.00	

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

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pipe 103c	7.90	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	Exceeds max. Depth/Rise

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

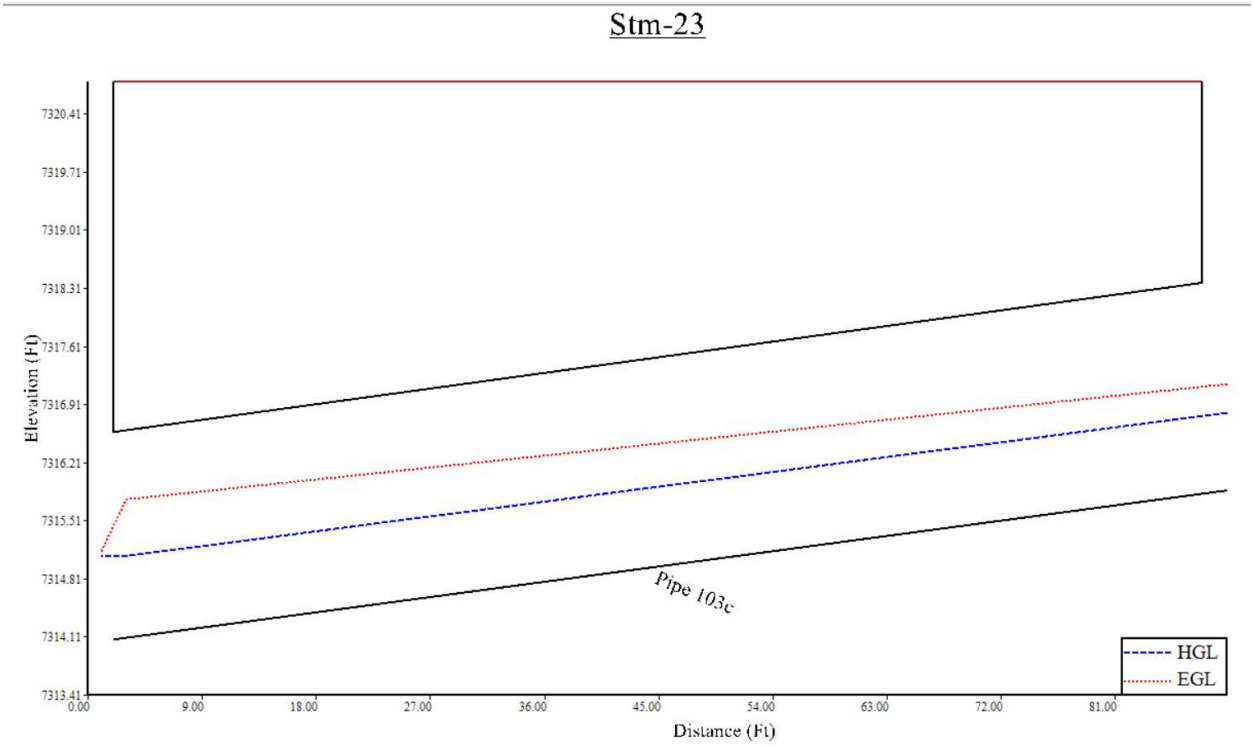
Grade Line Summary:

Tailwater Elevation (ft): 7315.09

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pipe 103c	7314.08	7315.88	0.00	0.00	7315.09	7316.81	7315.77	1.39	7317.16

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

Profile(s):



MONUMENT RIDGE EAST - FILING NO. 1
FINAL DRAINAGE REPORT
(Pipe Summary)

Pipe ID	Filing 1 (Interim) - Flow (cfs)		Future - Flow (cfs)		Control (F1=Filing 1, Fut=Future)	Pipe Diam
	Q_{10}	Q_{100}	Q_{10}	Q_{100}		
100	5.0	14.3	8.7	14.5	Fut	24"
101	9.9	28.7	17.4	29.0	Fut	24"
102	9.9	28.7	17.4	29.0	Fut	24"
103	2.0	6.7	7.9	21.2	Fut	30"
104	No Flow (stub for future)		21.8	37.7	Fut	30"
105	No Flow (stub for future)		14.6	26.5	Fut	30"
106	No Flow (for future)		36.4	64.2	Fut	42"
107	9.5	21.4	6.2	10.5	F1	24"
108	19.0	42.9	12.5	21.0	F1	30"
109	No Flow (stub for future)		17.9	30.3	Fut	30"
110	No Flow (for future)		17.9	30.3	Fut	30"
111	No Flow (stub for future)		4.2	7.0	Fut	24"
112	No Flow (for future)		22.1	37.3	Fut	36"
113	3.6	7.0	4.7	7.5	Fut	24"
114	3.6	7.0	26.8	44.8	Fut	36"
115	22.6	49.9	39.3	65.8	Fut	42"
116	22.6	49.9	39.3	65.8	Fut	42"
117	7.6	28.0	7.2	19.5	F1	36"
118	No Flow (stub for future)		0.3	5.5	Fut	18"
119	7.6	28.0	7.5	25.0	F1	36"
120	7.6	28.0	7.5	25.0	F1	36"
121	25.7	67.2	19.7	71.2	Fut	48"
122	7.5	15.9	12.1	22.5	Fut	24"
123	14.9	31.9	24.3	45.0	Fut	30"
124	1.5	3.1	2.1	3.8	Fut	18"
125	59.2	118.3	59.2	118.3	F1=Fut	54"
126	60.0	120.7	60.2	121.1		54"
127	102.6	211.4	102.6	211.4		54"
128	162.6	332.0	162.8	332.4		78"
129	162.6	332.0	162.8	332.4		78"
130	7.8	14.9	7.8	14.9		24"
131	7.8	14.9	7.8	14.9		24"
132	15.6	29.8	15.6	29.8		30"
133	6.2	11.7	6.2	11.7		18"
134	21.8	41.5	21.8	41.5		30"
135	28.0	53.2	28.0	53.2		36"
136	11.4	34.1	12.2	43.2	Fut	36"
137	9.3	17.4	9.3	17.4	F1=Fut	24"
138	1.6	5.4	1.6	5.4		18"
139	1.2	2.9	1.2	2.9		18"
140	0.6	1.1	0.6	1.1		18"
141	2.4	5.2	2.4	5.2		18"

Culvert Report

Design Point F21 Existing 1-48in Pipe

Invert Elev Dn (ft)	=	51.92
Pipe Length (ft)	=	70.00
Slope (%)	=	5.41
Invert Elev Up (ft)	=	55.71
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

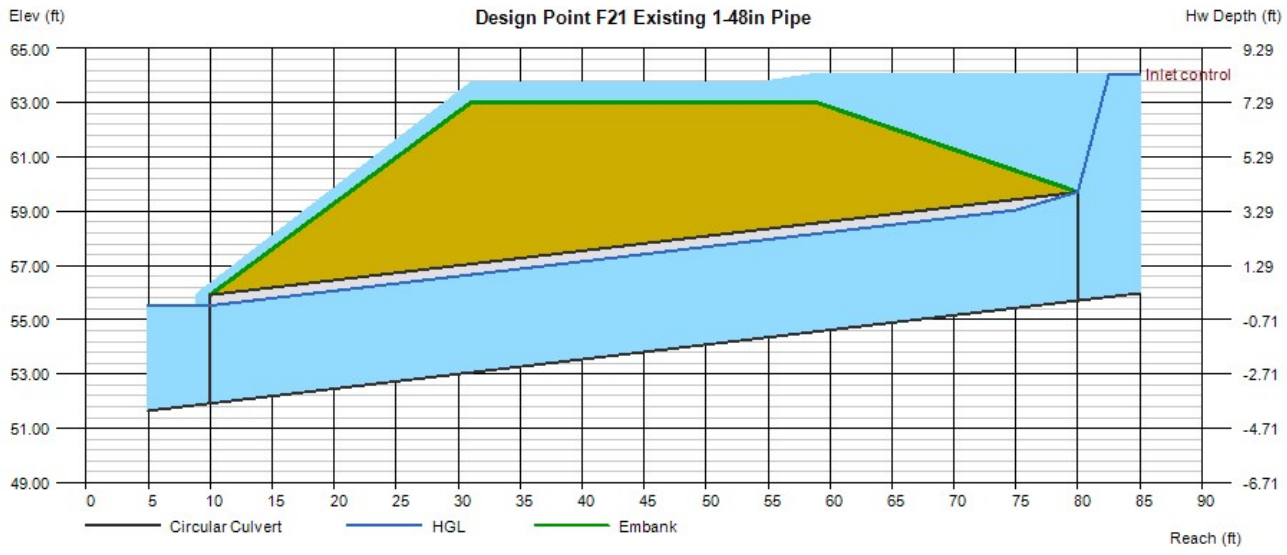
Top Elevation (ft)	=	63.00
Top Width (ft)	=	28.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	488.00
Qmax (cfs)	=	488.00
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	488.00
Qpipe (cfs)	=	151.49
Qovertop (cfs)	=	336.51
Veloc Dn (ft/s)	=	12.70
Veloc Up (ft/s)	=	12.70
HGL Dn (ft)	=	55.53
HGL Up (ft)	=	59.32
Hw Elev (ft)	=	64.07
Hw/D (ft)	=	2.09
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Dec 29 2025

Design Point F21 Proposed 3-48in Pipes

Plans show 2-48" (1 existing and 1 proposed) and 1 54". Please revise design calculations

Invert Elev Dn (ft)	=	51.92
Pipe Length (ft)	=	70.00
Slope (%)	=	5.41
Invert Elev Up (ft)	=	55.71
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	3
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0018, 2, 0.0292, 0.74, 0.2

Embankment

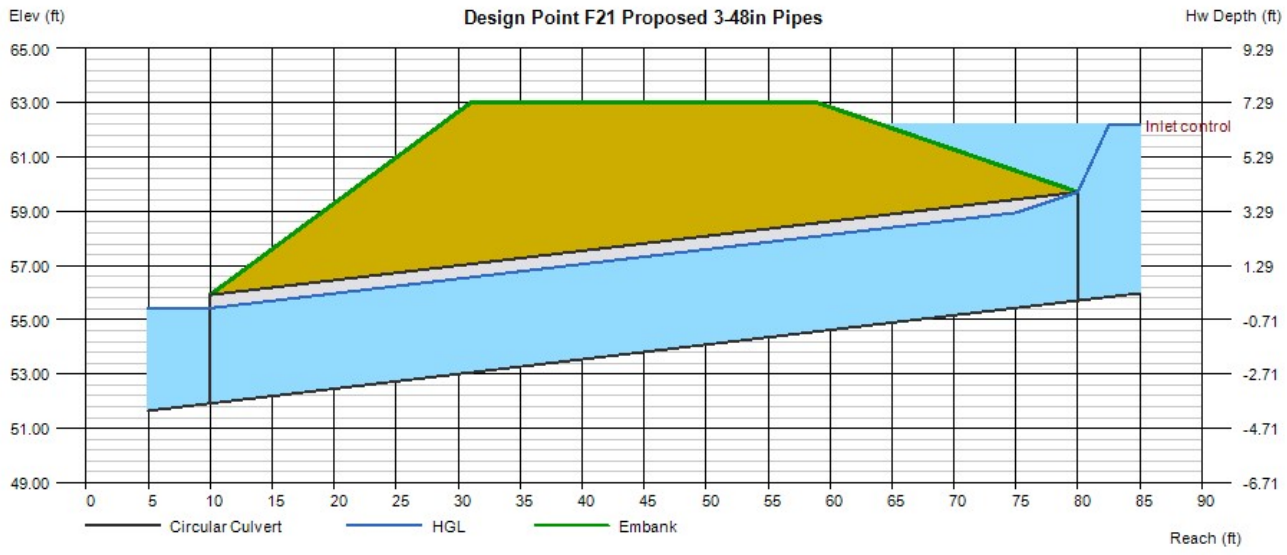
Top Elevation (ft)	=	63.00
Top Width (ft)	=	28.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	420.30
Qmax (cfs)	=	420.30
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	420.30
Qpipe (cfs)	=	420.30
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	11.99
Veloc Up (ft/s)	=	11.99
HGL Dn (ft)	=	55.43
HGL Up (ft)	=	59.22
Hw Elev (ft)	=	62.19
Hw/D (ft)	=	1.62
Flow Regime	=	Inlet Control



Culvert Report

DP F28 - Existing 48inch

Invert Elev Dn (ft)	=	7274.00
Pipe Length (ft)	=	85.00
Slope (%)	=	2.35
Invert Elev Up (ft)	=	7276.00
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

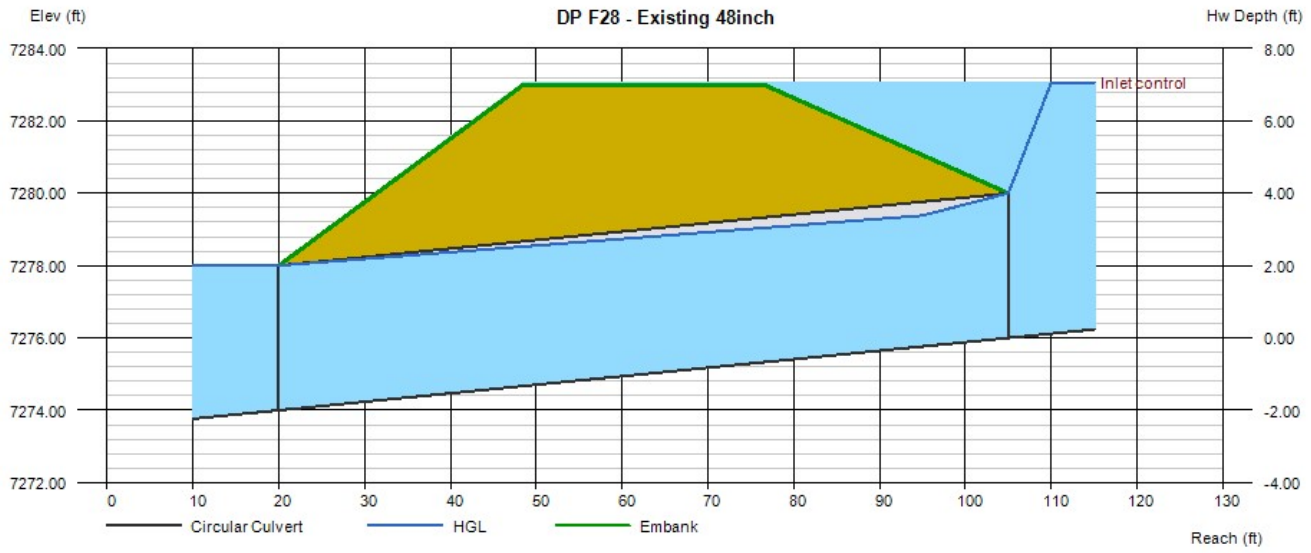
Top Elevation (ft)	=	7283.00
Top Width (ft)	=	28.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	150.50
Qmax (cfs)	=	150.50
Tailwater Elev (ft)	=	Crown

Highlighted

Qtotal (cfs)	=	150.50
Qpipe (cfs)	=	147.14
Qovertop (cfs)	=	3.36
Veloc Dn (ft/s)	=	11.71
Veloc Up (ft/s)	=	12.43
HGL Dn (ft)	=	7278.00
HGL Up (ft)	=	7279.57
Hw Elev (ft)	=	7283.06
Hw/D (ft)	=	1.76
Flow Regime	=	Inlet Control



Culvert Report

DP F29 - Existing 48inch

Invert Elev Dn (ft)	=	7270.00
Pipe Length (ft)	=	180.00
Slope (%)	=	2.22
Invert Elev Up (ft)	=	7274.00
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

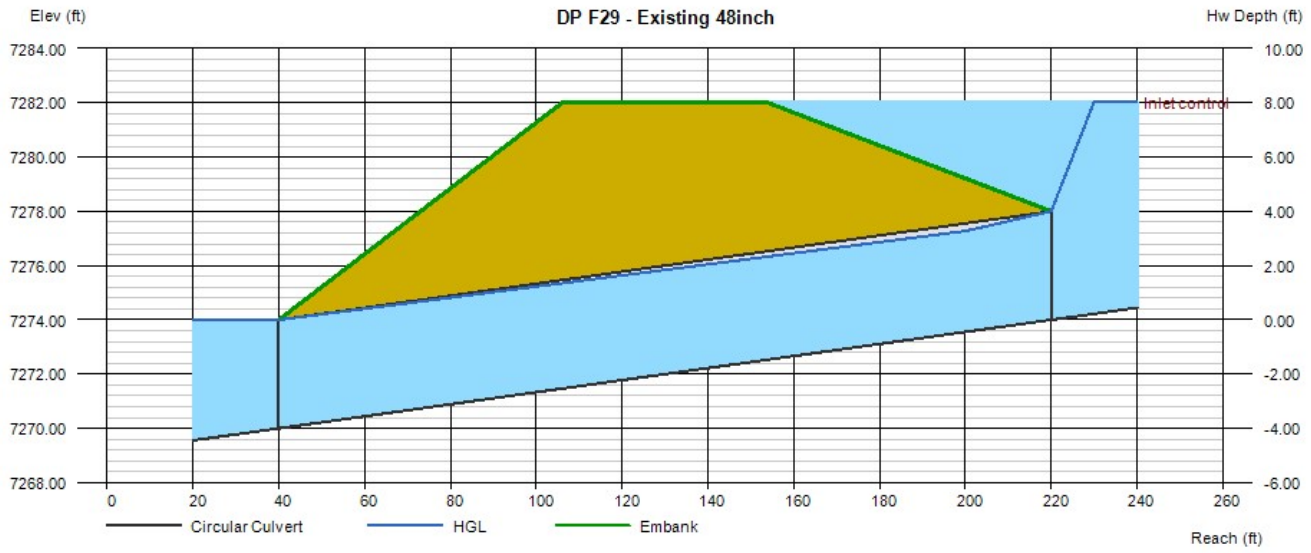
Top Elevation (ft)	=	7282.00
Top Width (ft)	=	48.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	164.70
Qmax (cfs)	=	164.70
Tailwater Elev (ft)	=	Crown

Highlighted

Qtotal (cfs)	=	164.70
Qpipe (cfs)	=	162.89
Qovertop (cfs)	=	1.81
Veloc Dn (ft/s)	=	12.96
Veloc Up (ft/s)	=	13.46
HGL Dn (ft)	=	7274.00
HGL Up (ft)	=	7277.68
Hw Elev (ft)	=	7282.04
Hw/D (ft)	=	2.01
Flow Regime	=	Inlet Control



MONUMENT RIDGE EAST - FILING NO.1
FINAL DRAINAGE REPORT
(Percent Impervious Summary - Forebays (Future))

Forebay	*Area (acres)*									*% Imp*
	Streets/Drives/Walks	*Streets - Gravel*	*Roof*	*Lawn*	*Res 1/8*	*Res 1/4*	*Res 1/3*	*Res 1/2*	*TOTAL*	
					POND 1					
1-A	3.15	0.84	1.53	3.39	0.00	0.00	0.00	0.52	9.43	56.51
1-B	2.40	0.00	1.35	1.91	0.00	0.00	0.00	0.00	5.66	63.87
					POND 2					
2-A	4.63	0.00	2.26	3.75	0.00	0.00	0.00	0.00	10.64	62.63
					POND 4					
4-A	1.51	0.00	0.00	0.00	2.80	0.00	6.25	1.60	12.16	46.09
4-B	3.15	0.00	0.00	4.06	0.21	0.00	0.00	0.00	7.42	44.29
4-C	0.30	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.61	49.18
					POND 5					
5-A	0.58	0.00	0.00	0.00	0.63	0.00	1.28	0.72	3.21	48.40

Land Use	**% Impervious**
Streets/Drives/Walks	100
Lawn	0
Res 1/8ac or less	65
Res 1/4ac or less	40
Res 1/3ac or less	30
Res 1/2ac or less	25

MONUMENT RIDGE EAST - FILING NO.1
FINAL DRAINAGE REPORT
(Percent Impervious Summary - Forebays (Interim))

Forebay	*Area (acres)*									*% Imp*
	Streets/Drives/Walks	*Streets - Gravel*	*Roof*	*Lawn*	*Res 1/8*	*Res 1/4*	*Res 1/3*	*Res 1/2*	*TOTAL*	
POND 1										
1-A	(Not used in the Interim Condition)									
1-B	0.80	0.00	0.00	14.87	0.00	0.00	0.00	0.00	15.67	5.11
POND 2										
2-A	2.77	0.84	0.00	13.38	0.00	0.00	0.00	0.52	17.51	20.40
POND 4										
4-A	1.51	0.00	0.00	0.00	2.80	0.00	6.25	1.60	12.16	46.09
4-B	2.29	0.00	0.00	7.07	0.00	0.00	0.00	0.00	9.36	24.47
4-C	0.23	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.90	25.56
POND 5										
5-A	0.58	0.00	0.00	0.00	0.63	0.00	1.28	0.72	3.21	48.40

Land Use	**% Impervious**
Streets/Drives/Walks	100
Lawn	0
Res 1/8ac or less	65
Res 1/4ac or less	40
Res 1/3ac or less	30
Res 1/2ac or less	25

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: REP
Company: PRC Engineering
Date: June 24, 2026
Project: Monument Ridge East - Pond 1 - FOREBAY NO. 1 - A (FUTURE)
Location: Colorado Springs, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 56.5 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.565

C) Contributing Watershed Area — Area = 9.430 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.60 in

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

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

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

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = 0.247 ac-ft

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

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

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.577 ac-ft

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

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.00700 ac-ft

B) Actual Forebay Volume — V_F = 0.007 ac-ft

C) Forebay Depth
(D_F = 18 inch maximum) — D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 62.70 cfs

ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$) — Q_F = 1.25 cfs

E) Forebay Discharge Design

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

Flow too small for berm w/ pipe

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

G) Rectangular Notch Width — Calculated W_N = 6.1 in

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: REP
Company: PRC Engineering
Date: June 24, 2026
Project: Monument Ridge East - Pond 1 - FOREBAY NO. 1 - B (FUTURE)
Location: Colorado Springs, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 63.9 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.639

C) Contributing Watershed Area — Area = 5.660 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.60 in

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

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

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

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = 0.164 ac-ft

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

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

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.395 ac-ft

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

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 2% of the WQCV) — V_{FMIN} = 0.00300 ac-ft

B) Actual Forebay Volume — V_F = 0.003 ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 29.00 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 0.58 cfs

E) Forebay Discharge Design

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

Flow too small for berm w/ pipe

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

G) Rectangular Notch Width — Calculated W_N = 4.7 in

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: REP
Company: PRC Engineering
Date: June 24, 2026
Project: Monument Ridge East - Pond 1 - FOREBAY NO. 1 - B (INTERIM)
Location: Colorado Springs, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 5.1 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.051

C) Contributing Watershed Area — Area = 15.670 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.60 in

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

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

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

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = 0.067 ac-ft

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

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

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.072 ac-ft

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

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 0% of the WQCV) — V_{FMIN} = 0.00000 ac-ft

A FOREBAY MAY NOT BE NECESSARY FOR THIS SIZE SITE

B) Actual Forebay Volume — V_F = 0.002 ac-ft

C) Forebay Depth
(D_F = 12 inch maximum) — D_F = 12.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 28.70 cfs

ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$) — Q_F = 0.57 cfs

E) Forebay Discharge Design

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

Flow too small for berm w/ pipe

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

G) Rectangular Notch Width — Calculated W_N = 4.5 in

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: REP
Company: PRC Engineering
Date: June 24, 2026
Project: Monument Ridge East - Pond 2 - FOREBAY NO. 2-A (FUTURE)
Location: Colorado Springs, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 62.6 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.626

C) Contributing Watershed Area — Area = 10.640 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.60 in

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

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

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

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = 0.303 ac-ft

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

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

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.642 ac-ft

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

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.00900 ac-ft

B) Actual Forebay Volume — V_F = 0.011 ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 64.20 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 1.28 cfs

E) Forebay Discharge Design

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

Flow too small for berm w/ pipe

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

G) Rectangular Notch Width — Calculated W_N = 6.1 in

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: REP
Company: PRC Engineering
Date: June 24, 2026
Project: Monument Ridge East - Pond 2 - FOREBAY NO. 2-A (INTERIM)
Location: Colorado Springs, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 20.4 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.204

C) Contributing Watershed Area — Area = 17.510 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.60 in

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

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

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

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = 0.239 ac-ft

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

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

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.314 ac-ft

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

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 2% of the WQCV) — V_{FMIN} = 0.00500 ac-ft

B) Actual Forebay Volume — V_F = 0.011 ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 54.30 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 1.09 cfs

E) Forebay Discharge Design

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

Flow too small for berm w/ pipe

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

G) Rectangular Notch Width — Calculated W_N = 5.7 in

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: REP
Company: PRC Engineering
Date: June 24, 2026
Project: Monument Ridge East - Pond 4 - FOREBAY NO.4-A (FUTURE)
Location: Colorado Springs, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 47.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.470

C) Contributing Watershed Area — Area = 12.280 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.60 in

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

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

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

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = 0.283 ac-ft

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

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

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.544 ac-ft

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

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.00800 ac-ft

B) Actual Forebay Volume — V_F = 0.008 ac-ft

C) Forebay Depth
(D_F = 18 inch maximum) — D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 42.00 cfs

ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$) — Q_F = 0.84 cfs

E) Forebay Discharge Design

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

Flow too small for berm w/ pipe

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

G) Rectangular Notch Width — Calculated W_N = 5.2 in

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: REP
Company: PRC Engineering
Date: June 24, 2026
Project: Monument Ridge East - Pond 4 - FOREBAY NO.4-A (INTERIM)
Location: Colorado Springs, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 46.1 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.461

C) Contributing Watershed Area — Area = 12.160 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.60 in

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

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

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

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = 0.277 ac-ft

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

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

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.527 ac-ft

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

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.00800 ac-ft

B) Actual Forebay Volume — V_F = 0.008 ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 46.80 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 0.94 cfs

E) Forebay Discharge Design

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

Flow too small for berm w/ pipe

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

G) Rectangular Notch Width — Calculated W_N = 5.4 in

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: REP
Company: PRC Engineering
Date: June 24, 2026
Project: Monument Ridge East - Pond 4 - FOREBAY NO. 4-B (FUTURE)
Location: Colorado Springs, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 60.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.600

C) Contributing Watershed Area — Area = 7.740 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.60 in

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

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

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

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = 0.213 ac-ft

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

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

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.446 ac-ft

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

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 2% of the WQCV) — V_{FMIN} = 0.00400 ac-ft

B) Actual Forebay Volume — V_F = 0.004 ac-ft

C) Forebay Depth
(D_F = 18 inch maximum) — D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 34.90 cfs

ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$) — Q_F = 0.70 cfs

E) Forebay Discharge Design

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

Flow too small for berm w/ pipe

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

G) Rectangular Notch Width — Calculated W_N = 5.0 in

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: REP
Company: PRC Engineering
Date: June 24, 2026
Project: Monument Ridge East - Pond 4 - FOREBAY NO. 4-B (INTERIM)
Location: Colorado Springs, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 24.5 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.245

C) Contributing Watershed Area — Area = 9.360 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.60 in

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

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

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

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = 0.145 ac-ft

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

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

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.205 ac-ft

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

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 2% of the WQCV) — V_{FMIN} = 0.00300 ac-ft

B) Actual Forebay Volume — V_F = 0.004 ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 31.90 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 0.64 cfs

E) Forebay Discharge Design

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

Flow too small for berm w/ pipe

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

G) Rectangular Notch Width — Calculated W_N = 4.9 in

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: REP
Company: PRC Engineering
Date: June 24, 2026
Project: Monument Ridge East - Pond 4 - FOREBAY NO. 4-C (FUTURE)
Location: Colorado Springs, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 51.6 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.516

C) Contributing Watershed Area — Area = 0.600 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.60 in

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

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

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

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = 0.015 ac-ft

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

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

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.029 ac-ft

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

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 0% of the WQCV) — V_{FMIN} = 0.00000 ac-ft

A FOREBAY MAY NOT BE NECESSARY FOR THIS SIZE SITE

B) Actual Forebay Volume — V_F = 0.001 ac-ft

C) Forebay Depth
(D_F = 12 inch maximum) — D_F = 12.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 7.50 cfs

ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$) — Q_F = 0.15 cfs

E) Forebay Discharge Design

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

Flow too small for berm w/ pipe

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

G) Rectangular Notch Width — Calculated W_N = 2.9 in

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: REP
Company: PRC Engineering
Date: June 24, 2026
Project: Monument Ridge East - Pond 4 - FOREBAY NO. 4-C (INTERIM)
Location: Colorado Springs, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 25.6 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.256

C) Contributing Watershed Area — Area = 0.900 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.60 in

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

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

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

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = 0.014 ac-ft

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

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

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.021 ac-ft

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

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 0% of the WQCV) — V_{FMIN} = 0.00000 ac-ft

A FOREBAY MAY NOT BE NECESSARY FOR THIS SIZE SITE

B) Actual Forebay Volume — V_F = 0.001 ac-ft

C) Forebay Depth
(D_F = 12 inch maximum) — D_F = 12.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 17.40 cfs

ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$) — Q_F = 0.35 cfs

E) Forebay Discharge Design

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

Flow too small for berm w/ pipe

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

G) Rectangular Notch Width — Calculated W_N = 3.7 in

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: REP
Company: PRC Engineering
Date: June 24, 2026
Project: Monument Ridge East Filing No 1 - POND 5 Forebay No. 5-A
Location: Colorado Springs, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 48.4 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.484

C) Contributing Watershed Area — Area = 3.210 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.60 in

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

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

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

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = 0.075 ac-ft

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

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

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.147 ac-ft

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

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 1% of the WQCV) — V_{FMIN} = 0.00100 ac-ft

B) Actual Forebay Volume — V_F = 0.004 ac-ft

C) Forebay Depth (D_F = 12 inch maximum) — D_F = 18.0 in **DF > DF MAXIMUM**

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 17.40 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 0.35 cfs

E) Forebay Discharge Design

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

Flow too small for berm w/ pipe

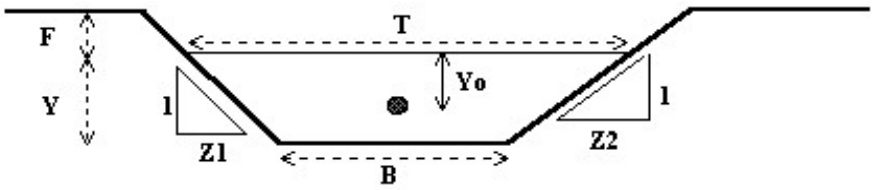
F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = in

G) Rectangular Notch Width — Calculated W_N = 4.3 in

Normal Flow Analysis - Trapezoidal Channel

Project: MONUMENT RIDGE EAST - Pond 1 FB1 Out

Channel ID: Trickle Channel Qt = 1% of Q100 (31cfs) = 0.31cfs; 3.38cfs>0.31cfs, OK



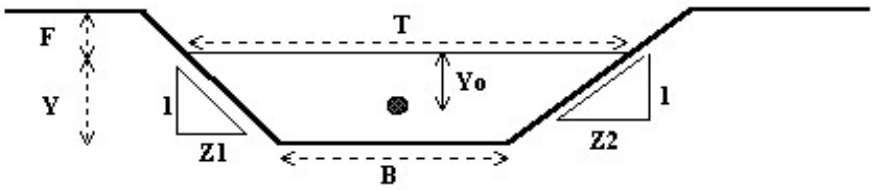
Design Information (Input)			
Channel Invert Slope	So =	0.0050	ft/ft
Manning's n	n =	0.015	
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	0.00	ft/ft
Right Side Slope	Z2 =	0.00	ft/ft
Freeboard Height	F =	0.00	ft
Design Water Depth	Y =	**0.50**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**3.38**	cfs
Froude Number	**Fr =**	**0.84**	
Flow Velocity	**V =**	**3.38**	fps
Flow Area	A =	1.00	sq ft
Top Width	T =	2.00	ft
Wetted Perimeter	P =	3.00	ft
Hydraulic Radius	R =	0.33	ft
Hydraulic Depth	D =	0.50	ft
Specific Energy	Es =	0.68	ft
Centroid of Flow Area	Yo =	0.25	ft
Specific Force	Fs =	0.04	kip

Normal Flow Analysis - Trapezoidal Channel

Project: MONUMENT RIDGE EAST - Pond 1 FB2 Out

Channel ID: Trickle Channel Qt = 1% of Q100 (60cfs) = 0.60cfs; 3.38cfs>0.60cfs, OK



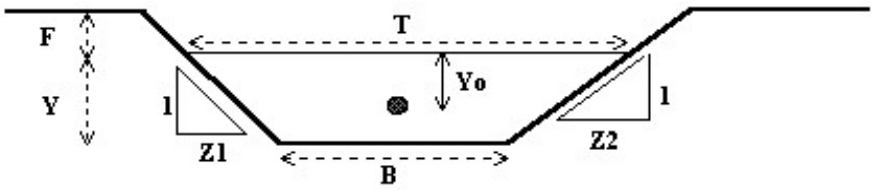
Design Information (Input)			
Channel Invert Slope	So =	0.0050	ft/ft
Manning's n	n =	0.015	
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	0.00	ft/ft
Right Side Slope	Z2 =	0.00	ft/ft
Freeboard Height	F =	0.00	ft
Design Water Depth	Y =	**0.50**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**3.38**	cfs
Froude Number	**Fr =**	**0.84**	
Flow Velocity	**V =**	**3.38**	fps
Flow Area	A =	1.00	sq ft
Top Width	T =	2.00	ft
Wetted Perimeter	P =	3.00	ft
Hydraulic Radius	R =	0.33	ft
Hydraulic Depth	D =	0.50	ft
Specific Energy	Es =	0.68	ft
Centroid of Flow Area	Yo =	0.25	ft
Specific Force	Fs =	0.04	kip

Normal Flow Analysis - Trapezoidal Channel

Project: MONUMENT RIDGE EAST - Pond 2 FB1 Out

Channel ID: Trickle Channel Qt = 1% of Q100 (116cfs) = 1.2cfs; 3.38cfs>1.2cfs, OK



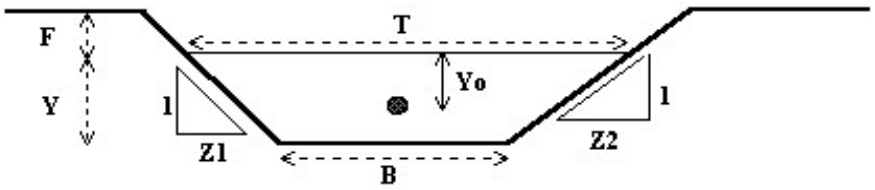
Design Information (Input)			
Channel Invert Slope	So =	0.0050	ft/ft
Manning's n	n =	0.015	
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	0.00	ft/ft
Right Side Slope	Z2 =	0.00	ft/ft
Freeboard Height	F =	0.00	ft
Design Water Depth	Y =	**0.50**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**3.38**	cfs
Froude Number	**Fr =**	**0.84**	
Flow Velocity	**V =**	**3.38**	fps
Flow Area	A =	1.00	sq ft
Top Width	T =	2.00	ft
Wetted Perimeter	P =	3.00	ft
Hydraulic Radius	R =	0.33	ft
Hydraulic Depth	D =	0.50	ft
Specific Energy	Es =	0.68	ft
Centroid of Flow Area	Yo =	0.25	ft
Specific Force	Fs =	0.04	kip

Normal Flow Analysis - Trapezoidal Channel

Project: MONUMENT RIDGE EAST - Pond 2 FB2 Out

Channel ID: Trickle Channel Qt = 1% of Q100 (1.2cfs) = 0.012cfs; 3.38cfs>0.012cfs, OK



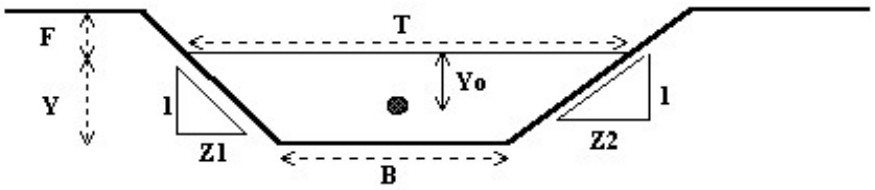
Design Information (Input)			
Channel Invert Slope	So =	0.0050	ft/ft
Manning's n	n =	0.015	
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	0.00	ft/ft
Right Side Slope	Z2 =	0.00	ft/ft
Freeboard Height	F =	0.00	ft
Design Water Depth	Y =	**0.50**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**3.38**	cfs
Froude Number	**Fr =**	**0.84**	
Flow Velocity	**V =**	**3.38**	fps
Flow Area	A =	1.00	sq ft
Top Width	T =	2.00	ft
Wetted Perimeter	P =	3.00	ft
Hydraulic Radius	R =	0.33	ft
Hydraulic Depth	D =	0.50	ft
Specific Energy	Es =	0.68	ft
Centroid of Flow Area	Yo =	0.25	ft
Specific Force	Fs =	0.04	kip

Normal Flow Analysis - Trapezoidal Channel

Project: MONUMENT RIDGE EAST - Pond 4 FB1 Out

Channel ID: Trickle Channel Qt = 1% of Q100 (42cfs) = 0.42cfs; 3.38cfs>0.42cfs, OK



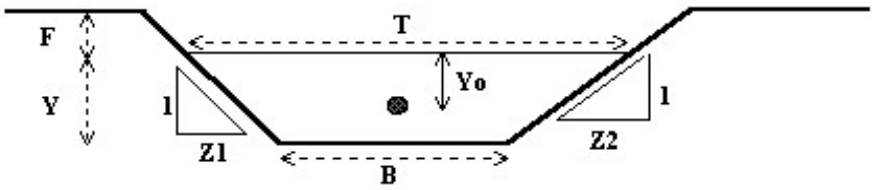
Design Information (Input)			
Channel Invert Slope	So =	0.0050	ft/ft
Manning's n	n =	0.015	
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	0.00	ft/ft
Right Side Slope	Z2 =	0.00	ft/ft
Freeboard Height	F =	0.00	ft
Design Water Depth	Y =	**0.50**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**3.38**	cfs
Froude Number	**Fr =**	**0.84**	
Flow Velocity	**V =**	**3.38**	fps
Flow Area	A =	1.00	sq ft
Top Width	T =	2.00	ft
Wetted Perimeter	P =	3.00	ft
Hydraulic Radius	R =	0.33	ft
Hydraulic Depth	D =	0.50	ft
Specific Energy	Es =	0.68	ft
Centroid of Flow Area	Yo =	0.25	ft
Specific Force	Fs =	0.04	kip

Normal Flow Analysis - Trapezoidal Channel

Project: MONUMENT RIDGE EAST - Pond 4 FB2 Out

Channel ID: Trickle Channel Qt = 1% of Q100 (35cfs) = 0.35cfs; 3.38cfs>0.35cfs, OK



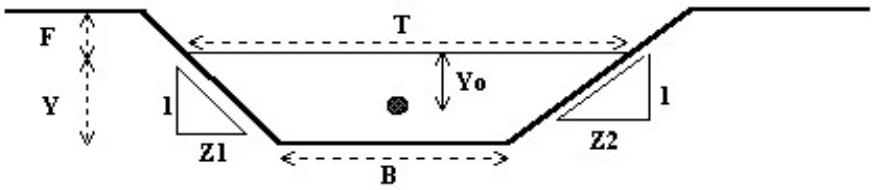
Design Information (Input)			
Channel Invert Slope	So =	0.0050	ft/ft
Manning's n	n =	0.015	
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	0.00	ft/ft
Right Side Slope	Z2 =	0.00	ft/ft
Freeboard Height	F =	0.00	ft
Design Water Depth	Y =	**0.50**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**3.38**	cfs
Froude Number	**Fr =**	**0.84**	
Flow Velocity	**V =**	**3.38**	fps
Flow Area	A =	1.00	sq ft
Top Width	T =	2.00	ft
Wetted Perimeter	P =	3.00	ft
Hydraulic Radius	R =	0.33	ft
Hydraulic Depth	D =	0.50	ft
Specific Energy	Es =	0.68	ft
Centroid of Flow Area	Yo =	0.25	ft
Specific Force	Fs =	0.04	kip

Normal Flow Analysis - Trapezoidal Channel

Project: MONUMENT RIDGE EAST - Pond 4 FB3 Out

Channel ID: Trickle Channel Qt = 1% of Q100 (7.5cfs) = 0.075cfs; 3.38cfs>0.075cfs, OK



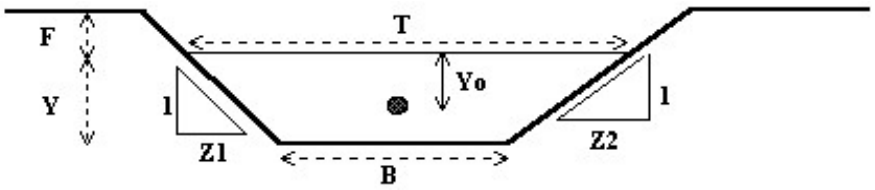
Design Information (Input)			
Channel Invert Slope	So =	0.0050	ft/ft
Manning's n	n =	0.015	
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	0.00	ft/ft
Right Side Slope	Z2 =	0.00	ft/ft
Freeboard Height	F =	0.00	ft
Design Water Depth	Y =	**0.50**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**3.38**	cfs
Froude Number	**Fr =**	**0.84**	
Flow Velocity	**V =**	**3.38**	fps
Flow Area	A =	1.00	sq ft
Top Width	T =	2.00	ft
Wetted Perimeter	P =	3.00	ft
Hydraulic Radius	R =	0.33	ft
Hydraulic Depth	D =	0.50	ft
Specific Energy	Es =	0.68	ft
Centroid of Flow Area	Yo =	0.25	ft
Specific Force	Fs =	0.04	kip

Normal Flow Analysis - Trapezoidal Channel

Project: MONUMENT RIDGE EAST - Pond 5 F3 Out

Channel ID: Trickle Channel Qt = 1% of Q100 (2.1cfs) = 0.021cfs; 3.38cfs>0.021cfs, OK



Design Information (Input)			
Channel Invert Slope	So =	0.0050	ft/ft
Manning's n	n =	0.015	
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	0.00	ft/ft
Right Side Slope	Z2 =	0.00	ft/ft
Freeboard Height	F =	0.00	ft
Design Water Depth	Y =	**0.50**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**3.38**	cfs
Froude Number	**Fr =**	**0.84**	
Flow Velocity	**V =**	**3.38**	fps
Flow Area	A =	1.00	sq ft
Top Width	T =	2.00	ft
Wetted Perimeter	P =	3.00	ft
Hydraulic Radius	R =	0.33	ft
Hydraulic Depth	D =	0.50	ft
Specific Energy	Es =	0.68	ft
Centroid of Flow Area	Yo =	0.25	ft
Specific Force	Fs =	0.04	kip

CONDUIT OUTLET RIPRAP EROSION PROTECTION
APRON DESIGN CALCULATIONS

Project: Monument Ridge East
Drainageway:
Client:

CONDUIT DESCRIPTION	Date: 6/22/2026	STRUCTURE ID
Proposed 48" RCP - Pipe 121	By: REP	N/A

INPUT (Yellow Cells)

Number of Conduit Units	1		HEC-RAS STATION
Total Design Discharge (cfs)	71.2	Q	N/A
Unit Conduit			
Width (Box Culvert) (ft)		W	DESIGN STORM
Height (Box Culvert) (ft)		H	100yr
or			
Diameter (Pipe) (ft)	4.0	D	"NON-COHESIVE" or "EROSION RESISTANT" SOILS
Unit Design Discharge (cfs)	71.2	Q	Non-Cohesive
Outlet Flow Velocity (ft/s)	15.8	V	
Outlet Flow Depth (ft)	1.6	Y	
Tailwater Depth (ft)	1.6	Yt	
Froude Number Fr=Vo/((g*Do)^0.5)	2.24	Fr	
Froude Number Parameter Fp=Q/WH^1.5 (Box) or Q/D^2.5 (Pipe)	2.2	Fp	
Expansion Factor[2]	5.5	Ef	
Allowable Non-Eroding Velocity in Downstream Channel (ft/s) *(5 ft/sec Non-Cohesive Soils, 7 ft/sec Erosion Resistant Soils)*	5	V	

NOTES:
1. Design Methodogy - Urban Drainage and Flood Control District (UDFCD), "Urban Storm Drainage Criteria Manual (USDCM) Volume 2), Jan 2016, Chapter 9

2. Expansion Factor from USDCM2 Figure 9-35 (Pipe) or Figure 9-36 (Box)

3. If outlet velocity (Vo) exceeds recommended value of 15 ft/s, use another type of protection measure.

OUTPUT (Blue Cells)

Area Required of Flow at Allowable Velocity (sf) At=Q/V	14.2	At	
Expansion Angle of the Flow (degrees) Θ=Tan^-1(1/(2*Ef))	5.2	Θ	
Length of Protection (ft) - Unadjusted Lp=(1/(2*TanΘ))*(At/Yt-W (Box) or D (Pipe))	27	Lp	

Length of Protection Adjustments

Froude Number Parameter (Fp) ***Less Than*** *8 (Box) or 6 (Pipe)*

Fp<8.0 (Box) of Fp<6.0 (Pipe)?	Yes	Lp Min. is 3H or 3D and Max. is 10H or 10D
Lp Minimum Criteria Met?	No	Use 3H or 3D Minimum
Lp Maximum Criteria Met?	Yes	No Adjustment Necessary
Lp Minimum (ft)	12	Adjusted Length
Lp Maximum (ft)	0	Not Applicable
Length of Protection Required (ft)	27	Lp Adjusted

Froude Number Parameter (Fp) ***Greater Than*** *8 (Box) or 6 (Pipe)*

Fp>8.0 (Box) of Fp>6.0 (Pipe)?	No	No Adjustment Necessary
Add 1/4H (ft) Box or 1/4D (ft) Pipe	0	Not Applicable
Multiply Whole Number by Which Fp is Greater	0	Not Applicable
Length of Protection Required (ft)	0	No Adjustment Applied

RESULTS (Red Cells)

Length of Protection Required (ft)		**27**	**Lp**
Channel Bottom Width (Minimum) (ft)	T=2(Lp*TanΘ)+W or D	**9**	**T**
Riprap Size (Minimum) (in) Circular	$D50=0.023*Q/(Yt^{1.2}*D^{0.3})$	**8.2**	D50 (Calculated Mean Rock Size)
Riprap Size (Minimum) (in) Box	$D50=0.014*H^{0.5}*Q/(Yt*W)$		
		9	**D50 (Standard Mean Rock Size)**
Riprap Thickness (in)	Tr=2*D50	**18**	**Tr**
Riprap Type		**L**	**USDCM Designation**

CONDUIT OUTLET RIPRAP EROSION PROTECTION
APRON DESIGN CALCULATIONS

Project:	**Monument Ridge East**
Drainageway:	
Client:	

CONDUIT DESCRIPTION	Date:	12/21/2025	**STRUCTURE ID**
Proposed 78" RCP - Pipe 129A	By:	REP	**N/A**

INPUT (Yellow Cells)

Number of Conduit Units		1	
Total Design Discharge (cfs)		332.4	Q
Unit Conduit			
Width (Box Culvert) (ft)		0.0	W
Height (Box Culvert) (ft)		0.0	H
or			
Diameter (Pipe) (ft)		6.5	D
Unit Design Discharge (cfs)		332.4	Q
Outlet Flow Velocity (ft/s)		12.7	V
Outlet Flow Depth (ft)		4.8	Y
Tailwater Depth (ft)		2.6	Yt
Froude Number	Fr=Vo/((g*Do)^0.5)	1.02	Fr
Froude Number Parameter	Fp=Q/WH^1.5 (Box) or Q/D^2.5 (Pipe)	3.1	Fp
Expansion Factor[2]		4.4	Ef
Allowable Non-Eroding Velocity in Downstream Channel (ft/s)		5	V

(5 ft/sec Non-Cohesive Soils, 7 ft/sec Erosion Resistant Soils)

HEC-RAS STATION
N/A

DESIGN STORM
100yr

"NON-COHESIVE" or "EROSION RESISTANT" SOILS
Non-Cohesive

NOTES:
1. Design Methodogy - Urban Drainage and Flood Control District (UDFCD), "Urban Storm Drainage Criteria Manual (USDCM) Volume 2), Jan 2016, Chapter 9

2. Expansion Factor from USDCM2 Figure 9-35 (Pipe) or Figure 9-36 (Box)

3. If outlet velocity (Vo) exceeds recommended value of 15 ft/s, use another type of protection measure.

OUTPUT (Blue Cells)

Area Required of Flow at Allowable Velocity (sf)			
	At=Q/V	66.5	At
Expansion Angle of the Flow (degrees)			
	Θ=Tan^-1(1/(2*Ef))	6.5	Θ
Length of Protection (ft) - Unadjusted			
	Lp=(1/(2*TanΘ))*(At/Yt-W (Box) or D (Pipe))	84	Lp

Length of Protection Adjustments

Froude Number Parameter (Fp) ***Less Than*** *8 (Box) or 6 (Pipe)*

Fp<8.0 (Box) of Fp<6.0 (Pipe)?	Yes	Lp Min. is 3H or 3D and Max. is 10H or 10D
Lp Minimum Criteria Met?	No	Use 3H or 3D Minimum
Lp Maximum Criteria Met?	No	Use 10H or 10D Maximum
Lp Minimum (ft)	19.5	Adjusted Length
Lp Maximum (ft)	65	Adjusted Length
Length of Protection Required (ft)	65	Lp Adjusted

Froude Number Parameter (Fp) ***Greater Than*** *8 (Box) or 6 (Pipe)*

Fp>8.0 (Box) of Fp>6.0 (Pipe)?	No	No Adjustment Necessary
Add 1/4H (ft) Box or 1/4D (ft) Pipe	0	Not Applicable
Multiply Whole Number by Which Fp is Greater	0	Not Applicable
Length of Protection Required (ft)	0	No Adjustment Applied

RESULTS (Red Cells)

Length of Protection Required (ft)		**65**	**Lp**
Channel Bottom Width (Minimum) (ft)	T=2(Lp*TanΘ)+W or D	**28**	**T**
Riprap Size (Minimum) (in) Circular	$D50=0.023*Q/(Yt^{1.2}*D^{0.3})$	**17.3**	D50 (Calculated Mean Rock Size)
Riprap Size (Minimum) (in) Box	$D50=0.014*H^{0.5}*Q/(Yt*W)$		
		18	**D50 (Standard Mean Rock Size)**
Riprap Thickness (in)	Tr=2*D50	**36**	**Tr**
Riprap Type		**H**	**USDCM Designation**

CONDUIT OUTLET RIPRAP EROSION PROTECTION
APRON DESIGN CALCULATIONS

Project: Monument Ridge East
Drainageway:
Client:

CONDUIT DESCRIPTION	Date: 12/21/2025	STRUCTURE ID
Proposed 18" RCP - Pipe 138	By: REP	N/A

INPUT (Yellow Cells)

Number of Conduit Units	1		HEC-RAS STATION
Total Design Discharge (cfs)	6.5	Q	N/A
Unit Conduit			
Width (Box Culvert) (ft)	0.0	W	DESIGN STORM
Height (Box Culvert) (ft)	0.0	H	100yr
or			
Diameter (Pipe) (ft)	1.5	D	"NON-COHESIVE" or "EROSION RESISTANT" SOILS
Unit Design Discharge (cfs)	6.5	Q	Non-Cohesive
Outlet Flow Velocity (ft/s)	11.8	V	
Outlet Flow Depth (ft)	0.5	Y	
Tailwater Depth (ft)	0.6	Yt	
Froude Number Fr=Vo/((g*Do)^0.5)	2.94	Fr	
Froude Number Parameter Fp=Q/WH^1.5 (Box) or Q/D^2.5 (Pipe)	2.4	Fp	
Expansion Factor[2]	5.2	Ef	
Allowable Non-Eroding Velocity in Downstream Channel (ft/s) *(5 ft/sec Non-Cohesive Soils, 7 ft/sec Erosion Resistant Soils)*	5	V	

NOTES:
1. Design Methodogy - Urban Drainage and Flood Control District (UDFCD), "Urban Storm Drainage Criteria Manual (USDCM) Volume 2), Jan 2016, Chapter 9

2. Expansion Factor from USDCM2 Figure 9-35 (Pipe) or Figure 9-36 (Box)

3. If outlet velocity (Vo) exceeds recommended value of 15 ft/s, use another type of protection measure.

OUTPUT (Blue Cells)

Area Required of Flow at Allowable Velocity (sf) At=Q/V	1.3	At	
Expansion Angle of the Flow (degrees) Θ=Tan^-1(1/(2*Ef))	5.5	Θ	
Length of Protection (ft) - Unadjusted Lp=(1/(2*TanΘ))*(At/Yt-W (Box) or D (Pipe))	3	Lp	

Length of Protection Adjustments

Froude Number Parameter (Fp) ***Less Than*** *8 (Box) or 6 (Pipe)*

Fp<8.0 (Box) of Fp<6.0 (Pipe)?	Yes	Lp Min. is 3H or 3D and Max. is 10H or 10D
Lp Minimum Criteria Met?	No	Use 3H or 3D Minimum
Lp Maximum Criteria Met?	Yes	No Adjustment Necessary
Lp Minimum (ft)	4.5	Adjusted Length
Lp Maximum (ft)	0	Not Applicable
Length of Protection Required (ft)	4.5	Lp Adjusted

Froude Number Parameter (Fp) ***Greater Than*** *8 (Box) or 6 (Pipe)*

Fp>8.0 (Box) of Fp>6.0 (Pipe)?	No	No Adjustment Necessary
Add 1/4H (ft) Box or 1/4D (ft) Pipe	0	Not Applicable
Multiply Whole Number by Which Fp is Greater	0	Not Applicable
Length of Protection Required (ft)	0	No Adjustment Applied

RESULTS (Red Cells)

Length of Protection Required (ft)	5	**Lp**	
Channel Bottom Width (Minimum) (ft) T=2(Lp*TanΘ)+W or D	4	**T**	
Riprap Size (Minimum) (in) Circular $D50=0.023*Q/(Yt^{1.2}*D^{0.3})$	**3.3**	D50 (Calculated Mean Rock Size)	
Riprap Size (Minimum) (in) Box $D50=0.014*H^{0.5}*Q/(Yt*W)$			
	6	**D50 (Standard Mean Rock Size)**	
Riprap Thickness (in) Tr=2*D50	12	**Tr**	
Riprap Type	VL	**USDCM Designation**	

CONDUIT OUTLET RIPRAP EROSION PROTECTION
APRON DESIGN CALCULATIONS

Project: Monument Ridge East
Drainageway:
Client:

CONDUIT DESCRIPTION	Date: 12/21/2025	STRUCTURE ID
Proposed 3-48" RCP - Project Outfall	By: REP	N/A

INPUT (Yellow Cells)

Number of Conduit Units	3	
Total Design Discharge (cfs)	426.6	Q
Unit Conduit		
Width (Box Culvert) (ft)	0.0	W
Height (Box Culvert) (ft)	0.0	H
or		
Diameter (Pipe) (ft)	4.0	D
Unit Design Discharge (cfs)	142.2	Q
Outlet Flow Velocity (ft/s)	13.2	V
Outlet Flow Depth (ft)	3.2	Y
Tailwater Depth (ft)	1.6	Yt
Froude Number Fr=Vo/((g*Do)^0.5)	1.30	Fr
Froude Number Parameter Fp=Q/WH^1.5 (Box) or Q/D^2.5 (Pipe)	4.4	Fp
Expansion Factor[2]	3.5	Ef
Allowable Non-Eroding Velocity in Downstream Channel (ft/s) *(5 ft/sec Non-Cohesive Soils, 7 ft/sec Erosion Resistant Soils)*	5	V

HEC-RAS STATION	DESIGN STORM	"NON-COHESIVE" or "EROSION RESISTANT" SOILS
N/A	100yr	Non-Cohesive

NOTES:
1. Design Methodogy - Urban Drainage and Flood Control District (UDFCD), "Urban Storm Drainage Criteria Manual (USDCM) Volume 2), Jan 2016, Chapter 9

2. Expansion Factor from USDCM2 Figure 9-35 (Pipe) or Figure 9-36 (Box)

3. If outlet velocity (Vo) exceeds recommended value of 15 ft/s, use another type of protection measure.

OUTPUT (Blue Cells)

Area Required of Flow at Allowable Velocity (sf) At=Q/V	28.4	At
Expansion Angle of the Flow (degrees) Θ=Tan^-1(1/(2*Ef))	8.1	Θ
Length of Protection (ft) - Unadjusted Lp=(1/(2*TanΘ))*(At/Yt-W (Box) or D (Pipe))	48	Lp

Length of Protection Adjustments

Froude Number Parameter (Fp) ***Less Than*** *8 (Box) or 6 (Pipe)*

Fp<8.0 (Box) of Fp<6.0 (Pipe)?	Yes	Lp Min. is 3H or 3D and Max. is 10H or 10D
Lp Minimum Criteria Met?	No	Use 3H or 3D Minimum
Lp Maximum Criteria Met?	No	Use 10H or 10D Maximum
Lp Minimum (ft)	12	Adjusted Length
Lp Maximum (ft)	40	Adjusted Length
Length of Protection Required (ft)	40	Lp Adjusted

Froude Number Parameter (Fp) ***Greater Than*** *8 (Box) or 6 (Pipe)*

Fp>8.0 (Box) of Fp>6.0 (Pipe)?	No	No Adjustment Necessary
Add 1/4H (ft) Box or 1/4D (ft) Pipe	0	Not Applicable
Multiply Whole Number by Which Fp is Greater	0	Not Applicable
Length of Protection Required (ft)	0	No Adjustment Applied

RESULTS (Red Cells)

Length of Protection Required (ft)	**40**	**Lp**
Channel Bottom Width (Minimum) (ft) T=2(Lp*TanΘ)+W or D	**28**	**T**
Riprap Size (Minimum) (in) Circular D50=0.023*Q/(Yt$^{1.2}$*D$^{0.3}$)	**15.2**	D50 (Calculated Mean Rock Size)
Riprap Size (Minimum) (in) Box D50=0.014*H$^{0.5}$*Q/(Yt*W)	**18**	**D50 (Standard Mean Rock Size)**
Riprap Thickness (in) Tr=2*D50	**36**	**Tr**
Riprap Type	**H**	**USDCM Designation**

T/2=14' CL Pipe to Edge of Riprap, 3' spacing between 3-48" pipes = 14'x2 sides+1/2(4)x4'+2x3' = 42' wide by 40' long

CONDUIT OUTLET RIPRAP EROSION PROTECTION
APRON DESIGN CALCULATIONS

Project: Monument Ridge East
Drainageway:
Client:

CONDUIT DESCRIPTION	Date: 6/22/2026	STRUCTURE ID
Proposed 18" RCP - Pipe 141	By: REP	N/A

INPUT (Yellow Cells)

Number of Conduit Units	1		HEC-RAS STATION
Total Design Discharge (cfs)	5.2	Q	N/A
Unit Conduit			
Width (Box Culvert) (ft)		W	DESIGN STORM
Height (Box Culvert) (ft)		H	100yr
or			
Diameter (Pipe) (ft)	1.5	D	"NON-COHESIVE" or "EROSION RESISTANT" SOILS
Unit Design Discharge (cfs)	5.2	Q	Non-Cohesive
Outlet Flow Velocity (ft/s)	10.7	V	
Outlet Flow Depth (ft)	0.5	Y	
Tailwater Depth (ft)	0.3	Yt	
Froude Number Fr=Vo/((g*Do)^0.5)	2.72	Fr	
Froude Number Parameter Fp=Q/WH^1.5 (Box) or Q/D^2.5 (Pipe)	1.9	Fp	
Expansion Factor[2]	2.3	Ef	
Allowable Non-Eroding Velocity in Downstream Channel (ft/s) *(5 ft/sec Non-Cohesive Soils, 7 ft/sec Erosion Resistant Soils)*	5	V	

NOTES:
1. Design Methodology - Urban Drainage and Flood Control District (UDFCD), "Urban Storm Drainage Criteria Manual (USDCM) Volume 2), Jan 2016, Chapter 9

2. Expansion Factor from USDCM2 Figure 9-35 (Pipe) or Figure 9-36 (Box)

3. If outlet velocity (Vo) exceeds recommended value of 15 ft/s, use another type of protection measure.

OUTPUT (Blue Cells)

Area Required of Flow at Allowable Velocity (sf) At=Q/V	1.0	At	
Expansion Angle of the Flow (degrees) Θ=Tan^-1(1/(2*Ef))	12.5	Θ	
Length of Protection (ft) - Unadjusted Lp=(1/(2*TanΘ))*(At/Yt-W (Box) or D (Pipe))	6	Lp	

Length of Protection Adjustments

Froude Number Parameter (Fp) ***Less Than*** *8 (Box) or 6 (Pipe)*

Fp<8.0 (Box) of Fp<6.0 (Pipe)?	Yes	Lp Min. is 3H or 3D and Max. is 10H or 10D
Lp Minimum Criteria Met?	No	Use 3H or 3D Minimum
Lp Maximum Criteria Met?	Yes	No Adjustment Necessary
Lp Minimum (ft)	4.5	Adjusted Length
Lp Maximum (ft)	0	Not Applicable
Length of Protection Required (ft)	4.5	Lp Adjusted

Froude Number Parameter (Fp) ***Greater Than*** *8 (Box) or 6 (Pipe)*

Fp>8.0 (Box) of Fp>6.0 (Pipe)?	No	No Adjustment Necessary
Add 1/4H (ft) Box or 1/4D (ft) Pipe	0	Not Applicable
Multiply Whole Number by Which Fp is Greater	0	Not Applicable
Length of Protection Required (ft)	0	No Adjustment Applied

RESULTS (Red Cells)

Length of Protection Required (ft)	5	**Lp**	
Channel Bottom Width (Minimum) (ft) T=2(Lp*TanΘ)+W or D	4	**T**	
Riprap Size (Minimum) (in) Circular D50=0.023*Q/(Yt$^{1.2}$*D$^{0.3}$)	**7.2**	D50 (Calculated Mean Rock Size)	
Riprap Size (Minimum) (in) Box D50=0.014*H$^{0.5}$*Q/(Yt*W)			
	9	**D50 (Standard Mean Rock Size)**	
Riprap Thickness (in) Tr=2*D50	18	**Tr**	
Riprap Type	L	**USDCM Designation**	

Rock Chute Design Data

(Version 4.01 - 04/23/03, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Pond 1 Rundown **County:** EL Paso
Designer: REP **Checked by:** ISM
Date: 6/24/2026 **Date:**

Input Channel Geometry

Inlet Channel	Chute	Outlet Channel
Bw = 6.0 ft.	Bw = 8.0 ft.	Bw = 8.0 ft.
Side slopes = 0.0 (m:1)	Factor of safety = 1.00 (F_s)	Side slopes = 100.0 (m:1)
n-value = 0.013	Side slopes = 3.0 (m:1) → 2.0:1 max.	n-value = 0.045
Bed slope = 0.0200 ft./ft.	Bed slope (4:1) = 0.250 ft./ft. → 2.5:1 max.	Bed slope = 0.0050 ft./ft.
Freeboard = 1.0 ft.	Outlet apron depth, d = 1.0 ft.	Base flow = 0.0 cfs

Design Storm Data (Table 2, NHCP, NRCS Grade Stabilization Structure No. 410)

Drainage area = acres Rainfall = ○ 0 - 3 in. ○ 3 - 5 in. ◉ 5+ in.

Apron elev. --- Inlet = 100.0 ft. --- Outlet = 94.5 ft. --- (H_{drop} = 4.5 ft.)

Chute capacity = Q5-year
Total capacity = Q10-year
Minimum capacity (based on a 5-year, 24-hour storm with a 5+ inch rainfall)

Q_{high} = 21.2 cfs High flow storm through chute → Tw (ft.) = Program

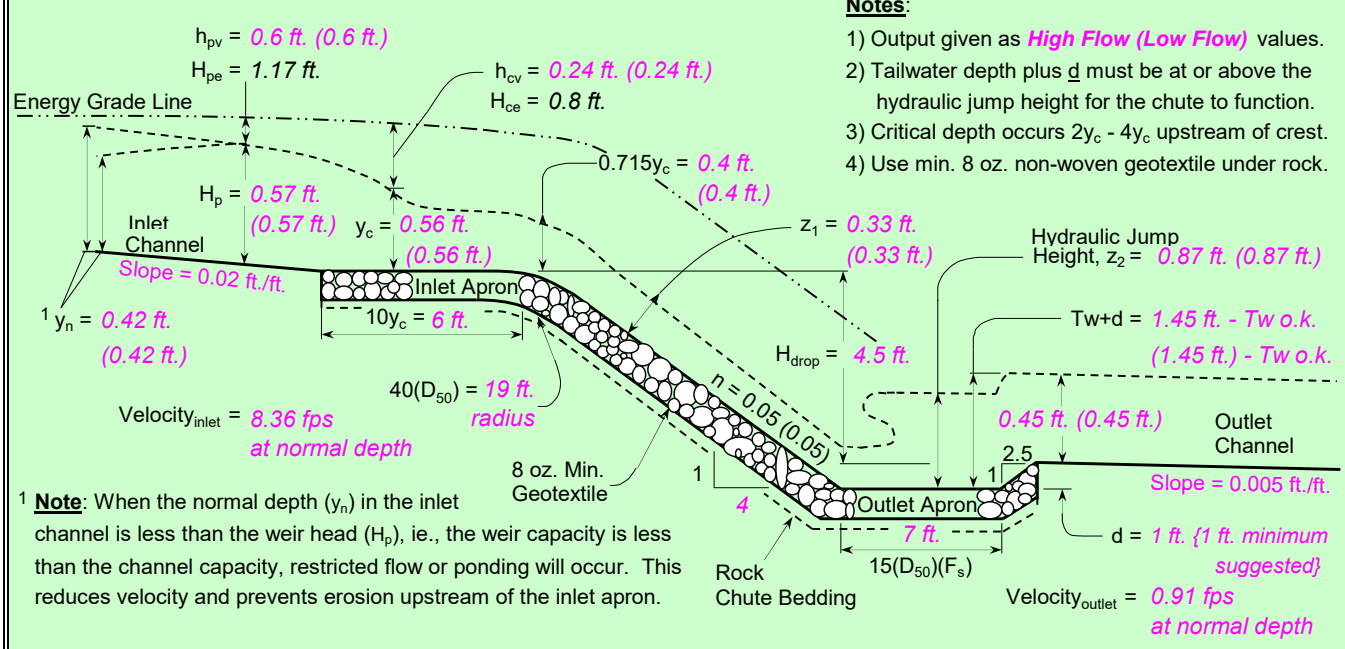
Q_{low} = 21.2 cfs Low flow storm through chute → Tw (ft.) = Program

***Note**: The total required capacity is routed through the chute (principal spillway) or in combination with an auxiliary spillway.*

***Input tailwater (Tw)**:*

0.25

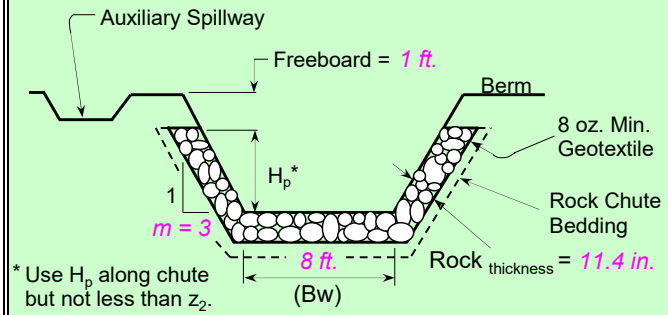
Profile and Cross Section (Output)



Notes:
1) Output given as ***High Flow (Low Flow)*** values.
2) Tailwater depth plus d must be at or above the hydraulic jump height for the chute to function.
3) Critical depth occurs 2y_c - 4y_c upstream of crest.
4) Use min. 8 oz. non-woven geotextile under rock.

[1] **Note**: When the normal depth (y_n) in the inlet channel is less than the weir head (H_p), ie., the weir capacity is less than the channel capacity, restricted flow or ponding will occur. This reduces velocity and prevents erosion upstream of the inlet apron.

Profile Along Centerline of Chute



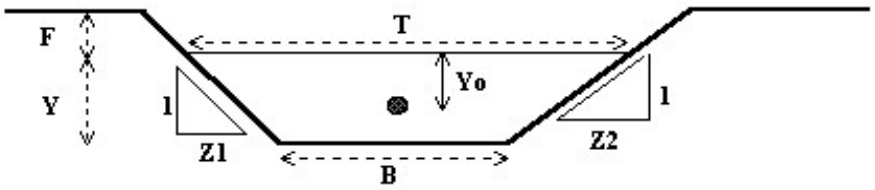
Typical Cross Section

q_t =	2.37 cfs/ft.	Equivalent unit discharge
F_S =	1.00	Factor of safety (multiplier)
z_1 =	0.33 ft.	Normal depth in chute
n-value =	0.05	Manning's roughness coefficient
D_{50}(F_s) =	5.7 in. (14 lbs. - 50% round / 50% angular)	
2(D_{50})(F_s) =	11.4 in.	Rock chute thickness
Tw + d =	1.45 ft.	Tailwater above outlet apron
z_2 =	0.87 ft.	Hydraulic jump height
*** ***The outlet***	***will***	***function adequately***

High Flow Storm Information

Normal Flow Analysis - Trapezoidal Channel

Project: MONUMENT RIDGE EAST - Collection Outfall Channel
Channel ID: Channel Slope= 2.0% for Q100 = 211cfs (minimum)

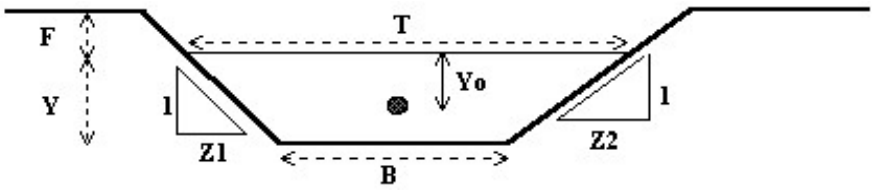


Design Information (Input)			
Channel Invert Slope	So =	0.0200	ft/ft
Manning's n	n =	0.030	
Bottom Width	B =	20.00	ft
Left Side Slope	Z1 =	1.00	ft/ft
Right Side Slope	Z2 =	1.00	ft/ft
Freeboard Height	F =	1.00	ft
Design Water Depth	Y =	**1.29**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**213.13**	cfs
Froude Number	**Fr =**	**1.24**	
Flow Velocity	**V =**	**7.76**	fps
Flow Area	A =	27.46	sq ft
Top Width	T =	22.58	ft
Wetted Perimeter	P =	23.65	ft
Hydraulic Radius	R =	1.16	ft
Hydraulic Depth	D =	1.22	ft
Specific Energy	Es =	2.23	ft
Centroid of Flow Area	Yo =	0.63	ft
Specific Force	Fs =	4.29	kip

Normal Flow Analysis - Trapezoidal Channel

Project: MONUMENT RIDGE EAST - Collection Outfall Channel
Channel ID: Channel Slope= 0.5% for Q100 = 211cfs (minimum)



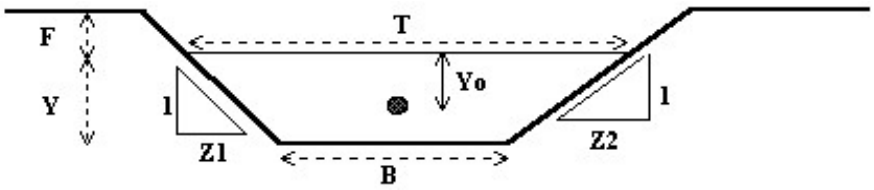
Design Information (Input)			
Channel Invert Slope	So =	0.0050	ft/ft
Manning's n	n =	0.030	
Bottom Width	B =	20.00	ft
Left Side Slope	Z1 =	1.00	ft/ft
Right Side Slope	Z2 =	1.00	ft/ft
Freeboard Height	F =	1.00	ft
Design Water Depth	Y =	**2.00**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**221.40**	cfs
Froude Number	**Fr =**	**0.65**	
Flow Velocity	**V =**	**5.03**	fps
Flow Area	A =	44.00	sq ft
Top Width	T =	24.00	ft
Wetted Perimeter	P =	25.66	ft
Hydraulic Radius	R =	1.71	ft
Hydraulic Depth	D =	1.83	ft
Specific Energy	Es =	2.39	ft
Centroid of Flow Area	Yo =	0.97	ft
Specific Force	Fs =	4.82	kip

Normal Flow Analysis - Trapezoidal Channel

Project: MONUMENT RIDGE EAST - Pond 5 Outfall Channel

Channel ID: Channel Slope= 10.0% for Q100 = 10.8cfs (minimum)



Design Information (Input)			
Channel Invert Slope	So =	0.1000	ft/ft
Manning's n	n =	0.030	
Bottom Width	B =	12.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft
Freeboard Height	F =	1.00	ft
Design Water Depth	Y =	**0.18**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**10.96**	cfs
Froude Number	**Fr =**	**2.06**	
Flow Velocity	**V =**	**4.85**	fps
Flow Area	A =	2.26	sq ft
Top Width	T =	13.08	ft
Wetted Perimeter	P =	13.14	ft
Hydraulic Radius	R =	0.17	ft
Hydraulic Depth	D =	0.17	ft
Specific Energy	Es =	0.55	ft
Centroid of Flow Area	Yo =	0.09	ft
Specific Force	Fs =	0.12	kip

POND 1

Figure 13-12c. Emergency Spillway Protection

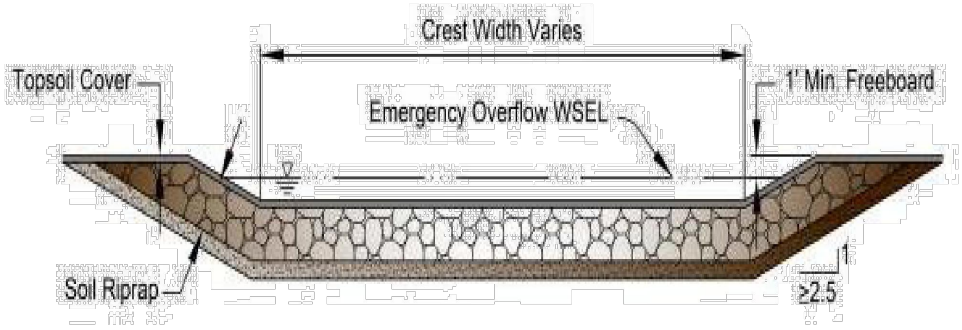
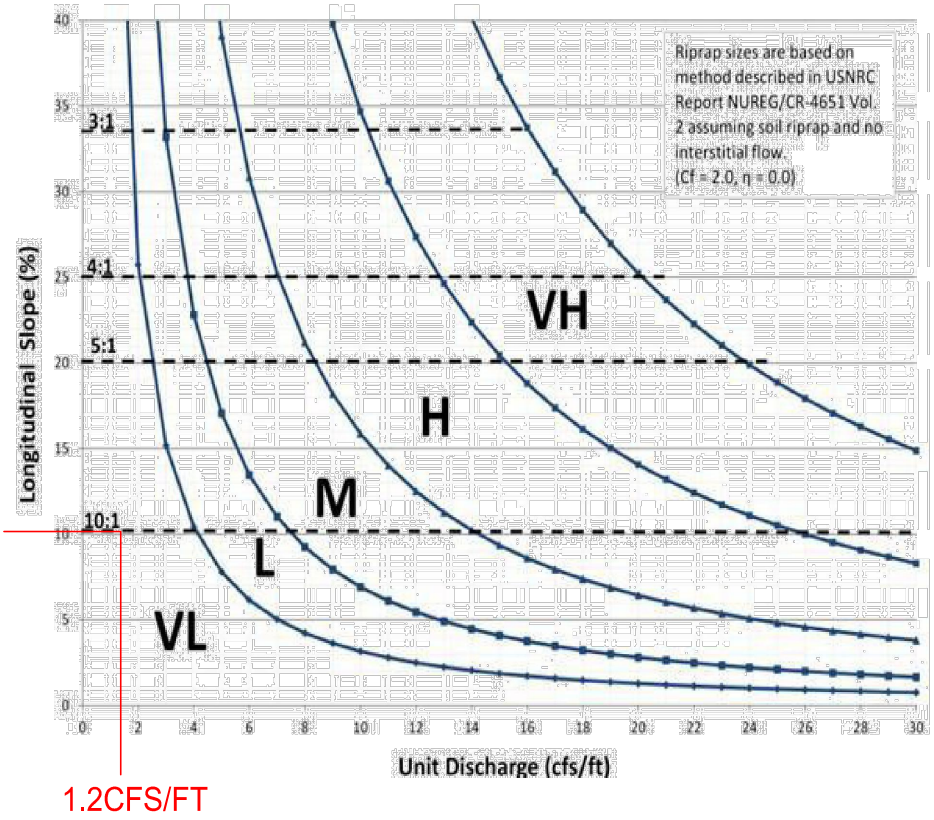


Figure 13-12d. Riprap Types for Emergency Spillway Protection



1.2CFS/FT

USE TYPE VL RIPRAP

POND 2

Figure 13-12c. Emergency Spillway Protection

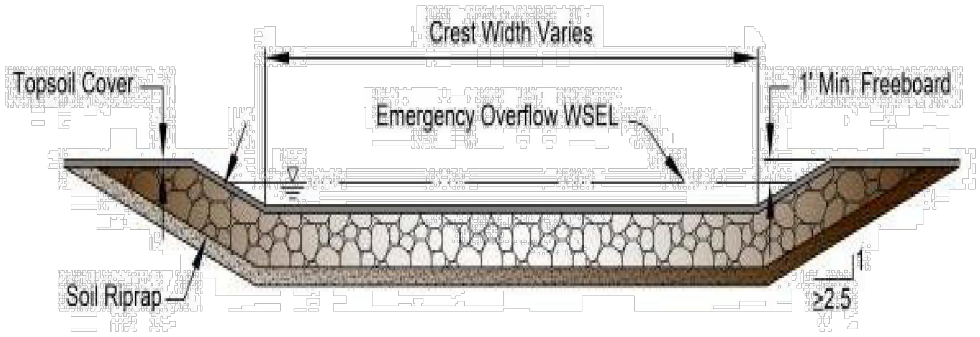
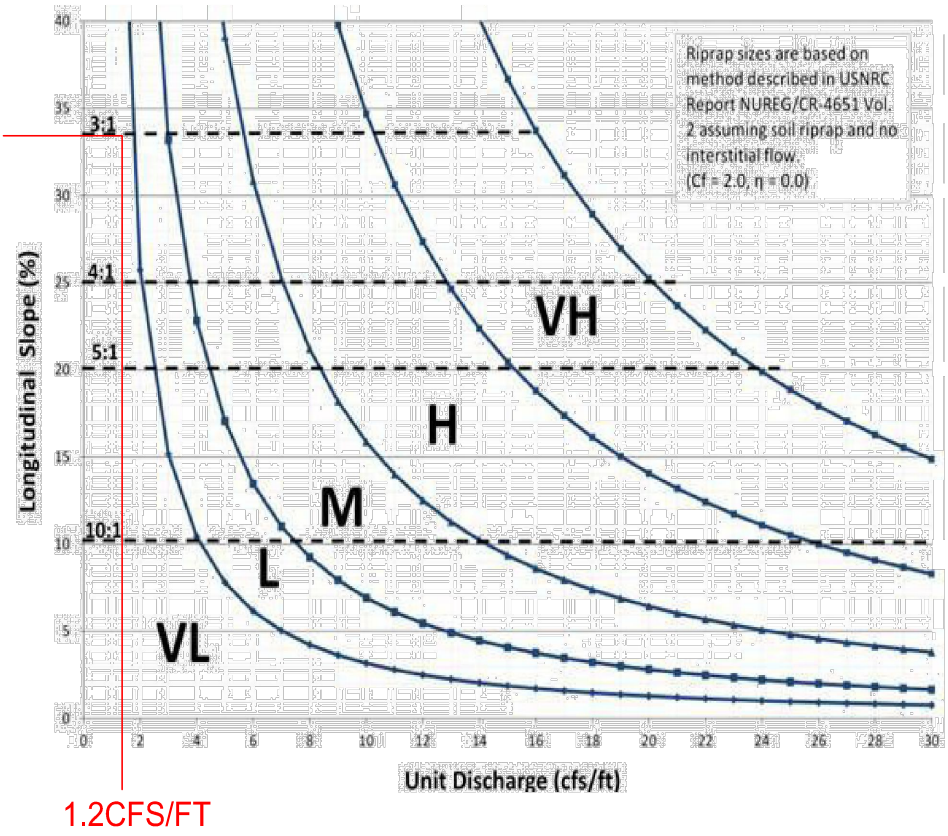


Figure 13-12d. Riprap Types for Emergency Spillway Protection



1.2CFS/FT

USE TYPE VL RIPRAP

POND 4

Figure 13-12c. Emergency Spillway Protection

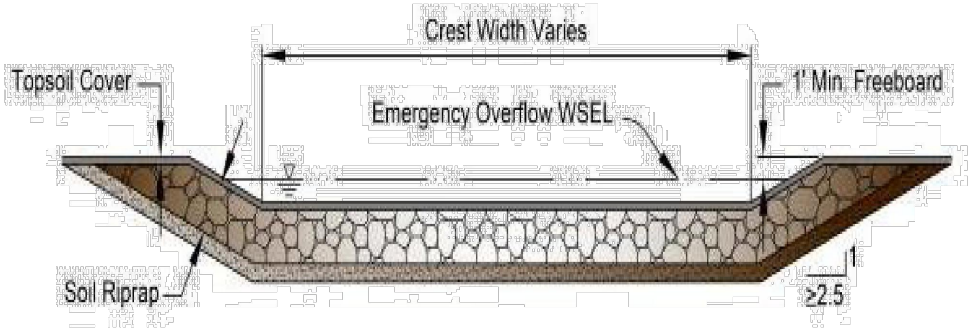
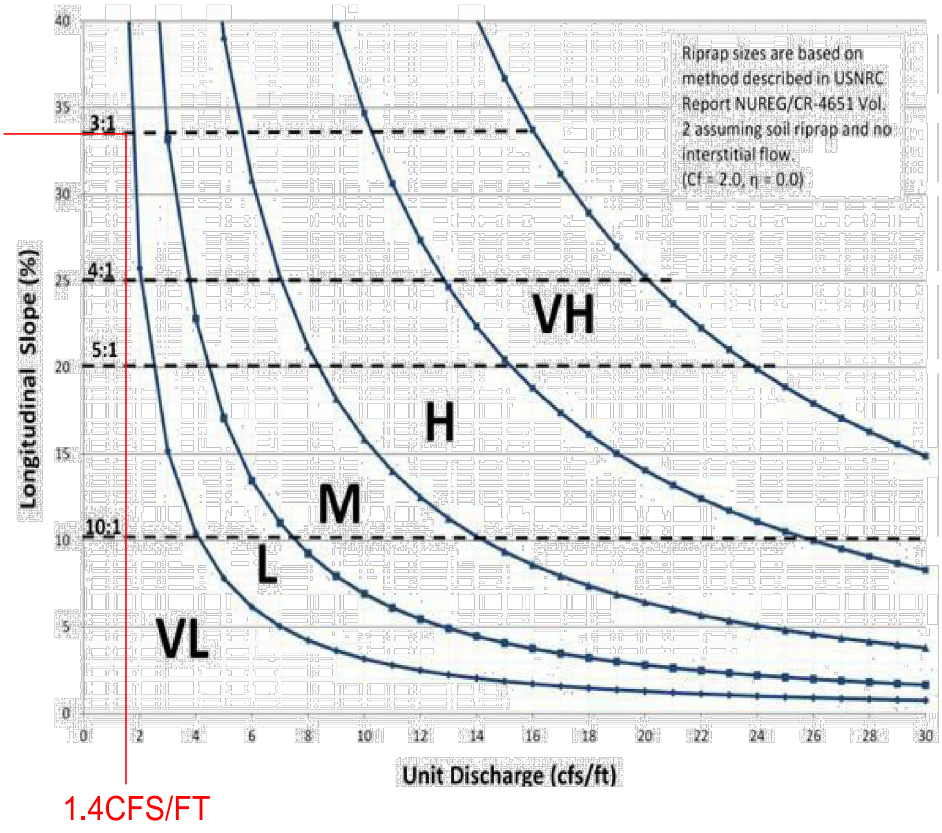


Figure 13-12d. Riprap Types for Emergency Spillway Protection



USE TYPE VL RIPRAP

POND 5 SPILLWAY

Figure 13-12c. Emergency Spillway Protection

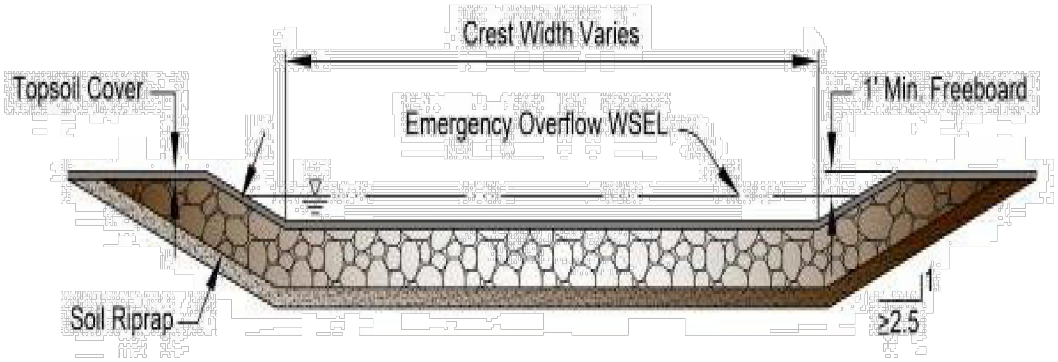
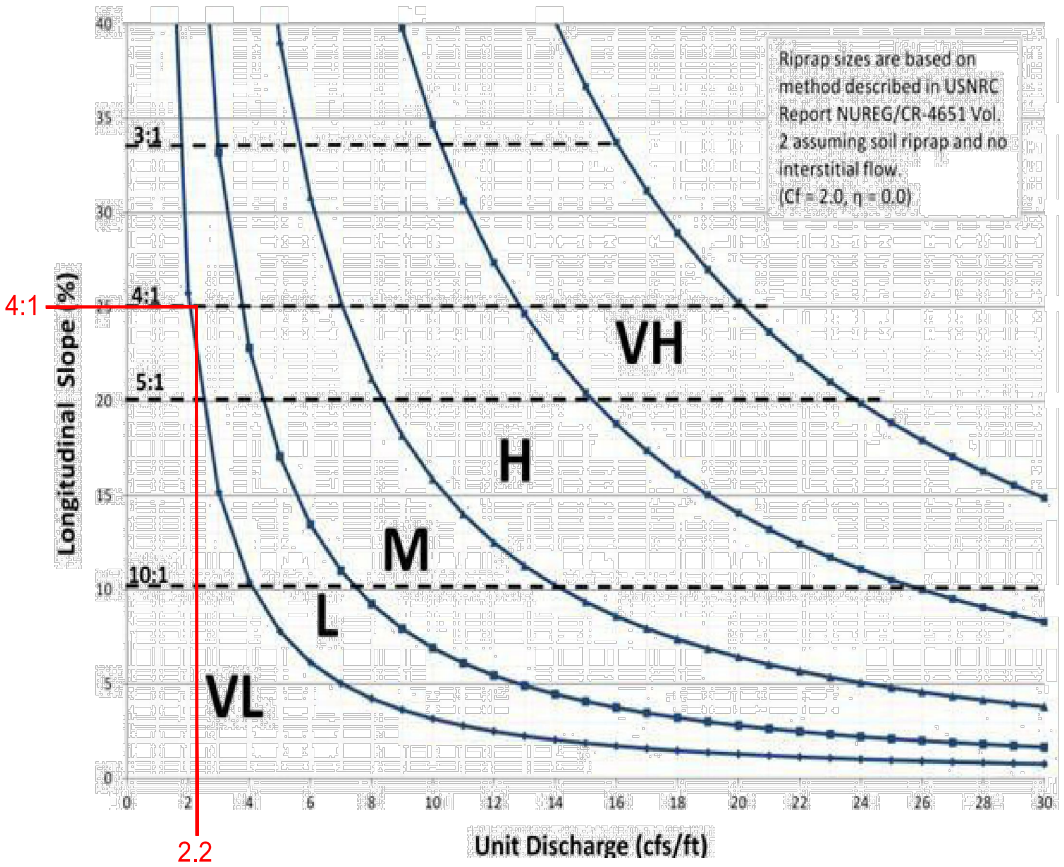


Figure 13-12d. Riprap Types for Emergency Spillway Protection



USE TYPE L, 18" THICK

COLLECTION STRUCTURE SPILLWAY

Figure 13-12c. Emergency Spillway Protection

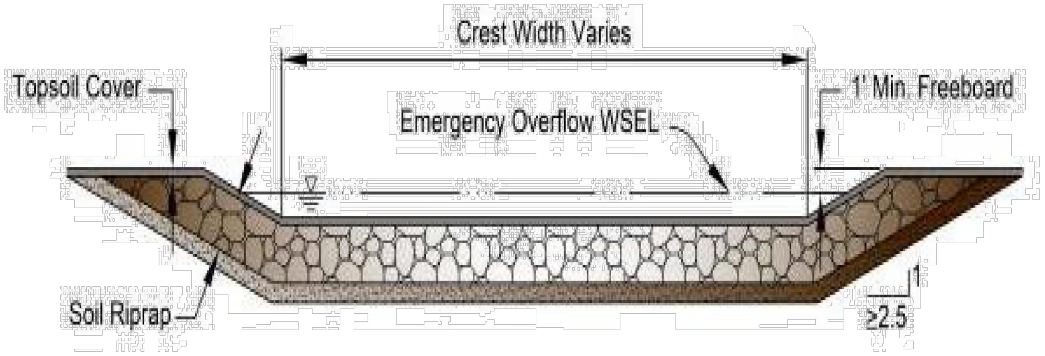
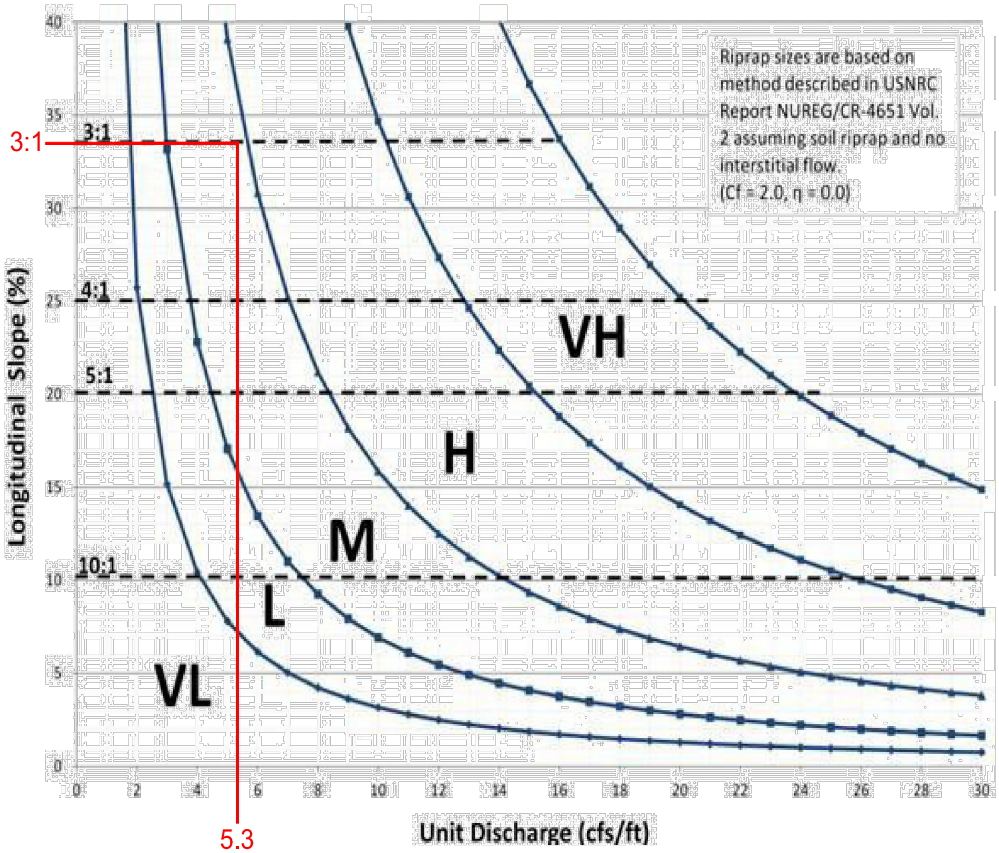


Figure 13-12d. Riprap Types for Emergency Spillway Protection



3:1

5.3

USE TYPE M, 24" THICK

Rock Chute Design Data

(Version 4.01 - 04/23/03, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Pond 1 Rundown **County:** EL Paso
Designer: REP **Checked by:** ISM
Date: 6/24/2026 **Date:**

Input Channel Geometry

Inlet Channel	Chute	Outlet Channel
Bw = 6.0 ft.	Bw = 8.0 ft.	Bw = 8.0 ft.
Side slopes = 0.0 (m:1)	Factor of safety = 1.00 (F_s)	Side slopes = 100.0 (m:1)
n-value = 0.013	Side slopes = 3.0 (m:1) → 2.0:1 max.	n-value = 0.045
Bed slope = 0.0200 ft./ft.	Bed slope (4:1) = 0.250 ft./ft. → 2.5:1 max.	Bed slope = 0.0050 ft./ft.
Freeboard = 1.0 ft.	Outlet apron depth, d = 1.0 ft.	Base flow = 0.0 cfs

Design Storm Data (Table 2, NHCP, NRCS Grade Stabilization Structure No. 410)

Drainage area = acres Rainfall = ○ 0 - 3 in. ○ 3 - 5 in. ◉ 5+ in.

Apron elev. --- Inlet = 100.0 ft. --- Outlet = 94.5 ft. --- (H_{drop} = 4.5 ft.)

Chute capacity = Q5-year
Total capacity = Q10-year
Minimum capacity (based on a 5-year, 24-hour storm with a 5+ inch rainfall)

Q_{high} = 21.2 cfs High flow storm through chute → Tw (ft.) = Program

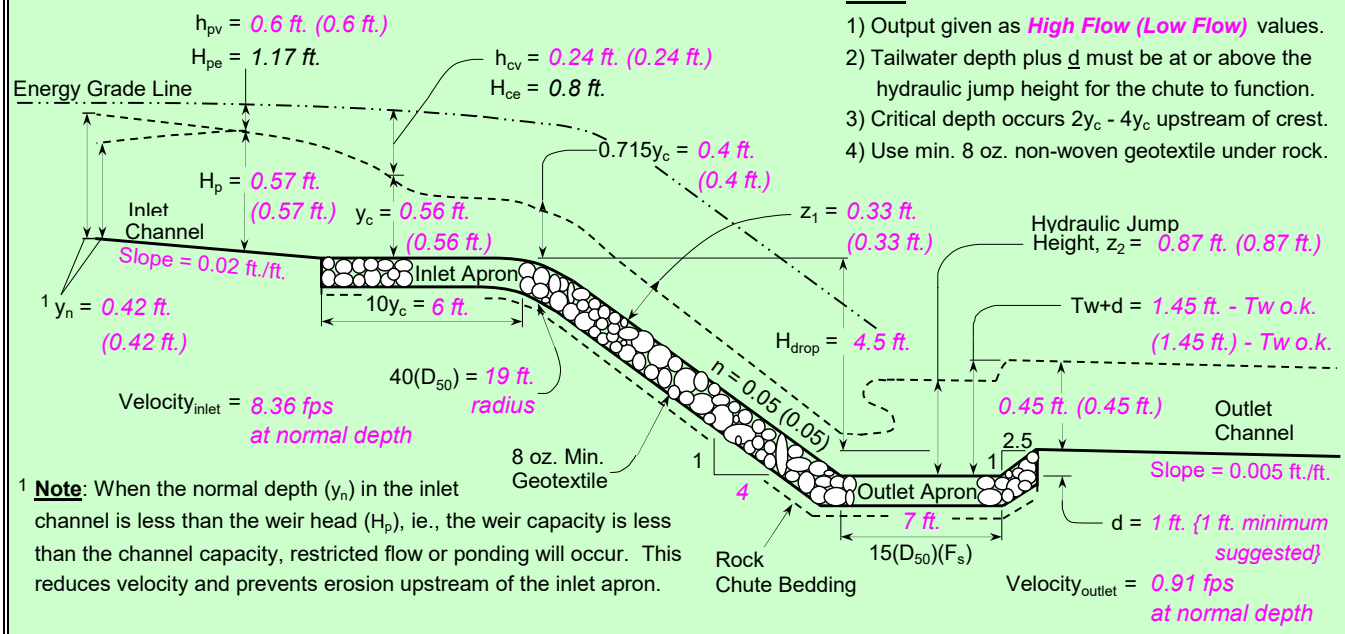
Q_{low} = 21.2 cfs Low flow storm through chute → Tw (ft.) = Program

***Note**: The total required capacity is routed through the chute (principal spillway) or in combination with an auxiliary spillway.*

***Input tailwater (Tw)**:*

0.25

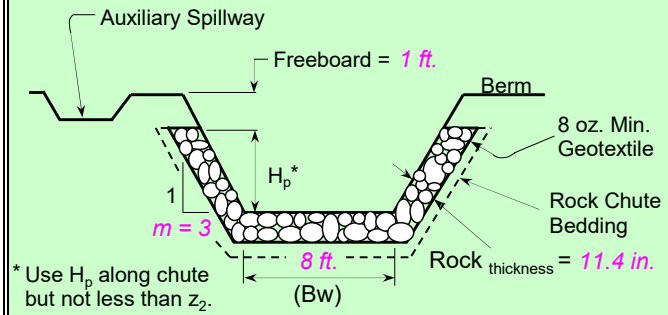
Profile and Cross Section (Output)



Notes:
1) Output given as ***High Flow (Low Flow)*** values.
2) Tailwater depth plus d must be at or above the hydraulic jump height for the chute to function.
3) Critical depth occurs 2y_c - 4y_c upstream of crest.
4) Use min. 8 oz. non-woven geotextile under rock.

[1] **Note**: When the normal depth (y_n) in the inlet channel is less than the weir head (H_p), ie., the weir capacity is less than the channel capacity, restricted flow or ponding will occur. This reduces velocity and prevents erosion upstream of the inlet apron.

Profile Along Centerline of Chute



* Use H_p along chute but not less than z_2.

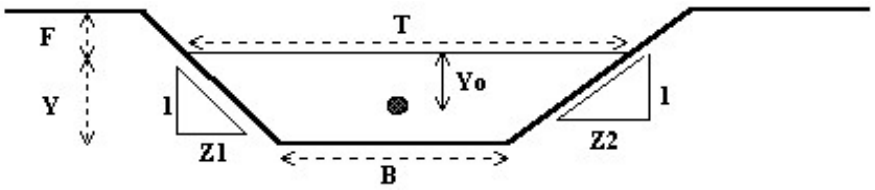
Typical Cross Section

q_t =	2.37 cfs/ft.	Equivalent unit discharge
F_S =	1.00	Factor of safety (multiplier)
z_1 =	0.33 ft.	Normal depth in chute
n-value =	0.05	Manning's roughness coefficient
D_{50}(F_s) =	5.7 in. (14 lbs. - 50% round / 50% angular)	
2(D_{50})(F_s) =	11.4 in.	Rock chute thickness
Tw + d =	1.45 ft.	Tailwater above outlet apron
z_2 =	0.87 ft.	Hydraulic jump height
*** ***The outlet***	***will***	***function adequately***

High Flow Storm Information

Normal Flow Analysis - Trapezoidal Channel

Project: MONUMENT RIDGE EAST - Collection Outfall Channel
Channel ID: Channel Slope= 2.0% for Q100 = 211cfs (minimum)

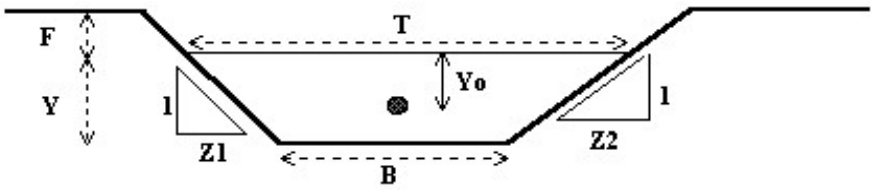


Design Information (Input)			
Channel Invert Slope	So =	0.0200	ft/ft
Manning's n	n =	0.030	
Bottom Width	B =	20.00	ft
Left Side Slope	Z1 =	1.00	ft/ft
Right Side Slope	Z2 =	1.00	ft/ft
Freeboard Height	F =	1.00	ft
Design Water Depth	Y =	**1.29**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**213.13**	cfs
Froude Number	**Fr =**	**1.24**	
Flow Velocity	**V =**	**7.76**	fps
Flow Area	A =	27.46	sq ft
Top Width	T =	22.58	ft
Wetted Perimeter	P =	23.65	ft
Hydraulic Radius	R =	1.16	ft
Hydraulic Depth	D =	1.22	ft
Specific Energy	Es =	2.23	ft
Centroid of Flow Area	Yo =	0.63	ft
Specific Force	Fs =	4.29	kip

Normal Flow Analysis - Trapezoidal Channel

Project: MONUMENT RIDGE EAST - Collection Outfall Channel
Channel ID: Channel Slope= 0.5% for Q100 = 211cfs (minimum)



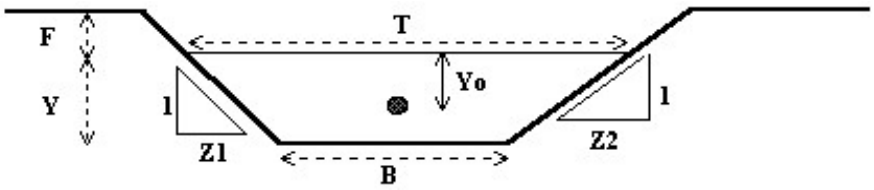
Design Information (Input)			
Channel Invert Slope	So =	0.0050	ft/ft
Manning's n	n =	0.030	
Bottom Width	B =	20.00	ft
Left Side Slope	Z1 =	1.00	ft/ft
Right Side Slope	Z2 =	1.00	ft/ft
Freeboard Height	F =	1.00	ft
Design Water Depth	Y =	**2.00**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**221.40**	cfs
Froude Number	**Fr =**	**0.65**	
Flow Velocity	**V =**	**5.03**	fps
Flow Area	A =	44.00	sq ft
Top Width	T =	24.00	ft
Wetted Perimeter	P =	25.66	ft
Hydraulic Radius	R =	1.71	ft
Hydraulic Depth	D =	1.83	ft
Specific Energy	Es =	2.39	ft
Centroid of Flow Area	Yo =	0.97	ft
Specific Force	Fs =	4.82	kip

Normal Flow Analysis - Trapezoidal Channel

Project: MONUMENT RIDGE EAST - Pond 5 Outfall Channel

Channel ID: Channel Slope= 10.0% for Q100 = 10.8cfs (minimum)



Design Information (Input)			
Channel Invert Slope	So =	0.1000	ft/ft
Manning's n	n =	0.030	
Bottom Width	B =	12.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft
Freeboard Height	F =	1.00	ft
Design Water Depth	Y =	**0.18**	ft

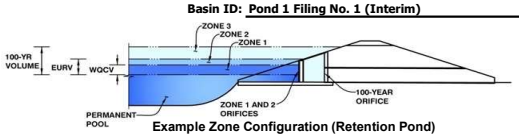
Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**10.96**	cfs
Froude Number	**Fr =**	**2.06**	
Flow Velocity	**V =**	**4.85**	fps
Flow Area	A =	2.26	sq ft
Top Width	T =	13.08	ft
Wetted Perimeter	P =	13.14	ft
Hydraulic Radius	R =	0.17	ft
Hydraulic Depth	D =	0.17	ft
Specific Energy	Es =	0.55	ft
Centroid of Flow Area	Yo =	0.09	ft
Specific Force	Fs =	0.12	kip

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Monument Ridge East

Basin ID: Pond 1 Filing No. 1 (Interim)



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	19.44	acres
Watershed Length =	1,320	ft
Watershed Length to Centroid =	590	ft
Watershed Slope =	0.036	ft/ft
Watershed Imperviousness =	9.41%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.103	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.171	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.245	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.554	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.864	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	1.422	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.800	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.347	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	3.340	acre-feet	inches
Approximate 2-yr Detention Volume =	0.109	acre-feet	
Approximate 5-yr Detention Volume =	0.171	acre-feet	
Approximate 10-yr Detention Volume =	0.365	acre-feet	
Approximate 25-yr Detention Volume =	0.515	acre-feet	
Approximate 50-yr Detention Volume =	0.537	acre-feet	
Approximate 100-yr Detention Volume =	0.697	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.103	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.068	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.526	acre-feet
Total Detention Basin Volume =	0.697	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

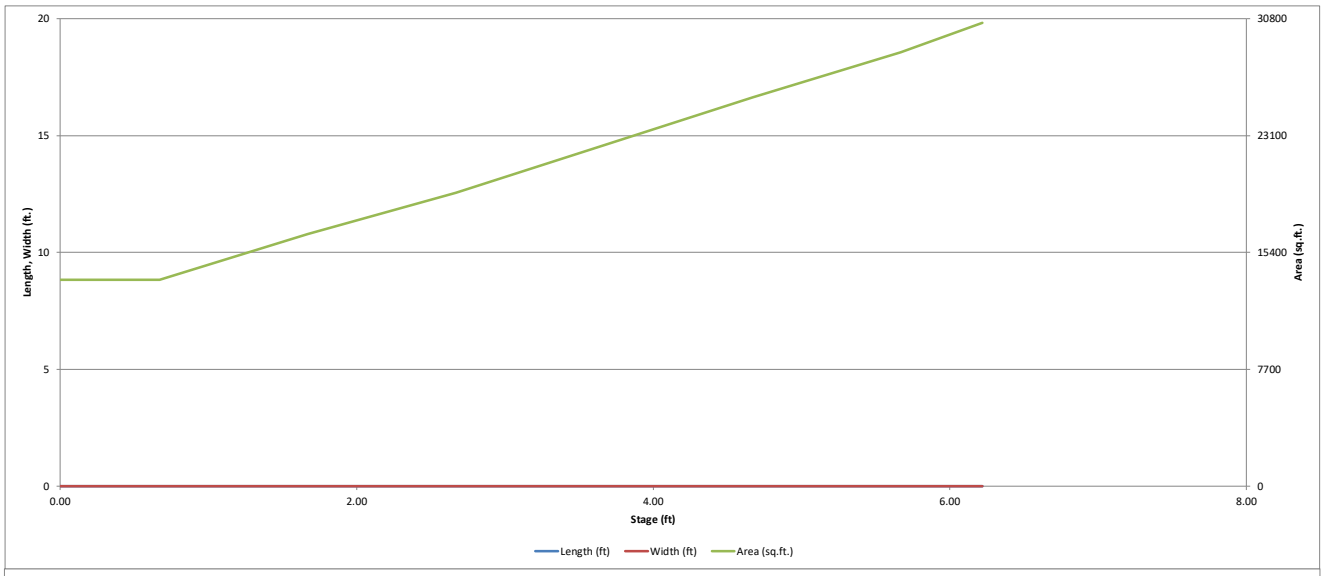
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	13,610	0.312		
ISV 7307	--	0.67	--	--	--	13,610	0.312	9,119	0.209
7308	--	1.67	--	--	--	16,624	0.382	24,236	0.556
7309	--	2.67	--	--	--	19,335	0.444	42,215	0.969
7310	--	3.67	--	--	--	22,486	0.516	63,126	1.449
7311	--	4.67	--	--	--	25,629	0.588	87,183	2.001
7312	--	5.67	--	--	--	28,596	0.656	114,296	2.624
7312.55	--	6.22	--	--	--	30,531	0.701	130,556	2.997

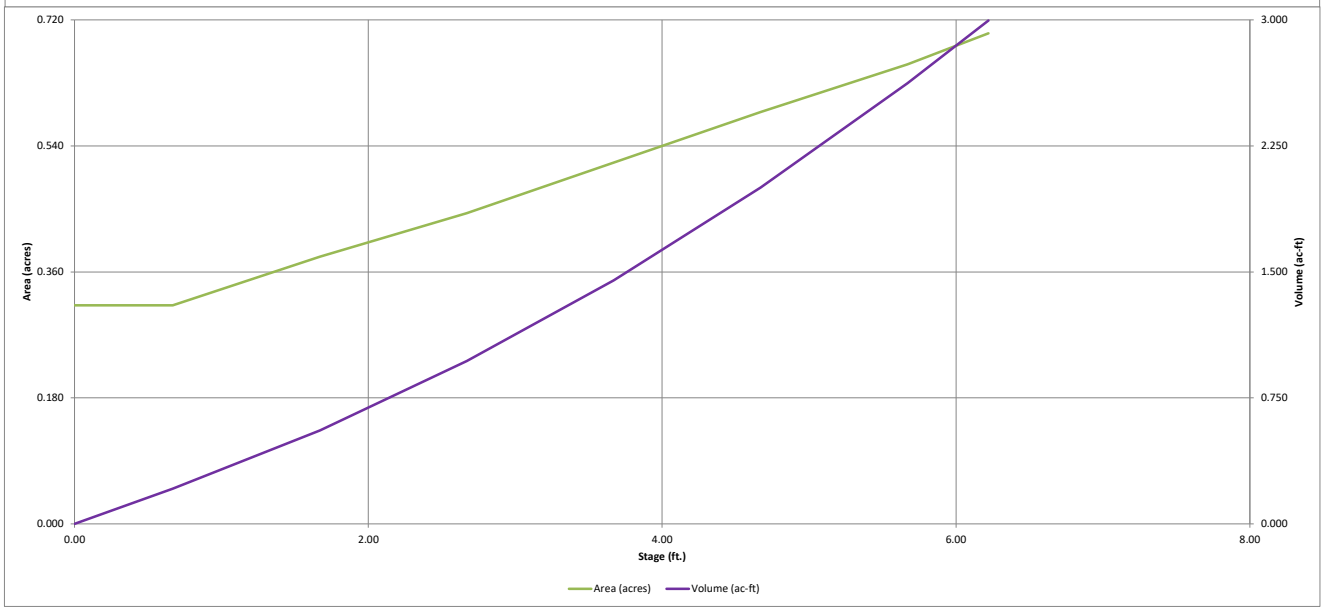
What happened to the 4 pages of 1 table each titled "Water Quality Treatment Summary Table?" They were just before this page on the previous submittal and I had comments on them. They are no longer included in this FDR. Please add them back in. They are very helpful in verifying if your project is in compliance with PCM requirements in the MS4 Permit.

Remember to revise them per my V5 comments (PDF page 264 of that V5 FDR.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



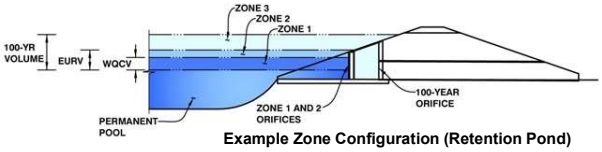


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Monument Ridge East**

Basin ID: **Pond 1 Filing No. 1 (Interim)**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.33	0.103	Orifice Plate
Zone 2 (EURV)	0.55	0.068	Orifice Plate
Zone 3 (100-year)	2.03	0.526	Weir&Pipe (Restrict)
Total (all zones)		0.697	

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

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.01	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.50	0.50	1.00	1.00			
Orifice Area (sq. inches)	2.10	5.00	5.00	2.00	2.00			

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.01	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.01	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	4.38	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	19.78	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	9.89	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	4.52	N/A	ft^2
Outlet Pipe Diameter =	30.00	N/A	inches	Outlet Orifice Centroid =	1.16	N/A	feet
Restrictor Plate Height Above Pipe Invert =	26.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.39	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.40	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.53	feet
Spillway Crest Length =	60.00	feet	Stage at Top of Freeboard =	5.93	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.68	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	2.80	acre-ft

Calculated Parameters for Spillway

Routed Hydrograph Results

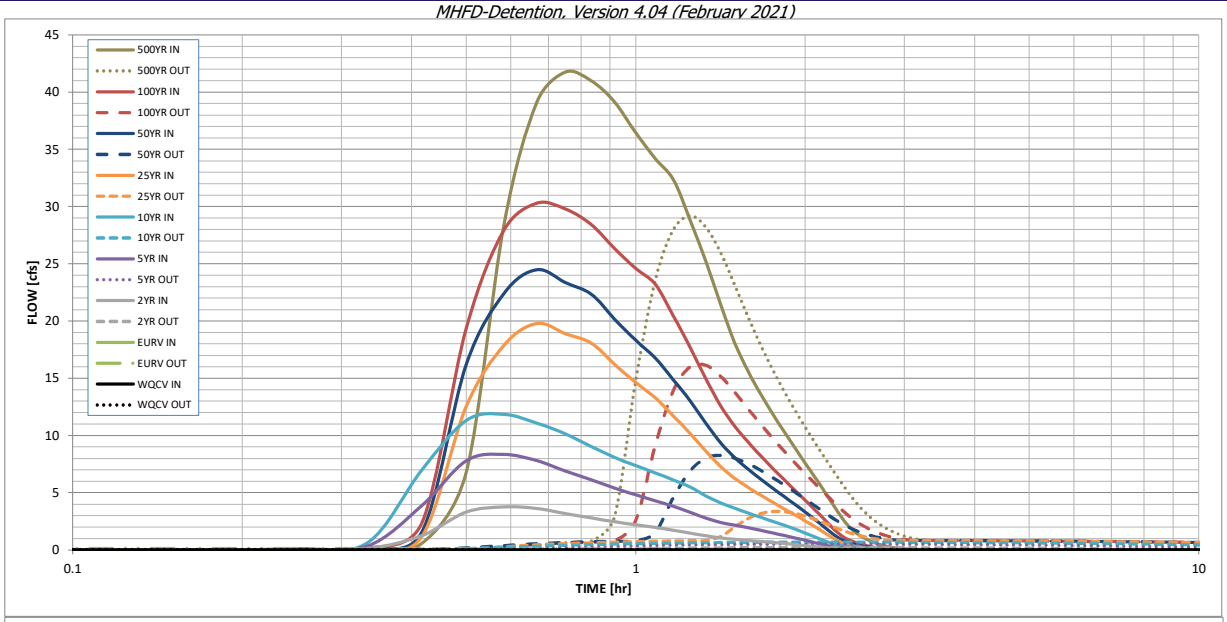
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

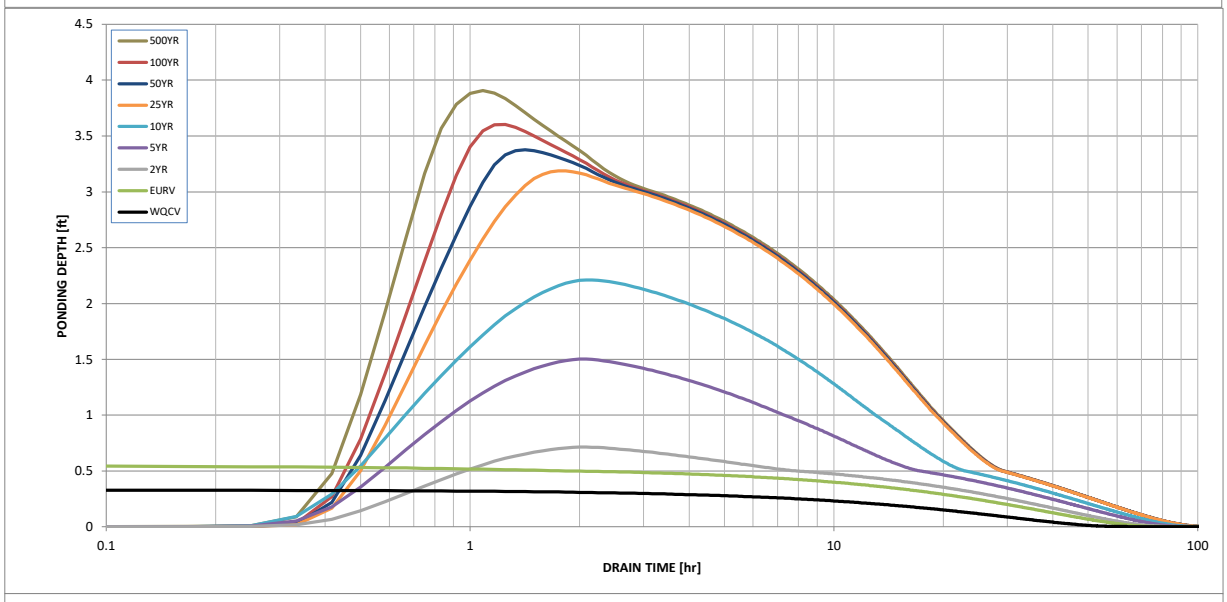
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.103	0.171	0.245	0.554	0.864	1.422	1.800	2.347	3.340
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.245	0.554	0.864	1.422	1.800	2.347	3.340
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.5	6.9	10.4	18.4	23.1	28.8	40.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.13	0.36	0.54	0.95	1.19	1.48	2.07
Peak Inflow Q (cfs) =	N/A	N/A	3.8	8.3	11.8	19.8	24.5	30.3	41.8
Peak Outflow Q (cfs) =	0.0	0.1	0.2	0.5	0.7	3.4	8.3	16.1	29.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.1	0.2	0.4	0.6	0.7
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.1	0.4	0.8	1.4
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) =	51	64	68	69	68	65	61	54	45
Time to Drain 99% of Inflow Volume (hours) =	**57**	71	75	79	81	82	79	76	70
Maximum Ponding Depth (ft) =	0.33	0.55	0.71	1.50	2.21	3.19	3.38	3.60	3.91
Area at Maximum Ponding Depth (acres) =	0.31	0.31	0.32	0.37	0.42	0.48	0.49	0.51	0.53
Maximum Volume Stored (acre-ft) =	0.103	0.172	0.222	0.492	0.772	1.205	1.298	1.413	1.570

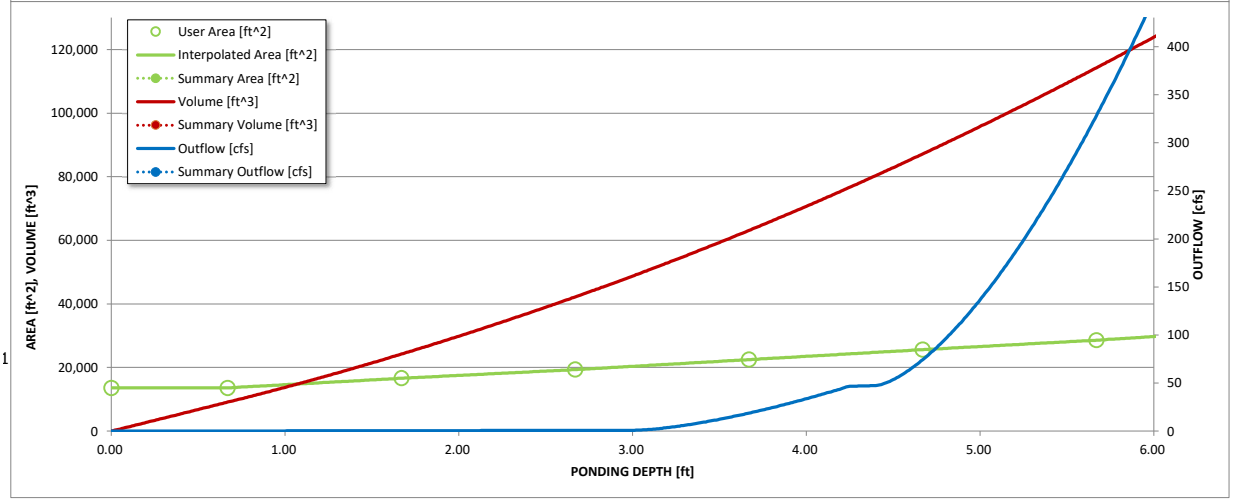
Please tweak the inputs to get this closer to 40hrs

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







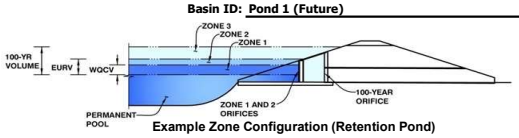
S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Monument Ridge East**

Basin ID: **Pond 1 (Future)**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	25.78	acres
Watershed Length =	1,320	ft
Watershed Length to Centroid =	590	ft
Watershed Slope =	0.036	ft/ft
Watershed Imperviousness =	41.32%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.394	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	1.122	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.076	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.597	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.064	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	2.728	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.247	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.922	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	5.266	acre-feet	inches
Approximate 2-yr Detention Volume =	0.830	acre-feet	
Approximate 5-yr Detention Volume =	1.156	acre-feet	
Approximate 10-yr Detention Volume =	1.581	acre-feet	
Approximate 25-yr Detention Volume =	1.761	acre-feet	
Approximate 50-yr Detention Volume =	1.847	acre-feet	
Approximate 100-yr Detention Volume =	2.108	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.394	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.728	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.987	acre-feet
Total Detention Basin Volume =	2.108	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

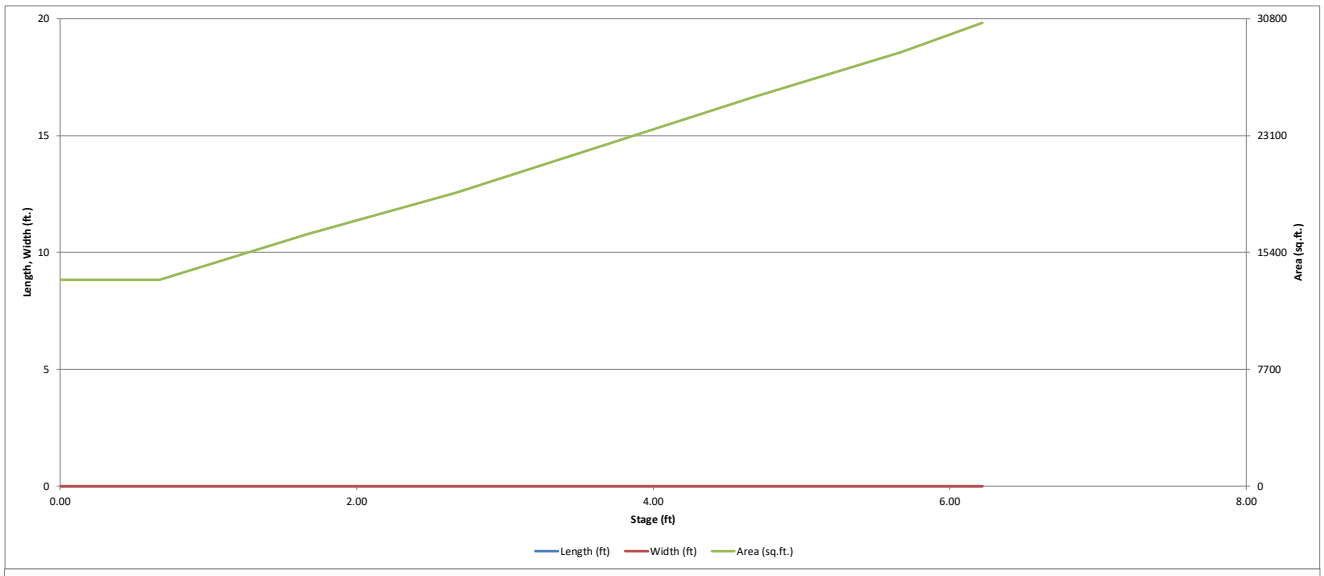
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

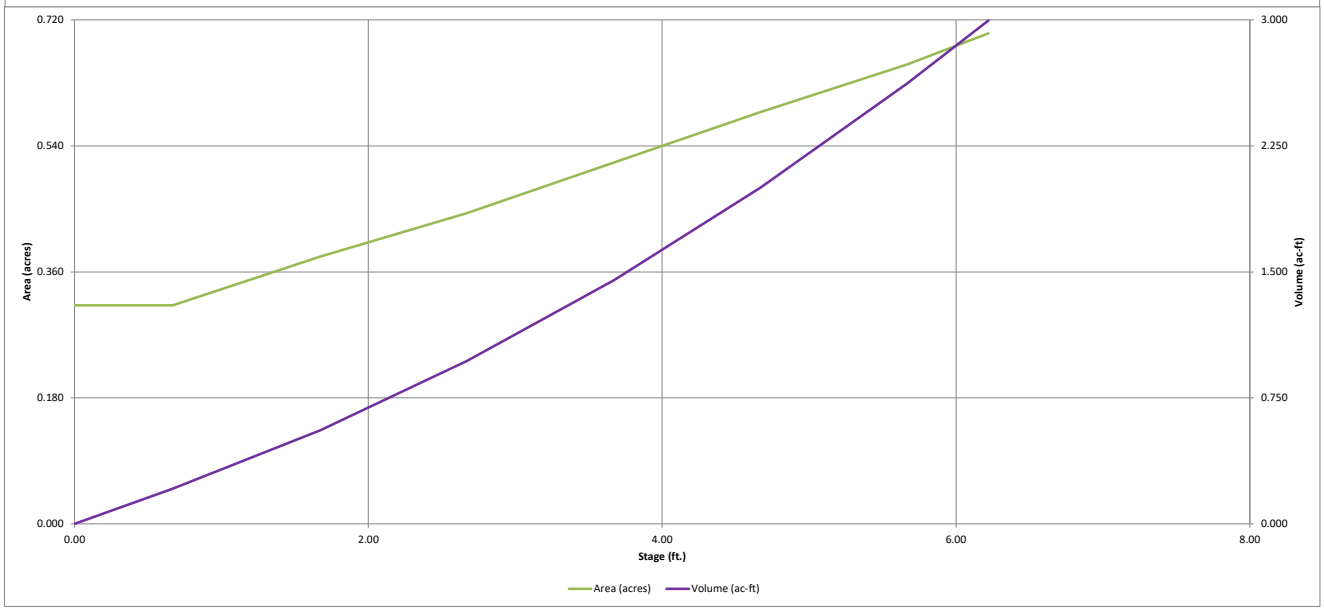
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	13,610	0.312		
ISV 7307	--	0.67	--	--	--	13,610	0.312	9,119	0.209
7308	--	1.67	--	--	--	16,624	0.382	24,236	0.556
7309	--	2.67	--	--	--	19,335	0.444	42,215	0.969
7310	--	3.67	--	--	--	22,486	0.516	63,126	1.449
7311	--	4.67	--	--	--	25,629	0.588	87,183	2.001
7312	--	5.67	--	--	--	28,596	0.656	114,296	2.624
7312.55	--	6.22	--	--	--	30,531	0.701	130,556	2.997

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



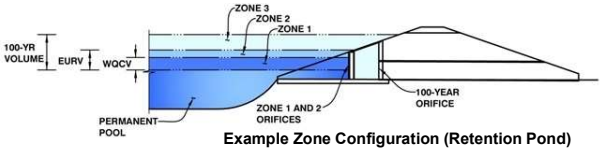


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Monument Ridge East**

Basin ID: **Pond 1 (Future)**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.23	0.394	Orifice Plate
Zone 2 (EURV)	3.01	0.728	Orifice Plate
Zone 3 (100-year)	4.85	0.987	Weir&Pipe (Restrict)
Total (all zones)		2.108	

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

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.01	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	1.00	1.50	1.50			
Orifice Area (sq. inches)	5.40	0.30	0.30	0.30	0.30			

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.01	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.01	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	5.39	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	19.78	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	9.89	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.67	N/A	ft^2
Outlet Pipe Diameter =	30.00	N/A	inches	Outlet Orifice Centroid =	0.98	N/A	feet
Restrictor Plate Height Above Pipe Invert =	21.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.98	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.40	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.53	feet
Spillway Crest Length =	60.00	feet	Stage at Top of Freeboard =	5.93	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.68	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	2.80	acre-ft

Calculated Parameters for Spillway

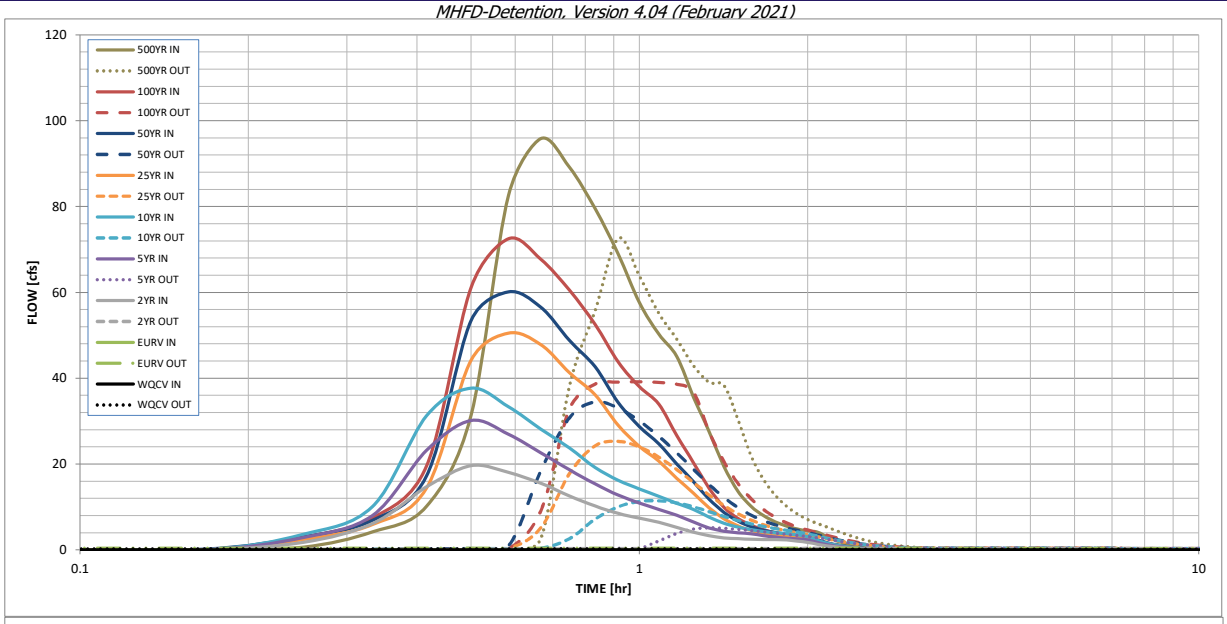
Routed Hydrograph Results

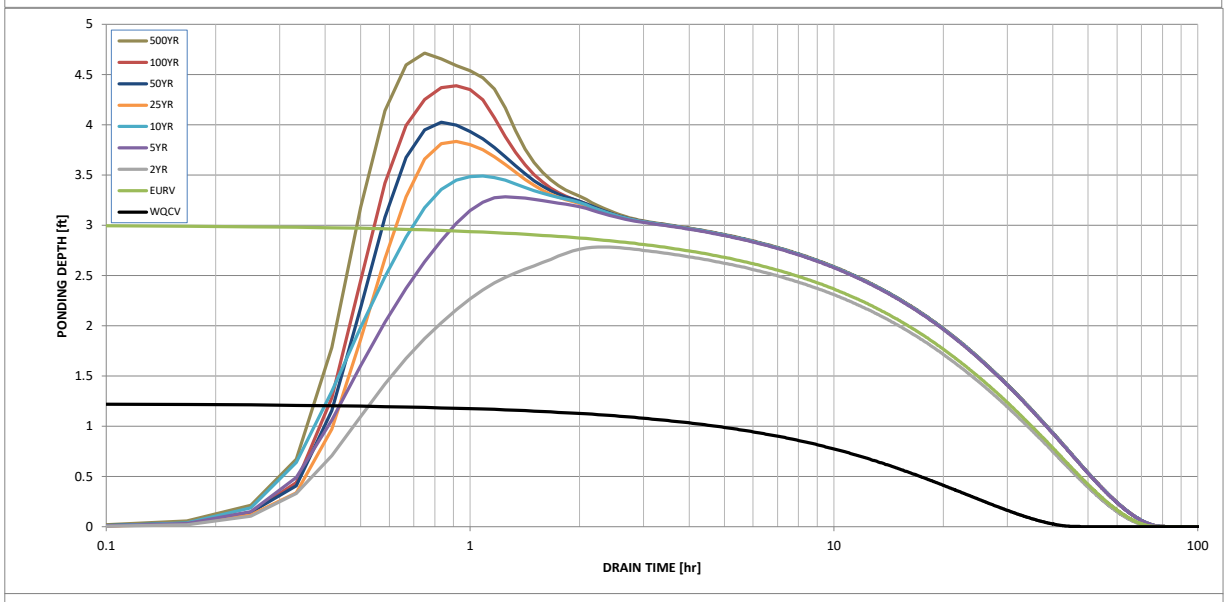
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

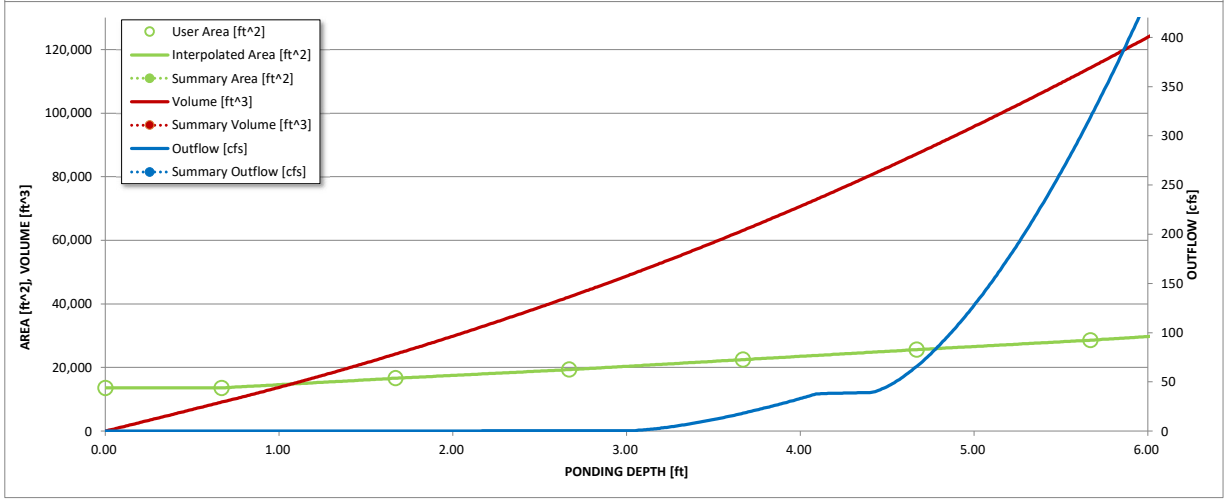
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.394	1.122	1.076	1.597	2.064	2.728	3.247	3.922	5.266
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.076	1.597	2.064	2.728	3.247	3.922	5.266
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	3.7	10.2	15.3	26.9	33.7	42.2	58.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.14	0.40	0.59	1.04	1.31	1.64	2.28
Peak Inflow Q (cfs) =	N/A	N/A	19.6	30.1	37.7	50.5	60.1	72.5	95.8
Peak Outflow Q (cfs) =	0.2	0.4	0.4	5.1	11.4	25.3	34.5	39.2	72.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.7	0.9	1.0	0.9	1.2
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.6	1.2	1.7	2.0	2.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	63	63	64	62	59	57	55	51
Time to Drain 99% of Inflow Volume (hours) =	**42**	69	69	71	70	68	67	66	64
Maximum Ponding Depth (ft) =	1.23	3.01	2.78	3.28	3.49	3.83	4.03	4.39	4.71
Area at Maximum Ponding Depth (acres) =	0.35	0.47	0.45	0.49	0.50	0.53	0.54	0.57	0.59
Maximum Volume Stored (acre-ft) =	0.395	1.124	1.018	1.253	1.352	1.533	1.634	1.834	2.025

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







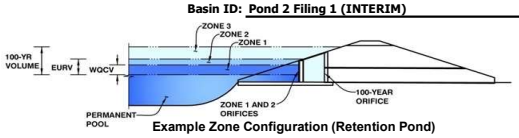
S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Monument Ridge East - Filing No. 1**

Basin ID: **Pond 2 Filing 1 (INTERIM)**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	22.36	acres
Watershed Length =	1,370	ft
Watershed Length to Centroid =	560	ft
Watershed Slope =	0.049	ft/ft
Watershed Imperviousness =	18.35%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	82.0%	percent
Percentage Hydrologic Soil Groups C/D =	18.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.203	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.396	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.480	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.) =	1.273	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	1.880	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.324	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.940	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	4.096	acre-feet	inches
Approximate 2-yr Detention Volume =	0.280	acre-feet	
Approximate 5-yr Detention Volume =	0.440	acre-feet	
Approximate 10-yr Detention Volume =	0.684	acre-feet	
Approximate 25-yr Detention Volume =	0.848	acre-feet	
Approximate 50-yr Detention Volume =	0.894	acre-feet	
Approximate 100-yr Detention Volume =	1.117	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.203	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.194	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.721	acre-feet
Total Detention Basin Volume =	1.117	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

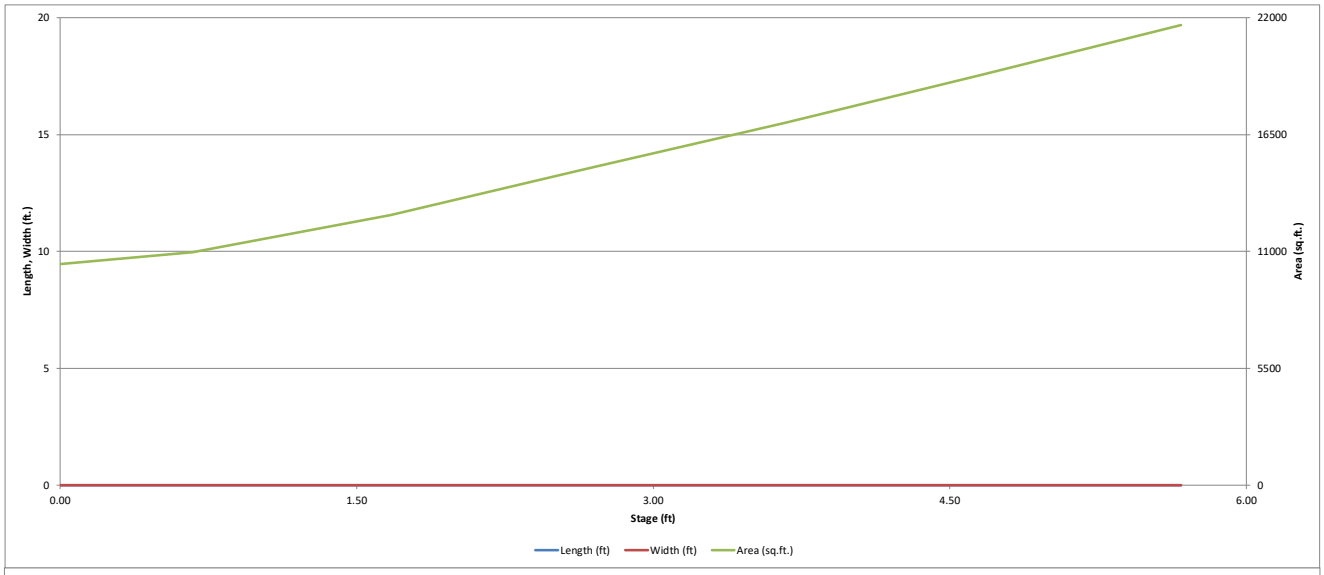
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

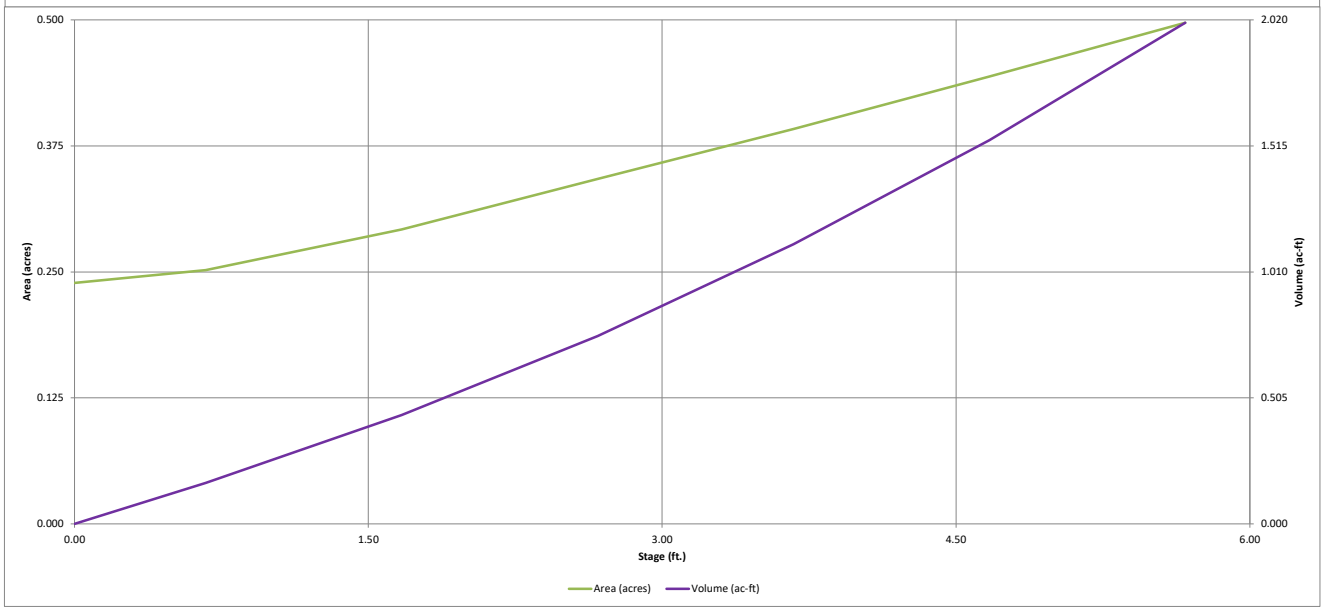
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	10,410	0.239		
ISV 7274	--	0.67	--	--	--	10,963	0.252	7,160	0.164
7275	--	1.67	--	--	--	12,719	0.292	19,001	0.436
7276	--	2.67	--	--	--	14,905	0.342	32,813	0.753
7277	--	3.67	--	--	--	17,066	0.392	48,798	1.120
7278	--	4.67	--	--	--	19,340	0.444	67,001	1.538
7279	--	5.67	--	--	--	21,660	0.497	87,501	2.009

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



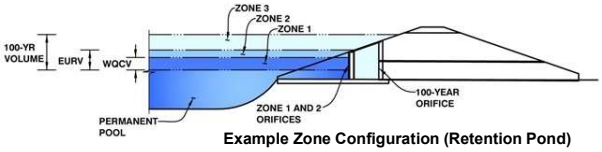


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Monument Ridge East - Filing No. 1

Basin ID: Pond 2 Filing 1 (INTERIM)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.82	0.203	Orifice Plate
Zone 2 (EURV)	1.54	0.194	Orifice Plate
Zone 3 (100-year)	3.67	0.721	Weir&Pipe (Restrict)
Total (all zones)		1.117	

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)

Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft^2

Underdrain Orifice Centroid = feet

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

Invert of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)

Depth at top of Zone using Orifice Plate = 2.60 ft (relative to basin bottom at Stage = 0 ft)

Orifice Plate: Orifice Vertical Spacing = N/A inches

Orifice Plate: Orifice Area per Row = N/A inches

Calculated Parameters for Plate

WQ Orifice Area per Row = N/A ft^2

Elliptical Half-Width = N/A feet

Elliptical Slot Centroid = N/A feet

Elliptical Slot Area = N/A ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.50	1.50					
Orifice Area (sq. inches)	3.10	0.12	6.00					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.60	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	5.00	N/A	feet
Overflow Grate Type =	Close Mesh Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	2.60	N/A	feet
Overflow Weir Slope Length =	5.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	5.60	N/A	
Overflow Grate Open Area w/o Debris =	19.78	N/A	ft^2
Overflow Grate Open Area w/ Debris =	9.89	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.17	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	36.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	18.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	3.53	N/A	ft^2
Outlet Orifice Centroid =	0.86	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.57	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= 4.00 ft (relative to basin bottom at Stage = 0 ft)

Spillway Crest Length = 35.00 feet

Spillway End Slopes = 4.00 H:V

Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth= 0.40 feet

Stage at Top of Freeboard = 5.40 feet

Basin Area at Top of Freeboard = 0.48 acres

Basin Volume at Top of Freeboard = 1.88 acre-ft

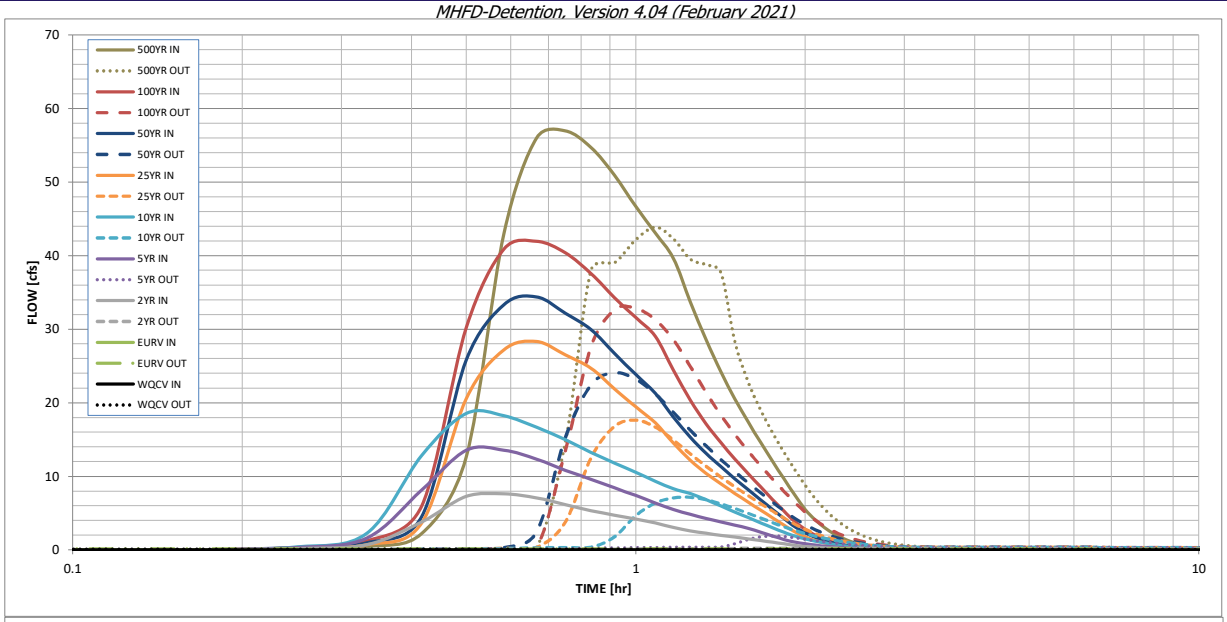
Routed Hydrograph Results

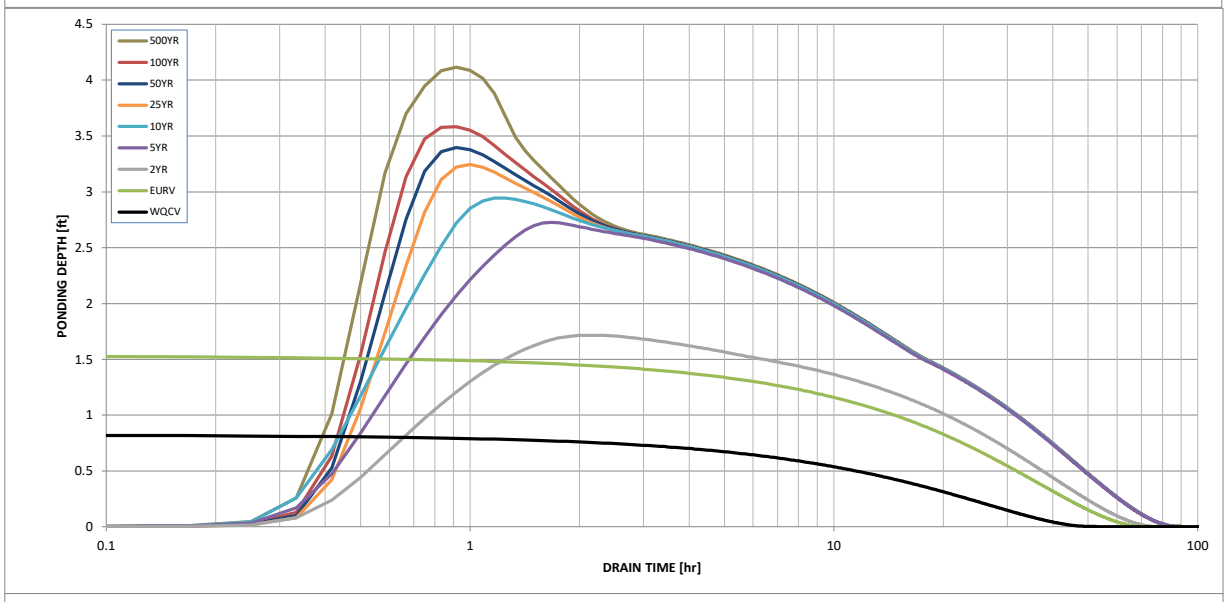
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

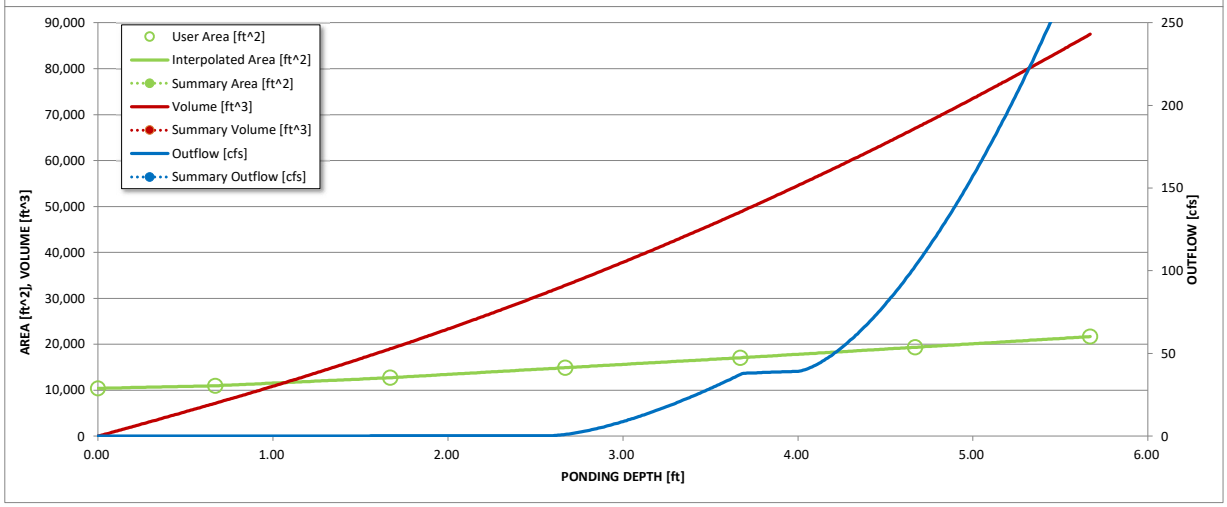
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.203	0.396	0.480	0.876	1.273	1.880	2.324	2.940	4.096
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.480	0.876	1.273	1.880	2.324	2.940	4.096
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	3.7	9.4	14.1	24.1	30.0	37.4	52.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.17	0.42	0.63	1.08	1.34	1.67	2.33
Peak Inflow Q (cfs) =	N/A	N/A	7.6	13.6	18.5	28.3	34.4	41.9	56.9
Peak Outflow Q (cfs) =	0.1	0.2	0.2	1.9	7.2	17.6	24.1	32.8	43.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.5	0.7	0.8	0.9	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.3	0.9	1.2	1.6	2.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	43	59	64	70	67	62	59	55	49
Time to Drain 99% of Inflow Volume (hours) =	**46**	65	70	78	76	73	72	69	66
Maximum Ponding Depth (ft) =	0.83	1.54	1.72	2.73	2.94	3.24	3.40	3.58	4.12
Area at Maximum Ponding Depth (acres) =	0.26	0.29	0.29	0.34	0.36	0.37	0.38	0.39	0.41
Maximum Volume Stored (acre-ft) =	0.205	0.399	0.448	0.770	0.847	0.956	1.013	1.085	1.298

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







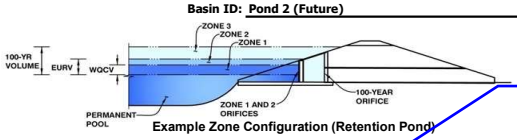
S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Monument Ridge East**

Basin ID: **Pond 2 (Future)**



Example Zone Configuration (Retention Pond)

See comments on drainage plan about diverted area

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	14.41	acres
Watershed Length =	1,370	ft
Watershed Length to Centroid =	560	ft
Watershed Slope =	0.049	ft/ft
Watershed Imperviousness =	48.33%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	82.0%	percent
Percentage Hydrologic Soil Groups C/D =	18.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.242	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.727	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.706	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.013	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.288	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	1.646	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.942	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.315	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	3.075	acre-feet	inches
Approximate 2-yr Detention Volume =	0.562	acre-feet	
Approximate 5-yr Detention Volume =	0.786	acre-feet	
Approximate 10-yr Detention Volume =	1.016	acre-feet	
Approximate 25-yr Detention Volume =	1.113	acre-feet	
Approximate 50-yr Detention Volume =	1.163	acre-feet	
Approximate 100-yr Detention Volume =	1.308	acre-feet	

Define Zones and Basin Geometry

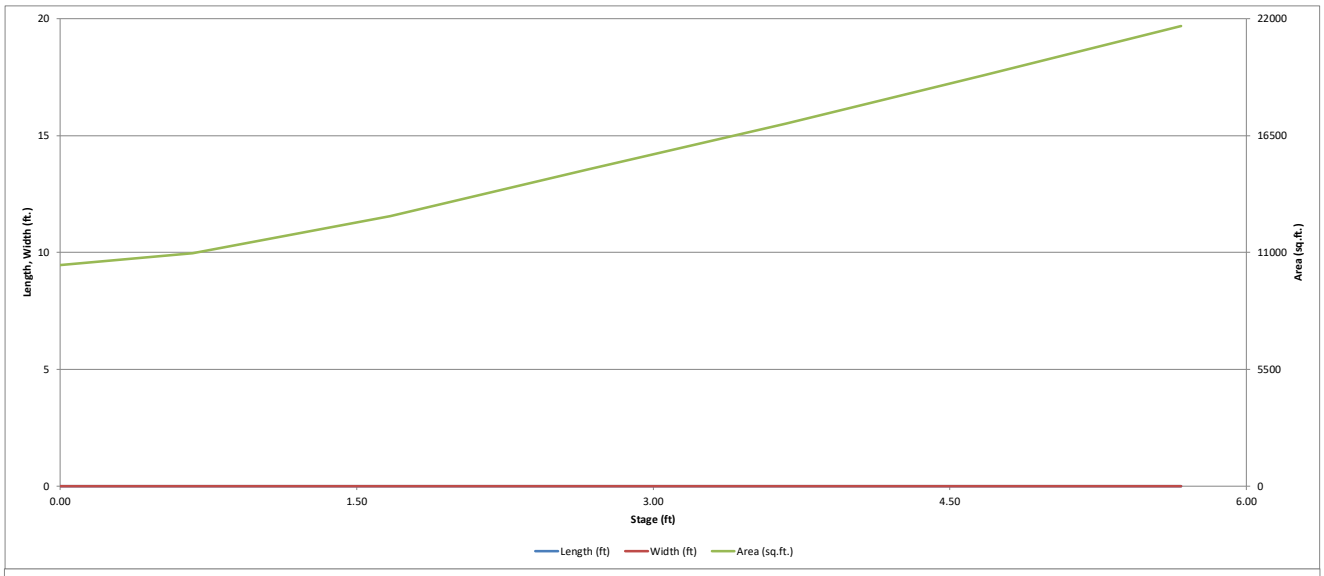
Zone 1 Volume (WQCV) =	0.242	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.485	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.581	acre-feet
Total Detention Basin Volume =	1.308	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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	

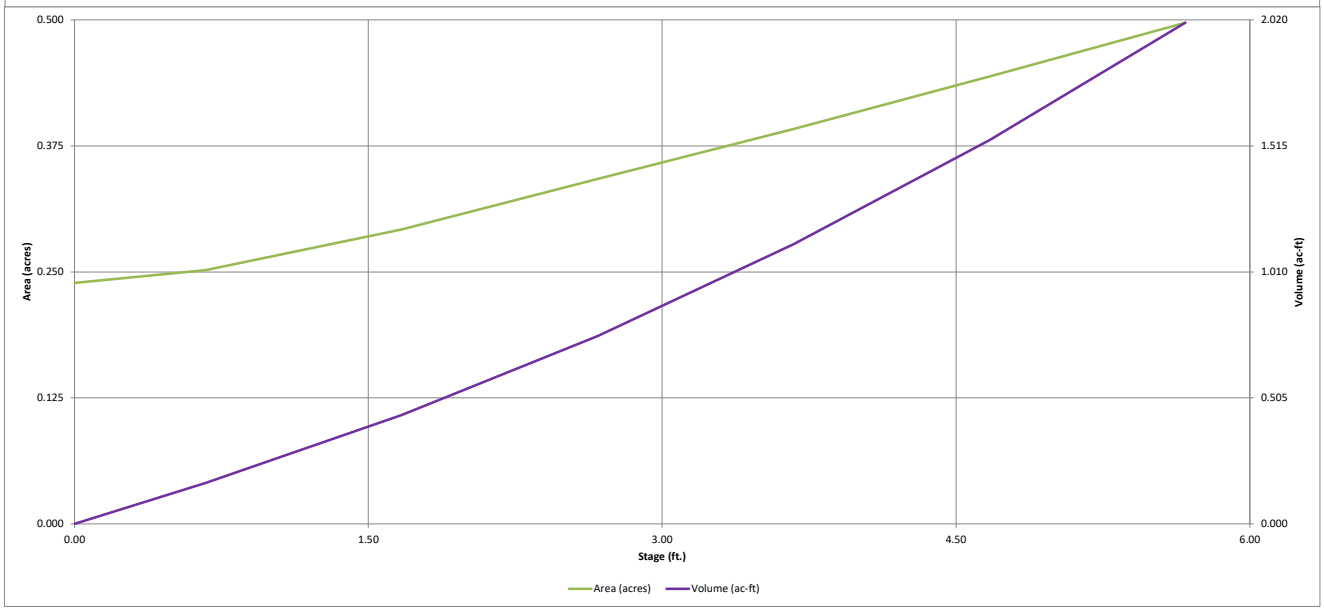
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	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

Stage Description	Depth Increment = 1.00 ft Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	10,410	0.239		
ISV 7274	--	0.67	--	--	--	10,963	0.252	7,160	0.164
7275	--	1.67	--	--	--	12,719	0.292	19,001	0.436
7276	--	2.67	--	--	--	14,905	0.342	32,813	0.753
7277	--	3.67	--	--	--	17,066	0.392	48,798	1.120
7278	--	4.67	--	--	--	19,340	0.444	67,001	1.538
7279	--	5.67	--	--	--	21,660	0.497	87,501	2.009

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



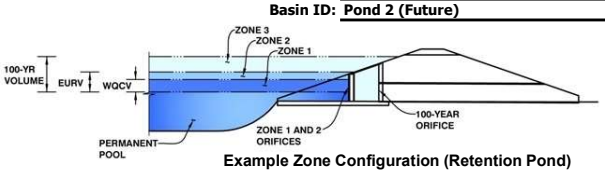


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Monument Ridge East**

Basin ID: **Pond 2 (Future)**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.98	0.242	Orifice Plate
Zone 2 (EURV)	2.60	0.485	Orifice Plate
Zone 3 (100-year)	4.14	0.581	Weir&Pipe (Restrict)
Total (all zones)		1.308	

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)

Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft^2

Underdrain Orifice Centroid = feet

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

Invert of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)

Depth at top of Zone using Orifice Plate = 2.60 ft (relative to basin bottom at Stage = 0 ft)

Orifice Plate: Orifice Vertical Spacing = N/A inches

Orifice Plate: Orifice Area per Row = N/A inches

Calculated Parameters for Plate

WQ Orifice Area per Row = N/A ft^2

Elliptical Half-Width = N/A feet

Elliptical Slot Centroid = N/A feet

Elliptical Slot Area = N/A ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	2.00					
Orifice Area (sq. inches)	3.50	1.60	1.60					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.60	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	5.00	N/A	feet
Overflow Grate Type =	Close Mesh Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	2.60	N/A	feet
Overflow Weir Slope Length =	5.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	12.59	N/A	
Overflow Grate Open Area w/o Debris =	19.78	N/A	ft^2
Overflow Grate Open Area w/ Debris =	9.89	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.17	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	12.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.57	N/A	ft^2
Outlet Orifice Centroid =	0.58	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.57	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= 4.00 ft (relative to basin bottom at Stage = 0 ft)

Spillway Crest Length = 35.00 feet

Spillway End Slopes = 4.00 H:V

Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth= 0.51 feet

Stage at Top of Freeboard = 5.51 feet

Basin Area at Top of Freeboard = 0.49 acres

Basin Volume at Top of Freeboard = 1.93 acre-ft

Routed Hydrograph Results

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

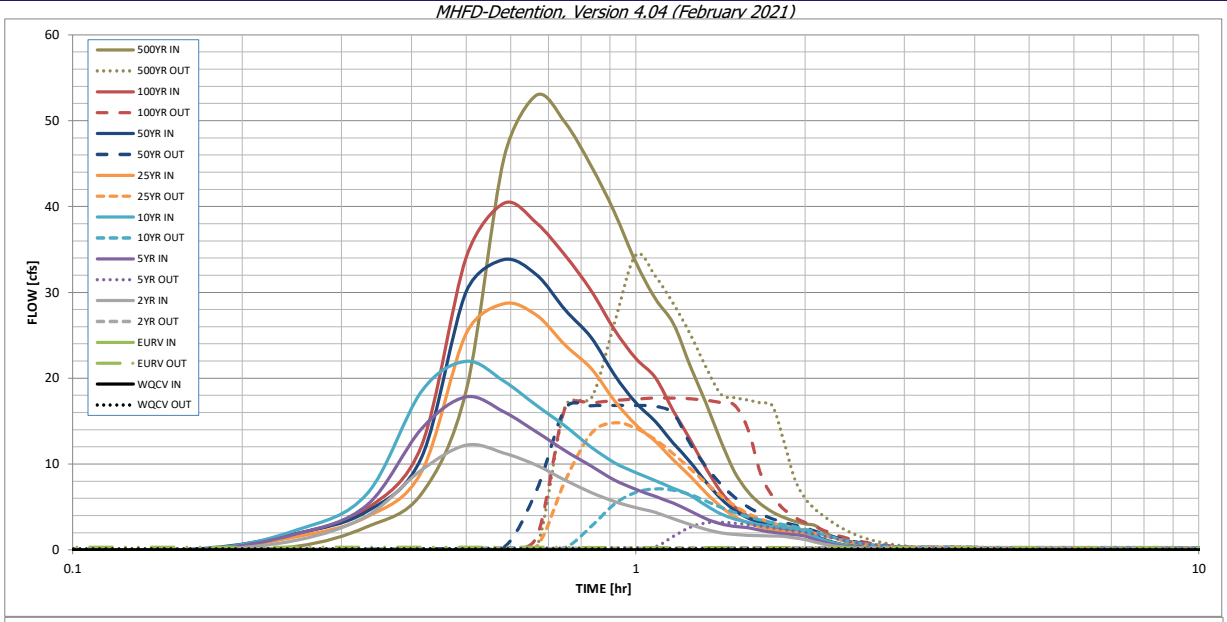
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.242	0.727	0.706	1.013	1.288	1.646	1.942	2.315	3.075
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.706	1.013	1.288	1.646	1.942	2.315	3.075
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.0	5.1	7.8	13.3	16.6	20.7	28.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.14	0.36	0.54	0.92	1.15	1.44	2.00
Peak Inflow Q (cfs) =	N/A	N/A	12.2	17.8	22.0	28.7	33.8	40.4	53.0
Peak Outflow Q (cfs) =	0.1	0.3	0.3	3.2	7.1	14.8	16.8	17.7	34.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.9	1.1	1.0	0.9	1.2
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.3	0.7	0.8	0.9	0.9
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) =	41	64	65	65	63	60	58	56	52
Time to Drain 99% of Inflow Volume (hours) =	**45**	71	71	72	71	70	69	67	65
Maximum Ponding Depth (ft) =	0.98	2.60	2.40	2.80	2.95	3.17	3.36	3.88	4.28
Area at Maximum Ponding Depth (acres) =	0.26	0.34	0.33	0.35	0.36	0.37	0.38	0.40	0.42
Maximum Volume Stored (acre-ft) =	0.244	0.729	0.663	0.795	0.847	0.931	1.001	1.204	1.369

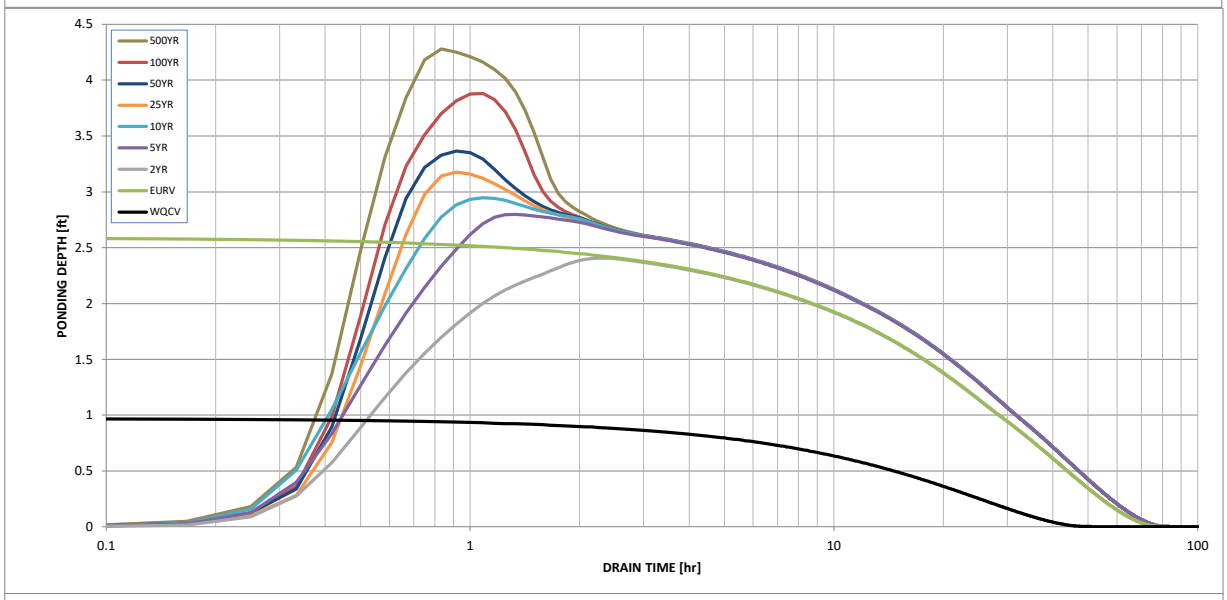
Provide estimated calculations for Pond 3

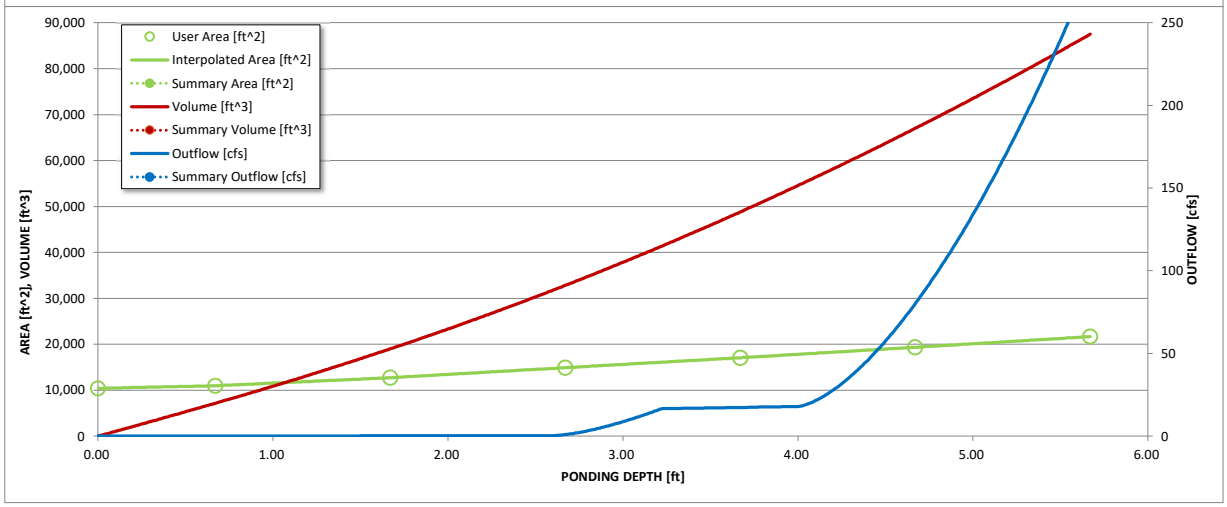
If diversion is approved these will need to be adjusted to meet the allowable pre-developmen peaks (Ponds 2 and 3)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







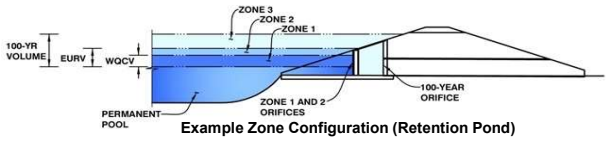
S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Monument Ridge East - Early Grading Plan**

Basin ID: **Pond 4 Filing 1 (Interim)**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**		**Note: L / W Ratio < 1**
Watershed Area =	23.20	acres	**L / W Ratio = 1**
Watershed Length =	1,005	ft	
Watershed Length to Centroid =	490	ft	
Watershed Slope =	0.045	ft/ft	
Watershed Imperviousness =	35.84%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	56.0%	percent	
Percentage Hydrologic Soil Groups C/D =	44.0%	percent	
Target WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.326	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.822	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.877	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.348	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.782	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.353	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.818	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.419	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	4.617	acre-feet		inches
Approximate 2-yr Detention Volume =	0.645	acre-feet		
Approximate 5-yr Detention Volume =	0.966	acre-feet		
Approximate 10-yr Detention Volume =	1.237	acre-feet		
Approximate 25-yr Detention Volume =	1.389	acre-feet		
Approximate 50-yr Detention Volume =	1.455	acre-feet		
Approximate 100-yr Detention Volume =	1.709	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.326	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.496	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.887	acre-feet
Total Detention Basin Volume =	1.709	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

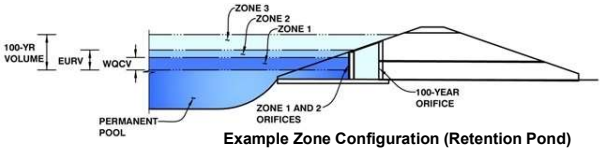
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	3,275	0.075		
ISV 7262	--	0.67	--	--	--	3,275	0.075	2,194	0.050
7263	--	1.67	--	--	--	7,262	0.167	7,463	0.171
7264	--	2.67	--	--	--	8,942	0.205	15,565	0.357
7265	--	3.67	--	--	--	12,109	0.278	26,090	0.599
7266	--	4.67	--	--	--	17,543	0.403	40,916	0.939
7267	--	5.67	--	--	--	23,582	0.541	61,479	1.411
7268	--	6.67	--	--	--	28,562	0.656	87,551	2.010
7268.7	--	7.37	--	--	--	37,113	0.852	110,537	2.538

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Monument Ridge East - Early Grading Plan

Basin ID: Pond 4 Filing 1 (Interim)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.52	0.326	Orifice Plate
Zone 2 (EURV)	4.37	0.496	Orifice Plate
Zone 3 (100-year)	6.20	0.887	Weir&Pipe (Restrict)
Total (all zones)		1.709	

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

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.63	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.50	2.50	3.00	3.50			
Orifice Area (sq. inches)	2.20	1.00	1.00	1.00	1.00			

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.63	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.63	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	5.60	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	19.78	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	9.89	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.53	N/A	ft^2
Outlet Pipe Diameter =	36.00	N/A	inches	Outlet Orifice Centroid =	0.86	N/A	feet
Restrictor Plate Height Above Pipe Invert =	18.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.57	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.85	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.57	feet
Spillway Crest Length =	50.00	feet	Stage at Top of Freeboard =	7.42	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.85	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	2.54	acre-ft

Calculated Parameters for Spillway

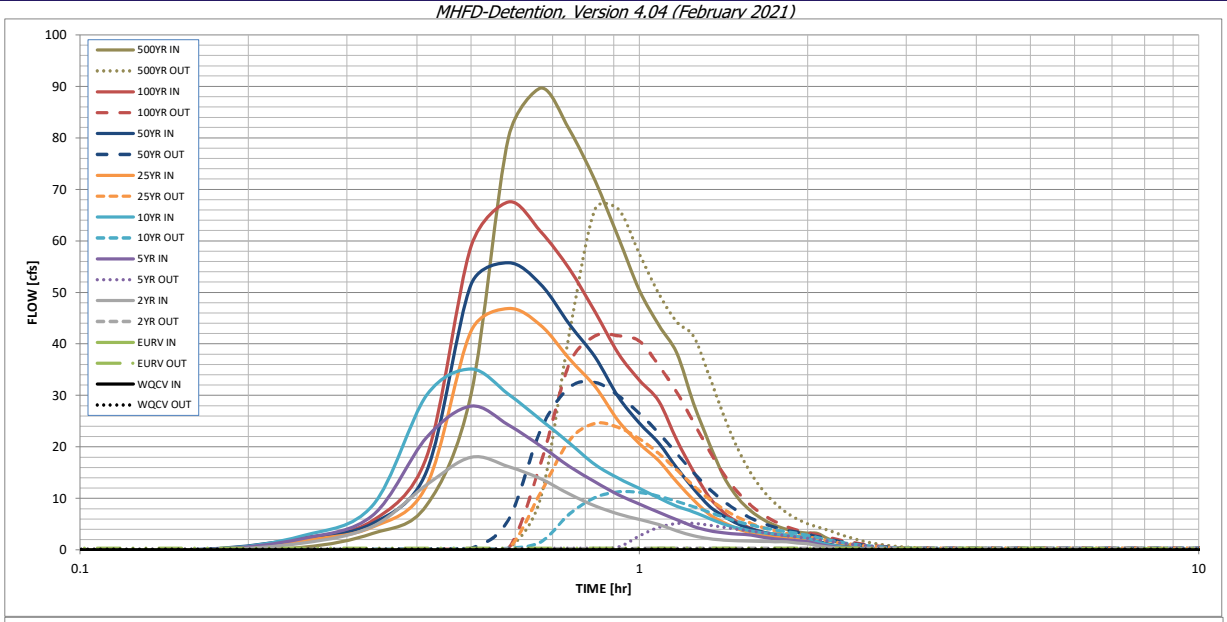
Routed Hydrograph Results

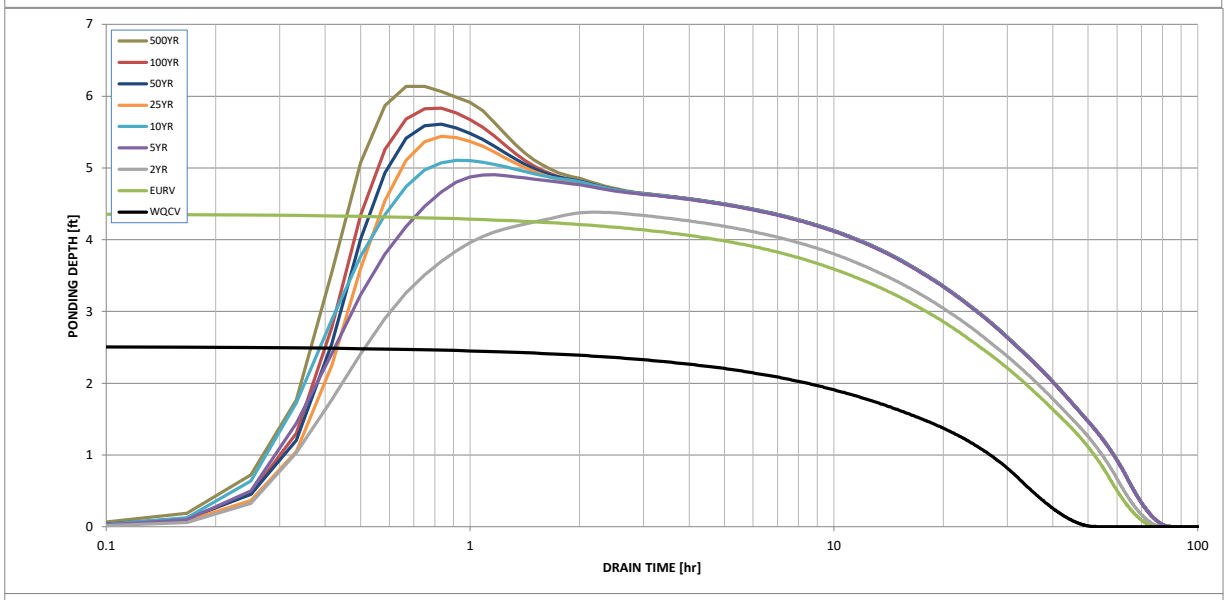
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

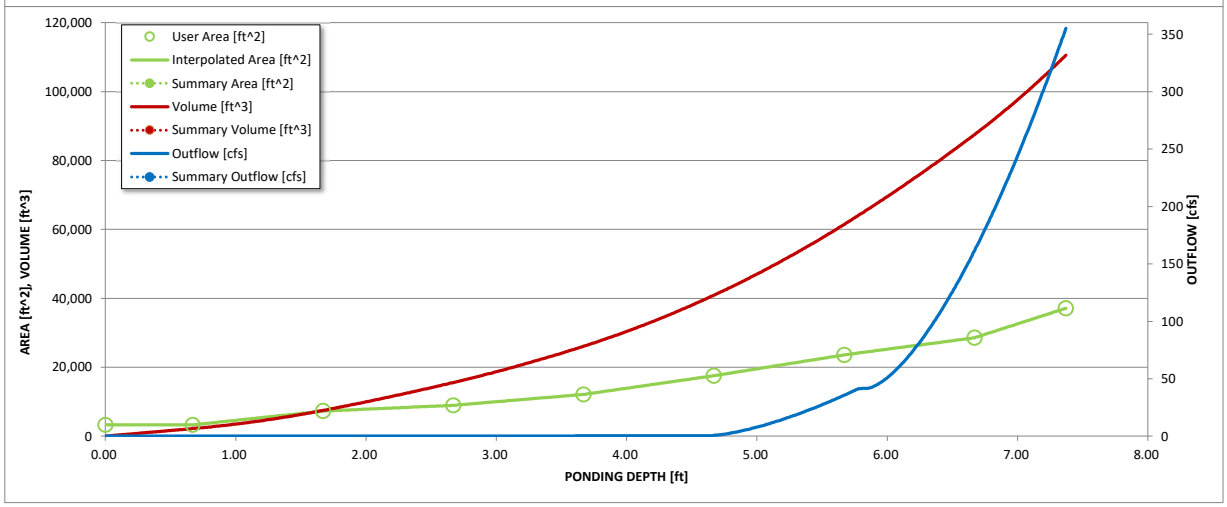
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.326	0.822	0.877	1.348	1.782	2.353	2.818	3.419	4.617
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.877	1.348	1.782	2.353	2.818	3.419	4.617
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	5.5	12.5	18.4	29.4	36.2	44.9	62.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.24	0.54	0.79	1.27	1.56	1.94	2.69
Peak Inflow Q (cfs) =	N/A	N/A	18.0	27.9	35.1	46.8	55.8	67.6	89.7
Peak Outflow Q (cfs) =	0.2	0.3	0.3	5.1	11.3	24.6	32.5	41.6	66.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.8	0.9	0.9	1.1
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.6	1.2	1.6	2.1	2.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	44	64	66	66	64	60	58	55	50
Time to Drain 99% of Inflow Volume (hours) =	**47**	69	72	74	72	71	69	68	65
Maximum Ponding Depth (ft) =	2.52	4.37	4.38	4.90	5.11	5.44	5.61	5.83	6.14
Area at Maximum Ponding Depth (acres) =	0.20	0.37	0.37	0.43	0.46	0.51	0.53	0.56	0.59
Maximum Volume Stored (acre-ft) =	0.327	0.824	0.828	1.036	1.125	1.285	1.374	1.499	1.672

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.02	0.50
	0:15:00	0.00	0.00	1.33	2.19	2.72	1.83	2.27	2.24	3.16
	0:20:00	0.00	0.00	4.55	6.68	8.61	4.41	5.12	5.65	8.64
	0:25:00	0.00	0.00	12.65	21.84	30.00	12.48	15.26	18.06	30.13
	0:30:00	0.00	0.00	18.00	27.91	35.10	42.47	51.51	58.91	80.03
	0:35:00	0.00	0.00	16.18	24.26	30.24	46.84	55.77	67.58	89.65
	0:40:00	0.00	0.00	13.79	20.17	25.25	43.60	51.55	61.77	81.52
	0:45:00	0.00	0.00	10.82	16.20	20.72	37.04	43.78	54.51	71.64
	0:50:00	0.00	0.00	8.52	13.19	16.54	31.71	37.42	46.19	60.70
	0:55:00	0.00	0.00	6.97	10.71	13.91	25.08	29.74	38.17	50.44
	1:00:00	0.00	0.00	5.89	8.89	11.92	20.66	24.64	32.94	43.62
	1:05:00	0.00	0.00	4.93	7.29	10.10	17.30	20.72	28.87	38.21
	1:10:00	0.00	0.00	3.70	5.86	8.46	13.16	15.90	21.31	28.45
	1:15:00	0.00	0.00	2.73	4.54	7.37	9.71	11.89	15.23	20.74
	1:20:00	0.00	0.00	2.17	3.72	6.12	6.92	8.51	10.29	14.20
	1:25:00	0.00	0.00	1.91	3.30	5.00	5.31	6.54	7.24	10.09
	1:30:00	0.00	0.00	1.77	3.04	4.24	4.08	5.03	5.37	7.54
	1:35:00	0.00	0.00	1.70	2.87	3.71	3.29	4.05	4.17	5.88
	1:40:00	0.00	0.00	1.64	2.44	3.34	2.78	3.42	3.36	4.75
	1:45:00	0.00	0.00	1.60	2.14	3.09	2.45	3.01	2.81	3.99
	1:50:00	0.00	0.00	1.57	1.92	2.90	2.23	2.73	2.46	3.50
	1:55:00	0.00	0.00	1.34	1.75	2.63	2.10	2.57	2.31	3.28
	2:00:00	0.00	0.00	1.17	1.59	2.25	2.03	2.47	2.26	3.19
	2:05:00	0.00	0.00	0.83	1.12	1.56	1.42	1.72	1.59	2.23
	2:10:00	0.00	0.00	0.58	0.77	1.08	0.98	1.19	1.10	1.54
	2:15:00	0.00	0.00	0.39	0.52	0.74	0.67	0.81	0.76	1.06
	2:20:00	0.00	0.00	0.26	0.33	0.49	0.45	0.54	0.50	0.70
	2:25:00	0.00	0.00	0.17	0.21	0.31	0.29	0.35	0.33	0.45
	2:30:00	0.00	0.00	0.10	0.14	0.19	0.19	0.22	0.21	0.29
	2:35:00	0.00	0.00	0.05	0.08	0.10	0.10	0.12	0.11	0.16
	2:40:00	0.00	0.00	0.02	0.03	0.04	0.05	0.05	0.05	0.07
	2:45:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

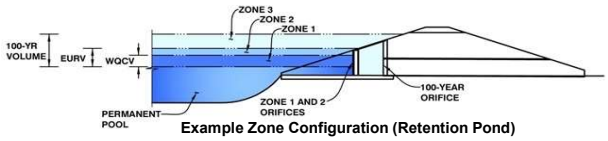
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Monument Ridge East - Early Grading Plan**

Basin ID: **Pond 4 (Future)**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	21.18	acres
Watershed Length =	1,005	ft
Watershed Length to Centroid =	490	ft
Watershed Slope =	0.045	ft/ft
Watershed Imperviousness =	43.35%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	56.0%	percent
Percentage Hydrologic Soil Groups C/D =	44.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.333	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.921	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.943	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.386	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.787	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.297	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.725	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.266	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	4.364	acre-feet		inches
Approximate 2-yr Detention Volume =	0.735	acre-feet		
Approximate 5-yr Detention Volume =	1.069	acre-feet		
Approximate 10-yr Detention Volume =	1.340	acre-feet		
Approximate 25-yr Detention Volume =	1.477	acre-feet		
Approximate 50-yr Detention Volume =	1.542	acre-feet		
Approximate 100-yr Detention Volume =	1.768	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.333	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.588	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.847	acre-feet
Total Detention Basin Volume =	1.768	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

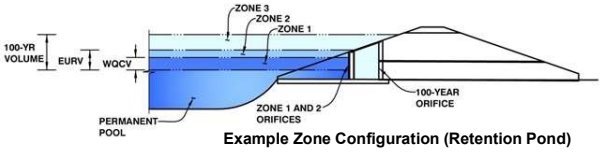
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	3,275	0.075		
ISV 7262	--	0.67	--	--	--	3,275	0.075	2,194	0.050
7263	--	1.67	--	--	--	7,262	0.167	7,463	0.171
7264	--	2.67	--	--	--	8,942	0.205	15,565	0.357
7265	--	3.67	--	--	--	12,109	0.278	26,090	0.599
7266	--	4.67	--	--	--	17,543	0.403	40,916	0.939
7267	--	5.67	--	--	--	23,582	0.541	61,479	1.411
7268	--	6.67	--	--	--	28,562	0.656	87,551	2.010
7268.7	--	7.37	--	--	--	37,113	0.852	110,537	2.538

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Monument Ridge East - Early Grading Plan

Basin ID: Pond 4 (Future)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.55	0.333	Orifice Plate
Zone 2 (EURV)	4.63	0.588	Orifice Plate
Zone 3 (100-year)	6.29	0.847	Weir&Pipe (Restrict)
Total (all zones)		1.768	

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

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.63	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.50	2.50	3.00	3.50			
Orifice Area (sq. inches)	2.10	1.30	1.30	1.30	1.30			

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.63	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.63	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.26	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	19.78	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	9.89	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.16	N/A	ft^2
Outlet Pipe Diameter =	36.00	N/A	inches	Outlet Orifice Centroid =	0.80	N/A	feet
Restrictor Plate Height Above Pipe Invert =	16.50		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.49	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.85	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.57	feet
Spillway Crest Length =	50.00	feet	Stage at Top of Freeboard =	7.42	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.85	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	2.54	acre-ft

Calculated Parameters for Spillway

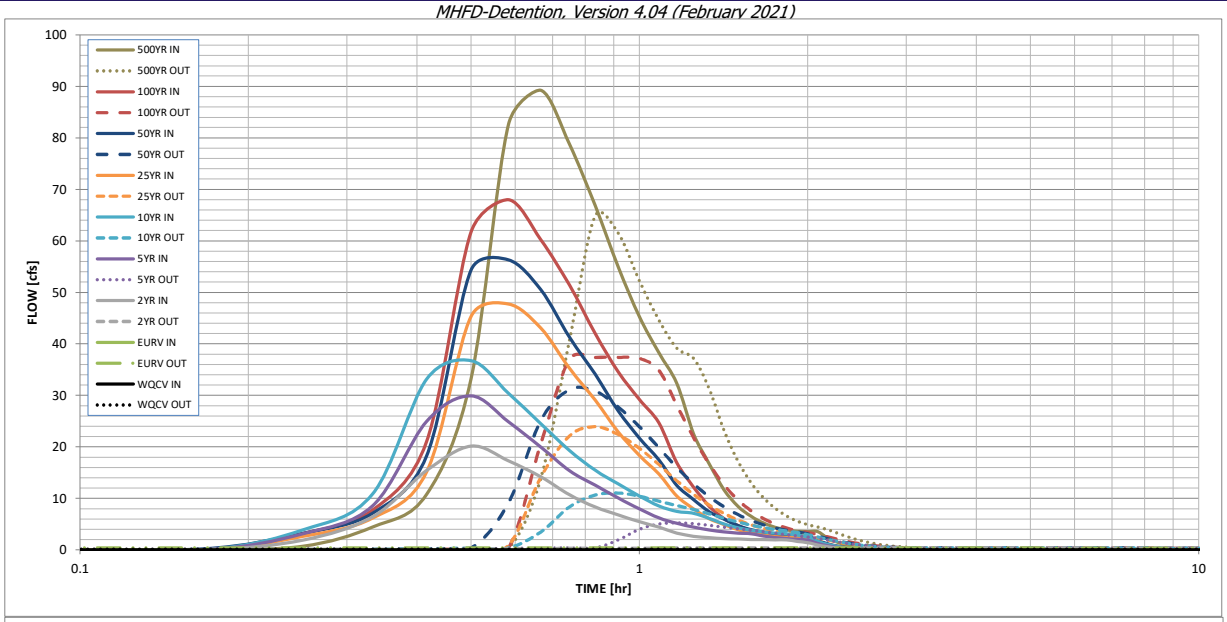
Routed Hydrograph Results

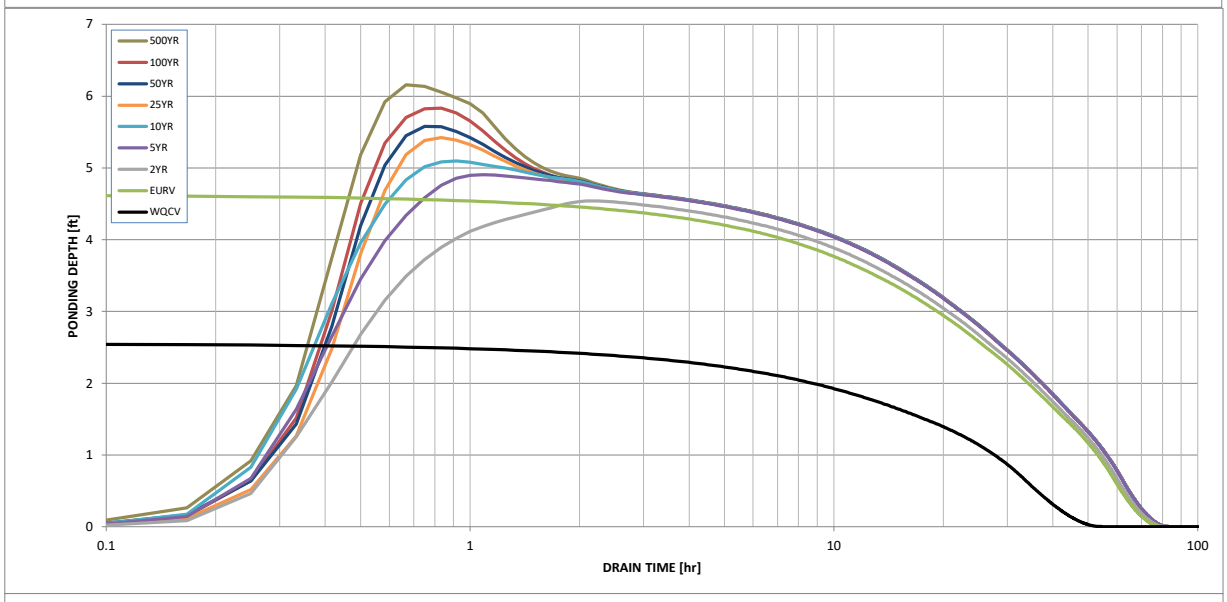
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

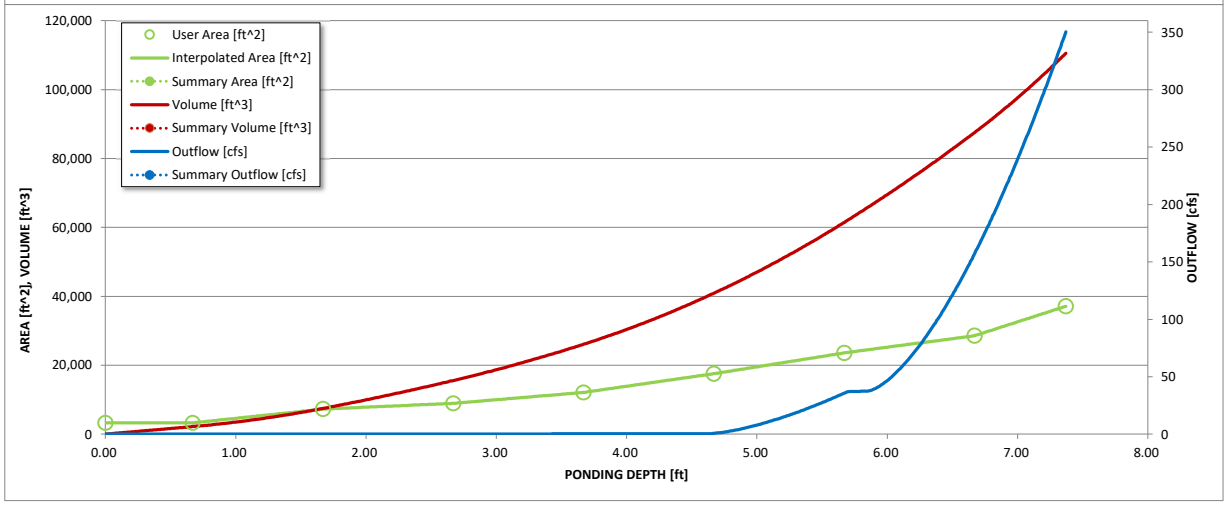
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.333	0.921	0.943	1.386	1.787	2.297	2.725	3.266	4.364
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.943	1.386	1.787	2.297	2.725	3.266	4.364
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	4.9	11.0	16.2	26.0	32.1	39.8	55.3
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.23	0.52	0.76	1.23	1.52	1.88	2.61
Peak Inflow Q (cfs) =	N/A	N/A	20.1	29.9	36.8	47.8	56.3	68.0	89.3
Peak Outflow Q (cfs) =	0.2	0.4	0.4	5.3	11.0	23.9	31.1	37.4	64.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.7	0.9	1.0	0.9	1.2
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.5	1.2	1.6	1.9	1.9
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) =	45	64	65	64	61	58	56	53	48
Time to Drain 99% of Inflow Volume (hours) =	**49**	71	72	72	71	69	68	66	63
Maximum Ponding Depth (ft) =	2.56	4.63	4.54	4.91	5.10	5.42	5.58	5.83	6.16
Area at Maximum Ponding Depth (acres) =	0.20	0.40	0.39	0.43	0.46	0.51	0.53	0.56	0.60
Maximum Volume Stored (acre-ft) =	0.335	0.923	0.888	1.036	1.121	1.280	1.358	1.499	1.690

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.02	0.70
	0:15:00	0.00	0.00	1.91	3.13	3.88	2.61	3.21	3.18	4.44
	0:20:00	0.00	0.00	6.43	8.56	10.80	6.15	7.13	7.70	10.79
	0:25:00	0.00	0.00	15.40	24.96	33.15	15.10	18.20	21.01	33.19
	0:30:00	0.00	0.00	20.15	29.87	36.76	45.33	54.32	61.70	82.57
	0:35:00	0.00	0.00	17.29	24.87	30.43	47.76	56.33	67.99	89.26
	0:40:00	0.00	0.00	14.21	19.97	24.51	43.05	50.51	60.23	78.73
	0:45:00	0.00	0.00	10.68	15.37	19.31	35.23	41.30	51.38	66.89
	0:50:00	0.00	0.00	8.31	12.56	15.48	29.12	34.12	42.05	54.94
	0:55:00	0.00	0.00	6.78	10.07	12.80	22.91	26.98	34.57	45.30
	1:00:00	0.00	0.00	5.47	7.96	10.48	18.36	21.71	29.22	38.29
	1:05:00	0.00	0.00	4.40	6.22	8.51	14.76	17.50	24.70	32.34
	1:10:00	0.00	0.00	3.26	5.15	7.46	10.44	12.53	16.93	22.57
	1:15:00	0.00	0.00	2.65	4.43	7.10	7.98	9.76	12.21	16.73
	1:20:00	0.00	0.00	2.35	3.86	6.12	6.07	7.40	8.48	11.69
	1:25:00	0.00	0.00	2.19	3.50	5.02	4.92	5.97	6.11	8.45
	1:30:00	0.00	0.00	2.10	3.27	4.30	3.90	4.72	4.71	6.53
	1:35:00	0.00	0.00	2.03	3.14	3.80	3.26	3.93	3.77	5.21
	1:40:00	0.00	0.00	1.99	2.69	3.48	2.86	3.43	3.16	4.38
	1:45:00	0.00	0.00	1.96	2.38	3.26	2.59	3.10	2.78	3.85
	1:50:00	0.00	0.00	1.95	2.18	3.10	2.45	2.92	2.64	3.64
	1:55:00	0.00	0.00	1.63	2.04	2.86	2.36	2.81	2.58	3.55
	2:00:00	0.00	0.00	1.41	1.89	2.50	2.32	2.76	2.57	3.54
	2:05:00	0.00	0.00	0.94	1.25	1.66	1.54	1.83	1.72	2.36
	2:10:00	0.00	0.00	0.61	0.81	1.08	1.01	1.20	1.13	1.54
	2:15:00	0.00	0.00	0.39	0.51	0.69	0.65	0.77	0.72	0.99
	2:20:00	0.00	0.00	0.24	0.31	0.42	0.40	0.47	0.44	0.60
	2:25:00	0.00	0.00	0.14	0.19	0.25	0.25	0.29	0.27	0.37
	2:30:00	0.00	0.00	0.07	0.10	0.13	0.13	0.16	0.14	0.19
	2:35:00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.06	0.07
	2:40:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

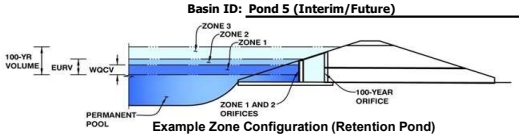
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Monument Ridge East - Early Grading Plan**

Basin ID: **Pond 5 (Interim/Future)**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**		**Note: L / W Ratio < 1**
Watershed Area =	3.21	acres	**L / W Ratio = 0.83**
Watershed Length =	340	ft	
Watershed Length to Centroid =	160	ft	
Watershed Slope =	0.028	ft/ft	
Watershed Imperviousness =	48.40%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	100.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Target WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		

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

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.054	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.166	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.146	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.210	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.266	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	0.343	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.404	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.483	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	0.641	acre-feet	inches
Approximate 2-yr Detention Volume =	0.125	acre-feet	
Approximate 5-yr Detention Volume =	0.171	acre-feet	
Approximate 10-yr Detention Volume =	0.228	acre-feet	
Approximate 25-yr Detention Volume =	0.250	acre-feet	
Approximate 50-yr Detention Volume =	0.262	acre-feet	
Approximate 100-yr Detention Volume =	0.293	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.054	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.112	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.128	acre-feet
Total Detention Basin Volume =	0.293	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	

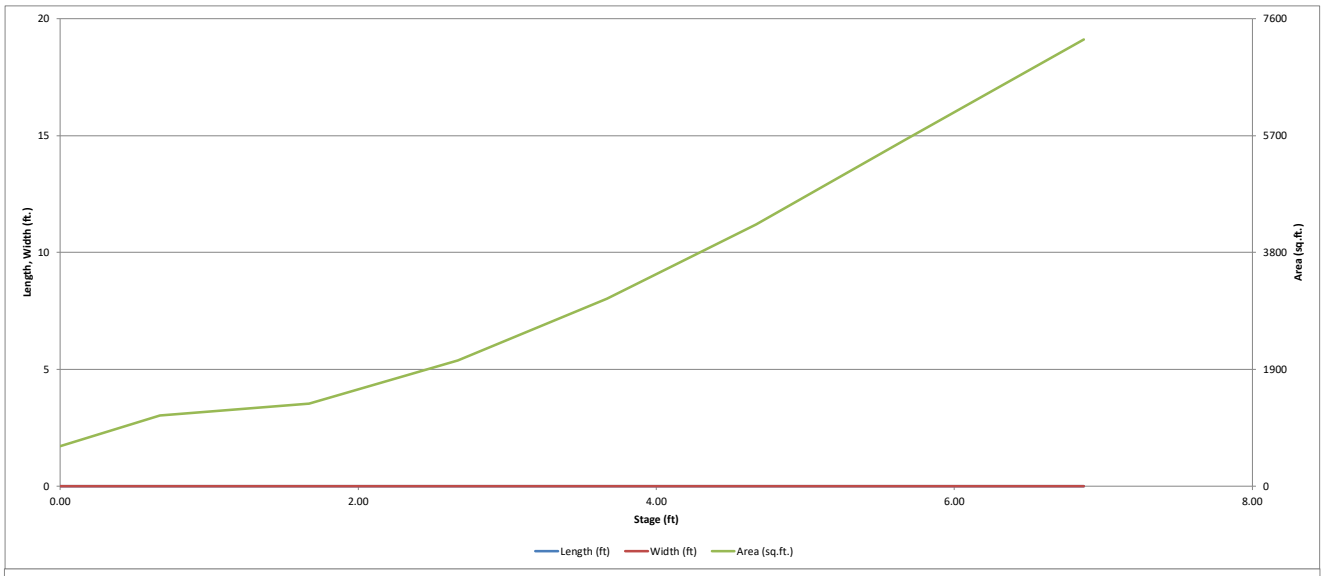
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

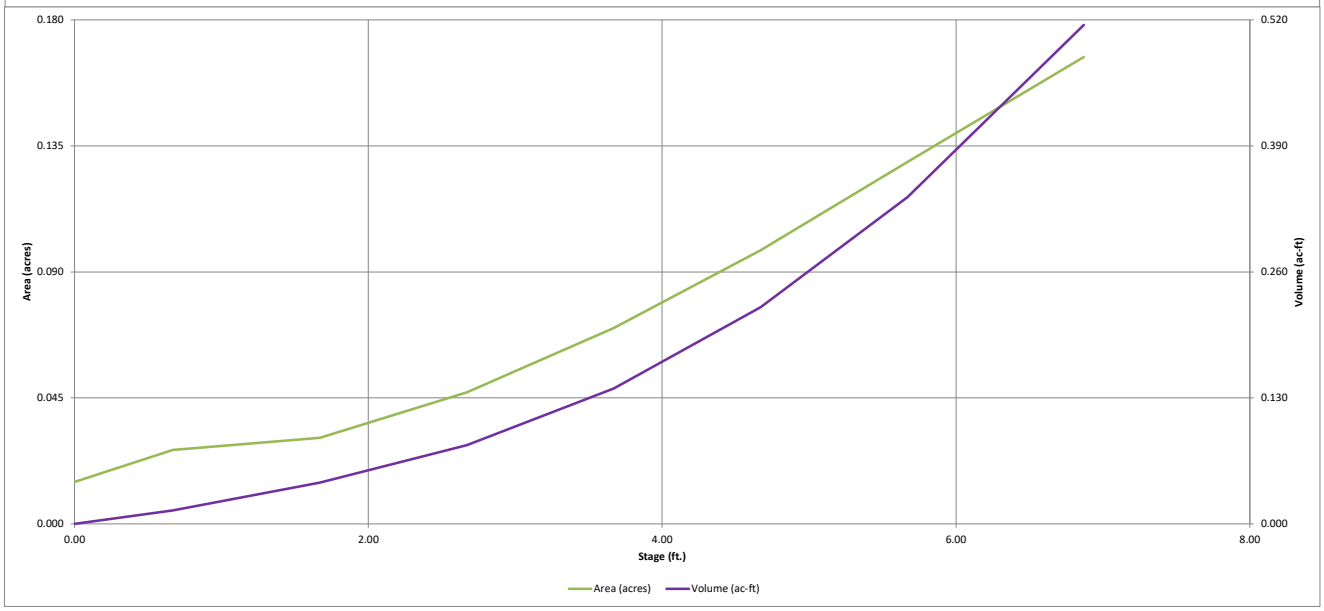
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	650	0.015		
ISV 7270	--	0.67	--	--	--	1,151	0.026	603	0.014
7271	--	1.67	--	--	--	1,340	0.031	1,849	0.042
7272	--	2.67	--	--	--	2,044	0.047	3,541	0.081
7273	--	3.67	--	--	--	3,047	0.070	6,086	0.140
7274	--	4.67	--	--	--	4,256	0.098	9,738	0.224
7275	--	5.67	--	--	--	5,630	0.129	14,681	0.337
7276.2	--	6.87	--	--	--	7,263	0.167	22,417	0.515

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



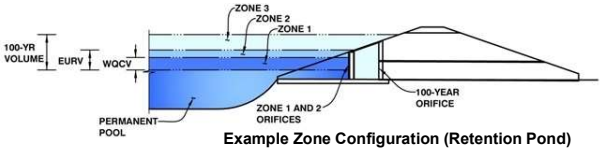


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Monument Ridge East - Early Grading Plan

Basin ID: Pond 5 (Interim/Future)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.02	0.054	Orifice Plate
Zone 2 (EURV)	4.02	0.112	Orifice Plate
Zone 3 (100-year)	5.32	0.128	Weir&Pipe (Restrict)
Total (all zones)		0.293	

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

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.02	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	2.00	3.00				
Orifice Area (sq. inches)	0.42	0.28	0.28	0.28				

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.02	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.02	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	45.52	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	19.78	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	9.89	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.43	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.26	N/A	feet
Restrictor Plate Height Above Pipe Invert =	5.30		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.15	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.70	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.64	feet
Spillway Crest Length =	5.00	feet	Stage at Top of Freeboard =	6.34	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.15	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.43	acre-ft

Calculated Parameters for Spillway

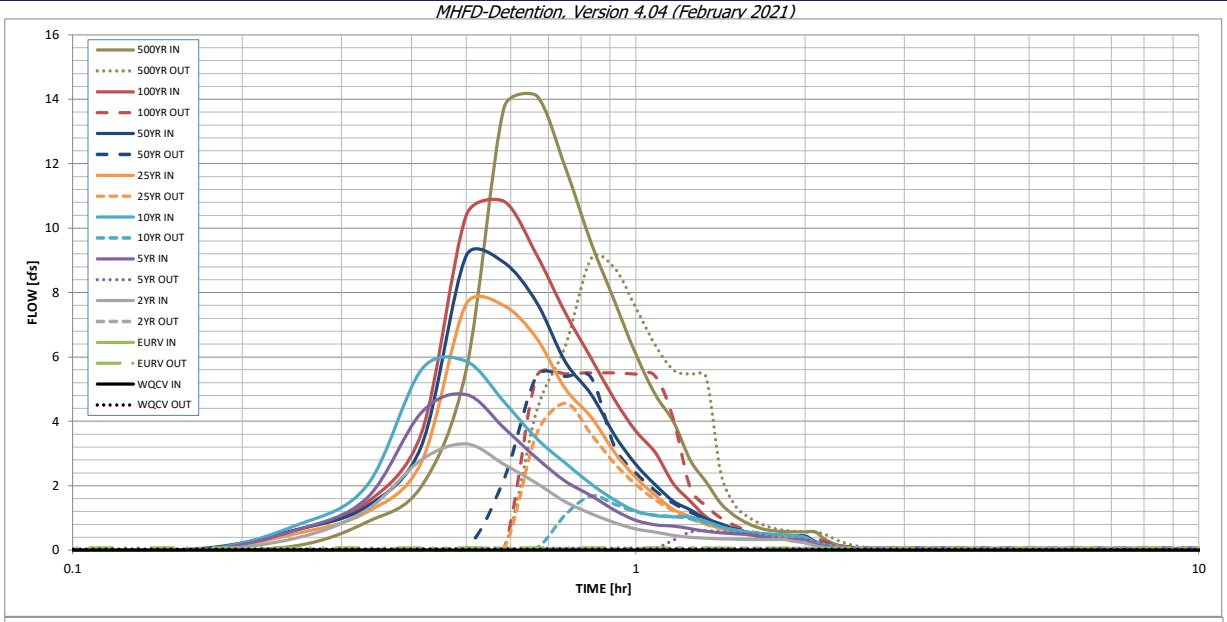
Routed Hydrograph Results

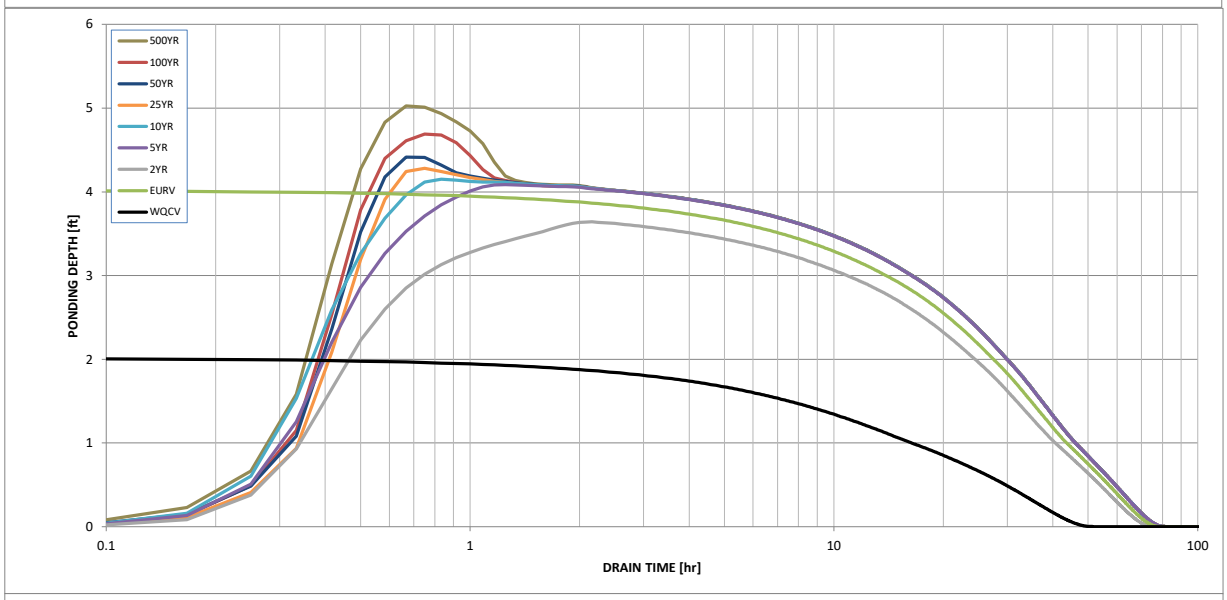
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

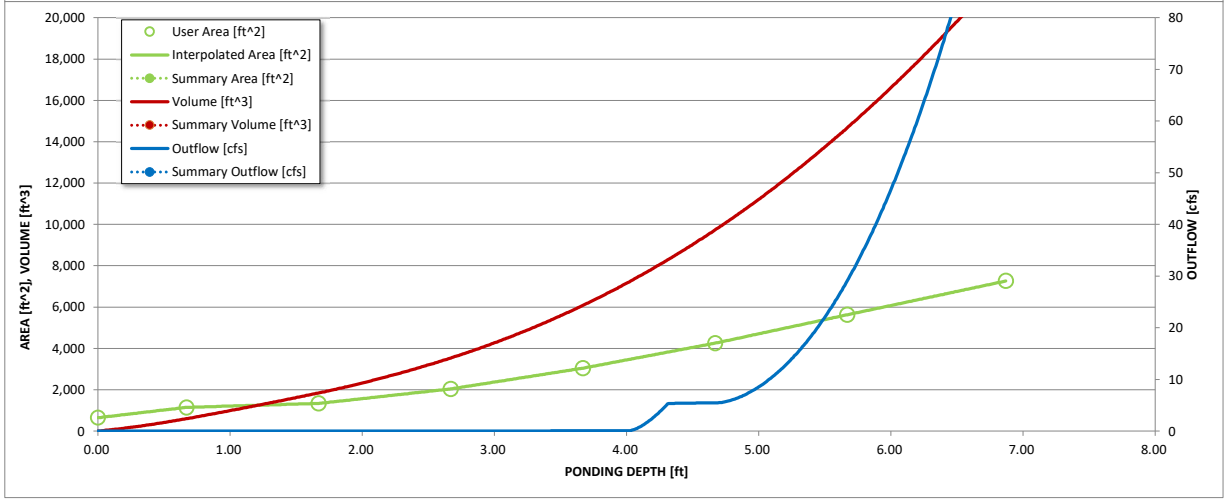
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.054	0.166	0.146	0.210	0.266	0.343	0.404	0.483	0.641
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.146	0.210	0.266	0.343	0.404	0.483	0.641
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.6	1.5	2.3	3.9	4.8	6.1	8.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.17	0.47	0.72	1.21	1.50	1.89	2.63
Peak Inflow Q (cfs) =	N/A	N/A	3.3	4.8	5.9	7.6	9.1	10.8	14.1
Peak Outflow Q (cfs) =	0.0	0.1	0.1	0.6	1.7	4.6	5.4	5.5	9.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.7	1.2	1.1	0.9	1.1
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.00	N/A	0.0	0.1	0.2	0.3	0.3	0.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	43	63	61	64	62	59	57	54	49
Time to Drain 99% of Inflow Volume (hours) =	**46**	70	68	71	70	69	67	66	64
Maximum Ponding Depth (ft) =	2.02	4.03	3.64	4.08	4.15	4.28	4.41	4.69	5.03
Area at Maximum Ponding Depth (acres) =	0.04	0.08	0.07	0.08	0.08	0.09	0.09	0.10	0.11
Maximum Volume Stored (acre-ft) =	0.054	0.167	0.138	0.171	0.176	0.188	0.199	0.226	0.260

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.14
	0:15:00	0.00	0.00	0.38	0.62	0.77	0.52	0.64	0.63	0.87
	0:20:00	0.00	0.00	1.26	1.62	2.01	1.19	1.37	1.48	1.99
	0:25:00	0.00	0.00	2.81	4.28	5.62	2.75	3.26	3.66	5.61
	0:30:00	0.00	0.00	3.30	4.83	5.86	7.64	9.14	10.39	13.74
	0:35:00	0.00	0.00	2.67	3.80	4.61	7.59	8.93	10.84	14.11
	0:40:00	0.00	0.00	2.08	2.86	3.47	6.58	7.69	9.18	11.88
	0:45:00	0.00	0.00	1.50	2.14	2.70	5.01	5.85	7.36	9.55
	0:50:00	0.00	0.00	1.14	1.69	2.05	4.14	4.84	5.96	7.74
	0:55:00	0.00	0.00	0.85	1.24	1.56	3.05	3.58	4.68	6.09
	1:00:00	0.00	0.00	0.66	0.93	1.21	2.26	2.67	3.70	4.83
	1:05:00	0.00	0.00	0.56	0.79	1.08	1.70	2.03	3.03	4.00
	1:10:00	0.00	0.00	0.46	0.74	1.04	1.27	1.53	2.06	2.79
	1:15:00	0.00	0.00	0.40	0.67	1.03	1.03	1.26	1.53	2.12
	1:20:00	0.00	0.00	0.37	0.59	0.89	0.81	0.97	1.04	1.44
	1:25:00	0.00	0.00	0.35	0.54	0.73	0.68	0.82	0.77	1.07
	1:30:00	0.00	0.00	0.34	0.51	0.62	0.55	0.65	0.60	0.82
	1:35:00	0.00	0.00	0.33	0.49	0.56	0.48	0.56	0.49	0.68
	1:40:00	0.00	0.00	0.33	0.42	0.52	0.43	0.50	0.44	0.60
	1:45:00	0.00	0.00	0.33	0.37	0.49	0.41	0.47	0.42	0.58
	1:50:00	0.00	0.00	0.33	0.34	0.48	0.39	0.45	0.42	0.57
	1:55:00	0.00	0.00	0.27	0.33	0.45	0.39	0.44	0.42	0.57
	2:00:00	0.00	0.00	0.23	0.30	0.40	0.39	0.44	0.42	0.57
	2:05:00	0.00	0.00	0.14	0.18	0.24	0.23	0.27	0.25	0.34
	2:10:00	0.00	0.00	0.08	0.11	0.14	0.14	0.16	0.15	0.21
	2:15:00	0.00	0.00	0.04	0.06	0.08	0.08	0.09	0.09	0.12
	2:20:00	0.00	0.00	0.02	0.03	0.04	0.05	0.05	0.05	0.07
	2:25:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	2:30:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

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).

STORMWATER INFRASTRUCTURE - COST ESTIMATE SUMMARY

9/22/2026

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE
Permanent Control Measure - Features				
Aggregate Base (135#/CF)	712	Tons	$ 42.00	$ 29,904.00
Forebay (Concrete)	7	Each	$ 4,000.00	$ 28,000.00
Outlet Structure (w/micropool)	4	Each	$ 15,000.00	$ 60,000.00
Retaining Wall	4,530	Square Foot	$ 55.00	$ 249,150.00
Soil Riprap	351	Cubic Yards	$ 102.00	$ 35,802.00
Trickle Channel	571	Linear Foot	$ 83.00	$ 47,393.00
18" RCP	46	Linear Foot	$ 111.00	$ 5,106.00
24" RCP	26	Linear Foot	$ 161.00	$ 4,186.00
30" RCP	438	Linear Foot	$ 167.00	$ 73,146.00
36" RCP	106	Linear Foot	$ 191.00	$ 20,246.00
42" RCP	158	Linear Foot	$ 275.00	$ 43,450.00
Manhole, Type 1	1	Each	$ 18,950.00	$ 18,950.00
Manhole, Type 2	1	Each	$ 9,314.00	$ 9,314.00
30" Flared End Section	4	Each	$ 1,002.00	$ 4,008.00
36" Flared End Section	2	Each	$ 1,146.00	$ 2,292.00
			Sub-total	$ 630,947.00
			20% Contingency	$ 126,189.40
			PCM Features Total	**$ 757,136.40**
System Features				
18" RCP	334	Linear Foot	$ 111.00	$ 37,074.00
24" RCP	764	Linear Foot	$ 161.00	$ 123,004.00
30" RCP	531	Linear Foot	$ 167.00	$ 88,677.00
36" RCP	1,334	Linear Foot	$ 191.00	$ 254,794.00
42" RCP	366	Linear Foot	$ 275.00	$ 100,650.00
48" RCP	123	Linear Foot	$ 349.00	$ 42,927.00
54" RCP	1,172	Linear Foot	$ 465.00	$ 544,980.00
78" RCP (CSP price, RCP not listed)	602	Linear Foot	$ 728.00	$ 438,256.00
48" Flared End Section	3	Each	$ 2,094.00	$ 6,282.00
54" Flared End Section	2	Each	$ 2,790.00	$ 5,580.00
78" Flared End Section	1	Each	$ 4,368.00	$ 4,368.00
Curb Inlet (Type 16) Triple	1	Each	$ 12,500.00	$ 12,500.00
Curb Inlet (Type D-10-R) L=4'	2	Each	$ 7,500.00	$ 15,000.00
Curb Inlet (Type D-10-R) L=8'	2	Each	$ 11,500.00	$ 23,000.00
Curb Inlet (Type D-10-R) L=10'	1	Each	$ 12,500.00	$ 12,500.00
Curb Inlet (Type D-10-R) L=12'	6	Each	$ 14,000.00	$ 84,000.00
Curb Inlet (Type D-10-R) L=16'	3	Each	$ 16,250.00	$ 48,750.00
Manhole, Type 1	11	Each	$ 18,950.00	$ 208,450.00
Manhole, Type 2	17	Each	$ 9,314.00	$ 158,338.00
Rip Rap, d50 size from 6" to 24"	1,004	Tons	$ 102.00	$ 102,408.00
Permanent Turf Reinforcement Mat (TRM)	331	SY	$ 13.00	$ 4,303.00
Drainage Channel Lining, Concrete - Collection Structure	38	Cubic Yards	$ 815.00	$ 30,970.00
Grated Inlet (Triple CDOT Type D) - Collection Structure	1	Each	$ 35,000.00	$ 35,000.00
			Sub-total	$ 2,381,811.00
			20% Contingency	$ 476,362.20
			System Features Total	**$ 2,858,173.20**
			PCM Features Total	$ 757,136.40
			System Features Total	$ 2,858,173.20
			GRAND TOTAL	**$ 3,615,309.60**

STORMWATER INFRASTRUCTURE - COST ESTIMATE
POND 1 (INCLUDING HOLDING AREA)

9/22/2026

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE
Permanent Control Measure - Features				
Aggregate Base (135#/CF)	365	Tons	$ 42.00	$ 15,330.00
Forebay (Concrete)	2	Each	$ 4,000.00	$ 8,000.00
Outlet Structure (w/micropool)	1	Each	$ 15,000.00	$ 15,000.00
Retaining Wall	3,670	Square Foot	$ 55.00	$ 201,850.00
Soil Riprap	150	Cubic Yards	$ 102.00	$ 15,300.00
Trickle Channel	134	Linear Foot	$ 83.00	$ 11,122.00
30" RCP	82	Linear Foot	$ 167.00	$ 13,694.00
42" RCP	104	Linear Foot	$ 275.00	$ 28,600.00
Manhole, Type 1	1	Each	$ 18,950.00	$ 18,950.00
Manhole, Type 2	1	Each	$ 9,314.00	$ 9,314.00
30" Flared End Section	2	Each	$ 1,002.00	$ 2,004.00
			Sub-total	$ 339,164.00
			20% Contingency	$ 67,832.80
			PCM Features Total	**$ 406,996.80**

STORMWATER INFRASTRUCTURE - COST ESTIMATE
POND 2

9/22/2026

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE
Permanent Control Measure - Features				
Aggregate Base (135#/CF)	347	Tons	$ 42.00	$ 14,574.00
Forebay (Concrete)	1	Each	$ 4,000.00	$ 4,000.00
Outlet Structure (w/micropool)	1	Each	$ 15,000.00	$ 15,000.00
Soil Riprap	37	Cubic Yards	$ 102.00	$ 3,774.00
Trickle Channel	147	Linear Foot	$ 83.00	$ 12,201.00
36" RCP	33	Linear Foot	$ 191.00	$ 6,303.00
42" RCP	54	Linear Foot	$ 275.00	$ 14,850.00
30" Flared End Section	2	Each	$ 1,002.00	$ 2,004.00
			Sub-total	$ 72,706.00
			20% Contingency	$ 14,541.20
			PCM Features Total	**$ 87,247.20**

STORMWATER INFRASTRUCTURE - COST ESTIMATE
POND 4

9/22/2026

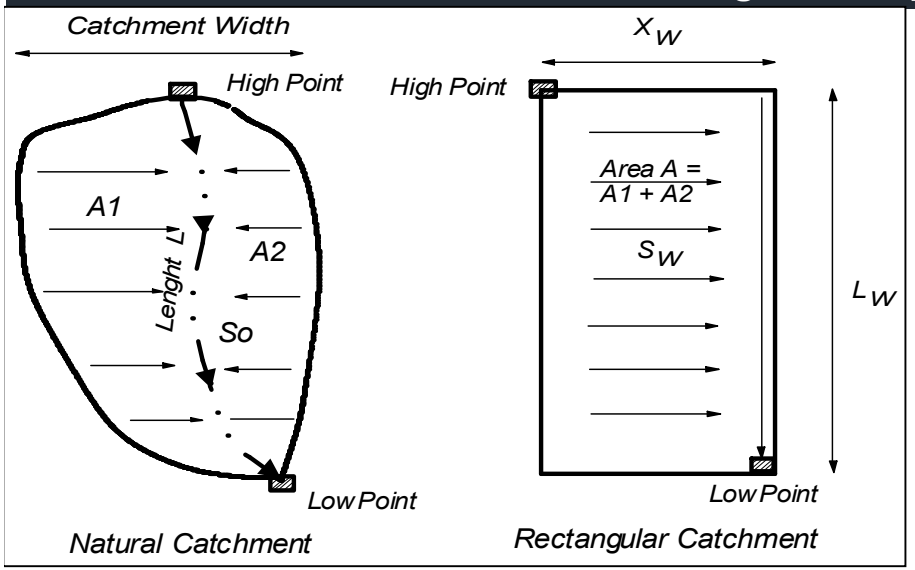
ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE
Permanent Control Measure - Features				
Forebay (Concrete)	3	Each	$ 4,000.00	$ 12,000.00
Outlet Structure (w/micropool)	1	Each	$ 15,000.00	$ 15,000.00
Soil Riprap	118	Cubic Yards	$ 102.00	$ 12,036.00
Trickle Channel	266	Linear Foot	$ 83.00	$ 22,078.00
18" RCP	22	Linear Foot	$ 111.00	$ 2,442.00
30" RCP	356	Linear Foot	$ 167.00	$ 59,452.00
36" RCP	73	Linear Foot	$ 191.00	$ 13,943.00
42" RCP	0	Linear Foot	$ 275.00	$ -
36" Flared End Section	2	Each	$ 1,146.00	$ 2,292.00
			Sub-total	$ 139,243.00
			20% Contingency	$ 27,848.60
			PCM Features Total	**$ 167,091.60**

STORMWATER INFRASTRUCTURE - COST ESTIMATE
POND 5

9/22/2026

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE
Permanent Control Measure - Features				
Forebay (Concrete)	1	Each	$ 4,000.00	$ 4,000.00
Outlet Structure (w/micropool)	1	Each	$ 15,000.00	$ 15,000.00
Retaining Wall (Adjacent to Pond)	860	Square Foot	$ 55.00	$ 47,300.00
Soil Riprap	46	Cubic Yards	$ 102.00	$ 4,692.00
Trickle Channel	24	Linear Foot	$ 83.00	$ 1,992.00
18" RCP	24	Linear Foot	$ 111.00	$ 2,664.00
24" RCP	26	Linear Foot	$ 161.00	$ 4,186.00
			Sub-total	$ 79,834.00
			20% Contingency	$ 15,966.80
			PCM Features Total	**$ 95,800.80**

Convert Natural Catchment to a Rectangular Shape



Subcatchment Center	Z=0.5
Side Collector	Z=1
Skewed Location	0.5<Z<1

Dimensionless Variables

$$Y = \frac{L}{L_w}; \qquad X = \frac{A}{L^2}$$

$$Y = (1.5 - Z)(2.286X - 0.286X^2)$$

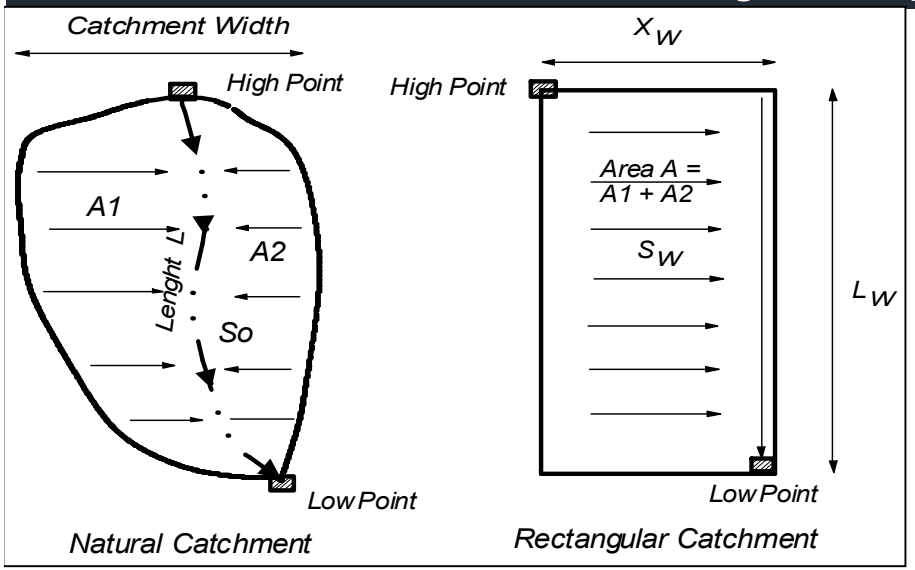
$$\frac{Lw}{L} = (1.5 - Z)[2.286(\frac{A}{L^2}) - 0.286(\frac{A}{L^2})^2]$$

$$S_o/S_w = A/(LL_w) + L_w/L$$

$$X_w = A/L_w$$

Subarea ID	Area acre	A1 acre	A2 acre	L ft	High Pt Elev. ft	Low Pt Elev. ft	Z=Am/A	X=A/L²	Y=Lw/L	Lw ft	Xw ft	So %	So/Sw	Sw %
E1	31.89	9.56	22.33	1,472	375.6	306.3	0.70	0.64	1.08	1,587	875	4.71	1.67	2.81
E2	1.36	0.69	0.67	311	390.6	359.5	0.51	0.61	1.28	399	148	10.00	1.76	5.68
E3	60.16	22.38	37.78	2,576	450.6	289.9	0.63	0.39	0.75	1,928	1,359	6.24	1.28	4.89
E4	65.57	21.21	44.36	2,374	501.6	310.2	0.68	0.51	0.89	2,121	1,346	8.06	1.46	5.52
E5	17.47	8.18	9.29	795	310.2	289.6	0.53	1.20	2.26	1,800	423	2.59	2.80	0.93
E6	1.38	0.67	0.71	544	310.2	270.0	0.51	0.20	0.45	243	248	7.39	0.90	8.20
E7	41.48	19.90	21.58	2,026	339.1	255.7	0.52	0.44	0.93	1,887	957	4.12	1.40	2.93

Convert Natural Catchment to a Rectangular Shape



Subcatchment Center	Z=0.5
Side Collector	Z=1
Skewed Location	0.5<Z<1

Dimensionless Variables

$$Y = \frac{L}{L_w}; \qquad X = \frac{A}{L^2}$$

$$Y = (1.5 - Z)(2.286X - 0.286X^2)$$

$$\frac{Lw}{L} = (1.5 - Z)[2.286(\frac{A}{L^2}) - 0.286(\frac{A}{L^2})^2]$$

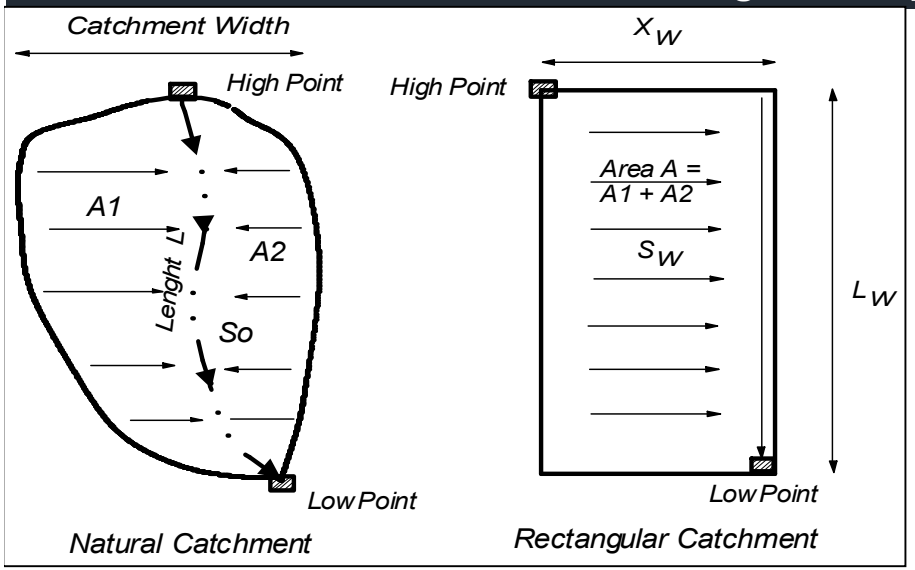
$$S_o/S_w = A/(LL_w) + L_w/L$$

$$X_w = A/L_w$$

Subarea ID	Area acre	A1 acre	A2 acre	L ft	High Pt Elev. ft	Low Pt Elev. ft	Z=Am/A	X=A/L²	Y=Lw/L	Lw ft	Xw ft	So %	So/Sw	Sw %
AA	15.16	7.40	7.76	1,420	73.0	22.0	0.51	0.33	0.71	1,007	655	3.59	1.17	3.07
BB	2.74	1.96	0.78	570	54.5	20.2	0.72	0.37	0.63	358	333	6.02	1.21	4.96
CC	1.03	0.27	0.76	222	14.0	7.0	0.74	0.91	1.41	312	144	3.15	2.05	1.54
DD	12.75	2.18	10.57	1,012	50.3	11.5	0.83	0.54	0.78	785	708	3.83	1.47	2.60
EE	1.81	1.10	0.71	650	328.2	304.0	0.61	0.19	0.37	242	326	3.72	0.87	4.26
FF	0.80	0.53	0.27	459	28.3	10.1	0.66	0.17	0.31	142	245	3.97	0.84	4.70
GG	4.90	2.60	2.30	481	320.0	294.6	0.53	0.92	1.81	870	245	5.28	2.32	2.28
HH	8.56	5.39	3.17	472	310.8	274.0	0.63	1.67	2.63	1,243	300	7.80	3.27	2.39
II	0.90	0.45	0.45	320	92.4	72.3	0.50	0.38	0.83	267	147	6.28	1.29	4.86
JJ	6.78	1.96	4.82	692	96.3	55.7	0.71	0.62	1.03	710	416	5.87	1.63	3.61
KK	0.92	0.70	0.22	567	50.8	30.5	0.76	0.12	0.21	118	341	3.58	0.81	4.43
LL	0.51	0.20	0.31	190	35.2	28.0	0.61	0.62	1.16	220	101	3.79	1.69	2.24
MD2a	5.86	2.11	3.75	805	338.4	305.4	0.64	0.39	0.74	593	431	4.10	1.27	3.22
MD2b	6.30	3.85	2.45	884	322.6	274.5	0.61	0.35	0.68	603	455	5.44	1.20	4.55
MD5	1.58	0.81	0.77	631	64.0	61.4	0.51	0.17	0.38	241	286	0.41	0.83	0.49
ME	3.21	1.12	2.09	462	98.4	76.3	0.65	0.66	1.17	539	259	4.78	1.73	2.77
MO2	0.51	0.25	0.26	179	56.3	48.9	0.51	0.69	1.43	257	87	4.13	1.92	2.16

MO3	1.36	0.69	0.67	392	89.1	60.5	0.51	0.39	0.83	326	182	7.30	1.30	5.63
MO4	0.74	0.16	0.58	245	56.3	48.5	0.78	0.54	0.82	201	160	3.18	1.47	2.16
MO5	60.15	21.32	38.83	2,827	448.6	289.9	0.65	0.33	0.61	1,736	1,509	5.61	1.15	4.89
MO6	0.63	0.23	0.40	326	304.2	293.6	0.63	0.26	0.49	161	170	3.25	1.02	3.20
MO7a	65.57	25.51	40.06	2,674	485.9	309.6	0.61	0.40	0.77	2,062	1,385	6.59	1.29	5.11
MO7b	18.40	7.47	10.93	1,405	354.2	280.3	0.59	0.41	0.80	1,121	715	5.26	1.31	4.02
MO8	1.38	0.98	0.40	603	308.2	270.3	0.71	0.17	0.29	176	341	6.29	0.86	7.33

Convert Natural Catchment to a Rectangular Shape



Subcatchment Center	Z=0.5
Side Collector	Z=1
Skewed Location	0.5<Z<1

Dimensionless Variables

$$Y = \frac{L}{L_w}; \qquad X = \frac{A}{L^2}$$

$$Y = (1.5 - Z)(2.286X - 0.286X^2)$$

$$\frac{Lw}{L} = (1.5 - Z)[2.286(\frac{A}{L^2}) - 0.286(\frac{A}{L^2})^2]$$

$$S_o/S_w = A/(LL_w) + L_w/L$$

$$X_w = A/L_w$$

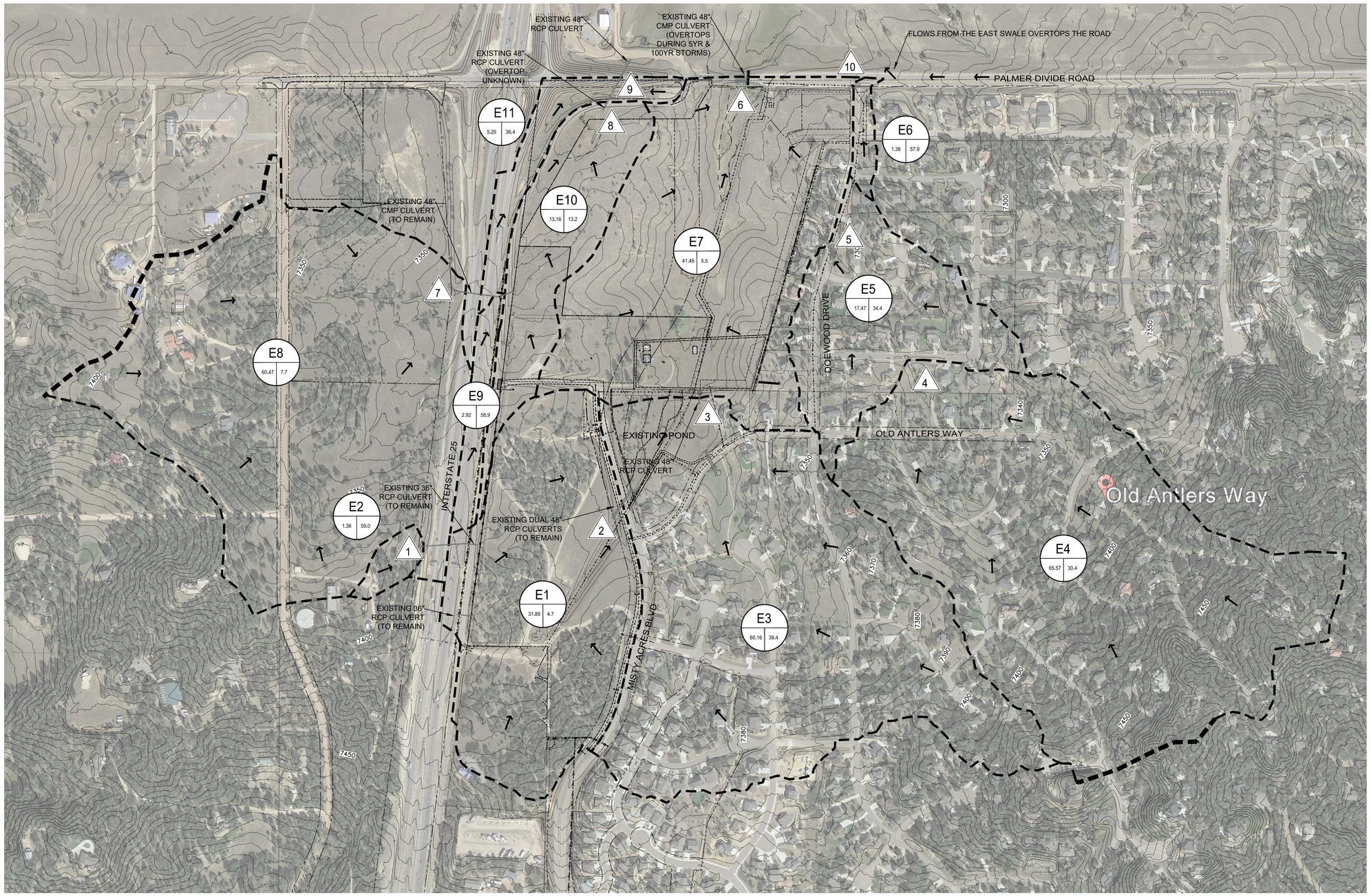
Subarea ID	Area acre	A1 acre	A2 acre	L ft	High Pt Elev. ft	Low Pt Elev. ft	Z=Am/A	X=A/L²	Y=Lw/L	Lw ft	Xw ft	So %	So/Sw	Sw %
A1F	6.55	2.77	3.78	863	354.2	322.0	0.58	0.38	0.77	664	430	3.73	1.27	2.94
A2F	2.41	0.12	2.29	174	352.4	338.8	0.95	3.47	2.47	429	245	7.82	3.87	2.02
A3F	1.18	0.71	0.47	331	343.6	316.3	0.60	0.47	0.91	301	171	8.26	1.43	5.79
A4F	4.65	2.85	1.80	748	352.9	322.7	0.61	0.36	0.70	524	386	4.04	1.22	3.32
A5F	2.22	1.48	0.74	355	328.1	307.2	0.67	0.77	1.32	469	206	5.89	1.90	3.10
B1F	5.02	1.11	3.91	917	349.8	316.3	0.78	0.26	0.41	380	575	3.65	1.04	3.51
B2F	0.31	0.09	0.22	160	327.9	321.6	0.71	0.53	0.89	142	95	3.94	1.48	2.66
B3F	0.36	0.11	0.25	172	324.7	315.8	0.69	0.53	0.91	157	100	5.17	1.49	3.47
B4F	0.45	0.15	0.30	205	321.2	313.9	0.67	0.47	0.84	172	114	3.56	1.39	2.55
B5F	1.11	0.34	0.77	260	316.7	304.2	0.69	0.72	1.20	312	155	4.81	1.80	2.68
B6F	3.38	1.53	1.85	1,493	371.8	311.3	0.55	0.07	0.14	213	691	4.05	0.61	6.69
B7F	0.74	0.44	0.30	254	314.6	307.7	0.59	0.50	0.97	246	131	2.72	1.48	1.83
B8F	0.20	0.08	0.12	125	303.7	299.9	0.60	0.56	1.07	133	65	3.04	1.59	1.91
B9F	2.94	2.12	0.82	407	374.1	298.1	0.72	0.77	1.24	506	253	18.67	1.87	10.01
C1F	9.66	1.56	8.10	1,160	328.3	279.5	0.84	0.31	0.45	527	798	4.21	1.14	3.68
D1F	7.42	3.24	4.18	1,230	312.6	273.2	0.56	0.21	0.45	548	590	3.20	0.93	3.46
D2F	0.61	0.36	0.25	229	288.2	273.1	0.59	0.51	0.99	226	118	6.59	1.50	4.39

O1	7.52	3.53	3.99	887	378.1	329.6	0.53	0.42	0.87	776	422	5.47	1.35	4.05
O2	0.51	0.21	0.30	149	355.2	348.8	0.59	1.00	1.82	272	82	4.30	2.37	1.81
O3	1.37	0.69	0.68	311	390.6	359.5	0.50	0.62	1.30	403	148	10.00	1.77	5.64
O4	0.74	0.14	0.60	244	356.6	348.5	0.81	0.54	0.80	194	166	3.32	1.48	2.25

Unresolved Review 5 Comment:
For SWMM data please only put output summary tables in the appendix. Please put all of SWMM data currently in the appendix in it's own standalone appendix report. Data makes it hard to review and move through the report.

Review 6 Comment:
Thank you for removing the data from this report, but summary tables need to be included and a separate appendix report was not received with this submittal.

Address all V5 comments made on the SWMM model sheets prior to resubmitting.



Surface Routing Summary

Design Point	Design Point/ Contributing Basins	Flow Q_{10}	Flow Q_{100}	Comments	Ownership (Private or Public)
1	E2	**3.3**	**5.7**	existing 36" RCP culvert	Public
2	DP1,E1	**21.8**	**62.2**	existing dual 48" RCP culverts	Public
3	DP2,E3	**107.2**	**225.6**	Misty Ac 1 Pond Attenuation of Q10=58cfs, Q100=130cfs (per MDDP), yields Q10out=49.2cfs and Q100=95.6cfs)	Private
4	E4	**92.1**	**191.4**	unk pipe sizes, assume no peak flow attenuation	Public
5	DP4,E5	**109.4**	**225.2**	low point collection structure, size TBD in FDR	Public
6	DP3 (attenuated),DP5,E6,E7	**214.3**	**488.0**	existing 48" CMP culvert, overtops road	Public
7	E8	**40.8**	**113.3**	existing 48" CMP culvert	Public
8	DP7,E9,E10	**52.9**	**137.4**	existing 48" RCP culvert, overtop elev unk	Public
9	DP8,E11	**60.1**	**151.4**	existing 48" RCP culvert, overtop elev unk	Public
10	E6	**4.7**	**8.0**	existing 24" culvert	Public

LEGEND

- A — BASIN ID
- #.## / ##.# — % IMPERVIOUS
- BASIN AREA (ACRES)
- # — DESIGN POINT
- DRAINAGE BASIN BOUNDARY
- EXISTING CONTOUR
- PROPOSED CONTOUR
- SURFACE FLOW DIRECTION

GENERAL NOTES

1. EXISTING TOPOGRAPHY PROVIDED BY THE COLORADO WATER CONSERVATION BOARD (CWCB).
2. ALL CONTOURS REFLECT EXISTING CONDITIONS.
3. CONTOURS SHOWN ON THIS MAP REFLECT A 5' CONTOUR INTERVAL.
4. AERIAL IMAGERY FROM GOOGLE EARTH DATED 2019

NORTH

0 100 200 400

PRC ENGINEERING
45 LEFTHAND CIRCLE, SUITE 400A
COLORADO SPRINGS, CO 80907

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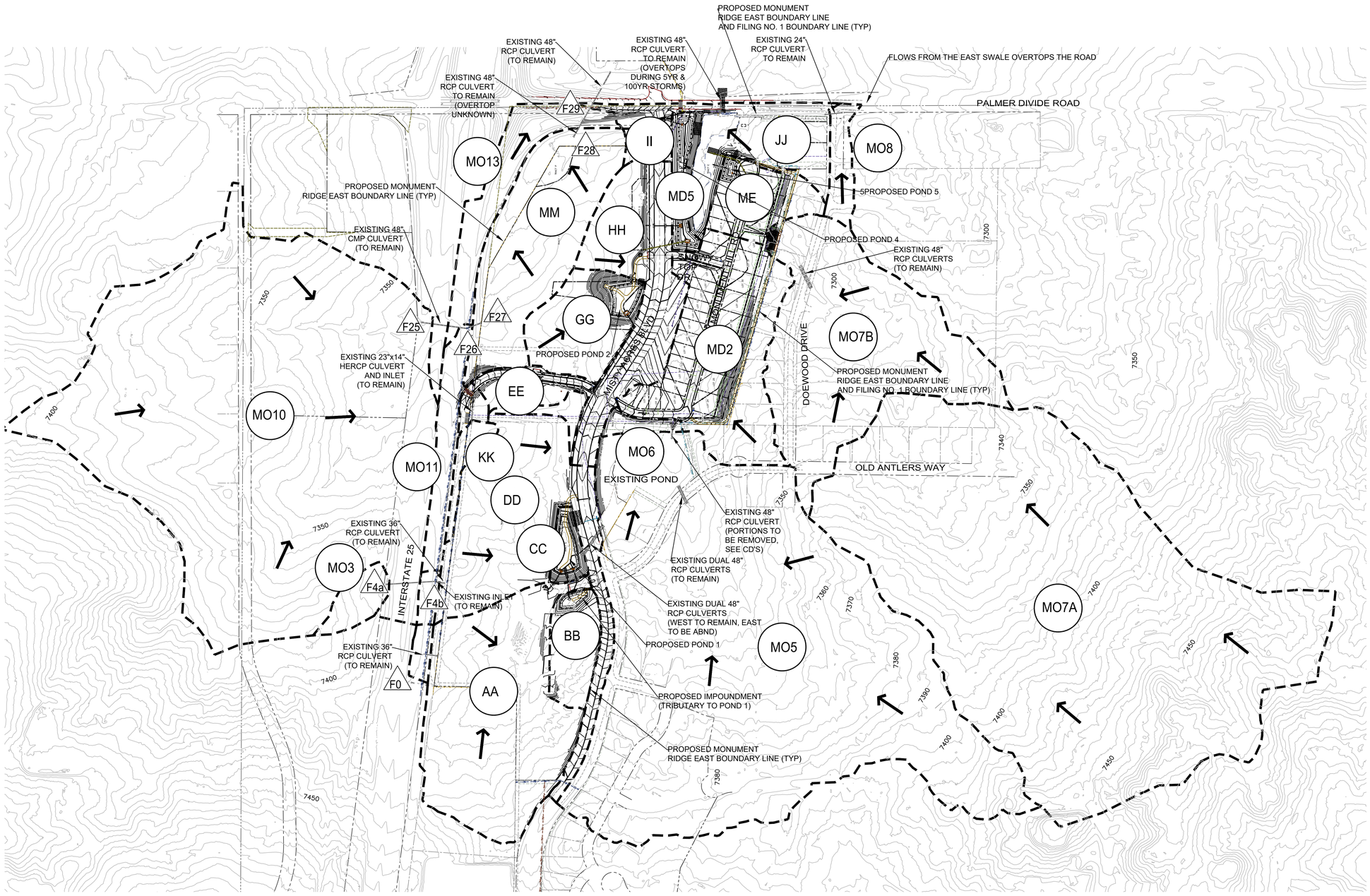
MONUMENT RIDGE EAST

TOWN OF MONUMENT
EL PASO COUNTY, COLORADO

◆ DRAINAGE PLAN
EXISTING CONDITIONS (PER MDDP)

issued 9/22/26

D1
sheet number



LEGEND

A — BASIN ID

DRAINAGE BASIN BOUNDARY

GENERAL NOTES

1. EXISTING TOPOGRAPHY PROVIDED BY THE COLORADO WATER CONSERVATION BOARD (CWCB).
2. ALL CONTOURS REFLECT EXISTING CONDITIONS.
3. CONTOURS SHOWN ON THIS MAP REFLECT A 5' CONTOUR INTERVAL.
4. AERIAL IMAGERY NOT SHOWN FOR CLARIFICATION.
5. ALL BASINS FOR THE SITE HAVE BEEN SHOWN HEREIN, HOWEVER DUE TO THE SCALE OF THE DRAWING, SOME SMALLER BASINS ARE NOT LABELED. REFER TO D2 AND D3 MAPS.

NORTH

0 100 200 400

PRC ENGINEERING
1685 W. UINTAH STREET, SUITE 114
COLORADO SPRINGS, CO 80904
PRC ENGINEERING

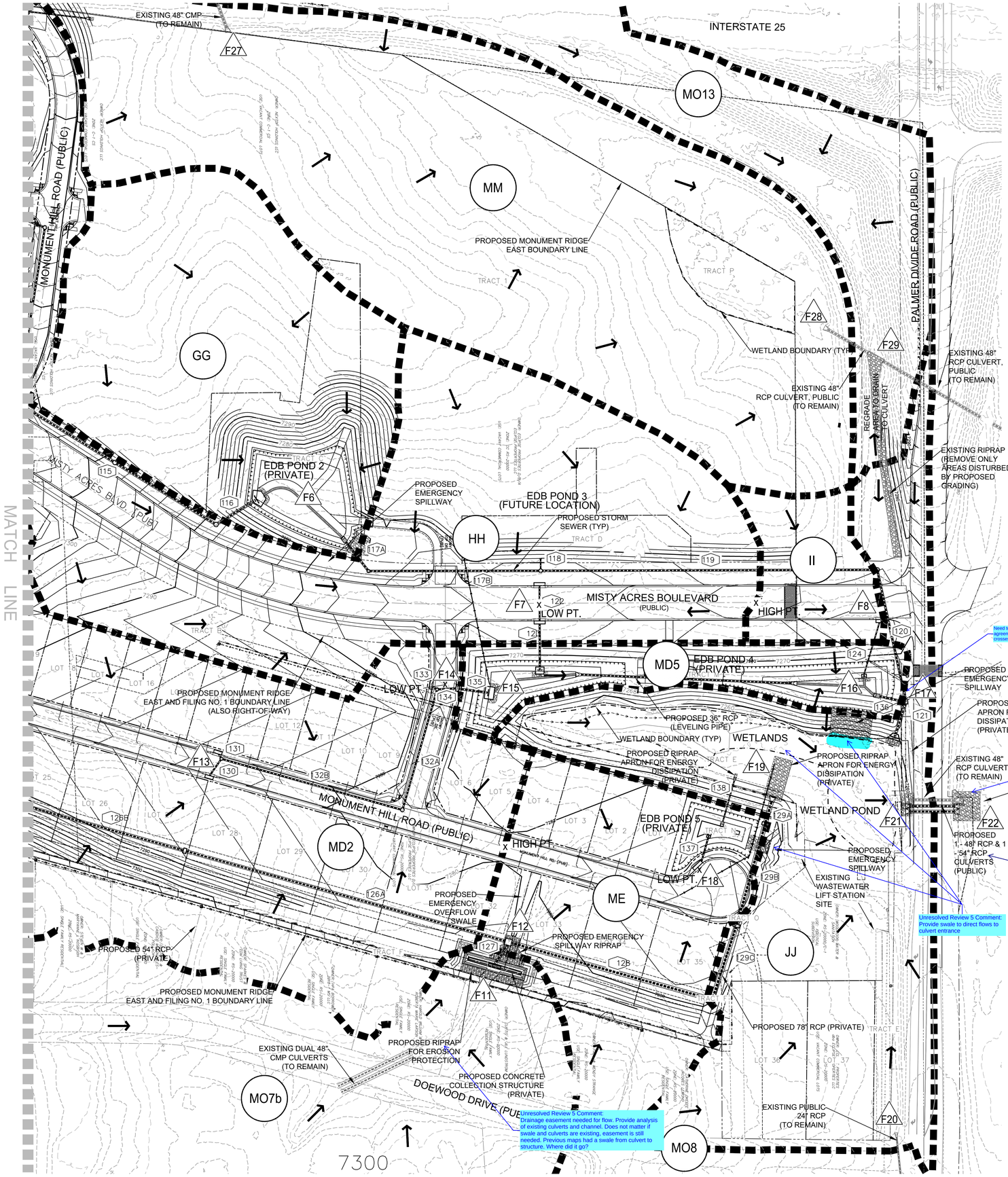
MONUMENT RIDGE EAST - FIL. NO. 1

TOWN OF MONUMENT
EL PASO COUNTY, COLORADO

◆ DRAINAGE PLAN
INTERIM CONDITIONS - OVERALL

issued	6/23/26

D2
sheet number



ROUTING SUMMARY

Design Point	Contributing Basins/Design Points	Flow Q_{10}	Flow Q_{100}	Comments
F0	MO2	2.1	3.5	existing 36" RCP culvert
F1	AA,DP F0	9.9	28.7	proposed 2-12' D-10-R inlets, future Q100=29cfs at DPX1, size for future condition
F2	BB	2.0	6.7	proposed 18" RCP
F3	DP F1, DP F2,CC	14.5	38.1	flow to pond 1, unrouted
F4A	MO3	3.3	5.7	existing 36" RCP culvert
F4B	MO4	3.0	4.9	existing type C inlet
F4C	DP F4A, DP F4B, DD	19.0	42.9	proposed 2-8' D-10-R inlets, future Q100=21cfs at DPX5, size for interim condition
F5	EE	3.6	7.0	proposed triple type 16 inlet, future Q100=7.5cfs at DPX7, size for future condition
F6	DP F4C,DP F5,GG	28.1	64.0	flow to pond 2, unrouted
F7	FF,HH	14.9	31.9	proposed 2-16' D-10-R inlets, future Q100=45cfs at DPX9, size for future condition
F8	II	1.5	3.1	proposed 10' D-10-R inlet, future Q100=3.8cfs at DPX10, size for future condition
F9	POND 1 OUT,MO5	59.2	118.3	Misty Ac 1 Pond Attenuation of Q10=58cfs, Q100=130cfs (per MDDP), yields Q10out=59.2cfs and Q100=118.3cfs)
F10	MO6	0.8	2.4	proposed type C inlet
F11	MO7A, MO7B	102.6	211.4	low point collection structure
F12	DP F9, DP F10, DP F11	162.6	332.0	proposed 78" RCP
F13	50% MD2	15.6	29.8	proposed 2-12' D-10-R inlets
F14	50% MD2	12.3	23.4	proposed 2-12' D-10-R inlets
F15	DP F7, DP F13, DP F14	38.2	75.5	flow to pond 4 (south)
F16	DP F8, DP F15	41.5	83.1	total flow to pond 4
F17	POND 2 OUT,POND 4 OUT	25.7	67.2	flow to depression area
F18	ME	9.3	17.4	proposed 16' D-10-R inlet
F19	DP F9,DP F10,DP F11, POND 5 OUT	161.6	324.5	flow to depression area
F20	MO8	4.7	8.0	existing culvert, unk size
F21	POND 1 OUT, POND 2 OUT,POND 4 OUT, POND 5 OUT,DP F9,DP F10,DP F11,MO8,JJ	200.8	420.6	Total flow routed to project outfall under Palmer Divide Road. The flows listed have already taken into consideration the future pond release values and flows entering the site from the east. i.e. - these values reflect future conditions after the entire
F22	POND 1 OUT, POND 2 OUT,POND 4 OUT, POND 5 OUT,DP F9,DP F10,DP F11,MO8,JJ	200.8	420.6	outfall location (design point for report reference only)
F23	KK	1.2	2.9	existing type C inlet
F24	LL	1.2	2.3	proposed 2-4' D-10-R inlets
F25	MO10	40.8	113.3	existing 48" RCP culvert
F26	MO11	12.4	20.1	existing dual type C inlet
F27	DP F25,DP F26	47.6	124.4	design Point F26 outfall
F28	DP F23, DP F24,DP F25, DP F26,MM	57.9	150.5	existing 48" RCP culvert
F29	DP F28,M013	65.4	164.7	existing 48" RCP culvert

PIPE SUMMARY

Pipe ID	Filing 1 (Interim) - Flow (cfs) Q_{10}	Filing 1 (Interim) - Flow (cfs) Q_{100}	Pipe Diam
100	4.9	14.3	24"
101	9.9	28.6	24"
102	9.9	28.6	24"
103	2.0	6.7	30"
104	No Flow (stub for future)		30"
105	No Flow (stub for future)		18"
106	No Flow (for future)		42"
107	9.5	21.4	24"
108	19.0	42.9	30"
109	No Flow (stub for future)		30"
110	No Flow (for future)		30"
111	No Flow (stub for future)		24"
112	No Flow (for future)		36"
113	3.6	7.0	24"
114	3.6	7.0	36"
115	22.6	49.9	42"
116	22.6	49.9	42"
117	7.6	28.0	2#36"
118	No Flow (stub for future)		18"
119	7.6	28.0	36"
120	7.6	28.0	36"
121	25.7	67.2	48"
122	7.4	15.8	24"
123	14.8	31.6	30"
124	1.5	3.1	18"
125	59.2	118.3	54"
126	60.0	120.7	54"
127	102.6	211.4	54"
128	162.6	332.0	78"
129	162.6	332.0	78"
130	7.8	14.9	24"
131	7.8	14.9	24"
132	15.6	29.8	30"
133	6.2	11.7	18"
134	21.8	41.5	30"
135	28.0	53.2	36"
136	11.4	34.1	36"
137	9.3	17.4	24"
138	1.6	5.4	18"
139	1.2	2.9	18"
140	0.6	1.1	18"
141	2.4	5.2	18"

LEGEND - STORMWATER

- A — BASIN ID
- # — DESIGN POINT
- # — PIPE ID
- DRAINAGE BASIN BOUNDARY
- XXXX — EXISTING CONTOUR
- XXXX — PROPOSED CONTOUR
- SURFACE FLOW DIRECTION

LEGEND - MISC

- RIGHT-OF-WAY
- LOT LINE
- (E) SANITARY MAIN, MH
- (E) WATER MAIN, VALVE, FH
- (P) SANITARY MAIN, MH
- (P) SANITARY FORCE MAIN
- (P) STORM SEWER, INLET, MH
- (P) WATER MAIN, VALVE, FH
- LOT NUMBER (OR TRACT)

GENERAL NOTES

1. EXISTING TOPOGRAPHY PROVIDED BY BEAR CREEK SURVEYING VIA AERIAL PHOTOGRAPHY.
2. CONTOURS SHOWN ON THIS MAP REFLECT A 2' CONTOUR INTERVAL.
3. AERIAL IMAGERY NOT SHOWN FOR CLARITY.
4. ROADS ARE CLASSIFIED AS EITHER PUBLIC "[PUB]" OR PRIVATE "[PVT]" AS SHOWN ON PLAN.
5. REFER TO SHEET D2 FOR OVERALL BASIN MAP.
6. ALL STORM SEWER LOCATED WITHIN PUBLIC RIGHT-OF-WAY IS PUBLIC. ALL OTHER STORM SEWER IS PRIVATE.

NORTH

0 30 60 120

PRC ENGINEERING
1560 BRIARGATE BOULEVARD, SUITE 114
COLORADO SPRINGS, CO 80904
PRC ENGINEERING

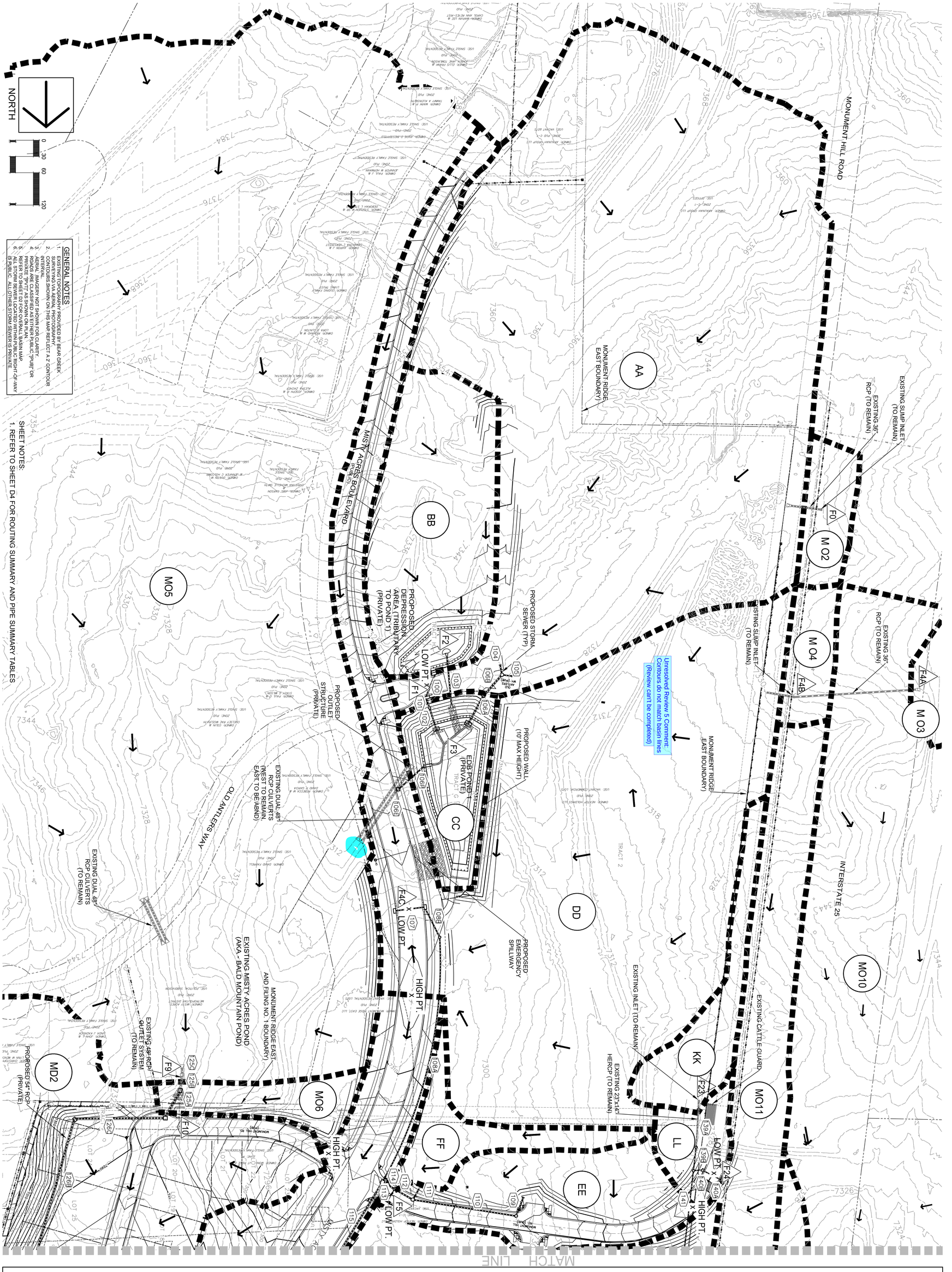
MONUMENT RIDGE EAST - FIL. NO. 1

TOWN OF MONUMENT
EL PASO COUNTY, COLORADO

◆ DRAINAGE PLAN
INTERIM CONDITIONS - NORTH

issued	9/22/26

D4
sheet number



GENERAL NOTES

1. EXISTING TOPOGRAPHY PROVIDED BY BEAR CREEK SURVEYING, INC. ON 10/30/2020.
2. CONTOURS SHOWN ON THIS MAP REFLECT A 2' CONTOUR INTERVAL.
3. AERIAL IMAGERY NOT SHOWN FOR CLARITY.
4. PROPOSED STORM SEWER SYSTEM IS "PUBLIC" OR PRIVATE "[PVT]" AS SHOWN ON PLAN.
5. REFER TO SHEET D2 FOR OVERALL BASIN MAP
6. ALL STORM SEWER SYSTEMS WITHIN RIGHT-OF-WAY IS PUBLIC. ALL OTHER STORM SEWER IS PRIVATE

SHEET NOTES:

1. REFER TO SHEET D4 FOR ROUTING SUMMARY AND PIPE SUMMARY TABLES

- DRAINAGE PLAN
  INTERIM CONDITIONS - SOUTH

MONUMENT RIDGE EAST - FIL. NO. 1

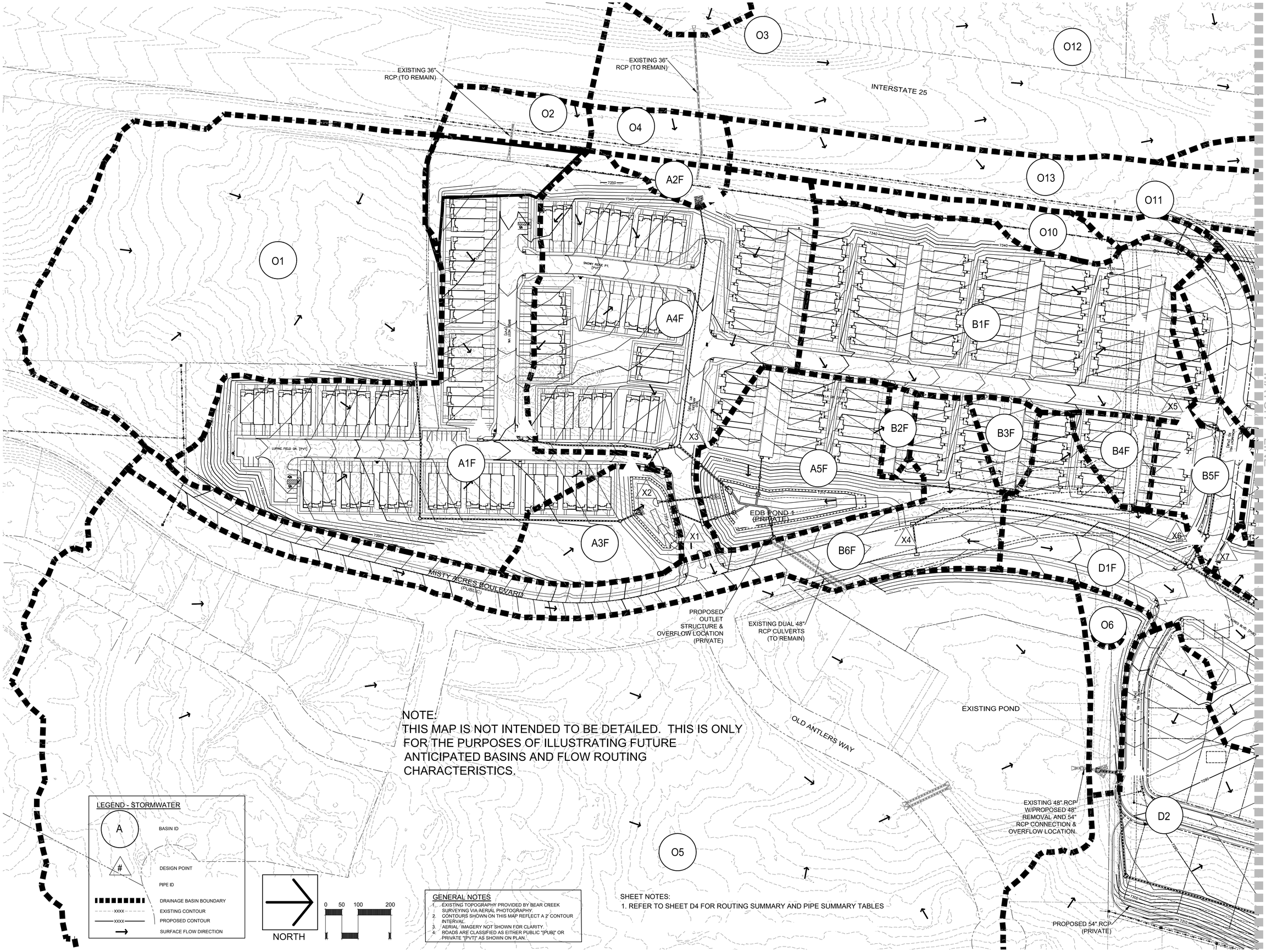
TOWN OF MONUMENT
EL PASO COUNTY, COLORADO

PRC ENGINEERING
1685 W. UINTAH STREET, SUITE 114
COLORADO SPRINGS, CO 80904

PRC ENGINEERING

Issued 6/23/26

D3
sheet number



PRC ENGINEERING
1435 CRESTMOOR DRIVE, SUITE 114
COLORADO SPRINGS, CO 80904
PRC ENGINEERING

MONUMENT RIDGE EAST

TOWN OF MONUMENT
EL PASO COUNTY, COLORADO

◆ DRAINAGE PLAN
FUTURE CONDITIONS - SOUTH

issued 6/24/25

D5
sheet number

Unresolved: Identify the area proposed to be diverted and include in the deviation request. This would likely not be approved unless flows and volumes between the outfalls balance out

EXISTING 48" CMP

INTERSTATE 25

PALMER DIVIDE ROAD (PUBLIC)

B7F

B8F

B9F

C1F

D1F

D2F

X8

X9

X10

EDB POND 2 (PRIVATE)

EDB POND 3 (PRIVATE)

EDB POND 4 (PRIVATE)

EDB POND 5 (PRIVATE)

MISTY ACRES BOULEVARD (PUBLIC)

MONUMENT HILL RD. (PUB)

MISTY ACRES BLVD. (PVT)

WHITE SNOW GR. (PVT)

GALAXY CREST PL (PVT)

PROPOSED STORM SEWER (TYP)

WETLAND BOUNDARY (TYP)

WETLANDS

EXISTING 48" RCP CULVERT

EXISTING 48" RCP CULVERT

REGRADE AREA TO DRAIN TO CULVERT

PROPOSED 36" RCP (LEVELING PIPE)

PROPOSED RIPRAP OR IMPACT BASIN FOR ENERGY DISSIPATION (PRIVATE)

EXISTING 48" CMP CULVERT (TO REMAIN)

PROPOSED 2 - 48" RCP CULVERTS

EXISTING WASTEWATER LIFT STATION SITE

PROPOSED 54" RCP (PRIVATE)

EXISTING DUAL 48" CMP CULVERTS (TO REMAIN)

PROPOSED CONCRETE COLLECTION STRUCTURE (PRIVATE)

PROPOSED 78" RCP (PRIVATE)

DOEWOOD DRIVE (PUBLIC)

83'-3 3/4"

83'-3 3/4"

MATCH LINE

ROUTING SUMMARY

Design Point	Contributing Basins	Flow Q_{10}	Flow Q_{100}
X1	A4F	**17.4**	**29.0**
X2	O1,A3F	**7.9**	**21.2**
X3	A2F,O2,O3,O4	**14.6**	**26.5**
X4	B6F	**12.5**	**21.0**
X5	B1F	**17.9**	**30.3**
X6	B2F,B3F,B4F	**4.2**	**7.0**
X7	B5F	**4.7**	**7.5**
X8	B1F,B2F,B3F,B4F,B5F, B6F,B7F,B8F,B9F	**48.1**	**80.0**
X9	D1F	**24.3**	**45.0**
X10	D2F	**2.1**	**3.8**

Update for proposed improvements

Provide DPs

NOTE:
THIS MAP IS NOT INTENDED TO BE DETAILED. THIS IS ONLY FOR THE PURPOSES OF ILLUSTRATING FUTURE ANTICIPATED BASINS AND FLOW ROUTING CHARACTERISTICS.

Unresolved: correct the scale

LEGEND - STORMWATER

- A — BASIN ID
- # — DESIGN POINT
- PIPE ID
- DRAINAGE BASIN BOUNDARY
- XXXX — EXISTING CONTOUR
- XXXX — PROPOSED CONTOUR
- SURFACE FLOW DIRECTION

GENERAL NOTES

1. EXISTING TOPOGRAPHY PROVIDED BY BEAR CREEK SURVEYING VIA AERIAL PHOTOGRAPHY.
2. CONTOURS SHOWN ON THIS MAP REFLECT A 2' CONTOUR INTERVAL.
3. AERIAL IMAGERY NOT SHOWN FOR CLARITY.
4. ROADS ARE CLASSIFIED AS EITHER PUBLIC "(PUB)" OR PRIVATE "(PVT)" AS SHOWN ON PLAN.

NORTH

0 50 100 200

PRC ENGINEERING
1560 BROADWAY STREET, SUITE 114
DENVER, COLORADO
COLORADO SPRINGS, CO 80904
PRC ENGINEERING

MONUMENT RIDGE EAST

TOWN OF MONUMENT
EL PASO COUNTY, COLORADO

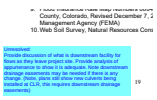
◆ DRAINAGE PLAN
FUTURE CONDITIONS - NORTH

issued	6/24/25

D6
sheet number

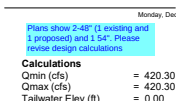
V6_Drainage Report - Final.pdf Markup Summary

CDurham (4)



Subject: Text Box
Page Label: 21
Author: CDurham
Date: 10/15/2026 3:24:54 PM
Status:
Color:
Layer:
Space:

Unresolved:
Provide discussion of what is downstream facility for flows as they leave project site. Provide analysis of appurtenance to show it is adequate. Note downstream drainage easements may be needed if there is any change. (Note, plans still show new culverts being installed at CLR, this requires downstream drainage easements)



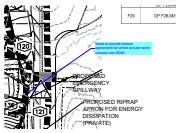
Subject: Text Box
Page Label: 222
Author: CDurham
Date: 10/16/2026 10:59:09 AM
Status:
Color:
Layer:
Space:

Plans show 2-48" (1 existing and 1 proposed) and 1 54". Please revise design calculations

---



Subject: Text Box
Page Label: 261
Author: CDurham
Date: 10/16/2026 11:05:11 AM
Status:
Color:
Layer:
Space:



Subject: Callout
Page Label: 309
Author: CDurham
Date: 10/16/2026 3:35:36 PM
Status:
Color:
Layer:
Space:

Need to provide license agreement for where private storm crosses into ROW.

Glenn Reese - EPC Stormwater (4)



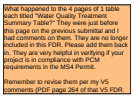
Subject: SW - Highlight
Page Label: 9
Author: Glenn Reese - EPC Stormwater
Date: 10/15/2026 1:30:27 PM
Status:
Color:
Layer:
Space:

For
permanent mitigation of groundwater entering the pond facility, a clay liner will be
required on the bottom and side slopes. Refer to the geotechnical engineering
report for the project for additional information related to the liner requirements.



Subject: SW - Textbox with Arrow
Page Label: 9
Author: Glenn Reese - EPC Stormwater
Date: 10/15/2026 1:31:38 PM
Status:
Color:
Layer:
Space:

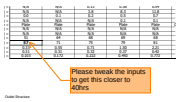
Copying this Review 5 comment for reference/discussion as I still don't see any liner details in the V6 Soils Report:
I just want to note for my own tracking:
- The geotech report still does not have any details, specs, or discussion about the clay liner.
- The only change from the previous V4 version of the Soils Report (dated 8/7/24) to this latest V5 version (dated 7/16/26) in the groundwater section (on PDF page 9) was the addition of one paragraph and the table was revised.



Subject: SW - Textbox
Page Label: 265
Author: Glenn Reese - EPC Stormwater
Date: 10/15/2026 1:32:39 PM
Status:
Color:
Layer:
Space:

What happened to the 4 pages of 1 table each titled "Water Quality Treatment Summary Table?" They were just before this page on the previous submittal and I had comments on them. They are no longer included in this FDR. Please add them back in. They are very helpful in verifying if your project is in compliance with PCM requirements in the MS4 Permit.

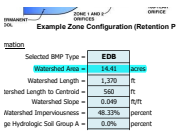
Remember to revise them per my V5 comments (PDF page 264 of that V5 FDR.



Subject: SW - Textbox with Arrow
Page Label: 267
Author: Glenn Reese - EPC Stormwater
Date: 10/15/2026 1:09:27 PM
Status:
Color:
Layer:
Space:

Please tweak the inputs to get this closer to 40hrs

Jeff Rice - EPC Engineering Review (18)



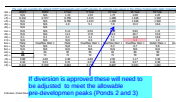
Subject:
Page Label: 277
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 4:00:18 PM
Status:
Color:
Layer:
Space:

Watershed Area = 14.41 acres



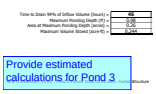
Subject: Callout
Page Label: 277
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 4:03:36 PM
Status:
Color:
Layer:
Space:

See comments on drainage plan about diverted area



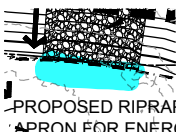
Subject: Callout
Page Label: 279
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 3:54:15 PM
Status:
Color:
Layer:
Space:

If diversion is approved these will need to be adjusted to meet the allowable pre-developmen peaks (Ponds 2 and 3)

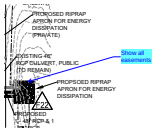


Subject: Text Box
Page Label: 279
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 4:05:39 PM
Status:
Color:
Layer:
Space:

Provide estimated calculations for Pond 3

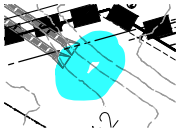


Subject:
Page Label: 309
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 1:53:47 PM
Status:
Color:
Layer:
Space:



Subject: Callout
Page Label: 309
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 1:54:13 PM
Status:
Color:
Layer:
Space:

Show all easements

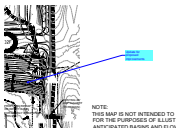


Subject:
Page Label: 310
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 4:08:41 PM
Status:
Color:
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Space:



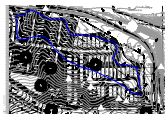
Subject: Text Box
Page Label: 310
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 4:10:40 PM
Status:
Color:
Layer:
Space:

(Review can't be completed)



Subject: Callout
Page Label: 312
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 1:52:53 PM
Status:
Color:
Layer:
Space:

Update for proposed improvements



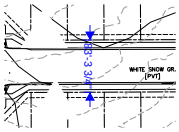
Subject: PolyLine
Page Label: 312
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 2:16:53 PM
Status:
Color:
Layer:
Space:



Subject: Callout
Page Label: 312
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 2:44:13 PM
Status:
Color:
Layer:
Space:

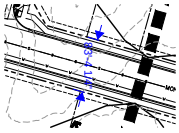
Unresolved: Identify the area proposed to be diverted and include in the deviation request. This would likely not be approved unless flows and volumes between the outfalls balance out

---



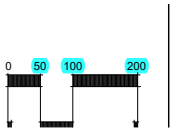
Subject: Length Measurement
Page Label: 312
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 2:20:06 PM
Status:
Color:
Layer:
Space:

83'-3 3/4"



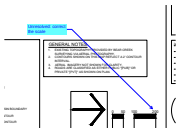
Subject: Length Measurement
Page Label: 312
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 2:30:16 PM
Status:
Color:
Layer:
Space:

83'-4 1/4"



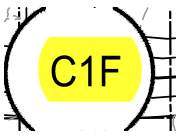
Subject:
Page Label: 312
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 2:30:42 PM
Status:
Color:
Layer:
Space:

50 100 200



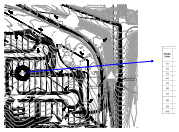
Subject: Callout
Page Label: 312
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 2:30:59 PM
Status:
Color:
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Space:

Unresolved: correct the scale

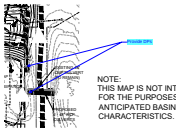


Subject:
Page Label: 312
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 3:57:19 PM
Status:
Color:
Layer:
Space:

C1F



Subject: Arrow
Page Label: 312
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 3:59:15 PM
Status:
Color:
Layer:
Space:



Subject: Callout
Page Label: 312
Author: Jeff Rice - EPC Engineering Review
Date: 10/16/2026 4:00:02 PM
Status:
Color:
Layer:
Space:

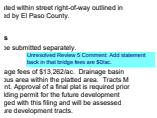
Provide DPs

Joseph Sandstrom (10)



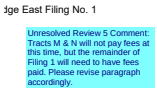
Subject: Text Box
Page Label: 13
Author: Joseph Sandstrom
Date: 10/15/2026 9:58:14 AM
Status:
Color:
Layer:
Space:

See comment on page 23 of the CDs. Based on the 10 year HGL, of a statement can be made that the 5 year HGL will be less than 80% of the pipe, please include that statement. This will satisfy the ECM without needing to submit a deviation request for consideration (which may or may not be approved).



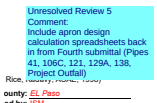
Subject: Text Box
Page Label: 20
Author: Joseph Sandstrom
Date: 10/15/2026 2:03:09 PM
Status:
Color:
Layer:
Space:

Unresolved Review 5 Comment: Add statement back in that bridge fees are $0/ac.



Subject: Text Box
Page Label: 20
Author: Joseph Sandstrom
Date: 10/15/2026 2:04:23 PM
Status:
Color:
Layer:
Space:

Unresolved Review 5 Comment:
Tracts M & N will not pay fees at this time, but the remainder of Filing 1 will need to have fees paid. Please revise paragraph accordingly.



Subject: Text Box
Page Label: 261
Author: Joseph Sandstrom
Date: 10/15/2026 2:32:16 PM
Status:
Color:
Layer:
Space:

Unresolved Review 5 Comment:
Include apron design calculation spreadsheets back in from Fourth submittal (Pipes 41, 106C, 121, 129A, 138, Project Outfall)



Subject: Text Box
Page Label: 306
Author: Joseph Sandstrom
Date: 10/15/2026 2:36:17 PM
Status:
Color:
Layer:
Space:

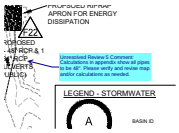
Unresolved Review 5 Comment: For SWMM data please only put output summary tables in the appendix. Please put all of SWMM data currently in the appendix in it's own standalone appendix report. Data makes it hard to review and move through the report.

Review 6 Comment:
Thank you for removing the data from this report, but summary tables need to be included and a separate appendix report was not received with this submittal.



Subject: Text Box
Page Label: 306
Author: Joseph Sandstrom
Date: 10/15/2026 2:38:24 PM
Status:
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Space:

Address all V5 comments made on the SWMM model sheets prior to resubmitting.



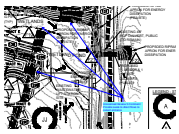
Subject: Callout
Page Label: 309
Author: Joseph Sandstrom
Date: 10/15/2026 3:14:10 PM
Status:
Color:
Layer:
Space:

Unresolved Review 5 Comment: Calculations in appendix show all pipes to be 48". Please verify and revise map and/or calculations as needed.



Subject: Callout
Page Label: 309
Author: Joseph Sandstrom
Date: 10/15/2026 3:15:39 PM
Status:
Color:
Layer:
Space:

Unresolved Review 5 Comment:
Drainage easement needed for flow. Provide analysis of existing culverts and channel. Does not matter if swale and culverts are existing, easement is still needed. Previous maps had a swale from culvert to structure. Where did it go?



Subject: Callout
Page Label: 309
Author: Joseph Sandstrom
Date: 10/15/2026 3:16:39 PM
Status:
Color:
Layer:
Space:

Unresolved Review 5 Comment:
Provide swale to direct flows to culvert entrance



Subject: Text Box
Page Label: 310
Author: Joseph Sandstrom
Date: 10/15/2026 3:18:01 PM
Status:
Color:
Layer:
Space:

Unresolved Review 5 Comment: Contours do not match basin lines